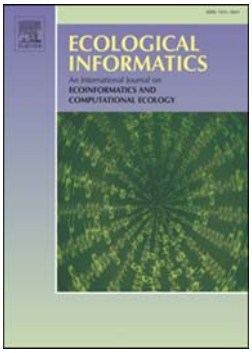

Architectural modelling of an olive tree: Generative tools for the scientific visualization of morphology and radiation relationships

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ARCHITECTURAL MODELLING OF AN OLIVE TREE: GENERATIVE TOOLS FOR THE SCIENTIFIC VISUALIZATION OF MORPHOLOGY AND RADIATION RELATIONSHIPS

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Abstract
This research integrates the agricultural study of trees with the sciences of representation, in order to describe the architectural form of an olive tree and to show a scientific visualization of the relationship between morphology and light interception in the canopy. The representation of plant architecture, manipulated with pruning operation for agricultural purposes of light optimization, describes the action of sunlight in the tree, testing the potential of digital design tools – especially generative modelling. Through the design of a specific algorithm, the tree is interpreted like a fragmented photovoltaic panel, analyzed using 14,000 control points corresponding to the leaves. The possibility to select these classes of elements becomes the instrument to explain the canopy structure, finding categories that describe and simulate the annual radiance and illuminance. The developed modelling process and its purely theoretical significance constitute the basis for a variety of applications in data analysis and comparison between different models, evaluations, theories, and operations.

Keywords
Trees digital modelling, generative algorithm, sun lighting analysis, scientific application

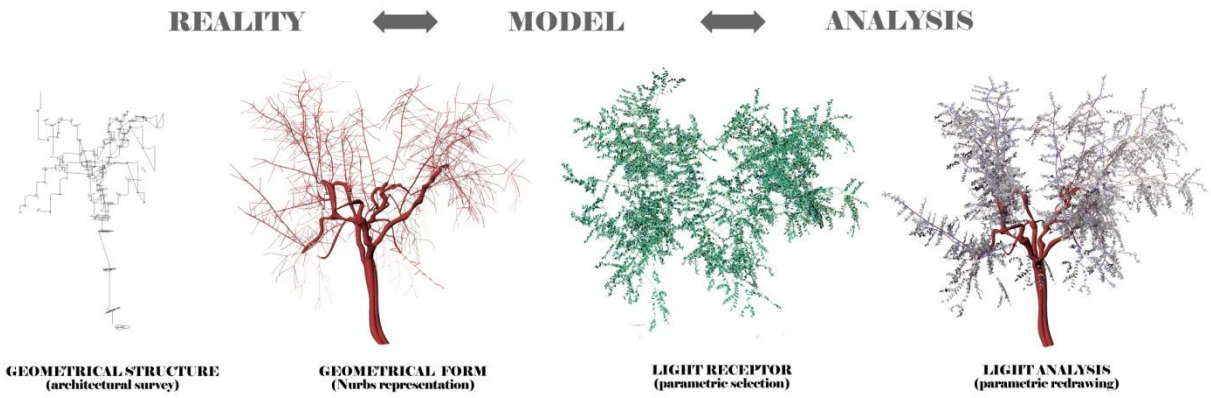

Figure 1. Graphical abstract.

1. Introduction

1.1 Digital representation of the "architecture" of the plant

Digital representation of plants has been a subject of interest for several decades for different authors (Hanan, 1997; Birch et al., 2003). They have investigated the conceptualization of plants in three-dimensional models , with a focus on the "geometric structure" (Sinoquet, Andrieu, 1993), on the "form" (De Reffye et al., 1989), or on the "topological structure multiscalar" (Godin, Caraglio, 1998). Godin (2000) defines the concept of "architecture" of the plant as "*any individual description based on decomposition of the plant into components, specifying their biological type and/or their shape, and/or their location/orientation in space and/or the way these components are physically related with one another*".

In this correspondence with architectural form, it is possible to think of a tree or a plant as the target of an architectural survey whose scope is to create a digital model.