# Exploration of 3D knitting for load-bearing, transformable structures.

This research-through-design explores 3D knitting for load-bearing, transformable structures using a Material-Driven Design approach. 3D knitting is a low-waste textile production method that allows for highly adaptable designs and an iterative design process. Current literature is studied in various domains, exhibiting the knowledge gap on development of 3D knitted, load-bearing, transformable structures on the scale of a sitting object.

A tinkering phase resulted in a Design Space, demonstrating the range of possible materials, structures, geometries and transformability methods. Multiple concepts are developed to define the relationship between the parameters. The final demonstrator is Prototype 98, a sitting object showing the adaptability, load-bearing capacity, transformability, material expressions and streamlined, low-waste production process of 3D knitted, transformable, load-bearing objects. The Prototype 98 is a bending-active textile hybrid structure. The load-bearing capacity is evaluated through a technical evaluation which exhibited the framework material to require improvement. User research exhibited the novelty of the design. The transformability of the sitting objects allows for eight variations of the aesthetics within one product. The sitting surfaces are highly adaptable through the knitted material, enabling personalization of the aesthetics and ergonomics of the chair.

The development and production process of the Prototype 98 show the need for modelling software for knit structures and textile hybrid structures to improve the technical performance and reduce the number of required iterations. Further research into the bursting strength of knit structures related to the yarn materials could improve the load-bearing capacities of the object and bring forward the limitations of the applied rigidifying method.
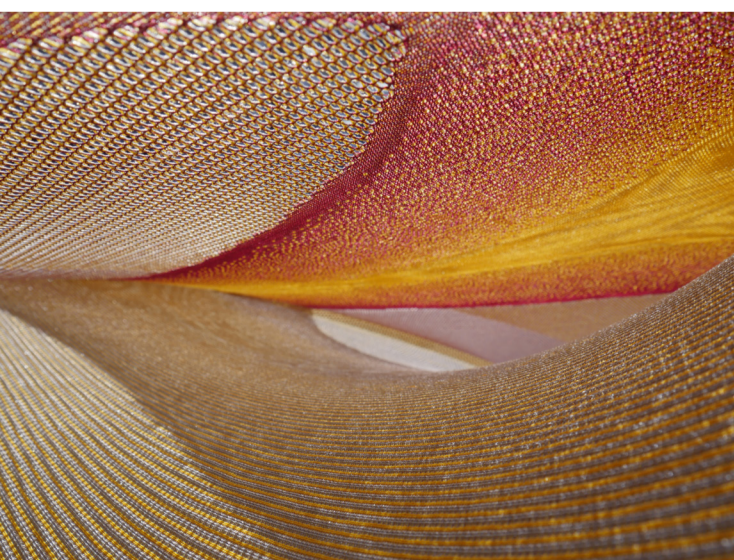
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