SHADING DESIGN WORKFLOW FOR ARCHITECTURAL DESIGNERS

REFLECTIONS P3 TO P-5

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The goal of my graduation project is to develop a methodology focusing on designers as a target user for the proper assessment of static shading devices as a mean to contribute to the daylight quality comfort in office buildings. Although the methodology could be applied any sort of building, offices seem like a suitable architectural program since plenty of this buildings have large glazed façades and a considerable amount of occupants that need to perform tasks comfortably.

During the research theory on shading design had to be explored. The very basic parameters regarding shape and orientation as well as ideal performance indicators for daylight quality comfort. Over this stage performance of software related to environmental, energy and radiance analysis had to be compared in order to determine which one will suit better for the methodology since one of the main purposes of the project is to integrate this methodology from an early design stage using parametric design tools and processes, the parametric design environment chosen was Grasshopper for Rhino. Interviews with two of the creators of the chosen software which was Ladybug and Honeybee were needed in order to understand a better way to guide the research, since the inputs given over these interviews regarding the purpose of the creation of the software and in their experience what is the major gap between designers and specialists on the subject were really important.

The next phase of the research implied how to begin to assess the expected results from the chosen indicators within the Ladybug and Honeybee workflow. The practice of the programming the workflow was really useful in terms of obtaining understandable metrics, understanding the relevance of materials along with daylight quality indicators, their influence of design decisions and moreover envisioning future situations where the methodology could fit and be useful. Most of the tested simulations over this period were deeply related to daylight factor, luminance and illuminance and different way to represent and inform as more graspable information to the designer, most of this results come in form of grid based analysis, false color images and 2-d graphs depending on the indicator. This sort of interactive representation in real time is what makes this workflow relevant to the following stage of the research.

Understanding the big picture regarding the process to program the needed metrics to generate a proper simulations and approaching the desired numbers for the indicators was an important step but yet not making a remarkable difference on the current workflow, the next big questions came from my mentors, “What makes this methodology special?”.

This very important and reflective question leads to the next, and yet to conclude part of the research which will be merging of a parametric design of shading devices along with the parametric workflow for environmental design as final step for the goal of the methodology, which will be optimization of a rough preliminary design that could suit all indicators but can be improved and informative to the designer. In order to achieve this, the use of multi-objective optimizing tools such as modeFrontier, which will give the user a set of optimized results from which the designer will be able to assess the best options possible. In order to make the data exportable from the Grasshopper environment to modeFrontier the use of recently developed plug-in Dashboard was used, as form to run energy and lighting simulations in the Grasshopper environment through an optimized tool of another source and the being able to portray the results again in Grasshopper in order to being the assessment through post optimization process.

Through the use of all the mentioned workflows and processes it was proven that a designer can actually assess for informed design choices, can be able to support the decisions based on verified data, and may be able to transmit the information onto further aspects on the design stage.

It is important to remark that indirectly through this project it is becoming more evident that the use of specialized proprietary software (in this case for optimization) which is not easily accessible, should have a closer approach to the really accessible, rapidly expanding and designer oriented world of parametric design. Therefore the link between this two separate sorts of workflow is indisputably needed for approaching more informed and scientific based design in order to have access to more intelligent and healthy buildings, specially as mentioned before for the group of designers that may not have access to specialist as the larger more specialized firms do.

Aspect 1 - the relationship between research and design

The relationship between research and design in case of the project is important since the aim of the investigation is to find a suitable and logic form of workflow in order to lead designers to make more informed and better decisions in this case of static shading devices. Following the same structure of workflow and using the proper tools, optimization can be applied to other fields of design such as complex geometry or structures and in more advances design stages, depending on the case. In the specific case of the project the aims are in the front end towards energy and daylight quality comfort and in the back end into sustainability.

Aspect 4 - the relationship between the project and the wider social context

The relationship between the project and wider social context regarding the nature of the project is quite broad, since the idea is to create a methodological workflow focused for designers. This gives the designers the opportunity to understand at least in the case for shading design for daylight quality the indicators that have to pursued and finally through an optimization process make the best and most informed design decision. Since one of the target users of this workflow are the architects which have may have no access to a building technologist or sustainable design specialist. Being able to follow and understand could be quite helpful for improving design of buildings in general but also helps to decrease the paradigm around parametric design and its only use for generating complex geometry and the possible lack of commitment to the built environment, while adding aspects of sustainability, science and technology to the design process.
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The next phase of the research implied how to begin to assess the expected results from the chosen indicators within the Laydubug and Honeybee workflow. The practice of the programming the workflow was really useful in terms of obtaining understanding metrics, understanding the relevance of materials along with daylight quality indicators, their influence of design decisions and moreover envisioning future situations where the methodology could fit and be useful. Most of the tested simulations over this period were deeply related to daylight factor, and solar gain, and inform as more graspable information to the designer, using Virtual Reality as a final output for communication and assessment.

Understanding the big picture regarding the process to program the needed metrics to generate a proper simulations and approaching the desired numbers for the indicators was an important step but yet not making a remarkable difference on the current workflow, the next big questions came from my mentors, “What makes this methodology special?”. This very important and reflective question leads to the next, and yet to conclude part of the research which will be merging of a parametric design of shading devices along with the parametric workflow for environmental design with the support of optimization as a way to reach for the better performing results, using emerging forms of representation in order to take user to a more immersive and interactive experience of design.

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Also I was fortunate enough to be able to interview urban designer and sustainability expert Greg Keefe, which in 1996 was in charge of the design of the building which was used for the case study The Esplanade of Singapore. The insights and outputs provided by the experienced of Professor Keefe, became quite useful due to that fact that I had a comparison point to take in account as a point of departure, which led to determine that the workflow as it is know seems to have a significant advance and improvement with the tools currently available for designers. While making a comparison of that can be done in 1996 and 2016, it can be stated that the improvements can be noticed in the sophistication level of the calculations, the time taken to develop and change a design and also the ways in which results can be assessed and explored.

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With the implementation of the use of Virtual Reality in the project with the help of the VR Research Group at TU Delft, it became possible to explore the results with a level of precision, clarity and interactivity that the regular “on-screen” or in VR for portable devices can not offer. It became possible to explore the results in a 1:1 to scale with a high degree of accuracy in terms of visibility the exterior and aesthetics from the point of view of the designers in a live size model which was not possible before. Also not only the results of the shading devices directly in the room were able to be explored but also a like size mock-up of a detail of the shading device. Having to opportunity to take my project to this level of communication leads me to state that VR is the next form of communication for many sorts of designers.

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