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# Beyond typology, beyond optimization

*Exploring novel structural forms and architectural spaces at the interface of Human and Machine Intelligence*

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## Abstract

The aim of this research is twofold. The first goal is to generate multiple novels and structurally informed forms that go beyond the conventional structural typologies. The second goal is to learn how to navigate in the space of generated forms, based on subjective criteria that comes from the designer. Hence, this approach exceeds the results of a pure optimization in which only quantifiable criteria are taken into account.

This research deals with these aspects through a prototypical implementation of a computer-aided workflow in which the designer and the machine coexist and potentially yield in a process in which both can unfold their strengths. In particular, the machine is not only used to optimize a given task but also to guide and support designers in the quest for innovative and appropriate solutions for structural concepts and design tasks. [1]

In the present work, Machine intelligence in the form of three algorithms (Generation of Equilibrium Forms; Combinatorial Equilibrium Modelling (CEM) [2], Clustering; Self Organizing Map (SOM) [3], and Classification; Gradient Boosting Trees) is combined with the ability of humans to evaluate non-quantifiable aspects in a discursive manner. More specifically, a cyclic, three-staged work-flow is proposed that exemplifies the interaction between machine and human intelligence. In each of the three stages, the machine produces a structured landscape of forms in equilibrium from which the designer has to select the desired forms that potentially fulfill the exemplary design brief. Through this repeated evaluation, the machine can learn the non-linear correlation of forms and their properties and generate candidates itself. A stadium roof is used as a case study to test the proposed approach. This test indicates that it is possible to combine the strengths of human and machine intelligence already in the conceptual generative design phase.

References

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