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The spatial knowledge politics of crisis mapping for community development

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Abstract Crisis mapping, the combination of software-as-a-service mapping and reporting aimed at large numbers of individuals, is proposed for chronic problems as well as acute issues; it is universalized for global south disasters as well as global north community development. It supposedly affords a new spatial knowledge politics (SKP) that unfolds in local communities. We tested the role of spatial knowledge politics in crisis mapping for community development by co-developing, with local organizations, four applications based on the prominent mapping-telecommunications crisis platform, Crowdmap by Ushahidi. We assessed crisis mapping's effectiveness in North American community based activities in Francophone and Anglophone Canada. We found persistent technical challenges, consistent with the literature, although crisis mapping allowed increased opportunities for the developer to insert their knowledge. Analysis of the contributions illustrated the use of crisis mapping to report on place-based features that enabled contributors to connect, but also limited the ability to express location and place in 160 characters. It revealed tensions in conceptualization of local spatial knowledge politics as witness versus political influence. Crisis mapping could simultaneously aid and disrupt traditional place-based politics of community based organizations. Our critique serves as a test of crisis mapping's universality for other fields and its promise of a new SKP.

Keywords Knowledge politics · Geoweb · Community based organizations · Empowerment · Canada

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Introduction

Crisis mapping is promoted as a method by which impacted individuals can easily report and share digital geographic information, related to challenges and solutions to natural and human-induced disasters. Crisis maps promise to provide real-time information, create situational awareness, produce additional data unmatched by previous mapping processes, better direct resource distribution, and increase connection between online and offline networks (Gao et al. 2011; Meier 2012a; Ziemke 2012; Zook et al. 2010). Crisis mapping projects often enable large numbers of people to interact online (Ziemke 2012), which is why crisis mapping is often used interchangeably with the more anodyne terms crowdmapping and crowdsourcing. Through platforms such as Ushahidi (https://www.ushahidi.com), Crowdmap (https://crowdmap.com) (also by Ushahidi) and the crisis mapping arm of OpenStreetMap (OSM), Humanitarian OpenStreetMap Team (HOT), non-experts can build their own mapping applications ("apps") and crowdsource

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content about natural and human-induced crises. In addition to the reporting done by individuals in the affected areas, crisis mapping allows remote individuals to assist by digitizing post-crisis data (e.g., updating damaged road infrastructure in OSM). Crisis mapping emerged to partially address the inequities of access to the Internet by enabling individuals to rapidly contribute geographic content via text message (short message service or SMS) as opposed to inputting contents directly onto an online map (Ziemke 2012). Affected individuals could take advantage of all these features of crisis mapping and engage in spatial knowledge politics (SKP) to better navigate and influence their local environment.

The best known example of crisis mapping is for the 2010 Haiti Earthquake, where remote mappers rapidly mapped affected areas and constructed apps to enable mapping and local reporting (Meier 2012b; Forrest 2010). Prominent members of the crisis mapping community have claimed that crisis mapping could be seamlessly repurposed for chronic problems as well as acute events (Meier 2011). For example, HarassMap (http://harassmap.org) was developed in 2005 so that individuals could report incidents of sexual harassment. The underlying software, Ushahidi, offers, as Okolloh (2009) argues, an ease in and immediacy of contributing, anonymity, and an ability to contest dominant culture and existing state practices. Expanding crisis mapping could "enable communities to create continuous and constructive responses to issues that matter to them, from election monitoring to tracking human rights violations" (Nesta 2016).

Crisis mapping began to be rhetorically linked to community development. Community development as a set of objectives, prioritizes a role for local individuals and groups to determine their own community needs, select approaches that match their skills and capacities, and work collectively towards common goals (Burns et al. 2004; Florin and Wandersman 1990; Kretzmann and McKnight 1993; Lyndon et al. 2011). Community development also functions as a locus of activity, occurring within local nonprofit corporations or grassroots community based organizations. Crisis mapping could presumably represent the objectives of community development, by facilitating local empowerment (e.g., visualize the importance of social/green spaces, use playgrounds to contest in the face of rezoning plans), and social capacity (e.g., group members learn the software). It could enable community participation (e.g., citizens map damaged sidewalks), and the maps could shift public discourse and public policy (e.g., group members point out social housing issues and critical living conditions).

In this paper, we describe how SKP manifests in crisis mapped community development. We report on four cases of community development projects assisted by the most commonly used crisis mapping software, Ushahidi's Crowdmap. Cases varied by income, language, and a sense of urgency about the specific community issue. Through participant observation and community engagement, we observed real-time user interaction with each app throughout its lifecycle. Observations allowed for findings related to system development and administration, citizen sensing and political influence. We advance others' work in three ways. First, we examine the lifecycle of development, deployment, use and influence of crisis mapping. Second, we focus on the impacted people as opposed to the remote actors, the latter of which tends to be the focus of crisis mapping. Last, we interrogate how SKP emerges in community development differently from crisis mapping, particularly where it impacts traditional politics.

The spatial knowledge politics of crisis mapping

Elwood (2010, 352) characterizes SKP as

> ways in which individuals and institutions leverage digital spatial data and spatial technologies in negotiating social, political, and economic processes, often doing so in ways that rely upon the differential influence and authority that is granted to particular forms of knowledge or representations.

Elwood and others argue that the geospatial web (geoweb), an example of which is Ushahidi, produces SKP in a way that differs from older geospatial technologies (Elwood 2010; Elwood and Leszczynski 2013; Sieber et al. 2016). On the geoweb, Elwood and Leszczynski (2013) argue that non-expert knowledge can be privileged over authoritative data. This privileging of knowledge results in part from the concept of citizen as sensors, where spatial knowledge is valued because local residents are presumed closer to phenomena, can sense subtle changes, contribute

information as or more accurate than experts such as government officials, and are greater in numbers than experts (Goodchild 2007). Certain platforms render it impossible to identify the credentials of contributors so the technology can blur traditional dichotomy between expert and non-expert (Elwood and Leszczynski 2013). Elwood and Leszczynski (ibid.) assert that there are now different ways of validating geoweb data. Goodchild and Li (2012) explicate crowdsourcing validation methods whereby, non-expert function as expert curators (e.g., in Wikipedia) or a contributor is rated instead of a contribution (e.g., on Amazon). The geoweb thus promises greater non-expert "influence and authority" over processes affecting people's lives.

Elwood and Leszczynski (2013) contend that geoweb-enabled SKP enables new types of geovisual framings, including a politics of bearing witness. The sheer variety of assembled platforms (e.g., geolocated tweets, photographs, social checkins) offer opportunities for multiple visual multimedia narrative representations, compared to more database-structured and quantitative means of interaction found in GIS (ibid.). Peter Gabriel illustrates the power of narrative politics in his nonprofit, WITNESS (https://witness.org), which gave cameras to survivors of human rights violations. By offering visual testimonials about crimes, he argued that perpetrators would be brought to justice: "in those cases where photographic film or video evidence existed, it was almost impossible for the oppressors to get away with it" (Gabriel et al. 2008, 35). (It should be noted that Ushahidi means 'witness' in Swahili.) These sentiments align with the rhetoric of the visual power of maps and mapping technologies to embody local knowledge and empower local citizens.

Burns (2014) is not so sanguine about SKP in crisis mapping. He critiques crisis mapping for its lack of on-the-ground local knowledge. The role of remote mappers is particularly problematic because during crises remote mappers were deciding which local knowledge would be prioritized and how it would be classified. As he recounts, problems are inherent in any classification system, which stratifies information and where certain information is more important than others, some is misclassified and some omitted. Burns (ibid.) also sees challenges in maintaining locational privacy and anonymity of contributions. Burns' critiques are interrelated. Remote mappers, who are digitizing damaged infrastructure and manually geocoding victim reports, frequently live outside the impacted area and outside the country. They may be unaware of local custom and political situations. For example, remote mappers can fail to understand the impacts of violating victims' privacy when their locations are geocoded (Morrow et al. 2011). Meier (2011), who worked for Ushahidi and Leson (2015), former head of HOT, both lament the lack of local contributors. (We note that, to crisis mappers, "local" tends to refer to mappers as opposed to community development actors.)

Geoweb-enabled SKP may foreground non-expert knowledge. However, the quantification and accuracy requirements of crisis mapping platforms can sideline non-Cartesian knowledge practices because they do not match the standard mapping practices (Burns 2014). Instead of the promise of qualitative narratives, "certain events in the context of a crisis (like acts of violence, detentions or demolitions) are (geo)coded, forwarded through a chain of translations and end up as discrete quantifiable objects in a database" (Bittner et al. 2013, 940). The pursuit of highly structured locational accuracy (e.g., "this road is damaged in this manner at this exact location") might actually discourage contribution of local spatial knowledge. Much community data, like perceptions of degraded playgrounds, may not require high positional and attributional accuracy (Sieber and Haklay 2015). Community data may necessitate an assessment of authenticity but not positional accuracy. One cannot take advantage of the geoweb to negotiate various processes if the technology is not user-friendly in terms of what one wishes to contribute.

Meier (2012a, 2012b) argues for the affordances provided by crisis mapping technologies in terms of high levels of interactivity and ease in system development. When deploying a crisis mapping app, Okolloh (2009) stresses the importance of using simple yet effective tools and expressing clear project goals. Additionally, she encourages mappers to gain community trust and create a sharing culture that includes two-way information flows (ibid.). Her recommendations resonate with numerous Information and Communications Technology (ICT)-based initiatives in North American community development. Practitioners (e.g., Gurstein 2002; McIver 2003) find that community-based ICT projects consistently fail because of a lack of local participation. The

introduction of technology can increase digital inequalities, perceived as "the difference between those for whom ICTs are an instrument of power and autonomy, and those for whom digital technologies mark a continuing lack of same" (Barney 2004, 161). ICTs often do not result in better community inclusion and may exacerbate internal tensions. To a certain degree, this is because communities are not homogenous. A community is a complex environment characterized by multiple and diverse goals, identities, structures and motivations (Haugh and Kitson 2007). For the purposes of this paper, community is defined by physical location and is jurisdictional (e.g., the state designates neighborhoods), although it is important to note that communities often are impacted more by exogenous factors than endogenous factors (Bhattacharyya 2004). Technology can advantage some community members while disadvantaging others.

Insufficient participation and local people's inability to leverage technical tools for political gain, can arise from a deficit of local skills. Historically, local community organizations and groups have lacked technical resources to realize benefits from new ICTs (Barndt 1998; Haklay et al. 2008). ICT initiatives require that developers integrate community development goals (e.g., self-help) and provide training to facilitate adequate participation and inclusionary discourse within communities (Steyaert 2000). For ICTs to serve community development, practitioners need skills to satisfy both fields (Stoecker 2005).

Crisis mapping advocates frequently invoke the word empowerment (e.g., Arney et al. 2014; Meier 2012b, 2013). When crisis mappers operationalize empowerment, they refer to outcomes like witnessing, storytelling, aid, as well as achieving cultural and social shifts (Meier 2012a; 2012b; Zaretsky 2014). However, empowerment, as a concept and when combined with participatory mapping, is fraught. It is both process and outcome, difficult to measure, subject to the scale of analysis (e.g., individual, community), amenable to appropriation and exploitation, and often not long-lasting (Corbett and Keller 2005). Corbett et al. (2016) return to the subject and report that not much has changed. Geoweb-enabled empowerment is frequently reduced to 'non-experts can now make maps' (i.e., digital mapping is no longer a top-down expert-driven process).

Empowerment may derive from new abilities to represent place. Elwood and Lesczynski (2013) argue that the SKP of the geoweb enables a kind of relational place-making, where individuals utilize emergent technologies to navigate among existing and new identities and connections in their communities. Pierce et al. (2010) refer to Massey (2005, 141) who sees places as bundles of space–time trajectories that connects place-making to two forms of networked politics:

> First, there are formal arenas (e.g. legislatures, parliaments, city councils) – what Amin and Thrift (2006) call 'big-P politics'. Second, informal interactions of all kinds can emerge in support of competing ideas and ideals. These 'small-p' or 'new' politics are often the key realm for contentious politics where power struggles are not specifically territorial or locally fixed. (Pierce et al. 2010, 57).

Elwood and Lesczynski (2013) contend that a geoweb-driven SKP focuses more on knowledge representations and less on traditional politics (e.g., participation in local governance). Therefore, geoweb-driven SKP complicates the connection between small-p and big-P traditional politics. Much of the SKP literature on the geoweb emphasizes the potential for the platforms to marshal large sectors of the unaffiliated general public across jurisdictional scales. These big data affordances are not fixed in specific locales (Brandusescu et al. 2015). This contrasts participatory mapping and public participation GIS, which held a traditional big-P politics frame and where participants' primary agenda for maps and spatial analyses to attempt to influence government (Sieber 2006; Sieber et al. 2016). While we might acknowledge the transjurisdictional promise of the geoweb, for community development, politics tend to be local.

Applying the concerns of community development problematizes a geoweb-enabled SKP that emphasizes individuated knowledge representations. Indeed, the narrative change envisaged by witnessing might very well dilute the importance of the efforts required for collective organizing and political power (McAlevey 2016). Even (Gabriel et al. 2008, 38) identified the need to tie witness to traditional political influence. Because of potential conflicts in the conceptualization of SKP of crisis mapping–whose knowledge and which politics–it is useful to examine it more closely in the context of community development.

Similarity of technical issues aside, crisis mapping applied to community development may play out

differently from crises in a significant temporal way. Community development, as a field, expresses crises that do not occur instantaneously but involve long term challenges. Non-acute crises can roll out as a type of "unequal power of spectacular and unspectacular time" (Nixon 2011, 6). Community development, as a practice and a set of organizations, is involved in the geoweb version of small-p politics (e.g., ad hoc mobilizations enabled by social media). However, community development stresses a conventional notion of politics where, for example, community residents advocate to city officials to prevent a park from being demolished or to federal workers to build more affordable housing (Shaw 2008). As much as these might be strengthened with relationship-building geosocial media campaigns, community development positions itself vis-à-vis the formal arena of the state. Civil society organizations have an established role in a participatory democracy, where for example community based organizations are viewed as legitimate representatives of the less powerful in their locales (Pateman 1970). In this traditional big-P politics positioning, community development can further neoliberalism, where government service provisions is delegated to the nonprofit sector (Cornwall 2008; Haugh and Kitson 2007). Goals like social capacity building and self-help, which are aided by the user-friendliness of the geoweb, have been critiqued as part of that neoliberal delegation (Shaw 2008; Mowbray 2011). The big-P is not absent in its own problems but diverges from the crowd-based "witness only" formulations of geoweb-driven SKP.

Methodology

Our goal was to understand the SKP of applying crisis mapping, which combines mapping and reporting, to community development. We worked with three communities in Canada, one Francophone and two Anglophone, and co-developed four apps. The organizations, with which we worked, expressed a need for an interactive visualization that showcase their community problems. Community organizers possessed prior social media and/or mapping (technical) capacity and had used the technologies in community organizing. Table 1 describes our cases, which varied by income, language, and specific community issue.

Our methods included developing the mapping app, acquiring the telecommunications hardware and rendering the reporting software interoperable, and finally observing and interacting with the communities.

Developing the mapping portion of the apps

For each case we developed a customized app based on the same software/hardware platforms. We explored various options for the mapping and for telecommunications software. For the latter, we chose software that allowed multiple mediums of communication, for example, for dumb and smartphone reporting and for web use. For the former, we chose the crisis mapping platform, Crowdmap, which is the less technical version of Ushahidi. Crowdmap does not require that developers (i.e., the nonprofits) install and host the app on their server. The developer also must possess coding expertise (i.e., in PHP) to build the app and handle any errors and system administration experience to manage the server. Crowdmap is a cloud-based service-as-a-software in which Ushahidi hosts the apps. Crowdmap still must be customized/modified for each app.

Acquiring software, hardware to develop the reporting portion of the apps

Separate telecommunications software is required to collect reports for the application. Implementation of a reporting system is further challenged by the diverse media by which participants could contribute content. First, participants could send messages as SMSs by using "dumb" mobile phones, Global System for Mobile Communications (GSM) modem and supporting software. Second, a smartphone app could be downloaded to send messages.[1] Third, an email message could be sent to the corresponding Crowdmap email address. Fourth, tweets with the hashtag(s) used for the Crowdmap page could be sent as messages. Fifth, they can post directly on the Crowdmap deployment website. We enabled all five methods so participants could use the technology message type with which they were most comfortable.

[1] The name of the crisis mapping software Ushahidi is shared with the smartphone app. There is only one smartphone app that is used for both Ushahidi and Crowdmap - Ushahidi.

Table 1 Case characteristics

Case	Location	Income	Home ownership	Immigrant pop as % of total.	Languages	Mandate	Admin structure	# of posts
Espaces Lachine	Lachine, QC	Low-income	42%	33% of 41, 625	French, English	-Long-standing with yearly objectives -Youth Education	Professionalized	29 (including both paper and digital posts)
Saine Alimentation	Lachine, QC	Low-income	42%	33% of 41, 625	French, English	-Long-standing with yearly objectives -Nutrition	Professionalized	27 (all SMS, sent by community professionals)
Acadia Park Spaces	Vancouver, BC	Temporarily poor (students)	0%	60% of 1592; 1/3 adults, 1/3 children, 1/3 other occupants (including grandparents, dependents 19 or over)	English, Mandarin, Spanish, Farsi	-Short duration created for threat of land-use change: from housing to commercial units	All-volunteer	61 (96 = includes posts with multiple categories) - SMS: 3 - Web/app: 57 - Email: 1 - Twitter: 0
Let the People Speak	Vancouver, BC	Middle income	34%	32% of 27,305	English, Mandarin	-Long-standing advocacy community based nonprofit	All-volunteer	Never launched

Not all messaging was directly from the contributor. In Lachine, for example, participants uncomfortable with digital contributions, could write messages on sticky notes and place them on a large paper map. Some messages were told to community organizers (e.g., when children were mapping) who wrote SMSs. All other contributions were made via SMSs and web reports. We focused on SMSs because smartphone and data plan penetration in Canada remains low (Statista 2016). We used FrontlineSMS, which is free and open source software, supported by numerous foundations and phone companies.

Observing and interacting with the communities

In these cases, we investigated SKP through participant observation. Participant observation constitutes "active looking, improving memory, informal interviewing, writing detailed field notes, and perhaps most importantly, patience" (DeWalt and DeWalt 2002, vii). A systematic review allowed us to standardize and compare across cases, even though cases varied in characteristics. Participant observation also demands establishing trust with organizations or individuals (Bernard 1994; Howell 1972). We had approximately ten meetings in Lachine with community organizers about the user interface of the app, brought along native francophones to assist with language-specific technical jargon, and solicited participant feedback. We spent two weeks in Acadia Park handing out flyers, translated by community members into the predominant local languages. We hosted a booth at the healthy food event Saine Alimentation at which we described the project. Overall, we spent six months with the Vancouver-based projects and one year with the Montreal-based projects.

Our research contained a co-design element. This is common in community informatics, where some members of the community may be "less equipped to formulate problems, but focus very much on providing solutions and answers" (Stewart and Claeys 2011, 104). We discussed the customization of the graphical user interface of each app with the groups' organizers. We developed several versions of Crowdmap apps, mockups, and prototypes based on comments from community town hall meetings. We also co-produced the dissemination tools, site design, bilingual storyboards (comics) to improve community understanding of the projects' objectives. We worked with community members to develop the apps. In Lachine we held a 'mapping and apping' workshop, where we encouraged the 20 young mothers to mark up printed maps with sticky notes or submit messages via the designated mobile number for the app. Beyond the actual contributions, we took notes of our observations and feedback (e.g., reaction to using the app, interactions between organizers and residents, email feedback on the project). We co-analysed the results by working with community members to categorize messages in terms of tone, theme, and political intent.

Results

We observed in real time, as four community development apps were developed and used. SKP emerged throughout an app's lifecycle. First, we observed SKP while co-developing and maintaining the system, including the differential skill requirements and the role of the external moderators in validating contributions. Second, we considered ways in which local citizens as sensors co-constituted SKP: what the residents/citizens chose to contribute online, which knowledge they valued, and how they aggregated content to construct place. Third, we examined the role of the app in traditional, big-P politics in light of competing geoweb efforts, community gatekeepers and collective action.

SKP of location/design in crisis mapping

We recruited organizations with the understanding that apps would be co-developed. The community organizers agreed that local knowledge and organizational capacity would be incorporated into the app. Those individuals possessed deep knowledge of youth group coordination, professional expertise in community event management, long-lived experience with local issues, and connections with fellow community members. What groups did not necessarily possess was computer expertise to maintain the system. Nor was the software necessarily amenable to the leveraging potential of SKP.

Community organizers in Lachine were determined to assume responsibility of the entire technical process. They quickly found the high skill level required for technical management and the needed allocation of time daunting. Acadia Park organizer

asked us to administer the site during its usage because she saw learning a new platform as hard, given limited volunteer time: "I'm not technical. Others may have phones, but I don't even have a cellphone" (personal communication with the first author). Both Lachine and Acadia Park encountered technical administration problems similar to adoption of other ICTs by community organizations. To acquire skills requisite for app development, organizations likely would have to shift from knowledge of community development theory and practices to skills necessary to maintain this new platform. These shifts also appeared to displace existing GIS knowledge since map-based app maintenance increasingly looks quite different from the data handling and spatial analysis found in GIS. Maintaining Crowdmap requires system administration such as upgrading to new versions, resolving interoperability issues, managing user data, and monitoring site performance. Crisis mapping also requires hardware knowledge, which relied on considerable knowledge from us (e.g., knowing people in Europe to purchase GSM modems that were unavailable in North America, and finding experts to unlock modems), knowledge that was lacking within the organization. The crisis mapping rhetoric assumes that its users will find someone to develop and manage the app (Brandusescu et al. 2015). Even when the community possesses app development knowledge, there is a distancing between the technical and non-technical staff in any innovation (Rogers 2003; Elwood and Ghose 2004). One needs to ensure technically skilled personnel are infused with community development expertise (Stoecker 2005).

Because of anticipated difficulties in developing the app, the authors made a deliberate decision to deploy the easier-to-use Crowdmap over the more customizable Ushahidi. Even Crowdmap proved too difficult. The Lachine organizers found the lack of app customizability frustrating. Organizers wanted to change the page tabs from 'Reports' and 'Get Alerts' to 'Messages' and 'Get Messages' but much of the Crowdmap interface cannot be modified. Similarly, Acadia Park organizers wished to be prescriptive about the page tabs to maintain a positive message, which rendered the presence of the 'Get Alerts' tab further problematic as organizers wanted to showcase a happy and safe neighborhood.

An advantage of the geoweb is that data is more unstructured and thus more natural. Contributors in our projects did not articulate where they lived in terms of x, y coordinates but described place in familiar and colloquial ways. However, the app imposed a logic of representation, where location (an x, y) was privileged over place. Conveying what is meant by "actual location" that can be converted into an x, y was challenging to us (and to community organizers) in places of deep colloquial knowledge. Even the "[founder of] FrontlineSMS acknowledges that, 'top-down' activist projects often lack the deeper, bottom-up understanding of the 'local landscape – not just its geography, but also the language, culture, and daily challenges of the people'" (McDonald in Palmer 2014, 352). The geoweb was supposed to privilege a more nuanced representation of place but the crisis map forced us to place a pushpin (or a series of x,y's).

Despite the implication that geocoding is automatic in Ushahidi software, geolocation is automatic only when a smartphone app is used with its location setting enabled. A moderator must parse the location from the content in, for example, SMS or emails. We were assisted by community organizers but we largely functioned as the moderators who verified (classified and geocoded messages and excised any personal identifiable information) and then approved reports, which would display on the app. We received SMSs describing the weather of place or a sculpture in a (unnamed) park. SMS content like 'I love picnics at the park' could not be geocoded because there are several parks in Lachine. Contributions like 'the best food is at home' were also problematic because of privacy concerns. The French phrase for home contains identifying features (e.g., Chez Tremblay), which required us to make decisions about which content exposed privacy.

Our own role in validating the data created a process by which outsider politics (i.e., our notions of what was important) was inserted into the collective knowledge of the app (Elwood and Lesczynski 2013). Our research matches the distantantiation in crisis mapping and numerous community ICT projects, even though we were on-the-ground receiving SMSs. For example, 'Je participe à des activités culinaires dans La Caserne' ('I take part in cooking activities at The Barracks') presented difficulties for us in attaching a location because the activity was inside a building. Our argument here is that a remote mapper need not be physically distant to be disassociated from community SKP. For us, the app administrator functioned as a

"remote mapper", who arrived in the community, but lacked on-the-ground knowledge of the culture and community ties to easily geocode contributions. Instead of "resituating expertise", as promised by crisis mapping (Elwood and Leszczynski 2013; Burns 2014), skills and control remained with the expert. Indeed, crisis mapping is creating new experts, which continue to preclude individuals on the ground.

Crisis mapping is extolled in part because presumably "anyone" can publish. We instituted several communication media for contributing because we observed that not anyone could contribute easily or at all. Elwood and Lesczynski (2013, 551) critique the geoweb-based rhetoric that if anyone can do it, this presumes that everyone has already done it. The ease-of-use rhetoric also assumes there is no non-representation. Crisis mapping excludes innumerable people who cannot participate, whether because of digital inequities, lack of awareness or fear of reprisals. Our findings affirm a long-standing challenge in using ICTs for community development. ICTs are invariably attached to a liberation discourse (Diamond 2010) in which technologies ignite a disruption of existing power structures and an expansion of participation. However, even a platform advertized as easy-to-use and simple to embed content, like Google Earth, may be too challenging to use (Corbett 2014).

Citizens as sensors co-constituting spatial knowledge

Citizen sensing forms an essential component of SKP because supposedly non-experts can leverage the platforms, apps and data to amplify their local knowledge. Types of citizen contributions varied by tone, theme and political intent. Community organizers wanted to base one of Lachine's apps on access to healthy food in their community. Poor areas are known to suffer food insecurities and food deserts (Story et al. 2008). Youth sent text messages about healthy food places near their schools, playgrounds and homes. Twenty-seven reports were collected based on a set of five food-related questions. Figure 1 shows participants attesting to the community's health and food-related assets.

Acadia Park residents wanted an app that supported their protest against the University of British Columbia (UBC), which planned to redevelop the land occupied by student housing for market-priced condominiums. The community organizers expressed the potential for the app to highlight particular assets of their community, for example, a measure of the "greenness" of their neighborhood. The app was used to feature what would be lost, like the playground, which was recognized as a social space, a play space,

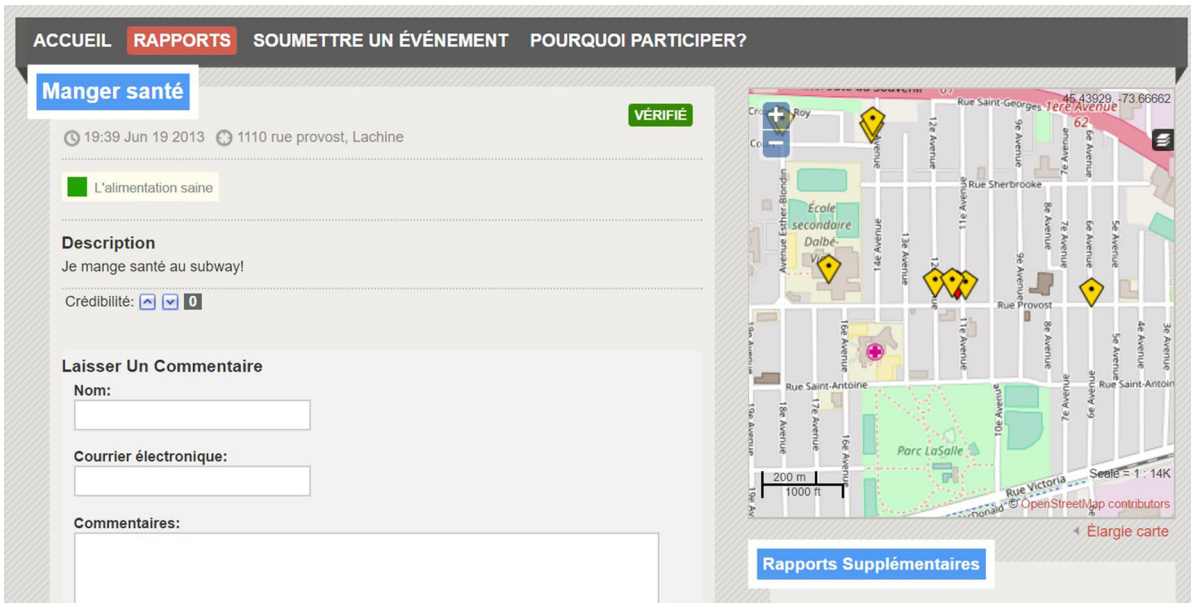

Fig. 1 A message (*red* place mark on map) submitted to *Saine Alimentation de Lachine*, on the healthiness of food. The *yellow* placemarks represent other submitted messages

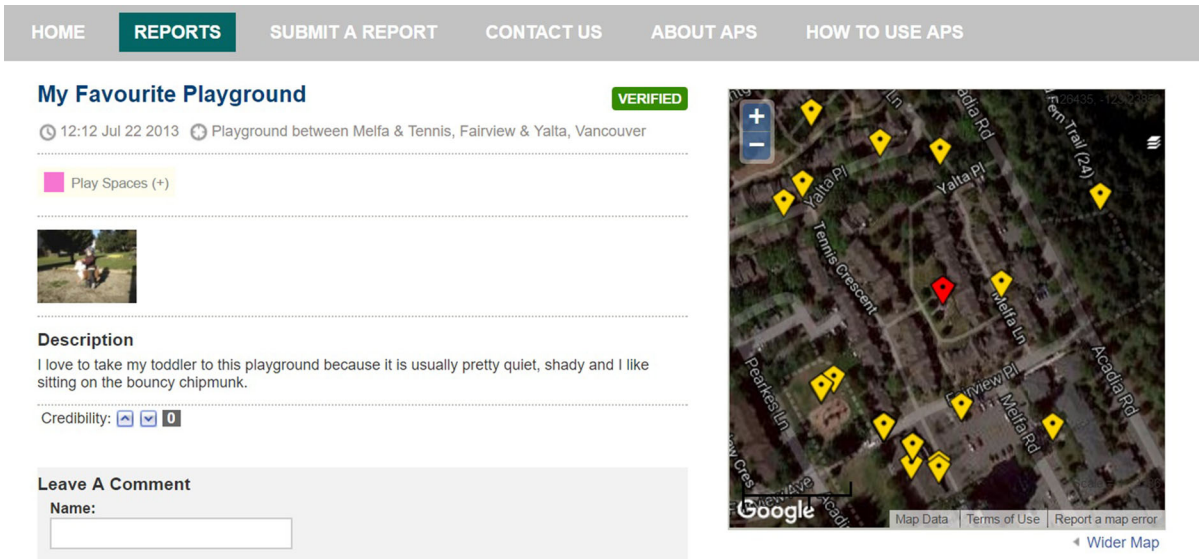

Fig. 2 A message submitted (*red* place mark on map) to Acadia Park Spaces, on community play spaces for children. The yellow placemarks represent other submitted messages

and a common ground for different cultures to meet. Residents reported that, even though enclaves existed within each culture and ethnicity, children playing together would break the barriers between micro communities. Residents also used the app to communicate with each other by commenting on each other's messages. Initial contributions and subsequent app-based conversations facilitated reflection on place (Fig. 2).

Massey spoke of "individual experiences of place-making contribut[ing] to the construction of a global sense of place" (Massey in Pierce et al. 2010, 58). For Acadia Park residents, crisis mapping was used to highlight the legacy of the community. The interactive map serves as a 'memory tool of loss' where community members could recall what they loved about the place. This exemplifies the space–time bundle, where members tried to capture a moment amid the impact that UBC's land use decision would have on the future of the community.

> Now that the courts are in the final stages of decommissioning, there are no playgrounds on the south end of Acadia Park for families to access. I realize it is not a long walk to the commonsblock, but it would be great to have access to even a small playground right outside our apartment building, especially since we are higher density and don't necessarily have ground access like the fortunate families living on the north side of the neighborhood (message submitted to Acadia Park Spaces, August, 2013).

The Grandview-Woodland app centred on the impacts of imminent rezoning. The first author built the app and seeded it with comments made during a community meeting for the City of Vancouver's community draft plan. Comments included attendees' concerns about rent increases or densification, relocation problems, and decreases of green spaces. The app was never deployed. A Grandview-Woodland respondent disliked the anonymity afforded by Crowdmap, which could be one reason for the lack of deployment. A lack of anonymity held risks because residents "might fail to accept responsibility for their posts/contributions" (personal communication with the first author, 2013). That same respondent expressed concern about the challenge of assessing the authenticity of the contributors when one did not their motivations. Contributors might actually be city employees or extra-jurisdictional actors (perhaps those from already dense areas). In crisis mapping and, manifest on the software platforms, the anonymity of contributions is considered an asset. How does a community member negotiate new relationships when they do not know to whom they are talking?

Grandview-Woodland also voiced concern over whether app contributions could capture community

sentiment. "Your project – just like the city planners who have dumped their draft Community Plan [see below] on us – concentrates on individual sites and spaces. There is apparently no appreciation of the neighborhood as holistic which, to us, is significantly more important than any particular site" (personal communication with the first author, 2013). A respondent argued that community articulated here was greater than 160 characters, x, y points, and locations. A mapping app may articulate the language of the crowd, but still not be holistic. Palmer (2014) argues that the technology (or the platform host) itself may be complicit. Equipping users with a technology may appear to empower them to represent their knowledge on a map. Yet, the crisis mapping platform can restrict the knowledge displayed because local spatial content is often unique, heterogeneous and non-quantifiable.

Contributions to the app expose a dynamic tension in community development, with resulting compressions and expansions of the bundles of space–time. In crisis mapping, space expands, because remote mappers from all over the world can engage in the crisis, but time compresses due to the acuteness of the emergency response. Compressions and expansions work in reverse in community development. The jurisdictional space is small–indeed, residents may not want outsiders contributing to the app–but the time horizon encompasses the slow moving and structural issues extant in the community (e.g., poverty, displacement, and discrimination). For example,

> Acadia Park could easily support higher density and still be a vibrant, safe community if we all get the chance to really work with UBC in developing these plans…BUT…it still bugs me that rich people can live in mansions with sprawling lawns and boulevards and no one tells them that they need high risers (message submitted to Acadia Park Spaces, July, 2013).

As noted in (Brandusescu et al. 2015, 628), "Crises in communities are often chronic and are ongoing, and the role of community development research is to bring awareness and encourage processes that can alleviate protracted historical processes." Crisis mapping contributions therefore can be conducive to knowledge-making in space–time bundles, although a lack of acute urgency can limit the number of contributions submitted.

P in SKP as political influence

Crisis mapping in our cases was used less to navigate intra-community relationships via the geoweb and more as a tool to assist in influencing government. In numerous instances, the big-P politics was as important or superseded the small-p in terms of the app's importance. This is partly a function of case selection, but it also relates to the raison d'etre of many community based organizations, which centers around issues of political power (or lack thereof).

Acadia Park saw their mapping app as a complement to their existing political efforts, which aimed to protest the UBC Board of Governors' decision to reduce student family housing by half. Residents also used crisis mapping to advocate for an alternative to the university's planning of their remaining living area.

> What if the line were re-drawn on the Land Use Plan, so that the new student housing neighborhood were beside the daycares and what will be left of the forest after Block F turns into a giant condo development? If we were on the back end of Acadia Rd/Osoyoos Crescent, it would be quieter, more contained, we could keep the stands of forest to buffer from other neighborhoods? The style of the neighborhood could be laneway housing with cars on perimeter or underground…(message submitted to Acadia Park Spaces, August, 2013).

Grandview-Woodland likewise regarded social media tools as instruments of political influence and saw mapping as an extension of that power. However, organizers were skeptical of the community's ability to wrest political power from municipal control. They viewed the zoning map as an extension of the city's power because it represented new zoning goals for the city, rather than the goals of the residents. The organization was contesting the city's rezoning efforts to "densify" existing residential land, which would increase commercial development and replace existing affordable housing with mixed use, more expensive housing. Vancouver is considered the third least affordable housing market in the world and, as a result of relaxed immigration policies for wealthy individuals, has experienced an influx of millionaire migration that has raised housing prices by 40 percent

Fig. 3 The City of Vancouver (2013) Grandview-Woodland community draft plan map that was presented at a community town hall meeting

(Talmazan 2016; Ley 2010).[2] Figure 3 shows the map produced by the city to indicate proposed rezoning changes. The rezoning map became the centerpiece to explain the plans the city had for the neighborhood and solicit feedback on the draft proposal.

According to one respondent, the city's mapping process, which contained technical components similar to the app, had been co-opted by state/officials. The city's process was viewed as a way to "inform" but not engage community members in the redevelopment plans. The City of Vancouver used its rezoning map as a geovisual framing "to structure user experience of and interaction with information from and about an organisation and its activities" (Elwood and Leszczynski 2013, 552). Residents distanced themselves from the community draft plan because they could not see their knowledge represented on the maps. Comments such as "This is our neighborhood. Not that yellow line" and "The purple area is an anomaly", were expressed during a community town hall meeting. At that same town hall meeting, the city planner frequently apologized for using the map, "Sorry guys, I'm going to have to use my map [Fig. 3] again." This evokes a long-standing problem where maps are used as instruments of state knowledge and invocations of state power (Harley 1988). The city, as the originator of collaborative mapping project, acted both as a framer and authenticator of spatial knowledge. That is, the city functioned as a mapping gatekeeper (Rambaldi 2005), constraining the venue and the map legend and moderating the online discussion forum.

This meeting centred on whose knowledge became legitimized, which influenced the community based organization's decision not to deploy the app. We were asked several times by one respondent how the app differed in any way from the City's map. We explained to the respondent that app contributions (messages) required intervention via the moderator (the researcher, an outsider). The way Crowdmap organizes reports resembled the segmenting of feedback sought by the city (Fig. 4). Being critical geographers, we found it hard to disagree, even though we invested time in prototyping the app. We were reminded of how exogenously introduced participatory mapping, however initially welcomed, can run afoul of existing community activities and historical context (Kyem 2004). If community members have been "burned" by collaborative mapping efforts then they may be far less inclined to use mapping, even as it is promoted as newly empowering.

We also observed how crisis mapping could potentially displace the role of traditional community gatekeepers and therefore be perceived as a threat to the ability to distil a community's knowledge, control the source and message of that knowledge, and disseminate information back to the community and to the city. In our cases, gatekeepers functioned as

[2] Millionaire influence in the housing market is so severe that provincial and federal changes now prohibit these practices (Nelms 2017).

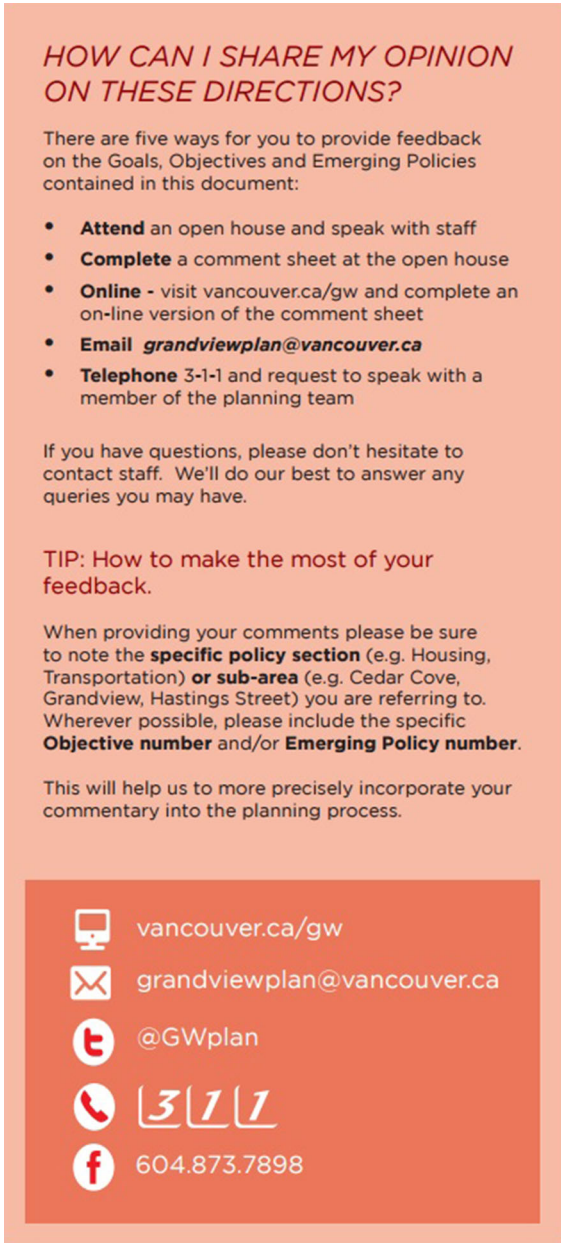

Fig. 4 Image from the City of Vancouver (2013) Grandview-Woodland community draft plan requesting citizen input. Note its similarities to the tabs of Crowdmap

intermediaries who attained decision making authority in the community. For example, Grandview-Woodland was worried that the app would allow the City to receive the "wrong" message from uncommitted community members who were untroubled by densification. Reliance on gatekeepers can exclude voices who disagree with community activists. Crisis mapping could be seen as a remedy to that control, where new voices can contribute. Digital tools can aid in the displacement but they are not essential. The City of Vancouver eventually decided to displace existing community organizers and create a citizens' assembly, composed of randomly selected volunteers who evaluated the Grandview-Woodland Community Plan (Citizens' Assembly on the Grandview-Woodland Community Plan 2015).

The geoweb offers a new form of collectivity: situational aggregations of individuals as opposed to pre-assembled organizations (Sieber and Haklay 2015). Use of emergent technologies "tends to be driven by specific passions, not by broader adherence to political movements or philosophies…[which] cuts across traditional party lines and creates new and unusual coalitions" (Zuckerman 2014, 157). The problem with these tools is the lack of a single well-crafted voice, particularly among individuals assembling with little common purpose other than perhaps frustration (Tufekci 2014). Contributions of thousands of residents may address a crisis in civics, which is low participation rates, but the volume represents a huge signal to noise problem in crisis mapping. There also is a temporal component where the ephemera implied by a space–time bundle–the flash mob–may lack persistence to create long-lasting effects. The cost is a loss of consensus-driven agreement that is the hallmark of the community organization acting as a gatekeeper (Burns et al. 2004). Instead we may experience "a pointillist public sphere where it's easy to pay attention to the small range of topics you and your friends are interested in, but where it requires a great deal of work and conscious effort to see the bigger picture" (Zuckerman 2014, 165). A gatekeeper, whether individual or group, functions in online spaces as a lens to amplify the signal. Without a gatekeeper, the narrative cannot be shaped in advance and the agenda-setting cannot be managed. The technology allows the contributors to be divided and "conquered." Moreover, organizational sustainability might effectively be traded for immediacy and transparency needs, that is for the satisfaction of the contributor (Tufekci 2017).

Our research also found interactions of big-P traditional politics and small-p politics of relationships within and beyond the community. In Grandview-Woodland, an elderly woman was able to live alone because she was assisted by reliable neighbors. The

city–the traditional politics–had proposed no strategies to preserve existing social networks or sufficient affordable housing. More broadly, neighborhood restructuring would destabilize the safety net of housing-related subsidy permits (e.g., disability, welfare, and pension). In the case of Acadia Park, residents existed within a contradiction of place. Their landlord, UBC, needed to offer affordable student housing but also could exploit Vancouver's lucrative housing market. The latter would negatively impact social connections built among residents within the community. The app allowed Acadia Park residents to bear witness to place but the app accomplished little more in terms of political influence than a memorial to another time. The above examples illustrate small p in community development. Compared to its community development application, crisis mapping struggles to include any small-p politics, unless it refers to the social networks established among remote and local mappers, where the latter are not necessarily embedded in existing community development efforts.

Conclusion

Crisis mappers claim that anyone can use their technologies. This rhetoric speaks to affordances of new technologies in response to urgent situations: the speed and lowered cost of response in the deployment by developers and use by the impacted. More importantly, crisis mapping speaks to new ways that SKP is produced. Crisis mapping promises a kind of community witnessing, a role for remote non-experts, and new forms of legitimation. We examined crisis mapping's repurposability for community development in the global north, its impact on spatial knowledge, and its invocation of SKP.

We considered SKP throughout the lifecycle of its promises and use. The geoweb may lower the barrier to entry, but apparently only if one is an end user. Barriers may not be lowered significantly for the end user, considering the requirements needed for contributing. Unstructured spatial knowledge may provide more avenues for presenting information to politicians, yet someone has to structure that data. Like many ICTs, crisis mapping shifts whose knowledge is privileged during app development and maintenance. The shift can occur despite the rhetoric of simplicity of operations or the recognized necessity of community development expertise. Geocoding introduces the politics of moderators, who interject their own interpretation as to the locations of contributions. This set of findings does not distinguish community development from crisis mapping but serves to highlight the loss of local agency. Findings suggest that, even in community development, the need for a "remote mapper" persists. Additionally the software imposes its own logic on place. We commented on user interfaces and character length, but the impact of the technological ecosystem (e.g., Ushahidi, FrontlineSMS, telecommunications companies) on crisis mapping warrants greater investigation.

We observed a variety of contributions as citizens sensed their community, from crises, to positive assertions of place, to poignant remembrances. For example, citizens affirmed their feelings by commenting on each other's contributions. We found that some community members were concerned about the app's ability to adequately capture resident expressions and the community writ-large. This suggests the limits to crisis mapping as a medium for social relations.

Lastly, crisis mapping was used as a complement to influence traditional politics. We found SKP linked to big-P politics as much as or more than small-p politics. This was because community organizations wanted tools to advocate for political change. These tools were not unproblematic. Our research revealed tensions in tool-enabled SKP as witness (remembering a place) versus political influence (fighting to keep a place). The tools enabled a displacement of gatekeepers, who ordinarily address the signal-to-noise problem. We may need to shift our thinking from citizen efforts to existing organizations that already possess norms, structures, and gatekeepers. Indeed we wonder if we should legitimize individualized tools (either through critique or participant observation), which may occur at the cost of envisioning collective technologies.

Compliance with ethical standards

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Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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