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Emergent use of social media: A new age of opportunity for disaster resilience

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Abstract

Social media are forms of information and communication technology disseminated through social interaction. Social media rely on peer-to-peer (P2P) networks that are collaborative, decentralized, and community driven. They transform people from content consumers into content producers. Popular networking sites such as MySpace™, Facebook™, Twitter™, and Google™ are versions of social media that are most commonly used for connecting with friends, relatives, and employees. The role of social media in disaster management became galvanized during the world response to the 2010 Haiti earthquake. During the immediate aftermath, much of what people around the world were learning about the earthquake originated from social media sources. Social media became the new forum for collective intelligence, social convergence, and community activism. During the first 2 days following the earthquake, "texting" mobile phone users donated more than $5 million to the American Red Cross. Both public and private response agencies used Google Maps™. Millions joined MySpace™ and Facebook™ discussion groups to share information, donate money, and offer comfort and support. Social media has also been described as "remarkably well organized, self correcting, accurate, and concentrated," calling into question the ingrained view of unidirectional, official-to-public information broadcasts. Social media may also offer potential psychological benefit for vulnerable populations gained through participation as stakeholders in the response. Disaster victims report a psychological need to contribute, and by doing so, they are better able to cope with their situation. Affected populations may gain resilience by replacing their helplessness with dignity, control, as well as personal and collective responsibility. However, widespread use of social media also involves several important challenges for disaster management. Although social media is growing rapidly, it remains less widespread and accessible than traditional media. Also, public officials often view P2P communications as "backchannels" with potential to spread misinformation and rumor. In addition, in absence of the normal checks and balances that regulate traditional media, privacy rights violations can occur as people use social media to describe personal events and circumstances.

Key words: social media, resilience, vulnerability, disaster management, peer-to-peer architecture, emergency response, information/communication technology

Introduction

On January 12, 2010, a devastating earthquake struck Port-au-Prince, Haiti. After this natural disaster, a powerful new tool was widely used to reduce disaster-related morbidity and mortality risk. The ways in which people used social media to inform and to assist quake victims and responders have reshaped the ways in which we will confront disaster-related challenges in the future.

The growing role of social media in disaster management

Social media are forms of information and communication technology (ICT). Created using highly

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accessible and scalable publishing techniques, social media are designed for dissemination through social interaction. Social media are also collaborative, decentralized, networked, and community driven. They support the democratization of knowledge and information, transforming people from content consumers into content producers and analysts. Popular networking sites such as MySpace™, Facebook™, Twitter™, and Google™ are versions of social media that are most commonly used for connecting with friends, relatives, and employees. During the immediate aftermath, much of what people around the world were learning about the earthquake originated from social media. These sites have taken on a new role: assisting disaster-affected populations to build resilience and reduce vulnerabilities in real time.

Changing and evolving networked communication systems now offer the public with ever-increasing information access. These systems also provide faster sharing of a widening range of resources. In the past, the public was only an information consumer, not a provider. In recent years, social media have grown in popularity and expanded globally. Google™, MySpace™, Facebook™, Skype™, and Twitter™ are now at the cutting edge of this new and interconnected world. During the Haiti disaster, the online communication site Twitter™ played an especially large role as it quickly relayed disaster-related information. Twitter™ even became a main topic of extended electronic discussion after the quake. Not only after the Haiti quake but also after earthquakes in Chile and Mexico both public and private response agencies used Google Maps™ extensively. Millions throughout the globe joined My Space™ and Facebook™ discussion groups to share information, donate money, and offer comfort and support. Within hours of the Haiti quake, "Haiti" was a trending word on Twitter™. Users in Haiti provided live earthquake coverage, including pictures and information about damaged areas. The same phenomenon occurred yet again after the Chilean earthquake. Pacific islanders used cell phones and Skype to monitor hazard-prone beaches for signs of an impending tsunami, and cyber traffic was not limited to individual users; social as well as traditional media mega-outlets such as CNN™ shared these feeds.

Figure 1 depicts a comparison of trends among Google™ Web site[1] searches and news stories for January 1-30, 2010. Peaks in Web site searches occurred on the following dates during that timeframe:

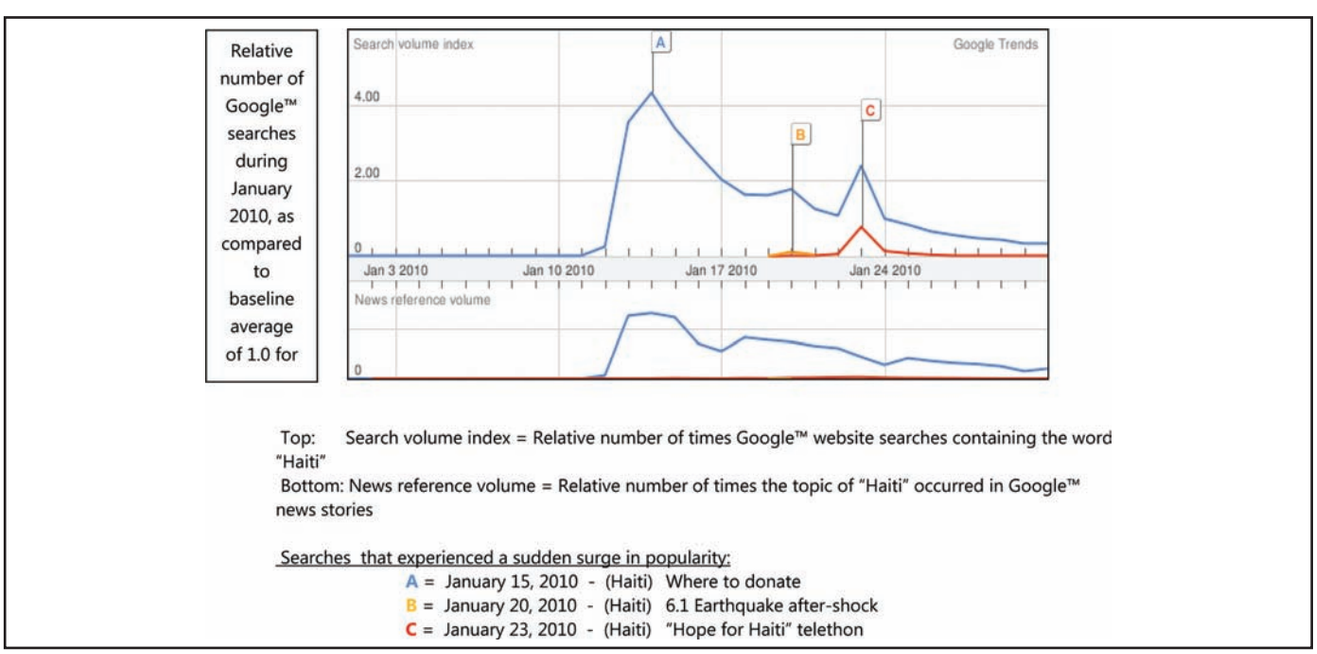

Figure 1. A comparison of trends among Google™ Web site searches and news stories for January 1-30, 2010.

- January 15 (when searches surged for the topic (Haiti):-where to donate.[2]

- January 20 (when searches surged for the topic (Haiti): 6.1 earthquake after-shock.[3]

- January 22 (when searches surged for the topic (Haiti)We: Hope for Haiti telethon.[4]

Sutton et al.[5] accurately predicted that emergent uses of social media would broadly change disaster management models. Studies of social media use in response to the Virginia Tech shootings and Southern California wildfires in 2007, as well as during the 2008 Democratic National Convention and Hurricanes Gustav and Ike revealed that the public used social networking to verify facts, coordinate information, bring together resources, and make communities more resilient during disasters.[5]

During disaster responses, public social media users now serve as "information brokers" or "technical facilitators" as they assist in connecting people and information via various media. This decentralized communication network has been described as "remarkably well organized, self-correcting, accurate, and concentrated."[5] In addition to acting as a source of information available to the public, social media are also a useful source of information about the public. Insights from local communities and traditional societies with experience and with historical continuity can enrich scientific understandings of complex adaptive systems.[6] Augmentation of scientific understanding with traditional knowledge and community-based participation is an important research tool.

January 12, 2010: A new age of human adaptation

The role of social media in disaster management galvanized during the world response to the January 2010 Haiti earthquake. For example, social media became central to the effort that raised millions of dollars. During the immediate quake aftermath, much of what people around the world were learning about the Haiti earthquake originated from social media sources.

Although most online consumers relied on traditional media for quake coverage, these consumers then turned to Twitter and blogs to "share" information, to "react" to situations, and to rally "support." Thus, social media became the new forum for collective intelligence,[7] social convergence,[8] and community activism related to the Haiti disaster. Literally, millions of people donated via text messages. During the first 2 days following the earthquake alone, "texting" mobile phone users donated more than $5 million to the American Red Cross.[9]

The effect of social media on human adaptation and resilience to disasters

Disaster resilience is

> "...the ability of a system community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions."[10]

Faced with massive transformation, resilient systems have the necessary components for renewal and reorganization. In other words, they can cope, adapt, or reorganize without sacrificing essential services.[11] Social media offer disaster-affected populations another means to

- absorb disaster impact,

- reorganize into more effective approaches to risk reduction, and

- adapt to new socioeconomic and environmental conditions.

Similarly, "resilience" is related to

- the magnitude of shock that the system can absorb and remain within a given state;

- the degree to which the system is capable of self-organization; and

- the degree to which the system can build capacity for learning and adaptation.

In the field of disaster management, these factors are referred to as absorptive capacity, organizational capacity, and adaptive capacity, respectively.[12]

Adaptive capacity is the "ability of a social-ecological system to cope with novel situations without losing options for the future."[12] According to Folke et al.,[11] "resilience is key to enhancing adaptive capacity."[11] In social systems, those institutions and networks that learn and store knowledge, create flexibility in problem solving, and balance power among interest groups play an important role in building adaptive capacity.[5,13,14] Social media have thus become new means for vulnerable populations to increase their resilience to disasters.

The effect of social media on disaster organizational systems

A peer-to-peer (P2P) network is any distributed network architecture composed of participants who make some of their resources directly available to other network participants without the need for central coordination. Recent ICT advances have opened P2P systems access for a significant number of groups to share and store knowledge through social media. P2P communication is changing the way societies communicate, do business, and manage disasters.

In fact, social media are changing the fundamental organizational structure of disaster response itself. A new system of meta-adaptive, P2P distributed response networks has augmented the traditional hierarchical-based, centralized, and socially organized incident management system.

One way to rank social systems is according to their flexibility and adaptability. Rigid or static systems are, for example, brittle and environmentally indifferent. In times of stress, these systems lack the capacity to adapt structures or functions and tend to disintegrate. The flexible and proactive meta-adaptive systems are at the other end of the scale. In effect, they are learning systems that also incorporate facilities for prediction and long-and short-term planning in response to variable scenarios.

The P2P concept continuously evolves to expand its role as the active, relational dynamic in distributed networks (ie, not just computer to computer, but human to human). In contrast to the traditional, hierarchical

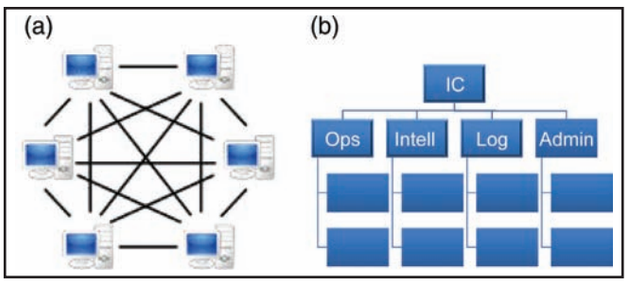

Figure 2. A comparison of (a) modern P2P and (b) traditional hierarchical incident management systems.

client-server model where only servers supply and clients consume, peers are both resource suppliers and consumers. Figure 2 illustrates the fundamental difference between these two structures for social organization that helped to manage the Haiti disaster response.

The comparison of various characteristics of these two architectures and the implications for each social system during a disaster response is given in Table 1.

However, public participation in social media has influenced more than organizational structure. It now includes material and psychological benefits for vulnerable populations gained through people's participation as stakeholders in the disaster response. International standards of humanitarian assistance are based on empowered local populations and disaster victims having a voice in their own response and recovery.[15]

Empowerment is also the process by which individuals and communities replace their helpless stance as victims by recovering their dignity, regaining control over resources, and recovering their sense of personal and collective responsibility.[16]

Opportunities and mechanisms for participation by members of the public are also expanding the disaster information arena.[5,17] Social media, by its very nature, supports the democratization of knowledge and information, as well as the empowerment of the public to become disaster managers/incident commanders of their own social systems. Disaster-affected populations report a psychological need to contribute, and by doing so, they are better able to cope with the enormity of their situation.[5] Thus, an exchange of information via text-based sharing sites can serve a dual purpose of providing much needed information and doing it in a manner that is also therapeutic.

Table 1. A comparison of key characteristics of peer-to-peer and hierarchical architecture		
	Peer to peer	**Hierarchical**
Users	Public	Institutions
Sanction	Nonofficial	Official
Empowerment	Individual	Organizational
Activation	Immediate	Delayed
Adaptability	High	Moderate
Accessibility	Inclusive	Exclusive
Sources of public information	Many	One
Structure	Dynamic	Static
Scalability	High	Moderate

The effect of social media on crisis informatics

In the traditional, hierarchical incident command systems model, hazard warning was communicated unidirectionally—from officials to the public via the media.[18] The multidirectional flow of information characteristic of P2P networks has instead allowed for crisis informatics decentralization. Other essential P2P architecture attributes include dynamic content, scalability, even openness, freedom, and collective intelligence. These have contributed to a strikingly well-organized and remarkably flexible crisis communication model. Social media have called into question more than ever before the ingrained view of unidirectional, official-to-public information broadcasts. Many who went online for information during the Southern California wildfires of 2007 found misinformation emanating from public authorities and from the major media. In contrast, many of these information seekers also had access to accurate information at the local level and provided that information as a corrective.[5]

Social media have enabled the public to adapt to this new environment by providing a low-cost and easily accessible means for crisis management and communication. The comparison of key characteristics of social media with those of traditional media is given in Table 2.

Social media challenges

Widespread use of social media to promote disaster risk reduction involves several important challenges, including, but not limited to, awareness, content accuracy, public policy, security issues, and personal privacy.

The need for heightened awareness

Although social media is growing rapidly, it remains less widespread and accessible than traditional media. Although widely used among younger information consumers, social media has yet to win broad-based acceptance among most population groups. Yet, as web-based social interactions increase in popularity, profitability, and utility, this will most likely change.

Current beliefs held by many traditional response agencies include negative assumptions regarding the accuracy and utility of information gained from social media. Public officials often view P2P communications as "backchannels" with strong potential to spread misinformation and rumor, thereby compromising public safety. Nevertheless, with each new disaster social media, P2P communications grow as means for supporting additional—and often critical and accurate—dissemination of information in the public sphere.[5] Even traditional news media increasingly rely on information generated by the public and co-opt social media commonly used for backchannel communication.

The need for public policy updates

Changes in disaster management models due to social media occur in spite of an obvious failure to

Table 2: A comparison of key characteristics of social media and traditional communication media		
	Social media	**Traditional media**
Sources	Public	Corporations Organizations Government
Format	Online discussion forums Web broadcasting Weblogs and Wikis Podcasts, pictures, and video Social network platforms	News Entertainment Advertisement Risk communication Public service Propaganda
Technologies	Mobile phones • Voice • Text and instant messaging • Picture and video sharing Computers • VOIP • E-mail and instant messaging • Videoconferencing • File sharing Digital music players Internet	Television Radio Internet
Information flow	Multidirectional	Unidirectional
Information control	Low	High
Integration with ICS	Low	High
Adaptability	High	Low
Relevance for local residents	High	Low
Intelligence	Collective	Proprietary
Empowerment	Individual	Organizational
Dependency on power grid	Moderate	High
Dependency on cellular networks	Moderate	Low
Accuracy of information	Variable	Variable
Cost	Low	High
Accessibility	Inclusive	Exclusive
Timeliness of information	Immediate	Delayed
Abbreviations: VOIP, voice over internet protocol; ICS, incident command systems.		

recognize these activities formally.[5] Note that the current transformation of disaster management and crisis informatics has occurred within a rather conspicuous public policy or congressional void. An improved awareness will help public policy to better serve this new adaptive capacity for public resilience.

The need for improved quality assurance

Newfound vulnerabilities have accompanied the growing power and influence of social media. In the aftermath of the Haiti disaster, some used microblogging services to spread rumors and outright lies. The Federal Bureau of Investigation warned Internet users who received requests for charitable donations on behalf of earthquake victims to "apply a critical eye and do their due diligence before responding. Past tragedies and natural disasters have prompted individuals with criminal intent to solicit contributions purportedly for a charitable organization and/or a good cause."[19]

The need for individual privacy right protection

In the absence of the normal checks and balances that regulate traditional media, privacy rights violations can occur as people use social media to describe personal disaster-related events and circumstances. No current mechanisms monitor or regulate such infractions to individual privacy rights. For example, concerns regarding personal privacy issues were raised after the 2007 student murders at Virginia Tech.[20]

Conclusions

Opportunities and mechanisms for public participation in disaster relief are expanding. Social media allows for wide-scale interaction between members of the public. This interaction can become collectively resourceful, self-policing, and can generate information not otherwise readily obtainable through more traditional disaster management systems.

The need remains, however, for fusion of social media into existing institutional programs for crisis informatics and disaster risk management. The use of social media has proven a valuable asset for adaptation and improvisation related to the public health and medical consequences of disasters. These tools are especially valuable for saving lives during a disaster's impact phase and especially during its immediate aftermath, when traditional disaster management capabilities are not available. Disaster managers should do what they can to mitigate the loss of these communication networks during a wide variety of natural and technological hazards. This will harden the network's capacity and prevent its damage or loss when a disaster strikes.

The application of social media to achieve disaster resilience also needs further study. This would require not only more research but also simultaneous consideration by emergency management institutions for integrating these aspects of public response into a modernized meta-adaptive system.

Thus, social media has changed how the world responds to disasters—traditional disaster management methods have not changed with a "bang," but with a "tweet."

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