Chapter 94

New Developments in Geographical Information Technology for Urban and Spatial Planning

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ABSTRACT

Measuring urban form, modelling 3D point clouds and visualizing data within an (augmented) mixed reality environment through mobile devices are three of the new developments in Geographical Information Technology for urban and spatial planning. New geographical information technology supports data representation for urban and spatial planning. This chapter has two main objectives: (i) to demonstrate that geographical information technology supports every stage of urban and spatial planning, and (ii) to argue that technologies are a means for the external representation of cities and territories. The chapter sections include measuring urban form (quantitative analysis of urban shape), modelling 3D point clouds for the extraction of urban parameters, and the visualization of virtual models through mobile devices.

1. INTRODUCTION

What if John Snow had not analyzed, back in 1854, the spatial relationship between deaths by cholera and the location of water wells in a neighborhood in London? What if the assessment of potential locations for urban expansion was based solely on non-geographical data? What if information on the potential of solar energy was not introduced in urban planning models?

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These issues reveal the many applications of Geographic Information Systems (GIS) and particularly three degrees of such systems (in the general sense of the term): spatial analysis, location assessment, and data modelling. Spatial analysis translates the zero degree of GIS work targeted at planning decisions since decision making is "outside data"; location assessment incorporates *a priori* criteria and therefore the spatial intelligence that results from the criteria certified by institutions; data modelling reduces the forecast of determinants for the simulation of future spatial situations.

Studies on planning are believed to need these three GIS degrees. GIS technology has been consolidated and its most recent advances correspond to 3D data modelling and the incorporation of time into modelling processes.

The consolidation of GIS has enabled the dematerialization of processes that imply the virtual organization of geoinformation. Shanon's information theory has laid the foundations for the virtualization of territories as we know them today. Geoinformation feeds the *external representation* of the territory, namely through computational modelling (2D, 3D, 4D). The full range of GIS consolidation has allowed for: (i) the digital transcription of information that must favor the acceleration of public access; (ii) the digital transcription of information that must favor the transparency of processes (of debate, decision, assessment, etc.); (iii) the digital transcription of information that promotes public participation in the planning process; and (iv) the transcription of digital information that recreates the collaborative construction of knowledge and a culture of permanent assessment. It seems that we can accept that GIS *technology* has contributed to this "dematerialization" and that it allows for the virtual organization of geoinformation over a network.

On the one hand, Remote Sensing has become a public service in the age of the information society, to which States, public and private institutions and companies contribute. This service has reached a high maturity level, directly related to the increase in geometric and spectral sensor resolution, the performance of scientific investigation as regards the construction of new algorithms designed to digitally process images, and the development of applications, the communalization of added-value services, and a, albeit timid, decrease in the rates for orbital data, and fundamentally the already mentioned growing "democratization" of GIS platforms. On the other hand, the operational interest of digital image processing is enabling us to obtain semantically significant classes from the classification of spectral data – i.e., grouping pixels into classes or obtaining image segments based on pixel oriented approaches (in the first case) or object oriented approaches (in the second case) can present, from the geometric point of view, a good definition of border (in agreement with the demands for cartographic quality; positional accuracy) and, from the semantic point of view, an interesting content (with high levels of thematic accuracy). Regarding these subjects, the automatic extraction of vector-based geographic information from digital images has not fully answered either the operational and formal needs (those that stem from the law) or the actual urban and spatial planning needs.

The aforementioned developments place the question: What are the new developments in terms of Geographical Information Technology applied to urban and spatial planning? The general scope of this chapter is precisely to introduce some new developments in Geographical Information Technology for Urban and Spatial Planning.

This chapter was guided, therefore, by the following ideas: (i) measuring urban shape demands algorithms that have not yet been implemented and therefore open source programming is one of the most recent developments as regards geographic information technologies applied to urban and spatial planning; (ii) 3D point cloud modelling from LiDAR data and UAV data enable the extraction of urban