

Portfolio

December 2020

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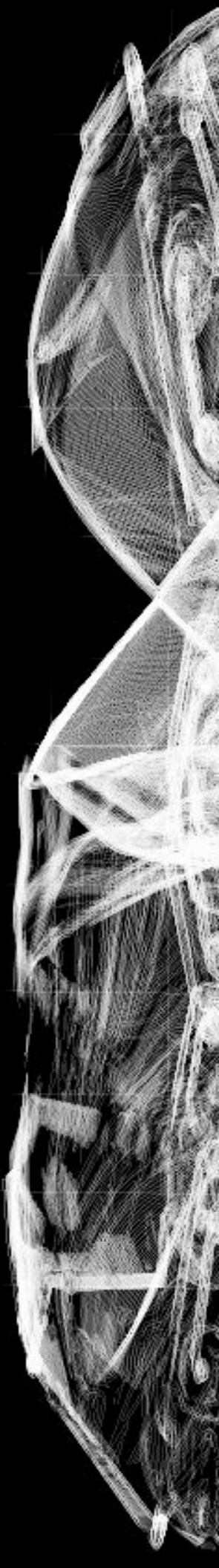
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Katarina Richter-Lunn
investigations

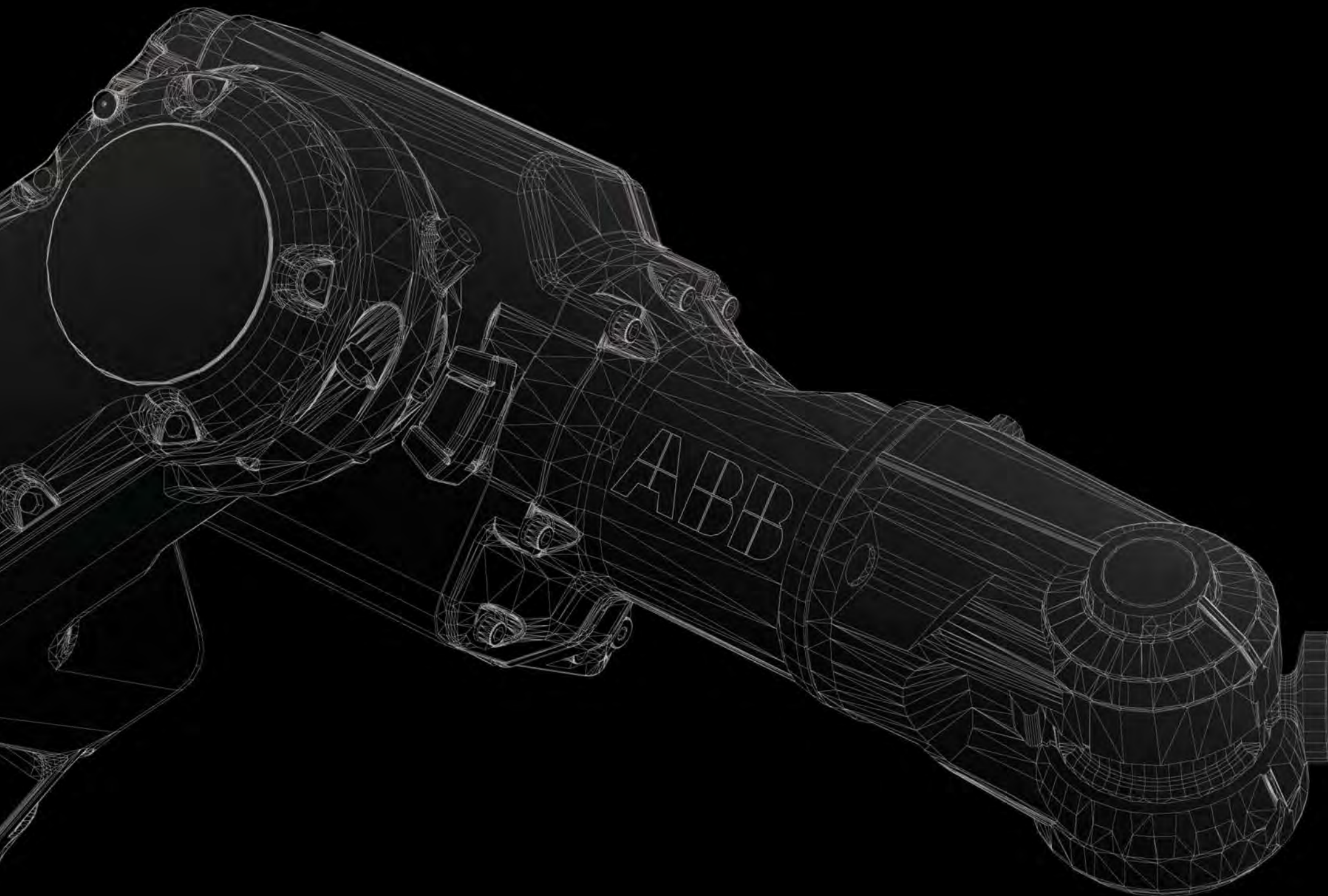


Translations

Harvard Graduate School of Design - Spring 2020
Prof. Jose Luis Garcia del Castillo Lopez & Zach Seibold

This project investigates the potential of room-scale motion tracking and electroencephalogram (EEG) wavelength biodata to moderate a physical discourse between a human and UR10 (Universal Robots 2020) industrial cobot in the context of live performance. Beyond the traditional experience of performance, incorporating a synchronous live interpretation of both mind and body metrics reveals novel translations of the performer's movements by providing greater insight into their current mental state.

The duality of visualizing both mind and body simultaneously seeks to expand our vision of how robots can operate beyond their common utilitarian role and become active agents in collaborations. Just as we look to machines to respond to our limitations, it is now possible for robots to look to humans to expand theirs.



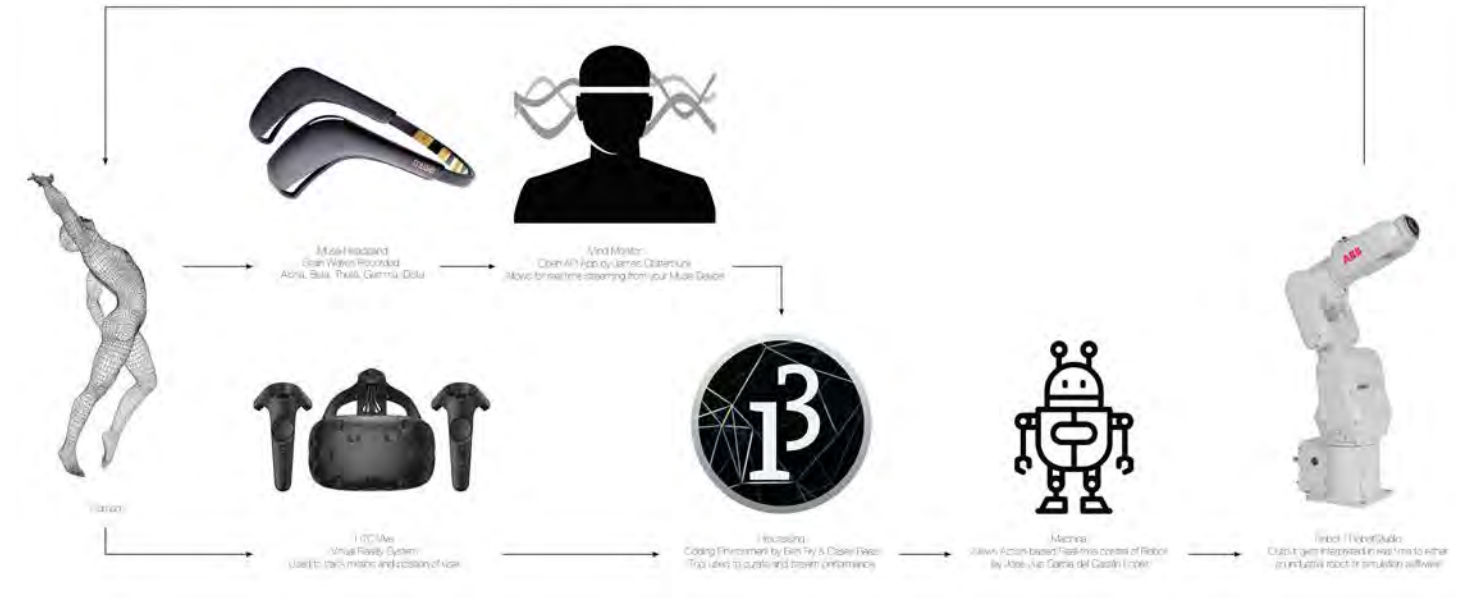
Translations

Harvard Graduate School of Design - Spring 2020
 Prof. Jose Luis Garcia del Castillo Lopez & Zach Seibold

Publication: Richter-Lunn, K., 2020, September. Mind and Machine: Interaction, Performance and Mental Expression through Robotics and Computation. In ANFA 2020: Sensing Spaces, Perceiving Place. The Academy of Neuroscience and Architecture.

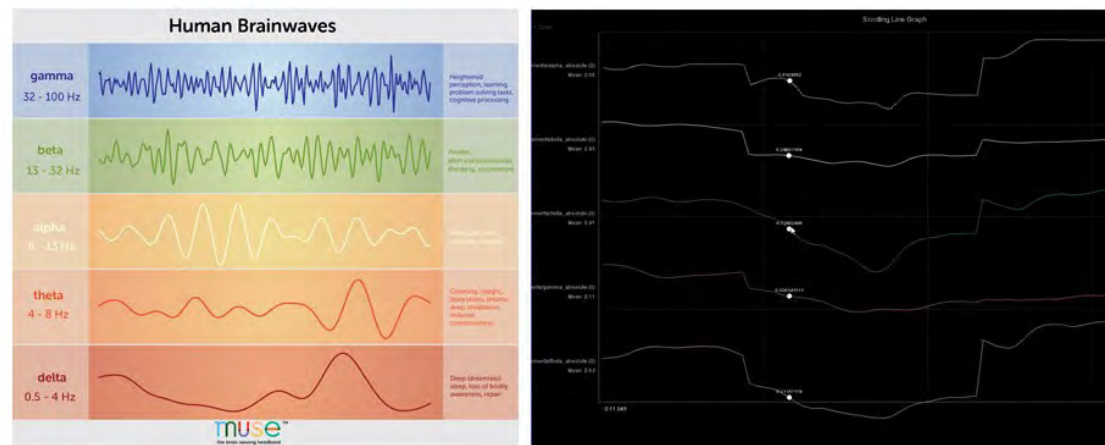
Since their implementation in industrial contexts in the early 1960's, robots have played a crucial role in the automation of systems to increase efficiency. Utilizing industrial robots as a tool in a design industry has led to great progress within the field of architecture and fabrication. However, their current use leaves little room for a dialogue to occur between humans and machines, making the design process primarily one directional: from production to product.

The potential for human machine collaboration has expanded over the past years from the use of autonomous curious robots like Mimus (Gannon 2016), to collaborative performance pieces such as OUTPUT (Cuan et al. 2019), Are we human, or are we dancer (Moore 2020), and Pas de Deux (Sheppard 2019). These case studies offer a moment of reflection – for both performer and audience – to re-envision the role of machines in augmenting, exposing, and extending human expression beyond the familiar. Exploring how to push the use of robotics outside the limitations of what we believe machines to be capable of, this paper proposes a human-machine discourse in which the tool transcends its utilitarian capacity to become a



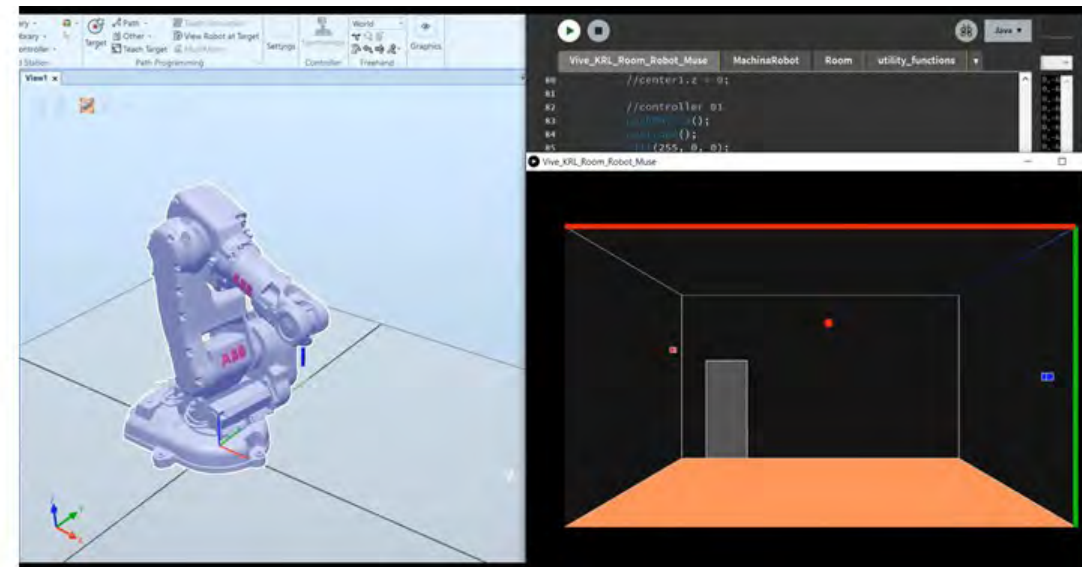
System Structure

The HTC Vive controllers communicate the position of the dancer in space. This tracking data can be coordinated, scaled and re-oriented to the robots' coordinate system. At the same time, the Muse Headband communicates the current EEG frequencies of the dancer, providing the most dominant brainwave at that moment. Communication between these devices and Processing (Reas and Fry 2001) occurs through the OSC streaming library oscP5 (Schlegel 2011), the app Mind Monitor (Clutterbuck 2020), and the HTC Vive library ViveP5 (Pazzi 2020). These applications and libraries allowed for the data to remain continuous and current while the unique capabilities of Machina (García del Castillo y López 2018) allows for this communication to dynamically interface with the robot, or simulation software.



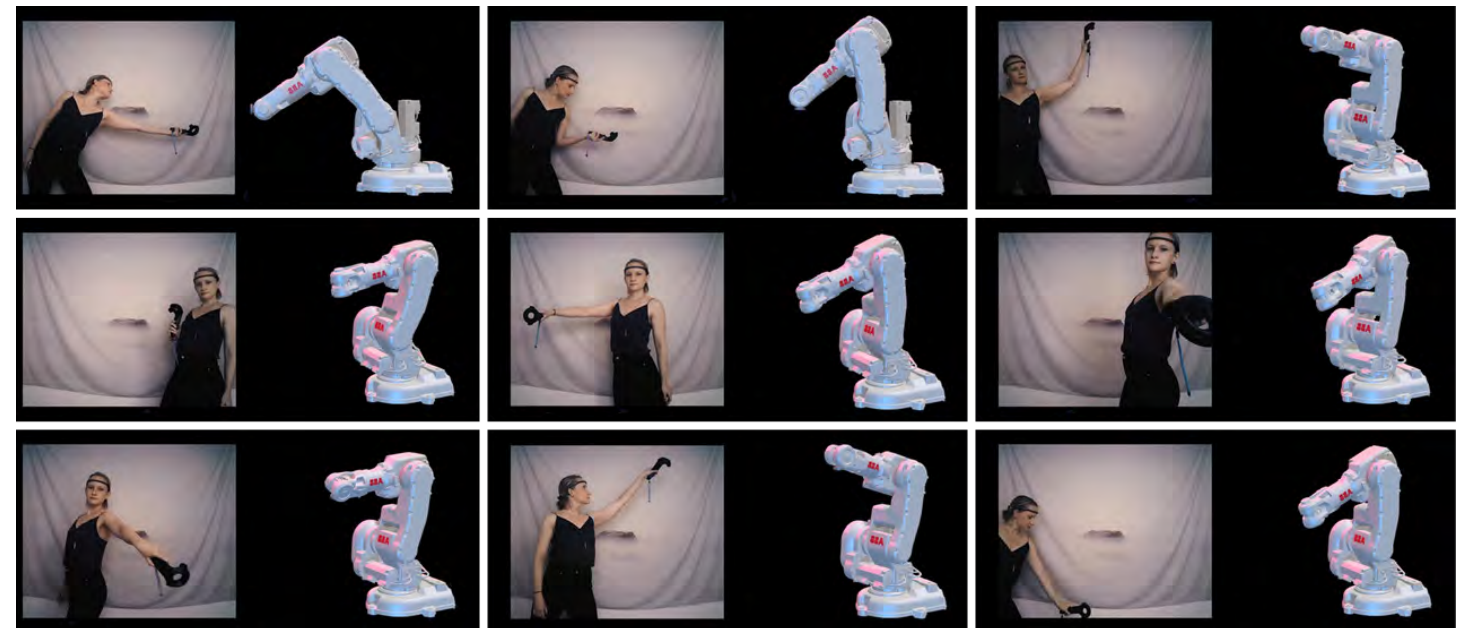
Step 01 – Manipulation with Muse – EEG Data

Muse is a wearable brain sensing headband. The device measures brain activity via 4 electroencephalography sensors and converts the data into interpreted EEG brainwave signals (Delta, Theta, Alpha, Beta, and Gamma). Each of these brainwaves are represented by a certain frequency range and are said to inform a current most prevalent state of mind.



Step 02 – Manipulation with HTC Vive – Physical Movement

The HTC Vive is a virtual reality headset which uses "room scale" tracking technology to allow users to move around in a virtual 3D space and interact with that environment. The controllers, which are the primary key used for this performance piece to track location and motion of a person in space.



A series of "filters", based on the current performer's most dominant EEG frequency range, influence the nature of the specific commands that are streamed to the robot. These commands include changing the speed of the robot, rotation of the axes, and transformations (change of orientation and position of the TCP). Specifically, each action is associated with the current EEG wavelength and alters the fidelity with which the robot mirrors the performer's movement. For instance, when the performer loses focus or starts to daydream (i.e. enters Delta range frequencies) the robot slows down, decreases the scale of its movements, and rotates its axes towards its origin. In contrast, if the performer enters "Beta frequencies", which indicate excitement and alertness, the robot accelerates, scales the expansion of its movements up, and rotates its axes outwards. The "Alpha state" is considered as the "high fidelity state" and thus mirrors the performer's movements with no alterations. These filters are represented through a series of conditional statements each activated by the frequency range. Each filter instructs a different operational mode for the robot; adjusting the speed, scale joint rotation and transformation

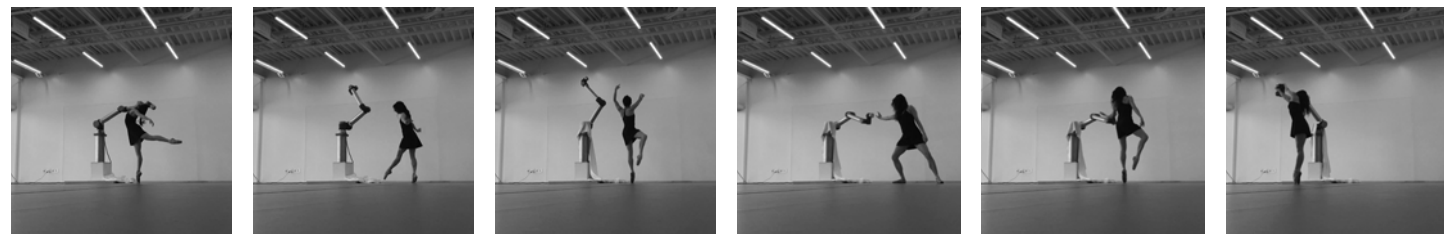
Robot/ Human Duet

Harvard ArtLab Collaboration with resident Dr. Merritt Moore

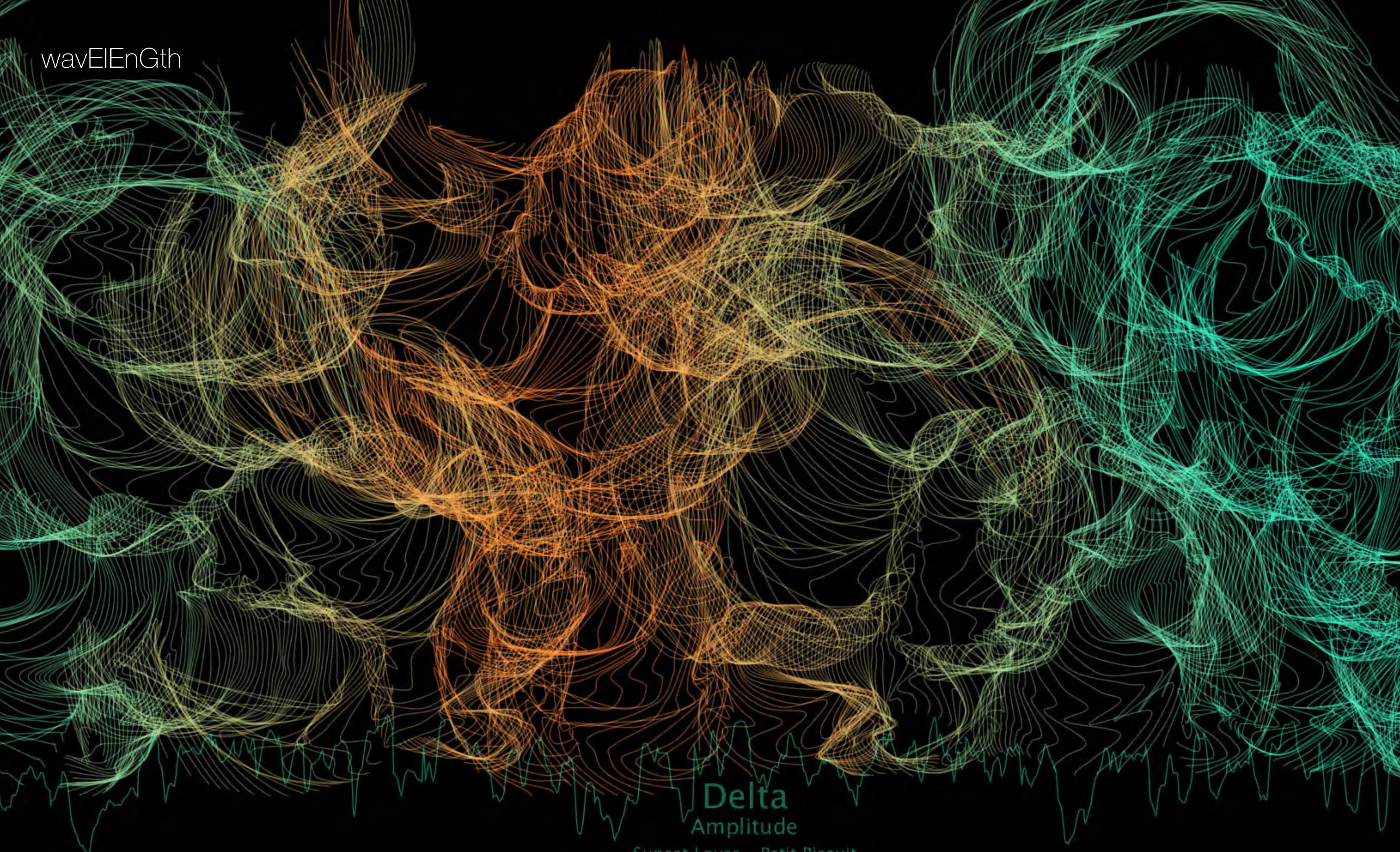
Team: Merritt Moore, Alice Williamson, Jose Luis Garcia del Castillo Lopez, Katarina Richter-Lunn

"Are we human or are we dancer" - the Killers

Dance as a medium of expression has, much like music, the ability to be captured and recorded through precise measurement, while still holding the power to convey and induce strong emotion and cross-cultural understanding. With exploration between robot and machine dialogues having already started among artist and scientist, the question goes back to how this relationship can inform the audience of something as personal as their current mental well-being. In this exploration, we collaborated with scientist and dancer Dr. Merritt Moore in her research into the human-robot duet, which explores the potential of giving the audience their own agency over the performance. Currently, Dr. Moore's work looks at creating a dialogue between the dancer and the robot, where her movements inform those of the machine. However, we have been increasingly interested in how one might expand this conversation to incorporate the audience's response.



wavEIEngth



Delta
Amplitude

Sunset Lover - Petit Biscuit

wavEEnGth

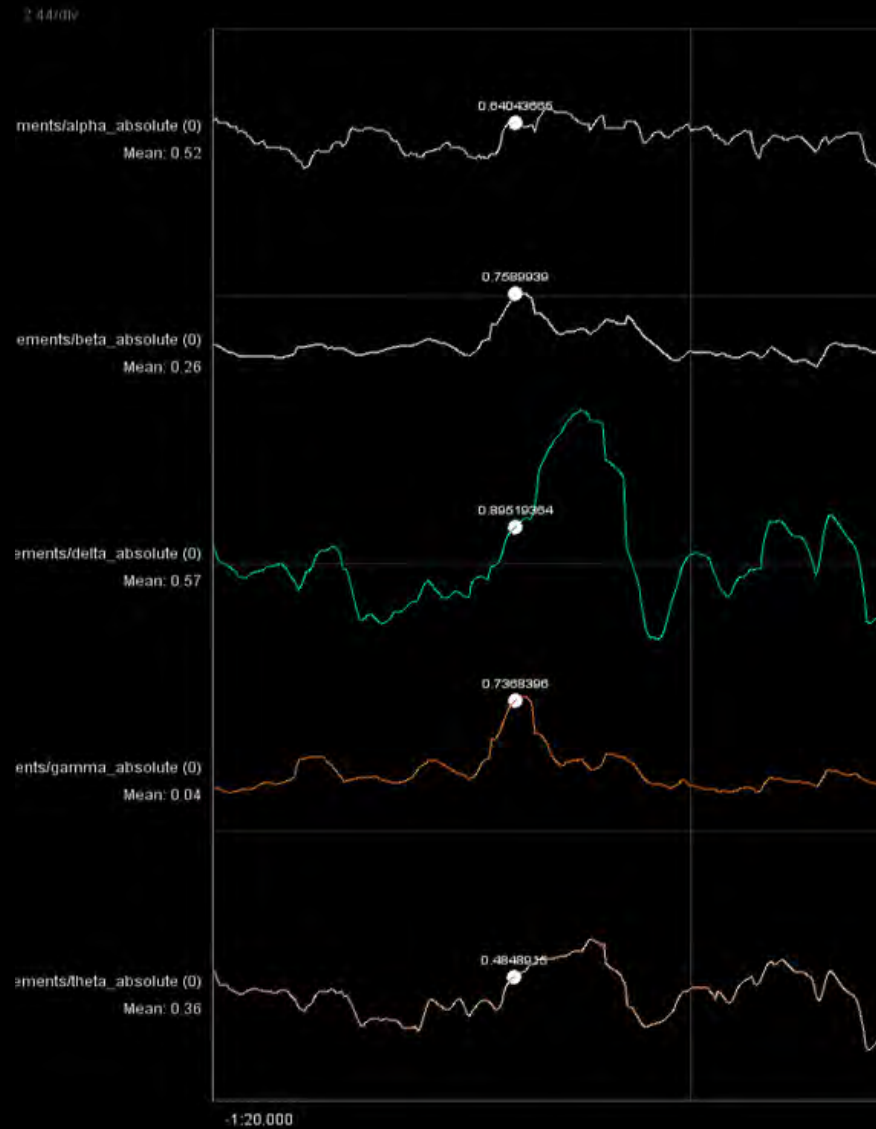
Harvard Graduate School of Design - Fall 2019
 Prof. Jose Luis Garcia del Castillo Lopez

Publication: Richter-Lunn, K., 2020, September. Mind and Machine: Interaction, Performance and Mental Expression through Robotics and Computation. In ANFA 2020: Sensing Spaces, Perceiving Place. The Academy of Neuroscience and Architecture.

This exploration constitutes a visual and auditory interpretation of sound filtered by the recurrent brain activity imprint of its listener. The goal is not only to change the way music is experienced, but also to give participants a new understanding of the underlying technologies through an immersive medium. Sound was analyzed alongside the current brain wave activity from the listener, with use of the Muse headband (Muse 2020) and open API from Mind Monitor (Clutterbuck 2020). This activity was then analyzed in real time to affect different characteristics of sound, such as amplitude, rate, and pan, allowing users to have a certain amount of agency over the music they are listening to, while also giving them live EEG biofeedback of their current state of mind. This relationship between environmental stimuli and brain activity allows for multiple senses to be triggered simultaneously. In this sense, this study seeks to not only consciously make people more aware of the correlation between their thoughts and their surroundings, but also perhaps question the benefits of such influences through the subconscious act of listening to music.

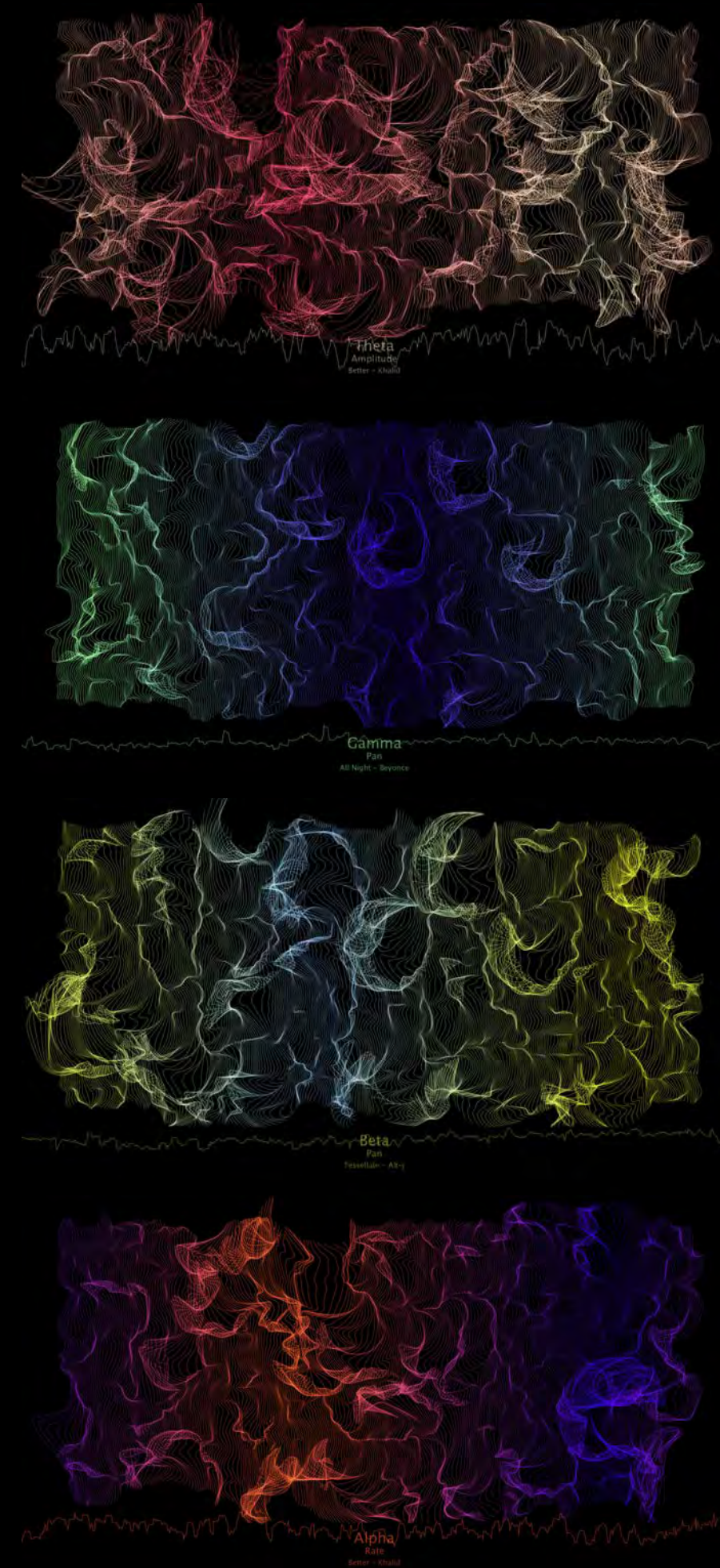


Muse Headband: Brain Wave Data recorded: Alpha, Beta, Theta, Gamma, Delta
 Mind Monitor: Open API App by James Clutterbuck: Allows for real time streaming from your Muse Device
 Processing: Coding software by Ben Fry & Casey Reas: Tool used to develop visual and audio manipulations
 Output: Sound and Visuals: Output gets then delivered in real time back to the user through both visual and auditory representations.



System Architecture

The architecture of the systems acts in such that all data collected through the muse headband gets first streamed through Bluetooth to the open API app MindMonitor which reads and transmits that data out in the form of five brain wave types: Al-pha, Beta, Delta, Theta and Gamma. This data gets trans-ferred by an OSC protocol through a Processing library called oscP5 (Schlegel 2020) and becomes the variable, which controls both the visual output and the song ma-nipulations. The user at this point can choose through a series of keys to alternate between different songs, dif-ferent brain waves and choose the auditory manipula-tion they want to observe; change in amplitude, rate or plan. Handing over these controls to the user allows them to not only explore the different patterns in their brain wave activity but also allows them to choose which type of auditory manipulation appeals to them the most. One person might prefer the more subtle alter-ation of "pan", which hints at your current wave fre-quency by moving from one earphone to the other (ide-ally experienced with either dual mono stereo or ear-phones), while someone else might prefer the more dis-tinguished alterations of sound through "rate" (song speed) or "amplitude" (song volume). Being exposed to both the auditory and visual representation of these manipulations showed to be impactful in how users were then able to "control" their brain



Robot Zen Garden

Harvard Graduate School of Design - Spring 2020

Prof. Jose Luis Garcia del Castillo Lopez & Zach Seibold

Team: Katarina Richter-Lunn, Sana Sharma

Project exploration: Uncertain Mediums

As the goal for this assignment was to allow a robot to draw geometry shared from a digital environment, we wanted to explore non-standard, ephemeral media that could capture the robot's creative process and output.

We chose sand as the 'canvas' for our experimental work, as it added an element of unpredictability to the drawing output.

We also had the opportunity to develop several custom end effectors that enable alternative forms of drawing.



Sea Armadillo

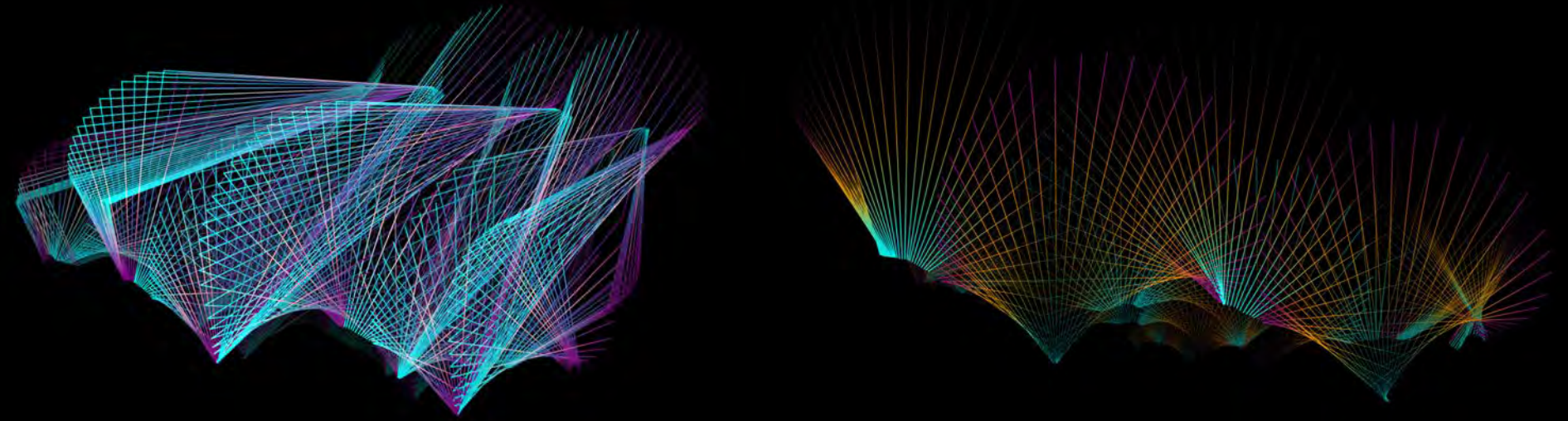
Harvard Graduate School of Design - Fall 2019

Prof. Jose Luis Garcia del Castillo Lopez

Team: Erin Hunt, Katarina Richter-Lunn, Sana Sharma

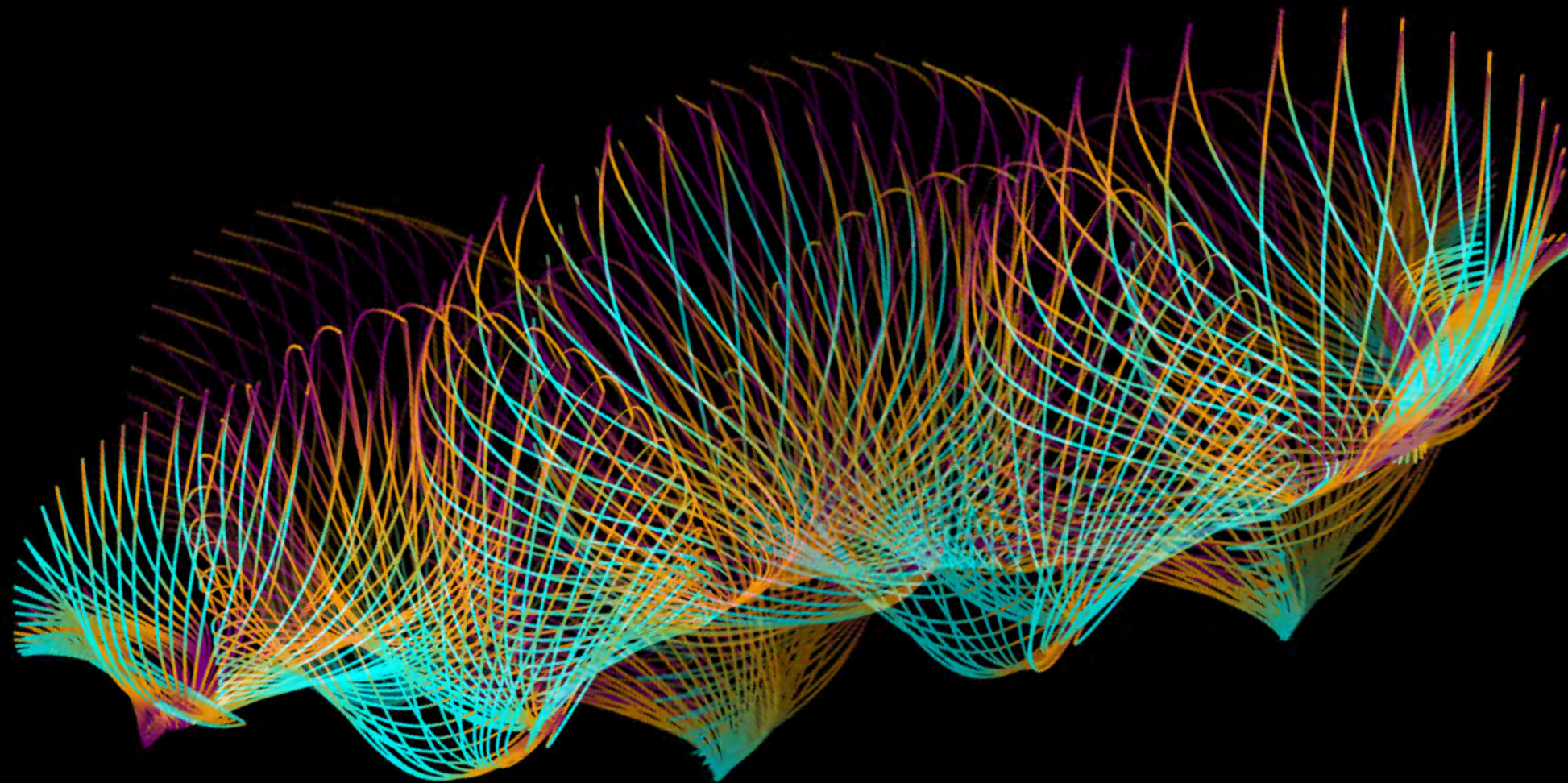
Conceptual visualization of your body motion

Our group was inspired by sea creatures, including octopi, jellyfish, and nudibranchs. Our recordings incorporated organic movements to convey the form and traversal methods of a few of these creatures.



Working off of the initial pose definition developed in preparation for Assignment[0], we iterated upon a series of definitions that implemented distinct methods to visualize and render our data. (Software = C# and Grasshopper)
This allowed us to develop a series of methods, exploring translation, scaling output by sine and logarithmic functions, and changing display outputs to spheres, lines, polylines, and bezier curves.

We recorded 10 sessions based on various sea creature motions. Our primary CSV dataset was based on a cartwheel motion collected by taping controllers to the hand and foot.



Metallic Hedgehog

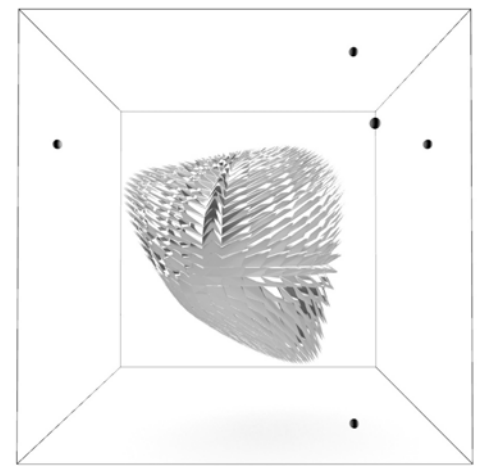
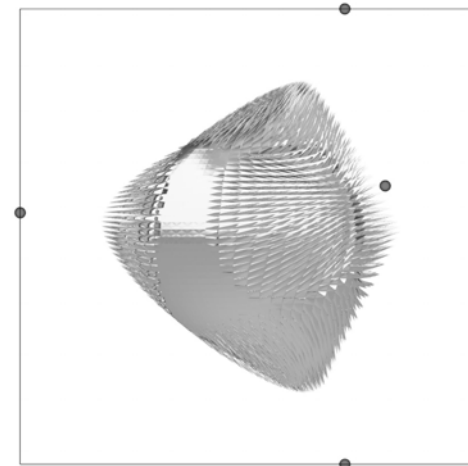
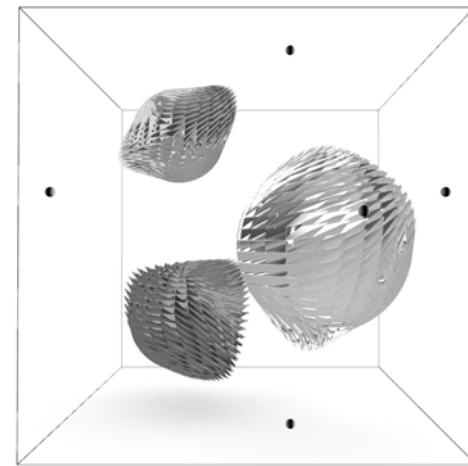
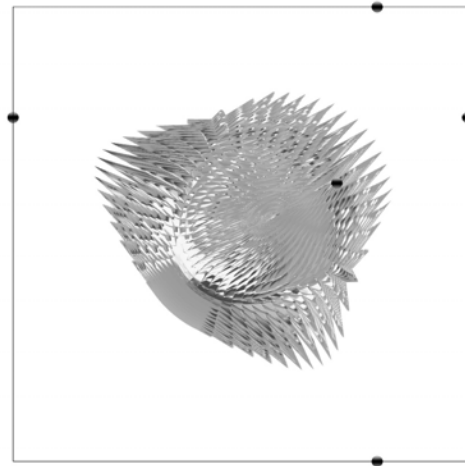
Harvard Graduate School of Design - Fall 2019

Prof. Jose Luis Garcia del Castillo Lopez

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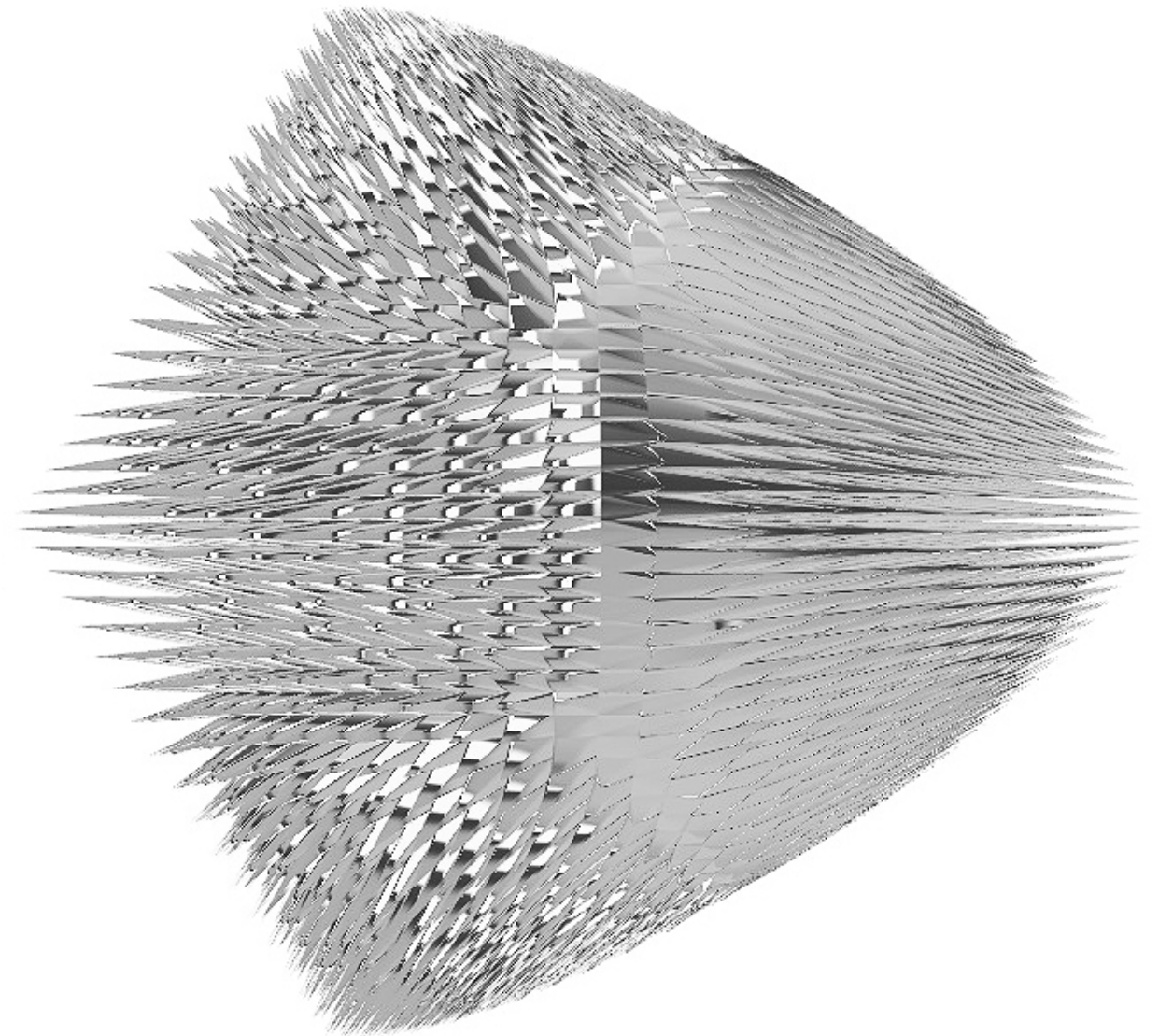
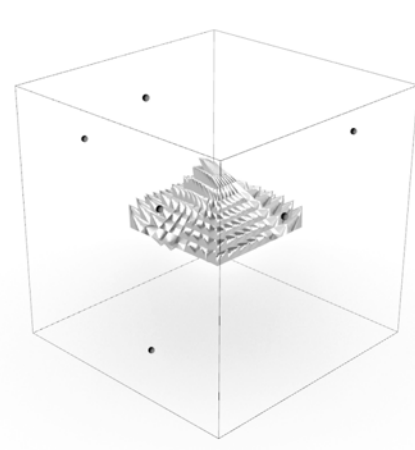
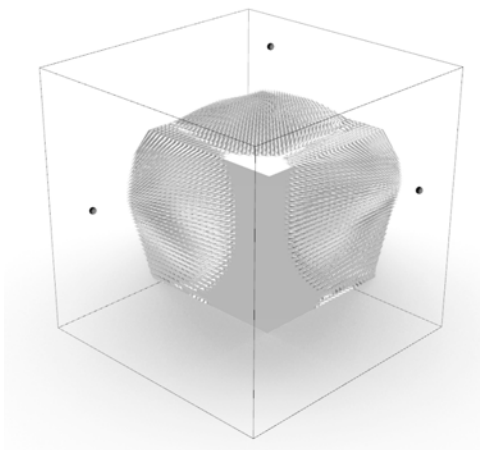
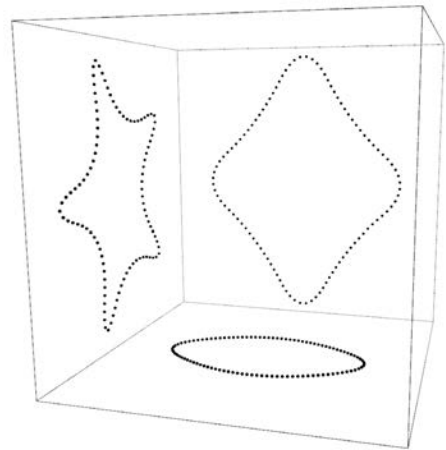
Conceptual visualization of ferro fluids

Our initial inspiration for this assignment came from the motion of ferrofluids, which are liquids that become strongly magnetized in the presence of magnetic fields. The ferrous particles within the liquid move in response to the magnetic field, changing the form of the liquid overall.

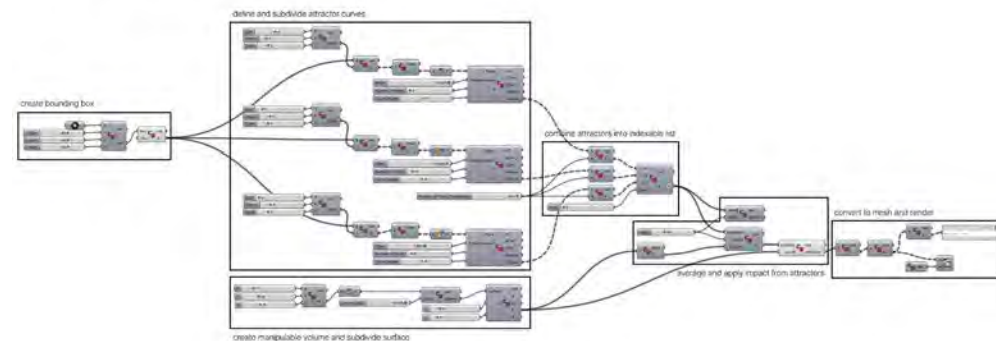


Series of Stills from our simulations mimicking ferro fluid motion.

To manipulate 3d objects, we subdivided the volumes and translated their midpoints to a new location based on the attractors. We then extruded a surface to the new point. In this way, the parent object could be considered a volumetric space composed of a collection of point objects, which when manipulated affect the shape of the overall volume.



Grasshopper Definition



To create smoother motion of the objects, we defined curves along each facade of our bounding box. Subdividing the curves created a list of points that we could cycle through to create the appearance of smooth motion for the attractors along each face.

Echinoderms

Harvard Graduate School of Design - Fall 2019

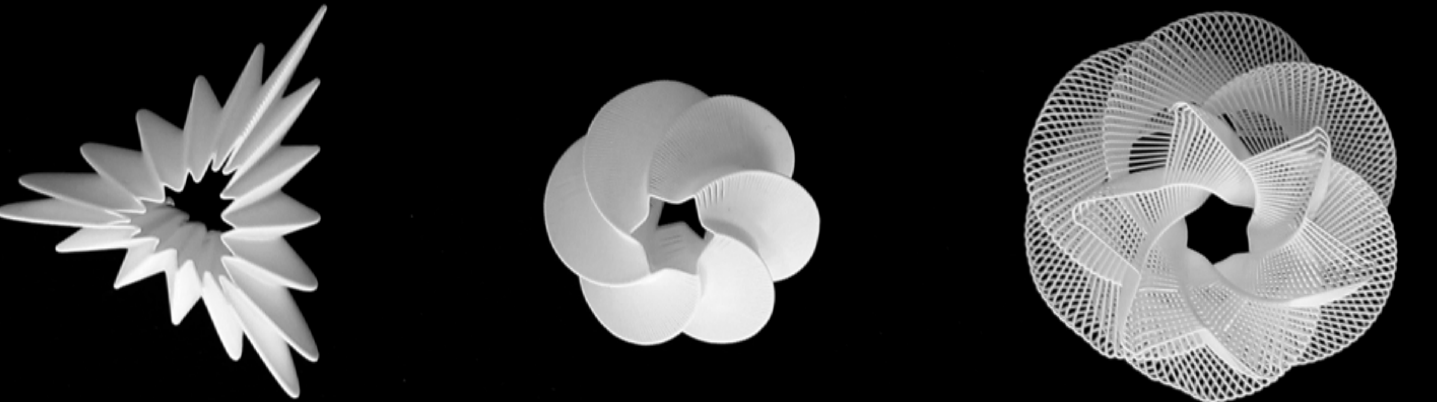
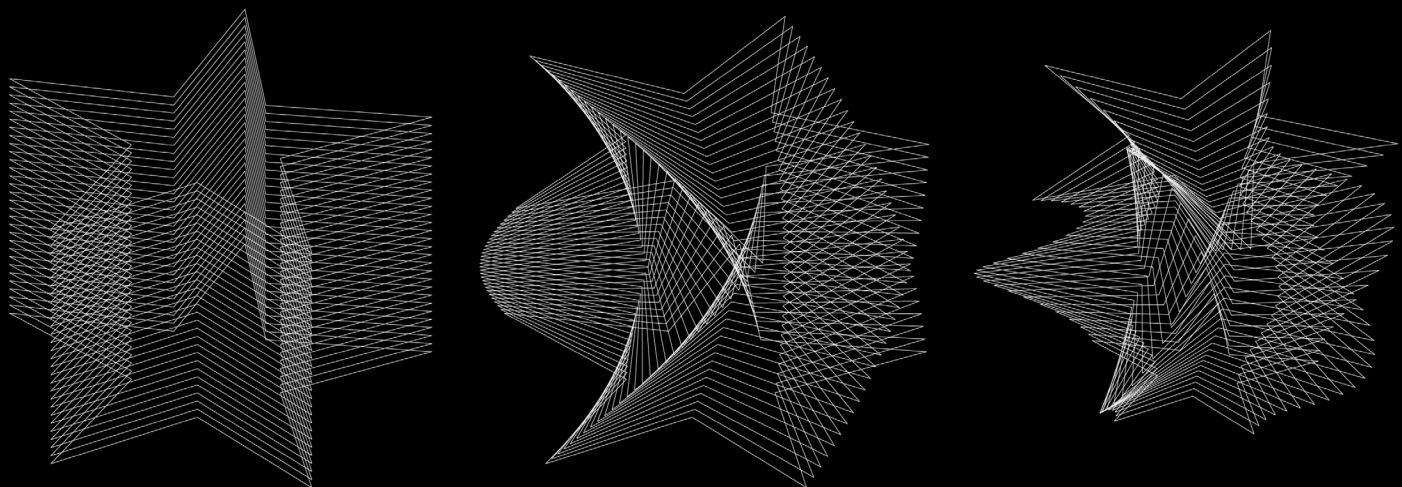
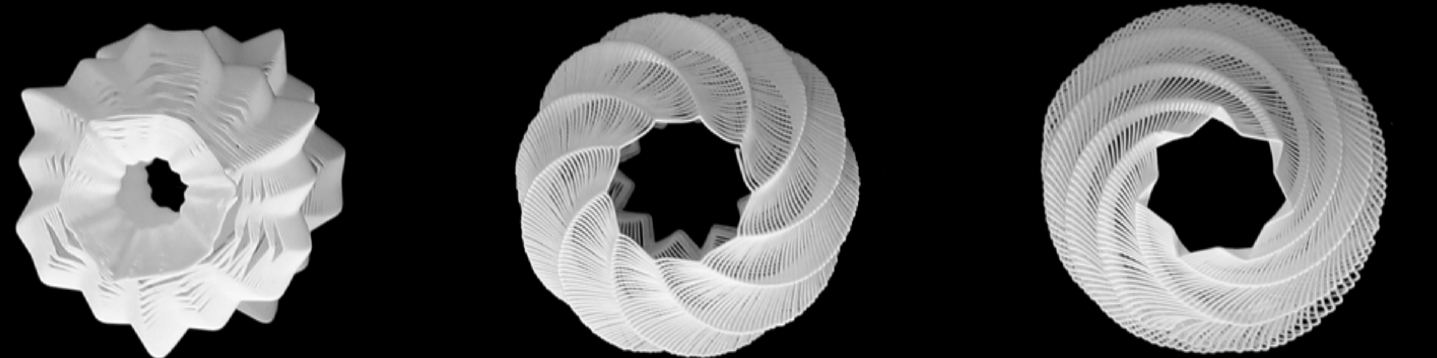
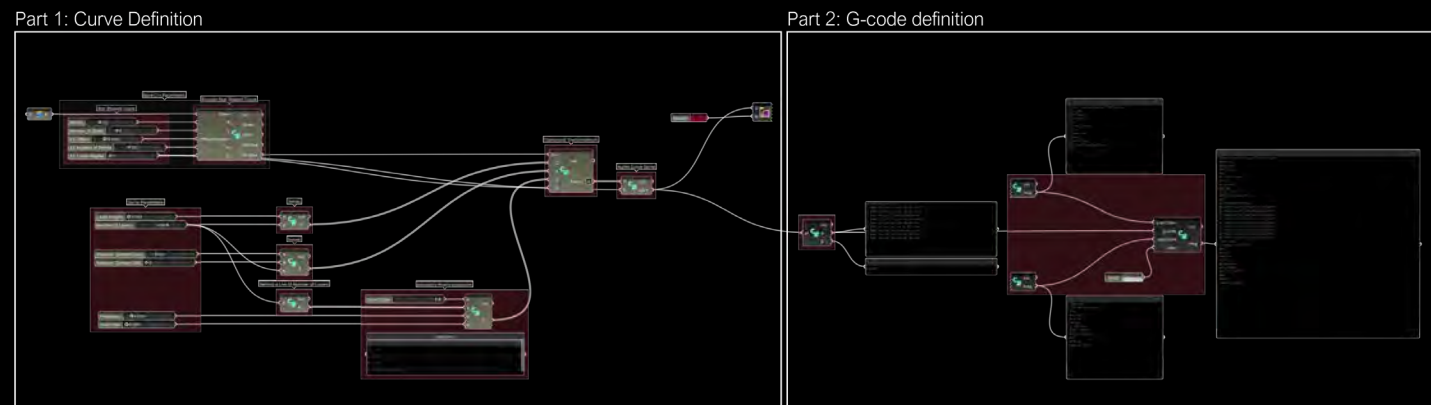
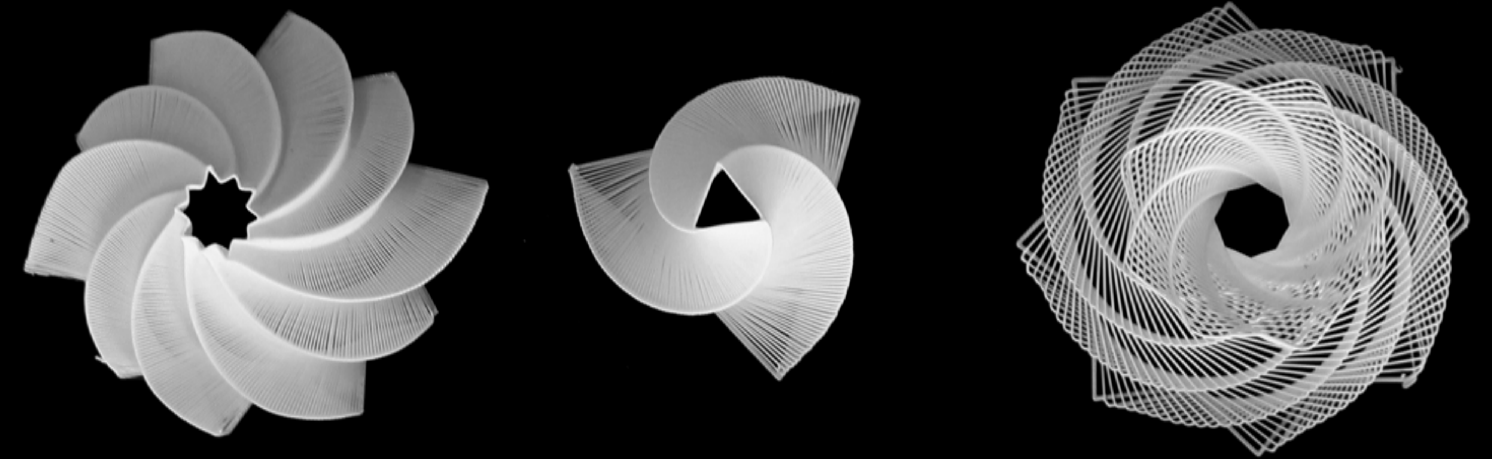
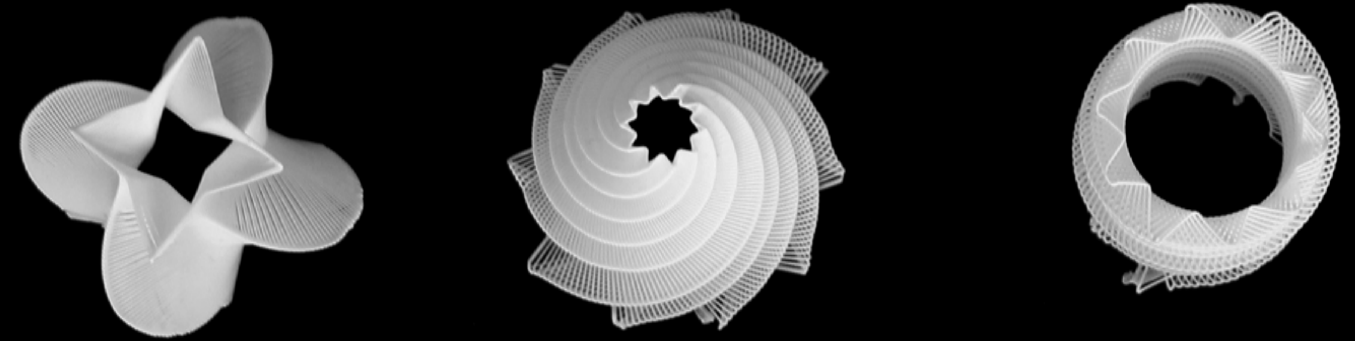
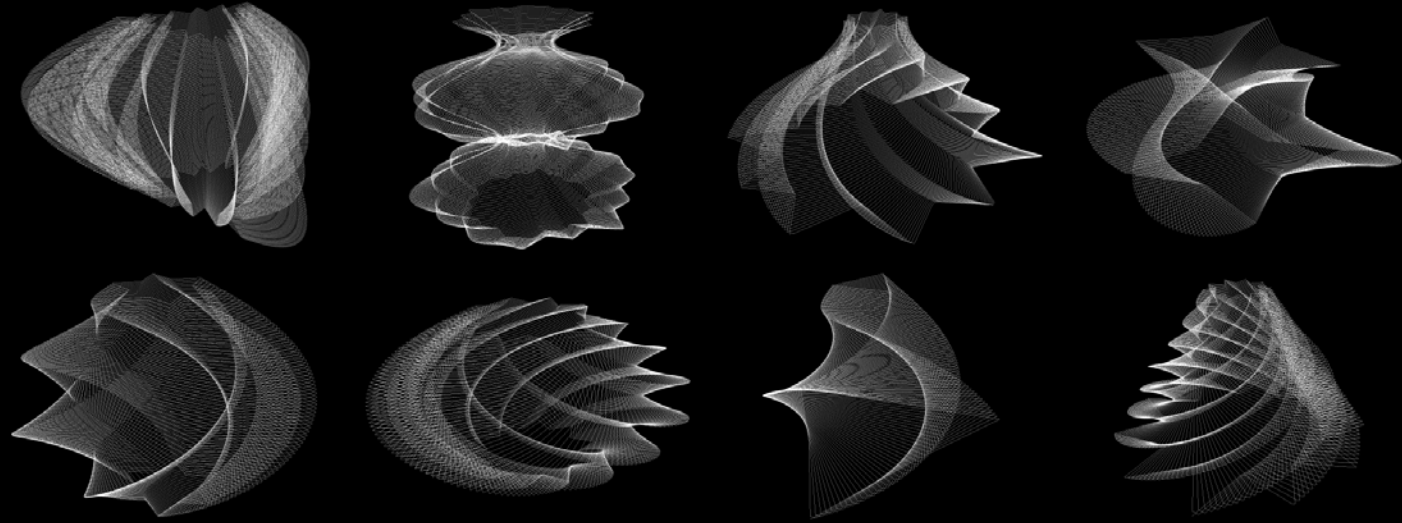
Prof. Jose Luis Garcia del Castillo Lopez

Team: Erin Hunt, Katarina Richter-Lunn, Sana Sharma

Novel generation of custom G-code

We took formal inspiration from the radial symmetry and diverse shapes produced by diatoms, sea urchins, and other small sea creatures. Our goal was to create a single continuous curve with stepwise z-motion, eliminating the need for infill to print hollow volumes.

By using rotation and profile as our main parameters, we could test the how slope and span of our designs would affect bridging and layer deposition.



DOZE



Sleep. Personalized.

DOZE

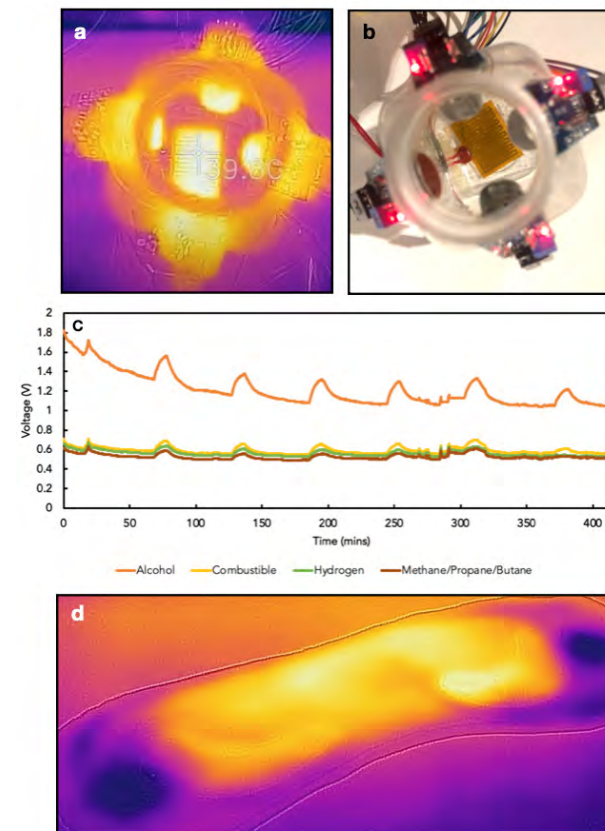
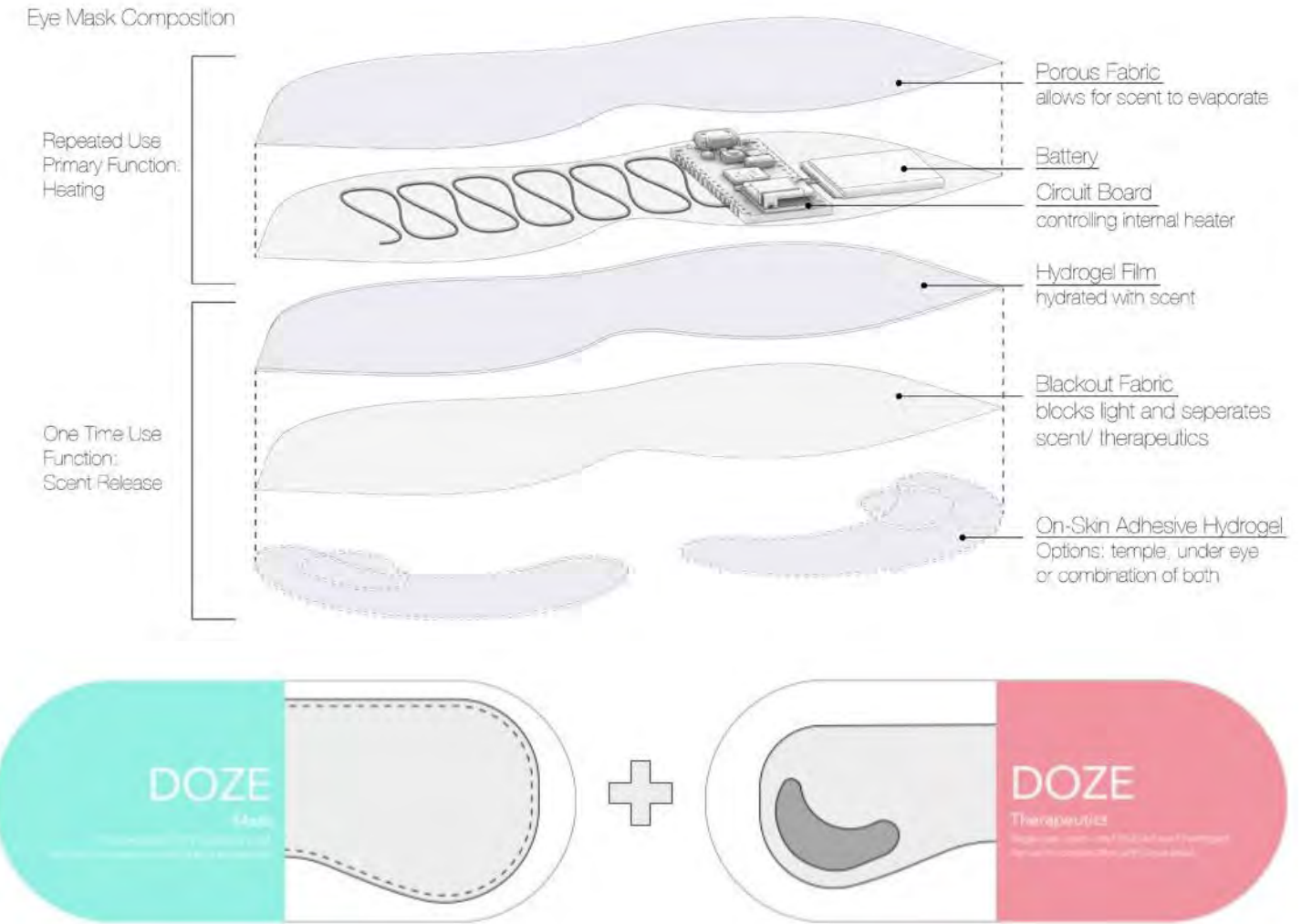
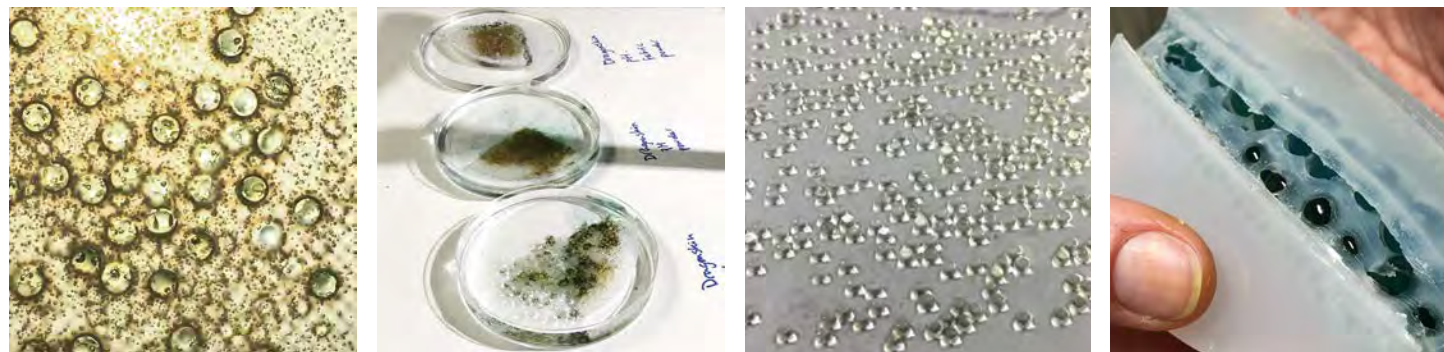
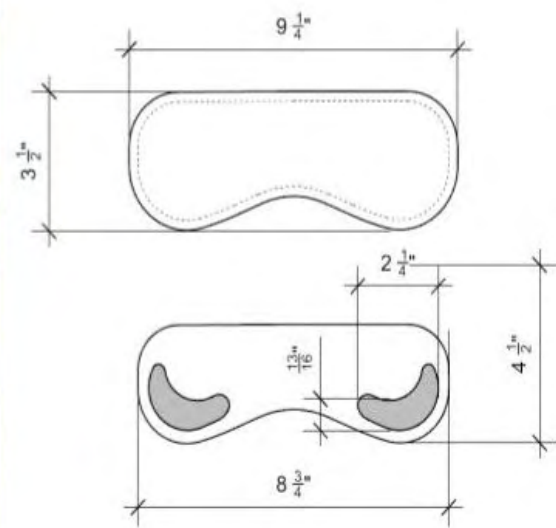
Harvard Graduate School of Design - Fall 2019

Prof. Jonathan Grinham & Joanna Aizenberg

Team: Grace Chee (MARCH - Harvard), Trevor Cobb (MDE - Harvard), Katarina Richter (MDes Tech - Harvard), Irmady Wicaksono (Media Lab - MIT)

Publication: Chee, G., Cobb, T., Richter-Lunn, K., Wicaksono, I. and Freedman, B.R., 2020, September. Doze: hydrogel-based epidermal platform for personalized scent diffusion. In Adjunct Proceedings of the 2020 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2020 ACM International Symposium on Wearable Computers (pp. 17-20). <https://doi.org/10.1145/3410530.3414407>

Doze is an on-skin, hydrogel-based sleep mask which seeks to improve, enhance, and augment sleep through the use of programmed scent diffusion in tune with the user's cortical rhythms. Taking advantage of hydrogels' unique properties, the Doze mask encapsulates and emits therapeutic scents at a regulated pace. The release of scent is controlled by an embedded heater within the layers of the mask and communicates remotely to a smart device. This communication allows for a personalized dosage release based on the user's biometric or contextual data. Investigating both the pervasive power of smell in enhancing sleep as well as natural topical remedies, this personalized mask explores the potential for unintrusive solutions to the ever-growing rarity of a good night's sleep.



Prototype Design

The prototype consists of two parts: the Mask and the Therapeutics. Within these two parts are multiple layers integrating the technology, scent infused hydrogel and adhesive face mask. The Mask holds the "permanent" components, and is made of a soft, porous material that encloses the battery and circuit board controlling the heater. These are made of small and flexible systems in order to make them seamless with the top layer of the mask. Envisioned as a separate package, Therapeutics would hold "single-use" sets of hydrogel insertions, pre-embedded with your personalized scent. The scent-infused hydrogel would be separated by a piece of material which would prevent eye irritations while also adding a "black-out" layer for light.

Detection of Odor Compounds

In order to characterize the quantity of odor release, we developed an automated, controllable system that consists of MQ2 (high-sensitivity to combustible gas), MQ3 (alcohol), MQ4 (methane, propane, and butane), and MQ8 (hydrogen) gas sensors placed in a sealed container with a heating element at the bottom. A temperature profile (FLIR Duo) was also captured to accurately measure the temperature on the flexible heating pad. The system is connected to a microcontroller (Arduino Nano) that simultaneously reads and records all of the sensor data overtime, and actuates the heating element with a driving circuit powered from the lithium-polymer battery (3.7V). As can be observed that the odor compound release with the majority of alcohol concentration of the scent-infused hydrogel increases and forms a peak as we simulate an overnight actuation with a frequency of one release per hour.

Institute of Experiential Therapy

Thesis Prize - Cal Poly

Fifth year - Prof. Karen Lange - 2016

Embedded within the urban fabric of downtown Manhattan, the IET investigates the possibilities of experiential therapy and embodied cognition within architecture.

Through the juxtaposition of psychological theory and architectural space, the users are exposed to a series of placebo programs and experiential spaces that trigger a subconscious response to fears and phobias within themselves.

It is by paralleling a sense of discomfort with that of relaxation that the users undergo systematic desensitization through their environment resulting in a new method of confronting the epidemic of psychological instability constructed by our society.

embodied cognition: perception of the world through the body and its senses rather than thought

placebo programs: the advertised program to the main public

experiential programs: circulation and space that resides between each placebo program

systematic desensitization: the psychological process known today to cure phobias

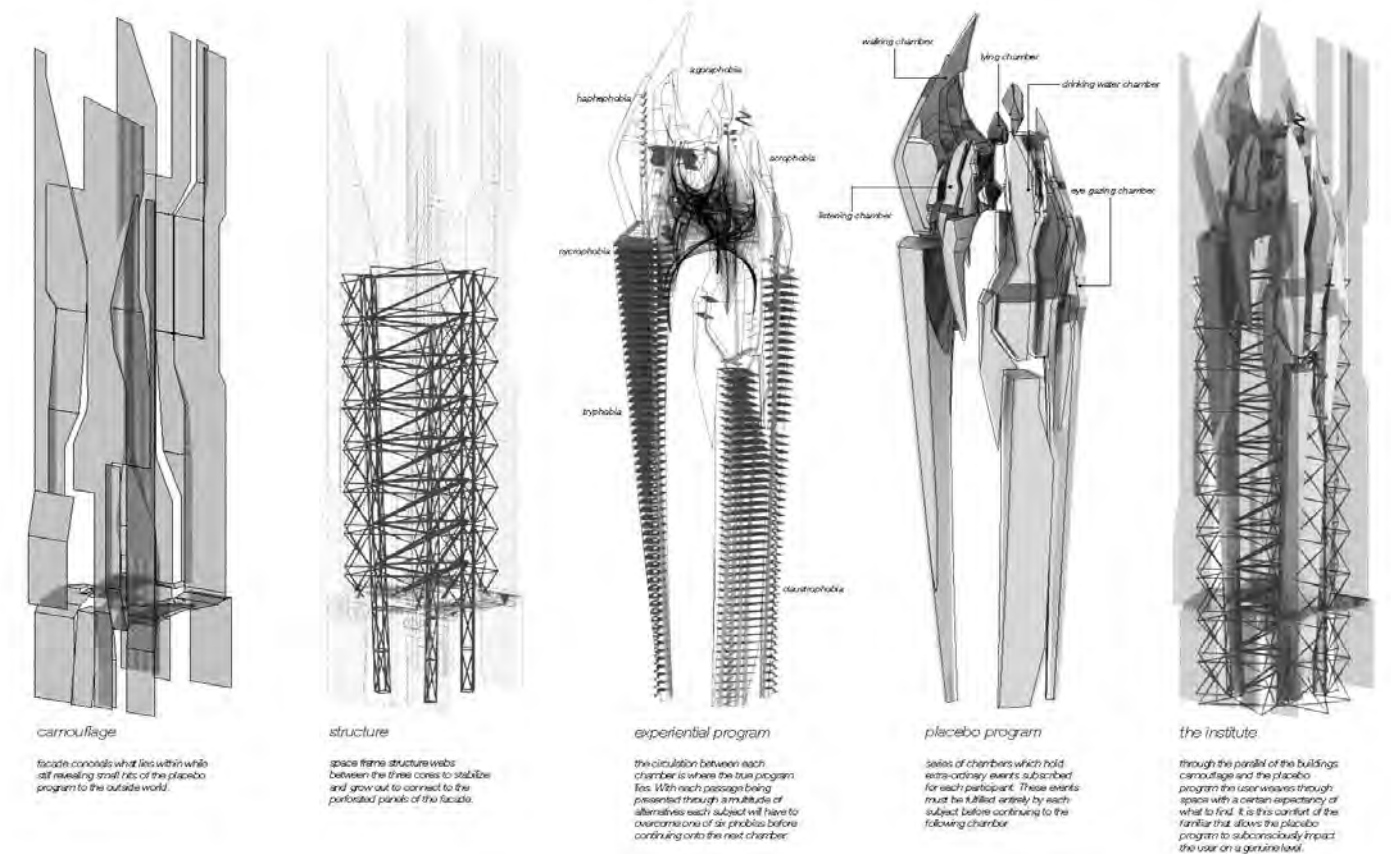
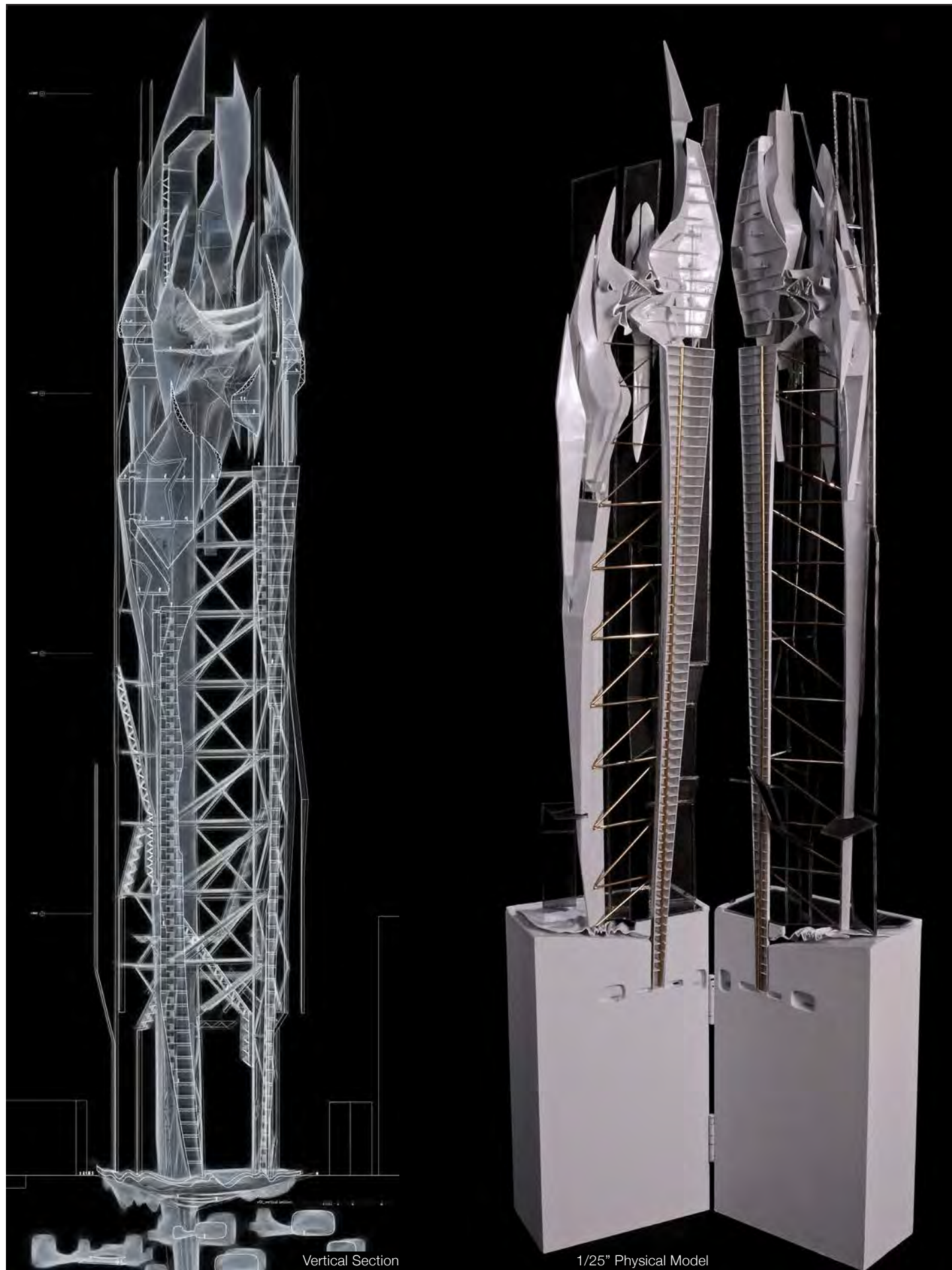


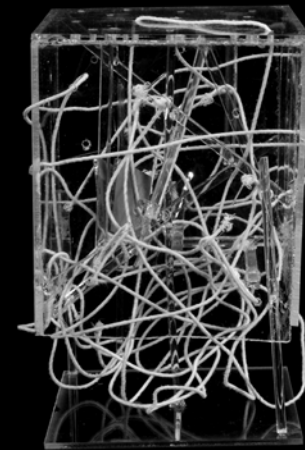
Embedded Therapy

- addressing phobia and unsettling through the built environment

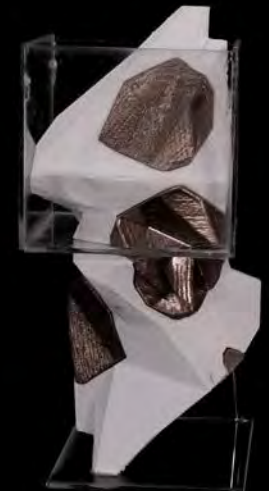
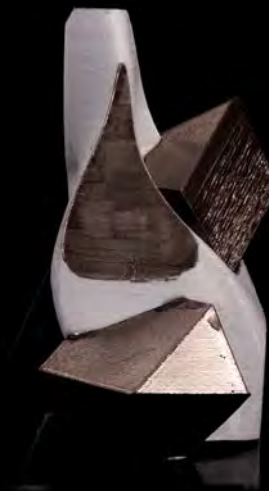
Through experiential stimulation in architecture, an embodied therapy can begin to influence the user at a subconscious level and provide a new, accessible cure for environmentally induced phobias.

Today we are faced with phobia, fear and unsettling every day. Although most of us do not reflect on the environments that construct these behaviors, we are constantly affected by them. Through investigation of what might happen when embedding these fears and phobias into our surroundings, I seek to access the subconscious mind where lies a person's most vulnerable self. Once such vulnerability is provoked, a specific sensibility in each individual can be triggered by connecting to both mind and body. Through the pairing of psychological theory and architectural manipulation one can begin to re-envision the idea of embodied therapy and confront the epidemic of psychological instability constructed by our society.

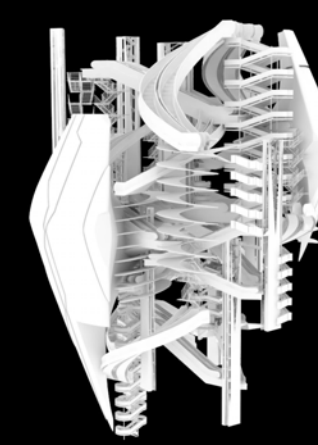
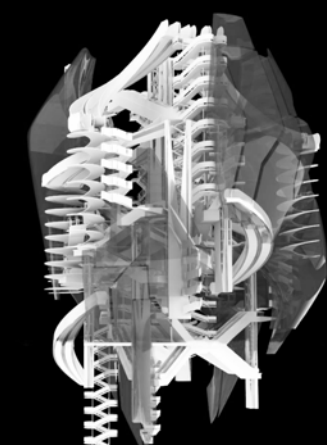
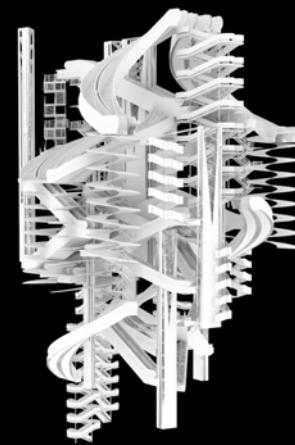




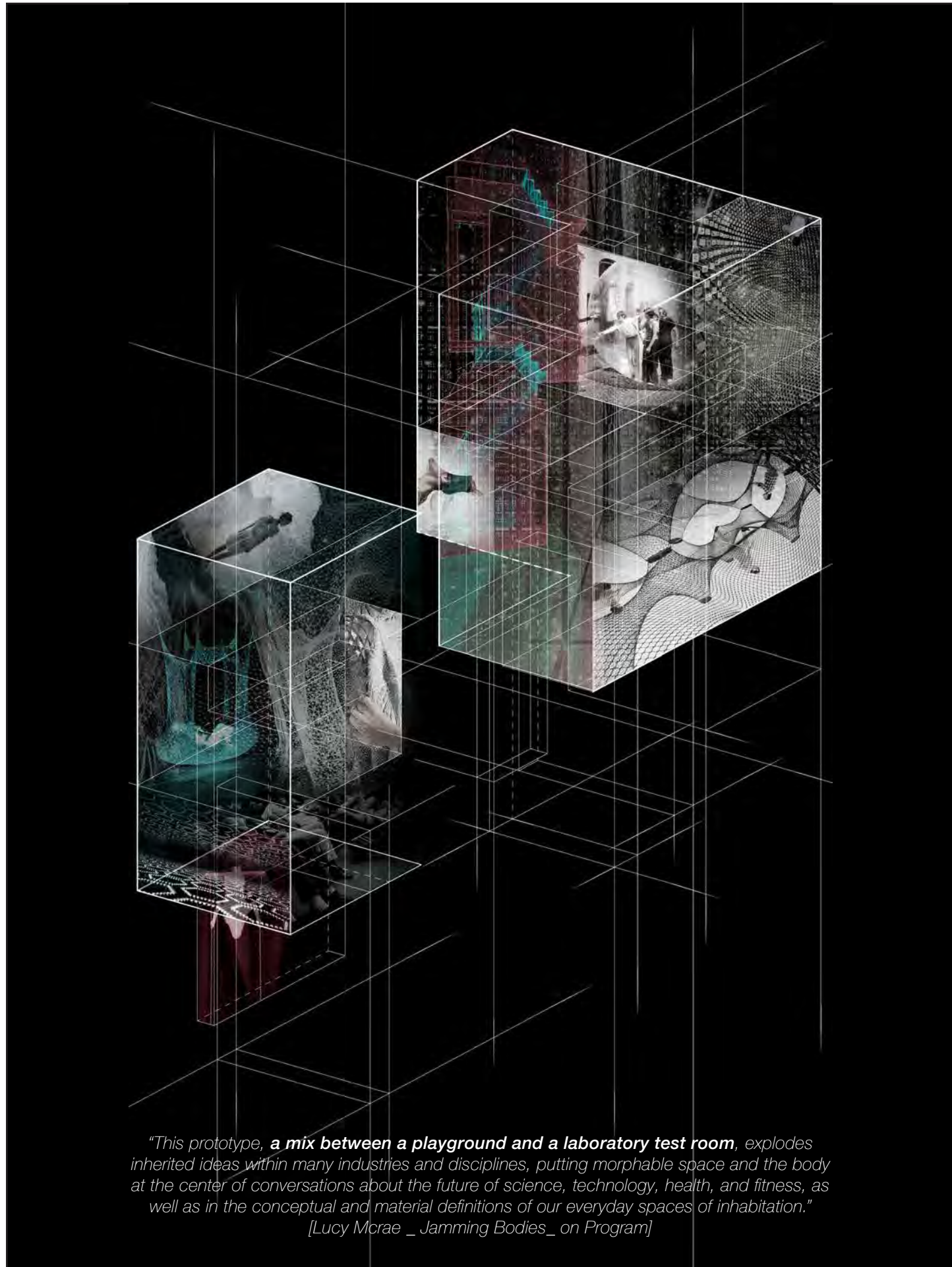
Phase one - Investigation of the concept formally. Looking to find the balance between restrained form and the oddity of the program trying to escape from its shell.



Phase two - Generation of a solid from which you add and subtract, submerge and elevate. These form studies begin to address scale, and difference in program.



Phase three - Development of the formal studies that integrate computation to generate the shape and overarching spacial language of the project.



Ground Zero

Sitting within the heart of Manhattan lies a site so politically and emotionally charged that it is rare to enter it and not be altered in some way. I chose this site because the broad impact and embedded fear gave me the opportunity to utilize the emotion triggered by the site and access either the fears and phobias that visitors are aware of, or those that are hidden within their unconscious. This would allow the program to contradict the political and historical burden that hovers in the air and perhaps provide a moment of levity and reflection in which individuals could begin to confront some of their own personal burdens in addition to those inherent on the site.

*Top Image: 1/64" Site model
Bottom Images: 1/2" Detail model*



Attaché

*EvoLo Vmodern 2016 Competition - Honorable Mention
Vellum - Prof. Karen Lange - 2015*

Attaché is an experiment that investigates the varied impact of sensory environments on the mind and body.

By reframing the chair simply as a means of connection, the spine becomes one of conflicted evocation: the lounge chair - the embodiment of relaxation and dénouement. This association is directly felt when lowering oneself to the chair. By bringing the body close to the ground and in some ways falling into its seat one is then committed to the experience and proceeds to surrender into the back attachment.

The embedded "spine" of the chair slowly latching on to the body as one releases into it is both an attachment as much as it is the attacher. Although rooted into the back design of the chair, it also begins to inset itself into the experiencer. It was observed by many that sat in the chair that they could still feel the pressure points triggered long after their experience ended or even some had delicate imprints of the spine on their own back. It is this idea of the attachment both physically, mentally, emotionally and anatomically that I was interested in extracting. Users saw how their senses can be triggered and thus became more and more aware of their personal sensitivities, which allowed the experience to alter them in a variety of ways.

This investigation looks at how experiences in one's environment can effect cognition on a multitude of levels, and how perhaps it can be applicable on a larger scale. Thinking about how one can directly connect with the mind and body without the necessity of latching on to it.





Attaché

\a-tə-'shā, ,a-'ta-, ə-'ta-\ n.

the physical connection:

*01_ Tout ce qui sert à attacher, à retenir, lien, courroie, agrafe, etc./
Everything that serves to attach, hold back, tie, clip, etc.*

the emotional connection:

*02_ Sentiment qui unit à quelque chose, à quelqu'un/
Feeling that unites to something, to someone.*

the mental connection:

*03_ Liaison, relation qui fait dépendre quelqu'un d'une autre personne ou d'un milieu/
Link, relationship making someone dependent on another person or a medium*

the anatomic connection:

*04_ Articulation des membres, et en particulier le poignet et la cheville/
Joints members, especially the wrists and ankles*



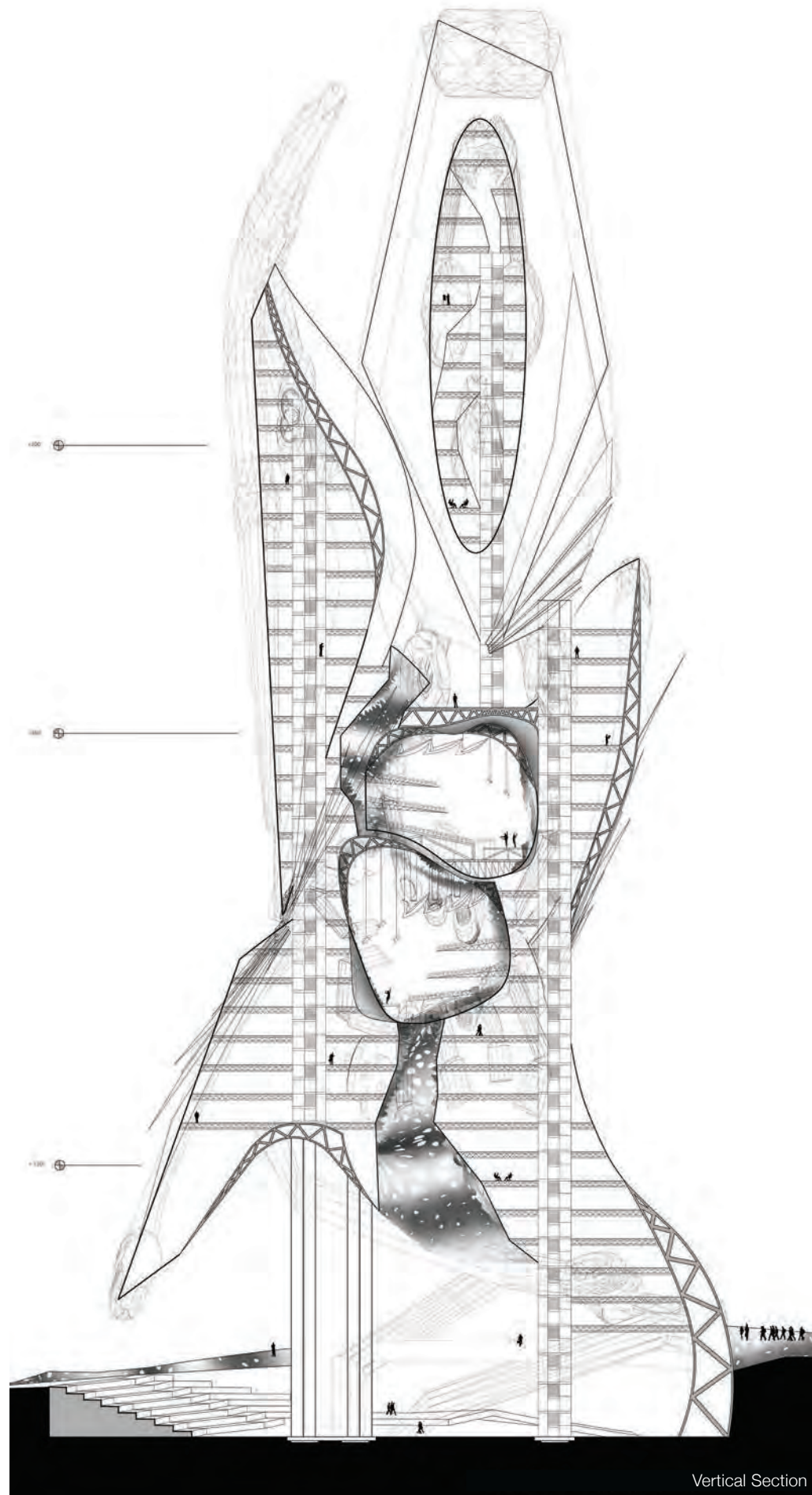
Unsettled

MAD architects design award - Finalist - Cal Poly
Fourth Year - LA Metro - Prof. Stephen Phillips - 2015

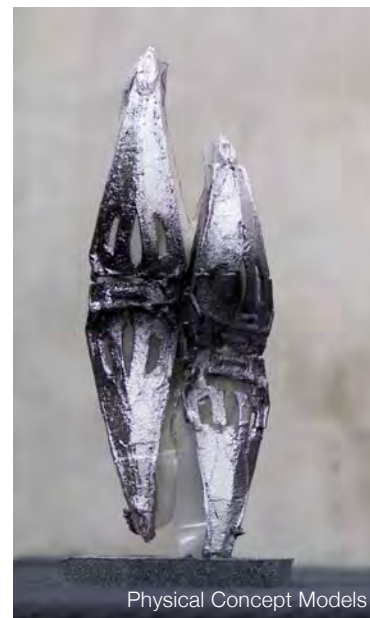
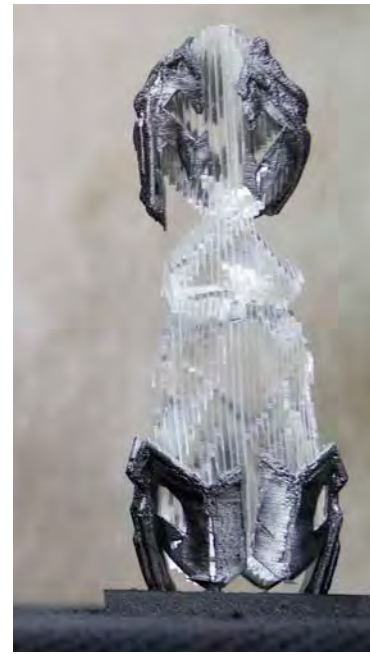
Unsettling or disturbing sensations become especially interesting when they are directly related to architectural form. By taking an unsettling form out of context, it's characteristics can be evaluated independently and we can discover what triggers our uneasiness.

Although each individual experiences forms, spaces and textures differently, general characteristics can be extrapolated. By isolating and manipulating these characteristics, we can discover more subtle elements which might also trigger the disturbed. Many might think that horror is found in the absurd when in fact it is most commonly found in the usual. One common trait that I chose to emphasize in my research is that of symmetry. Although we might believe that most living organisms are perfectly symmetrical, we can simply look to the mirrored features of a human face to prove otherwise. In fact, the minor alteration of one aspect of a symmetrical form is more recognizable than one difference among a multitude. Through isolation and slight alterations to symmetry these forms begin to touch the senses and make us wonder about the source of our instincts.

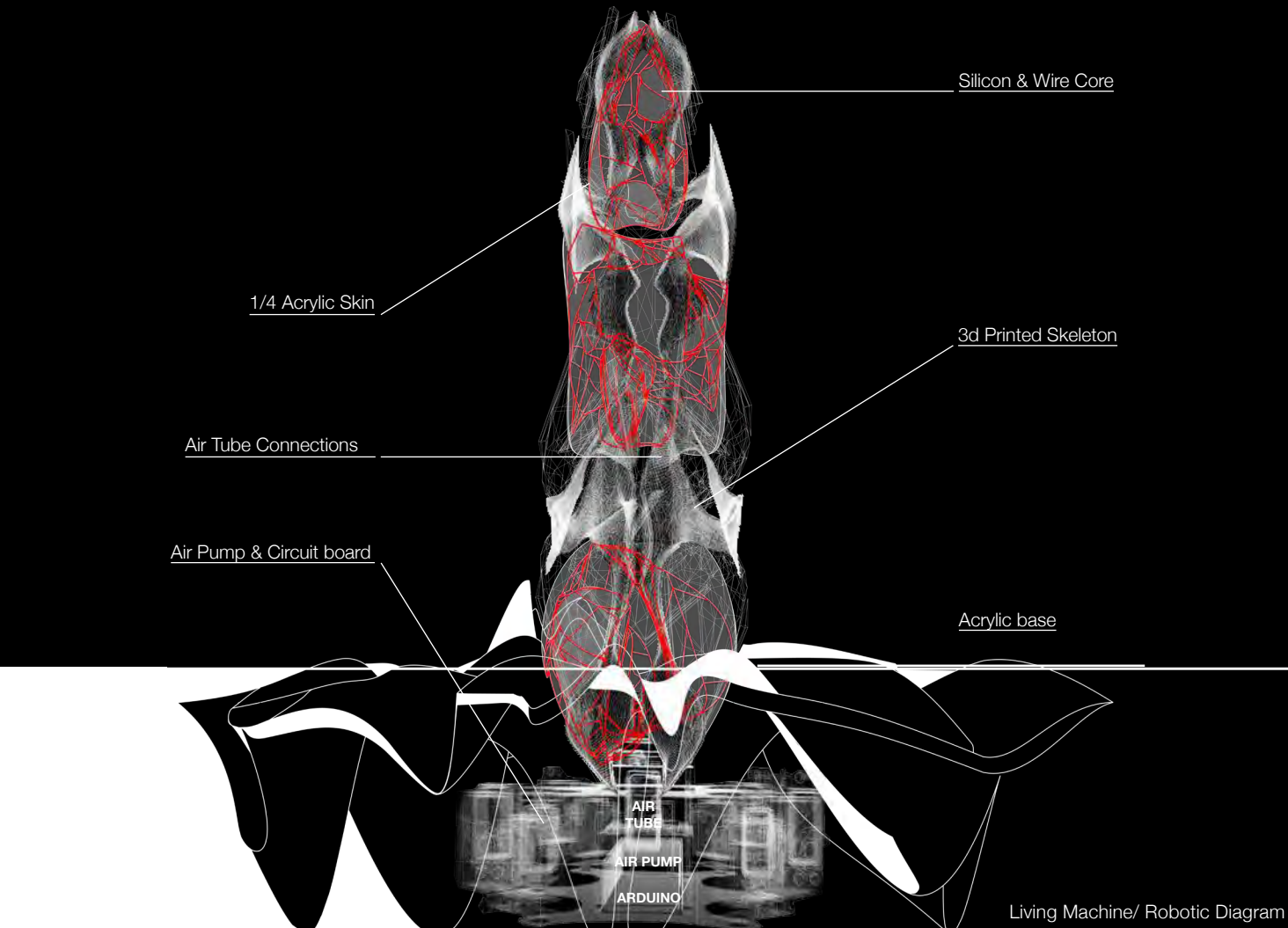
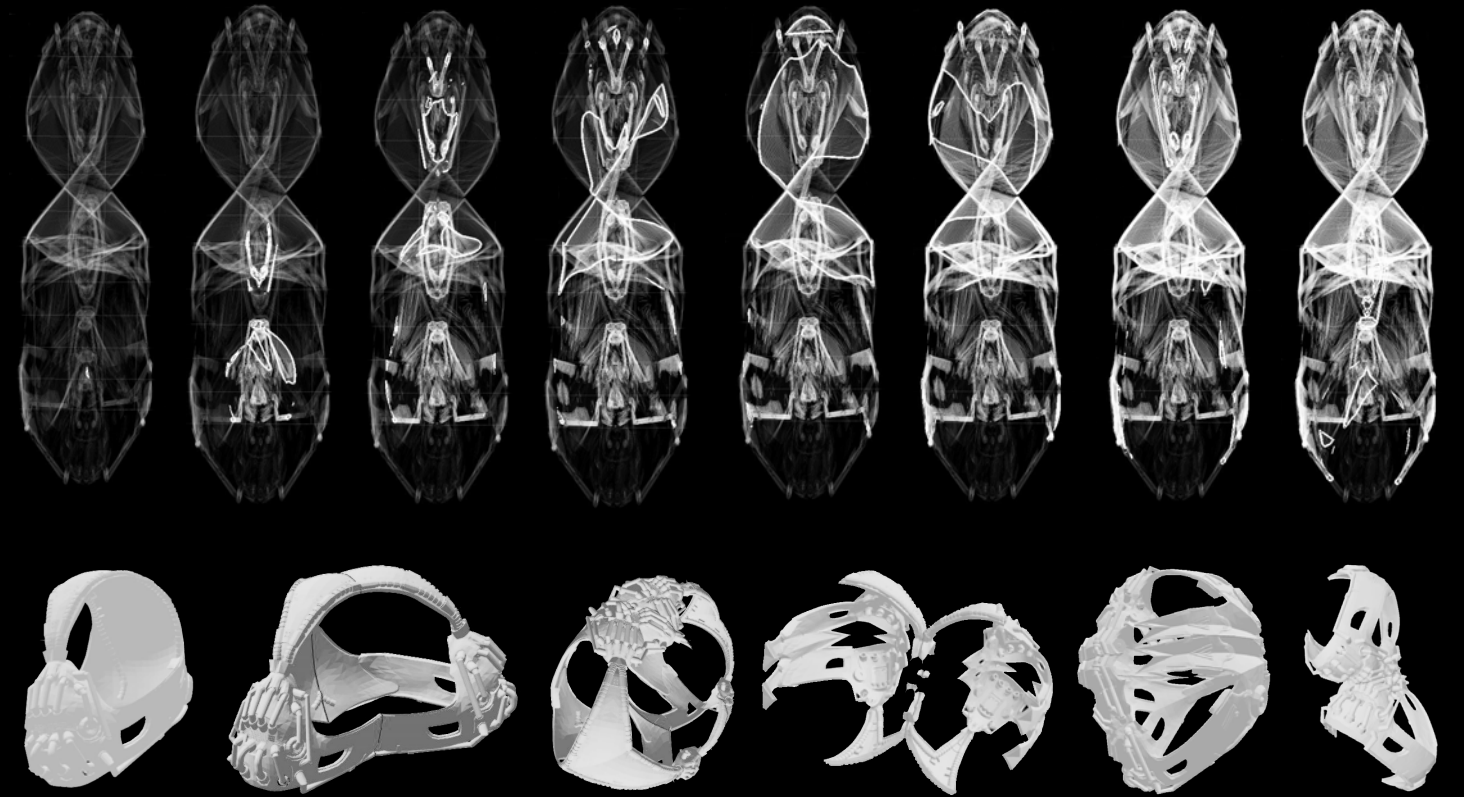




Vertical Section



Physical Concept Models

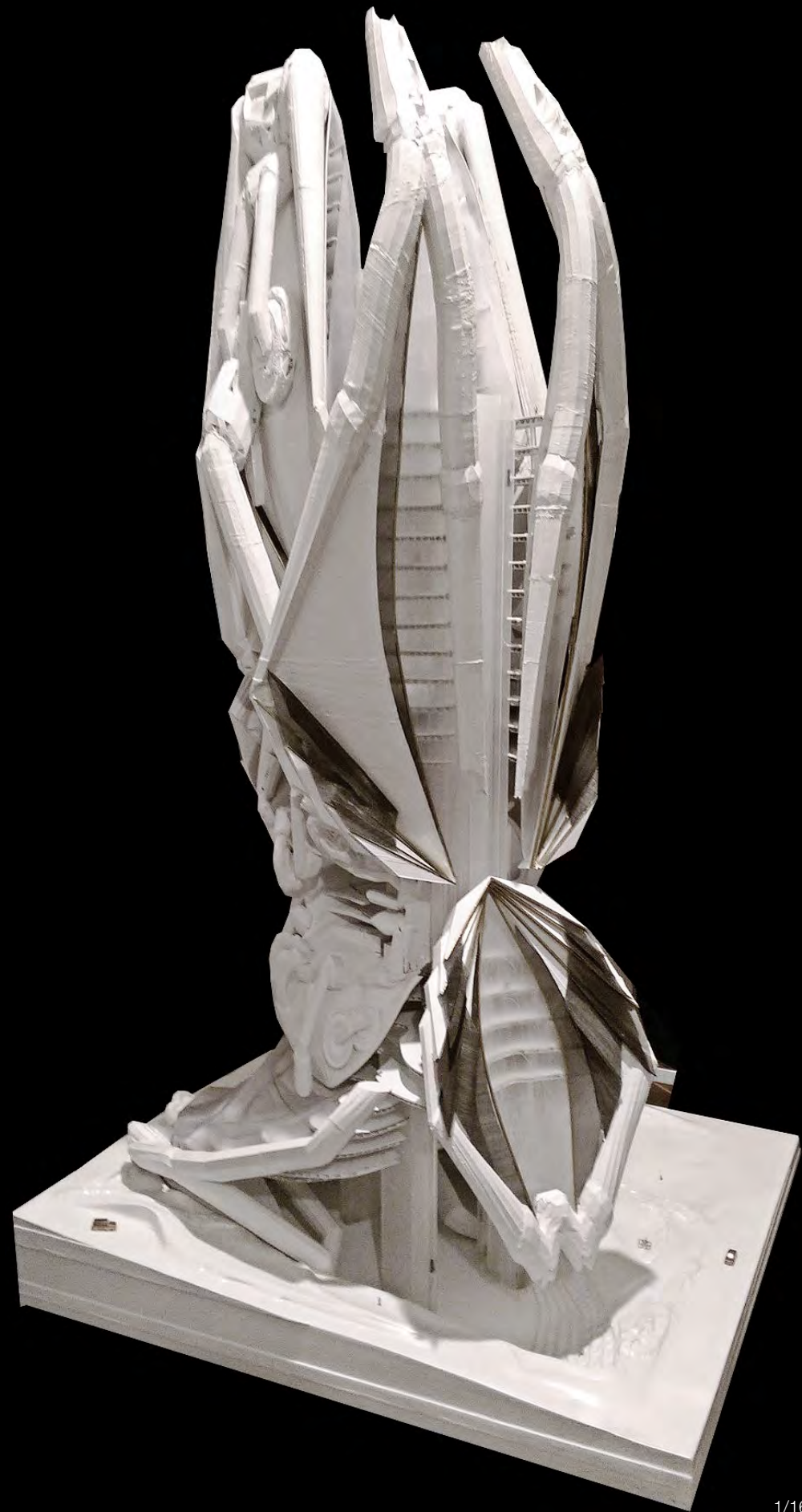


Living Machine/ Robotic Diagram

- The Living Machine -

Through the process of isolating the elements which make up the living body this machine was brought to life by simply adding the breath.

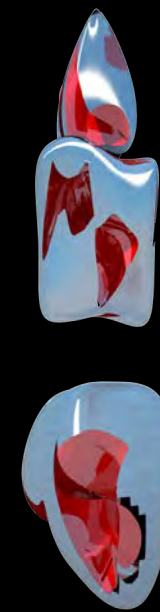
With a hard skeleton and outer shell the inner organs are both restricted and supported within the body. It is then through the use of Arduino and a common fish tank pump that air circulates in and out of the soft silicon core to a prescribed rhythm. The notion of breath provokes a sense of familiarity as well as unease, leaving someone conflicted by their response to this living object.



1/16" Scale Physical Model



Living Machine/ Robot



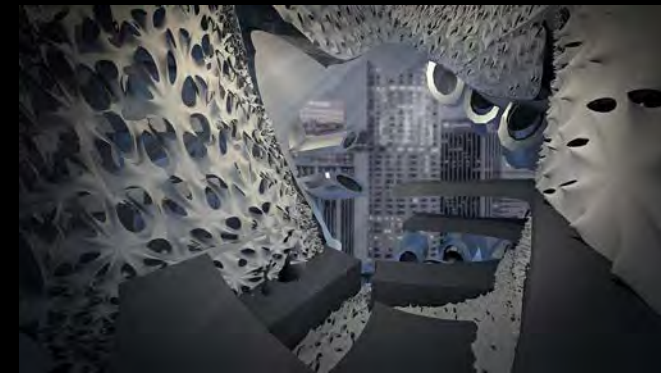
Organ



Skeleton



Skin



Symbiosis

Best of Show - Nominee - Cal Poly

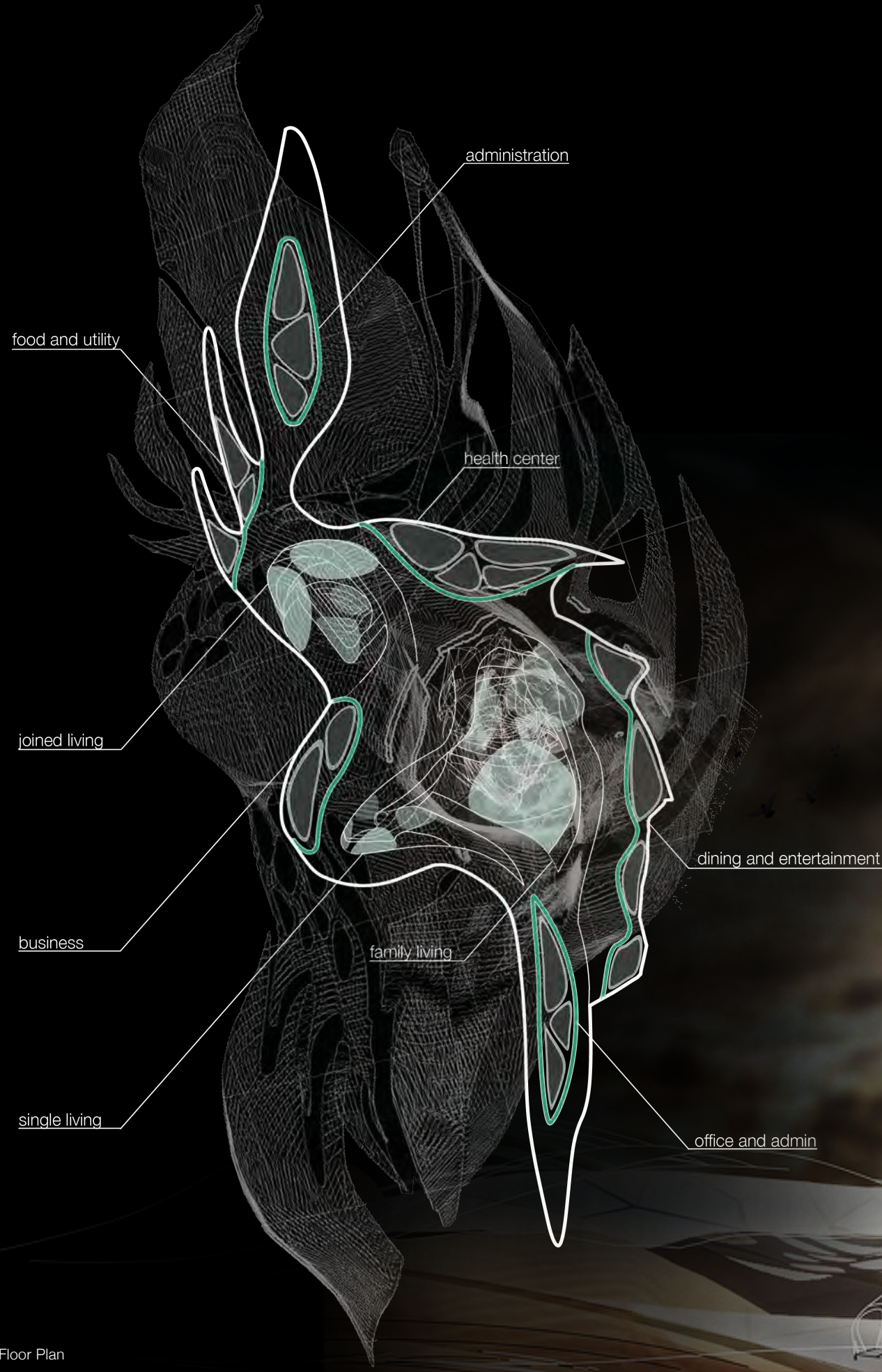
Third year - Prof. Margarida Yin - Spring 2014

One single structure was formed through the osmosis of different concentrations.

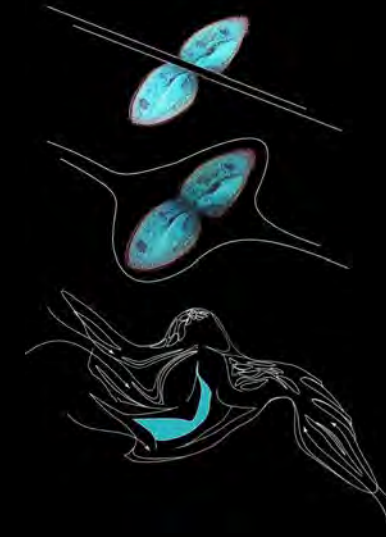
Breaking the tension bonds between these two living organisms allowed them to come together as a harmonic entity while still maintaining their unique compositions. This binary fusion evolved into a self supporting ecosystem which nourishes those who visit, live and work within this society. Sitting within the border of Señora, Mexico, and Arizona, USA this new environment serves as an open network for those from every identity looking for a place to work, cultivate, live and learn symbiotically.



Physical Section Model



Floor Plan



Polarization creates a separation of two solutions of different concentration

Osmosis is the spontaneous net movement of solvent molecules through a partially permeable membrane into a higher solute concentration.

Binary Fusion occurs when a cell (or body, population, or species) adheres itself from two or more parts into one. The regeneration of those parts don't change in identity but simply mix to create a new symbiotic concentration.



**Hydrophilic Skin
(fog capturing)**

Skin system will include three main materials which will connect directly onto the triangular space frame. These systems include thin film solar panels, hydrophilic net, and white aluminium panels.

Space Frame Structure

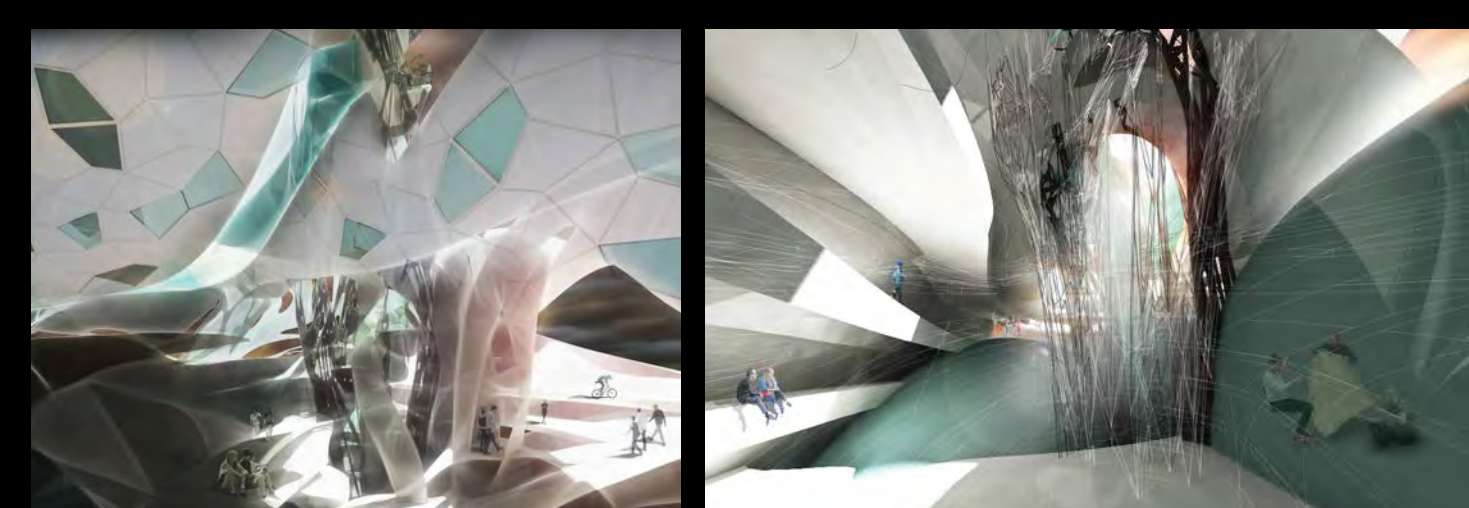
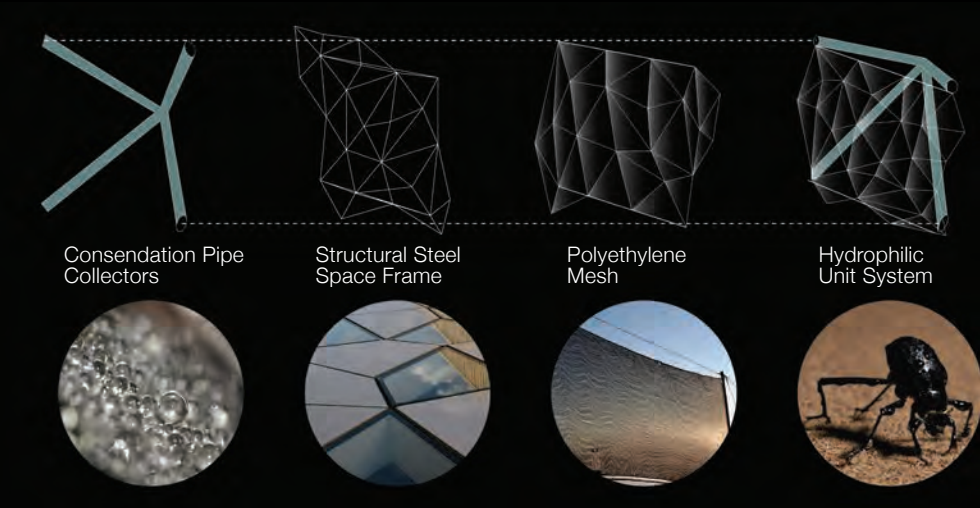
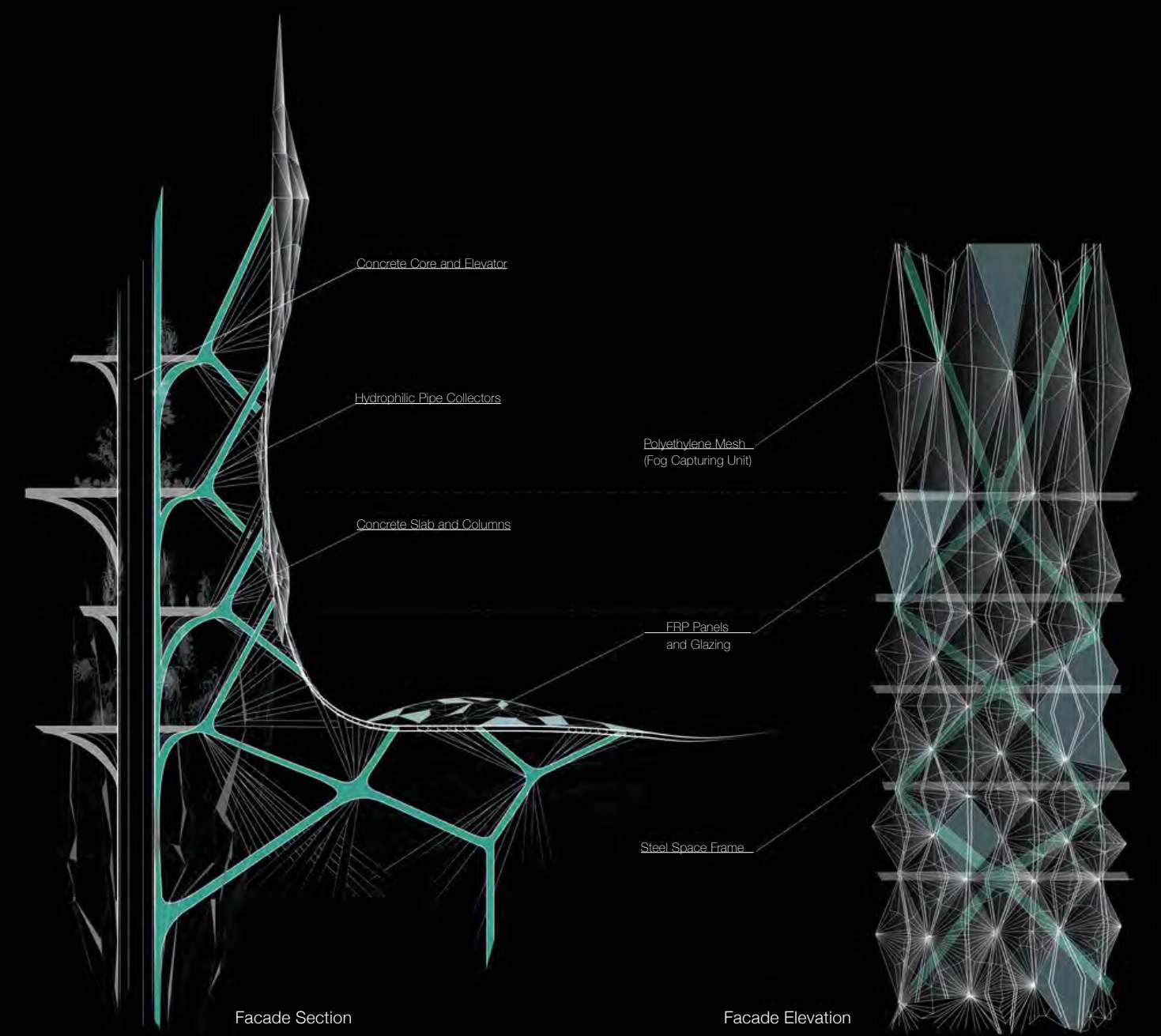
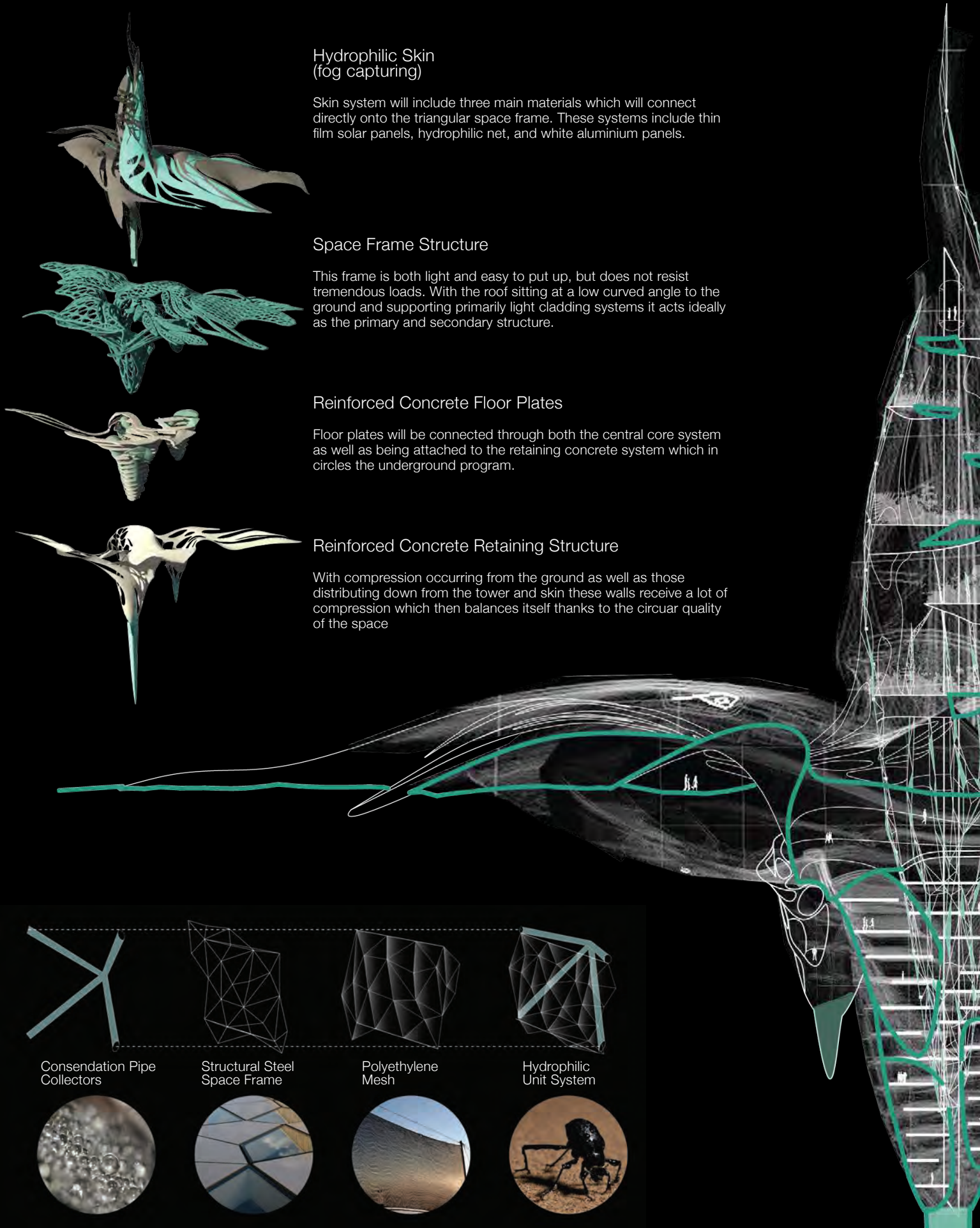
This frame is both light and easy to put up, but does not resist tremendous loads. With the roof sitting at a low curved angle to the ground and supporting primarily light cladding systems it acts ideally as the primary and secondary structure.

Reinforced Concrete Floor Plates

Floor plates will be connected through both the central core system as well as being attached to the retaining concrete system which in circles the underground program.

Reinforced Concrete Retaining Structure

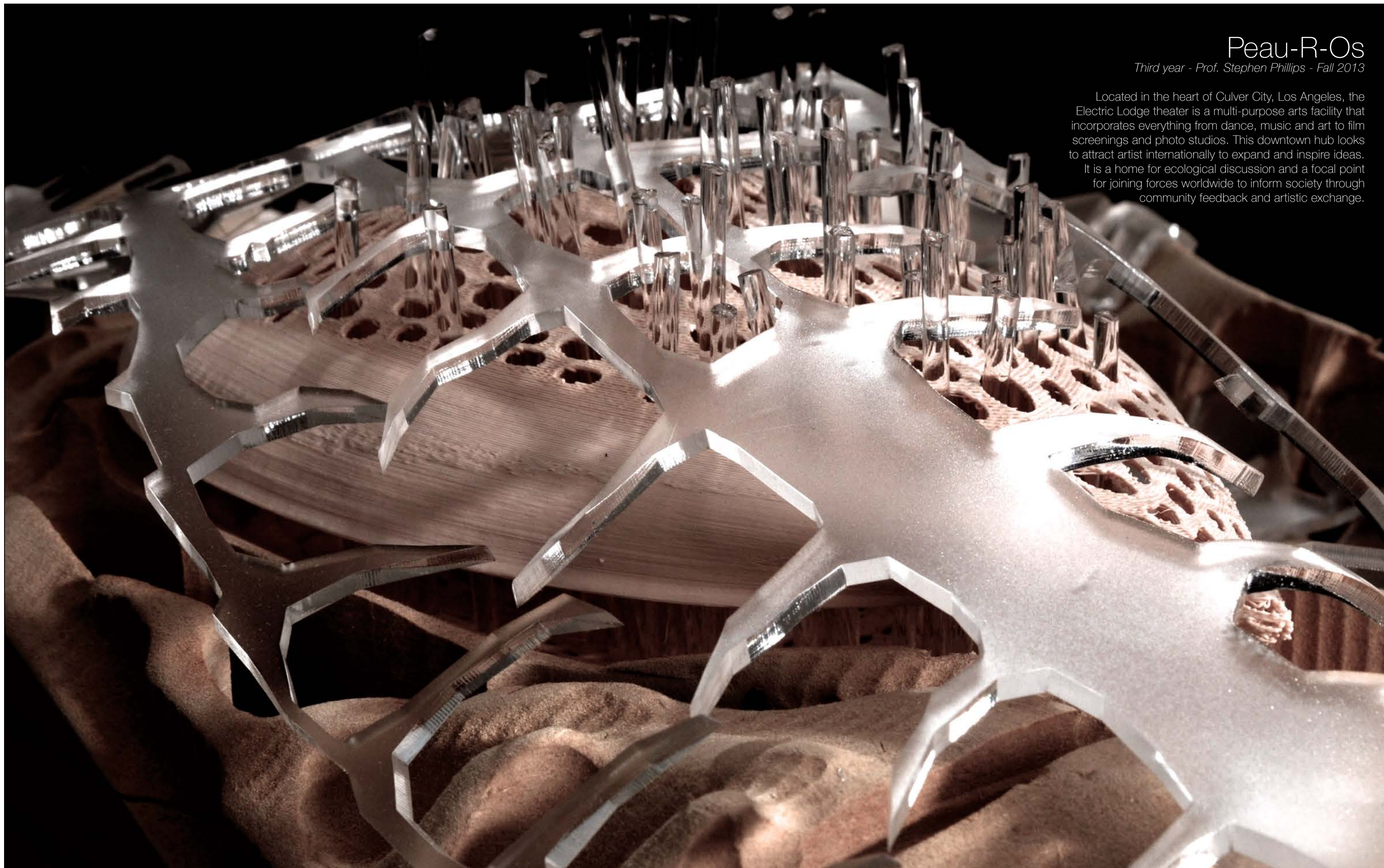
With compression occurring from the ground as well as those distributing down from the tower and skin these walls receive a lot of compression which then balances itself thanks to the circular quality of the space



Peau-R-Os

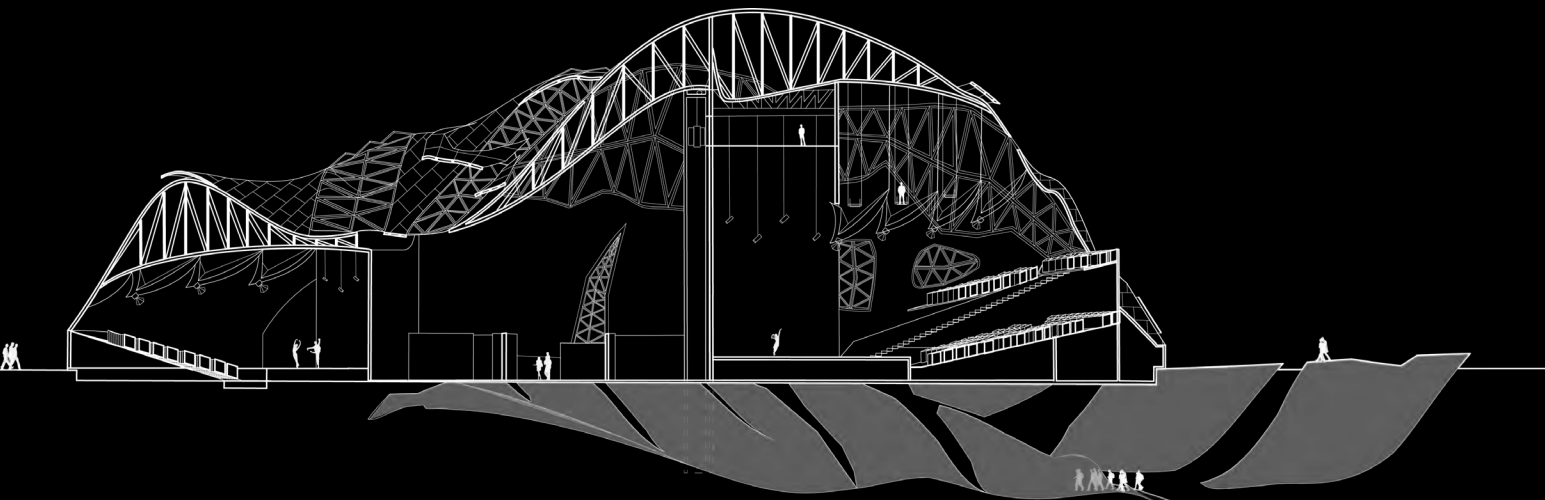
Third year - Prof. Stephen Phillips - Fall 2013

Located in the heart of Culver City, Los Angeles, the Electric Lodge theater is a multi-purpose arts facility that incorporates everything from dance, music and art to film screenings and photo studios. This downtown hub looks to attract artist internationally to expand and inspire ideas. It is a home for ecological discussion and a focal point for joining forces worldwide to inform society through community feedback and artistic exchange.

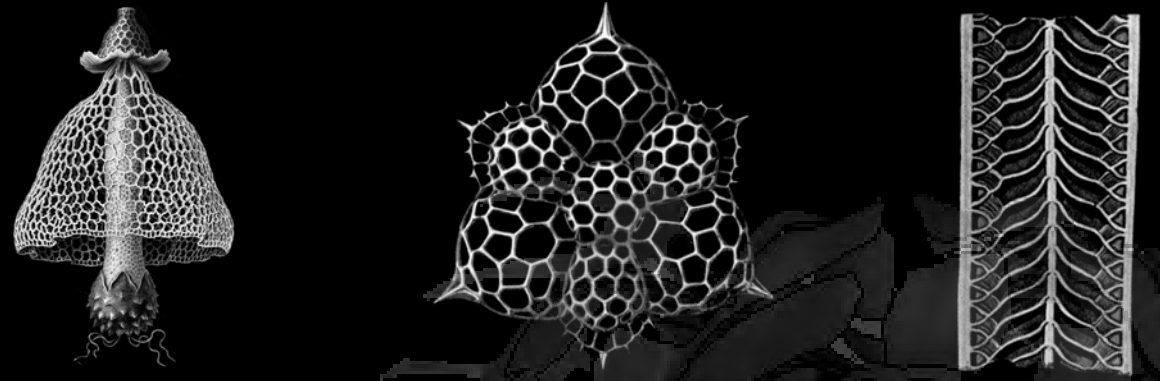




Floor Plan

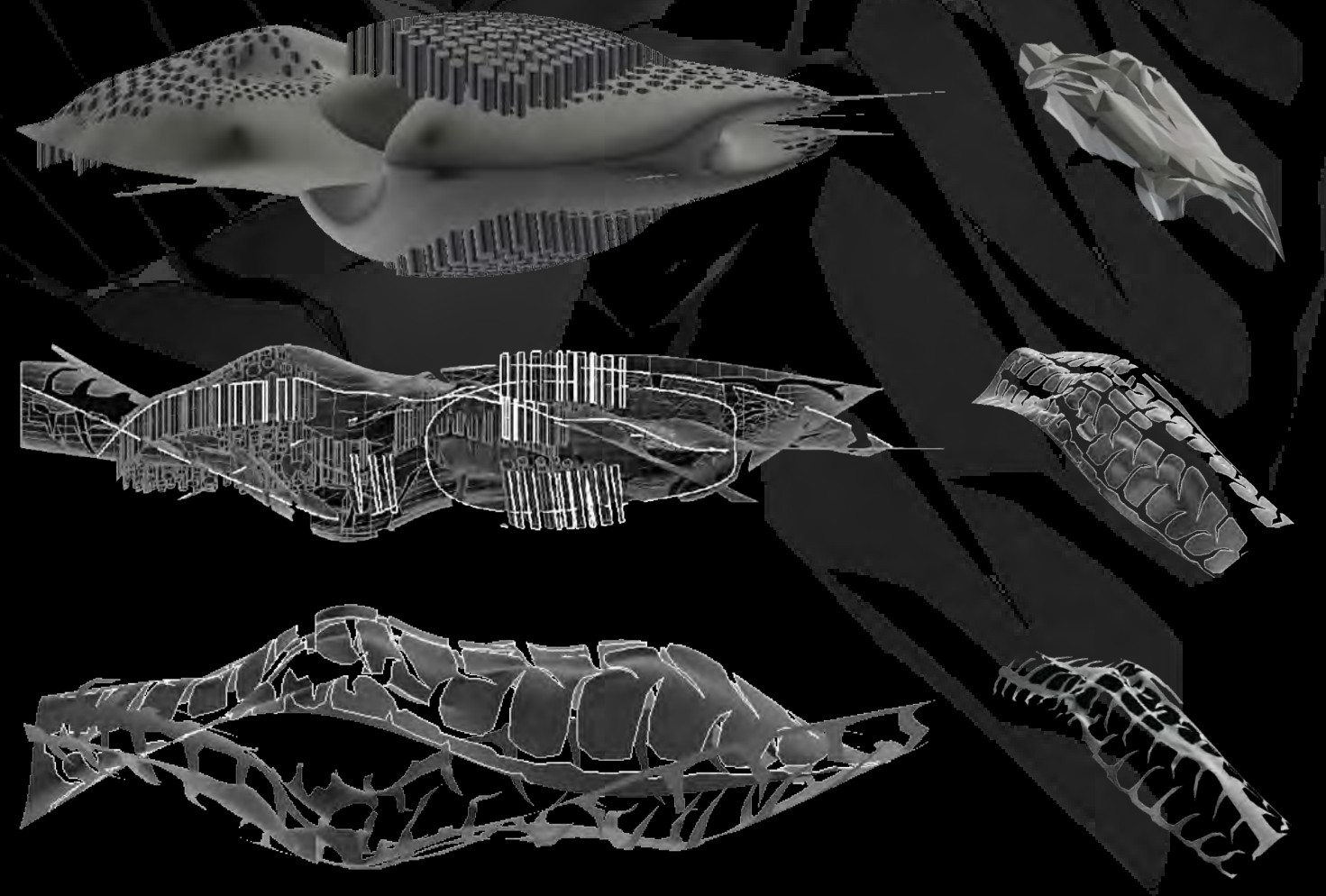


Vertical Section



Skin - Cell - Spine [Images above: from Ernst Haeckel's "Art Forms In Nature"]

Seeking inspiration from living organisms the form begins to grow and take on the entirety of the site. Sprawling both horizontally and vertically, the porous skin allows for the programs to intermingle with each other, creating a discourse among disciplines while the skeletal structure drapes and formulates the overall expanse of the project.



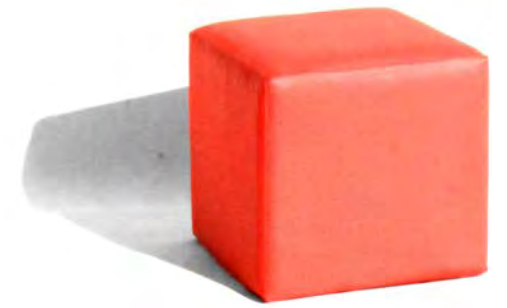
ShowRoom

Studio 400 Bookshow - Prof. Karen Lange - 2016

Showroom was a gallery installation produced by 18 architecture thesis students. The installation served to present each of our books, comprising research from fall academic quarter.

Our purpose was to create an implied space of sameness within vast darkness.

This space consisted of an array of unconventionally placed furniture, 18 tall 'pedestals' on top of which each book rested, and 'the cloud'. In order to grab a book, visitors had to crawl, climb, and punch through the cloud. This constant struggle and relaxation, socializing and concentration, allowed for different worlds to be experienced within a 12' x 20' square.





Unda Da Sea

Third Year - Prof. Jeff Ponitz, Mark Cabrinha
& Clare Olsen - Fall 2013

This Inhabitable sensorial space was looking at combining a new texture to a living environment. Through the idea that one would be encapsulated within this piece the goal was to intrigue and protect those within. Leaving those who inhabit it aware of the senses that they are triggering and distort senses of the world around them.

Our team was focused on the essence of the blurred. Meaning that although the fabric surrounding the viewer is translucent, it is also was distorted through the thermoforming of the plastic. Much like the view of a fish through a fish bowl.

This effect combined with that of the soft glow of light emitted from above leaves one with a new look on the space they occupy as well as that of the exterior world looking in.

Team: Juan Robledo, Mariana Diaz,
Josephine Tetzner, Katarina Richter



Flection

Adaptive Concrete Masonry Assemblies

Sponsored by: The Concrete Masonry Association of California and Nevada

Third Year - Prof. Mark Cabrinha - Spring 2014

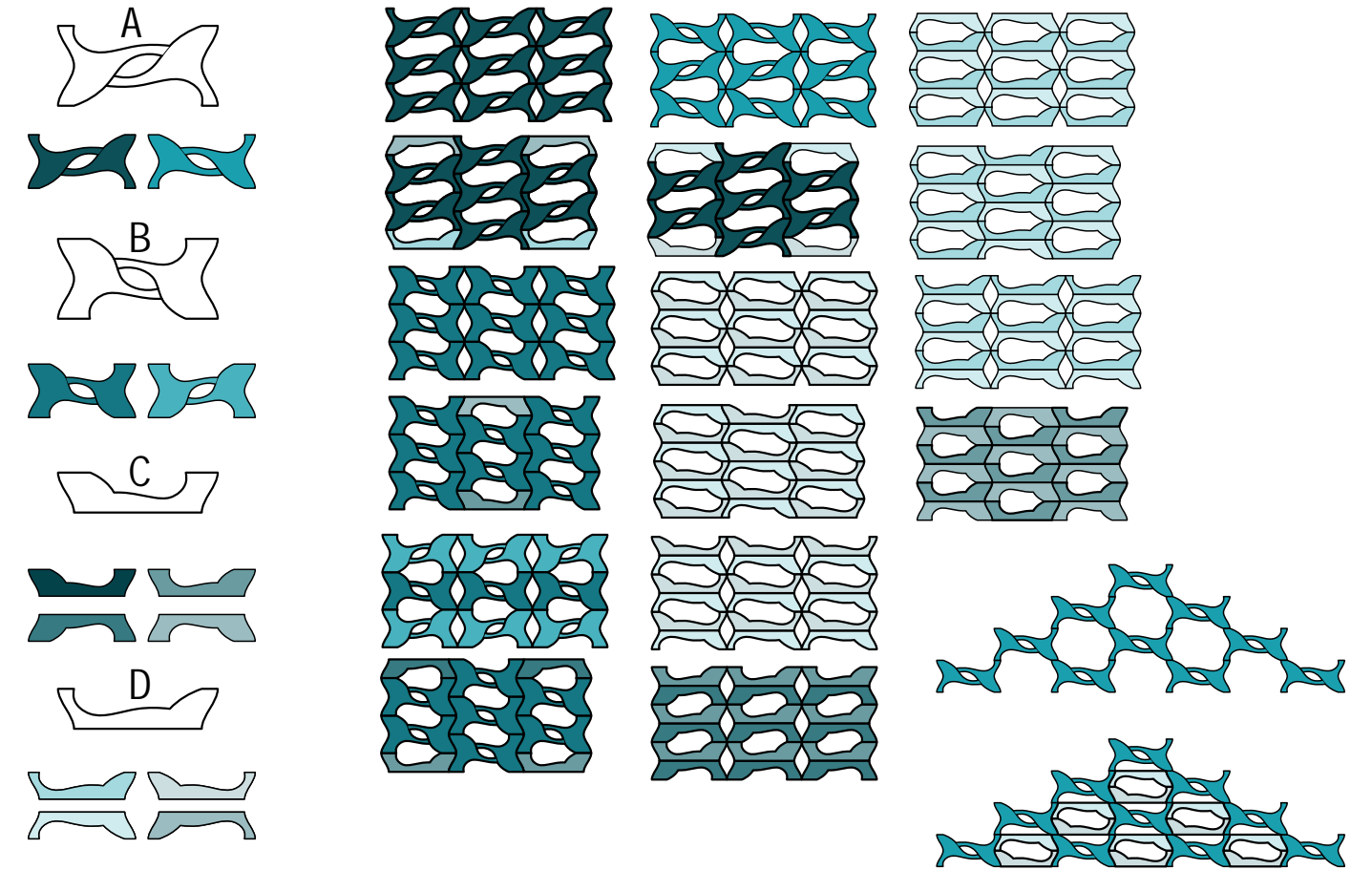
The Material Innovation Lab is an advanced applied design research laboratory that initiates, conceives, and executes full-scale building assemblies through industry and academic partnerships. Enabled through advances in design, fabrication, and environmental analysis, a focus is placed on high-performance assemblies that respond to variable solar and thermal criteria based on climate.

In our team we were particularly interested in the weaving logic of a facade system and how through a simple unit we would be able to achieve a multitude of desired outcomes.

Through our design we emphasized the strength of concrete in the diagonal part of the unit, while also creating an adaptable surface.

Through different assemblies, we achieved an entirely enclosed surface as well as a highly porous wall for light and air to filter through. With a touch of grace and delicacy added to the ascetic of concrete, the image of the CMU block can now begin to be re-envisioned.

Team: Mariana Diaz, Katarina Richter



Unit Types: A, B, C, D

Arrangement Diagrams: Some of the possible continuous configurations for each unit type



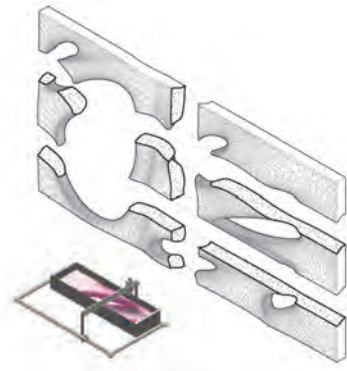
SurfSIP

Fifth Year - Prof. Jeff Ponitz - Fall 2015

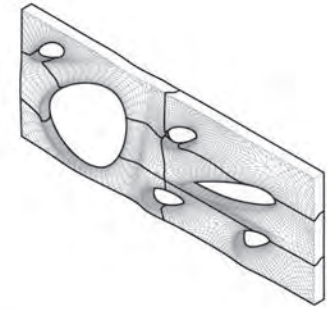
SurfSIP investigates the surfboard making process as it could pertain to the design and fabrication of a Structurally Insulated Panel (SIP).

The surf board fabrication process lends itself to particular manufacturing: surface intricacy, customization, and structural integrity. Unlike many other fabrication processes, the surfSIP does not require a form-making mold to be constructed. The size of a panel is limited to the dimensions of a standard EPS foam block - which come in a max of 4' X 16' X 3'. These stocks of foam are then CNC milled, and structural adhered together to create the entire SIP. The subsequent application of fiberglass and resin hide the joints for a seamless aesthetic to provide three standard glazing units that can be reconfigured in a myriad possible variations. The dimensions of these glazing units can be customized to the desired amount of light and view. The potential to arrange these glazing units sets the stage for client customization in which the user can design their own surfSIP wall, and roof while maintaining a streamline fabrication process.

Team: Mariana Diaz, Kevin Geraghty, Marcus Hernandez, Katarina Richter



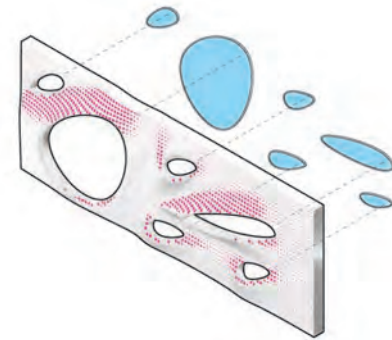
CNC EPS foam blocks into blanks
Flip mill six 4' x 6' x 2' foam blocks



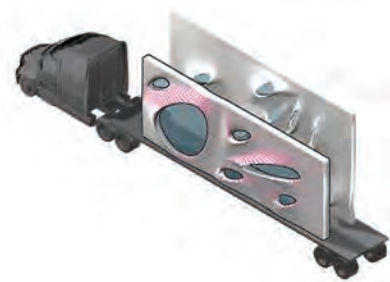
Assemble blanks
Assemble the foam blanks using structural adhesive into the full panel



Apply glassing, resin and graphics
After applying a first coat of fiberglass and resin the panel is sanded and applied graphics. A final gross coat seals and finishes the panel



Insert glazing system
Windows get attached from the interior

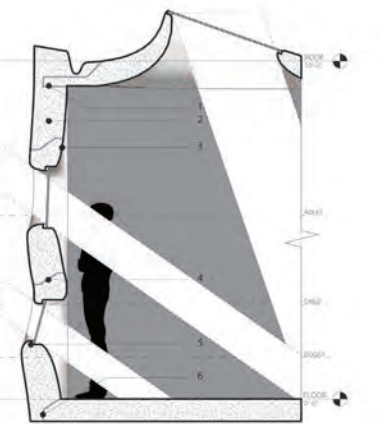
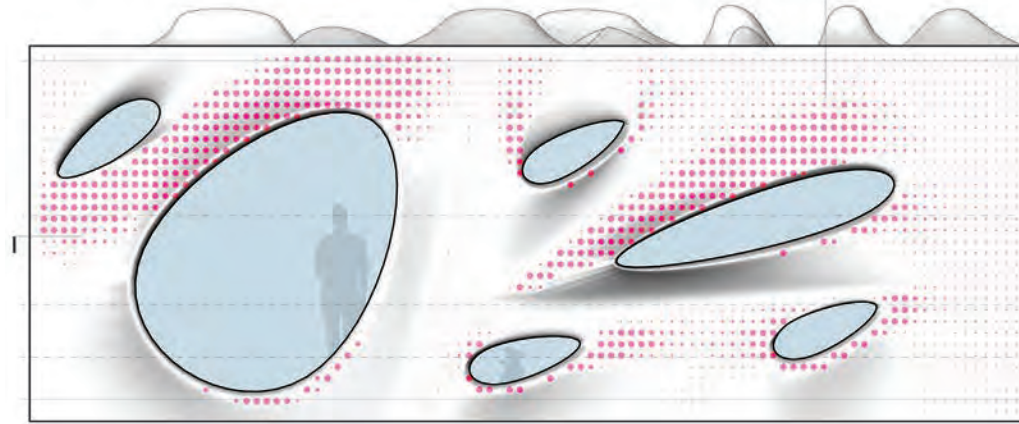


Transport To Site
Super SIP wall and roof sized to fit a 30' flatbed truck.



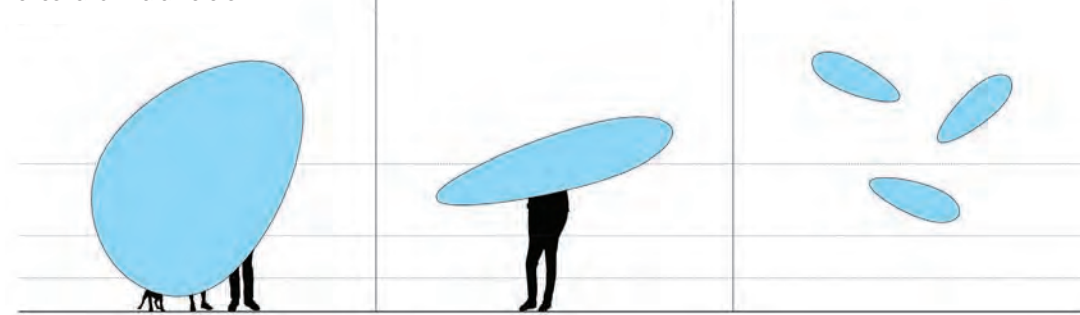
LEGEND
 SIP ROOF TO SIP PANEL ATTACHMENT
 EPS FOAM
 TRIP LAYER
 BLOCK JOINT
 WINDOW ATTACHMENT
 FLOOR TO SIP PANEL ATTACHMENT

SCALE: 1" = 1'-0"

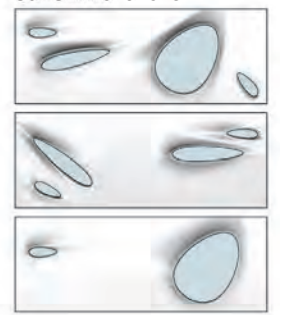


Half Scale Mockup

Fenestration Parameters



SurfSIP Variations



L'Hérisson

Vellum Entry, Fall 2014

3D printed PLA - Wood Veneer - Edison Lightbulb

L'hérisson lamp begins an investigation into the element of texturing through the use of digital tools. The piece, being primarily 3D printed, starts an ongoing interest in the effect certain surface treatments have on the viewer, evoking different emotions. When observing this lamp one often finds themselves either provoked by disgust or fascination. It is the power of influencing the senses through optical tactility that enables a provoking response to an object, such as a lamp.



Couple Parfait

Winner of the Peoples choice Award - Cal Poly

Vellum Entry, Fall 2013

Cherry Wood, Galvanized Steel, Edison Lightbulb

This piece made perfectly for two, holds place for two white wine glasses, two red wine glasses, and two champagne glasses. These are accompanied by three personalized bottle holders; for white wine, red wine and champagne. Soft light glows from the core while small carved indents in the wood cradle wine accessories. With its rugged and refined touch this piece accompanies every glass perfectly, just as the wine completes the piece itself.



Trois Liaisons

Vellum Entry, Fall 2012

Cypress Wood, Galvanized Steel, Edison Lightbulb

1] Communication between different elements of an organization through a common plane.

2] Link/ contact established between different materials for the communication of an order or idea .

3] A romantic affair.

Small side table with a height of 2'. Made of 3 fundamental materials: Cypress wood, galvanized steel and a Thomas Edison carbon filament light. Shows the contrast between man-made and nature while exploring the various levels of interaction that the steel and wood create through their connection.

One piece of steel attaches under the table, one meets flush with its surface and another penetrates the piece and rises above it.



"When the body is contained within low pressure, the senses are deliberately isolated, shifting the biology of the body. This is having a cellular affect on the circulation of the body. When a vacuum is applied to the skin it automatically sends fresh oxygen to the blood cells, draining wast from the nephrotic system.
It is a sensation of being hugged by a machine." [Lucy Mcrae]

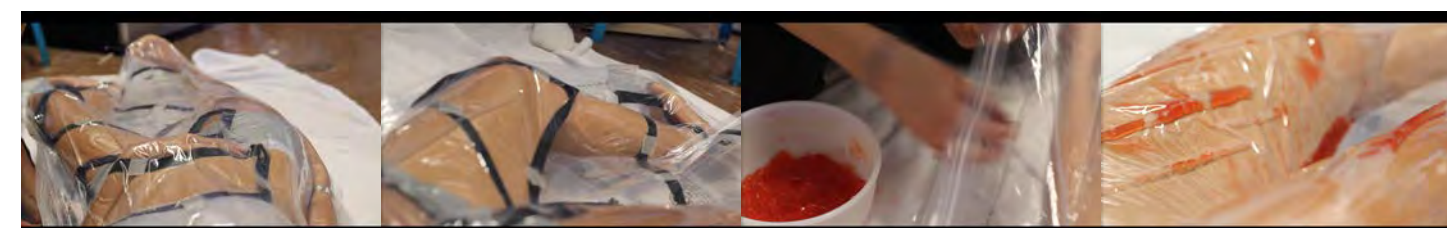
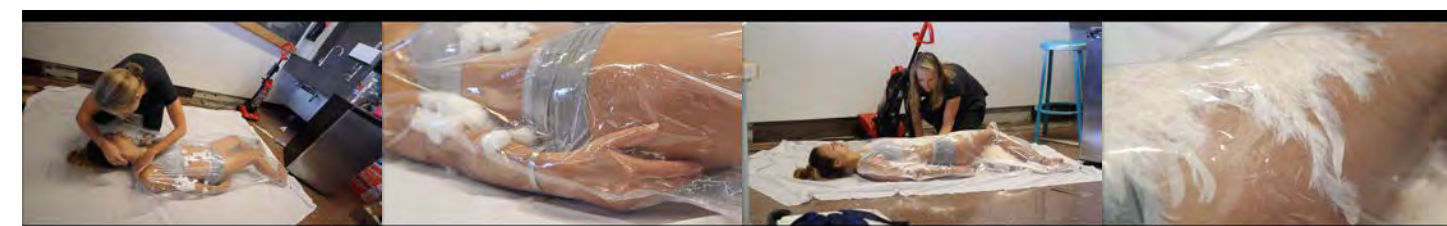
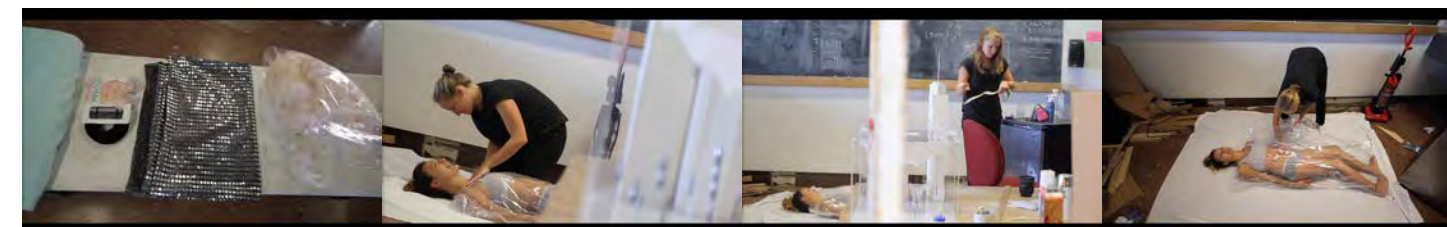


Enveloped - <https://vimeo.com/147211906> Personal Research Experiment - Fall 2015

This experiment explores how one could alter the senses through the form of a second skin. With the use of a vacuum pressure plastic bag and a variety of textured materials, the model was captured within this second skin and the material, making her vulnerable to the experience. During each material placement, her comfort level and heart rate were recorded to study which stimuli she responded to the most and why. This process not only illustrated whether the common judgments of what is conformable and what is not is true, but also arose questions on where these misconceptions might come from. Do these ideas of what is scary and what is comforting arise from our perceived environment or are they innate responses? These questions begin a conversation of how environment, experience, and psychology can be combined in order to elicit a prescribed response in an individual. Perhaps, by accessing a person's vulnerability one can enable more genuine responses and affect their cognitive perception of their environment.

Textures tested:

Polyester fiber cotton balls - Feathers - Velvety silk material - Sequin material - Magnets - Velcro - Strawberry Jello



Cube

Personal Research Experiment - Fall 2015

Through the CUBE one will begin to be faced with the concept of the phobia, the fear, or the unsettling. This experiment seeks to investigate what happens if those fears commence to be part of your constant surrounding. What if you have no ability to wake up or run away? **What if you simply need to face them?**

Through a mirror which embeds many common fears, often forgotten or ignored, people are forcefully confronted with these issues while interacting with this piece. While reading the stories engraved into the translucent acrylic people start to slowly identify what is hidden behind the first layer and begin to see their own reflection staring back at them through the lens of a potential fear.



MickeyTec

Hackaton curated by Jose Sanchez, during **Acadia 2014**: Design Agency, University of South-California (USC), Los Angeles.

Personal Role: Finding original Disney characters and through the software creating new iterations of them (bottom images) These were then put all together with the team to create overall complex objects made up of simple familiar figures.

These series of computer generated drawings are entirely composed of 3D-Models of disney characters such as Mickey and Donald duck. Through the use of Processing and a script developed by architects Knut Brunier, Benjamin Dillenburger, Gilles Retsin and Manuel Jimenez-Garcia these objects get sequentially mirrored, rotated and intersected over many iterations, while maintaining a 3D printable geometry. As an additive process, the generated form is a collage that retains small details from the original, yet it is a unique spatial composition.

Team: Knut Brunier, Benjamin Dillenburger, Gilles Retsin, Manuel Jimenez-Garcia with Burcin Nalinci, Curime Batliner, Emmanuel Osorno and Katarina Richter.





Green tea, 3 Week fermentation, Integrated shredded corn husks

Bio-Film

Personal Research Experiment - 2017, 2018, and Ongoing

This experiment was inspired by an interest in using bacteria to grow fabric. From biology to architecture this new bio cellulose has taken the field by storm showing to have boundless potential. With the primary interest of learning how this substance grows and can be combined with other materials we set out on a long process of experimentation.

First we evaluated how changing the ingredients of the culture altered the outcome. For instance, using green tea rather than black tea as a base for the culture. The second round of variables introduced were in the process of drying the cellulose, whether that be hanging it outside on a clothing line or lying it on a piece of wood to dry inside. Lastly, we begun the most unpredictable and exciting part of the experiment: seeing how the cellulose would react to different materials and levels of manipulation. These processes varied from letting the cellulose grown around and within a piece of synthetic lace to combining the cellulose with other natural elements such as corn husks and fibers. All trials produced very unexpected results, ranging from disastrous to fascinating, but mostly with a lot more knowledge and potential for further pursuits.

Team: Emmanuel Osorno, Katarina Richter



1) Green tea, 2 Week fermentation, Dried on two varied pieces of wood



2) Black tea, 2 Week fermentation, Integrated Corn fibers, Dried hanging



3) Black tea, 3 Week fermentation, Dried on smooth plastic



4) Black tea, 4 Week fermentation, Dried two on top of each other



5) Close up of Image 4: Two pieces of culture combined with metal mesh integrated in the middle. Culture fuses together when still wet and in contact.



6) Green Tea culture grown with synthetic lace. Culture grew within the gaps of the lace creating an overall film throughout the fabric.



Process images of each stage of the cellulose: fermentation with mother culture - extract top film of cellulose and wash - place on surface or hang for drying (we altered this process when starting to insert different materials and substances into the fermentation and drying process)



3D printed pattern imposed on dry malleable cellulose

Bio-Synthetic

Personal Research Experiment - 2017, 2018, and Ongoing

Following months of experimenting this new bio-cellulose material, I decided to explore how it can connect to the body and mold itself to a particular form. After failed attempts to embed structure into the cellulose while it was still growing, I realized that it would be best to sandwich the rigid framework within two pieces of cellulose and allow them to merge together, completely enveloping the structure. This was the method used in my first formal experiment (1,3). To further this idea, after drying the cellulose, I wanted to see how the fabric could be altered if another material application was used such as 3D printing. This is where I looked at using a 3D pen to add rigidity to the otherwise flexible fabric and with the mannequin as the mold construct a formal constrain to the fabric (2). I see this having a lot of potential in how bio transformable fabric, and the frame work used, could become directly responsive to the body or environment it surrounds.



1) Experiment 01 - Metal Wire + BioCellulose



2) Experiment 02 - Imposed pattern and stiffness after drying

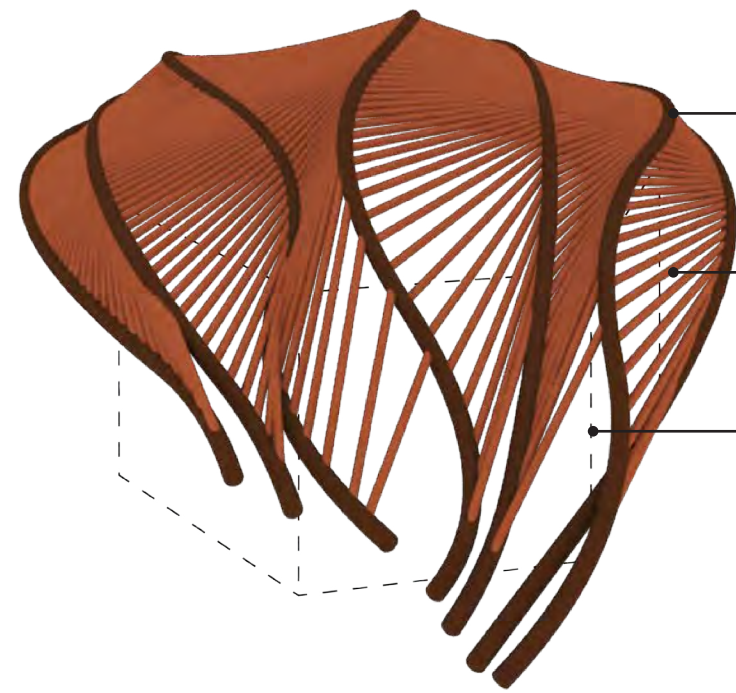


3) Experiment 01 - Embedded structure before drying

The Nest

Personal Research Experiment - Santa Barbara, CA - Expected Completion Dec 2018

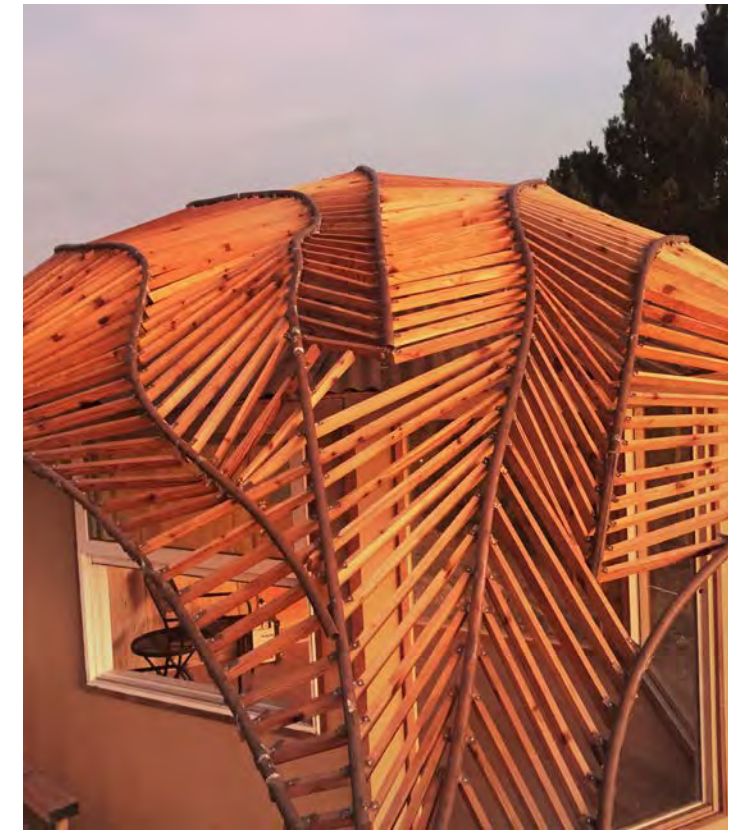
This small art studio for my mother was an opportunity for me to jump to a slightly larger scale in my fabrication investigations. Starting off with a very straight forward hexagonal floor plate my mother was looking for something sculptural and organic that would blend into the hill side. I took the idea of the spline to stretch seven elongated copper pipes overtop of the hexagonal shape which creates a new sculptural language for the studio. This guides the eye through the movement of each piece out to the hillside. The wood members connecting the pipes together serve both as added rigidity to the structure but also as its complexity. These ribs gradient over the piece providing more solidity at the center and slowly open up as they get closer to the natural surrounding.



1" Dia. Copper Pipes
Heated and rolled to achieve curvature.

1"x2" Cedar Wood planks
Attached to small welded clips connected to the copper pipes.

Hexagonal Studio Space
Studio space of 115 sf with 4 sides of full glazing sites underneath the sculptural roof.



Future Cities Lab

With Partners : Nataly Gattegno & Jason Kelly Johnson
San Francisco - June - September 2014



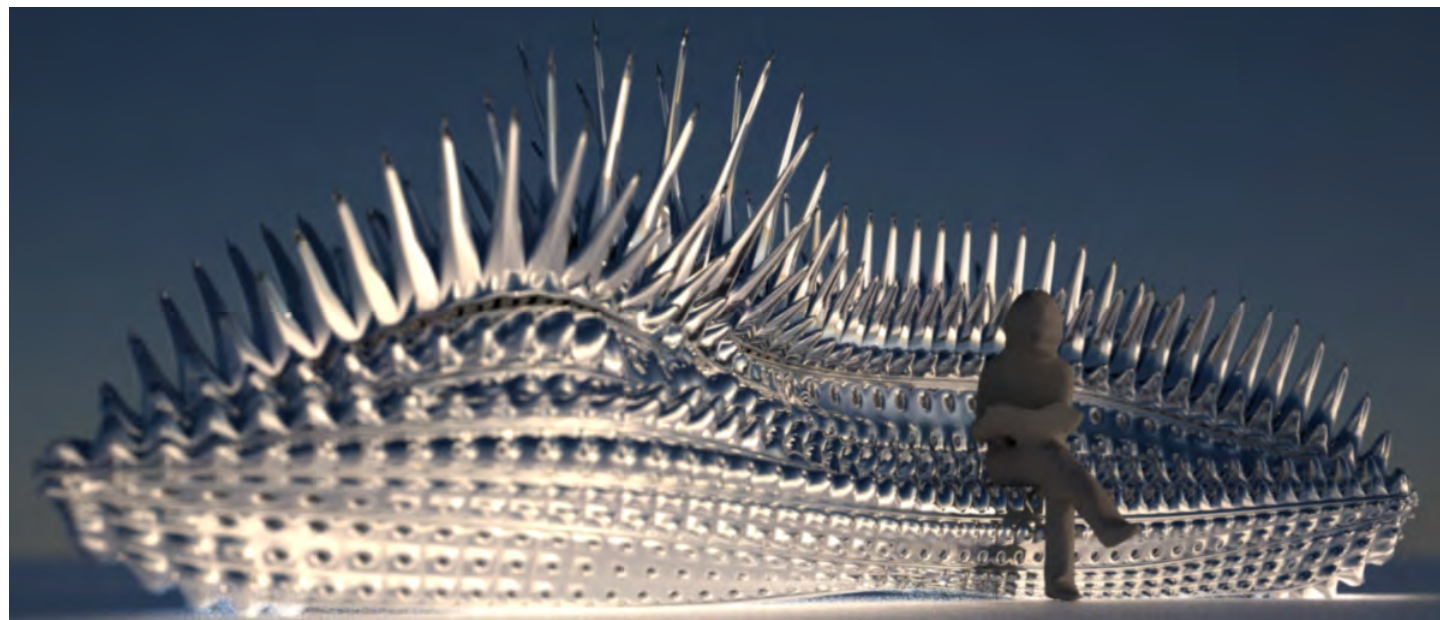
LIGHTSWARM - *Team Member*
Primary Role: Robotic programming, computational scripting, construction, installation and assembly

Lightswarm is an interactive light installation in a state of perpetual flux. Responding to sounds harvested from the YBCA grand lobby and the surrounding city, the site-specific artwork activates the south facing façade with playful swarms of light. During the day the filtered sunlight produces ever-changing patterns of shadows, while in the evening the façade is transformed in a dynamic electro-luminescent composition visible from the interior lobby, the garden and the city beyond. <http://www.future-cities-lab.net/projects/#/lightswarm/>



PARALUX bench - 2014 3D printer World Expo - *Designer*
Primary Role: Design, computational scripting, and 3D printing

The Parallax Bench is an experimental prototype for a full-scale 3D printed responsive bench. Each module of the bench is printed using multiple materials ranging from soft to hard, opaque to translucent. Thousands of pressure sensors and LEDs are woven into the modules allowing it to respond in real-time to people sitting and standing within its proximity. Small 3D printed prototype exhibited at the 3D Printer World Expo. <http://www.future-cities-lab.net/news/2014/8/18/parallax-bench-exhibited-at-3d-printer-world-expo>



IwamotoScott

With Partners: Lisa Iwamoto & Craig Scott
San Francisco - September - December 2014

REDPOINT, San Francisco - *Project Designer*
Primary Role: Interior design, concept development, cost and feasibility, parametric modeling, document production, planning and zoning, material research, engineering systems

Satellite workspace for the silicon valley based venture capital firm located in a 4'200 sf raw brick and timber space fronting South Park. Four main design elements anchor the new space and act as a complimentary set of custom fabricated components in dialogue with each other - these include:

- 35' long Douglas fir work desk supported by steel lattice frame cantilevered from two of the existing timber columns.
- Freestanding work bar in front of an existing brick arch niche and counter-weighted door.
- Catenary ceiling sculpture overhanging work table using climbing rope.

<https://iwamotoscott.com/projects/redpoint-ventures>



Freelandbuck

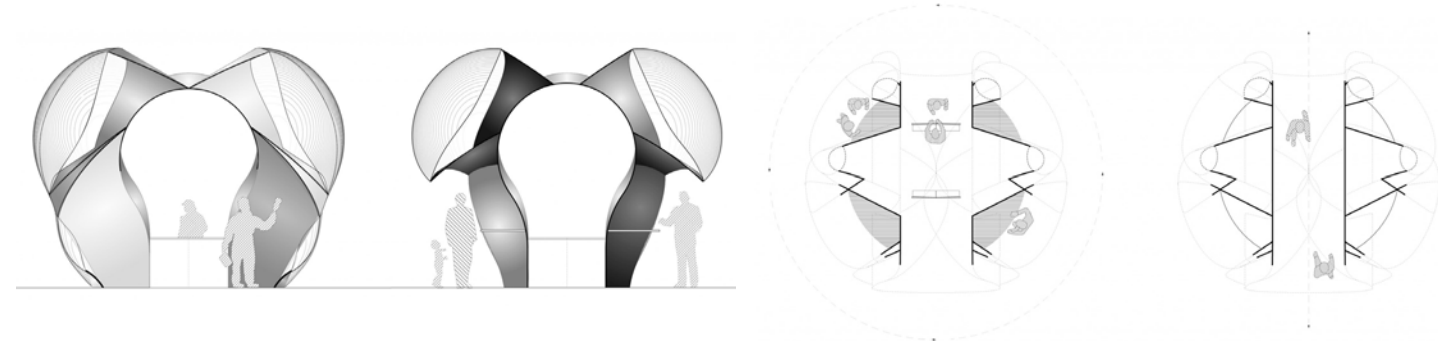
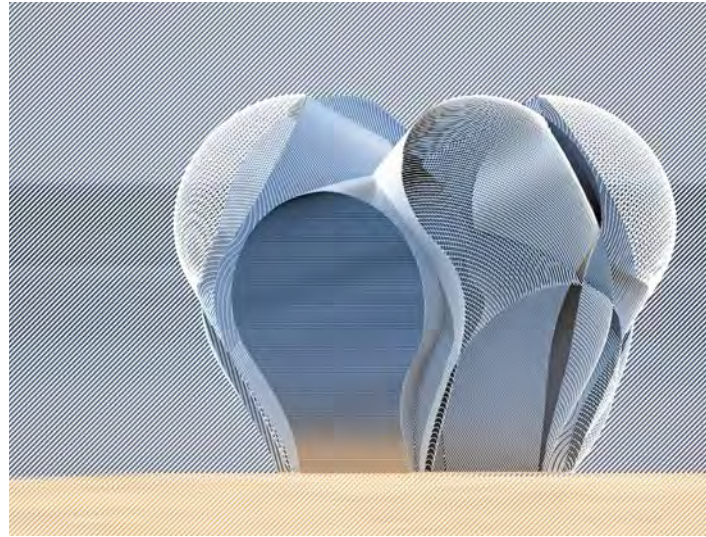
With Partners: David Freeland & Brennan Buck
Los Angeles - January - June 2015

Lakefront Kiosk Competition, Chicago 2015

Primary Role: design, material research, model construction, competition entry

Beacon, a proposed Lakefront Kiosk in Chicago, plays on the distinct iconography of Lake Michigan's many lighthouses in more mediated, multifaceted form. We reduced the profile of the lighthouse to that of a light bulb – a symbol more than an icon. Suggesting both 2d cliché and a wide array of 3-dimensional visual effects, it is not a neutral original, it has built in familiarity.

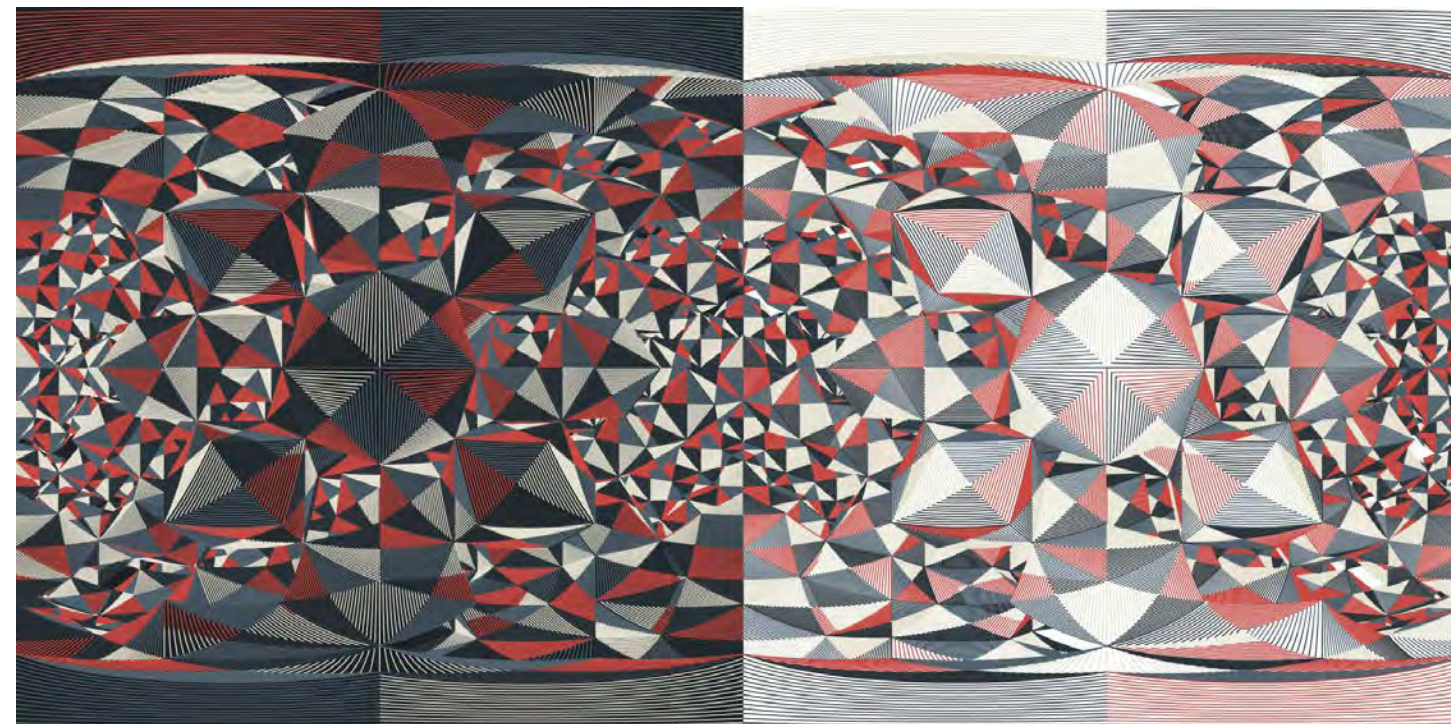
<http://www.freelandbuck.com/projects/lakefront-kiosk/>



Research Drawing Series - Surface Tension Expo, New York Institute of Technology, Nov 2015 - Designer
Primary Role: Design, idea development, computational scripting, drawing production, 3D printing

These 'Objective Perspective' drawings describe complex interior volumes as seen through the 'lens' of discrete objects. The project draws on our interests in drawings with image-like properties, utopian studies of polyhedral geometries and structures from the 1960's, and Piranesian interior volumes with uncertain extent and orientation. Primarily though, these drawings push representation toward a type of metaphor – a way of expanding the definition of the viewing subject and speculating on foreign views of the world.

<http://www.freelandbuck.com/speculations/projections/>



Tighe Architecture

With Principal: Patrick Tighe
Los Angeles - June - September 2015

Woodrow Wilson Residence - Los Angeles - Team Member

Primary Role: Pre-design, schematic and design development of exterior skin system

The new residence is built within a heavily wooded site in the Hollywood Hills. A concrete base is burrowed into the hillside where the heavy foundation is expressed as simple concrete mass. The façade of glass allows for optimal transparency and is protected with a layer of screens that allow for sun protection and privacy. The floating mass is shaped by the constraints of the site and a series of openings that frame specific views.

<https://www.tighearchitecture.com/hollywoodhills>





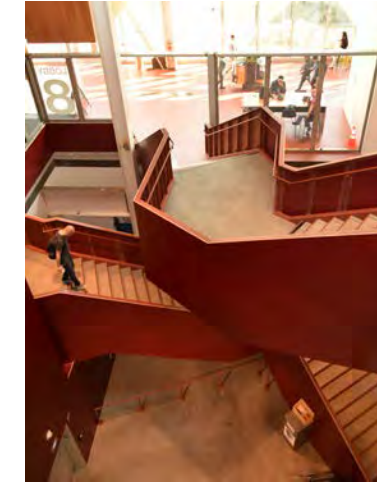
Gehry Partners

With Partners: Frank Gehry & Craig Webb
Los Angeles - July 2016 - May 2017

Facebook 21 - Menlo Park, CA - *Project Interior Designer (DD, CD, CA)*

Primary Role: All scope of interior design coordination; lighting, finishes, spacial design, electric, equipment, code regulation, material selection and interior details.

Expanding the company's existing footprint, this ground up design was built in less than 18 months as a an expansion from the previously finish Gehry Partners MPK 20 building. Formed to bring the outdoors into the office space, the project centers on a sheltered green space with 40-foot-tall redwood trees and an amphitheater-style courtyard. MPK21 was designed to reduce impact on the environment and enhance employee well-being. Inside, an open workspace connects to a single pathway that runs the length of the building and serves as both circutation and open work space.





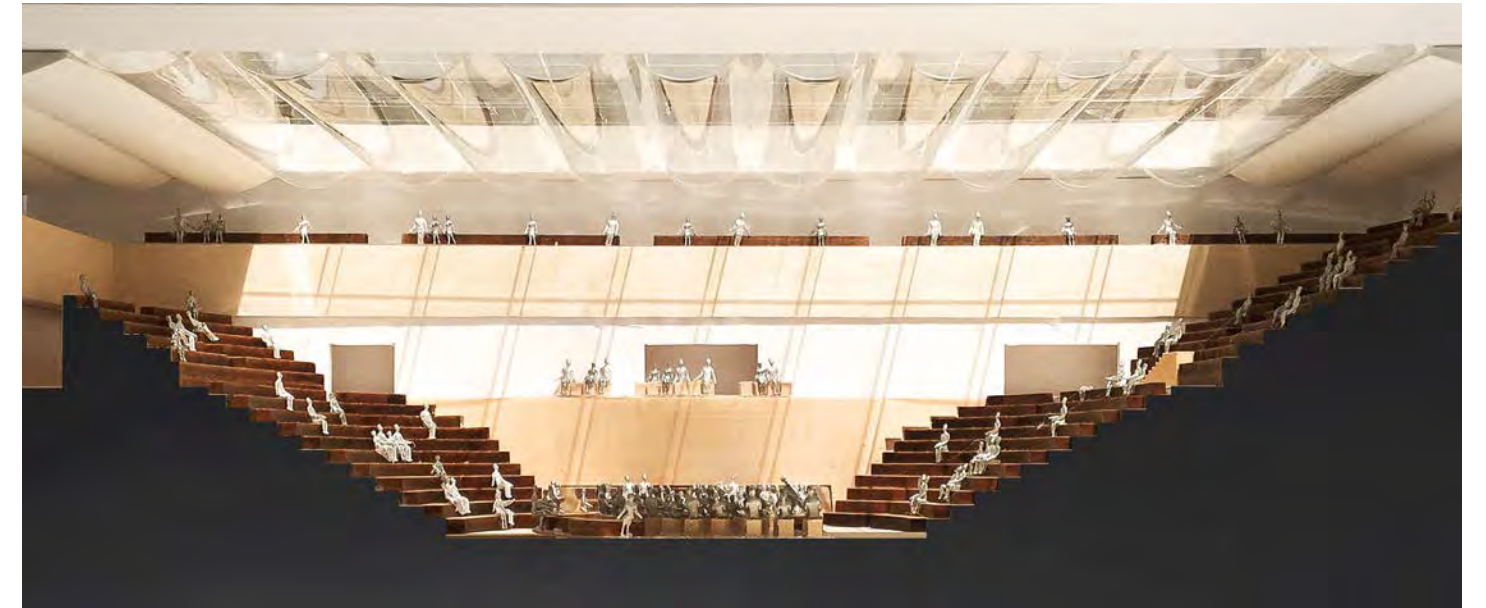
Gehry Partners

With Partners: Frank Gehry & David Nam
 Los Angeles - April 2017 - February 2018

LVMH - Arts, Talents, et Patrimoine - Paris, France - *Designer (SD, DD, CD)*

Primary Role: Design of the roof top restaurant and bar, facade detailing development, concert hall design and coordination

La Maison LVMH / Arts – Talents – Patrimoine is a new multi-disciplinary cultural institution for Paris dedicated to artists and live performances, as well as the applied arts and artisanal craftsmanship. It will open in 2020 following renovation of the former Musée des Arts et Traditions Populaires in the heart of the Bois de Boulogne. It hosts a diversified program of activities and events with two exhibition, concert and performance spaces, as well as artists' workshops, a documentation center and a restaurant with stunning panoramic views at the city. - All Renders property of SORA IMAGES - <http://www.sora-images.com/>





Gehry Partners

With Partners: Frank Gehry & David Nam
Los Angeles - February 2018 - Present

King St Towers - Toronto, Canada - Designer (SD, DD)

Primary Role: building design and development, consultant coordination, residential unit design, core and facade system studies, full building statistics and evaluation.

King St. East and West are two high rise residential towers located downtown Toronto. With the west tower soaring up to 92 stories and the East to 82 stories these two towers will be among the tallest buildings in North America. These towers will be grounded by stepped podiums that will house multi use program and act as a transition from street scale up to the tower. Above the planted terrace at the top of the podium will flow the "waterfall" of the tower slowly creating more and more ripples in its curtain wall as you go up the building. - All Renders property of SORA IMAGES - <http://www.sora-images.com/>

