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Open Geodata – A support to humanitarian aid

An analysis of OpenStreetMap's crowdsourcing and open data benefits

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Abstract

The world is changing rapidly and data are becoming increasingly important. This article focuses on open source geographic data and examines the effect of crowdsourcing on humanitarian aid. Research and examples show the difference this phenomenon makes when compared to other mapping services. OpenStreetMap is the leader in terms of efficiency in geodata crowdsourcing and its openness is a key to the development of poor or crisis-stricken countries. Its development and effectiveness have already given a revival towards geographic information and saved lives.

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Key words: Geodata, Open source, Crowdsourcing, OpenStreetMap (OMS).

Introduction

OpenStreetMap (OSM) is a free world map created and without restrictions modified by volunteers under an open license. In this report we look at what OpenStreetMap brings to mapping just as Wikipedia has changed the knowledge landscape with this type of data collection and openness (Chilton, 2009) or YouTube who has changed the video world. To do so, we are exploring what crowdsourcing offers as new perspectives to the geodata and more specifically for humanitarian aid. Several examples are put forward in order to study the real impact on humanitarian projects and to demonstrate that geoinformatics does indeed bring a radical change (Jiang, 2013). One of the first question coming in mind is why use OpenStreetMap rather than Google Maps or another commercial mapping service? According to the reporter S.Wroclawski, it is not just a question of practicality, but also the kind of society we want to live in (Wroclawski, 2014). He responds in this way by emphasizing the importance of understanding that what is on the ground has become a major business. With built-in GPS and smartphones, the market for telling you where you are, where you are going and where you need to go has become huge. In response to this, OSM allows no one company to have a monopoly and prevents any company from deciding where you are, where you should go and what is on the map. In addition, their crowdsourcing allows to map and preciously display certain regions for the first time while other mapping services do not yet offer any information, answering the society's demand for instant information (Chilton, 2009). "*With most maps, it's only economical to collect street data because of the scale of thing — driving around with a GPS is the only way to do*

it. Whereas with OpenStreetMap, we have cyclists, hikers, people involved in geocaching, […]. The level of detail that people are recording is incredible." explains Steve Coast, founder of OpenStreetMap (Eisenberg, 2008).

Based on those words, we can imagine that on a humanitarian level, OpenStreetMap can be used to map very little known or popular areas through local volunteers with the knowledge to make a very accurate mapping. In this continuity, we can also assume that the free service offered allows a support in every region without facing too many difficulties. Finally, as Steve Coast says in the previous paragraph, the fact that there are so many different ways for mapping allows us to map in an optimal way through anyone and anywhere, but also in any situation (natural disasters, epidemics, etc.) and to update the geodata almost instantly.

In order to go into more details, this work first briefly analyzes the benefits that crowdsourcing itself brings to open geodata and why it can be so successful in today's society. The main part presents what this phenomenon brings to humanitarian aid and why it can be perceived positively in the future. Finally it ends with a conclusion and an open discussion.

Crowdsourcing benefits

It is often pointed out that the general benefits of Open Source are based on non-financial or intrinsic incentives such as ego gratification, peer recognition or simply to put one’s skills forward. But Crowdsourcing can also offer lower risk (Schenk & Guittard, 2009). Indeed, since the work is not done under monopole, the risk of dependence on a service provider is declining. Moreover, there is no call for tenders, which reduces the risk of not obtaining a satisfactory contribution. In this case, the necessary data may be requested for different reasons or different regions. Crowdsourcing allows any user to quickly add and/or update the geodata needed for their project. The ease of access by everyone allows regular interventions ranging from amateurs to the greatest experts, which offers security on the updating and quality of the data (Howe, 2008). “*Given the right set of conditions, the crowd will almost always outperform any number of employees – a fact that companies are becoming aware of and are increasingly attempting to exploit. That, in a nutshell, is what crowdsourcing is about*” – Jeff Howe.

Crowdsourcing in connection with geodata offers a wide range of advantages. Starting with scientific research where, for example, OSM is used to search for roadless regions (Batty, 2007; Hobson et al., 2016) but also through the lifestyle around

video games like Pokémon Go which uses OSM (Hoofer, 2017) and other applications using specialized maps for cycling, skiing, etc. (Chilton, 2009). From an economic point of view, the main advantages coming from crowdsourcing are the strong reduction of data collection costs and the time needed for the next update. Without neglecting the fact that the phenomenon of user-generated content will not disappear anytime soon (Richter & Winter, 2011). Finally, linked to humanitarian aid, as we will see later, this phenomenon makes it possible to re-establish the conversation between societies and governments for the support and development of poor countries and for prompt and inexpensive aid during disasters.

Why does it work ?

Although at the creation of OpenStreetMap it was difficult to say that such a crowdsourcing project could work, but some criteria allowed its development and now shows clearly its efficiency. First, the availability. All of the world's map data can be downloaded and community map updates can be tracked. It is also possible to download smaller maps (such as a particular country). "*Whether you're wrangling raw geodata or presenting a web-map mashup, the possibilities provided by OpenStreetMap, and by third parties within the OpenStreetMap ecosystem, offer endless potential for geo map hacking fun!*"[1]. Secondly, the quality. Already in 2014, 10 years after the launch of the platform, the quality has become just as good as Google Maps and the quality of offline maps much better (Sterling, 2014). Thirdly, the provision of simple information on a non-profit basis. The fundamental information is not the store reviews or the websites of the buildings mapped. For this purpose OSM allows an optimal use of their data not loaded unnecessarily and offering the most relevant information according to projects (“Mapping the Zombocalypse,” 2014). To make it simple, there is no worthless commercial information. Fourthly, results and impact are clearly perceived. OpenStreetMap volunteers use an open tagging system to classify data as they see fit, allowing them to map what they want, when they want (Coast, 2011). This can be seen in simple examples such as the fact that Tesla uses open source for these tools, allowing customers to improve by themselves the quality of the map in the periphery of their daily life[2], but also, as we will see later, on a very large scale such as in Haiti, where access to this data could save lives. In a nutshell, the availability, quality, simplicity and global impact of geodata are changing the purchase and use of geographical information, by their users.

Why it is important for humanitarian aid

Today's society needs instant information, especially in crisis situations. To make it simple, Hurricane Katrina has shown the dilemmas that inadequate mapping data can pose for aid and emergency work. In the aftermath of the hurricane, aid agencies relied on Google maps for data. However, the lack of local knowledge created a big gap in the updating of the map. This is due to the data providers who have a long delay between the reality and catching up with its representation (Maron, 2007). Crowdsourcing could actually have avoided such a problem. Similarly, there has been a pressing need for up-to-date cartographic data to analyze and understand conflicts such as the conflict in Gaza. Here, the OpenStreetMap community was able to map the region initially by acquiring aerial imagery and once the crisis subsided, volunteers entered the Gaza Strip and worked with the inhabitants to complete the map (Chilton, 2009).

It’s thanks to the crowd and the extremely fast updates offered by the crowdsourcing that in 2010 "*the most complete digital map of Haiti's roads*" was designed by crisis volunteers using available satellite imagery to map Port-au-Prince in just few days (Batty, 2010; Richmond, 2010), see figure 1. This could be done in response to one of the worst earthquakes in recent history and provided data for organizing assistance and managing search and rescue operations (for example, the generated map could be loaded on the rescue team's equipment). Likewise in the Philippines after the Hayian typhon, volunteers contributed to the development of maps adding roads and details not available on published maps (Mackenzie, 2013). This input reflects assistance in the making of critical decisions about where to send food, water and supplies (Meyer, 2013). Once again, wherever commercial mapping services like Yahoo or Google maps have limited data, for example in Africa or in countries with low development, OSM offers quick and actual information. As another example, this facility allows online maps to be drawn up which helps to race the origin and track the spread of viruses. This was done during the deadly Ebola epidemic in Africa (“How the Internet Is Stopping the Ebola Outbreak, One Street Map at a Time,” 2014). These cases are the most consistent and show the strongest impact and effectiveness of open

source through geodata. I invite you to go on the OSM HOT (Humanitarian OpenStreetMap Team) [1] web page to take a look at all the other projects that have been and are being developed since its creation in 2010.

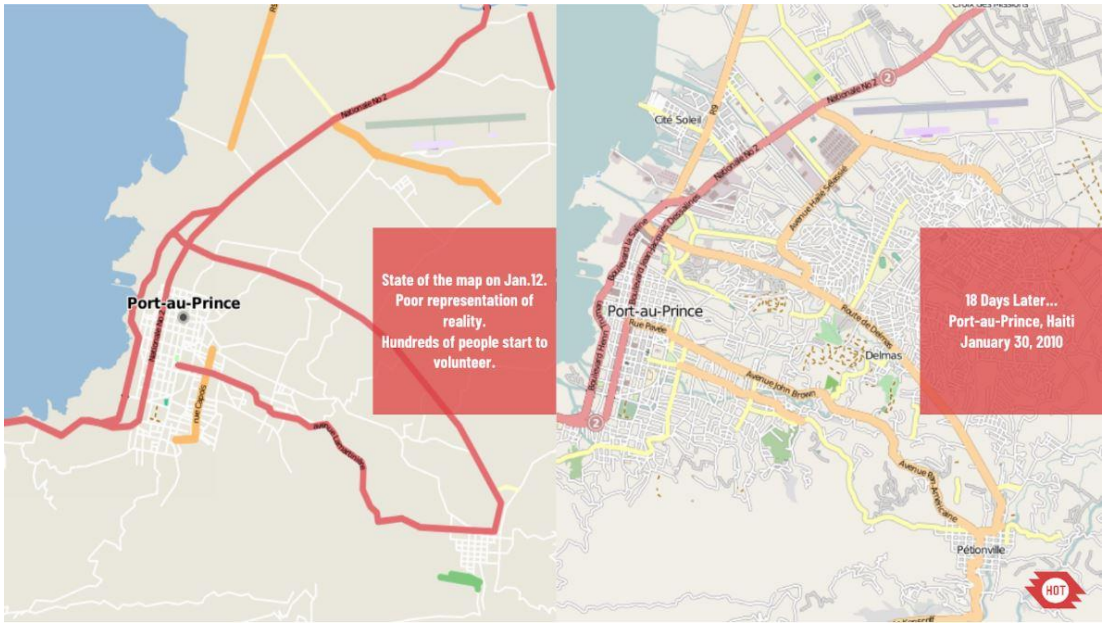

Figure 1: Map of Port-au-Prince from OpenStreetMap on January 12. and 30. 2010
https://www.hotosm.org/updates/haiti-10-years-later-growth-of-a-crisis-mapping-community/

To express the growing development, let's take a look at the current projects. In Peru it is estimated that millions of people live in unmapped areas while the Covid-19 virus is spreading, so the development of geodata has allowed the distribution of funds for vulnerable families and the addition of information on the locations of hospitals and pharmacies, without forgetting roads and inhabited buildings in order to estimate population density and to know the number of vaccines to be brought to the field (Scoles, 2020). In Makoko – Nigeria, mapping has enabled the government to plan the support and development of the region. The maps helped to rekindle the conversation about slum development and its potential (Oluwatosin, 2020). In Uganda, the addition of geodata related to energy-saving solution retail stores in Bidibidi, has led to a better understanding of the current market and provided information on improving access to quality energy-saving products among the refugee population (Amadi & Nassozi, 2020).

[1] https://wiki.openstreetmap.org/wiki/Humanitarian_OSM_Team

Future – Growth is not expected to stop

The current aid provided to Peru in a few days proposed a response to the Covid-19 catastrophe with the contribution of 1,462 people marking 200,500 buildings and more than 3,000 miles of road. Nevertheless, this represents only a small part of the intervention knowing that for this disaster the area to be mapped is the whole world. However, thanks to the drones and satellite images, there is and will be no need to be on site to help (Scoles, 2020). Just as the company Maxar[2] is helping during the current situation in Peru by providing satellite images, other companies can help in the future and contribute to humanitarian efforts such as HOT. Just as help from the crowd has increased over the last few years. Apart from the increasing activity of the crowd, the tools available are also continuously developing. Scientific calculation and analysis of data can be done long since through different languages (C++, Python, Java, R). Many tools have been and are being developed and frequently updated like the R package "osmdata" for downloading and using data from OSM[5] or the python library "esy-osmfilter" able to read and filter OSM data files and export them to a Python dictionary or JSON file[6], to name a few of the last ones.

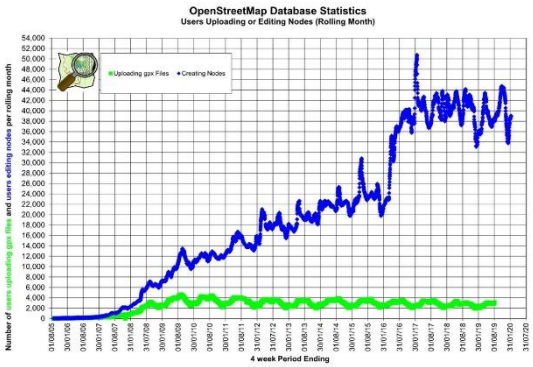

Figure 2: increase in nodes over time

https://wiki.openstreetmap.org/wiki/Stats

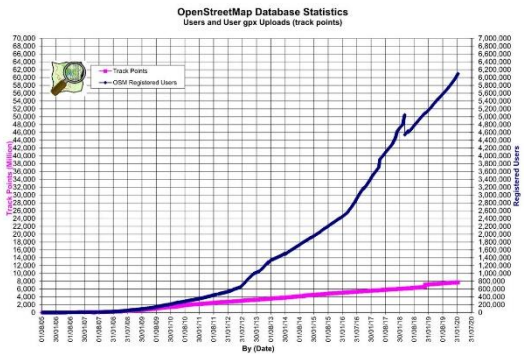

Figure 3: increase in users over time

https://wiki.openstreetmap.org/wiki/Stats

In order to illustrate the constant growth of OpenStreetMap since its creation and the positive future potential, figures 1 and 2 above illustrate the evolution of the number of nodes and users[3]. To give precise numbers about the very last years, in May 2016 OpenStreetMap had 2'654'260 users and 3'356'387'699 nodes and on June 6, 2020 these numbers increased to 6'622'763 users and 6'093'182'918 nodes[4]. To demonstrate

[2] Maxar is committed to supporting the humanitarian community by providing critical and actionable information to assist response efforts through an Open Data Program. https://www.maxar.com/

this in another way, let's simply take a look at figure 4 below in comparison to the Port-au-Prince map proposed ten years earlier in figure 1.

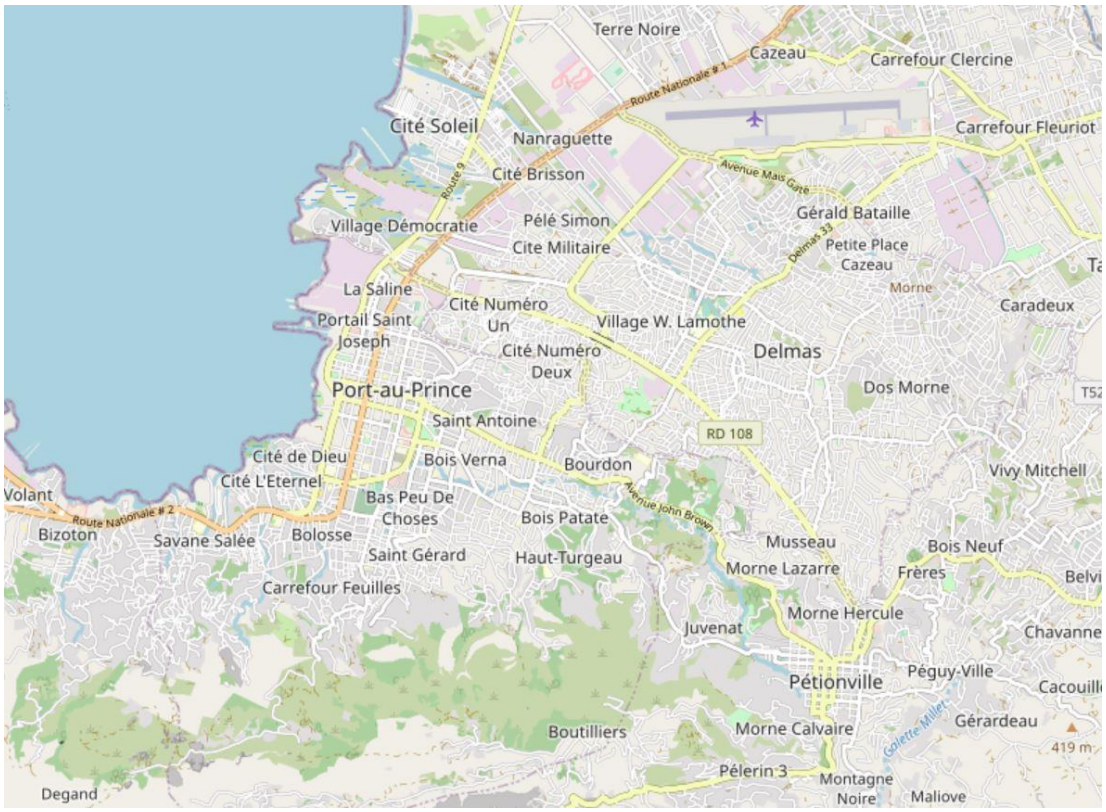

Figure 4: Map of Port-au-Prince from OpenStreetMap on 17.06.2020

https://www.openstreetmap.org/#map=13/18.5420/-72.3172

Conclusion

People quickly realized that crowdsourcing could have commercial and sustainable benefits for geodata. The fundamental advantage of OSM is that the addition of data remains with the individual contributor and he can benefit directly from it. This allows contributors to not just work only for a company, but to contribute and use the data for projects of their choice (Chilton, 2009). The crowdsourcing offers a large amount of precise and very regularly updated geodata. This forces vendors to reconsider their data policies and pricing models which place data consumers at great advantage.

The examples shown above indicate what open source geodata coupled with crowdsourcing can offer to humanitarian aid. The collective, cost-free representation and extremely fast updates are a key point that makes this phenomenon extremely useful in crisis situations and poor countries. Since 2010, all geodata that can be obtained enables HOT (the humanitarian OpenStreetMap team) to act globally and contribute to the achievement of sustainable development goals. This enables them to make a

difference in many areas : (1) Disaster risk reduction, (2) gender equality, (3) environment, (4) clean energy, (5) transportation, (6) sustainable cities, (7) public health, (8) water and sanitation, (9) poverty elimination, (10) refugee response, (11) disaster response[7]. But also enables anyone else to contribute in any domains. On the other hand, it is important to underline the fact that today's satellite images as well as images provided by drones make it possible to participate in mapping while staying at home (Cawley et al., 2020). This information, paired with the experience developed during the large amount of projects already carried out and the increasing numbers observed in the previous section, lead to promising support in the coming years in the field of humanitarian aid. Not to mention that the HOT community provided vital mapping data for 92 disasters and crises, and mapped an area where 150 million people live in more than 50 countries (Radford, 2020). To complete, Tyler Radford says in his publication – "*While we haven't yet achieved our vision, I'm optimistic that we'll get there: OpenStreetMap's promise in disaster is now proven, and the future potential to reduce human suffering and improve lives is only as limited as our imaginations.*" While there will always be room for more and better, I would like to wrap up with Radford words about Covid-19 crisis in Peru. "*Even the less than perfect mapping has saved a few lives. Getting vaccines to the right place, in the right quantities, without any maps or population counts is a problem. With maps – even imperfect maps – it is less of a problem.*"

Discussion

In order to discuss this topic, it seems important to emphasize that the experience accumulated and the amount of land mapped during all these past projects brings a lot of knowledge and content for the management of future potential disasters. The fact that large, poor and at-risk areas are already mapped and that entire projects are being developed to anticipate potential future risks leads us to believe that the geodata collected in crowdsourcing for humanitarian aid support are becoming increasingly efficient. Moreover, the use of drones and satellite images has already proved its worth in recent projects, which leads us to believe that other companies could come and offer their services in the near future. This would increase the speed of mapping and map updating as people can support the causes from their homes. In addition, the continuing tools development shows a serious belief in the value of the geodata and the activity that can be generated around it, which is once again a strong sign for future projects.

As predicted, OpenStreetMap offers many benefits to humanitarian aid. The fact that it has open access, that anyone can create or modify data and that updates are extremely fast, allows companies and locals to make quick and accurate interventions and updates on affected areas. This makes it possible to respond to a need for information extremely quickly. Behind these activities, the open source data available for intervention services increases their effectiveness and thus the number of people rescued or assisted. As hoped, we can see that the way in which OSM collects and makes available geographical data is effective regardless of the type of area affected (town or village, accessible or not, etc.). Although today they can anticipate areas at risk, no one is immune to what nature has in store for them. Nevertheless, the experience and methods used, as seen in the examples given, still promise effective and rapid interventions thanks to the availability of geodata.

This paper illustrates the evidence of the usefulness of OSM for the humanitarian aid in a qualitative way and analyzes the topic in a rather broad way by outlining different cases. The previously established examples demonstrate aid in response to disasters in Haiti, to public health in Africa and Peru, to poverty eradication and refugee response in Nigeria, and to sustainable cities in Uganda. However, it should be kept in mind, that there are many other areas of activity that can be supported. It would be interesting to observe the ways in which OSM data is used in these other cases, and the value it added. Such as the support of gender equality during projects through the proposal of equal participation of local volunteers during interventions. The medium/long-term environmental mapping projects to address issues such as climate change or flooding. The data collection to improve the use of renewable energy sources such as solar and hydropower. But also the access to safe drinking water, where mapping of water points can identify areas at risk of disease, and finally, the collaboration with communities and disaster management agencies to map and understand risks by developing key data on critical infrastructure to improve planning and response activities to various potential natural hazards. Each of the themes mentioned in this paragraph may be the subject of future in-depth studies to observe the advantages of the OSM data system compared to the use of other mapping systems.

Finally, it might be interesting to look proportionally at the areas in which the OpenStreetMap map is used. In other words, an estimation about the proportion of volunteers that mapped for humanitarian aid, for example by observing which regions have been mapped at which period of time with reference to the interventions made by

HOT until today. This could show a growth potential or be a great measure of people engaging good actions thanks to the open source of geodata. On the other hand, quantitative analysis would provide concrete figures on the advantage of this type of geodata compared to other mapping systems. For example by estimating the number of lives saved or the time saved during interventions in comparison to other services. This could be done by faking a humanitarian intervention using two or more different mapping services. Also here such information could manifest the good side of open geodata.

I hope that I have clarified and deepen the subject of crowdsourcing in relation to open geodata and how they can help humanitarian aid, as well as lots of others domains in a good way. Optimistically it will contribute to the thinking on this topic.

Notes

[1] https://www.programmableweb.com/api/openstreetmap/articles

[2] https://teslamotorsclub.com/tmc/threads/openstreetmaps-and-smart-summon.170675/

[3] https://wiki.openstreetmap.org/wiki/Stats

[4] https://www.openstreetmap.org/stats/data_stats.html

[5] https://docs.ropensci.org/osmdata/articles/osmdata.html

[6] https://pypi.org/project/esy-osmfilter/

[7] https://www.hotosm.org/what-we-do

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