Success Story
COMET

VRVis Center
VRVis – Visualization, Rendering and Visual Analysis Research Center
Programme: COMET – Competence Centers for Excellent Technologies
Programme line: K1-Centers
COMET subproject, duration and type of project:
VAMOS, 01/2014 – 12/2016, multi-firm

LiteVis – Simplifying complex decisions in lighting design

Lighting Design in buildings is a complex task. It is necessary to consider conflicting requirements like uniformity and intensity of the light distribution, aesthetic concerns, investment costs and individual wishes of customers. The long simulation times of currently available design tools make changes in a planned setting extremely tiresome.
In a collaborative project involving researchers from three groups at the VRVis, a completely new approach to solving these challenges was created and successfully introduced to both scientific audiences as well as to industry partners.

A challenging task - re-thinking today's design workflow

Today's typical workflow of a lighting designer for creating a light solution for a new indoor office can be a tiresome process: Starting with the creation of a 3D model, he or she places light sources in the scene and starts a simulation run using a light simulation software. After waiting for several minutes to hours for the complex calculations to complete, the result tells the designer if the placement and the choice of light sources was a good decision, or if certain criteria in terms of light quality or aesthetics have not been met. Every improvement takes up another few hours to simulate – and if the customer at the presentation is not happy with the outcome after a week's work, one has to start over.

While the problem of long-running simulations has already been successfully tackled at the VRVis research center in the last years, several researchers joined forces in order to find a solution to the following questions:

- How can all the requirements (light quality, aesthetics, customer wishes, and costs) be integrated in a common tool?
- Is there a way to explore, compare and rank different lighting solutions?
- How can the importance of requirements be interactively changed, and therefore the ranking be updated?
- Is it possible to find the best-fitting solution within a drastically shorter time than with current solutions, and can the superiority of this result be proven to a customer?

Supported by our company partner Zumtobel Lighting (via the COMET VAMOS project and by additional input from lighting designers) as well as from funding in the FWF project VISAR and the strategic COMET projects HEDAVICI and ENSEMBLE, several researchers from VRVis started working on these challenges in 2014 in order to propose new approaches to lighting design.

bmwfw Federal Ministry of Science, Research and Economy
bmvit Austrian Ministry for Transport, Innovation and Technology

Performance and Insight - A guarantee for success

In previous years, VRVis researchers had succeeded in speeding up the light simulation process by orders of magnitudes as compared to commercially available tools. The next challenge was to automatize and assess the individual simulation runs. By introducing freely configurable measurement surfaces for quantifying various quality criteria of lighting design (see Figure 2), the gathered data can now be used to compare individual runs both qualitatively and quantitatively. Furthermore, the automatic simulation of similar scenarios now enables to, e.g., simulate hundreds of variations of a modelled scene with a single click (e.g. with different luminaries or with slightly modified light positions).

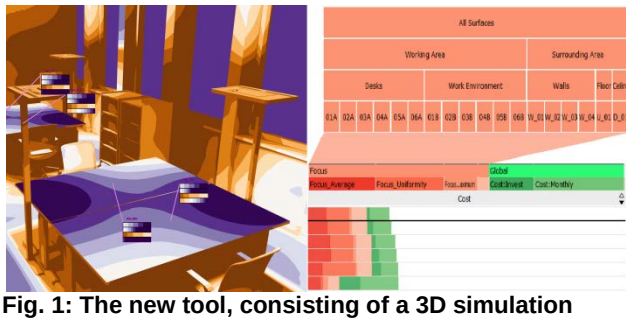

Fig. 1: The new tool, consisting of a 3D simulation view and a novel view for ranking lighting designs by a weighted sum of quality metrics.

VRVis researchers developed a novel visualization that allows ranking the simulation runs according to a weighted sum of multiple goals. This enables light designers to identify the optimal solutions for individual customer preferences in real time by interactively modifying the weights of the individual target values (see Fig. 1). Any selected simulation run can be immediately seen in the 3D simulation view, and can be compared using a false color visualization method.

Impact and effects

Our company partner Zumtobel Lighting recognised the huge potential of the approach already based on initial conceptual studies and showed great interest in supporting us with their knowledge. Their lighting designers were tightly integrated in the planning stages of the interaction workflows, which ensured the practical relevance of the resulting approach. Plans exist to implement the methods developed in this basic research prototype in their standard software tools in 2017. This project has also been nominated for the e-Award and the Mercur award (where it achieved the 3rd place) in 2015.

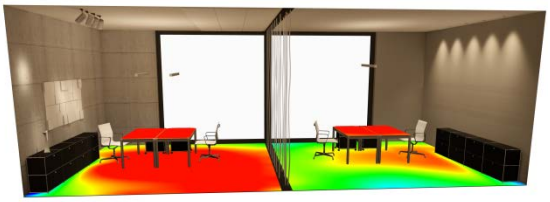

Fig. 2: Measurement surfaces can be placed on arbitrary locations in the scene. They are used to gather data and to visualize if certain criteria in terms of light quality are met.

Furthermore, the work has received a lot of attention in the scientific world. A corresponding publication was presented at the prestigious IEEE Vis conference in Chicago in October 2015 and is published in the journal IEEE TVCG. There are numerous ideas for extending this successful topic at the VRVis research center.

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