A SPECULATIVE PORTFOLIO CREATED UNDER THE INSTRUCTION OF TREE, MOUNTAINS AND ARTHROPODS

YUSHUO DING 2024

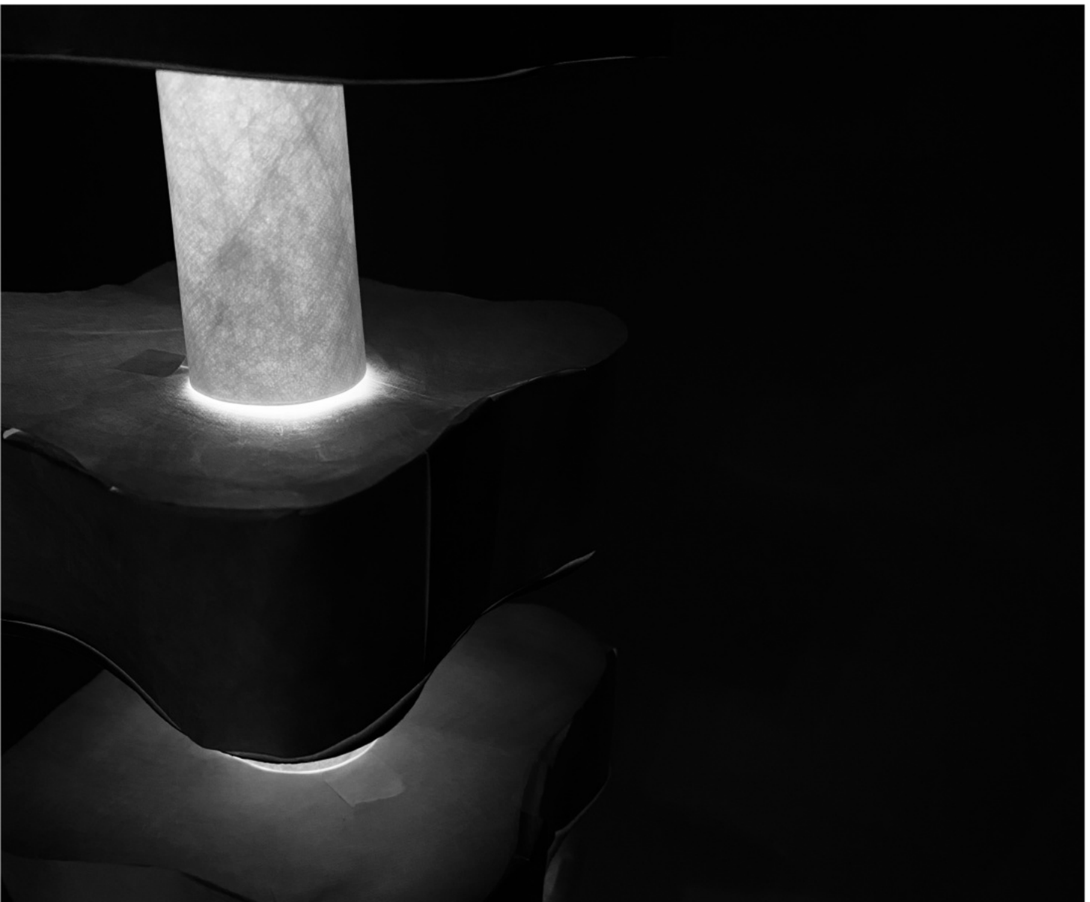
1

CONCRETE JUNGLE

INDEPENDENT PROJECT

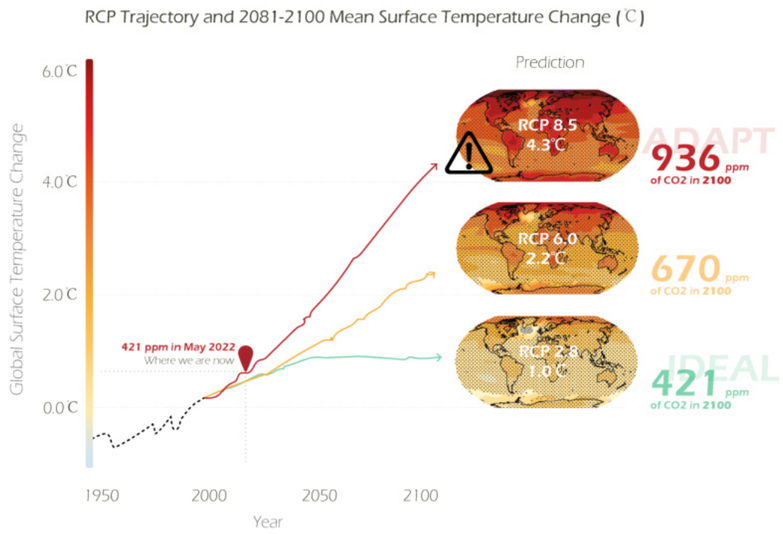
A Bionic Experiment Inspired by Xylem.
A Mistifier of the Urban Zone

Exterior Model Made of Dupont paper



BACKGROUND

Representative Concentration Pathway (RCP)



+1.4 celcius

The most ideal situation. If we could cut down CO2 emission in recent years to almost 0 then it's achievable

Ave.Temp: 14.9℃

+2.8 celcius

A temperature change above 2 celcius is alarming enough for most species but RCP 6.0 is less stressful to cope with

Ave. Temp: 16.3℃

+4.3 celcius

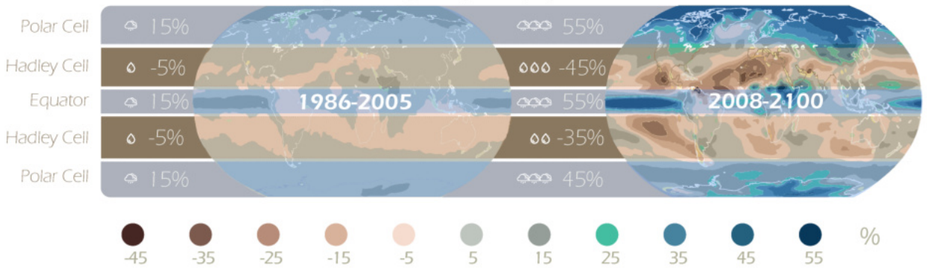
Likely where we are heading to if business-as-usual. RCP 8.5 requires great adaptation to the insufferable weathers

Ave. Temp: 17.8℃

PRECIPITATION

Deserts will experience increased aridity, high precipitation regions will face heightened flooding, and the temperature differentials between cold and warm areas will diminish.

1986-2005 & 2008-2100 Change in Average Precipitation (%)



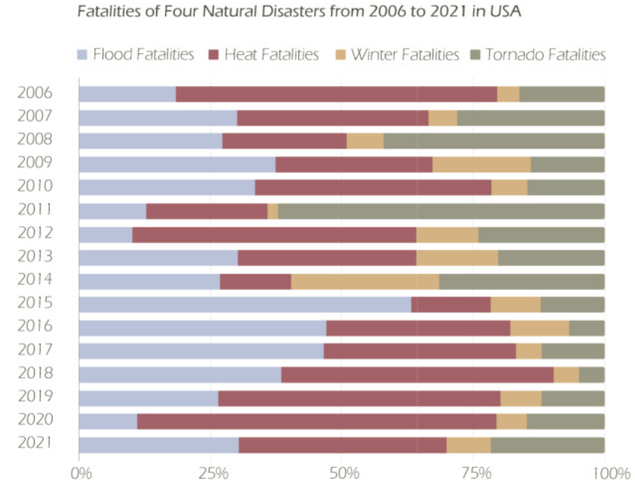
CLIMATE CHANGE'S THREATS ON ANTHROPOGENIC ACTIVITIES

- *Global decrease of low-latitude fisheries yields with a global trend to catches having smaller fishes*
- *Reduced growth and survival of commerically valuable shellfish and other calcifiers e.g. corals, calcareous red algae*
- *A general decrease on average crop yields and increases in yield variability*
- *Marine and terrestrial biodiversity loss*
- *Urban risks associated with water supply systems*
- *Urban risks associated with energy systems*
- *Urban risks associated with housing and displacement*
- *Declining work productivity, increasing mortality from exposure to heat waves. Particularly at risk are agricultural and construction workers, homeless people, children and women who have to walk long hours to collect water (AR5 IPCC)*

June 2022

Abnormal phenomenon and extreme weather become more imminent and frequent. We might not be able to alter them any time soon but still have time to adapt.

All these data points to POLARIZATION of climate behavior.



65%

Within these four common type of fatalities, the sum of Heat and Flood mortalities exceeds 65% of the overall fatalities for 13 years out of 16 years

URBAN HEAT ISLAND IN SAN DIEGO-TIJUANA REGION

Urban Heat Island is defined as cities being warmer than the surrounding rural areas.

Utilizing regional temperature data from Climate Central and NASA, the map reveals that the Otay Mesa zone near the San Diego-Tijuana border exhibits high aridity and susceptibility to heat.

CASESTUDY

ADAPTATION OF TRADITIONAL ARCHITECTURE IN THE WARM REGION

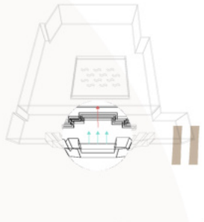
Step 1.2 Small Window but Big Ratio

Step 1.3 Smaller cross section -> faster speed -> stronger breeze

Step 1. **Wind Generator**

Step 2. **Pushes Out the Heat**

Step 3. **Vapor Cooling and Air**



INDIA
Hawa Mahal

VENTURI EFFECT

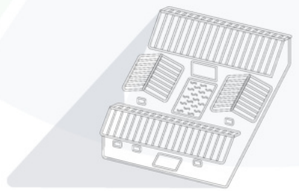
THAILAND
Ruean Thai

CHINA
Heyuan

Step 1. **Breeze between the Stilts (also as a Heat Insulator)**

Step 2. **Cool Wind Seeps Through the Wooden Floor**

Step 3. **Heat Escapes Pointy Roof Through the Special Material**



3 principles: Faster speed creates lower perssure; pressure flows from high to low; hotter air has lower density.

Air inside the room is still, thus higher pressure. It flows out of the room toward the wind above the central pool and rises.

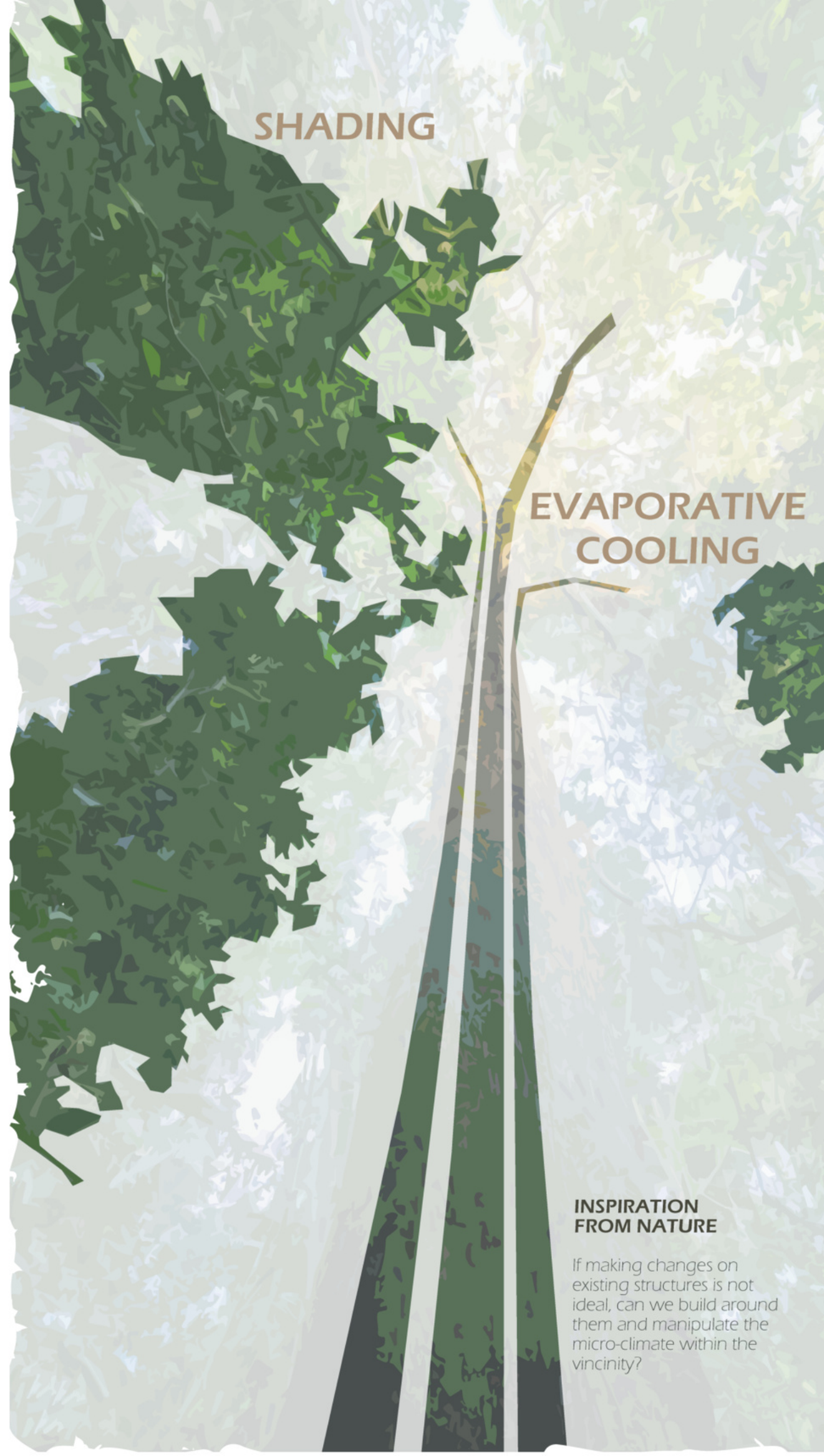
Step 1. **Breeze In**

Step 2. **Bring Out the Heat**

Step 3. **Cool Air Spreads Out**

A commonality shared by these traditional buildings is Venturi Effect, where wind speed increases with a narrowing cross-sectional area. Applying this principle to modern architecture can harness wind, cutting air-conditioning energy. Yet, optimal cooling involves vapor and robust air circulation. The project's aim is to reshape the micro-climate nearby. Unlike interior-focused circulation in the case study, this endeavor targets reducing external heat.

Inspired by the vegetation-Urban Heat Island correlation (Portland State Uni), the project aims to counter this by providing shade and promoting evapotranspiration. If successful, it could positively influence the microclimate, mitigating the Urban Heat Island's impact on vulnerable communities. To push the speculative one step further, if successfully design a promising material and appropriate planning, maybe recreational spaces or houses can be built using this system?



INSPIRATION FROM NATURE

If making changes on existing structures is not ideal, can we build around them and manipulate the micro-climate within the vincinity?

Guard cells of stomata swell and open up

Water effuses from the leaf as the air's potential gradient diminishes.

The advancing transpiration front draws water up, continues the cycle

As water transpires from leaves, xylem in the stem passively transporting water up from roots. where more water enters from higher potential gradient

At a molecular level, water molecules moves up the vessels with the help of capillary action

The red arrows are adhesive force between H2O and the wall while the white arrows are cohesive force between H2O molecules

water transpires through the stomata, thus drawing the rest of the water up from the root

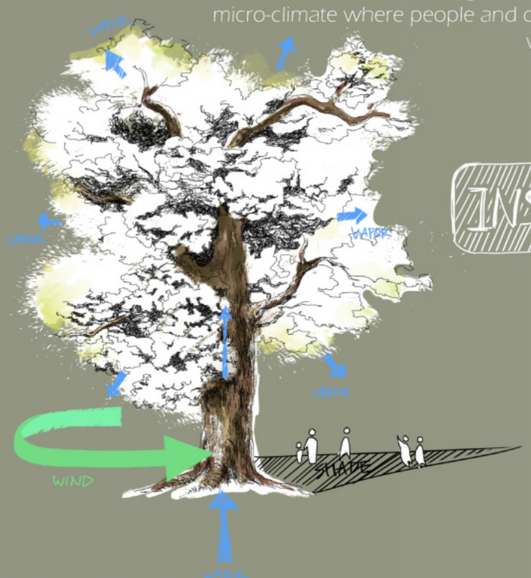
Osmosis also helps with permeating water from a higher concentration area to a lower concentration area through the root hairs, supplying the water to transpire

A SPECULATION...

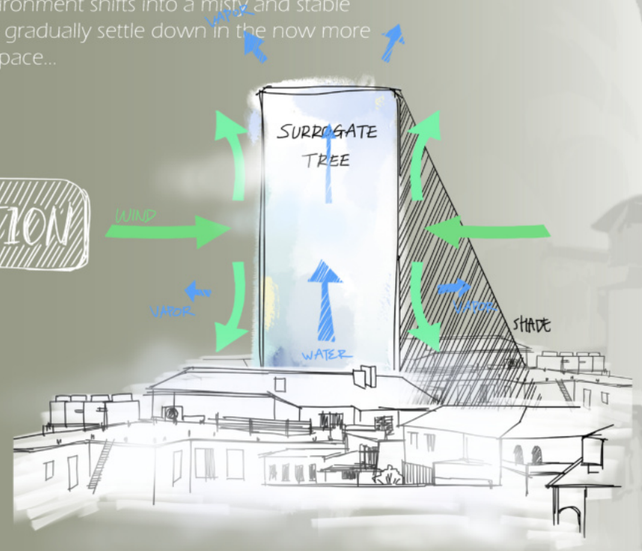
A Strange and Crude Visualization

WHAT IF...

Amidst a deserted barren zone, a cluster of gigantic plants start to grow in this inhabitable region. They transpire water and coupled with downdraught effect to disperse the vapors to the surrounding vincinity. The environment shifts into a misty and stable micro-climate where people and other species gradually settle down in the now more welcoming space...



INSPIRATION



MOODBOARD

STRUCTURAL

PHYLLOTAXIS

INCREASE LIGHTING THROUT THE DAY

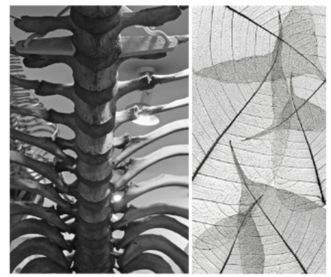
The exterior draws inspiration from the Fibonacci order observed in leaves, a strategic arrangement that plants employ to capture more light for photo-synthesis.

CONNOTATION

Mist softens the contour and blend in with the landscape

the biopunk sensation of the building comes from the iterative pattern that is often found in nature. As time passes, hopefully some species will form a symbiotic relationship with the building to grow on it and enhances this organic connotation.

FUNCTIONAL



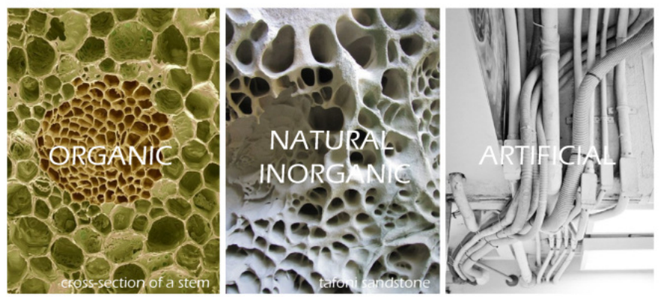
The similarity between the spine & STEM

A not-so-direct biomimicry of the veins and spines in both function and aesthet-ics

similar to a transportation of cerebrospi-nal fluid in the spine, or passive transpor-tation of water in the leaf veins, the essential function of the tower is to disperse water to every pore of the building then evaporate

MATERIAL

Material is the essence of biomimicry, after the water being pulled up in the centural pipes, the porous material disperses the water to each floor and eventually into the air by capillary actions and pressure gradient difference



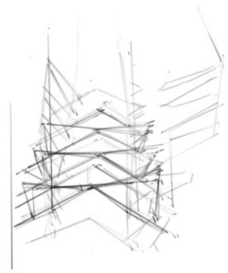
INSPIRATION OF THE EXTERIOR

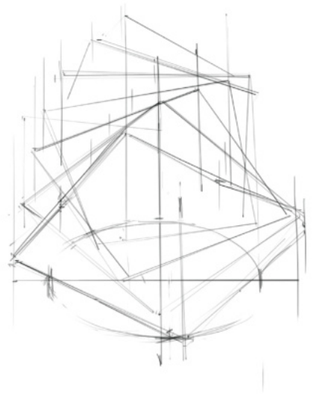
A WHALE FALL

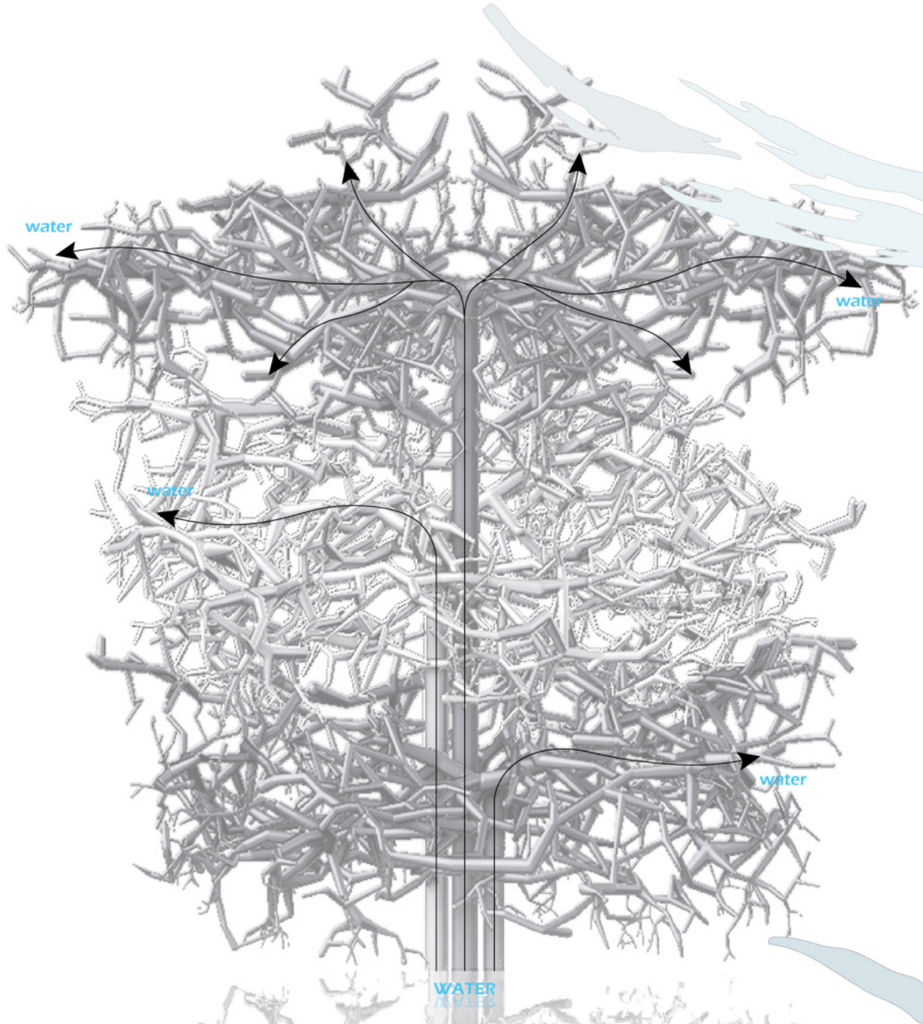
The death of a whale
fosters a garden
of lives
in the abyssal zone

A TCRE GROWS

I hope the creation of Tcres
transforms into
pillars of gardens
in the barran field







INTERNAL PIPES STRUCTURE/XYLEM

A concept sculpture of the waterways within the tower. **Arrows is a rough representation of how water might travel**. The main pipes are at the heart of the tower and disperse water through porous material of each floor.

DOWNDRAFT AND UPDRAFT

Though a headache to many architects, I want to utilize the wind effects caused by tall buildings to disperse vapors faster, thus more effectively reduce apparent temperature. The spiral exterior intensifies the upward and downward flow of winds.

CONCEPT RENDER front

Modeled with Zbrush and Rhino3D rendered in photoshop

Cake Cut Concept Render Rhino3D and Photoshop

Primary Succession

1st Year

Lichen/Pioneer Species

5th Year

Intermediate Species

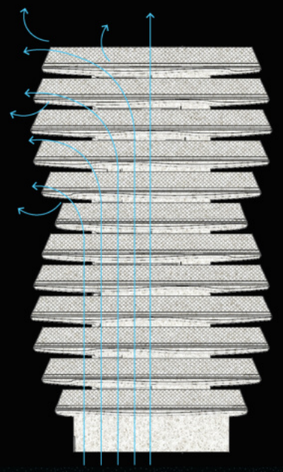
10th Year

Time As A Measurement

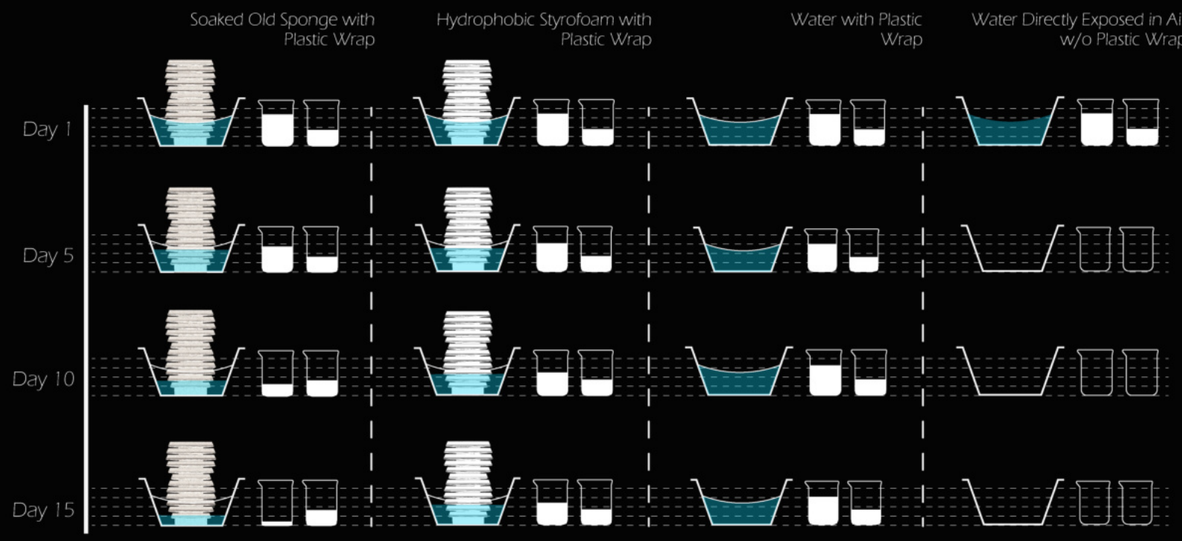
The exterior glass will be replaced by metal grid fence to avoid bird collision and to host native species that can form a symbiosic relationship with the building like Desert Wild Grape, Chaparral Clematis or Virgin's Bower

EXPERIMENT

REGARDING THE MATERIAL



WATER RESERVOIR

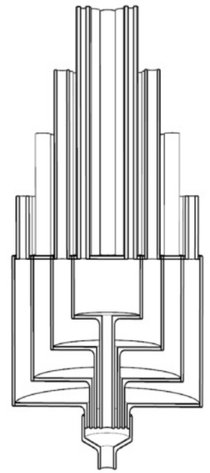


Testing Capillary Action on Scaled Down Models Made Of Different Materials

Volume Change of Three Basins of 750mL Water in late August to mid September (Average Temp of 39 degree Celsius Under the Sun at Noon)

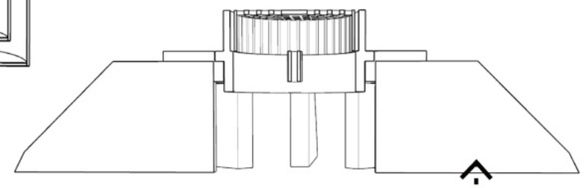
In conclusion, Water in the basin containing old sponge evaporate faster then the one with hydrophobic styrofoam with plastic wrap and the control group, but it's much slower than water evaporates directly under the sun. The result of the experiment isn't ideal and has many flaws such as the plastic wrap in the comparison groups aren't completely sealed off, so presumably the evaporation in both groups would be slower than the current outcome. To archieve the best result requires further exploration of materials with better capillarity.

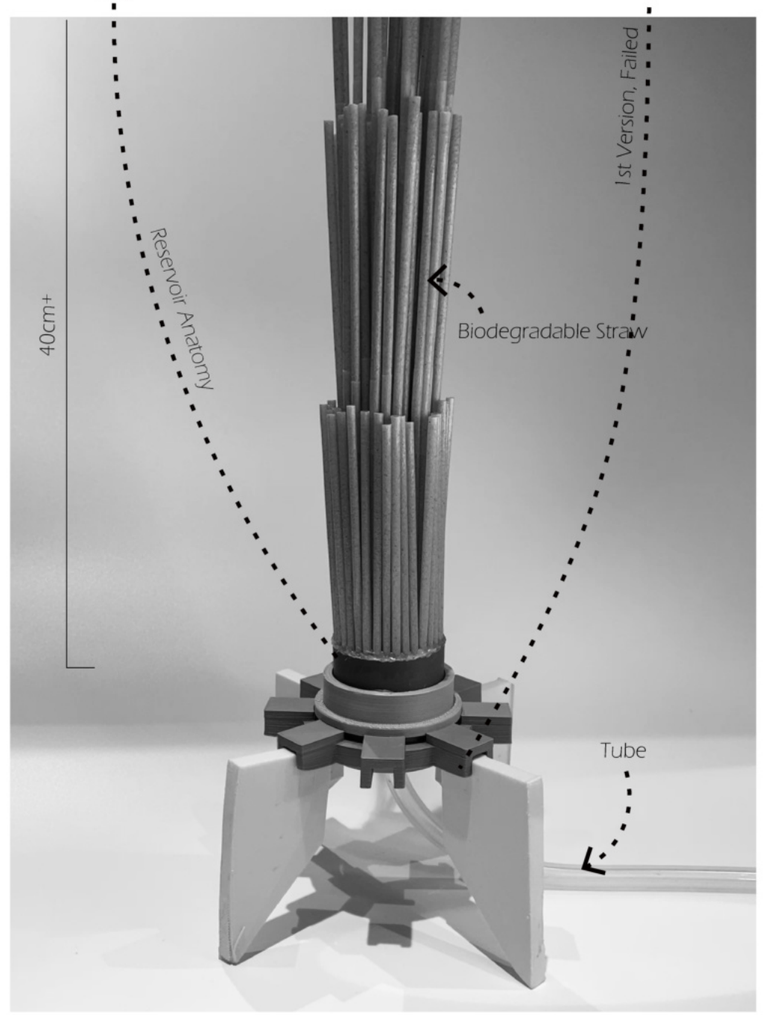
Packaging Styrofoam Model

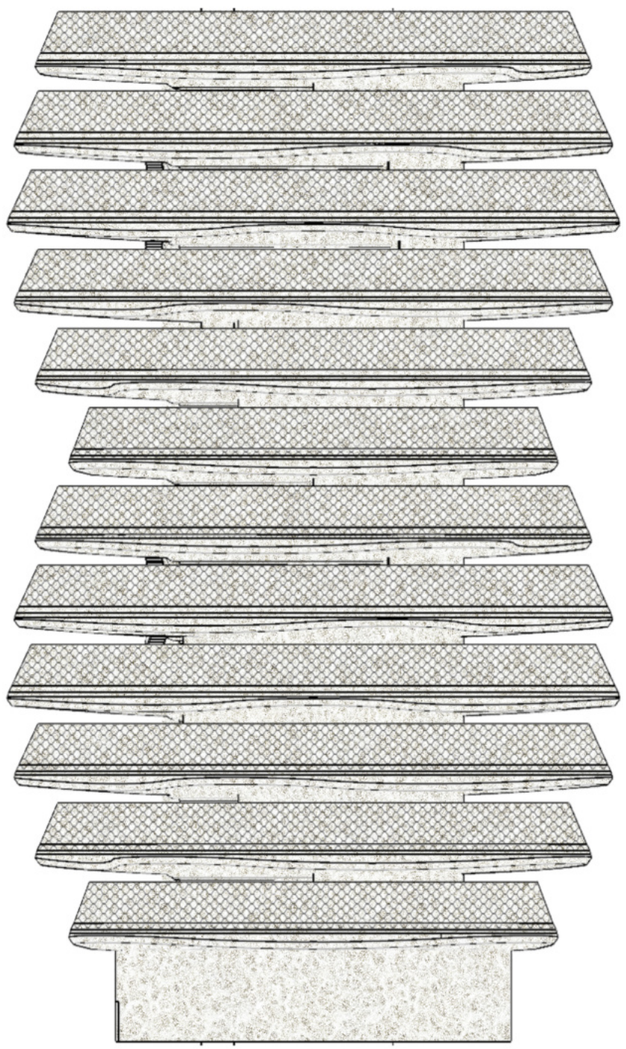


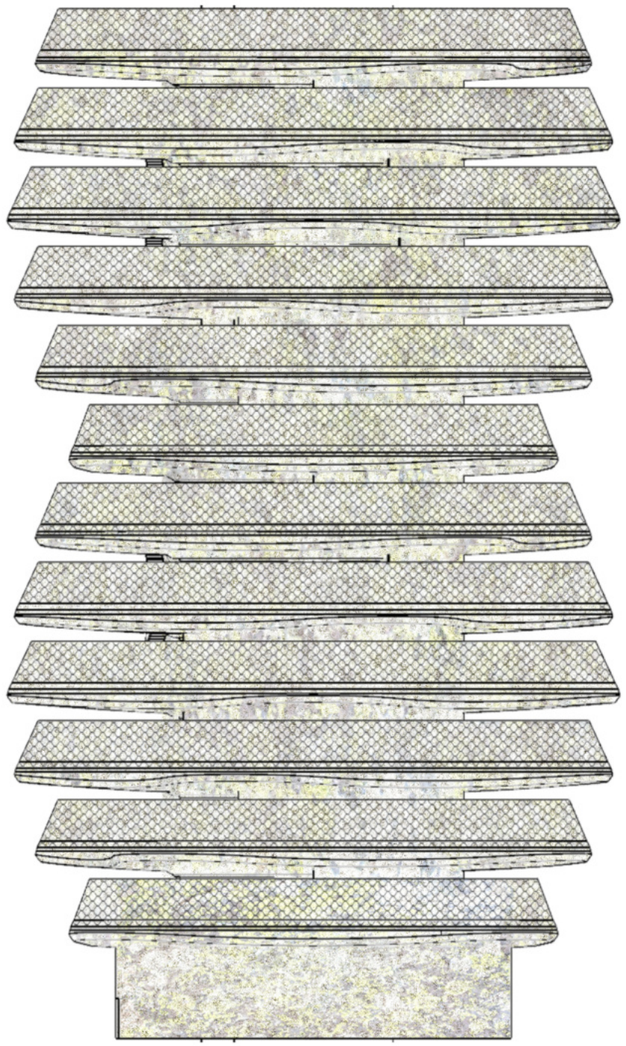
REGARDING THE AQUIFER STRUCTURE

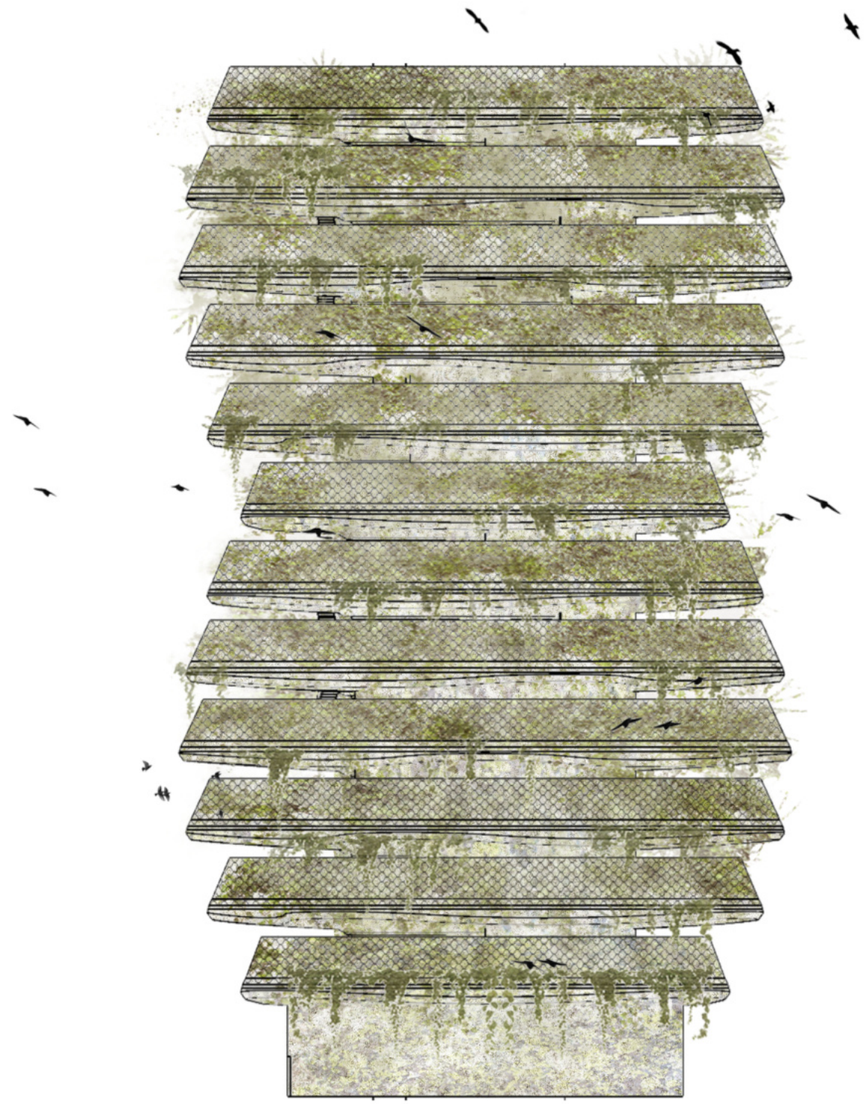
The pipe structure work as the "xylem" to transport water to each floor, where capillarity of water in the porous material brings it up to evaporate. In this case, since there is not enough evaporation and the radius of the straw (2mm) is too wide for capillary action to pull water up, I use pascal's theorem, connecting a "reservoir(bottle of water)" to the device and hold it above the highest level of straws to pump water in. My first design failed as water only flows out of the first level of straws. The second 3D printed design on the left worked. However, both material and structural experiments work mediocre in the scale of 1:75, whether this speculation is truly viable in real life is still in question.











FUTURE STUDY

Some unanswered questions:

- How to recycle the evaporated water?
- What's the scale it takes or number of tcres to change the albedo?
- How big should the reservior be?
- Can it use sea water?
- What's its cost?
- Will it generate profit?
- How difficult is the maintenance?
- What are the side effects of altering microclimate? Will the local regime change?

REFERENCE

vegetation's influence on surface/apparent temperature https://www.osti.gov/biblio/10180633
Factors of why surface temperature is lower under trees https://link.springer.com/article/10.1007/s00484-020-02030-8
Vulnerable groups susceptible to heat stroke https://www.sciencedirect.com/science/article/abs/pii/S0169204615001309
landscape parameter's impact on surroundings https://www.researchgate.net/publication/289518900_Contribution_of_trees_and_grasslands_to_the_mitigation_of_human_heat_stress_in_a_residential_district_of_Freiburg_Southwest_Germany
https://climatechange.chicago.gov/climate-change-science/future-climate-change
https://fia.umd.edu/answer-find-a-time-lapse-map-of-wildfire-growth-in-california/
https://www.weather.gov/hazstat/
Mortality by climate data https://www.epa.gov/climate-indicators/climate-change-indicators-heat-related-deaths
Urban heat island https://cds.climate.copernicus.eu/cdsapp#!/software/app-health-urban-heat-islands-current-climate?tab=app
https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202206

2

Forward To The Past

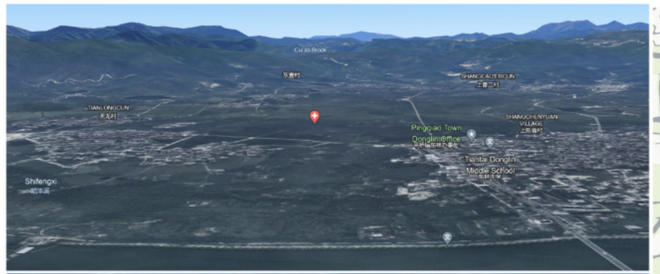
INDEPENDENT PROJECT

In the future, perhaps commercialized exoskeletons will aid seniors in leading convenient lives, or perhaps an elixir of eternity will erase the concept of physical "elderly" altogether. Alternatively, individuals may seek refuge from the cyber future, yearning for simplicity in a humble room within a serene community—existing solely for the sake of existence.

Rendered in Blender and Photoshop

INTRODUCTION

This concept emerged during my stay with my grandmother, recovering from her brain surgery in 2023. Nestled in her hometown - Tiantai in China - renowned for botanical diversity and the convergence of three religions (Daoism, Buddhism, Confucianism), this retirement haven seeks inspiration from the indigenous rock and bamboo dwellings, harmonizing with the local environment. In contrast to successful senior care facilities yet unaffordable for many, this design veers away from commercialization, offering decentralized spaces for residents to relish the serenity of nature and foster intimate connections within the community. This visionary retreat envisions a departure from bustling e-commerce cultures, providing a tranquil haven for my family and future seniors to escape the hurried pace of modern life prevalent in nearby cities like Hangzhou.

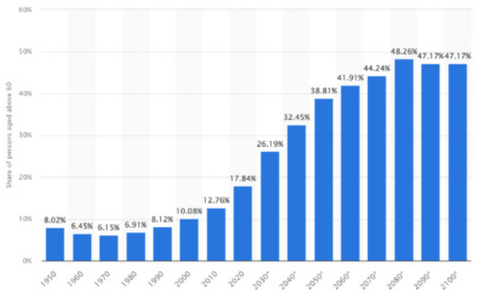


RESEARCH

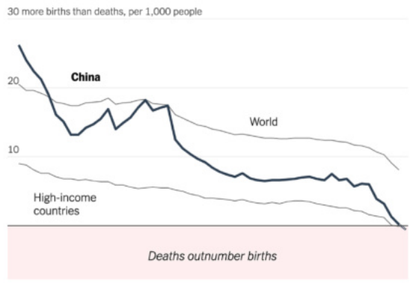
Who composes the future senior community?

Cultural stereotypes often depict the elderly as either adorable sages or stoic cynics, oversimplifying the rich diversity within each generation. We often overlook the fact that we become them in fifty years, highlighting the need to embrace the unique personalities that exist across all age groups.

stereotype word cloud



Graph from Statista.com



Graph from New York Times

It is a trend evident in both data and cultural environment that unveils a shifting priority away from childbirth. There will be a growing population of seniors without offsprings. They might be **more prone to spare their retirement lives on self-fullfillment and awareness and connection with their friends or pets**.

Who are the design's residents? A survey collected from various groups

I interviewed mid-age Hangzhou residents from different occupations – homemaker, entrepreneur, educator, construction contractor, government official, media entertainment, and programmer. The list on the left ranks their to-do after retirement.

Interview Keywords:
FREEDOM, SENSE OF BELONGING AND CONTROL, DIGNITY

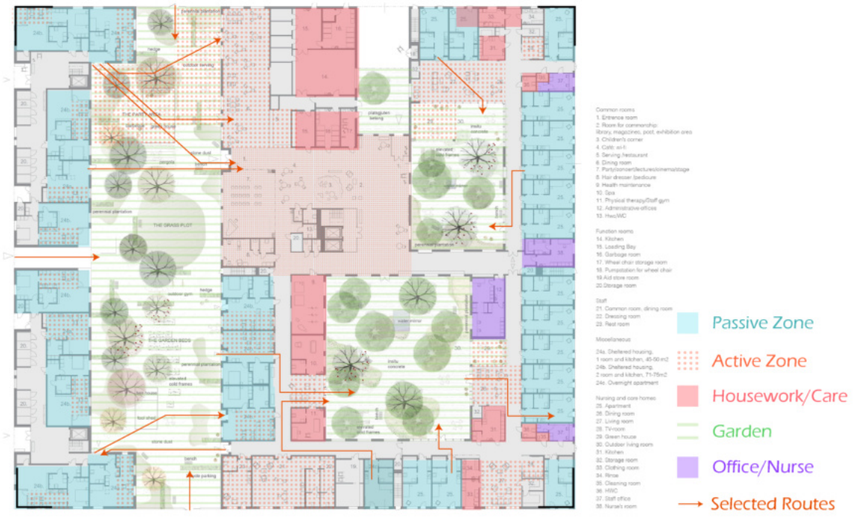
CASESTUDY

THE GARDENS CARE HOME/
MARGE ARKITEKTER, SWEDEN

The Gardens Care Home in Örebro, Sweden sets in a field nexts to natural reserves, 11 minutes drive from the downtown. It's near to parks, schools, shopping malls and the Orebro central station.

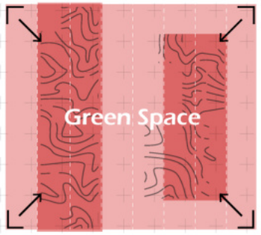
Each residental unit, either sheltered housing or apartment, provides individual kitchen and bathroom to ensure privacy, independence and sense of belong.

The easily and equally accessible **center** of The Gardens are shared spaces such as courtyards or multipurposes rooms, which take up 3/5 of the architecture. The designers encourage residents to spend more time **socializing** and **interacting with the environment**.

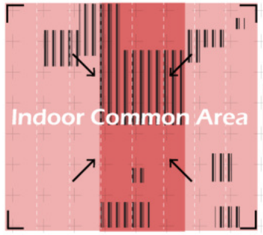


CONGREGATING INWARD

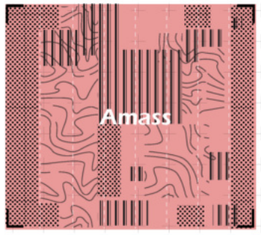
2 stories Residence, being the passive or **quiet** zone resides at the **outer ring**



Green spaces, the places for reading, gradening or partying sit between the **quiet** and **active zones** as a **transition**



Multifunctional areas, the **active** and shared spaces for socializing are at the **heart** of the architecture

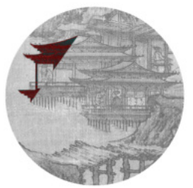


SHAPE AND FORM

Some weathered village houses, constructed in the 50s with local raw materials and bamboo, face challenges such as poor lighting and uneven ground (see photos below). On the other hand, Taizhou boasts a rich historical heritage from the Sui, Tang, and Song dynasties (AD 581-1279). Given the predominantly cloudy and humid climate with distinct seasons, optimizing natural lighting while maintaining comfortable temperatures is paramount. Inspired by the layered adaptation of vegetation to varying light intensities, I envisioned the lower layers with increased leaf surface area capturing light, and the canopy leaves being thinner and smaller. Applying this concept to the design, the single-story building features larger windows for direct light, while the two-story structure relies more on scattered lighting.

Forest Stratification

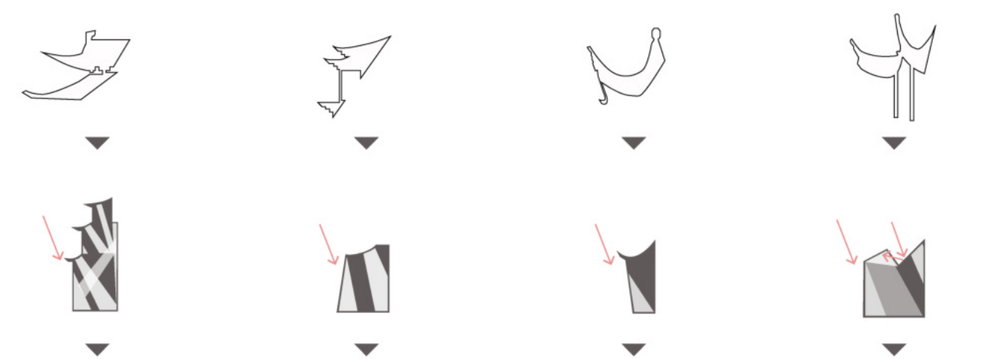
Ma Yuan Dancing and Singing (detail) 1160-1125

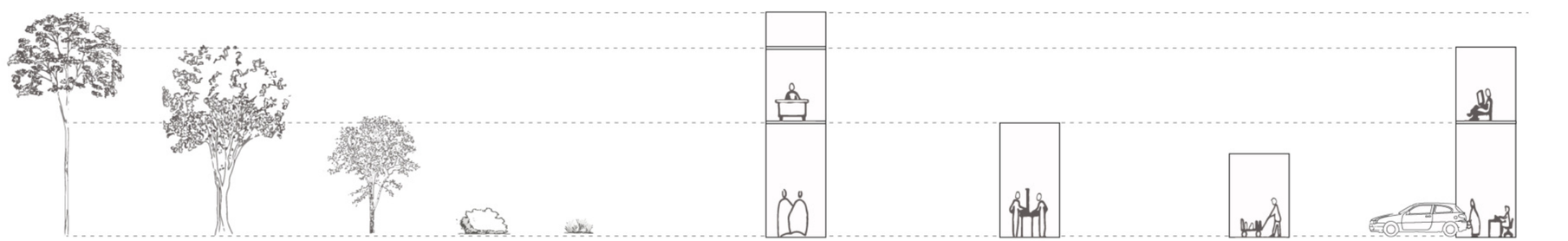


Li Cheng A Solitary Temple Amid Clearing Peaks(detail) 960AD-1127

Local historic heritage(Pavillion)

Local historic heritage(Gazebo)





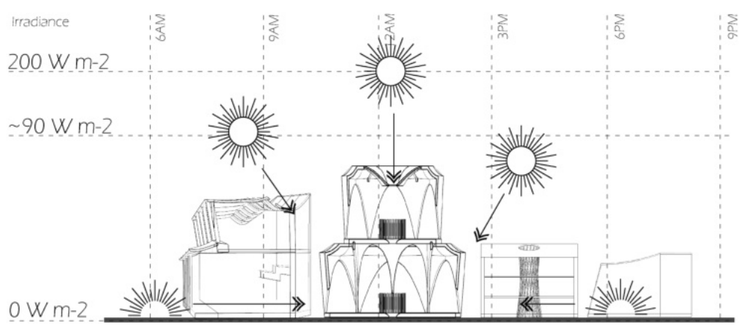
2.5 Stories
Garden/Multifunction Room with Better Lighting

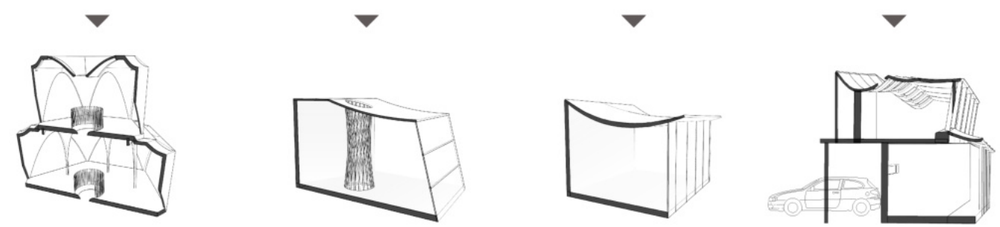
1 Stories
Staff Office/Common area

1 Stories
Physical Therapy/ Workshop

2 Stories
Residence/Multipurpose space/ Garage

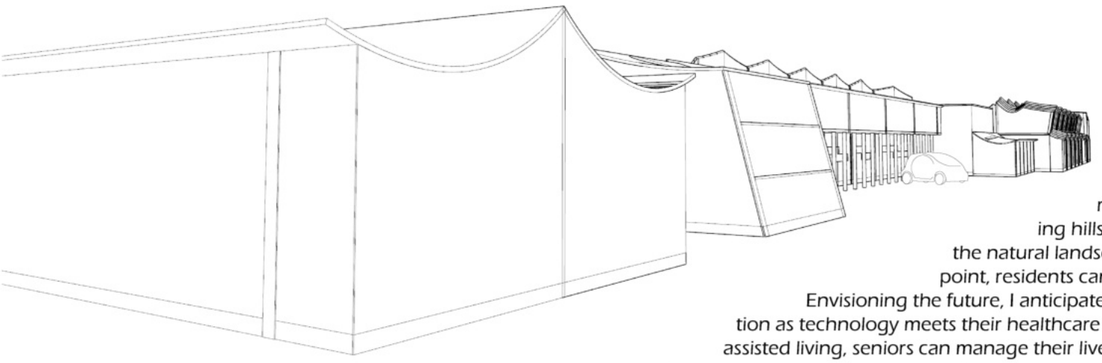
Light Intensity On a Winter Sunny Day



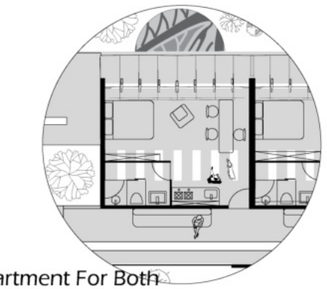


I take inspiration from the stone house and ancient exquisite architecture to form the geometric shapes and curvatures. According to Wang Chen, expert in elderly-oriented design, sudden change in light intensity, such as going from a well-lit room to an enclosed dark bathroom, is hazardous to the seniors. In response, I adopt my inspiration and create a roof with ceiling windows gather scattered light that bounces off the curvature so that the inside is softly lit evenly across the bedroom or bathroom.

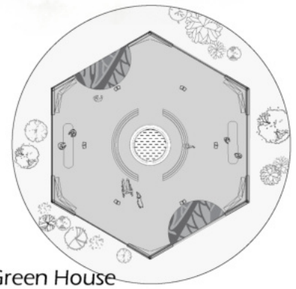
A CLOSER LOOK



Looking from the front entrance, the contour of the the roof ridges seamlessly merge with the surrounding hills. Offering a panoramic 270-degree view of the natural landscape and central garden from any vantage point, residents can immerse themselves in the scenic beauty. Envisioning the future, I anticipate local seniors prioritizing intimate socialization as technology meets their healthcare needs. With advancements in nursing and assisted living, seniors can manage their lives more independently, enjoying increased freedom. The building comprises four structural modules, catering to essential daily activities.

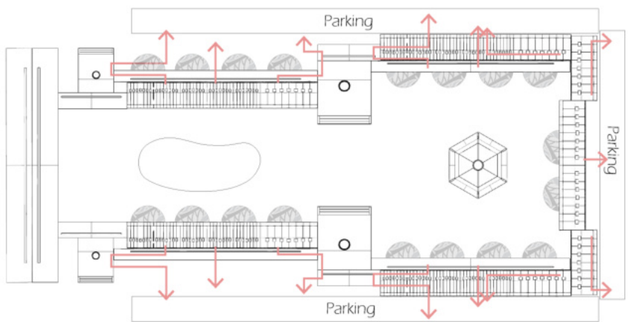


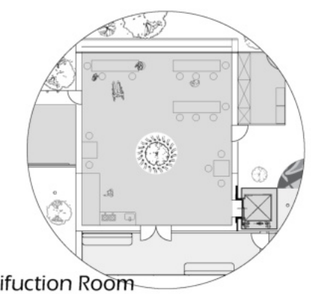
Apartment For Both Residents and Staffs



Green House

Underneath the residential building, parking spaces ensure convenient access. While the community forms a connected space around the garden, each of the seven living units features two exits directly linking to parking areas. I believe that a sense of belonging and control stems from freedom. Residents should feel liberated to choose between quiet solitary living or engaging in group activities. The Northern section is more compact than the south, with two main common areas on both ends, providing dwellers enough room to socialize and interact. 7 units in the west wing is also open to travelors to book. The Southern section is spaced out and mostly consist of residental and multifuction units. At the center is a greenhouse for mindfulness.
Both sections leave space in the central garden for resident to grow their own plants, hoping it'd enhance their sense of purpose, influence and accompliment.

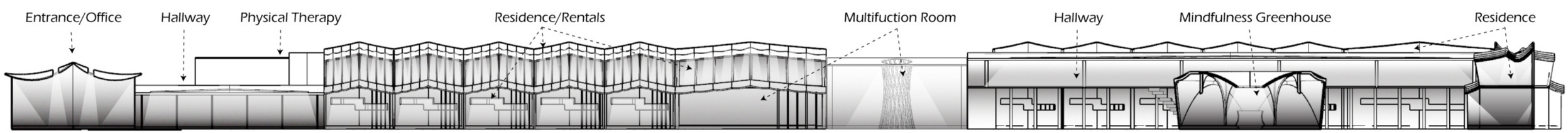


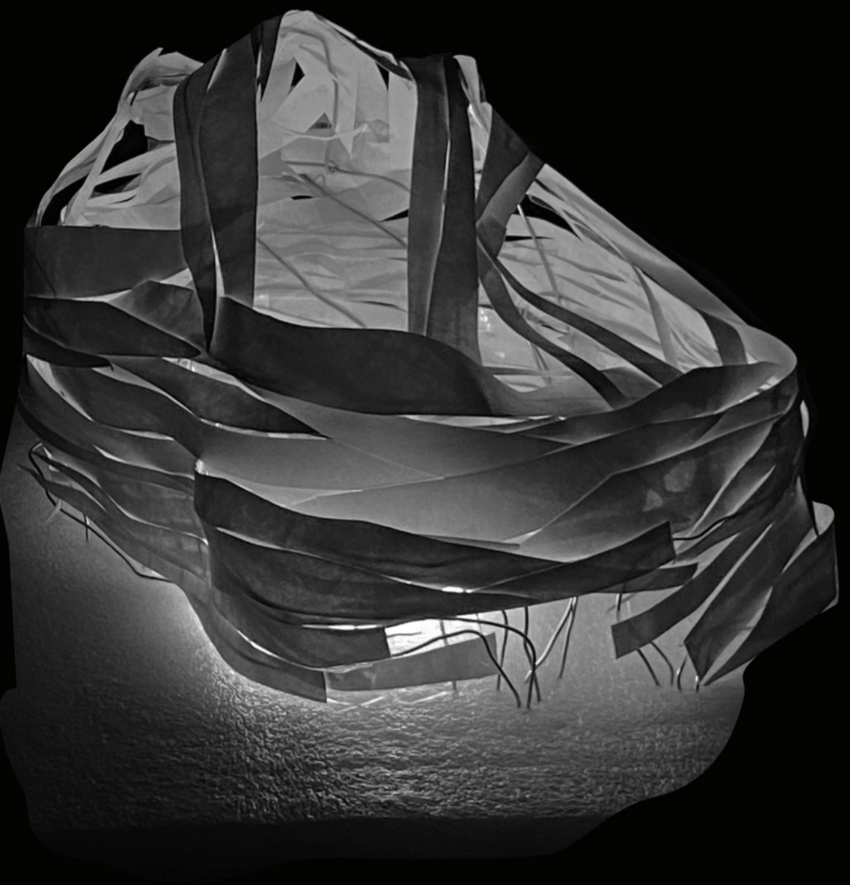


Multifuction Room

Physical Therapy Room

N





3

SLEEP TIGHT - A REHAB

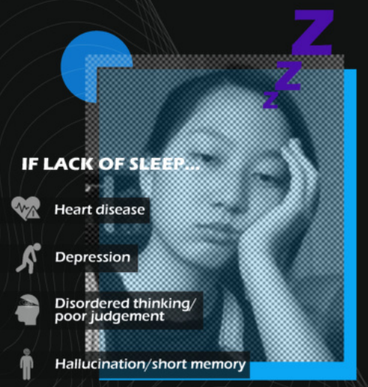
INDEPENDENT PROJECT

" A fun act of question to rethink the meaning of Human-centric design:
Is it about indulging humans' desires or
navigating humans' needs for long-term benefits? "

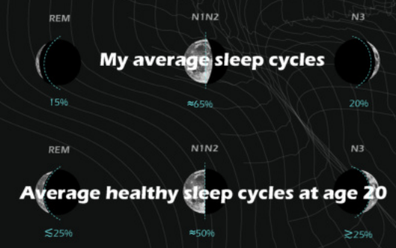
— YUSHUO DING

BACKGROUND

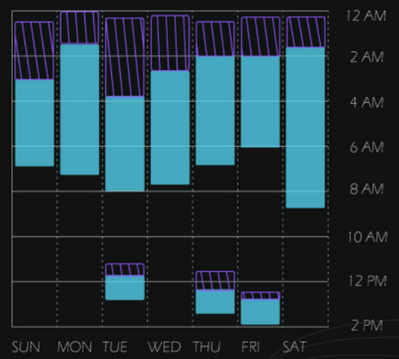
I AM MY CLIENT



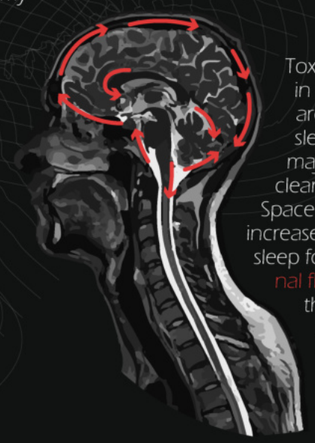
My summer break left my sleep disrupted. I spent the rest of the month in borderline insomnia.
I started searching for a product to correct my behavior



My typical sleep cycles



On average, my daily sleep time is **5.36h**. However, I waste **2.64h** trying to sleep.



Toxin accumulates in brain while we are awake and sleep plays a major role in cleansing them. Space in brain increases 60% during sleep for cerebrospinal fluid to flow through to remove the toxin

EXISTING PRODUCTS

Are mostly APPs

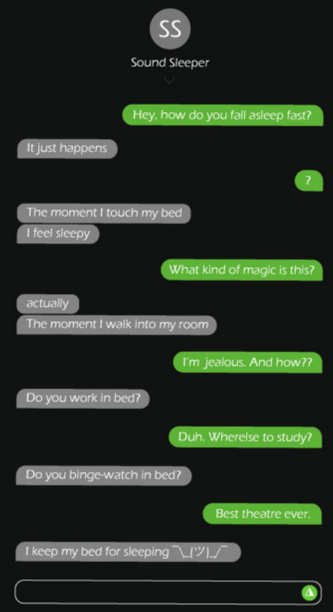
- ✕ Meditation
- ✕ Brain Waves
- ✕ Sleep Tracking
- ✕ Ambient Music
  ... ... and many other APPS

Is there a product that can ACTIVELY initiating users' behavior instead of PASSIVELY waiting to be used?

- ✕ Sleep therapy
- ✕ Medicines or supplements for sleep assist

I lack the motivation to use them.
I need an tangible external force to push me into a healthy routine.

RESEARCH



CONDITIONED AROUSAL BEHAVIOR

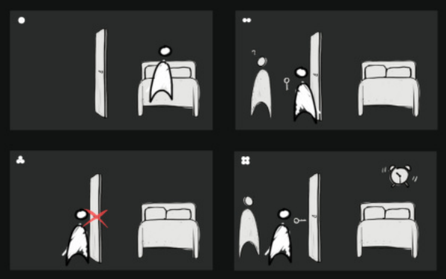
SOME FACTORS AFFECTING SLEEP

- Light
- Food/Drugs
- Stress
- Sleep schedule
- Physical pain

My problem is that I don't have a sleep schedule since I work in bed, eat in bed, binge watch shows in bed, I can't relate "sleep" to my bed

▸SO... my PAIN POINT is

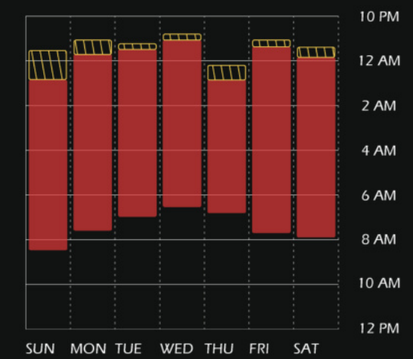
EXPERIMENT



To avoid the urge of lying in bed, I locked up my bedroom and gave the key to my sister by 8AM

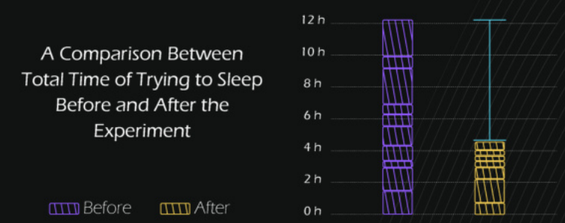
She only gave the key back at 10:30PM so my bed has been out of sight between 8AM to 10:30PM

2nd Week After the Experiment



My Daily Average sleep is **7 hours 12 min,** and I spend about **38 mins** trying to sleep

A Comparison Between Total Time of Trying to Sleep Before and After the Experiment



- ▸ **MORE EASILY FALLING ASLEEP**
- ▸ **REGULATED CIRCADIAN RHYTHM**
- ▸ **SIGNIFICANTLY LESS INSOMNIA**

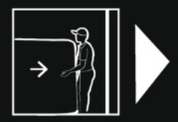
IN CONCLUSION
– METHOD WORKS ✓

The experiment validated my hypothesis: associating the bed solely with sleep facilitates quicker sleep onset. Therefore, the key is to keep the bed out of sight during the day. Yet, not everyone has a sibling or a separate room for beds. I seek a tangible product that actively shapes user behavior.

A NEW PRODUCT

IF MAKING THE BED DISAPPEAR IS A SERVICE

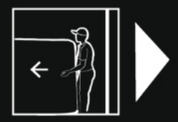
7AM
Wake You Up



7:10 AM
Pack your mattress

7:20 AM
No bed to sleep on

9PM
Return your mattress



9:10 PM
Install mattress

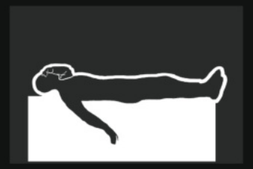
9:20 PM
Sleep tight in bed

Unfortunately the plan fails easily at step 1 if the user is unwilling to get up and open the door...

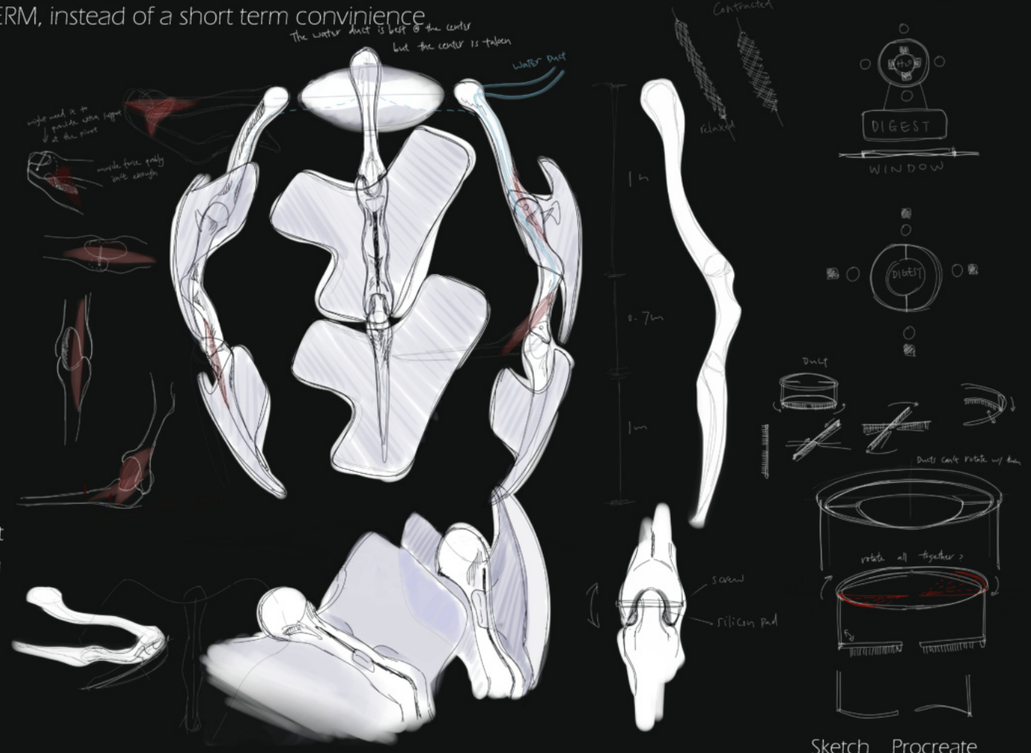
FEATURES OF THE NEW PRODUCT

- This product DOES NOT require EXTERNAL interference to perform
- The appearance and disappearance of the bed is NOT UP TO THE USER. If the user cannot get up or lay down within the time frame they set up before(unable to change in a seven-day cycle), they have to sleep on the floor
- Unlike existing products, this design purpose is to SHAPE AN EFFICIENT and CONSISTENT SLEEP PATTERN and making life healthier IN THE LONG TERM, instead of a short term convinience

User Manual

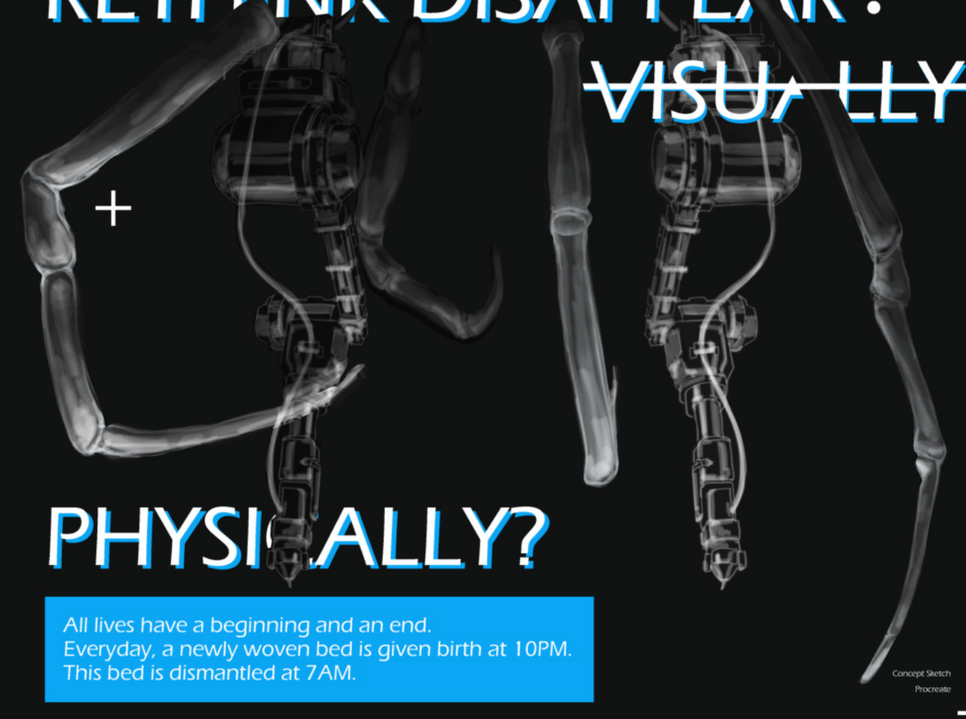


If you don't get up in time, you will fall



Sketch Procreate

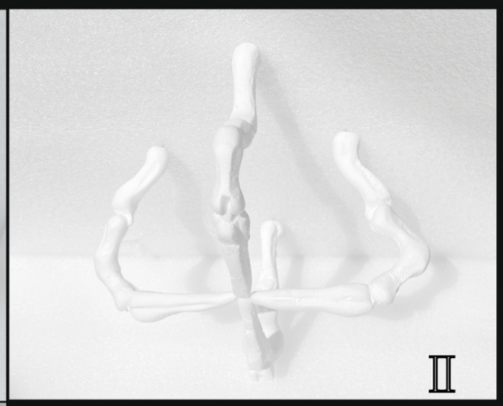
RETHINK DISAPPEAR : ~~VISUALLY~~



PHYSICALLY?

All lives have a beginning and an end.
Everyday, a newly woven bed is given birth at 10PM.
This bed is dismantled at 7AM.

Concept Sketch
Procreate



Stage II

On. Half dropped down, printing arms are knitting

Stage I

Off. Folded On the Ceilling

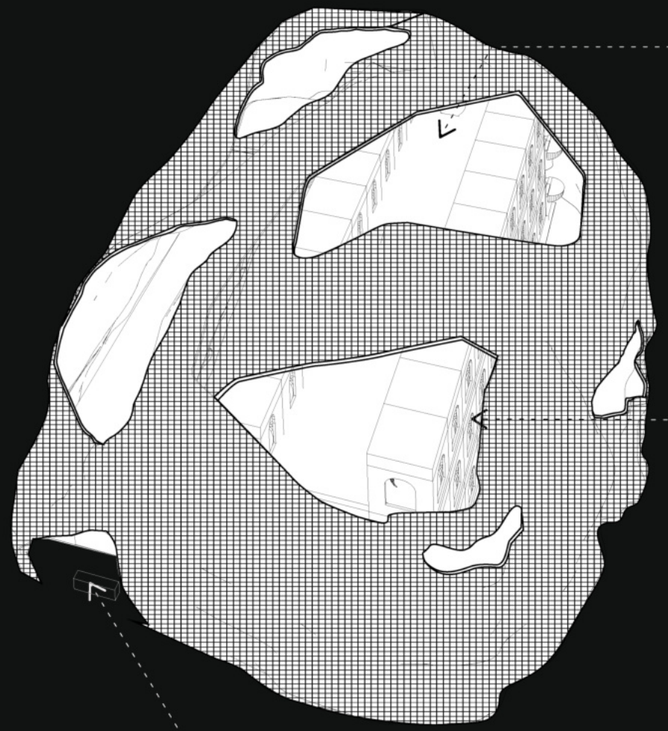
Stage III

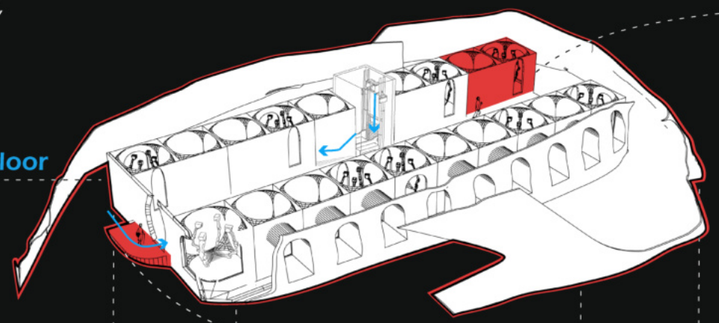
Sleeping. The Bed is finished, printing arms can remove the bed and recycle the material in the morning

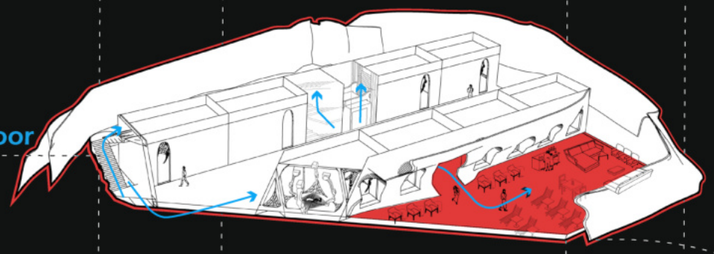
MOVABLE CLAY MODEL OF THE ARMS

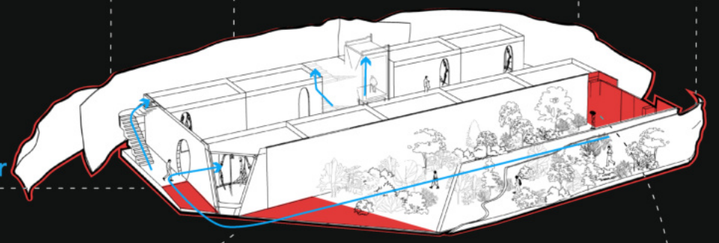
LAYOUT & RENDER

Given that the installation of the device may not be suitable in a typical household, a dedicated building is designed to serve as a sleep therapy center.









3F Sleeproom

3F Stairway

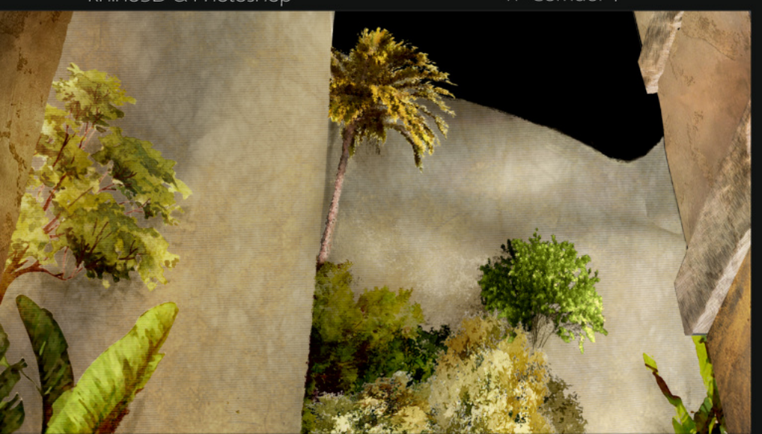
2F Louge

1F Reception

Renderings of Selected Areas

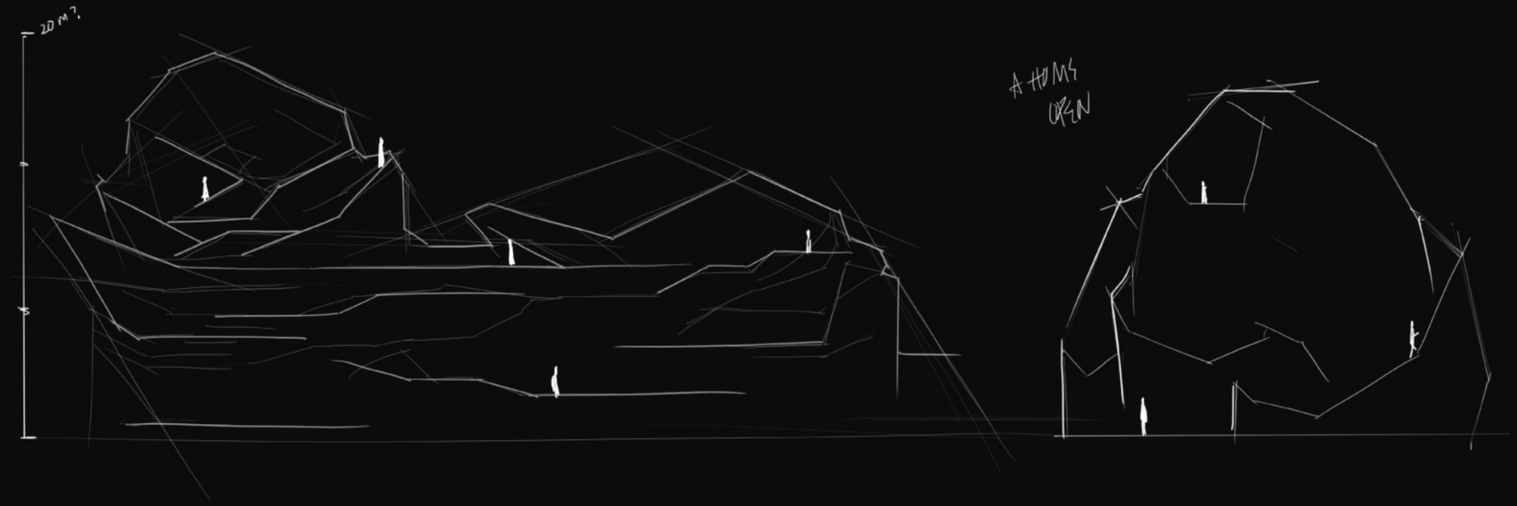
Rhino3D & Photoshop

1F Corridor



The interior will grow vegetation like a green house. **Nevertheless**, having a large surface of glasses with vegetation inside will severely **increase bird-building collision**.

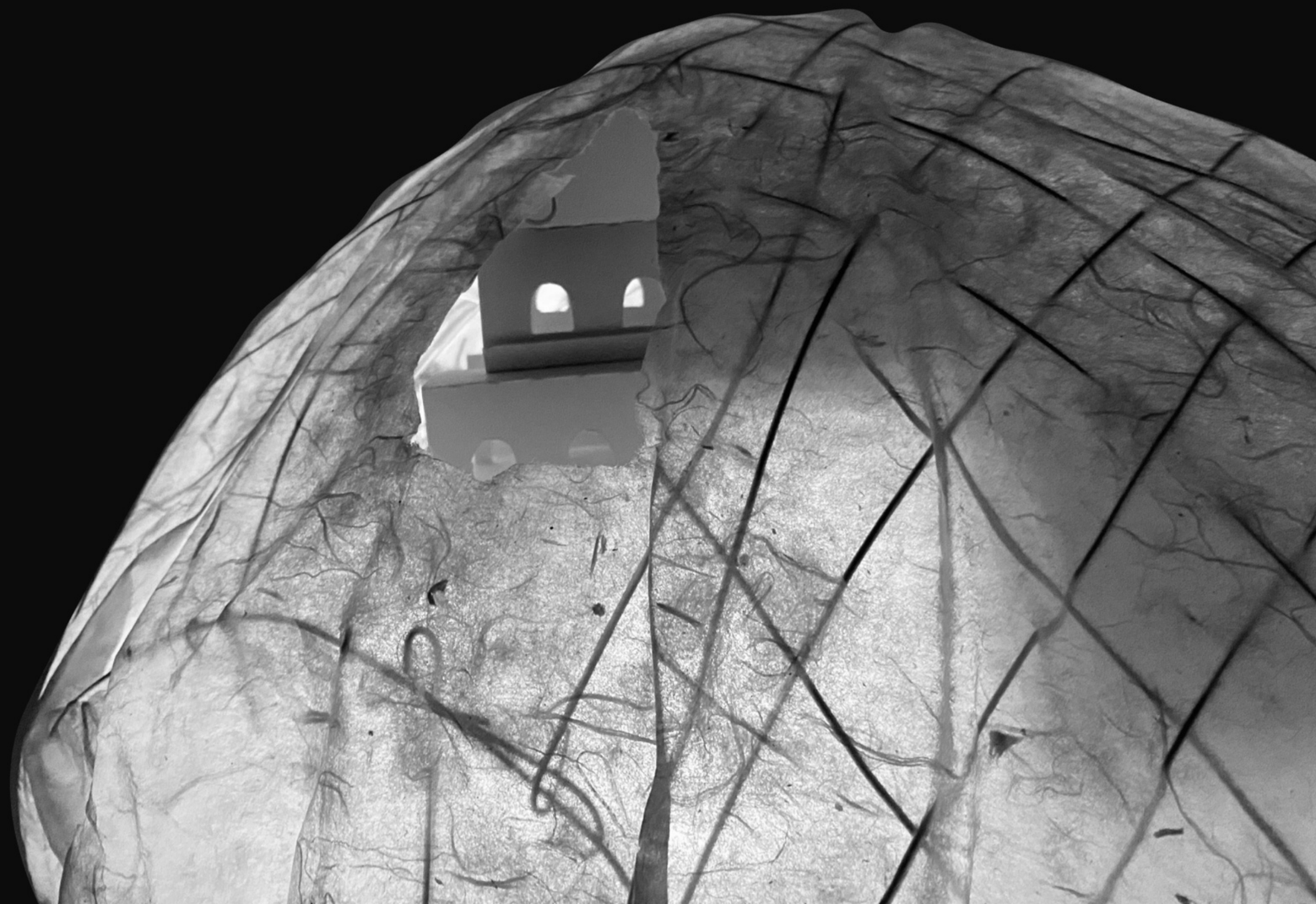
Thus, I turn to **translucent texture** that not only prevents bird-strikes but also renders a cozy atmosphere to sleep in, meanwhile provide sufficient natural light during the day.



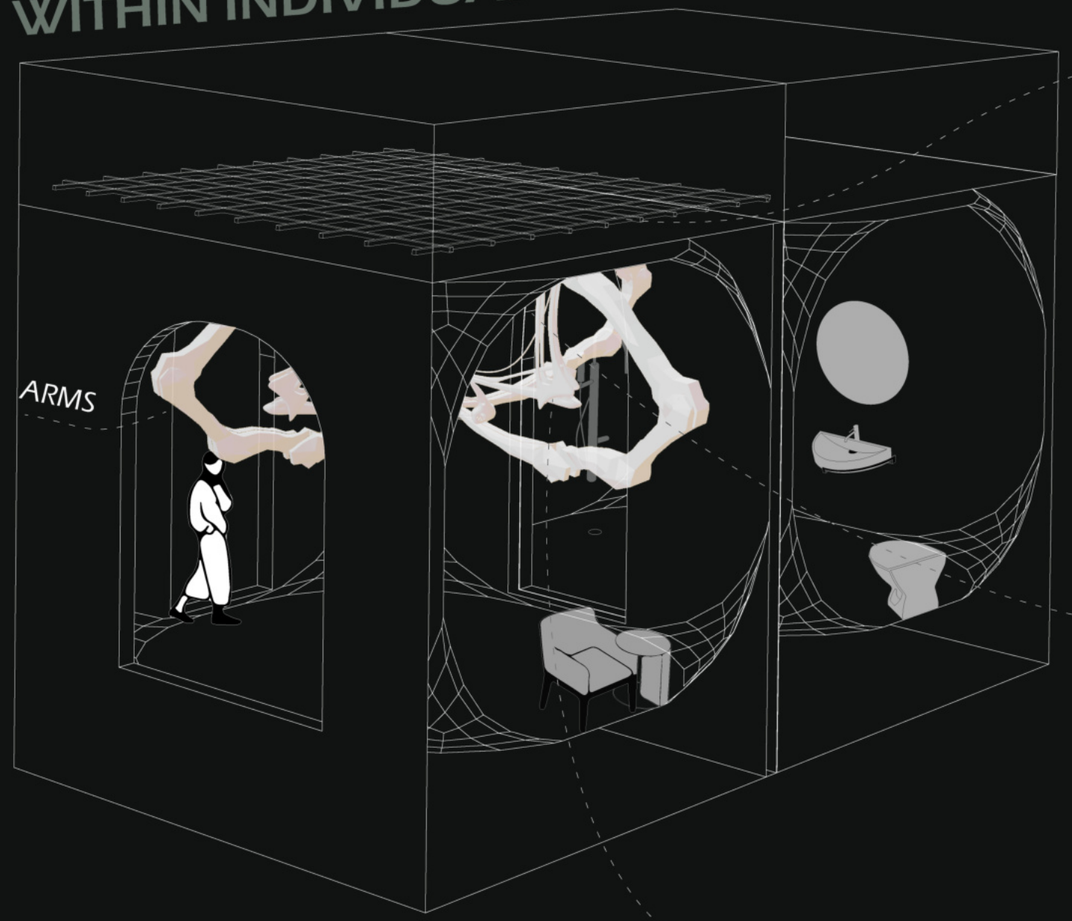
EXTERIOR

I've seen exqiusite ancient handmade lanturn so I tried out the traditional method of rice paper paste as the images shown here.
The effect was great but the only problem is the durability due to its thinness.
Dupont paper's texture is also ideal for the exterior, especially during the night when the building is lit-up inside while remaining sturdy.
The simple structure of interior is composed of the same sleeping units.
These two features remind me of **wasps**, who are masters of constructing p aper nests.

The model is crafted with rice paper.
The one featured on the cover image is constructed using Dupont paper.

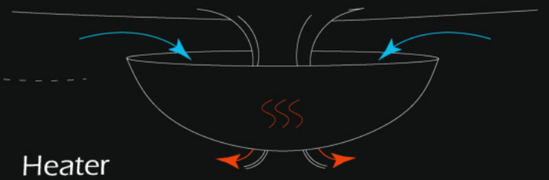


WITHIN INDIVIDUAL UNIT



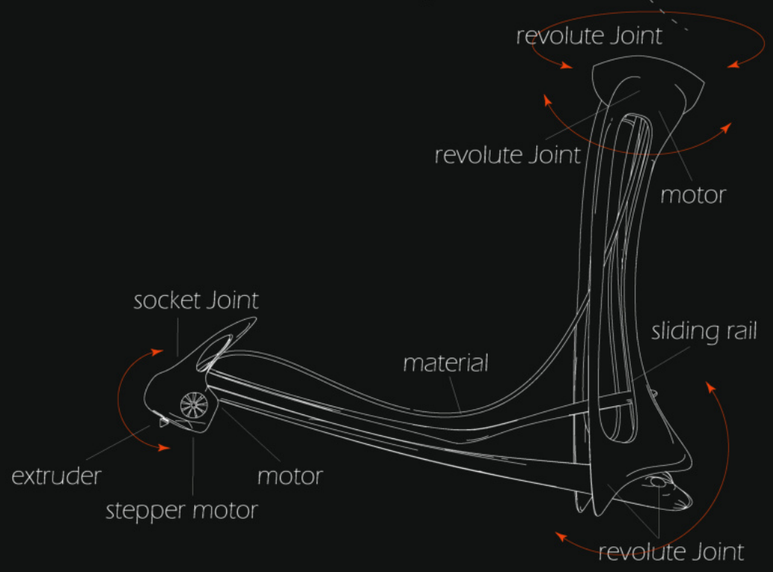
Rack

I use a hidden rack in the ceiling **to withstand heavy weight**. In addition to the weight of a person, the structure should be durable to hold a material container, two printer arms and four supportive arms, each with motors on some movable joints.



Heater

The heater hangs on the ceilling and contains heating coils. It **collects** and **reuse** the material by decreasing the thermoplastic's viscosity and transport it to the printer.



Printer

To minimize the weight on the ceiling and to match the bionic style of the four arms, the printer is composed of **flexible yet resilient** and **hollowed-out** skeleton for support. The printing head is shaped like a hook to collect used threads and recycle them in the heater.

MATERIAL

Thermoplastic stands out as the most suitable material among existing options. Hot melt adhesive is the initial consideration, releasing minimal, rarely toxic fumes, crystallizing quickly at room temperature. While it has a high melting point, around 100 degrees Celsius, it exhibits weldable viscosity at 80 degrees Celsius. It adheres well to support arms upon crystallization and can be reheated and reused several times below 200 degrees Celsius. However, its elasticity is a significant drawback.

Alternative ingredients, such as polyol + diisocyanates + short-chain diols, can solidify and form strings at room temperature, but they release slight amounts of methylene diphenyl diisocyanate vapors when heated. Another option is bio-based propylene succinate, with a melting point just above 45 degrees Celsius, but information about its crystallization speed and reusability is not readily available.

REFERENCE

propylene succinate https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2663674/

Commericialization of glycol + polysuccinate https://pubs.acs.org/doi/10.1021/acsomega.9b03663

TPU's melting point https://www.matweb.com/search/datasheet.aspx?matguid=1932586b674346e2a9d5cb4c7462dd33&n=1&ckck=1

Conditioning Psychology https://www.britannica.com/science/conditioning

Brain anatomy https://www.med.harvard.edu/aanlib/home.html