

Backchannels on the Front Lines: Emergent Uses of Social Media in the 2007 Southern California Wildfires

Jeannette Sutton¹, Leysia Palen¹ & Irina Shklovski²
University of Colorado, Boulder¹ University of California, Irvine²
suttonj@colorado.edu, leysia.palen@colorado.edu, irina.s@uci.edu

ABSTRACT

Opportunities for participation by members of the public are expanding the information arena of disaster. Social media supports “backchannel” communications, allowing for wide-scale interaction that can be collectively resourceful, self-policing, and generative of information that is otherwise hard to obtain. Results from our study of information practices by members of the public during the October 2007 Southern California Wildfires suggest that community information resources and other backchannel communications activity enabled by social media are gaining prominence in the disaster arena, despite concern by officials about the legitimacy of information shared through such means. We argue that these emergent uses of social media are pre-cursors of broader future changes to the institutional and organizational arrangements of disaster response.

Keywords

Crisis Informatics, disaster, information and communication technology, wildfire

INTRODUCTION

Disaster situations are non-routine events that result in non-routine behaviors. In times of disaster, people and organizations adapt and improvise (Wachtendorf, 2004) to suit the conditions as needs demand. Even emergency response organizations—which are strongly organized around locally- and federally-mandated protocols—adapt to accommodate the situation particulars for warning, rescue, and recovery. Indeed, in the US, the organizational structure that is activated during times of crisis is designed to be internally flexible. However, its ability to be externally flexible when interfacing with the public is in doubt (Wenger, 1990; Buck, et al, 2006; Palen and Liu, 2007). Members of the public are known by sociologists to improvise in disaster situations, and are responsible for leading important rescue and relief activities (Tierney, et al. 2001; Kendra and Wachtendorf, 2003; Palen and Liu, 2007). They leverage their own social networks to find and provide information outside the official response effort, and to make critical decisions about, for example, heeding warning and making plans to evacuate (Mileti, et al., 2006).

These facts are often ignored during local and federal disaster management planning and policy implementation, with the focus almost entirely on the role of the official response and their management of public-side activities. This stance places public peer-to-peer communications as “backchannel” activity that does not have full legitimacy in the information arena of disaster. However, the increasing presence of information and communications technology (ICT) is making peer-to-peer communications and public participation more visible—and their influence more apparent—because ICT-based interactions often leave digital ‘traces’ that persist and diffuse. The ingrained view of unidirectional, official-to-public information dissemination is called into question more than ever before, as previously backchannel activities become increasingly prominent.

Our research on *crisis informatics* takes a broad view of disaster activity—one that considers the trajectories of change and the information pathways that are emerging as a result of new media and capabilities across the entire social space (Palen, et al., 2007; Palen and Liu, 2007). Empirically, it is not especially helpful—nor yet possible—to say, for example, that disaster response is better or worse in the widespread presence of ICT. We argue instead that the point of entry to the practical and theoretical space of concerns is in considering *how* ICT is changing this arena. By taking the view that technology and society are co-adaptive (Orlikowski, 1992), we can anticipate that new and emergent

behaviors we see now might be the catalysts of change that will re-arrange roles in the disaster response situations of the future.

In this paper, we report on our first round of findings from research we conducted during and after the October 2007 fires in Southern California. Using data from a broadly distributed on-line questionnaire, we report on emerging features of a rapidly changing information arena, showing illustrations of emergent, ICT-supported “backchannel” response activity, and instances of incorporation of such backchannel activity into more recognized, traditional information outlets. The patterns of technology adoption and use that we present here have been observed in prior disasters (Taylor et al., 2005; Palen & Liu, 2007), yet the reasons for and descriptions of respondents’ information seeking behaviors further illustrate the mounting need for changes in emergency response management policy that take into account the changing, ICT-extended information arena of disaster, and recognize its advantages.

BACKGROUND: THE DISASTER INFORMATION ARENA

In the 1970’s, in response to a series of major wildfires, California instituted what is now known as the incident command system (ICS), an organizational command-and-control arrangement for multi-agency response to wildfire—which has since grown to be the basis for federal all-hazards response protocols—to increase responder and public safety through improved means of coordination. ICS also managed information dissemination within and between agencies, and between the official or “formal” response and the media, which has been largely responsible for distributing information to the public. In this model—reinforced by the broadcasting abilities that only television and radio possessed—communication of hazard warnings was based on a unidirectional process from officials to the public via the media (Tierney et al., 2001). Though there has always been strong evidence of other grassroots processes of information dissemination, this model has been more seriously tested only in recent times. Even though disaster scholars recognize that technological and social developments over the last decade mean the public no longer relies on a single source of official information (Sorensen & Sorensen, 2006), planning around hazard information dissemination is still based on the conventional unidirectional model of information dissemination.

The term “backchannel” is used in several disciplines and thus has several definitions¹. In this paper, we use “backchannel” as understood in the areas of public policy, politics and law to mean a secret, unofficial, or irregular means of communication (McCarthy & Boyd, 2005). So defined, backchannel or peer-to-peer communications are positioned in contrast with the official or “formal” communications to the public. Public officials often view backchannel communications as having strong potential to spread misinformation and rumor, thereby compromising public safety. Nevertheless, with each new disaster, peer-to-peer communications through social media such as social networking sites, text and instant messaging applications, blogs, wikis and other web forums, are growing as a means for supporting additional, often critical and accurate, dissemination of information within the public sphere. Furthermore, backchannel communication tools provide the opportunity for the public to actively engage in the creation of information rather than to be passive consumers (McCarthy & Boyd, 2005).

In this paper, we discuss how traditionally backchannel communication methods are gaining prominence and perhaps credibility within the disaster information arena. The research here does not claim that social media were in widespread use in the Southern California Fires to the exclusion of more conventional meanings of information seeking and provision. Our objective is to show critical instances of ICT improvisation and adaptation by several stakeholders in the social arena that foretell much larger changes to the disaster information arena in the future.

METHOD

The October 2007 Southern California wildfires began in Malibu, CA on October 20, 2007. Over the next 19 days, more than 20 blazes ignited from a variety of causes in the region from Santa Barbara County to San Diego County’s border with Mexico. Cumulatively, the wildfires destroyed nearly 1500 homes, burned over 500,000 acres of land and caused massive evacuations. Within days of the start of the fires, our research team developed a strategy to collect empirical data using qualitative methods of observation, interview, and collection of on-line texts as a means of conducting “quick response research” to capture perishable data before features of social phenomena that arise in non-routine situations disappear (Stallings, 2002).

¹ The term “backchannel” is also found in linguistics (most commonly pragmatics, discourse processes, sociolinguistics and conversational analysis) as well as in computer networks and systems architecture fields. However we believe that for the main purpose of this paper, the definition used by public policy and law is most appropriate.

As evacuation orders began to be lifted by day 10, we developed an on-line questionnaire about ICT use and information gathering and sharing activity to capture a broad base of experiences by those affected by the wildfires. The questions were informed by initial findings from face-to-face interviews as well as earlier research. The questionnaire was a combination of a series of multiple choice questions and free response text fields. We asked about ICT use for keeping in touch with others during the wildfires; evacuation experiences; information seeking for fire-related issues; and volunteering of time, goods or services, including on-line participation and information generation.

We disseminated the questionnaire to people in our personal and professional networks and posted solicitations on local forums and online newspapers in the affected communities as well as the appropriate discussion groups on Craigslist, Facebook and Flickr. We asked all respondents to forward the invitation to their contacts. An on-line deployment of the questionnaire means that our data tell us almost exclusively about the experiences of people who are already communication technology-users. Thus we treat this questionnaire as a qualitative means for engaging greater numbers of participants than we could by more traditional on-site means, and not one that is a representative sample of the affected population. For the analysis presented in this paper, we give particular attention to the data collected via free-response questions. All data reported in this paper are reproduced exactly as written by respondents.

Respondent Overview

At the time of this analysis, 307 respondents had accessed the questionnaire with 279 completing it. Approximately 38% of respondents were male. Participants ranged in age from 18 to over 65 (average age was 35-44 years old). Approximately 44% or 122 respondents resided in voluntary or mandatory evacuation areas during the wildfires. More than a third of our respondents (N=93) reported evacuating for an average of 4-5 days. Eleven of our respondents reported major damage due to the fire and an additional eight lost their homes. Overall, 92% of our respondents owned mobile phones and 70% owned laptop computers with wireless access, suggesting that this population had access to ICT despite potential relocations. Though the evacuee population was somewhat less likely to own mobile technologies such as mobile phones or laptop computers with wireless access, they were, nevertheless, more likely to report sharing information via ICTs during the wildfires.

FINDINGS

Backchannel Communications by Members of the Public

The majority of our questionnaire respondents indicated that they sought information using mobile phones to contact friends or family (54%); through information portals and websites advertised in traditional media (76%); by accessing alternative news sources and individual blogs (38%); through discussions on various web forums (15%); from photo-sharing sites such as Flickr or Picasa (10%). Just less than 10% of our respondents used Twitter, in spite of the active media coverage on the topic. However, most of those who did use it said they discovered this technology during the wildfires. This kind of technology adoption during disasters to accommodate needs has been previously observed in prior unpublished research with text messaging during Hurricane Katrina. Although the majority of our respondents simply reported searching for information on-line, more than a third (36%) reported posting information or participating in discussion groups on-line. In fact our respondents reported exchanging information through posting and active discussions with others via text messaging (20%), discussion boards or community online forums (16%), posting on personal blogs (9%), sharing photos on sites such as Flickr or Picasa (8%), and broadcasting via Twitter (4%). In this section, we describe issues around these information seeking and provision activities.

Responding to Information Dearth

Faced with the problem of “information dearth” during the wildfires (not uncommon in any disaster situation), respondents used a variety of means to seek information. Our respondents indicated that traditional media outlets such as those reporting on national and local news networks remained an important way to get information about the fires. However, some of our respondents reported that the information was insufficient, either because it lacked specificity to their area; was biased towards metropolitan areas; seemed focused on the sensational at the expense of those in rural or outlying areas; or was simply inaccurate. Though several official information sources were cited as helpful (including the US Forest Service’s *inciweb.org*, the Orange County Fire Authority’s *ocfa.org*, and San Diego County’s *sdcountyemergency.com*), some official information sources were described as consistently slow to update information to at-risk and evacuated communities or simply overwhelmed and stymied by on-line traffic.

Syndicated news media regularly converge to a disaster site to bring national attention to the local situation. They raise awareness of the ongoing efforts by first responders, the state and federal assistance deployed to the disaster-stricken zone, and the needs of local residents during the rescue and response phases. As an example, extensive coverage of recent disasters has resulted in substantial humanitarian outreach and giving to affected communities. However, as national news reaches out to a broad audience, its relevance for local residents can be low and inaccurate. Several respondents wrote that traditional news sources were slow and not helpful; did not know what they were talking about; and were useless during “the mess.” For example, one respondent from a rural area explained:

Most of the news media ... are utterly clueless about anything in rural areas. They constantly gave out bogus information, like locations and directions that made no sense at all.

And another wrote:

national news websites were completely worthless as they ignored everything except the comparatively minor Malibu fire which burned near some celebrity homes.

Many of our respondents indicated that local news outlets were more accurate, due to their credibility with viewers, and knowledge of geography and local affairs, though even here, many reported that local news had a hard time keeping up-to-date with rapid changes. In some instances, local newscasts were not available via traditional dissemination methods of radio and television, once residents were evacuated outside of their local area.

Such conditions are ripe for peer-to-peer based sharing of information. As one San Diego County resident explained:

the only way we all have to get good information here is for those who have it to share it. We relied on others to give us updates when they had info and we do the same for others.

Another, who had evacuated with livestock for nearly a week and spent that time without access to information necessary for decision making, explained how these conditions became the motivation for getting “knowledge” out to others:

[I felt] extreme frustration when I couldn't get information myself. Once I was able to get online again, I shared whatever knowledge I had.

This remark is in keeping with previous research on disaster behavior, where people take initiative in offering help (Fritz and Mathewson, 1957; Kendra and Wachtendorf, 2003) to assist victims (in this case, those who were without necessary information) or responders.

Some felt that the media or public officials were not providing information they should; in reaction, there were some instances of people using social media to fill a communication gap:

I used my press pass to go into fire areas, then blog and send emails to residents of East County who had no newspaper to provide what *should* have been made available via traditional media.

People and communities have to be locally self-supporting to possess sufficient resilience to respond to and overcome disaster (Tierney, 2006; White House, 2006). Several community forums that proved useful in this event, including *rimfotheworld.net* and *socalmountains.com*, were born out of such a need when they were established several years before in fire-prone mountain communities. A respondent explains what her community learned from prior experience:

What we learned in the Cedar fire is that there is no “they”. “They” wont tell us if there is danger, “they” aren't coming to help, and “they” wont correct bad information. We (regular folks) have to do that amongst ourselves.

Here, “regular folks” have taken the initiative to help themselves. Prior disaster experience, such as that described above can lead not only to increased resiliency, but also to a loss of trust in local governments and media to provide information (Kasperson, 2003; Sorensen, 2000). One of our respondents explained her doubt about the usefulness of the official communications in this way:

Proceedings of the 5th International ISCRAM Conference – Washington, DC, USA, May 2008
F. Fiedrich and B. Van de Walle, eds.

The county so-called emergency site was always crashed.

For our respondents, the October 2007 wildfires appear to have reinforced the need for additional sources of information beyond those that “should” be supplied by public officials and traditional media outlets. Experiences with previous fires that affected some individual’s communities alerted them to the need for communication channels that did not rely on government agencies and could be implemented, moderated, and updated by locals who had accurate, up-to-date, and relevant information for those who were at risk.

Coping with Stress: “The scariest thing is not knowing”

In addition to goals of reducing the problems of information dearth, some of our respondents reported a *need* to contribute, and by so doing, were better able to cope with the enormity of the situation. Stress that comes from the inability to find accurate and relevant information is magnified in potentially life-threatening situations. Policy makers have regularly – but incorrectly – identified such stress reactions in disasters as leading to “panic”: extreme or groundless behavior that leads to irrational flight (Quarantelli, 2001). Quick response research has instead shown that people regularly engage in orderly information-seeking activity and make rational choices from this search (for a summary see Fischer, 1998). Many of our respondents indicated that stress reactions, rather than leading to flight, instead served as catalysts first to find information for themselves and second to share information with others:

Missing info caused me the most stress so sharing to reduce others stress just seemed the right thing to do.

This activity was actively implemented through back-channel communications such as blogs, forums, and other text-based sharing sites. Here, people were able to organize their thoughts as they generated content for others. This activity also appeared to serve as a collective and networked space through which individuals coped with feelings of insecurity about the events surrounding them.

I found writing to be a healing activity and a way to cope. Communicating to relatives in other states comforted me as well. Writing helps to organize thoughts and to put feelings in perspective and it is a reflective time. There is a feeling of isolation when phone lines are down.

Disaster researchers have indicated that social interaction is crucial to successful coping with disaster fallout (Dakof & Taylor, 1990; Smyth & Pennbaker, 1999). Presence of major stressors, such as loss of property, bereavement or relocation can not only mobilize an existing individual support network, it can also motivate action to provide support and assistance to others who experience similar stressors. Thus sharing of information via text-based sharing sites can serve a dual purpose of providing much needed information to others through a psychologically beneficial practice of talking about traumatic events.

Back-Channel Information Providers

Back-channel information providers served in the role of “information brokers” or “technical facilitators” as they assisted in connecting people and information via a number of technology media. Often these people had skills for collecting and collating statistics, generating data mash-ups, creating web-forums and annotating maps. Some had other direct experience with the fires or insider knowledge through their personal networks and connections to government personnel. Others were simply local residents who helped to establish listservs, distribute information by email, or contribute to discussion groups. One respondent explained that he had special knowledge of the geography and terrain because of his employment with the fire department. Information requests were coming to him from outside of the department as well as within:

I work for a fire department, others came to me for the latest updates. My agencies land did burn in the fires, so I was compelled to develop maps and stats to keep my boss updated.

Others found that information requests were coming from friends and neighbors who had evacuated and could not access local information or simply did not have the ability to “plug in” to available technologies to learn about the status of their homes or communities:

I was plugged in to everything I could find and I knew that a lot of my less tech savvy friends were having problems getting real

Proceedings of the 5th International ISCRAM Conference – Washington, DC, USA, May 2008
F. Fiedrich and B. Van de Walle, eds.

information from the news, so I just soaked up as much as I could from the internet and regurgitated it through text messages, instant messaging, twitter, and my blog

In addition to those who used newer forms of ICT to share information, others had access to older forms of back-channel communications such as scanners and amateur radio. For instance, members of one Community Emergency Response Team (CERT) worked diligently to monitor a number of sources and then channel that information to those in need:

The Ramona CERT group was monitoring scanners for firefighting (with a cell phone). Ham radio operators were also a good resource.

Still others created personal blogs (i.e. *fallbrookfire.tomdale.net*) or discussion forums (i.e. *ramonarelief.com* or *imperialstorm.com*) to facilitate communication and information exchange among friends and community members.

Legitimation of Backchannel Activity using Social Media

Previously backchannel activities are becoming increasingly more visible and legitimate as a means of retrieving reliable information. In fact, they are being adopted as useful, viable sources of information not only by at-risk populations, but also by traditional media and some emergency management personnel—actors that traditionally comprise the “front channel.” In this disaster, we saw evidence that community forums were increasingly seen as reliable, authoritative sources of information both by community insiders and by outsiders. Traditional news media are increasingly relying on information generated by members of the public (for example, CNN’s “I-Reporters”), as well as co-opting social media that are commonly used for backchannel communication, as additional methods of information dissemination. In our data, local news media that leveraged current tools such as Twitter and Google maps received high praise.

Within the first few days of the onset of the October 2007 fires, community information sites and on-line bulletin boards (that were both stand-alone and attached to traditional media sites) were developed and used both by media and local residents. Though some sites were created because of this particular disaster (i.e. *ramonarelief.com*, via personal communication with originators), others, like *rimoftheworld.net* were already in existence. These existing sites re-focused their efforts on obtaining and disseminating up-to-date information for this disaster through a variety of sources such as police scanners and private individuals who had relationships with firefighters and other response personnel. Still others (i.e. *signonsandiego.com*) became important sites of community convergence and exchange of information by private individuals who shared personal knowledge as well as information obtained via other websites and sources.

Our respondents identified several important sources that repeatedly proved accurate and reliable. These information sources had amassed substantial audiences over time; we believe that their popularity was, in part, responsible for providing a form of collective error-correction. These sources were often described in contrast to the majority of regional and national mainstream media outlets for their ability to provide up-to-date information of immediate, local relevance. These included a grassroots site (*rimofthworld.net*), developed by local residents in a mountain community; a local, county-based newspaper (*signonsandiego.com*) that made rapid on-line updates and hosted a community web forum; and an affiliate of a national publicly-operated news producer (KPBS) that used a range of newer back-channel communications media in ways that most others did not. We will discuss each of these in turn.

The first, *rimoftheworld.net*, is a community website for residents in the San Bernardino mountain area of Lake Arrowhead. The site was created as an information resource for the area in 2001, and gained popularity as residents discovered it as a result of the Old Fire of 2003. The content and participation in this site is extensive, and includes area news collected and submitted by residents, discussion forums, photo galleries, maps of the area and links to local and government information websites. The vast majority of the respondents from the mountain community served by this site mentioned *rimoftheworld.net* as an important and often vital information source. For instance, one respondent wrote that she “would have been lost” without it. Another respondent, who lost his home to the fire, wrote:

Rimoftheworld.net kept me informed and helped me save what little I was able to recover before evacuating not to mention being able to get my animals out. I knew about the fire within five minutes of it starting

During the October 2007 wildfires, the site operators collaborated with local officials and firefighters to provide up-to-date local information as quickly as possible. This information was then reposted to a number of other local forums and discussion boards. As the fires subsided, site operators conducted photo tours of the affected areas street by street, posting pictures of each affected lot in a public gallery.

The second, *signonsandiego.com*, is an affiliate of the San Diego Union Tribune – the largest daily newspaper of San Diego County. The service provides access to recent newspaper articles as well as spaces for discussion. An open discussion forum accommodated a substantial increase in traffic during the wildfires. In comparing this traditional media site with others that proved to be less effective, one respondent wrote:

`www.signonsandiego.com had a place to post comments, not quite a blog, but it had good info and their servers could handle the traffic. All others, useless`

The third, KPBS, an NPR affiliate in San Diego County, provided radio and television broadcasts along with additional information releases through social media. KPBS' website was cited by many respondents as having timely and accurate information. It was also one of the few commercial (albeit publicly owned) sources to actively use Twitter feeds and annotated Google maps (which is in contrast with the San Diego map available on the official San Diego county emergency response site that was too large to download and four years out of date). When their radio towers went down, KPBS continued to provide streaming broadcasts of their coverage on-line. Several respondents identified the inclusion of new technologies as a key to the success of KPBS during the wildfires, writing:

`I used KPBS twitter page and their excellent google map overlay. Listened to KPBS via an internet stream when their radio transmitter burned`

These cases illustrate activities by both alternative and mainstream organizations that have capitalized on social media to serve appreciative audiences in steps that support a process of legitimization into the larger arena of disaster response. Such an interpretation evokes Orlikowski's extension of Giddens' structuration theory, where the agency and use of technology and the social structures that support them are mutually reinforcing, and support co-evolution and -adaptation of emergent socio-technical arrangements (Orlikowski, 1992).

CONCLUSIONS

Opportunities and mechanisms for participation by members of the public are expanding the information arena of disaster. Social media supports backchannel communication, allowing for wide-scale interaction between members of the public that has qualities of being collectively resourceful, self-policing and generative of information that cannot otherwise be easily obtained. The institution of disaster response is built on a model of information flow put in place to closely manage rumor-mongering. Indeed, the spread of misinformation is a concern that officials should not ignore. However, we also know, through historical and new research, that people will use information from any number of sources to satisfy their needs and inform their actions in the face of disaster (Traylor et al. 2005; Sorensen and Sorensen 2006). These activities of information gathering, verification and distribution—which are extended and expanded in our increasingly networked society—require not only more research, but also simultaneous consideration by the institutions of emergency management for integrating these real—and helpful—aspects of public response into emergency management policies and procedures.

Our data suggest that social media support the influence of the existing public-side information production and distribution. As a consequence of the growing utility of social media and the ubiquity of peer-to-peer communications, we believe that a change in disaster management models will come about in spite of any failure to formally recognize these widely distributed and often strikingly well-organized information activities. However, we argue that simply letting these inevitable changes take place would nevertheless result in needless delay, conflict and missteps. Instead, we call for efforts by public officials to actively consider how to align with peer-to-peer information exchange and to develop new conceptualizations of the information production and dissemination functions for disaster response. These re-conceptualizations will undoubtedly require the inclusion of social media as an additional, valuable tool-set for information management in disasters. The ability of people to improvise in disaster with flexible technology increasingly at their disposal creates conditions for change in the social structures and, subsequently, the institutional arrangements of disaster response.

ACKNOWLEDGEMENTS

We are indebted to those who participated in this research, especially in the face of personal loss. We acknowledge inspiration for our title from our colleague Paul Aoki's article on a naval tactical command and control environment (Aoki, 2007). We thank our colleagues in the connectivIT lab, the Natural Hazards Center, and the University of California, Irvine for their assistance and consultation. This research is supported by an NSF CAREER grant IIS-0546315 awarded to Palen and NSF grant CMMI-074304 awarded to the Natural Hazards Center.

REFERENCES

1. Aoki, P. M. 2007. Back stage on the front lines: perspectives and performance in the combat information center. In the *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM Press, NY
2. Buck, D.A., Trainor, J. & Aguirre, B.E. 2006. A Critical Evaluation of the Incident Command System and NIMS. *Journal of Homeland Security and Emergency Management*, 3(3).
3. Dakof, G., & Taylor, S. E. 1990. Victims' Perceptions of Social Support: What is Helpful from Whom? *Journal of Personality & Social Psychology*, 58(1), 80-89.
4. Fischer III, H. W. 1998. *Response to Disaster: Fact Versus Fiction & Its Perpetuation--The Sociology of Disaster*. New York: University Press of America.
5. Fritz, C. E. & Mathewson, J. H. 1957. *Convergence Behavior in Disasters: A Problem in Social Control*. Committee on Disaster Studies. Disaster Research Group.
6. Kasperson, R.E. 2003. The Social Amplification of Risk: Assessing 15 Years of Research and Theory. In *The Social Amplification of Risk*, edited by J. X. Kasperson, R. E. Kasperson, N. Pidgeon & P. Slovic. Cambridge, MA: Cambridge University Press, 13-46.
7. Kendra, J.M. & Wachtendorf, T. 2003. Reconsidering Convergence and Converger: Legitimacy in Response to the World Trade Center Disaster. *Terrorism and Disaster: New Threats, New Ideas: Research in Social Problems and Public Policy*. 11, 97-122.
8. McCarthy, J. & Boyd, D. 2005. Digital Backchannels in Shared Physical Spaces: Experiences at an Academic Conference. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '05) Extended Abstracts*. ACM Press, NY
9. Mileti, D., Bandy, R., Bourque, L.B., Johnson, A., Kano, M., Peek, L., Sutton, J.N. & Wood, M. 2006. *Annotated Bibliography for Public Risk Communication on Warnings for Public Protective Actions Response and Public Education*. <http://www.colorado.edu/hazards/publications/informer/infrmr2/pubhazbibann.pdf> accessed on 12/15/07
10. Orlikowski, W. 1992. The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science*, 3(3), 398-427.
11. Palen, L. & Liu, S. 2007. Citizen Communications in Disaster: Anticipating a Future of ICT-supported Public Participation. In the *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '07)*. ACM Press, NY, 727-736.
12. Palen, L., Vieweg, S., Sutton, J., Liu, S., & Hughes, A. 2007. Crisis Informatics: Studying Crisis in a Networked World. *Proceedings of the Third International Conference on E-Social Science*, Ann Arbor, MI, Oct 7-9, 2007. <http://ess.si.umich.edu/papers/paper172.pdf>
13. Quarantelli, E.L. 2001. *The Sociology of Panic*. Preliminary Paper #283. Disaster Research Center, University of Delaware.
14. Smyth, J. M. & Pennebaker, J. W. 1999. Sharing One's Story: Translating Emotional Experiences Into Words as a Coping Tool. In C. R. Snyder (Ed.) *Coping: The Psychology of What Works* New York: Oxford University Press, pp. 70-89.
15. Sorensen, J. 2000. Hazard Warning Systems: A Review of 20 Years of Progress. *Natural Hazards Review* 1, 119-125.
16. Sorenson, J. H. & Sorenson, B. V. 2006. Community Processes: Warning and Evacuation. In H. Rodriguez, E. L. Quarantelli & R. R. Dynes (Eds.) *Handbook of Disaster Research*, 183-199. New York: Springer.
17. Stallings, R.A. (Ed.). 2002. *Methods of Disaster Research*. International Research Committee on Disasters: Xlibris Corporation.
18. Taylor, J. G., Gillette, S. C., Hodgson, R. W. & Downing, J. K. 2005. *Communicating with Wildland Interface Communities During Wildfire*. Open File report 2005-1061, Fort Collins, Colorado: U.S. Geological Survey, Fort Collins Science Center.
19. Tierney, K.J. 2006. Social Inequality, Hazards and Disasters. In Daniels, R.J., D.F. Kettl, & H. Kunreuther Eds. *On Risk and Disaster: Learning from Hurricane Katrina*. Philadelphia: University of Pennsylvania Press.

Proceedings of the 5th International ISCRAM Conference – Washington, DC, USA, May 2008
F. Fiedrich and B. Van de Walle, eds.

20. Tierney, K. J., Lindell, M. T. & Perry, R. W. 2001. *Facing the Unexpected: Disaster Preparedness and Response in the United States*. Washington, DC: Joseph Henry Press/National Academy Press.
21. Wachtendorf, T. 2004. *Improvising 9/11: Organizational Improvisation Following the World Trade Center Disaster*. Ph.D. Dissertation, Department of Sociology, University of Delaware.
22. Wenger, D. E., Quarantelli E.L. & Dynes, R.R. 1990. *Is the Incident Command System a Plan for All Seasons and Emergency Situations?* University of Delaware, Disaster Research Center. Preliminary Paper #215.
23. White House. 2006. *The Federal Response to Hurricane Katrina: Lessons learned*. Washington, DC: White House.