A Qualitative Enquiry into OpenStreetMap Making

Yu-Wei Lin

School of Media, Music and Performance, University of Salford, UK

y.lin @ salford.ac.uk

Abstract

Based on a case study on the OpenStreetMap community, this paper provides a contextual and embodied understanding of the user-led, user-participatory and user-generated produsage phenomenon. It employs Grounded Theory, Social Worlds Theory, and qualitative methods to explore the produsage processes of *OpenStreetMap* making, and how knowledge artefacts such as maps can be collectively and collaboratively produced by a community of people, who are situated in different places around the world but engage with the same repertoire of mapping practices. The empirical data illustrate that *OpenStreetMap* itself acts as a boundary object that enables actors from different social worlds to co-produce the Map through interacting with each other and negotiating the meanings of mapping, the mapping data and the Map itself. The discourses also show that unlike traditional maps that black-box cartographic knowledge and offer a single dominant perspective of cities or places, OpenStreetMap is an embodied epistemic object that embraces different world views. The paper also explores how contributors build their identities as an *OpenStreetMaper* alongside some other identities they have. Understanding the identity-building process helps understand mapping as an embodied activity with emotional, cognitive and social repertoires.

Keywords: OpenStreetMap; produsage; user-participatory culture; user-generated content; qualitative research; open source; cartography; mapping;

1. Introduction

Innovation that draws on diverse resources in a distributed (and often virtual) environment to advance Open Technologies (referring to both technological artefacts and technology-enhanced knowledge-intensive services) is becoming one of the most significant phenomena in contemporary society. Concepts like "open innovation" (Chesbrough, 2003; von Hippel, 2005), "co-production" (Gibbons *et al.*, 1994), "prosumer" (Toffler, 1980), "prosumption" (Tapscott 1995; Tapscott and Williams, 2006), "community-based knowledge creation" (Lee & Cole, 2003), "commons-based peer production" (Benkler, 2006), "crowdsourcing" (Howe, 2006), "produsage" (Bruns, 2008), or anything with a -2.0 suffix (O'Reilly, 2005) have been introduced not only to highlight the the blurring line between producers/developers and consumers/users, but also to emphasise the

importance of the involvement of users/consumers in a development process in today's knowledge-based society.

These user-led, user-participatory and user-generated "open innovations" are perhaps best exemplified by the success of Free/Libre Open Source Software (FLOSS) (or Free/Open Source Software (F/OSS)), whose source code, which codifies the behaviours of software, is made available to anyone to read, study, modify, distribute and redistribute. This transparent, open and collaborative way of developing technologies, which utilises spontaneous community intelligence, has attracted researchers from different backgrounds to make sense of it for the last decade, notably from business and management studies with an emphasis on modelling and providing recommendations of best innovation practices (e.g., Hertel et al., 2003; Von Krogh et al., 2003; Lakhani and Von Hippel, 2003; Lee and Cole, 2003; Weber, 2004; Feller *et al.*, 2005; West and Gallagher, 2006).

Whereas existing literature provides good case studies of how individual projects achieved or realised open innovations, this body of work often leads to categorical, positivistic, prescriptive, and instrumental conclusions about strategies and processes by which FLOSS projects are formed and managed. Quantitative questionnaire-based online surveys appear to be a popular way of understanding FLOSS contributors' motivations, targeting mainly at those who are involved in developers-centred activities (coding, programming, bugs-reporting, providing-patches) (see e.g., Hertel et al., 2003). Generalising and codifying open source software development into theoretical models is another observable avenue of research (see e.g., Lee and Cole, 2003; Von Krogh et al., 2003; Feller et al., 2005). However, these studies, again, focus only on technical activities (such as programming, testing and bug-reporting and bug-fixing) executed by core developers. Despite recognising the role of users in FLOSS communities, these studies fail to include activities of users into the whole FLOSS development processes. The snapshots produced along this line thus fail to capture the continuously changing and emerging FLOSS community ecologies.

While these methodologies and methods remain powerful in business and development discourse, academic debate increasingly challenges their adequacy for understanding a produsage process, which is supposed to be "ongoing, perpetually unfinished, iterative, and evolutionary" (Bruns, 2008). It has been suggested that instead of treating FLOSS communities as a static and homogeneous entity, more attention should be paid to the heterogeneity, dynamics, connectivity, liquidity surrounding a boundless innovation ecosystem, where actors and artefacts travel fluidly, interact with, and are mutually shaped by other factors in different situations, in which the technologies are devised and mended (Lin, 2005a, 2005b). Seminal work based on qualitative methodologies and methods has been produced to bridge this gap. For example, Coleman takes an anthropological position to look at the dynamics of Debian GNU/Linux community (Coleman 2005, 2009). Moving away from the prevalent pre-defined and categorised motivation studies, she explores "the plasticity of human motivations and ethical perceptions" and how "developers commit themselves to an ethical vision *through*, rather than prior to, their participation in a F/OSS project" (Coleman, 2005: chapter 5). By showing how developers incorporate legal ideals like free speech into the practices of everyday technical production, Coleman traces the path by which older liberal ideals persist, albeit transformed, into the present (Coleman, 2009: 448). Similarly, Lin (2005a, 2007) considers FLOSS as a socially-informed algorithms where hacker culture is constantly defined, annotated, practised, situated and re-defined by a diverse range of actors. In her socio-historical analysis of the evolution of EMACSen (plural form of EMACS - Editing MACroS), one of the first programmes written by Richard Stallman, the founder of the Free Software Foundation (FSF), she employs the social worlds theory to understand how actors from different backgrounds exchange, negotiate and enact various versions of local and situated knowledge, and thereby (co-)produce a plethora of text editor software extended from the same source.

Following the lead of such contextual accounts, which emphasise the exchange, interaction and negotiation between actors themselves and the environments where they situate during a produsage process, this paper employs a practice-based, sociological perspective to explore the everyday practices, experiences, roles and identities of the actors involved, and the artefacts they employed to achieve produsage. Drawing on the empirical data on the *OpenStreetMap* community, the paper aims to understand how actors from different backgrounds engage with the making of OpenStreetMap, occupy different roles, work together to realise a world map that is used for various purposes. The paper also seeks to investigate how socio-technical meanings emerging from these collective or individual activities are assigned, exchanged, negotiated and re/presented. In so doing, we would be able to learn how OpenStreetMap is accepted, adopted, configured and re-configured in different situations and contexts. Also, we would be able to de-mystify the often presumed "openness" and "sociality" in an open innovation system, and deepen our understanding of produsage.

2. OpenStreetMap

Parallel to the FLOSS ethos "free" as in "free speech," not as in "free beer"[1], it is stated on the main page of the OpenStreetMap project that "OpenStreetMap creates and provides free geographic data such as street maps to anyone who wants them"[2]. Its wiki-based website invites people to view, contribute and use the map in collaborative, creative and unexpected ways. Types of contributions vary, ranging from writing core software, uploading the global positioning system (GPS) traces one records, drawing a new road based on available GPS data, to fixing a typo in a road name. The geographical data collected are uploaded to OpenStreetMap.org, and available under Creative Commons Attribution-Share Alike 2.0 Generic licence, free to share, modify and remix. The map has been used for various purposes, even in commercial terms.

Historians and critical geographers have pointed out that maps are the products of the negotiations of different meanings, powers and cultures (Harley, 1990; Wood, 1992; Crampton & Krygier, 2006; Dodge *et al.*, 2009). Maps have been created for various different purposes, simplified, generalised or customised to meet different requirements. They are the representations of the visions, the perspectives, the expectations, the cultures, the knowledges, the understandings, the epistemologies of the eras and of the makers when they were produced. As such, map-making has been considered as a highly political, cultural and socio-technical process. The complexities of the world have long been simplified and reduced to a known geometric scale in their maps by professional cartographers.

The advent of OpenStreetMap has transparentised and democratised cartography; non-cartographers are now provided with an opportunity to participate in the map-making process. The fact that geographical data do not have to be produced, validated and published by an official organisation such as UK's Ordnance Survey[3] has attracted geographers to investigate this "open source mapping" movement and its impacts on cartography (Tulloch, 2007; Perkins & Dodge, 2008; Dodge *et al.*, 2009; Gerlach, 2010). It is generally agreed that such "citizen cartography" or "amateur cartography" (or as Gerlach (2010) terms "vernacular mapping") subverts the existing norms in cartography by re-distributing the power of map-making from the experts to the lay. Like many other digital cartography projects, OpenStreetMap has brought interactivity and mash-up into play. More importantly, by making all sources and changes of information available on the wiki, it transparentises the map-making processes (in terms of techniques, data, content, members), thereby

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1   http://www.gnu.org/philosophy/free-sw.html
2   http://wiki.openstreetmap.org/wiki/Main_Page
3   http://www.ordnancesurvey.co.uk/oswebsite/

opens up a bright new field that demonstrates alternative models of map creation and use.

In the beginning of 2010, OpenStreetMap gained huge media coverage on their WikiProject Haiti[45], which has successfully created an updated and detailed map for Haiti within a month after the earthquake devastated its capital, Port-au-Prince, on 12 January resulting in at least 150,000 lives lost. To create a new map, OpenStreetMapers and CrisisMappers[6] downloaded satellite images (some free and some are from commercial image providers) and traced the outlines of streets on top so a map emerged. The locals used Garmin GPS locators to collect fresh data, to trace roads to offer a baselayer, to locate transportation resources such as road network, water and sanitation infrastructure, health and medical facilities such as hospitals, ad hoc settlements such as refugee camps, collapsed buildings, and landslides. Tools like Java OpenStreetMap Editor (JOSM), Potlatch, Merkaartor have been used for editing, whilst wikis, mailing lists, *Google Group* have been used to organise the day-to-day activities of the project. Ongoing work on improving the OpenStreetMap data continues as recovery and re-construction in the disaster zone progress. Meanwhile, the participants have jotted down the lessons learned, documenting what went well and what went wrong during the process on a wiki[7] that is also continuously being updated. This body of knowledge, constructed in a distributed and collaborative fashion by the locals in Haiti as well as mappers based elsewhere around the world, has been proven inspiring and useful when another earthquake hit Chile on 27 February 2010[8] and when other disasters happened.

This episode described above illustrates most of the activities taking place within the OpenStreetMap project everyday. The empirical importance of OpenStreetMap, in my opinion, is greater than any other FLOSS projects because of its wider applicability, diversity and extensibility. As the empirical data is going to show below, many members consider the entry barrier of OpenStreetMap is lower than many other FLOSS projects that require contributors to be equipped with programming skills, yet different from *Project Gutenberg* or *Wikipedia*, the other two prominent produsage examples. Also, as the project is still at its infant stage (relatively speaking), many issues overlooked in previous studies on Wikipedia or other FLOSS projects can be explored further. As such, it is easier for researchers to identify what it takes to become an "everyday mapper" in different socio-technical contexts (programmers, artists, activists, cartographers, amateurs) and the barriers.

3. Research methodology and qualitative methods

The focus of the study is on understanding how OpenStreetMap was constructed and maintained, rather than on attempting to validate various categorical motivations generalised from existing produsage studies. The questions I am particularly interested in and would seek to answer in this paper are: who are the mappers, what are their roles in the project, what have they produced and for what purposes, who have been using the maps for what purposes, what challenges have they encountered while mapping, what pre-existing knowledge they require to participate in the project. Interaction and relationships between diverse actors themselves and technological artefacts are at the heart of contextualising the produsage of OpenStreetMap. It has been shown that many processual issues such as interaction strategies and interlocking contextual relationships can be captured and elicited by the fieldwork data, based upon the three generic principles of theoretical

4   http://wiki.openstreetmap.org/wiki/WikiProject_Haiti
5   http://www.guardian.co.uk/technology/2010/feb/04/mapping-open-source-victor-keegan
6   http://www.crisismappers.net/
7   http://wiki.openstreetmap.org/wiki/WikiProject_Haiti/Tasks_and_Ideas
8   http://wiki.openstreetmap.org/wiki/WikiProject_Chile

saturation, constant comparison method of analysis and theoretical saturation (Glaser and Strauss, 1967). In light of that, this study combines the Grounded Theory, as a methodological approach, and the Social Worlds Theory (some also term it "the Negotiated Arenas Theory"), as a conceptual framework (Strauss, 1978a, 1978b; Clarke, 1991) to analyse the practices and roles of actors from different social worlds, their relationships and interactions between themselves, the surroundings, and the artefacts embedded in their everyday practices.

The Negotiated Arena / Social Worlds Theory is largely considered as originated within the Chicago Symbolic Interactionism School of sociology, with Barney Glaser, Anselm Strauss, and Tom Shibutani, amongst others, as early proponents. Strauss's understanding of social worlds as "*universes of discourse*" is particularly popular in the science and technology studies (STS). His definition of a social world has been well summarised in Ulmer (1997),

> "[Social worlds are] networks of regular activity and mutual response whose boundaries are set by lines of communication and participation. [...] [S]ocial worlds usually encompass various sub-worlds, which are segmented according to such factors as formal organizational allegiances, professional identities, access to resources and power, or ideology. The boundaries of social worlds may be the same as those of formal organizations, or they may encompass a site or network wherein various formal organizations intersect around shared tasks" (p. 22).

The social worlds theory "aims at capturing, describing, and rendering susceptible to analysis the multiple simultaneous organized actions of individuals, groups of various sorts, and formal organizations" (Clarke, 1991, p. 131). As argued by many social scientists (e.g., Clarke, 1991; Ulmer, 1997; Vasconcelos, 2007), "its major strength lies in the flexibility and openness that enable to capture shifts in the understanding of dynamic situations in complex organisational arenas, as mentioned above. " (Vasconcelos, 2007). According to Clarke (1991), "Social worlds theory is especially strong in analyzing such situations where there are typically overlapping, cross-cutting, and conflicting worlds and organizations coming together around shared tasks, with strong commitments extending far beyond the confines of the immediate organizational situation." (p. 140).

The combination of the Grounded Theory as a methodological approach and the Negotiated Arenas/Social Worlds Theory as a conceptual framework is "particularly powerful", as remarked by Vasconcelos (2007), "for:

1. analysing different perspectives on issues through the discursive practices of involved organisational actors,
2. defining the premises around which these discourses are constructed and deployed and, simultaneously,
3. exemplifying how, in turn, discourses inform back different worldviews in dynamic social contexts."

(Vasconcelos, 2007, p. 125)

The above has motivated me to be guided by the grounded theory and the social worlds theory. Participatory observation and semi-structured interview were employed as the data collection methods.

As a casual mapper myself, I have been observing, following, and getting involved in some local

community events such as *mapping parties*. I have been tracking the paths I took on foot, by underground, by cars, bus and bikes, with Bluetooth GPS devices connected to laptops, smart phones or stand-alone GPS devices. My own experience enabled me to get a sense of vernacular mapping activities, and based on that, I constructed 3 central questions I would like to explore further at the 4th State of the Map conference in Girona, Spain on 9-11 July 2010 where 16 semi-structured interviews with participants and a more focused and deeper participatory observation were carried out.

The 3-day conference provided a good platform for participants from different countries and backgrounds to meet, socialise, share knowledge and discuss ongoing issues. The participatory observation at this conference enabled me to acquire richer and up-to-date snapshots of different social worlds and sub-worlds within the OpenStreetMap community, and how they interact with one another. The programme was constructed in light of different needs and interests of these social worlds. In addition to the planned programme, there were also emergent lightning talks where speakers registered themselves on a wiki if they would like to give a short talk on their current work.

Over those three days, 48 scheduled talks, 4 panel discussions, 3 working groups, 1 workshop, and more than 50 lightning talks took place. This showed a heterogeneous mix of efforts, interests, concerns, expectations and attempts from the governments, the business, NGOs and the voluntary sector, and individual community members (e.g., mapping power lines in Germany, everyone has his/her own "specialities").

Although the period of this particular fieldwork was relatively short, my intensive and ongoing engagement with the OpenStreetMap community has allowed me to build some detailed and complex accounts of the dynamics within the community.

In addition to the participatory observation, 16 semi-structured interviews were conducted with respondents from 9 different European countries. These respondents were selected randomly at the conference. 3 of the interviewees were female and 13 were male. Each interview lasted for about 10-15 minutes. Most were conducted face-to-face, but two were conducted via email. No significant differences were found in the input from face-to-face and email interviews.

The semi-structured interview guide was as below:

1. What's your background?
2. How did you come across to OpenStreetMap?
3. What have you contributed to the OpenStreetMap so far?
4. What problems have you encountered when mapping?
5. Do you use OpenStreetMap in your everyday life? Why or why not?
6. What are the barriers of using OpenStreetMap in everyday life?
7. Have you been involved in any other open source / open data communities? Is OpenStreetMap any different from them? How is OpenStreetMap unique compared to other communities?

Although the number of interviews was small, a point of redundancy did emerge, and both the perspectives and the narratives gathered were broad and thick enough to portray the mappers and the practices they engaged with (Lincoln & Guba 1985).

Each interview was transcribed and close textual analysis was undertaken to extract key themes in relation to the mappers' practices, motivations and problem-solving processes. The interview data

pertaining to vernacular mapping practices and the fieldnotes pertaining to the dynamics within the OpenStreetMap community (with an overview of the actors from different social worlds) were triangulated. Although the data collection process was guided by the Grounded Theory, when analysing the data, particular attentions were paid to what motivated the mappers and how the mappers worked together to co-produce the map. This is because the theoretical lacunae that has been outlined above lie within a framework that insists on the importance of contextuality and embodiment around the construction of technological artefacts. Three recurring themes (as detailed in the discussion below) then emerged.

4. Discussions

4.1 The embodied map

In light of my interview data, 13 out of these 16 respondents have IT background and are able to write software programmes. The other three are working in the area of geographical information systems (GIS).

Most of the interviewees started mapping in the villages, towns, cities where they live. The mappers had the local knowledge about the streets, roads, and places. They mapped while walking dogs, taking a stroll to local pubs, or running errands to local grocery shops. Most of them took GPS or smart phones to record the routes, but some of them took paper-based land registry to map. Interviewees have reported that the reason why they started mapping was because there was no data about where they live in the OpenStreetMap, or they have passion for geographical science (self-motivated, passion for knowing, self-learn). Those who have technical and programming backgrounds did not find it particularly difficult when they started. And these people turned out to have experience of contributing to other open source, open data projects (often Wikipedia and GNU/Linux would be compared). Most of the interviewees have started mapping since the inception of the project, when the interface was not that user-friendly. A couple of them did not get on with mapping right away because the technical barriers were too high. At that time, mappers were unable to see how the map was rendered and what they contributed on the map, and did not receive much (local) community support because the early mappers were scattered at different parts of the world. OpenStreetMap did not attract those who are less technically savvy until *Potlatch*, a Flash-based OpenStreetMap editor that allows users to edit the Map online, was developed.

Asked if they were using OpenStreetMap in everyday life, most of the respondents said yes. All respondents were fully aware of the incompleteness of the Map. In fact, they thought the Map was more correct and more detailed than many available commercial maps. When using the Map, they might get upset when the Map was incorrect or when a road was missing. However, they all reported that this imperfection would not stop them from using the map. In fact, they would be pleased to have an opportunity to improve the Map. Spotting a new road to map or adding a new piece of data to the Map means happiness and fulfilment to them.

The interview data suggests that more than 90% of the respondents started mapping in their vicinity. Even when they are in diaspora (immigrating to another European country in this case), they would use other techniques such as importing existing data (e.g., French Cadastre, aerial imagery) to generate geographical information and maps. This highlights the connection between

OpenStreetMap and the emotional attachment to a place. Respondent E, a French living in London, told me, 'At least in my hometown every time I see some new contributors, I actually contact them to say "thank you", "very nice of you to actually contribute". Try to make contact because I care about my hometown to some extent.'

Being able to do something for a place which has special meanings is one of the key motivations for these contributors. Mapping, just like blogging, is a personal way of expressing, preserving memories, documenting one's footprints, a way of travelling, and a way of remembering events in everyday life. So a lot of mappers they do not just map their local places. In fact, a lot of less developed areas were mapped by outsiders or even foreigners when they travel (e.g., not necessarily in Africa, even small villages in the UK or in Spain). A lot of them did mapping in their spare time (i.e., evenings, weekends, holidays). Taking mapping as a hobby shows their passion for cartography, even if they are not professional cartographers.

Map making has long been a highly technical work involving expert-led data collection and rendering. Therefore, it was unsurprising that a lot of discussions at the conference were about how to make sure the data collected met the highest accuracy and precision. For example, there was an ad-hoc workshop on audio mapping and a key issue raised was how to synchronise time/clock on the GPS devices with other recording devices, such as voice recorders, video recorder, camera. The narratives around technical skills and technologies for collecting accurate and precise mapping data emphasise that constructing OpenStreetMap is, indeed, a scientific and technical activity. However, OpenStreetMap making is more than just a techno-scientific activity. It is socio-technical as the mappers engage themselves with a variety of different tools that motivate them to share their knowledge and experiences with other mappers. It is also socio-cultural because, for some, mapping has become a hobby and a personal thing. It is certainly emotional, as if the interviewees expressed their happiness when mapping a new road, or as if they were upset because certain data or technical infrastructure was unavailable. The Map, thus, is an embodied socio-technical object where emotions, scientific facts, epistemologies are inscribed at the same time.

4.2 The OpenStreetMap Arena and the Social Worlds

In light of the topics presented in the programme of the State of the Map 2010 conference, the most prominent episodes in the OpenStreetMap community for the past year covered OpenStreetMap's involvement in helping rescue and reconstruct the regions suffering from natural disasters, and the increasing interests and actions from the governments in freeing their geographical data. Apart from "Humanitarian OpenStreetMap Team" (HOT) that led the Wikiproject Haiti and the Map Kibera project, some individuals have started producing maps for minorities in the society. For example, the conference featured the presentations on mapping for and by people with disabilities. Lulu-Ann, a devoted female OpenStreetMapper, has initiated the "OSM for the blind[9]" and the Wheelchair Accessibility map[10] projects. With a first degree in computer science, she has the programming skill to develop both the front-end interface and the back-end infrastructure to enable the disabled and the abled to map and create point of interests (POIs) for the people with disabilities. The Libero Accesso / Accesso Libera Tutti[11] in Italy, funded by the Regione Toscana and the Comune di Castelfiorentino, is a project that engages the public to map the accessibility of the urban area and public services for walking impaired and citizens experiencing a permanent or temporary reduced

9   http://wiki.openstreetmap.org/wiki/Blindmap
10 http://www.wheelchair.accessiblemaps.org/
11 http://www.geologyx.it/eng/progetti.html

mobility. The German NGO Sozialhelden[12] has started the Wheel Map[13], another location-based website for wheelchair users based on the OpenStreetMap data.

On the one hand, these initiatives highlight the importance of the free and collaborative maps produced by volunteers by means of GPS survey data, digitized aerial imagery and existing public sources of geographic data for humanitarian work, especially in places where base map data is often scarce and out of date. On the other hand, they also demonstrate the elasticity, manipulability and resilience of open technologies and open data, which underpin the concept of empowerment and catalyse the produsage of maps.

Another prominent theme at the State of the Map 2010 conference was open data (especially public sector information). There were representatives from city councils in Sweden and Spain who came to learn how to release geographical and land registry data owned by the local governments, and the legal and the socio-technical issues involved. The recent release of mapping data and geographical information for free re-use by UK's Ordnance Survey and the whole "Making Public Data Public" initiative[14] have been considered as a triumph after relentless campaigns for the past years. The freed public geographical data can be imported to the OSM, and there was a whole session dedicated to imported data (e.g. corine, polygons, trees in Girona).

Freeing the data is important, but how to use and reuse the open data is another question. Given the trend of tagging and searching location-based information, free geographical data is attractive to many commercial entities. The convergence of mobile smart phone industry and the GIS industry was a visible market trend. Business interests in OpenStreetMap have rapidly grown, not only from companies doing GIS business but also from companies running search engines such as AOL and Microsoft. In fact, the list of sponsors revealed the very competitive business landscape: Ericsson, ALO Local, Bing, 1Spatial, u-blox, Logiball, Spanish Minstry of Promotion, Patch, Mapquest, Cloudmade, City's Best, Ito, just to name a few. AOL even announced more investment in OpenStreetMap at the conference.

Through examining the fieldnotes, four social worlds involved in the OpenStreetMap arena have been identified: business social world, government social world, NGO / Third Sector social world, and another social world where many individuals and less organised communities (or communities that are loosely coupled) reside. The Map has been shaped by the actors from these four social worlds and the negotiations between them. Through their interactions with each other and with the artefacts (tools, technologies, policies, data), they have constructed meanings and representations of the world they know – the Map. These people and organisations have different concerns, interests, beliefs, mindsets, practices and ways of working. Sometimes these social worlds collide (at a panel discussion at the conference or on the mailing lists), and sometimes they do not meet each other at all. When their worlds collide, conflicts may arise, as seen in a heated discussion at the panel "What's Wrong with the OSM"[15] on 10 July 2010, whose panel members consisted of representatives from the commercial sector, the Third Sector / Voluntary Sector, and the community (Steve Coast the initiator and the leader).

Some actors in the commercial social world have exploited and re-appropriated the free geographical data through printed hardcopy maps, high-definition printed map posters, computer and video games, web-based map similar to the rival GoogleMaps. Some actors in the NGOs are

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12 http://sozialhelden.de/
13 http://wheelmap.org/
14 http://data.gov.uk/
15 Footage / video recording of the session available at http://vimeo.com/13353798

busy producing and generating new free data, so they can be used for other humanitarian purposes. Governmental actors are busy comparing data in OpenStreetMap and their official maps and maintaining their authority / orthodoxy in data provision and validation. Amateurs cartographers and mappers are having fun mapping every street they walk and every place they visit. And as noticed by many of my respondents and reflected in my observation, everyone is using different methods to document their journeys, to produce their version of the Map, and to use it for various intellectual, leisure, scientific purposes (e.g., comparison, study, navigation).

OpenStreetMap in this case behaves like a *boundary object* that can engage and mobilise actors and groups from different social worlds. Boundary objects, defined by Star and Griesemer (1989: 393) are

> "objects which are both plastic enough to adapt to local needs and the constraints of the several practices employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use. These objects may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds."

Commonly shared by different actors in these social worlds, the Map contains and harmonises the epistemic differences amongst the groups of users, developers, and *produsers*.

Such diversity and fragmentation also makes OpenStreetMap difficult to be characterised. As Gerlach (2010) remarks, it is inappropriate to categorise OpenStreetMap as either counter-mapping or indigenous mapping. He proposes the term "vernacular mapping" to refer to such emergent, intuitive, spontaneous, everyday generation of geographical abstractions of the world, which "attend to the everyday, to reorientate and disorientate bodies and things in the spaces of day-to-day life" (p. 166). "Maps are not mere static renderings of the world but instead can move alongside and, indeed, change the world." (ibid.) The Map, being a *free* digitised epistemic object, demonstrates high versatility and rich affordance.

4.3 Identity building – "I am an OpenStreetMaper, not a Wikipedian."

Asked of whether they have experiences with other open source or open data projects, the respondents often referred to another famous wiki-based project - Wikipedia. As observed in the Wikipedia community, OpenStreetMap has groups of highly motivated individuals who are not necessarily programmers (Ciffolilli, 2003). In light of my interview data, those who have also been involved in the FLOSS development thought the barrier of entry is much lower in OpenStreetMap than in other FLOSS projects. Respondent E remarked,

> "Communities of open source need to be limited in scope because there's only so many people who can actually code. OSM actually engages with a lot of people. I'm not saying everyone, because it's not that straightforward, but there's actually much more people who can actually contribute and make a small difference. Sometimes they just map one street because that's where they live."

The relatively short history of the Map might have contributed to its levels of versatility and (in) stability. I suspect that because the five-year-old OpenStreetMap project is relatively young (compared to Wikipedia which was initiated in 2001, and the nearly three-decade-old GNU/Linux communities), many norms, rules, practices remain highly dynamic, shifting, emergent, fluid, fragmented, individual and unstable. On the one hand, this indicates that norms, rules, practices within the OpenStreetMap community exist ample space for negotiation, manipulation and perhaps innovation. But on the other hand, some members consider such uncertainty confusing and hence a negative factor of the current state of the community, especially speaking of collaboration and coordination. The comment from Respondent D, who has been involved in OpenStreetMap, Project Gutenberg, Wikipedia and Debian GNU/Linux projects, is expressive:

> "[Knowing rules] is kind of easy in Debian. It's clear what you need to do. You know what you should know. There's a strong leadership and there's also an organisation of becoming a developer in Debian. But in OpenStreetMap, no one really knows what you should know. Everyone has different ideas what you should know. Debian is more structured. There's just no authority in OpenStreetMap, except for the one who shouts louder. In Wikipedia and Gutenberg, the form of writing in the text is very structured. People don't read those rules so much, but it's explicit that you need to follow them [referring to the editorial rules]. It's harder to find those in OSM because it's... You have a map, and you see the map, but the data below it's not the same as the map. The rule governing the data is not obvious in the Map. It's hard to know what is what. You have to find your middle ground somewhere. So it's always up to you. No one can tell you "do this", and you do it. You always have to make your own decisions. I think. This is the hardest case, you know."

His frustration was echoed by other mappers who also expressed that the lack of community support was one of the most difficult things when they started mapping. The environment was quite isolated. There was no community in their local surrounding initially. Often, a town was mapped by only one or a few mappers. Respondent O termed this "single-users-contributions" (in contrast to community-contributions), meaning that the innovation started from every single person doing small things in their isolated environments and in their own ways. This resonates with "the 90-9-1 theory" (Nielsen, 2006; Mader, 2007) which finds that "in most online communities, 90% of users are lurkers who never contribute, 9% of users contribute a little, and 1% of users account for almost all the action."

But this has a consequence. Respondent N observed, "Due to the nature of OSM, its pool of contributors is much more geographically diverse than other projects (people make an explicit effort to attract mappers in areas where data does not currently exist), and thus may be more prone to culture clashes between mappers (particularly when it comes to tagging or naming)". Respondent E, who candidated for a position at the OpenStreetMap Foundation, also found flamewars and disruptive communication challenging. This respondent has observed that arguments often emerged when discussing controversial issues such as licensing or ideologies on the mailing lists, and a solution to that problem is to meet face-to-face:

> "That's why I'd like to actually be able to see people face-to-face because it's easier to have a discussion than working with words. I mean, English is not my first language, even if I speak very well. There are times you don't necessarily get idiomatic expressions. Again, not everyone is fluent in using words to convey the exact meanings. So this leads to sometimes unnecessary aggression and very difficult."

The annual State of the Map conference thus serves as an important platform and occasion for the

people to meet and discuss issues. Apart from that, the respondent also suggested to have better communication between different communities:

> "I'd like to have more talks between the communities. Each community (French community, British community, German community) they are actually pretty much islands. Sometimes those islands are composed of sub-islands. But I think sometimes we should create bridges to actually get more talks. Because most of the time it happens on the main mailing list and it could be quite conflictual, while some informal bridges can actually ease a lot of things if done properly."

However, the instability and lack of established rules (likely due to the relatively short history of OpenStreetMap) also lowers the entry barrier and gives newcomers an opportunity to be accepted as a member and build their identity as an OpenStreetMapper. Respondent J and Respondent K both said, "There are too many Wikipedians and it's too difficult to contribute to other open source projects because I'm not a programmer. And OpenStreetMap is about GIS which I like a lot."

Interestingly, the 6th Wikimania conference, a conference for users of the wiki projects operated by the Wikimedia Foundation, was held in Poland from 9-11 July 2010, overlapping with the State of the Map. By attending the State of the Map conference in Spain, the participants has made a strong statement and positioned themselves as OpenStreetMappers.

Respondent A and D both have been involved in both Debian GNU/Linux and OpenStreetMap. They both acknowledged the fact that in order to contribute to OSM, one needs to be away from the computer and "go out and do something". Getting the contributors away from the computers is another unique selling point of OpenStreetMap. Asked of the differences in various open source, open data, and/or open content projects, Respondent D who has been involved in Project Gutenberg, OpenStreetMap and Debian Linux commented:

> "Debian is very different. The task is very well-defined in Debian. Well, in some way. In OpenStreetMap, I don't know, people work in so many different ways to produce the same thing. And Gutenberg, you have a book, it's pretty easy to do. You don't need any help. You can just do it on a computer. OpenStreetMap you need to go out and do stuffs. It's a lot more work to do OpenStreetMap than Gutenberg."

He continued on the barrier of entry to the communities,

> "Debian has been harder to get into, I think, compared to OpenStreetMap. Community-wise - to be included in the community. But this is because you know you need to have a lot more special skills in Debian than in OpenStreetMap. You can always draw a map, well, as long as you know how to use a mouse. But in Debian it takes some trained knowledge of technologies. Gutenberg, though, that's different. But you don't need the same amount of help."

Some common themes have emerged from the interview data, and they show that technical skills, types of knowledge, interests, experiences, and levels of expertise are interlinked with the roles one holds, the identities one positions her/himself, one's senses of belongings, her/his relationships with the Map and with other members within the communities. It does matter whether one uses Potlach or JOSM to edit the map. Several respondents mentioned that they engaged with the project and mapping more actively after OpenStreetMap offers the WYSIWYG interface, the web-based editing tool Potlach has enabled many users who have not got extensive technical skills to contribute to the

OpenStreetMap project. Even a small improvement of reducing the amount of time the contributors needed to wait in order to see their contributions appearing on the Map helped motivate the mappers. These commodities and instruments (e.g., tools for editing and rendering), with which mappers engage in everyday mapping activities, enact empirical meanings (Knorr Cetina, 1999). They resemble what Knorr Cetina terms "epistemic objects". Although it is beyond the scope of this paper, it is important to examine the roles these epistemic objects play in constructing OpenStreetMap further in future research in order to understand what meanings they signify and how they are used to construct mapping and geographical knowledge.

OpenStreetMap, like other technologies, is inscribed with social values and political interests existing in modern societies, as well-revealed in the field of Science and Technology Studies (STS) and innovation studies (e.g., Winner, 1986; Star, 1991). However, built on FLOSS and open data, OpenStreetMap has a greater capability to enrol and recruit members from more diverse backgrounds into its innovation network than other maps (Callon, 1986a, 1986b). Take OpenStreetMap and Google Maps as a comparison. Whereas Google and OpenStreetMap both encourage users to use them for their own needs (and as a result, add values to their products, see e.g., Lee, 2010), OpenStreetMap has also mobilised different communities and individuals to join the rescue and humanitarian social work in Haiti. Whereas using Google Maps and other Google services is bound to various intellectual property rights restrictions, OpenStreetMap welcomes communities and individuals with different skills, resources and backgrounds to participate in technological development, mapping and map-making processes. As noted in Section 4.2, there is no doubt that OpenStreetMap is what Star and Griesemer terms "boundary object" because it is "both plastic enough to adapt to local needs and the constraints of the several practices employing them, yet robust enough to maintain a common identity across sites." (*op. cit.*). When the members of different social worlds negotiate various meanings they assign to the boundary object – OpenStreetMap – they simultaneously also build and negotiate their identity as an OpenStreetMapper, as an amateur cartographer, as an activist, or as Respondent O identified himself – a Neogeographer. As Simpson and Carroll (2008) suggest, "identity is inherently emergent, precarious, and negotiated" and "identity construction is a dynamic, relational process". And I would like to add that building an identity as an OpenStreetMapper is a dynamic, relational and socio-technical process where actors and technological artefacts interact and the use and development of certain types of technologies contributes to identity construction. Yet again, this has to be explored more fully in future studies on produsage.

5. Conclusions

Based on the ethnographic observation and 16 qualitative semi-structured interview data collected from the State of the Map 2010 conference, I have provided a current version of how OpenStreetMap has been *produsaged*, and various emotional, cognitive and social repertoires involved in open source mapping. This qualitative inquiry into the OpenStreetMap making contextualises and enriches our understanding of the process of produsage. By placing the emphasis on the mappers' subjective experiences with mapping, I have illustrated how this interactive and digital map has been made, and the socio-technical meanings (at both the macro and micro levels) emerging from such open source mapping processes. The data shows that OpenStreetMap is an boundary object, shaped by actors coming from the business, governmental, NGO/Third-sector and individuals-local social worlds. I have discussed the relationships and interactions between the OpenStreetMappers and the technologies, artefacts, data. I have also discussed the identities of the OpenStreetMappers and how they associate themselves with the places where they locate, and with

the OpenStreetMap community rather than other open source or open data communities (such as Wikipedia, Project Gutenberg, LinuxKernel). Emotional attachments to the project itself and to the places which were mapped insinuate that OpenStreetMap is an embodied epistemic object.

Academic debate increasingly supports the view that modern technologies are socially constructed artefacts. It is not surprising to find out that OpenStreetMap is a complex system of hardware, software, and people, shaped by perceptions, norms, rules, and habits, and occurring within varied social and cultural settings. In fact, perhaps it is fair to say that all artefacts constructed through a produsage process are embodied epistemic objects negotiated and co-produced by a heterogeneous group of actors from different social worlds. Through the lens of Social Worlds Theory, this paper has uncovered, described and articulated the socio-technical complexities in this process. However, there remain many questions to be answered, including what epistemologies, perceptions, norms, rules, and habits, cultural settings are comprised in the technologies going through produsage processes, and how they mutually shape the technologies. And to answer these endless questions, more research is needed in order to understand the socio-technical complexities within and across distributed produsage communities.

As observed in many other produsage cases, the OpenStreetMap itself is an unfinished artefact which will be infinitely continuing (Bruns, 2008). This study has merely scratched the surface of an iceberg. In the future, I should like to collect more fresh data and analyse conversations and discourses on the mailing lists and wikis in order to understand a variety of questions regarding knowledge produsage in more details, including how actors from different social worlds produce and re/use mapping data, how these social worlds and many sub-worlds reside within the arena interact and negotiate with each other about their expectations of and different meanings of the Map, different types of knowledge were produced and consumed by different social worlds, how people from different social worlds negotiate the knowledge produced: the frequency, intensity, degree of importance of negotiation and other strategies, their consequences.

Acknowledgement

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