

Models as design tools – physical models and their epistemic value

Johanna RUGE

M.Sc.

HafenCity University Hamburg

Hamburg, Germany

johanna.ruge@hcu-hamburg.de

Johanna Ruge is a Doctoral Research Associate at the Department Design and Analysis of Structures at HCU. Her research focuses on the use of models in the structural design process.



Annette BOEGLE

Prof. Dr.-Eng.

HafenCity University Hamburg

Hamburg, Germany

annette.boegle@hcu-hamburg.de

Annette Boegle is a Professor for Design and Analysis of Structures at HCU. Her research focuses on design of spatial lightweight structures, history of structural design, and digital/conceptual design processes.



Contact: johanna.ruge@hcu-hamburg.de

1 Abstract

In the twentieth century, efficient and elegant structures were designed by engineers like Heinz Hossdorf. At that time, these structures could not be analytically calculated or evaluated. Instead, physical models were built to verify the engineer's intuition, gain experience and allow further development of designs.

Nowadays, engineers use digital models that allow the calculation of nearly any conceivable structure. This results in two phenomena: First, when every shape is feasible and most materials are at disposal, there is a high risk of arbitrary design. Additionally, engineers spend most of their time on calculations – yet our society needs engineers that design rather than compute.

In this paper, it is suggested that the models used by engineers have a great influence on the structural designs they develop. To better understand models as tools for design engineers, a theory of model-use in structural design is needed. This paper contributes to this task by addressing the influence of materiality of models on their epistemic value. For this purpose, it analyses the physical models of Hossdorf. Lacking theories in the field of structural design on model-use, Hossdorf's models are analyzed using theories from the field of philosophy of science and technology. Important properties of physical models are traced and it is discussed, whether these properties can be found in today's digital models. Three qualitative properties for ideal models are suggested, and further research on model-use is motivated.

Keywords: model-use; structural design process; physical models; digital models; design tools; epistemology; materiality; Heinz Hossdorf.