Honors thesis

ARCHITECTURE CONSTRUCTION AND CITY

Abstract

Interactive Architecture in the Digital Age: Parametric Design of an Open Source Responsive Solar Filter

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The present dissertation deals with the transformations that are crossing the way we conceive architecture in the digital age. The rapid evolution of technology and the consequent digitalization of information have produced important effects on the project of architecture. These effects are able to revolutionise the generative process itself.

Architecture has to become an active component in a world informed by data. In the digital age, the continuous decoding of the real ambient leads to achieve a stream of data that could shape architecture as a living being, able to adapt itself and react to environmental stimuli.

The present research aspires to explore new horizons of the project in order to structure a way of design that aims to be more adherent to the context and to the human being, conceived as the centre of the project.

Delineated in a not merely technologic perspective, the definition of interaction reflects itself in the ontological framework of the project, and aims to restore the connection of the input with the output, redefining the dialectic between the user and architecture.

The first chapter of the dissertation explores the dynamics of swarm intelligence and mass customisation, determined by the digital revolution, considering the potentiality of implications in architecture. The purpose of the second chapter is to analyse concrete systems of interaction design and the effects that can spring from the application of interaction paradigm in architecture.

Finally, in the third chapter, the analysis of the scenario depicted in the research is applied to the design of a responsive solar shadow component, articulated to pursue interaction as the main requirement. Interaction is materialized thanks to an algorithm that organizes geometric relationships and establishes relations with the context.

The project consists in a responsive surface that aims to be an active filter between inner and external ambient, able to process environmental variables as inputs, and return bespoke outputs to the user. Based on parametric modelling, the surface, constantly informed, responds to fluctuating daylight conditions and internal functional demands. Thanks to the application of an emergent design, the structure reaches swarm dynamics that allow a self-organisation, based on a local response to external inputs.
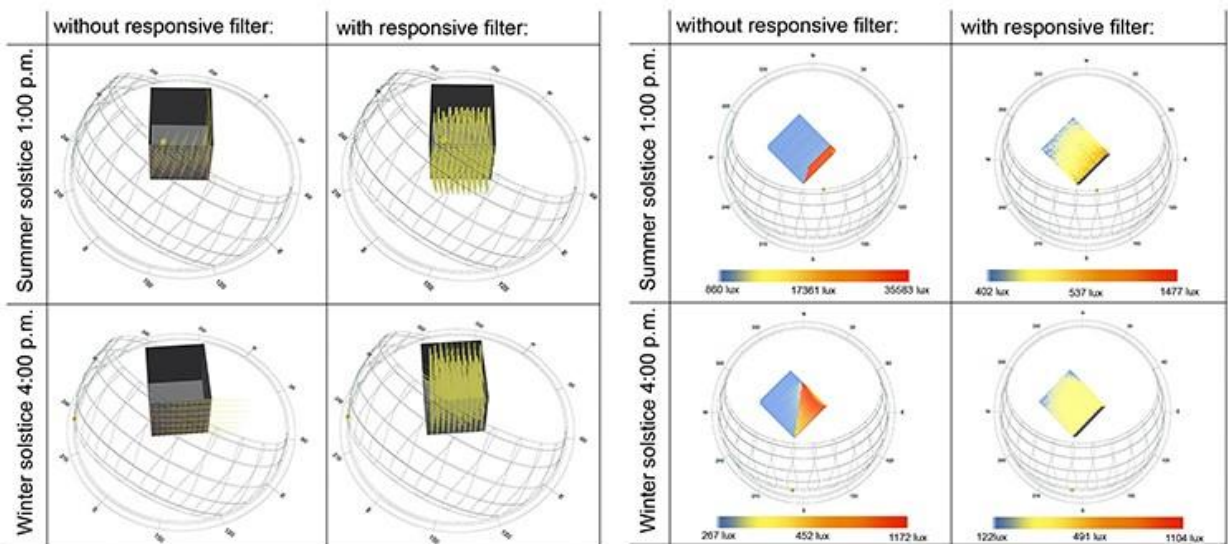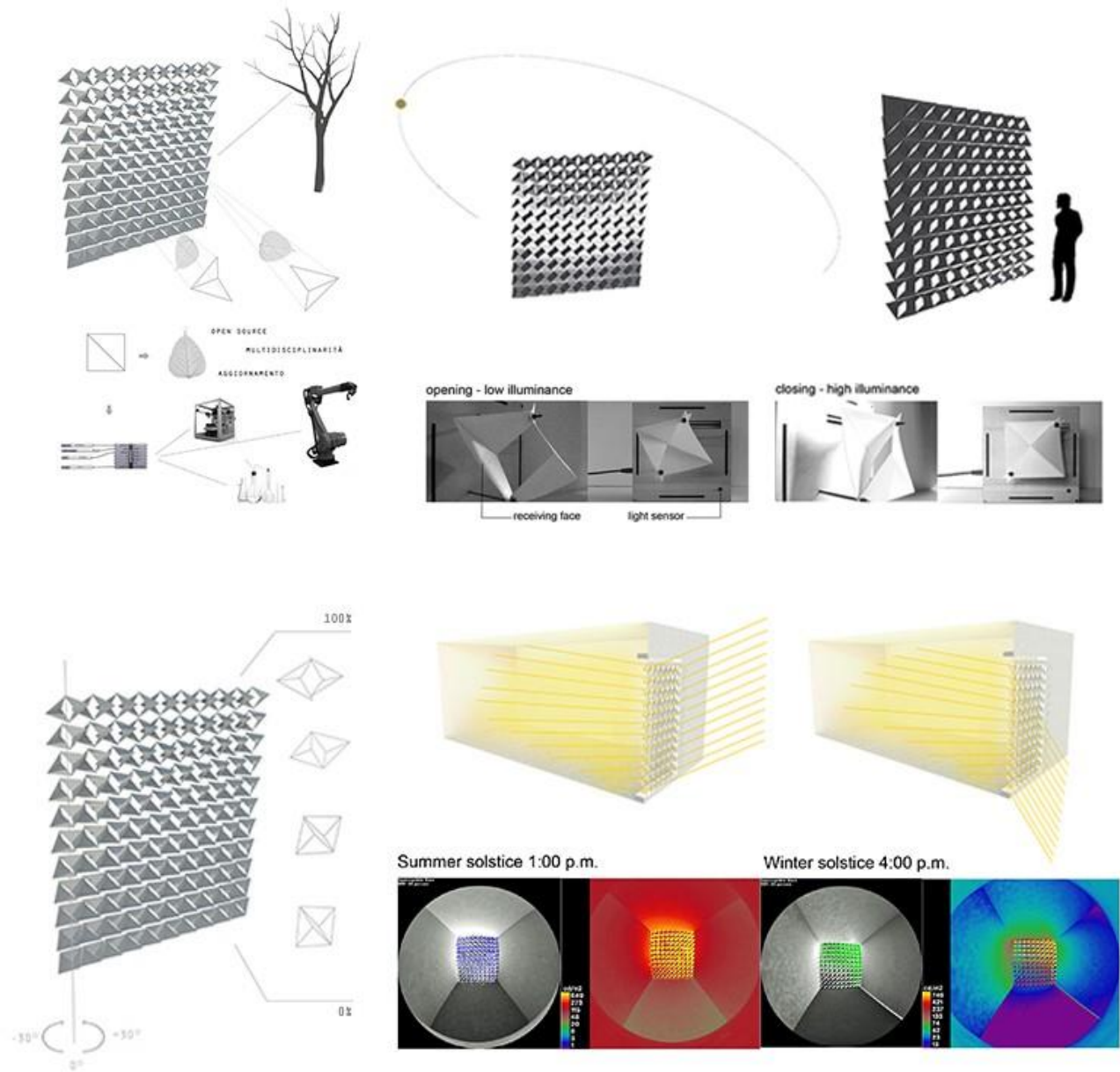
The project integrates different levels of interaction. Data-driven design spans from design inception to construction; the relation with the context is fundamental as sets the inputs by which the algorithm could exist in the real world, and interact with it.

The main interaction is with the physical ambient: broadly investigated as the framework in which architecture can act as an active filter, it includes both the environment and the inner space. The main factor to deal with is solar radiation: the responsive surface modules optimises natural daylight, adapting themselves to different solar density. This helps avoid overheating and reduce glare risk, enhancing the comfort.

Therefore, the interaction with the user permits to join the *existenzmaximum*; avoiding a merely functionalist perspective, places the human being in the centre of the project.

Finally, interaction means also to create new links, allowing the exchange of knowledge and the growth of the project. Organized as a sharable code, the project encourages multidisciplinary and takes advantage from collective intelligence phenomena, allowing an endless upgrading through a bottom-up approach.

The project includes the realisation of a responsive prototype, able to transmit sensible data from the real world to the virtual project, filling the gap between virtual and real ambient.

opening - low illuminance

receiving face   light sensor

closing - high illuminance

Summer solstice 1:00 p.m.   Winter solstice 4:00 p.m.

	without responsive filter:	with responsive filter:		without responsive filter:	with responsive filter:
Summer solstice 1:00 p.m.			Summer solstice 1:00 p.m.	860 lux 17361 lux 35583 lux	402 lux 537 lux 1477 lux
Winter solstice 4:00 p.m.			Winter solstice 4:00 p.m.	267 lux 452 lux 1172 lux	122 lux 491 lux 1104 lux

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