The Symbiotic Relationship of Crisis Response Professionals and Enthusiasts as Demonstrated by Reddit's User-Interface Over Time

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ABSTRACT

Since the Aurora, Colorado movie theater shooting of 2012, the web aggregation community Reddit has been an enthusiast-driven, public-facing source of information about crisis response efforts. We describe the evolution of Reddit's software from the Boston Marathon Bombing of 2013 to the Ferguson unrest throughout 2014. Initially, Reddit was built to aggregate verified news but beginning with the Aurora movie theater shooting, Reddit began to aggregate and verify breaking news. In response to criticism of Reddit's actions during the Boston Marathon Bombing, Reddit re-designed their software in an effort to more accurately mimic crisis response professionals by fostering rigor, information control, and tighter bureaucracy. Reddit's ability to swiftly change its software serves as an example of the possibilities of crisis informatics in practice. We highlight the processes that Reddit has taken to maintain its efficacy even within the current issues surrounding information verification and automated spreading of rumors and falsehoods.

Keywords

Reddit, Crisis Informatics, User-Interface, Communities, Social Networks.

INTRODUCTION

This research contributes to understanding how the actions and media coverage of crisis response professionals influence the practices of crisis response enthusiasts over time. We situate our research using two concepts–publics or public groups and communities of practice. Publics are groups of people indirectly associated with a topic or event (Liu et al., 2011). The events that bring these people together can often lead to the establishment of a community of practice (Lave & Wenger, 1998) as participation in a group over time will often lead to routinized community norms and methods. Specifically, we examine the community of practice that formed in the web aggregation community Reddit during the Boston Marathon Bombing of 2013. The community of practice that developed during the Boston response influenced changes to Reddit's user-interface (Potts & Harrison, 2013) that were deployed during the Ferguson Riots (or Ferguson Unrest) of late 2014.

The Boston Marathon Bombing is our starting point as much of the current state of the crowd's place in crisis response begins there. During the Boston Marathon Investigation, Reddit-users processed all publicly available information in and around the Boston area in an effort to identify the then unknown bombers. The efforts of Reddit lead to two attempts to name the bombers–both attempts were incorrect and highly publicized. The vociferous public response led to a clash between crisis-response professionals and the public about the nature of crowdsourcing crisis response (Konkel, 2013; Nhan et al., 2015; Potts & Harrison, 2013; Tapia & LaLone, 2014). At the center of the clash were the place of citizen journalists in crisis response (Tapia & LaLone, 2014). To situate this clash, we use the three types of public groups that appear within crisis response.

First, there are those impacted by the disruption that lead to a crisis. The nature of the disruption defines these

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public groups. The second kind of public are crisis-response professionals. The nature of the professional is well-defined (e.g. (Bruning et al., 2004; Bruning & Ledingham, 1999)). The third type of public is loosely defined as a collection of groups that emerge near or outside the impacted area. Recent technological developments have created public groups that are bound by software and represented by a user-interface. The groups bound by software could be bound by a Twitter Hashtag like #Pray4Boston or a group devoted to a specific cause like pet recovery in Hurricane Sandy (White et al., 2014). This third type of group the focal point of the present research. Reddit is a loosely defined group bound together by software.

During a crisis response event, interested Redditors (members of Reddit) gather around that topic and often establish a topically-oriented sub-section of Reddit called a subreddit. This moves Reddit from public groups to communities of practice (Lave & Wenger, 1998). It establishes a community of practice because each subreddit has its own set of norms, practices, and rules. Reddit's public failure during the Boston Marathon Bombing is the sole event responsible for changes to Reddit's user-interface (Leavitt, 2016; Potts & Harrison, 2013). Reddit focused on codifying the practices that worked and using their interface design to ensure those practices that did not work well were no longer possible. The communities of practice from previous events provided the practices that needed to be represented by the interface and those practices were attempts to mimic crisis responders themselves.

PUBLIC GROUPS, NETWORKED PUBLIC GROUPS, AND CRISIS RESPONSE

According to Moynihan (2009), crisis-oriented public groups have historically been organized in one of two ways (Figure 1, next page): command and control (top down) and networked governance (central command with autonomous, hierarchically organized groups). Credential-identified professional responders act within a rigidly hierarchical network maintained by official authority in the form of training, licenses, and certificates. These methods of response were created during the Cold War. They established a military style command structure that operated much like a military unit. In addition to the command structure, this credential-bound public group would typically act in near privacy. The privacy afforded by credentials began to wane as new types of communication technologies allowed the public to keep track of responders and their activities. Technologies like police scanners, social media, cheap cameras, and the ability to broadcast to the Internet via telephone, removed a significant amount of crisis responder privacy. The loss of privacy was innocuous. However, as those tools that the citizens used became more powerful and widely available, the loss of privacy began to matter in significant ways.
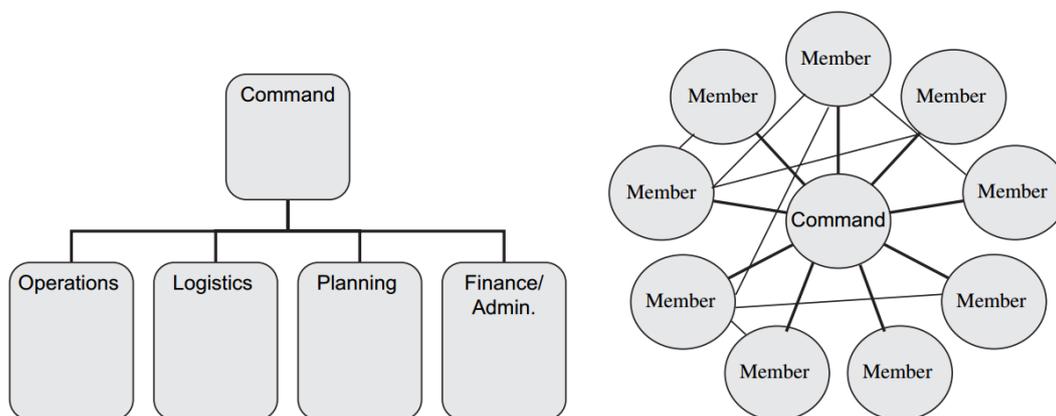

Figure 1 - Command and Control hierarchy versus Networked Governance (Moynihan, 2009)

Given these two structures, it was previously impossible for the (untrained) public to participate in a crisis response. The public was also unable to gain information about the response from the responders themselves. In the past, responders will typically only discuss response efforts with other responders. Now, response professionals release information through social media via official accounts or through official media sources. In addition to receiving information, it is similarly difficult to provide information to response professionals. Generally, responders only accept information through official methods such as interviews or tip lines. Pre-established information-sharing channels like those mentioned above are what software-mediated groups like Reddit are confounding.

For example, during the Boston Marathon Bombing, the official methods of interacting with responders nearly collapsed under the weight of over 10 terabytes of images, videos, and tips (Konkel, 2013). This deluge of data paired with internet-accessible police blotters and scanners meant that an active criminal investigation was

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under the scrutiny of enthusiast groups with high-levels of technological expertise (Büscher & Liegl, 2014). Groups of citizens bound by software like Reddit, began to organize around aiding criminal investigation. The public responded to initial activity favorably. Many began to feel that the crowd could solve crimes without professional intervention (Konkel, 2013; Tapia et al., 2014). Reddit seemed to have an ability to traverse crisis informatics in ways previously unobtainable.

CRISIS INFORMATICS

Citizen use of social media and other kinds of software during crisis response has been an active research domain for several years and has fallen under the moniker, "crisis informatics" (Palen & Anderson, 2016). This research often engages the practice of average citizens reporting on activities "on-the-ground" during a disaster (e.g. (Dailey et al., 2016; Dailey et al., 2018)). Research focuses on the data these citizens produced because it is potentially valuable to real-time response efforts (e.g. (Palen & Vieweg, 2008; Palen et al., 2007; Starbird et al., 2012; Starbird & Stamberger, 2010; Sutton et al., 2008; Terpstra et al., 2012; Vieweg et al., 2008)). As the potential value of these data has become more evident, the need to make social media data useful to emergency responders has become a strong research focus (see Tapia et al. (2013)). However, this research is unbalanced and has focused primarily on the challenges of processing and sorting social media data (MacEachren et al., 2011).

Interestingly, most research about crisis response and social media centers on the use of Twitter data. Each point of data within a Twitter corpus is brief. Therefore, it represents a unique opportunity for researchers to find information that may or may not contain about certain situations on the ground (Kaufhold & Reuter, 2016). However, recent polls about social media use during a crisis found that most users (73%) would turn to Facebook for help and maintain their privacy restrictions on their communication, thereby reducing the effectiveness of social media significantly. Just 21% of their respondents claimed to use Twitter (Reuter & Spielhofer, 2016). While groups on social media are often described in great detail post-event (e.g. (White et al., 2014)), more work is needed to understand other types of online communication like the web aggregation community Reddit. This work is still nascent but many generalities can be seen with crisis response and social media.

Fifteen years of crisis informatics research has revealed three important developments. First, social media use during a crisis events has become commonplace. More and more people use social media to both communicate and organize during events. Next, the geographical representation of crisis informatics research can be found globally now versus its initial focus on the United States. Attempts to organize online denizens through efforts like virtual and technical communities (Van Gorp, 2014), incident management teams (McLennan et al., 2006), and Virtual Operations Support Teams (VOSTs) (Büscher & Liegl, 2014) continue to be attempted but never fully realized (Reuter & Kaufhold, 2018). Mistrust and expectations continue to provide barriers to accepting social media data in real time. The recent growth of "Fake News" has further confounded these efforts (Starbird, 2017). And additional developments have called into question the ethical nature of using social media data at all (Grassegger & Krogerus, 2017). We offer our case study not as an answer to the growing issue of fake news but as an effort to describe efforts to correct the spread of misinformation for crisis informatics and crisis response professionals to learn from.

CONTEXT OF CASE STUDY

Reddit is considered a "social news" website that affords its users the ability to link to other websites, post pictures, vote (positive or negative) on other posts, and post multimedia content in "live threads." The tagline for the site is, "the front page of the internet" and as the ninth most popular webpage on the internet, it nearly is. Reddit can also be considered a tool for reporting and awareness to a limited degree due to the specific type of user that it attracts. The audience of Reddit is majority male (53%), between the ages of 18-29, and from the United States (54%). Nearly 6% of all Americans have an account on Reddit (Duggan & Smith, 2013). As of 2015, Reddit has received over 70 million user submissions, over 700 million comments about those submissions, nearly 7 billion votes, and over 80 billion page views (Leavitt, 2016).

The site is organized topically, with each overarching topic (e.g. politics, gaming, python) is referred to as a subreddit. Each item on a subreddit is referred to as a post and each subreddit are organized via date or popularity (ratio of positive votes to number of votes). Users can also organize their interface by subreddit, message other users, and gain access to hundreds of independent systems connected (unofficially) to subreddit communities. These systems include chat tools like authentication servers for other forums, Imgur, Internet Relay Chat, Discord Chat, or Slack Chat. These services allow Redditors to organize and act in tandem in many ways. When all of these tools are assembled, Reddit has four qualities that make it a target of opportunity for research: 1) a desire to act, 2) significant levels of participation, 3) time, and 4) technical skill (See: (Duggan &

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Smith, 2013)). During a crisis response effort, the sheer volume of data processing often dwarfs the capacity of professional response efforts.

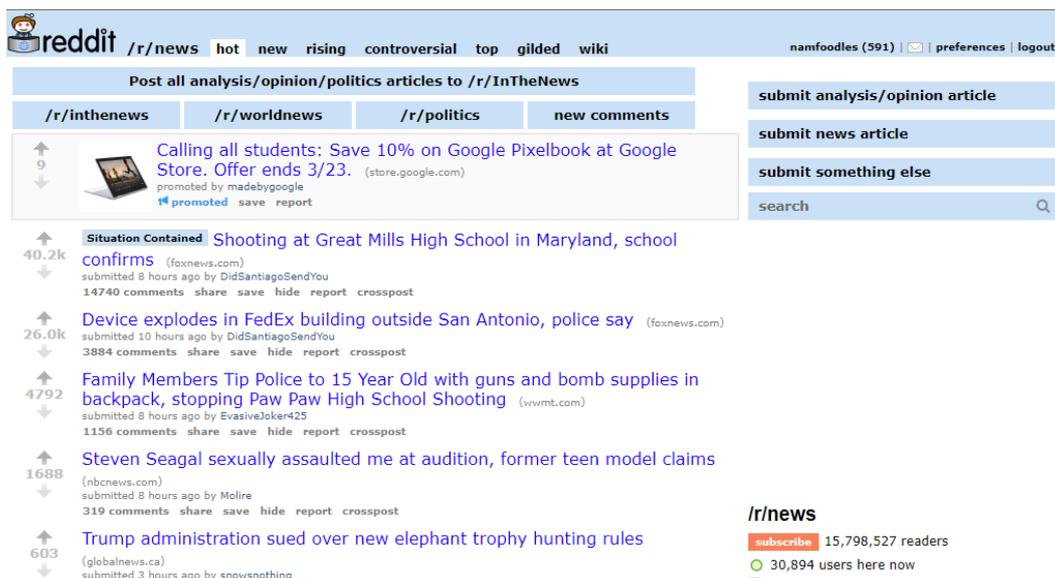**Figure 2 – Reddit's Normal Interface**

The selection criteria for this research was selected as a "before and after." If interface and affordance represent the internal discourse about the place and nature of a community, then these two cases need to reflect two different modes of thought (Potts & Harrison, 2013). We also wanted two cases whose gaps and attrition-based data loss over time could be remedied by news media and supplemental discussion on other sites. The first choice was the Boston Marathon Bombing. This case represents the most public interaction between professional crisis responders and enthusiasts. By most accounts, the interaction ended in failure (Madrigal, 2013; Nhan et al., 2015; Tapia et al., 2014). After this encounter, the administrators and members of Reddit began developing new tools deployed during the Ferguson Unrest.

Case Summaries

The Boston Marathon Bombing and Ferguson Unrest are two cases wherein professional crisis responders were the focus of Reddit's response efforts. During each event, Redditors used web-accessible police scanners, hand-coded Google Maps, and video streams from individuals on the ground to fill situational knowledge gaps. An inventory of the data collected and examined within these case studies shown in Table 1. The following examines what Redditors did during the Boston Marathon Bombing that caused their software to need to change. We then discuss Reddit's activities during the Ferguson Unrest.

The Boston Marathon Bombing

On Monday, April 15, 2013, at 2:49 pm, two bombs exploded 210 yards (190 m) from the finish line of the Boston Marathon, abruptly terminating the race. These bombs killed three people and injured 264 others. Within hours of the initial event, the FBI called for bystanders to share images and video of the event (Tapia et al., 2014). Reddit was actively involved with aggregating and disseminating information about the situation in Boston and the hunt for the bombers. Their involvement manifested in a manner that was available to Redditors, through their user interface. In total, their work spread out over 21 individual threads, several chatrooms on Internet-Relay Chat, countless supplemental posts, and private messages.

The narrative of these posts tells a story about the birth of a community of practice from the public groups of Reddit. When the event occurred, the author of the original post posted a thread in the wrong subreddit. This thread was immediately deleted. The creator of the second thread, this time in the correct location, established the procedure for breaking news using the Reddit User Interface. The creation of 20 more threads using this structure appeared over the next 10 days. As thread 2, 3, and 4 came and went, the discussion of where to discuss the Boston Marathon Bombing and if its subreddit would dominate the threads. This began to change as the threading stabilized and content moved from "What is going on?" to "What do we do now?" and "Who did this?"

The discussion of how to verify information immediately became a problem. Starting in thread 3, discussion of

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too much speculation began to pepper the threading. Different news media began to discuss contradictory information and so Reddit began to dig deeper. Groups listened to the police scanner and other camera feeds around the area. By thread 11 (2 days after the bombing), two themes dominated the discussion. The first was that Reddit was becoming a problem. Concepts like, "beware the insomniac Reddit army!" warned of possible pending disaster. Another theme was that some of the efforts to catch the Boston Bomber were getting out of hand. Many comments begged the FBI to release the names and identities of the bombers as to avoid drama.

Event	ID	Activity	Likes	Major Event	Sub-Event
Boston	1	1914	3632	Transcribing Scanner	Talk about thread being removed
Boston	2	3936	3089	Worldnews Mod Anger	Praise for threads
Boston	3	3728	3006	Please not to click unless needed	Calls for facts, not speculation
Boston	4	4398	2871	Moroccan national speculation	Why this subreddit?
Boston	5	205	879	Slower verification.	Thread not fully created
Boston	6	2107	1824	Number of injuries and deaths	New York Post isn't trustworthy source
Boston	7	998	1410	Hospital discussion	What was the bomb made of?
Boston	8	1631	1544	Original Post Deleted	Bag discussion, bomb speculation
Boston	9	822	1527	Should start witch hunt, it's getting bad	Deleted
Boston	10	906	1399	Victim of Blast Needs Support	Photo dump discussions
Boston	11	184	806	Need to be wary of "Insomniac Reddit Army!"	Please FBI release soon or witch hunts out of hand
Boston	12	3705	1536	Please no Speculation	Random Acts of Pizza article on CNN
Boston	13	1804	1515	Original Post Deleted	Press Briefing Cancelled, no new news
Boston	14	1960	2280	Thank you for doing this	Pictures are heartbreaking
Boston	15	375	795	Victim of Blast needs support	no need to keep speculating
Boston	16	3802	1218	Reddit DDOS	Ferilizer Explosion
Boston	17	3688	990	Picture Quality	Discussion of finding suspects
Boston	18	3667	798	Discussion of incorrect suspects	Mike Mulugeta, Sunil Tripathi
Boston	19	1850	863	Original Post Deleted	Posts to Tasranaev twitter account
Boston	20	3212	783	Discussion of staying off streets	Police asking not to broadcast search
Boston	21	2787	834	Investigation Over	Police Band not being encoded
Unrest	1	1530	1447	Political Discussion dominated	
Unrest	2	384	386	Going to sleep, read live thread	
Unrest	Live	8000+	N/A		

Table 1 – Post and Comment Inventory with Emergent Themes from Each

On thread 16 (3 days after the bombing), Reddit's public support ran out when it released photos of the bombing suspects. During this thread, Reddit was the target of a Distributed-Denial of Service attack (DDOS). By thread 18, Reddit's goodwill would expire. The names Mike Mulugeta and Sunil Tripathi originated from a single tweet:

> *@KallMeKG: BPD scanner has identified the names:*
> *Suspect 1: Mike Mulugeta Suspect 2: Sunil Tripathi.*
> *#Boston #MIT [5]. [April 19, 2:50pm, cited in (Starbird et al., 2014)]*

The news media would repeat these names after they were offered by Redditors. However, this tweet seems to have been an effort to sabotage the public's efforts. Mike Mulugeta did not exist and Sunil Tripathi had tragically committed suicide before the bombing but his body was not found for several more days. After the

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Boston event, Reddit began work on their graphic interface.

Ferguson Civil Unrest and Riots

On August 9, 2014, police officer Darren Wilson shot and killed Michael Brown outside of a convenience store in Ferguson, Missouri. This shooting sparked numerous protests and riots across the city that continued until November 2014 after Darren Wilson's acquittal. Redditors started a thread about the Ferguson Unrest as normal. However, Reddit had begun its shift from simple aggregation of existing information and began to supplement it with, "Live Threads." Many comments on the initial thread were simply, "Go to the Live Page for more information."

Live threads, unlike the old threads that required careful handoffs paired with focused manipulation of the Reddit voting system, were controlled by an administrator who could distribute thread editing rights. There were approximately 10-15 administrators throughout the event. Live Threads functioned as an interactive canvas capable of accepting all types of multimedia data. Many of the data for these maps came from Vine, Facebook Live, and several other streaming services. Other Redditors created "fire maps" via Google Maps that showed real-time estimates of where fires were currently blazing. Throughout this event, the only "drama" was about how slow or fast the page was updated. The page kept clear of little more than information aggregation in real time. The difference between Ferguson and Boston Marathon Bombing activity shown in Figures 3 and 4.

Figure 3 & 4 - Standard Reddit Page versus a Live Page

METHOD AND DATA

In this research, we evaluate enthusiast groups within the confines of an information communication technology. For work on media, it is important to deploy a method that can include dynamic content like affordances, multimedia content, individuals, groups, rhetoric and how these things change over time. This research used two methodological approaches. The first approach is Qualitative Media Analysis (QMA) or as it was previously known – Ethnographic Content Analysis (Altheide & Schneider, 2012). QMA uses a technology or group of texts as a culture that a researcher must get to know.

As that researcher comes to understand the norms and values within that text given the technology used to generate the text, the researcher's ability to discuss and ask questions of the text deepens. The second approach fills in gaps of the first by incorporating the general user interface as the result of discourse about the nature of a community. User Interfaces and the method in which information is delivered are direct reflections of internal discourse about internal norms and things of importance (Potts & Harrison, 2013). By assembling the rhetoric and computational elements of how that rhetoric delivery all aspects of Reddit are simultaneously represented.

Data

In total, our data inventory contains:

- 21 threads with an additional 33,599 comments that represent Reddit's public activity during the Boston Marathon Bombing;
- 2 Static Threads about Ferguson created before August 11, 2014 when the Live Thread Began;

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- Several discussions of the development of the Live Thread tool;
- 1 Live thread representing Reddit's activity during all phases of the Ferguson Unrest with over 8000 updates.

Each thread was frozen through tools that translated HTML to a PDF. The iOS application, *iAnnotate* (https://www.iannotate.com/), facilitated coding of the PDFs on three occasions by a single researcher. Data evaluation occurred in three passes to allow the researcher to learn a little more about the nature of Reddit and the various groups at work within these disparate events. Color coding is used when identifying a theme. *IAnnotate* examines each color for further detail.

The researcher can compare what they coded each time. Meta-events and sub-events where assigned to threads as applicable. Establishing a meta-narrative spread out across the various threads helped the researcher make sense of where and why some aspects of Reddit's efforts began to stray from its original intent. The Live Thread is where a majority of this re-coding took place. To augment the Live Thread, additional discussions among the CEO of Reddit and the community at large provided context for the development of these tools (e.g. (Koebler, 2016; Leavitt, 2016; Potts & Harrison, 2013)). Throughout our analyses, three themes emerged that display how Reddit changed over time.

DISCUSSION

Reddit's software exemplifies the rhetorical composition of what Reddit is and how their communities of practice can act. There are three points of discussion through our two crisis events that exemplify how crisis responders changed Reddit and Reddit's software. First, we will discuss how Reddit, a site meant to aggregate information has moved from established events to breaking news. Breaking news was a source of controversy during the Boston Marathon Bombing efforts. Second, we discuss how the move to breaking news has adjusted the hierarchy of the user base. By centralizing all information into a multimedia feed not part of any subreddit, Reddit needed to adjust its affordances to address issues of abuse, power, and cliques. Finally, we discuss how Reddit absorbs and sometimes protects against counter-groups that seek to disrupt and destroy information verification efforts. As a popular web community, Reddit has essentially inserted itself between the public and crisis response professionals to focus the flow of information in a standardized way Reddit controls.

From Aggregation to Breaking News

Reddit's design to allows users to post about an item of interest and discuss it with others. This is the formation of the public groups. As the, "Front page of the Internet" Reddit meant to reflect established, stable content in a way that was useful for people to access. The site grew quickly, and behaviors stabilized. However, as Redditors began to cover breaking news rather than stabilized events, behaviors started to change (Singer et al., 2014). Instead of curating and aggregating content, Redditors began to look for content that was not from routine sources like news sites or officials (Leavitt, 2016). They began to look for content on social media that indicated ground-level activity.

This shift began slightly before the Boston Marathon Bombing, but became the norm after the posting of the first stable thread. The impact the different affordances Reddit has deployed to meet stablized versus breaking news are of interest. In this section, we break down how each point of origin reflected the needs of stabalized events and breaking news. Next, we describe the manifestation of effort as seen by a random passerby (often called a lurker). Finally, we will describe how these differences address concepts of rigor needed to cover breaking news.

Reddit during Boston

The normal set of affordances (shown in figure 3) of a Reddit post is simple. The post contains a title, a body of text, an up or down arrow indicating how a user rates its value (up for positive, down for negative), and a numeric score indicating the number of positive votes it has received. Each post can receive a reply and each response has the same affordances as above. These responses are from other Redditors and are additions to the discussion. Each central post (independent of responses) can hold approximately 10,000 characters. Once the threshold is met, the post it is not possible to edit further. These posts would reach 10,000 characters because as Redditors found new information, they would edit the original post to reflect new content.

The creation of a new thread occurred once that post reached the limit. Over the course of the 10-day Boston Marathon Bombing investigation, there were 21 threads. Each of these threads contained their own internal controversies, events that were speculative and later voted down. Reddit's emergence using its standard

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affordance package (vote up to express *like* or if this information is correct) was difficult to follow during the speed and information-rich nature of this event. In addition, the maintaining the threads is a single original poster (OP) who could then ask administrators of the Subreddit to give editing rights to the current post. A post can make it to the top of a Subreddit if it receives the most votes in the thread.

With the normal affordance package of the time, there were scores of actors to keep in check. The necessity to create a new thread when a rate limit was reached created 21 opportunities for sabotage of the Redditors maintaining these threads to lose control of their progress. Over the course of the response, a counter group formed. This group of Redditors formed a Subreddit called: r/findthebostonbombers. As the response progressed, this group received rapidly increasing attention from the press. The public's perspective from the press challenged Reddit's possibility and the effort was inevitably seen as a failure (Leavitt, 2016; Madrigal, 2013; Nhan et al., 2015; Tapia et al., 2014).

Reddit during Ferguson

As an effort to make it easier to engage breaking news-style posts, Reddit introduced the Live Threads (shown in figure 4). These threads were based on behaviors from previous crisis responses and news reporting incidents. Live Threads are meant to reflect the criticisms and design flaws that became evident throughout the Boston Marathon Bombing Investigation. They afford for a series of moderators to curate a single page with no character, page, or voting limitations.

According to the developer of the tool:

> The "reporters" for a stream can post updates and anyone watching gets sent those updates in real time. Unlike with self-post or comment based live updates, there's no limit to how many updates can be posted during the course of an event. Liveupdate streams exist outside of subreddits and are designed to be submitted like any other link to whatever (multiple) subreddits are relevant to the stream. (Spladug, Reddit Developer)

The first two tests of this system were the United States State of the Union Address in 2014 and the beginning of the conflict in the Ukraine. Once those tests were complete, Reddit opened the creation and administration of these pages to all Redditors. The first full-scale deployment of these new affordances was the Ferguson Live Page. The initial page created during the first wave of Ferguson Unrest and continued through the last wave. Live pages represent a step away from interfering with investigative efforts while also attempting to address issues of authority and rigor within the Reddit community.

Instead of speculation through comments or notes of discussion within the thread itself, the moderators maintain a stream of data without any other style of response allowed. In the wake of these threads, traditional posts are created to discuss the content that is on it. However, these threads are independent of the Live Pages themselves. Each Live Page also contains a sidebar with information on who is updating the page and other information deemed pertinent by the team administrating the Live Page. This closed system addresses nearly every aspect of weakness identified by the press, the public, and the credential-bound public groups of professional crisis response.

The Consequences of Authority and Rigor within Reddit

Credential-bound public groups like professional crisis responders are often identifiable by badges, by training, and by credentials. Redditors have attempted to emulate the training these credentials indicate by adjusting their software. Interestingly, through Reddit's Interface, discussions form around an event. Being an administrator for a Live Thread is essentially being a part of a credential-bound public group. The curators the Boston Marathon Bombing Investigation and Ferguson Unrest efforts were enthusiastic about data gathering. They used their resources to gather more data, more quickly than professional responders. Many curators indicated that they wanted to get involved because it was a way that they could apply their feelings of sadness and anger created by the tragedies. Reddit's new behavior exhibited in Boston was adopted quickly and many of the users who were aggregating data appropriated the tools they had available. As is often the case with emergent groups within a crisis, appropriated technologies (Dourish, 2003) and procedures were the norm (White et al., 2014).

Reddit during Boston

By helping to organize information, the curators indicated that they felt as though they were helping everyone come to understand the events a little better. Unfortunately, there are disagreements between groups about the helpful nature curation activities. Because each of the 21 threads on the Boston effort took place over a period of 10 days, the crowd posting information and the reasons for posting information fluctuated. From the beginning

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of the investigation until around the 9th thread, two days into the event on April 17th, a poster noted,

> *"Hey OP, I notice as time goes on these threads are more and more speculation and response as opposed to breaking news (which is natural, considering new info is coming in less and less frequently). Has there been any talk about how much longer these live update threads will keep happening?"*

As time went on and photos of suspects were added, the spirit of speculation and the desire for facts eventually dwindled. The split between those who wanted to gather information and those who wanted to find the suspects resulted in the creation of a subreddit: r/findbostonbombers. This subreddit sought to do what the main pages would not: name suspects, find information about them, and release that information to the public. Initially, the public welcomed the drive to find and identify the perpetrators. In one article, a reporter noted:

> *"The subreddit, r/findbostonbombers, …is at least slightly more responsible. Threads are dedicated to confirming people as innocent, and highly up-voted posts call on the media not to spread images, remind redditors of the dangers of false accusations, and lay down pretty stiff rules of conduct." (Hern, 2013)*

However, the Reddit community was publicly shamed after falsely accusing an individual by the name of Sunil Tripathi to be the Boston Bomber. As a result of being accused, Sunil's parents, who had been searching for their son for a number of days, began to receive death threats and targeted harassment (Kotenko, 2013; Nhan et al., 2015; Starbird et al., 2014; Tapia et al., 2014). The accusation was the result of bad information, a mistake, or sabotage. Discussions such as the one displayed in Figure 5 speak of a purposeful sabotage from a group citizens formerly of the community 4chan called /Pol/ (Dewey, 2014). /pol/ or the Politically Incorrect board of a rival web community called 4Chan has been the center of numerous controversies as well as the starting place of the alt-right (Nagle, 2017).
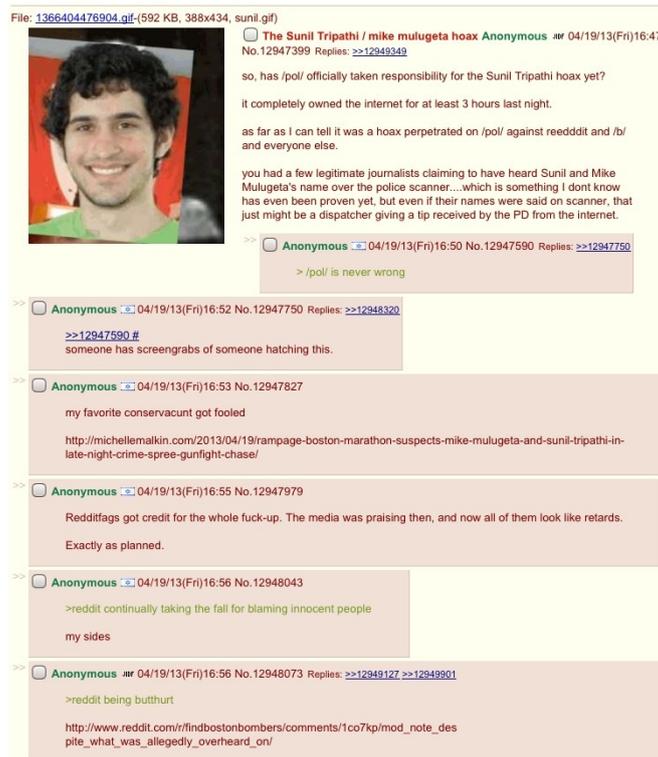

Figure 5 - Screenshot from 4Chan about possible sabotage and fraud on Reddit

Regardless of the reason for the false accusations, it tarnished Reddit's reputation, and citizen engagement within crises. In-person detective work of professionals later produced the identity of the Tsarnaev brothers. Additionally, the work of Reddit forced the FBI to quicken their investigation while struggling to maintain command and control as a whole (Montgomery et al., 2013). This negative reaction forced Reddit's leadership to offer an apology to all those wrongly accused. Parallel to that shame, the FBI also reprimanded the press for their role in wrongly identifying suspects (Leavitt, 2016; Potts & Harrison, 2013).

Reddit during Ferguson

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Between the end of the Boston Marathon Bombing and the Ferguson Unrest, Reddit created a new tool for emergent events. Live Threads are real-time tools that can display all manner of multimedia content but cannot be commented on. Instead, these pages are carefully curated by volunteers who have sole administrative access to their contents. By centralizing efforts onto one living document, the content of the page and not the politics control and flow processes management become more important. Reddit does not permit multiple Live Threads, which decreases likelihood of dissent and errors. However, dissent does still occur. In fact, it may become more personal. Throughout the Ferguson Unrest, there were many tense moments within the Live Thread.

For example,

> *Please don't yell at me if it's not updating fast enough for your liking. As I've stated to pretty much everyone who's complained/griped at me for something they didn't like, if you don't like how we do it, you're perfectly welcome to go start your own life absorbing/time sucking/relationship stressing/learning too much about how racist and terrible people can be/exhausting live feed and run it however you want. If you do a good job, I'll close this one up and let you have the center stage and I'll go back to getting more than a few hours sleep each night. /u/TheDeech*

By decreasing the likelihood of the interference of counter-groups, Reddit directly addresses the issues of rigor that levied against Reddit during the Boston Marathon Bombing. The Live Thread showed aggregated content only. Through the Live Threads, users move from defending their content and processes to assembling information in real time as centralized administrators.

Protection Against Other Emergent Citizen Groups

Citizen groups differ in intent, makeup, and ability and not every group is out to be helpful, at current (McMahon et al., 2016). Reddit is able absorb aggressive groups seeking to spread rumor. There have been numerous "battles" or "encounters" between Reddit and other internet communities like it (e.g. SomethingAwful, 4Chan, Anonymous, etc). Each time, the end of the encounter leaves plans for sabotage when the opportunity presents itself later (e.g. (Massanari, 2015)). Reddit's interface has changed over time to meet the weaknesses these past encounters have manifested. In changing its interface, it has enabled protections against sabotage and invasion. During the Boston Marathon Bombing investigation, Reddit was not the only networked public groups engaged. To give more context to Reddit's activities, it is important to describe how each additional public approached the investigation differently and how each group interacted each other.

Reddit during Boston

The Boston Marathon Bombing response attracted interested enthusiasts from numerous other spaces online. Briefly, we describe the actors. The hacker-activist (hacktivist) group Anonymous was present during the event pursuing an agenda that the Boston Marathon Bombing was a "False Flag" operation meant to distract from the passing of the Cyber Intelligence Sharing and Protection Act (CISPA) (Tapia et al., 2014). Anonymous was also present before the event due to a post made on the website 4chan that predicted the bombing. As the Boston Marathon Bombing investigation began, the web community 4Chan took to seeking out the same suspects that everyone was (Hern, 2013; Konkel, 2013; Montgomery et al., 2013).

Over time, as the public interest in citizen-groups grew, the discussion between groups soured. Reddit was declared to be a, "sleuthing circlejerk" and when Sunil Tripathi was mis-identified as the Boston Marathon Bombing suspect, a Distributed Denial of Service (DDOS) attack was performed on Reddit (Kotenko, 2013). It is unclear if the mislabeling of Tripathi was the result of acting too quickly or sabotage, but it remains the single event that changed the public's opinion of crowdsourcing criminal investigations (Tapia et al., 2014). Between that moment and the start of the Ferguson Unrest, Reddit's public encounters allowed them to frame the Live Threads.

Reddit during Ferguson

By moving the discussion from the standard posts to the Live Threads, the likelihood that another group could interfere with the investigative efforts of that crowd is much lower. However, it still happens. For example, during the Ferguson unrest the hacktivist group Anonymous continually released the public information for each member of the relevant police department. This "doxxing" or public releasing of documents containing sensitive information has become more routine as the ability to find those data has become easier (Leong & Morando, 2015). Discussion on the posts about Ferguson were often about trying to find the police officer. Yet, none of the activities from these other communities made it into the Live Thread other than administrator notes saying, "We will not post that information." Throughout the Ferguson Unrest, the administrators of the Live Thread

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maintained a constant feed of information. The realization of these pages is little more than information flow without controversy and they succeeded…for a time.

CONCLUSION

In the introduction of this article we stated that we would contribute to understanding how the actions and media coverage of crisis response professionals change the practices of enthusiasts over time. After examining the history of Reddit and its user-interface, the relationship should seem straight forward. Reddit seeks to harness their resources to provide accurate, verifiable information to anyone who wants it. Redditors use their software to focus the flow of information during a response effort. While these efforts have yet to officially become a representative of crisis response professionals, spaces and communities like Reddit are providing more reliable of information with each response. Reddit is constantly re-working its software to define what matters to information flow within a crisis. It also defines what is important for crisis response professionals to do and what information verification requires.

We contribute to an understanding of the relationship between enthusiasts and professionals a bit further. We provide a case study of a moment in time wherein multiple enthusiast publics and crisis professionals clashed. The result of this clash resulted in re-defining, or forcing enthusiast group categories to form. By highlighting the shape of that clash through the lens of crisis and Reddit, we also highlight the rigid nature of professional crisis responders and how they may eventually need to accept the capabilities of the crowd more officially. How the rigidity of crisis response professionals influences the entanglement of enthusiasts is deserving of further inquiry.

Also of interest is something that occurred noticeably, but inconsistently throughout our two case studies. Periodically, Redditors mention crisis response professionals giving information to Redditors directly, though anonymously. These crisis response professionals who use back channels to communicate with Redditors allows Reddit to gather certain kinds of on-the-ground information at speeds that may be faster than professional news media. The existence of individuals who are members of public groups like Reddit and crisis response professionals is deserving of further inquiry.

Each electronic improvement can unintentionally create new exploitative opportunities. Shortly before and continuing through the election of Donald Trump, aggressive campaigns that seek to control information flow have become more regular. During the Orlando nightclub shooting response of 2016, the tech-savvy and exploitative subreddit r/the_donald stepped in to aggregate the information online about the attacks. This group deleted mention of the victims and ways to help. Other Redditors tried to sabotage the Live Thread itself. This took the form of deleting any mention of the shooter being referred to as a radical Muslim (Koebler, 2016). The confrontation is the latest attempt to game the system Reddit uses to control the appearance of politically-motivated threads in more public areas of Reddit (Leavitt, 2016; Mills, 2018). Reddit has begun to change their software again to stop these types of attacks in the future.

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