Integrating analog and digital Architecture

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Abstract

The integration between traditional handcraft and high tech may seem a paradox, especially in the architectural field, but its intersection opens up a new range of formal explorations and construction methods. By the means of a practical approach in the form of an application exercise, this research aims at better understanding the difficulties and possibilities of implementing this concept into architecture, whether in the integration between vernacular and modern architecture or in the restoration of historical buildings.

Key words: digital fabrication, parametric modeling, rapid prototyping

Introduction

Contemporary architecture is marked by the increasing use of digital and computational methods in the design and fabrication process. Still it usually does not connect directly to pre-existing architectural elements, being entirely generated by digital means. The objective of this research is to study the integration between the built (analog) and the digitally designed and fabricated elements. The chosen method was the exploratory research applied to a practical exercise of building an object-sized model, which evidences the difficulties and potentials of the studied concept.

Results and Discussion

The exercise consisted in adapting a parametrically designed and digitally fabricated cover to a handmade structure made of bamboo rods, on which were attached bolts and nuts as fixings for the cover. The process begins by scanning the bolts with a 3D MicroScribe Scanner. With these scanned points, the cover consisting of triangular elements was designed using *Grasshopper*, a parametric modeling plugin for the CAD Software *Rhinoceros*. The elements were then nested into a printable layout and cut out with a CNC vinil cutting machine. The material chosen for the cover was a 0.125mm plastic sheet, which is flexible enough to adapt to the irregularities of the underlying structure, and is translucent, so it does not hide the bamboo rods.

During the exercise, difficulties and the potential of this method became evident. Acquiring too much or too little information in the scanning stage led to a slow modeling progress, more subject to errors.

The learning of the parametric modeling software is very time consuming, making the early design process very slow. On the other hand, the flexibility of this modeling concept is its main benefit. Substituting one of the bamboo rods in the structure in an advanced state of the design phase did not result in too many problems when making adaptations. The only necessary procedure was to scan the new points and to reference them into the modeled geometry in *Grasshopper*. This shows the clear advantage of this design method, since the digitally modeled and fabricated parts fits easily onto a geometrically complex built structure, whether in an object or in an architectural scale.

Image 1. Built model

Conclusions

With this research, we expect to extend the possibilities of applying digital fabrication on the architectural field, creating new possibilities of formal explorations and of adding new architectural elements to existing ones.

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