Institution: University College London

Unit of Assessment: 14 – Civil and Construction Engineering

Title of case study: Participatory GIS in action: new social enterprise Mapping for Change

1. Summary of the impact

The social enterprise Mapping for Change (MfC) was established to make use of participatory mapping knowledge and software created through research at UCL. Since 2009, MfC has secured more than 20 contracts worth in excess of £435,000, and has delivered over 30 projects in many communities, directly engaging more than 5,000 people and reaching far more online and indirectly. Its projects have increased community engagement in the local environment, led to new environmental monitoring by local authorities and stimulated policy debate about noise and air pollution.

2. Underpinning research

Participatory geographic information systems (GIS) uses geographic information technologies to work with communities to solve the problems that they face – from neighbourhood management to monitoring air pollution. Since joining UCL's Department of Geomatic Engineering in 2001, Professor Muki Haklay (Professor of Geographical Information Science) has researched the methodologies and technologies of participatory GIS, including usability engineering aspects (e.g. [5]). From 2007 onwards, he extended his work to the area of citizen science, in which lay participants collect and analyse data using scientific methodologies and tools [1,2]. Moreover, he has since become recognised as an international research leader in these areas.

During 2007-2008, Haklay (as PI) obtained funding from HEFCE through HEIF 3 for the 'Mapping Change for Sustainable Communities' (MCSC) project, supported by Dr Claire Ellul (then a post-doctoral researcher, now a lecturer at UCL). As part of the MCSC project, Ellul developed the software infrastructure for a unique web-based system allowing the rapid creation and adaptation of community maps [1, 4], with a focus on extensibility, reliability, generality, anticipation of change and growth. UCL's research included the development of a web-based collaborative mapping system, using usability engineering and human-computer interaction (HCI) research to ensure that the system is trusted and usable to people with limited literacy, and the development of new methods for community engagement through mapping [e.g. 3].

UCL's framework and software development was undertaken hand in hand with research into the practicalities of how to use a structured process to work with communities in conducting both on- and offline community mapping. The research included carrying out targeted activities with different groups in London. The projects were initially developed by Haklay through his own research, often in collaboration with community organisations such as Planning Aid for London or London Sustainability Exchange, and continued as a fundamental part of MCSC [2, 4]. The insights yielded by this research resulted in the development by Haklay and researchers at the charity London 21 Sustainability Network, from 2008 onward, of a series of toolkits for use by community organisations, non-governmental organisations and interested individuals, including two for general community mapping and one for noise mapping.

Further research conducted by Haklay, Ellul and their research team since 2007 has looked at appropriate methods for participant recruitment in different contexts (for example, in EU FP7 EveryAware project), and the extent to which community groups and individuals within those groups, once recruited, will contribute to mapping and citizen science projects and maintain their contribution over time. The research provides insight into the success of online recruitment techniques when compared to offline ones [2]. The outcomes of combining high- and low-tech approaches have also been investigated; current projects combine paper mapping and paper forms, sketches and post-it notes with noise meters, diffusion tubes and wipes for air pollution, mobile noise apps and online mapping. The mix of technologies and approaches extends concepts of participatory GIS developed by Haklay from a level where users are just given data to a level where they are involved in the overall system and experiment design, protocol development and results analysis – that is, towards fully collaborative science.

The underlying computer code for the mapping application and the knowledge of how to integrate the application's use during participatory processes are based on the research described above. They integrate lessons in the area of geospatial web (geoweb) technologies, usability and human-computer interaction of GIS studies, community engagement and public access to environmental information. Since 2009, the software and processes have benefited from dual development through requirements and lessons within UCL research projects such as EPSRC Adaptable Suburbs, and through needs emerging from MfC activities. The same underlying system is made available for research and practice, fast-tracking knowledge transfer between the two.

3. References to the research

References 1, 4 and 5 best indicate the quality of the research.

1. Ellul, C., Francis, L. and Haklay, M., 2011, *A Flexible Database-Centric Platform for Citizen Science Data Capture*, Computing for Citizen Science Workshop, in Proceedings of the 2011 Seventh IEEE International Conference on eScience (eScience 2011) http://doi.org/fx2dsv
2. Ellul C., Francis L., and Haklay M., 2011, "Engaging with local communities: A review of three years of community mapping", in: Zlatanova S, Ledoux H, Fendel E, Rumor M, *Urban and Regional Data Management*, Taylor and Francis ISBN 9780415674911. Available on request.
3. Liu, Y., Ellul, C., and Haklay, M., 2010, *Planning Alerts for Community Maps*, Geographical Information Science Research – UK (GISRUK 2010), UCL, UK, 14-16 April. (Abstract peer reviewed). http://discovery.ucl.ac.uk/19284/1/19284.pdf
4. Ellul, C., Haklay, M. Francis, L. and Rahemtulla, H., 2009, *A Mechanism to Create Community Maps for Non-Technical users*, The International Conference on Advanced Geographic Information Systems & Web Services – GEOWS 2009, Cancun, Mexico, 1-7 February. (Peer reviewed) http://doi.org/d26gcz
5. Haklay, M., and Tobón, C., 2003, Usability Evaluation and PPGIS: Towards a User-Centred Approach, *International Journal of Geographical Information Science (IJGIS)*, **17**(6), 577-592 http://doi.org/fmtkxx
6. Harrison, C.M., and Haklay, M., 2002, The Potential for Public Participation GIS in UK Environmental Planning: Appraisals by Active Publics, *International Journal of Environmental Planning and Management (JEPM)*, **45**(6), 841-863 http://doi.org/ddppvd

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4. Details of the impact

Between 2000 and 2008, Prof Haklay provided consultancy and pro-bono advice to third-sector organisations that used participatory mapping methods, such as London 21 Sustainability Network and London Sustainability Exchange, which indicated the market need for participatory mapping services. Thus, in 2009, Haklay and partners from the London 21 Sustainability Network established a social enterprise, Mapping for Change (MfC) [a]. MfC projects **help communities use mapping and geographical technologies** to collect, analyse and display information about their life and environment, and then **develop action plans** on the basis of it. Projects are developed through a process of co-design with the participants themselves, and examples of these projects are given below. Any profit is reinvested in the company to provide further support to communities and groups that require help.

Mapping for Change currently has the equivalent of three full-time staff, with an additional two consultants employed on an ad-hoc basis. Since 2009, MfC has secured **more than 20 contracts worth over £435,000** and support from public, private and third sector organisations across Europe. It has delivered more than 30 projects in many communities, **directly engaging over 5,000 people and reaching far more online and indirectly** [b]. The website has registered around 2,000 users, with some 3,000 additional users carried forward from London 21. Users do not need to be registered to use the maps, but can register to add data. Google Analytics shows that in the 12 months to 30 June 2013 almost 15,000 people visited the site, which had more than 30,000 page views. Visitor numbers of 16,800 were recorded the preceding year, growing from 8,200 in the corresponding period for 2010-2011 and 3,400 for 2009-2010. In the last year, 50% of visitors came from the UK, with others from countries including Poland and Spain (where MfC has

major projects running), the US, Mexico, France, Turkey, India and Germany. Almost 4,200 visitors visited the site more than twice in the last year. Clients include leading charities such as the British Trust for Conservation Volunteers, the Department of Energy and Climate Change, and international clients such as the Northern Alliance for Sustainability (ANPED).

Mapping for Change holds 198 themed map layers containing more than 15,000 points of community-sourced data, with each layer designed by the relevant community group themselves. The layers are grouped into around 60 mini-sites, which are maps for individual communities. Mini-sites can be hyper-local (focusing on a neighbourhood), regional, national or international. MfC prioritises engaging local communities and ensuring that its projects are inclusive, and this system and the way it is used allows community groups to be fully involved in the design of their maps from the outset of any project.

Noise pollution and air quality on the Pepys Estate, London (January 2008 – Ongoing): The Pepys Estate in Deptford, London, suffered noise pollution from a local scrapyard. In 2008, residents used noise meters supplied by MfC and were involved in the development of a measurement protocol that was both scientifically sound and practical to implement. Between January and February 2008, they took more than 1,500 noise measurements throughout the day and night to develop their own 'noise maps' [c]. As a result, the **Environment Agency appointed an acoustic consultant to carry out a detailed analysis of noise** in and from the scrapyard, which led to the scrapyard's licence being revoked [d]. Lewis Herlitz, Director of the Pepys Community Forum, said: "The Noise Mapping work is a major breakthrough for residents. It allowed them to **develop an evidence base about how noise damages their quality of life**. It shows that their long-standing concerns are real and need to be acted on. It provides an opportunity for **greater community engagement** around monitoring and speaking up for an improved environment. There is no going back" [e].

In 2011, residents wanted to assess the estate's air quality. Diffusion tubes (commonly used to measure nitrogen dioxide) were placed around the area, and wipe samples taken to assess the quantity and type of metals being deposited on vertical surfaces. Ozone levels were measured and leaf samples collected. As a result of the mapping survey, the **local authority (Lewisham) has installed diffusion tubes at the main junctions identified by the project** as having higher levels of NO_2. They also installed a PM10 monitoring station in the neighbourhood to monitor the local situation [f]. Previously, the closest fixed monitoring station was just over a kilometre away.

Local council policy changes, Barking 2008: Working alongside the neighbourhood management team in Marks Gate, Barking and Dagenham, Mapping for Change led the development of a local action plan from the results of 130 individual maps of local perceptions in 2008 created by local residents. The neighbourhood management team used the participatory process to identify the issues of most concern to the residents and then act on them in collaboration with a range of local stakeholders, including the police and local authority. These included a community group organising for a **previously dirty lake to be cleaned four times a year**, with the **council parks' service allocating a budget** for the clean up; the mapping team acted as a link between community groups and council departments, with the result that the **library is now open three extra days a week** and its issue figures have doubled; local **street pastors use the map to identify and target anti-social behaviour hotspots**; and information about crimes reported to the mapping team that were not reported to police have been passed on, **helping the police develop a more accurate picture of local crime and antisocial behaviour** [g].

Royal Docks Noise Mapping (2009-2011): Concerned about increasing levels of noise from London's City Airport, residents in London's Royal Docks carried out **noise mapping for use in a campaign against plans to expand the airport's operations**. Working in partnership with local campaign group Fight the Flights, MfC provided noise meters and worked with residents to develop a protocol for noise measurement. This was used during normal flight operations and, due to the on-going relationship between MfC and the community, during the eruption of the Icelandic volcano that grounded all flights in April 2010. Noise levels rose to the 60-decibel range on only three occasions during the no-flight period, whereas during normal flight operations highs of 87 decibels

were recorded with just under a third of all readings exceeding 60 decibels. These efforts, and the **noise mapping activities, gained coverage in** The Evening Standard, bringing this important issue to the attention of a broader public audience across the city [h]**.** One of the participants reported feeling that "the Royal Docks mapping project brought residents together and gave them **confidence to call for changes in their community**" [i].

Heathrow Airport Noise Mapping (2011-ongoing): Mapping for Change is working in partnership with HACAN (Heathrow Association for the Control of Aircraft Noise) and the EU-funded EveryAware project to map noise issues around the airport. **Mobile phone software developed by MfC provides a low-cost, widely available noise monitoring tool.** More than 250 people in the Heathrow area are contributing data to the noise map. Following MfC's work with HACAN, in 2013 the **Royal Borough of Windsor and Maidenhead initiated a large-scale citizen-driven noise-monitoring project** using the WideNoise App [j]. Importantly, the project also highlighted the importance of the MfC approach to citizen science – where projects are co-designed with the participants. Indeed, due to this process participants showed a full understanding of the limitations of the tool, stating that: "It will never stand up in court to the levels taken by professional microphones, but is great for the general awareness of the level" [k].

Air quality mapping around London (2011-ongoing): In 2011, MfC used diffusion tubes to measure nitrogen dioxide levels at seven locations around London, with participants recruited through social media. The results showed that along main road networks NO_2 levels were as much as 75% above EU guidelines; it also highlighted issues in several residential back roads used as rat-runs. In Putney, concerns raised by the Putney Society about air quality were successful in leveraging political support to lobby for change, leading **Transport for London to introduce to the area in 2012 new buses that comply with higher emission standards** [l] [m]. In Highbury, Jenny Jones, the Green Party mayoral candidate, held a meeting with 40 residents to discuss air quality. She said the mapping results were "terrifying" but that the turnout had brought her hope and she recognised that the issue was obviously important for local communities [n]. MfC has **partnered with other London organisations to call for action on air pollution** [o] and has hosted an Air Pollution conference attended by around 120 participants from local government and community groups in April 2013 [p], leading to the development of further action on air pollution by community groups and local authorities, such as community air quality monitoring in the Barbican in collaboration with the City of London which will start in the autumn of 2013.

5. Sources to corroborate the impact

[a] Mapping for Change community maps: http://communitymaps.org.uk/
[b] For corroboration of Mapping for Change's projects, contracts and employees, contact the managing director at MfC. Contact details provided separately.
[c] Mapping Change for Sustainable Communities: Pepys Estate: http://youtu.be/17hR_YfrK-I
[d] Corroboration of Environment Agency revocation of scrapyard licence: http://bit.ly/19SIHCI
[e] Lewis Herlitz quote: http://www.london21.org/borough/news/show/25/1501/
[f] 2011 Air Quality Progress Report for London Borough of Lewisham, p.48: http://bit.ly/1g01brh
[g] Evidence of practical outcomes of mapping community perceptions in Marks Gate: http://youtu.be/P2m8Hge4UBE
[h] Coverage of noise mapping in the Evening Standard, 20/11/10: http://bit.ly/18nroKW
[i] Quote from Royal Docks project participant: http://bit.ly/GzHpoy
[j] Royal Borough of Windsor and Maidenhead's noise-monitoring project: http://www.rbwm.gov.uk/public/eh_davies_commission.pdf
[k] Quote from Heathrow mapping project participant, page 64: http://bit.ly/1altqfY
[l] Early plans of Putney residents after measuring pollution levels, including urging council to introduce low-emission buses: http://bit.ly/15zZUoB
[m] Corroborates Putney Society involvement in MfC project and that TfL will make Putney priority for greener transport methods: http://bit.ly/193NtlH
[n] Quote from Jenny Jones: http://bit.ly/18VxjVF
[o] London Mayor candidates called on to pledge to ease air pollution (including MfC): http://bit.ly/18T9js7
[p] Proceedings at the London air quality conference: http://bit.ly/18w7w8z