JIANING YU

DESIGN + X

2019 - 2023

CONTENT

This Is Loofah

Alternative Material for Furniture Design

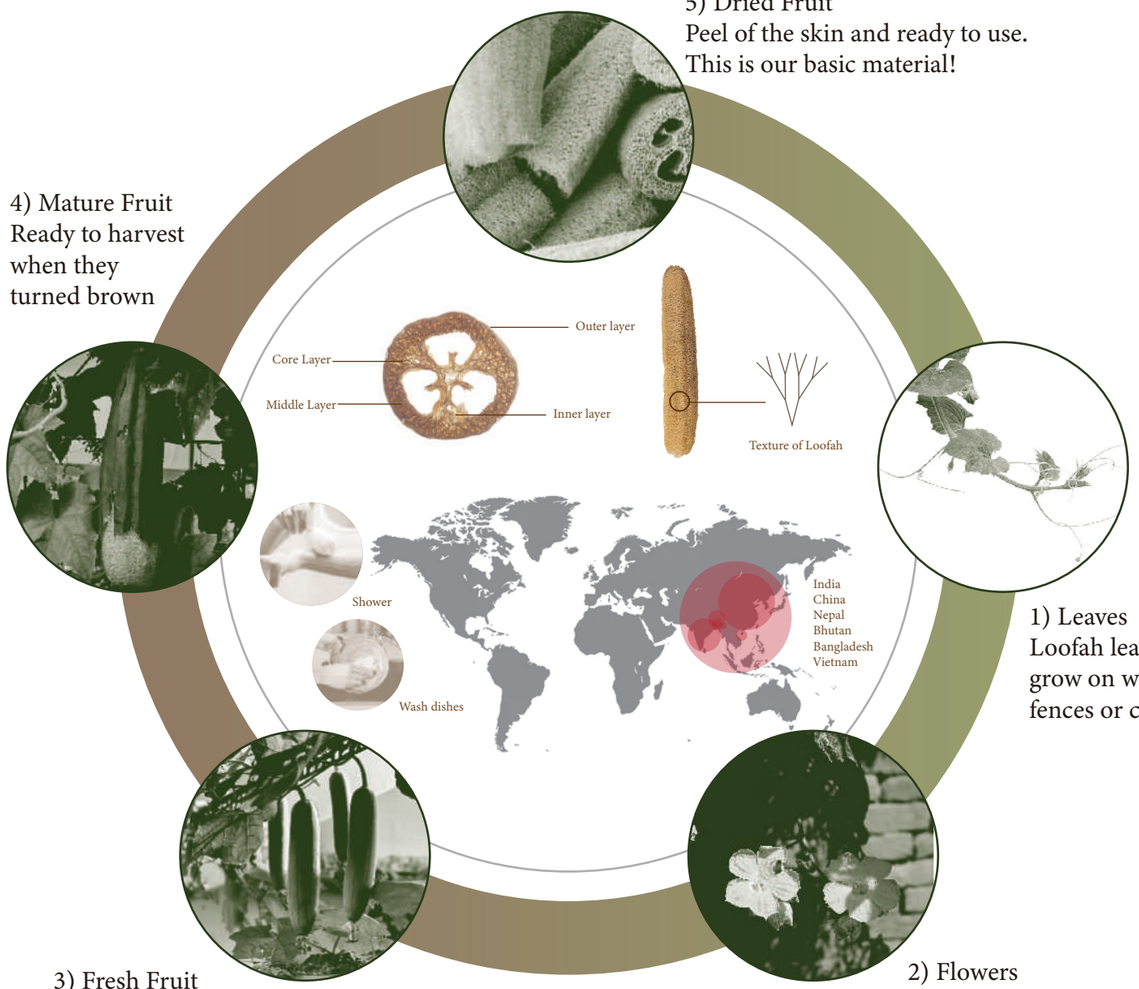
Group Project
Collaborate with Winnie Heung
My contributions: research (100%), design (50%), drawing (100%), photo-taking (50%)
Sep - Dec, 2021
Tutor: Dennis H.K. Cheung
Materials: Loofah, gelatine, coffee grounds, water, vinegar

Loofah is the vascular bundle obtained by removing the peel and pulp of the fruit of the Cucurbitaceae plant Luffa after it is mature and dried. Due to its short growth cycle and high yield, Luffa is widely planted in China and Southeast Asia. In rural China, loofahs are a common and cheap dishwashing tool. However, loofah is far more than that. Its unique three-dimensional fiber structure allows it to be stretchable and compressive at the same time, and its high-density pores make it easy to combine with other components.

This project aims to explore the possibilities of loofah as an alternative material for functional furniture. We first obtained a “loofah + gelatine + coffee grounds” combination with best performance through a series of comparative experiments. On this basis, we expanded the form of loofah and designed the basic form into functional, aesthetic, and, of course, biogedradable furniture.

INTRODUCTION

Life Cycle of Loofah



5) Dried Fruit
Peel of the skin and ready to use.
This is our basic material!

4) Mature Fruit
Ready to harvest when they turned brown

1) Leaves
Loofah leaves grow on walls , fences or cage.

3) Fresh Fruit
After the flowers are pollinated, it will grow loofah!

2) Flowers
The plant sprouts vines and produces bright yellow flowers

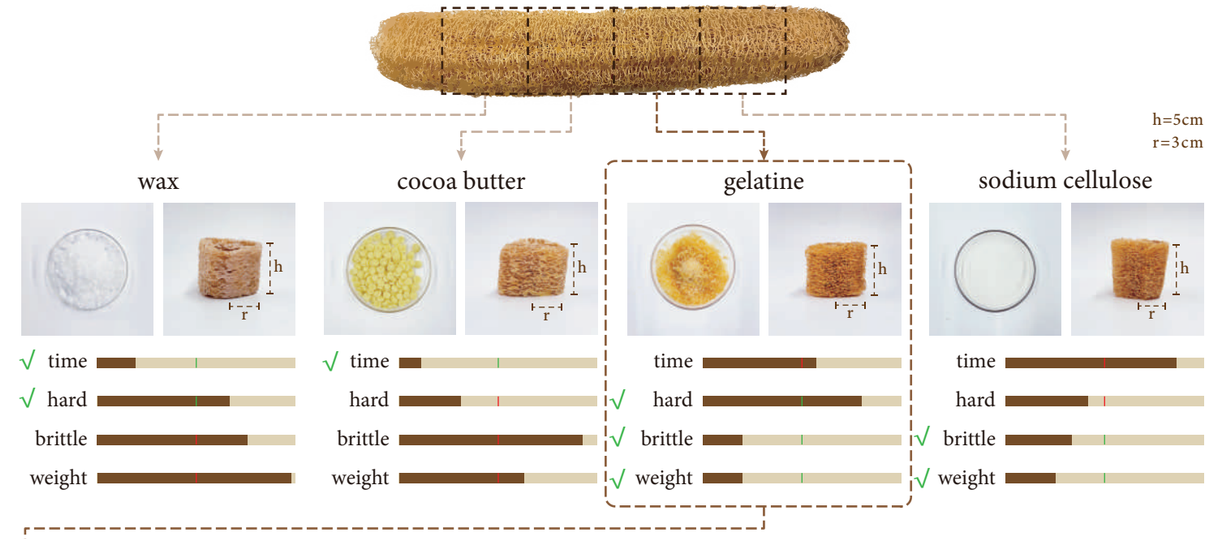
Interwoving Fiber Structure

Fibre type	Density (g/cm3)	Cellulose (%)	Lignin (%)	Tensile Strength (MPa)	Modulus of elasticity (GPa)
Aramid	1.4	--	--	1000	70
Carbon	1.7	--	--	4000	230~240
Bamboo	0.6~0.8	60.8	32.2	140-800	11~30
Loofah	0.82-1.02	60.0-66.5	9.1~15.5	?	?
Flax	1.5	64.0~71.0	2	345-1100	27.6

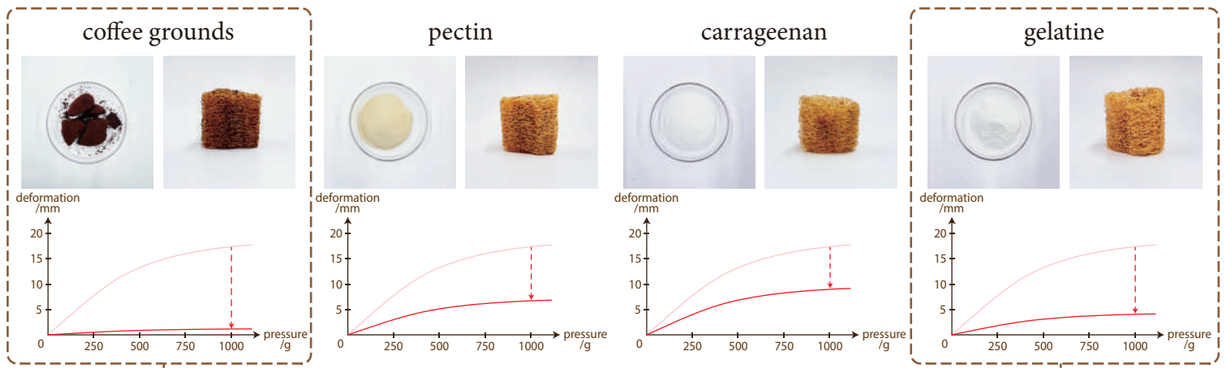
Resource from:
Fuqua, M. A., Huo, S., and Ulven, C. A. (2012) Natural fiber reinforced composites, Polymer Reviews 52(3):259-320

EXPLORATION

Q1: What bio-binders are suitable for loofah?

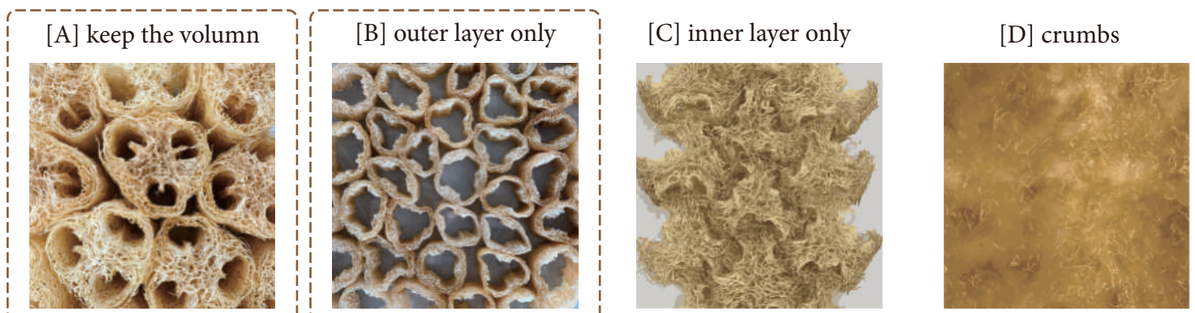


Q2: Can this combination perform better?



<Our Recipe> coffee grounds : carrageenan : water = 1 : 1 : 10

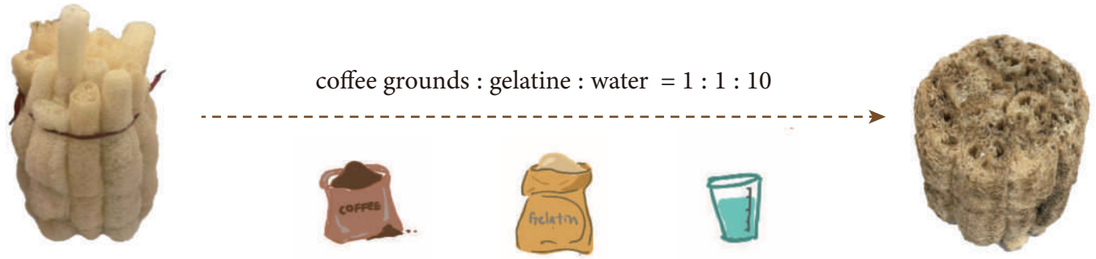
Q3: How to create forms that have design potentials?



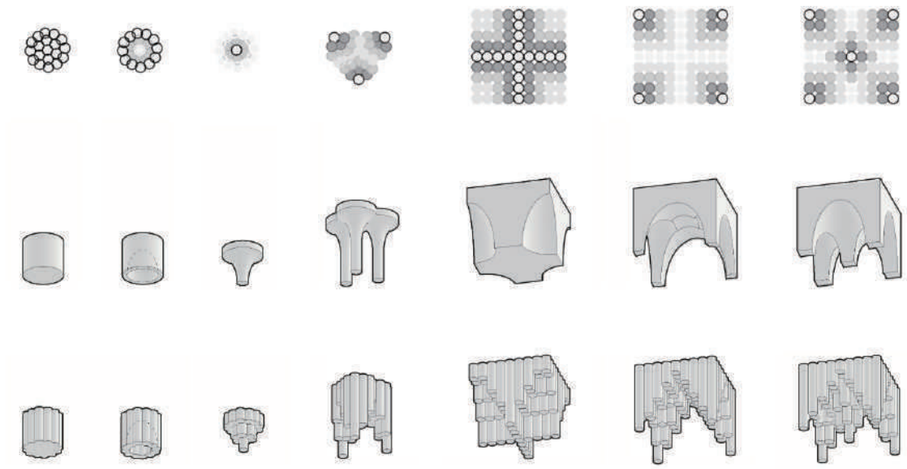
Q4: What can be created from the basic forms? And what is the prototyping process like?

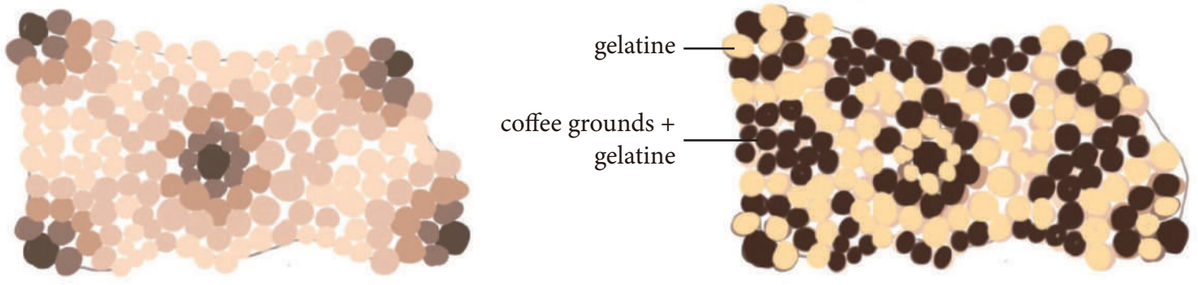
[A] COFFEE TABLE

Formula



Form Finding





45 cm 35 cm 25 cm 15 cm 8 cm

Prototyping of 1:1 Coffee Table

Post-testing

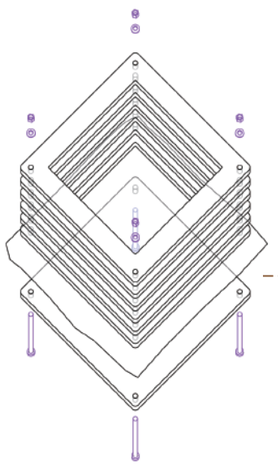
Nov 15, 2021 *Dec 15, 2021* *Nov 15, 2023*

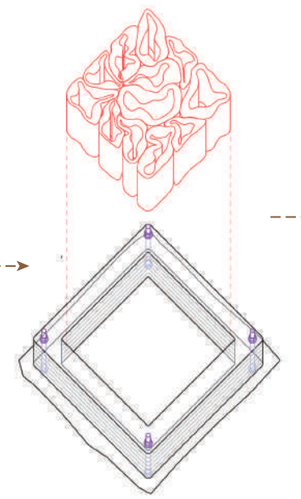

Thesis 2021

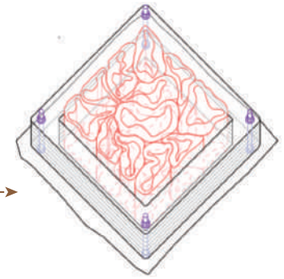
[B] HANGING DOME

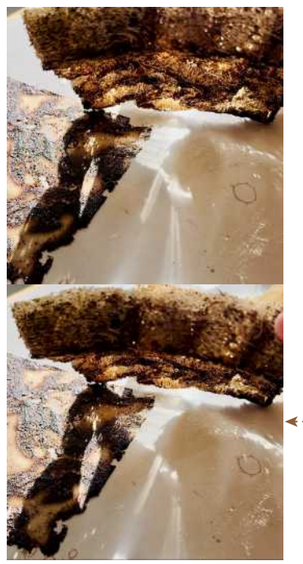
Formula

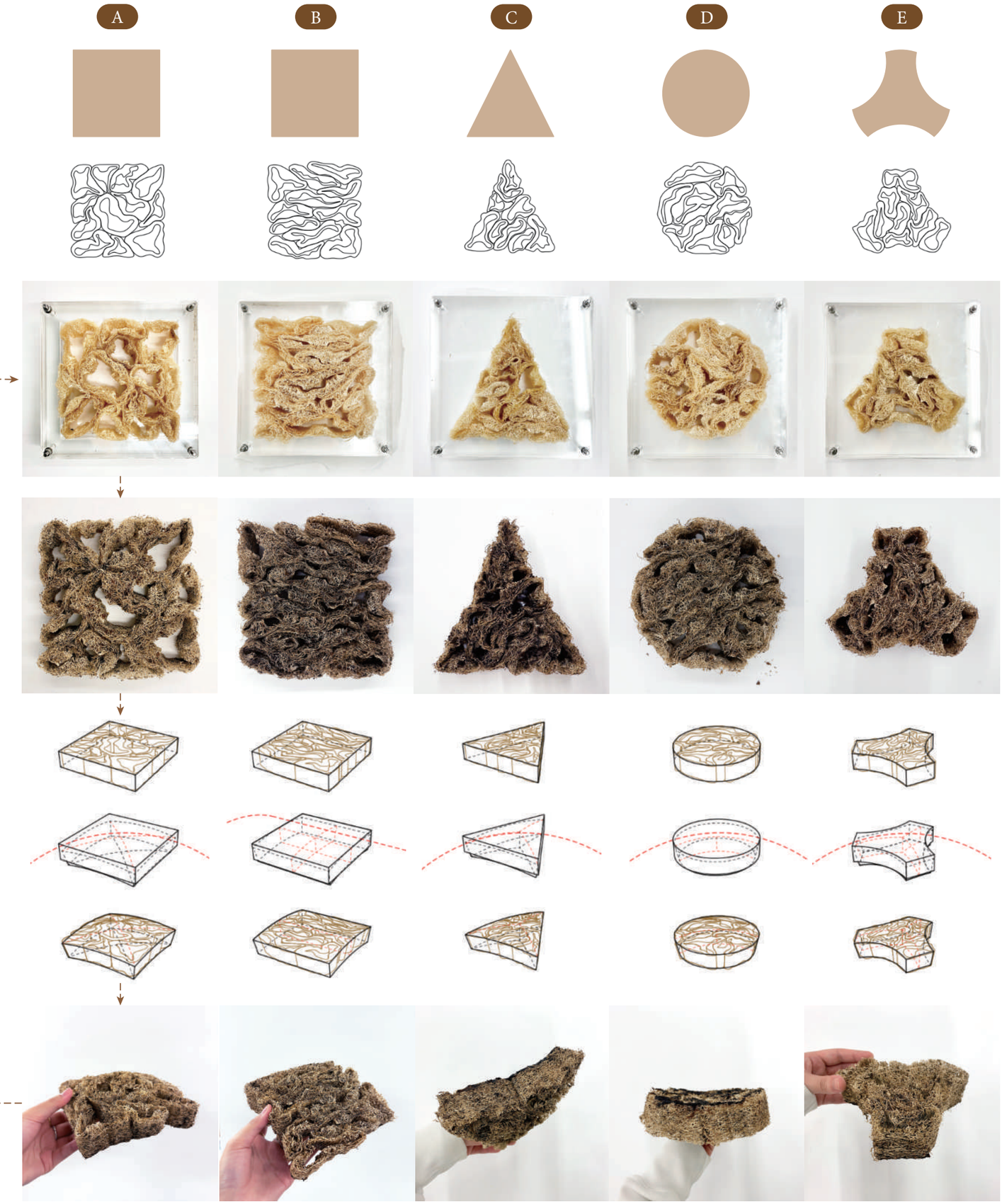
In the previous experiment, we found that:
1) After adding coffee grounds, the material would bend and deform due to shrinkage force when it dries;
2) Loofah fiber without the middle structure can be easily deformed and can be infinitely extended. Thus we add both and put them in modules of different shapes to test their deformation capabilities.











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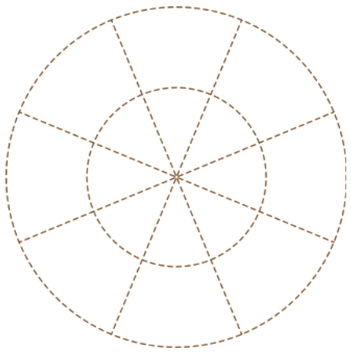
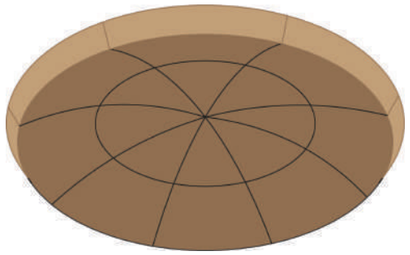
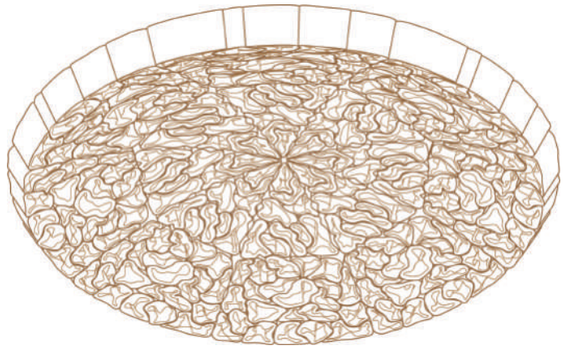
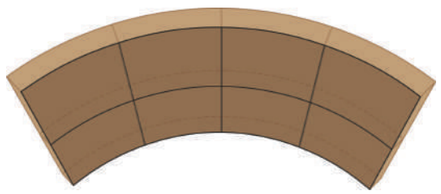
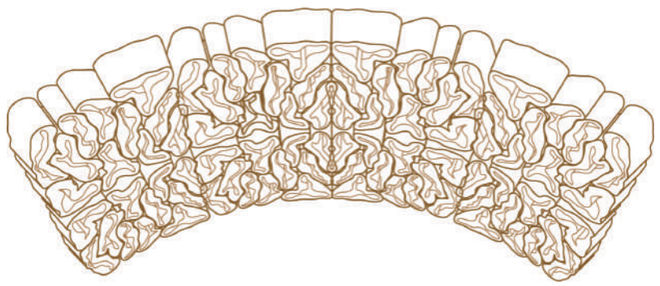
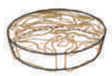


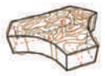


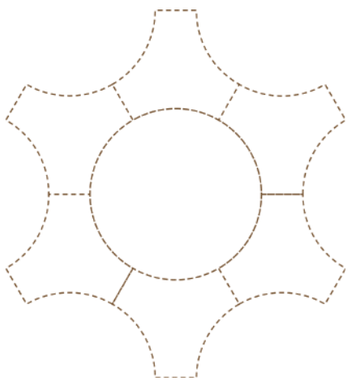


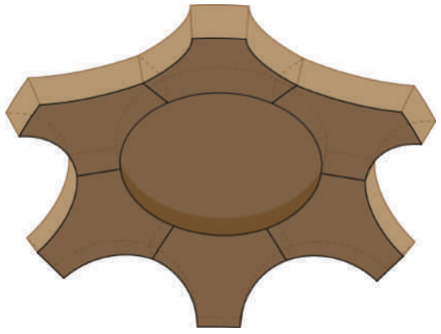


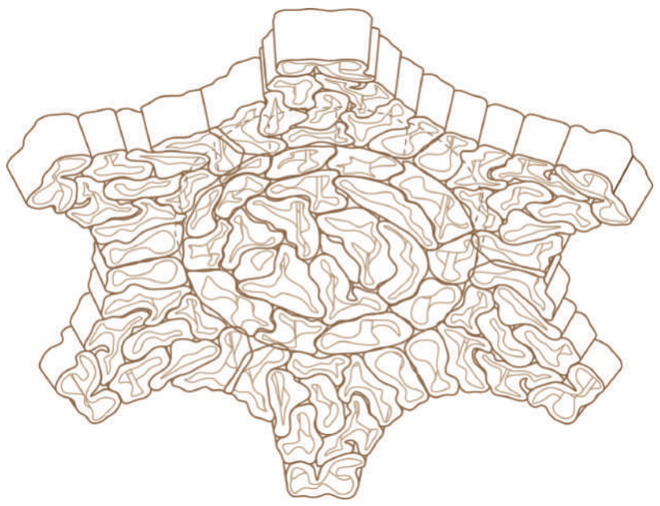




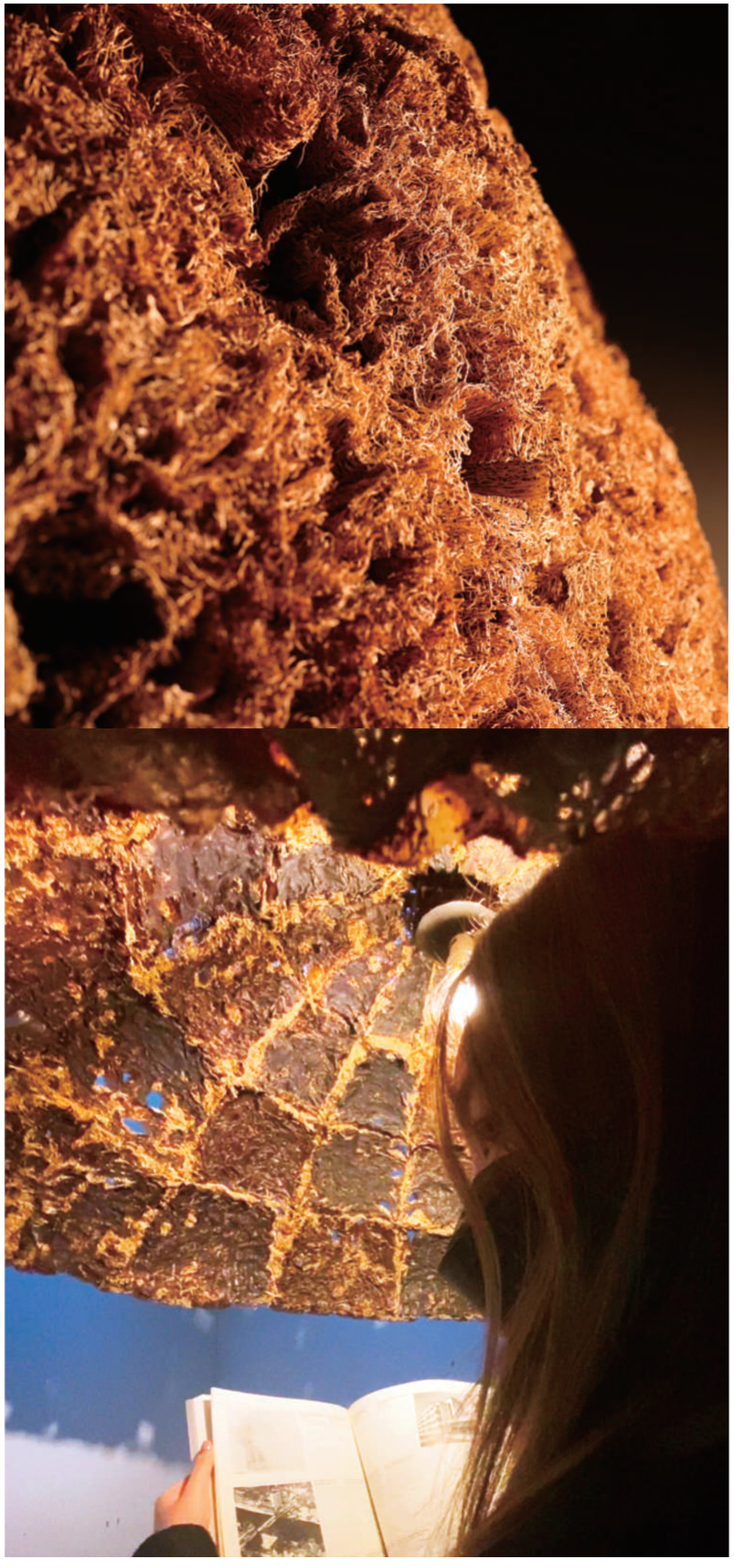


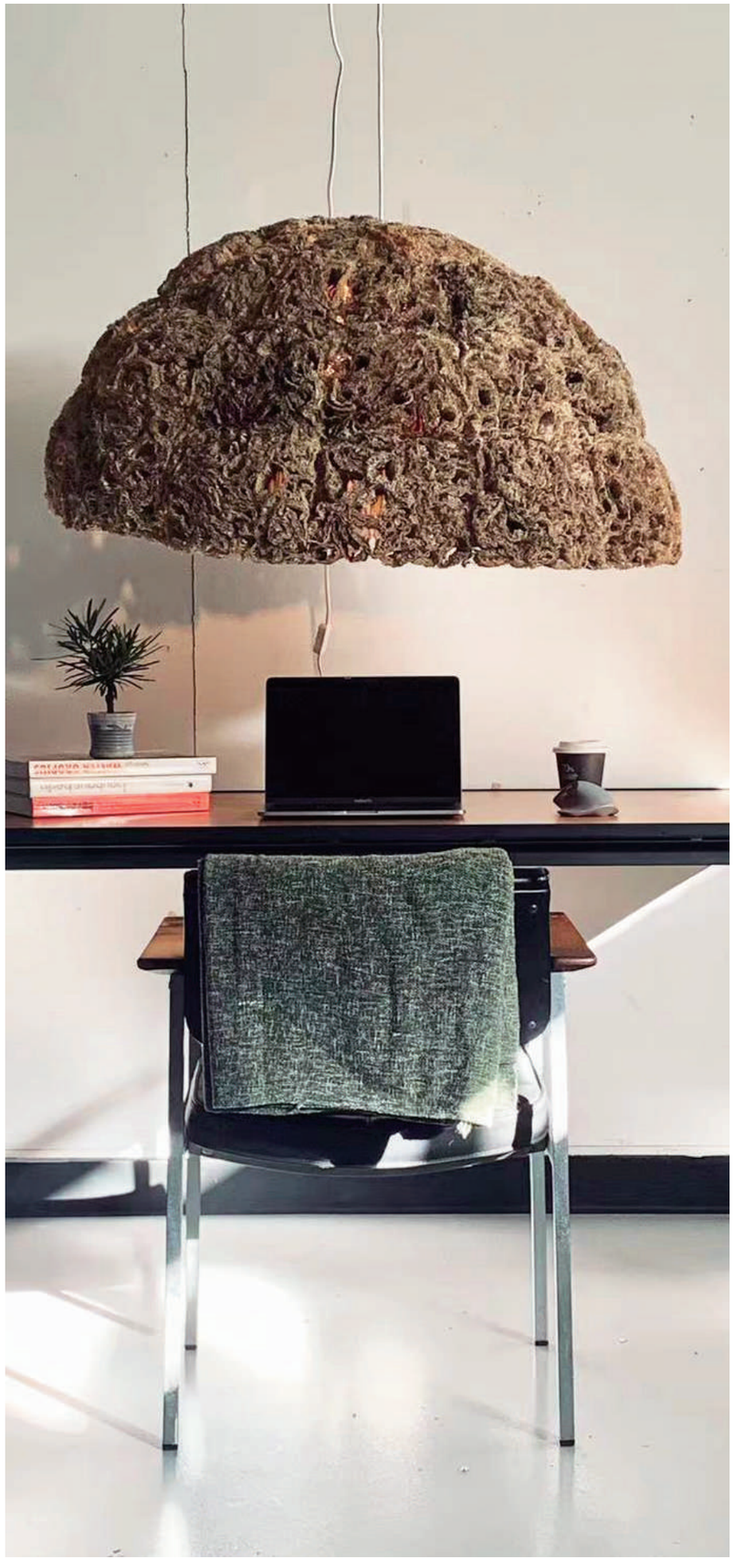


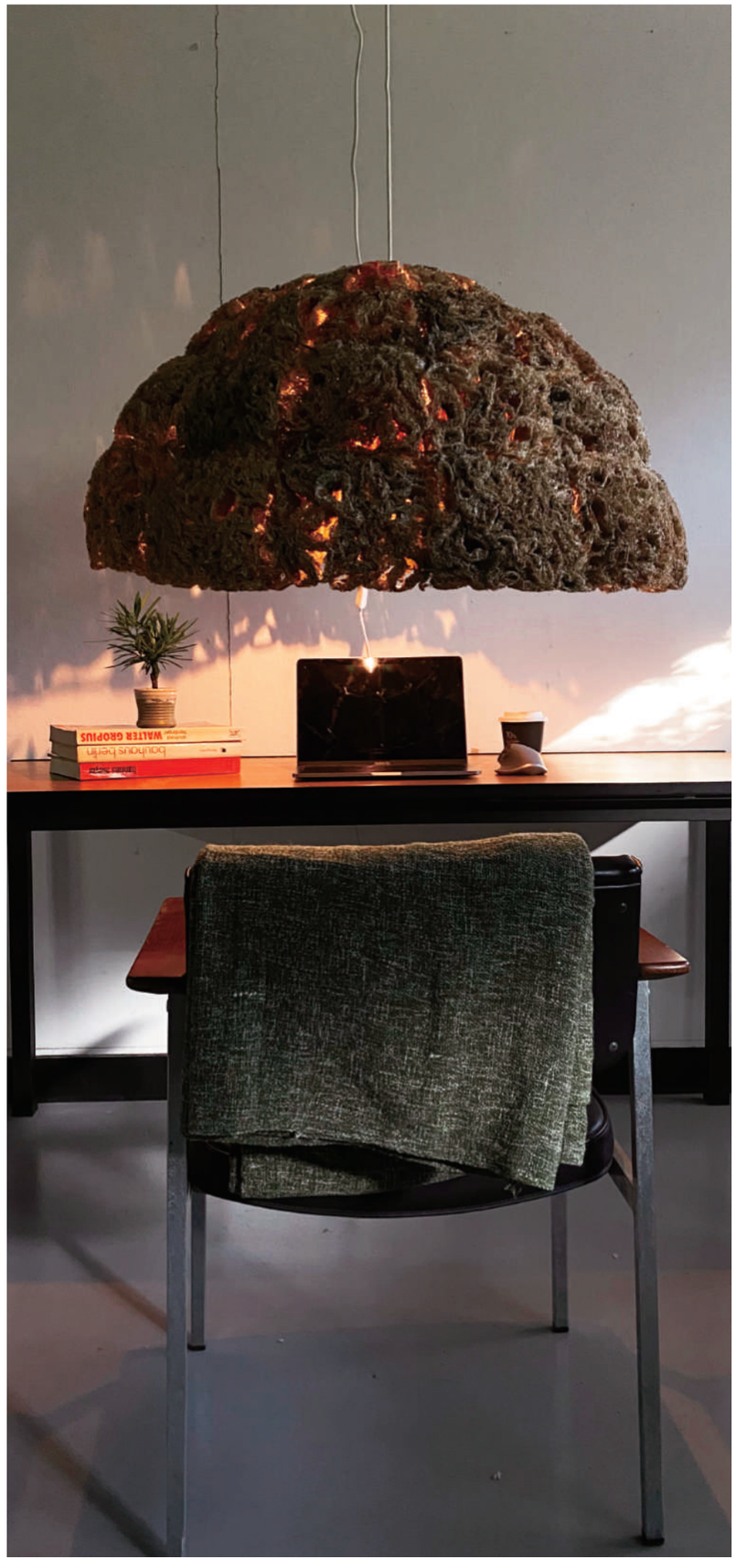




Prototyping of 1:1 Hanging Dome



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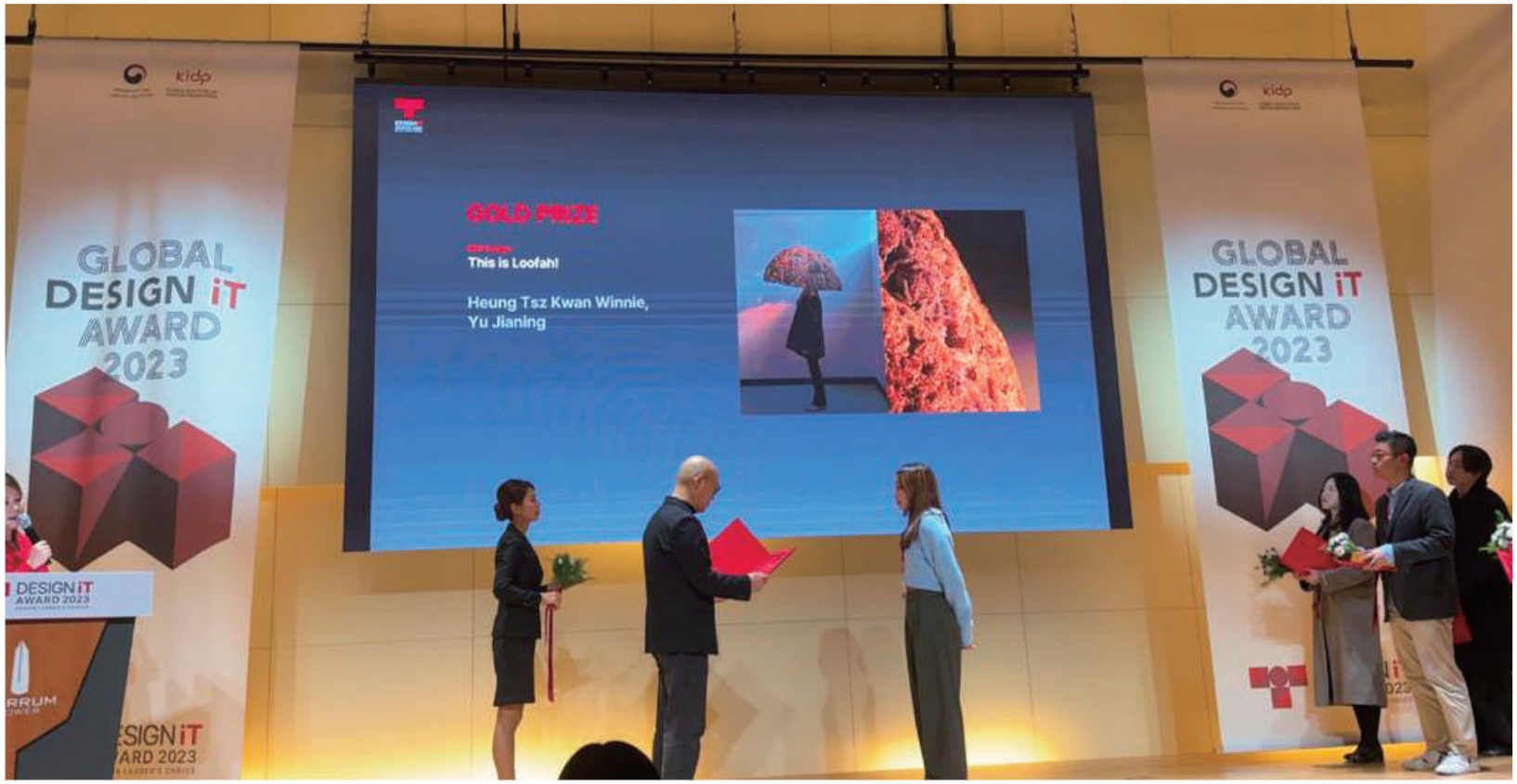


2023
Gold Prize (ESG)
Global Design iT Award

https://designitaward.com/-blog/win/this-is-loofah/

2021
"Alternative Materials"
Exhibition at PMQ, HK

2022
Journel Interview
South China Morning Post

https://www.scmp.com/lifestyle/arts-culture/article/3207851/upcycled-waste-sustainable-furniture-and-homewares-made-eggshells-earth-paper-fruit-peel-even-blood

South China Morning Post — Thursday, January 26, 2023 — B7

LIFE

It used to be that plastic and food were the main focus in conversations about our environment, but now fashion is really being talked about

SOCIAL MEDIA INFLUENCER VENETIA LA MANNA ON THE GROWING AWARENESS OF THE ENVIRONMENTAL COSTS OF THE FAST FASHION INDUSTRY > FASHION, B9

Waste not, want not

Designers are seeking ways to use waste materials, from eggshells to blood, to craft sustainable goods, furniture and construction materials

Peta Tomlinson
lifs@scmp.com

Most people walk past construction sites without paying them any attention. Not Niko Leung Hong-kei.

Curious about what lies beneath, the Sai Kung-based product designer hunts down subsoil from different parts of Hong Kong from which to craft sustainable homewares.

Her medium – rammed earth and ceramics – continues one of the oldest construction techniques in China, while giving new purpose to discarded material that might otherwise be stockpiled or end up in landfill.

Leung's two years working at architectural manufacturing company Royal Tichelaar Makkum in the Netherlands fuelled her desire to research purposeful reuse of discarded soil from building sites.

In 2015, she returned to Hong Kong and in 2021 – upon securing funding from Design Trust – she co-founded Hong Kong Soil with architectural designer Coby Leung Lok-kwan.

However, exploring the techniques of building houses with rammed earth proved challenging. "It's difficult to get the material," Niko Leung says. "Dirt is low cost and widely available, but to recycle it for non-builders' work is nearly unprecedented here in Hong Kong." Nevertheless, the partners were able to source small amounts – totalling about 15 tonnes – to experiment with.

The students pick any type of waste they think might have potential

DENNIS CHEUNG,
UNIVERSITY OF HONG KONG

Not all of the raw material is suitable. A good soil for rammed earth requires the right ratio of sandy loam and gravelly clay. For functional ceramics, mainly clay is preferred.

Plus, it is hard to find "clean" earth in Hong Kong, because many sites have been previously developed or are on reclaimed land.

Putting a grid over a map of Hong Kong, the partners plotted potential sites within a 5km radius, dug below their surface, then analysed the samples.

Apart from physical composition, there are distinct variances in colour and texture in soil from the New Territories, Hong Kong Island and Kowloon.

Along with various private consignments, Leung's work so far has resulted in two sets of ceramic candle holders and an essential oils diffuser sold through the Candle-in-Sai Kung, Hong Kong Soil also made a rammed earth bench for the 2022 Hong Kong-Shenzhen Bi-City Biennale of Urbanism/Architecture.

While the market seems ready for locally sourced and produced ceramic homewares, Leung would like to see the wider adoption of rammed earth in Hong Kong building and structures such as village houses.

"In the past, farmers would routinely build their own houses with rammed earth," she says. "Today, a lot of designers and architects would love to use rammed earth because of its low embodied energy, ability to regulate humidity, and high thermal mass.

"And in the modern context, when we see an reliance on imports, the proximity of the material sourced in construction is important.

"It's also a reminder to source mindfully and treat our land with care and respect. I very much see the future economic and cultural significance earth could bring."

At the University of Hong Kong, adjunct assistant professor Dennis Cheung Hok-kwan, architect and founding partner of Studio Byte, whose focus is material innovation and novel construction techniques, challenges his Design+ programme students to test ways in which waste can sustainably be used to create new materials for furniture or construction.

"The students pick any type of waste or leftover material they think might have potential, imagine an end product, and then do a lot of experiments, formula testing and mock-ups to gauge its viability," Cheung explains.

The aim, he says, is "more about investigation" than product commercialisation. "I've been trying to push the boundaries with them," he adds of the course, Alternative Material, launched in 2021 and continuing in 2023.

It is up to the students to pursue the work privately, should they choose to.

Students Winnie Heung Tsz-kwan and Nonny Yu Jianing led a project experimenting with loofah, a plant used as a natural sponge for scrubbing and cleaning. Their aim in exploring its potential for furniture production was to use a resource grown in abundance in rural China, while having a social impact as well.

"As architecture students, we are sensitive to the beautiful structure of the loofah," Yu says. "It's also very cheap," Heung adds.

Using natural binders such as glycerine and coffee grounds, the group made two prototypes – a coffee table and a lampshade.

Yu and Heung say they would like to see these 100 per cent biodegradable pieces go into commercial production. They also hope to produce a DIY kit farmers could use to make furniture for sale, thereby boosting their income.

Another project explored the potential of egg and oyster shells as a sustainable construction material.

Hong Kong textile designer Hume Ng Yan-ling already turns eggshells into high-end architectural finishes, in collaboration with ethical design brand Nature Squared.

By adding oyster shells to the mix, the students came up with a formula showing that these calcium-rich bivalve shells, when pulverised, baked in an oven and sealed with a fabric mesh reinforcer, can be as strong as cement, only far more eco-friendly.

One "really good exploration with a surprising outcome" came after students gathered hard and soft crustacean shells from local seafood restaurants.

"They eventually found out that, when heated in an oven to a certain degree, the chitosan, shell powder and bone glue mixture would swell like a dough, becoming a much larger object with air enclosed inside," Cheung says.

Though early in the experimental stage, the students' work suggests its potential for a lightweight, organic building material with inbuilt insulation.

By experimenting with paper refuse, one group aimed to reduce the amount of waste dumped in landfills; paper products are the third-largest component of municipal waste in Hong Kong.

As architecture students, we are sensitive to the beautiful structure of the loofah

WINNIE YU, STUDENT

They found that when paper pulp is mixed with xanthan, an emulsifier used for thickening food, then compressed until it solidifies, a structural mass is formed.

This material could be cast into blocks, or 3D-printed via a robotic arm if sand is added. They also developed another material from rolled-up paper that can be cut into slabs with a woodgrain appearance.

Duy Ngoc Anh Huynh, one of the Design+ project leaders, said that, in addition to furniture and household items, the group's work also looked at using paper waste as a potential material in 3D-printed construction.

"Although we have successfully created a material that is 3D printable and significantly hardens when dried (named mekilite), we are looking further into optimising the drying process as well as further testing to validate potential in construction applications," he said.

The group is now looking into larger-scale production "because we have received a lot of interest in that material, specifically for furniture applications".

Sabrina Siu Man-yan and Angelique Nicole worked with durian – a fruit whose skin, once the flesh is extracted, can be compressed into a brick-like block.

Similar to biopiperie, a biocomposite made from the inner core of the hemp plant, durian skin could be another truly sustainable construction material even if, during its production, the smell is rather off-putting.

Another group used powdered blood, a slaughterhouse by-product. "Meat is one of the most consumed food types around the world, and yet its biggest by-product – [blood], a very high nutrient-rich, has very limited treatments," explained Gabriella Chan, one of the project leaders.

"We wanted to tackle the problem of blood waste, and the site in slaughterhouses."

The group's idea was to incorporate blood powder into a self-watering planter encouraged to release nutrients into the soil slowly. Employing a form designed using parametric software, the product was realised in 3D-printed clay.

Chan says the team sees many opportunities for this material beyond household objects. "With the right tools and techniques, we see our concept being applied to urban landscape planning and even in the architecture field," she says.

Cheung says such experiments in nations "urgent" given the impact of climate change and over-consumption in general.

"I try to push designers to work out materials that will respond creatively to this situation. It's actually alarming and urgent," he says.

Cheung hopes that, eventually, the course he is teaching at HKU will build transferable skills for the continuing education of designers.

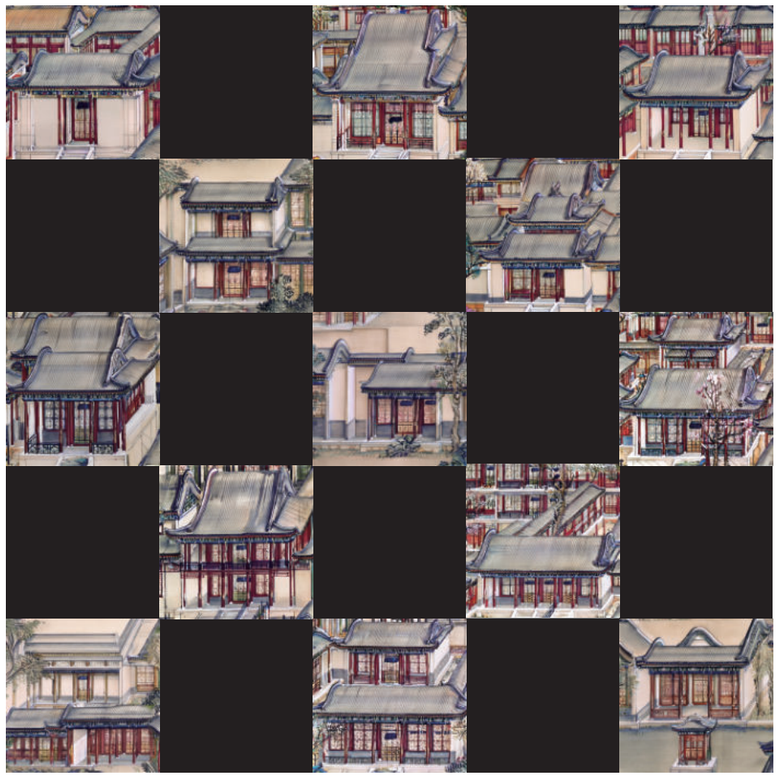
Without the ability to appreciate natural resources, and to think and act sustainably, "I would say designers are contributing to even more waste in the world", he says.

Today, a lot of designers and architects would love to use rammed earth because of its low embodied energy, ability to regulate humidity, and high thermal mass

NIKO LEUNG, HONG KONG SOIL

A rammed earth bench, made for the Hong Kong-Shenzhen Bi-City Biennale of Urban/Architecture.

Clockwise from top left: A table made from loofah; paper waste used in construction; durian skin furniture; and candle holders made of reclaimed earth. Photos: Handout



Parallel Nostalgia

AI-Enabled Public Participation as a Booster for the Old Summer Palace's Digital Restoration

Individual Project
Oct - Dec, 2023
Tutor: Xu Zhang
Tools: Stabble Diffusion, LoRA, ControlNet, ComfyUI, Rhino

The Old Summer Palace (Yuanmingyuan), once a renowned imperial garden, has suffered the ravages of war since the 19th century and now exists only as remnants. Through interviews, I discover a cognitive bias among the public rowards Yuanmingyuan, as well as a lack of connection to the ongoing digital restoration project. Considering Yuanmingyuan's design principles and characteristics, i.e. integrated and chimerical art, I began contemplating the potential of StableDiffusion's text-to-image model for engaging the public in the process of Yuanmingyuan's digital restoration.

"Forty Scenes of the Old Summer Palace", which was created 300 years ago, provides the most vivid depiction and documentation of a portion of Yuanmingyuan's landscapes. This collection of artworks is not only visually stunning, but also contains a wealth of information about the spatial relationships and architectural features. I trained LoRA models using substaintial data collected from "Forty Scences" and designed a step-by-step workflow in ComfyUI. By translating the graphical inputs from users into spatial infomation and then into textual prompts, users can imagine and create scenes that are not covered in the "Forty Scenes". The final outcomes are showcased on an online platform, allowing people to see different individuals' visions of Yuanmingyuan. This AI-assisted approach not only enhances public engagement and connection with Yuanmingyuan's restoration but also collects inspirations for the ongoing digital restoration project through the vast creations and trends generated.

BACKGROUND

Past and Present of the Old Summer Palace

*"There was, in a corner of the world, a wonder of the world; this wonder was called the Summer Palace. The slow work of generations had been necessary to create it. This edifice, as enormous as a city, had been built by the centuries... **This wonder has disappeared.**"*

I - Imperial Summer Palace: echoes of a golden era

enrichment

II - Disaster: ravaged by wars

decline

III - Lagacy in Ruins: reminder of history

Year 46 of Kangxi Era

The Old Summer Palace was founded in 1709 as a gift from Emperor Kangxi to the fourth prince Yinzhen at that time (later Emperor Yongzheng).

Middle of Yongzheng Era

In 1722, Emperor Yongzheng ascended the throne and began to expand the Old Summer Palace. By 1735, the Old Summer Palace had **35 scenic spots** and became a grand royal garden with a total area of **200 hectares**.

Year 9 of Qianlong Era

In 1736, Emperor Qianlong ordered painters to document the beautiful scenery of the Old Summer Palace.
In 1744, "Forty Scenes of Yuanmingyuan", jointly painted by Shen Yuan and Tang Dai was completed.

Middle of Qianlong Era

The Old Summer Palace has undergone two rounds of expansion, with the number of scenic spots increased to more than 80s, including some "Western Buildings" built in imitation of Western architectural styles.

End of Guangxu Era

The expansion is completed and the total garden area reaches **450 hectares.**

Year 10 of Xianfeng Era

During the Opium War, the Old Summer Palace was burned by fire within three days and nights. Almost all of the wooden buildings were destroyed, and the Qing government was unable to repair it.

Year 26 of Guangxu Era

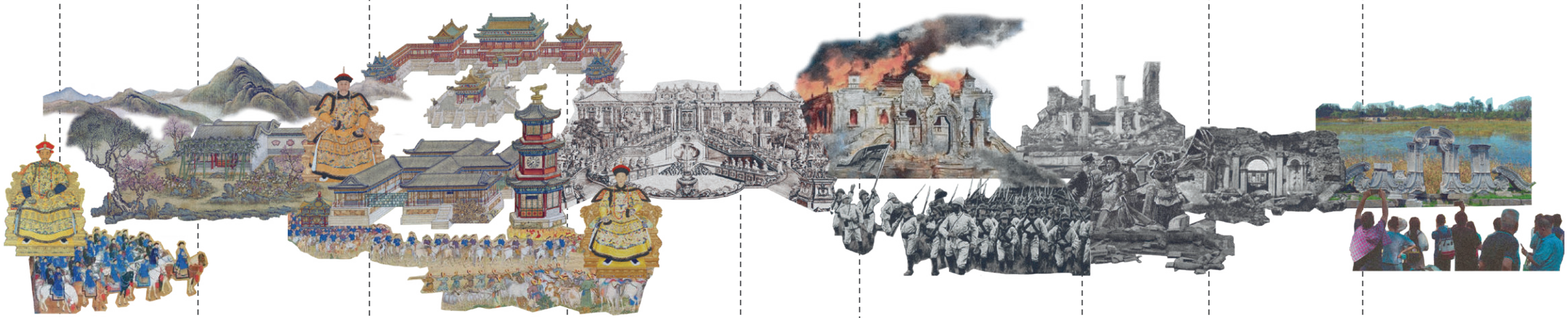
During the Sino-Japanese War, the Old Summer Palace suffered a second destruction and civilian thefts.

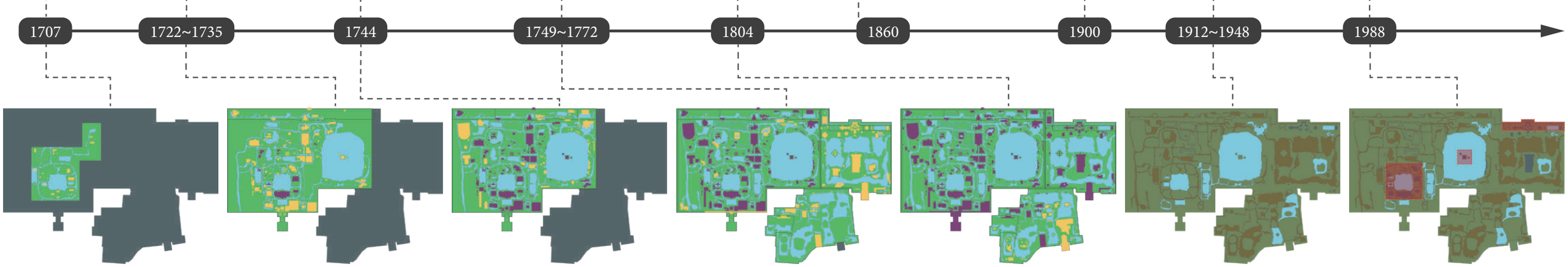
Republian Era

Destroyed by warlords' melee, the landscape pattern of the Old Summer Palace disappeared and turned into cultivated land and residential areas.

People's Republic of China

The government attached great importance to the protection of the Old Summer Palace. Several survived scenic spots were open to the public.
However, controversy over the reconstruction of the Old Summer Palace has been continuing for devades.





IDEATION

Restoration of the Old Summer Palace

"This edifice ... had been built over the centuries, for whom? For the peoples.
For the work of time belongs to man."

I - Challenges

> 70% Opposition & Prejudice

In an online survay in 1985, 70% of interviewees believe that Yuanmingyuan should not be rebuilt since its ruins are the best example of patriotic education.

< 2% Available to the Public

In the 1990s, Professor Guo Daiheng pointed out that the current Yuanmingyuan that people could see was only 2% of its glory days. Therefore she proposed the digital restoration plan.

> 50% Missing Historical Info

The restoration project has been carried out for 10+ years, and more than half of Yuanmingyuan's landscape has digital models. However, due to the lack of historical data and Prof. Guo's death, the last 50% progressed very slowly.

> 50% Unsatisfied Voices

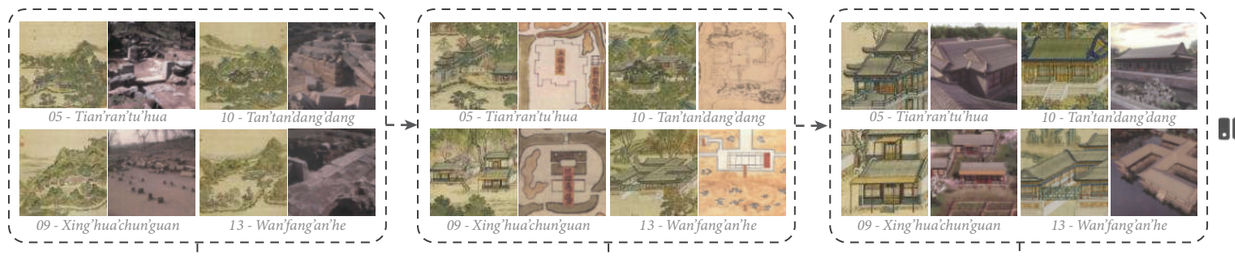
In 2014, the team demonstrated the digital Yuanmingyuan to the public via an online tour app. But many people commented that there were certain differences between the models and real buildings in history.

II - Methods

the 1990s: Proposal of Restoring the Old Summer Palace Digitally

For the 50% with sufficient historical references

>90% fidelity



For the 50% lacking historical references

high uncertainty

Today: How can the Public get Engaged and Help with the Restoration?

General Public

The public can reimagine the landscape and building based on their own understanding and preferences

Generative AI

AI models can refine people's ideas and draw them out by learning landscape and building elements from Forty Scenes

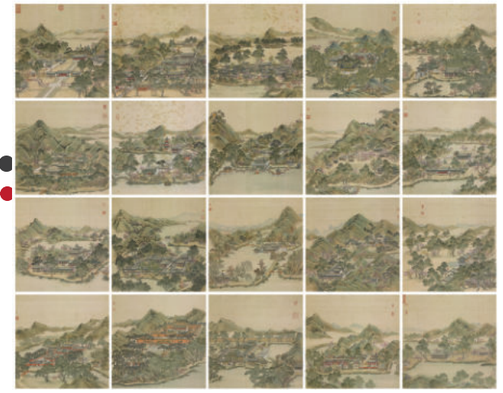
Crowdsourcing creations and trends can give the professional team valuable insights for further analysis

Professionl Teams

III - Findings

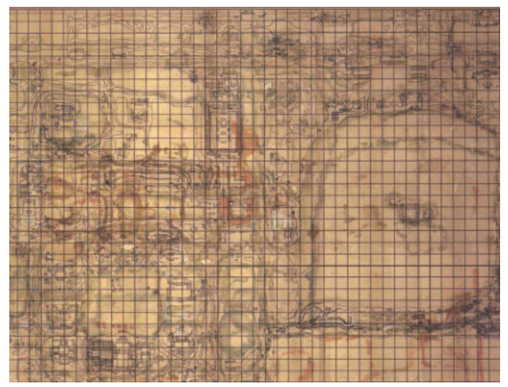
Forty Scenes Painting

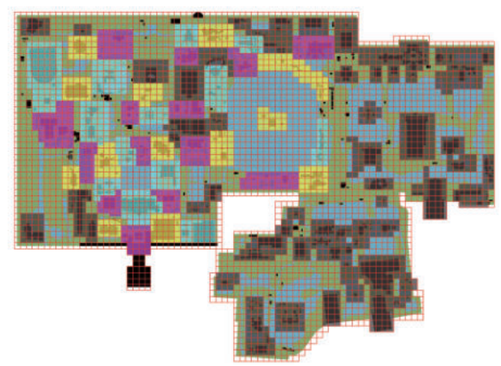
These paintings show forty scenic spots from the Qianlong period, detailing landscapes & gardens.



Grids

Yuanmingyuan has a collection of over 100 gardens. The designers applied grids to manage and guide the placement of each of them. Each garden can be located in a group of grids.





METHOD

Human-AI Collaborative Creation

*"**Imagine some inexpressible construction,** something like a lunar palace, and you will have the Old Summer Palace (Yuanmingyuan)."*

How can the user generate an effective painting in StabbleDiffusion th LoRAs?

Step-by-step User Inputs

inspiration — Forty Scenes Painting — *training dataset*

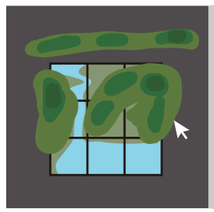
Adaptations of SD Model

***define** spatial information* — New Painting — ***visualize** spatial information*

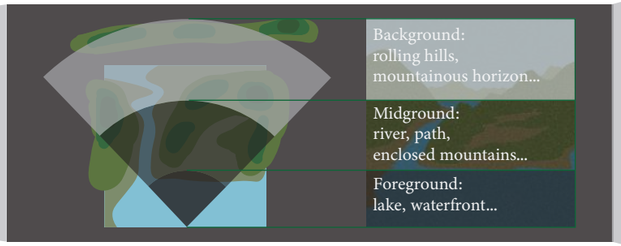
Ways to Translate

Ways to Control

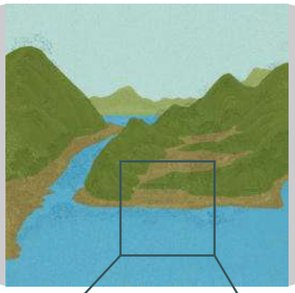
Step 1: Graffiti Mountains



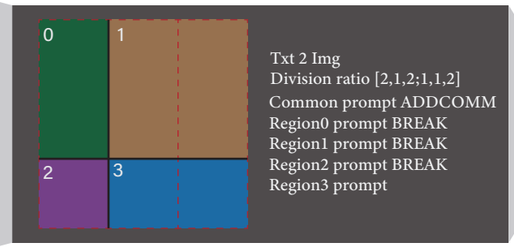
Decode the graffiti input from the user into landscape spatial relationship in the painting by identifying foreground, midground, and background



landscape



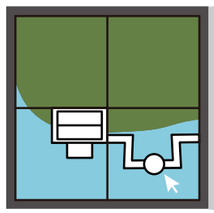
***RegionalPrompter**: divide the canvas and control landscape elements to be drawn on different regions*



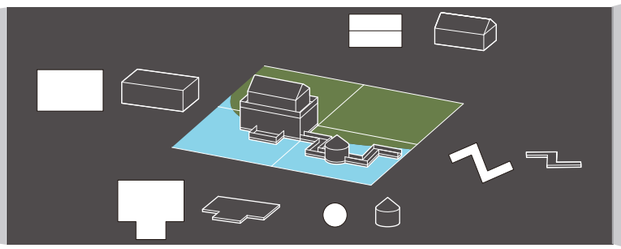
LoRA

dataset 1 - landscapes

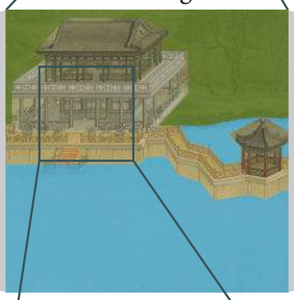
Step 2: Add Blocks



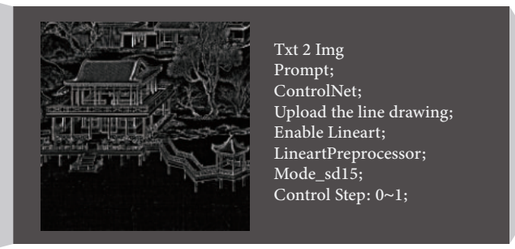
Abstract building elements into blocks and transform the input geometric patterns into 3D axonometric



building



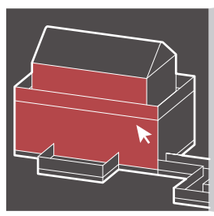
***Controlnet-Lineart:** guide the building to be drawn based on the outline*



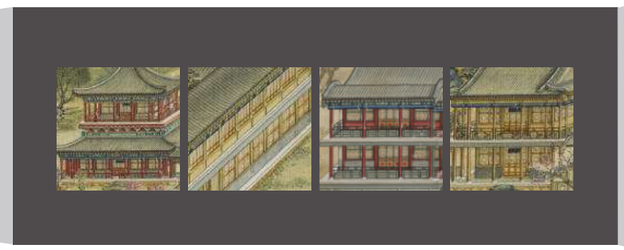
LoRA

dataset 2 - buildings

Step 3: Appreciate Details



Recognize the feature of the selected regions and search for similar elements in the database (In this case, two-story facade is selected for detailed drawing)



facade details

***Controlnet- Inpaint:** partially redraw wite details*

LoRA

dataset 3 - details

"Decoding Inexpressible Chimerical Art"

TESTING

"If people did not see it they imagine it."

Lou'yue'yun'kai (镂月云开), is the 4th in the Forty Scenes Collection (1709). However, besides the painting(right) and Emperor Qian Long's calligraphy (left), there is no authoritative historical archives left today.

Taking 镂月云开 as an effective validation datapoint, I adjusted parameters of trained LoRA models, making sure that the generated outcomes fit as closely as possible with the original painting.

LoRA

I : fulllandscape

dataset: 40 images
repeat: 100
epoches: 12
learning rate: 1e-4
epoches: 05 ~ 10
(prefer: 09 -> Loss = 0.0889)
weights: 0.5 ~ 0.9
(prefer: 0.8)

II : detailedlandscape

dataset: 125 images
repeat: 100
epoches: 12
learning rate: 1e-4
epoches: 05 ~ 09
(prefer: 07 -> Loss = 0.0903)
weights: 0.7 ~ 0.9
(prefer: 0.8)

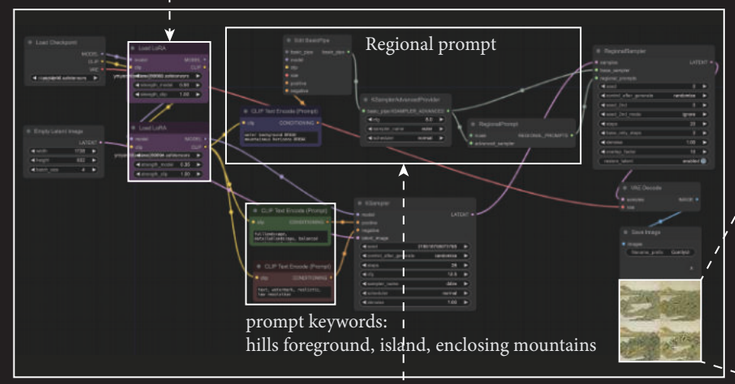
ymybuilding

dataset: 80 images
repeat: 100
epoches: 12
learning rate: 8e-5
epoches: 08 ~ 11
(prefer: 010 -> Loss = 0.089)
weights: 0.6 ~ 0.9
(prefer: 0.9)

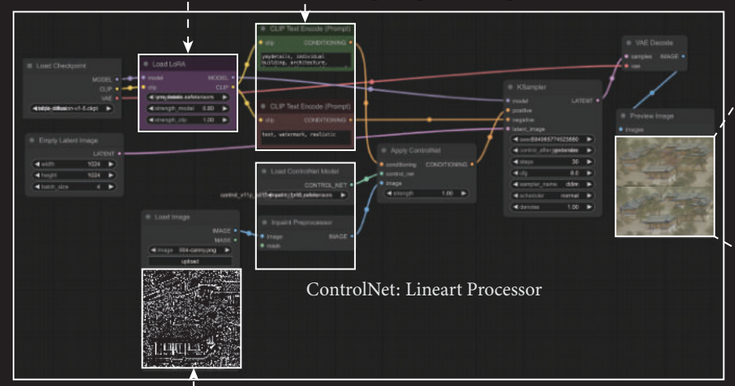
ymydetails

dataset: 80 images
repeat: 100
epoches: 12
learning rate: 8e-5
epoches: 04 ~ 07
(prefer: 06 -> Loss = 0.0842)
weights: 0.6 ~ 0.9
(prefer: 0.8)

ComfyUI Workflow

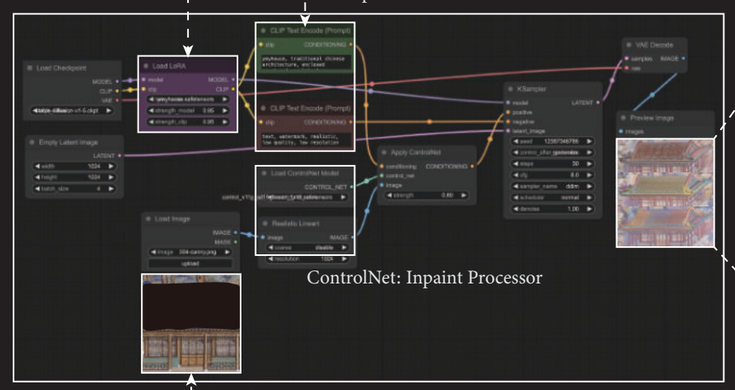


prompt keywords:
building complex, rooftop, facade, wall



lineart input

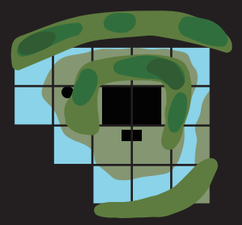
prompt keywords:
rooftop with colorful tiles



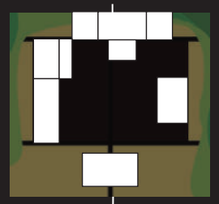
inpaint area:
roof

Outputs

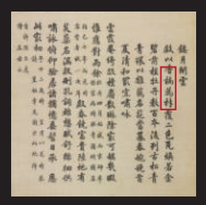
Step 1 - landscape



Step 2 - building



Step 3 - details



According to Emperor Qian Long's calligraphy, we know that he appreciated the design of the roof. Designers utilized tiles of two different colors to make it as fancy as a fairy palace.

LITERATURE REF

Letter to Captain Butler on Anglo-French Troops Expedition to China (excerpt)

by Victor Hugo (France, 1861)

There was, in a corner of the world, a wonder of the world; this wonder was called the Summer Palace.

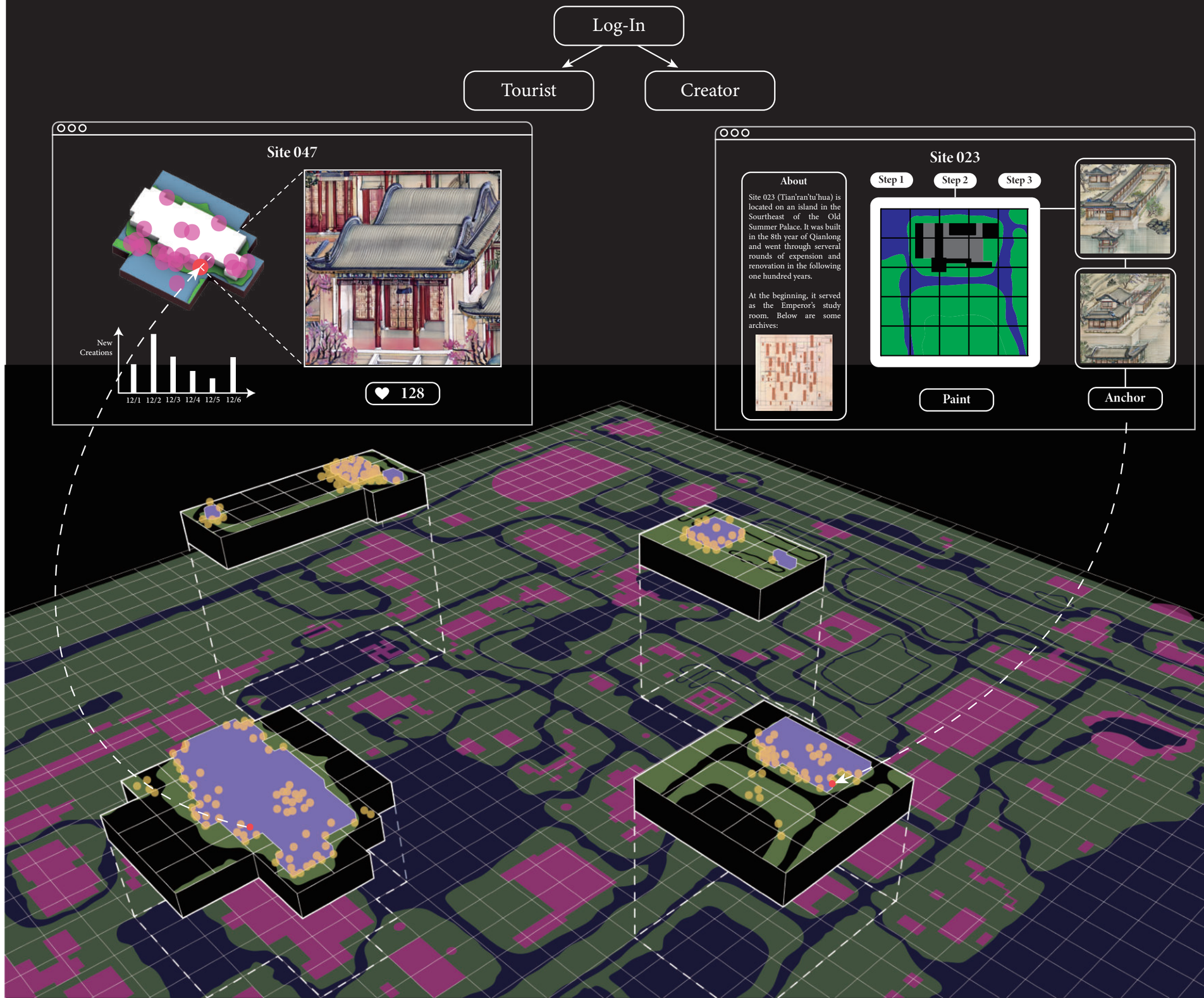
Art has two principles, the Idea, which produces European art, and the Chimera which produces oriental art. The Summer Palace was to chimercial art what Parthenon is to ideal art. All that can be begotten of the imagination of an almost extra-human people was there. It was not a single, unique work like the Parthenon. It was a kind of enormous model of the chimera, if the chimera can have a model. Imagine some inexpressible construction, something like a lunar building, and you will have the Summer Palace. Build a dream with marble, jade, bronze and porcelain, frame it with cedar wood, cover it with precious stones, drape it with silk, make it here a sanctuary, there a harem, elsewhere a citadel, put gods there, and monsters, vanish it, enamel it, gild it, paint it, have architects who are poets build the thousand and one dreams of the thousand and one nights, add gardens, bassins, gushing water and foam, swans, ibis, peacocks, suppose in a word a sort of dazzling cavern of human fantasy with the face of a temple and palace, such was this building.

The slow work of generations had been necessary to create it. This edifice, as enormous as a city, had been built by the centuries, for whom? For the peoples. For the work of time belongs to man. Artists, poets and philosophers knew the Summer Palace; Voltaire talks of it. People spoke of the Parthenon in Greece, the pyramids in Egypt, the Coliseum in Rome, Notre-Dame in Paris, the Summer Palace in the Orient. If people did not see it they imagined it. It was a kind of tremendous unknown masterpiece, glimpsed from the distance in a kind of twilight, like a silhouette of the civilization of Asia on the hori- zon of the civilization of Europe.

This wonder has disappeared.

PARALLEL NOSTALGIA

Proposal for an Online Platform to Assist the Public in Reimagining and Touring the Old Summer Palace



Urban Canvas

Interactive Data Collection and Visualization for Migrant Female Workers

Individual Project
Jan - May, 2022
Tutor: Xun Liu
Tools: Arduino, Prosessing, Geospatial API, Unity AR Foundation

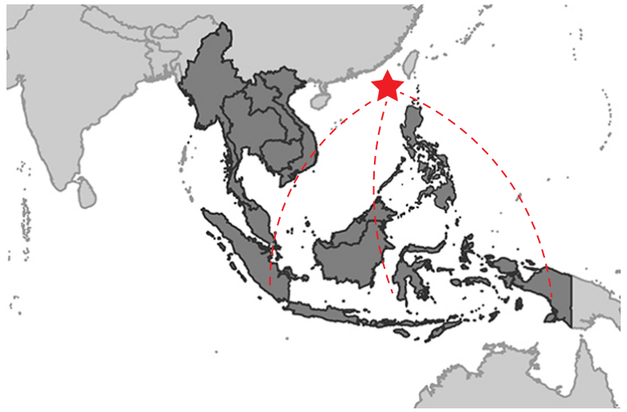
For half a century, "Filipino Sisters" have been a very special group in Hong Kong. On Sunday, their weekly holiday, they usually gather on the streets of Central to share food, sing, dance and chat with friends. The business district of Central, which used to be bustling with traffic, becomes the base of "Filipino Sisters" on this day. Since the pandemic, conflicts between locals and migrant domestic helpers have increased. According to reports, more than 70% of foreign domestic helpers suffered from depression. For them, Central CBD, their main gathering place, is full of "cold" curtain walls and shopping malls with "no entry" written on them. "This place is like a cage for us, even on Sunday."

Based on the concept of Urban HCI, this project aims to turn the "cage" into a "drawing board" and "an outlet for emotional expressions", providing migrant domestic workers with a way to record and express themselves through virtual interaction with urban buildings.

The implementation of the project is divided into two parts: hardware and software. First of, individual and environmental data is collected via sensors and then visualized into graffiti patterns of varius colors and sizes, etc.; Secondly, the user can “shoot” her representative graffiti onto the iconic skyscrapers in Central via augmented reality. Hopefully, Urban Canvas can enable these migrant female to record and share their holiday experiences in an artistic way while enhancing their interaction with urban spaces in the city.

BACKGROUND

Migrant female workers in Hong Kong: Unheard Voice



As of 2021, there are more than 340,000 migrant workers in Hong Kong, most of whom are females from Southeast Asia countries. They are hired by local families as domestic helpers. However, in a recent survey conducted by HELP, we found that more than 70% of domestic helpers suffer from depression to varying degrees or are prone to depression.

340 thousands migrant workers in Hong Kong

over 70% depression

Sunday is a statutory rest day for domestic helpers. On this day, most of them gather in Central. I interviewed 12 of them on two consecutive Sundays and summarize the following painpoints:

1. **Separation** — *"I have been working here for 8 years. Leaving my own kids makes me painful."*
2. **Isolation** — *"We are not allowed to get into or even get close to those expensive shopping malls."*
3. **Supervision** — *"We want to defend our rights. But the police are watching us."*
4. **Poor Conditions** — *"We don't have an elegant gathering place. But I still enjoy meeting with my firends."*
5. **Ignorance** — *"I love my culture and want to share it with the city. But I just don't know how to be seen and heard."*

How to help them express & be healed

Manila, Philippine

Central, HK

IDEATION

A way to enable migrant female workers to Express HerSelf

Observing the group

Sensing

Wearable device

Processing

Individual data

emotional state

average value in t

- low (<150)
- middle (150 ~ 300)
- high (>300)

color

body state

average change in t

- low (<50)
- middle (50 ~ 100)
- high (>100)

size

Environmental data

friends num

average value in t

- no one detected (0)
- detected (1)
  - small group
  - large group

fold

noise level

average value in t

- low (<100)
- middle (100 ~ 200)
- high (>200)

rotation

temperature

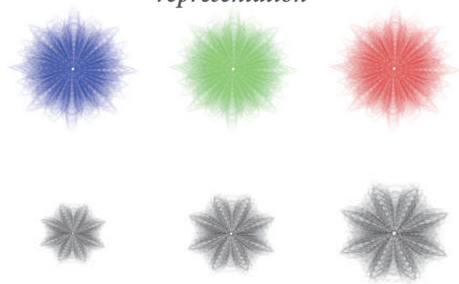
average value in t

- low (<10)
- middle (10 ~ 25)
- high (>25)

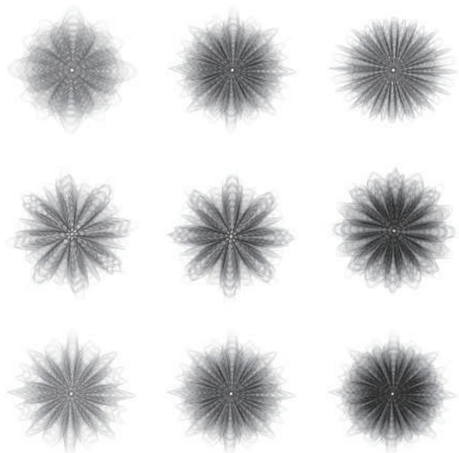
frame

Visualizing

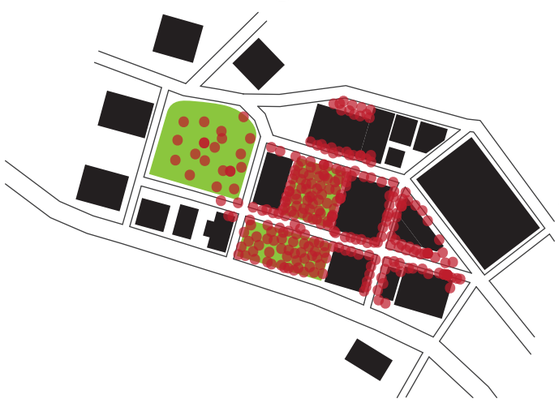
Individual representation



Environmental representation



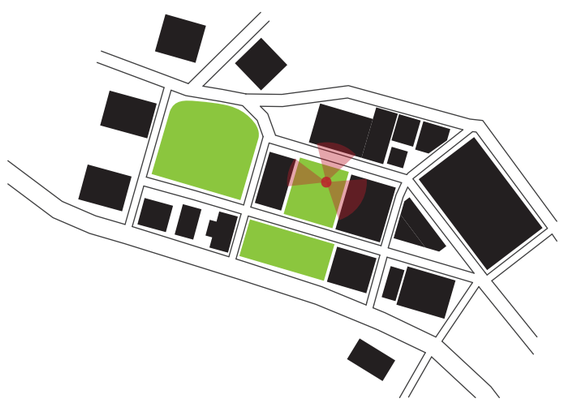
Observing the site



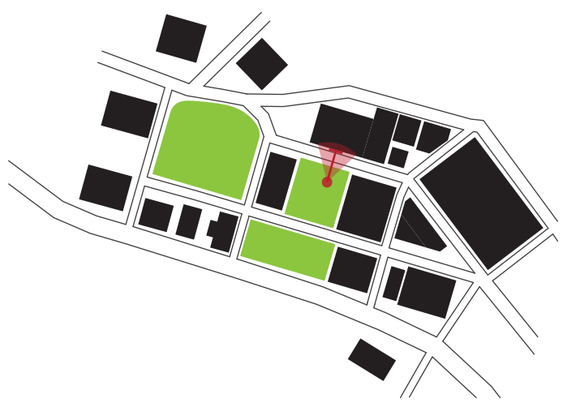
Mobile phone

- location
- direction

“Aiming”



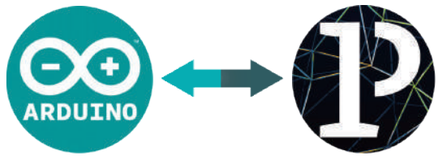
“Shooting”

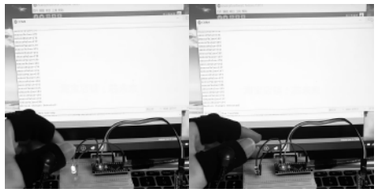


PROTOTYPING PART 1

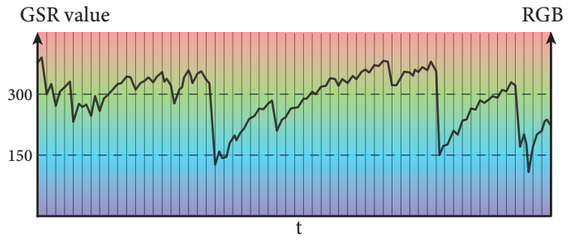
Sensor testing and Pattern generation

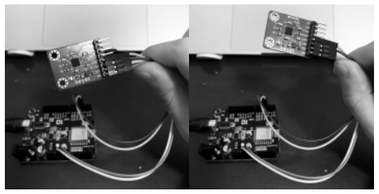
Senered data is transfered from Arduino to Processing as parameters for Pattern Generation



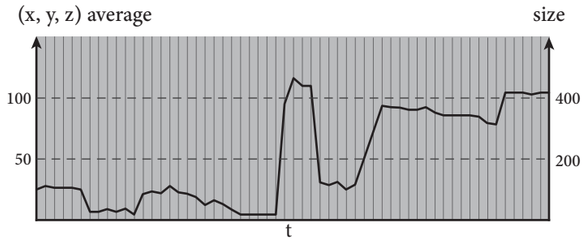


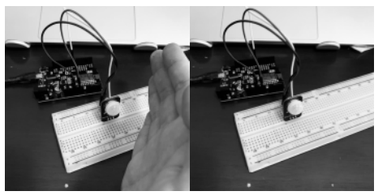
GSR sensor can detect the user's **emotional status.** Based on color psychology, I convert the detected electrodermal values into **RGB values.**



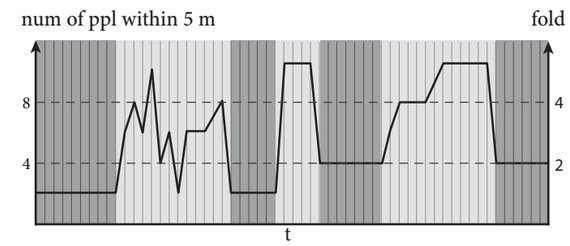


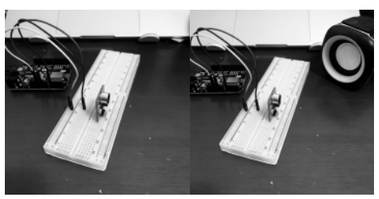
Accelerometer can detect the acceleration of an object. I converted the average change of (x,y,z) to **pattern's size** in representation of user's **dynamic level.**



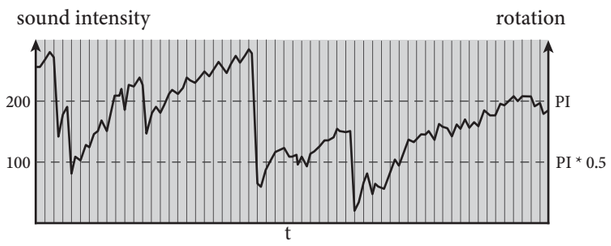


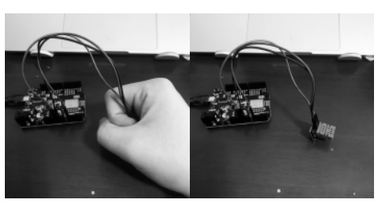
PIR sensor can detect if there're people moving around and **mmWave radar** can detect anyone staying around. The combination reflects **group activity status.**



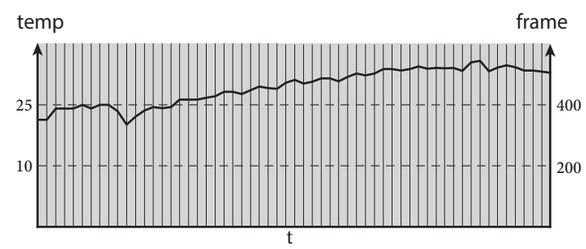


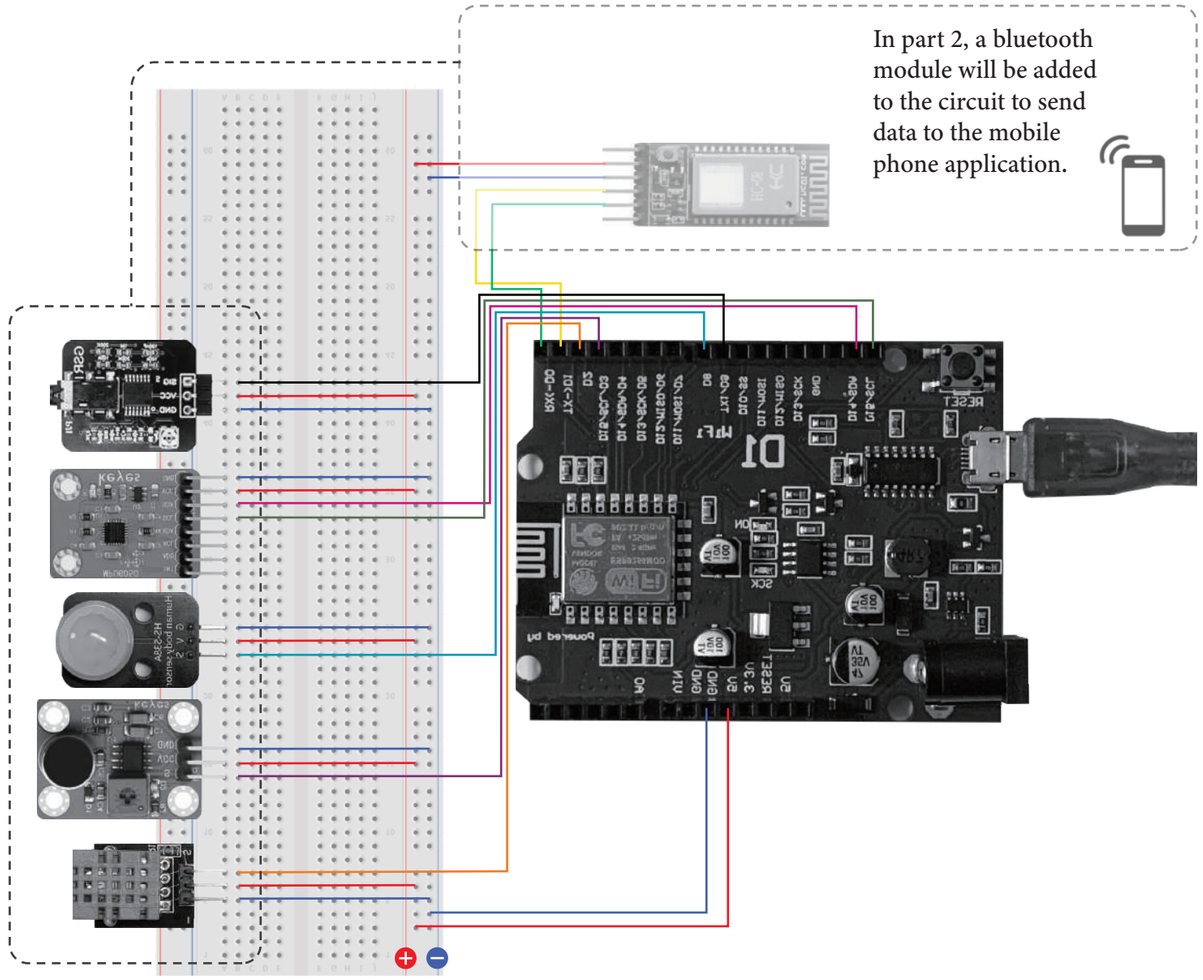
Sound sensor detects the **noise level** of the environment and its intensity is converted to the **rotation** of the pattern.

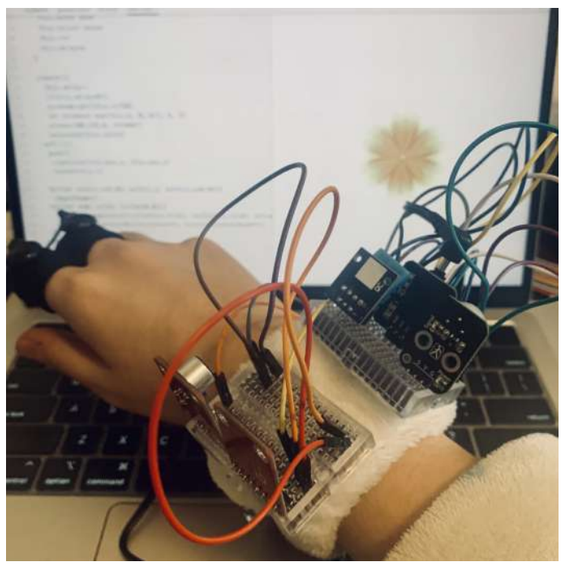


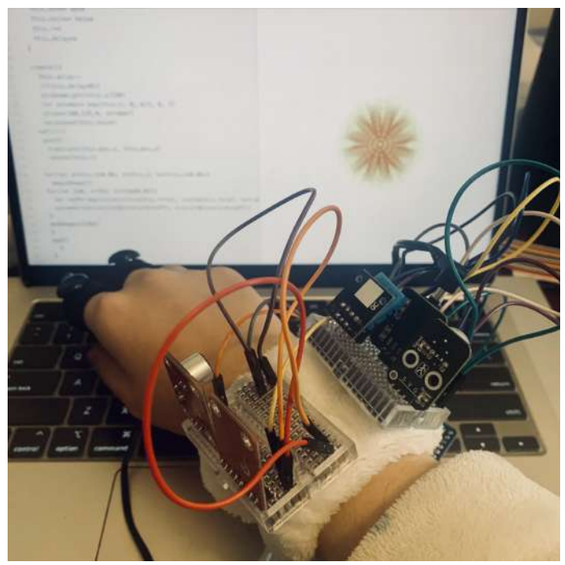


Temperature sensor detects the temperature of the environment and its value is converted to the **frame** of pattern generation process.



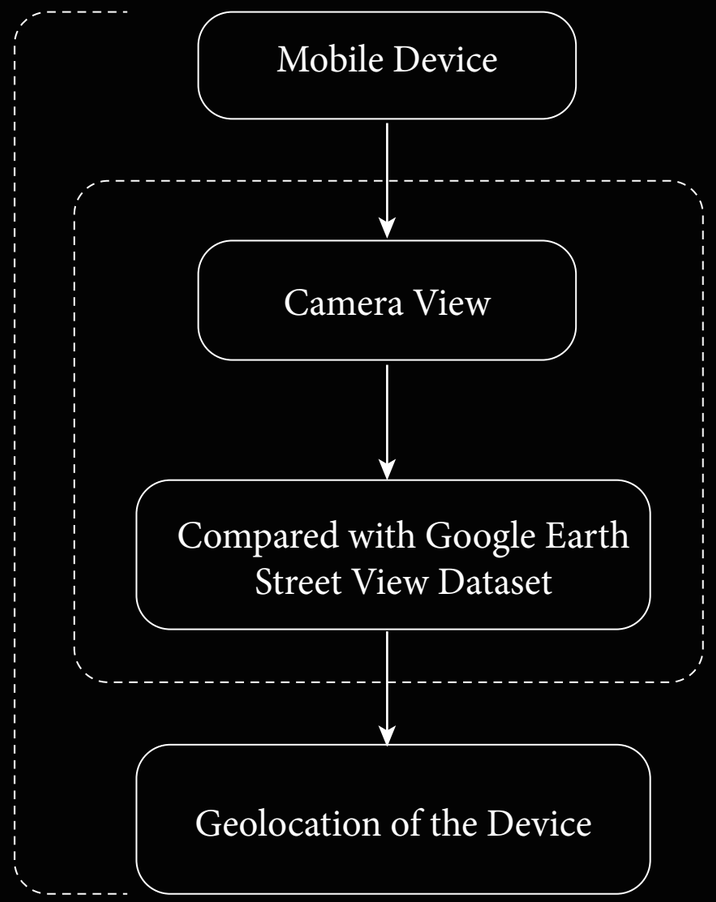


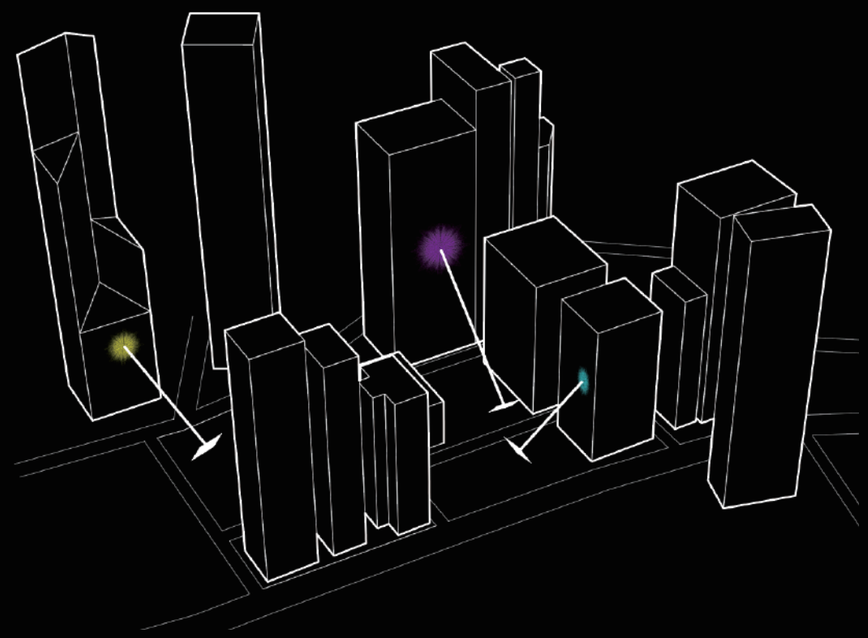




PROTOTYPING PART 2

Urban HCI: to make Skyscrapers the Canvas

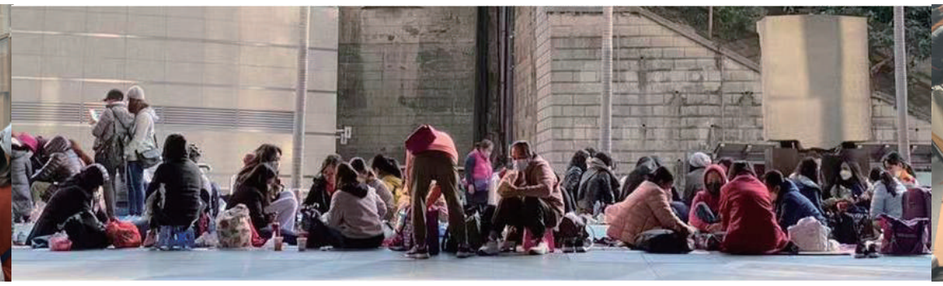




Utilizing Geospatial API, I created a demo in Unity that supports global localization of mobile device. The user can anchor virtual object in the space and share it with others. (The proposal is supported by Geospatial Lab)

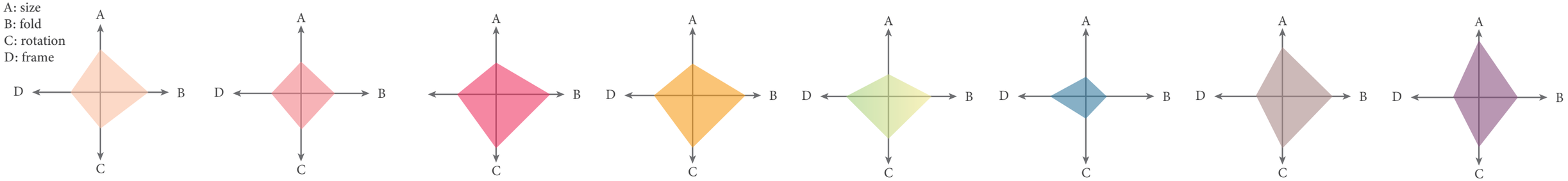
USER JOURNEY

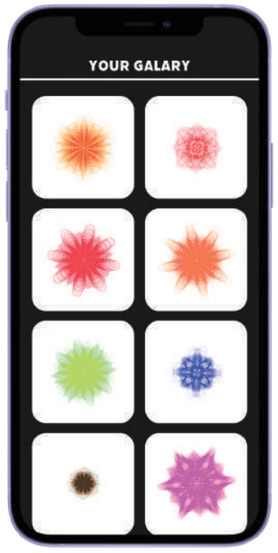
One-day of Filipino Sisters' holiday in Central

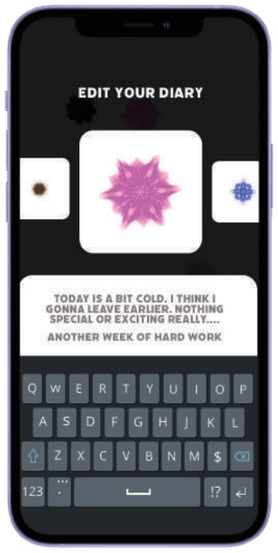


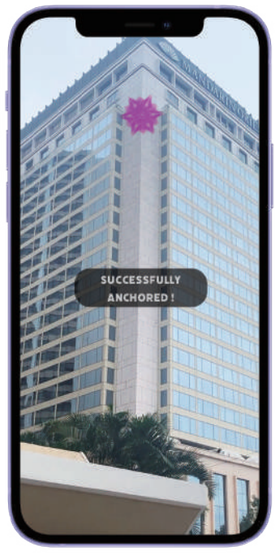
10 a.m. 11 a.m. 12 p.m. 13 p.m. 14 p.m. 15 p.m. 16 p.m. 17 p.m.

A: size
B: fold
C: rotation
D: frame









FitHub

Interactive AI Coaching Experience

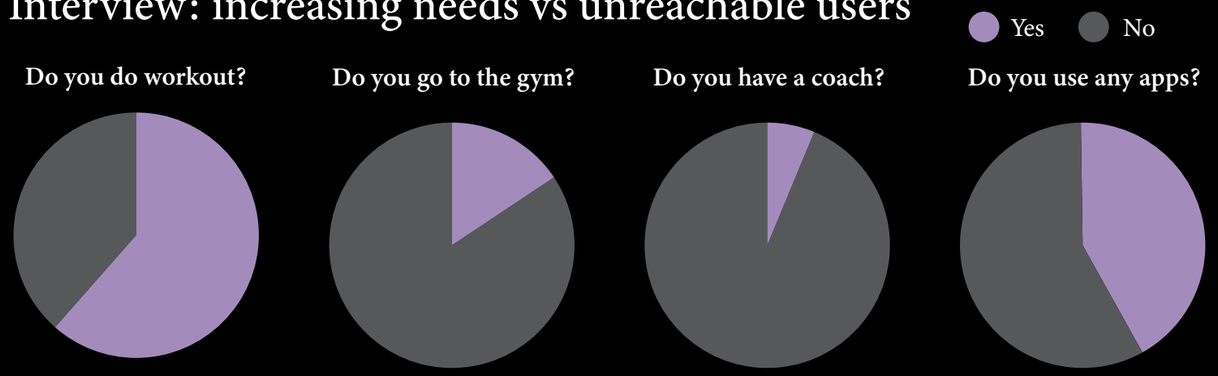
Feb - May, 2023
Individual Project
Supervisor: Kristof Crolla
Tools: Python, OpenCV Library, MediaPipe, Unity MARS

This project focuses on the development of a process-oriented smart fitness product that employs computer vision and spatial interaction technology to improve the fitness experience. Motivated by the popularity of fitness in the post-pandemic era and the need to alleviate unnecessary body anxiety, my objective is to design a smart fitness product for fitness beginners who don't have access to personal coaches or to a gym.

The final deisgn outcome is an open-source, pose-based fitness platform with three key features. First, it is open-source and community-driven, allowing users to upload publicly available fitness videos to the platform, which will be processed and turned into a tutorial using machine learning algorithms. Second, it is interactive, with the fitness experience conducted in AR mode, focusing the user's attention on their own body ad movements. Third, it is decentralized and anonymous, utilizing blockchain technology to protect user privacy and establish a unique motion database for each user. Users will have the opportunity to monetize their motions and poses.

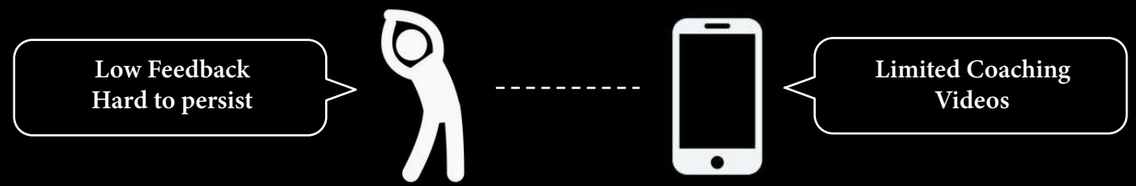
IDEATION

Interview: increasing needs vs unreachable users

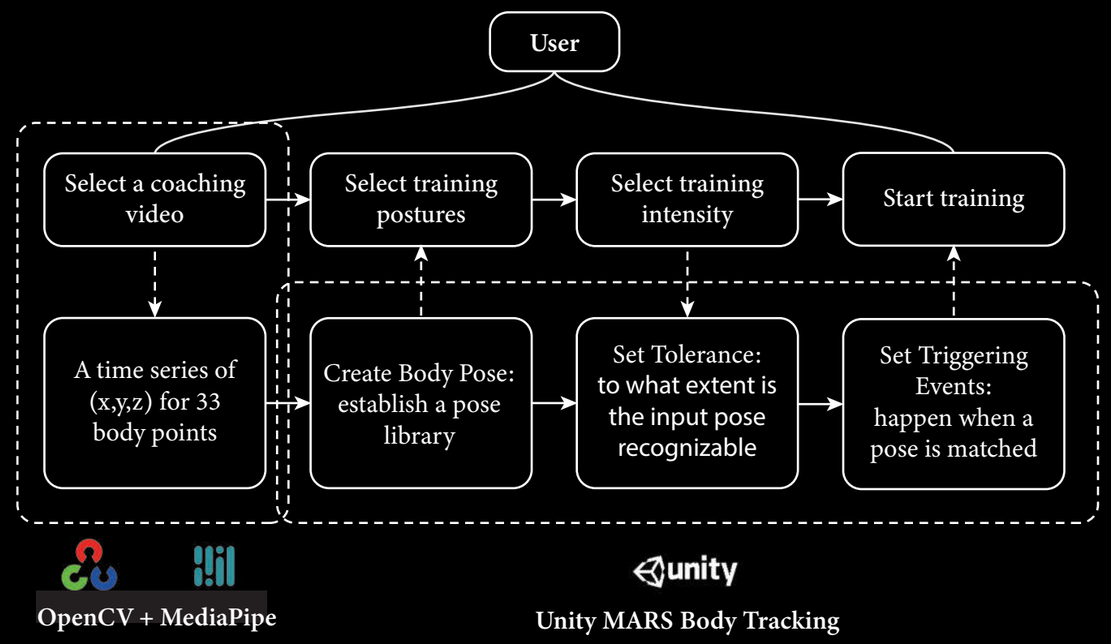


The poularity of fitness activities is gradually increasing around the world. As people pay more attention to health and fitness, more and more people are beginning to realize the importance of actively particiating in physical exercise. In my interviews with 30 ppl in the age of 20-30, 24 of them said that they would do exercise on a daily basis. **However, not many of them go to the gym, not to mention having a fitness coach/trainer.**

Scenario: individual coachless workouts



Solution: pose-based customizable interactive training

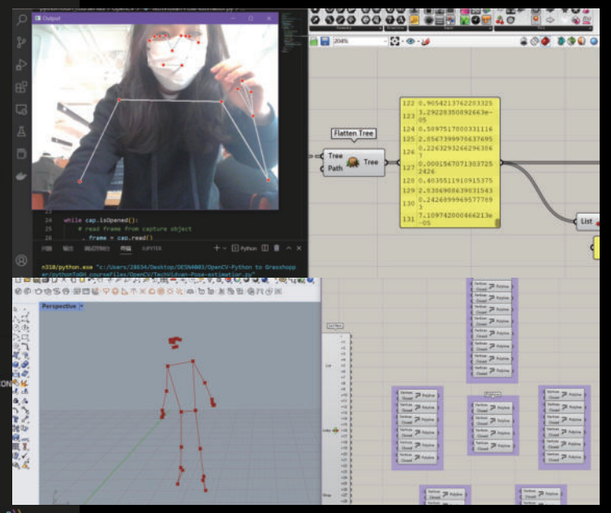


PROTOTYPING

Input: Pose Extraction

```python
import cv2
import mediapipe as mp
import socket

#INPUT SEND DATA
IP = '192.168.1.165' #paste your own IP here
port = 2001

# initialize Pose estimator
mp_drawing = mp.solutions.drawing_utils
mp_pose = mp.solutions.pose

pose = mp_pose.Pose(
    min_detection_confidence=0.5,
    min_tracking_confidence=0.5)

# create capture object
cap = cv2.VideoCapture(0, cv2.CAP_DSHOW) # ('sample.mp4')

while cap.isOpened():
    # read frame from capture object
    _, frame = cap.read()

    try:
        # convert the frame to RGB format
        RGB = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)

        # process the RGB frame to get the result
        results = pose.process(RGB)

        # print(results.pose_landmarks)
        # draw detected skeleton on the frame
        mp_drawing.draw_landmarks(
            frame, results.pose_landmarks, mp_pose.POSE_CON

        # show the final output
        cv2.imshow('Output', frame)

        # how to connect to Grasshopper
        n = 'skeleton_tracking'
        d = True
        p = results.pose_landmarks
        template = str(
            'name:{}|detection:{}|points:{}'.format(n, d, p))

        def UDP_client(IP, port, message):
            sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
            sock.sendto(bytes(message, "utf-8"), (IP, port))


        UDP_client(IP, port, template)

    except:
        break
    if cv2.waitKey(1) == ord('q'):
        break

cap.release()
cv2.destroyAllWindows()
```

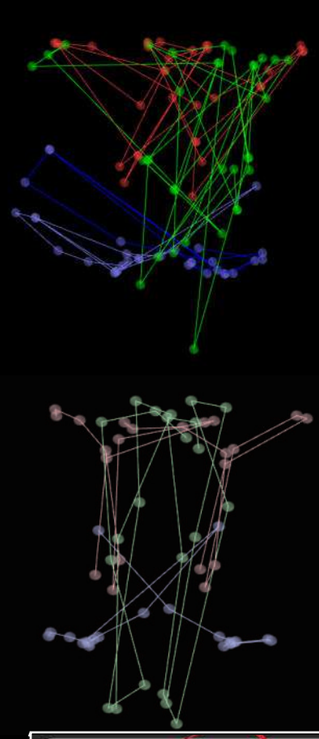
Body Data Calibration

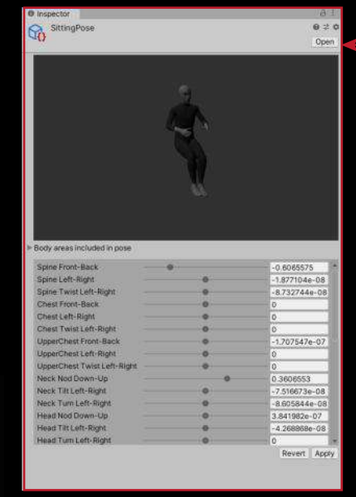


Since the depth of space is estimated based on the algorithm, the (x, y, z) values we initially obtained are not accurate. Therefore, further data process is needed. I used the visual programming tool Grasshopper to adjust the scale of the skeleton.

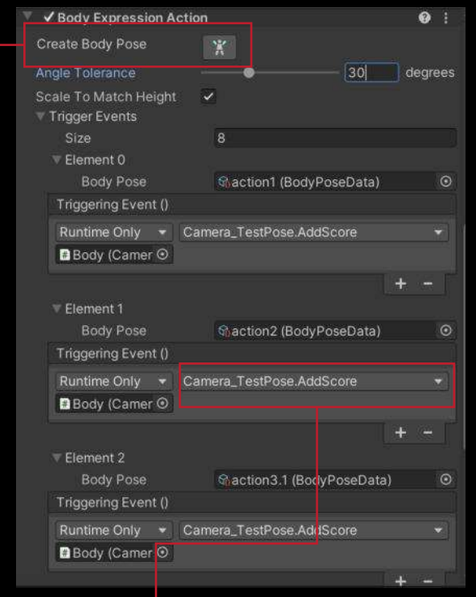
Video Analysis

Output: Pose Evaluation





Create Body Pose:
Pose data is received via **MediaPipe Unity Plugin**. For each type of pose extracted from the coaching video, we create a standard pose and set it as a trigger.

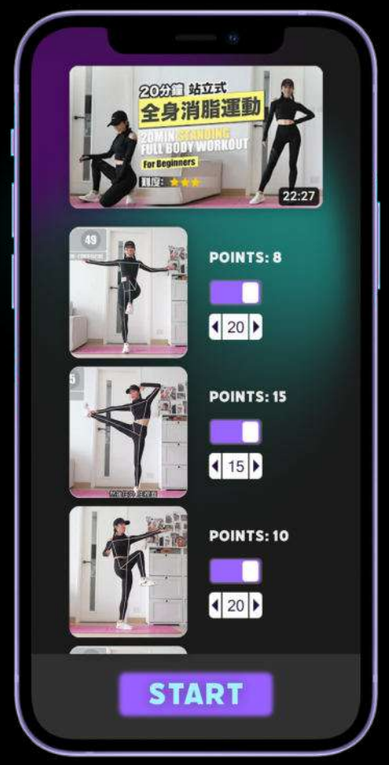


```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class Camera_TestPose : MonoBehaviour
{
    public GameObject objToColor;

    public void Colorblue()
    {
        objToColor.GetComponent<Renderer>().sharedMaterial.color = Color.blue;
        ScoreScript.scoreValue ++ ;
        Debug.Log("Matched pose +1");
        // System.Threading.Thread.Sleep(3000);
        // objToColor.GetComponent<Renderer>().sharedMaterial.color = Color.red;
    }
```

Triggering Events: Everytime the standard pose is met within the tolerance, our triggering events will happen. In this case, I change the avatar's color from red to blue, add value to score and show "**Matched pose +1**". Using this mechanism, we can design and develope more rewarding interactions!

Testing demo

USER EXPERIENCE



Customizing

Detecting

Low Match (<80%)

High Match (>90%)

Non-Existence

Neural Radiance Field (NeRF) as Medium for Heterogeneous Space Generation

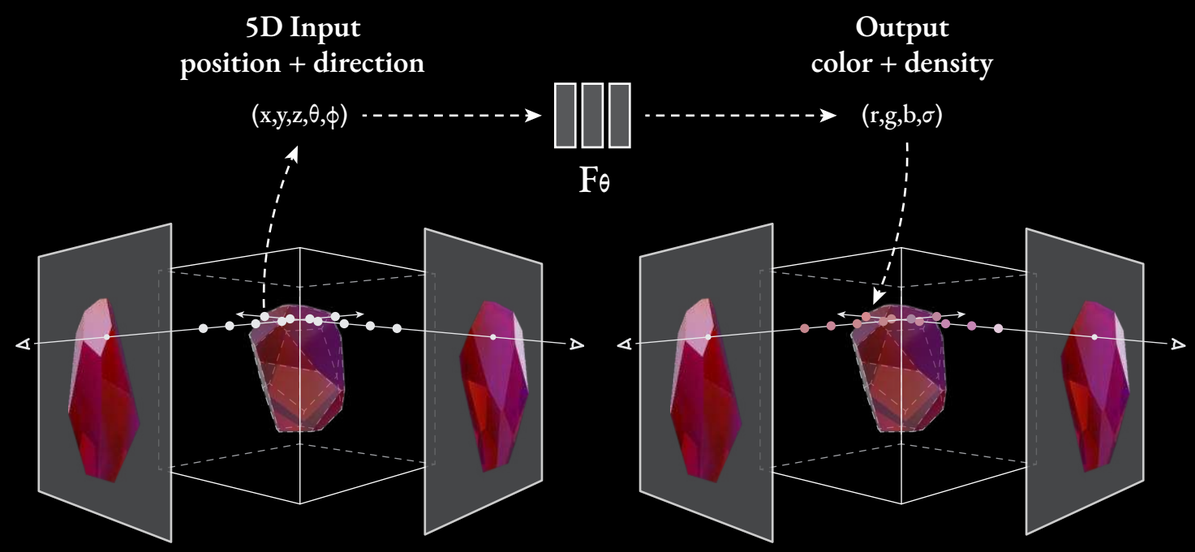
Jun - Sep, 2023
Research&Teaching Assistant
Supervisor: Haotian Zhang
Collaborate with Jason Chun Hei Chan
My contribution: technical workflow exploration (80%),
physical model making (50%),
workshop preparation (50%)
Tools: Instant-NGP, Python, Blender, Premiere Pro

This project is a series of research oriented experiments inspired by Neural Radiance Field (NeRF) and its innovative mechanism for realistic 3D documentation and reconstruction. As architects, our interest lies in exploring innovative ways to combine digital and physical modeling and photography process with NeRF and to collage contrast spatial features for new sparial experience. The project includes two phase of experiments: In pahse I, we collage cities with contrast urban pattern languages; and in phase II, we enclose infinite landscape view inside a house, reverting the spatial relationship between interior and exterior.

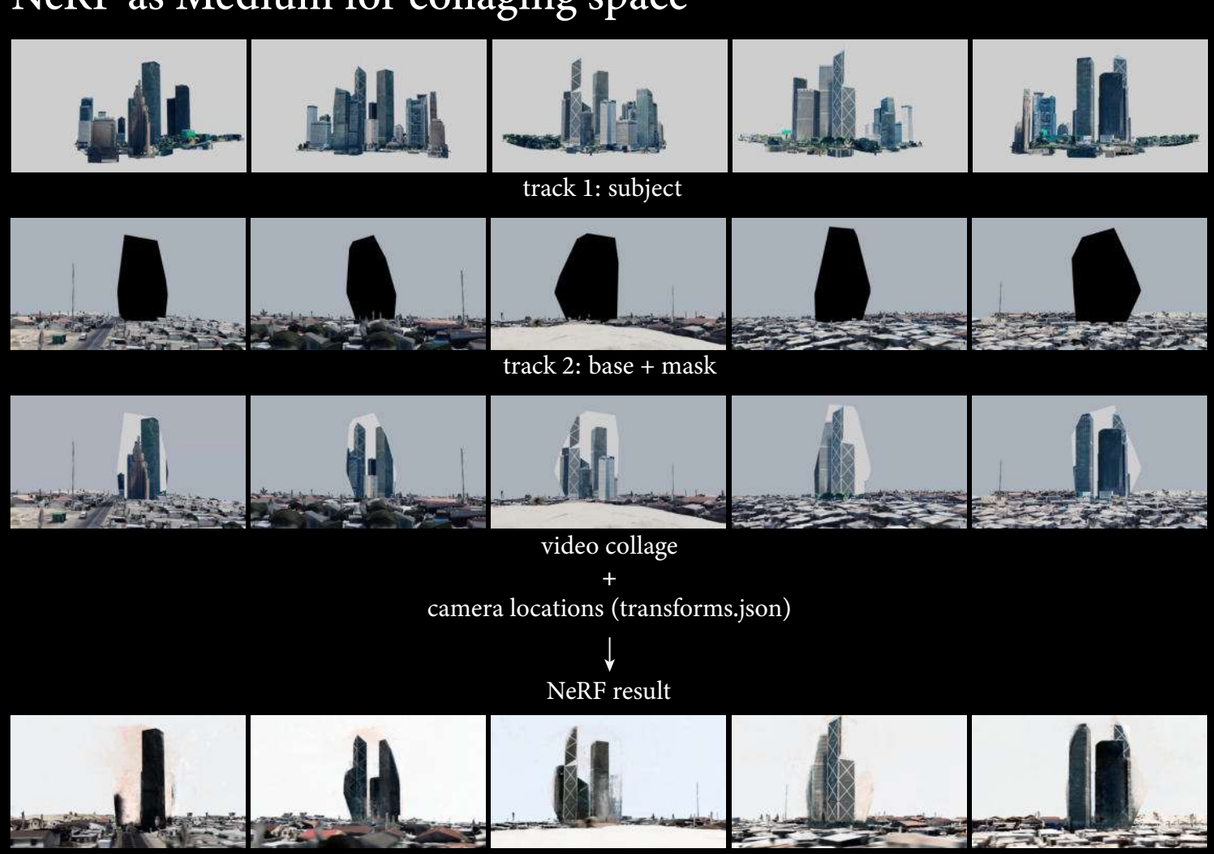
The outcome of our research was shared and taught in a worshop as part of ACADIA 2023. https://2023.acadia.org/Workshops

INSPIRATION

Neural Radiance Field (NeRF): building an implicit representation of the scene



NeRF as Medium for collaging space



PHASE I - City Collage

Inspiration

Different video clips of the city are added to each face of the polyhedron via masks. In the process of circling 360 degrees, both the geometry and urban space change.

In the results generated by Instant-NGP, we observe some dynamic spatial experiences as the geometry rotates.

Collage Cities in Geometries

Closed vs Open Grids

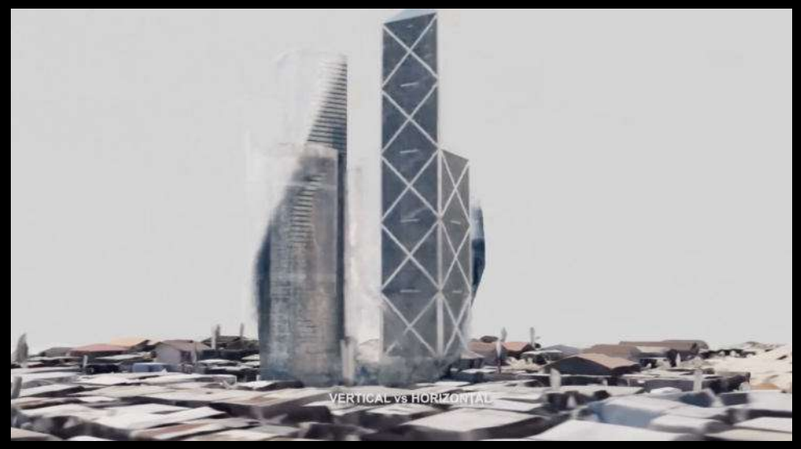
Barcelona & Portland

Polytheism vs Monotheism

Tokyo & Rio De Janeiro

Vertial vs Horizontal

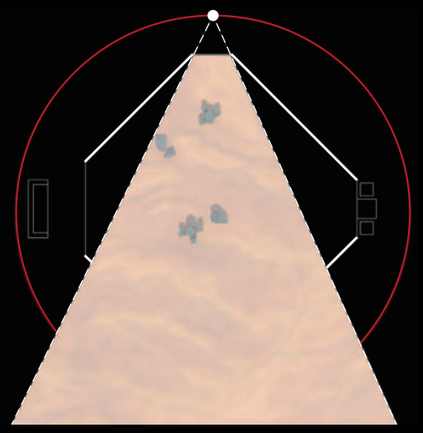
Hong Kong & Capetown



Video: https://youtu.be/mVt89dsNFCM

PHASE II - Indoor Landscape

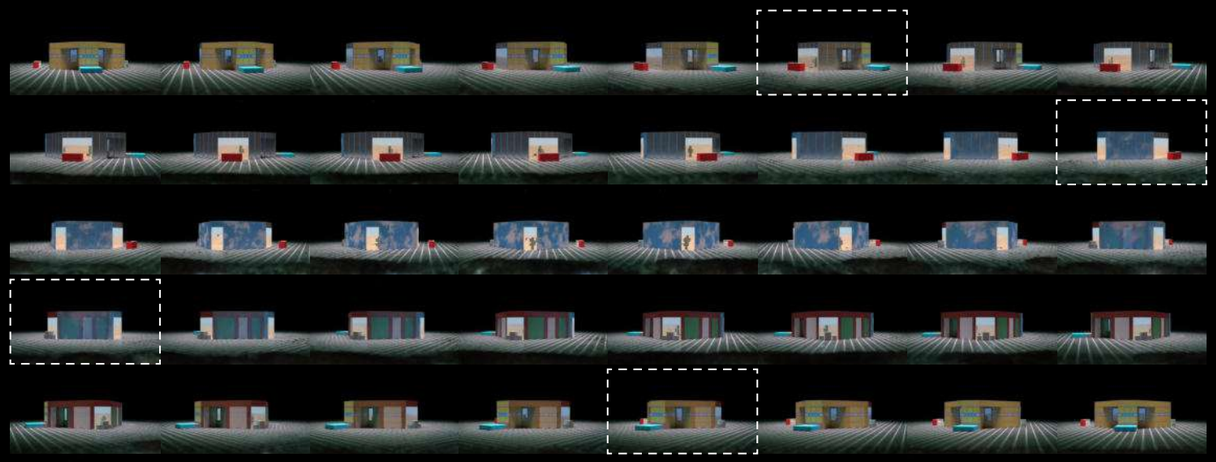
Diagram

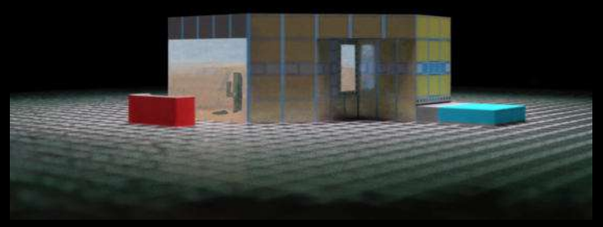


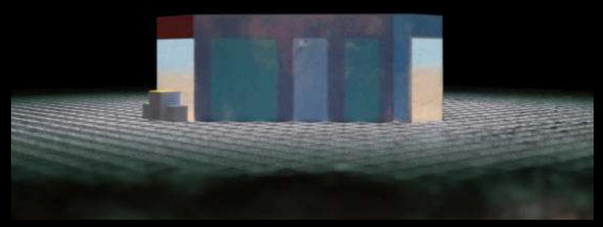
As nerf requires multi-angle photos to reconstruct a scene, what if we change the scene that it observes at different angles?
In the real world, we see landscapes through windows, what if we enclose the landscape inside and make our living room the outside?

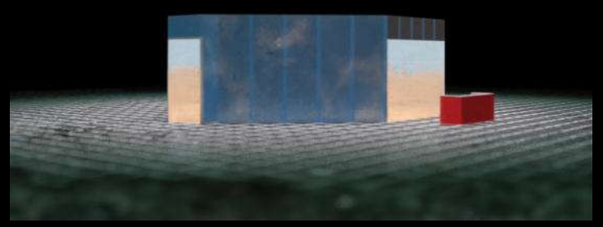
Using both digital and physical photo-taking methods, we collage 360 degree views of a house with different facades and landscape into ONE scene.

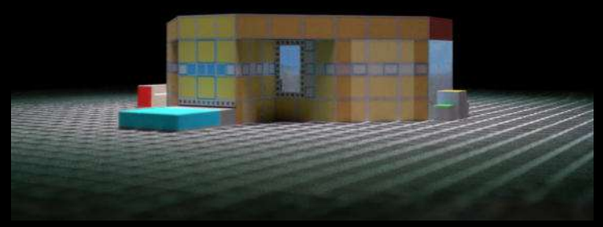
Digital Simulation (Blender to Instant-NGP)



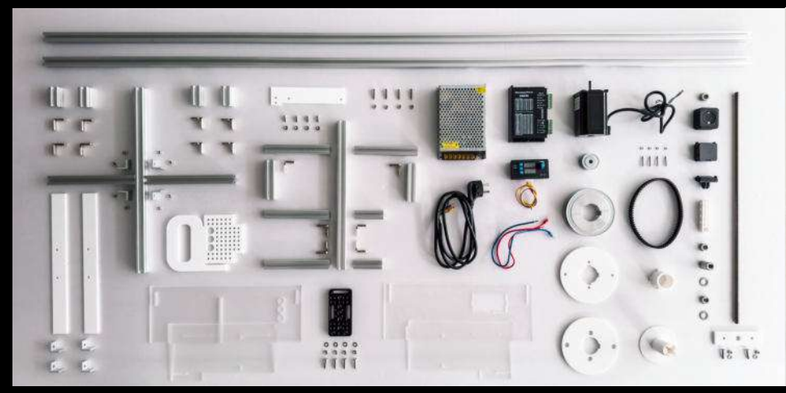


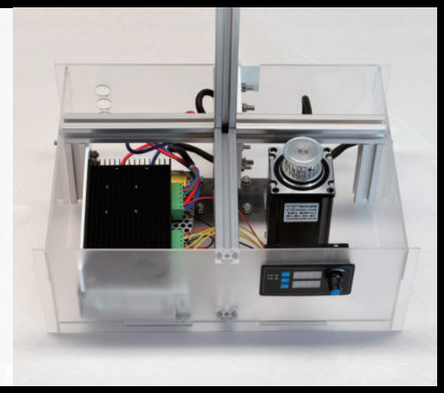


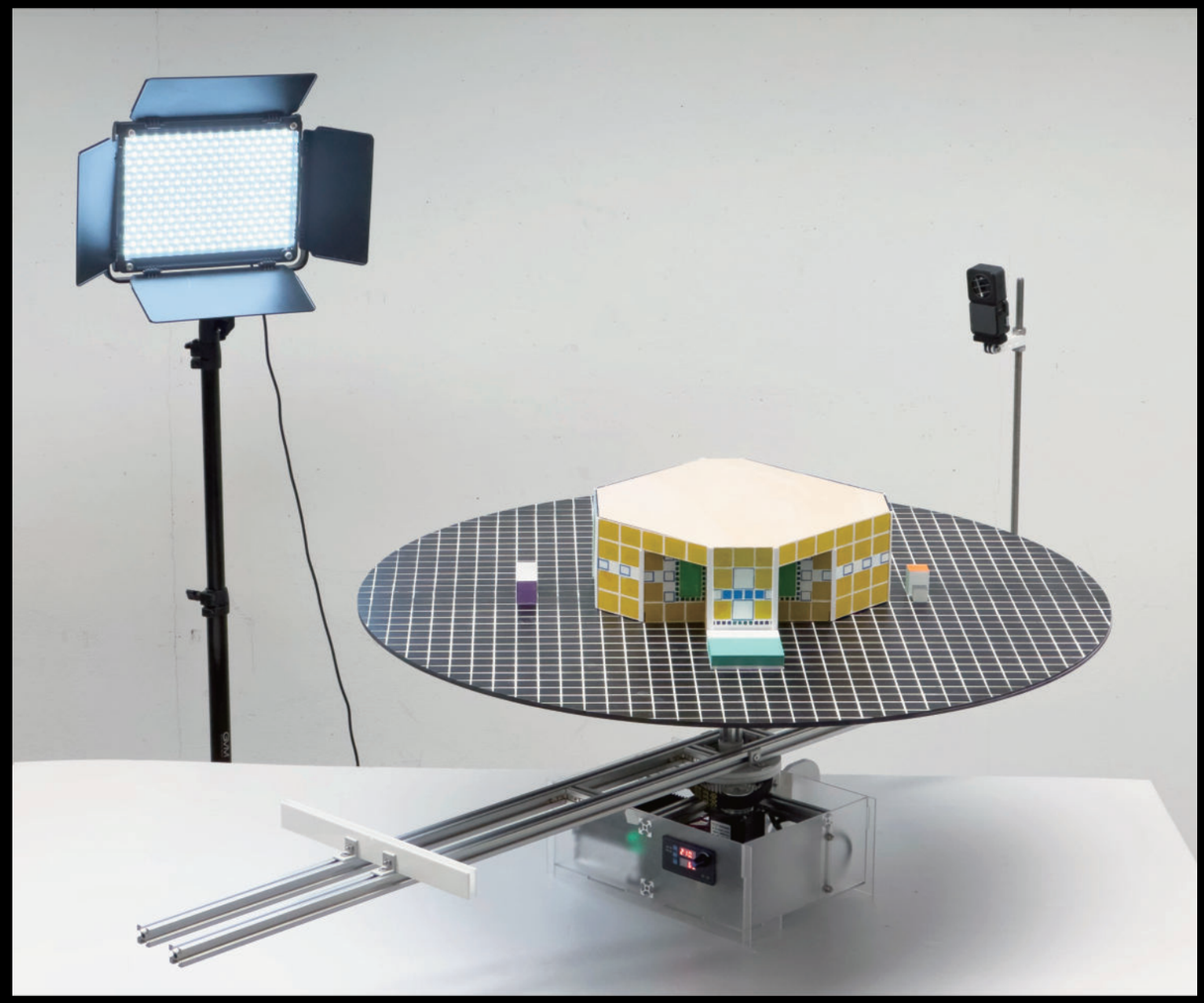


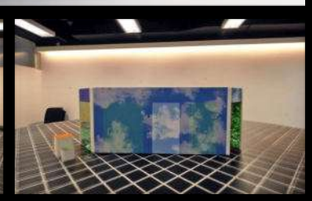


Physical Simulation









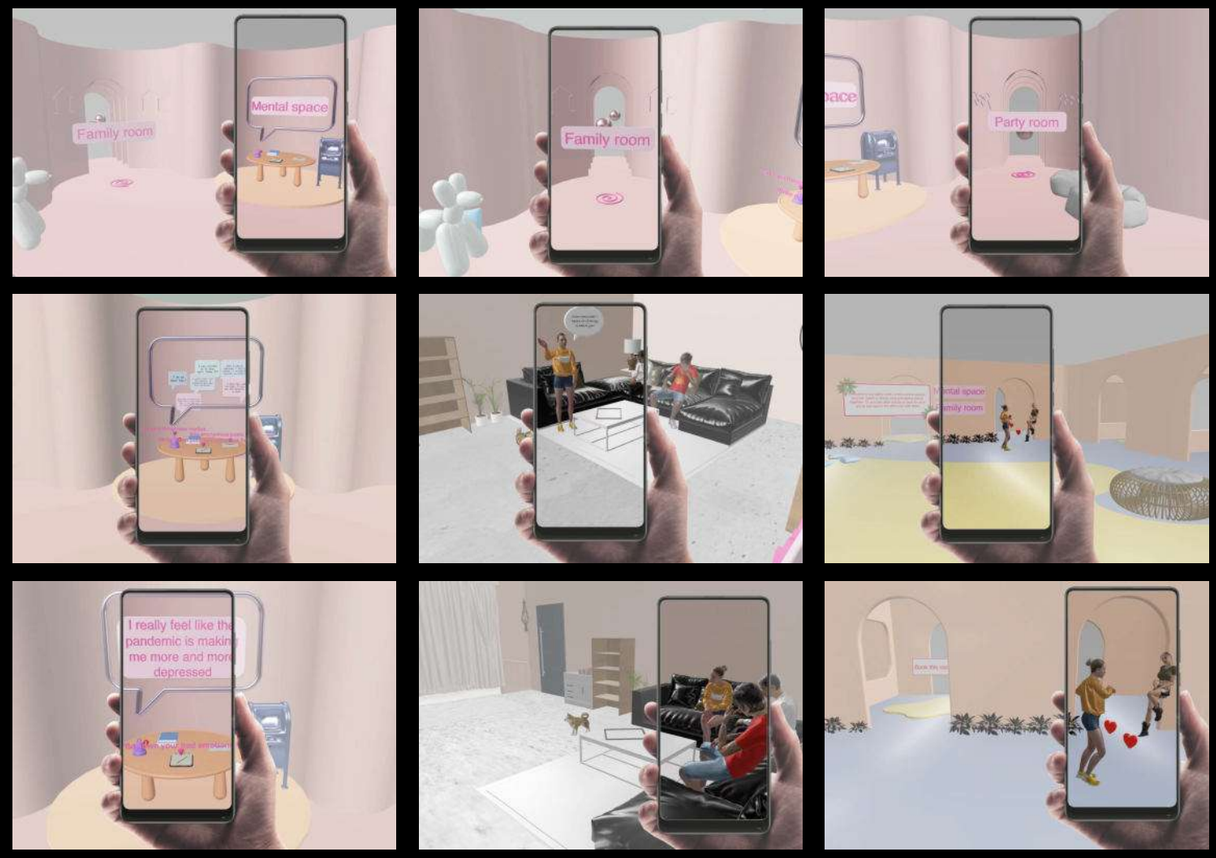
OTHER WORKS - I

Social Trail

Metaverse Storytelling

Aug - Nov, 2022 @ DID NUS, Singapore
Collaborated with Lucas Cheung
Tutor: Hunn Wai
Tools: UE5, Rhino, Premiere Pro

Video: https://youtu.be/RgqyKy9v-mg



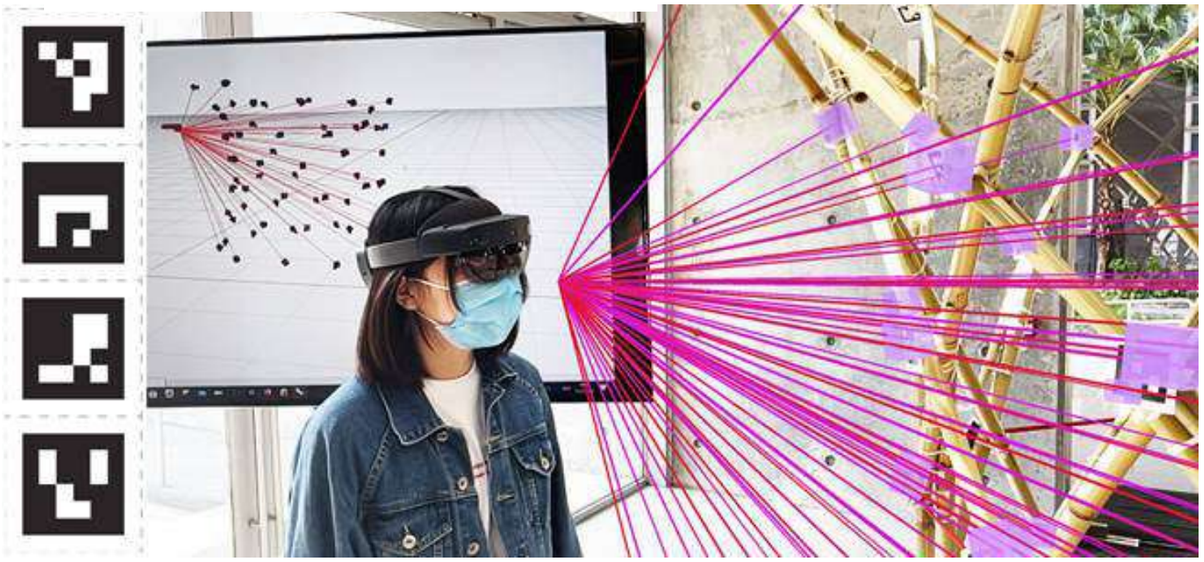
METAHome

AR Social Experience

Jan - Feb, 2022 @ HKU, Hong Kong
Individual Practice
Tutor: Sébastien Tran Dinh
Tools: Blender, Reality Capture, Reality Composer (ARKit)

Demo 1.0: https://youtu.be/WNcPQ1fCzGE
Demo 2.0: https://youtu.be/xONqCIA474A

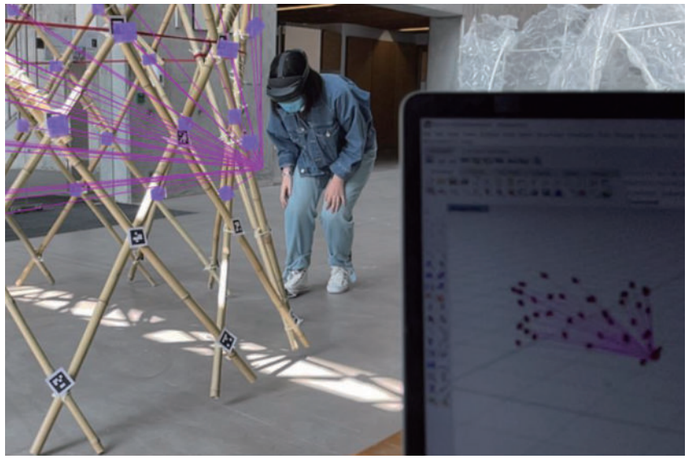
OTHER WORKS - II



AR Fabrication

Workshop for CADDRIA 2021

April, 2021 @ CUHK, Hong Kong
Student helper
Leader: Kristof Crolla, Garvin Goepel
Tools: Hololens 2, Fologram (Grasshopper)



Human-AI Decision Making in Sepsis Diagnosis

Proceeding Paper for CHI 24

May - Oct, 2023 @ Northeastern University, USA
Student research assistent (second author)
Supervisor: Dakuo Wang
Mian contributions: literature review, interview, UI design, coding

Rethinking Human-AI Collaboration in Complex Medical Decision Making: A Case Study in Sepsis Diagnosis

ANONYMOUS AUTHOR(S)
SUBMISSION ID: 2342

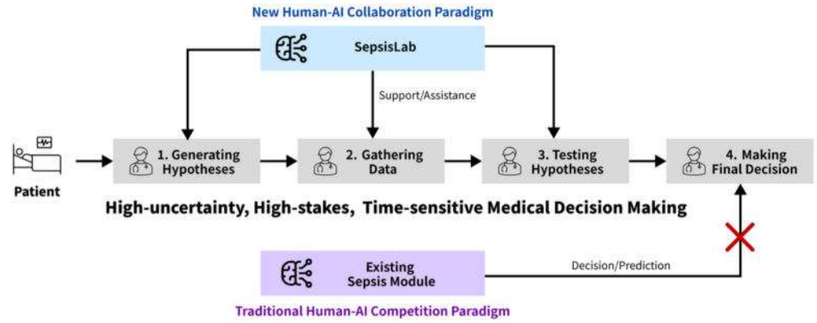
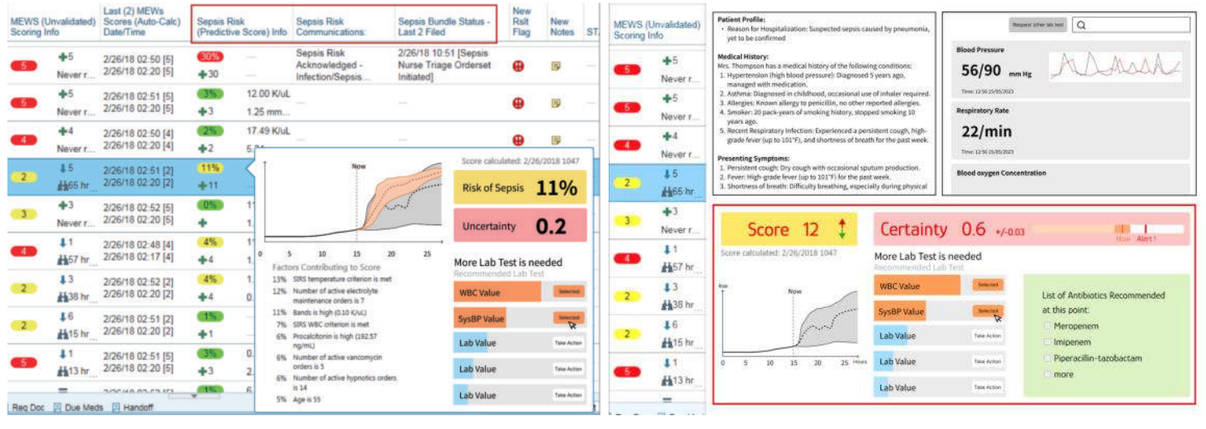


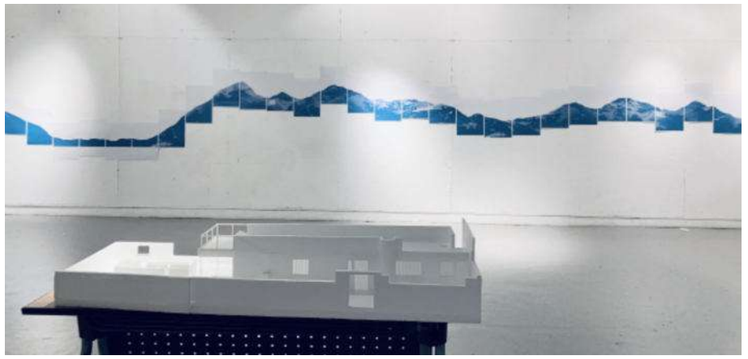
Fig. 1. **Existing EPIC Sepsis Module and Our Proposed Sepsis Decision-Support Module in Medical Decision Making Workflow**. Our work focuses on sepsis diagnosis, a high-uncertainty, high-stakes, time-sensitive medical decision-making process. Physicians usually take four steps: (1) generating hypotheses, (2) gathering data, (3) testing hypotheses, and (4) making final decisions. Our study results point out that existing sepsis module is not helpful, forming a human-AI competition paradigm. We propose a new module to establish a human-AI collaboration paradigm.

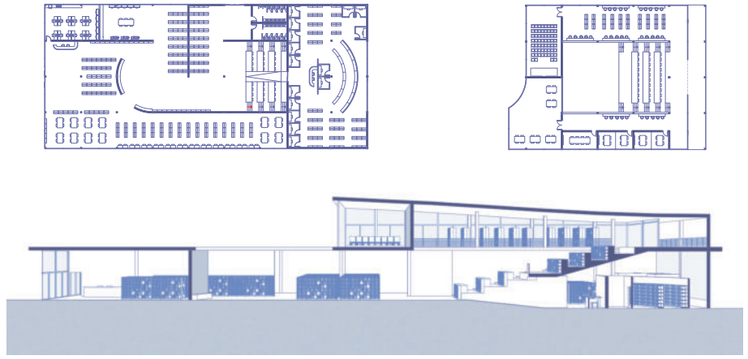


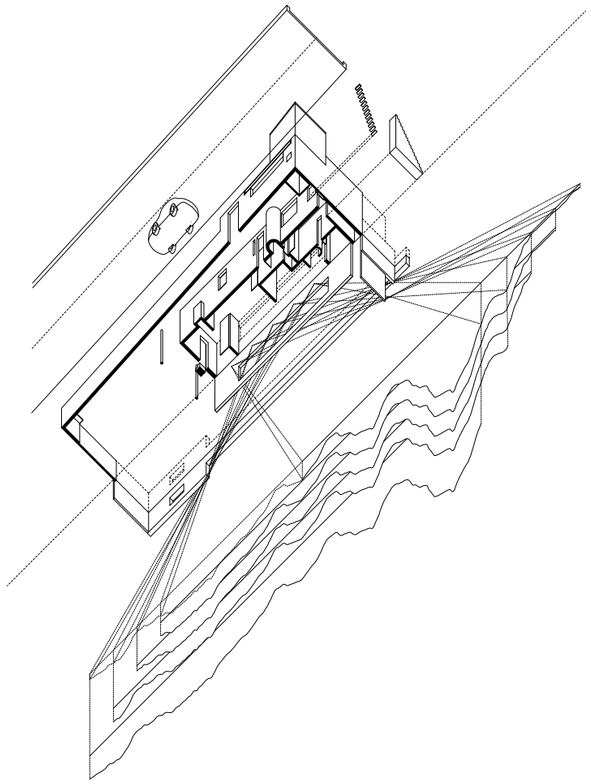
OTHER WORKS - III

Architectural Practices

Minor in Architectural Studies (2019-2022)

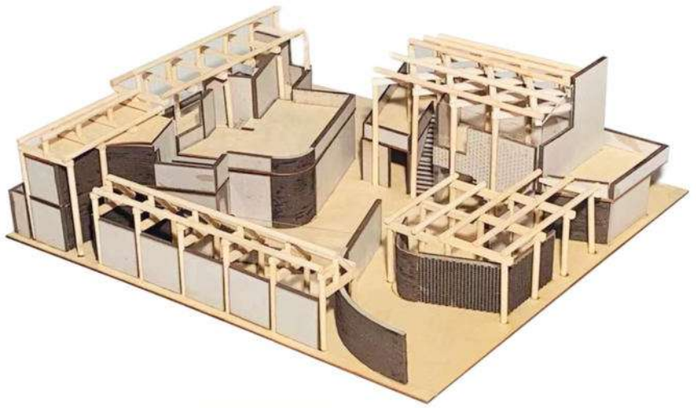






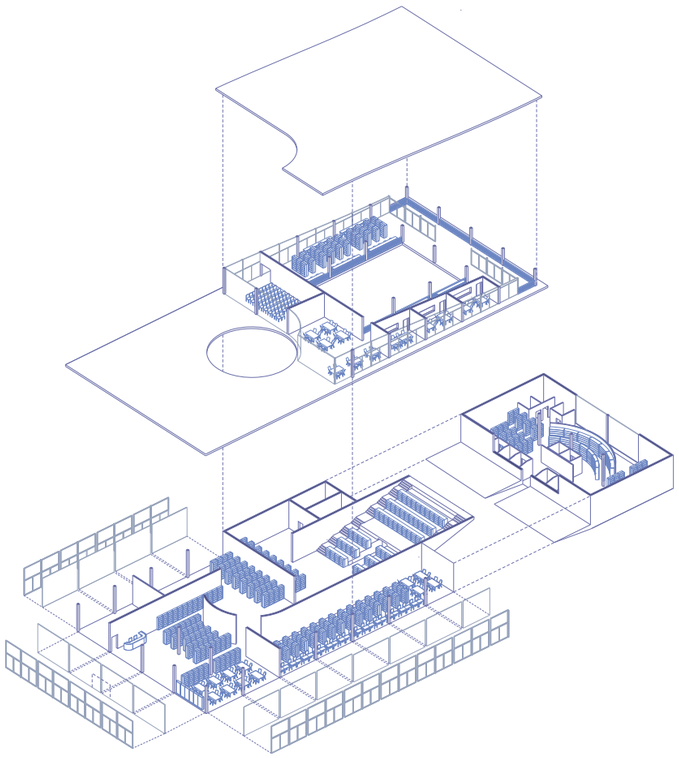
Architectural Analysis: Villa Le Lac

Sep - Nov, 2020
Individual Practice
Tutor: Haotian Zhang
Concept: Windows as the Door



Renovation: Vernacular House

Jan - April, 2021
Collaborate with Nicola Wong
Tutor: Lidia Ratoi
Concept: Intertwined Brick Walls and Wooden Columns



Competition: Mies Memorial Library

Nov - Dec, 2021
Collaborate with Fergal Tse, Oscar Wong, and Winnie Heung
Finalists
Concept: Flowing Bookshelves