Crisis Map Mashups in

Mapping of crisis information is not new; however, neo-geograp
rise to new forms of crisis mapping. Map-based "web mashups
GPS-enabled devices. Map mashups are typically web services
then displayed in some geographic form—**by Sophia B Liu an**

Long before the geospatial community got around to creating "mashups," the concept of "composing" a new product by mashing different components was successfully used in such other domains as music. Map mashups entered the mainstream of cartography after Google introduced its public Google Maps API in 2005. Web 2.0 technology, which enables online social communication, mass collaboration, information sharing, and user-centered design, has made the creation and use of web mashups widespread. In this article, we explain why crisis map mashups are created and how they are often designed.[1] As an example of how ubiquitous web mashups have evolved, we present a crisis mashup created in response to the 2010 Chile earthquake using the *Ushahidi* open source platform.

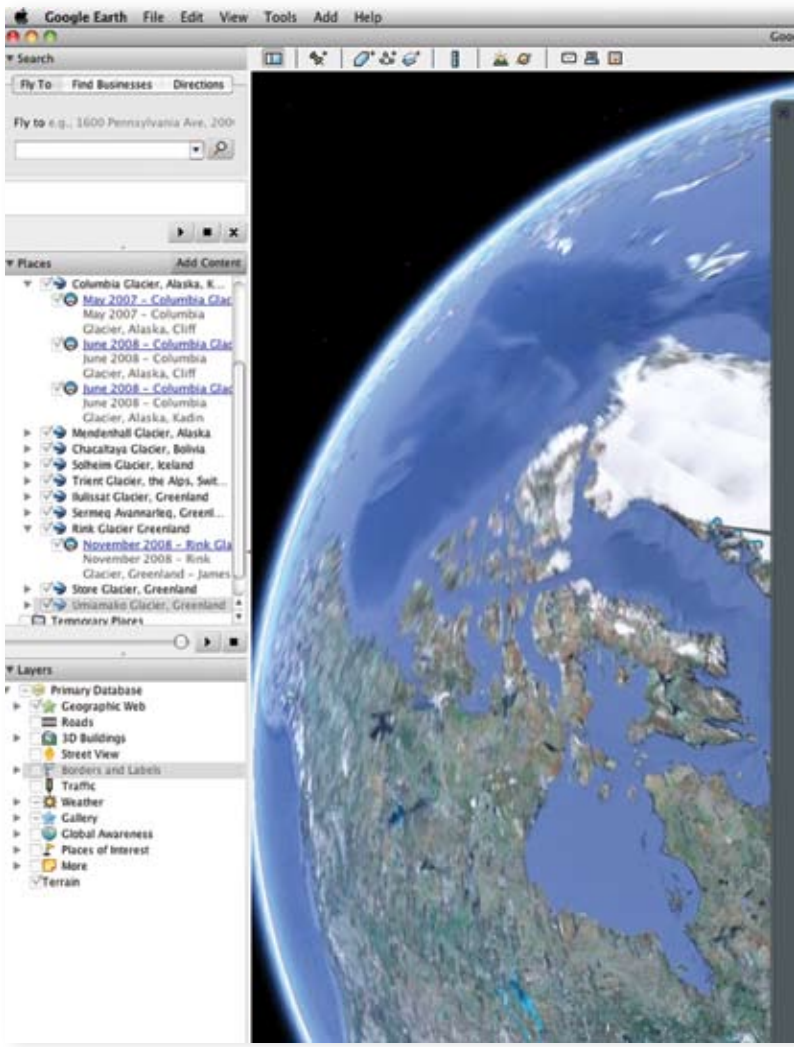
WHY CRISIS MASHUPS?

Many mashup developers recognize that mapping crisis information is often more compelling and perceptible than reading text-based crisis reporting. A map of a crisis provides a clear and understandable spatial context and dynamic clustering of information by geo-location.

Typically, map mashups are created to keep track of sensitive, rapidly changing crisis data and making this information more accessible and usable by formal responders and members of the general public. Some web developers create map mashups because they want to display crisis information on a map in real time, incorporating ephemeral crisis information from social media sites and the crowd in the impact zone of a crisis.

One of the features which make some map mashups so popular is bi-directional communication. The flow of information from the field to the map and back again to the field is powered by web-based crisis mapping tools. Only the administrator of the map tool needs to have Internet connection.

Compared to most professional mapping techniques, map mashups typically do not require extensive training to build.



Moreover, they are fast and robust enough to visualize different data types at multiple geographic scales, thus making crisis information accessible to multiple stakeholders in different ways.

[1] A more in-depth analysis of these emergent neogeographic practices around map mashups in the crisis context can be found by Liu and Palen (2010) in the *Cartography and Geographic Information Science* journal.

a Participatory Age

hic tools and practices employed in recent disasters are giving
" are one of these new forms, enabled by Google Maps and and
which combine or "mash up" multiple sources of data which are

d Anahi Ayala Iacucci

Another point to remember is that map mashups stand to greatly benefit from crowd-sourcing technologies. Mashing up data from reliable, verified sources with those coming from unverified, unknown crowds yields highly effective situational awareness visualizations of geo-referenced location information. This is because the "crowd" may provide more accurate data than the experts developing the map.

DATA AND DESIGN OF CRISIS MASHUPS

Not only do crisis mashups differ in the type of data used to create them; the design used to display crisis information varies as well.

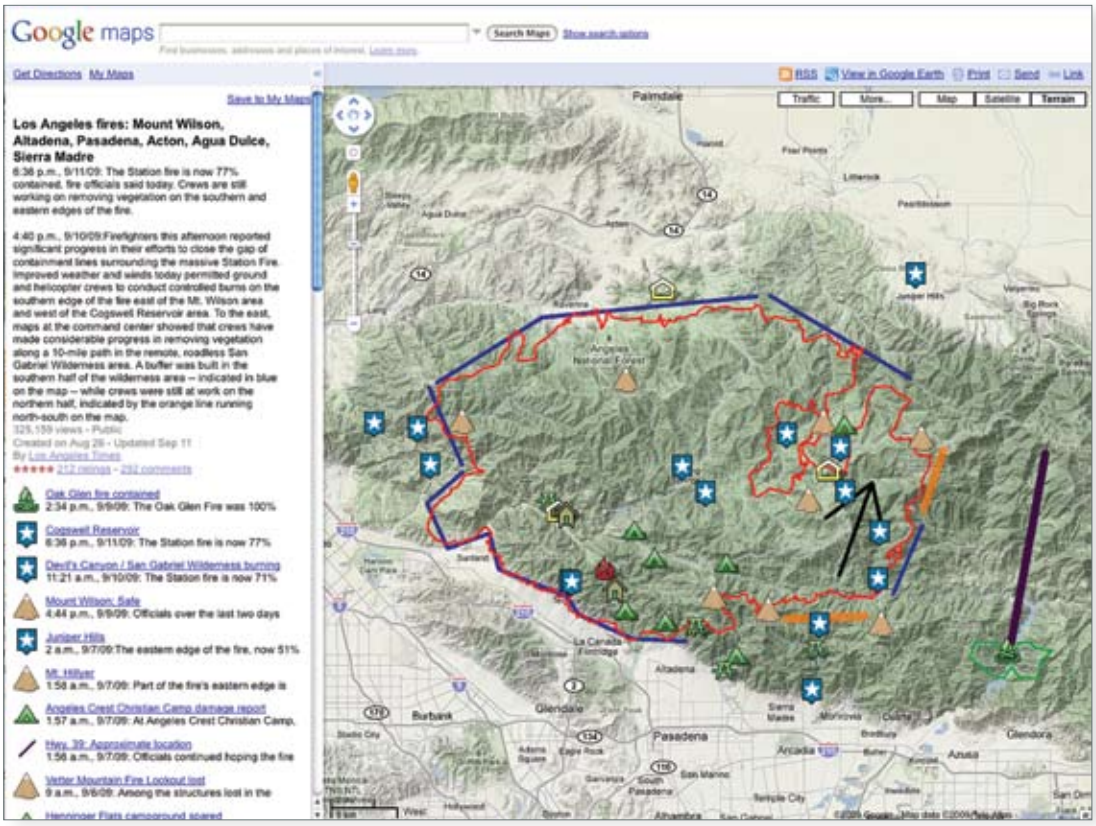
DATA: Crisis mashups typically use publicly available scientific data, commercial and licensed data, data unearthed by professional and citizen journalists, and data posted on social media sites.

The inclusion of user-generated content in mapping crises and the response to them has been facilitated by mobile information and communication technologies. The text messages people send via their wireless phones and the video, photos, or e-mails shared via Facebook, Twitter, and YouTube travel in near real time, across boundaries, to enhance our understanding of the world around us. Future map mashups will likely become more robust if valuable crisis information is published as open data in standardized formats.

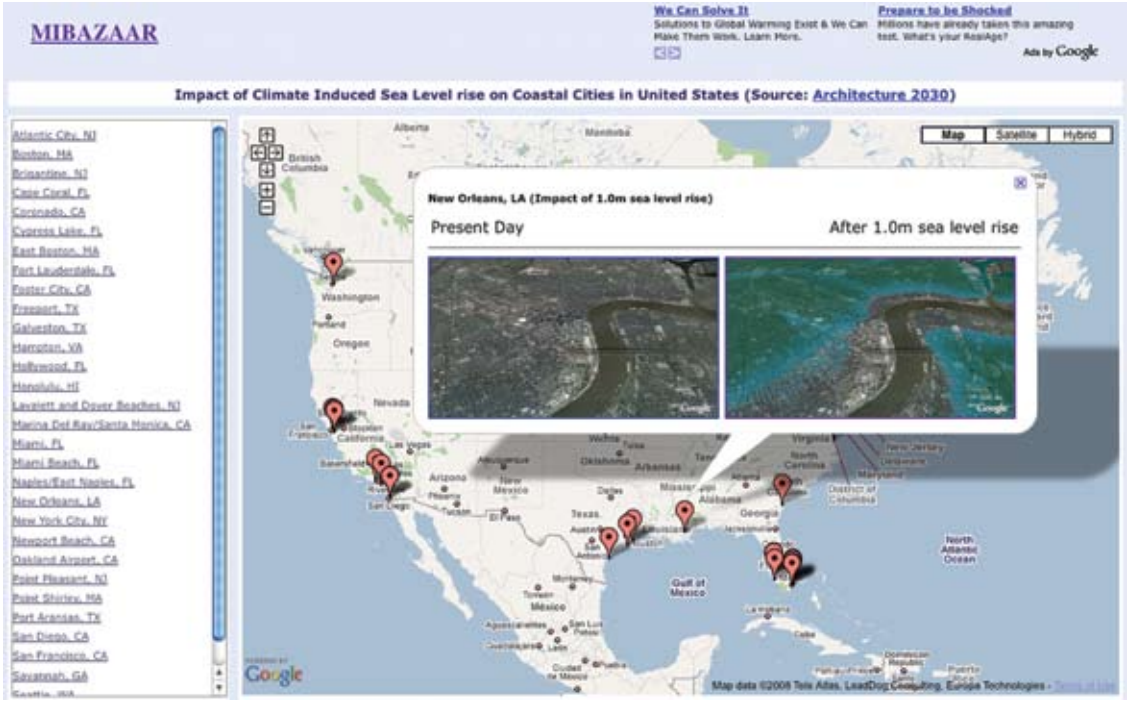
DESIGN: During a crisis, we need both spatial and temporal information to gain situational awareness of the crisis. Many crisis mashups are designed to communicate such information. However, some design features may represent spatiality and temporality simultaneously while others focus on either the spatial or just the temporal aspects of a crisis.

For example, the 2007 San Diego wildfire[2] and the 2009 Los Angeles wildfire[3] mashups using Google My Maps require users to manually time-stamp and geo-code the crisis reports.

[2] http://bit.ly/2007SanDiegoFireGoogleMyMap. [3] http://bit.ly/2009LAFireGoogleMyMap.



The 2009 Los Angeles wildfire mashup [http://bit.ly/2009LAFireGoogleMyMap].



The Sea Level Rise mashup [http://www.mibazaar.com/nationundersiege/]

Twitter map mashups, such as those created for the swine flu[4] and the Iran protests[5], use the geo-location information associated with the Twitter user's profile to automatically map a user's tweets on the map mashup. Location information is likely to become more accurate as users opt-in to location-aware features.

Most mashups map near real-time crisis information. However, some also provide historical crisis data, while others map potential crises.

[4] http://www.mibazaar.com/swineflu; [5] http://www.mibazaar.com/irantweets.html.

Iran protests, 2009 [http://www.mibazaar.com/irantweets.html]

For example, the Extreme Ice Survey[6] mashup (see pp. 10-11) presents the physical geographic changes of various glaciers by displaying time-lapse videos of the glacial retreat on Google Earth over a multi-year period.

In contrast, the Sea Level Rise on Coastal Cities in the U.S. mashup[7] annotates a Google Map with projections of sea-level rise images from a coastal impact study report by a non-partisan, non-profit climate change study group. Given this ability of mashups to represent the potential futures, it is worth considering how map mashups can be used to engender a more long-term perspective around crisis response.

USHAHIDI-CHILE

When the 8.8 magnitude earthquake struck Chile on February 27, 2010, Anahi Ayala Iacucci, along with others, launched the Ushahidi-Chile Situation Room Project at Columbia University's School of International and Public Affairs (SIPA). Students from SIPA's New Media Task Force partnered in the project with a group of students who had been researching the Ushahidi[8] platform (http://www.ushahidi.com) for a separate international development project.

The Ushahidi-Chile mashup was set up by Patrick Meier, the Director of Crisis Mapping and Strategic Partnerships at Ushahidi, a couple of hours after the earthquake erupted and was initially managed from the Situation Room at Tufts University. Within 48 hours, however, Ushahidi-Chile[9] became the responsibility of the SIPA students.

Assisted by more than 60 SIPA student volunteers trained to monitor social and traditional media reports from Chile, Anahi started working on the mashup on March 1, 2010. The students manually mapped over 100 incidents—all during midterms week. Within two days, Ushahidi-Chile had over 150 volunteers and in three days, they mapped 700 reports. To date, more than 1,200 Ushahidi-Chile reports have been mapped.

Several factors contributed to the success of Ushahidi-Chile. The media monitoring and crisis mapping activities on Ushahidi-Chile were modeled on those used for the Ushahidi-Haiti (http://haiti.ushahidi.com/) instance developed barely a month before. A trusted volunteer network was mobilized using pre-existing social ties among students. Free cloud computing tools (i.e., Google Groups, Google Docs and Forms, and Skype Public Chat) were used along with Facebook Groups and Events to facilitate the distributed coordination efforts for Ushahidi-Chile.

Multiple Google Groups were set up to broadcast instructions to the volunteers and coordinate mapping activities. Also, multiple Google Docs and Spreadsheets were created to capture and map geographically distributed information gleaned from media monitoring.

The Media Monitoring List for Ushahidi-Chile contained over 250 links to official governmental Twitter feeds from Chile, Twitter users, Twitter lists, Twitter Spanish-speaking experts, Spanish and English news sites, blogs, Facebook groups, and other relevant links that provided live updates on the Chile earthquake.

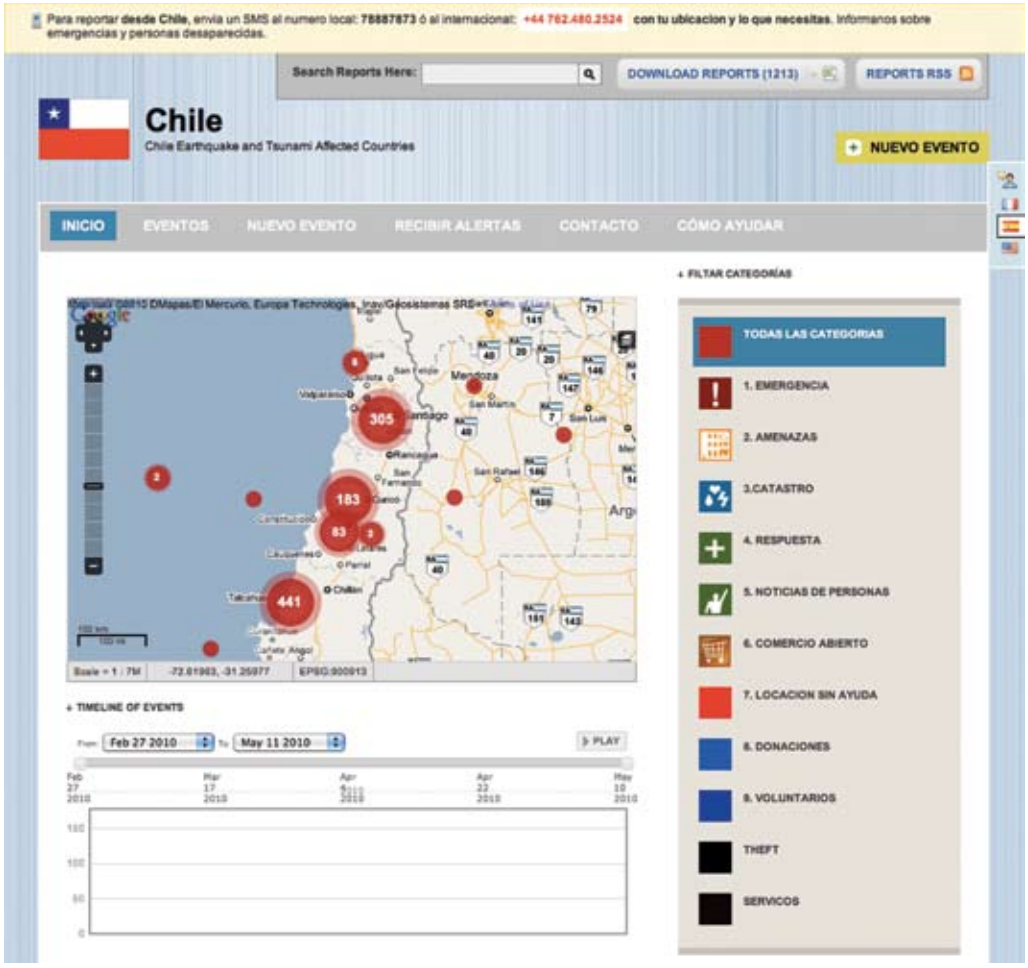
Google Docs and Spreadsheets became an invaluable collaboration tool, facilitating ad-hoc data updating in real time. Skype Public Chats made possible instant communication among the distributed Ushahidi volunteer network. Through Skype, the volunteers also had access to a transcribed digital trace of their previous communications.

Facebook Groups and Events were used to mobilize volunteers and inform them of crisis mapping training and other related activities. Later, a wiki was created to provide real-time updates of new projects and lessons learned, thus serving as a more complete instruction guide for old and new volunteers. This wiki was also used to aggregate useful information about managing the platform and organizing the workflow around an Ushahidi instance.

The "mash-mapping" of the Chile earthquake was a two-step process. The first step involved monitoring the media for relevant crisis reports from the crowd. Then the volunteer students identified the GPS coordinates for each report and geo-tagged the

[6] http://www.extremeicesurvey.org. [7] http://www.mibazaar.com/nationundersiege/. [8] In the next issue of the *ACSM Bulletin*, we will take a closer look at this platform as a crisis mapping management tool. [9] http://chile.ushahidi.com/.

Ushahidi-Chile [http://chile.ushahidi.com/]



reports visually on the Ushahidi map. The result was a comprehensive and an up-to-date crisis map mashup of the 2010 Chile earthquake which was made available to respondents on the ground.

The Ushahidi-Chile mashup has been found effective in rescuing earthquake victims, identifying the nearest hospitals, and delivering aid supplies. The mashup has increased understanding of the impact of this and other earthquakes on specific factors in our society. Equally important, it offered volunteer mappers a tangible way of contributing to the disaster relief efforts by helping to manage crisis information.

LESSONS FROM USHAHIDI-CHILE

The wide participation in mapping the Chile earthquake and the rescue and relief response to it was made possible by the ability of the Ushahidi tools to collect information from SMS text messages via mobile phones and so provide people with a direct and accessible communication channel outside the mainstream media and government agencies.

Future crisis mashups should also consider integrating social networking tools, cloud computing services such as Google Groups/Docs/Forms, and mobile technologies to harness the power of the crowd for timely and effective crisis response.

The crisis mapping efforts around Ushahidi-Chile is, in some ways, a step towards the semantic web. The volunteers manually extracted meaning and value from online content, digital sources and SMS and then re-structured that information by giving it a title, a description, and a geo-location. This sometimes meant interpreting the message and the context in which it was created so as to provide a semantic and contextual point-of-view.

Ushahidi's Meier envisions developing a Mechanical Turk Service plug-in (similar to Swift River[10]) to facilitate what he calls "*turk-sourcing*." This type of sourcing would disaggregate the time-consuming tasks of media monitoring and geo-location determination into human intelligence tasks.

Our review of a myriad of crisis map mashups, and in particular the in-depth evolution of the Ushahidi-Chile map mashup, suggests that computing and communication technology have come together to create a powerful means for managing crises—the map built from data meshed from widely dispersed data.

REFERENCES

Liu, S. B. and Palen, L. 2010. The New Cartographers: Crisis Map Mashups and the Emergence of Neogeographic Practice. *Cartography and Geographic Information Science* special issue: "New Directions in Hazards and Disaster Research" 37(1): 69-90.

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[10] http://swift.ushahidi.com.