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# Human Computing as a Horizon of SM4D: Crowdsourced Crisis Response and Beyond

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**Abstract**

Crowdsourced crisis response harnesses distributed human networks in combination with ICTs to facilitate emergency response. We discuss two recent projects, “Mission 4636” in Haiti and “Pakreport” in Pakistan, as examples of crowdsourced crisis response and SM4D. We review technical and organizational improvements that occurred across these two systems and as well as key areas for future improvement.

**General Terms**

Human Factors, Design, Management, Theory

**ACM Classification Keywords**

H.4.3 Information Systems Applications — Communications Applications, K.4.2 Computers and Society: Social Issues

**Introduction**

Crowdsourced crisis response harnesses distributed human networks in combination with information and communication technology (ICT) to create scalable, rapid communication systems that promote well-being, survival, and recovery during the acute phase of an emergency[6]. We discuss two recent collaborative projects, “Mission 4636” in Haiti and “Pakreport” in Pakistan, as prototypical examples of crowdsourced crisis response and SM4D. We review technical and organizational improvements that have occurred across these two systems and also address the potential of crowdsourced crisis response systems to incorporate crisis victims together with a geographically diffuse populations of sympathizers to promote rapid response and save lives.

In 2010, crowdsourced crisis response systems were deployed in Haiti following the January earthquakes and in Pakistan during the flooding that began in July. The purpose of both systems was to translate, geocode, and disseminate SMS-based requests for help to emergency responders. Each required collaboration among technology companies, international non-governmental organizations and emergency relief agencies. They also entailed the extension of existing tools to produce multi-step workflows that enhanced the abilities of emergency response systems to meet extraordinary demand. We conclude that crowdsourcing platforms are versatile social media tools, and that the speed, scalability and flexibility of crowdsourcing can complement and enhance development and humanitarian efforts.

## **SMS & Crowdsourced Crisis Response**

Distributed, SMS-based systems can facilitate humanitarian responses to crises worldwide. During the violence that followed the disputed 2007 presidential elections in Kenya, [Ushahidi](#) pioneered the use of [FrontlineSMS](#) for crisis mapping and response. Since then, Ushahidi and others have deployed FrontlineSMS and similar reporting systems in a variety of settings. One constraint of such systems emerges when linguistic and other factors prevent a scalable means of filtering, verifying, translating, and geo-tagging all the incoming SMS reports. Crowdsourcing, or the act of engaging distributed groups of people to complete microtasks or generate information, offers unique advantages in such situations when combined with (a) willing communities of volunteers and (b) a highly elastic “on-demand” labor platform.

The rise of Crowdsourced Crisis Response exemplifies the trend of projects that blend crowdsourcing and SMS networks to advance the social welfare aims at the core of ICT for Development (ICTD) research and now Social Media for Development (SM4D). In this sense, both Mission 4636 and PakReport extend existing tools and approaches and contribute several unique innovations to the fields of SMS-based interventions and emergency response.<sup>[3]</sup>

Rapid emergency response adds an additional layer of complexity and difficulty to ICTD projects and research<sup>[8]</sup>. Ken Banks and the creators of FrontlineSMS first applied an SMS-based reporting system to crowdsource election monitoring in Nigeria in 2007<sup>[2]</sup>. Subsequently, the FrontlineSMS system was extended by Ushahidi to help map post-election violence in Kenya later that year. FrontlineSMS itself incorporated this system into the [FrontlineSMS:Medic](#) project to promote health care through effective data collection and patient-physician interactions.<sup>1</sup>

## **Mission 4636**

Following the January 12, 2010 earthquake in Haiti, a group of organizations collaborated to create an SMS “short code” — 4636 — than anyone could text to report urgent needs, missing persons information, and any other emergency-related information to first-responders. Messages were then routed to Kreyol-speaking volunteers, who translated, classified and geo-located each SMS before passing the information along to emergency personnel. The system involved CrowdFlower in a massive collaboration with Digicel (the largest cell phone provider in Haiti), Ushahidi, FrontlineSMS:Medic, the U.S. State Department, InSTEDD, Thompson Reuters and other groups.

Mission 4636 introduced several key innovations to previous ICTD projects and crisis response efforts. First, the project expanded on the work of FrontlineSMS, Ushahidi and related groups to integrate both the survivors of emergencies as well as the promoters of ongoing community development into the recovery process. Second, Mission 4636 also took advantage of the distributed effort of volunteers and paid workers to achieve a response of sufficient scale and speed in the wake of an unexpected event. Finally, and perhaps most uniquely, Mission 4636 represented an attempt to bypass the dual barriers of scale and language through a complex, multi-step workflow that incorporated a number of organizational actors around the world. This adoption of multiple tools as well as collaborative strategies in response to a sudden crisis are a valuable set of resources and examples for emergency responders<sup>[5]</sup>. They are also a compelling model that might be adapted to other SM4D projects.

## **PakReport**

In response to the flooding that began in Pakistan during the summer of 2009, CrowdFlower partnered with Ushahidi and Pakreport to setup and maintain a crowdsourcing task for the translation, categorization and geolocation/mapping of

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<sup>1</sup>A case study by Goldstein and Rotich situates Ushahidi’s early work within the broader context of the Kenyan elections<sup>[4]</sup>.

SMS reports related to the disaster. A telecommunication provider in Pakistan established a short code to which anyone can text messages, requests for help or reports on the impact of the flooding. CrowdFlower, via Ushahidi, received an inbound feed of these messages. The task displays an SMS message to a volunteer, who then translates the message from Pashtu or Urdu into English. The volunteer then categorizes the message and, if geographic details are contained in the message, marks its location of origin on a map. All of these details, labels and annotations are passed back via Ushahidi to relief agencies and partners in Pakistan.

For PakReport, CrowdFlower added a novel level of redundancy for quality control to the geolocation stage of task. For each incoming text message, multiple workers then reviewed each message, resulting in multiple points on a map. The CrowdFlower platform then calculated the centroid of the resulting points, weighting the individual points by the worker's trust score (calculated as a function of each worker's agreement with other workers).

## **Key Challenges**

### **Quality**

Between Mission 4636 and Pakreport, the move towards more robust quality control processes illustrates an underlying challenge relevant to crowdsourced SM4D projects that rely on distributed networks of volunteers or other sorts of crowds. Some recent work has begun to assess interface design adjustments that might be necessary to incorporate workers from India and other "Southern" populations.[7] Nevertheless, no research that we are aware of has examined whether quality or speed differences may exist between paid versus volunteer "crowds" or between those working under "normal" circumstances and those working in response to a humanitarian crisis. Furthermore, the differences between participating in crowdsourcing work via a PC interface versus a mobile interface likewise remains unstudied.

## **Collaboration**

With Mission 4636, the biggest technical constraint had to do with the various SMS providers changing the formats of their feeds during the aftermath. Such changes imposed major obstacles for SMS message processing, as CrowdFlower engineers had to alter the underlying structure of the system for processing messages quickly after each change. This example of a core challenge to a social-media based crisis response speaks to broader concerns about collaboration across multiple organizations in multiple languages and distant locations. The observations from these two crisis relief efforts suggest a need for formatting standards and guidelines for the a) development of collaborative workflows for crisis relief and b) the formatting of data that will be exchanged by many parties or actors in a short amount of time.

## **Impact Assessment**

The multi-organizational and transnational character of PakReport and Mission 4636 has severely constrained impact assessment for both of these projects. Lacking both personnel on location in Haiti as well as sufficient time to plan and execute an assessment in the midst of the crisis, CrowdFlower was unable to assess Mission 4636 in a substantive way independent of the self-reports of collaborating organizations.[6] In the case of PakReport, the system is still live and so internal evaluations are ongoing. At the same time, no formal infrastructure or plan is in place for CrowdFlower or the other project participants to debrief and assess the results.

## **Future Directions**

Future work should aim to capitalize on the impact and the efficiency possible via crowdsourced crisis relief. In addition, CrowdFlower's experience with both projects leads us to conclude that mixed methods assessments of project impacts should be a central focus of future SM4D research and, in particular, interventions related to crisis response. Also, the development of organizational and in-

infrastructural means to support collaboration under crisis conditions is necessary. There are many different kinds of solutions available here, ranging from more technical (SMS data reporting standards) to more social (more formal mechanisms for coordination between local, regional and international actors involved in crisis relief efforts).

In emergencies, social media should be used to engage individuals to report incidents and to share data as well as to recruit volunteers for crowdsourced data processing to enhance relief efforts. Social media also should be used to publicize crowdsourced initiatives for crisis relief. Social media channels, networks and researchers all have the opportunity to contribute to the dissemination of these results and the ultimate uptake of these strategies. At a minimum, social media can and should contribute to awareness building and publicity about these options to enhance and amplify the impact of relief efforts. The more familiarity the global relief community develops with respect to these options, the more quickly and smoothly each subsequent integration or deployment can be launched.

Both Mission 4636 and PakReport provide an example of some ways in which social media usage in the Global North and South can promote crisis relief. The tools and techniques applied in should be refined in parallel with the evolution of crowdsourcing as a field. Especially relevant to SM4D concerns are CSCW and ICTD studies of crowdsourcing that demonstrate the importance of international context and population-specific system design and user interface issues.[1, 7, 9] The implementation of insights developed through research along these lines can contribute to the effectiveness of future crowdsourcing and SM4D interventions.

Mission 4636 and PakReport were successful and notable recent developments in part due to the way in which multiple organizations collaborated quickly and effectively. Both projects illustrate the opportunities for flexible, crowdsourcing platforms to serve as part of a broader SM4D toolkit for disaster relief. Social media can serve as both a component of future implementation of these crowdsourcing tools as well

as a channel by which the humanitarian community learns to embrace them.

## References

- [1] J. Antin and A. Shaw. Social Desirability Bias in Reports of Motivation on Mturk. In *CSCW Horizons: The 2011 ACM Conference on Computer Supported Cooperative Work*, Hangzhou, China, 2011.
- [2] K. Banks. And then came the nigerian elections: The story of frontlinesms. *SAUTI: The Stanford Journal of African Studies*, (Spring/Fall):1–4, 2007.
- [3] N. Eagle. txteagle: Mobile crowdsourcing. In *Internationalization, Design and Global Development*, pages 447–456. Springer, Berlin, 2009.
- [4] J. Goldstein and J. Rotich. Digitally networked technology in kenya’s 2007-2008 post-election crisis. *Berkman Center for Internet and Society: Internet & Democracy Case Study Series*, 2008.
- [5] M. F. Goodchild and J. A. Glennon. Crowdsourcing geographic information for disaster response: a research frontier. *International Journal of Digital Earth*, 2010.
- [6] V. Hester, A. Shaw, and L. Biewald. Scalable Crisis Relief: Crowdsourced SMS Translation Crisis Relief with Mission 4636. In *ACM DEV’10*, London, United Kingdom, 2010.
- [7] S. Khanna, A. Ratan, J. Davis, and W. Thies. Evaluating and improving the usability of mechanical turk for low-income workers in india. In *ACM DEV’10*, Londong, UK, 2010.
- [8] C. F. Maitland, N. Pogrebnayakov, and A. F. van Gorp. A fragile link: Disaster relief, icts and development. In *Information and Communication Technologies and Development, 2006*, 2006.
- [9] A. Shaw, J. Horton, and D. Chen. Designing incentives for inexpert raters. In *The 2011 ACM Conference on Computer Supported Cooperative Work (CSCW, 2011)*, Hangzhou, China, 2011.