

REFLECTION

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ITERATIVE DESIGN SYSTEM

The Iterative Design System (IDS) has been developed mainly using a research by design approach, where various tests throughout the research process give insight in the functioning of the IDS. Exploration of various means of facilitating the design process gives insight in how the Iterative Design System can best facilitate decision-making in performance-driven design processes.

The design brief, describing the design variables and performance objectives, was determined at an early stage of the research process. The design brief was chosen to closely resemble an architectural design process, since the suitability of the Computational Design System to contribute to 'realistic' design processes is an important aspect of its relevancy. At

the time, however, complexity of this large amount of aspects was not recognized. Reducing the amount of design variables and performance objectives may have provided the opportunity to improve processing of analysis results. Focusing on fewer design aspects interrelationships between design aspects and performances may have been clearer, which may have benefitted research conclusions.

Nevertheless, five out of ten objectives have had great influence on the design processes of the author and the peer reviewer. Consequently, the IDS is in line with the main research question of this thesis, which concerns multi-variate, multi-objective decision-making.

DATA PROCESSING SYSTEM & VISUAL ANALYTICS SYSTEM

Development of the Data Analytics System (DAS) uses both a research by design and a design by research approach. Literature study indicates flaws of current visual analytics tools and provides an understanding of suitable data analytics methods. Development and testing of a prototype of the Visual Analytics System provides an understanding of its functionality.

Designing the DAS alongside continuous testing was an effective way to determine suitable data analytics methods. It also gave insight in the importance of various aspects that literature research did not provide, such as means of interaction, operability and user experience.

The prototype of the visual analytics tool is elaborate. An advantage is that results of personal testing and peer review have been very insightful to determine the level of intuitivity of the use of the DAS. A drawback is that development of the prototype was time-intensive, which took away from further optimization of the data analytics methods and of the functionality of the IDS.

GRADUATION PROCESS

GRADUATION TOPIC

The research question is, in my opinion, a very relevant topic; I see great potential in the use of computational design in the various stages of the architectural design process, but have experienced the difficulties in interpreting information in various simulation tools. Furthermore, various Msc Architecture students have expressed a certain reluctance to use computational design in their design process. Various researchers in the field of design exploration and optimization have indicated the necessity of further research in data visualization in the field of architecture.

A curious phenomenon is that data analytics methods used in other engineering industries do not meet the demands of practitioners in the field of architecture. Experience in the field of architecture and research throughout this graduation process suggest that there is a large difference in design approaches between these disciplines; most engineering disciplines focus on optimization of one or a few quantifiable performance criteria, whereas the architectural design approach is characterized by exploration and high-dimensional trade-offs. This graduation research acknowledges this difference in design approaches, which may be a relevant contribution to current research.

RELEVANCY OF GRADUATION RESULTS

Various MSc Architecture students have observed that the design flexibility is limited by the use of generative design in the architecture process. This indicates that the use of a computational design system may not be applicable in design processes comparable to theirs. This thesis explores various parametric models with the aim to maintain high design flexibility. In the end, the use of multiple parametric models that follow architectural design concepts are seen as a suitable computational design approach for traditional design processes.

A noteworthy observation concerning relevancy is that computational design systems may not be relevant for small design projects, since the absolute improvements in (e.g.) energy-related performances do not weigh against the effort of setting up the computational design systems. Computational design systems are applicable in bigger projects, though, when performances are of greater consequence (whether that is related to sustainable aspects, financial aspects, or to social-cultural impact). The VAS provides ways to visualize and quantify performances that can invoke and substantiate discussion among a multi-disciplinary design team, further contributing to its suitability in large design projects.

Research conclusions indicate that the computational design system does not optimally facilitate performance-driven design processes. Most notably, the system shows flaws in the analysis of interrelationships between design aspects. Hence, this graduation research does not contribute much to the assessment of data analytics methods.

I am convinced that the computational design system in this thesis has the potential contribute to sustainable development. The computational design system facilitates a new approach on sustainable design in which both architectural qualities and sustainable performances can be considered in the design process. Use of the system may prevent clashes between the two aspects and thus may benefit both energetic performance and architectural quality.

However, development of the computational design system involved a considerable focus on user experience. Peer review and the author's experience indicate that the use of a game-like environment that is highly interactive encourages performance-driven decision-making. High level of interactivity and features inspired by computer games provide novel ways of extracting building information.