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ORIGINAL RESEARCH

Innovations in Humanitarian Technologies Working Group–Report of the Proceedings, Humanitarian Action Summit 2011

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Abbreviations:
HAS = Humanitarian Action Summit
ICCM = International Conference on Crisis Mapping
ICT = information and communication technologies
NGO = non-government organization
OCHA = Office for the Coordination for Humanitarian Affairs
UN = United Nations
WG = Humanitarian Action Summit Working Group

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Background and Evolving Issues

Over the last decade, the global rapid rise in the use of information and communication technologies (ICT) for individuals and communities has posed both promising opportunity and significant challenges for organizations engaged in crisis and disaster response. The 2009 Humanitarian Action Summit (HAS) convened a range of humanitarian stakeholders engaged in exploring the evolving role of ICT, particularly the application of mobile communications, satellite imagery, and mapping, to humanitarian crises and disaster response. The HAS working group (WG) is composed of experts versed in these technologies and their potential for operational field applications as well as humanitarian practitioners who have operational experience with a general understanding of ICT applications. In 2009, the WG broadly acknowledged several critical issues that directly addressed the utility, efficiency, and feasibility of implementing these new technologies in humanitarian field operations, including:

1. Mobile communications might have a radical effect on future crises based on the realities that more individuals in the world own cell phones than do not (current global cell phone subscriptions topped five billion by the end of the decade).[1]
2. Given an intact network, short messaging service (SMS) texts, email, or web-based messages have the potential to be sent from anyone, anywhere, at anytime.
3. Open platforms can receive text or voice data from anyone, anywhere, at anytime; and audio, visual, or written narratives concerning an event can be shared anywhere at anytime.

For humanitarian operations whose informational sources may be outside national or mainstream media, the crisis-affected public use of blogs, Twitter updates, photo-postings, SMS texting, YouTube videos, etc. (the so-called "citizen journalist" phenomenon) has tremendous implications. The 2009 WG endorsed accessibility and implementation through facilitated dialogue between developers who design technological applications and the humanitarian organization clients who would assimilate and deploy them. The endorsed dialogue would include management of the information flows to provide real time analysis for targeted field decisions, standardization of tagged and formatted data to improve cross-platform collaboration and enhance information sharing among users, open source software to enhance collaborative field adaptations among developers and humanitarian practitioner "end-users," and attention to the ethical implications of using and securing personally identifiable data.[2] Moving forward, the working group supported the idea of a community of practice that would engage these initial issues.

A community of practice evolved in the form of a broader group of stakeholders, including software developers, human rights experts, donors, policy-makers, and academics, for the first International Conference on Crisis Mapping (ICCM) in October 2009. This convocation helped define the specialty of "crisis mapping," which leverages mobile platforms, computational and statistical models, geospatial technologies, and visual analytics to power effective early warning for rapid response to complex humanitarian emergencies (see http://crisismappers.net). It also further clarified the realities of ICT informational field challenges. For instance, patterns arrayed on a map, while giving decision-makers useful visualization, must still be put in context and compared to baseline information to determine if what is seen constitutes an important change. Acquiring data from local sources, while shedding light on cause and context and potentially empowering affected communities, requires a degree of vetting, "ground-truthing," and rapid analysis beyond the capacities (and perhaps desires) of host governments and

the traditional humanitarian response apparatus. The wide range of information that stands to flow during a crisis, in excess of the usual population, demographic, mortality and common programmatic indicators, still carries an ethical obligation to ascertain its relevance and decision to act.[3]

With the January 2010 Haitian earthquake, the use of ICT for humanitarian operational problem-solving expanded exponentially—by virtue of the vast global network of non ICT volunteers and both volunteer and non-volunteer information and communication technologists who responded; by virtue of the over 3 million Haitian cell phone users had some access to mobile communications and social media throughout the disaster;[5] and by virtue of the fact that much critical baseline in-country information was destroyed or non-existent for immediate responders and provoked the need for more complete operational datasets. Combined, these three enabling factors created unprecedented collective intelligence opportunities and challenges for humanitarian operations and ensured that Haiti would be a watershed event for ICT in humanitarian crises.

The lessons learned from the Haiti experience dominated the discussion at the second ICCM meeting in October 2010. Represented by large numbers of organizations, including operational United Nations field agencies and the ICT community (many of which were still involved in Haiti's transition from relief to development), the ICCM consensus was that an operational gap existed between the established, traditional cluster-led humanitarian response mechanism and the (largely voluntary) technical community. At the core of that gap are differences in working philosophies. The latter group values open data-sharing and self-characterizes as collaborative and proactive problem-solvers, often with innovative data management software, whose flexible field approach runs counter to the procedural, more formalized and hierarchically structured UN cluster system. This acknowledged disconnect was evidenced by the lack of a means to channel new information flows (rapidly processed imagery, geospatial data, crowd-sourced messaging, etc) into the workflows of the traditional responders, particularly the established humanitarian non-governmental agencies and the UN cluster lead, the Office for the Coordination for Humanitarian Affairs (OCHA) and its rapid response unit, the UN Disaster Assessment and Coordination (UNDAC) team.

ICCM 2010 participants, now a broad group of interdisciplinary humanitarian stakeholders, had a palpable sense that the technology was moving ahead of the humanitarian response system. To address this concern, OCHA and the UN Foundation and Vodafone Foundation commissioned the Harvard Humanitarian Initiative (HHI) to help the information cluster lead formulate a framework that would integrate evolving information and communication technologies and the rapidly evolving ICT volunteer community into formalized humanitarian response operations. This integrating framework study, titled *Disaster 2.0,* was an analysis of 40 interviews from information management key informants intimately engaged with the Haiti response. The study formed objectives and became the basis for discussion and recommendations of the 2011 working group.[5]

Framework

The gathering, processing, and dissemination of data into information that guides a timely, meaningful, targeted, effective humanitarian response activity remains a constant, unifying objective among stakeholders regardless of the evolutionary changes in ICT. Largely the domain of the UN's Inter-agency Standing Committee led cluster system, information management is conceptually a "rate-limiting step" in the effort to gain humanitarian response situational awareness, because:

- it commences as close to the triggering event as possible,
- it synthesizes large amounts of disparate and usually incomplete and often inaccurate data, and
- it attempts, through multiple iterations of analysis, to get in front of the humanitarian juggernaut that is hundreds of response organizations with thousands of personnel responding to acute needs.

Information bottlenecks, delays, and inaccuracies often leave a vacuum in which humanitarian responders arrive and direct resources haphazardly and real population needs remain unmet. If, in the course of crisis-evolving time, this vast quantity of data leads to information that congeals to actionable knowledge, it is often appreciated beyond the time of its usefulness and typically during a "lessons learned" analysis much later.

With Haiti fresh in mind, the *Disaster 2.0* key informants identified major themes to consider for future humanitarian information management:

1. Information gaps: The quality of in-country baseline datasets determines the ability of responders to make comparisons with new ground data needed to direct resources in the immediate response; if baseline data is destroyed or non-existent, the UN clusters heavily depend on NGO field responders for basic who-what-where data that can be synthesized into a situational map. Critical baseline data includes updated population information, updated locations and capacities of key civilian infrastructure (hospitals, government services, schools, electrical grids, etc), and street level maps that detail these population and infrastructure attributes.
2. Information fragmentation: For the purposes of cybersecurity and individual protection, the clusters' closed proprietary systems lock data in tools and formats not easily shared across clusters or with the greater humanitarian community. This lack of data harmonization results in "silo-ing" which fragments information, crippling its accessibility.
3. Enhanced tools and capacities of the ICT community: In particular, the technologies that enabled crowdsourcing—tools for collecting, processing, and viewing publicly available high resolution satellite and aerial imagery; wiki-like platforms where stakeholders can add or modify geospatial or prose data to create maps and narratives; other collaborative platforms with open interfaces that could match-up data stored in the platform on web services—can organize and manage collective intelligence for improved decision making during a crisis. Coupled with the mobile-enabled and socially linked affected community, the voluntary and non-voluntary ICT community is making a significant and permanent contribution to the quality of humanitarian response.
4. Information overload on an inadequately tooled system: With the potential for innumerable sources of information, the velocity and volume of information can overwhelm

the capacity of field responders to validate and manage it despite increased investment in bandwidth and connectivity. Since the UN cluster system manages structured and unstructured data within clusters and across clusters, the resources required for the processing and systematizing of greater amounts of information must be available for OCHA and each cluster.

5. Integration: While every crisis theater of operations will differ, the need for the ICT community and UN cluster agencies to share information and communicate effectively will be a constant. Ideally this would entail a common set of protocols that would connect people, work flows and data flows between UN operational agencies and their traditional NGO partners, the volunteer (and non-volunteer) ICT community, and the locally affected population. Technically this would require open data exchanged over open interfaces using open schema.
6. Enhanced expectations: Rapid access to information through new ICT has generated high expectations from decision makers outside the crisis zone, senior UN humanitarian officers, senior NGO leadership, government policy makers, as well as the wired global community, whose presumptions for rapid analysis, briefings, and operational response can further overwhelm field information management capacity.

Working Group Reflections

With the *Disaster 2.0* study as the springboard, the WG elaborated on the information management and integration challenges delineated above, with the following discussions:

1. *In regards to humanitarian decision-making, who needs to know what, where, and when?*

   Working group members from across the operational spectrum stressed the need for essential consensus-driven standardized data that reflect the emergency time course. Data defined by the humanitarian community as necessary for problem solving in each sector and phase (and for informational products) could be managed in a common free (non-proprietary) formatted operational dataset, easily accessible and shared (The most plausible starting point for this initiative would be OCHA's core dataset and the venue for sharing information, the UN cluster system). WG members from the UN argued that the UN cluster move toward interoperability within and develop a common interface with its volunteer networks without. For this, the formal humanitarian and informal technical communities will need to reach out to each other. Challenges that remain include identifying disaster-specific data needs and the contexts that define them, building the technical capacity of the local population who provide critical core data, understanding how users use it and whether it makes a difference for the affected population in a crisis, and determining what security and protections need to be in place before data can be 'openly' shared.
2. *But can all data be trusted, qualified and verified, especially that which is crowd-sourced and flowing rapidly?*

   The Haiti response had multiple examples of successful cases in which citizens were localized and saved through text messaging, crowd-sourced geospatial information produced detailed actionable maps, and where local information remained critical to ongoing relief efforts. Nonetheless, the real time fact checking of large volumes of crowd-sourced information remains a tremendous challenge for organizations that must distribute life-saving resources fast and efficiently. The WG stressed the need for trusted and secure networks of individuals whose information simultaneously embraces local knowledge (with critical translation as needed) and lends itself to "ground-truthing." This social network can also filter information, mitigating the information overload problem. Decision makers feel more confident in the quality and veracity of data and its analysis when the information comes from trusted social networks developed over time in the field. In order to capture accurate local data rapidly, networked local capacity should best be built beforehand.
3. *In regards to data systems - how to manage, integrate?*

   Are the UN cluster system and its established NGO partners aware of the ICT community's data gathering and management capacity? Whether the emergence of a larger ICT community presence in Haiti has provoked organizational change or influenced core processes, to a focus on technology that encourages more integrative data management systems or manages multiple types of information flows or outsources information management to relieve field workers, within the cluster system remains to be seen. In the Haiti crisis, information flows increased over improved infrastructure such as connectivity and bandwidth and the access to imagery and mapping tools were heralded as an immense positive step forward in achieving situational awareness during a complex crisis. A significant amount of the useable information distilled from that data continues to come from outside the UN cluster. The cluster's information management capacity to deal with these facilitated data flows, to process and analyze large files of imagery, to exchange information with partnering volunteer technical organizations, and to receive tens of thousands of individual calls for help from affected communities will likely require a workable engagement with the humanitarian volunteer ICT community.

Working Group Recommendations

The WG debated a four element design proposed in *Disaster 2.0* that would serve as distinct open and neutral conventions for discussing, hypothesizing, testing, and evaluating ICT integration in the humanitarian sphere. Within these four elements participants from across the humanitarian ICT spectrum would explore problems, test solutions, experiment without the fear of failure and its implications, provide feedback, and archive lessons learned in the overarching interests of ICT for humanitarian operations.

These four elements, illustrated in Figure 1, consist of a forum, a lab, a deployment cell, and a consortium. Each would be fueled by a networked group of individuals that represent diverse organizations within the technical community who would function as "super-nodes." Super-nodes would undertake the challenge of establishing and developing each structural entity. In addition,

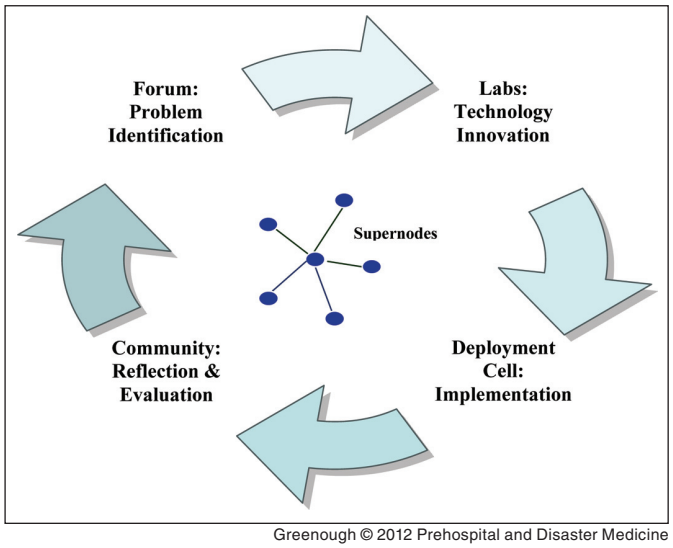

Figure 1—(Color online) Four elements for ICT in humanitarian operations

super-nodes would also be represented by researchers and practitioners to ensure the outcomes from each can be translated to the realities of ground operations. In maintaining the energy for each element, super-nodes would be empowered to capture and communicate outputs from each element and provide feedback.

The Forum

The WG envisioned an open inclusive neutral space for idea sharing and problem-focused discussion. This "safe space" would allow for organizational and integrative field challenges to surface and potential solutions to emerge that could be developed for field testing in the laboratory element. Information managers, technologists, academics, donors, and experienced local community disaster managers would populate this space to begin to understand their respective operational mindsets and perspectives, and in so doing, engender trust. The network of crisis mappers is one such example. In that spirit, the Forum could begin to tackle the cultural and organizational impediments to integrating ICT in humanitarian operations as well as the technical challenges discussed above.

Humanitarian Lab

The WG envisioned a physical space where field problems and their potential solutions, born from the Forum, could be tested and where technical issues and tools could be fleshed out in advance of future crises. This element would likely include multi-disciplinary exercises and simulations inherently designed with evaluative components to determine what succeeds and fails in varying contexts. The lab might include likely partners such as the UN Global Pulse and InSTEDD Innovation Labs and entail events like the Camp Roberts humanitarian exercises, the ISCRAM community (the International Community on Information Systems for Crisis Response and Management) summer courses, HHI's Humanitarian Studies in the Field course, various search and rescue simulations, and Random Hacks of Kindness, among others. Lab initiatives would consciously include global and local partners, especially members of populations where future crises are likely to occur.

Deployable Cells

The WG described groups with multidisciplinary skills who would field test the applications of information tools, and while doing so, teach them, deploy them, and build local and organizational capacity around them. This element would implement and apply forum-generated and lab-tested innovations in real field environments. Such deployed teams would draw from across the specialized tasks that define information management and as crises unfold, liaison with information managers within the UN cluster and the voluntary technical community.

Consortium

The academic consortium would systematically evaluate and archive the integrating process, technologies, and applications using a range of methodologies for the larger humanitarian stakeholder community. At its core inclusive, the consortium will encourage links amongst academics, practitioners, and specialists across multiple disciplines. Interuniversity partnerships can leverage their respective strengths, promote developing and developed world relationships, and work toward building the evidence base for the implementing and translating strategies that emerge from the lab and task force. Research institutions are in a position to convene the community of practice around these findings and archive them for ongoing validation. The results of formal evaluation study and consortia evidence-based work will continue to trigger new discussion and debate around evolving ICTs or revised approaches within the Forum.

In addition to the technical disciplines inferred, the four elements will necessarily attract designers and software developers, logisticians and systems engineers, the NGO community, disaster managers, the military, social movement advocates and innovators, among others.

The evolving field of crisis mapping and integration of ICT into formal humanitarian response activities will generate broader issues surrounding new ways of sharing information. We are learning how to exchange knowledge not only during crisis response but also within this growing multi-disciplinary community of technologists, volunteers, humanitarians and academics. This new way forward is not without major controversy. Disparate and competing elements and organizations across this discipline continue to work diligently toward a common good, toward acceptable standards and to better defining the way forward. The humanitarian community is multidisciplinary and demands the trespassing of professional boundaries. It is not an easy task but it is a necessary one. As such we are hopeful that the discussion will catalyze healthy discourse and debate from all stakeholders.

Conclusions

The UN cluster and the established humanitarian community will need to take defined steps toward integrating ICT in an effort to improve outcomes for affected populations during humanitarian crises. The momentum developed through the Haiti response, the crisismappers network, this WG, and the problem-solving volunteer technical community in general will continue to transform humanitarian operations.

References

1. International Telecommunications Union website. Available at: http://www.itu.net/pressoffice/stats/2011/01/index.aspx . Accessed 22 May 2011.
2. Greenough PG, Chan JL, Meier P, et al. Applied technologies in humanitarian assistance: report of the 2009 applied technologies working group. *Prehosp Disaster Med* 2009;24(4):s206-s209.
3. Meier P, Ziemke J. ICCM 2009: Conference Report, Dec 2009.
4. Corley A (2010, Feb). Why Haiti's cell phone networks failed. IEEE Spectrum, Feb 2010. Retrieved from http://spectrum.ieee.org/telecom/wireless
5. Harvard Humanitarian Initiative. Disaster 2.0: The Future of Information Sharing in Humanitarian Emergencies. Washington, DC and Berkshire, UK: UN Foundation & Vodafone Foundation Technology Partnership, 2011.