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# Interactive Construction Design Tool with Real Time Analysis

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Construction design on one hand contains a lot of thoughts on statical, functional and cost-demands, while on the other hand it sometimes also has to fulfil aesthetical demands from the architect or designer. Building design can be viewed as an integrated process between engineers and architects. Each professional area has it's digital tools. Engineering has various analysis tools, and architectures has several digital design tools. With these relatively new digital tools, things new possibilities have appeared in both engineering and architecture – both in virtual reality and in the build reality. Now the architect can, in dialogue with the engineer, design with attention to far more complex problems compared to earlier. As the programmes are far from integrated in each other today this hybrid practice is difficult for an architect to work with on his or hers own. It would be more easy available to architects, if these tools were integrated.

Development today in CAD programmes goes more towards also doing the design inside the CAD programme, in stead of only using the computer in the projecting phase, but that could limit the work of the designer, as many of the CAD programmes available today are developed with the aim to make projecting more efficient, and not to make the designs more elaborate etc. This would be desirable in a digital tectonic tool, as there is no use for complex calculations in standard buildings. In such various technical parameters can be decided from looking in a table – e.g. with various beams for a roof structure. The lack of integration between the existing design and analysis tools also causes a problem with the architects work flow. To go from one result to the next – to do a design iteration – the architect/designer will have to go all the way back to the formulation of the problem, and change the basic parameters of the problem. The problem exists when the designer wants to evaluate a design from a technical point of view. Then he or she would usually have to export the 3D design model to a different file-format before the data can be understood by the calculation tool. This is not always a smooth running operation in itself. When the design model is finally inside the calculation programme, then the user will have to formulate the boundary conditions for the evaluation. Finally there is the question of getting the results from the evaluation back into the design tool. Another problem about analysis tools is, that the architect in order to be able to use the calculation or analysis tools must have a fundamental understanding of the technical areas in play. The programmes existing today are mainly designed for engineers and technicians and are used for verification of the building some time after the initial sketches are developed by the architect.

A digital design tool for architectural design should provide the possibility for the architect to work with both the aesthetic as well as the technical aspects of architecture without jumping from aesthetics to technical and back, but to work with both simultaneously and real time. Therefore the

aim of this paper is to address the problem of a vague or not existing link between digital design tools, used by architects and designers, and the analysis tools developed by and for engineers. Another aim of this research is to look into integrated digital design and analysis tools in order to find out if it is suited for use by architects and designers or only by specialists and technicians - and if not, then to look at what can be done to make them more available to architects and designers. An example of a prototype for this digital design tool for integrated real time structural analysis integrated within a Generative Component parametric design system is presented.