

Seeking the Trustworthy Tweet: Can Microblogged Data Fit the Information Needs of Disaster Response and Humanitarian Relief Organizations

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ABSTRACT

Message data has, as yet, not been adopted by large-scale, international humanitarian relief organizations in an instrumental fashion. While the largest of these organizations have adopted messaging as part of their Public Relations functions, few have used any form of message data originating in the field, at the time of disaster. The message data being contributed by bystanders and those affected by a disaster, as it is happening, has largely been deemed as unverifiable and untrustworthy, and thus construed as unsuitable for incorporation into established mechanisms for organizational decision-making. In this paper, we describe the discursive barriers to the use of microblogged data by Humanitarian NGOs during times of disaster. We present data and findings from a study involving representatives from thirteen humanitarian organizations. Our analysis suggests that the organizational barriers, both in terms of function and structure, and the data itself, form barriers to organizational use of microblogged data. We propose three socio-technical solutions to surpassing adoption bottlenecks, namely bounded microblogging, microblogged data as contextual data, and/or use of computational solutions.

Keywords

Humanitarian, relief, NGO, disaster, twitter, microblogging, trust.

INTRODUCTION

Disaster and crisis phenomena, including natural and man-made disasters (e.g., hurricanes, tsunamis, resource conflicts and genocide) as well as intentional or accidental hazards (e.g., terrorist bombings, chemical spills) require a coordinated response among a variety of people and organizations and have severe consequences for the safety of communities. Society has always had to manage these crises, but with the proliferation of networked technologies, researchers have begun to focus on the constituent elements of networks, with the eventual aim of leveraging the power of network elements in providing information as a way of mitigating the impacts of and speeding up the recovery from extreme events (see Maitland et al., 2007; Maitland et al. 2009; Maldonado et al. 2009; Ngamassi, et al. 2010 and Tapia et al. 2009). Examples of such ad hoc networked power include warnings of impending disasters, and citizen reports to authorities to improve the overall situation assessment.

Much has been written concerning the value of using messaging and microblogging data from crowds of non-professional participants during disasters. Often referred to as microblogging, the practice of average citizens reporting on activities “on-the-ground” during a disaster is seen as increasingly valuable (see Palen et al. 2008, Palen et al 2009, Sutton et al 2008, Vieweg et al 2008). Data produced through microblogging is seen as ubiquitous, rapid and accessible (see Vieweg et al, 2010), and it is believed to empower average citizens to become more situationally aware during disasters and coordinate to help themselves (see Palen et al. 2010).

However, despite the evidence of strong value to those experiencing the disaster and those seeking information concerning the disaster, there has been very little uptake of message data by large-scale, international humanitarian relief organizations. While the largest of these organizations have adopted messaging as part of their Public Relations and Communications functions, as a method of getting the word out concerning their relief and development activities, currently, their scope is limited to information dissemination as opposed to information gathering for instrumental purposes, for example, as a determinant in the distribution or mobilization of relief efforts. The real-time message data being contributed by bystanders and those affected by

Reviewing Statement: This full paper has been fully double-blind peer reviewed for clarity, relevance, significance, validity and originality.

a disaster has been deemed as unverifiable and untrustworthy, and it has not been incorporated into established mechanisms for organizational decision-making. Due to the perceived lack of authentication, large-scale responders have been reluctant to incorporate microblogged data into the process of assessing a disaster situation and the subsequent decision-making process to send aid workers and supplies to disaster locations. Committing to the mobilization of valuable and time sensitive relief supplies and personnel, based on what may turn out be illegitimate claims, has been perceived to be too great a risk

BACKGROUND

Microblogging in Crisis Situations

As social media and more specifically, microblogging, become more integrated into the daily lives and everyday communication patterns of much of the developed world, scholars of disasters and emergency response see hope in these practices. The existence of over four billion cell phones throughout the world, coupled with information sharing sites such as Facebook, Flickr, Twitter, and virtual universal connectivity, provide the technological basis for worldwide information collection, sharing and dissemination (e.g., Jansen et al 2009). These microblogging practices are often described as rich sources of timely data that may offer affected individuals and responders valuable information. According to Vieweg et al. (2010) microblogging is seen to have intrinsic value across responder organizations and victims because of its growing ubiquity, communications rapidity, and cross-platform accessibility. In disasters, which occurred recently in developed environments, average citizens offered ground-level information describing the local specifics of the crisis, keeping outsiders informed about the ground realities.

For the greater part, these scholarly and journalistic accounts argue that microblogging has the potential to facilitate citizen empowerment with a many-to-many information flow. Palen et al. (2010) argues that social media used around crises involves self-organizing behavior that can produce accurate results, often in advance of official communications (see also Palen et al. 2007 and 2008; Vieweg et al 2008 and Sutton et al. 2008). The value asserted here is that microblogging allows for average citizens to offer information to each other during a crisis through which those affected can respond to the immediate needs of their neighbors. Organized official crisis responders and aid organizations are portrayed as arriving late to the scene and not possessing as timely and accurate information as citizens at the scene. Crisis situations are thus portrayed as socially distributed information systems that directly support members of the public during a crisis (Palen et al. 2010).

There have been several recent studies on the use of social media and microblogging during crisis including studies of Facebook use during the 2007 Virginia Tech shootings and the 2008 Northern Illinois University shootings (Palen et al. 2007; Palen et al. 2008 and Vieweg et al. 2008) and during the 2007 southern California wildfires (Sutton et al, 2008).

In addition, there have been a number of research efforts that have examined the act of everyday people (not scientists) using their personal cell phones to collect data in picture or text form. This data is then uploaded using the Internet to be shared and/or analyzed. This research has produced terms such as Participatory Sensing, Urban Sensing, Human Centered Sensing, Opportunistic Sensing, People-Centric Sensing, and Citizen Sensing (see Burke et al., 2006; Campbell et. al. 2008; Hall and Jordan, 2009). Soft sensors are defined as human knowledge providers who process information in qualitative and ambiguous ways and convey that knowledge to an aggregating structure for the purposes of discussion, collaboration, information dissemination, reporting and decision-making. Soft sensors may act as individuals or as part of an ordered or unordered (ad-hoc) network. Soft sensor networks may be self-organizing or directed, but in either case, bring with them cognitive limitations (Mullen 2008). Soft sensors are able to provide contextualized information and create ad-hoc information linkages that are consistent with knowledge elements and patterns. In other words, soft sensors are situationally aware.

Soft sensing is gaining prominence in society and research for two major reasons. First, as previously noted, the information infrastructure exists to support global observation and interconnection. The proliferation of cell phones, increased capability of communication services and near-global e-connectivity provide the enabling factors to support ad hoc observation and distribution of information. Second, the emergence of digital natives, who have always known cell phones, the web, and digital social networks, involves a generation who are quite comfortable with the concept of sharing their observations and opinions on the web.

The ubiquity of mobile handheld devices, especially mobile phones, provides a ready-made network of hard and soft sensors. Contemporary mobile devices, besides being a communication system, provide a suite of sensor capabilities; audio, photo, video, and location by employing their as using built-in GPS technology. The combination of humans (as soft sensors) and mobile devices could serve to enhance or fill in gaps in current sensor coverage. Likewise, participatory sensing, using mobile technology, may serve as the primary sensing

capability or increasingly supplement existing sensing systems, which bears importance in the resource constrained regions, which largely form the arena for modern relief operations. The information shared by soft sensors has the advantage of contextualization. The soft sensor has already processed information cognitively, which includes contextual as well as feature elements when sharing it. The variability of expertise and the ad hoc nature of participator sensing, however, undermines the validity of the information shared and the trust which is subsequently elicited, limiting their overall efficacy (Stephenson, 2005).

The Problem of Microblogged Data for Organizational Use

Currently, there are numerous extant challenges to the use of citizen observers, namely, issues of reliability, quantification of performance, deception, focus of attention, and effective translation of reported observations/inferences. Temporally, the problem arises at the stage when emergency responders and relief organizations begin engaging their organizational mechanisms to respond to the crises in question. For decades, these organizations have operated with a centralized command structure, standard operating procedures, and internal vetting standards to ascertain appropriate responses to disasters. While not optimized to current expectations of speed, efficiency and knowledge, these mechanisms have been successful at bringing rescue, relief and recovery to millions. A central aspect of these organizational mechanisms is complete control over the flow of information concerning the crisis from source to organizational decision maker. This ensures accuracy, security, legitimacy and eventually, trust. As yet, no mechanisms have been fashioned for harvesting microblogged data from the public in a manner, which facilitates organizational decisions

The central question in the arena has been asked by several scholars; Leysia Palen, Kenneth Mark Anderson, Gloria Mark, James Martin, Douglas Sicker, Martha Palmer, and Dirk Grunwald, at the Association of Computing Machinery and British Computing Society's 2010 Conference on Visions of Computer Science.

“How can publicly-available, grassroots, peer-generated information be deemed to be trustworthy, secure and accurate, so that it can be leveraged and aligned with official information sources for optimal, local decision-making by members of the public?” (Palen et al. 2010)

However, even though this question focuses on how this data can be deemed trustworthy by responding organizations, it is still focused on aligning information and getting information to the public in question. The information cannot be seen as only to be consumed by the public, but it must be seen as to be consumed by responders as well, as the sustenance from which they will make decisions as to which vehicles to dispatch, estimating supplies of food, water and shelter to be mobilized and the locations to be serviced, etc.

We conceive the current discourse as being problematic, as the proponents of microblogging and informing the public often see the process as a timely transfer of accurate, local information. A commonly neglected notion is that the information could likely be used to make critical decisions on action, which involve people, goods and materials, which may ultimately save lives.

Emergency responders and relief agencies must view this as a two-way exchange of information. On the one hand, these organizations see it as part of their mission to deliver information and services to people affected by a disaster in an effective and coordinated manner. On the other hand, these organizations must collect information from affected areas in order to coordinate supplies and assistance. Much of what has been lauded about the use of microblogging in disaster situations only concerns itself with the flow of information to the public and ignores the organizational need for data from which operational decisions can be made.

The Problem of Trust in Microblogged Data for Responders

There is a fundamental tradeoff between the authoritativeness of information and its timeliness. Humanitarian information systems have traditionally favored authoritativeness and so have lagged events. New real-time informational sources threaten this equilibrium, but the issue of validation remains the single biggest challenge in organizational information seeking and decision-making.

The key issue is that information will not be used unless it is trusted to be accurate. According to a United Nations study of the potential of social media for humanitarian relief, “While they [social media and microblogging] make available information that would not have emerged otherwise, they pose a serious challenge in terms of authentication. Validation is a fundamental issue in the further use of social media in situations of conflict and disaster” (Coyle et al., 2009).

As presented at the *Emergency Data Summit*, “The social web is creating a fundamental shift in disaster response that is asking emergency managers, government agencies, and aid organizations to mix their time-honored expertise with real-time input from the public. As of today, most of us are not yet ready to collect, respond or react to this incoming social data in a timely manner. The use of publicly available data in times or

places of crisis raises issues of authenticity, privacy, veracity and ownership.” (Emergency Social Data Summit, 2010) According to Coyle et al. (2009), the issue of authentication is a key barrier to overcome and the expediency with which these information flows propagate compounds this problem. There is an urgent need for the development of methods and applications for verification of crowdsourced information (Coyle et al., 2009). According to Dr. David Wild, the most common concern from the emergency management community about the use of social media such as Twitter in disasters (and citizen involvement in general) “is one of trust: specifically, the risk of misinformation and rumors spreading virally and thus causing all kinds of untold complications. Officials usually carefully curate information that is given to the public through well-organized channels (e.g. a Public Information Officer at the scene)” (Wild, 2010). Mazzarella agrees. He states, “Integrating Twitter or a Twitter-like capability into a public safety or emergency management environment raises unique suitability considerations based upon its use context. These considerations include security and privacy, user identity management and authentication, evidence preservation and chain of custody, and practical possession and control matters. As with any alerting mechanism, the actual credentials and permissions of the person authorized to send alerts must be carefully managed” (Mazzarella, 2009).

RESEARCH DESIGN

This research stems from a larger project, which aims to find mechanisms to make tweets and other forms of SMS useful to emergency responders and humanitarian NGOs. While overall the project has had a necessary computational bent, the authors of this paper, conducted a requirements analysis with the membership of the organization NetHope for the qualitative aspects of the larger project.

NetHope is an information technology collaboration of 28 leading international nongovernmental organizations (NGOs) representing more than \$30 billion (U.S.) of humanitarian development and emergency response serving millions of beneficiaries in more than 180 countries. NetHope brings IT professionals from NGOs to share their technology resources and expertise and together. The Board of Directors of NetHope facilitated the data gathering for the requirements analysis phase of this research and is what will appear in this paper.

We conducted thirteen interviews from thirteen distinct international humanitarian relief organizations. Each interview lasted between 60 and 75 minutes and was audiotaped and transcribed. The transcribed interview data were analyzed using analytic induction, a mixture of deductive and inductive approaches to our analysis (Epstein and Martin 2004). First, we developed a set of codes based on insights we had gained from the larger research, previous studies on social media and microblogging use in humanitarian relief and emergency response and the interview core questions. These codes were used deductively. The interview guide that was used asked questions concerning both formal and informal uses of Twitter, dissemination and gathering of information via Twitter, reliability of Twitter data, and barriers to the use of Twitter data. During the coding process, we also identified codes that emerged from the data. This inductive approach is a typical approach to qualitative data analysis. For these codes, the process was iterative and cyclical, drawing from a framework developed by Seidel (Seidel, 1998).

FINDINGS

This paper concerns itself with the perceived mismatch between microblogged data and the needs of humanitarian relief organizations. Through our interview data, we found that the sources of this mismatch fell into two overarching categories, data mismatch and organizational structure and function mismatches. In the first category, we have identified the untrustworthy nature of microblogged data as the major sticking point. In the second category, we identified three structural elements of humanitarian organizations, which may impede the uptake, or use of microblogged data.

Data Mismatch 1: Microblog Data are Untrustworthy

Drawing from our interview data, this perceived mismatch was the single universal theme threading through all interviews. This theme was also the strongest and most clearly expressed. All subjects believed that the data produced through microblogging was untrustworthy. Equally strongly, the subjects stated that the veracity, accuracy, and legitimacy of data were the most important factors in data used in organizational decision-making. In addition, while the speed of gathering data was mentioned, it was not to be achieved at the cost of veracity.

One subject said, *“Yeah, more information is better, but you still have to triangulate. So I’d be cautious – I mean, I’d love it. I think it would be another area to look at, but you would still wanna be triangulating. I don’t think speed is necessarily the number one tool that an emergency operator needs to use.”* Another subject said, *“But sure, I think as you say getting information in a real-time way, but again it depends on the quality of the*

information and who it comes from. But if it comes from a trusted source and you're able to get something on a near – on a more immediate basis, then it would absolutely make a difference.” Another subject said, “It might be hard to trust the data. I mean, I don't think you can make major decisions based on a couple of tweets, on one or two tweets.”

The respondents focused on the importance of the decisions to be made by the organization based on the data gathered. The decisions were framed as life-or-death decisions in which no margin or error could be tolerated. Some of those interviewed could imagine using data from citizens via microblogging in the future, but only if some of the major obstacles to the trustworthiness of data were resolved, with the emergence of a theme of increasing scale of messages being accorded more trust

One subject stated, “No. No way. The chain from the field has to be unbroken. We have to know who is sending us the information and how it gets here. There can be no doubt, no question.” Another participant said, “We only use data that we can confirm...So we're only going to share information from others if we have had phone calls or face-to-face conversations or relationships with them well in advance. We would not just simply retweet something that's out there.”

Another important area of concern here was delivering humanitarian aid post disaster in conflict zones. Several respondents spoke of the need for trustworthy sources of information in terms of security. One respondent said, “But imagine if you're in a war zone and something's happened and an enemy has figured out that you're communicating by Twitter and not by any other means. They can either block that or they can flood the network with false information that leads your people to the wrong area.” Another respondent said, “Okay. It's more difficult to respond in conflict...You've gotta be very, very, very careful and keep in mind that the people who are most vulnerable and most needy generally have the least access to communication devices or guns. And that's who you're trying to help. Not so that they get guns, but so that you can actually help save lives of millions. And in this context, belligerents can disguise themselves as civilians and in a sense like Twitter, you don't actually get to see the person tweeting....You have to be very careful about who and what is on the other end and what their motivation or intention is.”

From this, we understand that the data themselves are problematic for humanitarian organizations. The data are created in such a way that the organization cannot make use of them in the traditional way. In the next section we will examine the organizations themselves and the means in which they consume data, identifying the organizational mismatches involved in the uptake of microblogged data.

Structural Mismatch 1: Public Relations versus Emergency Response

Most large international humanitarian and relief organizations are divided into functional sub-areas. It is common to find a department of public information and communications and a separate department of emergency response. What we found in all thirteen organizations was that these two departments operated independently and used radically different tools to gather data, disseminate data and make decisions. When the organizations were initially contacted the request was for the interviewer to speak with the member of the management who worked with/knew the most about the organizational use of microblogged data. This universally put the interviewer in contact with a subject from the Public Relations, Public Information or Communication department. While some initial interviews were conducted with these Information Officers, it was clear that these individuals used Twitter as a means of dissemination of organizational information.

One interviewee stated, “Sure, we use twitter. Our communications department has an account that we push out a bunch of stuff about what <NGO name removed> is doing in each region and our programs. We talk mostly about our own programs, but will sometimes post about what is going on in the region or country. We don't repost anybody else's stuff.” Another subject stated, “ So <NGO name removed> has several different Twitter accounts, each of which are designed to communicate with a slightly different demographic....so, for example, for the <NGO name removed> media account, we're targeting mostly the news media, of course, and making it easy for them to pick up on different press releases, those kinds of things.”

This use of Twitter did not involve the gathering of data from citizen Twitter users in a disaster-affected area. When the interviewer requested to speak with someone in the Emergency Response department, this was granted, but met with universal perplexity. None of the subjects interviewed used Twitter data as an input to decisions made surrounding a disaster response. One subject stated, “No, the only folks that use Twitter in <NGO name removed> are the communications people. We don't use Twitter here.” Another respondent exclaimed, “Twitter is for getting stuff out there—not for operational stuff! We would never use Twitter that way.” Lastly, a participant said, “Yeah ..I think <name removed> might have told you what we use Twitter for, and it is more PR communications. So we don't have any current Twitter usage that is – how would you say it – program content, fundamental, necessary. We haven't even thought about it in that sense.”

It was apparent that across all of these organizations the organization had already decided that microblogging served only a dissemination function and thus, the technology was allocated to the department within the organization who matched this function. In order for microblogging to be seen as a data-gathering tool as well as a dissemination tool it would have to be reinterpreted by the organization.

Structural Mismatch 2: Emergency Response and Post-Disaster Recovery

Another distinction was made between organizations involved in immediate emergency response and those involved in post disaster recovery. This difference was sometimes between departments within humanitarian organizations and sometimes between the types of organizations themselves. Some subjects found that the parts of their organizations, which were involved in the first three days post disaster, were less likely to make use of microblogged data. Only those parts of the organization, which were engaged in the second phase of disaster response, relief and recovery, would be likely to make use of microblogged data, if at all.

One subject stated, *“Maybe other NGOs who do more development, you know, programmatic stuff, would be into Twitter. They could get updates on stuff that was not so critical. I know people who do Child and Maternal Health Programs and Food Security Programs who might benefit from this kind of updating. But there is no way people doing emergency work will rely on this.”* Another interviewee said, *“No, we just can’t use Twitter right away. Immediately after a disaster we send in an assessment team. They fill out the reports and get it back to us in a few hours. We’ll get a flash report right away and then the interim and a sitrep (situation report).”* A subject stated, *“Lives are on the line. Every moment counts. We have it down to a science. We know what information we need and we get in and get it... We would never try out anything new at this point.”*

The data needs of the organization are very specific and critical in the first three days post disaster. These data needs are the least likely to be trusted to outside (the organization) sources, despite the potential for timely, geographically centered data. The NGOs were unwilling to trade data assurance, veracity and authenticity for speed. In addition, the subjects felt that their organizations would never try something new during the first three days after a disaster.

A subject said, *“When we do needs assessments, we drive around and we look with our eyes and we talk to people and we assess what’s on the ground and that’s how we make our evaluations.”* One interviewee said, *“Look. It’s just not going to happen. We have to have certain kinds of information from the field and some random crowd of Twitters are not going to give it to us.”* Another subject stated, *“Twitter might be useful right after a disaster, but only if the person doing the Tweeting was from <NGO name removed>, you know, our own people. I guess if our own people were sending us back Tweets about the situation it could help.”* Lastly, a subject said, *“fast is good, but bad information fast can kill people. It’s got to be good, and maybe fast too.”*

In these crucial first days of crisis the organization reverted to standard operating procedures that have served the organization, and its beneficiaries for decades. While some agreed that they’d like to try microblogged data and see how it could be used, most said it would have to happen during the downtimes, between disasters, and even then, it may not be used during an actual disaster for quite some time. All found that those parts of the organizations or other organizations that dealt with capacity building and recovery post disaster might be more amenable to trying microblogged data because the time pressure and criticality of the data and choices were less acute.

Structural Mismatch 3: Missing Organizational Support for IT and Innovation

At some point, each of the interviewees stated that their organization did not have the organizational will to try out new technologies. Most expressed this as a lack of resources, support, leadership and interest to adopt new technologies.

There was also an element of time pressure. The interviewees felt overwhelmed and saw microblogging as having a steep learning curve without much of a return on investment for their organization. One interviewee said, *“Frankly, we are just too busy. We have too much else to do. There is no time to learn new things like Twitter. We can hardly get the things done we need to get done to meet our own goals.”* Another subject stated, *“we have so many fish to fry, and this is something that I think would be useful to us, but it’s – we’re not – we’re just not there yet.”*

Several informants expressed this in terms of resources. One said, *“So we literally have not had the resources to make that happen. I think we’ve just been staffed, as I noted recently, to keep the lights on, but our resourcing is utterly incommensurate going from good to great, as our CEO likes to say we need to do.”* Another subject said, *“ We aren’t an IT company, we do relief, and IT folks are the last to get hired around here and the first laid off...They are way over worked and way under paid... There is no way we can get more out of them to do*

Twitter stuff. They are barely keeping our computers working as it is.” Another participant said, “Who is going to do it? PR? It’s not going to be me...no one else around here can do it.” Another subject said, “Our emergency response group, who’s been around and are highly competent folks, are not particularly oriented towards technical solutions to things... I don’t know if I’d characterize them as more traditional or what, but they go in there and they do the usual. Water sanitation, protection, child development, that sort of stuff, so they’re not really thinking about technology solutions to these kinds of things.”

Some subjects found that there was a lack of interest on the part of both the employees and on the part of the organizational leadership. One participant stated, “I don’t think there are enough <people interested in Twitter use or data> – and there are people – there are some really clued-in people at <NGO name removed> that use the feeds and are interested in them, but in terms of formal usage of formal adoption it just hasn’t happened yet. It’s on my list and I think it’s on the list of the folks who do PR here to sort of attack that, but it’s not – with everything else that’s going on it’s not rising to the top.” One subject said, “They are just not interested. It doesn’t seem all that useful. It might be fun, but we don’t have the time or money for fun.” One participant said, “I just wonder sometimes whether this world of emergency response is really gonna be helped by technology solutions or whether, in fact, it really is about doing actual assessments with your eyes and your experience and so on.” Lastly, one interviewee stated, “We tried to get the president and CEO both to use Twitter. We failed abysmally, so they’re not – they almost never use it.”

From this, we gather that the organizations do not recognize any organizational value to microblogged data, other than in their dissemination use by Communications departments. They see microblogged data as simultaneously frivolous and requiring technical skills and time to master. They do not see it as integrating well into their organizational mission and hence they do not allocate resources to support the organizational use of Twitter.

DISCUSSION

Frustration and Hope

If there were no perceived problems with data gathering during the time of disaster on the part of the humanitarian relief organizations then the discussion could end here. We could simply end with the statement that the microblogging technology and data were deemed unacceptable to humanitarian organizations.

However, this is not the end of the story. While all of the participants agreed that microblogged data, in its current form, was not consumable by their organization, they expressed significant frustration with their current systems and hope for microblogged data in the future.

Respondents were frustrated in three ways. First, they were frustrated by the mechanisms through which they gather data from affected areas. One subject stated, “Usually by phone or email from someone in that – from one of our staff in that country who is near the program – who is in the program area that’s been impacted. And so it can be quite slow before all that trickles through all the different layers to get to us.” Often, the subjects stated that while they would never sacrifice accuracy for speed, they would really like both. Many were frustrated with how slow the traditional methods of gathering post-disaster data had remained despite the growing ubiquity of smart phones and high quality connectivity and power worldwide. Second, respondents were frustrated by their organizations inability to be forward-thinking and innovative. A combination of a lack of resources, a constant state of crisis and a culture of mistrust and disinterest in new technologies, blended to create strong resistance to developing tools to make use of microblogged data. Thirdly, most of the respondents admitted that many of their technological changes were motivated by the demands of their donors. At this point in time their donors have not demanded that these organizations make use of microblogged data. The subjects believed they would need to wait until this occurred for real change to begin.

Respondents often projected an air of looking over a fence and coveting the neighbors’ tools. The subjects of this study were technologically savvy, owning their own smart phones and participating in social media. They understood the growing role mobile technologies and crowdsourcing was having in society. Many participants responded with a strong sense of technological wonder at the uses Facebook, Twitter, and a score of iPhone applications were having in communities hit by crises as neighbors aided neighbor.

Despite the NGOs current inability to make use of microblogged data by emergency and disaster responders, they often expressed hope that they would find a way to do so. Universally, the interviewees said that microblogged data could be seen as a vast trove of potentially useful information concerning a disaster zone. One subject said, “Twitter is huge. They saved some lady from a building in Haiti based on what she put up on Twitter. The possibilities are huge.” The subjects were often excited and hopeful about what role microblogged data might play in the future. Another subject said, “Yes! Yes! Because that would – again, it would tell us what resources are already in the ground, what resources are still needed, who has the right staff, what we

could provide. I mean, it would just – it would give you so much more real-time data, so that as we're putting our plans together we can react based on what is already known as opposed to getting there and discovering, oh, they don't really need medical supplies. What they really need is construction supplies or whatever." Another participant said, "So being able to sort of have some way of tracking movement, understanding medical needs and shelter needs and conditions on the ground, being able to track populations and families, all of that can be really, really well served by something like Twitter data." Finally, one subject stated, "Twitter data could potentially be used the same way... for crisis mapping. When an emergency happens there are so many things going on in the ground, and an emergency response is simply prioritization, taking care of the most important things first and knowing what those are. The difficult thing is that things change so quickly. So being able to gather information quickly.... <with Twitter> There's enormous power."

In sum, there exists strong interest and motivation, on the part of some members of the humanitarian relief community to find ways to make use of microblogged data. The stumbling blocks to making the data useful are significant, both structural and data-related. The motivation to take on these barriers will only grow if the leadership and emergency response departments of these organizations can clearly see the value of the microblogged data. That will take innovative technologists, time, and trust.

According to King (2005), humanitarian efforts require four types of information: Background, Situational, Operational and Analytical. Background information can provide a picture of the history, culture, politics and geography of a country. Such data provides a baseline against which to understand a current crisis. Situational information relates to the current crisis situation: Who is affected? What are their current needs? What is the status of the existing infrastructure? Operational information is what is needed for an organization to both plan and carry out its assistance: Who is already addressing which problems, and where are they working? Analysis information allows for assessment of causes, trajectories, and future responses.

These organizations all engage in some form of ongoing data collection. When a rapidly developing situation occurs, these organizations change their data collection focus from the ongoing form to a new form often referred to as assessment. While fairly straightforward to conceptualize, these information needs must be addressed in complex and dynamic circumstances. Information gathering can be difficult while information constantly changes. Necessary information for action can be incomplete, contradictory or unavailable. Physical damage assessments may be limited or inaccessible because of infrastructure damage created by the disaster itself, and information on social conditions may be mere estimations. In situations involving conflict and the military, security concerns can lead to the default classification of information collected by these sources, further limiting available information.

Three Possible Future Directions:

Here we propose three potential reconciliation paths between the hope and frustration concerning microblogged data use by humanitarian organizations.

Bounded Microblogging Environment. One potential solution would be the construction of a "Bounded Microblogging Environment" where membership was controlled to only those vetted by a particular organization or community. A simple implementation would something like a list on Twitter. This bounding would address many of the authentication and security issues. The NGOs would sacrifice some of the value of bystander microblogging during disasters if an additional means were not created to enable new members through an automatic authentication system, to the bounded microblogging community. In addition the organizations would have to alter their current mechanisms of post-disaster assessment to allow for new flows of data from the field into the decision making process. The humanitarian relief community and technologists would need to come together to construct, train and maintain this bounded environment in ways that would support the NGOs data needs considering their limited resources.

Despite being the potential solution that currently best meets the needs of the humanitarian community, bounded environments undermine the value of the system. By vetting membership, the sources remain official and make the on-the-ground nature of ordinary Twitter users superfluous and leads to the development organization enforcing its schema on Twitter users rather than creating schemas adapting to a massive community of users. The power of the medium lies in the fact that people, out of their own volition, make localized observations and that organizations could harness that multitude of data. The bounded environment argument neutralizes that, so in effect, at that point, when you have a group of people vetted to join a trusted circle, the data does not scale, because that pool by necessity would be small.

Bounded environments might be a way of introducing Twitter into the humanitarian centric organizational discourse, as a starting point, because these organizations, as seen from the evidence presented above, are not

likely to initially embrace the medium. Bounded environments could hence demonstrate the potential for Twitter to move beyond the PR and Communications departments.

Microblogging as Ambient or Context

A second option is using microblogged data as ambient or contextual data to enrich the information provided to the NGO at the time of disaster. We assert that the more formal the information gathering and transmission process is, the greater the loss of contextual information. Since human beings on the ground during a disaster can provide highly contextualized information, with obvious trust and validity issues, they could perhaps be used to convey contextual information rather than instrumental type information (i.e. factual in nature). These local human participants could provide ambient, grassroots information as an add-on to traditional, trusted institutional lines of information gathering.

This is akin to ambient journalism. According to Burns (2010) Hermida describes ambient journalism as: “broad, asynchronous, lightweight and always-on communication systems [that] are creating new kinds of interactions around the news, and are enabling citizens to maintain a mental model of news and events around them” (Hermida 2). His ideas appear to have two related aspects. He conceives ambient journalism as an “awareness system” between individuals that functions as a collective intelligence or kind of ‘distributed cognition’ at a group level (Hermida 2, 4-6). Hermida alludes to how para-journalists now fulfill the earlier role of ‘first responders’ and stringers, in providing the “immediate dissemination” of non-official information about disasters and emergencies (Hermida 1-2; Haddow and Haddow 117-118). Several of our subjects had similar ideas. One subject said, “*Usually information exists. The question is the context doesn’t exist.... that’s really what I see as the biggest value and why would you use that in the future is creating the context...So essentially we are information and context poor.*” We suggest that adding contextual information through microblogged data may alleviate some of the uncertainty during the time of disaster. Since the microblogged data would not be the single data source upon which decisions would be made, the standards for authentication and security could be less stringent. This solution would offer the organization rich contextual data, while reducing the need for absolute data authentication, reducing the need for the organization to structurally change, and reducing the need for significant resources.

Computational Solutions

We believe better computational models will eventually deduce informational snippets with acceptable levels of trust. Even the best of offline disaster response leads are tenuous at best with the associated time sensitive nature, the frenetic pace of activity and the harrowed state of the residents of the affected zones. The scalable approach would be to develop a means of using machine learning, entity extraction, and text classification techniques, which can not only extract useful data but also classify them into categories useful to organizations, from what people are observing naturalistically on Twitter. The NGOs would gather microblogged data arising from geographically significant areas, apply some analytical techniques that automate classifications such as those being constructed by projects such as Ushahidi, and use the classified information to enhance the data gathered in more traditional ways. The aggregated data can also help to address the issue about data authenticity. These models seem the most promising in that they will use data produced by citizen observers, are scaleable, and will manage the needs for data authenticity and security, as demanded by the NGOs. Caragea et al. describes a related research in this area (2010); however, more progress is needed for developing a comprehensive solution.

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