Chapter 90
Three Dimensional Volunteered Geographic Information:
A Prototype of a Social Virtual Globe

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ABSTRACT

The dawn of GeoWeb 2.0, the geographic extension of Web 2.0, has opened new possibilities in terms of online dissemination and sharing of geospatial contents, thus laying the foundations for a fruitful development of Volunteered Geographic Information (VGI) systems. The purpose of the study is to investigate the extension of VGI applications, which are quite mature in the traditional bi-dimensional framework, up to the third dimension by means of virtual globes. Inspired by the visionary idea of Digital Earth, virtual globes are changing the way people approach to geographic information on the Web. Unlike the 2D visualization typical of Geographic Information Systems (GIS), virtual globes offer multi-dimensional, fully-realistic content visualization which allows for a much richer user experience. The proposed system should couple a powerful 3D visualization with an increase of public participation thanks to a tool allowing data collecting from mobile devices (e.g. smartphones and tablets). The participative application, built using the open source NASA World Wind virtual globe, is focused on the cultural and tourism heritage of Como city, located in Northern Italy. Users can create and manage customized projects and populate a catalogue of cartographic layers which is available to the entire community. Together with historical maps and the current cartography of the city, the system is also able to manage geo-tagged data, which come from user field-surveys performed through mobile devices in order to report POIs (Points Of Interest). Users can also extend POIs information adding more textual and multimedia contexts (e.g. images, audios and videos) directly on the globe. All in all, the resulting application allows users to create and share contributions as it usually happens on social platforms, additionally providing a realistic 3D representation enhancing the expressive power of data.

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INTRODUCTION

Paradigms for publishing geographic information over the Web have radically changed in the last decades. While the first Web maps were primarily static, today's Web maps can be fully interactive and integrate multiple media. This means that both Web mapping and Web cartography have to deal with interactivity, usability and multimedia issues (Neumann, 2008). The collection of services related to online fruition of geospatial information, defined by Scharl and Tochtermann (2007) as the Geospatial Web, has experienced such a revolution that the term GeoWeb 2.0 was coined to define it. According to Maguire (2007), this new model represents nothing but the geographic extension of the wider overturn of Web nature known as Web 2.0 (O'Reilly, 2005). Web 2.0 is a concept coined to describe the global trends of exploiting the new Internet technologies to create, share and use information within an innovative generation of collaborative applications. The concept provides a clear explanation of an unprecedented Web user interaction in terms of disseminating and sharing contents.

GeoWeb 2.0 and the non-stop diffusion of mobile devices have opened unprecedented opportunities for generating and sharing contents online. Initially there was no consensus on how to call this new trend, with different appeared lexicons such as user-generated content, collective intelligence, neogeography (Turner, 2006) and crowdsourcing (Howe, 2006). All of them blended into the general idea of exploiting Web 2.0 to create, share and analyse geographic information via multiple computing devices and platforms (Sui et al., 2013). However the most successful definition of this dramatic innovation in the history of geography was introduced by Goodchild (2007a), who coined the term Volunteered Geographic Information (VGI) as a special case of Web user-generated-content. Goodchild himself compared humanity to "a large collection of intelligent, mobile sensors" able to register an incredibly rich amount of geographic information (Goodchild, 2007b). The ability of capturing, integrating and interpreting this information can be enriched by a tremendous number of available sensor-equipped devices, including the new mobile phones provided with a GPS receiver and a camera to geo-tag multimedia contents, and a non-stop Internet connection to immediately Web-publish them. However, besides a number of studies focusing on field-data collection using mobile devices (e.g. Burke et al., 2006), a couple of considerations can be inferred. First, few academic research has studied the implementation of VGI systems able to address the problem of entirely managing data from its collection in situ to its Web-publication. In addition, literature is almost silent about VGI applications involving user data interaction also in the third dimension.

For several years geographic information has been represented on the computer in a bi-dimensional way, as natural evolution of the computerization of the classic 2D paper maps. With the growth of the 3D computer graphics and the spread of high-performance hardware (processing power, storage capabilities, 3D-enabled video cards, etc.) the geospatial viewer started to show data in the three-dimensional aspects of their virtual geographic features. Nowadays the so-called virtual globes are a highly advanced evolution of these viewers, providing the ability to render terrain, imagery and vector datasets over a whole 3D digital model of the Earth, with the freedom of exploration and the ability to visualize huge amounts of data.

The concept of Digital Earth was proposed by Al Gore (1999), who described the possibility for citizens to interact with a computer-generated multidimensional spinning virtual globe and to access vast amounts of environmental and cultural information. The idea was to help citizens understand the Earth and human activities as part of its history. A Digital Earth greatly helps this citizen interaction. The combination of the Web and access to geographic data has made possible the development of powerful virtual globes which now provide this Digital Earth. The terms Digital Earth and virtual globe are