Chapter 11

Geometrical Characterization of a Rototraslative Generative Tower: The Turning Torso Case Study

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ABSTRACT

This chapter studies the geometric generation of the shape of a well-known building designed by the Spanish architect Santiago Calatrava. The building is a skyscraper located in Malmö, Sweden named Turning Torso. The first step for analyzing the morphogenetic process is research on all of the available references that deal with building. This work aims to fully describe the process that has led the generation of the building itself.

FRAMING

The approach of contemporary architecture with urban environment has always been in continuous development. The link between concept and real building has been driven since ancient times by traditional drawing tools which discretized the architect ideas into shapes. In late eighties’ computer aided design machines speeded up the drafting and modifying processes, leaving unchanged the rest of design techniques. The following evolution can be traced back to the verge of XX century, still going on. A paramount achievement is the introduction of innovative tools, which are deeply changing the whole design process. Because all of these modifications are still in progress, it is difficult to frame samples into manageable categories, in an historical sense. Although for the purpose of this research, it was not possible to analyse the morphogenesis (meant as the process that make shape out of an idea) of a large sample of buildings, a single case study has been picked, where these kinds of processes gain sediment, because its processes are completed in full. The shape characterization has been analyzed and perceived as a result of a synergy between environmental, structural and functional issues, not as a complexity.

showing off in itself. In recent years architectural morphogenesis started relying more on digital tools as designing instruments, more than traditional drawing assistant (Del Mese, 2006). It is useful, for the purpose of this work, a framing for understanding the used methodology.

The two main purposes for using parametric tools in morphogenesis were the optimization process of a pre-chosen to shape (D’Uva, 2013) or the generation of a completely new shape, also known as generative design. The optimization process strategy made possible the construction of complex shapes, balancing the constructive feasibility with the perceptive issues of an idealized form. Generative design, instead is meant as a creation of the perceived shape, where shape generation is driven by specifically designed constraints. For the purpose of this research, the optimization issues have not been explored, choosing to focus on relations between constraint in the process of shape creation. An example of this process is analyzed in the case study, a well-known building designed by the Spanish archistar Santiago Calatrava.

His work is framed into the spanish tradition dating back from the work of Gaudi in the common ground of organic architecture, the tension toward the inspiration of natural shapes. The similarities in their works is much more evident in comparison with modernism tradition of Tavora and Siza, where geometrical hardness of architecture is in strict contrast with the fluidity of Calatrava’s shapes.

The case study building is a skyscraper located in Malmö, Sweden; it is named Turning Torso because of the resemblance of a human torso. The area where the building is located is called Västra hamnen, a former dockland area in the western harbour of the city. The area was an industrial park a couple of decades ago, when it started to be interested by a large sustainable development, which brought in 1998 to the opening of the Malmö university. Following the timeline, the urban planning forecasted a residential area called BO01, partially completed in 2001 and still in development. In such timespan the area was interested by an housing expo, with aim of fueling the investment in the city with a sustainable development. In this cultural and urban environment, turning torso makes up a landmark because of the out-of-scale mass in comparison with neighbouring housing. The building itself has accomplished the status of a symbol of the new development in the city of Malmo, (Andberg, 2015) as the whole area is a response to the economic crisis which has struck Sweden in mid 1990s.

MORPHOGENESIS

The first step for analyzing the morphogenetic process is researching on all of the available references that deal with building. These works, because of diverse reasons do not show a complete geometric path that leads from scratch to the final building but, in best cases only, they demonstrate with few figures the key steps of design process; most of the times only a couple of drawings and photos are exhibited. This work aims to fully drawing the process that has lead the generation of the building itself. For clarity purposes the process is divided into steps, which correspond to operation in the generative software. The generative software used for this work is Grasshopper for Rhinoceros, which has been worked out for the aim of rebuilding a shape as coherent as possible to the original Calatrava’s building. This work has been conducted with inestimable help of Paolo Tomelleri for the design of representation and algorithm.

The step of form generation evolves by the rotation of a single story around an axis that run perpendicular to the ground up to the top floor of the building.

The importance of understanding in full the design of this building resides in the unique approach that the architect has toward structure and shape. The curricula of Calatrava connect the strong points of engineers and architects because the challenging relationship between form, structure is solved in joining