Chapter 18
Future 3D Urbanism:
From UAV Data Modelling to Information Visualization

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ABSTRACT

Urbanism has mainly used 2D data for both the urban analysis and diagnosis and the presentation of proposals for changes in the whole city or parts of the city. Even regarding the production of urban indicators, using, for example, the quantification of the existing green area in relation to the resident population, this practice is regularly based on the area and rarely on volume. This situation is mainly justified by the sluggishness and costs associated with obtaining 3D data. The recent development of data collection technology by unmanned aerial vehicles has triggered a change in this scenario. This chapter presents the UAV data acquisition and processing chain, analyses the positional accuracy of UAV data processing performed with GCP measurements obtained from GNSS, demonstrates how positional accuracy assessment and UAV workflow's quality control are relevant for ensuring the accuracy

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of derived UAV geospatial products, and demonstrates the usability of 3D models in a theoretical 3D urbanism context.

INTRODUCTION

Cities and urban areas can be understood from a physical and material perspective as spaces formed by multiple strata or overlapping layers with various characteristics and attributes that, albeit different, confer on them distinctiveness and uniqueness as if they were living organisms. These overlapping layers or strata can be observed and analysed in various fields (social, demographic, cultural, political, economic, etc.) from the dynamics of interaction and very diverse flows. Nevertheless, the intrinsic physical element corresponds to the urban, built and material spatial expression, characterized by its typologies, shape geometries and land-use and occupation. The physical properties directly associated with these spaces are usually studied and analysed on two-dimensional (2D) surfaces.

"Horizontal" (2D) urban analysis has been explored in "classical" studies of the dialectic of compact versus dispersed ("urban sprawl") urban models of urban growth. Other approaches to the urban form, developed from a quantitative perspective, have made it possible to translate the fundamental characteristics or elements of urban form into quantifiable attributes by calculating indices or indicators – spatial metrics – of a more or less complex nature. These measures support the analytical study of the 2D urban form to support decision making in regional and urban planning, transport planning, environmental and energy planning, analysis and monitoring of urban-rural sustainability, public health and urban safety, socio-spatial exclusion/inclusion, among others. An example of this quantitative perspective is the metrics applied to the study of (sustainable) urban form based on geometric shape parameters (urban shape analysis) obtained in 2D (Estanqueiro, 2011). In this approach, the characteristics of the urban form are understood to be reduced to their fundamental elements or properties, which identify and come close to the phenomenon or reality to be represented or handled using metrics (quantifiable measures in the form of indices or indicators) with a vital spatial element. These can be addressed separately or combined to support urban analysis and monitor the evolution and change of the urban form considering urban sustainability.

Concurrently, more recent studies have explored vertical and volumetric urban analysis, supported by the potential of producing 3D (three-dimensional) urban models. 3D urban modelling is a high potential source of data for the extraction of parameters of interest for studies on urban sustainability in its different dimensions, from a more detailed analysis (intra-urban scale, block, neighbourhood, urban axial segment or set of buildings or urban elements). In fact, the way of thinking about cities and urban planning has resorted to geospatial data that go beyond the two-