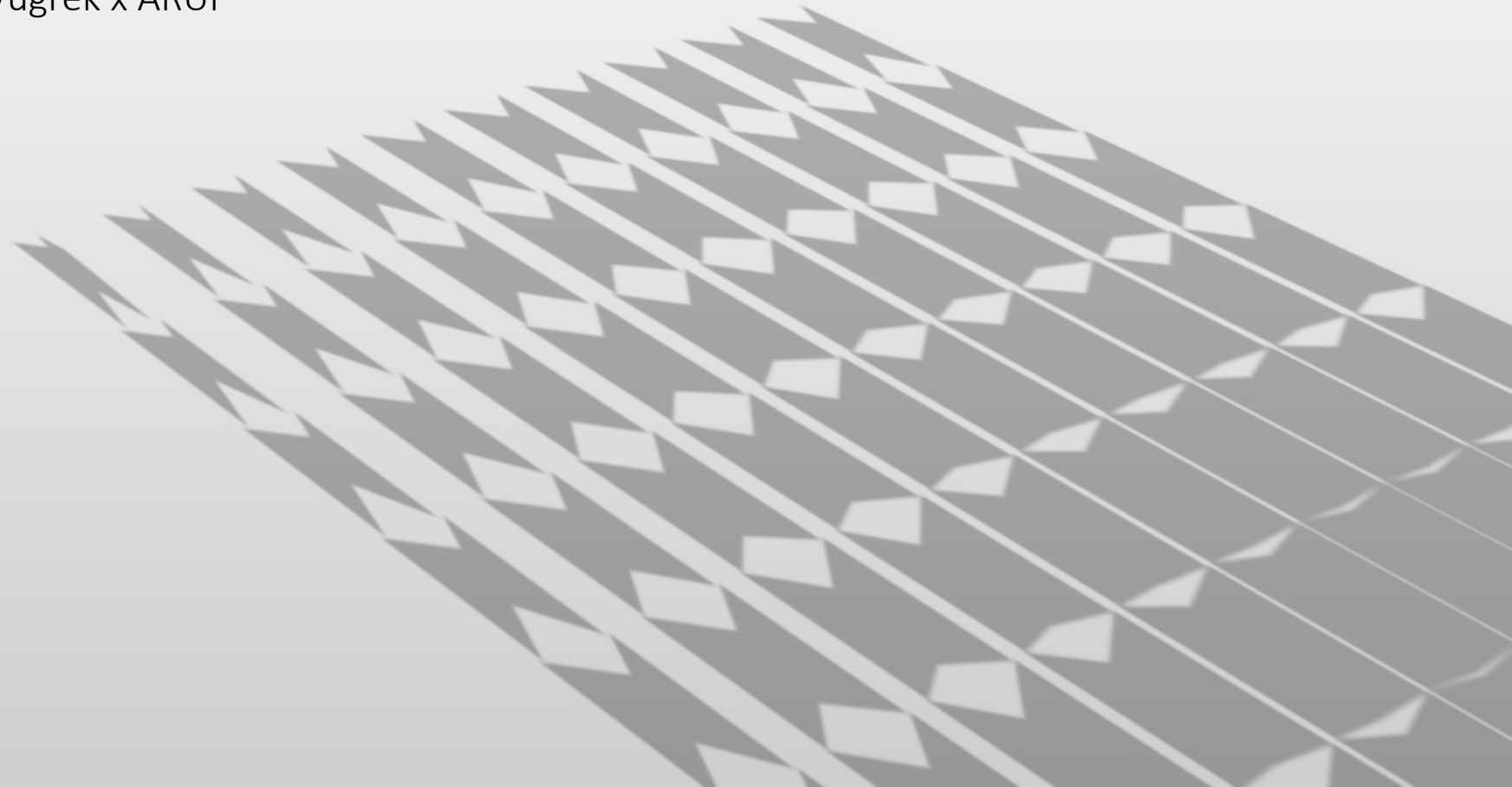


Kinetic/Dynamic Internal Shading Systems

Research Project by Timothy Vugrek x ARUP





Project Outline

To design and 'optimise' an internal dynamic/kinetic shading system that can effectively control the facade-related/generated lighting characteristics of an office space.

How can computational design tools be applied to optimise the design of an internal kinetic shading system for office environments?

Project Goals

- Developing upon current conventional 'blinds'
- Increase shading performance through a responsive and modular system
- Achieving complexity through simplicity



Venetian



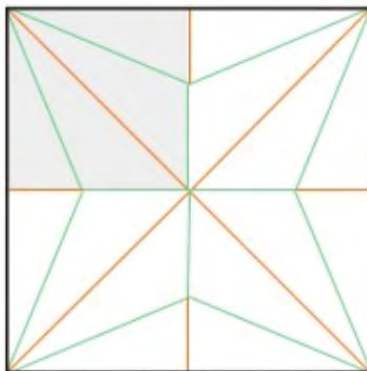
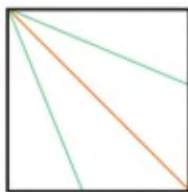
“Honeycomb”



Vertical

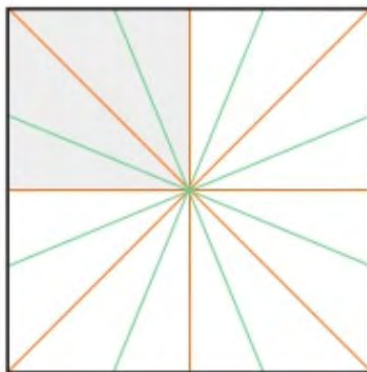
Why Origami?

- Potential of transforming planar surfaces
- 'Fold' one of the most basic design techniques
- Material hinges
- Reconfiguration of two-dimensional elements

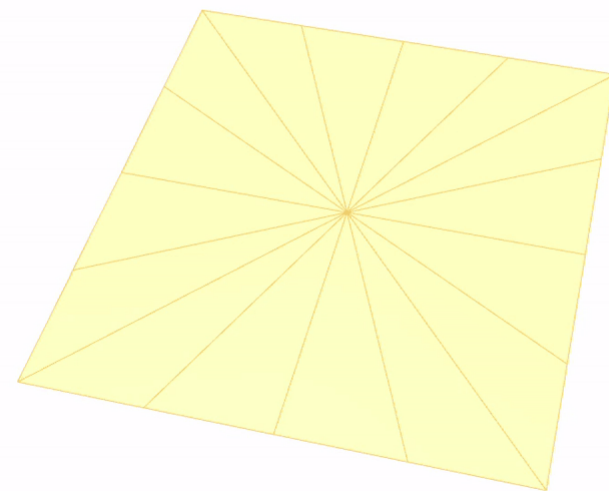
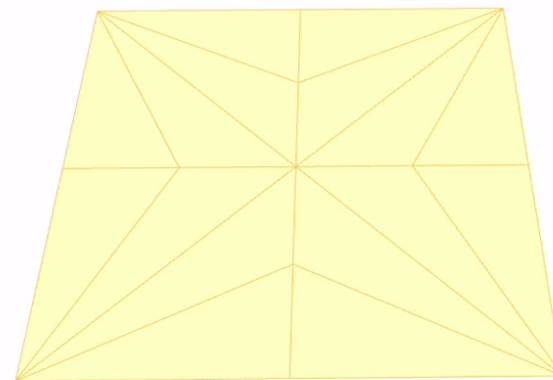


Folded motif

Repetition of the motif to create a star pattern of folds. The forms in the two photographs on the left are both folded from this single pattern. Each form is the other turned inside out.

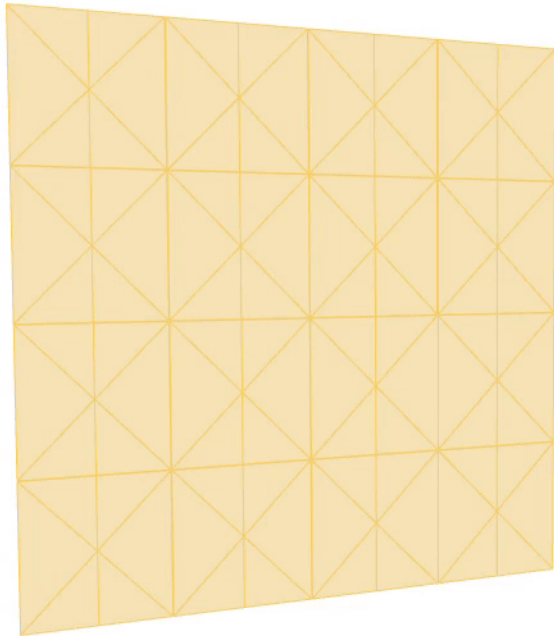


Repetition of the motif to create a radial pattern of folds. See photo opposite. Note that, like the example above and left, this form may also be turned inside out, though the difference is less dramatic.



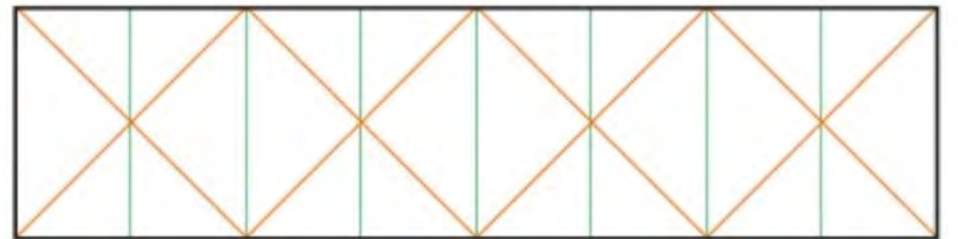
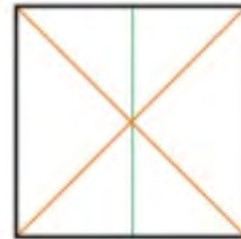
Chosen Motif

- Symmetrical and modular
- Efficient fabrication and construction
- 6 parts per module with 2 different elements

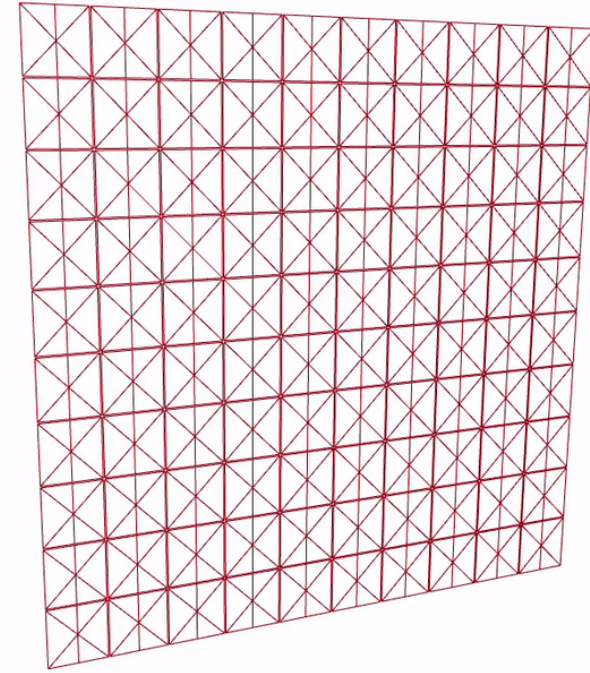
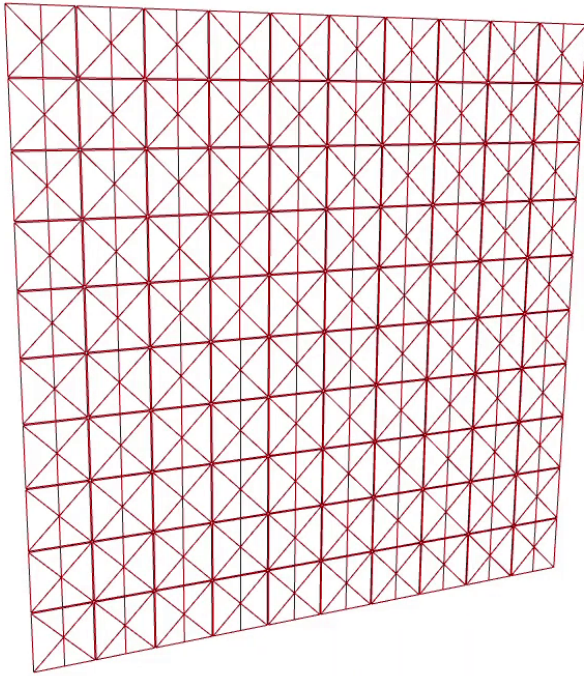


Folded motif

1.2.1_1
An example of
translation symmetry
(see photo overleaf).

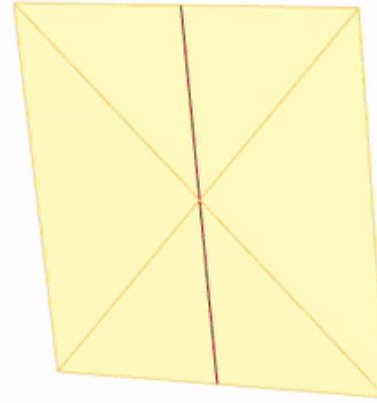


Developing a Parametric Model



Extracting Necessary Data From Model

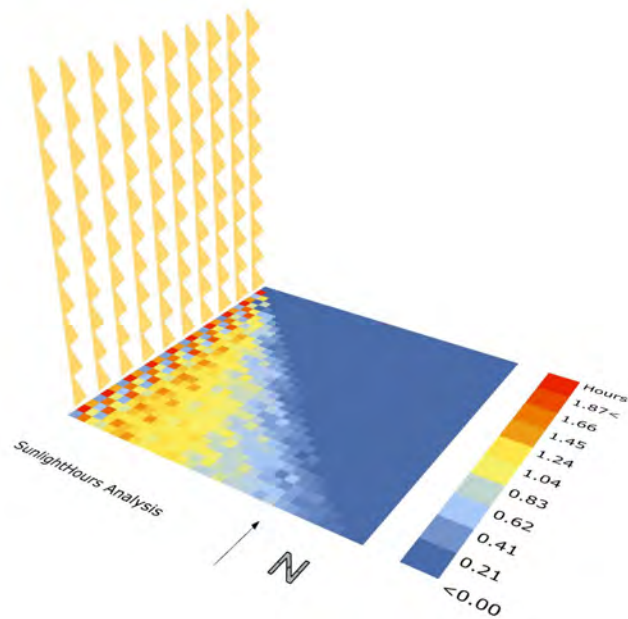
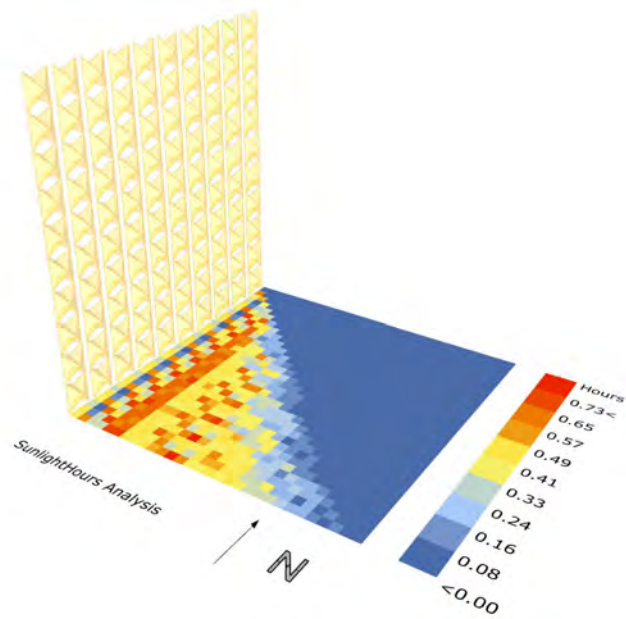
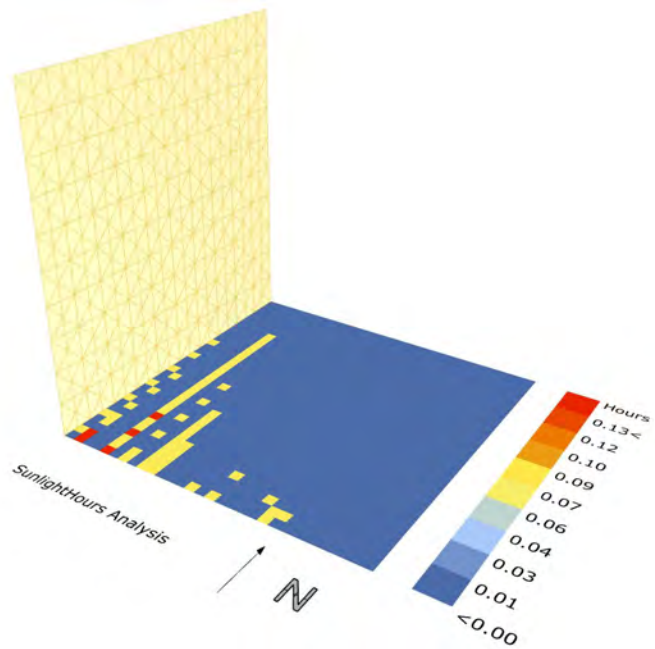
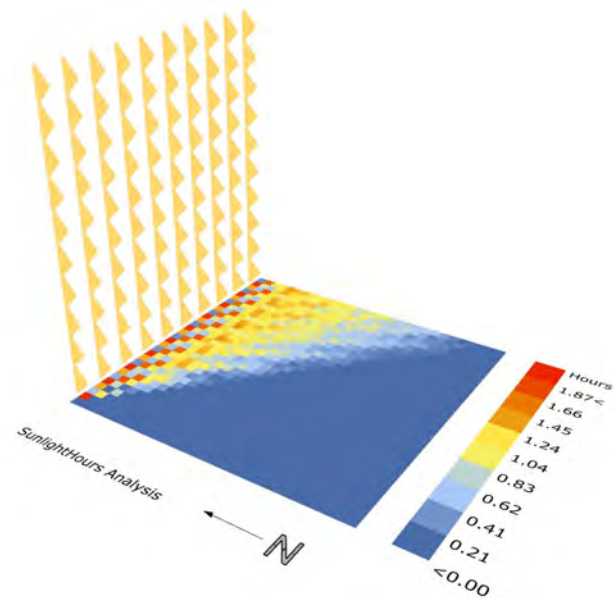
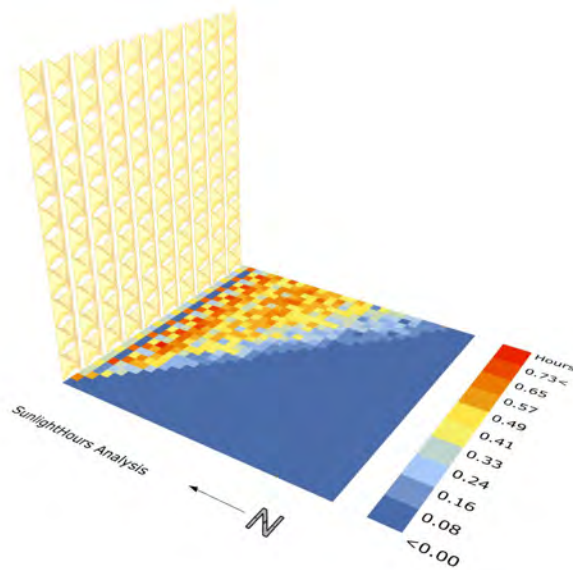
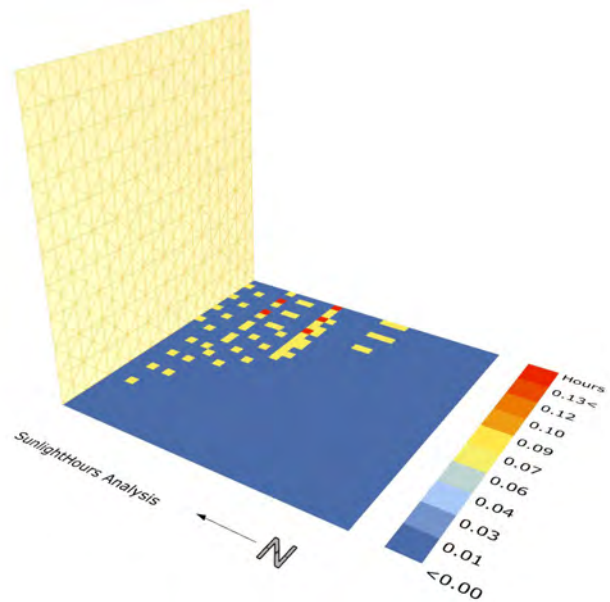
- Utilising new data from dynamic model
- Informs parameter adjustment
- Allows for project goals to be achieved

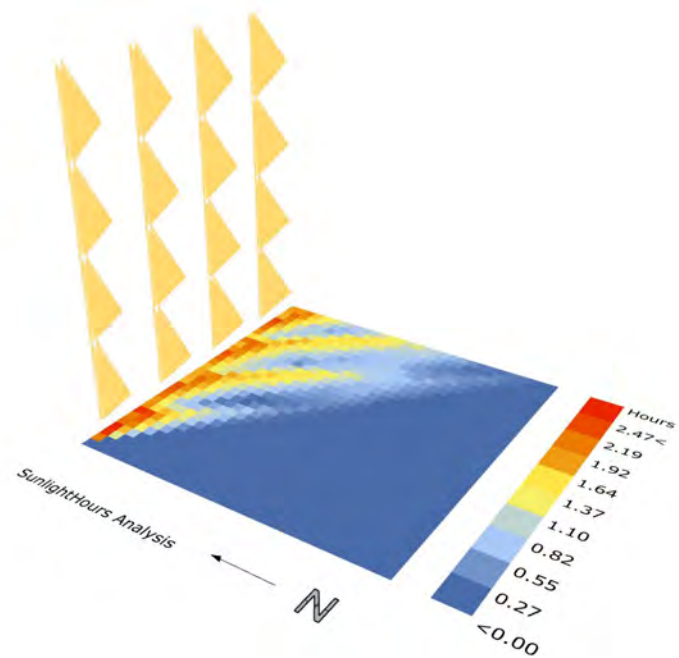
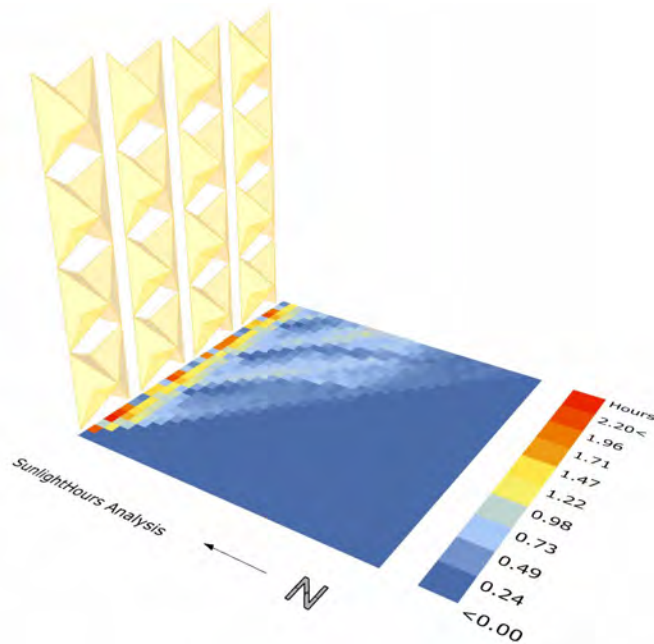
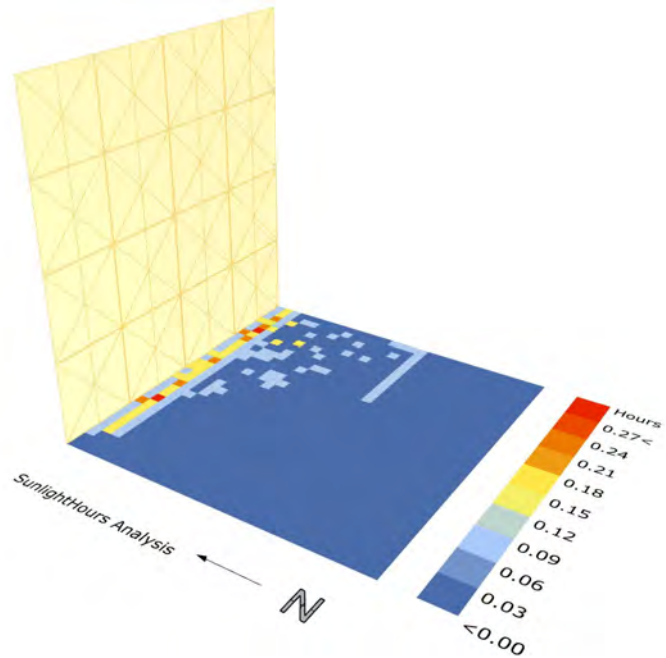
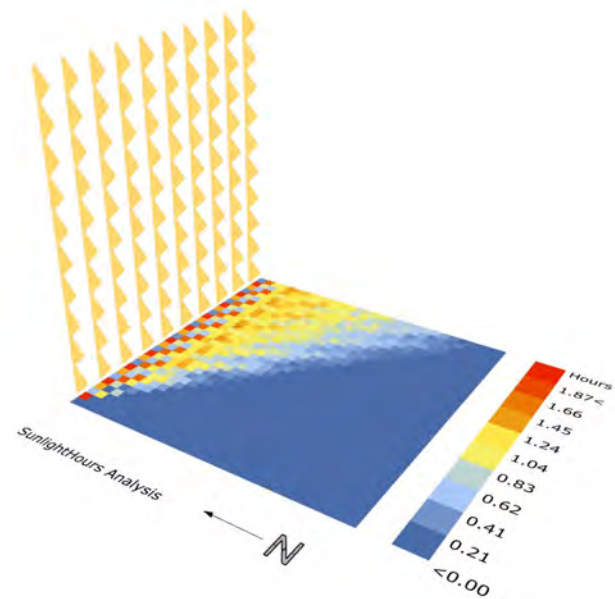
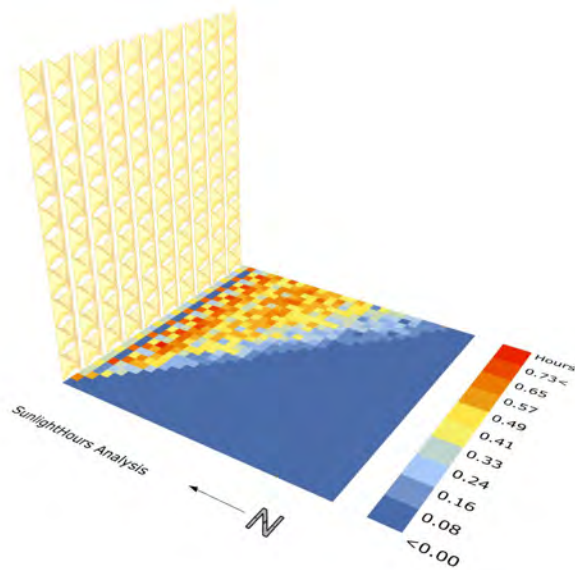
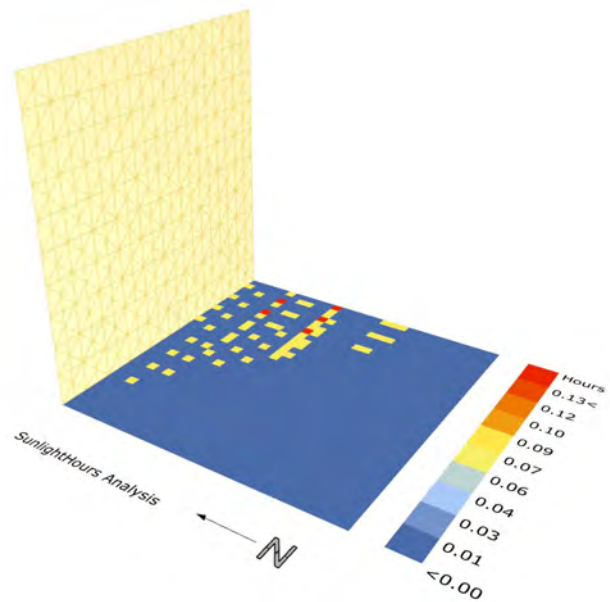


Amplitude(0.00 mm)

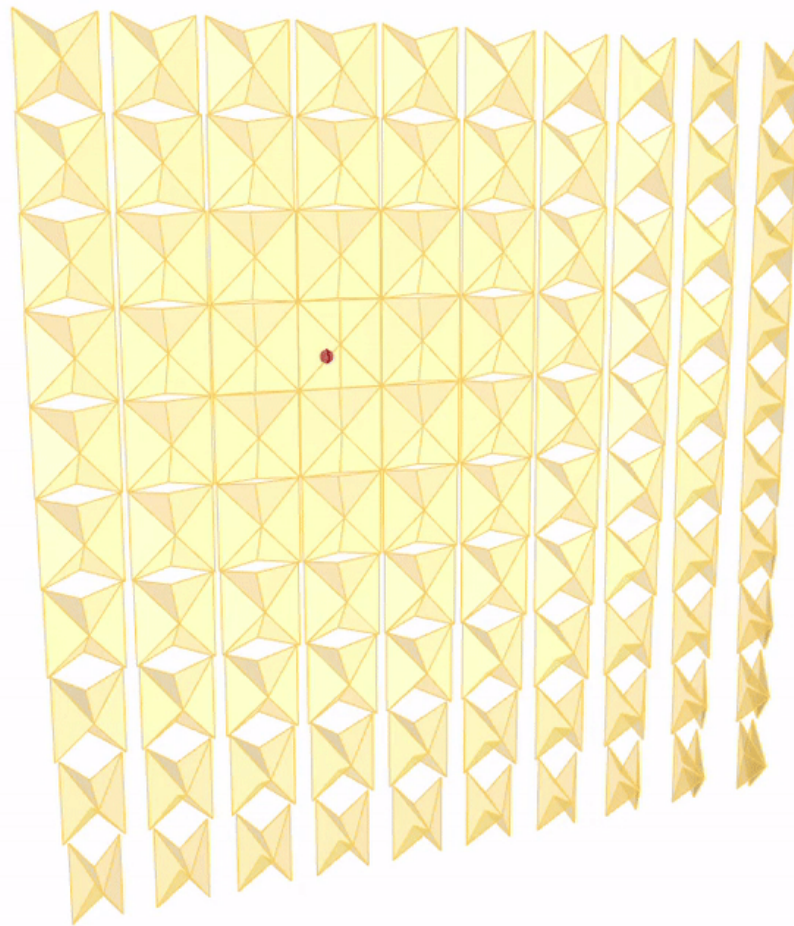
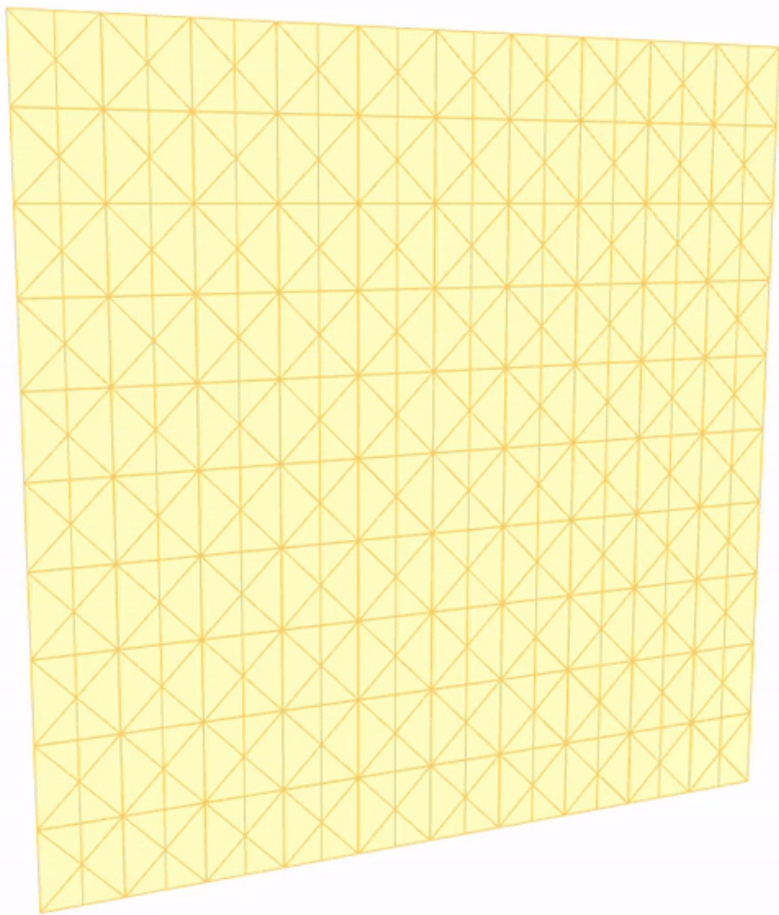
Daylighting Test 1

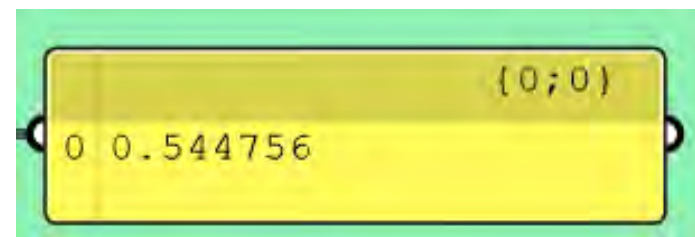
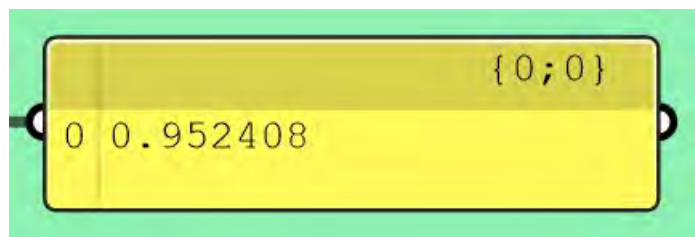
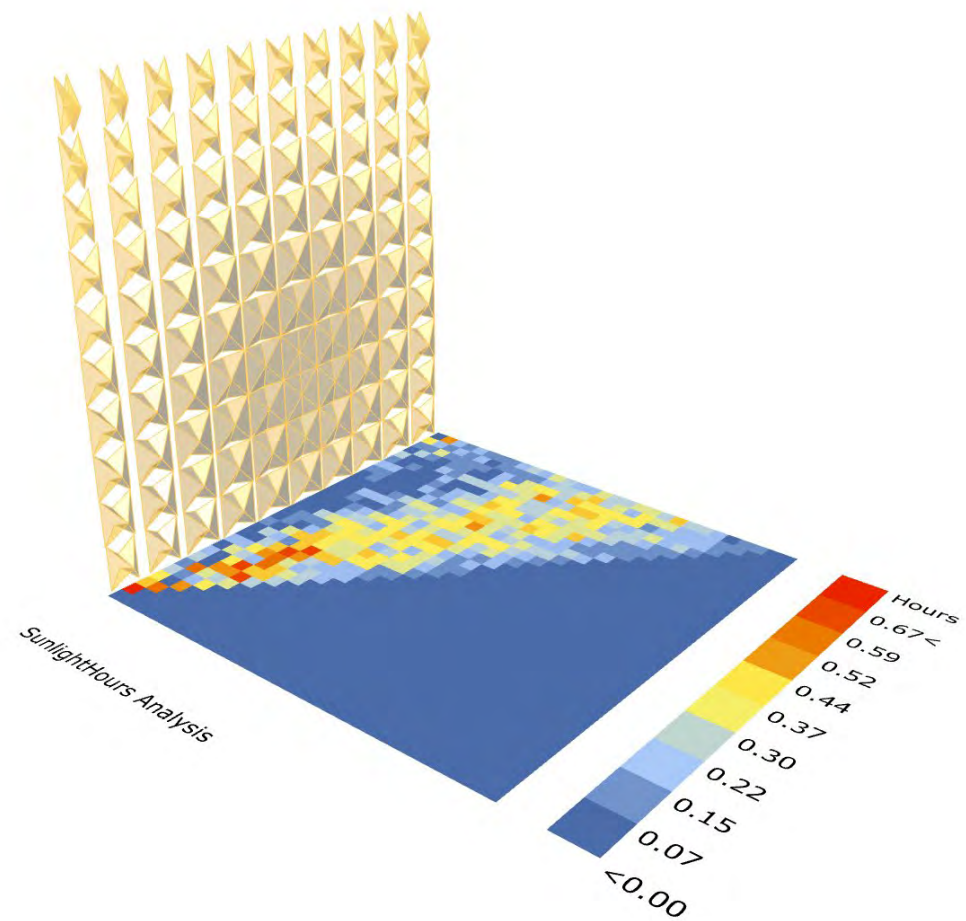
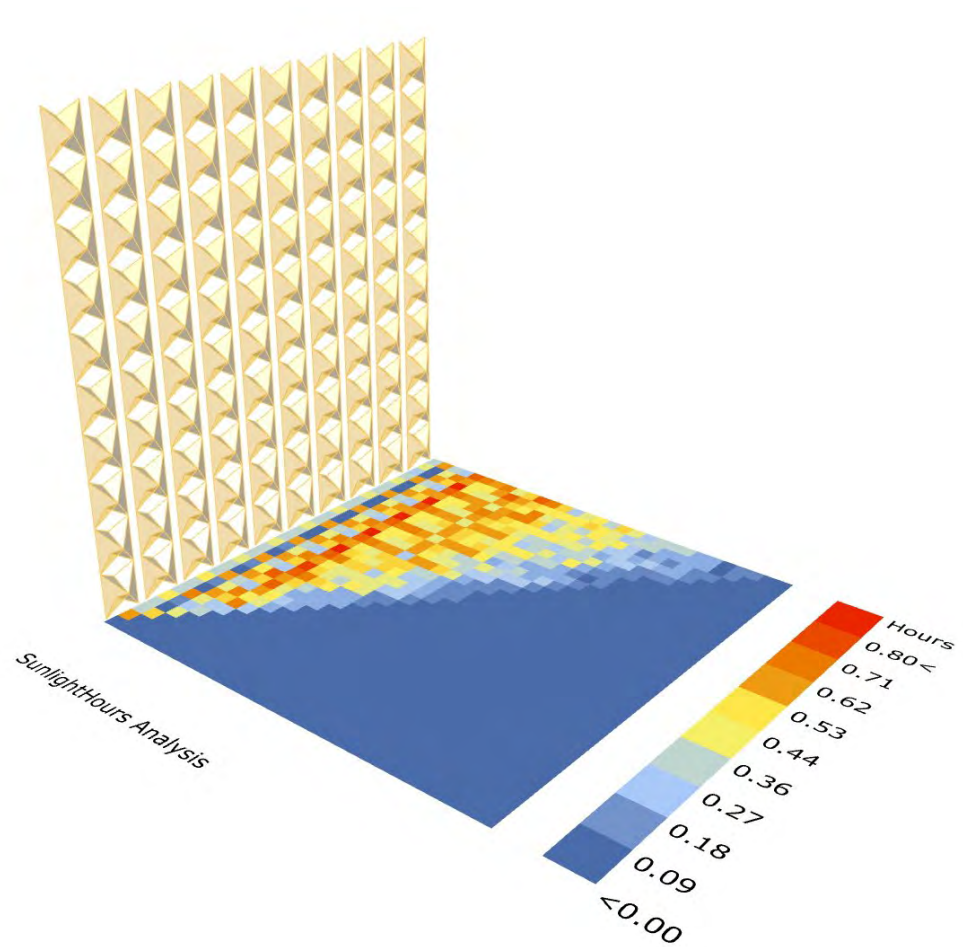
- Sydney CBD
- Winter Solstice
 - June 21st 9am – 3pm
- Orientation (North vs West)
- Module size (200mm² vs 500mm²)
- Opening positions (0 – 180 degrees) (0 – 0.5 - 1)

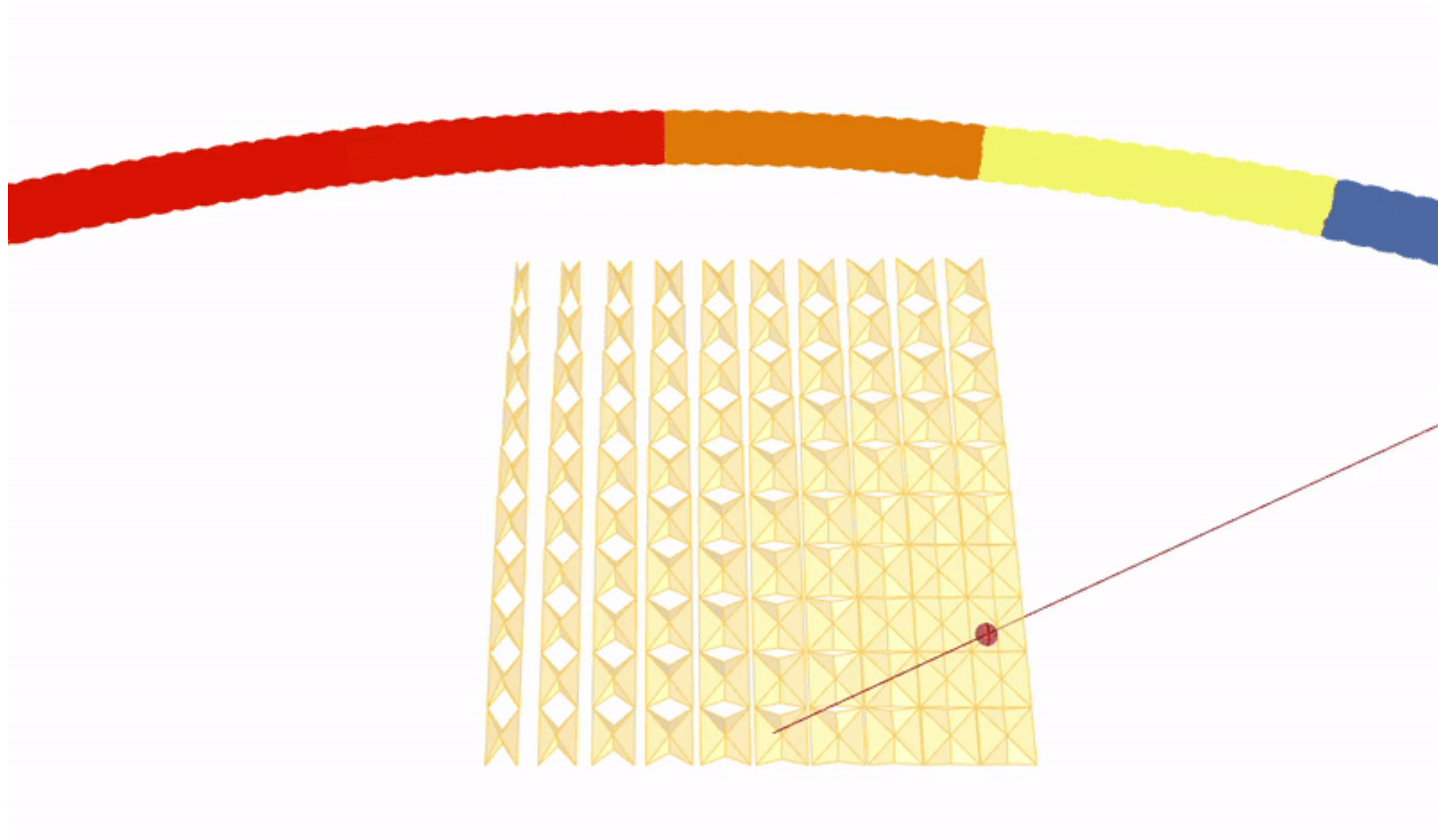


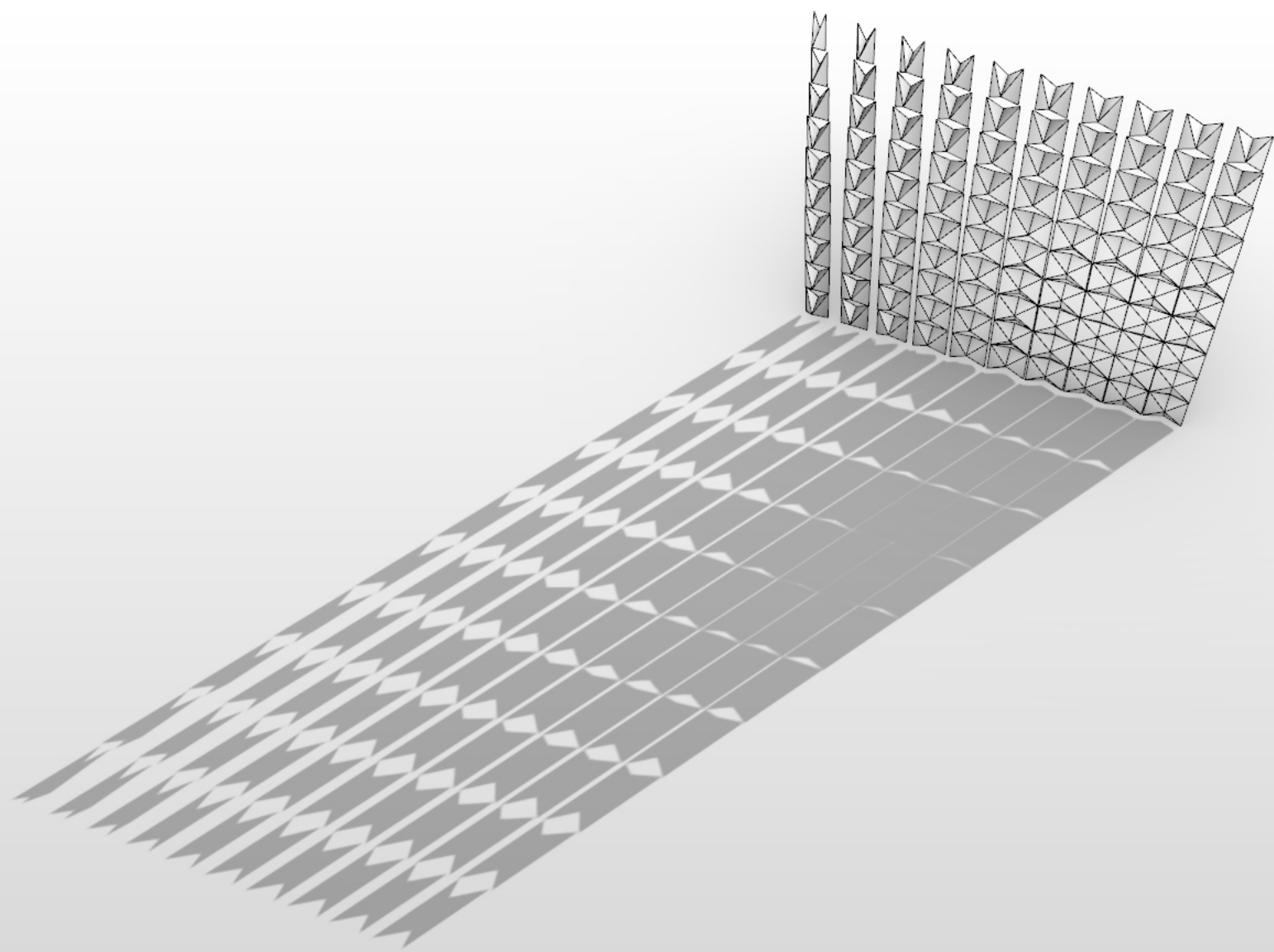


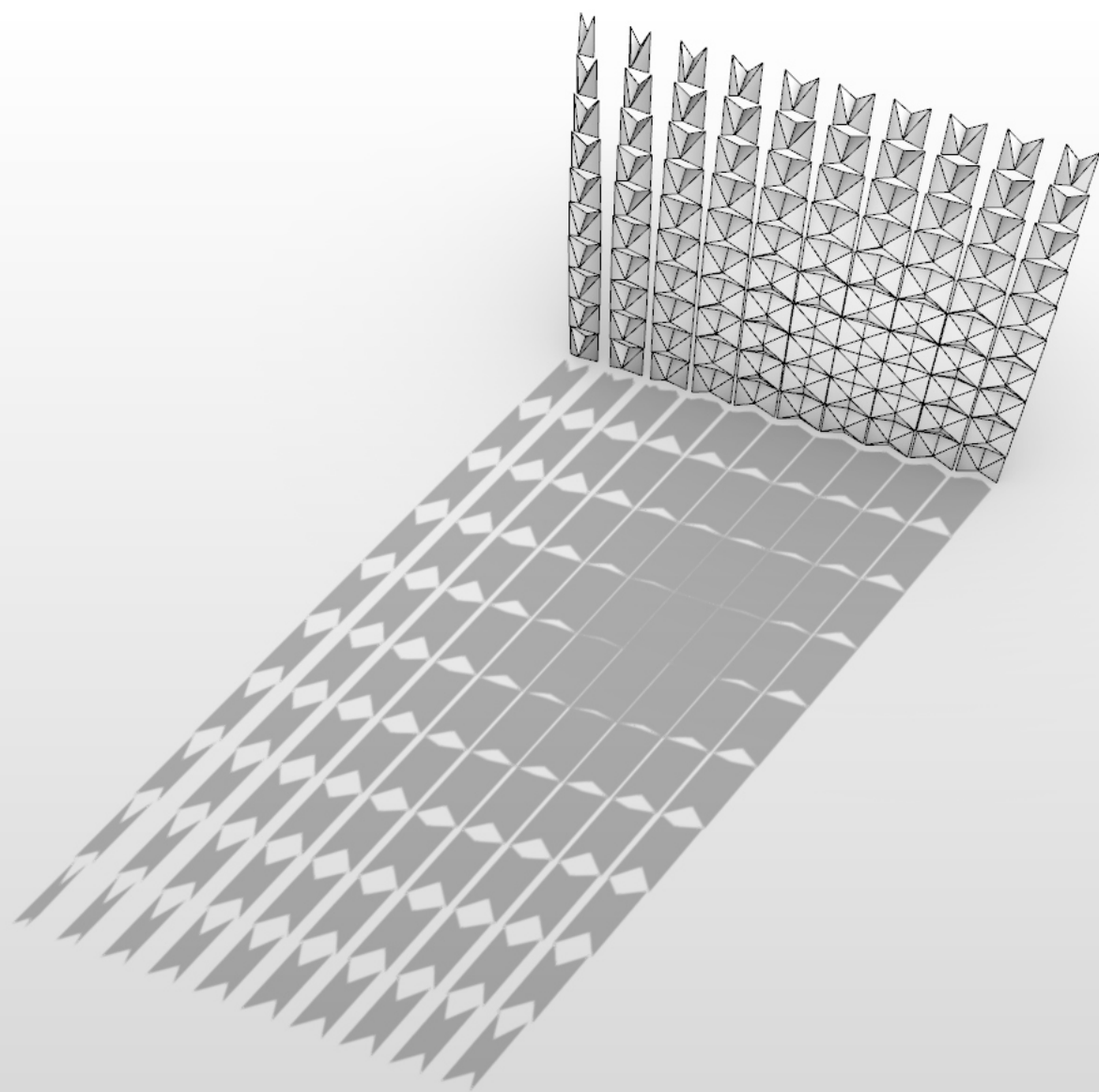
Global vs Dynamic

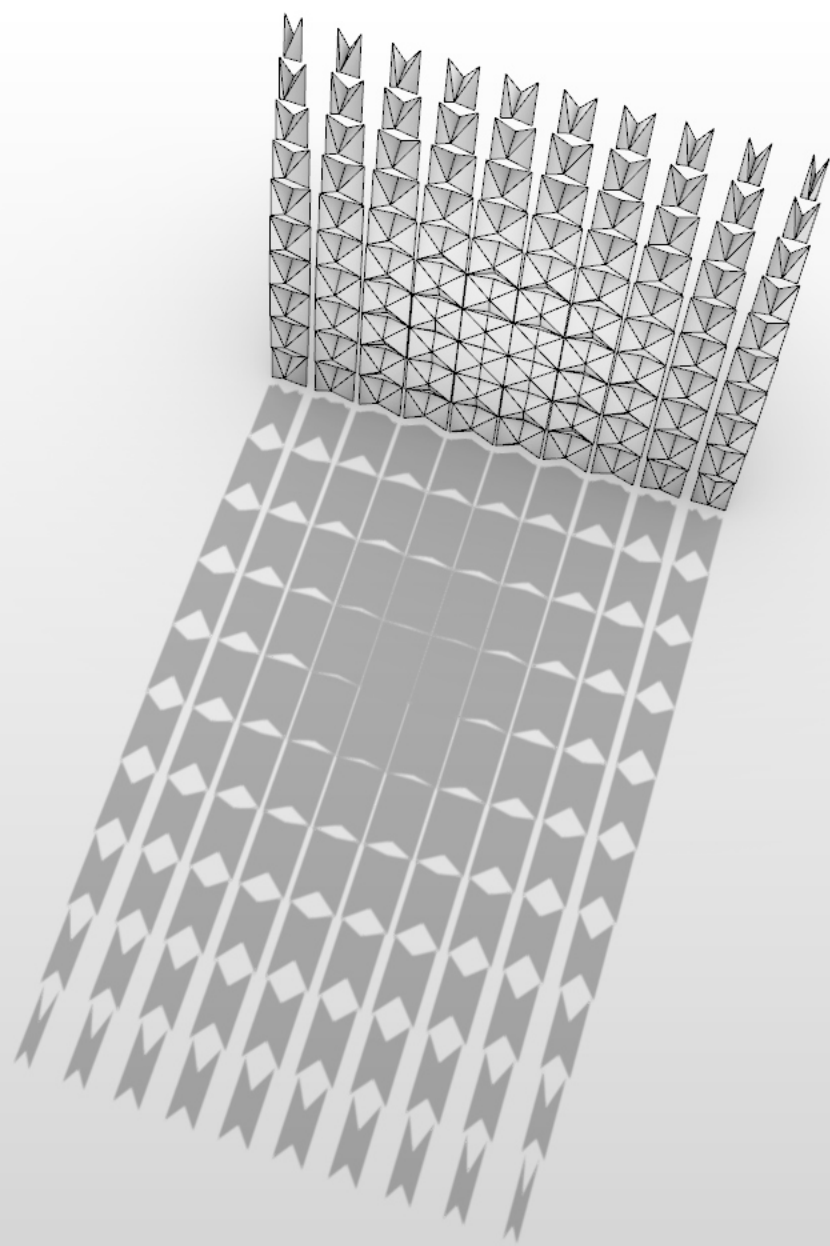


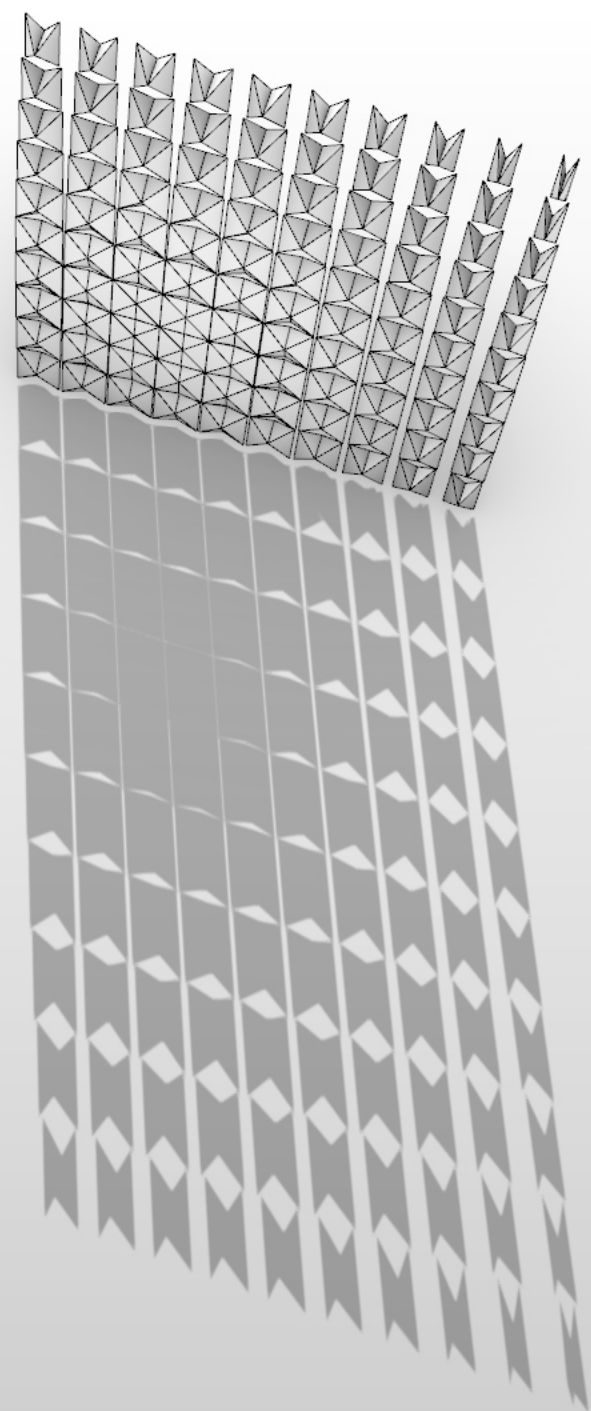


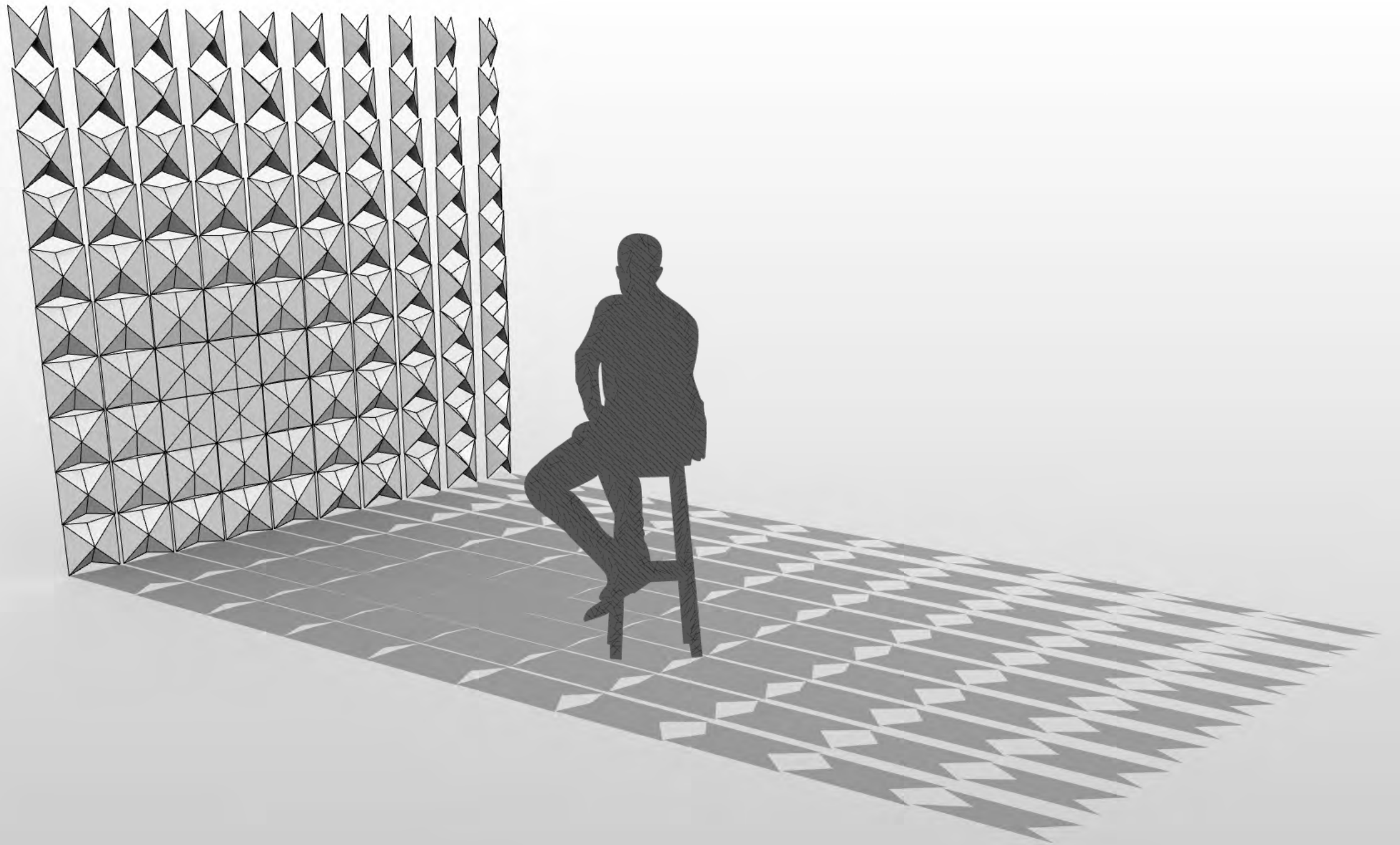


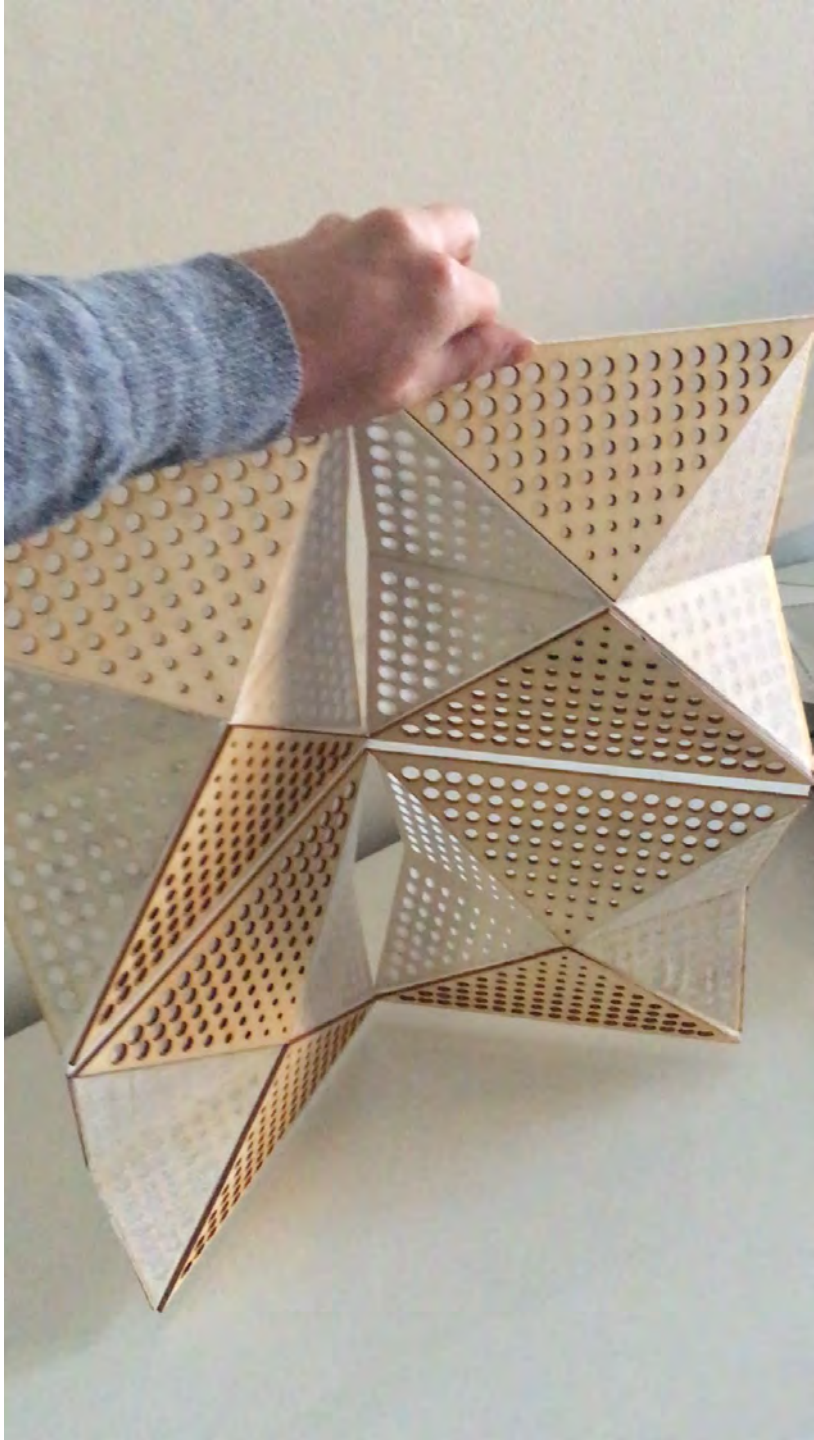






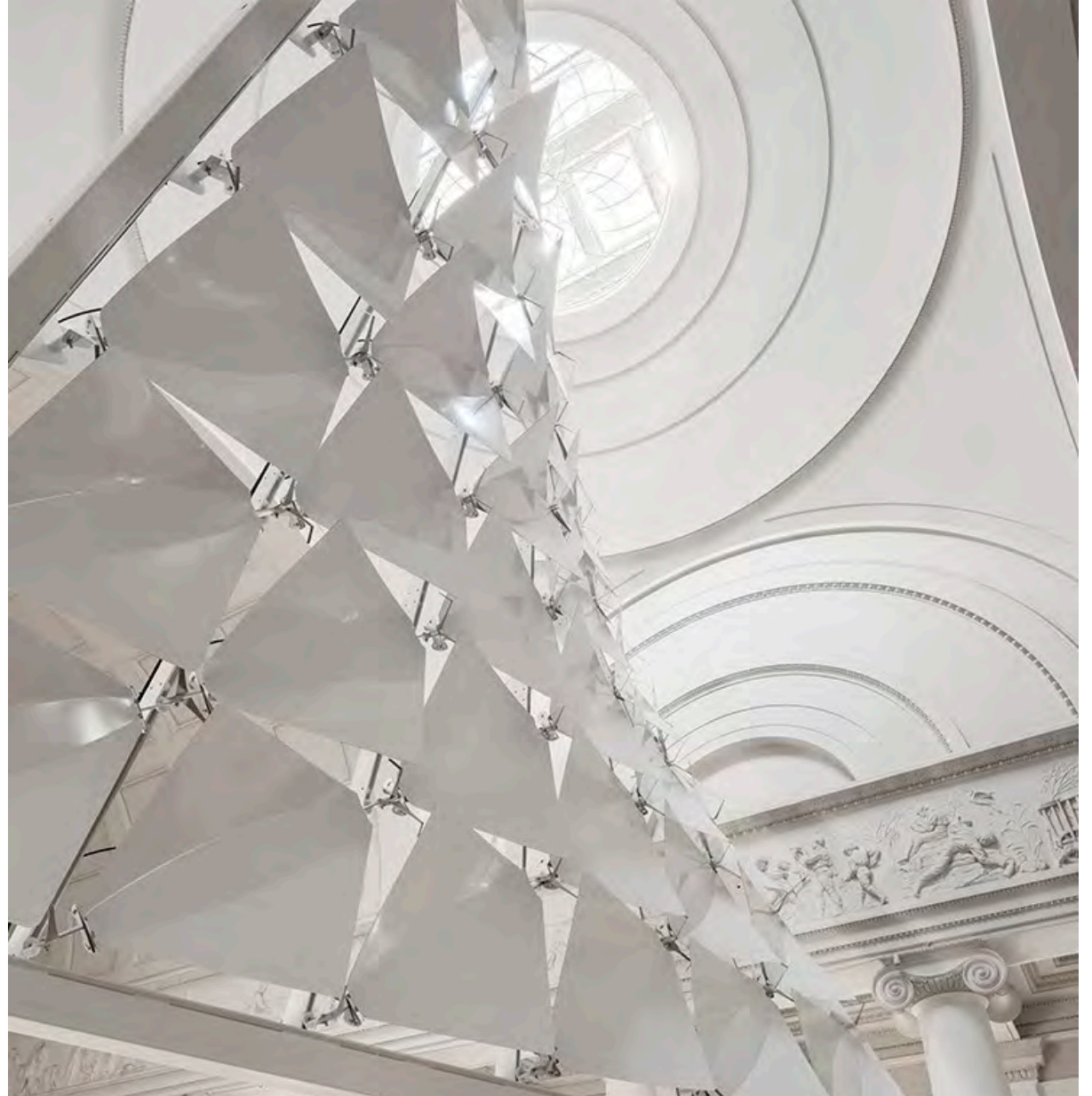








Al Bahar Towers (2012) – Abu Dhabi



FlectoFold (2017-18) - ITKE

Evaluation

- Parametric modelling and simulation has been beneficial in the design of a kinetic system (experimentation, visualisation, real time results)
- Analogue methods have highlighted that exploring material behavior is a limitation
- Pointing to further material and mechanical research