In Search of the Bigger Picture:
The Emergent Role of On-Line Photo Sharing
in Times of Disaster

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ABSTRACT

Eyewitness photography is increasingly playing a more significant role in disaster response and recovery efforts. This research elaborates on the ways in which members of the public participate during times of disaster by closely examining the evolving role of a prominent photo-sharing website, Flickr, in events that have occurred since its launch in February 2004. We discuss features of Flickr's emerging evolutionary growth as a community forum for disaster-related grassroots activity based on the findings from our qualitative study of 29 groups across six disasters over Flickr's nearly three-year lifespan. Our findings discuss efforts toward the development of norms that attempt to guide the nature of social practice around photographic content during disaster response and recovery efforts.

Keywords

Crisis informatics, disaster studies, Flickr, photo sharing, social media, citizen journalism, convergence.

INTRODUCTION

During times of disaster, people often take photos to document and make sense of these events. Sharing photos in such situations can be informative, newsworthy, and therapeutic. Such activity has been in place since the invention of cameras; now, with digital cameras and photo-sharing websites, the arena for sharing photographic-based information has expanded its reach. Digital cameras and camera-integrated mobile phones make opportunistic documentary photography more accessible, and on-line services that allow people to publish these photos support new forms of peer-to-peer communication and grassroots organization. This research elaborates the ways in which members of the public participate during times of disaster by closely examining the evolving role of a prominent photo-sharing website, Flickr, in events that have occurred since its launch in February 2004. This work is part of an ongoing research program on *Crisis Informatics* that strives to describe and study the changing information arena in disaster, where citizen-side information generation and dissemination activities are increasingly playing a critical role in disaster preparation, warning, response and recovery (Palen and Liu, 2007). Crisis informatics includes empirical study as well as socially and behaviorally conscious information and communication technology (ICT) development and deployment (Palen, Vieweg, Sutton, Liu and Hughes, 2007).

On-line Photo Sharing

"A picture is worth a thousand words." This well-known proverb communicates the power of the visual, and how it opens up new vistas for understanding and expressing the intricacies of human life in relation to situated experiences (Rosen, 2005). Photographs – visual texts – can support communication by vividly portraying noteworthy or unfamiliar objects and experiences. The evidential force of these human documents to visually present facts, information, and proof of our histories leave strong and long-lasting memory traces (Martin and Martin, 2004). Now with digital photography and on-line photo sharing, people can easily store, display, manipulate, and share their pictorial experiences. This is in part because the automatic and manually generated metadata – data about data – associated with digital photos provide contextual cues for organizing and searching for images.

Flickr allows its members to store, sort, search, and share photos and images via the Internet. Social organization around photos and topics of interest is evident through the creation of Flickr groups. According to one Flickr user (quoted from Giles, 2006, p. 15), "the photographs themselves can be seen as facilitators of community

building…[in that]…each photo is like a landmark or a virtual space where people can meet and have a conversation." "Everyday" and amateur photography is becoming a social and cultural documentary practice among the wider public (Harrison, 2004). The capabilities of Flickr support online documentary practice through "photoblogging," where real-world accounts are quickly recorded with less effort as compared to written blogs.

In this paper, we describe the evolution of Flickr's role during disaster response and recovery efforts by first turning to how photo sharing, as a form of social media, is woven into an existing phenomenon known as "convergence" in disaster settings. We then discuss features of Flickr's emerging evolutionary growth as a community forum for disaster-related grassroots activity based on our findings from our qualitative study of 29 groups across six disasters over Flickr's nearly three-year lifespan.

DISASTER CONVERGENCE & THE RISE OF SOCIAL MEDIA

Theories on collective behavior and social convergence are used to explain the different roles and motivations that emerge from the mass influx of volunteers, goods and services, and information in the aftermath of a disaster. Fritz and Mathewson (1957) and Kendra and Wachtendorf (2003) have documented the nature of this phenomenon by describing seven major types of informal, unofficial convergers: the returnees, the anxious, the helpers, the curious, the exploiters, the supporters, and the memorializers. These emergent communities of people acting in these roles often converge at the physical sites in and around the disaster impact zone. A converger's legitimacy to participate in the "response milieu" depends on his or her spatial, temporal, and psychological relationship to the disaster event (Fritz and Mathewson, 1957; Kendra and Wachtendorf, 2003). With the use of mobile and web technologies on the rise, similar forms of convergence behavior are beginning to appear on-line (Hughes, Palen, Sutton, Liu and Vieweg, 2008).

Members of the public regularly seek out accurate, relevant, and reliable information in the immediate post-disaster time period, activities that are expanding because of pervasive ICT (Palen and Liu, 2007). According to Fritz and Mathewson (1957), social convergence and information sharing are often framed as persistent, excessive problems in disasters that create a need for social control. At the same time, "media convergence," where information flows across multiple old and new media, is also "reshaping the relationship between media producers and consumers" (Jenkins, 2006, p. 19). Consumers are learning how to become producers by using these different media technologies to have better control over media flow. In an increasingly digitally connected society, we see the rise of a participatory culture that facilitates, over a broader reach and in new forms, activities of collective sensemaking.

Social media technology – mobile and web applications that support easy, ad hoc ways to communicate – are increasingly testing conventionally-understood boundaries between informal and formal crisis response activities (Palen and Liu, 2007; Palen et al., 2007) through grassroots organization and "citizen journalism" information reporting (Gillmor, 2006). During disaster response and recovery, people are more likely to use personal and collaborative media to tap their social capital and exploit their preexisting social networks to develop situational awareness (Farnham, Pedersen, and Kirkpatrick 2006).

METHOD

We conducted a longitudinal qualitative study to investigate if and how disaster-related Flickr activity evolved for six notable disasters between December 2004 and October 2007.[1] These disasters – natural, human-induced, and technological – do not account for all disaster-related Flickr activity, but were significant and widely publicized disasters useful as analytical landmarks (see timeline in Figure 1). The December 2004 Indian Ocean earthquake and tsunami event was chosen since it was the first major disaster that exhibited a widespread humanitarian response after Flickr's launch in February 2004. The July 7, 2005 London bombings led to notable forms of citizen journalism especially through the use of cameraphone photos. Hurricane Katrina, in August 2005, was the next major US disaster to occur since the terrorist attacks of September 11, 2001 that led to prolonged disaster response and recovery efforts and resulted in significant changes in disaster management practice and policy. Immediately

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[1] We acknowledge that the majority of the disasters chosen for this study occurred in the US. Though we subscribe to the view that research concerns such as these should be multi-national, we have found, across our investigations here and elsewhere, that the political context of disaster management is significant, particular and complex, and affects interpretation of the matter under study. This, coupled with language limitations, means that we strive to study only that which we think we can knowledgeably address, given the scope and nature of the matter at hand.

after the shooting at Virginia Tech in April 2007, students innovatively used social media to facilitate critical information generation and sharing activities (Palen et al., 2007). Immediately after the Minneapolis bridge collapse in August 2007, photojournalism activity was high across multiple photo sharing sites including Flickr. And finally, the Southern California wildfires in October 2007 were chosen as the most recent, widely-known disaster with many Flickr groups created in response.
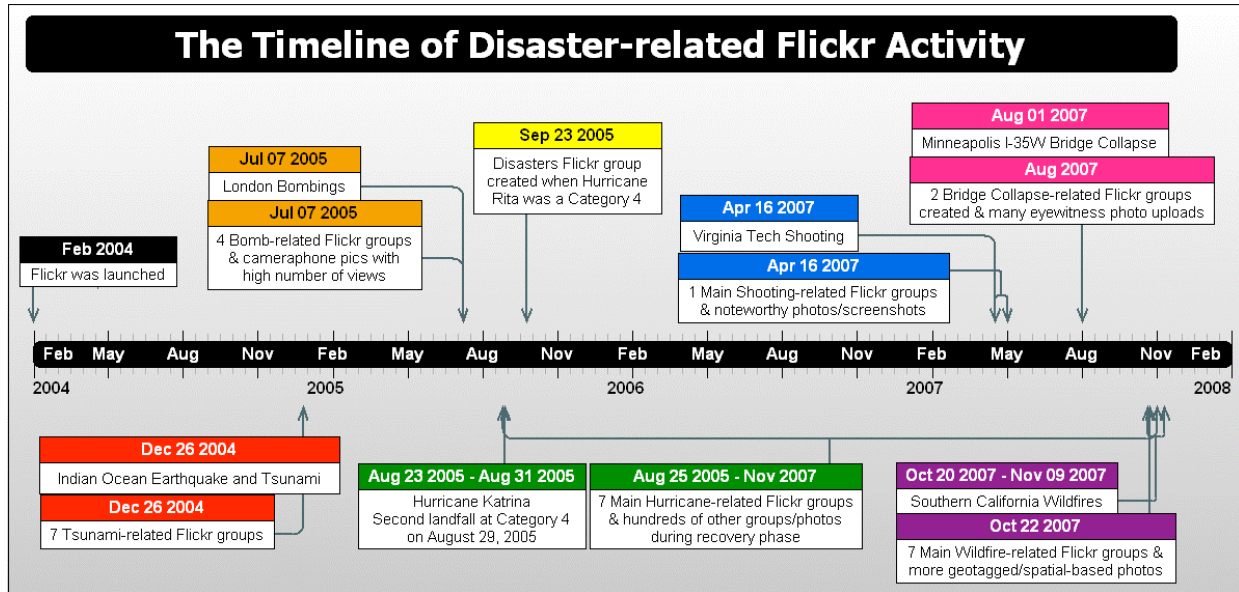

Figure 1: Timeline of Disaster-Related Flickr Activity

Within the context of each disaster event, we analyzed 29 Flickr groups that showed some form of significant participation based on their membership, discussion posts, and/or the number of photos in their pool (see chart in Figure 2). We analyzed each group's accompanying *About* description, discussions, activity of the top five contributors, and the group administrators' roles. We also analyzed the title, captions, tags, number of views, comments, and other metadata of significant disaster-specific Flickr photos. We conducted email-based interviews with nine Flickr users who uploaded unusual and significant photos, were group administrators, or were top contributors. For each interview, questions were individually tailored to each participant to understand what motivated them to join their respective groups and/or upload their particular photos. Our analysis considered content as well as the social context for how these images were produced and shared.

DISASTER-RELATED FLICKR ACTIVITY

Since its launch in 2004, different types of disaster-related activity have appeared in Flickr. Countless photos by individual contributors have been uploaded, a subset of which have been attached to particular Flickr groups. Figure 2 broadly describes overall levels of group-based activity by number of members, photos and discussions, and is intended to give a sense of the amount and nature of activity across the groups that were a part of our investigation. In this findings section, we first consider activities that might be considered norm-setting. We then describe the content of the photos, and how that content parallels the kind of physical space convergent behaviors that sociologists of disaster have long documented.
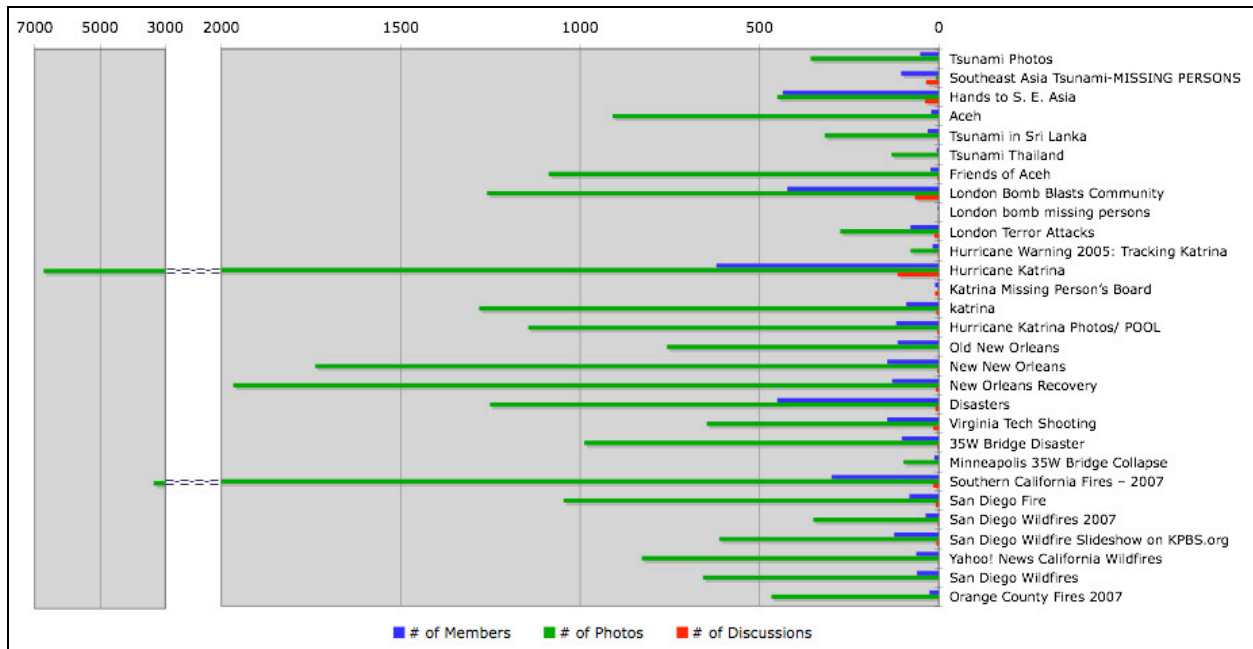
Figure 2: Participation by Numbers of Members, Photos and Discussions in 29 Disaster-Specific Flickr Groups.

Norm Development

Norms emerge from "private citizens working together in the pursuit of collective goals" (Stallings and Quarantelli, 1985, p. 94) to guide participation and interaction. The establishment of normative behavior also helps legitimate a collective's existence and presence. We see some early evidence for attempts at self-realization and legitimation in the "response milieu" (Kendra and Wachtendorf, 2003) by disaster-specific Flickr groups in the attention members pay to the stated purpose of the groups. Attempts to formalize a disaster-based tagging nomenclature suggest another area for normative development that might emerge over time. We discuss each in turn.

Finding Purpose with Disaster-Specific Flickr Groups

Each time a Flickr group is created, its group administrator (the "group admin") has the option to state the group's purpose, which at least initially defines the boundaries of the content that is to be posted. Oftentimes, group admins will solicit membership to their groups by finding independently posted photos (public photos that exist outside of the Flickr groups) and posting an invitation to join in each photo's comment box.

In groups created in the aftermath of December 2004 Indian Ocean Tsunami (the first instance of Flickr disaster-related activity), their stated purpose favored themes about newsworthiness, solidarity, historical value, and global education. The *Tsunami Photos* group consisted of "pictures, which will show the extent of devastation & other info about the Tsunami waves." The *Hands to S. E. Asia* group created a place to "gather images of our hands and send the power of our urge to help the people of S. E. Asia whose lives, families, homes and environment were damaged." The admin for the *Aceh* group thought it would be "a good time to get to know this historic region of Southeast Asia at the northern tip of Sumatra island [sic]."

Seven months later, groups created in the wake of the July 2007 London bombings again organized around themes of newsworthiness and global awareness. The group admin of *London Bomb Blast Community* initially requested that users "post all your personal photo's of the turmoil in London 07 & 21.07.2005 and the days thereafter so that the world can be informed [sic]."

For Hurricane Katrina, which hit the US Gulf Coast region six weeks later, we begin to see the start of some formalization around the role that Flickr groups might be able to serve in disaster, in large part because we also see the emergence of a particular user as a leader in creating disaster-related Flickr groups. "Kefira," the group administrator for the *Hurricane Katrina* group, posted that hers was an "image aggregator group." In an email interview, she expanded on this designation:

> *I wanted people who were still on-line or were afterwards able to get their personal experience out there into a localized location (the group). What followed though was that MANY people from across the world joined and we all posted a variety of news photos during the event which helped global viewers understand and also people in the thick of things understand if they didn't have a good source of news (A huge frustration for me during 9-11…I wished I had Flickr then).*

Following this foray into the topic of disaster, Kefira created the *Hurricane Rita* group "for the collection of images related to Hurricane Rita." We also noticed an emerging trend in group administration, where a Flickr user directly affected by the disaster would often become an additional group admin to support localized requests and activities.

Hurricane Rita, which occurred in the midst of the 2005 Hurricane Katrina aftermath, prompted the start of a meta-disaster group called *Disasters*, indicating what we believe to be another step in Flickr's evolution of disaster-related grassroots activities. Although the fledgling practice had been organized around specific events, the rapid succession of disaster events in an already hard-hit region and the rising occurrence of disasters around the world were the catalysts for formalizing a bigger-picture proposition for the role that Flickr might play in future disaster events. The *Disasters* admin posted the following statement:

> *We've seen new Flickr groups pop up for specific disasters including 9-11, the S.E. Asian tsunami of December 2004, Hurricane Katrina, Hurricane Rita, various earthquakes and volcanic eruptions, and other disasters around the world. This group is to serve as a general forum for photos and discussions of all major disasters. Whenever a disaster occurs, all people who are concerned are welcome to join.*

Whereas previous group creation was instigated in *response* to an event, the act of creating this catch-all or meta-group was looking to the *future*, and an attempt to establish a recognized destination for Flickr-based disaster-related communication. However, it became clear to the admin that this would not be the only group to contribute to since his latest announcement posting on the main group page about the August 2007 Minneapolis bridge collapse states, "There is a Flickr group dedicated to the August 1, 2007 bridge collapse in Minneapolis: *35W Bridge Disaster* and *Minneapolis 35W Bridge Collapse*. Please post your images and stories both there and here in the *Disasters* group." Although photos and discussions of major disasters around the world continue to populate this group, other disaster-specific groups continue to appear, and so the role of the *Disasters* group with its meta-purpose in the world of Flickr remains unclear.

The *Virginia Tech Shooting* group in April 2007 was the third disaster-related group created by Kefira with the purpose of being "an image aggregator" as well as a "way for us to cope with this nightmare." She elaborated in the interview that "the community aspects of Flickr makes it a caring place so its not just photos, not just news, but a personal context and place to come and give condolences and prayers/thoughts." The purpose and intent of this group was to reach beyond photos and news to become an "experience aggregator" as well. Ever since this disaster, news organizations began contacting the admins of disaster-related Flickr groups and seeking permission to use the photos in these groups for their news coverage.

By the time of the Minneapolis Bridge collapse in August 2007 and the Southern California Fires two months later, it became a regular practice to institute Flickr groups as events unfolded. The *35W Bridge Disaster* group had the expressed purpose of collecting photos related to the collapse; however, the admin also posted that the *Disasters* group provided a link to this group suggesting people reciprocate by cross-posting photos on the two groups.

Furthermore, the *35W Bridge Disaster* group provided links to other on-line resources relevant to the collapse (i.e. the local chapter of the American Red Cross and Wikipedia). We suggest that the inclusion of these links demonstrates a recognition that such a group *could* grow to serve a larger role in the greater response milieu space by pointing people to relevant resources and information outlets. These are the kinds of participative activities that direct and attract social involvement, and serve to coordinate the elicitation and generation of information.

Figure 3: Yahoo! News Link to Flickr Group

The *Southern California Fires – 2007* group provided links to five other Flickr groups created in response to the fires. In addition, Yahoo! News (Figure 3), KPBS, and News 8 created Flickr groups themselves, enabling them to use a collective set of eyewitness photos on their official news sites. These activities are ways of legitimating Flickr – its services *and* its members and their activities – as an authoritative source that is growing to serve an important societal function in disaster situations.

Tags are keywords associated with some object of information in the arena of social media – photos, in the case of Flickr. Tags can serve as indicators of collective interests and activities (Morville, 2005) when they are aggregated across many people. They allow users "to gather, sort, catalog and share collections of resources or metadata" (Fox, 2006, p. 169), though research has shown that the naming of tags varies greatly by people and even within a person's own practice, depending on their perception of the future use of tagged objects (Sen, Lam, Cosley, Frankowski, Osterhouse, Harper, and Riedl, 2006).

Some Flickr users have attempted to propel self-organization by providing instructions for tagging photos for specific disasters. Immediately after Hurricane Katrina, one blogger asked Flickr users to streamline tagging by using tags like 'katrinamissing' for missing persons, 'katrinafound' for those found, and 'katrinaokay' for all evacuees. Similarly, after the Minneapolis bridge collapse, an E-Democracy.org wiki author explicitly requested that people upload their photos to Flickr and tag them with 'mpls35W.' The admin for the *San Diego Fire* Flickr group suggested that users should agree to use a set of tags like 'SanDiego' and 'Fire,' although we note that these are common terms that might not have specific enough meaning at a future time.

Although some Flickr users have attempted to formalize the tagging of photos for Katrina and the bridge collapse, few appear to have followed these suggestions. Why this is the case could be attributable to any number of reasons, including a limited audience, poor marketing, that it required too much effort, poorly designed tags, and so on. Our investigation reveals little evidence that the practice has taken hold; however, we predict that this issue will continue to be a point of organizational activity, as the role of photo sharing sites in disaster contexts continues to emerge.

Photographic Content

The photographic content in the groups of study captures physical features of the disaster over time and features of social convergence that occurred at the geographical site of the disaster and even on-line.

Images of the Hazard

The activity around the Southern California Fires captures the kind of behaviors that can only happen in disasters that have protracted hazard agents. In the case of wildfires, the hazard lends itself to being photographed, and in fact builds on a tradition among wildfire fighters who have a culture around fire photography.

Figure 4: Fire Threat on Oct 23   **Figure 5: Fire Impact on Oct 29**   **Figure 6: Bus Bomb on July 7**

Between October 22-24, 2007, seven of the most active Southern California Fires Flickr groups were created with photos showing the smoke and fire at a distance where it might be interpreted as a "threat" (Figure 4) and up close showing immediate "impact" (Figure 5). Hurricane Katrina groups contain photos of the impending and ensuing storm. In contrast, hazard agents with sudden onset and short impact like bombings and earthquakes can be difficult or impossible to photograph; photos that document the event are then post-impact images of the aftermath. During the impact and inventory stages of the London Tube bombings, the "New incidents" discussion post in the *London Bomb Blast Community* group immediately provided updates about the bus bomb (Figure 6) that had occurred about an hour after the tube bombings.

Images of Post-Impact Response

A majority of the photos in these Flickr groups illustrate post-impact response and recovery efforts. After the Minneapolis bridge collapse, some photos taken immediately were posted to Flickr (Figure 7). Other photos documented rescue activities by emergency responders and members of the public (Figure 8). Across all the disaster events analyzed here, many photos were taken post-rescue and during the process of recovery, which is when focused formal and informal relief efforts take place. Many of the photos were of places where people converged on-site to perform relief services, to memorialize, or to witness the devastation (which is sometimes known as "disaster tourism") (Figure 9).

Images of Other On-Line Social Convergence Activity

We see evidence of users cross-referencing to other on-line activity by uploading screenshots of map mashups – sites that combine data from different on-line sources to create new information visualizations – and other social media sites. Screenshots of Google map mashups provided spatial information about the location of the disaster agent and relief resources. After the London bombings, some Flickr photos were screenshots of maps indicating the location of the London bombings. Similar cross-referencing behavior through maps appeared most recently during the Southern California wildfires with more extensive annotations of relief resources and eyewitness accounts (Figure 10).

In the wake of the 2007 Virginia Tech shooting tragedy, the Flickr user, who took a screenshot of Facebook search results (Figure 11), wanted "to track how information traveled much faster than conventional media." The same person also uploaded a screenshot of the search results for YouTube videos. Additionally, screenshots from SecondLife (Figure 12) were uploaded to Flickr by others to illustrate the memorialization activities in this virtual world. Such cross-referencing of other forums places Flickr – or at least the Flickr groups – in the web of on-line activity thus attracting additional viewers and participants to images that instill more value than what we conventionally associate with photographs.

Figure 7: Images Taken Immediately After the Minneapolis Bridge Collapse

Figure 8: Images of the Rescue Efforts After the Minneapolis Bridge Collapse

Figure 9: Physical Sites of Convergence during the Post-Impact Stages

Figure 10: Google Map Mashup Screenshots during the Wildfires

Figure 11: Screenshot of Facebook Group Search   **Figure 12: Screenshots from SecondLife of VT Memorials**

Images of Missing Persons and Related Resources

In disasters that span large regions without a constrained geographical center, and around which information resources can easily be organized, other means of communication need to be put in place to reach the far-flung populace. The Hurricane Katrina disaster demonstrated how difficult this is to do, though also foreshadowed the role on-line forums will have in the future (Palen and Liu, 2007). Displacement and division of family groups in the New Orleans Katrina evacuations gave rise to enormous activity on-line around "missing" persons. Although Flickr is a photo-based site, the use of Flickr groups as conduits for searching the missing appears to be minimal (though it is possible that images have since been deleted, so more 'quick response research' needs to be done to further explicate this activity). Three missing persons groups were included in our sample; their activity is, however, very low. Perhaps other on-line resources have been, to date, recognized as more authoritative sources for missing persons activity, and Flickr, possibly, lacks the critical mass of attention required to serve this function.

Images of Personal Belongings

In *Southern California Fires – 2007,* the admin created the "Strange Pictures" discussion to point out how people were uploading photos of their possessions by using Flickr as a personal repository, and then tagging them with 'fire.' Having these photos of personal belongings turn up in the results of her searches was initially 'strange' because it was unanticipated, but its advantages of efficiency and safekeeping immediately became clear. As she explained in this discussion post, people were "quickly taking pictures to inventory their houses for insurance purposes and then uploading them to Flickr before they evacuate."

Photo documentation during the warning and threat stages is no longer just motivated by personal reasons but may also be explicitly requested by formal agencies to facilitate recovery. Because Flickr is a repository for both personal use (though these photos are often publicly available) as well as group-based interaction, the features of Flickr – because they cannot discriminate between these two uses – produce curious points of convergence between different stakeholders in disaster settings.

CONCLUSION

The use of amateur photos from social media sites has made citizen journalism more visible through the cross-referencing and convergence of different media sources. Eyewitness photos especially from cameraphones have made citizen journalism even more significant to disaster response efforts, as they are no longer seen as mere personal accounts but also as evidential documents useful to formal response. It is now common for eyewitness photos to be requested by formal disaster response agencies. Mainstream media is already starting to use this information to their advantage with services like Yahoo!'s You Witness News and CNN's I-Report. No matter how good professional photojournalists are in crisis situations, "the sheer number of people with cameras and internet access makes it inevitable that many of the best pics will come from normal people," as one Flickr user posted.

As people voluntarily capture, gather and aggregate information through social media, the result is a very large-scale collection of information. It is not difficult to imagine a future where such information could in turn provide useful data for disaster response and recovery. Of course what we see in Flickr and other social media venues of today are only the beginnings of such possibilities, though the critical point to recognize here is that this activity is a result of innovation of technology at hand for new situations. This is a completely organic process that nevertheless has significant elements of self-organization. Our opportunity as a community of researchers who concern ourselves with human-computer interaction is to consider how we can shape technology development to adapt to this emerging phenomenon of wide-scale social interaction into avenues that help in disaster response, recovery, and education.

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