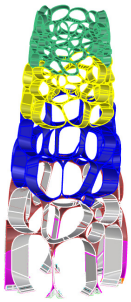
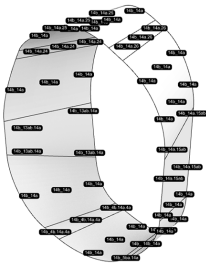
Dewitt Godfrey Sculptures :: AKT II

During my time at AKT II I collaborated with artist ***Dewitt Godfrey*** on many of his installations. The work centerd around computational form generation for his cellular sculptures all the way from geometry concept through to fabrication drawings. Several have been completed, including ***Leland*** and ***Beken*** which are shown on the right.



Top left: Beken in Alameda. Completed 2022

Top right: Hoops during fabrication of Beken.

Bottom left: Leland. Completed 2022

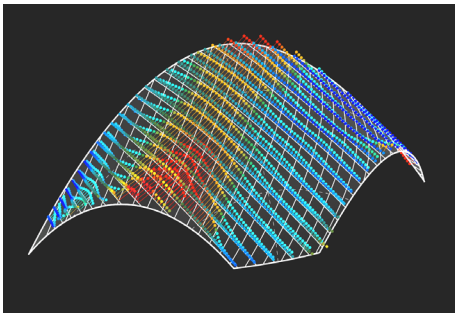
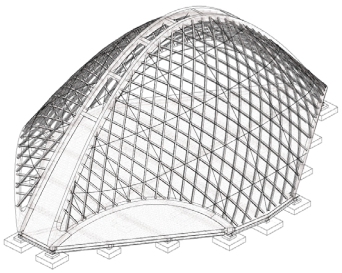
Bottom right: Digital model and fabrication data

Red Sea Timber Lattice Shells :: AKT II

The design by ***Foster + Partner*** for the hotel features a series of timber structures of various sizes and typologies. My involvement was on the design of the arrival hub, which was comprised of a cluster of timber gridshells. These were designed as lattice shells with only a rope facade to provide shade, and I carried out the geometry and form finding needed to be able to build these from bent timber lattices.

The process relied heavily on the in-house interoperability toolkit, ***Reakt***, for which I was the lead developer, as the design needed to take complex geometric constraints in terms of curvature and forming stresses into consideration. ***Currently in construction.***



Top left: Overview of cluster

Top right: Base node fabrication at Blumer Lehman

Bottom left: Form finding

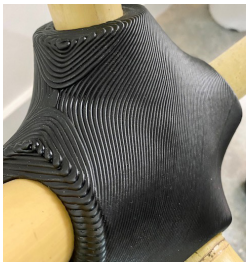
Bottom right: Iso of final design

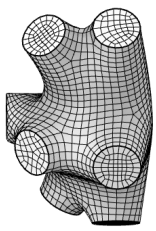
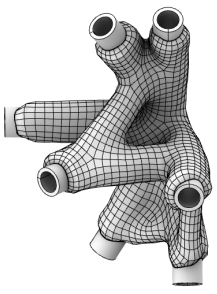
Khudi Bari @ Royal Academy :: AKT II

For the ***Royal Academy summer show 2022*** architect ***Marina Tabassum*** was invited to build a full scale iteration of her modular homes called Khudi Bari (meaning Tiny house). Our team at AKT II helped her with the realisation of this in a very short time.
My role focussed on a key issue, with both the exihibition piece and the original designs, which was the nodes.

As a team we took this as an opportunity to do some experimentation on potential node geometries and materialty which we could use including some 3d printed prototypes together with ***AI Build***. Due to time constraints, the final nodes ended up being welded aluminium.





Top left: Final Design

Top right: 3D printed nodes by AI Build

Bottom left: Final aluminium node

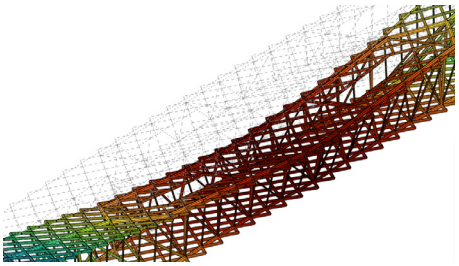
Bottom right: Node design studies

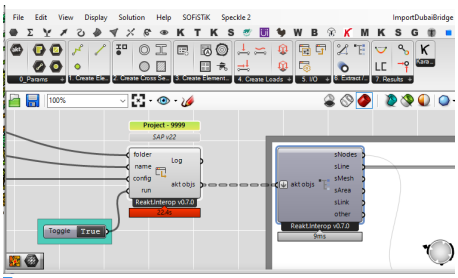
Reakt: AKT Interoperability toolkit

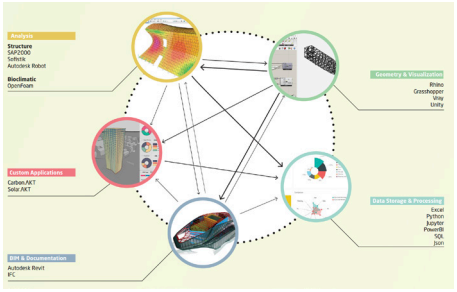
At AKT II I was the lead developer for the inhouse interoperability toolkit called Reakt.

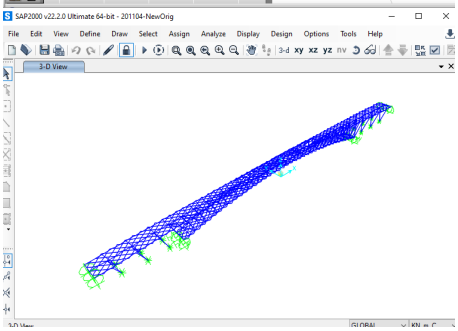
This is a software solution that is using an internal software agnostic object model (AKT. Core) to exchange data, mainly geometry for structural analysis and BIM, between the various software used in the AEC design process.

Using APIs of various analysis, BIM and CAD packages the core objects can be translated back and forth between the various native formats. The tools is primarily used through the custom grasshopper toolbar, which enables the import and export of data.









Top left: Analysis results imported to Rhino

Top right: Toolbar and grasshopper components.

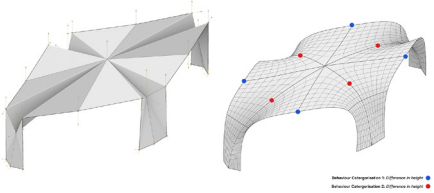
Bottom left: Overview diagram

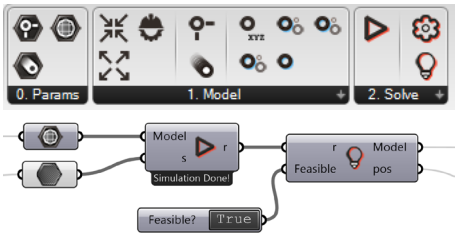
Bottom right: Model exported to SAP2000

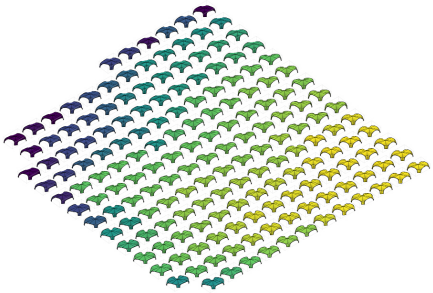
Quality Diversity Optimisation

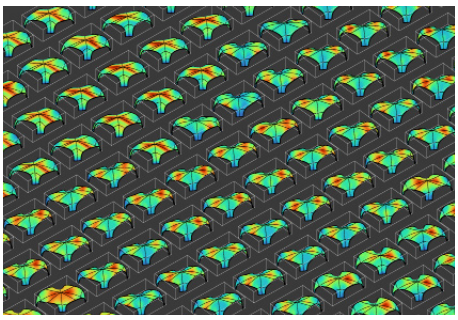
For the PrismArch project the team at University of Malta developed a framework for Quality-Diversity search, which I applied to shape optimisation of shells o explore how the algorithm could be used as a design tool.

The process worked by doing shape optimisation based on Rhino SubD objects, controlled through a set of custom grasshopper components, and was applied to some test cases. The research was presented at the 2023 IASS (International Association for Shell and Spatial structures) conference in a paper titled: **Design Space Exploration of Shell Structures Using Quality Diversity Algorithms**









Top left: Test case (Algier presidential palace by Zaha Hadid.
Top right: Custom grasshopper toolbar

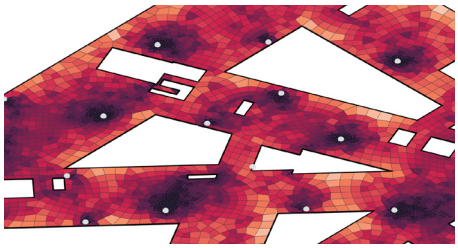
Bottom left: Feature map of an optimisation run

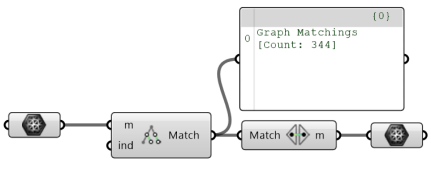
Bottom right: Close up of displacement plots

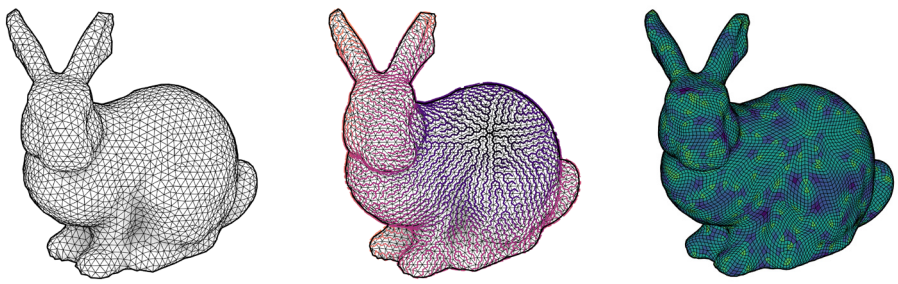
Structural Meshing

As part of the various grasshopper toolkits much work has been done in the background on computational geometry to support the modeling, analysis and making of complex structures.

One of the core topics is the qucik generation of quality FEA-suitable meshes, where quad meshes are preferred to triangles. For this I have been developing many different mesh processing algorithms, including here shown mesh quadrangulation algorithms.







Top left: FE mesh of a slab with varying mesh density

Top right: 3D printed nodes by AI Build

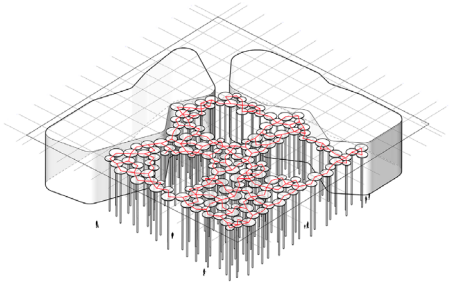
Bottom left: Final aluminium node

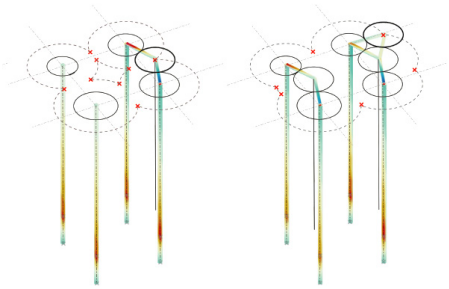
Bottom right: Node design studies

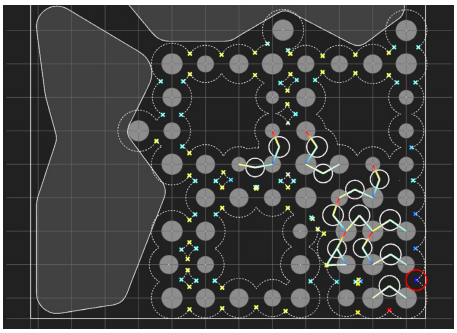
Sachsische Aufbaubank :: Knippers Helbig

The design by ***ACME*** for the new headquarters for SAB in Leipzig is an L-shaped building around a large public space. This space features a "forest of columns" rising 22m into the air.

A problem with this forest was that, due to a parking garage beneath, only around 50 columns located on a grid could be fixed at the base. This problem was solved using a computational approach which iteratively grew the forest of columns by adding a column at a time trying to minimise the energy of the system. This was done using ***Grasshopper*** and ***Karamba***.







Top left: Iso of design scheme

Top right: Interior view

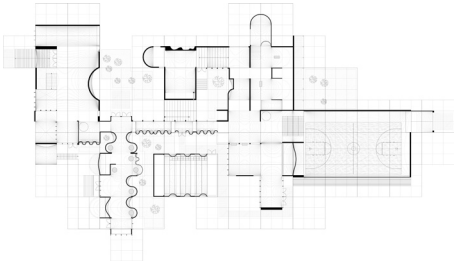
Bottom left: Plaster cast on membrane, model

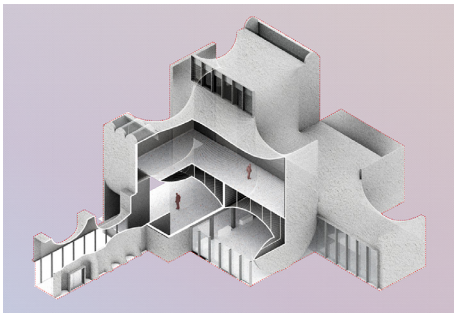
Bottom right: Highlightww of final design

Borderline Bodies :: M.Arch Thesis

The project explores a contemporary take on traditional vaulting through a set of adaptable modules. These are derived from a doubly curved, stiffened membrane spanning between a set of distinct, more conventional architectural elements, such as walls and floors, finding shapes that explore shapes that are bordeline structural and spatial.

By embracing the contrast between the two geometric types through their interaction as constraints and agent, a framework emerges which is both flexible and rigid. The project explores a range of spatial conditions across different scales where this module can act both architecturally and structurally in a continuous blend.





Top left: Plan

Top right: Interior view

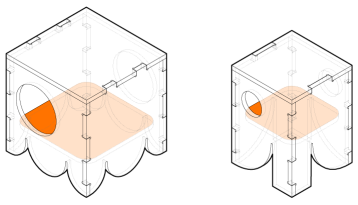
Bottom left: Plaster cast on membrane, model

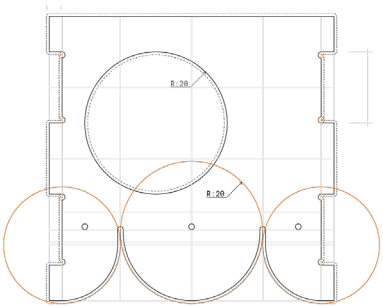
Bottom right: Highlightww of final design

Stool Samples :: Home Furniture

Personal project. Needed some stools / stands so designed a set made from CNC cut OSB boards. The idea was to create a family of figures which are sampled from an infinite set based on a language of primitive shapes in a grid layout.

This enables a creation of a group of cohesive pieces without actual repetition, that can easily be extended when needed.





Top left: Front view of one piece

Top right: Isometric drawing of two designs

Bottom left: Close up of finger joint

Bottom right: Fabrication drawing