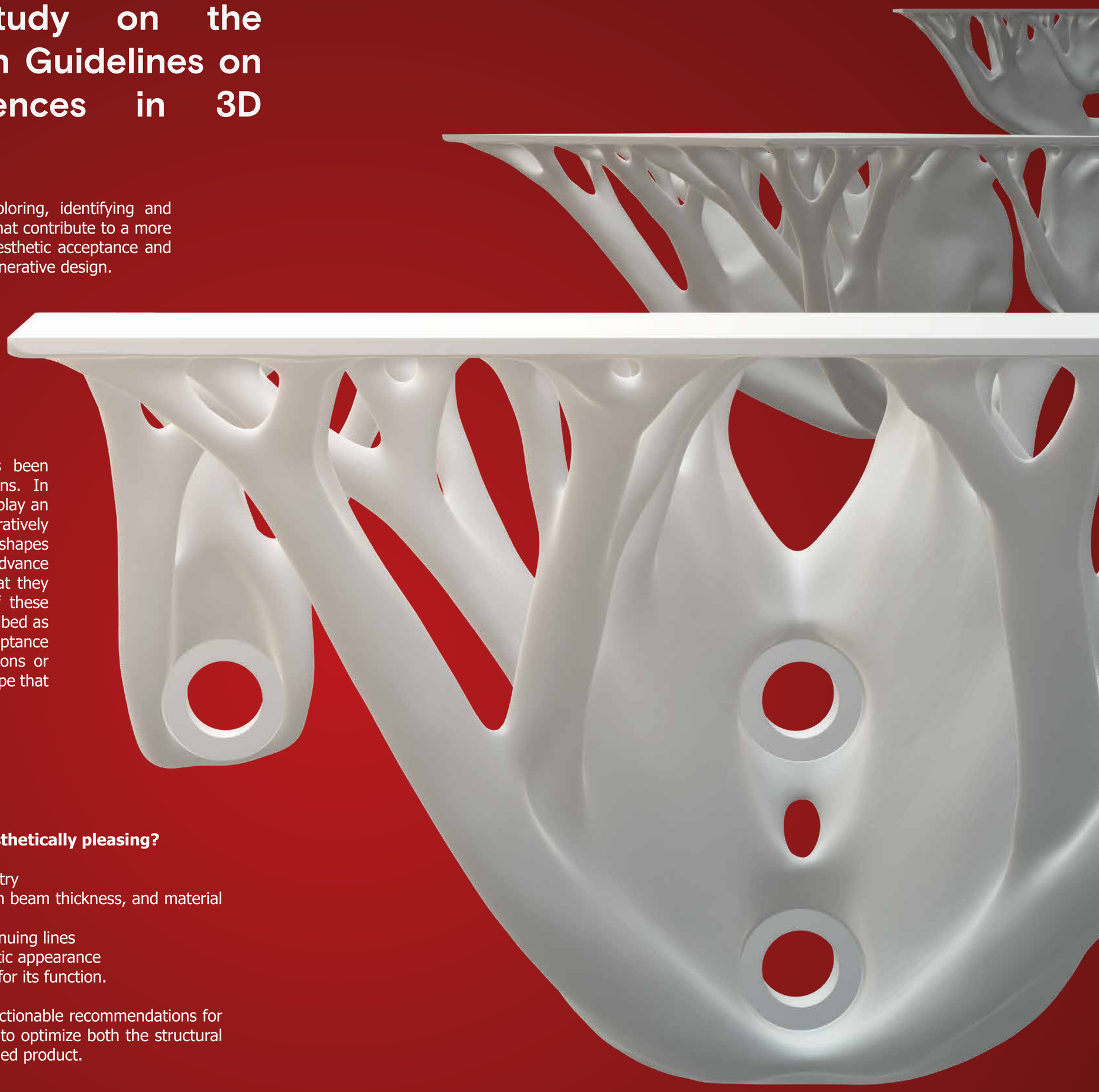
Intentional Aesthetics in 3D Generative Design

An Empirical Study on the Influence of Design Guidelines on Aesthetic Preferences in 3D Generated Shapes

This graduation project was aimed at exploring, identifying and validating aspects of 3D generated designs that contribute to a more aesthetic appearance in order to increase aesthetic acceptance and move towards intentional aesthetics in 3D generative design.



Performance-driven generative design has been commonly used in engineering applications. In addition to performance metrics, aesthetics play an important role in the acceptance of generatively designed forms. When generating these shapes using generative programs, it is not clear in advance what the outcome will be, and thereby what they will look like. However, the appearance of these shapes can currently almost always be described as quite novel and organic. This affects the acceptance of these shapes and the number of iterations or post-processing needed to end up with a shape that is aesthetically acceptable.

What makes a 3D generated design aesthetically pleasing?

Symmetry: A design must strive for symmetry
Balance: A design must strive for balance in beam thickness, and material vs void
Continuation: A design must be have continuing lines
Simplicity: A design must have a minimalistic appearance
Logic: A designs topology must look logical for its function.

These guidelines can therefore be used as actionable recommendations for designers, engineers and architects seeking to optimize both the structural and aesthetic qualities of generatively designed product.

Aesthetically Preffered Designs

Not Aesthetically Preffered Designs

The research was done through two user studies.

A first user study was conducted to test hypotheses and to gain valuable insights into what aspects of a 3D form are important for aesthetic appreciation. For this study, many 3D generated designs were created across different product groups. The designs were placed in a virtual environment in order for the participants to view them in true 3D through a virtual reality headset. Via an open discussion with the participants during the viewing of the different designs, valuable insights were gathered on aspects that positively or negatively contributes to the aesthetic appreciation of these forms. These insights resulted in guidelines to increase aesthetic appreciation for 3D generated designs.

A second, quantitative user study was then set up to validate the desired effect of the new guidelines. Twenty new designs were created and selected to be put in pairs containing designs that did and did not display features from the new guidelines. Through an online survey, these pairs were judged by 90 respondents on the desired effects, resulting in an extensive data set. Data analysis was conducted, and Pearson correlations showed a positive effect between the effects from the guidelines and the aesthetic appreciation of the generated forms.

Jesse Hols
Intentional 3D Generative Aesthetics
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Integrated Product Design

Committee Jun Wu
Paul Hekkert

TU Delft

Faculty of Industrial Design Engineering

Delft University of Technology