1. Creative projects

- Bentopiccola
- Little Jewels
- Ear-ear-ring
- Camaleonda ++
- Sidetable 1
- Photography + Visual Art

2. Academic work

- Glass Structures
- PBL Lab

All design, product, engineering, and imagery presented is my own, unless specifically noted otherwise.

3. Professional work

- Portland International Airport
- Data Driven Design
- Structural Engineering
- Foster + Partners
- BIG and Heatherwick

Professional work and consulting has been highly team-oriented; personal contributions are described explicitly.

Bentopiccola

Inspired by an enthusiasm for espresso and Italian design, this home espresso maker is based on the mechanism of a mid 1980s La Pavoni Europiccola.

As a prototype for a product to make this method of hands-on espresso preparation more accessible to newcomers, I have redesigned the base to integrate several new features.

1. Brew pressure can be back calculated from load cells positioned within the base, avoiding the need for an expensive external pressure gauge
2. All interaction points unified with handcrafted timber components to clarify the user workflow
3. Integrated scale for espresso pulled, enabled by a load cell in the brew platform assembly
4. Reflective brew platform, allowing the user to view the underside of the portafilter
5. Analogue instrumentation is embedded in the reflective brew platform, allowing the user to simultaneously reference brew pressure and progress

Analogue gauges minimize distraction from the tactile experience of brewing

The racetrack scallops of the top surface are designed for efficient CNC milling, and function as the drip-tray, exceeding the capacity of comparable machines.

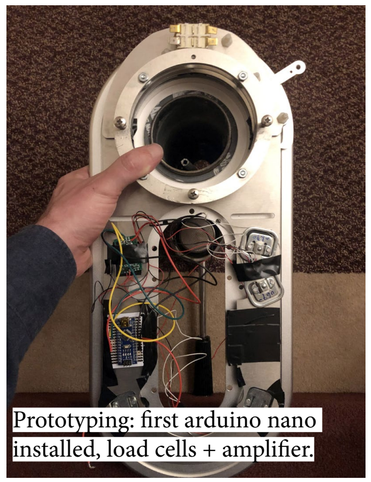
Designed and assembled in Boston, with CNC work, laser cutting, and anodization being outsourced.

Early conceptual design, developed in Rhinoceros and rendered using Blender.

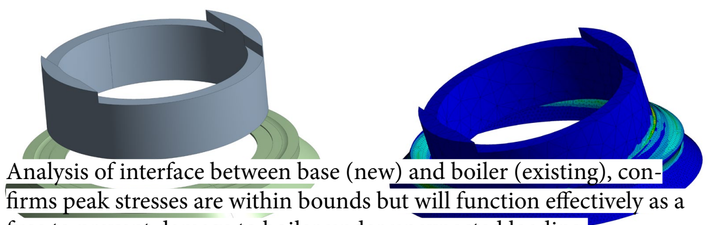
Boston, MA
2019 - 2020

Functional prototype: half-height base reduces machining cost and leaves underside open for prototyping componentry.

Outsourced parts: fit-up after laser cutting and anodization.



Prototyping: first arduino nano installed, load cells + amplifier.

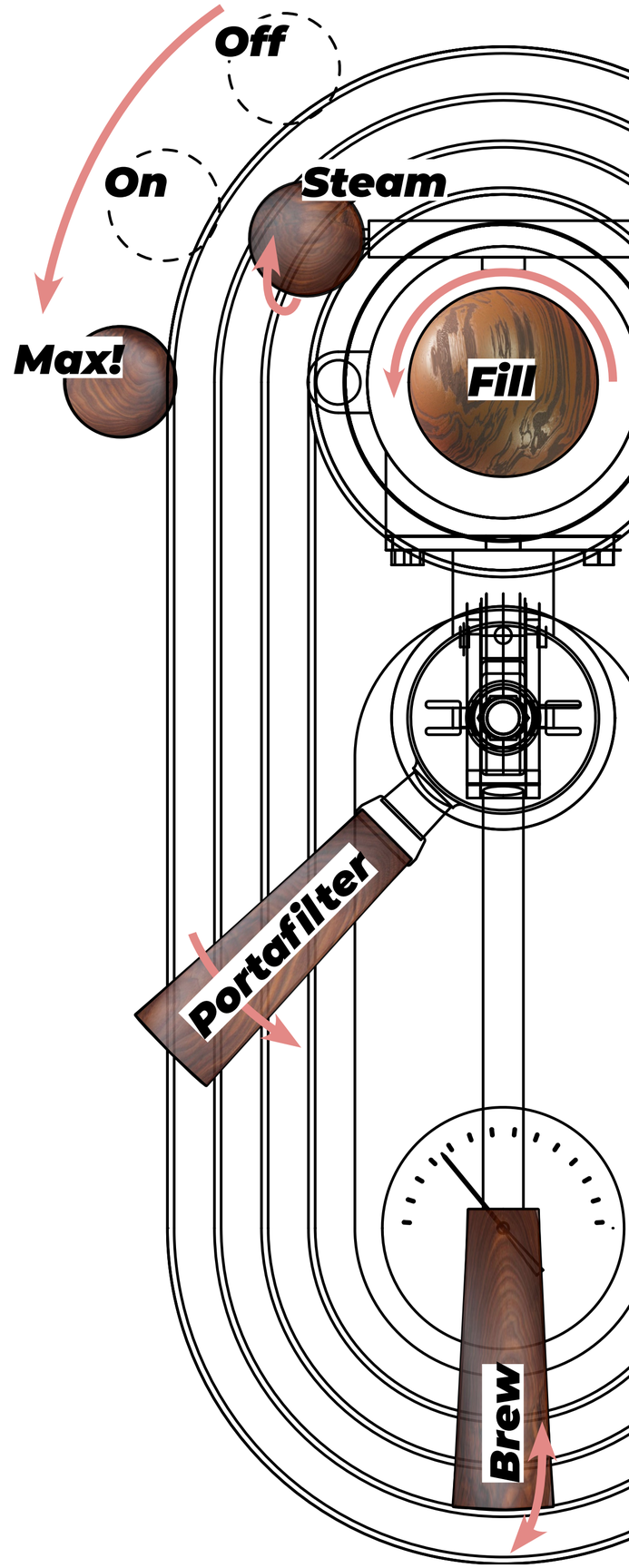


Analysis of interface between base (new) and boiler (existing), confirms peak stresses are within bounds but will function effectively as a fuse to prevent damage to boiler under unexpected loading.

Each gesture is an intuitive rotation about the central body; spherical touch points rotate, while cylinders act as levers. This offers experiential consistency with the core brewing mechanism, and is a commitment to this differentiating aspect versus typical pump-based machines.

Each interaction point is unified in materiality and gesture.

Analogue gauges embedded in the brew platform were selected to minimize distraction from the tactile experience of brewing, and are enabled by a pair of Arduino Nanos. These parallelize the sensing duties to reduce measurement/display latency, keeping the response time low enough that it feels intuitive and mechanical.



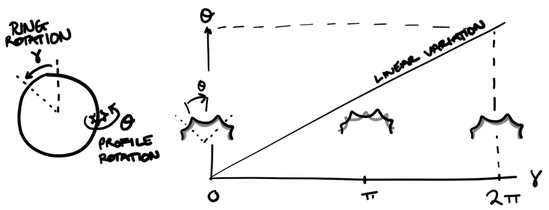
Little Jewels

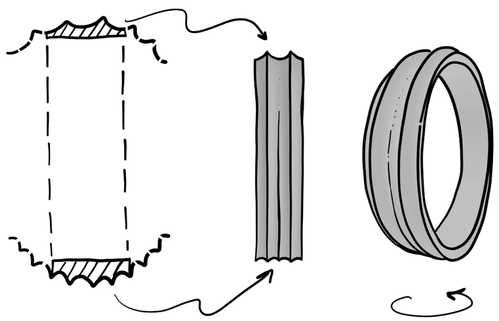
This jewelry collection is based on the geometry used by Gaudi to sculpt the columns of la Sagrada Familia.

Deeply inspired by the ideal of mathematical beauty that Gaudi had pursued in his work as a form of worship, this project began as a set of wedding rings and has now grown to include two additional pieces that use the same motif. The particular geometry in use here is inspired by Gaudi's elegant solution for subtractive manufacturing of his columns, which involved two counter-rotating sinusoidal guides. The result is a surface that can be described as the minima of two sine waves, beginning out of phase and passing through one another - or better yet, the result of taking a giant potato peeler to one of the columns.

"taking a giant potato peeler to one of the columns"

Prototyped in San Francisco, and finally realized in 10k gold casting + iron SLS, working with a fabricator in Belgium to cast and hallmark the gold.

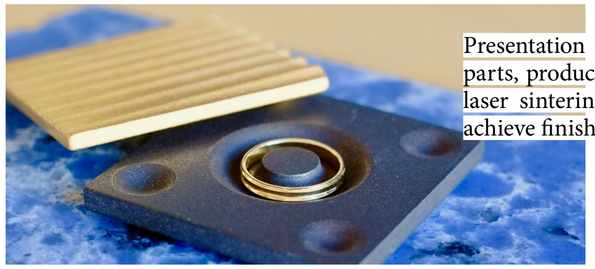




San Francisco, CA
2017 - 2018

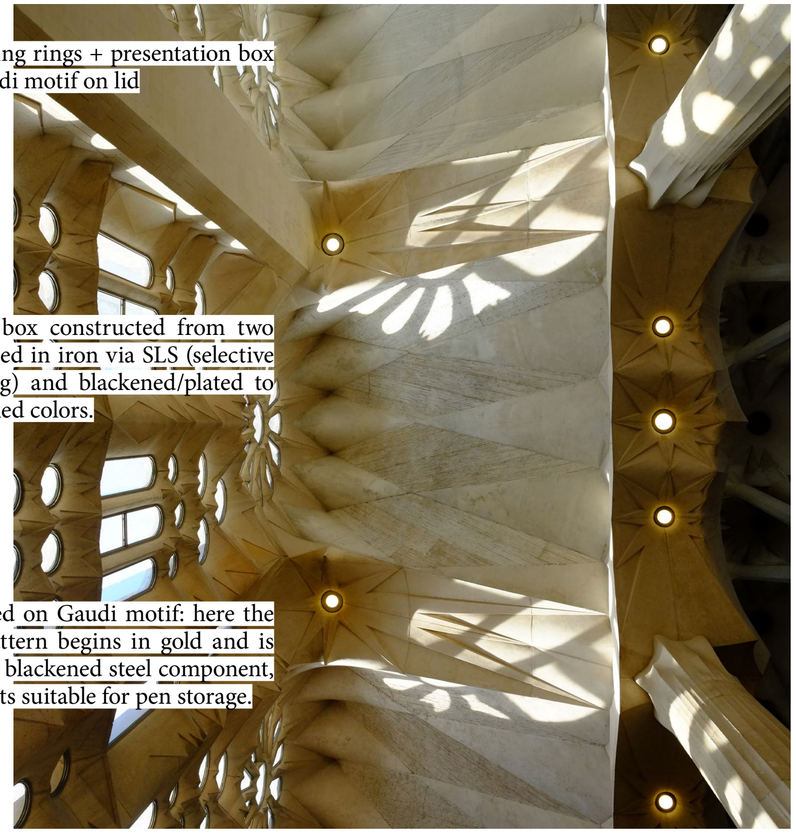
Each ring is printed in a lost-wax compatible resin, then cast in 10k gold.

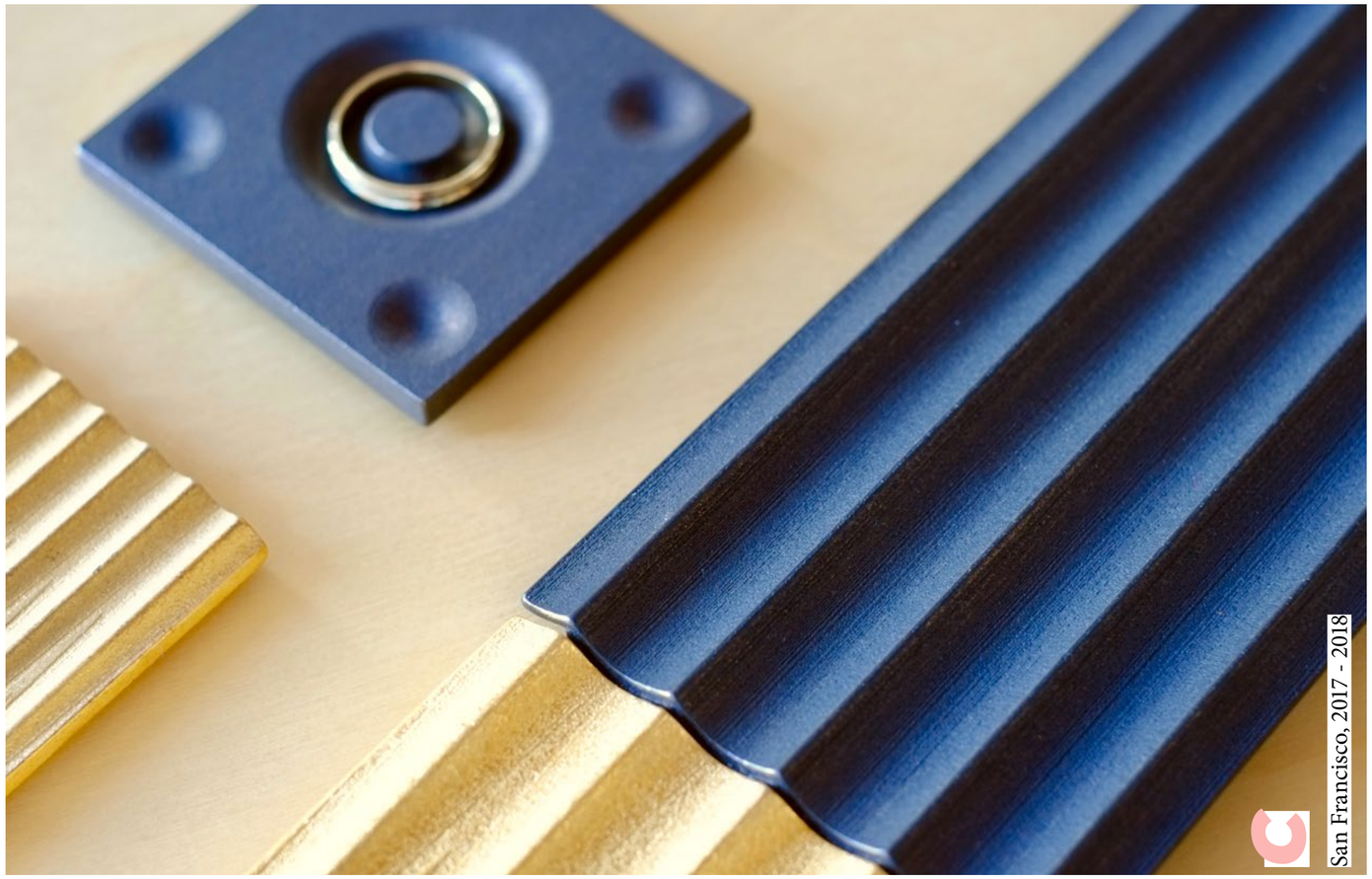
Pair of wedding rings + presentation box carrying Gaudi motif on lid



Presentation box constructed from two parts, produced in iron via SLS (selective laser sintering) and blackened/plated to achieve finished colors.

Pen tray based on Gaudi motif: here the sinusoidal pattern begins in gold and is paused at the blackened steel component, leaving indents suitable for pen storage.



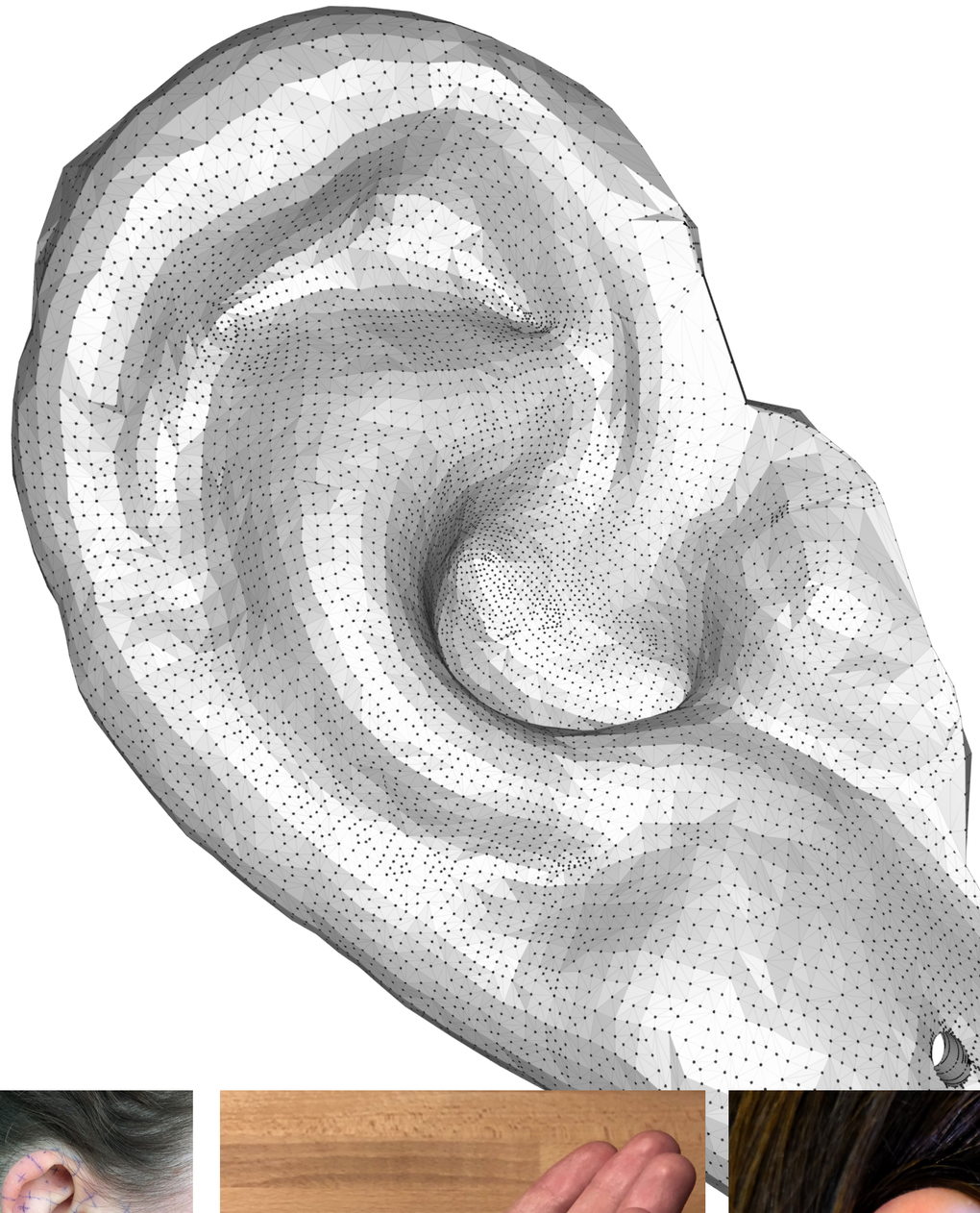


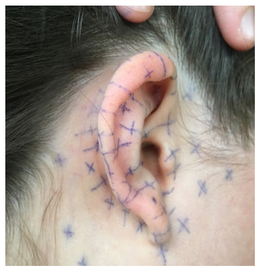
San Francisco, 2017 - 2018

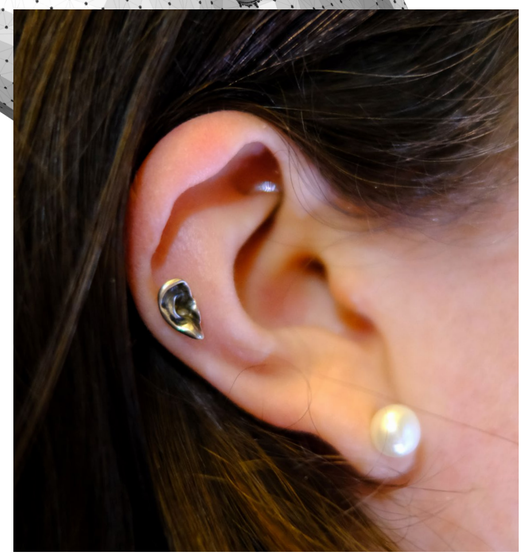
Ear-ear-ring

Having originally produced this model for a whimsical project in 2016 when photogrammetry was emerging as an accessible technique, it wasn't until 2018 that I realized I had missed the obvious: it had to become an earring for the very ear it was scanned from.

Lost-wax compatible 3d printed resin, cast in sterling silver by i.materialise.







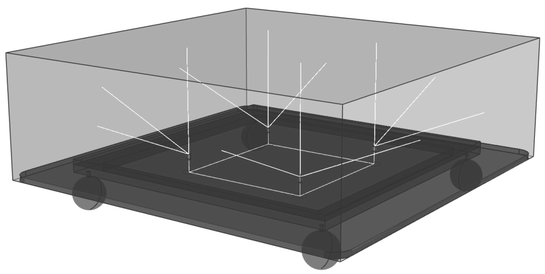
San Francisco, CA
2018 (Geometry 2016)

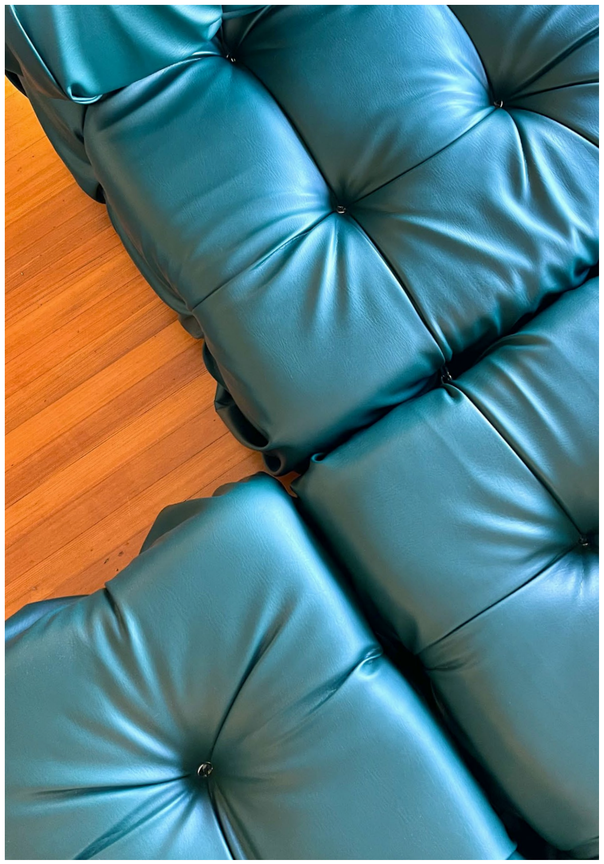
Cama-leonda ++

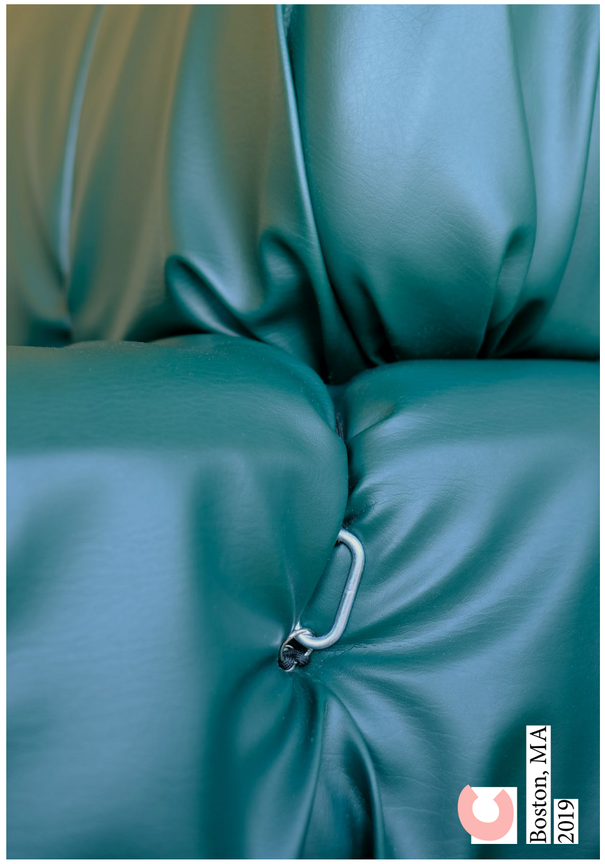
Strongly drawn to Mario Bellini's late 60's design for the Camaleonda modular sofa collection, and similarly strongly lacking the funds to purchase a vintage example, I took on the task of reverse engineering the hidden tensile structure that gives the sofa its elegant form and modular reconfigurability. Beyond this tension network, Bellini has achieved an elegance in both subtle functional details and design for manufacturing that I would never have understood without making my own.

Camaleonda ++ borrows its "plus plus" from the 80's full fat approach to leather upholstery, leaving us with a design that might respond to "what if de Sede had manufactured Bellini's Camaleonda?"

This project was realized in our apartment's common hallway based on an inexpensive foam mattress, using marker pens, a bread knife, punch kit, a particularly helpful chopstick, and a sewing machine, keeping the budget comfortably under 1/50th of a vintage example.





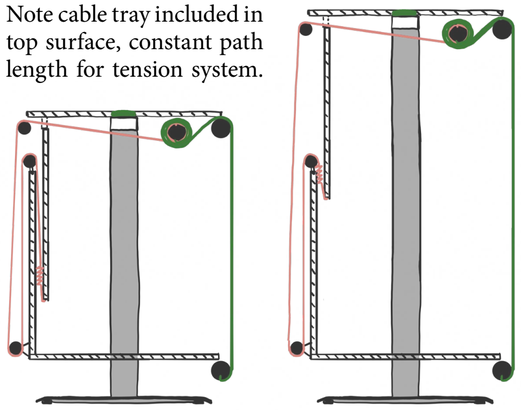


Side-table 1

Sidetable 1 is the second in a series of pieces of active multi-functional furniture enabled through simple mechanization. This piece is designed to function as a side table, storage unit, piano keyboard base, and sit-stand desk with motion through only a single degree of freedom. Each function lies on a continuum of height adjustment, with pre-programmed options to quickly switch between them.

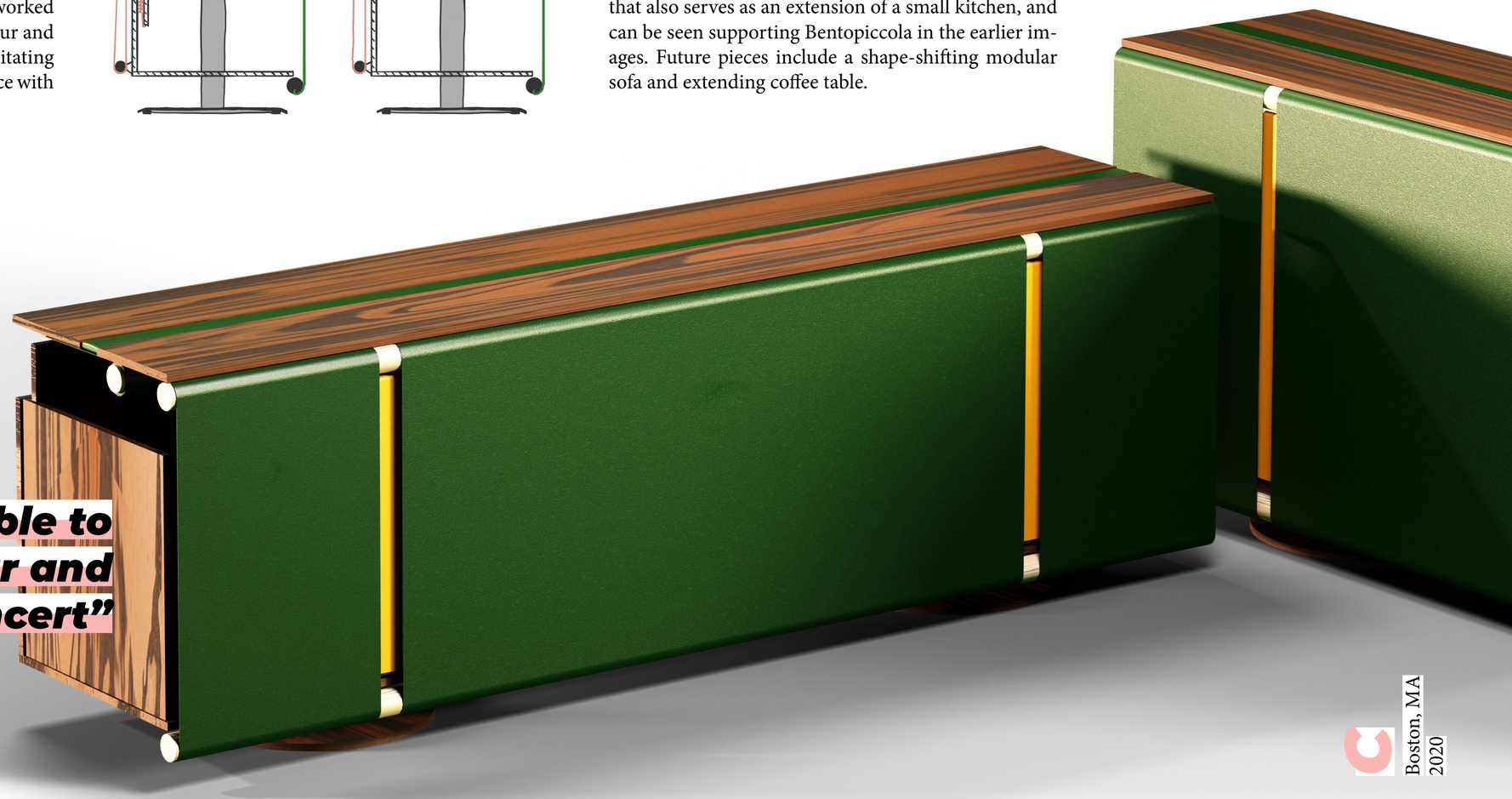
The wider ambition for these pieces is as a networked collection that is able to learn the user's behaviour and make adjustments predictively in concert, facilitating meaningfully different configurations of the space with minimal input required from the user.

Note cable tray included in top surface, constant path length for tension system.



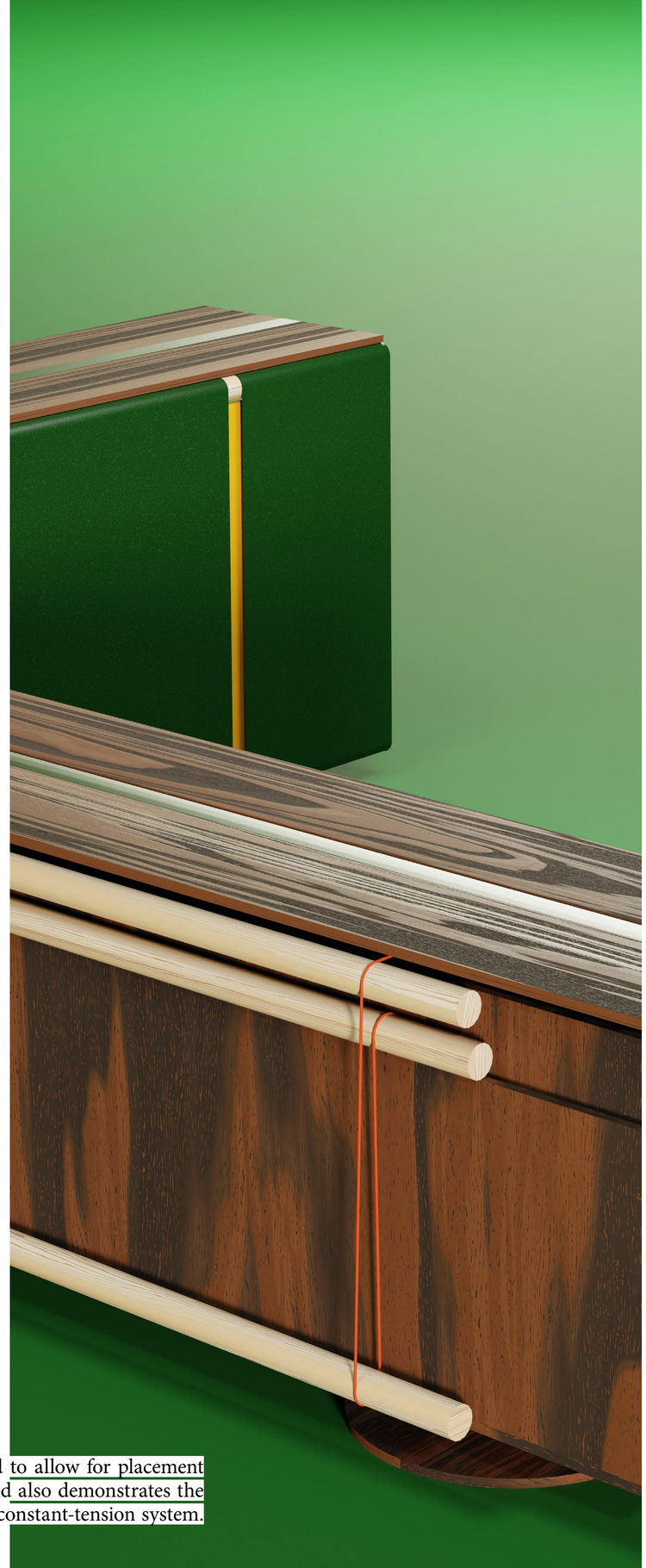
In order to present a clean enclosed facade while accommodating a wide range of heights, the front enclosure is made with a roller mounted textile that maintains a constant tension throughout the full range of adjustment. The user simply unhitches the bottom timber catch and the front textile is retracted like a roller door.

The prior piece in this series is a simple sit-stand desk that also serves as an extension of a small kitchen, and can be seen supporting Bentopiccola in the earlier images. Future pieces include a shape-shifting modular sofa and extending coffee table.

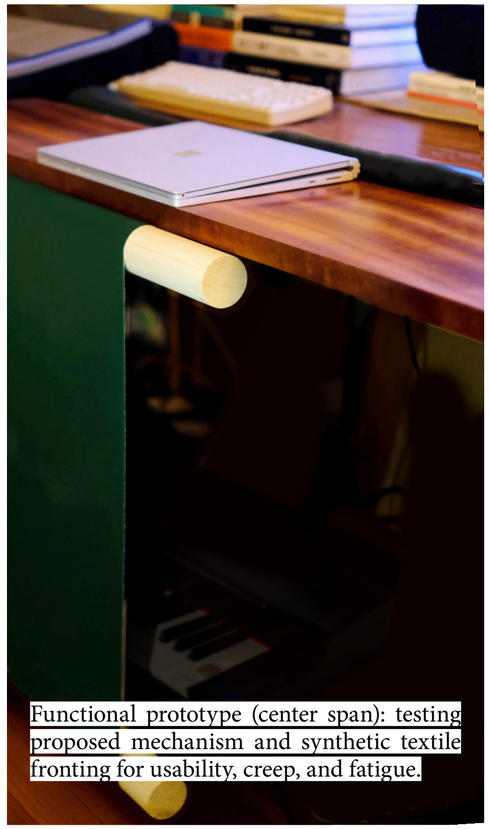


"a networked collection able to learn the user's behaviour and make adjustments in concert"

Boston, MA
2020



The back face is to be finished to allow for placement away from walls as desired, and also demonstrates the functional components of the constant-tension system.



Functional prototype (center span): testing proposed mechanism and synthetic textile fronting for usability, creep, and fatigue.

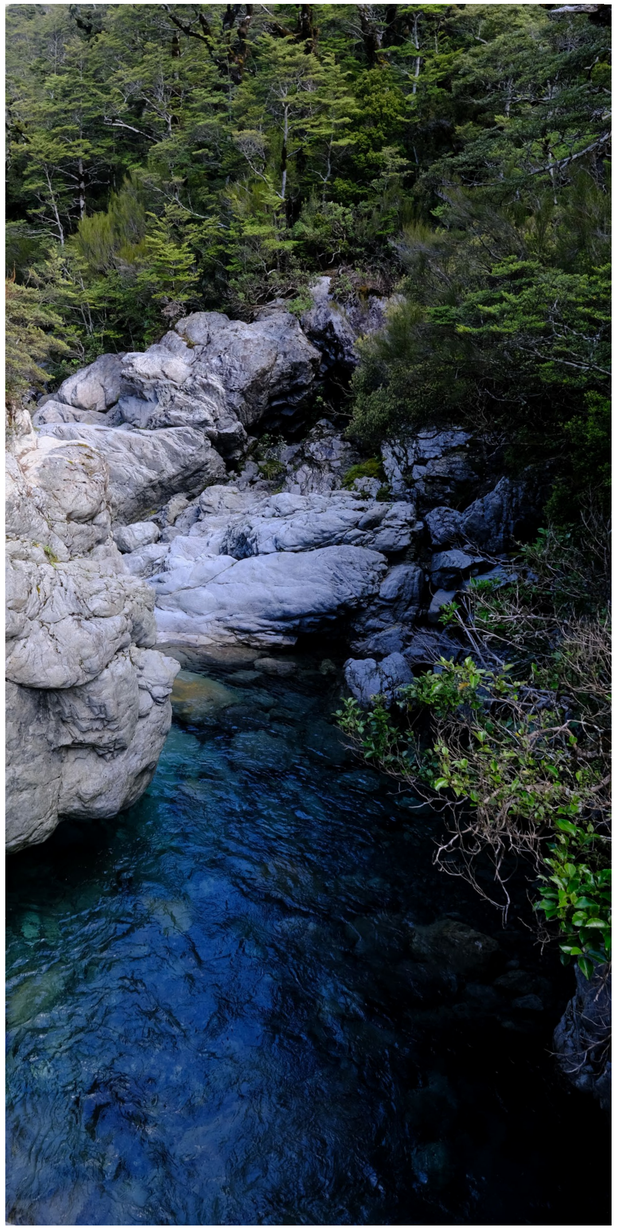
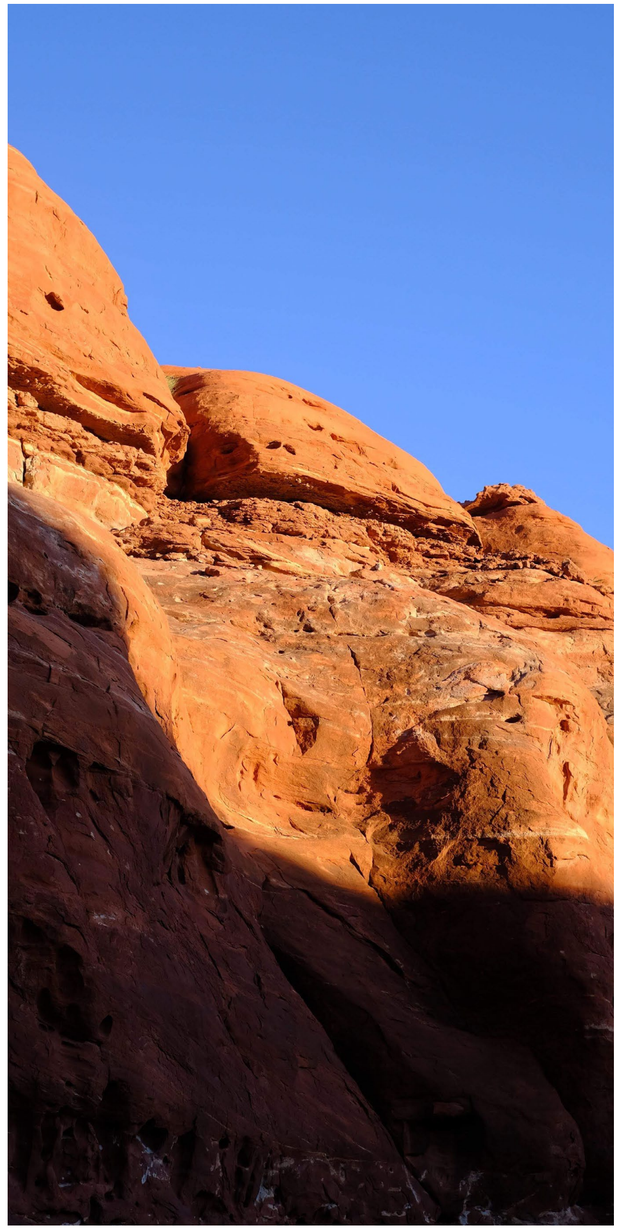
I'm passionate about designs that seem mystifying from a distance, but explain themselves through function upon closer examination. I'm optimistic that this approach to design has a subtle role in promoting mechanically inquisitive thought in users and potentially society more widely.

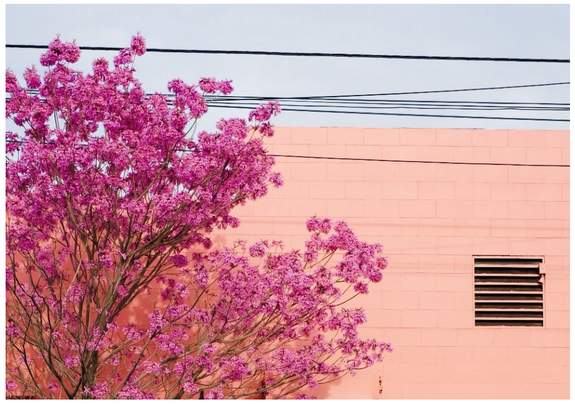
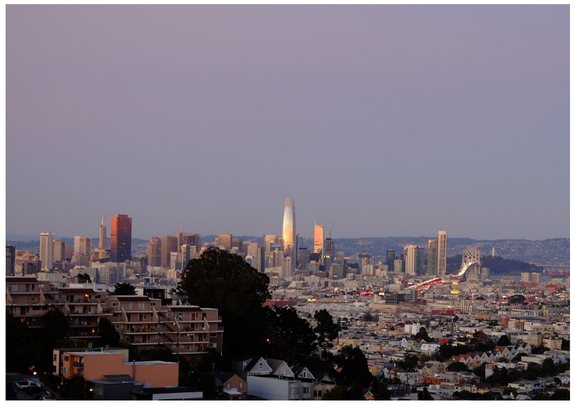
A clearly expressed external mechanism, functionally honest to the end user.

The structural trick at work here is offering sufficient rigidity in the side table's top panel to avoid the need for a continuous bottom plate. This allows both the seated workstation and enclosed piano keyboard configurations as these modes are reliant on unimpeded space to pull in a chair or access pedals.

Renders produced in Blender, original design in Rhino.

Boston, MA
2020

Photography

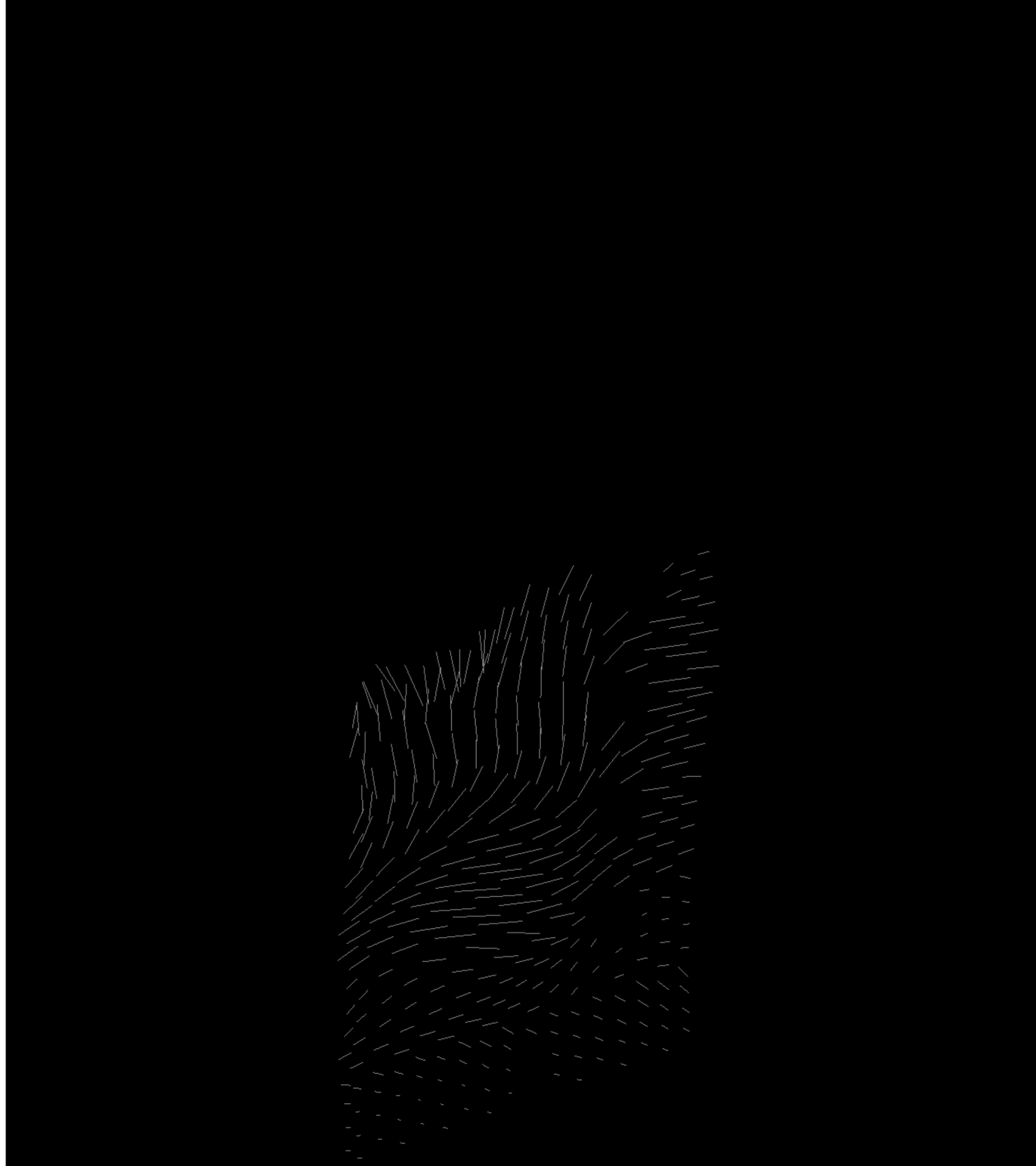
Left to Right:Arthur's Pass, New Zealand. Moab Desert, UT. Hangar One, Moffett Federal Airfield, CA.

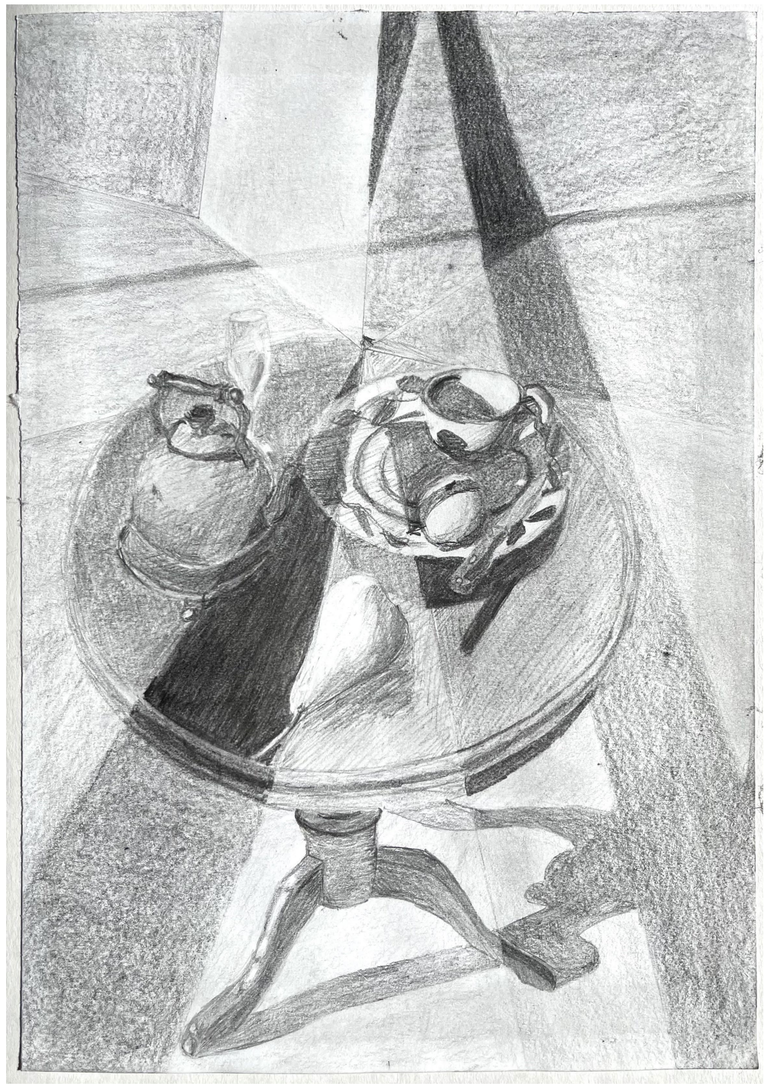
From top: San Francisco, CA.
Los Angeles, CA. San Francisco, CA.

This selection is intended to represent an affection for the built environment and the stark contrast it presents with our (often extreme) surroundings, seen through places I hold a personal connection with. Images are presented as shot, adjusted to crop/align.

Visual Art

(Otherwise non-functional compositions)





Sketches

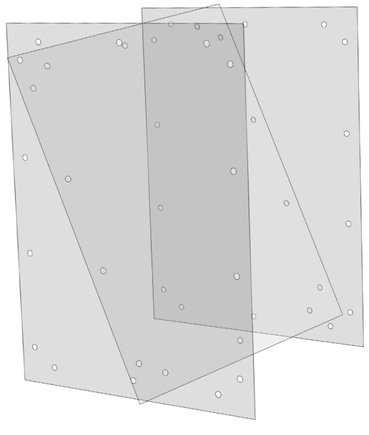
Top: Daylight intensity study, pencil.
Right: Still life; found objects from the Pacific, pastel/chalk on black paper.

Glass Structures

This work was undertaken as a student project while at Stanford University with an enthusiast group focused on transparent structures. We worked with Professor Jun Sato from University of Tokyo whose research program with Asahi Glass Co. provided access to this in-development architectural glass product derived from smartphone screen technology.

My personal contribution was to define the adaptable 3-panel unit that would serve as the building block for our desired arch form. In addition to assisting Professor Jun Sato with defining the structural capabilities of this flexible hardened glass material, I was also a part of the final construction team.

Photography courtesy of Nick Xu.



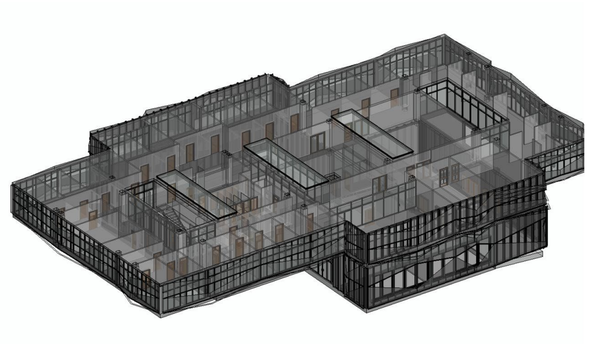
Stanford PBL Lab

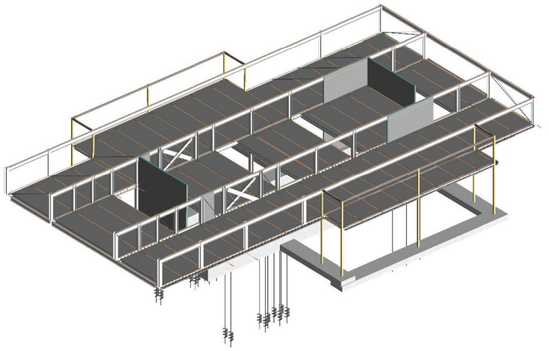
Our team were awarded as design project winners, receiving the DPR Challenge Award. My role was as structural engineering team lead, but for our final presented building I took on development of the architectural concept and floorplan in addition to the structural responsibilities.

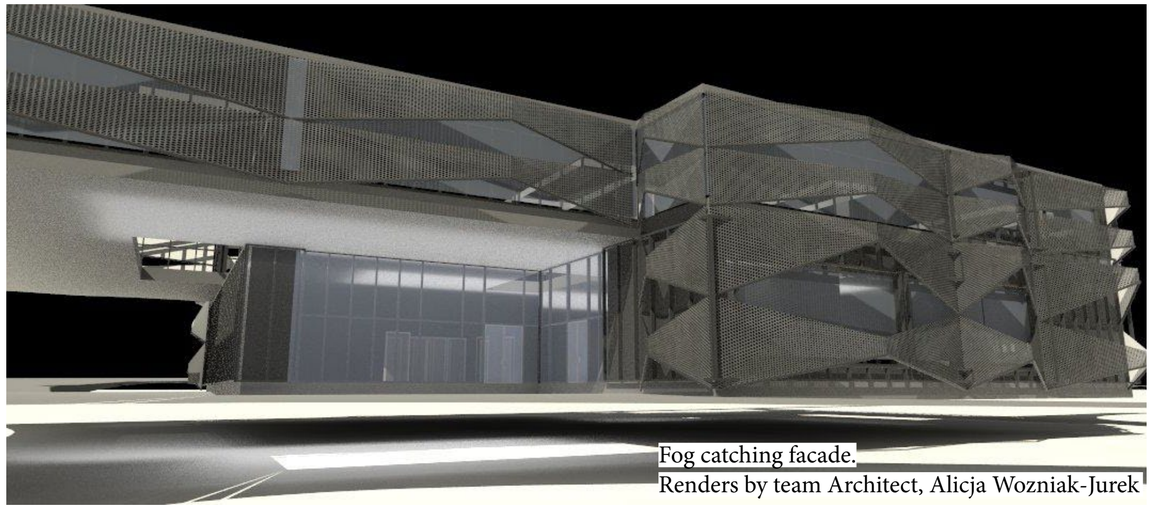
The use of cantilevers and openings was a response to the design brief which constrained our ground floor plan, a solution that was only achievable with close integration of architecture and structure. The double cantilever of the upper floor yields sufficient space to accommodate our program, avoiding the need for a third floor.

Prefabricated heavy timber floor units were proposed to enable the double cantilever.

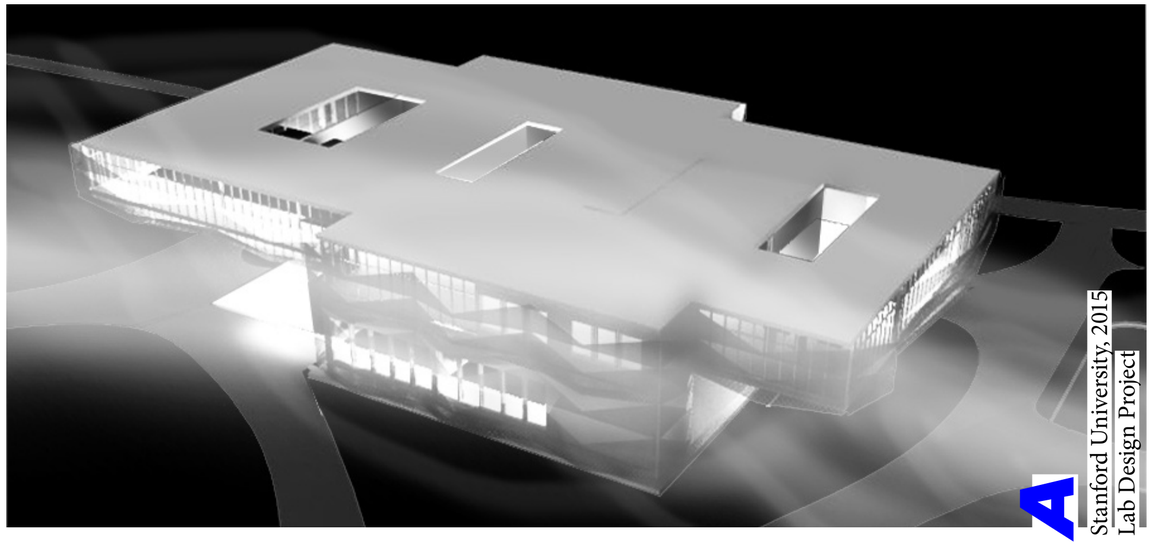
Our novel fog-catching facade system was patented with the Stanford Office of Technology Licensing after this project.







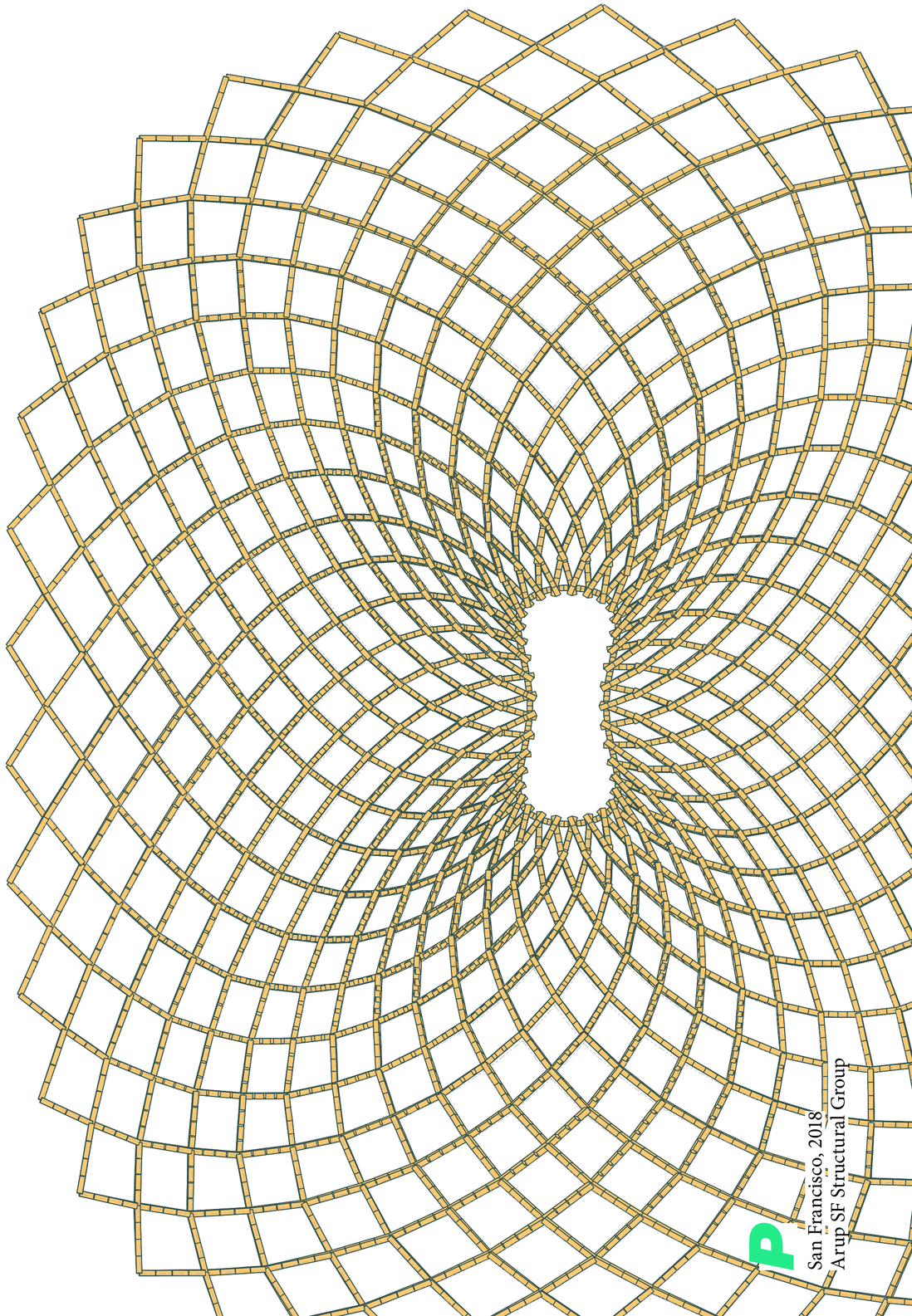
Fog catching facade.
Renders by team Architect, Alicja Wozniak-Jurek



Portland International Airport, ZGF

Computational design of optimized funicular canopy system based on repeating bloom-like geometry. Discretized design in order to use locally produced heavy timber sections, enabling economic construction with biophilic form. Varying double curvature of system is approximated using straight boards cut only at nodes. Two proposed configurations are presented here.

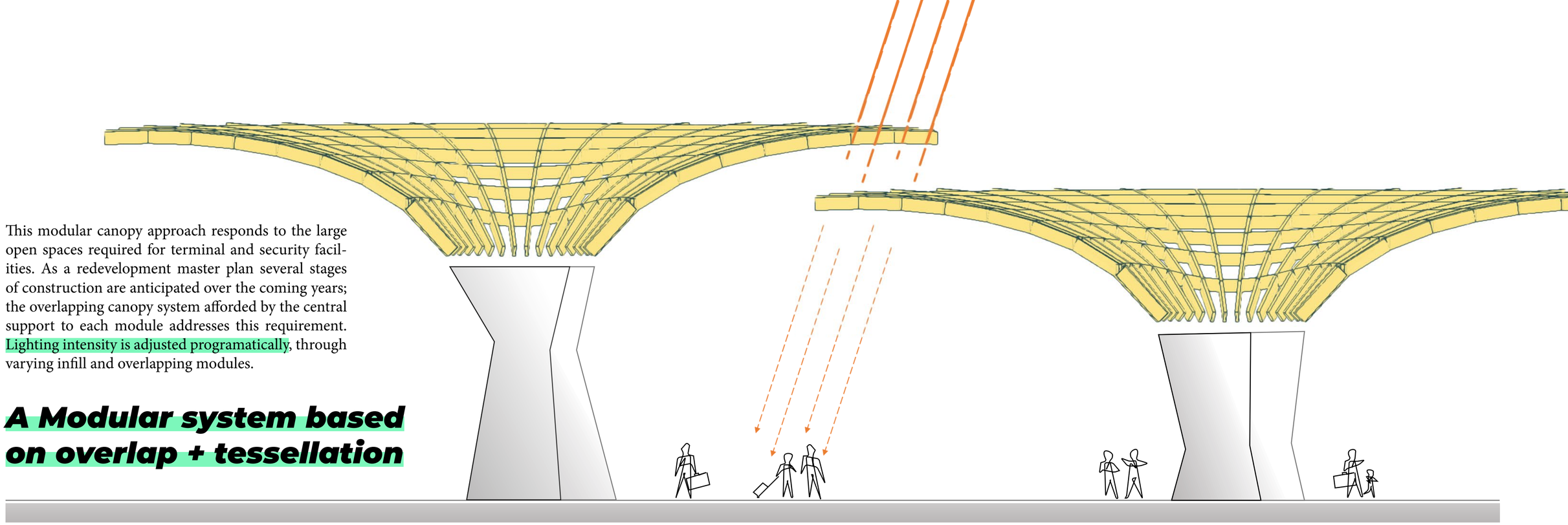
Served as design proposal lead for canopy concept, developing the form and engineering in tandem. All engineering and visual work my own. Engaged by ZGF Architects to promote divergent thinking and use of locally sourced timber within the core project team.

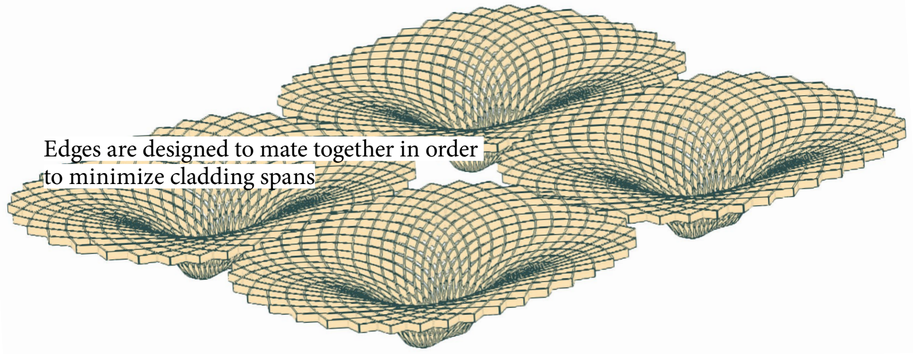


San Francisco, 2018
Arup SF Structural Group

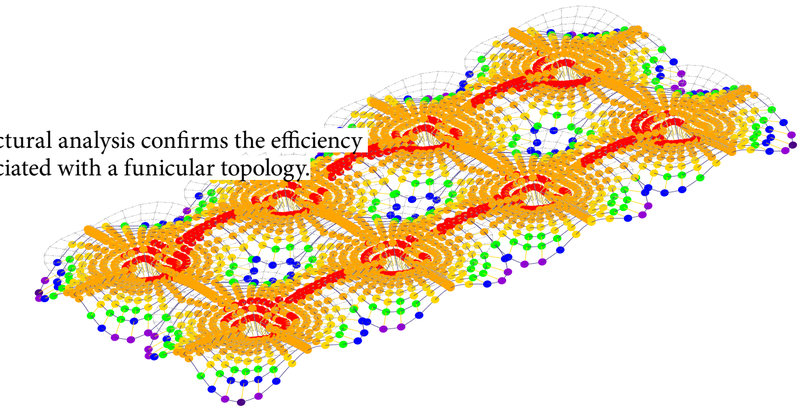
This modular canopy approach responds to the large open spaces required for terminal and security facilities. As a redevelopment master plan several stages of construction are anticipated over the coming years; the overlapping canopy system afforded by the central support to each module addresses this requirement. Lighting intensity is adjusted programatically, through varying infill and overlapping modules.

A Modular system based on overlap + tessellation

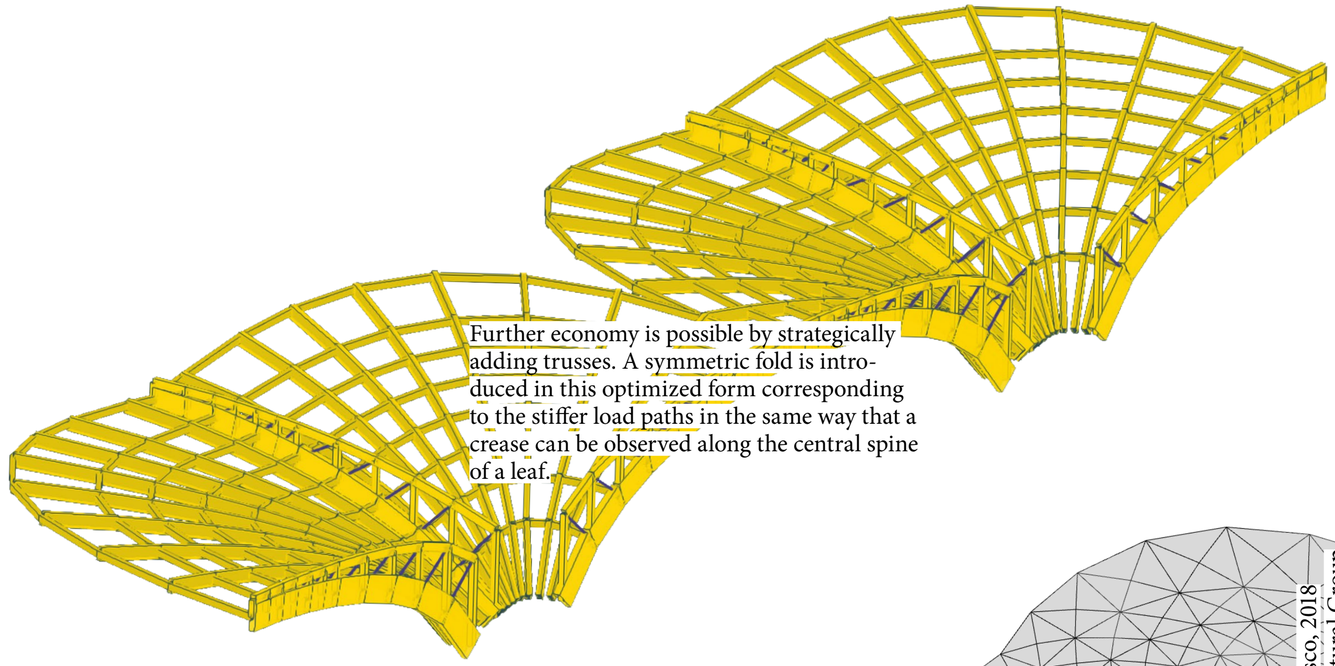




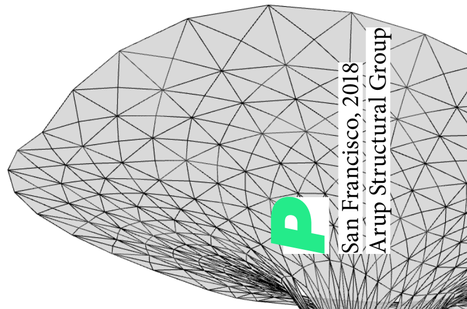
Edges are designed to mate together in order to minimize cladding spans.



Structural analysis confirms the efficiency associated with a funicular topology.



Further economy is possible by strategically adding trusses. A symmetric fold is introduced in this optimized form corresponding to the stiffer load paths in the same way that a crease can be observed along the central spine of a leaf.



San Francisco, 2018
Arup Structural Group

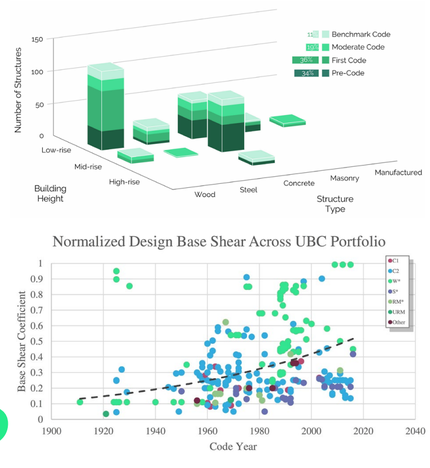
Data Driven Design

Working with large datasets to enable and inform design has been a constant thread in my professional and academic work. These projects rely on back-end development using Python, Julia, MongoDB, and node.js, and serve up visualization through live web interface plots or Grasshopper.

Stanford University, 2015
Graduate Research Project

ARPA-E Energy Behaviour Initiative: UX design, prototyping an app that helps people consider energy use when buying large appliances. Performed needfinding with users in their homes + at point-of-sale locations.

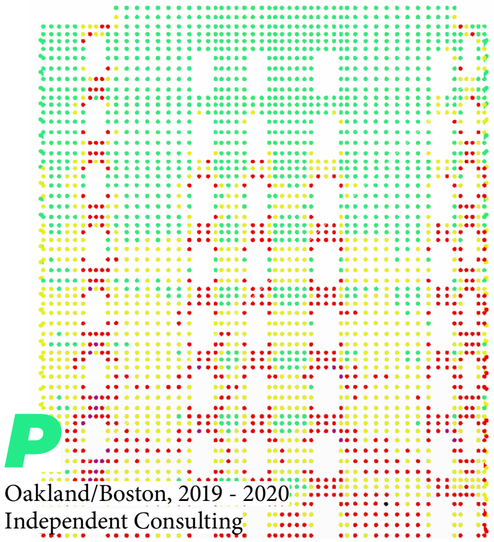
Influences energy use choices through a persistent efficiency range comparison based on scraped data, an approach supported by research to positively bias buying decisions toward energy efficient products.



San Francisco, 2017
Arup Advanced Technology + Research

Portfolio Risk study for the University of British Columbia: Automated the analysis of structural performance for the 328 building portfolio, enabling us to consider over 100 ground motions for each structure.

The scale of this project was an opportunity to develop a novel automation strategy covering all buildings, using both a scalable approach to FEA in LS-DYNA, and a data driven approach harnessing hundreds of thousands of analyses reflecting typical Canadian construction types. Web-based interactive front-end for client.



Oakland/Boston, 2019 - 2020
Independent Consulting

Monocoque Steel Design Methodology: Buckling governed design for a novel modular construction system.

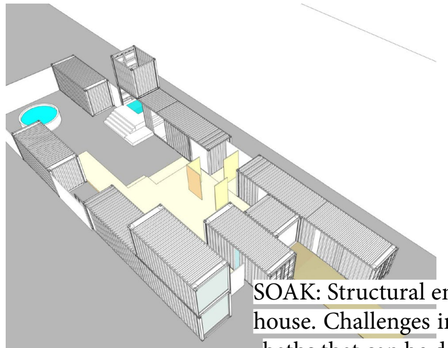
Behaviour is contingent on automated processing of an analysis database consisting of hundreds of thousands of results, in order to consider the many permutations necessary for design of this technology. Python + Grasshopper for 3D visualization directly on the architectural model.

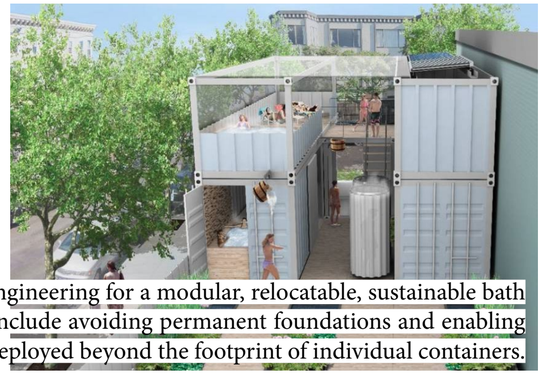
Structural Engineering

This collection of projects represents work where my contribution may be of interest, but was strictly technical and occurred after the aesthetic intent of the project was defined.

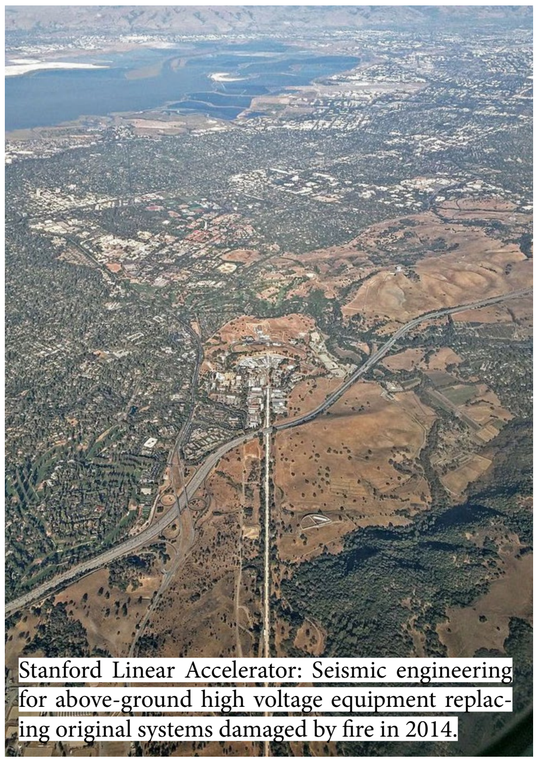
Specific contributions are called out for each project. Models are my own, and images representing each project come from the architect team or public domain.

Reforma 509: Engineering of the tubular lateral force resisting system necessary for Mexico City's long duration seismic events.

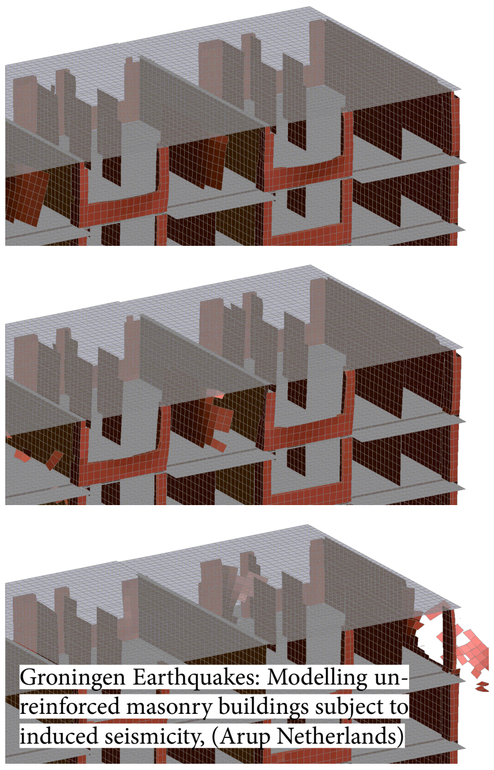




SOAK: Structural engineering for a modular, relocatable, sustainable bath house. Challenges include avoiding permanent foundations and enabling baths that can be deployed beyond the footprint of individual containers.



Stanford Linear Accelerator: Seismic engineering for above-ground high voltage equipment replacing original systems damaged by fire in 2014.



Groningen Earthquakes: Modelling unreinforced masonry buildings subject to induced seismicity, (Arup Netherlands)

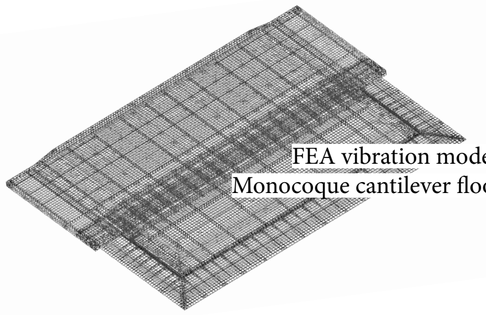
SFMOMA: Structural engineering calculations to enable a reconfigurable mixed-use performance auditorium for Snøhetta's extension.

San Francisco, 2015 - 2018
Arup Structural Group

Foster + Partners

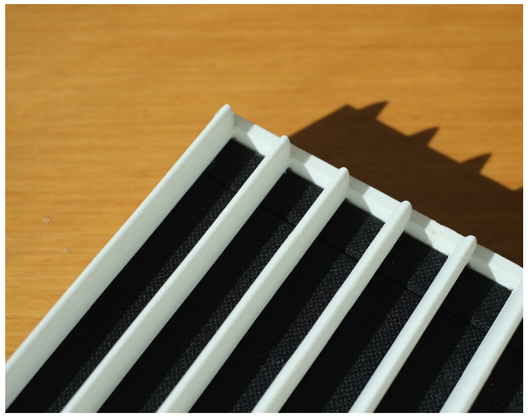
This body of work represents my efforts as a consultant to Foster + Partners while at Arup, San Francisco. This was a fortuitous opportunity to be involved in some of their key projects with Apple, including Apple Park and several flagship retail projects.

Specific contributions are called out for each project. Images representing finished work come from Apple/ Foster + Partners public communication with the exception of the 3d models, 3d printed sample, and Apple Park group photograph which are my own.



FEA vibration model: Monocoque cantilever floor

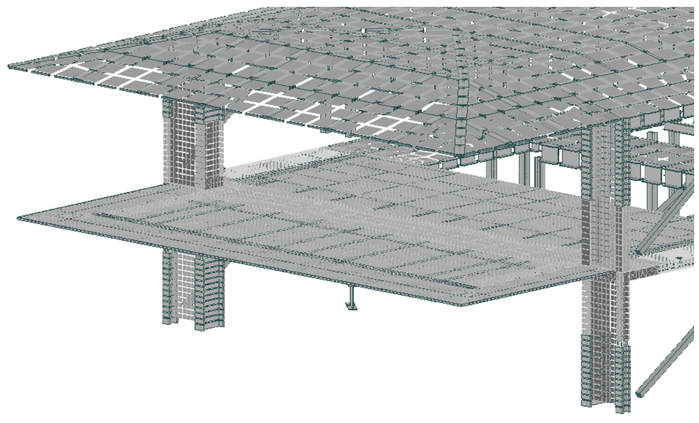
The monocoque steel design approach we developed for the Mexico City flagship's cantilever would become the basis of my subsequent consulting work in the modular construction space.



Steve Jobs Theater: Prototyping, testing, and design of louvered acoustic wall system. Additive manufacturing to determine acoustic reflectivity via scale testing.

Apple Park: Site visits focused on structural progress, involvement with facades engineering and envelopes team. Vibration analysis in FEA.

Apple Store San Francisco: Mechanization consultant conducting design review for world's largest operable door in a retail space.



Apple Store Mexico City: Primary design engineer for flagship store, long-span slender cantilever floor requiring ship-building style monocoque construction.

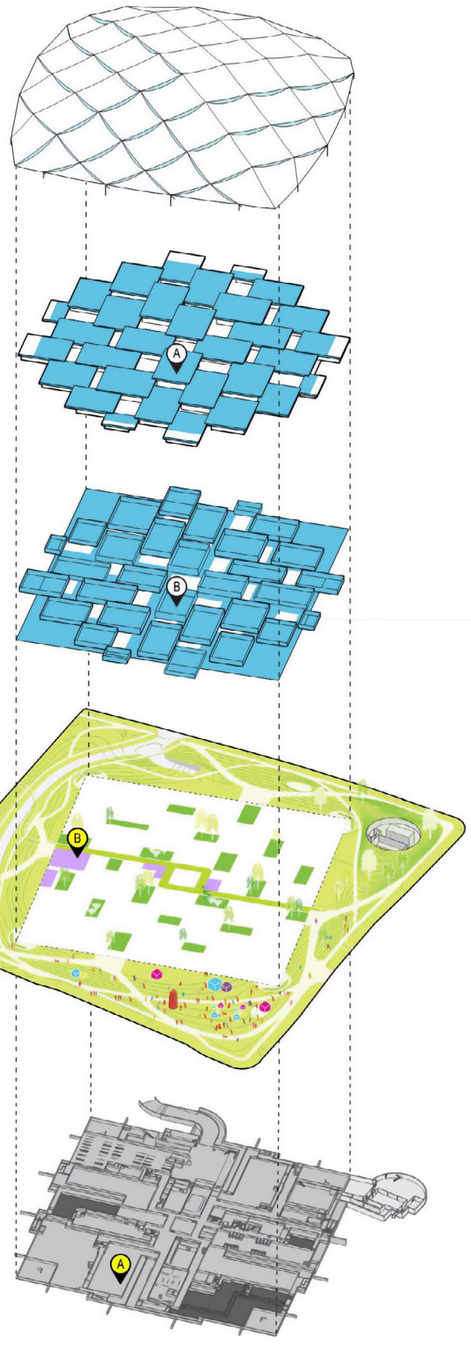
San Francisco, 2017 - 2018
Arup Advanced Technology + Research

BIG & Heatherwick

This collection of projects was undertaken alongside Bjarke Ingels Group and Heatherwick Studio who were engaged by Google across a range of moonshot built-environment projects, including two new campus projects, an aerospace research facility, and a 100,000 person off-site events facility.

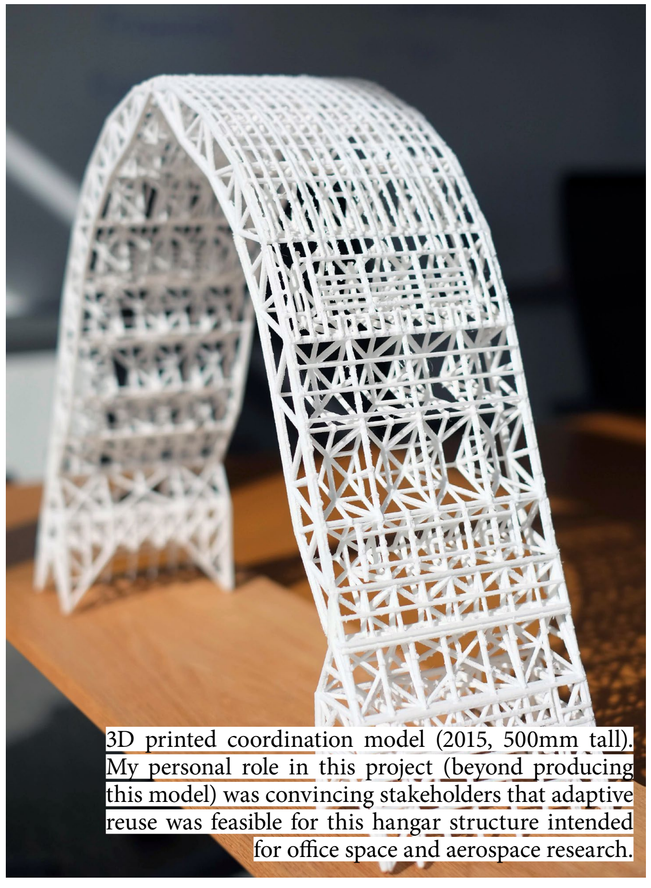
Much of this work remains confidential - images and collaborating architects are limited to those that have been publically disclosed, consequently omissions have been made. Personal role in each of these projects was supporting Google founders in pursuing their vision during masterplanning, acting as a researcher vetting emerging technologies to enable historically impossible buildings.

I conducted engineering studies to validate canopy system spans and materials, investigate the feasibility of robotic construction/maintenance, and inform interior air quality, energy, and water use projections. I also produced a series of large-scale 3D printed models to express our engineering concepts for each project.

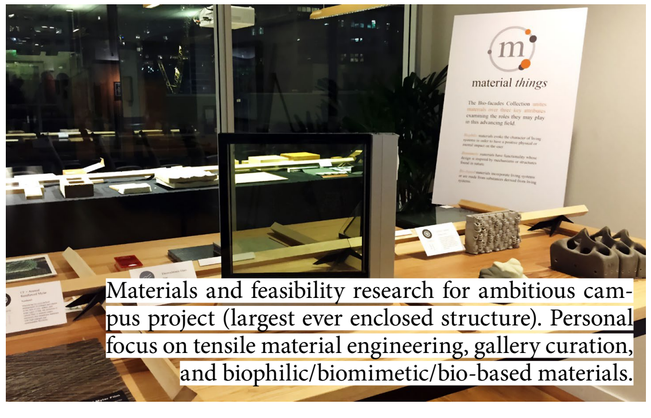


At Charleston East, my contributions during masterplanning assisted in establishing technical confidence in the draped catenary design and in winning Arup scope as engineer of record. This city-like collection of structures within a larger tented canopy was a core focus of my research.
Imagery: BIG + Heatherwick Studio plan submittal to City of Mountain View.

600,000 sqft Charleston East Campus Building
Imagery: BIG + Heatherwick Studio plan submittal to City of Mountain View.



3D printed coordination model (2015, 500mm tall). My personal role in this project (beyond producing this model) was convincing stakeholders that adaptive reuse was feasible for this hangar structure intended for office space and aerospace research.



Materials and feasibility research for ambitious campus project (largest ever enclosed structure). Personal focus on tensile material engineering, gallery curation, and biophilic/biomimetic/bio-based materials.

San Francisco, 2015 - 2018
Arup Advanced Technology + Research