# Chapter 13
# Parametric Generator for Architectural and Urban 3D Objects

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## ABSTRACT

*The main goal of this chapter is to present a research project, developed by Map-Aria research team, which consists in applying automatic generative methods in design processes.*

*The Map-Aria research team of the School of Architecture of Lyon develops modeling assistants within the process of architectural conception. They run specific heuristics dramatically reducing time-consuming tasks of wide scale architectural and urban modeling by the implementation of bio-mimetic and/or parametric generative processes. Prior experiments implemented rule-based generative grammars with interesting results.*

*The authors developed and finalized a specific tool able to model the global structure of architectural objects through a morphological and semantic description of its finite elements. This discrete conceptual model - still in study - was refined during the geometric modeling of the "Vieux Lyon" district, containing a high level of morpho-stylistic disparity. Future developments should allow increasing the genericity of its descriptive efficiency, permitting even more sparse morphological and\or stylistic varieties. Its general purpose doesn't consist in creating a "universal modeler," but to offer a simple tool able to quickly describe a majority of standard architectural objects compliant with some standard parametric definition rules.*

DOI: 10.4018/978-1-4666-2077-3.ch013

## INTRODUCTION: SETTING UP THE PROBLEMATIC

Following upon the research work led for several years in the field of the paramétric modeling and generative approaches (Herr, 2002; Galanter, 2002; Saleri, 2005), this study aims at setting up a tool allowing to generate quickly exploitable architectural objects in the workflow of computer generated images.

This research task follows and focuses on a former investigation described in “Urban and architectural 3D fast processing” in *Reflexing interfaces: the complex evolution of information technology ecosystems* (Saleri, 2008).

We implemented more accurate modeling functions in order to upgrade the visual precision of 3D enactments (visible on Google Earth portal, not uploaded yet). Visual improvement enhances global 3D model on general volumetric definition, roofing structure and facade definition. Most of remarkable architectural masterpieces are still made through classic 3D modeling workflow; for instance, the Thomassin House, the “Temple du Change”, the Saint Jean Cathedral exceed the descriptive model of the described tool and were modeled with traditional Maya geometric built-in routines.

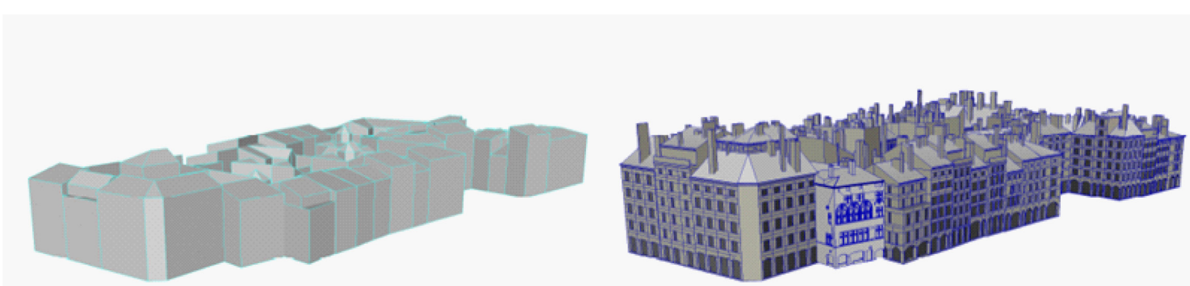
## MODEL

The general idea consists in a quick description of an architectural object by informing predefined fields, matching the characteristics of objects to be modelled through a fast and coherent description of the facade, the cross-section type and the plan.(checkboxes or scrolling menus which we can spread on demand by a direct observation of objects to be reproduced). The difficulty consists in the definition of an abstract model as precise as possible but generic enough to cover a wide variety of architectural elements (for example, ergodicity of descriptive model vs final resemblance of the produced models).

We can further discuss about the complexity mode of such a model, according to Rescher description (Rescher, 1998*)*, and we can summarize overall compositional (ontological) complexity, which is only part of the “models of complexity” described as “epistemic modes (formulaic complexity), ontological (compositional and structure complexity) and functional complexity, as follows:

- Constitutional complexity (number of elements of a system)
- Taxonomical complexity (heterogeneity, number of types of elements in a system).

*Figure 1. Visual enhancement of architectural models on the same block, comparing former and present version. The Thomassin House (visible on the right picture foreground) was modeled with traditional 3D construction sets. Obviously the polygon count is dramatically increased in the new model, consisting in 16.467 triangles (611 in the previous low-poly solution). In real-time applications both models are used for a LOD (Levels Of Detail) implementation.*



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