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Editorial

The Rise of Collaborative Mapping: Trends and Future Directions

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The nature of map production and the dissemination of spatially referenced information have changed radically over the last decade. This change has been marked by an explosion of user generated spatial content via Web 2.0, access to a rising tide of big data streams from remotely-sensed and public data archives, and the use of mobile phones and other sensors as mapping devices. All of these developments have facilitated a much wider use of geodata, transforming ordinary citizens into neogeographers. This increase in user-generated content has resulted in a blurring of the boundaries between the traditional map producer, *i.e.*, national mapping agencies and local authorities, and citizens as consumers of this information. Citizens now take an active role in mapping different types of features on the Earth's surface as volunteers, either by providing observations on the ground or tracing data from other sources, such as aerial photographs or satellite imagery. OpenStreetMap (OSM) and Ushahidi are two well-known examples of a growing collection of collaborative mapping communities that are building rich spatial datasets, which are openly accessible.

Many authors have written about the potential of this volunteered geographic information (VGI) as a low cost and effective way of collecting comprehensive amounts of spatial data to augment more authoritative sources, e.g., [1,2]. This innovative technology comes at the right time because maps are outdated in many parts of the world. This situation is unlikely to be resolved by traditional mapping agencies, many of which have been unable, for a number of reasons, to regularly update topographic and other maps [3], and is further exacerbated by the current financial climate of budget cuts. The lack of up-to-date information is undesirable and hindering development, particularly in areas of rapid change such as expanding cities and the developing world. Collaborative mapping or VGI might offer a solution for obtaining more up-to-date spatial data, or in some situations, it may form the only source of information available. However, the provision of up-to-date geo-information in itself does not mean that collaborative mapping will replace the products of traditional mapmaking organizations because maps need to be accurate and authoritative, aspects for which traditional mapping organizations have the capacity and reputation.

Thus, a big challenge for VGI lies in assessing data quality and in developing procedures to ensure that volunteers produce high quality data, usable in an authoritative context. All of the papers in this Special Issue touch upon this topic, but three of the papers deal specifically with data quality in the context of OSM. In the first paper, Fairburn and Al-Bakri [4] compare VGI from OSM with authoritative data from two sources: the UK Ordnance Survey and the Iraqi General Directorate for Survey. The comparison was based on an in-depth assessment of the positional accuracy of the features and a shape analysis, moving beyond previous attempts at assessing positional accuracy and at a larger scale of 1:2,500 [5]. The results, however, indicate that the OSM data would not pass the current accuracy thresholds required by the respective mapping agencies and therefore integration of the VGI with authoritative data is currently not viable at this scale. As part of this study, they implemented their methodology as a Matlab-based tool that can be used by others to carry out similar comparisons. In the second paper, by Jackson *et al.* [6], data from OSM are compared with: (a) the most authoritative dataset available; and (b) a hybrid OSM dataset in which mapping experts were involved in both the training of the volunteers and in quality control. The authors developed a methodology to assess the completeness and accuracy of point data, using school locations as their feature dataset. The results showed that the hybrid variant of OSM was more accurate than the OSM data alone, which clearly indicates that the involvement of experts in the control of quality has tangible benefits. The third paper, by Pourabdollah *et al.* [7], considers another aspect of integration, *i.e.*, how authoritative data from the UK Ordnance Survey can be integrated with OSM, enriching this latter dataset where data are missing and highlighting the differences in order to improve the quality. An analysis of the differences in the road network of both data sources also allowed the authors to analyze different patterns of quality, showing that the best quality could be found in areas with very dense road networks. The authors also highlight the fact that this approach could be used in the opposite manner, *i.e.*, to augment authoritative data, especially with the rich additional content that is not collected by mapping agencies.

In addition to volunteered information, citizens also provide other sources of spatially relevant data but in a more indirect manner, which the authors of [8] refer to in their paper as “incidental data”. For example, spatial information can be harvested from blogs, forums, twitter and other web-based media that could benefit the research and public sector communities. The challenges faced in integrating data from these multiple sources, *i.e.*, VGI, incidental data and scientific data on alpine glaciers, are discussed in [8]. The authors present a workflow on how this integration could be envisaged and provide thoughtful suggestions on how data quality could be addressed through collaborative assessment.

The final two papers [9,10], consider collaborative mapping as a means for citizen engagement in decision-making and public participation. Mitsova *et al.* [9] outline their blueprint for a collaborative geospatial shoreline inventory tool that brings together numerous spatial datasets for the Miami-Dade area of Florida. The tool allows stakeholders to query information using a map-based interface and initiate discussions and blogs based on specific coastal topics, e.g. urban development and options for shoreline stabilization using mashups, geo-tagged pictures and built-in mapping tools within the system. Lei Lei and Hilton [10] have developed a prototype of a spatially intelligent public participation system for environmental impact assessment. The system is comprised of components for mapping and analysis, e.g., scenario generation and "what if" queries; provision of comments and other user generated content such as geo-tagged photos and video; a data mining component to find patterns in the user generated content; and a mobile component for broadening the engagement options. The results of testing the system on a renewable energy project indicated that the system was effective in terms of opening up access to information, promoting collaboration and environmental awareness, and in making the process more transparent. The ability to visualize the information on a map and generate alternative scenarios was seen as a strong point for the system.

Collaborative mapping and VGI are clearly on the rise, and we can expect many more papers to appear in the future addressing the types of themes highlighted in this Special Issue, *i.e.*, data quality, integration of VGI and incidental data with authoritative data, and enhancement of public participation in decision-making processes through the power of online mapping and social media. Giving ordinary citizens the tools to map and document their environment will lead not only to an unprecedented amount of valuable geodata in the future, but will also produce a new generation of geo-empowered citizens. For us, it is clear that collaborative mapping will become a key component of this future world.

Conflict of Interest

The authors declare no conflict of interest.

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