COMMUNICATING GEOSPATIAL DATA QUALITY OF 3D OBJECTS IN VIRTUAL GLOBES

K. Jones [a] *, R. Devillers [a,b], Y. Bédard [b]

[a] Department of Geography, Memorial University of Newfoundland, St. John's, Newfoundland, A1C 5S7 Canada - (k39krj, rdeville)@mun.ca

[b] Department of Geomatics Sciences, Université Laval, Quebec City, Québec, G1V 0A6 Canada - Yvan.Bedard@scg.ulaval.ca

Convergence in Geomatics: Challenges and Opportunities

KEY WORDS: Virtual Globes, Volunteered Geographic Information (VGI), 3D models, Spatial Data Quality, Perceived Quality, Visualization, Decision-Making, User Awareness

ABSTRACT:

The recent emergence of virtual globes, such as Google Earth and Bing Maps 3D, is in the process of changing significantly the Geomatics landscape. While geospatial data were in the past mostly produced, distributed and even used by experts in Geomatics, they are now easily accessible by anyone that has a simple access to the Internet. The emergence of the Web 2.0 furthered these changes by allowing any user to create geospatial data and share them with the entire user community. This concept has been identified as 'Volunteered Geographic Information' (VGI) or 'Crowd-sourcing'. Because recent studies showed that datasets produced by such an approach often have a quality equivalent to datasets produced by national mapping agencies, these new approaches are generating growing interest from government and industry. These new opportunities for the Geomatics community also involve a number of new challenges.

A number of Web mapping applications such as Google Maps and OpenStreetMap allow lay users to add and modify geospatial data. In a similar way, Google allows users to create 3D models in Google Sketchup and then make them available to anyone for download in their 3D Warehouse. These approaches contrast from traditional geospatial data production mechanisms as they are not based on explicit production standards, but can allow thousands of users to contribute to the production of a single geospatial dataset. This creates challenges when one wants to rely on such data to make a decision, as the quality of the geospatial dataset can be highly heterogeneous or even unknown. For instance, a user of a virtual globe could be immersed in an urban 3D environment, but have little indication of how reliable the different 3D models visualised are.

This paper presents the results of a research project that aimed at designing and testing new approaches for communicating geospatial data quality information about 3D objects to lay users of virtual globes.

A number of methods have been proposed in the past by the research community for visualising geospatial data quality and uncertainty. Those approaches typically use traditional visual variables (e.g. colours, size, transparency) to portray the quality of the data on a 2D map. Some work extended it to 3D geospatial visualisation. However, none of these methods have been implemented in commercial applications for a number of reasons. First, most of these methods require a detailed assessment of the quality of the data, which is often not available. Second, these approaches are often complex and hence hard to understand by lay users. Third, most of these approaches are technically challenging and cannot be easily implemented in large datasets. For these reasons, this project explored alternative ways of communicating data quality information that would balance the efficiency of quality description with the ease of understanding and technical feasibility necessary in a crowd-sourced environment. Such an approach is described here as a 'symbiotic approach'.

A number of other domains have successfully implemented methods of communicating the reliability or quality of data/products to lay users. This includes popular Web sites or systems such as Amazon, eBay and ITunes which allow users to assess the quality of products using different rating and feedback systems. Most of these systems are based on a five-star ranking approach and often allow users to add more detailed comments in relation to their own context. This paper adapts such an approach to the assessment of the quality of 3D geospatial data in virtual globes. More specifically, it intends to communicate the external quality of these data, that is how the data can fit specific user's needs.

The symbiotic approach allows any user of virtual globes to provide ranking and feedback on a model created and shared by another user. In this process, a user first creates a 3D data model (e.g. a building) using software such as Google Sketchup and shares it through the 3D Warehouse. Then, other users can download the model into their virtual globe and assess and comment on its quality. Subsequent users can then examine through the cartographic interface the comments and ratings which other users have made about this model. Each user can then gauge how the given model fits their specific use (e.g. the dataset is good to use for assessing the aesthetic value of a real estate property) by assessing what other users have thought. We named this assessment of quality based on previous users' feedback 'perceived quality', as it does not rely on formal quality measurements but on personal judgement. Any user can then navigate into a 3D virtual globe, look at the various 3D models and get information about the perceived quality related to the objects visible in the environment.

* Corresponding author.

Several ways that can be used to visualize the rating system in 3D virtual globes were tested. The use of 2D and 3D symbols to display the five star ratings of the 3D objects was tested to see which approach would be most suitable. Also, the use of various visual variables (e.g. colour, size, shape) for the visualization of the five star rating system was tested to determine which visual variables would be viable options. Tests were performed for different places on the globe that have different types of environments, from dense north-American cities downtown to more dispersed urban setting in Europeans cities. This paper will present the different tests and the solutions selected that were then validated through a user test.

Paper presented at the Canadian Geomatics Conference in Calgary (AB), Canada, June 2010