

Chapter 8

Interaction and Intersection Between Digital Modelling and Design in Architecture: Different Approaches in Parametric Design

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ABSTRACT

Parametric modeling, usually considered modeling tools, has been analyzed in this chapter in a different way: as design tools for architect. First the use of parametric design has been considered from different approaches. Starting from the approach of Kas Oosterhuis Architect, in the Saltwater pavilion (1997), or Peter Cook Architect in the Kunsthaus (2003), in which the parametric tools have been used as shapes generation tools. Until the approach of the Japanese architect Kengo Kuma, in the Sunny Hills building (2013), where the parametric tools have been used to rethink traditional construction techniques, known as Chidori, in a parametric way. After the analysis of the different parametric approaches, a new perception on the architectural design will be provided. In particular, the analytic way and the creative way, that are usually separated in the architectural design, in some cases become the same thing. This new approach enhance their interaction, makes explicit and evaluable parts of the design process, reducing the gap between concept and goal in design.

INTRODUCTION

Everything flows, nothing stands still - Heraclitus of Ephesus

The chapter is based on the recent developments in the use of digital models in the Architectural Engineering Construction (AEC) sector. In particular, in relation to the concept of design, production and coordination. The purpose of this research is to propose a new design strategy based on the use of digital models. Digital design and digital fabrications are the areas critically analysed.

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Interaction and Intersection Between Digital Modelling and Design in Architecture

The research has been developed by the author through many trials in collaboration with:

- University Politecnico di Milano and University of Saint Joseph Macau, where the author is adjunct professor.
- University of Salford-Manchester, where the author made a research on digital tools in design.
- Digital fabrication company Robofold, where the author collaborates in a workshop.
- Design companies Kengo Kuma and Associate, Tokyo-Japan, where the author worked as designer.
- Glenn Murcutt Masterclass Sydney-Australia, where the author has been involved in a workshop
- Dubosc et Landowsky, Paris-France, where the author worked as designer.
- Atelier2 Gallotti Imperadori, Milan-Italy, where the author collaborates in many researches.

During this research, design models, fabrication models and coordination models have been analysed, tested in many experiments and applied in different real cases.

Digital design models have been studied starting from the approach of Kas Oosterhuis Architect, in the Saltwater pavilion (1997), or Peter Cook Architect in the Kunsthaus (2003), in which the digital tools have been used as shapes generation tools in a top down process; in the sense that the construction techniques have been considered as subsequent part of the design method. The opposite way has been investigated in the Kengo Kuma Architectural company, in particular in the Sunny Hills building (2013), in which the digital tools have been used, in a bottom up process, to generate a building shape from specific construction techniques (evolution of chidori wood connection). Both paths have been tested by the author, during a research period in Kengo Kuma Office in Tokyo-Japan and in a research in collaboration with the university of Politecnico di Milano.

Secondly digital fabrication has been analysed as a natural extension of the digital design. Digital design often goes in the direction of free form shapes and requires a customized fabrication. On the other hand, digital fabrication has been considered as a design strategy tools with the aim to explore new design solutions. CNC machine, like laser cutter, 3D printers and robot have been studied and tested in fabrication. Direct link between fabrication machine and design/modelling software has been tested in different object scale, from maquette to mock up, until real scale façade panels.

After the research phase, based on the theory in the digital age (Rivka Oxman, 2005)¹ and based on the cases study evaluated, the following principles have been identified as strategic in the AEC sector:

- The possibility to proceed by generating many different alternative design solutions, using parametric design models.
- The possibility to produce customized components, using digital fabrication models.

The possibility to propose meaningful alternatives to the logic of repetition, offered by the digital design, has been identified as a new paradigm in the design strategy. The possibility to proceed by an “ongoing design and production process” has been declined in different possibilities of options-making, that affects product, project and process.

Basing on the research of Dominik Holzer and Steven Downing (Holzer & Downing, 2010), that defined the design optioneering in 2010 as a new basis for engagement between architects and their collaborators, the author extends the first design optioneering idea to the overall construction process, from design to construction.

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