Textile Informed Structures: How to braid a roof

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Abstract
There is a great variety of textiles, both in terms of the behaviour of the fibres they comprise of and the assembly methods used to construct them. Hence, the definition of textile is expanded from including only conventional fabrics to encompass surfaces with a structure that follows the logic of textiles.[1] One can then refer to textile as a repetition of bindings, or joints, forming a non-hierarchical surface.

Analogies between classical textile assembly methods (knit, weave and bobbin lace) and structural systems are studied in this research. Similar to the work of K. Snelson the internal structural logic is identified by the joints used, and mapping these typologies onto structures.[2] The resulting modules aim to be used for the assembly of structures in the scale of architecture. Similar to the behaviour of the textile, these structures have the potential to grow in all directions depending on spatial requirements while still retaining some dynamic response.

Three concepts are proposed. Firstly, a translation of the general assembly method of textile and platonic solids, resulting in a scissor-like structure. Furthermore, parallels are drawn between woven textiles and tensegrity systems, and the basics of bobbin lace are mapped onto reciprocal structures. These are evaluated through the application on a case project - a free-form roof structure. The final concepts yield intriguing load bearing systems that illustrate the possibility to design and construct temporary structures able to seamlessly span irregular spaces.

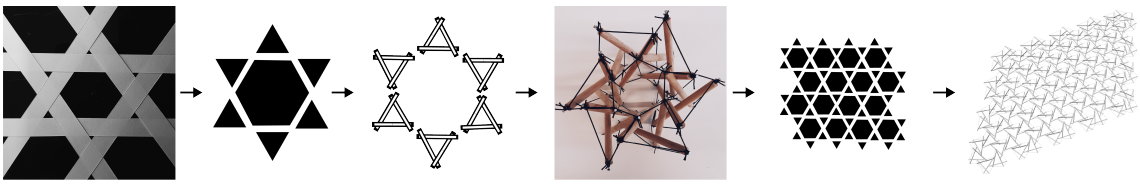

Figure 1: The tri-axial weave knot and its geometrical interpretation to a tensegrity module and its digital assembly

References

[1] M. Glazzard, *Re-Adressing The Role Of Knitted Textile Design Knowledge: Auxetic Textiles From A Practice-Led, Designer-Maker Perspective,* PhD thesis, Nottingham Trent University, 2014.

[2] K. Snelson, The Art of Tensegrity, in *International Journey of Space Structures*, vol. 27, no. 2-3, pp. 71-80, 2012.