Supporting the Social Media Needs of Emergency Public Information Officers with Human-Centered Design and Development

by

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ABSTRACT

By Amanda Lee Hughes

Supporting the Social Media Needs of Emergency Public Information Officers with Human-Centered Design and Development

Dissertation Directed by Professor Leysia Palen

Emergency response agencies, which operate as command-and-control organizations, push information to members of the public with too few mechanisms to support communication flowing back. Recently, information communication technologies (ICTs) such as social media have challenged this one-way model by allowing the public to participate in emergency response in new and unexpected ways. These developments place new pressure on emergency managers to release information over social media streams, monitor online activities during an emergency event, incorporate information provided by members of the public into response efforts, and engage in the public conversation around an event.

Within US emergency response organizations, public information officers (PIOs) are in a unique position to use these emerging communication technologies. PIOs are responsible for communicating official response information to members of the public during an emergency event and ensuring that the information available in the public arena is accurate and complete.

In this dissertation work, I examine how social media and the forms of public participation enabled by it are changing the role of the PIO. Based on this understanding, I explore ICT solutions for the PIO through human-centered methods that include the PIO in the design process. Finally, I design, implement, and evaluate a software application informed by this work that supports the social media needs of PIOs. With the aim of improving emergency response efforts, I demonstrate how empirically-based understandings of emergency management work can inform technology design, practice, and policy.

This dissertation research provides the following contributions: (1) an examination of PIOs’ roles and the sociotechnical environment in which they work; (2) a new model of PIO communication that takes into account new communication pathways that have been enabled by ICT; (3) a set of requirements for supporting PIO social media communication needs; (4) the design, implementation, and evaluation of a tool—the PIO Monitoring Application—that supports the social media monitoring, documenting, reporting, and organizing needs of PIOs during an emergency event; (5) a description of the likely future role of PIOs and how that role might be supported.
DEDICATION

To Kayla, who constantly amazes and inspires me.
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I want to begin by acknowledging my advisor, Leysia Palen, for which none of this would be possible. Leysia has invested significant time and effort on my behalf in teaching me to become a successful researcher, writer, and scholar. She has also been an amazing role model—an example of a strong, intelligent, compassionate woman that is deeply committed to both family and career. She makes me want to be a better person and everyone should have someone like Leysia in their life!

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CHAPTER 1: Introduction

Timely and accurate communication is a vital component of successful emergency management (Mileti and Fitzpatrick, 1992; Tierney, Lindell and Perry, 2001; Lindell and Perry, 2004; Reynolds and Seeger, 2005) and interaction with the public is especially important as people seek to understand how they are affected by emergency and disaster events (Wray, Becker, Henderson, Glik, Jupka, Middleton, Henderson, Drury and Mitchell, 2008). Effective emergency communication with members of the public can provide life saving protective measures, facilitate relief and recovery efforts, and reduce public anxiety and fears. Consequently, emergency managers place much importance in communicating with external stakeholders such as members of the public and the media (Sorensen and Sorensen, 2007).

In the United States, official communications with the public during an emergency are handled by Public Information Officers (PIOs). Performing the public relations function of emergency response efforts, PIOs are responsible for communicating current, accurate information about an emergency incident to the media, members of the public, and other directly or indirectly affected stakeholders. PIOs also monitor the public information arena during an emergency. Their duties in this capacity include identifying and correcting false rumors, as well as finding and correcting misinformation (Stockdale and Sood, 1989). Typically PIOs work in fire or police departments, or for emergency response organizations at the local, state, or federal level.

In recent years, PIOs are facing new demands and expectations by members of the public to provide information using rapidly evolving information communication technology (ICT), with particular attention to microblogging services and social media such as Twitter and
Facebook (American Red Cross, 2011). There is also new pressure to consider the public’s online activities and incorporate the useful and relevant information they provide back into emergency response efforts (Palen and Liu, 2007; Palen, Vieweg, Liu and Hughes, 2009). PIOs are discovering the benefits of using these new forms of ICT in their work, as one study participant explains:

*I think overall social media and the idea behind social media so well fits with public affairs, public information and emergency communication, because the whole idea it is to be able to reach out and connect with each other and that is the piece that makes all of those things successful. You’re successful with your public affairs, you’re successful with your emergency communication when you’ve been able to get the information that people need to them in an efficient manner. And to me that just is what it is. Social media is that (I6, 284).*

Due to these changing expectations, many PIOs have expanded their responsibilities to include monitoring and distributing messages and other content (i.e., photos, video) over social media.

Incorporating new ICT like social media into PIO work practice is not without its challenges. Emergency response organizations and the PIOs who work for them operate under conditions of great uncertainty. They are asked to respond to unpredictable emergency or disaster events where ICT may or may not be useful or even operational.

PIOs also find it challenging to keep up with the rapid advances ICTs have made. With social media, new platforms and websites are created every day and even existing social media continues to evolve along with users’ expectations and uses of the technology. PIOs must be aware of the forms of ICT in use by their community so that they can reach their stakeholders:

*We have to be aware and alert and constantly exploring how people are getting their information so that we can be sure we have the tools to provide it that way (I6, 282).*

---

1 This quote was taken from a set of 25 PIO interviews which I describe in Chapter 3 of this dissertation. The notation used first indicates the interview number and is followed by the line number in the corresponding interview transcription where the quote appears.
Keeping track of all the existing and newly emerging forms of ICT is difficult for most PIOs, especially when time and resources rarely allow for this kind of proactive research.

Further, PIO organizations are struggling to keep pace with ICT advances. Organizational acceptance of new technologies can be slow; leaders must be convinced that benefits outweigh drawbacks or legal ramifications before technology use can be sanctioned. The role of the PIO is defined under the National Incident Management System (NIMS), the management system currently used by all emergency response organizations in the United States. When trying to understand how ICT should be incorporated into PIO work, guidance is sought from NIMS guidelines and procedures, but to date NIMS has failed to provide any direction beyond requests to use ICT wisely (US Department of Homeland Security, 2008).

Due to the recent rapid evolution of ICT, especially in regard to social media, fundamental shifts have taken place in the duties and responsibilities PIOs are called to perform which is changing the nature of their work. This dissertation seeks to study this rapidly changing sociotechnical arena, with the goal of understanding future PIO work practice possibilities and designing participant informed ICT solutions.

1.1 Research Question

Relying on my training in human computer interaction (HCI) and crisis informatics, I design and create ICT solutions that account for the complex social organizations, relationships, processes, and technologies that encompass current PIO practice, and in turn future PIO work practice. The primary research question motivating this dissertation research is: How can ICT design and implementation support future emergency PIO practice in a complex and changing sociotechnical environment?
1.2 Research Design

To address my research question, I take a human-centered approach which involves PIOs in each of the 4 parts of this dissertation work (see Figure 1). Parts 1-4 were executed sequentially, with each building upon and validating the results of the previously executed parts (as depicted by the arrow in Figure 1).

Part 1—described in Chapter 3—explores PIO work practice and the sociotechnical system in which it takes place. While there is much research in the area of emergency management, current empirical accounts of PIO work are nonexistent. Further, before I could create ICT solutions for PIOs, I needed to understand their work practice and current ICT use (Beyer and Holtzblatt 1997; Kling, McKim and King 2003). Therefore, I conducted an interview study with 25 participants that focused on understanding PIOs’ roles and their experiences with ICT. Research questions that drove this empirical examination include: What tasks and responsibilities are encompassed in the work of a PIO, and how are they accomplished? How do PIOs perceive that ICTs (and more specifically social media) have affected their work?

Part 2 seeks to design ICT for future PIO practice, building upon the findings from part 1.
To accomplish this task, I chose a participatory approach in which I collaboratively explored and designed prototypes for future ICT tools with PIOs. These activities were conducted in the context of a participatory design workshop (Kensing and Madsen, 1991; Bødker, Kensing and Simonsen, 2004) which is described in Chapter 4. The research question for this part of my research is: *What needs do PIOs have for supporting the communication demands entailed by new forms of ICT, and what are the design requirements?*

In part 3 (Chapter 5), I developed five prototypes for tools that would support PIO work. These prototypes were derived from the design requirements developed in part 2 of this research. From the five prototypes, two were combined to create a prototype called the PIO Monitoring Application (PMA) for further development and testing. The PMA prototype was tested with 11 PIOs and iteratively implemented based on PIO feedback. The final product of this research component is a high-fidelity PMA prototype (Chapter 6) that supports the social media monitoring, reporting, and archiving needs of PIOs. The research question answered here is: *What tool features can support the information needs of current PIOs?*

Part 4 (Chapter 7) evaluates PMA through two studies: a field study and a usability study. Through these studies, I investigated the usability of PMA and evaluated its effectiveness in supporting PIO work. The research questions that guided this effort include the following: *What improvements does PMA offer over current PIO work methods? How can PMA more effectively support PIO work practice?*

Finally, Chapter 8 is a meta-level analysis of the research activities conducted in parts 1-4. From a sociotechnical perspective, I analyzed all the data collected throughout this dissertation work and offer insight on how new forms of ICT are shaping future PIO practice. The research questions for this analysis include: *How might the PIO role change in future emergency*
management organizations? What implications does this research have regarding future ICT use in the PIO role?

This research offers a response to the primary research question stated in the previous section by understanding the sociotechnical environment in which PIOs function, predicting future PIO practice based on this understanding, designing for this future, and implementing and evaluating these designs.

1.3 Contributions

This dissertation research provides the following contributions: (1) an examination of PIOs’ roles and the sociotechnical environment in which they work; (2) a new model of PIO communication that takes into account new communication pathways that have been enabled by ICT; (3) a set of requirements for supporting PIO social media communication needs; (4) the design, implementation, and evaluation of a tool—the PIO Monitoring Application—that supports the social media monitoring, documenting, reporting, and organizing needs of PIOs during an emergency event; (5) a description of the likely future role of PIOs and how that role might be supported.

1.4 A Note on Terminology

Before continuing, it is important to define and distinguish between an “emergency” and a “disaster.” The word “emergency” is used in two ways throughout this dissertation. The first use is as an adjective to describe people, organizations, or efforts that are part of the official response to both emergency and larger disaster events. Examples include “emergency response,” “emergency responder,” or “emergency management.” The second use of the word “emergency” is to refer to an event. Emergency events are those routine, daily incidents that emergency
responders handle, such as non-fatal car crashes and house fires. While emergencies can be disastrous for those involved, they do not typically affect the greater community or strain emergency response resources. Disasters are quite different however, as Auf der Heide explains:

One of the reasons disaster response is difficult to coordinate is because disasters are different from routine, daily emergencies. The difference is more than just one of magnitude. Disasters generally cannot be adequately managed merely by mobilizing more personnel and material. Disasters may cross jurisdictional boundaries, create the need to undertake unfamiliar tasks, change the structure of responding organizations, result in the creation of new organizations, trigger the mobilization of participants that do not ordinarily respond to local emergency incidents, and disable the routine equipment and facilities for emergency response. As a consequence of these changes, the normal procedures for coordinating community emergency response may not be adapted well to the situation (Auf der Heide, 1989, 37).

This research examines and seeks to design ICT for PIOs who respond to both emergency and disaster events. Disaster events are more complex and exacerbate problems encountered in everyday emergency incident responses. Therefore, the approach used here is that ICT should be designed for the complexities of disaster and then be allowed to “cascade down” to emergencies, rather than designing ICT for emergency situations and assuming (often incorrectly) that ICT will scale up to disaster events (Kristensen, Kyng and Palen, 2006, 162). By designing ICT for disaster events first, one can see where tools and processes for everyday emergencies break down, offering an opportunity for improvement that benefits both emergency and disaster response efforts. Additionally, PIOs can use this ICT in their routine emergency responses so that they already know how to use it when they are called to a larger disaster response—Kristensen and colleagues (2006, 162) refer to this as the familiarity principle.

Another term that needs definition is “social media.” Social media encompasses a wide array of online applications and services (e.g., blogs, wikis, social networking and media sharing sites) that allow users to connect, communicate, and collaborate with other users. Many social media applications are available today and the number continues to grow. Examples of the most
popular online social media sites include Twitter\(^2\), Facebook\(^3\), YouTube\(^4\), Flickr\(^5\), and Wikipedia\(^6\).

Social media are newer forms of ICT that continue to rapidly grow and evolve. In this dissertation, I find that social media are redefining the way that PIOs share and receive information from the media, members of the public, and other emergency stakeholders. Consequently, when examining ICT in this research a particular focus has been placed upon social media.

### 1.5 Dissertation Overview

Following this introductory chapter, the dissertation is divided into seven additional chapters. Chapter 2 presents the relevant background literature for this research in the areas of sociology of disaster, human and computer interaction, and crisis informatics. Chapter 3 reports on an interview study examining the PIO role and the effects of ICT on PIO work. Chapter 4 describes a participatory design workshop conducted with PIOs in which researchers and PIOs collaboratively worked together to reflect on the future of PIO work and how it might be improved with design. Chapter 5 explains the process by which the PIO Monitoring Application (PMA) was prototyped, tested with PIOs, and iteratively developed based on the results of the participatory design workshop and PIO feedback. Chapter 6 describes the final high-fidelity PMA prototype. Chapter 7 discusses the findings from a field study that evaluated PMA by having PIOs use it in an emergency setting and a usability study that tested the effectiveness of

\(^2\) [http://www.twitter.com](http://www.twitter.com)  
\(^3\) [http://www.facebook.com](http://www.facebook.com)  
\(^4\) [http://www.youtube.com](http://www.youtube.com)  
\(^5\) [http://www.flickr.com](http://www.flickr.com)  
\(^6\) [http://www.wikipedia.org](http://www.wikipedia.org)
PMA’s user interface. Lastly, Chapter 8 concludes the dissertation by offering an analysis of the changes PIOs are experiencing from a sociotechnical perspective and discussing the future of ICT in PIO work.
CHAPTER 2: Literature Review

The nature of the dissertation work presented here is interdisciplinary—drawing from different areas of research (i.e., human and computer interaction, crisis informatics, and sociology of disaster) and different academic and practitioner perspectives. I begin by discussing the sociotechnical approach taken in this research and how this approach has been applied to the study and design of information systems for emergency response. I explain the rationale for choosing to study the emergency PIO and give an accounting of the primary challenges PIOs face as they respond to both disasters and more routine emergencies. Finally, I examine the current efforts of both researchers and practitioners in addressing social media needs within emergency management.

2.1 A Sociotechnical Approach

Emergency responders work in an environment that is comprised not only of the organization they work for and the ICT they use, but also of the unpredictable emergency and disaster events to which they respond. Consequently, to better understand emergency management work and how it is structured, this research takes a sociotechnical perspective—one that promotes understanding through consideration of both the social and technical aspects of a work system. The social aspects of a work system may include individuals (with all of their skills, beliefs and values), organizational composition and incentive structures, while the technical aspects consider the tools and processes used within a system. Clegg states that:

Sociotechnical theory has at its core the notion that the design and performance of new systems can be improved, and indeed can only work satisfactorily, if the ‘social’ and the ‘technical’ are brought together and treated as interdependent aspects of a work system (Clegg, 2000, 2).
This research takes a sociotechnical approach to the study and design of ICT for emergency management work. In this section, I provide a brief history of the sociotechnical perspective, followed by a discussion of how this approach is used here. I then examine how sociotechnical principles have been applied to the study of crisis and discuss how my investigation builds upon this research.

2.1.1 History

The sociotechnical concept originated in the 1940’s at the Tavistock Institute in London with the examination of non-computing manufacturing systems (Emery and Trist, 1960). Linking the failure of many promising new technologies back to the social systems in which they were introduced, researchers concluded that successful technology adoption and use by organizations must consider both the social and technical environment, and how they work together.

Scandinavian researchers expanded on the Tavistock sociotechnical view by introducing participatory design and consideration of factors located external to an organization such as customers, suppliers, regulations and politics (Greenbaum and Kyng, 1991; Bratteteig and Bjerknes, 1995). Previous conceptualizations saw organizations as isolated, deterministic entities. Researchers found that by expanding the area of concern, a much more accurate and complete picture of an organization could be achieved. Including participants in the design process marked a significant shift in design philosophy, and many methods and practices still used today are based upon this participatory approach (Greenbaum and Kyng, 1991; Beyer and Holtzblatt, 1997; Bødker, Kensing and Simonsen, 2004).

Many scholars have written about how design based on a sociotechnical perspective can be achieved. Cherns (1976) outlines a set of sociotechnical design concepts that were later updated by Clegg (2000) to include new online ICT. Mumford (1995) created a design
methodology called ETHICS which is based on sociotechnical ideas. Building on his earlier Web Models (Kling and Scacchi, 1982; Kling, 1992), Kling developed a Socio-Technical Interaction Network (STIN) methodology that defines a conceptual framework for researching the deeply intertwined social and technical aspects of designing information systems (Kling, McKim and King, 2003).

2.1.2 Application to Research

The research here is based on the theory that ICT design for emergency managers can benefit from considering their work practice and all of the factors affecting that practice (e.g., organizational structure and incentives, policy and procedures, relationships with outside stakeholders, ICT advances) as a sociotechnical system. This perspective is informed by Suchman’s seminal work (1987) on plans and situated action, which recognizes that technology use is tightly interwoven with the situational context in which it takes place and to perform successful technology design one must consider this situational context. Hughes (1989, 51) states: “Technological systems contain messy, complex, problem-solving components. They are both socially constructed and society-shaping.” Not only are technology and social systems intertwined but they also dynamically and recursively shape and influence one another (Orlikowski, 1992). By envisioning the emergency management design space as a sociotechnical system, I can better understand the constantly evolving interplay between technology and the emergency management social context with the aim of designing and creating ICT that complements this understanding (Truex, Baskerville and Klein, 1999).

Further, in this dissertation work I rely on participatory design methods for including stakeholders in the design process (Greenbaum and Kyng, 1991; Kensing and Madsen, 1991; Beyer and Holtzblatt, 1997; Kristensen, Kyng and Palen, 2006; Buscher, Kristensen and
By involving emergency managers in the design process for ICT that they will use, the resulting products are more likely to address the needs of these emergency managers and consequently, they are more likely to be used.

### 2.1.3 Crisis Informatics

In recent years a sociotechnical approach to understanding disaster and emergency events has emerged termed crisis informatics (Hagar and Haythornthwaite, 2005; Palen et al., 2009):

Crisis informatics extends consideration of emergency response to not only include official responders (who tend to be the focus in policy and technology matters) but also members of the public. Therefore, crisis informatics views emergency response as an expanded social system where information is disseminated within and between official and public channels and entities. Crisis informatics wrestles with methodological concerns as it strives to develop new theory and support sociologically informed development of both ICT and policy (Palen et al., 2009, 469).

The research here builds upon and adds to a growing literature base in crisis informatics.

Many of the research efforts in crisis informatics have focused on empirical studies of online, public interactions during times of crisis. During the 2007 Southern California wildfires, members of the public turned to social media sites including personal blogs, community websites and other services like Twitter. These online resources provided details about road closures, community evacuations, shifts in fire lines, and shelter information that was specific and relevant to the public’s needs (Sutton, Palen and Shklovski, 2008; Shklovski, Palen and Sutton, 2008). In China, a popular online forum became an important location for people to converge, share information and cope with loss after the 2008 Sichuan earthquake (Qu, Wu and Wang, 2009). The public’s use of microblogging services and blogs have also been considered in times of war (Mark, Al-Ani and Semaan, 2009; Mark, Bagdouri, Palen, Martin, Al-Ani and Anderson, 2012) and political crisis (Burns and Eltham, 2009; Lotan, Graeff, Ananny, Gaffney, Pearce and boyd,
Further examples include observations of social convergence around disaster (Kendra and Wachtendorf, 2003a) in an online context (Hughes, Palen, Sutton, Liu and Vieweg, 2008), Facebook use surrounding the Virginia Tech shootings by students seeking to understand the event’s impact on their wide and diffuse social networks (Vieweg, Palen, Liu, Hughes and Sutton, 2008; Palen et al., 2009), use of the public photo-sharing site Flickr across a range of disasters (Liu, Palen, Sutton, Hughes and Vieweg, 2008), and Twitter use during a violent outbreak in the Seattle-Tacoma, Washington area (Heverin and Zach, 2010). The importance of these studies was to demonstrate that members of the public can and do use social media during times of crisis to seek and share information, provide assistance, and assess the effects of a crisis event.

Moving beyond these descriptive accounts of online citizen-based crisis phenomena, several research efforts have shifted toward understanding how and why such technologies are adopted and used in disaster and what that might mean for design. Wu et al. (2008) examined a campus emergency response text alert system at the University of Maryland and why its adoption rate was less than expected. This research found that just creating a feasible technical solution is not enough; the social context in which the solution is used must also be considered. In-depth analysis of Twitter messages sent during the 2009 Red River floods and the 2009 Oklahoma City fires revealed how Twitter users self-organize around information and offered insight into how a system for extracting valuable crisis information from these Twitter messages might be accomplished (Starbird, Palen, Hughes and Vieweg, 2010; Vieweg, Hughes, Starbird and Palen, 2010). Palen et al. (2011) predict the rise of the “Everyday Analyst” as members of the public increasingly incorporate digital information into their decision making processes. They argue that this analytic activity by members of the public will become increasingly important in
emergency response efforts and they present a proposal for designing and developing tools to support this activity.

A small but growing number of efforts in the crisis informatics domain have begun to support online activity by members of the public through ICT design and development. Researchers from the University of Maryland have proposed creating a 911.gov site that would allow citizens to submit and receive information via Internet capable devices (Jaeger, Shneiderman, Fleischmann, Preece, Qu and Wu, 2007; Shneiderman and Preece, 2007). “Ushahidi”\(^7\) was originally developed during the 2008 post-election fallout in Kenya and allowed citizens to report and map accounts of violence online. Since that time, Ushahidi has become a computing platform that supports citizen journalism (Gillmor, 2006) in a wide array of situations. At the University of Colorado at Boulder, Project EPIC (Empowering the Public with Information in Crisis) is making information generated during a crisis through social media more accessible to everyone, which in turn will aid crisis response and recovery by providing more trustworthy, accurate and timely information (Palen, Anderson, Mark, Martin, Sicker, Palmer and Grunwald, 2010). Under project EPIC’s umbrella, the Tweak the Tweet (TtT) effort seeks to standardize the format of Twitter messages during a disaster so that they can be more easily parsed for efficient analysis by machines (Starbird and Stamberger, 2010; Starbird, Palen, Liu, Vieweg, Hughes, Schram, Anderson, Bagdouri, White, McTaggart and Schenk, 2011). Another effort under project EPIC builds software infrastructure for the collection and analysis of the mass amounts of socially-generated online crisis information (Anderson and Schram, 2011).

While the crisis informatics literature is still growing, its primary focus has been on the

\(^7\) http://www.ushahidi.com/
public side of ICT use in disaster, though some are beginning to study what it means for emergency management and members of the public to work together during a crisis using social media (Perng, Büscher, Halvorsrud, Wood, Stiso, Ramirez and Al-Akkad, 2012). This research fills a gap and complements past research by examining how emergency responders use ICT, or attempt to use it and in turn exploring design implications and technical solutions that address the concerns of emergency managers from a crisis informatics perspective.

### 2.2 Emergency Management and the Role of the PIO

When my colleagues and I started examining the use of social media during times of crisis, our focus was on how social media were enabling new forms of public participation in disaster preparedness, response, and recovery (Palen and Liu, 2007; Liu et al., 2008; Vieweg et al., 2008; Hughes et al., 2008; Palen et al., 2009). An important research question emerged from these efforts: *How can emergency management leverage new forms of public participation enabled by social media?*

As we began studying emergency management organizations, we found that one role seemed to be experiencing the most change around the introduction of social media. This role, the public information officer (PIO), fills the public relations function of an emergency response and stands at the intersection between emergency management organizations and members of the public. Because of their position as an intermediary, PIOs have experienced pressure and tension from both the organizations in which they work and members of the public to incorporate and use social media in their work practice. Consequently, PIOs are experiencing many changes in the duties they are expected to perform. This research seeks to understand the changing role of the PIO and design ICT that helps PIOs leverage new forms of public participation enabled by social media.
Relevant research regarding the changing role of the PIO and the challenges they face can be divided into three main areas: the unexpected and heightened conditions of disaster, the use of social media technologies, and the constraints of an outmoded organization model. These areas are discussed in the following three sections.

2.2.1 The Unexpected and Heightened Conditions of Disaster

Research has shown that training and preparation can help mitigate the effects of an emergency or disaster event (Perrow, 2007), yet it is still impossible to know exactly when, how, and under what circumstances these events will occur. If a disaster affects a large area it can create complex organizational and coordination issues. In some emergencies or disasters, power networks go down making communication over electronic devices difficult. Public health and safety considerations may require evacuations and subsequent sheltering needs. This unpredictability can be difficult to deal with as PIO because one can never fully prepare for any particular situation; they are all different.

Additionally, the likelihood and severity of disaster events are increasing (Drabek, 1986). As areas increase in population density, there are more potential victims when disaster strikes. For example, hurricanes and earthquakes of the same magnitude as previous events incur greater losses because of population growth. Higher disaster losses also result when people move into high-risk areas, such as flood plains, earthquake fault lines, wildfire prone locations, or locations near nuclear power plants or toxic waste sites (Petak, 1985; Drabek, 1986). In the future, PIOs can expect to respond to more disasters and disasters of greater severity.

2.2.2 The Use of Social Media Technologies

Traditionally, the public has relied on emergency officials and the news media to provide
them with information surrounding emergency and disaster events. However, in recent years social media technologies have expanded access to resources and increased the speed at which information can be distributed and retrieved. With growing access to the Internet, the pervasive adoption of mobile technologies and an explosion of social networking sites (e.g., YouTube\(^8\), Flickr\(^9\), Facebook\(^{10}\) and Twitter\(^{11}\)) exponential amounts of informal, socially generated data are publicly and freely available. Members of the public are now able to quickly obtain and broker disaster-related information as well as seek support on-line through their peer networks (May, 2006; Palen and Liu, 2007; Palen et al., 2009; Qu, Wu and Wang, 2009; Heverin and Zach, 2010; Perng et al., 2012). These new forms of communication are challenging the belief that emergency officials are the only legitimate source of information (Britton, 1989).

Social media activity by members of the public strains previous models of emergency communication which have not been designed to handle incoming information from the public, let alone information flowing in such a rapid and dynamic manner. During the 2008 Democratic National Convention (DNC), a National Special Security Event (NSSE) that used NIMS, researchers observed PIOs as they attempted to incorporate the monitoring of online sources into response efforts (Sutton, 2009). At the time, traditional media websites were heavily favored while blogs and other social media were generally not used as sources of information or venues for message distribution. This observation seems to demonstrate the challenges PIOs face in overcoming their traditional training when learning to use and adopt new technologies, however the observation was made under non-disaster conditions so caution must be used when applying

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\(^8\) http://www.youtube.com
\(^9\) http://www.flickr.com
\(^{10}\) http://www.facebook.com
\(^{11}\) http://www.twitter.com
it to emergency and disaster situations where results will likely vary.

As PIOs begin to pay attention to citizen social media activity, they find a new role of “listener” is added to their already long list of duties (Latonero and Shklovski, 2011). Difficulties trying to listen are further aggravated because social media technologies shorten news cycles and the public demand information almost immediately. Previously, with more traditional forms of media, PIOs had more time to collect information and craft the message they wanted to share. Now, PIOs are struggling with how to provide timely, accurate information in such a shortened timeframe (Crowe, 2010).

Several studies have examined the use of social media in disaster and have made calls-of-action to emergency response organizations to better use these technologies to share and receive important information from the public (Sutton, Palen and Shklovski, 2008; Palen et al., 2009; Sutton, 2009; Crowe, 2010; Sutton, 2010). Further calls-of-action are coming from members of the public who are beginning to expect social media capabilities from emergency management organizations (American Red Cross, 2011). However, these calls rarely take into account the complex organizational factors that can prevent PIOs from using social media technologies to their full potential (Lowrey, Evans, Gower, Robinson, Ginter, McCormick and Abdolrasulnia, 2007). In this research, I examine the use of social media in PIO practice and the organizations in which they work with the goal of understanding how PIOs might use social media technology.

2.2.3 The Constraints of an Outmoded Organization Model

In the 1970s, following a series of disastrous fires in California, those assigned to study the event found that most of the identified problems could be tied to poor and inadequate management (Chase, 1980; FIRESCOPE California, 1988). Prompted by these findings, the Incident Command System (ICS) was created (Irwin, 1989)—a military-based, command-and-
control model of emergency management (Drabek and McEntire, 2003; Waugh and Streib, 2006) which is still in use today. ICS specifies an organization which can expand and shrink to fit the changing needs of each fire incident while also outlining clear lines of accountability and leadership and providing a clear set of goals, policies and procedures (Schneider, 1992), something that was clearly lacking in previous models. Figure 2 contains a diagram of the ICS organizational structure. Although this bureaucratic method of emergency response seems to work well for fire, many have described it as being overly authoritative and inflexible (Britton, 1989; Neal and Phillips, 1995; Buck, Trainor and Aguirre, 2006). For example, such organizations have been criticized for causing emergency management personnel to think “inside of a box” as they strictly execute organization rules and procedures (Clarke, 1999).

Figure 2: Diagram of the ICS Organizational Structure

On March 1, 2004 the National Incident Management System (NIMS)—a nationwide system designed for all-hazards response and based upon ICS—was established (Department of Homeland Security Press Office, 2004). NIMS was created in response to Homeland Security

It is hoped that ICS’s success with wildfire suppression will translate to NIMS and the all-hazards domain, yet there is some disagreement as to how appropriate the ICS approach is for an all-hazards response (Buck, Trainor and Aguirre, 2006). One of the reasons ICS works so well in the wildfire domain is because the personnel are fighting the disaster agent (fire) itself over long periods of time and a military-based structure like ICS works particularly well in this type of situation. However, in other circumstances such as terrorist attacks or hurricanes, where the disaster agent cannot be fought directly, this approach may not prove as effective (Wenger, Quarantelli and Dynes, 1990; Trainor, 2005).

More recently the strict, bureaucratic dimensions of NIMS are conflicting with the distributed, emergent qualities of social media. NIMS specifies that all messages released to the public must be approved by the commanding officer in charge of the incident. However, emergency practitioner Crowe (2010) notes that the dynamic nature of social media technology—where short, timely messages are the norm—make it difficult for PIOs to use while still getting approval for every message sent. Furthermore, within NIMS a press release is the most common form of publicly released information: the format of a press release is structured in a particular way using “formalized” language, quotes from emergency and public officials, and statistics about the incident. Unfortunately, the press release does not lend itself to the abbreviated, informal style of social media. For example, Twitter limits the length of messages to
140 characters and PIOs find it challenging to trim a press release to this length while still conveying all of the relevant and important information (Crowe, 2010).

Finally, PIOs often listen to social media despite no clear mandate that they are responsible for these duties under NIMS. Current official NIMS documentation (US Department of Homeland Security, 2008) contains only a short, two paragraph section regarding the use of Internet-based technologies. The guidance offered is non-specific and unhelpful for emergency personnel trying to incorporate online technologies like social media into their practice:

   The Internet and other Web-based tools can be used, as appropriate, during incidents to help with situational awareness and crisis information management (US Department of Homeland Security, 2008, 30).

This lack of guidance causes confusion because several entities within NIMS could potentially monitor social media channels. PIOs are sometimes tasked with observing social media activity because of their responsibility to monitor the public. In other cases, social media monitoring becomes part of an information and intelligence gathering function that falls under the Planning or Operations section of an incident.

### 2.3 Support for Social Media in Emergency Management

Communities of emergency practitioners, technologists, and researchers have begun exploring how social media can support emergency management organizations. This section examines the different efforts from these communities.

#### 2.3.1 Emergency Practitioner Efforts

A recent example of an emerging organization that utilizes social media in emergency response is the Virtual Operations Support Team (VOST) (Tucker, Lanfranchi, Ireson, Sosa, Burel and Ciravegna, 2012). Recognizing the potential of social media and other ICT to aid in
emergency management work, a small group of emergency practitioners have been developing the concept of a VOST as a way to virtually support emergency management teams. A long documented phenomenon in disaster is the emergence of new organizations, processes, roles, and tasks before, during and after a disaster (Dynes, 1970; Quarantelli, 1996; Tierney, Lindell and Perry, 2001; Drabek and McEntire, 2003; Rodríguez, Trainor and Quarantelli, 2006) and the VOST concept is one such example. This process of emergence is seen as a vital part of emergency response that helps responders meet unexpected needs and adapt to the uncertain conditions encountered in emergency and disaster situations.

A VOST is composed of trusted volunteers who can assist official emergency response teams in monitoring and archiving social media communications, updating websites and social media streams, and performing any other tasks that can be done online. To communicate and coordinate, a VOST uses Internet-based communications so team members can be located anywhere with Internet access. While much work remains before a concept like the VOST can be universally adopted into emergency management practice (Tucker et al., 2012), the VOST concept represents an important emergency practitioner innovation that is advancing ideas about how organizations, agencies, and individuals can provide support during an emergency.

Several online communities and resources have also emerged in recent years with the goal of understanding and supporting social media use in emergency management. These efforts, usually created by emergency practitioners, provide online forums for discussion as well as best practices and advice for common emergency response issues.

The Social Media in Emergency Management (SMEM) Initiative, an online community led by emergency practitioners, seeks “to explore best practices and bridge social media in
emergency management”\(^{12}\) through the exchange of ideas and experience. In support of this community’s goals, SMEM volunteers maintain a website\(^{13}\) that acts as a central clearinghouse of information about the different initiatives, opportunities and collaborative efforts around social media in emergency services. Members of the SMEM community also host a weekly chat session over Twitter using the hashtag #SMEMChat. These sessions take place from 12:30-1:30pm EST every Friday and provide opportunities for emergency practitioners, researchers and other interested parties to collectively discuss issues surrounding social media use in emergency response.

A growing number of emergency response practitioners are also creating websites or blogs where they provide resources, advice, and opinions about incorporating social media into emergency management. IDisaster 2.0\(^{14}\), Crisis Comms Command Post\(^{15}\), Engaging Others\(^{16}\), and Think Disaster\(^{17}\) are all blogs that provide exemplary practices, information, and opinion about social media use in emergency management. The International Association of Chiefs of Police (IACP) launched its online Center for Social Media\(^{18}\) in October 2010. The goal of this website is to help law enforcement personnel incorporate social media into their agencies by providing information and resources. These are just a few examples of the growing number of blogs and websites available today.

While these online efforts offer important perspective and insight into the challenges and issues encountered when using social media in emergency management, much of the material

\(^{13}\) http://www.sm4em.org/  
\(^{14}\) http://idisaster.wordpress.com/  
\(^{15}\) http://crisiscommscp.blogspot.com  
\(^{16}\) http://www.engagingothers.com/  
\(^{17}\) http://thinkdisaster.com/  
\(^{18}\) http://www.iacpsocialmedia.org/
presented is opinion-based and anecdotal. It is not uncommon to see personal opinions and anecdotes used to support broad claims that are not necessarily true. The research conducted in this dissertation takes a different approach by seeking to ground findings in empirical data.

2.3.2 Technologist Efforts

A growing area called Emergency Management Information Systems (EMIS) supports the roles, responsibilities and tasks of emergency management through the development of technology (Turoff, 2002; Van de Walle, Turoff and Hiltz, 2010). EMIS examples include systems that support emergency training through computer-based simulations that replicate disaster conditions in a virtual world (Dugdale, Pavard, Pallamin, el Jed and Maugan, 2004; Dugdale, Bellamine-Ben Saoud, Pavard and Pallamin, 2010). Researchers have even extended these simulations to include decision-making computer-based games (Jain and McLean, 2005). Other EMIS research includes geographic information systems (GIS) that support crisis through the use of mapping techniques and software that recognize and leverage the geospatial qualities of disaster (Cai, Bolelli, MacEachren, Sharma, Fuhrmann and McNeese, 2004; Koua, MacEachren, Turton, Pezanowski, Tomaszewski and Frazier, 2010; Liu and Palen, 2010). Research has also been conducted to support the decision-making processes of emergency response personnel (Turoff, Chumer, Walle and Yao, 2004; Van de Walle and Turoff, 2008; White, 2010). In recent years, members of this EMIS are beginning to explore the use of social media to support emergency management practices (Tucker et al., 2012; Floch, Angermann, Jennings and Roddy, 2012).
The Information Systems for Crisis Response and Management (ISCRAM)\(^{19}\) Conference supports EMIS through research and development of ICT for disaster management. This conference provides a venue where emergency researchers, practitioners, and professionals can present ideas and collectively discuss the issues facing ICT design and use in crisis situations.

One limitation of EMIS is that efforts tend to focus on supporting the internal communication needs of emergency management organizations. What is often lacking is a broader perspective that considers the whole disaster arena including people and organizations affected by the disaster such as members of the public or the media. This dissertation research examines the communication interface between emergency response organizations and members of the public and builds EMIS to support it.

### 2.3.3 Researcher Efforts

Regarding social media use in emergency management response, the few research efforts that have been undertaken to date have focused on the practical aspects of using social media (e.g., best practices) and not the complex sociotechnical issues surrounding its adoption and use (Kingsley, 2010; White, 2011). While these are important contributions to the understanding and use of social media in emergency management, the research proposed here will push beyond applied research, offering theoretical understandings and contributions that are based on the sociotechnical disaster arena.

\(^{19}\) http://www.iscram.org
CHAPTER 3: PIO Interview Study

Understandings of the current work practices and concerns of PIOs are limited; therefore, I conducted an exploratory interview study of the PIO role—the results of which are presented in this chapter. The emphasis of this empirical research was on how PIOs perceive that ICTs (and more specifically social media) have affected their work. By providing contextual insight into the role of a PIO, findings from this study guide predictions of future PIO practice and inform ICT design efforts. The material presented in this chapter is a slightly extended version of a journal article by the author (Hughes and Palen, 2012)\textsuperscript{20}.

3.1 The Study

During the summer and fall of 2010, we\textsuperscript{21} conducted semi-structured phone interviews with 25 PIOs across the state of Colorado. The PIOs in this study have been trained to fill the “Public Information Officer” position in a NIMS organization. Each has also responded to emergency or disaster events in the capacity of a PIO. We recruited study participants from different organization types, jurisdiction types, and jurisdiction sizes (see Figure 3). Interview questions were open-ended and centered on understanding PIO work and learning how PIOs perceive ICT affects that work. Interviews were between 30-45 minutes in length.

\textsuperscript{20} To cite material from this chapter, please use:


\textsuperscript{21} This journal article from which this material draws was coauthored, and therefore the plural pronoun “we” appears throughout this chapter.
After transcribing the interview recordings, we organized and analyzed the interview data using the affinity diagram method (Beyer and Holtzblatt, 1997)—a inductive technique for organizing qualitative data. Using a virtual note program\textsuperscript{22}, we assigned each piece of interview data to its own note; a data point was a segment that expressed a single idea. Next, we engaged in an inductive reasoning process where we rearranged and grouped notes into “common issues and themes” (Beyer and Holtzblatt, 1997). We duplicated data points that belonged to multiple evolving categories. This analysis, the results of which we outline in the following sections, produced a portrait of PIO work.

### 3.2 The Work of a PIO

We begin our analysis with a narrative of everyday PIO work that serves to familiarize the reader with the PIO role. This narrative also provides insight into the different types of activities that PIOs perform and thus the activities that ICT design could support.

\textsuperscript{22} StickySorter is a program for writing and organizing digital sticky notes. It is developed by Microsoft and available at the following link: http://www.officelabs.com/projects/stickysorter/
3.2.1 Incident Response

Perhaps the most demanding PIO work occurs in incident management situations. When responding to an emergency, PIOs manage the members of the media who come to the scene to report on the incident. PIOs establish a safe location outside the perimeter of the event where the media can congregate. Keeping the media confined to this area, however, can be challenging:

*Some of the media like to wander around and you have to be careful with that. Most of the time you get lucky and they try to be respectful, but you get the occasional person that likes to try and sneak off (I8, 126)*.23

Here we see glimpses of the sometimes adversarial relationship PIOs have with the media (Wenger, 1985; Quarantelli, 1991). One PIO offers further insight:

*I can’t tell you how many times I’ve been on a scene and I’ve spoken with the media and I was misquoted. Sometimes it’s no big deal…other times it is a big deal. They misuse numbers and that sort of thing becomes very dangerous (I16, 251)*.

Some members of the media disregard the rules and regulations of emergency response to get their story. Even so, PIOs understand that the media are important in emergency work and arrange media staging areas for mutual accessibility. When the perimeter is far from the incident scene, PIOs will either escort the media closer once it is safe, or take video footage and photos to share.

In addition to handling these physical logistics, PIOs act as mediators between incident command and the media—providing status updates, press releases, and on-camera interviews. In this capacity, PIOs must decide what information to share or withhold:

*My responsibilities include getting the information out, but I have to make sure that I’m coordinated with our detectives or whoever is the scene commander. Because especially with law enforcement, just to use an example, if there was a murder or something like that, we want to make sure family members have been notified before I release a name, or*

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23 This quote was taken from a set of 25 PIO interviews. The notation used first indicates the interview number and is followed by the line number in the corresponding interview transcription where the quote appears.
if there is something unique, we don’t want to give away our evidence (I18,113).

At times PIOs expressed frustration when asked to share sensitive incident information with those who do not understand the regulations that bind them:

They [the media] want to know how many people are dead, how many people are injured and what is the extent of their injuries. Well I can’t tell you. I can tell you how many are deceased, but I can’t tell you the severity of the injury, the type of injury. All I can say is that it’s either life threatening or non life threatening and of course that just drives the media goofy. They want all the details (I16, 338).

Members of the media and public are not bound in the same way by these regulations, which can sometimes be problematic when they generate their own intelligence using digital means. Such actions challenge PIOs because they can neither confirm nor deny information generated by the public without permission from incident command. In interviews, PIOs felt frustrated that the NIMS structure can prevent participation in the rapidly evolving public conversation about an event.

In recent years, more PIOs take video footage and photos of emergency incident scenes with equipment bought expressly for that purpose. These videos and photos appear on websites or in social media streams; in addition, media representatives request use of these materials with greater frequency. Some PIOs find unexpected value in these materials as well:

We are finding that the photos that we are taking that are available to the media actually have some historical value to the sheriff’s office, that we are capturing that anyway. Before we used to do less of that. So now we are finding that some of these great photos that we are sending are becoming a part of our history, the sheriff’s office, that we get to keep. In the old days when it just used to be the photographer for the [local newspapers], or the video from the television, we didn’t always have pictures, copies of some of the things that were happening (I15, 176).

Opportunities to create, archive, and share experiences through video and photography allow PIOs to become “digital curators” for their organizations. Their curatorial role is what Liu (2010) calls the “preservationist,” one who carefully gathers, stores, and maintains a collection of digital materials and artifacts for historical value.
Often, incidents that an emergency organization responds to are small and do not require an on-the-scene PIO. In these cases, the PIO will handle any public information requests remotely. It is a judgment call made by the PIO as to whether they will come to a scene, but it is not always a simple decision to make:

*You just never know. I sat and listened to my radio when I first started and we got a call for ducks in a storm drain. And I thought, yeah I should probably go over there and take some pictures or whatever and then I thought to myself, no one is ever going to cover that. Sure enough it was a slow enough news day that one of the agencies called and said, “do you have any pictures of that by chance?’ The one time I decided not to go (112, 136).*

Fortunately there are usually other members of the incident command staff that can function as a PIO when necessary and they are called to act in that capacity when it is outside reasonable work hours and/or inconvenient for the PIO to come to the scene.

In larger disaster events where more coordination is needed, responders establish a Joint Information Center (JIC). The JIC is a physical, centralized location that includes staff from affected jurisdictions and agencies, government partners, private sector parties, and nongovernmental agencies. Together, JIC members coordinate and support communication needs as they respond to media and public inquiries, issue emergency public information, monitor the media, and control false rumor. Large events that require a JIC usually require many PIOs.

In the fall of 2010, the greater Denver Area experienced several large wildfires. The fire with the biggest impact, the Boulder Fourmile Canyon Fire, was upgraded to a Type I incident—the highest level of severity—and federal response teams were brought in to help with the fire. The JIC for this event had approximately eight PIOs working full-time. A large number of PIOs were required to break up public information responsibilities and to relieve others from working 24 hours a day for the duration of the wildfire. A challenging aspect of this disaster was handling
requests from the press; the story had reached international attention and PIOs received calls at all hours of the day regarding the fire’s status.

With advances in ICT, it is not required that the JIC be a physical location. One PIO created a virtual JIC in response to a small emergency incident that required interagency communication and coordination:

*It really is not much more than a glorified emailed distribution list. That’s really what a virtual JIC is. It’s a very targeted e-mail distribution that also includes cell phone numbers and other ways to contact folks...So we never came together...but we were communicating several times a day there for several days and it was very effective (I6, 79).*

In addition to serving as a PIO for their own organization, some PIOs belong to federal organizations where they may serve on a larger incident response and/or deploy elsewhere in the country. Federal emergency response teams enlist highly trained members from other organizations and usually serve on a rotational basis. When these federal teams respond to an event, the members’ positions on the emergency team take precedence over regular work assignments. Events that our participants reported responding to include the attacks on the World Trade Center in 2001 and Hurricane Katrina in 2005. Large events like these require many JICs configured in a hierarchical system distributed across the disaster area.

### 3.2.2 Jurisdiction Size and Other Job Responsibilities

Larger urban areas usually have one or more full-time PIO(s) because the number of events they respond to justifies the extra staff. If an organization has more than one PIO, the PIOs rotate their on-call shifts to avoid “burn-out.” These larger jurisdictions also tend to use ICT more frequently and have more resources dedicated to ICT support. In contrast, most rural areas have only one PIO who is often part-time. Duties of a PIO in a rural area are typically less demanding and therefore these PIOs usually serve in other jobs capacities simultaneously.
No PIO constantly responds to incidents, even in large jurisdictions, so when PIOs are not on incident duty they have other responsibilities that vary from organization to organization. Outreach activities such as running awareness campaigns or organizing public safety events fall under the purview of some PIOs. Still others write stories for local papers, speeches for their leaders, or publicity materials such as flyers or brochures for their agency. In many organizations PIOs also maintain websites and social media streams. Their job is similar to a more traditional public relations position because they engage in public-facing communications (Motschall and Cao 2002).

In smaller jurisdictions where PIO work is not in regular demand, duties may also include tasks unrelated to public relations: administrative tasks, such as payroll or secretarial work, or other emergency response duties, such as crime scene investigator.

With the many responsibilities placed on PIOs, some find the multi-task nature of their jobs challenging:

I am a one man shop. I have no one else to help me... I try to figure out what’s important to me, what’s important to the department, what’s important to my bosses and then balancing those things and making them all work. That is the biggest problem that I have (I12, 188).

The largest complaint by the PIOs interviewed was that they lacked sufficient time and resources to complete all the duties they are expected to perform.

### 3.2.3 Career Development

In many law enforcement agencies and fire departments a member of the organization will be rotated into a PIO position for a period of roughly 3-5 years, depending on the organization. While this type of system offers opportunities for personal and professional growth, it also presents training issues because by the time the PIO becomes effective in their position they are rotated out again.
In other organizations the PIO position is filled by someone outside the organization, who most often has a media or public relations background. Two studies (Surette and Richard, 1995; Surette, 2001) looked at differences between civilian and sworn members of two PIO associations and found that civilian PIOs were notably more satisfied with their work than sworn PIOs, a fact that they ascribed to education and job familiarity.

While it may not be true in all organizations, the position of PIO seems to be respected by the members of the organization. Interviewees described either being handpicked or selected after applying for the position and passing a rigorous testing process:

*I was actually approached by staff in the police department to put in for the PIO. It was not in my career path, but at some point I finally went, OK, I’m seeing that the people who are coming out of public information unit are getting promoted. And so obviously there’s something about being a PIO that is respected that is giving people some polish and shine that I hadn’t really taken the time to notice (I15, 22).*

### 3.2.4 Training

All PIOs receive training in NIMS including additional training for the role of PIO. Classes are taught at the federal level at the FEMA training facility in Emmitsburg, MD, as well as the state level. In Colorado, PIOs additionally take a course in information sharing regulations that specify what information can and cannot be shared with the public. PIOs also have instruction specialized to their fields. For example, PIOs in fire departments receive training that is specific to fire hazards.

Furthermore, PIO work, like much emergency management, involves on-the-job training:

*A lot of times it’s trial by fire, you realize looking back, hindsight, I should have done this, this and this. So you take those teachable moments and hopefully carry them on to the next incident (I4, 226).*

Because so much of their work is learned on-the-job and events are unpredictable in what they demand of personnel, PIOs rely on other PIOs for help. They find it crucial to establish a network of trusted relationships with fellow PIOs:
All those PIOs...that responded to that scene, we just meshed so well, we knew each other, we knew each other’s preferences, we knew what bugged each other, we knew how to work together. It’s having your colleagues come in at a moment’s notice and know that you can trust their skills and abilities to back you up (I2, 362).

Networks like these let novice PIOs consult with a more experienced PIO when they have a problem or issue they don’t know how to handle.

PIOs also engage in training exercises with their peer networks that focus on using the systems required for a larger event. Because larger events rarely happen it is hard to have operational knowledge of these systems in place. Consequently, PIOs practice by using these systems for smaller events:

We look for opportunities to try and go ahead and utilize the joint information system that we have in place, even on those smaller things, because it does help to keep us fresh on all that. Then if something big happened, it will all seem a little more routine (I6, 72).

Similarly, PIO organizations train their members by conducting table top exercises or larger mock emergency responses. For example, several PIOs interviewed were going to participate in a mock exercise; they planned to simulate a multiple-fatality plane crash on the border between two counties. The exercise would test coordination as they worked together across county lines to handle the situation.

3.3 Challenges in PIO Work

Interviews highlighted several challenges faced by PIOs due to the nature of their work.

3.3.1 Negotiating Personal and Professional Boundaries

Emergency PIOs are typically on call 24/7 and as a result must live in a state of constant vigilance to their pagers or cell phones. Their work as a PIO becomes a part of who they are because it is hard to separate their professional life from their personal life and pervasive technologies have only exacerbated the problem:

The lines between personal and work have blurred a lot more...we’re on call 24 hours a
day and so, if I get a text message or an email from somebody at 8 o’clock at night, I just go ahead and respond to it. I guess in the past it would be ok to say we’l wait until the work day and deal with it then. But if I can deal with it at 8 at night, then I do. So, I feel like I’m doing work at home, so sometimes I’m doing personal things at work (I1, 455).

In this account, the cell phone operates as a boundary object, tying the PIO to home when they are at work and to work when they are at home (Nippert-Eng, 1996). It seems the only way to break this connection is to leave the cell phone or pager at home, or turn it off, which is what one PIO did when he took his kids swimming one afternoon. However, even in this case the PIO was still tied to his job because he had to inform management that he was at the pool and that he would be unreachable for some time.

The adoption of social media into official job responsibilities brings into question how employees use social media during their personal time. Most PIOs are funded by tax dollars which makes them accountable to the public and it is not hard to find examples of public officials who have been fired over social media faux pas (Maiman, 2009; Smith Horn, 2010; Jones, 2012). Many emergency response organizations are struggling with how to prevent their employees’ personal online activities from reflecting negatively on those same employees’ professional duties. One Colorado police department issued a policy regarding social media use by its officers in January of 2011 that some say is too extreme. The policy forbids their employees from identifying themselves as officers in any way on their personal social media accounts, whether it is posting pictures in uniform or displaying department “patches, emblems, equipment or property” (Bonham, 2011).

For PIOs this blurring of personal and work boundaries can become too much and some choose to leave the position:

*What usually comes in to play is the fact that you are attached to the pager, so that kind of drives the train a little bit... It’s just because at some point you are just like, ok I’m done being on the pager, I don’t want to play anymore (I22, 19).*
When designing ICT for PIOs, features that help PIOs separate their personal and work life (if this is something they want to do) should be considered.

3.3.2 Establishing and Maintaining Credibility

An important part of a PIO’s job is to establish credibility and trust with stakeholders. One PIO states:

*The only thing I have that keeps me employed is my credibility, and once I lose that I’m screwed (I2, 379).*

PIOs want to communicate in a way that portrays both them and the organization they work for as reliable information sources but establishing and maintaining trust can be challenging in today’s world:

*You have the media and you have reporters but honestly anyone who has a computer or a cell phone is a reporter these days so keeping the credibility of where information is coming out of and from what resource needs to be communicated (I14, 300).*

ICT features that help PIOs both determine and disseminate the credibility of information sources could be helpful.

3.4 Social Media in PIO Work

Though the majority of participants—20 of the 25—report using at least one form of social media in their emergency communications, the road to regular, formalized use is still rocky. One PIO describes the difficulties she has experienced when trying to get approval from her organization:

*Most fire department and police agencies have shied away from using social media. Just because it’s government, most agencies don’t feel comfortable going in to those areas and we’re usually slower, versus like a public entity, or a private entity, so we’ve really taken baby steps to try and alleviate the fears of our chief and our board of directors, that this is not something that will backfire in our faces (I4, 78).*

Of the five participants who do not use social media, two have gone as far as creating
Twitter and Facebook accounts. The last three participants have not engaged in social media in any fashion and have no intention of beginning in the near future:

> It's a combination of several thing. One, time. That's one more data entry point we have to do, where as I can do a telephonic interview with the media and get it done quickly, I can do press releases or [another PIO] can to get the word out. We need to be kind of light on our feet. We don't have the time or resources to twitter and Facebook and all that stuff (I16, 82).

### 3.4.1 New Communication Opportunities

Two PIOs explicitly report—though several others imply—that using tools such as Twitter or Facebook to send incident updates reduces the number of inquiries from the media and others. Directing the media and the public to a website seems to also reduce the number of phone calls to information hotlines.

Social media also create new opportunities for PIOs to distribute press materials and incident information straight to the public (Latonero and Shklovski, 2011):

> It [social media] has affected our ability to do our job and I'd probably say more in a good way. Because public information first, especially in emergencies, you want to get that information out in the quickest most efficient manner possible. And when you are sending out reverse 911 calls and telling people to evacuate, you want to be able to send them to a website or send them somewhere where they can get what the next step is, what that next information is. In the old days before the Internet, you couldn’t do that. You were so reliant upon the media to communicate your message for you, that anymore they supplement it, but you don’t have to rely on them. It’s very, very different (I2, 383).

Social media create a significant shift in PIOs’ ability to speak directly to the public without involving traditional media streams, opening up new communication pathways (Palen and Liu, 2007) and possibilities.

### 3.4.2 The Public

Another role that has experienced change due to social media advances is that of the public in emergency response. Citizens are the true “first responders “ (Dynes, 1970; Tierney and Quarantelli, 1989; Aguirre, 1993; Fischer III, 1998) as they are the first people on the scene of an
incident and often begin to coordinate and improvise relief efforts before emergency responders arrive (Fritz and Mathewson, 1957; Kendra and Wachtendorf, 2003a; Kendra and Wachtendorf, 2003b). These first responder citizens, equipped with digital devices, can now break the news about events and become first *reporters* as well. For example, when a failing plane landed on the Hudson River in February of 2009, initial reports from the scene came from a flight passenger who posted a picture on Twitter using his camera phone (Beaumont, 2009).

Part of PIO work is to monitor and control the message that is released to the public which can be challenging when citizens can more directly contribute to crisis communication:

*That is always a big topic of discussion within the PIO group because before Twitter and Facebook and all of that kind of stuff, PIOs were able to really manage the message. You know this is before someone can actually come to the scene, take a picture on their phone and put it on their Facebook (I20, 94).*

One PIO described citizen reporting during an emergency or disaster as “Totally annoying!” (I2, 212) mostly because uninformed people, though well-meaning, can propagate misinformation.

She explains:

*You get their perspective and I think you have to pay attention to it but in some ways they don’t know strategy and tactics for putting out fire. They don’t know why we don’t have water on a fire at this point. They don’t understand the hazmat situation, so a lot of misinformation gets out from people that think that they are helping (I2, 213).*

PIOs want to know what information members of the public report so they can incorporate it into response efforts or correct it if needed:

*When we have a huge incident … one of the things I had my PIO back in the office do was monitor the social networking sites … We got suspect information. We had information. I would then send the information to the people on scene, to my PIOs on scene, so that we say, ‘Here is what’s being reported on Facebook,’” and those people could then address it there quickly. In some ways it gives us a chance to more quickly correct misinformation and get the right stuff out there (I2, 280).*

PIOs must have strategies in place to address incorrect or outdated information. However, as PIOs begin to actively monitor social media streams and other citizen reporting venues, they
often discover that citizen reports can also provide important and relevant information (Latonero and Shklovski, 2011).

### 3.4.3 Lack of Time & Resources

Many PIOs want to spend more time developing social media capabilities for their organization but they lack the required time:

*It’s largely because I’m a one person show. If there were two PIOs for this department, that would make complete sense. One person is doing the written stuff, while the other person is dealing with the physical reality of corralling media, doing interviews, doing that part. But there’s only one of me and I’ve got to do that part first, because that is the most critical. Because we all know that if I don’t give the interview, they’re going to find a looky-loo [a bystander] person crying and that’s not what we want out. The realities are, social media will always be bumped second, for me as a single PIO (I7, 80).*

Even the PIOs who have incorporated social media into their work find it demanding to maintain and devote appropriate attention to all the different forms of communication. Adding social media to their responsibilities means there are more communication channels demanding their attention:

*You have to consider all of these different forms of communication and it can really tax a PIO, to think about the website to think about the press release, think about Twitter, think about Facebook. There are lots of forms of communication to get the message out. Sometimes it’s better to have one location for everyone to go to, instead of 5 locations that you have to feed in the middle of an incident (I15, 201).*

Some PIOs get frustrated by their inability to devote the time that working on social media technologies require. They want to investigate it but feel that there is a large learning curve. Also, if they are committing themselves to social media technology they want to be sure that they use it regularly and consistently; they do not want to build an expectation of social media use and not maintain it.

*Other PIOs feel that they are not using social media accounts properly:*

*It has been fairly inactive, which I know is not the way it’s supposed to be used. And that is primarily my fault, because I know the technology allows me to be on my cell phone*
and laptop computer. But to be honest with you in the thick of it they usually don’t have the time to sit there and do it (I7, 74).

In interviews we found that PIOs (especially those not actively using social media) frequently misunderstood the affordances of social media technology, and tended to overestimate. Several of the PIOs interviewed expressed that social media could likely solve many of their communication problems if only they knew how to use it properly.

3.4.4 Information Overload

PIOs sometimes struggle with retrieving and making sense of the crisis information available on the Internet:

New online ways of getting, receiving and organizing all that information and trying to prioritize it, and in an emergency response, that is one of the primary things that we’re doing. You have to triage the information because it can be so overwhelming. Maybe that’s the next battlefield, is how you take all that and make sense of it (I6, 229).

With social media, PIOs are unsure where to look for answers because information changes so rapidly and there is so much information available. This uncertainty can be troubling to a PIO when their job is to make sure they know everything that is happening in the public arena.

3.5 Changes in Traditional Media

Traditional media plays an important role in emergency communication by covering the status of disaster incidents and sharing important messages with the public (Quarantelli, 1989; Miletii and Fitzpatrick, 1992). However, with new types of ICT, traditional print and broadcast media are decreasing in demand, and are therefore suffering from major cutbacks and staff shortages (Picard, 2006; Lowrey et al., 2007; Reinardy, 2011).

Nearly all PIOs interviewed see significant changes in their relationship with the media. In past years, full reporting crews from all the local news outlets came to most major incidents, but now reporting crews are smaller, if they come at all. Instead of sending a multi-person crew,
one person might perform all duties. Moreover, greater instances of pooling and sharing resources occur. One metro area, for example, shares a helicopter between several television stations. A PIO describes these changes:

_We got one camera and it was for all five stations, it was the pool camera for the day. And that is a new experience with us that we see one camera, because we are used to seeing five. And it was one pool camera that was chosen to share that footage with all five stations. And it ended up on three of the five stations, so not everyone used it, but three of them did. Times have changed (I15, 167)._

Consequently, members of the media are far more aggressive when trying to obtain information from PIOs than in previous years:

_They are begging us, send us pictures from your scene, send us video footage, take pictures with your camera, yourself on camera, we don’t care. Why? It’s quick. They don’t have to send someone out here. Again, it’s all about money and how they can spread their people (I5, 224)._

One PIO feels as if she has become a reporter, which comes with its own advantages and disadvantages:

_That can work for you or against you, you have a lot more control about the message that is put out, the footage that ends up out there, but on the other hand it’s one more thing. That can be a lot of work on our end (I5, 232)._

While it can be argued that PIOs have always acted the part of a reporter in some ways, it has never happened to this degree before.

News media compete to get a story first, and in a digital age where stories can be scooped by citizens with cell phones, the media must release information more quickly. One PIO, expressing frustration with newspaper reporters, said that previously newspapers had one reporter dedicated to a beat who understood its issues and intricacies. Now that reporters have many beats and tighter deadline constraints, they take shortcuts:

_It’s so much easier for them to go online and pull a quote from a press release than it is to actually call someone. And I understand that, I understand they are overtaxed, but that has been a huge challenge (I20, 163)._

Further, the high rate of turnover in the media complicates matters of trust and mutual
understanding. Before, PIOs often developed close, trusting relationships with members of the media, but now such relationships are difficult to establish when staffing changes regularly.

The media also acquire more of their material from members of the public, fueled by the rise of the “citizen journalist” (Gillmor, 2006):

*I see it almost every day when I watch the news now, some PIO has sent a picture, or some citizen, they are now relying on citizens to take pictures of what they are seeing. They are putting cell phone photos on television and they are crappy photos. Which is a bit of a shame...I get frustrated when they accept photos from citizens. But then again, I guess they are just doing their job (I15, 186).*

3.6 Discussion

PIO work practice is changing in significant ways. Social media expand not only the scope and type of PIO activity, but also the information relationships or “pathways” that exist between PIOs, the media, and members of the public (Palen and Liu, 2007). We model these changes and present a view of how PIO work could be better imagined for the future of emergency management.

3.6.1 New and Changing Communication Pathways

An “officer of information,” as we think of it, must maintain communication links with their stakeholders. The classic rendering of PIO work depicts information moving from the PIO to the media, with the media then distributing that information to the public. Today, PIOs find that with social media they can distribute information directly to the public, effectively bypassing the media (Latonero and Shklovski, 2011). This distribution channel grants new control of the outgoing message, though retransmission by the public via social media gives that message a life that may persist after the message is no longer accurate.

The media—in their own struggles with this new information environment—are pushing the information-gathering component of reporting to PIOs and members of the public, which
puts greater demand on PIO resources. Often the media are dependent on PIOs for event coverage because they lack the resources to cover the event themselves. Moreover, new expectations from the media to provide in-depth information place further strain on the public information function of emergency response agencies.

Figure 4: PIO Communication Model

Figure 4 presents a new model of current PIO communication that depicts PIOs, the media, and members of the public as separate entities that bi-directionally communicate and affect one another. This model adapts and improves upon two prior models (Palen et al., 2010; Pechta, Brandenburg and Seeger, 2010). The first model presented a macro-level view of communication interfaces between emergency response organizations and the public (Palen et al., 2010) and offers improvement over classic models that depict communication between emergency management organizations and the public to be one-way. The model by Palen et al. adds a new communication pathway—enabled by recent forms of ICT—leading from the public to emergency response organizations, but this model does not explicitly consider the role the media might play. The second model recognized two-way communication channels that are
enabled by ICT, but combines the media and the public as one entity (Pechta, Brandenburg and Seeger, 2010).

In our model, we identify the media as a separate entity because their behaviors distinguish them from the public or PIOs. The media are sometimes analytically overlooked as actors that influence PIO work; however, this research demonstrates that the media do affect PIO work with respect to the pressures to compensate for a lack of resources in the news media industry. The actors and interactions defined in this new model of PIO communication can shape PIO work and therefore need consideration when designing new processes or divisions of labor for PIOs.

3.6.2 The Shifting Perception of PIO Work

Though social media add new communication channels and relationships to PIO work practice, much of that practice remains the same. PIOs still ensure that accurate and timely information concerning an emergency event reaches the public. The change we draw attention to here involves the perceptions of PIO work held by emergency management organizations as well as PIOs themselves.

In our research, we see evidence that the perception of the PIO role is shifting from that of a gatekeeper to a translator. A gatekeeper is one who manages or constrains the flow of knowledge or information. In the past, the communications that PIOs engaged in were primarily characterized as being one-way (though in practice the communication relationships were far more complicated) where PIOs acted as gatekeepers for emergency management organizations. This role is clearly changing: critically, prior misperceptions are being updated and corrected. As discussed in previous sections, the relationships PIOs have with other members of the emergency response milieu are increasingly complex, and involve multi-way, multi-party communication
vis-à-vis the public. In addition, PIOs realize that their control in the sense of “gatekeeping” the emergency information space has diminished because members of the public and the media can play more active roles using ICT.

A translator, on the other hand, is one who takes information and transforms it into another format so that it can be better understood by others. PIOs translate the information emergency response organizations share with the public—deciding what information to release or withhold, and how to portray that information. To do this, PIOs must be highly skilled so that they can distribute information effectively, efficiently, and accurately. PIOs must also translate information into a format that is useful for their internal organization. In emergency management, these tasks typically include monitoring the public arena during an emergency to determine what information is circulating, watching/reading media accounts of an event, and, more recently, monitoring online resources for information from the public.

Unlike the gatekeeper, the translator role recognizes the specialized knowledge required of PIOs to understand the needs and languages of their stakeholders. More visible technology-mediated interactions between PIOs and the public will continue to debunk the mischaracterization of passive information transmitters. With changing perceptions from within the institution and technology-abetted changes outside the institution, we see early evidence that PIOs perceive greater autonomy surrounding their work. In a PIO participatory design workshop (Greenbaum and Kyng, 1991; Muller and Druin, 2012) conducted by the authors in September 2011 (see Chapter 4), one PIO offered this observation:

*Well we’ve seen a dramatic turn around. The incident commander, who was the one that came down on us from day one and said “don’t release a single piece of information,” now comes to our meetings and asks, “how do I get my volunteer fire department on your Twitter account?” He has completely turned around. He was our adversary one year ago, but now is very much a believer because I think he felt the pressure from his citizens.*

For some, the ability to work with social media is starting to be recognized as a valuable skill set
by their colleagues, and is focusing new attention on what the “public information officer” role is meant to encompass.

### 3.6.3 Rethinking the Office of Public Information

Changing perceptions of the PIO role from gatekeeper to translator represent a significant shift in how emergency information is conceptualized. In addition, the title of the job role is confusing given changes in information accessibility. The “public information” office could be interpreted as “serving the public through provision of information” or “managing the information that is public.”; both are intended, which is problematic as information distributed within and generated from the public may simultaneously fall into the categories of “public” and “privileged.” Not only is the value of qualifying information as “public” questionable, but so is the meaning of serving the public when the PIO role lacks all the institutional imperatives to do so in today’s changing information climate.

The future of emergency management offers opportunities for rethinking the PIO role. One possibility is to redefine the PIO role to include resources (time, training, personnel) for an expanded set of tasks. However, such redefinition will need to happen continuously as the state of the art continues to change, and this frequent re-examination is likely unsustainable. An alternative, and one we advocate, is the decentralization of the ever-increasing job functions into other parts of the institution while simultaneously refocusing PIO responsibilities on the informational front line. We imagine the PIO role retaining public relations duties such as disseminating information to the public and responding to information requests made to emergency response organizations—tasks which require the specialized knowledge of a PIO. However, many newly emerging tasks (enabled by ICT) are candidates for redistribution—those which are often categorized as PIO responsibilities simply because they involve information
perceived as “public.” These tasks include monitoring social media for relevant and useful emergency information, as well as analyzing that information. We propose conceptualizing these as distinct and specialized tasks so they can be handled elsewhere within the emergency management institution. Other typical PIO job functions better understood as tasks that require new specializations include documenting emergency incidents (through video, photos, and online communications); identifying rumor and false information online; and coordinating and communicating with spontaneous digital volunteers (Starbird and Palen, 2011). When parsing PIO job functions into finer specializations and distributing it to other parts of emergency operations, the challenge is to organize the resulting decentralized activity into coherent, coordinated work.24

3.7 Conclusion

The study described in this chapter sought to understand how the introduction of social media affects the work of public information officers as the front-line personnel who interact with the public. Through their use of social media, members of the public have a changed relationship to the institution of emergency response. The public’s production of information may be relevant to responders: their communications will sometimes have value as data—as long as those data can be effectively received and interpreted. In addition, the speed and reach of social media communications create new demand and expectations by the public for frequent

24 A possible outcome is that with the careful articulation of these duties as distinct tasks, we could create technological solutions that better support them over time. Once the state of the art adequately supports these features of emergency work, distribution of these tasks across the emergency organization would need consideration once again.
crisis communications. These demands exert pressures on emergency responders to find ways to both receive and filter a great number of incoming communications, and to participate in ongoing social media-based conversations in the public sphere. In no place in emergency management are these pushes and pulls more intensely felt than in the public information officer branch. The composition of PIO work has changed in reaction to these new demands, and our examination of the challenges facing PIOs reveals paths toward innovation, both technological and institutional.

The institution of emergency management has the capacity to develop new literacies with emergent ICT. The ongoing challenge will be to ensure that policies and organizational arrangements keep pace with the ever-advancing technological abilities of its internal members and external constituents.
CHAPTER 4: PIO Participatory Design Workshop

In this chapter, I discuss the design, execution, and results of a participatory design (PD) workshop with PIOs which was based on the results of the PIO interview study (Chapter 3). The interview study revealed the many different types of PIOs in emergency management and consequently, for the workshop I recruited PIOs that represented these different types. The interview study conducted in Chapter 3 also helped shape the content of the workshop and the design problems that we addressed, as discussed later in this chapter.

During the workshop PIOs and I explored ideas and tools for supporting PIO work and I found that PIO attitudes toward social media were changing from those expressed in the interview study (conducted a year earlier) as they learned to incorporate activities of the public into their work, yet they still struggled with issues of trust, and liability. Workshop activities also revealed key technology needs for supporting PIO work practice such as the ability to monitor, document, and report social media activity.

4.1 Participatory Design Workshops

To build technologies that would address the needs of PIOs and directly involve them in the design process, I conducted a workshop based on PD methods (Greenbaum and Kyng, 1991; Muller and Druin, 2012). The workshop is a type of future workshop (Kensing and Madsen, 1991; Bødker, Kensing and Simonsen, 2004)—a technique for gathering researchers and end-users together to collaboratively create new ideas and solutions. Originally developed for use in German civic planning, future workshops (Jungk and Mullert, 1987) were designed to give groups of citizens with limited resources a role in the decision-making process. Future workshops are typically composed of three parts: discussion of existing problems, envisioning
the future, and making an action plan (Muller and Druin, 2012).

The PD workshop involved PIOs in the design process through discussion and prototyping which allowed them to emphasize what was important to them and their work practice. Even experts who reflect on their work find it difficult to envision how they might use new technologies—a known issue with involving participants in design (Beyer and Holtzblatt, 1997, 32). Through this workshop researchers guided PIOs through the technology design process, allowing the PIOs to interpret, participate, and contribute. Together, researchers and PIOs collaboratively reached consensus on technology features that could benefit future PIO practice.

4.2 Research Design

The goal of the PD workshop with PIOs was to co-design technology requirements that would provide improvement over current PIO work practice. Requirements identified during the workshop were then carried forward to the next phase of my research (Chapter 5) where I built prototypes based on them.

Since a wide variety of methods and protocols exist for conducting PD workshops (Bødker, Kensing and Simonsen, 2004; Muller and Druin, 2012), I was unsure which would work best for my research questions and objectives. Furthermore, research indicates that this type of workshop requires much planning, preparation, and practice to be successful (Beyer and Holtzblatt, 1997; Bødker, Kensing and Simonsen, 2004). Thus, to prepare for the PD workshop with PIOs, I conducted two pilot studies to test the protocol and resolve technical and logistical difficulties. In this section, I briefly describe these two pilot studies, followed by an explanation of the final PIO PD workshop design.
4.2.1 Pilot Study 1

To begin trialing methods for the PD workshop with PIOs, I conducted my first pilot study in June 2011 using a “design-by-playing” approach (Ehn, 1990). I crafted a card game in which players—six undergraduate students pretending to be PIOs—imagined themselves responding to a future wildfire that was modeled after a real event: the Boulder Four Mile Fire—a large, local wildfire that took place in September of 2010. The game consisted of ten playing cards (see Appendix A); each card depicted a scenario that had occurred during the Boulder Four Mile Fire that might use social media or benefit from its use (example cards are shown in Figure 5). Players sat around a table and took turns choosing a scenario card. Each player reacted to the scenario listed on his/her card by describing the physical actions s/he would take and the technology s/he would use or create to address the scenario. The game took two hours to complete.

Several concerned citizens have called into dispatch reporting the activities of a Twitter account spreading false and damaging information.

Several map mashups have been created surrounding this event. How would you evaluate the accuracy and effectiveness of such a tool?

Figure 5: Example Game Scenario Cards Used in Pilot Study 1

4.2.1.1 Workshop Protocol Adjustments

Results from this pilot called for significant redesign of my workshop protocol. During the pilot study the players became so grounded in what had happened during the Four Mile Fire (the event upon which the game scenario was based) that it was difficult for them to imagine how a similar event might play out in the future. I theorized that creating a unique emergency
event not closely tied to an actual emergency would be best so that participants could focus on this new event and not be distracted by a past event.

Using a game to spawn technology ideas and designs failed to produce tangible results. I wanted players to discuss and design technology for the scenarios, yet players often misunderstood the scenarios. When asked to design technology, they were confused about where to begin. The best design ideas I could extract from the results of this pilot study protocol were vague, verbal descriptions of future technology. Thus, I discarded the game concept in favor of other methods which I explored in my second pilot study.

4.2.2 Pilot Study 2

The second pilot study was held in July of 2011 and lasted four hours (for a detailed schedule see Appendix B). Participants for this pilot study were seven lab colleagues who pretended to be PIOs while they also observed as researchers. These colleagues understood the role of the PIO much better than the participants in the first pilot study because their research lies in the emergency domain. The pilot study served as an opportunity for these colleagues to familiarize themselves with the PD format and to understand how they could help conduct the final workshop with PIOs.

The first pilot study failed to engage participants in the design process and produce prototypes that I could implement and test. To remedy this problem, I turned to the PICTIVE method (Muller, 1992; Muller, Tudor, Wildman, White, Root, Dayton, Carr, Diekmann and Dykstra-Erickson, 1995). PICTIVE is a PD method that asks users to build low-fidelity

25 Sophia Liu, Casey McTaggart, Grace Muzny, Leysia Palen, Aleksandra Sarcevic, Aaron Schram, and Sarah Vieweg
26 Plastic Interface for Collaborative Technology Initiative through Video Exploration
prototypes for addressing their user interface concerns. These prototypes are constructed using paper and other office supplies—pens, pencils, tape, scissors, markers, Post-Its, etc. While serving as design artifacts that can be referred to and built upon, PICTIVE prototypes can also be used as conversation pieces to analyze user thoughts and needs. Objectives and outcomes of this method aligned with my workshop. Therefore, the second pilot study included two design sessions—an individual and a group session—that would test the PICTIVE method for the PIO workshop.

The second pilot study opened with a brief introduction followed by a brainstorming activity to get participants immersed in the problem space. For this study, I asked participants to think about how they use Twitter and what they expect from the technology, especially concerning its use in emergency management. On a large whiteboard I wrote participant answers so that everyone could refer to them throughout the study.

After the brainstorming session, each participant created a PICTIVE prototype of a Twitter interface that could be used during an emergency event. Before beginning their design, participants asked a few clarifying questions about the PICTIVE method and what was expected of them. Participants used a variety of Post-It notes, markers, and pencils when designing their prototypes (as seen in Figure 6). Upon finishing the design session, each participant took a turn standing before the group to explain his/her prototype. These explanations were instructive as no two designs were alike. Often someone would describe a feature of his/her prototype, such as the ability to display tweets graphically, and the others would agree that this was a feature they wanted to have. This design activity set the stage for the next session where participants would work together to improve these designs.
Next, the six participants divided into two groups and collaborated on a PICTIVE prototype—one that would combine ideas from the individual design activity. In each group one person emerged as the scribe; this person constructed the prototype while the other group members looked on. The other members were not passive, however, they offered ideas and were consulted about design elements. When the design session was done, each group shared its design with the other group.

During the group design activity, the original plan to have participants test their group prototypes using a scenario no longer appeared valid because everyone was tired after a long design session. Instead, we listed the features of the designs the participants created on the whiteboard and assigned each feature a priority.

4.2.2.1 Workshop Protocol Adjustments

This second pilot study yielded better research results than the first (i.e., insightful discussion and tangible design artifacts) and I would carry forward most of the elements to the final workshop. However, I also identified areas of improvement. First, participants asked many questions about the PICTIVE design sessions: What platform are we designing for? Are we confined to currently existing technology? How should a prototype look? This participant
feedback demonstrated a need to assemble more descriptive instruction sheets for the participants and provide more clarity when explaining design expectations.

While some sessions stayed on schedule, others did not and would require adjustment. For instance, participants agreed that the 30 minutes allowed for the PICTIVE design sessions were appropriate—some finished a little early, a few rushed at the end. In contrast, participants felt the brainstorming activity was too brief; they wanted more time to think about and discuss their experiences with Twitter before jumping into a design activity. Moreover, at times it was difficult to stay on schedule because participants were reluctant to stop a productive session so that we could proceed to the next activity. The final workshop schedule would need to assign appropriate times to each session and build in slack time, especially around those sessions most likely to exceed time limits.

Finally, this pilot study highlighted the need for many facilitators to help the final workshop run smoothly. Some of these roles include: note-takers, a videographer to position and operate the video equipment, and a table housekeeper to tidy the PICTIVE materials after each design session.

4.2.3 Participatory Design PIO Workshop

I conducted the final PD workshop with PIOs in September of 2011. The workshop was a full-day event located in the project EPIC\textsuperscript{27} lab space on the University of Colorado Boulder campus. Workshop activities began at 10am and continued until 3pm with lunch provided. The following sections provide an overview of the workshop design (for the detailed workshop plan document see Appendix C).

\textsuperscript{27}http://epic.cs.colorado.edu
4.2.3.1 Participants

Eight PIOs were recruited from those who participated in the interview phase of this research. PIO attendees represented a range of organizations and jurisdictions. Also, I wanted to avoid spending workshop time explaining what social media were, what they are capable of, and how they might be used in emergency response; thus I selected these participants based on their familiarity and proficiency with social media. Each participant PIO signed a consent form (see Appendix D) before the workshop began.

4.2.3.2 Agenda

The workshop design included four activities: an information management discussion, an individual PICTIVE design session, a group PICTIVE design session, and an idea brainstorming activity.

First on the workshop agenda was a discussion of PIO information management practice; the goal of this discussion was to understand how these particular PIO participants used social media in their work, what their main concerns or challenges were, and what support they felt they needed. This discussion took place in a casual environment that encouraged participation—a circle of chairs opening to a whiteboard (see Figure 7). I began by outlining the results of my PIO interview study (see Chapter 3). While I reported these results, participants agreed with interpretations of their changing role and offered specific examples to demonstrate their
agreement. Next, I reviewed a list of resources (see Appendix F) for using social media in emergency. We then transitioned into discussing the PIO information space—the data they work with and the challenges they encounter. PIOs expounded upon the experiences they have had with social media as they engage with members of the public. Designated scribes captured the conversation points on the whiteboard.

Next, the individual PICTIVE design session gave workshop PIOs an opportunity to apply insights from the prior discussion and externalize their information needs through design; the physical prototypes created would guide my future research, prototype design, and implementation. For this session, participants converged around a large table with prototype construction materials—paper, tape, scissors, pen, glue, markers—distributed across the workspace. After outlining the PICTIVE process, I showed them two examples from the prototypes created during the second pilot study, but I did not explain these examples in-depth to avoid influencing their prototype designs. I clarified that PIOs should work individually to design their information spaces and that there were no rules regarding how their prototypes should look. The design could be for any number of platforms: a mobile device, a computer screen, or a tablet device. Most participants started prototyping immediately (see Figure 8), while a few needed time to collect their thoughts. PIOs worked on their prototypes for half an hour, after which each stood before the group and described his/her design; all but one PIO completed and presented a prototype (she had to leave to attend to other commitments). As the participants explained their prototype design, researchers and other PIO participants asked questions and provided comments. Photos of the seven prototypes produced during this session appear in Appendix E.
For the following session, participants split into two groups and worked on a design idea to prototype. The goal of this session was to have the PIOs work together and explore prototype ideas (based on the PIO interview study in Chapter 3) that might be candidates for useful tools.

These informed prototype ideas were developed and selected to solicit prototype designs from PIOs that they may not have developed on their own (they are not technology designers). Members of the first group designed a social media communication tool for distributing the messages they send as a PIO during an emergency event. This group finished in the time allotted with a completed prototype. Group two designed a social media tool for using members of the public to crowdsource emergency information. Having a very different experience from the first, the second group never completed its prototype because the session time was mostly spent understanding the design idea and discussing concerns. When the two group design sessions completed, we met together to review each group’s prototype. The two prototype designs can be seen in Appendix E.
Lastly, throughout the workshop, both PIOs and researchers jotted down ideas, wants, needs, insights, and observations on Post-Its and posted them on the whiteboard under the title “Important Ideas” (see Figure 9). I encouraged this brainstorming activity to happen in the background so participants could capture thoughts as they occurred and not feel they had to interrupt the flow of the workshop to express an idea. Toward the end of the day’s activities, two researchers and two PIO participants organized the ideas captured on the whiteboard using the affinity diagram method (Beyer and Holtzblatt, 1997). Afterward, everyone gathered around the whiteboard to discuss the resulting organization. This activity served as a summary of the day’s events and gave everyone a chance to reflect on their workshop experience.

4.2.3.3 Facilitators

Guiding PIOs to the location, leading the workshop, observing participant activity, and collecting data—all these duties were more than one person could perform. Therefore, in the weeks prior to the workshop, I determined personnel requirements (see Appendix G) and assigned them to members of Project EPIC28.

Each PIO workshop facilitator received a research notebook designed to help them understand their responsibilities and provide a place for capturing observations. Inside the front

28 Members of Project EPIC that helped facilitate the PIO PD workshop include: Casey McTaggart, Leysia Palen, Kate Starbird, Lise St. Denis, Sarah Vieweg, and Jo White.
cover of the notebook was a detailed schedule that listed each workshop time slot, with its associated tasks and assignments (Appendix G). Inside the back cover of the notebook—see Appendix H—was information about their research duties (i.e., things to take notes on and guidelines for keeping detailed, useful notes).

4.2.3.4 Data Collection and Analysis

Throughout the workshop, several data collection activities took place. A videographer captured activity from two different angles while designated photographers snapped photos of artifacts and participants. Researchers wrote observations in their notebooks, which I collected at the end of the workshop. Paper PICTIVE prototypes created by PIOs served as design artifacts which I collected and photographed. I also digitally captured notes from the whiteboard as well as the organized Post-Its from the brainstorming activity.

After gathering these workshop data and transcribing the video, I began coding my data. The goal of this workshop was to obtain ICT design requirements and ideas that support PIO practice. Therefore, I parsed the workshop transcripts, prototypes, photos, and other data looking for examples of technology features that PIOs indicated were desirable. I also extracted items that informed technology design such as issues that might be caused or overcome by technology. After coding all this data, I sorted the codes into categories; the results of this analysis appear in the following section.

4.3 Findings

I discuss findings from the PIO PD workshop in two sections: (1) PIO work practice and (2) design requirements to support that practice. Many of the discoveries concerning PIO work practice confirmed earlier empirical findings (see Chapter 3), yet much had changed in the year
since that empirical work was performed and the workshop presented opportunities for gaining insight into these changes. Technology design requirements arose not only from PICTIVE design sessions but also from discussions where PIOs expressed specific needs that could be met with technology.

4.3.1 PIO Work Practice

All workshop activities allowed researchers to probe and examine PIO work practice as well as explore how ideas surrounding social media that seemed foreign at one time were now gaining acceptance. Here, I discuss how these PIOs have changed in their attitude towards social media and examine those ideas that are still met with resistance.

4.3.1.1 Critical Evaluation of Social Media

Workshop PIOs are coming to understand the merits and drawbacks of social media technologies for their work—though this understanding is nascent. For example, some found the Twitter search functionality helpful to discover new or critical information. Even though they flow by quickly, Twitter messages that contain the most important information tend to reappear. Workshop PIOs also discussed text messaging and how it can succeed where other heavier applications that rely on Internet connectivity fail. One PIO cautioned about the dangers of using third party tools that post Twitter or Facebook messages. His organization found that these tools can delay the delivery of a message by as much as half an hour, which can make the information contained in the message invalid by the time it posts. As a last example, Google alerts can search for keywords over time, allowing for a long-term approach to media monitoring. This alert strategy brings the information to the PIO instead of the PIO having to actively search for the information.

Because these PIOs are beginning to critically examine social media, they can better
adopt the social media tools and strategies that fit their practice. This examination process also considers the constraints PIOs must work with and the skills they possess. For instance, some PIOs have advanced technical skills so they are comfortable using complex or poorly-documented tools. Others have budget restrictions and cannot afford web-enabled phones or costly computer applications. PIOs in this category are usually constrained to using free tools and applications.

4.3.1.2 The Need for Organizational Change

During the workshop, conversations reflected growing recognition that social media quicken the pace of emergency communications. One PIO explains:

*It’s interesting because with the [large incident] last year we would be waiting to get official information from the field and 45 minutes would pass. We had the correct information but were just waiting to get the official word, and then we would send out a press release that had 45-minute-old information.*

To accommodate the increasing pace of communications, these PIOs understand that existing protocols need to evolve:

*And I think that is changing right now because there is just no time to write that press release, have the incident commander look at it, and get that approval. We’ve changed. We’re just doing it verbally now. We will read it back, where it’s on the radio or the phone, and say, “Is this OK for release?” And we are getting that approval but it takes a long time to develop that type of trust relationship.*

But shortening information response times does not come without drawbacks. For example, social media and the pressure to send information quickly demand that PIOs sometimes release incomplete information to meet public expectation:

*I think that the media and our organization have to take a little bit more risk because we want to be out in front of the story and not just in a reactionary position. You want to try and be the one that is proactive, but that might mean that you don’t have as much information as you would have had 5 years ago.*

Unfortunately, this preliminary release can backfire if the released information is later
discovered to be incorrect.

On the other hand, pressure from citizens can drive emergency management organizations toward use and acceptance of social media:

_We’ve seen a dramatic turn around. The incident commander, who was the one that came down on us from day one and said “don’t release a single piece of information,” now comes to our meetings and asks, “how do I get my volunteer fire department on your Twitter account?” He has completely turned around. He was our adversary one year ago, but now is very much a believer because I think he felt the pressure from his citizens._

Recognizing the growing relevance of their work, all workshop PIOs agreed that social media plays an important role in any emergency communication strategy. Some even said that at least one person should be dedicated to social media for every event. Another PIO sees value in having a person dedicated full-time to social media but he felt that his employer was unready to make this kind of position a budget priority. Even though PIOs may see the value in social media, resistance from the organization in which they work can prevent adoption.

### 4.3.1.3 The Public as a Resource

Over time citizen reports through social media have proved their worth. Two PIOs gave an example of how citizens provided useful information during a 2011 spring flood:

-[PIO #1] The video during the flood was very useful, it was nice to have people hosting YouTube videos so we could see the impact. Because I think some people thought that we were over-reacting because there was no impact to them from flash floods. So to be able to see what was going on up in the canyon was really useful.

-[PIO #2] Because our deputies and all, they are trying to do other things. They are not standing there with a flip camera showing what is happening. Yeah, you are right, that is where these folks out in the field can actually help us.

These PIOs found that engaged citizens can cover gaps in their coverage, which can be useful in large jurisdictions or events where resources are stretched thin.

One PIO talked about how she has adapted her practice to account for the activity of citizen journalist saying, “…as hard as it is you’ve got to let that citizen journalism go, because
it’s going to get out there.” She finds that trying to control the information published by these citizens is “just not worth it.” If the information is particularly damaging her organization might release their own statement, but they won’t directly reply to the citizen journalist. Thus she finds herself letting citizen journalist activity happen and at times even finds it can benefit response efforts if a citizen can tell them what is happening in an area where they don’t have emergency personnel.

Workshop PIOs see a growing number of citizens actively providing information as well as validating and correcting available information. Through their efforts, these citizens establish themselves as reliable, credible sources.

4.3.1.4 Resistance

Initially perceived as a failure, the second group’s PICTIVE design session revealed PIO attitudes concerning social media activity that still prevented them from accepting certain ideas. This group attempted to design a system for both soliciting and organizing volunteers to help with emergency response efforts. At first, the members of the group were unable to think beyond a traditional view of volunteers; to them, volunteers were people who collected donations of food and clothing, or provided shelter. These types of volunteers are important, but I wanted the group to include digital volunteers (Starbird and Palen, 2011)—people who sort, gather, and validate information using digital means—in their design. These PIOs found it challenging to imagine using digital volunteers, mostly due to perceived trust and liability issues. When assigning a task to a digital volunteer, such as finding the location of victims, they worried about whether the information they produced could be trusted. They did not want their organization to act on information that proved untrue or worse, harmful. Because they would be relaying the information to response organizations, these PIOs viewed themselves as responsible and
therefore liable for any misinformation.

The PIOs in Group Two were uncomfortable with the design concept. Before they could prototype, we had to discuss and examine their concerns with using a digital volunteer workforce. We spent most of the design time in discussion; consequently, the design was never completed. Even though these PIOs comfortably push information to the public over social media, they perceive great difficulty in actively seeking the support of citizens to help with emergency response efforts.

4.3.2 Design Requirements for PIO Practice

Another workshop goal was to discover technology design requirements that could better support PIO work practice. Insights emerged throughout the workshop—during the PIO information management discussion and also during the design sessions in which PIOs created and explained prototypes for tools that would support their work. Interestingly, the prototypes that PIOs created were much like the interfaces they currently use. This made it difficult to carry forward the prototypes for further development because they offered little-to-no improvement over existing tools. However, many common themes emerged across these prototypes (and in workshop discussion) as important functionality that PIOs wanted in tools that would support their work practice. I developed these themes into a list of design requirements which are explained with supporting evidence below.

4.3.2.1 Monitoring Public Information

With the introduction of social media to emergency communications, the quantity of data available in the public arena can be overwhelming; thus workshop participants sought tools to cope with this problem of information overload. Participants also wanted more efficient mechanisms for sorting and filtering social media data during an emergency as well as support
for aggregating and making sense of these data. All PIO prototypes included functionality for monitoring public information.

When monitoring public information, workshop participants spoke about the complexity of their information space. They wanted to see all available data, analyze it, and make their own interpretations. Consequently, prototypes of their ideal information space included interfaces with many communication channels open and visible (see Figure 10). Application windows in PIO prototypes displayed streams such as the local newspaper, weather station, social media (e.g., Twitter, Facebook, Flicker, etc.), county website, and email. While these workshop PIOs wanted to manage information more efficiently during an emergency, they were uncomfortable with interfaces that hid the process by which data are analyzed and interpreted. PIOs need tools that support this analytical process.

Figure 10: Individual PIO PICTIVE Prototypes
4.3.2.2 Organization

When creating prototypes of their ideal information space, PIOs mostly organized information by communication type. The prototype shown in Figure 11 demonstrates this organization scheme; separate panels appear for each of the different types of communication a PIO might use (i.e., Twitter, Facebook, Skype, YouTube, email). In contrast, when PIOs talked about the information they work with, they imposed higher-level organization on the data as they tried to make sense of it. In the group prototype session, for example, one group organized their data into the categories “public”, “media”, and “operations” (see Figure 12) because this represented the way that these PIOs thought about the messages they sent and received during an emergency.
Because workshop PIOs based their prototypes on tools they already use, they found it challenging to imagine accessing information differently, which in turn limited the ways they organized and made sense of emergency data. For example, if a PIO wants to monitor Twitter, Facebook, and Youtube communications, they will usually have an application dedicated to monitoring each of the three services. Few tools provide ways to aggregate the information from all three streams, and even fewer allow a user to impose higher-level organization schemes on the information. I hypothesized that such higher-level methods of organizing communication streams would help PIOs in their sense-making efforts, and test this idea in Chapter 5.

4.3.2.3 Reporting

As PIOs monitor social media, they need to report the communications they find with other members of the emergency response. Information provided by members of the public over social media can help emergency management understand the public’s wants or needs and the misinformation that may be circulating; therefore communicating this information to those who can act on it in a timely manner is important. However, methods for capturing and reporting social media activity are currently poor. Most PIOs cut and paste social media data or take screen shots for reporting purposes, which can be tedious and presents the information in an awkward...
format. Tools that make this reporting process easier would benefit emergency response efforts.

### 4.3.2.4 Documentation

Emergency organizations must keep records of their activity as public documents that can be used for after-action reviews and litigation purposes. As social media become integrated into emergency response efforts, these online activities must also be documented by emergency management organizations.

In a recent study of trusted digital volunteers in emergency management (Tucker et al., 2012), a key responsibility of these volunteers was to capture and archive formal responses agencies’ online activity relevant to the event because the PIO and her team lacked the time to do the task themselves. Unfortunately, PIOs rarely have the time or resources to archive social media activity. Further, few tools exist for documenting this activity, especially across different social media platforms.

One group prototype included functionality to create and save a history of the social media and other communications that PIOs use and monitor (Figure 13). Tools are needed that consider PIO requirements to archive their data.

![Figure 13: Prototype Showing “Save History” Option](image)

### 4.3.2.5 Mobile Support

Whether in the field or driving between locations, PIOs require remote access to the information and people they need to perform their jobs. All PIOs have cell phones, some web-enabled and some not. Ideally they want the same level of technology support in the field that they have when in the office so they
do not have to shuttle between sites to perform all their tasks. This need for mobile support appeared in the prototyping sessions; several PIOs created prototype designs for their mobile phone (see Figure 14).

![Figure 14: Mobile Phone Prototypes](image.png)

4.3.2.6 Coordination spaces

When responding to larger emergencies, PIOs often work with other agencies or organizations. Inter-organization communications can be challenging in these situations and workshop participants want spaces where they can handle requests and discuss assigned tasks. PIOs also identified the ability to create and maintain distribution lists—lists for the media, the public, and internal emergency organization members—as important. These types of coordination spaces appeared in several of the prototypes (Figure 15).
4.3.2.7 Repetitive tasks

Many tasks that PIOs perform are similar across events. For example, they prepare press releases about each response that follow a particular format and style of writing. Although the details change, much of the text remains the same and templates or scripts can be created to aid in future execution of these tasks.
As PIOs use social media more, they find that they repeatedly use certain types of messages. For instance, during the workshop PIOs talked about how social media allows them to post almost immediately—something one PIO called “lights on” communication—that lets people know they are aware of the situation and working on it. These types of communications help, at least initially, to appease information seekers until more information is available.

Messages like these could benefit from templating so that they are not constantly recreated.

### 4.3.2.8 Message Translation

Different forms of social media provide different means of communication. Twitter, for example, only allows 140 character messages, which means that lengthy press releases cannot be sent verbatim. A useful feature that one PIO prototyped (see Figure 16) would let PIOs type their message once and then translate that message to the different formats of the social media streams they use. This message translation would save time because PIOs would not need to re-craft each message multiple times.

### 4.3.2.9 Geo-located Data

Accurate maps are valuable tools during an emergency, yet they are hard to create and maintain. One PIO explains:

> At least in the call center, we first rely on Google maps, we would get people calling to
say, I’m located on county route 102J, can I go down evacuation route 1 and then over to Lefthand canyon, and we are like “I don’t know.” So there were just these…tiny roads that you probably wouldn’t even know. So we would just google back where they are at, then usually later we would get the GIS folks to get us a map. That was helpful, but again it’s the face of information. They produce the map. It’s a nice big map and we stick it up on the wall. We use it for a couple of hours and then another area would be evacuated or an area would open up, then that nice little line they had drawn would change, or the fire perimeter would change overnight with a gust of wind. So the mapping was always behind, always.

In the social media domain there is much potential around maps, since maps are often integral in response efforts and citizens could be used to crowdsource them.

Currently, geo-located social media data are limited in number but as more people send communications from geo-aware devices these numbers are increasing. Workshop participants want to employ this geo-aware data to understand where requests for help or status reports originate; they envision a dynamic map that displays the areas of concern for an event. Geo-located data could potentially anticipate problems, help understand

Figure 17: Prototypes Containing Geo-Location Data
situational awareness, and understand how different areas are affected by an incident. Many of the prototypes included support for geo-location data (Figure 17).

4.3.2.10 Data storage

As PIOs digitize their documentation and paperwork, they need secure, reliable storage locations. Many of the PIOs store their information using cloud-based data storage services. They recognize the importance of having this storage at another physical site, so if their data servers were to flood in an emergency, for example, they would not lose their data. This need for data storage appeared in PIO prototypes (Figure 18).

![Figure 18: Prototypes Containing Data Storage](image)

4.3.2.11 Search

Another important feature identified by PIOs was the ability to search across all of the information they monitor during an event. Searching within a single information type (e.g., Email, Facebook, Twitter) is usually supported, but the ability to extract all information pertaining to requests for help on Facebook and Twitter and Youtube, for example, is not supported. Several PIOs created a universal search function in their prototypes that would let
them search across all of the information they monitor (Figure 19).

4.4 Discussion

The PD workshop revealed that PIO participants were engaging more directly with members of the public over social media than previously. They talked about pushing emergency information out to the public over social media streams and they gave specific examples of information generated by members of the public that have helped in their response efforts. Yet there is still much room for improvement.

While the PIOs who participated in the workshop have grown comfortable with the idea that the public is generating useful information during an emergency, they still have reservations about the extent to which the public should be incorporated into response efforts. Specifically, the idea of soliciting help from digital volunteers raises concerns because PIOs are unsure whether they can trust unknown volunteers to provide them with accurate, actionable information.

Nonetheless, despite PIO discomfort with the concept of digital volunteers, I saw early evidence of ways in which this discomfort might be alleviated. For instance, during the workshop PIOs talked about how citizens were establishing themselves as trusted information sources by providing timely, credible information during emergency events. Once a citizen has established credibility in this manner, PIOs may be willing to consider this citizen a digital volunteer whom they could trust with emergency response related tasks. Further evidence of this
type of activity appeared in a recent study in which one PIO incorporated digital volunteers into emergency response efforts by utilizing a team of trusted volunteers that she knew before the event (Tucker et al., 2012). Thus, PIOs are finding ways to overcome trust issues by establishing rapport with citizens who can act as digital volunteers during times of emergency.

PIOs find it challenging to incorporate information from members of the public into response efforts when they are unsure what information the public can contribute. They often feel overwhelmed with the large quantity of data generated by the public during an emergency and the lack of good tools to help them make sense of it. As a result, limitations in the tools PIOs use can make it difficult for them to see the interesting and useful information that members of the public are generating around an event. Many of the areas of concern seen in the prototype designs and discussed during the workshop focused on PIO inability to adequately monitor, document, report, organize, and make sense of social media data during an emergency. A goal of this research is to enable PIOs with tools that overcome the challenges of using social media, so that they can more easily leverage social media communications when interacting with the public and incorporating members of the public into emergency response efforts.

4.5 Summary

In this chapter, I describe the PD workshop that sought to better understand how emergency PIOs engage with members of the public over social media and how technology could support that engagement. I found that these PIOs use social media frequently and they are growing more comfortable with its use. Through workshop activities I discovered many design requirements for supporting PIO work such as the ability to monitor, document, report, organize, and make sense of social media data. I carry these needs forward to the next phase of my research where I design technology prototypes in support of PIO work.
CHAPTER 5: Application Prototyping & Design

In this chapter, I describe the design of a tool—the PIO Monitoring Application (PMA)—that supports PIOs in monitoring, documenting, reporting, and organizing socially-generated information during an emergency event. The design process began with the creation of five low-fidelity prototypes based on earlier empirical work (Chapter 3) and participatory design activities (Chapter 4) with PIOs. These five prototypes were then evaluated by researchers and PIOs. Based on feedback, the most promising prototypes were combined to create a prototype—PMA. After creating a low and high fidelity PMA prototype, I conducted a study with 11 PIOs to test PMA and its design. This chapter concludes with a description of these PMA test findings.

5.1 Five Low-Fidelity Prototypes

Following the participatory design workshop, I created five initial low-fidelity paper prototypes based upon the needs identified in the PD workshop (see Section 4.3.2) and the empirical findings from Chapter 3. Relying on my training as a technology designer, I derived these prototypes using those features that PIOs expressed as most important combined with my knowledge of current technology capabilities. Often PIOs knew that different tasks they performed (such as social media monitoring) were inefficient, but they lacked the ability to envision new ways of performing these tasks; most of the prototypes designed by PIOs in the PD workshop mimicked the interfaces that they used at the time. My role as a technology designer was to interpret the needs of these PIOs into prototypes for new ICT that would provide improvement over their current work practice.

Each of the prototypes I designed went through several iterations before they were
evaluated for further development. I describe each prototype below.

5.1.1 Social Media Template Manager

The first prototype I developed was a web-based tool that manages social media templates for the common types of messages that PIOs send. The Social Media Template Manager helps PIOs create message templates so that they do not have to recreate the same messages from event to event. In the PD workshop, support for templates of commonly sent social media messages emerged as a feature that could help PIO communication be more efficient (Section 4.3.2.7 Repetitive Tasks).

In this design, the home page of the Social Media Template Manager (see Figure 20) lists the templates that a user has created. The columns of the template table indicate the name of the template, the type of social media the template supports, and the types of actions that can be taken on the template. Below the template table is a button that lets the user add a new template.

If the user clicks the “Add New Template” button or the “Edit” action, s/he is taken to a
new screen (see Figure 21) in which s/he can add a new template or edit an existing one. At the top of this screen, a text field for entering a template name appears. Next, the user can add new Twitter or Facebook messages to the template. Inside the template “Message” field, users can include customized elements inside brackets “< >”. Inserting these bracketed elements into the text indicates that these fields will be input by the user when the template is used. Each template can contain multiple messages for each social media type. For example, if a message is longer than 140 characters, a PIO can break the message into two or more Twitter messages. For convenience, the user can click on the customizable element they want to add to their message and click the “Enter Customizable Element” button to automatically insert it. When the user completes his/her template s/he clicks the “Save” button.

From the home page (Figure 20) PIOs can use a template by clicking on the name of the template. This action takes them to a new page where the selected template appears (Figure 22). Text entries for the customizable elements in this template appear at the top of the page. The user specifies values for these elements and the template messages are rendered using the given input. Before sending, the final messages can be inspected and altered. The user must enter his/her login credentials for the appropriate social media

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29 This prototype only supports Twitter and Facebook, though support for other social media types could be added.
platform to send messages.

### 5.1.2 Social Media Training Tool

The second prototype defines a tool for training PIOs in social media use for emergency management. In interviews, PIOs discussed the lack of social media training for the PIO role. FEMA, the federal organization that provides much of the PIO training in the US, has yet to incorporate social media in its course materials. Much of the training PIOs have with social media has been through firsthand experience, or from others sharing their experiences. This prototype creates training modules to help PIOs understand the different types of social media and how they can be used in emergency management. Available online, this tool could benefit the PIO community by offering consistent training materials that are available to everyone.

The prototype consists of a series of sequential web pages with educational material about social media and its use during emergency events (the prototype is located in Appendix I). At the end of this training, users take a test to confirm they have learned the material. Different training modules could be created based on the experience of the user. For example, an initial offering might consist of a Basic PIO Social Media Training Module that teaches a PIO what social media is, how it can be used in an emergency, and tactics for getting started. An advanced module might cover strategies for monitoring social media and the tools available for this task.

### 5.1.3 Digital Volunteer Coordinator

For the third prototype, I created a tool that would let PIOs interface more directly with digital volunteers (Starbird and Palen, 2011) during an emergency event. Interviews with PIOs revealed that they are often overwhelmed with social media, particularly the tasks of monitoring social media and responding to it (see Section 3.3.3 and Section 3.3.4). One way of easing this
burden is to use a digital volunteer workforce. In recent years, Starbird and Palen (2011) have observed the emergence of the digital volunteer in times of crisis—people who can help monitor social media streams for information, create digital maps, and other online tasks. This tool leverages this movement by providing a space (Section 4.3.2.6 Coordination Spaces) for PIOs to create and coordinate opportunities for digital volunteers to help during an emergency response.

This prototype could potentially address many of the requirements from the PD workshop depending on what opportunities PIOs create for digital volunteers. For example, digital volunteers could monitor social media streams (Section 4.3.2.1 Monitoring Public Information), document social media activity (Section 4.3.2.4 Documentation), compile reports of this activity (Section 4.3.2.3 Reporting), or create and maintain digital maps (Section 4.3.2.9 Geo-Located Data).

The home page of the application (Figure 23) lists all of the digital volunteer opportunities for a particular event. From this home page, volunteers can look through the available...
opportunities and help with those that fit their interests or abilities. PIOs can also add new opportunities on this page by clicking the “Add New Opportunity” button, which takes them to another view (Figure 24).

On the “Add/Edit Opportunity” page (Figure 24), PIOs can create a new opportunity by specifying a name, description, type, and status for the opportunity. In this version of the prototype only PIOs or other emergency officials can create new opportunities; digital volunteers can edit an opportunity however.

To work on an opportunity, a digital volunteer clicks on an opportunity from the home page. This action takes them to the “Add/Edit Opportunity” page which provides a workspace for coordinating and discussing work around the selected opportunity. Volunteers can earn a higher status with more privileges depending on the level of their activity and the quality of the information they provide.

5.1.4 History Reporting Tool

The next prototype imports social media data surrounding an emergency or disaster event and lets PIOs search and create reports using this data. This prototype addresses PIO needs for keeping records of social media data generated around disaster and emergency events (Section 4.3.2.4 Documentation) and the tool’s export functionality allows PIOs to create an external record that can be shared and stored (Section 4.3.2.10 Data Storage). Once social media data has been imported into the tool the user can perform queries against this
data, which supports PIO search requirements (Section 4.3.2.11 Search) as well as the ability to monitor social media activity (Section 4.3.2.1 Monitoring Public Information). In addition, reports generated using this tool can help PIOs demonstrate to their management the effectiveness of social media as a medium for communicating with the public (Section 3.3).

To use the tool, the PIO must first import the social media data they want to monitor. On the “Import Social Media Data” page (Figure 25), the user specifies his/her account information, an optional date range, and a hashtag to search for. Clicking the “Import Tweets” button brings the Twitter search results into the tool where they can then be used.

Once the PIO has imported data, s/he can use the tool to search and export (Figure 26) as well as create a report using the collected data (Figure 27). Searching is performed on the home page of the History Reporting Tool.

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30 Only support for Twitter appears in this prototype. Support for additional social media types could be added.
Also from the home page, a user can click the “Export…” button to download an Excel spreadsheet containing the collected data.

The “Generate Report” function (Figure 27) includes information that the user enters, such as the event name, the date and time of the event, the description of the event, and the name of the person generating the report. Optionally, users can include automatically generated analytics (graphs and statistical reports of the social media data) in the report as well.

5.1.5 Twitter Bucket Sorter

The last prototype explores an interface for sorting social media data into “buckets” that are defined by the PIO. In this tool, PIOs have a stream of social media data that they can drag-and-drop into different categories, essentially sorting the data. PIOs can search and view tweets relevant to an event using the Twitter Bucket Sorter—filling social media monitoring needs (Section 4.3.2.1 Monitoring Public Information). This interface also supports the sense-making of social media data by providing a way to organize it (Section 4.3.2.2 Organization).

Additionally, this tool lets PIOs collaborate on social media monitoring and sorting tasks (Section 4.3.2.6 Coordination Spaces). The design allows any number of people to sort tweets, making the task less demanding. Further, buckets can be assigned to people which provides another mechanism for coordination.

The prototype was initially designed for monitoring Twitter messages. Based on my
research with PIOs, Twitter is one of the most frequently used social media technologies in emergency events. Also, tweets are short (140 characters or less), easy to work with, and publically available. These reasons made Twitter an ideal social media type to begin exploring the sorting mechanism behind the Twitter Bucket Sorter. Support for additional social media types could be added later.

The home page for the Twitter Bucket Sorter (Figure 28) allows the PIO user to create a hierarchy of “buckets” or categories for sorting tweets. Categories are represented by dark blue squares with rounded corners in the prototype; Sorting Levels are represented by light blue squares. The top level is the source of data that the PIO wants to collect. In this prototype, the data are the results from a Twitter search on the term “#boulderfire”. At the Twitter Bucket Sorter home page, PIOs click on the sorting level where they want to categorize tweets.

This action takes them to a different interface where they can sort tweets into categories (Figure 29).

In the sorting interface, PIOs see a list of tweets in the center of the page. Existing buckets (or categories) appear...
on the left and right hand sides of the tweet list. Users can create a new bucket by clicking on the “Create New Bucket” button. The tweets in the list can be dragged and dropped into these buckets and once a tweet is moved into a bucket it is removed from the list of tweets. When the user is finished sorting they can click the “Finished Sorting” button at the bottom of the page. If the sorting page is a level containing no buckets (Figure 30), there is an option to export the tweets in that bucket into an Excel spreadsheet so that they can be archived or shared with others.

This prototype allows for many people to work on the tool by dividing the tweets for sorting between those who are working on a level. When a user is done sorting they click the “Finished Sorting” button to indicate they are done and that the tweets that were assigned to them can be reassigned to others.

5.2 Evaluation of Prototypes

Informally, I sought feedback on these five prototypes from several researchers and PIOs. I took the five paper prototypes described above to each evaluator and demonstrated the functionality of each prototype, after which I asked for their feedback. The goal was to discover which prototype(s) showed the most potential (i.e., usefulness, feasibility, innovativeness) for further development. I discuss the results of this evaluation process as well as the decision for further development for each of the prototypes below.

The Social Media Template Manager could potentially save time for PIOs when creating social media messages. However, discussions with PIO evaluators revealed that few of the messages they sent fit the criteria for a template. Every event response is different and usually requires unique messages. Because of its limited usefulness and scope (only supporting templates and nothing else), I chose not to develop this prototype further.

Many PIOs have not been trained in the use of social media and the Social Media
Training Tool could help with this lack of training. Still, the effort required to create new training modules, tailor the modules to all the different types of PIOs, and maintain this training was estimated to be quite large. Further, there is nothing innovative about this solution; it simply provides training where little exists. Consequently, I decided not to pursue development of this tool.

The Digital Volunteer Coordinator supports an emerging trend in emergency management to utilize digital volunteers in relief efforts (Starbird and Palen, 2011; St. Denis, Hughes and Palen, 2012), but when shown to PIOs, it was met with resistance—mostly concerns about whether digital volunteers could be trusted. During the PD workshop, I tested an earlier version of this prototype with similar results (Section 4.3.1.4 Resistance). I concluded that the Digital Volunteer Coordinator would currently face slow acceptance by a broad PIO audience, which would make it difficult to find PIOs to assist with the development and testing of the tool. For this reason, I determined not to implement this prototype.

PIO evaluators identified the History Reporting Tool and the Twitter Bucket Sorter as the most useful prototypes. The ability to store and create a record of the social media communications around an emergency event is a growing need for PIOs, and the History Reporting Tool meets that need. The Twitter Bucket Sorter provides a novel mechanism for sorting and organizing social media data; existing tools lack this capability. Through the exploratory creation of several designs, I found that the features of both prototypes could be combined to create a single tool. This combined tool could then support social media monitoring, analyzing, documenting, and reporting. Therefore, I created a new prototype called the PIO Monitoring Application (PMA) that combined the features of the History Reporting Tool and the Twitter Bucket Sorter.
5.3 PIO Monitoring Application (PMA)

The PMA interface is primarily based on the Twitter Bucket Sorter prototype (see Figure 31), except the buckets changed to categories that resemble a folder hierarchy on the left hand side of the interface. This hierarchy allows users to sort Twitter messages into any category at any time; in the Twitter Bucket Sorter prototype, users could only code for the level s/he was in and PIOs found this limiting. A copy option lets the user drop a tweet into more than one category. The current category folder would be located in the address bar above the sorting table—meaning that the user is only seeing tweets categorized in the chosen category. Users can also select tweets and click the “Email” button to create and send an email quickly and easily.

In this improved prototype, I created a separation of sorting the data (Figure 31) and viewing the data (Figure 32). When a user switches to the “View” page (Figure 32) of PMA the functionality of the category tree on the left of the page changes. Instead of showing only those messages that are waiting to be categorized, it shows all
messages that are contained in the current category. When PMA is in the “View” state, the user can export the data they’ve collected and create a report; this functionality comes from the History Reporting Tool.

5.3.1 High-Fidelity Prototype

After constructing a low-fidelity prototype of PMA (Figure 31 and Figure 32), I began building a high-fidelity version. Initially, this high-fidelity prototype (Figure 33) served as a proof-of-concept but quickly evolved into a prototype that could be used to test PMA with PIOs (see section 5.4). Though the functionality was limited and often incomplete, this prototype allowed PIOs to have hands-on experience with PMA—creating categories and sorting tweets—which generated much discussion and feedback. As a result of this testing, I significantly improved the high-fidelity PMA prototype. In Chapter 6, I outline the resulting software architecture, database design, and features of this improved PMA prototype.
The next step was to test PMA with PIOs to be sure the tool meets their needs. This testing not only evaluated PMA functionality, but also explored whether the idea of sorting information is helpful to PIOs. Does sorting support their practice? Does it actually help or is it just busy work? What does sorting offer PIOs?

When the test sessions began, the high-fidelity prototype of PMA only demonstrated basic functionality. Between sessions, I iteratively developed the prototype and by the end of the test sessions, the prototype had evolved into a working PMA that could be deployed and evaluated in an emergency setting (see Chapter 7).

In this section, I describe the PMA user test sessions conducted with PIOs. The detailed
user test plan document is located in Appendix K.

5.4.1 Participants

I conducted the PMA prototype test sessions with eleven PIOs. Of these eleven, one group of three tested together, two groups of two tested together, and the remaining four tested alone. Participant experience in the PIO position ranged from nine months to twenty years, with an average of approximately six-and-a-half years. A range of organization types was represented by these PIOs: fire department, public health, county government, law enforcement, university communications, and state emergency. All the chosen participants had experience using social media and each signed a consent form before testing began. More information about the participants is available in Appendix L.

5.4.2 Procedure

Test sessions lasted approximately one hour and were held at the PIOs’ place of work. I began each session by asking each participant to complete a short background questionnaire (see Appendix J) so I could better understand his/her experience as a PIO. Following the questionnaire, I explained the format and purpose of the test session and asked participants if they had any questions.

The first testing activity sought feedback from PIOs on the design of PMA by showing each participant the low-fidelity prototype of PMA (see Figure 31 and Figure 32). Using this prototype, I described the features of PMA and tried to help the participants understand what PMA could do. The prototype was used as a conversation piece to probe for feedback on how such a system might fit into PIO work practice.
Next, I asked the participants to perform several tasks. Each task was designed to test the usefulness of PMA as a tool or to test different design options. While performing these tasks, I asked the participants to “think aloud” (Lewis, 1982) and externalize their rationale for their actions.

The first task—a card sorting activity (Kuniavsky, 2003, 195–199)—was designed to show how PIOs filter and sort information and to test whether sorting information supports PIO work. For this task, I created a stack of 50 business cards; each card had one Twitter message printed on it from a Boulder, Four Mile Fire dataset (see Appendix M). When selecting tweets for the cards, I chose a variety of messages that could be categorized in many ways. On the back of the business cards, I printed a number so that I could record the way participant treated the card more easily. I gave the stack of cards to the participant and asked him/her to look at each card in the stack and read the message out loud. After reading the message, s/he was asked to organize the cards into piles that made sense to him/her. As the piles of messages became more defined, I encouraged the PIOs to assign labels (written on post-it notes) to the piles to form a group of like items (see Figure 34). I emphasized that there was no right or wrong way to perform this task and that not every card

![Figure 34: PIO Engaged in Card Sorting](image)

31 If there was more than one PIO in the test session, the cards were divided between the participants. They would then take turns reading the cards and collectively discuss how they wanted to handle or group the information contained on that card.
Participants took roughly half an hour to perform the card sorting exercise. Getting started took a little time because PIOs were not sure what types of information they would encounter. While processing the first few messages they refined their groups, rearranging and redefining them to fit the messages that they were seeing. Most of the PIOs did not feel comfortable labeling the groups until they had read about five or six messages.

When the PIOs finished reading and grouping all of the cards, I asked them if they wanted to change anything about their organization. This presented an opportunity for them to rename groups, merge groups or split them apart, or to organize the groups they defined into larger groups. Most of the PIOs were satisfied with their original organization and very few changes were made. When the PIOs were content with their groups, I used a paper clip to gather the cards in each category together, along with the label, so that their categorization scheme could be recorded after the test session (see Appendix M).

The next task gave the participants the opportunity to use the high-fidelity PMA prototype. I explained that the full application had not been implemented yet, but I had prototyped some of the functionality so that we could test some design options. After a brief explanation, I had the participants sit at the computer and perform several tasks using the prototype. To simulate data that a PIO might encounter in a real disaster, the prototype was pre-populated with Twitter data from the Boulder Four Mile Fire.

With this prototype, participants tried different ways of interacting with and categorizing Twitter data. On the left hand side of the PMA monitoring page was a set of categories, and on the right a list of Twitter messages to sort. I first showed the participants how to create their own categories and then instructed them to begin sorting the Twitter messages using either drag-and-
drop, or click-and-click to assign the tweets to a category. PIOs used the interface to sort the tweets provided for approximately ten minutes, during which I observed and asked questions about the way they performed the task.

Finally, for the last task, I provided PIO participants with several lists of tweets that corresponded with different categories (see Appendix N), and asked them what they would like to do with the information. For instance, one list contained tweets asking for help during the Boulder Four Mile Fire. I showed this list to the participants and asked them the following types of questions:

- Is this information interesting to you as a PIO? If not, are there others in your organization that might find it interesting?
- How would you like to access this information?
- What would you do with this information?
- If you want to send the information to someone else, how would you do that?
- Are there applications or tools that you currently use that might use this type of information?

I repeated this task using other tweet category lists, such as lists pertaining to the hazard status, offers, or rumors, because different examples invoked different responses. The aim of this task was to discover how PIOs might use information once it has been categorized using PMA.

At the conclusion of the session, I thanked each PIO for their participation, asked any remaining questions, and gave the PIOs an opportunity to ask me questions.

5.4.3 Data Collection & Analysis

After obtaining permission from PIO participants, I made video and audio recordings of each test session. During analysis I reviewed these recordings to be sure I captured all the PMA
suggestions, critiques, and ideas for improvements. Recordings were also an important analysis tool for the card sorting exercise. If I needed to understand why a PIO categorized a card in a particular way, I could refer to the video or audio recordings.

The categorization schemes that PIOs created during the card sorting exercise were captured and can be found in Appendix M. I analyzed the card sorting data by looking for patterns and significant groupings across participants.

Each participant completed a background questionnaire (see Appendix J). This questionnaire provided information about each participant’s PIO background and their experience using social media in a PIO position. Appendix L contains a summary of participant responses to the questionnaire for this test session. Finally, I took photos of the participants performing the different tasks during the test sessions.

5.5 PMA Test Findings & Improvements

Overall the response to PMA was positive. PIOs were excited by the ability to collect Twitter messages around an emergency event and export those messages into an Excel spreadsheet that could be saved as an archive or shared with others. Currently, few tools exist that provide this capability, and those that do are paid services which most emergency management organizations cannot afford. Though the ability to create a report was not functional in the PMA prototype, participants could still see the value in creating reports from the Twitter data they collect. One PIO really liked the ability to email Twitter messages because she found it cumbersome and error prone to copy and paste a tweet into an email. Another PIO imagined using PMA to gather statistics on how they use social media on a daily basis.

The only negative feedback received during the PMA test sessions was from a part-time PIO. She does not respond to many events and she was unsure if she would even use a tool like
PMA. Additionally, she expressed concerns that PMA is a tool for just one component of her job; she still has to work with the media, answer phone calls, and monitor the public arena independent of social media activity.

In the remainder of this section, I give an accounting of the findings from the PMA test sessions and discuss how these findings informed design improvements for PMA.

5.5.1 Using the Sorting Interface

When using the sorting interface of the high-fidelity PMA prototype, test participants used both the drag-and-drop and click-and-click methods for assigning tweets to categories. PIOs seemed to slightly prefer the drag-and-drop method, but this would likely change if they could use the tool for longer periods of time since the click-and-click method allows for faster sorting. Since I implemented both methods in the PMA prototype and they were both used frequently, I left the two sorting methods intact for the new version of PMA.

5.5.2 Creating Category Schemes

While there were similarities across the category schemes developed by participants, every scheme was different (Appendix M). For instance, different Twitter messages were deemed more or less important depending on the type of PIO that was looking at the message. In the card sorting exercise, most PIOs indicated that they would not respond to the tweet found in Figure 35, yet a PIO associated with a public health department felt that this message was an important behavioral health issue that she would want to respond to. Another tweet (Figure 36) was seen as important to a city government PIO because she was concerned with protecting city citizens from fraudulent housing offers; most of the other PIOs chose not to respond to this tweet.
Theres a man here at @amantecoffee freaking out about the fire. Understandable. His house is in 4MileCanyon. :/
#boulderfire
FreyDrew

I love that tweeps are offering room + free meals to #boulderfire displaced but how do you prevent scammers/opportunists?
Melsidwell

Figure 35: Behavioral Health Tweet Card

Figure 36: Housing and Food Tweet Card

Finding that every PIO participant categorized the same stack of Twitter messages differently lends supports for the current design of PMA in which users can customize their category schemes. However, some participants were unsure what categories to create when they started sorting. These participants thought that it would be helpful to have a categorization scheme developed by someone else that they could start with and then modify to fit their needs.

5.5.3 Choosing Category Names

The names PIOs chose for categories during the card sorting exercise and the prototype testing proved to be a powerful organization method that aided in sense-making. A common organizing method was to categorize tweets by the agency that sent them. For example, there were tweets from the local Red Cross Chapter and the Humane Society which some participants assigned to corresponding categories.

PIO participants sometimes named categories with the name of a coworker or an organization to which they wanted to route tweets for processing. The coworker or organization could then monitor the contents of this category for action items.

Another method for naming a category was to describe the physical action that the participant wanted to take on the message (i.e., call someone, reply to, verify, follow up). A
couple of PIOs created a “retweet” category where they placed important messages that they wanted to retweet. In this example, the old PMA prototype required users to use a different application to retweet a message; therefore, to make using PMA more convenient, I added the ability to retweet a message.

Almost all PIOs seemed to find value sorting tweets into reference categories—those categories that contained information that a PIO would likely never act on but that they wanted to refer to in the future. Example reference categories include the following: Media, Maps, Trends, Volunteers, and Donations. These categories were important for PIO sense-making because they provided a means by which PIOs could group and track the tweets they had seen.

5.5.4 Evaluating Tweet Content

Trust was important for PIOs when deciding how to process tweet information. Most PIOs looked at the Twitter account associated with a tweet to determine if the information could be trusted. Since data from real local events were used in testing, sometimes a PIO would recognize a Twitter account as belonging to an organization or person that s/he had worked with before. Previous experience could then be used to judge whether the information was trustworthy. In a few cases, the Twitter account was associated with having shared inaccurate information in the past, so the PIOs indicated that they would not trust information from this source. When the Twitter account was not recognized, PIOs relied on other mechanisms to determine whether the information could be trusted. These mechanisms included checking the Twitter account profile associated with the message or contacting the user of the account directly.

As a result of these observations, I modified the appearance of tweets in PMA to include more information about the Twitter account that had sent the tweet—the account photo, the name
of the user, and the account handle that when clicked would take the user to the profile page for
the account (see Figure 37 for a comparison of the old and new tweet format). In addition, I also
added the ability to reply to a Twitter message so that PIOs could easily contact the source of
each tweet.

<table>
<thead>
<tr>
<th>Old PMA Tweet Format:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tweet</strong></td>
</tr>
<tr>
<td>#Boulder is sepia and like a campfire right now. Bright sunny blue skies on either side of the amazing #boulderfire. Air is thick #fb</td>
</tr>
<tr>
<td>RT @MelindaJordan: The smoke from the Four Mile Canyon fire is even visible on weather radar now. <a href="http://bit.ly/bCtFF7">http://bit.ly/bCtFF7</a> #Longmont #Boulder</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New PMA Tweet Format:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tweet</strong></td>
</tr>
<tr>
<td><a href="https://twitter.com/hannabanna25">Hannah Smith</a> #PrayForColorado #HighParkFire #WoodlandHeightsFire #WaldoCanyonFire #WeberFire #TreasureFire #StateLineFire #LittleSandFire #SpringerFire</td>
</tr>
<tr>
<td><a href="https://twitter.com/All_Hazards">All_Hazards</a> RT @LittleSandFire: In contact with #LittleSand #COFire IMT *jp <a href="http://t.co/88pFJi">http://t.co/88pFJi</a></td>
</tr>
</tbody>
</table>

**Figure 37: Comparison of the Old and New PMA Tweet Format**

### 5.5.5 Adapting the Sorting Task to Practice

The PMA prototype as it was designed in Section 5.3 forces the user to categorize tweets
before more tweets can be retrieved. During testing, I discovered that this method of categorizing
tweets prevented PIOs from effectively monitoring Twitter data. If the Twitter stream was
moving quickly, PIOs would get a backlog of tweets that needed to be sorted before they could
view the most recent tweets. Further, sometimes PIOs did not want to do anything with a tweet,
but the prototype design kept the tweet in the interface as long as it was not categorized,
preventing a new tweet from taking its place. To work around this restriction, some PIOs created
a “discard” category where they could drop tweets they didn’t want to handle. Based on these findings, I significantly redesigned the prototype.

The new PMA prototype has two modes: streaming and archive. In the streaming mode (see Figure 38), tweets that contain the active search terms scroll down the page, with a tweet appearing at the top of the page every two seconds (if one is available). This tweet stream displays the twenty most recent messages. PIOs can categorize any tweet from this stream, but they are not forced to categorize messages to get new ones.

![Image](image.png)

**Figure 38: Event Streaming View for PMA Prototype**

In the archive mode (see Figure 39), all the messages collected under an event can be viewed, which provides a mechanism by which PIOs can revisit the messages they may have missed. Messages can also be sorted with the same categorization scheme that appears in the streaming mode of PMA. Archived tweets can also be sorted and searched. Additionally,
collected tweets can be exported into an Excel Spreadsheet or used to generate an event report.

Figure 39: Event Archive View for PMA Prototype

5.6 Summary

During this phase of my dissertation research, I iteratively prototyped, developed, and tested PMA to help PIOs use social media in their work practice. I began by developing five low-fidelity paper prototypes, based on empirical research and a PD workshop with PIOs. These prototypes were informally evaluated by both researchers and PIOs, after which I developed a new prototype (called PMA) by combining ideas from two of the five prototypes. After initial proof-of-concept development, I tested the PMA prototypes (both low- and high-fidelity) with
PIOs. I found that the ability to sort social media data in PMA helped PIOs monitor and analyze the data by providing tools to break streams of Twitter data into manageable pieces. Reports generated from sorted tweet data can help PIOs to understand trends and generate reports that can be used to show the effectiveness of social media during an emergency response. Based on the results of the test sessions, I improved the high-fidelity PMA prototype. I describe the final PMA prototype design in the next chapter (Chapter 6).
CHAPTER 6: The PIO Monitoring Application (PMA)

In this chapter, I describe the implementation and final design of the PIO Monitoring Application (PMA)—a software tool informed by this research (Chapters 3, 4, and 5) that supports the social media monitoring, documenting, reporting, and organizing needs of PIOs during an emergency event. I begin with an overview of the system architecture of PMA in which I outline the major components of PMA and how they interact. Next, I provide a detailed description of the final PMA user interface and its functionality. Following this description, I discuss the implementation of PMA and the technologies used in its development.

6.1 PMA System Architecture

A high-level diagram of PMA’s system architecture appears in Figure 40. PMA is a web-
based application, run from a web server, which PIOs can access from a browser client anywhere with Internet access. I elected to develop PMA as a web-based application because it allows the tool to be hosted on a web server where PIOs can access it without having to download or install anything. Also, because the code is located in only one place, fixing defects and adding new features is greatly simplified.

Data required to support PMA, such as user names and passwords, collected tweets, and configuration data are stored in a database on the server hosting PMA. PMA can read and write values from this database. The design of this database is outlined in Section 6.3.4.

In addition to the database, two processes running on the server machine support PMA. The first process, labeled “Twitter Collection Process” in Figure 40, reads the active search terms from the PMA database and collects tweets from Twitter.com based on these terms. This process dumps the search results into the “Twitter Queue Files” (Figure 40). The queue files are then processed by the “Twitter Consume Process” in Figure 40 which inserts the data into the PMA database. The implementation of these processes is discussed in further detail in Section 6.3.5.

Through the browser client, PIOs view the PMA user interface—the final interface design is described in Section 6.2. Data retrieval for populating the user interface is performed on the server-side, from the “PMA Web Application” in Figure 40, and passed to the client where the current user interface page is rendered. Many pages in PMA’s user interface can potentially change values in the PMA database located on the server. When the user makes changes by submitting a form on a PMA page, a HTTP POST request is sent to the “PMA Web Application”, which then makes the database changes. In many instances, the PMA web pages provide the ability to change database values without submitting a form. Here, the PMA interface
makes Ajax\textsuperscript{32} calls to the “PMA Web Application”, which makes the requested database changes and returns the results without refreshing the current page.

6.2 PMA User Interface

In this section, I step through the final PMA prototype user interface, describing its functionality and the PIO social media requirements it supports. When users first load PMA in a web browser, they are prompted to login with a username and password; the application cannot be used without a valid login. After successfully logging in, a drop-down-list appears at the top of the page (see Figure 42) that contains all of the events that have been created in PMA.

![Figure 41: PMA Login Interface](image)

6.2.1 Event Management

Each PMA event is associated with a real-life emergency and contains its own search

\footnote{\url{http://en.wikipedia.org/wiki/Ajax\_programming}}
terms, categorization scheme, and collection of tweets. Events act as an organizing feature within PMA: a way to logically separate social media data that PIOs monitor that corresponds with the emergency events that PIOs respond to (see requirement from Section 4.3.2.2 Organization). Users choose an event to work with in PMA by selecting one through the drop-down-list of events located at the top of the PMA interface. By default, the first event in the list is selected if the user has not previously selected an event.

![Image](image.png)

**Figure 42: PMA Event Details Page**

Upon logging in, PIOs see the “Event Details” page for the currently selected event (see Figure 42). Each event has a name, location, start and end date, and a summary. Users can update the details of an event at any time from this page. If there are no events within PMA to choose from, the user sees the “Create a New Event” Page (Figure 43).
PIOs create a new event by clicking on the “Create New Event” button next to the event drop-down-list at the top of PMA. Clicking this button presents a page that lets the user create a new event (seen in Figure 43). Once the user specifies the requested information and clicks the “Save” button, the event is created and it appears in the event drop-down-list as the currently selected event.

![Figure 43: PMA Create Event Page](image)

After creating a new event, the next step in using PMA is to create search terms for the event. Search terms are those key words that a PIO wants to use in searching for Twitter messages. A user specifies search terms by clicking on the “Search Terms” menu bar link, which takes him/her to the page seen in Figure 44. This page lets users create, edit, and delete search terms for the currently selected event. Search terms can be active or inactive; PMA collects
tweets for active search terms only.

![Image of PIO Monitoring interface](image)

**Figure 44: PMA Manage Search Terms Page**

### 6.2.2 Streaming View

Once a PIO has created an event and specified search terms, they are ready to start monitoring data (see Section 4.3.2.1 Monitoring Public Information). From the streaming view of PMA (Figure 45), PIOs can monitor tweets that match the key words they specified for the current event in real-time. A table of matching tweets appears on the right-hand side of the interface in which a new tweet appears every two seconds if there is one available. New tweets appear at the top of the list, and push the already existing tweets down—creating a scrolling effect. Only the twenty most recent tweets are kept in the streaming view.
If the tweet stream moves too quickly, PIOs can have difficulty processing the tweets before they scroll off the screen. Consequently, I implemented a feature that allows PMA users to pause and resume the stream of tweets. When the tweet stream is paused, or if tweets are flowing faster than they can be displayed, PMA queues the messages that have not yet been displayed. On the streaming page, an indicator appears that tells the user how many messages are waiting in the queue. If the number of queued messages gets too large the user can click the “Empty Queue” button that flushes the queue and brings the tweet stream up-to-date with the most recent messages.

Each tweet displays the user account name, handle, and picture, as well as the tweet message text and a timestamp for when the tweet was sent. A reply and retweet icon also appears.
to the right of each tweet which allows users to retweet the message or reply to the tweet author from their Twitter account.

To the left of the space where the tweets are displayed is the category scheme (see Figure 45). A category scheme consists of a hierarchy of categories, with the root category of the hierarchy named after the event to which the category scheme belongs. Categories provide a mechanism whereby PIOs can organize the social media data they are monitoring (see Section 4.3.2.2 Organization). All tweets belonging to an event are categorized in the root category automatically.

Users can right-click on any category and a menu for category creation and management appears (see Figure 46). The “Create” menu option, when selected, creates a new category under the category which was right-clicked. On the category right-click menu, users can also rename and delete a category. Currently, there are no limits to how many categories can be created for an event.

Another option available on the category right-click menu is the ability to create a rule. Rules allow the user to designate that tweets containing specific key words should be automatically categorized. The rule management interface appears as a Pop-up and can be seen in Figure 47. Each rule is comprised of a category to look for tweets within, a category to move the tweets to if they match the condition, and a condition to match, which consists of a string and a place to look for the string (i.e., inside the tweet text, or inside of the tweet user). Once a
rule is created, all new tweets will be tested against it to see if they match the rule’s condition and if a tweet matches, it will be categorized in the manner specified by the rule. The rule management interface also has a button labeled “Run Rules Now” which runs the rules against all the tweets currently stored in PMA. This option allows users to apply rule auto-categorization on tweets that have already been loaded into PMA before rule creation.

The rule feature can help automate categorization (Section 4.3.2.7 Repetitive Tasks), speeding the social media organization (Section 4.3.2.7 Organization) and sense-making processes of PIOs. A common scenario for using rules that many PIOs identified as useful during the testing in Chapter 5 is to help them extract messages sent from their own organization. Once all the messages from their organization are in one category, they can simply export the messages (this feature is described in the next section) into a file that they can store as a record of their efforts. Rules can also be helpful if there is a particular user or key word within their search results that a PIO wants to watch.

To categorize tweets, users can either click on a tweet and drag-and-drop it into a
category, or they can click on the tweet (selecting it) and then click on the category they wish to use. Only single tweet messages can be dragged-and-dropped, but multi-select is supported with the click-and-click model. Two buttons appear at the bottom of the tweet stream that let the user “Select All” of the currently shown messages, or “Unselect All” of the selected messages (see Figure 45).

At the top of the PMA streaming view, a clickable text message tells the user how many search terms are active. Clicking this status message sends the user to the search terms page. If there are active search terms, the text is green; if there are no active search terms, the text is red.

Finally, the PMA streaming view provides an email reporting function (see Section 4.3.2.3 Reporting). To email a tweet (or several tweets), the user selects the tweets that they want to email, and clicks the “Email” button. The email function uses a “mailto” link which opens the default email client for the computer PMA is accessed from, and creates a message that the user can send. This reporting option can help PIOs send tweets to others quickly and efficiently.

6.2.3 Archive View

The archive view of PMA (see Figure 48) allows the user to view all of the event tweets that PMA has captured given the search terms for the event. This interface uses paging, with 10 tweets displayed at a time. Each of the header row names in the table can be clicked to sort the displayed tweets by that column’s value in ascending or descending order. Below the table header row, a search row appears that lets users enter search parameters for each of the columns: Text, User, Time Sent, and Categories. For example, if a PIO enters the word “fire” in the Text search field and hits the enter key, the interface will return only those tweets that contain the word “fire”. These search (see Section 4.3.2.11 Search) and sort features let PIOs perform
advanced queries on the information that they have collected, which can help them analyze it.

Figure 48: PMA Archive View

For consistency and convenience, the categories work the same way in the archive view as they do in the streaming view. This allows PIOs to categorize messages after an event happens, when they have more time. If a category is left-clicked with no messages selected, it
shows the archive view with only the tweets in that category.

Additional features that appear only on the archive view are the “Export” and “Report” options. Clicking the “Export” button creates an Excel spreadsheet with information about each of the tweets contained in the currently selected category (see an example spreadsheet that was created by PMA in Figure 49). Using this feature, PIOs can create and save a record of the tweet data that they collected around an event (see Section 4.3.2.4 Documentation and Section 4.3.2.10 Data Storage). Further, because the tweet data is inserted into an Excel spreadsheet, the data can be manipulated easily; PIOs can sort, search, and create their own charts, graphs, and statistics from the data.

Figure 49: Excel Spreadsheet Containing Tweet Data Exported from PMA

The report feature of PMA automatically generates a report using the tweets collected for the current event (see Section 4.3.2.3 Reporting). When a user clicks the “Report” button, they are presented with a pop-up dialog box (see Figure 50) that lets a PIO name the report and select the different types of analysis to include in the report. A report is generated with the chosen
options when the user clicks the “Create” button. For an example of a report generated by PMA, see Appendix O.

The automatic report generation of PMA has the potential to provide comprehensive analysis of the tweets collected for an event. In this version of PMA, only four different kinds of data analysis are supported: Top Ten Twitter Users, Daily Twitter Activity, Twitter Category Report, and Top Twenty Hashtags. These different analytical reports of the collected tweet data can help PIOs answer questions and demonstrate to their organization how social media is used as well as its value. In future iterations, the PMA report functionality could be greatly expanded to perform more complex analysis and comparisons across data.

6.3 PMA Implementation

In this section, I describe the tools and technologies used in the development of PMA and discuss some of the PMA implementation details.
6.3.1 Development Configuration

I developed and tested PMA on a Windows 7 computer using Eclipse\textsuperscript{33} for a development environment and Mercurial\textsuperscript{34} for source control management. For hosting the PMA web application files, I used an Apache\textsuperscript{35} web server. As PMA became less of a prototype and more of a functional application, I created a production version on a publically-available web server. This public version of PMA was also served from a Windows 7 machine running an Apache server.

6.3.2 PMA Web Application

The specific web application technology used to develop PMA was Yii\textsuperscript{36}—a PHP\textsuperscript{37} framework based on the Model-View-Controller (MVC) pattern. One of the main goals in creating the PMA high-fidelity prototype was to have a functioning tool that PIOs could use and test as quickly as possible. Yii was a good candidate because most web servers already have built-in support for PHP and Yii is optimized for quick prototyping and development. Further, by using a web application framework like Yii\textsuperscript{38} (as opposed to technology only used for prototyping), the PMA prototype could evolve into a fully functional application over time.

6.3.3 Browser Client

Javascript was essential for client-side, dynamic manipulations of PMA web page

\textsuperscript{33}http://www.eclipse.org/
\textsuperscript{34}http://mercurial.selenic.com/
\textsuperscript{35}http://www.apache.org/
\textsuperscript{36}http://www.yiiframework.com/
\textsuperscript{37}http://www.php.net/
\textsuperscript{38}In retrospect, I wish I had implemented PMA using an MVC framework that has a larger development community and consequently better support, such as Ruby on Rails. While I was able to implement PMA successfully using Yii, I was often on my own for support and I had to create development components that would have been provided for me in other frameworks.
contents, and JQuery—a javascript library—made accessing web page elements and handling events easier. The JsTree JQuery plugin rendered and supported the creation, maintenance, and editing of the category scheme used in PMA. The script.aculo.us library supplied drag-and-drop functionality for PMA and Ajax provided dynamic updating of web page content without reloading the webpage. I also used PHP libraries Phpdocx and PhpExcel to generate Microsoft Word documents (for reports) and Microsoft Excel spreadsheets (for archiving tweets).

6.3.4 MySQL Database Design

PMA’s backend data storage and retrieval needs were supported with a MySQL database. Here, I outline the database design for PMA—the database tables and the relationships between them. A diagram of PMA’s database appears in Figure 51.
The *user* table stores information about PMA users, including their name, password, profile information, and email. Each *user* entry has a selected *event*; this is the event which is selected in the event drop-down-list at the top of PMA. The *event* table has entries for an event name, location, start and end date, and a summary.

An *event* can have multiple *filters*. The *filter* table stores the search terms for each event and whether they are active or not active. The Twitter Collect Process reads from the *filter* table to determine what search keywords it should send to the Twitter Streaming API, while the
Twitter Consume Process uses filter table entries to determine which Twitter messages belong to which events.

Twitter messages and all their associated data are stored in the tweets table. The tweetevent table links these tweets with the events to which they belong. A tweet can belong to multiple events.

The category table stores the category hierarchies used for sorting and a nested set model (Kamfonas, 1992) is used to represent the category hierarchy in the database. As users sort tweets into categories, new entries are created in the coding table. The coding table tells PMA which tweets belong to each category.

Finally, PMA uses the rule table to automatically categorize tweets. Each rule specifies a category to search in for tweets that contain a keyword in either the username or the text of the tweet. If a tweet matches, it is sent to the destination category specified in the rule.

### 6.3.5 Twitter Collect and Consume Processes

To retrieve Twitter messages for PMA, I created a PHP script—using the Phirehose\(^{45}\) PHP plugin—that opens a socket to the Public Twitter Streaming API\(^{46}\). This script (labeled the Twitter Collection Process in Figure 40) provides search terms to the API and then waits for tweets matching the terms to be sent back over the open socket. When this script receives a tweet, it copies the JSON\(^{47}\) for the tweet to a text file, which is rolled over if it is not empty every ten seconds, creating a queue (Twitter Queue Files in Figure 40). A second PHP script (labeled the Twitter Consume Process in Figure 40) reads and parses the JSON tweet data in the rolled

\(^{45}\) [https://github.com/fennb/phirehose/](https://github.com/fennb/phirehose/)

\(^{46}\) [https://dev.twitter.com/docs/streaming-apis](https://dev.twitter.com/docs/streaming-apis)

\(^{47}\) [http://www.json.org/](http://www.json.org/)
over queue files and inserts the tweets into the PMA MySQL database. This second script also checks each of the keyword search terms that are currently active against each tweet. If the script finds one of these keywords in a tweet message, it creates a code that associates that tweet with the event that is searching for the keyword. Both scripts run as Windows Services so that they constantly run in the background and restart if the computer reboots or the script stops.

6.4 Summary

This chapter describes the final design and implementation of the high-fidelity PMA prototype. The next step, evaluation of this final PMA prototype with PIOs, is described in the following chapter (Chapter 7).
CHAPTER 7: PMA Evaluation Studies

In this chapter, I describe the evaluation of the final PMA prototype (outlined in Chapter 6). PMA is a tool designed to help PIOs monitor, archive, analyze, and report social media data during an emergency event. I conducted two evaluation studies to assess different aspect of PMA. The first evaluation was a field study that took place during the 2012 Colorado Wildfire Season. Here I observed PIOs using PMA to perform social media duties. The primary goal of this study was to assess how PMA met PIO social media needs. The second evaluation was a usability study conducted with PIOs at their workplace. Here I designed a set of tasks that would guide PIO participants through PMA functionality. The primary goal of this study was to assess the effectiveness of PMA’s user interface.

Ideally, the usability study would have been conducted before the field study; however, the opportunity to evaluate PMA in the field during the Colorado Wildfire Season arose before the usability tests could be conducted. Crisis events are unpredictable and when studying them researchers must be prepared to adjust their schedules to take advantage of research opportunities.

This chapter describes the methods and results of these evaluation studies and outlines areas of future work and development for PMA. The studies are discussed in the order they were conducted.

7.1 PMA Field Study

In PMA field study, I wanted to understand how PMA might be used in a contextual setting—an emergency operations center (EOC) during the 2012 Colorado wildfire season. By observing how PIOs use PMA in the context of a real emergency, I gained insight that could not
be obtained by observing PIO behavior in a more controlled setting.

### 7.1.1 2012 Colorado Wildfire Season

Due to an extremely dry winter season and high summer temperatures, the state of Colorado has had a difficult 2012 wildfire season. In the months of June and July numerous large fires burned in Colorado. The two most severe fires combined—High Park Fire and Waldo Canyon Fire—burned 105,531 acres, destroyed 606 homes, and caused 3 deaths (Minshew and Schneider, 2012). Dry conditions and the high fire risk prompted Governor Hickenlooper to sign an executive order on June 14 banning all open fires in Colorado (Hickenlooper, 2012) and on June 28, President Obama approved a disaster declaration for Colorado which would provide additional funds and resources to fight the fires (USDA, 2012).

I first became involved in the 2012 Colorado wildfire season when I joined the Little Sand Fire Virtual Operations Support Team (VOST). The VOST concept is a recent innovation by emergency managers that uses a team of virtually-located volunteers to support the social media needs—monitoring and message distribution—of an emergency management team (St. Denis, Hughes and Palen, 2012). This VOST maintained four social media streams for the Little Sand Fire: a wordpress blog, a facebook page, a twitter account, and a G+ page. As a VOST member, I monitored social media activity around the fire and pushed PIO information over the four social media streams for the fire. I participated in this effort during the 9 days it was active.

As more large, high-priority fires started in Colorado, the Rocky Mountain Area Command Center (RMACC) recognized a need to coordinate information across the region. The

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48 A VOST can potentially accomplish any task that can be done using a computer and an Internet connection, but social media support has been the primary focus of efforts to date.
Rocky Mountain region includes the states of Colorado, Kansas, Nebraska, South Dakota, and Wyoming. To coordinate online information for the many fires around this region, the PIO leading the Little Sand Fire VOST effort was reassigned to head this effort. She began by selecting her team: she chose a team of PIOs who were known as social media leaders in their organizations and she enlisted the help of a VOST team (of which I was a member). The effort hosted a website at wildlandfires.info and was envisioned as a resource for anyone who wanted to know more about the wildfires in the Rocky Mountain region. Daily activities included gathering information about each active fire in the region and updating wildlandfires.info. Social media streams were used to guide people to wildlandfires.info when information updates were posted. While the team was still active, I conducted my PMA field study with the PIOs who were working on the wildlandfires.info effort.

7.1.2 Participants

Four PIOs participated in this field study. These participants were seasoned PIOs, with experience ranging between 6 and 27 years (for more detailed participant data see Appendix P). These PIOs were a good audience for PMA testing because they were comfortable using social media in their PIO duties and they had previous experience with which to compare their use of PMA. All participants signed a consent form and filled out a background questionnaire before the study began.

7.1.3 Procedure

The field study took place at the EOC for the wildlandfires.info project in Denver, Colorado. Prior to the field study, I spent a full day with the PIO participants in that location, getting to know them and their process better. During this time, I built rapport with these PIOs.
which helped them feel more comfortable and open on the actual test day.

On July 6th, 2012—the day of the field study—I spent nine hours (7am – 4pm) at the wildlandfires.info EOC. The four PIOs sat around a large conference table; each PIO had their own space, with their computer and mobile phone (one PIO had multiple computers). At the center of the table were a shared portable printer and a conference phone. On the walls they hung large sheets of paper that listed the current fires in the region and which PIO was responsible for which fire. During the day, they had two conference calls and periodically visitors would come by who wanted to learn more about their operation.

Throughout the day, I sat next to each PIO for a one-on-one session in which I demonstrated PMA and its features. PMA reception was positive and the PIOs had much to say about how the tool could help them with their social media needs as well as how PMA could be improved. PIOs were then asked to use PMA while I observed them. The length of observation time varied by participant: the shortest observation time was 15 minutes and the longest was 30 minutes. I encouraged PIOs to continue using PMA for the remainder of the day (which only happened in one case, largely because the PIOs had limited social media monitoring needs during the observation period). At times conducting these sessions was difficult because the PIOs had many responsibilities that drew their attention away from using PMA.

7.1.4 Data Collection and Analysis

During this field study, I took extensive notes using a datasheet developed beforehand (see Appendix R). I audio recorded each of the one-on-one PIO sessions. These audio recordings provided a backup for my notes that I could refer to if I missed or wanted to clarify a part of the sessions. I also took photos of the EOC workspace. I analyzed this field study data using the affinity diagram method (Beyer and Holtzblatt, 1997) to organize and group my hand-written
7.1.5 PMA Field Study Results

Overall the study PIOs’ perceptions of PMA were positive. All PIOs stated that they would use the tool and that it provides a significant improvement over current practice. One of the study PIOs has since recommended the tool to at least two other emergency managers (that I know of). This section outlines the results of the PMA field study.

7.1.5.1 Social Media Support for PIO Practice

As stated earlier in this chapter, the primary goal of this field study was to understand how PMA can support the social media needs of PIOs. I discuss the three areas of PIO social media work where PMA seemed to add the most value (according to PIO participants): analysis, documentation, and reporting.

7.1.5.1.1 Analysis Support

Within the context of the Colorado Wildfires, PIOs found several ways PMA could help them analyze the social media data they were monitoring. One PIO stated that when she looks at social media data around an event, she is usually trying to answer a question. She gave an example question: “For the High Park Fire, what are the public’s concerns around containment?” To answer this question, she needs to capture relevant information (messages about High Park Fire) and then query those messages for keywords like “containment”. She expressed excitement that PMA tweet collection and search features allow her to do this type of analysis.

Another PIO categorized the tweets she monitored around the sentiment they contained so that she could analyze how members of the public felt about the Colorado wildfires. To sort tweets by sentiment, she created categories such as “angry”, “sad”, “confused”, and “grateful”
and dropped tweets into these categories. Though she was unable to complete this analysis (she was called away to perform other duties), she explained how organizing tweets in this way would help her understand the public’s response to the event and their perceptions of the messages she released as a PIO. With this information, she could shape future messages to address the mood of the public. She also imagined creating a report that would display the number of sentiment category tweets in a pie chart⁴⁹. She saw PMA as a valuable tool for her PIO work.

Yet another PIO was proficient in Excel. Once she saw that PMA could export Twitter data into an Excel spreadsheet, she knew she could create graphs and statistics from this data that would help her analyze the Twitter traffic around an event.

7.1.5.1.2 Documentation Support

As social media use during emergency events increases, PIOs face growing concerns about how to document this activity. PIOs have directives from their organization (NIMS) and government (Open Records Act) to maintain public records of their emergency communications. Currently, social media platforms do not support these record keeping needs.

PIOs described the cumbersome and inefficient ways in which they currently capture social media activity. One PIO uses a screen capture tool to take screen shots of the Twitter messages she sends during an event. The resulting screen shots are stored in a very large pdf file that is difficult to parse and read. Another PIO described how two PIOs from her team worked full-time for two days taking screen shots of social media activity following a recent event. Unfortunately, screen shots are static data representations of social media activity that are difficult to manipulate. For example, if a PIO wants to use the text from a Twitter message that

⁴⁹ PMA has not been specifically designed for sentiment analysis. Other tools are available, such as LIWC (Linguistic Inquiry and Word Count) - http://www.liwc.net/, which focus on textual analysis tasks around sentiment.
has been captured with a screen shot, copy and paste does not work, s/he must retype the message.

PMA lets users collect Twitter messages around an event and export these messages into an Excel Spreadsheet that can be used for documentation. All PIOs noted how simple it was to document tweets using PMA and how much time such a capability could save them.

7.1.5.1.3 Reporting Support

The PIOs in this study have used social media in their PIO duties for several years. They were assigned to the wildlandfires.info project because each was seen as a social media leader within his/her respective organization. Interestingly, despite a proven track record of successful social media use, these PIOs still feel they have to prove the worth of the technology. One way they do this is by producing social media metrics to show their management. These PIOs stated that PMA’s ability to create a social media report would be invaluable. Not only would PMA’s reporting function save PIOs significant time by automatically generating metrics, charts, and graphs, but it would also help them convince management of the usefulness of social media.

PIOs shared many ideas about the types of metrics they would like to see in the PMA social media report. One metric is the number of people who potentially saw each tweet they sent during an event (also known as the tweet reach). PMA could calculate tweet reach using the follower count information collected with each tweet. PIOs also wanted to see retweet behavior, how many times each tweet was retweeted and which messages were retweeted the most. One PIO wanted the reporting function to show how Twitter activity evolved over a certain time period. Another PIO wanted PMA to report how often keywords that she specifies appear in collected tweets. Finally, PIOs imagined that after categorizing tweets they could create a report that shows how many tweets are contained in each category. For example, if a PIO had a “Fire
Prevention” category within PMA, s/he could demonstrate with a table or a graph how many tweets are about fire prevention.

7.1.5.2 Usability Issues

Though this field study was not intended to assess the usability of PMA, many issues became visible. I provide a list of these usability issues:

Browser and System Interoperability – I developed PMA using the Firefox browser on a Windows 7 computer. Several of the PIOs in this study use alternative browsers or operating systems, and we quickly discovered that PMA has interoperability issues.

Default Category Name - When PIOs created a new category, the default category name was “New Node”. The default category name should be “New Category”.

Changing the Default Category Name – When a new category is created, the cursor is placed at the end of the text entry field, after the default name. To change the name, PIOs had to delete the default name before typing a new name. Ideally the default name of the category would be selected so that the user can just start typing to replace it.

Categorization Feedback – When PIOs dropped a tweet into a category, there was no feedback telling them whether their action was successful.

Opening URL Links – Clicking on a URL link in some instances loaded the URL in the PMA window, forcing the user to hit the browser back button to return to PMA. Instead all URL links should open in new browser tabs.

Too Many Links - In the streaming interface sometimes the tweets have so many clickable links that it is easy to accidently click a link when attempting to select or drag-and-drop the tweet. The clicked link then opens in a new tab and shifts the browser focus to this new tab, which can be disorienting to the user as well as annoying if it happens frequently.
Switching Between Events – Sometimes a PIO wanted to switch to a different event within PMA, which is done by selecting the desired event from the drop-down list at the top of PMA. Switching events did not always work, and would often revert back to the previous event selection.

Excel Spreadsheet Format – All PIOs liked that PMA could export tweet data into an Excel spreadsheet, however, the current formatting in the excel spreadsheet is poor and can make the data difficult to read.

7.1.6 PMA Improvements

A month passed between the PMA field study and the PMA usability study. I used this time to improve the PMA prototype based on PIO feedback from the PMA field study. In this section, I provide a list of the PMA improvements I implemented:

- Implemented the full rule functionality for auto-categorizing tweets.
- Provided a column in the streaming view that appears to the right of the tweet showing the categories each tweet belongs to. This field updates to let users know that a tweet has been successfully placed in a category.
- Changed the default name for a new category to “New Category”.
- Fixed many, but not all interoperability issues. Now, PMA runs successfully on Firefox, Internet Explorer, and Safari web browsers as well as Windows and Mac operating systems.
- Fixed PMA to select the default name of the category upon creation so that the user can start typing to replace the default name.
- Fixed all URL links to open in new browser tabs.
- Removed the URL link to the tweet sender’s profile from the tweet picture. Now, even if
a tweet contains many clickable links, a user can always safely click on the tweet picture to select or drag-and-drop the tweet.

- Fixed problem where switching events did not always work.
- Rewrote the Excel spreadsheet generation component of PMA to use a more robust PHP library that supports advanced formatting.
- I used a new version of the PMA prototype—one that includes the above improvements—for the PMA usability study described in the next section.

7.2 PMA Usability Study

To assess the effectiveness of PMA's user interface, I conducted a usability study (Lazar, 2006; Rogers, Sharp and Preece, 2011). In this section, I outline the details of the study and its results.

7.2.1 Participants

Seven PIOs participated in the PMA usability study. Most of these PIOs, except one, had participated in the PMA test sessions conducted in Chapter 5. This study gave these participants an opportunity to see how PMA had evolved through their feedback. PIO experience for these participants ranged from 9 months to 21 years, and the type of PIO also varied widely. Detailed information about each participant can be found in Appendix Q.

7.2.2 Procedure

The usability test sessions were conducted at the PIOs’ place of work in late July and early August of 2012. Each session lasted approximately one hour. Before beginning, I obtained a completed background questionnaire and signed consent form from each participant. I then described PMA and its purpose and explained the format and aim of the usability test session.
Participants had the opportunity to ask questions at this time.

To test PMA, I created a series of tasks designed to guide a user through PMA’s features; this list appears in Figure 52. PIOs stepped through the list using their own computers. The goal was to learn how PIOs perceive PMA and its user interface. What do they find confusing? What do they like or dislike about the tool? Would they use this tool in their work? I asked the participants to “think aloud” (Lewis, 1982) as they completed the tasks so I could better understand their interactions with PMA. All PIO participants completed all tasks.

### PIO Monitoring Application Task List

1. Go to the following location in your web browser: [http://71.196.142.80/bucketsorter/](http://71.196.142.80/bucketsorter/)

2. Login using the credentials provided to you

3. Create a New Event – This can be anything, but preferably something that is currently getting Twitter traffic

4. Create Search Terms for Your Event

5. Switch to the Live Streaming Mode – conduct the following activities in this mode
   a. Pause and Resume the Live Stream
   b. Create a New Category and place a Twitter Message in this category
   c. Create and Run a Rule
   d. Select a Tweet and Email it to Someone

6. Switch to the Archive Mode – conduct the following activities in this mode
   a. Search for Tweets containing a keyword of your choice
   b. Place a Twitter Message in one of the categories you created
   c. Export the Twitter Messages for this event
   d. Create a Report from the messages in this event

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**Figure 52: PIO Monitoring Application Task List for Usability Testing**

After PIOs completed the tasks, I asked a few questions about their impressions of PMA and how they would or would not use the tool. Lastly, I thanked each PIO for their participation and gave them another chance to ask questions.
7.2.3 Data Collection and Analysis

Video recordings for each session were made with permission from the participant. I also kept notes of comments and actions on a sheet that mimicked the task list (Figure 52), except more space appeared between items to allow for notes. When analyzing the data from the test sessions, I grouped my observations by the task to which it referred. I discuss the findings from this analysis in the next section.

7.2.4 PMA Usability Study Results

The usability evaluation of PMA yielded many user interface issues as well as ideas for new features. I organize these findings by the different tasks that PIO participants were asked to perform.

7.2.4.1 Locating PMA and Logging In

Using their own computers, all PIOs successfully located PMA in a web browser and logged in to PMA successfully.

7.2.4.2 Event Creation

The process for creating a new event is not intuitive. When a user first logs in to PMA, s/he is directed to the Event Details page for the currently selected event. Consequently, most PIOs first tried to create a new event by editing the current event. This confusion could be solved by creating a new page—shown directly after logging in to PMA—that lets the user choose the event they want to work with or create a new event. With a little guidance, PIOs eventually saw the “Create New Event” button at the top of the PMA interface and clicked it.
Figure 53: PMA Create Event Page

On the event creation page (see Figure 53), the event name was the only required field; nonetheless most PIOs tried to specify values for all the fields. The most common question was whether the event end date is required (which it is not). Many events do not have an end date—they are ongoing—and this was often confusing. Later in the session, a few PIOs referred to the start and end date fields because they thought PMA’s features were tied to these date values, such as the report generation. The location field was confusing to one participant; she was unsure if it should contain the location where the event occurred or her location. Similar confusion happened for several participants around the summary field. Should it contain a summary of the event when it began, or should it reflect the current status of the event? The location, summary, and date fields are informational only; however, due to the confusion that they caused in this
study, it may make sense to simply remove them.

When choosing an event to create, I instructed the study participants to choose a current event that would have a lot of Twitter traffic. I wanted the PIOs to have live data that they could experiment with. Few participants had an active emergency event to monitor, so most created an event around the 2012 Summer Olympics which took place during the usability test sessions.

7.2.4.3 Search Term Creation

After successfully creating a new event, PIOs created search terms for their new event. Participants liked the ability to create as many search terms as they needed. Most of the PIOs finished this step with little difficulty, but there were several questions about how to construct the search terms. For example, participants wondered if they should include the “#” symbol when searching for a hashtag. Others wondered if search terms could include spaces, and if they could, how would the search behave: would tweet results match the individual words in the search term in addition to the whole term? Still others wondered if search terms were case-sensitive. The “Search Terms” page could benefit from some simple instruction on the behavior of different search term types.

Also, several participants wanted to perform complex search queries, such as searching by date, location, or Twitter username. These query types could be supported in future versions of PMA.

7.2.4.4 Live Streaming Mode

At this point, PIO participants were ready to begin monitoring tweets on the PMA “Streaming” page (see Figure 54). PIOs found the features associated with each tweet helpful. For instance, they liked to see the picture associated with the tweet sender. Sometimes the handle or screen name of a Twitter user is not recognized, but they can be recognized from their picture.
Study participants also appreciated that Twitter usernames were clickable and would open the Twitter profile of that user in a separate tab within their browser window. When investigating a tweet of interest, PIOs want to know more about the sender and providing a quick link to the sender’s profile helps them do this. All URLs that appear in tweet messages are clickable as well, letting PIOs follow these URL links without having to copy-and-paste the link into a new browser window. The information provided in these URL links is publically available so PIOs want to be sure that it is accurate. If the information is not accurate, they may want to take steps to ensure that the correct information is distributed. Finally, PIOs were pleased they could directly reply to a tweet sender and retweet each tweet using the buttons provided at the right-hand side of the tweet interface.

![PIO Monitoring - High Park Fire](image)

Figure 54: PMA Streaming View

PIOs had several ideas for improving the “Streaming” interface. First, Each tweet is
 draggable so a user cannot easily select the content of a tweet to copy-and-paste it. This problem occurs because holding the mouse button down on a tweet makes PMA think the user is trying to drag the tweet somewhere. One PIO suggested implementing a copy function that would allow the user to select a tweet (or several tweets) and copy the selected content to the user’s clipboard for pasting.

Another idea is to create a back-in-time option for each active search term. Often PIOs do not know what terms to monitor until several hours into an event. Currently, PMA captures Twitter activity from the time a search term is activated forward. A back-in-time option would allow PIOs to collect all available Twitter activity that matches their search terms even if it occurred before they activated the search.

7.2.4.4.1 Live Stream Manipulation

For this task, PIOs were asked to experiment with pausing and resuming the live tweet stream. PIOs saw value in this feature because there were many times when the tweet stream moved too quickly for them to process in real-time. Pausing the stream gave them time to decide how to handle a tweet and then resume the stream where they left off.

7.2.4.4.2 Category Creation and Twitter Message Categorization

Next, participants created a new category and categorized at least one of the live stream tweets in this new category. Users must right-click on an existing category to reveal a contextual menu that gives them the option to create a new category (see Figure 55). No test participant discovered how to create a new category on their own. They searched the interface and upon discovering no obvious way to create a new category, asked me how they could accomplish the task. Once PIOs learned about the right-click category menu, they understood how to use it and successfully created a new category. Nevertheless, the interface was not intuitive upon first
encountering PMA. Contextual help telling PMA users how to access the category right-click menu could be useful here.

PIOs liked naming a category as they pleased and creating multiple levels of categories and sub categories. These features let PIOs customize the interface to suit the particular needs of their organization and the events to which they respond.

During testing PIOs discovered a PMA defect in which newly created categories were not functional until after a page refresh. This defect was easy to work around, but should be fixed before releasing PMA for public use.

After successful creation of a category, PIOs tried to categorize one of the live stream tweets into the newly created category. Most participants began by trying to drag-and-drop a tweet into a category and they were pleased that this method worked. A few participants were unsure what to do and asked for guidance. Again, PMA could benefit from contextual help to guide users in interface interaction. When dragging a tweet over a category, participants found that the highlighting of the category did not change, which made it difficult to know if dropping the tweet in that location would drop it in the desired category. This is a usability issue that should be fixed in the next development iteration of PMA. Besides these few issues, participants found categorizing tweets simple and they found it useful that the interface updates to show that their categorization action was successful.
7.2.4.4.3 Rule Creation

The next task guided participants to create rules for auto-categorization. Most PIOs found the Rule Management interface because they remembered a “Rules” option on the category right-click menu (see Figure 55).

![Figure 56: Rule Management Pop-up Interface](image)

Within the Rule Management interface (see Figure 56), clicking the “Add New Rule” button produces a new rule which users can edit. PIOs encountered several problems with this interface. First, PIOs expected to enter the values for a new rule before it was created, so it was confusing that a default rule was created that they must then edit. Second, participants were unsure how to edit the rule values in the table, despite instruction provided at the top of the interface. Third, the editing capability was unreliable; participants usually had to click on a value several times before they could edit it. Finally, once a participant changed a rule value they were required to push an “OK” button that would save the changes. Often participants lost their changes when they navigated away from a field without clicking the “Ok” button, which was
frustrating. To remedy these issues, I plan to create an alternative rules interface in the next version of PMA that removes the in-line table editing feature in favor of a more traditional interface. This new interface would let users create a new rule by entering and submitting values in a form. Users could then edit an existing rule by clicking an edit button that brings up a form in which the existing rule values can be altered and submitted.

After they successfully created a rule, PIOs attempted to apply the rules to their PMA Twitter data by clicking the “Run Rules Now” button. While the button performs the expected function, no feedback is provided to let the user know that the rules have successfully run: the interface does nothing. A simple feedback mechanism, most likely a status message, will be added to the next version of PMA to fix this issue.

7.2.4.4.4 Tweet Reporting via Email

For the next task, PIOs selected a tweet and emailed it to someone. All PIOs quickly discovered that they should use the “Email” button to perform this task. Participants liked the ease of emailing a tweet to someone. Current methods of sending tweets to others include copy-and-pasting the tweet into an email and taking a screenshot of the tweet and attaching it to an email; both methods are inefficient and error prone.

PMA’s email functionality is currently provided by a “mailto” link which has several limitations. First, the length of the URL the “mailto” link generates is limited. This length limit varies by browser, with the shortest length limit starting at 2083 characters in Internet Explorer. If the body of an email message pushed the URL generated by the “mailto” link past this limit (i.e., the user has selected many tweets to send) the link does not work. Second, the content of a

50 This limit was retrieved from http://support.microsoft.com/kb/q208427
“mailto” link must be in plain text, so advanced formatting options are unavailable. Third, the “mailto” link uses the default email client configured for the computer on which PMA is running. During the testing, the PIOs were on their own computers so PMA used their default email client. However, one PIO noted that often, on large events, emergency management personnel are given a computer to use that may not have an email client configured. All of these issues could be resolved if PMA were to implement its own server-side email client that could generate and send emails.

7.2.4.5 Archive Mode

After exploring the “Streaming” page of PMA, the next task guided users to the “Archive” page (see Figure 57). Tweets display differently in archive mode, but they still contain the same features as the tweets in “Streaming” mode. PIO participants appreciated the consistency in features between the two modes.
7.2.4.5.1 Tweet Search

In archive mode users can search collected tweets for the current event by entering search parameters in the text boxes contained directly under the table header row. This task had participants use the search interface to return a subset of the collected tweets.
Most PIOs understood how to use the search capability without explanation and all PIOs found basic searches easy to perform. I define basic searches as those in which a single phrase was searched for within one column of the tweet table. Some wanted to perform complex searches, however, which proved difficult. For example, several PIOs tried to enter a time or date to search by and were unsuccessful because they had not entered the query in the format expected by the search function. One PIO tried to search for tweets in a date range, but eventually gave up because he had no idea how to format the query. The tweet search function can support advanced queries using logical operators (e.g., >, <, =, etc…) and timestamps but there is no way for a user to know this in the current interface. PMA needs to provide help for advanced searches.

Despite difficulties performing advanced searches, PIOs saw value in searching within the tweets they had collected for an event. They imagined using the interface to find tweets sent during a particular timeframe, tweets containing a keyword to understand different phenomenon, or tweets sent by a particular user.

7.2.4.5.2 Tweet Categorization

The purpose of this task was to demonstrate that the “Archive” category interface works in the same way the “Streaming” category interface does. Categorizing tweets in the “Archive” mode was seen as an important feature because during a real event it would be unlikely that they could sort all tweets as they appeared. This capability in the “Archive” mode would let them sort the data at any time, even long after an event was over.

7.2.4.5.3 Export

One feature that only appears in the “Archive” mode is the ability to export collected tweets into an Excel spreadsheet. All PIO participants found the “Export” button and reported
liking the export feature. Participants wanted to use the Excel spreadsheet as a record of Twitter activity. One PIO was pleased that he could download collected tweets into a formatted Excel spreadsheet. From a previous event, he had received a CSV file from a Twitter collection service that contained the tweets he had been monitoring for that event. He encountered many errors when converting this CSV file to an Excel spreadsheet; therefore, he was excited to see that PMA could give him an Excel spreadsheet already in the format he wanted to work with.

Currently, the PMA export feature downloads those tweets from the selected category within the “Archive” page. However, PIOs wanted support for more complex export selection. Examples include the ability to select tweets and export only those that are selected, or the ability to export tweets from multiple categories that a user chooses.

Participants had a few suggestions for improving the tweet data contained in the PMA generated Excel spreadsheet. One PIO wants PMA to include the timezone of the created date for each tweet. When trying to determine exactly when a tweet was sent, knowing the timezone can be very important. Another PIO wants to add an additional column to the spreadsheet that would provide an URL to the original tweet.

During one test session, a PIO participant chose a particularly active search term and by the time they got to the export task, PMA had collected over 20,000 tweets. PMA’s export function failed to create an Excel spreadsheet, which was concerning because relative to other emergency Twitter data sets collected by project EPIC, 20,000 tweets is a small number. This issue is only part of a larger set of concerns around the scalability of PMA. A next step in this research is to explore software, database, and hardware optimizations that can increase the amount of data PMA can process.
The last task participants performed was to create a report from the tweet data they had collected. To create a report, users must click on the “Report” button, which displays the create report dialog box (see Figure 58). Users can then specify a name for their report and check the data analysis options that they want to include. Participants had no difficulties finding the “Report” button and creating a report.

All participants saw the report functionality as an important and helpful feature of PMA and they offered feedback on the four data analysis types currently provided by PMA: Top Ten Twitter Users, Daily Twitter Activity, Twitter Category Report, and Top Twenty Hashtags. The Top Ten Twitter Users analysis provides a table of the top ten usernames and tweet counts within the collected tweet dataset. Participants found this information useful because if someone is sending a lot of messages around an event it is most likely someone they want to track and investigate. The breakdown of the daily tweet activity can help PIOs see trends across an event while the breakdown of tweets across categories can help them understand the data better. Finally, the Top
Twenty Hashtags analysis can help PIOs understanding what hashtags are used during an event. For example, one PIO shared his process for determining which hashtag to use for an event. He starts with a broad Twitter search using general terms and looks for the hashtags people are using. This analysis could tell him which hashtags people are using with what frequency during an event.

PIO participants liked the ability to generate these reports as often as they like using the most recently collected data. They imagined creating daily or even hourly reports to share with their emergency management team. Also, because this report is generated as a Microsoft Word Document, PMA users can change the contents of the file. One PIO saw the potential to enhance the report by inserting her own commentary and interpretations of the tables, charts, and graphs created by PMA.

During this task, I sought feedback from PIO participants about what additional types of analysis they would like to perform on the collected tweet data. Several PIOs wanted the option to create the report based on messages in one particular category. Another popular analysis was the ability to calculate the Twitter reach for each tweet (how many users potentially saw the tweet given the number of people following the tweet sender). Participants also wanted to see the messages that were retweeted the most, and calculate the reach of those tweets given all of their retweets. Metrics like these are deemed important by emergency management leaders.

7.2.4.6 Predicted PMA Use

At the conclusion of each session, I asked PIOs if they would use PMA and if so, how would they use it. All PIOs responded positively that they would use PMA—some even asked when they could begin to use it. Most of the ways these PIOs imagined using the tool have been covered in previous sections; however, there were two uses of PMA that I had not encountered
before.

The first use came from a PIO who imagined using PMA on an everyday basis to track Twitter messages that refer to his organization. While he does not expect to see a lot of Twitter traffic, he wants to understand how people talk about and refer to his organization and see if there is anything he can learn from it.

The second use was from a PIO who had been acting as a representative for a family of a recent shooting victim. This PIO helped the family respond to media requests and helped them understand what they could and could not talk about given the pending criminal case against the shooter. Because of the high-profile nature of the case, this PIO received almost 300 media calls per day at one point. This PIO talked about how PMA could be used to support his/her\textsuperscript{51} role. S/he could monitor what people were saying about the victim over Twitter, and give the families a record of that information (because most of it was very positive) when the time was right.

\section*{7.3 PMA Updates Based on Study Results}

A final important step in this evaluation phase is to update PMA based on the issues found in testing. The following list summarizes the changes I made to PMA\textsuperscript{52}:

Make the creation of a new event more intuitive (Section 7.2.4.2)

Create contextual help explaining how to create and manipulate categories and put tweets into these categories (Section 7.2.4.4.2)

Fix issue where a newly created category is not functional until after a page refresh

\textsuperscript{51} Gender neutral terms are used here to protect the identity of this PIO.

\textsuperscript{52} Note to committee members: I am currently implementing these changes, and plan to complete them before my dissertation defense. After the defense, I will update this section to be sure it reflects that actions I am taking.
Change category high-lighted to show when the user’s mouse is targeting it (Section 7.2.4.4.2)

Make the rule management interface more intuitive (Section 7.2.4.4.3)

Provide feedback when users run a rule (Section 7.2.4.4.3)

Include the timezone of the tweet creation timestamp in an exported Excel Spreadsheet (Section 7.2.4.5.3)

Improve the scalability of PMA (Section 7.2.4.5.3)

- Create new PMA report function capabilities:
  - Tweet reach (Section 7.1.5.1.3 and Section 7.2.4.5.4)
  - Retweet behavior (Section 7.1.5.1.3 and Section 7.2.4.5.4)
- Ability to create a report from tweets in a particular category (Section 7.2.4.5.4)
- Include help for choosing search terms (Section 7.2.4.3)
- Provide an option to copy the content of a tweet into the user’s clipboard for pasting (Section 7.2.4.4)
- Provide help to users wanting to perform advanced search queries in the PMA archive mode (Section 7.2.4.5.1)

7.4 Discussion

In this phase of my dissertation research, I conducted two studies that sought to evaluate the PMA prototype—its effectiveness as a tool for supporting the social media needs of PIOs. These studies revealed that PMA offers significant improvement over the social media monitoring, documentation, analysis, and reporting strategies currently employed by emergency PIOs. While usability issues exist, PIOs described the PMA user interface as clean, simple, and...
easy to use. Across both evaluation studies, all PIO participants stated that PMA was a tool they would use in their work.

Interestingly, before conducting these studies, it seemed that much of the advantage PMA offered over other applications was its ability to sort tweets into user-defined categories. These studies revealed, however, that the sorting capability was just a means to an end. The biggest advantage of PMA lies in the features that it provides to analyze, document, and report tweets once they have been sorted.

Conducting these evaluation studies offered new insight into the many ways PIOs could use PMA to support their work. PIOs shared examples of how PMA could be used in all types and sizes of emergency events. Participants also provided insight into how PMA could be used as a tool for analysis.

Many of the most popular features of PMA reflected the current state of emergency management. For example, PIO interest in the documentation feature of PMA reflects on how PIOs are currently struggling to find ways to efficiently document social media activity. The ability to create reports was also a popular feature; these PIOs are facing pressure to prove the value of social media in emergency response and reports like those which PMA creates could help them in these efforts.

Not only can PMA help individual emergency PIOs with their social media needs, but it can also help the larger PIO community. One PIO talked about how so many PIOs are struggling to keep up with their current duties. For these PIOs, it is overwhelming to think of adopting social media in their communication plan because it is time-consuming and they may be just a “one man” show. Other PIOs might be using social media but they are just getting by with the bare minimum of support. She believes that PMA could provide these types of PIOs with the
tools they need to make social media manageable and possibly even efficient.

7.5 Future Work

No software tool is ever truly complete; there are always improvements and new features that can be added. In the PMA evaluation studies, PIOs had many ideas for improving PMA’s user experience as well as ideas for additional features that would enhance PMA’s functionality. I capture these ideas in the following list:

- Implement more complex search terms (Section 7.2.4.3)
- Develop an internal email client for PMA to provide more advanced email options (Section 7.2.4.4.4)
- Create a back-in-time search option for collecting tweets (Section 7.2.4.4)
- Support more complex selection criteria for tweets to export (Section 7.2.4.5.3)
- Support PMA running on the Ipad and other mobile devices
- Provide a mechanism to track the action taken on a tweet
- Give users a way to share and import category schemes
- Support other types of social media beyond Twitter

The items in this list are considered ideas for future work because to implement them, they require significant architectural changes to PMA.

7.6 Summary

This chapter outlines the design, execution, and results of two evaluation studies—a field study that observed PMA use by PIOs in a real-world setting and a usability study that examined the effectiveness of PMA’s user interface. These studies found that PMA supports PIO practice
by supporting the analysis, documentation, and reporting of social media data during an emergency event. All PIO study participants claimed that they would like to use PMA to support their work. Following test activities, I updated PMA based on test results. The chapter concludes with a list of ideas for PMA improvements and new features.
CHAPTER 8: Conclusion

In this final chapter, I summarize research results and reflect upon the human-centered design approach used in this dissertation work. I also discuss future possibilities for the PIO role in emergency management and conclude with suggestions for further research.

8.1 Dissertation Summary

The purpose of this dissertation work is to support emergency PIOs as they adopt new types of ICT-enabled public communication, through human-centered design and system implementation. I began by conducting an empirical interview study with 25 PIOs across the state of Colorado (Chapter 3). This study explored PIO practice and the sociotechnical environment in which they work. Little research exists that examines and understands the work practice of PIOs in the emergency domain and this study fills this gap. Interviews sought to understand the tasks and responsibilities encompassed in the work of a PIO and how they are accomplished. Interviews also focused on how PIOs perceived that ICTs (and more specifically social media) have affected their work.

Through analysis of the PIO interview study, I developed a model of PIO communication that takes into account new pathways that have been enabled by ICT (see Section 3.6.1). This model provides understanding of the new pressures and expectations placed on PIOs by the media and the public which are changing and shaping the way PIOs work.

Based on the PIO interview study results, I conducted a participatory design (PD) workshop with PIO participants (Chapter 4). In this PD workshop, PIOs and researchers discussed PIO communication needs and designed new ICT prototypes to meet those needs. From workshop discussion and prototypes, I distilled social media support needs for PIOs (see
Section 4.3.2) such as the ability to monitor public information and the ability to document and report that information.

In the next phase of this dissertation research (Chapter 5), I designed five prototypes to meet the PIO social media needs identified in the interview study (Chapter 3) and the PD workshop (Chapter 4). These five prototypes were informally evaluated and two of the most promising prototypes were combined into a single prototype called the PIO Monitoring Application (PMA), which was further developed and tested with PIOs to validate that it supported the needs of PIOs. Chapter 6 describes the high-fidelity PMA prototype that resulted from these efforts.

Last, I assessed the final PMA prototype by conducting two user evaluation studies—a field study and usability study (Chapter 7). Each study tested different aspects of PMA. The field study sought to understand how PIOs might use PMA in their work environment and what advantages PMA offers over current work practice. The usability study sought to understand how PMA’s user interface could be improved to effectively support PIO work practice. I found that PMA helped meet the social media monitoring, analysis, documentation, and reporting needs of PIOs and all evaluation participants indicated that they would like to use the tool in their work.

Through the research activities in this dissertation, I demonstrated that by taking a human-centered design approach to ICT design and implementation, I could create a software tool (PMA) that helps support the social media monitoring, analysis, reporting, and documentation needs of PIOs in a changing sociotechnical environment.

8.2 A Human-Centered Design Approach

In this dissertation, I used a human-centered approach to ICT design and development. This approach advocates that to create technology that meets user needs, the target users must
actively participate in the design and evaluation process; therefore, I involved the study
subjects—PIOs—at every stage of this research. I interviewed PIOs to understand their work
practice as well as their needs and concerns around social media (Chapter 3). Throughout the PD
workshop (Chapter 4), I engaged PIOs in discussion of their needs and exploration of design
solutions for their work. As I built prototypes, I consulted with PIOs to ensure that the proposed
tools met their needs (Chapter 5). Finally, I involved PIOs in the testing and evaluation of PMA
at various stages of development (Chapter 5 and Chapter 7).

In the remainder of this section, I reflect upon the human-centered approach to ICT
design used in this research and offer several insights. These insights could be useful to
researchers in the crisis and emergency management domains as well as researchers conducting
broader human-centered research.

8.2.1 Supporting the Needs of a Broad and Diverse Community

The PIOs who participated in the interview study described in Chapter 3 varied across
three dimensions: organization type (i.e., fire, law enforcement, public health, government,
etc…), size of jurisdiction (i.e., rural or urban), and employment status (i.e., full- or part-time).
Designing technologies that support such a diverse community is challenging because it is
difficult to identify common requirements. Further, at times PIOs that seemed similar had very
different needs. For example, PIOs from some small communities expressed no need for social
media, yet PIOs from other small communities found social media vital because it let them reach
their small but geographically-dispersed community.

In all dissertation research that included PIO participation, I was careful to recruit a broad
range of PIOs that varied across these dimensions. This strategy proved helpful in the design of
PMA; results from the evaluation studies in Chapter 7 showed that PMA helped support the
social media monitoring, analysis, documentation, and reporting needs of a wide variety of PIOs.

8.2.2 Obtaining Research Access to Participants

When an emergency event occurs, emergency workers (such as PIOs) are often overwhelmed and I discovered that this is not the time to establish new relationships and embed yourself in the response effort as a researcher. During the 2012 Colorado Wildfires, I tried to gain research access to some of the large fire emergency teams, but was unsuccessful. Eventually, I gained permission to study the Colorado regional fire effort (see Section 7.1.1) through a prior research contact. I learned that a better way to obtain research access to an active emergency event is to establish and maintain relationships with emergency workers beforehand. Then, when an emergency event happens, they know and trust you, making it more likely that you will gain access.

8.2.3 Mixing Researchers and Participants

A human-centered research approach necessitates close researcher and participant involvement. During this dissertation research, I developed friendships with many of my participants, which sometimes made it difficult to maintain an objective perspective. On the other hand, building rapport with participants offered benefits, such as access to protected research sites and increased willingness to participate in research activities.

Interestingly, because of my position as a PIO researcher, I found that PIOs looked to me as the expert on their work; they did not necessarily trust their own experience as a valid perspective. I tried to combat this issue by encouraging PIOs to share their experiences, and I only related the experiences of other PIOs when deemed necessary.

Finally, at times PIOs were less critical of PMA because they knew I had created it and
they did not want to offend. I tried to assure participants that I would not be upset by their comments. Also, because PIOs knew I had created PMA, I was often pressured by PIO participants to make PMA available as quickly as possible and to create custom features that would benefit the specific needs of one PIO.

8.3 The Future of the PIO role

In this research, I explored the role of the PIO in emergency management and examined how new ICTs (particularly social media) have changed the role of the PIO by introducing new “communication pathways” (Palen and Liu, 2007) with members of the public and media. These new pathways place new demands on PIOs to adopt and use technologies like social media in their communication strategies, which changes the types of tasks that PIOs are asked to perform. This research demonstrates that the adoption of social media into PIO work practice is a complex sociotechnical process involving many factors (i.e., pressure to use social media from the public and the media, resistance to social media use from management, lack of support from emergency management structures and procedures) that have evolved over time and will continue to evolve. Here, I discuss future trends in PIO work practice based on results from my dissertation research.

8.3.1 Leveraging the Digital Volunteer

An important trend that continues to grow within emergency management response is the use of digital volunteers (Starbird and Palen, 2011). Already, a small group of PIOs and other emergency managers in the US have recognized that a team of digital volunteers (a VOST) can extend the capabilities of an emergency response team to monitor and maintain social media streams (St. Denis, Hughes and Palen, 2012). The creation of the VOST concept demonstrates
how deeply current emergency organization policies and structures need updating. Rather than wait for a solution from high-level management, emergency workers (including PIOs) have created and experimented with an unsanctioned organization that they feel will meet their needs and make their job easier.

The VOST concept is also advancing ideas about how volunteers can contribute and provide support during an emergency. Emergency organizations have models for working with volunteer organizations (e.g., Red Cross, CERT teams, etc.) and these models need to be redefined to include digital volunteers like VOSTs, but many issues must be addressed before digital volunteers can officially integrate with emergency organizations. For example, training is currently a problem for VOST members (St. Denis, Hughes and Palen, 2012). VOST training is done in an ad-hoc fashion that members refer to as Just-In-Time-Training or JITT. This type of training, one-on-one instruction when it is needed, works with smaller groups but quickly becomes ineffective as a VOST scales in membership. Further, the VOST concept is still new and rapidly evolving, which means that the responsibilities of its members are also constantly changing. In this environment, the VOST’s JITT model requires significant (and sometimes prohibitive) overhead in training and retraining its members. Until the VOST concept is more stabilized through further development and testing, efficient training will remain difficult.

Another important issue in working with digital volunteers is clearly defining the authority of these volunteers and their relationship with emergency management. In the recent 2012 Colorado wildfires, a VOST helped response efforts by maintaining websites and social media streams. When looking at these resources, members of the public were unsure if the information came from “official” sources and whether they could trust it. To further complicate matters, when PIOs were asked about the “official” nature of information provided over VOST
maintained resources, they chose to keep their relationship with the VOST ambiguous, likely because they, themselves, were unsure what the relationship was. During the 2012 Colorado wildfires, PIOs were able to sidestep public concerns about their use of a VOST; however, the concerns voiced by the public raise liability questions for the future. For example, if VOST members share information that inadvertently ends up putting people in harm’s way, who would be held accountable?

Finally, questions remain around how information provided by digital volunteers will enter emergency response organizations. In the case of the VOST, the emergency response point-of-contact has been the PIO. However, if emergency management organizations begin to use the VOST concept in a more formal way, this point of contact may shift away from the PIO and become embodied in a newly created role within NIMS.

As emergency management organizations seek to incorporate the efforts of digital volunteers like the VOST into their work, they will need to address these issues as they modify current volunteer agreements to include digital volunteers.

8.3.2 Changing the Emergency Management Organization

Anytime technology introduces the means by which employees in an organization can perform their job more efficiently and/or more effectively, changes will occur within that organization. In particular, this research is concerned with the changes to emergency management organizations (NIMS) as PIOs transition to using social media technology in their public communications. In this section, I discuss the ways NIMS is changing due to this transition and the likely future directions for the organization.

First, a major purpose of NIMS is to provide a consistent management structure across all emergency response organizations in the US. This consistent structure helps response
organizations work together because they use the same system and procedures. However, to date, there is no consistent social media strategy across emergency response organizations; all strategies vary, even among the limited sample of PIOs who participated in this dissertation research. This lack of consistency regarding social media use can be challenging when organizations must work together on an incident. Yet, danger also exists in requiring a single social media strategy. Different types of social media are more or less effective depending on the type of emergency event and the community affected by the event. One concern is that policy decisions made by federal organizations, such as FEMA, may mandate that PIOs use certain types of social media and not others. New policies must provide a consistent social media strategy that is flexible enough to allow emergency management organizations to use the social media technology that best fits the needs of their organization and community.

Second, tighter integration between the different NIMS positions are developing and will continue to develop as PIOs adopt social media into their practice. For example, current NIMS requirements specify that PIOs obtain permission from their commanding officer before releasing information to the public, but sending quick, timely updates over social media streams becomes difficult under these restrictions. In this research, I found examples of PIOs working closely with their commanding officers to establish trusted relationships where they could obtain permission to send messages more quickly (i.e., seeking message confirmation over the phone). At the same time, Hughes and Palen (2012) found early evidence that PIOs perceive greater decision making autonomy due to their more active role in managing public-generated emergency information (see also Chapter 3). It seems likely that the NIMS requirement that PIOs obtain permission for every message sent will be relaxed, if not eliminated in the near future, giving PIOs more autonomy and power within the organization.
Next, new relationships will develop between the different NIMS roles as PIOs expand their relationship with the public through social media. One NIMS role with whom PIOs will likely work closely with in the future is the situation unit. This unit is “responsible for the collection, organization, and analysis of incident status information, and for analysis of the situation as it progresses” (US Department of Homeland Security, 2008, 56). As PIOs monitor social media streams, they will want to provide relevant information from the members of the public to the situation unit.

Last, another possibility for organizational change is that the increasing job functions PIOs are called to perform (e.g., social media monitoring, rumor control, and message distribution) could be decentralized into other parts of NIMS (Hughes and Palen, 2012). Already we see the need for a redistribution of labor with the use of a VOST; PIOs have created a new external organization to help them with the tasks that social media demands. However, once technology solutions better support these newly formed PIO job functions, the decentralization process may need to be reconsidered (Hughes and Palen, 2012). PMA is one technology solution that seeks to support newly formed PIO tasks enabled by social media. Perhaps by the time FEMA updates NIMS (the last update happened in 2008), PIOs may have the capacity to handle their new job functions through technology solutions like PMA and external organizations like VOSTs. Thus decentralization may not be required.

One of the primary contributions of this research is PMA—a tool which helps PIOs monitor, report, and document social media in times of crisis. Though the tool is simple, it has the potential to simplify and ease the transition as PIOs incorporate social media into their response efforts. Consequently, PMA can shape and possibly exacerbate the organizational changes discussed above. Moving forward, it will be important to continue the study of PMA.
because how it is adopted and used by PIOs can reveal much about the NIMS organization and the ability of technology designers to affect change within these types of organizations.

### 8.4 Application to Other Domains

The emergency management domain can be a challenging environment to design for because the type of work performed in this domain is often intense. During an emergency event, PIOs must monitor the often crushing amount of information available in the public arena. Further, the demand for PIOs to provide information during emergency events can be overwhelming. By designing PMA to work well in the demanding environment of emergency response, I designed a tool that also works well in more relaxed environments where similar types of work take place. Consequently, though it was designed for PIOs, PMA can be a useful tool in a number of other domains.

PMA’s features are generic and highly-customizable, so anyone who has need of monitoring, analyzing, and reporting social media data may find it useful. PIO work is a type of public relations work. Therefore, if PMA supports PIO needs, it is likely that it would also support a broader class of public relations positions—both have the need to monitor and assess public information pertaining to their organization. PMA could also support marketing needs. Marketing professionals often monitor, analyze, and report social media activity around the products they represent and PMA could help these professionals in this task. As a last example, researchers who study social media trends may find PMA useful; already, several members of Project EPIC[^53] want to use PMA in support of their research.

[^53]: [http://epic.cs.colorado.edu/](http://epic.cs.colorado.edu/)
8.5 Suggestions for Future Research

A natural extension of this research would fully implement PMA and make it publically available for anyone to use. Once this is done, a prolonged study of PMA use by PIOs in real-world settings could take place. Though all PIOs in this research claimed they would use PMA, an extended study of their use would reveal if PMA can continue to meet PIO social media needs beyond initial adoption. This type of study would also likely provide insight into the operation of emergency management organizations and the changes that result to that organization from the use of PMA.

The research conducted in this dissertation focused on Colorado PIOs. Future studies could expand this scope to include PIOs across the US, ensuring that research findings from this dissertation generalize. While I hypothesize that dissertation findings will apply to other PIOs, there will likely be slight differences in PIO needs and expectations across the various regions of the US. These differences could offer additional insight into the nature of the PIO role.

Finally, as another next step, PMA could be deployed to the members of a VOST team. Digital volunteers will likely play an increasing role in the future of emergency management work and studying how VOST members use PMA could reveal much about digital volunteer needs and the contributions they can make to an emergency response effort. In addition, comparisons could be made between the way PIOs and VOST members use PMA.

8.6 Summary

This dissertation research designed and developed a novel application—grounded in empirical understandings of PIO work—to help PIOs monitor, analyze, document, and report social media data around an emergency event. Using a human-centered approach, PIOs
participated in the exploration, design, development, and evaluation phases of this research, resulting in an application (PMA) that all participants claimed they would use. Current PIO work practice requires a different set of skills and tools than in the past to manage and perform required tasks. PMA helps to ease the transition as PIOs learn to use social media and, as such, helps them perform their jobs in a changing technical and institutional environment.
References


Heath.


38. Hughes, A.L. and L. Palen (2012). The Evolving Role of the Public Information Officer:


Chicago, IL: University of Chicago Press.


Armonk, NY: M.E. Sharpe.


Appendix A  Game Cards Used in Pilot Study 1

Several concerned citizens have called into dispatch reporting the activities of a Twitter account spreading false and damaging information.

Police and Fire stations report being overwhelmed by citizens bringing unneeded donations.

Three different websites have been created by citizens to help with housing needs, the legitimacy of these sites is not known.

The fire starts on a holiday weekend, which creates a lack of personnel. Specifically there is a great need for messages to be translated into Spanish but the usual translators are on vacation.

It is early in the progression of the fire and the primary concern at this point is citizen and firefighter safety. However, citizens are complaining about the lack of information around the fire.

Damage to infrastructure and safety concerns require the power to be shut off to fire-affected areas.

In the rural areas affected, road and location names are not consistent, and there are many mistakes in the list of burned homes.

Several map mashups have been created surrounding this event. How would you evaluate the accuracy and effectiveness of such a tool?
Your job is to monitor the social media activity around this event. How would you approach this duty?

The first press release has been issued. How would you distribute this information over social media?
## Appendix B  Pilot Study 2 Schedule

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Duration</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome/ Getting Started</td>
<td>Explain what we are doing today</td>
<td>15 minutes</td>
<td>12:00-12:15</td>
</tr>
<tr>
<td>Twitter Show and Tell</td>
<td>Brainstorming/Discussion around Expectations for Twitter</td>
<td>15 minutes</td>
<td>12:15-12:30</td>
</tr>
<tr>
<td>Brainstorm/Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twitter Design Exercise</td>
<td>Using PICTIVE each participant designs their own vision of what they think Twitter could be for them</td>
<td>30 minutes</td>
<td>12:30-1:00</td>
</tr>
<tr>
<td>Discuss the Individual Designs</td>
<td>Have participants describe their design and what they did</td>
<td>20 minutes</td>
<td>1:00-1:20</td>
</tr>
<tr>
<td>Break</td>
<td></td>
<td>10 minutes</td>
<td>1:20-1:30</td>
</tr>
<tr>
<td>Discussion of Activities</td>
<td>Participants create a prototype of a Twitter dashboard combining ideas from previous activity</td>
<td>30 minutes</td>
<td>2:00-2:30</td>
</tr>
<tr>
<td>so far</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Design Session</td>
<td>Participants talk about why they created their prototype they way they did</td>
<td>15 minutes</td>
<td>2:30-2:45</td>
</tr>
<tr>
<td>Group Design Discussion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break</td>
<td></td>
<td>10 minutes</td>
<td>2:45-2:55</td>
</tr>
<tr>
<td>Future Lab Session Using</td>
<td>Participants are asked to step through a scenario using their prototype – a sort of proof-of-concept</td>
<td>30 minutes</td>
<td>2:55 – 3:25</td>
</tr>
<tr>
<td>Prototype</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab Discussion</td>
<td>Here we discuss the pilot study. We assign roles and functions</td>
<td>30 minutes</td>
<td>3:25-4:00</td>
</tr>
</tbody>
</table>
Appendix C  PIO Participatory Design Workshop Plan

2011

PIO Future Workshop Session Plan

Amanda Hughes
Computer Science PhD Candidate
University of Colorado at Boulder
9/16/2011
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# Schedule

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Duration</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup</td>
<td>Set up the workspace for the workshop and ensure safe arrival of PIOs</td>
<td>30 minutes</td>
<td>9:30-10:00</td>
</tr>
<tr>
<td>Welcome/Introductions</td>
<td>Explain the program for the day and introduce ourselves</td>
<td>30 minutes</td>
<td>10:00-10:30</td>
</tr>
<tr>
<td>PIO Research/Training</td>
<td>Present recent research from our lab, as well as give some training</td>
<td>30 minutes</td>
<td>10:30-11:00</td>
</tr>
<tr>
<td>PIO Information Space Discussion</td>
<td>Discuss what information PIOs use and how it is used</td>
<td>30 minutes</td>
<td>11:00-11:30</td>
</tr>
<tr>
<td>Break</td>
<td></td>
<td>10 minutes</td>
<td>11:30-11:40</td>
</tr>
<tr>
<td>Information Space Design Exercise</td>
<td>Participants design their ideal information space</td>
<td>30 minutes</td>
<td>11:40-12:10</td>
</tr>
<tr>
<td>Discuss the Individual Designs</td>
<td>Participants describe their design and what they did</td>
<td>20 minutes</td>
<td>12:10-12:30</td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td>30 minutes</td>
<td>12:30-1:00</td>
</tr>
<tr>
<td>Group Design Session - Part One</td>
<td>Participants are split into two groups and given a design idea to work on</td>
<td>20 minutes</td>
<td>1:00-1:20</td>
</tr>
<tr>
<td>Group Design Session - Part Two</td>
<td>A possible solution to their design task is presented (in prototype form) and they are given time to discuss and possibly rework their design</td>
<td>30 minutes</td>
<td>1:20-1:50</td>
</tr>
<tr>
<td>Group Design Discussion</td>
<td>Participants talk about their design and why they created it that way</td>
<td>20 minutes</td>
<td>1:50-2:10</td>
</tr>
<tr>
<td>Break</td>
<td></td>
<td>10 minutes</td>
<td>2:10-2:20</td>
</tr>
<tr>
<td>Idea Discussion and Ranking</td>
<td>Throughout the workshop a collection of ideas is created, this will be organized in the background before this discussion, here we will discuss the results and give priorities to the most important items</td>
<td>25 minutes</td>
<td>2:20 - 2:45</td>
</tr>
<tr>
<td>Closing</td>
<td>Final thoughts, Solicit for further ongoing research contact, Questionnaire</td>
<td>15 minutes</td>
<td>2:45-3:00</td>
</tr>
<tr>
<td>Take Down</td>
<td>Help is needed to take clean up and collect all data.</td>
<td>15 minutes</td>
<td>3:00-3:15</td>
</tr>
<tr>
<td>Debrief</td>
<td>Debrief on the workshop with the researchers</td>
<td>30 minutes</td>
<td>3:15-3:45</td>
</tr>
</tbody>
</table>
2 Setup (30 min)

Help will be needed to set up the location of the workshop. This includes things such as setting up video cameras, tables and chairs, signs leading to the location, and PICTIVE materials as well as tidying up the lab space. Volunteers are also needed to help the PIOs find their way to the lab space, and greet them when they arrive.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment (Names)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escorts</td>
<td>Help bring PIOs to the workshop location when needed</td>
<td>Jo, Sarah</td>
</tr>
<tr>
<td>Stagers</td>
<td>Help set up the lab</td>
<td>Casey, Lise</td>
</tr>
<tr>
<td>Videographer</td>
<td>Set up the video cameras and make sure they are ready to go.</td>
<td>Kate</td>
</tr>
<tr>
<td>Greeters</td>
<td>Meet and greet each PIO, make them feel welcome</td>
<td>Amanda, Leysia</td>
</tr>
</tbody>
</table>
3 Welcome/Introductions (30 min)

We begin with a short welcome speech (see Appendix C) and explanation of the format of the workshop. At the end of the speech, signed consent forms will be obtained from all participants after which video-recording can begin.

Next will be a round of introductions. To begin, the primary facilitator will introduce themselves and demonstrate the method of introduction. Next, everyone will pick a partner (someone sitting close by) and speak with them for roughly 5 minutes. Researchers will be asked to sit amongst the participants so both groups can get to know one another. Ideally each partnership would consist of one research and one PIO, but this will not be strictly enforced. At the end of the 5 minutes, partnerships will be asked to introduce their neighbor by writing the following pieces of information on a large post-it note that will be posted on the whiteboard under the “Participants” heading (see Appendix B):

1. Neighbor’s name
2. Your neighbor’s job position and organization where they work
3. What forms of social media your neighbor has used in their job

The welcome speech should take approximately 5 minutes and the introductions 25 minutes. Since the time schedule is tight for the workshop, the primary facilitator will need to be prepared to enforce time limits.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videographer</td>
<td>Start cameras recording after consent forms are all obtained</td>
<td>Kate</td>
</tr>
<tr>
<td>Researchers</td>
<td>Sit amongst the PIOs and introduce yourself</td>
<td>Casey, Jo, Leysia, Lise, Sarah</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Give the welcome, explain introduction activity and facilitate the introductions</td>
<td>Amanda</td>
</tr>
</tbody>
</table>
4 PIO Research and Training (30 min)

This segment of the workshop will begin with a brief overview of the research I have done on PIOs, which will then cover some of the recent research being conducted in the lab. I will then present some of my ideas about where PIO work is headed and share some resources about fitting social media into emergency management.

A scribe will capture significant ideas we discuss on post-it notes that will be placed under the “Important Ideas” category of the whiteboard (see Appendix B). At this point, I will introduce the concept of the “Important Ideas” brainstorming area on the whiteboard. Throughout the workshop participants and researchers will be encouraged to write down interesting ideas, wants, needs, insights, and any other significant points of data on post-it notes that will be gathered under the “Important Ideas” category on the whiteboard. I will encourage a lot of this activity to happen in the background, so participants can write down thoughts as they happen, and not feel like they have to interrupt the flow of the workshop to present their thoughts and ideas. Later in the workshop these ideas will be organized and we will report and discuss the results.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videographer</td>
<td>Move and reposition video cameras to get the best view of the discussion</td>
<td>Kate</td>
</tr>
<tr>
<td>Photographer</td>
<td>Take occasional photos of the discussion</td>
<td>Casey</td>
</tr>
<tr>
<td>Scribe</td>
<td>Write key discussion points on the white board</td>
<td>Jo</td>
</tr>
<tr>
<td>Researchers</td>
<td>Engage in the discussion, ask clarifying questions and take notes</td>
<td>Leysia, Lise, Sarah</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Explain and lead the discussion</td>
<td>Amanda</td>
</tr>
</tbody>
</table>
5 PIO Information Management Discussion (30 min)

This will be an informal discussion to get PIOs thinking and in the right frame of mind for the design component of the workshop. I will begin by asking PIOs what types of information they use and how they manage that information during an emergency. I will ask them to think about the last large event they responded to where they had to deal with information overload. Possible investigative questions include the following:

- What information challenges did you face?
- What information sources took the highest priority and why?
- Conversely, what information streams took the lowest priority and why?

During this conversation the scribe will be writing PIO responses on the whiteboard under the “PIO Information Space” category (see Appendix B). The idea here is to flesh out the different information streams PIOs pay attention to, and the concerns they have with that information so that they can refer to this list when they design their ideal information space in the next activity. This should be a very interesting conversation and I hope to capture a lot of rich data about how PIOs work.

Here I will encourage them to talk about “critical incidents”, times when systems were stressed and what they did. Throughout the workshop, I will try to get them to talk about things that have actually happened. We will dedicate a small space on the whiteboard (see Appendix B) to write these scenarios down as they arise, and return to them during the workshop to apply context to whatever is happening at the moment. For example, we might ask, “Would this design function well under this scenario?”. A second scribe will be dedicated to capturing these scenarios, as well as capturing any good ideas that should be placed in our “Important Ideas” space on the whiteboard.

<table>
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</tr>
<tr>
<td>Photographer</td>
<td>Take occasional photos of the discussion</td>
<td>Casey</td>
</tr>
<tr>
<td>Scribe</td>
<td>Write key discussion points on the white board</td>
<td>Jo, Sarah</td>
</tr>
<tr>
<td>Researchers</td>
<td>Engage in the discussion, ask clarifying questions and take notes</td>
<td>Leyvia, Lise</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Explain and lead the discussion</td>
<td>Amanda</td>
</tr>
</tbody>
</table>
6 Information Space Design Exercise (30 min)

For this exercise, PICOs will be asked to work individually to design their ideal information space application. To help PICOs with scope and what a finished design might look like, I will briefly display some of the PICTIVE prototypes created during the pilot study. On the table there is lots of paper, glue sticks, tape, post-its, scissors and markers (should these be set up at the beginning or brought out at this point?). We will also be distributing packages of pre-made page components (search bars, sample tweets, etc…) that should help speed up the design process.

I will be giving a brief explanation, as well as passing out an instruction sheet, of how we would like them to piece together, tape, or draw their ideal application interface. While participants are creating their designs we will need several researchers to “triangle” with the participants. Researchers will be asking the participants questions about their design. They will also be tasked with helping participants who are stuck and need help.

Another important component of this exercise is data collection using video and photos. We will need at least two photographers to be actively taking pictures of the designs as they evolve. These pictures will help us to be able to piece the progression of each design over time. The videographer will be in charge of setting the video cameras up to appropriately capture the action. It would also be desirable for the videographer to walk around with one video camera during some of the exercise to get a more dynamic view of the activity.

Right before the participants complete the exercise, I will ask them to put their name somewhere on their design. As participants finish their designs, the photographers will photograph these individual designs carefully so the participant’s name is visible and possibly the face of the participant is included (only if the participant is comfortable with this). I will then tape the designs up on the white board as soon as they are made (see Appendix B).

Finally, after everyone has finished their designs, the table housekeeper will tidy up all of the materials on the table.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videographer</td>
<td>Move and reposition cameras to get the best view of the design activity, also walk around with single video camera recording activity if appropriate</td>
<td>Kate</td>
</tr>
<tr>
<td>Photographers</td>
<td>Document the design progression and take photos of the final designs</td>
<td>Jo, Kate</td>
</tr>
<tr>
<td>Researchers</td>
<td>Walk around and observe design activities, ask questions, help those who are struggling, take notes on observations</td>
<td>Lysia, Lise, Sarah</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Explain design activity, answer questions and clarify where needed, put designs on whiteboard</td>
<td>Amanda</td>
</tr>
<tr>
<td>Table Housekeeper</td>
<td>Tidy up design materials in the center of the table</td>
<td>Lise</td>
</tr>
</tbody>
</table>
7 Discussion of Information Space Design Exercise (30 min)

In this exercise, I will ask each participant to come up to the whiteboard and demonstrate the features of their design. Emphasis will be made on keeping the description short (2-3 minutes) and I will be in charge of calling the participants up to explain their design and keeping the session on track time-wise.

I expect most PIOs will not have problems describing their design, but for those who do I will be prepared to ask them questions such as the following:

- Can you tell us about your layout?
- What are some of the elements/functions of your design?
- What does this component do?
- Why do you feel this feature is important?

During the design explanations, a scribe will identify the different functionality the PIOs describe and write these down on post-it notes and add them to the brainstorming section of the whiteboard. Video cameras will need to be moved to capture the PIOs describing their designs. Some video camera work may need to be done to get close-ups of where the PIOs are pointing when talking about their designs. Researchers/Note takers will be taking notes of their observations.

Since this is the last session before lunch, the food supervisor will need to take off part-way through this session to prepare for lunch, meet the caterers and make sure the caterers have everything they need.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videographer/Photographer</td>
<td>Move and reposition cameras to get the best view of the discussion, zoom in for close-ups of the design descriptions, take occasional photos of the discussion</td>
<td>Kate</td>
</tr>
<tr>
<td>Scribe</td>
<td>List functionality discussed by the PIOs on the white board</td>
<td>Jo</td>
</tr>
<tr>
<td>Researchers</td>
<td>Take notes</td>
<td>Leysia, Lise</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Call PIOs up to describe their designs, keep session moving and on-time</td>
<td>Amanda</td>
</tr>
<tr>
<td>Food Supervisor</td>
<td>Meet caterers, show them where to set up, answer any of their questions</td>
<td>Sarah</td>
</tr>
</tbody>
</table>
8  Lunch (30 min)

We will break for lunch and have informal conversations. Researchers will be asked to mingle with the PIOs, and listen in on the different conversations. Ideally, conversations will be led towards the workshop, its purpose and its activities, but this agenda shouldn’t be forced too much. I want to present the lunch as a networking opportunity as well, a chance for these PIOs to talk and share experiences. Sitting in on these types of conversations should be very interesting.

The food supervisor will be in charge of making sure everyone gets lunch and that it runs smoothly. Since the event is being catered, I don’t expect there will be much to do. There will also be a need for a runner to run errands and to help PIOs with whatever needs they may have.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Supervisor</td>
<td>Make sure things run smoothly</td>
<td>Sarah</td>
</tr>
<tr>
<td>Researchers</td>
<td>This is pretty informal, but ask questions, try to keep conversation relevant to the workshop, take notes</td>
<td>Lysa, Lise, Kate</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Make sure everyone is included, make sure we start back up on time</td>
<td>Amanda</td>
</tr>
<tr>
<td>Runner</td>
<td>Help PIOs find restrooms, help with any other needs that may arise</td>
<td>Jo</td>
</tr>
</tbody>
</table>
9 Group Design Exercise – Part One (20 min)

In this exercise, the PIO participants will be divided into two different groups with a facilitator for each group. Each group will be asked to build a prototype based on a design idea which will be explained to them. We will again distribute a package of pre-made page components to each group similar to the one used in the first individual design exercise.

Again, I will be giving a brief explanation of what we’d like them to do as well as passing out an instruction sheet. A researcher will be assigned to each group. Their responsibilities will include making sure group discussion stays on track and everyone is given an equal voice and a chance to contribute. This may include asking questions like, “And, Mary, what do you think?” to keep everyone engaged. Another way to engage the quieter people is to rotate the partially-built design so that it faces the quiet person, and use that as a tangible request for them to participate. These researchers will also be taking detailed notes of the things they observe.

A photographer will be assigned to each group to actively take pictures of the designs as they evolve. These pictures will help us be able to piece the progression of each design over time. The videographer will set up one video camera to focus on each group. It would also be desirable for the videographer to walk around with one video camera during some of the exercise to get a more dynamic view of the activity.

The groups will be separated. The two conference tables will be moved to different part of the room where each group can work. We will place the moveable whiteboard in between the two tables in an attempt to separate the groups to avoid distractions and cut down on noise. To make this work, the PICTIVE supplies will need to be divided in half, half of the supplies for each table.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videographers/Photographers</td>
<td>One per group, Move and reposition cameras to get the best view of the design activity, take photos of the design progression</td>
<td>Kate, Lise</td>
</tr>
<tr>
<td>Researchers</td>
<td>One per group, ask questions, keep discussion on track, ensure equal participation, take notes on observations</td>
<td>Jo, Leysia</td>
</tr>
<tr>
<td>Primary Facilitators</td>
<td>One per group, Explain design activity, answer questions and clarify where needed</td>
<td>Amanda, Sarah</td>
</tr>
</tbody>
</table>
10 Group Design Exercise – Part Two (30 min)

Here the previous exercise continues, except the facilitator for each group will interrupt the current design activity and introduce a previously designed prototype that addresses the design idea they are working on. After a brief explanation and discussion, participants will be encouraged to alter their current design.

Right before the participants complete the exercise, I will ask them to put their names somewhere on their design and figure out how they will discuss their design as a group. As participants finish their designs, the photographers will photograph these designs carefully (so the participant’s names are visible). I will then tape the designs up on the white board as soon as they are made. We will be using the smaller, moveable whiteboard for the discussion of these designs.

Finally, after everyone has finished their designs, the table housekeepers will remove the PICTIVE materials from the tables and facilitate moving the tables back together.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videographers/Photographers</td>
<td>One per group, Move and reposition cameras to get the best view of the design activity, take photos of the design progression and the final design</td>
<td>Kate, Lite</td>
</tr>
<tr>
<td>Researchers</td>
<td>One per group, ask questions, keep discussion on track, ensure equal participation, take notes on observations</td>
<td>Jo, Leysia</td>
</tr>
<tr>
<td>Primary Facilitators</td>
<td>One per group, Explain design activity, answer questions and clarify where needed</td>
<td>Amanda, Sarah</td>
</tr>
<tr>
<td>Table Housekeepers</td>
<td>Clean up and remove PICTIVE design materials from center of table</td>
<td>Amanda, Sarah</td>
</tr>
</tbody>
</table>
11 Group Design Discussion (20 min)

In this exercise, I will ask each group to come up to the whiteboard and demonstrate the features of their design. The groups will be advised to pick a spokesman to explain their design. I will be in charge of calling the groups up to explain their design and keeping the session on track time-wise.

In this session both the researchers and I will be charged with asking questions about the group designs. Here we may ask for clarification on how a particular module works. We may draw out differences between the group design and the individual designs, and ask them why they are there and how they made decisions about what they included in their design. Researchers will also be taking notes of their observations.

We will be using the smaller whiteboard here, so that we can have the group discussion in the center of the room. In the meantime, two researchers will be organizing the data under the “Important Ideas” category on the main whiteboard (see Appendix B) for the discussion to follow.

During the design explanations, a scribe will identify items that need to be added to our “Important Ideas”. These items will be captured on the smaller whiteboard and moved to the main whiteboard and incorporated into the new organization at the end of this discussion activity. Video cameras will need to be moved to capture the groups describing their designs. Some video camera work may need to be done to get close-ups of where the group members are pointing when talking about their designs.

<table>
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<tbody>
<tr>
<td>Videographer/Photographer</td>
<td>Move and reposition cameras to get the best view of the discussion, zoom in for close-ups of the design descriptions, take occasional photos of the discussion</td>
<td>Kate</td>
</tr>
<tr>
<td>Scribe</td>
<td>List functionality discussed by the groups on the white board</td>
<td>Sarah</td>
</tr>
<tr>
<td>Researcher</td>
<td></td>
<td>Lisa</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Call groups up to describe their designs, keep session moving and on-time, ask questions about each group’s design</td>
<td>Amanda</td>
</tr>
<tr>
<td>Idea Organizers</td>
<td>In the background, organize the idea board we’ve been creating throughout the workshop</td>
<td>Jo, Leyna</td>
</tr>
</tbody>
</table>
### 12 Idea Discussion and Rating (25 min)

Prior to this discussion the ideas in the “Important Ideas” category on the board will be organized. During this discussion we will explore the organization and ask PIOs to comment and critique the results (do they agree, disagree?). I imagine there will be opportunities to assign priorities to items within some of the categories. To do this every PIO participant will be given a certain number (5-10) of “dots” that they can assign to the items they think are most important. The take away from this activity will be several lists around different topics, with a priority ranking where appropriate.

<table>
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<tbody>
<tr>
<td>Videographer/Photographer</td>
<td>Move and reposition cameras to get the best view of the discussion, zoom in for close-ups of the design descriptions, Take occasional photos of the discussion</td>
<td>Kate</td>
</tr>
<tr>
<td>Researchers</td>
<td>Take notes, distribute voting “stars”</td>
<td>Casey, Lise, Sarah</td>
</tr>
<tr>
<td>Idea Organizers</td>
<td>Continue to lead the organization of ideas, and help lead the discussion</td>
<td>Jo, Leysia</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Lead discussion reviewing the functionality listed on the board, Explain rating system.</td>
<td>Amanda</td>
</tr>
</tbody>
</table>
13 Closing (15 min)

At this point all of the workshop activities have come to an end. I will thank them for their time, and they will be asked to fill out a questionnaire. This will also be a point where I can solicit for additional research opportunities such as the opportunity for me to shadow and observe one of them while working an event. This will also be a venue for any final words or comments on the workshop from the participants.

<table>
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<tr>
<th>Facilitator Need</th>
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<th>Assignment</th>
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<tbody>
<tr>
<td>Videographer</td>
<td>Move and reposition cameras to get the best view of the discussion</td>
<td>Kate</td>
</tr>
<tr>
<td>Researchers</td>
<td>Ask questions, hand out questionnaire</td>
<td>Casey, Jo, Leysa, Lise, Sarah</td>
</tr>
<tr>
<td>Primary Facilitator</td>
<td>Lead Debrief discussion, thank PFOs for their time, solicit for future research opportunities</td>
<td>Amanda</td>
</tr>
</tbody>
</table>
14 Take Down (15 min)

We will need some help cleaning up and collecting the data from the workshop. This includes things such as taking down video cameras, tables and chairs, signs leading to the location, and PICTIVE materials as well as tidying up the lab space. We will also need volunteers to help the PIOs find their way back to their cars.

Pictures and video taken during the workspace will be uploaded on to my computer. All designs will be saved and safely stored, as well as any other interesting artifacts left over from the workshop.

<table>
<thead>
<tr>
<th>Facilitator Need</th>
<th>Description</th>
<th>Assignment (Names)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escorts</td>
<td>Escorts to bring the PIOs back to their cars</td>
<td>Kate, Sarah</td>
</tr>
<tr>
<td>Clean Up</td>
<td>People to help take down everything set up in the lab for the workshop</td>
<td>Casey, Jo, Lise</td>
</tr>
<tr>
<td>Data Collectors</td>
<td>Gather researcher notebooks, upload pictures and video, gather and store design artifacts</td>
<td>Amanda, Leysia</td>
</tr>
</tbody>
</table>
15 Debrief (30 min)

Directly following the workshop, we will have a debrief session for all of the researchers. This will be a chance for us to share our observations and insights and come to some consensus on the results of the workshop. After the debrief, research notebooks will be collected.
Appendix A  Session Preparation

Room and Equipment Checklist

- Nametags
- Lunch & Snacks handled by caterer
- Magnets
- Dry-erase markers and eraser
- Laptop
- Projector or TV screen
- At least 2 digital cameras
- 2 video cameras and tripods
- Kleenex
- Notebooks for notetakers

PICTIVE PD Supply Checklist

- Post its – different colors, sizes, and shapes
- White and colored paper, 8.5x11 and 11x17
- Construction paper
- Scissors
- Scotch tape dispensers
- Glue sticks
- Markers
- Pens
- Pencils
- Colored pencils
- Butcher paper
- Set of personal PICTIVE “seed pieces” pages for each participant
- 2-3 sets of detailed PICTIVE “seed pieces” pages for the group design session

Handout and Instruction Printout Checklist

- This script in triplicate
- Facilitator assignments and instructions
- Instruction handout for individual design activity
- Instruction handout for group design activity
- Participant package #1 (sent ahead of time):
  - Informed consent form
  - Agenda
  - Parking pass
- Participant package #2 (given at beginning of workshop in nice folder):
  - Information on social media
  - Agenda
  - Questionnaire
  - Thank you Letter
Appendix B  Whiteboard Layout

Here is a view of the categories that we will layout on the whiteboard at the front of the room. For the group design activity, we will be using the portable whiteboard in the middle of the room for the discussion part of the exercise. This is being done so that two of the researchers can be organizing the “Important Ideas” brainstorming area at the big main whiteboard without distracting from our group design discussion.

<table>
<thead>
<tr>
<th>Important Ideas</th>
<th>Participants</th>
<th>PIO Information Space</th>
<th>Individual Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Scenarios
Appendix C  Welcome Speech and Disclaimer

Hi, Welcome.

My name is Amanda Hughes. I am a researcher pursuing a PhD in Computer Science here at the University of Colorado. We need your help in understanding how PIOs do their work, and to help us design tools for making communication through social media easier and more efficient for you.

We invited you here because you are all PIOs and participate in emergency communication. What we're going to do today is discuss how you relate to social media, how it fits into your work, and how it can support your PIO activities.

During this workshop we will have a lot of discussion. There will also be times where I ask you to create some designs from your experience as a PIO. These design activities will be done both individually and in groups.

While we're talking and designing, it is very important that you be as candid as possible. We want YOUR opinion. YOU are the experts here. No opinion is right or wrong.

Because we have a lot of ground to cover today, I may ask you to wrap up a thought or put it aside so we can move on. If you have an idea, but don't want to interrupt, or we've run out of time and have already moved on, please write the idea down on a piece of paper and put your name on it.

At this point, I should mention that we're also videotaping the session... This videotape, in case you are wondering, is so that we don't have to sit here feverishly scribbling notes, and can concentrate on listening to you. It's purely for research purposes and will only be seen by members of our research team.

Before we proceed I need to make sure that I have a signed informed consent from each of you. These forms allow us to videotape the session and use the results in our research.

(Only begin video taping after consent is given by all participants)

Any questions? Let's start!
Appendix D  Deliverables

- PIO Information Management Analysis
  - Current PIO information flows during an emergency.
  - Functional tools participants have experience with and how they are used.
- Individual and Group PICTIVE Mock-ups
  - Each participant’s individual PICTIVE design mock-up.
  - Participants’ more detailed group PICTIVE design mock-up.
  - Analysis of how those designs differ.
  - Participants’ expectations and mental models of how they see the designs.
  - Participant-suggested UI design visions: detailed content of each module that emerged from the group design session.
Appendix D  Participant Consent Form

Emergency Manager Communications in Non-routine Events
PARTICIPANT INFORMED CONSENT FORM/March 2012

Please read the following material that explains this research study. Signing this form indicates that you have been informed about the study and that you want to participate. We want you to understand what you are being asked to do and what risks and benefits—if any—are associated with the study. This should help you decide whether or not you want to participate in the study.

You are being asked to take part in a research project led by Leyis Palen (Professor of the Department of Computer Science, 430 UCB) and her research lab. Professor Leyis Palen can be reached at 303 492 3902 and palen@cs.colorado.edu.

Project Description: This project studies how emergency managers collect and share information during non-routine events, such as national security or crisis events. You are being asked to participate in this study because you work for or with an agency or organization that is involved in the public communications or emergency management of such events. Participation in this study is entirely your choice.

Procedures: If you agree to participate in this study, you'll be asked to interact with different communication technologies and imagine how you might use them during non-routine events. You will also be asked to envision what your future work might look like and what technology might support it. Researchers will observe your techniques for managing information and doing your work. This is not an evaluation of you or your work; we only want to know how practitioners complete their tasks and the techniques they use in the collection and sharing of data. We presume you are the experts, even when you feel that you have made a “mistake.” We are not looking for mistakes. We only seek to learn how real public information work is done. We will take notes, and when appropriate, ask questions for clarification. With your agreement, the researcher may photograph the research environment or audio and video record your activities. However, if you are uncomfortable or do not want to be recorded, the researcher will abide by your wishes.

Risks and Discomforts: There are no foreseeable risks for participation in the study.

Benefits: There are no direct benefits to you from taking part in this study.

You have the right to withdraw your consent or stop participating at any time. You have the right to refuse to answer any question(s) or participate in any procedure for any reason. You have the right to request that audio- or video-recording be stopped or deleted at any time for any reason.

Confidentiality: We will maintain the privacy of your data. We will use a pseudonym instead of your real name in any published work that evolves from this research, and only then if the information does not uniquely reveal who you are without your permission.

Collected data will not be shared directly with supervisors or other personnel or anyone outside the professor's research group. With your permission, data excerpts may be presented publicly in classes or at meetings or conferences at a later time. Names and other identifying information will not be revealed, although your voice may be recognizable. If the audio or video recording captures an important issue that we would like to present but is of concern to you, then we might seek your permission to use the piece using digital techniques to obscure your voice. If this is not acceptable, then we will not use the excerpt. Data will be kept secured. If you object to any of these stipulations or require further specifications, please detail this below and we will follow your request.

Other than the researchers, only regulatory agencies such as the Office of Human Research Protections and the University of Colorado Institutional Review Board may see your individual data as part of routine audits.

Invitation for Questions: If you have questions about this study, please ask the researcher before you sign this consent form.

If you have questions regarding your rights as a participant, any concerns regarding this project or any dissatisfaction with any aspect of this study, you may report them—confidentially, if you wish—to the Institutional Review Board, 3100 Marine Street, Rm A15, 563 UCB, (303) 735-3702.
Authorization: I have read this paper about the study or it was read to me. I know the possible risks and benefits. I know that being in this study is voluntary. I choose to be in this study. I know that I can withdraw at any time. I have received, on the date signed, a copy of this document containing 2 pages.

If the audio- or video-recording form of data collection applies, please consider, check and initial your choice below.

○ I agree ___do not agree ___ to be audio/video taped for research purposes by your lab group only.

Name of Participant (printed) _____________________________________________

Signature of Participant ______________ Date ______________.
(Also initial all previous pages of the consent form.)
Appendix E  PIO Prototypes

Individual PIO Prototype #1

Individual PIO Prototype #2
Individual PIO Prototype #3

---

**GO!** (Approved for dissemination)

- 13:42 (Text) The campus is under a flash flood watch...
  - □ Web alert (news.colorado.edu)
  - □ Social media (Twitter)
  - □ U of C Boulder (Facebook)
  - □ Housing (Twitter)
  - □ E-ncmo
  - □ Advisory/News Release (multimedia)
  - □ Text message
  - □ Campus info line (telephones/voicemail)

* Map available at [http://www.map....][1] Colorado.edu
Individual PIO Prototype #4

Individual PIO Prototype #5
Individual PIO Prototype #6
Individual PIO Prototype #7

Inflow
Official Information

Aggregation of Information

Dissemination Panel
- Text alert
- Web alert
- Twitter
- Facebook
- Internal emails
- Phone script
- Talking points
- News release

Media Monitoring
- Print
- Radio
- Video

Public Monitoring
- Twitter
- Facebook
- YouTube

Group PIO Prototype #1

Media

Public

Operations
Group PIO Prototype #2
Appendix F  PIO Training Handout

PIO Workshop – September 16th, 2011

Social Media Resources

SMEM

The Social Media in Emergency Management Initiative “SMEM” is an informal network of Cross-functional disciplines, including emergency management practitioners, Virtual Operations Support Team Volunteers, First Responders, and practitioners in academia, who seek to explore best practices and bridge social media in emergency management. Their website at SM4EM.org is intended to centralize the various initiatives, opportunities and collaborative activities underway in the worlds of social media & emergency services.

The SMEM initiative also hosts a Twitter chat every Friday from 10:30-11:30am using the hashtag #SMEMChat. Each week they discuss a different topic and archives of past discussions can be found at the SM4EM.org website.

Crisis Commons & Crisis Camps

CrisisCommons is a global network of volunteers who use creative problem solving and open technologies to help people and communities in times and places of crisis. Seeks not only coders, programmers, geospatial and visualization ninjas but collaborative, smart and savvy folks who can lead teams, manage projects, search the internet, translate languages, apply intuitive and universal access interfaces. Initiative embraces innovation and open systems. Their work can be found online at: http://wiki.crisiscommons.org/wiki/Main_Page

#VOSG / #VOST (Virtual Operations Support Group or Team Concept)

This concept was initially conceived by Jeff Phillips (@LosRanchosEM) and tested during the #SMEM11 camp at NEMA. A concept paper has been developed which outlines the process that was used. This concept continues to be fleshed out in conversation. The VOSG website can be located at http://www.vosg.us/

Humanity Road

http://www.humanityroad.org/ - Humanity Road’s mission is to educate the public before, during and after disasters on how to survive, sustain and reunite with loved ones. Humanity Road volunteers are trained and equipped to use Internet and mobile communications technology to collect, verify and route information online during sudden onset disaster. Using the Internet, they provide public safety information as well as directing the public to governmental and aid agencies that are providing assistance for the disaster.

Crisis Mappers
http://crisismappers.net/ - Crisis Mappers leverage mobile & web-based applications, participatory maps & crowdsourced event data, aerial & satellite imagery, geospatial platforms, visual analytics, and computational & statistical models to power effective early warning for rapid response to complex humanitarian emergencies.

Social Media in Emergency Management Blogs

<table>
<thead>
<tr>
<th>Blog Website</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://idisaster.wordpress.com/">http://idisaster.wordpress.com/</a></td>
<td>We want to provide information about Web 2.0 and other information communications technologies that are (or could be) used by members of the emergency management community. The intent is to provide exemplary practices, news and information about applications of new media, with the longer-term objective of improving practice and outcomes in emergency management. Kim Stephens</td>
</tr>
<tr>
<td><a href="http://chiefb2.wordpress.com/">http://chiefb2.wordpress.com/</a></td>
<td>A husband, dad, emergency response professional and golfer. Constantly wondering how I got from there to here and how I get from here to there. Views expressed here are mine alone, and not related to my real job.</td>
</tr>
<tr>
<td><a href="http://crisiscommscp.blogspot.com/">http://crisiscommscp.blogspot.com/</a></td>
<td>A blog on crisis communications best practices, emergency information and emergency management ... an open forum for exchanging ideas and experience for PIOs and people specializing in crisis communications. Patrice Cloutier</td>
</tr>
</tbody>
</table>

Preparedness Campaigns

<table>
<thead>
<tr>
<th>Campaign Website</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.2beeready.org/">http://www.2beeready.org/</a></td>
<td>2Bee Ready is a grassroots movement of social media participants who have come together to spread the emergency preparedness message.</td>
</tr>
<tr>
<td><a href="http://www.30days30ways.com/">http://www.30days30ways.com/</a></td>
<td>September is National Preparedness Month and what better way to celebrate than to challenge ourselves to consider one basic task per day to enhance our personal readiness for emergencies. Points are awarded for completing each task and prizes are given.</td>
</tr>
<tr>
<td><a href="http://do1thing.com/">http://do1thing.com/</a></td>
<td>Do 1 Thing is a 12-month program that makes it easy for you to prepare yourself, your family, and your community for emergencies or disasters.</td>
</tr>
<tr>
<td><a href="http://emergencykitcookoff.blogspot.com/">http://emergencykitcookoff.blogspot.com/</a></td>
<td>The challenge is to create a blue-ribbon (but easy-to-follow) recipe from the foods you would typically find in an emergency kit. We’re not looking for gourmet cuisine, but</td>
</tr>
</tbody>
</table>
we’re also not looking for simple PB and crackers. Get creative with the ingredients and create a hot or cold dish that you’d eat if asked to shelter in place.

http://www.shakeout.org/

On Thursday, October 20th at 10:20 a.m.* millions of people will participate in the 2011 Great California ShakeOut, where people will practice how the will protect themselves during earthquakes and increase their overall preparedness.

Some Interesting People to Follow on Twitter
PIOResearcher – Amanda Hughes
Epiccolorado
Kim26stephens
TheFireTracker2
Schuback
Jack4cap
Patricecloutier
LosRanchosEM
UrbanAreaAlicia

Notes:
## Appendix G  PIO Workshop Schedule & Assignments

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Time</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Setup</strong></td>
<td>Set up the workspace for the workshop and ensure safe arrival of PIOs</td>
<td>9:30-10:00</td>
<td>Escorts – Jo, Sarah; Stagers – Casey, Lise; Videographer – Kate; Greeters – Amanda, Leysia</td>
</tr>
<tr>
<td><strong>Welcome/Introductions</strong></td>
<td>Explain the program for the day and introduce ourselves</td>
<td>10:00-10:30</td>
<td>Videographer – Kate; Researchers – Casey, Jo, Leysia, Lise, Sarah; Primary Facilitator – Amanda</td>
</tr>
<tr>
<td><strong>PIO Research/Training</strong></td>
<td>Present recent research from our lab, as well as give some training</td>
<td>10:30-11:00</td>
<td>Videographer – Kate; Photographer – Casey; Scribe – Jo; Researchers – Leysia, Lise, Sarah; Primary Facilitator - Amanda</td>
</tr>
<tr>
<td><strong>PIO Information Space Discussion</strong></td>
<td>Discuss what information PIOs use and how it is used</td>
<td>11:00-11:30</td>
<td>Videographer – Kate; Photographer – Casey; Scribe – Jo, Sarah; Researchers – Leysia, Lise; Primary Facilitator - Amanda</td>
</tr>
<tr>
<td><strong>Break</strong></td>
<td></td>
<td>11:30-11:40</td>
<td></td>
</tr>
<tr>
<td><strong>Information Space Design Exercise</strong></td>
<td>Participants design their ideal information space</td>
<td>11:40-12:10</td>
<td>Videographer – Kate; Photographers – Jo, Kate; Researchers – Leysia, Lise, Sarah; Primary Facilitator – Amanda; Table Housekeeper – Lise</td>
</tr>
<tr>
<td><strong>Discuss the Individual Designs</strong></td>
<td>Participants describe their design and what they did</td>
<td>12:10-12:30</td>
<td>Videographer/Photographer – Kate; Scribe – Jo; Researchers – Leysia; Primary Facilitator – Amanda; Food Supervisor – Sarah</td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td></td>
<td>12:30-1:00</td>
<td>Runner – Jo; Researchers – Leysia, Lise, Kate; Primary Facilitator – Amanda; Food Supervisor – Sarah</td>
</tr>
<tr>
<td><strong>Group Design Session - Part One</strong></td>
<td>Participants are split into two groups and given a design idea to work on</td>
<td>1:00-1:20</td>
<td>Videographers/Photographers – Kate, Lise; Researchers – Leysia; Primary Facilitators – Amanda, Sarah</td>
</tr>
<tr>
<td><strong>Group Design Session - Part Two</strong></td>
<td>A possible solution to their design task is presented (in prototype form) and they are given time to discuss and rework their design</td>
<td>1:20-1:50</td>
<td>Videographers/Photographers – Kate, Lise; Researchers – Jo, Leysia; Primary Facilitators – Amanda, Sarah; Table Housekeepers – Amanda, Sarah</td>
</tr>
<tr>
<td><strong>Group Design Discussion</strong></td>
<td>Participants talk about their design and why they created it that way</td>
<td>1:50-2:10</td>
<td>Videographer/Photographer – Kate; Scribe – Sarah; Idea Organizers – Jo, Leysia; Researcher – Lise; Primary Facilitator – Amanda</td>
</tr>
<tr>
<td><strong>Break</strong></td>
<td></td>
<td>2:10-2:20</td>
<td></td>
</tr>
<tr>
<td><strong>Idea Discussion and Ranking</strong></td>
<td>Throughout the workshop a collection of ideas is created, here we discuss the results and give priorities to the important items</td>
<td>2:20 – 2:45</td>
<td>Videographer/Photographer – Kate; Researchers – Casey, Lise, Sarah; Idea Organizers – Jo, Leysia; Primary Facilitator – Amanda</td>
</tr>
<tr>
<td><strong>Closing</strong></td>
<td>Final thoughts, Solicit for further ongoing research contact, Questionnaire</td>
<td>2:45-3:00</td>
<td>Videographer – Kate; Researchers – Casey, Jo, Leysia, Lise, Sarah; Primary Facilitator – Amanda</td>
</tr>
<tr>
<td><strong>Take Down</strong></td>
<td>Help is needed to take clean up and collect all data.</td>
<td>3:00-3:15</td>
<td>Escorts – Kate, Sarah; Clean Up – Casey, Jo, Lise; Data Collectors – Amanda, Leysia</td>
</tr>
<tr>
<td><strong>Debrief</strong></td>
<td>Debrief on the workshop with the researchers</td>
<td>3:15-3:45</td>
<td>Everyone</td>
</tr>
</tbody>
</table>
Appendix H  PIO PD Workshop Researcher Guidelines

Note Taking Guidelines

- Please write clearly and legibly.
- Indicate which session of the workshop you are taking notes for. Also, while it is not necessary to timestamp every note, try to jot down the time on occasion. These conventions will help us be able to match your notes with what happened on the video.
- If you hear a good quote, try and capture the essence of the quote in your notes, an approximate time, and who said it so we can find it again in the video.
- If something particularly noteworthy or interesting happens, write down a brief description of the event, the time and mark it with a star (or some such mark so we can recognize it as important).

Research Priorities

Whenever you are assigned to a session as a researcher there are several things I’d like you to look for generally as well as specifically. Here are the general things every researcher should look for:

- Listen for interesting insights into how PIOs do their work
- Try and understand why the PIOs build their designs the way they do
- If things get thrown out during the design sessions, ask why

Here are some specific things to look for (these can be divided up among the different researchers):

- Keep your eyes open for unexpected insights and novel ideas, especially regarding tools and services we could potentially build
- Try and understand the goals and motivations of the PIO participants. This is not easy to do and is where your skills with psychology and ability to ask open and incisive questions come in.

Mostly, keep your eyes open, use your judgment, and ask interesting questions.
Appendix I  Social Media Training Tool Prototype

Twitter use in Emergency Management

A training module for emergency managers learning how to use Twitter

Twitter – What is it?

• A microblogging service that lets you send messages of 140 characters or less
Twitter in Emergency Management

• Examples
  – “Forest Service engines being pulled out of east flank of #EstesParkFire #WildhandHeightsFire. Air tanker being diverted from #HighParkFire”
  – “Three major wildfires now burning on this Saturday. #HighDriveFire #HighParkFire #pyramiddtnfire Live coverage on 7 http://t.co/ps7VwSVQ “

What is Twitter Good For?

• Posting breaking news
• Linking to a blog or website with more information
• Sharing other site, photos, video, media stories with the public
• Sharing information with a wide audience
• Engaging with members of the public
• Monitoring trends – rumor, things to respond to
Getting Started

- Create an Account
- Sending Messages

Twitter Conventions

- Retweet – a reposting of someone’s tweet
- Hashtags - The # symbol, called a hashtag, is used to mark keywords or topics in a Tweet. It was created organically by Twitter users as a way to categorize messages.
Twitter Community

• Follow - Following someone means you’ve chosen to subscribe to their Twitter updates. When you follow someone, every time they post a new message, it will appear on your Twitter home page.
• Followers – These are the people following you
• Groups

Twitter Tools

• TweetDeck
• TweetChat
• Monitter
• HootSuite
• TwitterFall
Quiz?

- Test what has been learned
Appendix J  PIO Background Questionnaire

In what age group do you fall?
___ 19 and under
___ 20 – 29
___ 30 – 39
___ 40 – 49
___ 50 – 59
___ 60 +

For what department or organization do you work?

How long have you been a PIO?

On average how much time do your PIO duties take in a week (this can be stated approximately as either a percentage or the number of hours)?

In your work as a PIO, do you use social media? Please list the social media you use and an estimate of how long you’ve used each in the table below.

<table>
<thead>
<tr>
<th>Social Media Name</th>
<th>How Long in Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In your work as a PIO, do you use applications to monitor or archive social media activity? Please list any applications you use and a brief description of how you use them.

<table>
<thead>
<tr>
<th>Application Name</th>
<th>Used for</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cooperative PIO Monitoring Application: Usability Study Procedure

Amanda Hughes
Computer Science PhD Candidate
University of Colorado at Boulder
4/23/2012
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  1.1 Session Overview ........................................................................................... 3
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1 Introduction

My name is Amanda Hughes. I am a PhD candidate in the Department of Computer Science at the University of Colorado Boulder and today I will be working with you to test some ideas for improving how you use social media.

1.1 Session Overview

I have been studying PIOs and their work for the past few years and I have been designing a tool to help you sort and filter social media. Today I would like to have you test the ideas I've developed and get your feedback.

We will begin our session with a short background questionnaire, so I can better understand your experience as a PIO. Following the questionnaire, I will show you an application mockup and ask you some questions about it. Next, I will have you perform several tasks. These tasks are designed to help me understand how you work and think, and to test different design options to see which you prefer. At the conclusion of the session, I have a few questions for you and you will have an opportunity to ask me any questions you may have.

Our session today is expected to last approximately 1 hour. If you need to stop at any time, feel free to do so.

Do you have any questions at this point?

1.2 Informed Consent

Our research is sponsored by federal grants and overseen by the University of Colorado Boulder and they require that we inform you of what will take place during this session and obtain your permission to proceed. The consent form also gives us permission to use the data we collect from this session in our research, including descriptions of your activity, conversations, and video or pictures of our session. We will protect your identity in any papers or presentations that may result from this work.

At this time, I would like to ask you to sign a consent form stating that you understand the study and you agree to participate.

[Give participant consent form and a pen]

1.3 Background Questionnaire

To begin, I would like to have you fill out a short background questionnaire that will help me understand who you are.

[Give participant the background questionnaire]
2 Explanation of PIO Monitoring Application

Here I want to show the PIO a fully mocked up version of the Application to help them understand what the application is about, and then also to have them understand the possibilities, what it could do. Here is a list of the features I want to talk about:

- PIOs can create their own categories
- Select a method of searching, i.e. by hashtags
- Automatic filtering for some steps – filter out tweets contains specific text, or retweets
- How to code a message multiple ways
- Different types of views – sort and view mode
- Ability to have divide up the work
- Archiving of activity – how would they want to store it, or keep that data
- Ability to send a tweet, or multiple tweets to someone – through email (any other method?)
- Exporting messages on a page
- Ability to create reports, stories of the day’s activities – what format do they use?
- Could be applied to other social media, not just Twitter

During and following this demonstration, I will get their feedback by asking questions like the following:

- Tell me what you think this tool does?
- What kinds of situations might you use this tool for?
- Would it fit into your process?
- Could you imagine using it on a small event? A large event?
- Who in your organization might like to use something like this?
- What would be the process to start using a tool like this? Would you have to get permission to use it? What types of evidence would you need to convince them that you should be able to use it?
- What do you like about it? What do you dislike about it?
- Are there things that you would change? What might those things be?

3 Tasks

I am going to ask you to perform several tasks. During these tasks I would like you to “think aloud”. This means that you talk out-loud as you work, so I can hear what you are thinking. This is helpful to me so I can understand things that are confusing or things that don’t work well. Remember that I am not testing you.

3.1 Category Creation

This first task will help me understand how you filter and sort information.
3.1.1 Part One

Here I have a stack of cards. Each one has a Twitter message pertaining to the Boulder Four Mile Fire that happened in September of 2010. To begin, read or skim through the messages and organize them into groups that make sense to you. There are no right or wrong groupings. Try to organize all the cards, but not everything needs to belong in a group.

Next imagine the labels you might assign to each group. I'd like you to use the provided materials (paper, Post-Its, pens, markers) to label these groups. There are no rules about the labeling, feel free to do it in any way that makes sense to you. You don't have to label a group either. Remember to speak your thought process as you decide how you might handle each of these tweets.

[Paper clip these cards in groups together with the label]

Next, I'd like you to organize these groups into any larger groups that make sense.

[For this part of the task I am using a small stack of Twitter messages printed on business cards. These messages will be hand selected to provide a variety of interesting messages that could be categorized in many different ways. Next, I will want to provide them with materials that will allow them to create and easily change how they want to sort and make sense of the Tweets.]

- What is their process?
- Do they change and refine the categories over time?

3.1.2 Part Two

Now, I'd like to explore some category types that you may not have thought of yet.

- What about the possibility of having these categories be names of Coworkers, whom the information should be routed to? What might that look like?
- What about using categories that describe the physical action you want to take on the message (i.e. for reference, call about, reply to, verify, follow up)? Could you revisit the tweets you've already worked with and imagine how you might use these type of categories? Do they make sense to you?

[In this activity, I want to open up their mind to different category possibilities. This will be somewhat dependent on what they have done in the first two tasks, because they may have already done this type of categorization on their own. Further, they may come up with categories that I haven't even imagined yet. So some of this will need to be played by ear, and I'll have to use my judgment here. I may even skip this part of the task altogether.]

- How does this change things?
- What type of things might you assign to [name of co-worker]?
- Do you imagine starting out with set categories, or nothing and evolving, or a combination of the two? Do they like this method better?
- Does it help to start with a set of categories?
3.2 Data Interaction

The full application has not been implemented yet. However, I have prototyped some of the functionality so that we can experiment with it. Now, I’d like to have you get on the computer and try some different ways of interacting with and categorizing this data. I’ll be having you work with a simple prototype that mocks up some of these ideas.

[The user will be asked to code data from a real event. Categories for coding will be provided.]

On the left hand you have a set of categories, and on the right a list of twitter messages to sort. You can either use drag and drop, or click and click to assign the tweets to a category.

[Give a quick demo of how the drag and drop works.]

Please attempt to use the interface to sort some of these Twitter messages.

3.2.1 Questions

- What interaction experience do you prefer? Why?
- Which required more work?

3.3 Data Uses

Next, I am going to provide you with different lists of tweets that correspond with different categories. So, for example, this list [hand list to PIO] contains tweets asking for help during the #boulderfire. Imagine that you obtained this list by tagging tweets using the application we’ve been looking at.

- Is this information interesting to you as a PIO? If not, are there others in your organization that might find it interesting?
- How would you like to access this data?
- What would you do with it?
- If you want to send it to someone else, how would you do that?
- Are there applications or tools that you currently use that might use this type of information?

I now repeat this task using lists of different categories. Different examples will likely invoke different responses and may include the following types of messages:

- Help requests
- Hazard Status
- Offers
- Rumor

4 Session Conclusion

Thank you so much for your participation. Your feedback will help me improve this application.
[Ask any questions that you may still have, clarifications, concerns that remain open]

Do you have any questions or comments for me? If you think of anything later you may feel free to contact me at any time.
## Appendix L  Participant Information for the PMA User Test Sessions

<table>
<thead>
<tr>
<th>Participant Number</th>
<th>Age/Group</th>
<th>Organization Type</th>
<th>Time as a PIO</th>
<th>Time per week as a PIO</th>
<th>Social Media used as a PIO</th>
<th>Applications used for social media</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>40-49</td>
<td>Fire Department</td>
<td>6 years</td>
<td>10%</td>
<td>Facebook – 2 years, Twitter – 2 years, LinkedIn – 1 year, UStream – 4 months, YouTube – 2 years, QR Codes – 6 months</td>
<td>Hootsuite – monitoring</td>
</tr>
<tr>
<td>102</td>
<td>40-49</td>
<td>Fire Department</td>
<td>9 months</td>
<td>25%</td>
<td>Facebook – 9 months, Twitter – 9 months, LinkedIn – 9 months, UStream – 3 months, YouTube – 9 months, QR Codes – 9 months</td>
<td>Hootsuite – monitoring</td>
</tr>
<tr>
<td>103</td>
<td>50-59</td>
<td>Public Health</td>
<td>20 years</td>
<td>5%</td>
<td>Facebook – 2 years, Twitter – 2 years</td>
<td>Tweetdeck – monitoring specified Twitter and FB feeds, Google Reader – media monitoring</td>
</tr>
<tr>
<td>104</td>
<td>40-49</td>
<td>County Government</td>
<td>6 years</td>
<td>Only during emergencies</td>
<td>Twitter – 3 years, Facebook – 3 years, Youtube – 3 years</td>
<td>Hootsuite – monitoring</td>
</tr>
<tr>
<td>105</td>
<td>30-39</td>
<td>County Government</td>
<td>4 years</td>
<td>Only during emergencies</td>
<td>Twitter – 3 years, Facebook – 3 years, Youtube – 3 years</td>
<td>Hootsuite – monitoring</td>
</tr>
<tr>
<td>106</td>
<td>30-39</td>
<td>County Government</td>
<td>2.5 years</td>
<td>Only during emergencies</td>
<td>Twitter – 3+ years, Facebook – 3+ years, Youtube – 2+ years</td>
<td>Hootsuite – monitoring Facebook</td>
</tr>
<tr>
<td>107</td>
<td>40-49</td>
<td>Fire Department</td>
<td>16 years</td>
<td>75%</td>
<td>Facebook – 3 years, Twitter – 3 years, LinkedIn – 3 years, HootSuite – 6 months, Google Alerts – 2 years</td>
<td>Hootsuite – monitoring FB and Twitter, Google Alerts – media monitoring</td>
</tr>
<tr>
<td>109</td>
<td>40-49</td>
<td>University Communication</td>
<td>4 years</td>
<td>20%</td>
<td>Twitter – 2 years, Facebook – 2 years</td>
<td>Hootsuite – monitoring</td>
</tr>
<tr>
<td>110</td>
<td>30-39</td>
<td>University Communication</td>
<td>3 years</td>
<td>3%</td>
<td>Facebook – 3 years, Twitter – 3 years</td>
<td>Hootsuite – monitoring across channels</td>
</tr>
<tr>
<td>111</td>
<td>40-49</td>
<td>State Emergency</td>
<td>10 years</td>
<td>100%</td>
<td>Twitter – 5 years, Facebook – 5 years, Google Blog, Maps – 5 years, Youtube – 5 years</td>
<td>Hootsuite – monitoring, Google Alerts – monitoring, Monitor – monitoring</td>
</tr>
</tbody>
</table>
Appendix M  Card Sorting Exercise Results

Colorado Mountain Ranch plans to transport 18 horses and let the rest roam free, says report on scanner. #boulderfire

gwbstr

<table>
<thead>
<tr>
<th>Participant #</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>103</td>
<td>Urgent Action</td>
</tr>
<tr>
<td>104, 105 &amp; 106</td>
<td>Monitor-&gt;Rumor Control</td>
</tr>
<tr>
<td>107</td>
<td>Informational Only, FYI</td>
</tr>
<tr>
<td>108</td>
<td>Must Respond</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>location/proximity</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
</tr>
</tbody>
</table>

Were hearing livestock to the Boulder County Fair Grounds, smaller animals to Longmont Humane Society #boulderfire #4milefire #fourmilefire

kwgndenver

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<tr>
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<tbody>
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<tr>
<td>103</td>
<td>Pets/Domestic Animals</td>
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<tr>
<td>104, 105 &amp; 106</td>
<td>Assistance-&gt;Animals/Animal</td>
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<tr>
<td></td>
<td>Evacuation/Shelter</td>
</tr>
<tr>
<td>107</td>
<td>Retweet</td>
</tr>
<tr>
<td>108</td>
<td>Maybe Answer</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
</tr>
</tbody>
</table>

The wind is not helping the conditions for fire fighters at 4 Mile Canyon fire. #Boulder

copydiva

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>103</td>
<td>Situational Awareness</td>
</tr>
<tr>
<td>104, 105 &amp; 106</td>
<td>Chatter-&gt;Of Interest</td>
</tr>
<tr>
<td>107</td>
<td>Informational Only, FYI</td>
</tr>
<tr>
<td>108</td>
<td>Monitor</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
</tr>
</tbody>
</table>

#boulderfire apparently there now was just a motorcycle crash in the canyon where the fire is..sounds like chaos - http://bit.ly/ajQjeB

brentter
Crazy - almost all of my news about the #BoulderFire is coming from Twitter - thank you local community for keeping me informed

menro

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<tr>
<th>Participant #</th>
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</tr>
</thead>
<tbody>
<tr>
<td>101 &amp; 102</td>
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<td>Chatter-&gt;Of Interest</td>
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<tr>
<td>107</td>
<td>Informational Only, FYI</td>
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<tr>
<td>108</td>
<td>Monitor-&gt;Watch, Hear what others are saying</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
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</table>

I love that tweeps are offering room + free meals to #boulderfire displaced but how do you prevent scammers/opportunists?

melsidwell

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<tbody>
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<td>107</td>
<td>Follow Up/Direct Message</td>
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<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
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Dont forget to update your NONTWITTER friends on #boulderfire stuff. Send emails&texts, make phone calls! Surprising how late info gets out

G_Little

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<td>Chatter-&gt;Of Interest</td>
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<tr>
<td>107</td>
<td>Informational Only, FYI</td>
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<tr>
<td>108</td>
<td>Monitor-&gt;Watch, Hear what others are saying</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
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</table>

Trust that my condo in NW #Boulder in Dakota Ridge will be there when I land from Miami... #goodnightandgoodluck

312Will

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<tr>
<td>107</td>
<td>Informational Only, FYI</td>
</tr>
<tr>
<td>108</td>
<td>Maybe Answer</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
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</table>
There's a man here at @amantecoffee freaking out about the fire. Understandable. His house is in 4MileCanyon. :-/ #boulderfire

FreyDrew

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<tr>
<td>108</td>
<td>Monitor-&gt;Watch, Hear what others are saying</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
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</table>

Still keeping Linden and Lee Hill closed #boulderfire, #fourmilocanyonfire

milliman

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<td>Operations-&gt;Road and Closures</td>
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<td>107</td>
<td>Info</td>
</tr>
<tr>
<td>108</td>
<td>Map Monitor/Verify/Respond</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>location/proximity</td>
</tr>
<tr>
<td>111</td>
<td>Info Retweet-People/Animal/Evac Shelter</td>
</tr>
</tbody>
</table>

844 klondike Ave structure fire http://bit.ly/albums - units being toned now #boulder #ned #boulderfire

mattbeaty

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<tbody>
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<td>104, 105 &amp; 106</td>
<td>Chatter-&gt;Other events</td>
</tr>
<tr>
<td>107</td>
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</tr>
<tr>
<td>108</td>
<td>Must Respond</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
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</table>

ash falling at my house in lefthand canyon, no reverse 911, wind seems to have calmed. #boulderfire #fourmile (wish there were 1 hash)

lioncaller

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<tbody>
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<td>101 &amp; 102</td>
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<td>Monitor-&gt;Trends</td>
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<td>107</td>
<td>Action/Respond To</td>
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<td>108</td>
<td>Hashtag confusion</td>
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<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
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If you can help w #geo tagging locations for #boulderfire pls follow @epiccolorado for instructions.

RVAREGal

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<tbody>
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<td>Monitor-&gt;Trends</td>
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<td>107</td>
<td>Info</td>
</tr>
<tr>
<td>108</td>
<td>Map</td>
</tr>
<tr>
<td></td>
<td>Monitor/Verify/Respond</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>outreach and volunteers</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
</tr>
</tbody>
</table>

@suesalinger Its DIY, to act on info. no calls 4 action frm officls yet. Post yr #offer @epiccolorado #boulderhelps #boulderfire

RedCross on 9 right now - they're feeding 200 firefighters. N Boulder Rec Ctr, New Vista, Ned. Still No Call For Us To Help. #boulderfire

@suesalinger

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<tr>
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<td>Volunteers</td>
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<tr>
<td>104, 105 &amp; 106</td>
<td>Assistance-&gt;Donations and Volunteer</td>
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<td>107</td>
<td>Follow Up/Direct Message</td>
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<td>108</td>
<td>Monitor</td>
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<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
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</tbody>
</table>

We need to put into action some kind of #boulderfire fund for the victims. Who wants to help me?

@BlogLuvr29

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<tbody>
<tr>
<td>101 &amp; 102</td>
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<td>103</td>
<td>Red Cross-&gt;Money Donations</td>
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<tr>
<td>104, 105 &amp; 106</td>
<td>Assistance-&gt;Funds/Misc Help</td>
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<td>Follow Up/Direct Message</td>
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<td>108</td>
<td>Monitor</td>
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<tr>
<td>109 &amp; 110</td>
<td>monitor</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
</tr>
</tbody>
</table>
RT @SVVSD: Students/families of St. Vrain Valley School District impacted by fire & need school-related help call 303-591-6141 #boulderfire

westerncitizen

For help w/pets 2nite call Dispatch 303-441-3333. Pets will be housed either here or transported by officer to @LongmontHumane #boulderfire

HumaneBoulder

<table>
<thead>
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<td>104, 105 &amp; 106</td>
<td>Schools</td>
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<td>Donations</td>
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<td>Would Retweet/ Potential Official Message</td>
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<tr>
<td>109 &amp; 110</td>
<td>outreach and volunteers</td>
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<tr>
<td>111</td>
<td>Info Retweet- People/Animal/Evac Shelter</td>
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<td>Pets/Domestic Animals</td>
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<tr>
<td>104, 105 &amp; 106</td>
<td>Assistance- &gt;Animals/Animal Evacuation/Shelter</td>
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<td>107</td>
<td>Follow Up/Direct Message</td>
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<tr>
<td>108</td>
<td>Would Retweet/ Potential Official Message</td>
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<tr>
<td>109 &amp; 110</td>
<td>resources</td>
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<tr>
<td>111</td>
<td>Info Retweet- People/Animal/Evac Shelter</td>
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</table>

RT @blogpaws: FYI from Boulder, CO - shelters taking in pets need canned cat & dog food. If in area, pls help. PLS RT #boulderfire
carondg

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<td>Assistance- &gt;Animals/Animal Evacuation/Shelter</td>
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<tr>
<td>107</td>
<td>Retweet</td>
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<td>108</td>
<td>Monitor</td>
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<tr>
<td>109 &amp; 110</td>
<td>outreach and volunteers</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
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</table>

RT @theinnermarykay: Donate now to the CO Red Cross - quick,easy way to help: #boulderfire http://ht.ly/2ANE7 Donate 1st, then RT characterinc

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<tr>
<td>104, 105 &amp; 106</td>
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<td>Donations</td>
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<td>Accounts to watch</td>
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<td>109 &amp; 110</td>
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<tr>
<td>111</td>
<td>Info Retweet- People/Animal/Evac Shelter</td>
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</table>
Commendations to @laurasrecipes who rocked the scanner coverage on #boulder fire today! Encourage others to help! I can do 1-3 tomorrow

fishnette

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<tbody>
<tr>
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<td>Volunteers</td>
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<tr>
<td>107</td>
<td>Info</td>
</tr>
<tr>
<td>108</td>
<td>Watch but leave alone</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don't respond</td>
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Kind of frustrating not to be able to see what's going on with the #boulderfire from here, websites don't have much info.

torqueflite

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<tr>
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<tr>
<td>107</td>
<td>Retweet</td>
</tr>
<tr>
<td>108</td>
<td>Monitor-&gt;Watch, Hear what others are saying</td>
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<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
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<td>Respond</td>
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If you want to volunteer to help with #boulderfire call Volunteer Connection at 303-444-4904 or email services@volunteerconnection.net

winedunce

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<td>108</td>
<td>Would Retweet/ Potential Official Message</td>
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<tr>
<td>109 &amp; 110</td>
<td>outreach and volunteers</td>
</tr>
<tr>
<td>111</td>
<td>Info Retweet-People/Animal/Evac Shelter</td>
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Anyone have any suggestions where my spouse and I could stay with 2 golden retrievers and 2 cats. We had to evacuate. #boulderfire

Colleen108

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<tbody>
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<td>109 &amp; 110</td>
<td>monitor</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
</tr>
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</table>
Looking for rentals in #Boulder for clients who have been displaced - please let me know if you have anything! #boulderfire (pls RT)

jenflycolorado

If you want to firefighters putting out the #boulderfire they are in need of: chapstick, socks and saline

evolverritos

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<tr>
<td>111</td>
<td>Info Retweet-People/Animal/Evac Shelter</td>
</tr>
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</table>

<table>
<thead>
<tr>
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<tr>
<td>103</td>
<td>Red Cross-&gt;Money Donations</td>
</tr>
<tr>
<td>104, 105 &amp; 106</td>
<td>Assistance-&gt;Donations and Volunteer</td>
</tr>
<tr>
<td>107</td>
<td>Donations</td>
</tr>
<tr>
<td>108</td>
<td>Maybe Answer</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>monitor</td>
</tr>
<tr>
<td>111</td>
<td>Monitor but don’t respond</td>
</tr>
</tbody>
</table>

Cant give time? Make donations to help #boulderfire efforts - contact 211 or (866) 760-6489

COEmergency

Summit Cty - Please help #boulderfire victims. Collecting clothing & toiletries on 9/10, 12-6 & 9/11,10-6. Walmart parking lot - Frisco.

BreckBroker

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<td>Retweet</td>
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<tr>
<td>108</td>
<td>Must Respond</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
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<tr>
<td>111</td>
<td>Monitor but don’t respond</td>
</tr>
</tbody>
</table>
**Sarajuliet**

RT @fishnette: scanner: fire burning out on Dixon Road. theyre torching the hillside across Gold Run Road to fight back? #boulderfire

---

**theinnermarykay**

RT @CarlaYoung: OMG...my thoughts and prayers are with all the #Boulder friends!

---

Hey @redcrossdenver, are you guys going to be doing anything with #boulderfire victims? Want to bring supplies, etc. but dont know where.

---

**Gingerlyspice**

RT @backhomeagain: Can anyone give me an update on the wonderland hills area. Looks like its getting really close! #boulderfire

---

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<td>101 &amp; 102</td>
<td>Tasks</td>
</tr>
<tr>
<td>103</td>
<td>Situational Awareness</td>
</tr>
<tr>
<td>104, 105 &amp; 106</td>
<td>Chatter-&gt;Of Interest</td>
</tr>
<tr>
<td>107</td>
<td>Donations</td>
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<tr>
<td>108</td>
<td>Maybe Answer</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>location/proximity</td>
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<tr>
<td>111</td>
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</tr>
</tbody>
</table>

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<td>101 &amp; 102</td>
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<tr>
<td>104, 105 &amp; 106</td>
<td>Chatter-&gt;Of Interest</td>
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<tr>
<td>107</td>
<td>Action/Respond To</td>
</tr>
<tr>
<td>108</td>
<td>Accounts to watch</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
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<td>103</td>
<td>Red Cross-&gt;Supplies\Donations</td>
</tr>
<tr>
<td>104, 105 &amp; 106</td>
<td>Assistance-&gt;Donations and Volunteer</td>
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<tr>
<td>107</td>
<td>Informational Only, FYI</td>
</tr>
<tr>
<td>108</td>
<td>Maybe Answer</td>
</tr>
<tr>
<td>109 &amp; 110</td>
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</tr>
<tr>
<td>104, 105 &amp; 106</td>
<td>Monitor-&gt;Trends</td>
</tr>
<tr>
<td>107</td>
<td>Follow Up/Direct Message</td>
</tr>
<tr>
<td>108</td>
<td>Maybe Answer</td>
</tr>
<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
</tr>
</tbody>
</table>
RT @boulderweekly: We want to talk to people who have lost their homes in the #BoulderFire. Do you know anyone?

CoyoteRidge

1st friend put stuff in fireproof garage & got out. Other friend had secs to leave. House gone. Only clothes on her back. #boulderfire

wiscobeth

If you have any photos of the #BoulderFire, tweet them to me or send them to news (at) denvernewshd (dot) com. #4milefire #FourMileFire

kwgndenver

@fishnette: im reporter at CPR. putting together a story on social media / #boulderfire on deadline. call 303 871 9191 x458. thanks

zacbarr

<table>
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<tr>
<th>Participant #</th>
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</tr>
</thead>
<tbody>
<tr>
<td>101 &amp; 102</td>
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<tr>
<td>103</td>
<td>Media Requests</td>
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<tr>
<td>104, 105 &amp; 106</td>
<td>Not Us - Media</td>
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<td>107</td>
<td>Action/Respond To</td>
</tr>
<tr>
<td>108</td>
<td>Monitor</td>
</tr>
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<td>109 &amp; 110</td>
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<td>Informational Only, FYI</td>
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<tr>
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<td>Watch but leave alone</td>
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</table>
Theres a huge fire in #Boulder County and I'm tweeting about it on @kwgndenver.

AlexisGentry


WendyNorris

Map: Fire Detection Maps of Active fires Rocky Mountain (West) (WY, CO) http://bit.ly/c4XdMY ht @USFS #BoulderFire

CrisisMappers
Red Cross getting more calls for people looking for loved ones. #Boulderfire evacuees encouraged to PLEASE register at www.safeandwell.org

RedCrossDenver

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<td>Red Cross</td>
</tr>
<tr>
<td>104, 105 &amp; 106</td>
<td>Operations-&gt;Missing Persons</td>
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<td>107</td>
<td>Informational Only, FYI</td>
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<td>108</td>
<td>Would Retweet/ Potential Official Message</td>
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<tr>
<td>109 &amp; 110</td>
<td>outreach and volunteers</td>
</tr>
<tr>
<td>111</td>
<td>Info Retweet- People/Animal/Evac Shelter</td>
</tr>
</tbody>
</table>

#Boulder fire closes Boulder Canyon, Left Hand Canyon and Four Mile Canyon. Stay safe.

yogamusclelive

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<tr>
<td>104, 105 &amp; 106</td>
<td>Operations-&gt;Road and Closures</td>
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<td>107</td>
<td>Retweet</td>
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<td>108</td>
<td>Map</td>
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"According to early radio traffic, the Fourmile fire started when an RV crashed into a propane tank" via http://bit.ly/bFvB6H #boulderfire

spyyddir

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<td>104, 105 &amp; 106</td>
<td>Monitor-&gt;Rumor Control</td>
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<td>107</td>
<td>Info</td>
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<td>108</td>
<td>Must Respond</td>
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<td>109 &amp; 110</td>
<td>background</td>
</tr>
<tr>
<td>111</td>
<td>Respond</td>
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</tbody>
</table>

#boulderfire Camera says the fire is approaching Dixon and Gold Run Roads. Hear is a map: http://tinyurl.com/37fdkt

boulderagent

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<td>101 &amp; 102</td>
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</table>
Just released by NASA: Very latest image of Fourmile Canyon fire as seen from space:
http://bit.ly/92IsIv #boulderfire #wildfire #colorado

yulsman

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</table>

RT @kwgndenver: Sheriff Joe Pelle: "To my knowledge, there are no casualties, no fatalities, and no serious injuries" #boulderfire

Kelly_cookson

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<tr>
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<tr>
<td>109 &amp; 110</td>
<td>status</td>
</tr>
<tr>
<td>111</td>
<td>Incident Info/OPS</td>
</tr>
</tbody>
</table>

updated fire estimate based on IR mapping last nite, total fire area now estimated at 6168 acres #boulderfire

DougInBoulder

Fire 30% contained; heavy tanker involvement today on NW edge of fire in prep for 30-50 mph winds forecast for tonight. #boulderfire

mikehartCXO

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<tr>
<td>109 &amp; 110</td>
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</table>
@fishnette THANKS to U on keeping the folks informed, I am watching TV Breifing and the guy knows nothing! #boulderFire

wind4me

#Boulderfire Thank you for your huge generosity, but we cannot receive any perishable food donations at BRFD. We appreciate your support!

rkaplan1

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<td>Not Us - Media</td>
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<tr>
<td>107</td>
<td>Action/Respond To</td>
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<tr>
<td>108</td>
<td>Monitor-&gt;Watch, Hear what others are saying</td>
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<tr>
<td>109 &amp; 110</td>
<td>chatter/not our area</td>
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## Citizen Report Tweet List

<table>
<thead>
<tr>
<th>Tweets</th>
<th>Username</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx 4 report! RT @HKoren @hlane not here at 55/arapahoe but it looks to be settling northwest of #boulder towards reservoir/longmont</td>
<td>hlane</td>
</tr>
<tr>
<td>Driving west on CO 66, white plume of smoke to the south maybe 20,000 feet high #boulderfire</td>
<td>paxr55</td>
</tr>
<tr>
<td>Walnut &amp; 18th #boulderfire [link]</td>
<td>nikkibot</td>
</tr>
<tr>
<td>#Boulder fire from McCaslin Blvd in Superior @dailycamera @Boulder [link]</td>
<td>jaydischord</td>
</tr>
<tr>
<td>My home is right under the plume of smoke! [link] #Boulder wildfire.</td>
<td>CampSteve</td>
</tr>
<tr>
<td>RT @paxr55: Driving west on CO 66, white plume of smoke to the south maybe 20,000 feet high #boulderfire</td>
<td>CalFireNews</td>
</tr>
<tr>
<td>Friends house is gone. Landlord came downstairs and said flames are coming, leave now. Doesn't even have his wallet. #boulderfire</td>
<td>wiscobeth</td>
</tr>
<tr>
<td>Ash falling at 95th and Baseline #boulder</td>
<td>dvdhns</td>
</tr>
<tr>
<td>the Four Mile Canyon fire has produced so much smoke, its blocking out the sun here on 4th Street, and its mighty stinky #boulder</td>
<td>thegreghoy</td>
</tr>
<tr>
<td>Its now raining ashes on our home. #Boulder #wildfire.</td>
<td>CampSteve</td>
</tr>
<tr>
<td>@boulderagent the fire is getting over there?? near Dakota Ridge? It doesn't look that way from here. Looks like its up Canyon #boulderfire</td>
<td>metroseen</td>
</tr>
<tr>
<td>Heres the view from Stanford Dr in south Boulder: [link] #boulderfire</td>
<td>superyates</td>
</tr>
<tr>
<td>Steven on our message board: &quot;Strong smoke smell at DIA, and they're changing the flight patterns as we speak.&quot; (unconfirmed) #Boulder #fire</td>
<td>kwgndenver</td>
</tr>
<tr>
<td>light ash falling at my office, 2401 Broadway, from #boulderfire, approx. 6 miles west up Fourmile at Emerson Gulch</td>
<td>bldr_architect</td>
</tr>
<tr>
<td>Lots of us up Flagstaff. Smoke everywhere. #boulderfire [link]</td>
<td>AllyBSpeakin</td>
</tr>
<tr>
<td>1st friend put stuff in fireproof garage &amp; got out. Other friend had secs to leave. House gone. Only clothes on her back. #boulderfire</td>
<td>wiscobeth</td>
</tr>
<tr>
<td>Wildlife officer at Labelle &amp; Sugarloaf sees flames heading her direction #boulderfire #fourmiledenverfire</td>
<td>Colo_kea</td>
</tr>
<tr>
<td>#boulderfire My house on Melvina Hill was at the epicenter of it! [link]</td>
<td>JoeySchusler</td>
</tr>
</tbody>
</table>
# Resources Tweet List

<table>
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<tr>
<th>Tweets</th>
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<tbody>
<tr>
<td>There's a huge fire in Boulder County and I'm tweeting about it on @kwgndenver.</td>
<td>AlexisGentry</td>
</tr>
<tr>
<td>map of area just ordered evacuated by reverse 911: <a href="http://bit.ly/9JuULq">http://bit.ly/9JuULq</a> #boulderfire</td>
<td>fishnette</td>
</tr>
<tr>
<td>Spreadsheet for info and photos coming from #boulderfire: <a href="http://bit.ly/b87IZ1">http://bit.ly/b87IZ1</a> #boulderfire see next tweet for tags</td>
<td>epiccolorado</td>
</tr>
<tr>
<td>For those affected by the #boulderfire, call the incident call center at 303-413-7737, instead of 9-1-1 (if no new emergency to report)</td>
<td>KGNU</td>
</tr>
<tr>
<td>RT @COEmergency: Updates direct from Boulder OEM re #boulderfire boulderoem.com/component/content/article/5</td>
<td>FireInfoGirl</td>
</tr>
<tr>
<td>RT @bouldercounty: Information about Fourmile Wildfire - Please check status page on <a href="http://bit.ly/9YQTHJ">http://bit.ly/9YQTHJ</a> #boulder</td>
<td>BCH_HealthED</td>
</tr>
<tr>
<td>Fire watch: Partial list and map of homes lost in Boulder County fire: <a href="http://bit.ly/9p5CFQ">http://bit.ly/9p5CFQ</a> #BoulderFire</td>
<td>boulderweekly</td>
</tr>
<tr>
<td>Map: Fire Detection Maps of Active fires Rocky Mountain (West) (WY, CO) <a href="http://bit.ly/c4XdMY">http://bit.ly/c4XdMY</a> ht @USFS #BoulderFire</td>
<td>CrisisMappers</td>
</tr>
<tr>
<td>Red Cross getting more calls for people looking for loved ones. #Boulderfire evacuees encouraged to PLEASE register at <a href="http://www.safeandwell.org">www.safeandwell.org</a></td>
<td>RedCrossDenver</td>
</tr>
<tr>
<td>American Family customers who have claims related to the #Boulderfire should contact our 24-hour Customer Care Center, 1-800-MY-AMFAM.</td>
<td>amfam</td>
</tr>
<tr>
<td>Amazing &amp; up-to-date google map of #boulderfire. Includes known structure fires, closures, &amp; evacuation areas. <a href="http://bit.ly/d0KYvT">http://bit.ly/d0KYvT</a></td>
<td>nataliegeer</td>
</tr>
<tr>
<td>Xcel Energy has established a #boulderfire hotline (800-545-0677) on the status of power in certain neighborhoods. <a href="http://ht.ly/2CRLH">http://ht.ly/2CRLH</a></td>
<td>bouldercounty</td>
</tr>
</tbody>
</table>
## Rumor Tweet List

<table>
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<tr>
<td>&quot;According to early radio traffic, the Fourmile fire started when an RV crashed into a propane tank&quot; via <a href="http://bit.ly/bFvB6H">http://bit.ly/bFvB6H</a> #boulderfire</td>
<td>spyyddir</td>
</tr>
<tr>
<td>UPDATE latest EVACUATIONS #boulderfire Reverse 911 fails command asks twitter HELP <a href="http://c1n.tv/boulder/blog/">http://c1n.tv/boulder/blog/</a></td>
<td>BoulderChannel11</td>
</tr>
<tr>
<td>UPDATE:#boulderfire Command &quot;MORE Evacuations&quot; BOULDER TWITTER 911 fail <a href="http://c1n.tv/boulder/blog/">http://c1n.tv/boulder/blog/</a> firetruckslost/HomesBurn people missing</td>
<td>BoulderChannel11</td>
</tr>
<tr>
<td>Not to cause panic or false rumors, but do I hear a siren in Boulder? #boulderfire</td>
<td>ECP Perkins</td>
</tr>
<tr>
<td>RT @BoulderChannel1: UPDATE: Missing people, hikers, bikers, 4 wheelers, #boulderfire residents trapped and burned alive. <a href="http://c1n.tv/">http://c1n.tv/</a> ...</td>
<td>JannScott</td>
</tr>
<tr>
<td>BLOCKING @BoulderChannel1 Irresponsible news troll, just trying to get blog hits w unconfirmed sensationalist headlines. #boulderfire</td>
<td>beachroses</td>
</tr>
<tr>
<td>#Twitter seems to have been indispensable during the #BoulderFire. Official Emrg. management suffered many public communication failures.</td>
<td>CalFireNews</td>
</tr>
<tr>
<td>UPDATE: FIRE TEAMS SEARCHING FOR BODIES #Boulderfire FOUR MILE FIRE <a href="http://c1n.tv/boulder/blog/">http://c1n.tv/boulder/blog/</a></td>
<td>BoulderChannel11</td>
</tr>
<tr>
<td>#boulderfire officials are relying on twitter to spread the word about possible evacuations, since reverse-911 call system has failed.</td>
<td>PaulMcNett</td>
</tr>
<tr>
<td>People! Stop guessing what &quot;West of Broadway&quot; means. Its not helping. Theyll tell soon enough. Dont cause panic. #boulderfire</td>
<td>AllyBSpeakin</td>
</tr>
<tr>
<td>everybody panic!#boulderfire</td>
<td>dawnkie</td>
</tr>
<tr>
<td>Possible human stupidity started #boulderfire. Increasingly convinced that human stupidity will do us in.</td>
<td>timmytink</td>
</tr>
</tbody>
</table>
## Help Tweet List

<table>
<thead>
<tr>
<th>Tweets</th>
<th>Username</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening to the scanners... apparently people have already lost their homes? Anyone know where to find shelter/bring supplies? #boulderfire</td>
<td>ickaickaicka</td>
</tr>
<tr>
<td>If you want to help us map tweets on our spreadsheet, DM me your email (tell me to follow first) and I’ll give you access. #boulderfire</td>
<td>epiccolorado</td>
</tr>
<tr>
<td>If you can help w/ #geo tagging locations for #boulderfire pls follow @epiccolorado for instructions.</td>
<td>RVAREGal</td>
</tr>
<tr>
<td>@NileGreenberg Its DIY, to act on info. no calls 4 action frm officls yet. Post yr #offer @ epiccolorado #boulderhelps #boulderfire</td>
<td>suesalinger</td>
</tr>
<tr>
<td>@kgnu twitter community wants to help. can u help organize aid? #boulderfire</td>
<td>suesalinger</td>
</tr>
<tr>
<td>RedCross on 9 right now - theryre feeding 200 firefighters. N Boulder Rec Ctr, New Vista, Ned. Still No Call For Us To Help. #boulderfire</td>
<td>suesalinger</td>
</tr>
<tr>
<td>#boulderfire #src Scanner: Woman needs help with three horses.</td>
<td>cuindependent</td>
</tr>
<tr>
<td>#boulderfire please tweet me if anyone needs help! animal care or otherwise!</td>
<td>LilMissOktane</td>
</tr>
<tr>
<td>So proud of everyone following + helping w/ #boulderfire, Im heading down to N. Boulder Rec Center to see what I can do to help.</td>
<td>stiricide</td>
</tr>
<tr>
<td>We need to put into action some kind of #boulderfire fund for the victims. Who wants to help me?</td>
<td>BlogLuvr29</td>
</tr>
<tr>
<td>N.B. Rec Center E.C. moving 2 overnight facility. If you can offer shelter for ppl/animals (esp animals) pls let them know. #boulderfire</td>
<td>stiricide</td>
</tr>
<tr>
<td>RT @fishnette: scanner: some of Pinebrook subdivision is #evac. but part on loop they need more help. #boulderfire</td>
<td>Tanukun</td>
</tr>
<tr>
<td>RT @SVVSD: Students/families of St. Vrain Valley School District impacted by fire &amp; need school-related help call 303-591-6141 #boulderfire</td>
<td>westerncitizen</td>
</tr>
<tr>
<td>For help w/pets 2nite call Dispatch 303-441-3333. Pets will be housed either here or transported by officer to @LongmontHumane #boulderfire</td>
<td>HumaneBoulder</td>
</tr>
<tr>
<td>RT @blogpaws: FYI from Boulder, CO - shelters taking in pets need canned cat &amp; dog food. If in area, pls help. PLS RT #boulderfire</td>
<td>carondg</td>
</tr>
<tr>
<td>@HumaneBoulder has been super to our cats! We volunteered today. If you want to help, consider sparing $5: <a href="http://bit.ly/bjr9K6">http://bit.ly/bjr9K6</a> #boulderfire</td>
<td>Musicshosh</td>
</tr>
<tr>
<td>@caseyeaston #boulderfire I have heard that we food and drinks are needed at the firehouse at Jay and 55th</td>
<td>perfect_circles</td>
</tr>
<tr>
<td>RT @theinnembourgay: Donate now to the CO Red Cross - quick, easy way to help: #boulderfire <a href="http://ht.ly/2ANE7">http://ht.ly/2ANE7</a> Donate 1st, then RT</td>
<td>characterinc</td>
</tr>
<tr>
<td>Tweets</td>
<td>Username</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>I feel God has spoke to me to help with #boulderfire</td>
<td>BlogLuvr29</td>
</tr>
<tr>
<td>@tranquilotravel I want to be there to help serve meals or whatever needs to be done. #boulderfire</td>
<td>BlogLuvr29</td>
</tr>
<tr>
<td>Pets and people welcome at my apartment in Longmont if shelter is needed from four mile fire #boulderfire #offer</td>
<td>Bouldergolfpro</td>
</tr>
<tr>
<td>My real job is massage therapy &amp; I'm offering a free (30min) session to all fireman/emergency people. <a href="http://twitgoo.com/1on7va">http://twitgoo.com/1on7va</a> #boulderfire</td>
<td>OnlyInBoulder</td>
</tr>
<tr>
<td>#BoulderFire #offer have big bag of dog food, unopened. Bring to Humane Society in a.m., or where in Boulder?</td>
<td>Colo_kea</td>
</tr>
<tr>
<td>@indras_net is offering workspace (with wifi) use for any affected by the #boulderfire - across from YMCA shelter! <a href="http://bit.ly/9sFY5R">http://bit.ly/9sFY5R</a></td>
<td>indras_net</td>
</tr>
<tr>
<td>Please patronize @bigredff restaurants, as they have offered to help feed residents displaced by #boulderfire.</td>
<td>MO_242</td>
</tr>
<tr>
<td>RT @picasboulder: #boulderfire P's help get this message to those who need it - if you were evacuated we would like to provide you lunch o ...</td>
<td>Elaine4Tea</td>
</tr>
<tr>
<td>RT @ashleykingsley: If anyone needs any #help #housing #petsitting as a result of the #BoulderFire please get in touch. We have room. #e ...</td>
<td>Frankie645</td>
</tr>
<tr>
<td>RT @EsmaaSelf @RickMontanez @COEmergency: Per @BoulderOEM - to offer goods or donations for #boulderfire call (303) 413-7737</td>
<td>tweetingdonal</td>
</tr>
<tr>
<td>real resource forum for those affected and who want to help #boulderfire <a href="http://bit.ly/b1bDM3">http://bit.ly/b1bDM3</a> meals and places to stay</td>
<td>dasn101</td>
</tr>
<tr>
<td>RT @edaconsulting: Awesome resources for sharing help for #boulderfire evacuees <a href="http://boulderfirehelp.phpbb3now.com/index.php">http://boulderfirehelp.phpbb3now.com/index.php</a></td>
<td>pookla</td>
</tr>
<tr>
<td>RT @downtownboulder: RT @AtlasPurveyors: Free drinks 2 anyone who has been displaced b/c of the 4 mile fire. #boulderfire R thoughts R w/ ...</td>
<td>CSRHomeCook</td>
</tr>
<tr>
<td>RT @SaltBistro: all evacuees and firefighters, please come into Salt and have a Toms Tavern Burger and a draft beer on us. #Boulderfire</td>
<td>userealbutter</td>
</tr>
<tr>
<td>#boulderfire Well be accepting donations today to purchase food for firefighters &amp; buy meals for displaced families.</td>
<td>picasboulder</td>
</tr>
<tr>
<td>Cant give time? Make donations to help #boulderfire efforts - contact 211 or (866) 760-6489</td>
<td>COEmergency</td>
</tr>
<tr>
<td>do any restaurants or stores need anyone to pick up donations for the firefighters? I have volunteers! #boulderfire</td>
<td>metroseen</td>
</tr>
<tr>
<td>Three big bags of clothes headed for Boulder. Hope it fits someone! #boulderfire</td>
<td>ChrisReinhard</td>
</tr>
</tbody>
</table>
## Questions Tweet List

<table>
<thead>
<tr>
<th>Tweets</th>
<th>Username</th>
</tr>
</thead>
<tbody>
<tr>
<td>#boulder #fire looks thick. Have the planes dropped water yet? <a href="http://plixi.com/p/43645574">http://plixi.com/p/43645574</a></td>
<td>Tery</td>
</tr>
<tr>
<td>#boulder #fire - from the north it looks like the smoke column is thinning out. Can anyone say what the winds are doing back there?</td>
<td>rachael_hazen</td>
</tr>
<tr>
<td>Anyone know if the wildfire is near Logan Mill?? Have friends there, cant reach them. Cant access net right now! #wildfire #boulder</td>
<td>eatplaylove</td>
</tr>
<tr>
<td>#gold hill #boulder #fire: anyone know if they need volunteers</td>
<td>higginsk8</td>
</tr>
<tr>
<td>Hey @redcrossdenver, are you guys going to be doing anything with #boulderfire victims? Want to bring supplies, etc. but dont know where.</td>
<td>ickaickaicka</td>
</tr>
<tr>
<td>With all the #BoulderFire stuff going on, is there anything normal people can do?</td>
<td>joseph_flasher</td>
</tr>
<tr>
<td>Anyone know if theres been a call for donations, supplies, food, shelter? for evacuees or firefighters? #boulderfire #boulder #fire</td>
<td>suesalinger</td>
</tr>
<tr>
<td>if there is anyway citizens can help please send out a tweet. shelter, food, etc. plenty of us want to help somehow #boulderfire</td>
<td>NileGreenberg</td>
</tr>
<tr>
<td>RT @backhomeagain: Can anyone give me an update on the wonderland hills area. Looks like its getting really close! #boulderfire</td>
<td>gingerlyspice</td>
</tr>
<tr>
<td>RT @thecupboulder: How can we get iced coffee to the firefighters? #boulderfire</td>
<td>mrkvm</td>
</tr>
<tr>
<td>RT @boulderweekly: We want to talk to people who have lost their homes in the #BoulderFire. Do you know anyone?</td>
<td>CoyoteRidge</td>
</tr>
<tr>
<td>ideas on where to take empty bbq propane tanks? will gas stations take them? #boulderfire thanks!</td>
<td>fishnette</td>
</tr>
<tr>
<td>Is there anywhere to donate toys for #boulderfire?</td>
<td>shellimeyers</td>
</tr>
<tr>
<td>Need to post a link for donations - money &amp; items. Seen links go by, any recommendations on one or 2 places to refer people? #boulderfire</td>
<td>frzndeadguymdays</td>
</tr>
</tbody>
</table>
Appendix O  Sample PMA Report

High Park Fire

Twitter Communication Report

Overview

The total number of Twitter messages collected for the High Park Fire Event is 7355.

Top Twitter Users

Twitter messages for the High Park Fire Event do not represent all of the Twitter traffic around this event. These messages were collected using the search term(s): #highparkfire

The following table shows the ten Twitter users that sent the most tweets for the High Park Fire Event:

<table>
<thead>
<tr>
<th>User</th>
<th>Number of Tweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>ColoradoFires</td>
<td>305</td>
</tr>
<tr>
<td>SMDayFoCo2012</td>
<td>139</td>
</tr>
<tr>
<td>webbymnews</td>
<td>74</td>
</tr>
<tr>
<td>coloradoan</td>
<td>64</td>
</tr>
<tr>
<td>WriteWeb</td>
<td>55</td>
</tr>
<tr>
<td>Tuckertown</td>
<td>53</td>
</tr>
<tr>
<td>LarimerSheriff</td>
<td>49</td>
</tr>
<tr>
<td>WayneDBJr</td>
<td>47</td>
</tr>
<tr>
<td>usfsclrd</td>
<td>44</td>
</tr>
<tr>
<td>denpostdana</td>
<td>41</td>
</tr>
</tbody>
</table>

Daily Twitter Count

Twitter messages for the High Park Fire Event do not represent all of the Twitter traffic around this event. These messages were collected using the search term(s): #highparkfire

The following table and graph shows the number of Twitter messages sent by date for the High Park Fire Event:

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of Tweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-06-22</td>
<td>1055</td>
</tr>
<tr>
<td>2012-06-27</td>
<td>2352</td>
</tr>
<tr>
<td>2012-06-28</td>
<td>878</td>
</tr>
<tr>
<td>2012-06-29</td>
<td>754</td>
</tr>
<tr>
<td>2012-06-30</td>
<td>645</td>
</tr>
<tr>
<td>2012-07-01</td>
<td>341</td>
</tr>
<tr>
<td>2012-07-02</td>
<td>447</td>
</tr>
</tbody>
</table>
Twitter messages for the High Park Fire Event do not represent all of the Twitter traffic around this event. These messages were collected using the search term(s): #highparkfire

The following table and graph shows the number of Twitter messages in each category for the High Park Fire Event:

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Tweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Park Fire</td>
<td>7355</td>
</tr>
<tr>
<td>Ire Department</td>
<td>342</td>
</tr>
<tr>
<td>Police</td>
<td>212</td>
</tr>
<tr>
<td>Red Cross</td>
<td>83</td>
</tr>
</tbody>
</table>
Top Twenty Hashtags

Twitter messages for the High Park Fire Event do not represent all of the Twitter traffic around this event. These messages were collected using the search term(s): #highparkfire

The following table shows the twenty hashtags that appeared in the most tweets for the High Park Fire Event:

<table>
<thead>
<tr>
<th>Hashtag</th>
<th>Number of Tweets</th>
<th>Percentage of Tweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>#highparkfire</td>
<td>7012</td>
<td>95%</td>
</tr>
<tr>
<td>#waldocanyonfire</td>
<td>2252</td>
<td>31%</td>
</tr>
<tr>
<td>#flagstafffire</td>
<td>1395</td>
<td>19%</td>
</tr>
<tr>
<td>#cofire</td>
<td>384</td>
<td>5%</td>
</tr>
<tr>
<td>#cofires</td>
<td>155</td>
<td>2%</td>
</tr>
<tr>
<td>#colorado</td>
<td>155</td>
<td>2%</td>
</tr>
<tr>
<td>#weberfire</td>
<td>98</td>
<td>1%</td>
</tr>
<tr>
<td>#smday</td>
<td>93</td>
<td>1%</td>
</tr>
<tr>
<td>#pineridgefire</td>
<td>87</td>
<td>1%</td>
</tr>
<tr>
<td>#cowx</td>
<td>78</td>
<td>1%</td>
</tr>
<tr>
<td>#fortcollins</td>
<td>76</td>
<td>1%</td>
</tr>
<tr>
<td>#wildfires</td>
<td>75</td>
<td>1%</td>
</tr>
<tr>
<td>#co</td>
<td>71</td>
<td>1%</td>
</tr>
<tr>
<td>#waldofire</td>
<td>70</td>
<td>1%</td>
</tr>
<tr>
<td>#fl</td>
<td>52</td>
<td>1%</td>
</tr>
<tr>
<td>#wildfire</td>
<td>52</td>
<td>1%</td>
</tr>
<tr>
<td>Hashtag</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>--------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>#littlesandfire</td>
<td>48</td>
<td>1%</td>
</tr>
<tr>
<td>#firefighters</td>
<td>45</td>
<td>1%</td>
</tr>
<tr>
<td>#loc</td>
<td>44</td>
<td>1%</td>
</tr>
<tr>
<td>#littles</td>
<td>41</td>
<td>1%</td>
</tr>
</tbody>
</table>
### Appendix P  Participant Information for the PMA Field Study

<table>
<thead>
<tr>
<th>Participant Number</th>
<th>Age Group</th>
<th>Organization Type</th>
<th>Time as a PIO</th>
<th>Time per week as a PIO</th>
<th>Social Media used as a PIO</th>
<th>Applications used for social media</th>
</tr>
</thead>
<tbody>
<tr>
<td>112</td>
<td>30-39</td>
<td>Bureau of Land Management</td>
<td>7 years</td>
<td>5%</td>
<td>Facebook – 2 years, Twitter – 2 years, Flicker – 2 years, Wordpress – 2 years, Google+ - 1 year</td>
<td>Monitter – aggregating, TweetDeck – aggregating, HootSuite – aggregating, TweetCast – aggregating, Echofn – aggregating</td>
</tr>
<tr>
<td>113</td>
<td>20-29</td>
<td>US Forest Service</td>
<td>6 years</td>
<td>100%</td>
<td>Twitter – 2+ years, Facebook – 2+ years, Flickr – 2+ years</td>
<td>Monitter – monitor/listen/search, Addictomatic – analytics</td>
</tr>
<tr>
<td>114</td>
<td>50-59</td>
<td>US Forest Service</td>
<td>27 years</td>
<td>100%</td>
<td>Facebook – 3 years, Twitter – 3 years, Google+ - 1 year, Groupme – 6 months, Yammer – 6 months</td>
<td>Addictomatic, Monitter, TweetDeck, Ice Rocket, Technorati, Google Alerts, Google News – monitoring</td>
</tr>
<tr>
<td>115</td>
<td>50-59</td>
<td>State Forestry Department</td>
<td>15 years</td>
<td>Only on fire assignments</td>
<td>Facebook – 4 years, Flickr – 4 years, Twitter – 4 years</td>
<td>Tweetdeck, Google search</td>
</tr>
</tbody>
</table>
## Appendix Q  Participant Information for the PMA Usability Study Sessions

<table>
<thead>
<tr>
<th>Participant Number</th>
<th>Age Group</th>
<th>Organization Type</th>
<th>Time as a PIO</th>
<th>Time per week as a PIO</th>
<th>Social Media used as a PIO</th>
<th>Applications used for social media</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>40-49</td>
<td>Fire Department</td>
<td>6 years</td>
<td>10%</td>
<td>Facebook – 2 years, Twitter – 2 years, LinkedIn – 1 year, UStream – 4 months, YouTube – 2 years, QR Codes – 6 months</td>
<td>Hootsuite – monitoring</td>
</tr>
<tr>
<td>102</td>
<td>40-49</td>
<td>Fire Department</td>
<td>9 months</td>
<td>25%</td>
<td>Facebook – 9 months, Twitter – 9 months, LinkedIn – 9 months, UStream – 3 months, YouTube – 9 months, QR Codes – 9 months</td>
<td>Hootsuite – monitoring</td>
</tr>
<tr>
<td>103</td>
<td>50-59</td>
<td>Public Health</td>
<td>20 years</td>
<td>5%</td>
<td>Facebook – 2 years, Twitter – 2 years</td>
<td>Tweetdeck – monitoring specified Twitter and FB feeds, Google Reader – media monitoring</td>
</tr>
<tr>
<td>108</td>
<td>20-29</td>
<td>County Sheriff’s Office</td>
<td>1 year</td>
<td>5%</td>
<td>Blog – 2-3 years, Twitter – 2 years, Facebook – 2-3 years, Youtube – 3+ years</td>
<td>Twitter – basic documentation, Hootsuite – Monitor/Post/Document, CrowdBooster – Reports/Documentation, RowFeeder – Hashtag Tracking</td>
</tr>
<tr>
<td>110</td>
<td>30-39</td>
<td>University Communication</td>
<td>3 years</td>
<td>3%</td>
<td>Facebook – 3 years, Twitter – 3 years</td>
<td>Hootsuite – monitoring across channels</td>
</tr>
<tr>
<td>111</td>
<td>40-49</td>
<td>State Emergency</td>
<td>10 years</td>
<td>100%</td>
<td>Twitter – 5 years, Facebook – 5 years, Google Blog, Maps – 5 years, Youtube – 5 years</td>
<td>Hootsuite – monitoring, Google Alerts – monitoring, Monitter – monitoring</td>
</tr>
<tr>
<td>116</td>
<td>40-49</td>
<td>Police Department</td>
<td>21 years</td>
<td>100%</td>
<td>Facebook – 5 years, Twitter – 4 years, LinkedIn – 4 years, Flickr – 4 years, Foursquare – 2 years, Tumblr – 1 year, Google – 3 years</td>
<td>Hootsuite – posting, Tweetdeck – monitoring, ESRI – social media aggregator</td>
</tr>
</tbody>
</table>
Appendix R  PMA Field Study Notes Datasheet

<table>
<thead>
<tr>
<th>What Do You Like?</th>
<th>What Doesn’t Work?</th>
<th>Improvement Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>