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Viewpoint

An assessment of Public Participation GIS and Web 2.0 technologies in urban planning practice in Canela, Brazil

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ABSTRACT

Recent advances in Geographic Information Systems (GIS) and Web 2.0 technologies provide new ways of creating sophisticated Web applications that strengthen social interactions based on comments on online maps, which have the potential to improve Public Participation GIS (PPGIS) practices. In this paper, we address this promising approach to analyze the impact of collaborative Web 2.0 tools applied to PPGIS applications in urban planning actions. We develop a Web 2.0 PPGIS application through free, easy-to-use tools, which consist of a Web mapping service, with eligible geospatial data layers, where users explore and comment. A database stores the contributions in a format supported by GIS. We also set up a prototype version in Canela (Brazil), to test its usability. The results showed that it is a valuable approach for engaging the public. It could promote communication among users and decision makers in a more interactive and straightforward way. Besides, it is easy to set up and understandable by non-experts. The Web 2.0 PPGIS may serve as a social tool for any spatially-related issue involving community members in any context.

Introduction

Urban planning handles problems of the built, natural, and social environments, where a wide range of features have to be balanced against each other to reach solutions (Webber and Rittel, 1973). Undoubtedly, key players in urban planning are the inhabitants, who know the reality and the problems around them better than anyone else. Citizens' knowledge provides a rich source of updated information that helps to improve the quality of the analysis, leading to different solutions than when using traditional forms of data. Nevertheless, involving members of society in planning decisions affecting their lives is a recent trend, principally influenced by legislation. For instance, the United Nations Local Agenda 21[1] program enshrines the practice in its principles; and the Aarhus Convention[2] established that sustainable development can only be achieved by involving stakeholders.

However, public participation for urban planning decisions is not a straightforward process. It deals with problems that co-evolve, with an infinite number of solutions (Webber and Rittel, 1973; Tang et al., 2005). Besides, the complexity and interdisciplinary characteristics of all studies needed to produce an urban analysis demand up-to-date tools and methods to represent space and its inherent relations. As most urban studies data are found in map forms, visualization capacity, employing mapping services, found in Web 2.0 tools, and the capacity to model multiple outcomes of GIS, are critical (Elwood, 2006).

As a result of the use of GIS capabilities by the public, the term Public Participation GIS (PPGIS) has emerged (Nyerges et al., 1997). Rather than using these in a traditional way, as for spatial analysis, geospatial capabilities are used for production of maps and spatial stories that help to characterize the local space (Elwood, 2006). Since traditional participation methods received some criticism, based on the limited ability to sufficiently engage the public, to provide useful data, and to promote an exchange of ideas (Forrester et al., 1999; van den Brink et al., 2007), PPGIS can be perceived as a technological evolution enabling more interactive methods.

PPGIS projects are though still limited in their ability to communicate, organize, and reflect user participation (Carver, 2001). According to Steinmann et al. (2004), although up-to-date research efforts are concentrating in new technologies around the Web (Rinner et al., 2008; Sidlar and Rinner, 2009), the reality is that exchange platforms are exceptions. Also, Hanzl (2007) states that

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[1] List of actions to be taken nationally and locally for a sustainable development: http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm.

[2] The UNECE (United Nations Economic Commission for Europe) convention on access to information, public participation in decision-making and access to justice in environmental matters on June 1998 in the Danish city of Aarhus: http://www.unece.org/env/pp/.

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most of the examples described in the literature are still experimental: they corroborate available technical possibilities but do not apply to real participatory planning actions.

Recent changes in how people are using new information technologies for their own interest (Castells, 2001) are reflected in an increasing volume of user-generated geospatial content, available for everyone (Goodchild, 2007; Hudson-Smith and Crooks, 2008; Turner, 2006). This poses new challenges in PPGIS applications. Centralized, top-down approaches dominated by institutions, politicians, and technicians are not suitable anymore. New perspectives are thus required that enable a bottom-up decision making strategy, building on effective participation and communication among experts and non-experts. Therefore, the issues addressed in this paper are twofold:

- Enhancing effective participation and communication among experts and non-experts via an easy-to-use and interactive exchange platform.
- Exploiting the local knowledge and user-generated content to enrich urban planning actions, though the use of Internet and Web 2.0 collaborative tools.

In this paper, we combine principles of public participation, urban planning, PPGIS, and Web 2.0 tools to, first, develop a Web 2.0 PPGIS prototype, and, second, to evaluate its usability in a real-world case study of Canela, Brazil. We first outline the background ideas and technologies used in our project and describe related works. Then, the case study is presented. The following two sections describe the prototype implementation and assess the usability test. Finally, we close with lessons learned from the project, and future work recommendations.

Web 2.0 and the programmable Web

Web 2.0 (O'Reilly, 2005) is shifting the Web to turn it into a participatory platform, in which people not only consume content (via downloading) but also contribute and produce new content (via uploading). Web 2.0 ideas (Vossen and Hagemann, 2007) incorporate new techniques (tagging, social networks, blogs, wikis, mashups), which are breaking the barriers between users and data-providers, by creating new and useful links among them (Hudson-Smith and Crooks, 2008).

Although Web 2.0 technologies are enabling innovative, collaborative, and easy-to-use services and applications, embedding participatory practices into existing institutional organizations still needs plenty of effort. As van den Brink et al. (2007) have stated there is high resistance, lack of qualifications and variable interest by participants that together act as entry barriers. Then, "useful links" are defined here as the ability to connect official and informal information. Users are more proactive in creating Web 2.0 spatial content themselves. Neogeography (Turner, 2006) and Voluntary GIS (Goodchild, 2007) show the successful user-created-content map applications (Haklay and Weber, 2008). Therefore, paying attention to Web 2.0 techniques is essential to collaborative decision-making.

Apart from a participatory platform, the Web is also becoming a programmable platform (Programmable Web, 2009). Today, most Web 2.0 services offer programmatic access by lightweight application programming interfaces (APIs). These publicly-available APIs (around 1.500 according to Programmable Web, 2009) allow programmers to easily combine services and resources from remote sources into so-called mashups that meet specific user needs. Various Web 2.0 technologies are available today to set up mashup applications. The ones enabling our prototype focus on three conditions: they support rapid development, are easy-to-learn, and are free or open source. Online web mapping services are essential to visualize and inspect the geospatial data across a map. Microsoft, Google, and Yahoo! are some examples of online mapping tools. We decided to use Google Maps because it provides an easy-to-use, well-documented API (Google, 2009). In short, this API enables AJAX (Asynchronous JavaScript and XML) to build more interactive, advanced Web applications.

Related work: collaborative geographic applications

A key aspect in collaborative geographic applications is the interoperability between geospatial data and tools available on the Internet to users wanting to build up their content. Table 1 shows a comparison of some relevant examples, which vary from simple geospatial data visualization portals to more interactive systems.

London Profiler (London Profiler, 2009) is an example of a geovisualization portal that delivers geospatial data online, which pictures London neighborhood data through Google Maps services and GMapCreator (GMapCreator, 2009). It allows users to select the desired layer by distinct classes or to overlay a KML file URL (though opinion sharing is not supported). Hackney (Map Hackney, 2009), a London borough, displays various maps by topics. Users may provide their opinions by e-mail, but are not georeferenced on a map-based discussion. Orange County Interactive Mapping (Orange County Interactive Mapping, 2009), from the city of Orlando, Florida, allows participants to attach a map, where they can sketch it to the e-mail message. These two examples primitively allow two-way flows of information.

Virtual Slaithewaite, one of the first online applications for participatory urban planning (Kingston et al., 2000), allows citizens to zoom and pan, to select features, to get information about it, and to add their comments. Any features selected provide a free-form typing text box. As comments are not organized or related to each other, tracking discussions over time is not though supported. The Argumentation Map prototype (Keßler et al., 2005) developed solutions for georeferencing comments. It makes geographic references in discussions and uses them for linking text messages to maps. Later, Sidlar and Rinner (2007) and Sidlar and Rinner (2009) have conducted usability and utility tests on the prototype. Finally, WikiMapia (WikiMapia, 2009), a collaborative Web mapping strategy, combines Google Maps and Wiki, where any user can add a place mark to any location and provide information. Registered users can also check certain areas and send personal messages to one another. Besides, users can vote for or against other users' contributions as a means of data trust.

Despite these efforts and projects, except for the Argumentation Map prototype and subsequent works, the use of Web 2.0 services is still limited to delivering collaborative applications (Rinner et al., 2008). In general, users can post comments on a map, but user-friendly map-based citizen's opinion and interactive discussion is still not widely supported. We expect to engage more citizens in local actions for urban planning by using the emerging technologies for web-based collaborative social networks (missing in most of the early applications).

To characterize the usability of Web 2.0 and GIS technologies in practice, we have assessed the impacts of the Web 2.0 PPGIS prototype in the following real-world case study.

Case study: local participation for urban planning in Canela

In January 2009, the first version of the prototype was presented to potential users in Canela, Brazil (see evaluation text). Brazil encourages public participation via legislation. Existing projects range from public participation meetings, such as Participa-