Citizen Mapping: Using Common Geospatial Technologies to Map Informal Settlements in São Paulo, Brazil*

Vitor Pessoa Colombo**

* Conference paper presented at the International Tech4Dev Conference in Lausanne (CH), on June 28th 2018 (*SE03-HAB - Sustainable habitat and cities: Learning from the slum*)
** Teto - São Paulo, Brazil

Presenting author's email address: vitor.pessoacolombo@gmail.com

***Biography of Presenting Author*:** Vitor is a Brazilian architect who graduated in Switzerland (B.Sc. École Polytechnique Fédérale de Lausanne, M.Sc. Accademia di Architettura di Mendrisio) and since march 2016 he has collaborated with the NGO Teto in São Paulo in order to develop citizen mapping processes that provide the necessary geographic information to support humanitarian action in socio-economically vulnerable human settlements.

Abstract

The present paper focuses on the work conducted by the NGO Teto in São Paulo (Brazil), where a series of datasets providing geographic information on slums is being elaborated thanks to recent geospatial technologies well suited for a non-specialist, volunteered workforce. The objective here is to contribute to the present debate over potential uses and limitations of geographic data collected and elaborated by engaged citizens who are not specialists in the field, focusing on the possible social outcomes of such methods. Two case studies are presented to illustrate how new technologies facilitate *citizen mapping*, and how the latter may support humanitarian action in precarious settlements by providing relevant spatial information. Ultimately, this study argues for citizen-driven initiatives and participative processes as useful tools to *complement* authoritative data, specially in the Global South where an informational gap distinguishes the *formal* from the *informal* sectors of the cities.

Keywords: VGI, citizen mapping, informal settlements

Extended Abstract

Since the 2000's, developments in geospatial technologies and telecommunication have largely "democratised" the use of geographic information systems (GIS) through user-friendly interfaces such as Google Earth, which allowed for the visualisation and production of geographic information by non-specialists, giving rise to what scholars name *volunteered geographic information*, or "VGI" (Goodchild 2007; Verplanke et al. 2016). Such practice represents a dramatic shift in cartography, as it becomes an activity no longer exclusive to experts and makes way for alternative representations of space that may reveal new types of information, specially those coming from groups and places that have been ignored or marginalised by "classic" cartographic processes (Elwood et al. 2012).

There are, of course, limitations to spatial data generated by untrained GIS users equipped with non-professional GPS devices, both in qualitative and quantitative terms. However, these imperfections do not impede positive outcomes; on the contrary, the possibility of increasing spatial data through citizen-driven initiatives enables new kinds of support for humanitarian action. For instance, in the context of developing countries where accurate data on slums are limited (UN-HABITAT 2015) and where rapid urbanisation processes often result in strong socio-spatial segregation (Davis 2006; UN-HABITAT 2016), citizen-driven initiatives like VGI constitute an opportunity to bridge the informational gap between the consolidated, legally constructed ("formal") parts of the city, and the precarious, auto-constructed ("informal") parts of the city (Pessoa Colombo and Pacifici 2016), signifying a first step towards the social and urban integration of informal settlements.

Following this line of thought, Teto's team in São Paulo has elaborated a mapping process based on the voluntary work of engaged citizens and on the use of geospatial technologies made available by mobile devices and open source software. Although "VGI" seems to be semantically fit to describe Teto's method, it is too often related to processes that alienate local inhabitants, who have no say neither in the elaboration nor in the publication of the data generated (Verplanke et al. 2016); in contrast to this type of process, Teto's mapping method values local spatial knowledge, and thus the direct involvement of local inhabitants, while the data generated is not publicised without the approval of the people concerned. For these reasons, the term "citizen mapping" is preferred over "VGI" to describe Teto's work.

In Brazil, citizen-driven mapping initiatives have appeared only recently (cf. Prefeitura do Rio 2014) and they remain marginal. Also, there is little governmental support: the federal guidelines to map informal settlements published by the Ministry of Cities (2010) do not mention any possible contribution by citizens or any kind of VGI system. Facing this situation, Teto aims to explore the potential of *citizen mapping* to foster social changes in areas characterised by extreme poverty and insecure land tenure, by promoting self-awareness and providing quantitative data to support various processes such as land regularization or identification of populations living in risk areas that would otherwise be ignored.

We will focus on two case studies that show how citizen mapping can provide information that makes a difference during negotiations between public institutions and private stakeholders, thus having a direct social impact. The first case study is the community Malvinas, where an eviction process took place in order to displace and secure families that were living in a risk area; the second case study is the community Porto de Areia, where another eviction process is in place, this time to make way for a new road. In both cases, we will see how the authoritative data were inaccurate, miscalculating the number of people that should be affected by each process.

The methods used to elaborate the geodata needed to verify the number of families concerned by the two eviction processes are not identical: in Malvinas, the mapping process was based on satellite imagery obtained from Google Earth, while in Porto de Areia the mapping process was based on aerial imagery collected by drone. Both methods required *ad hoc* preliminary organisation with the local inhabitants – which was facilitated by the fact that Teto has been working with these communities for some years already – and also on-site verifications after the vectorisation of the raster datasets (polygons drawn over aerial or satellite imagery) in order to determine the exact number and position of houses and families. These on-site verifications relied on the use of common geospatial technologies like Google Maps, that can display georeferenced maps (elaborated with open source software QuantumGIS) as layers added over a virtual globe while showing the geographic position of the mapper.

Teto's citizen mapping has the advantage of being low-cost and relying on common technologies, what makes it accessible to a large public. At present, it must stimulate the contribution of local inhabitants to the actual map-making (the drawing phase), still very limited, in order to make it a truly participative mapping process. Recent experiences elsewhere have shown that a more active participation to the cartographic process helps legitimising the work amongst the community, allowing for longer term projects (Karanja 2010). Additionally, it is crucial to increase the interaction with local governments in order to validate the information generated by citizen mapping – public institutions must acknowledge and use such information, otherwise it is a "missed opportunity" to effectively complement authoritative sources of geographic information (Haklay et al. 2014).

As some scholars have pointed out, there's still much room for research on the social impacts of VGI (or citizen mapping) methods in the field of GIScience, marked by an academic divide between qualitative and quantitative approaches of GIS (Cochrane et al. 2017). One must remind that a map is not an *end* in itself, but a *means* to understand social issues in space, and that the *process* behind the elaboration of a map can be just as important as the information displayed.

References

Cochrane, L., Corbett, J., Evans, M., & Gill M. (2017). Searching for social justice in GIScience publications. Cartography and Geographic Information Science, 44(6), 507–520.

Davis, M. (2006). Planet of Slums. London: Verso.

Elwood, S., Goodchild, M. F., & Sui, D. (2012). Researching Volunteered Geographic Information: Spatial data, geographic research, and new social practice. Annals of the Association of American Geographers, 102, 571-590.

Goodchild, M. F. (2007). Citizens as sensors: The world of volunteered geography. GeoJournal, 69(4), 211-221.

Haklay, M., Antoniou, V., Basiouka, S., Soden, R., & Mooney, P. (2014). Crowdsourced geographic information use in government. Report to GFDRR (World Bank). https://openknowledge.worldbank.org/handle/10986/20725. Accessed 21 December 2017.

Karanja, I. (2010). An enumeration and mapping of informal settlements in Kisumu, Kenya, implemented by their inhabitants. Environment and Urbanization, 22(1), 217-239.

MINISTÉRIO DAS CIDADES (2010). Guia para o mapeamento e caracterização de assentamentos precários. PDF Document. http://www.cidades.gov.br/images/stories/ArquivosSNH/ArquivosPDF/Publicacoes/Mapeamento_Ass_Precarios.pdf. Accessed 21 December 2017.

Pessoa Colombo V., & Pacifici M. (2016). Mapping informality: A participative experience in São Paulo, Brazil. Revista CIS, 13 (21), 46-93.

PREFEITURA DO RIO DE JANEIRO (2014). IPP lança mapeamento participativo da cidade do Rio de Janeiro em Manguinhos. http://www.rio.rj.gov.br/web/guest/exibeconteudo?id=4863995. Accessed on 1 December 2017.

UN-HABITAT (2015). Habitat III issue papers: 22 – informal settlements. PDF Document. https://unhabitat.org/habitat-iii-issue-papers-22-informal-settlements/. Accessed on 1 December 2017.

UN-HABITAT (2016). World cities report 2016: Urbanization and development – emerging futures. PDF Document. https://unhabitat.org/books/world-cities-report/. Accessed on 1 December 2017.

Verplanke, J., McCall, M. K., Uberhuaga, C., Rambaldi, G., & Haklay, M. (2016). A shared perspective for PGIS and VGI. The Cartographic Journal, 53(4), 308-317.