

01

**Rippling**

无线信号交互界面

无线信号友好的  
室内空间

PRODUCT |  
SERVICE |  
SYSTEM |  
TECHNOLO-  
GY-BUSINESS  
DEVELOP-  
MENT

INFORMATION EXPERIENCE

02

**Hygi-flake**

药理学可视化工具

三维跨尺度可交互的  
药理信息可视化工具

03

**Caochangdi  
treasure hunt**

草场地社区儿童  
服务设计

面向草场地城中村中的儿童  
的教育娱乐服务设计

SERVICE DESIGN |  
COMMUNITY ENGAGEMENT

NOVEL INTERFACE

04

**Behaviourscape**

空间化交互界面

为开放办公环境设计的、区域响  
应式的室内区隔系统

05

**Others**

其他

**Secret coding**

INFORMATION EXPERIENCE |  
USER INTERACTION

“藏着”心事的首饰

**Acousticform**

INTERACTIVE ARCHITECTURE

探索通过座椅控制声音  
微环境的可能性

**Colour factory**

INTERACTIVE ARCHITECTURE

建筑是“大地的调色盘”  
用光在大地上作画

**Snailing**

PHYSICAL COMPUTING |  
PRODUCT DESIGN

以幸福回忆为食的储藏罐  
精灵

**BioMc**

PRODUCT DESIGN | NOVEL INTERFACE

智能“绿色”人居环境：探  
索植物作为传感器和执行机  
构的可能性



# RIPPLING

## SKILLS

Research  
Prototype  
Electromagnetics simulation  
System architecture  
3D modelling/rendering/  
animation  
User interaction  
Business development  
Contact making

无线信号友好的  
室内空间

## NOVEL INTERFACE

Product | Service |  
System |  
Technology-business  
development

# 无线信号交互界面



“涟漪”是一种可用于开发有电磁属性的家具的新型建筑/室内材料。基于此设计的建筑环境将更有利于无线信号在空间中的传播。

项目提出了一种新的、在创新电子通信设备（路由器，中继器等）外的、提高无线信号效率的可能性。

可以反射Wi-fi信号的墙纸，不会阻挡信号的门板和墙体，可以定点增强信号强度的灯具……这一系列“电磁家具”可以引导信号去到用户需要的位置，减少建筑本身对信号的遮挡、吸收，更有效率、有针对

性地设计信号的分布。它既是一套低成本的、被动式的无线通讯设备，又是一张实体的、用户友好的、人与信号间的交互界面。

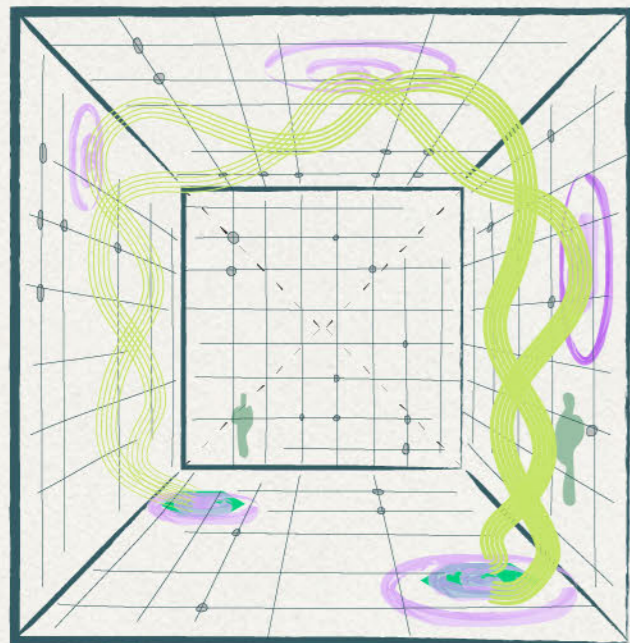
SOLO  
PROJECT

MARCH  
-MAY  
2022  
2 MONTHS





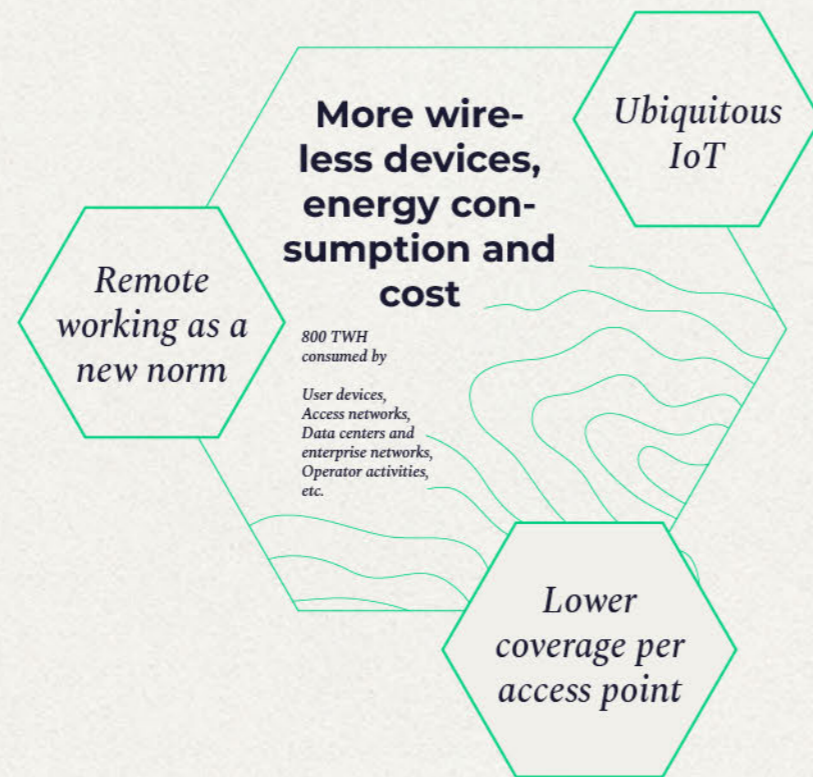
# Problem statement



## Future challenge for wireless solutions

“4X more Wi-Fi hotspots”  
 “~3.6% of the global electricity”

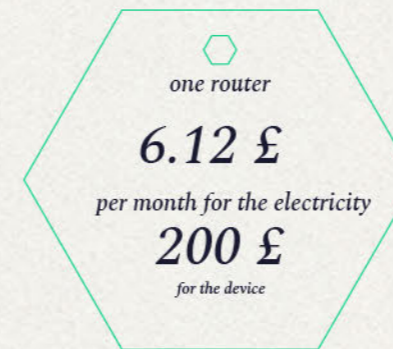
There is a steep rise in wireless communication traffic caused by soaring remote virtual human communication and ubiquitous IoT applications. According to research reported by Ericsson, The communication industry consumed 3.6% of the world's electricity in 2015. Meanwhile, as the current spectrum is not sufficient, we are planning to use signals at higher frequencies. The coverage of each device will be significantly lower than current ones and more devices will be needed.



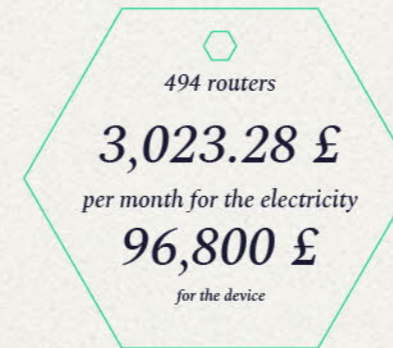
**Wireless connection calls for a more sustainable solution.**

## Cost for the wireless connectivity

You spend



Royal College of Art South Kensington campus spends



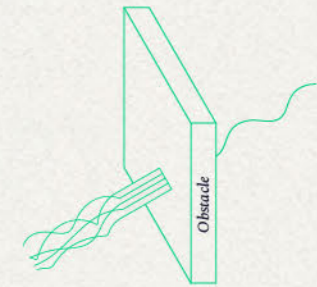
Per wifi router per month energy:  $30'60'60'24'30/3,600,000 = 21.6$  kwh  
 Per wifi router per month cost:  $28.34'21.6/100=6.12$  pounds

“We will install 194 new access points (an increase of 65% in RCA Kensington campus). The increase is actually greater than this.” —RCA IT technician  
 All routers in RCA Kensington campus per month cost:  
 $(194+300)*6.12 = 3023.28$  pounds  
 $194*6.12 = 1187.28$  pounds  
 $(194+300)*200 = 96800$  pounds  
 $194*200 = 38800$  pounds

## Signals blocked and absorbed by walls and floors

Signals in the future can not transmit through walls and turn around the corners. The electromagnetic property of the environment would have a significant impact on the signal performance.

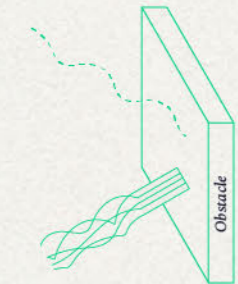
Transmission



90%

Concrete/brick would absorb 90 percent of the signals

Reflection



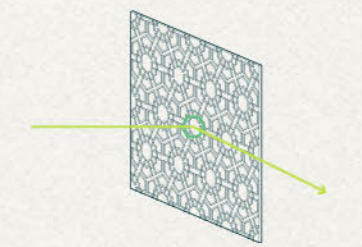
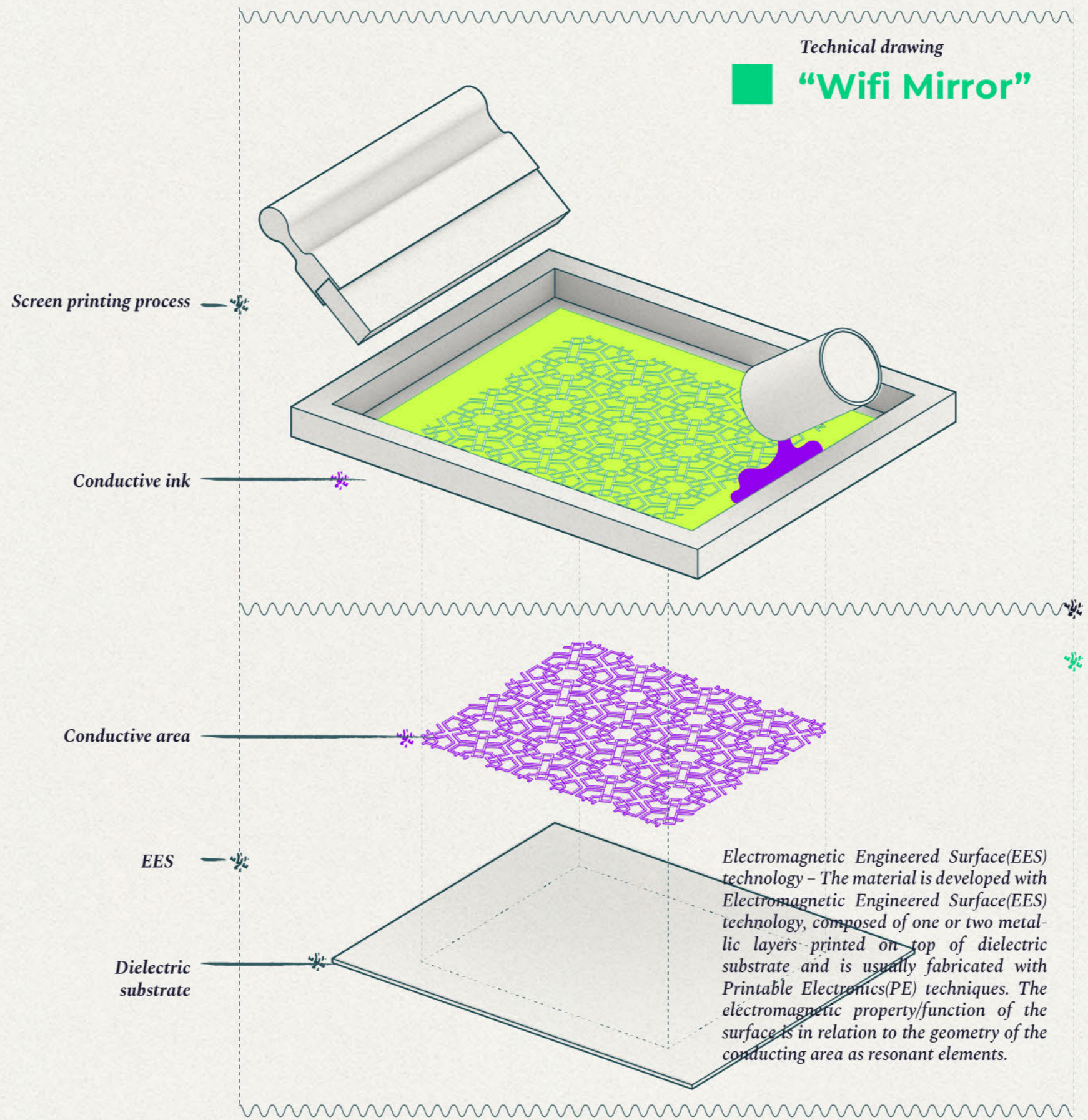
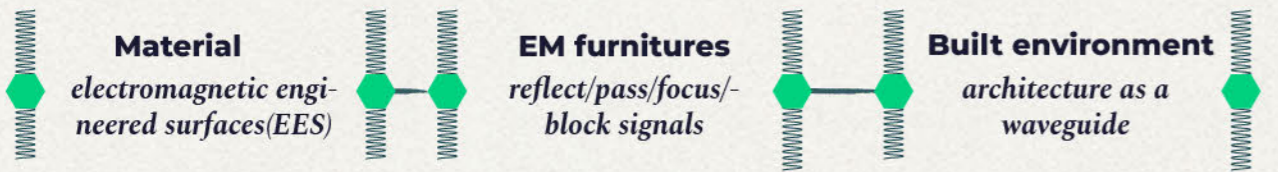
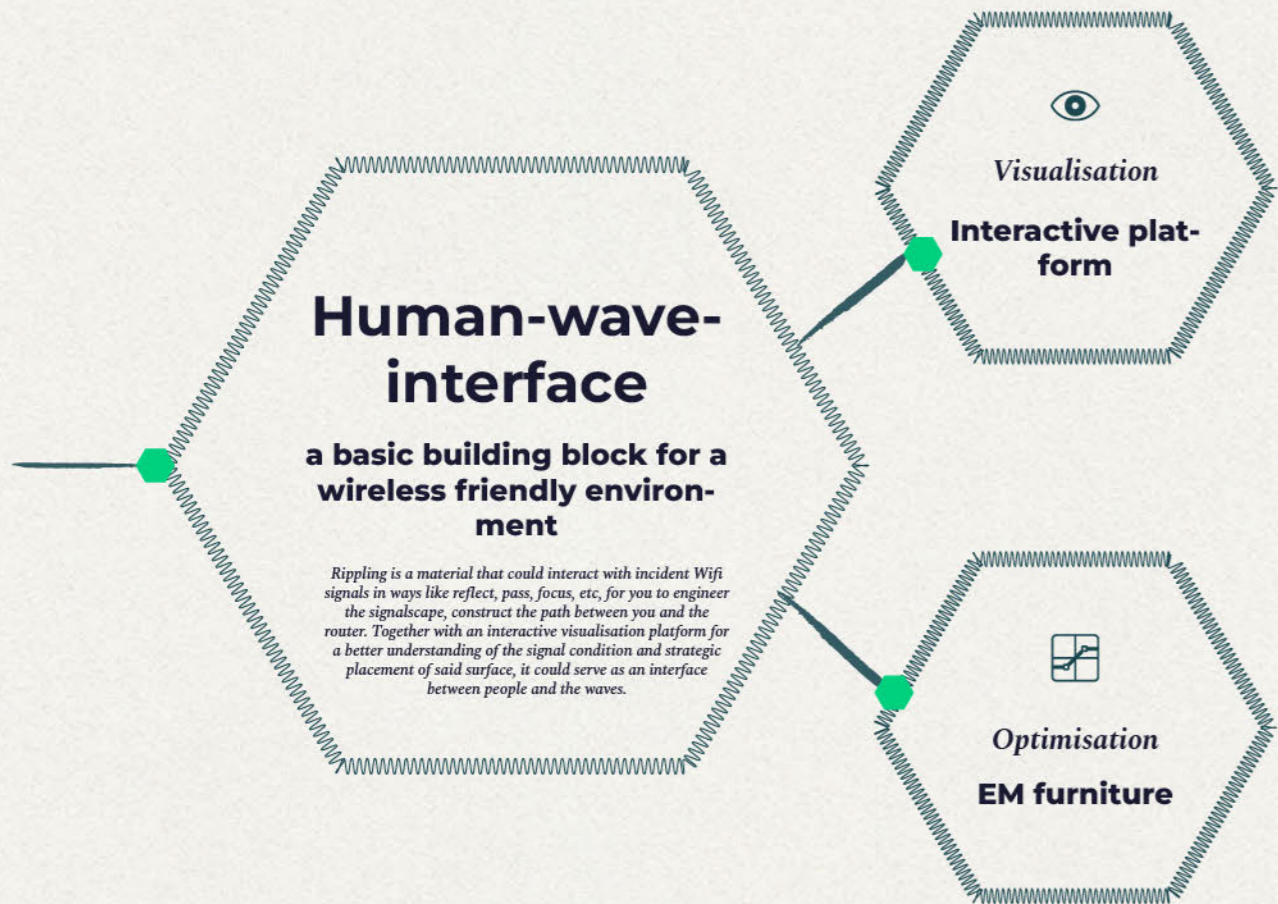
1-10%

Normal surface materials would only reflect 1-10% of the signals.

*What if we can enhance signal efficiency with a wireless friendly architecture?*

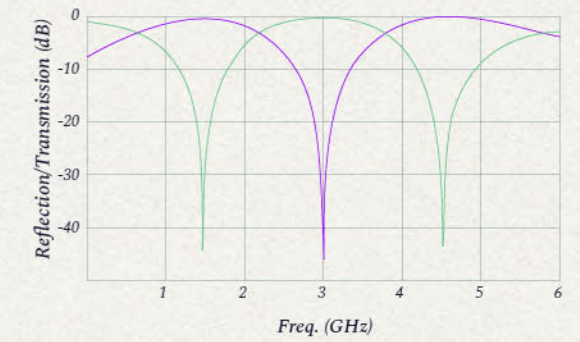


# Concept

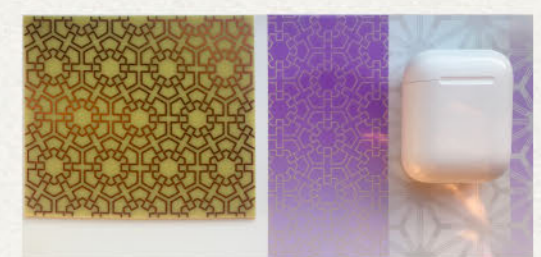


Specular reflection with a full specular Wifi reflector at 2.4GHz and 5.3GHz

This surface is frequency selective, fully reflecting waves at 2.4GHz and 5.3GHz, at which Wifi operates. Such property is acquired with a hexagonal meandered loop configuration of the conducting area.



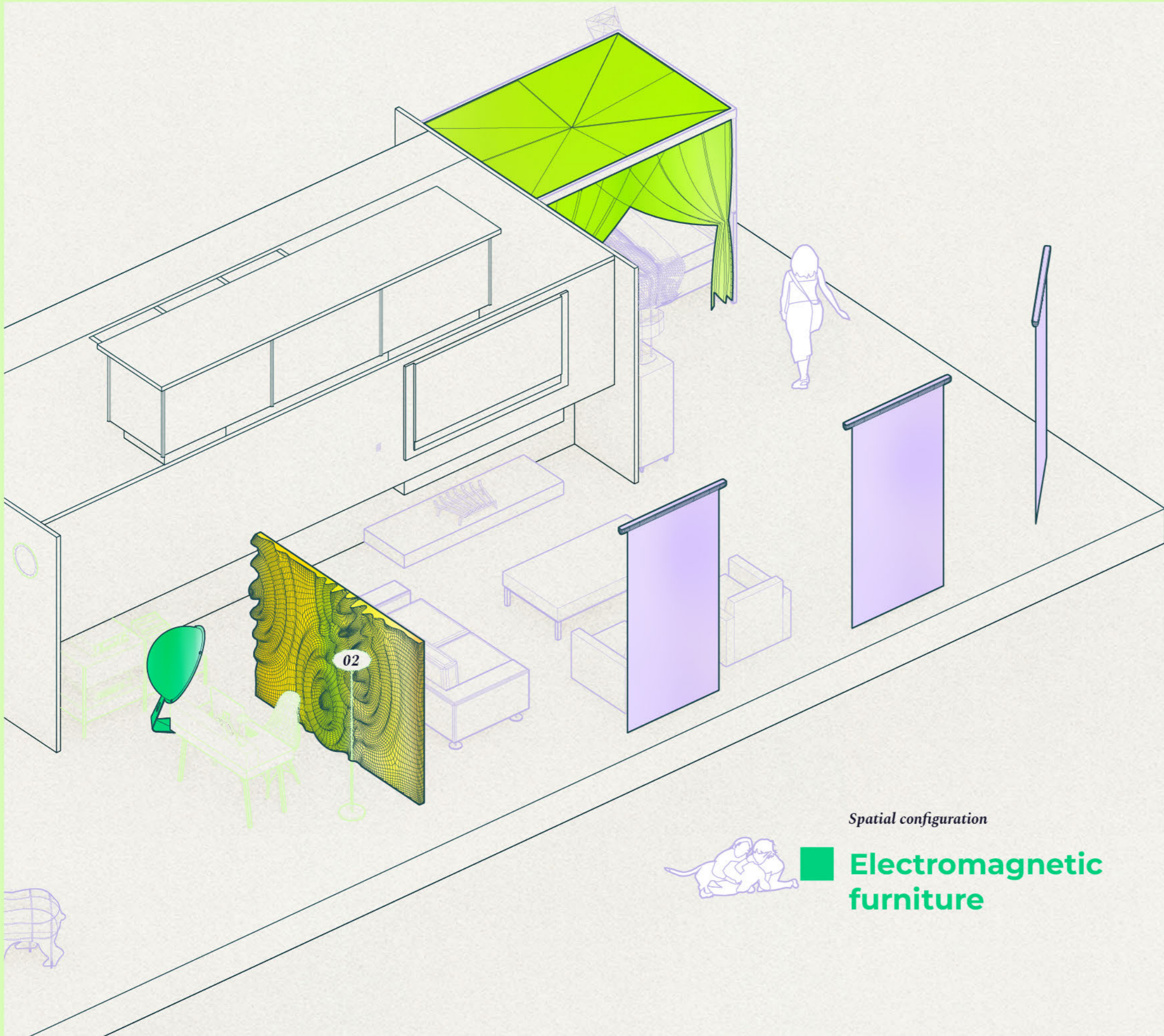
S-parameters of meandered hexagonal loop element printed on 100 micron thick PET for normal excitation



Prototype

M. R. Chaharmir, J. Ethier, D. Lee and J. Shaker, "Design of dual-band frequency selective surfaces to block Wi-Fi using printable electronics technology," 2016 17th International Symposium on Antenna Technology and Applied Electromagnetics (ANTEM), 2016, pp. 1-3, doi: 10.1109/ANTEM.2016.7550238.

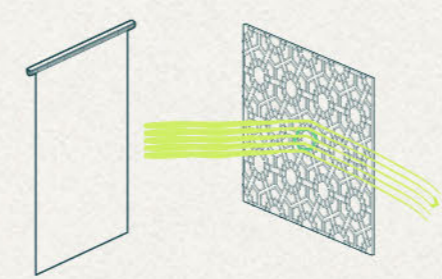




Spatial configuration



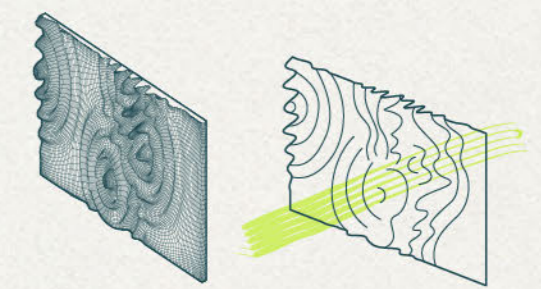
**Electromagnetic furniture**



01 Reflector

**Decorative panel**

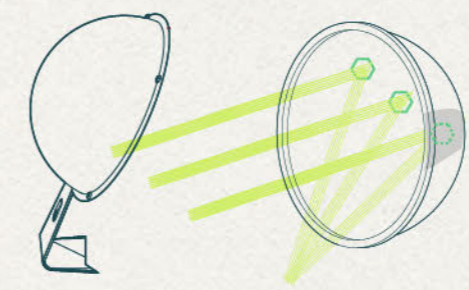
Signal guide, construct a signal channel in the open space



02 Transmitter

**Wifi-pass byobu**

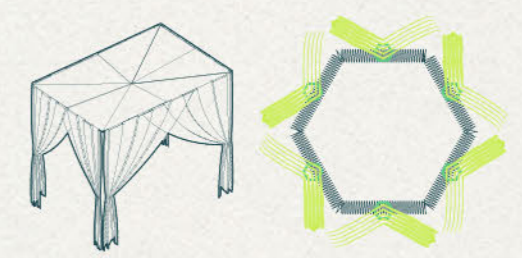
A spatial separation transparent to signals



03 Focus

**Signal-focus lamp**

Concentrate signals at critical locations



04 Shield

**Bed Canopy**

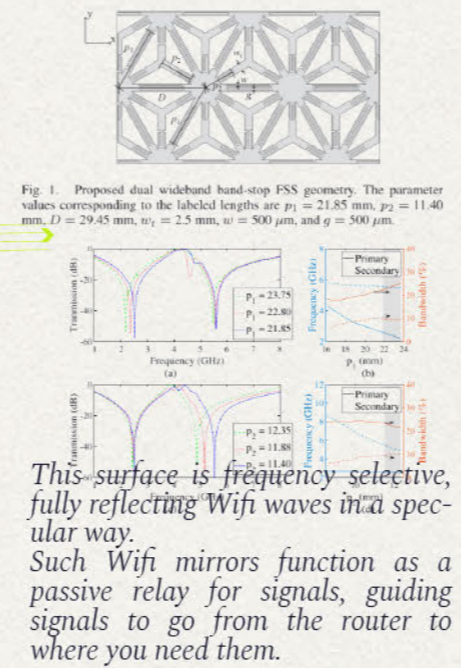
For a non-disrupted nice rest



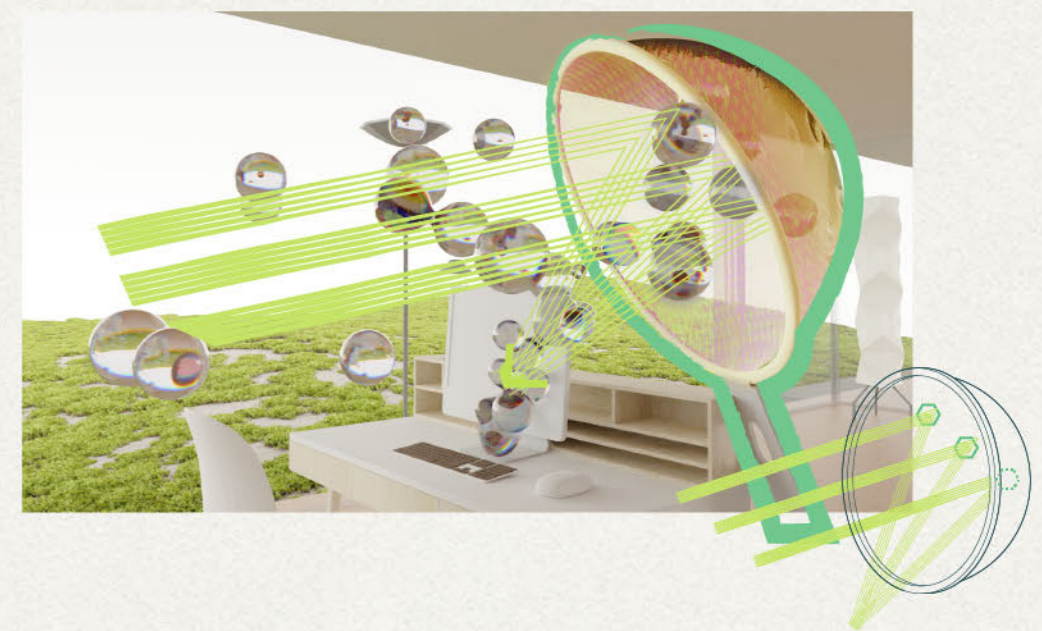
# Product categories

**01**  
**Reflector**  
**Decorative panel**  
*Signal guide, construct a signal channel in the open space*

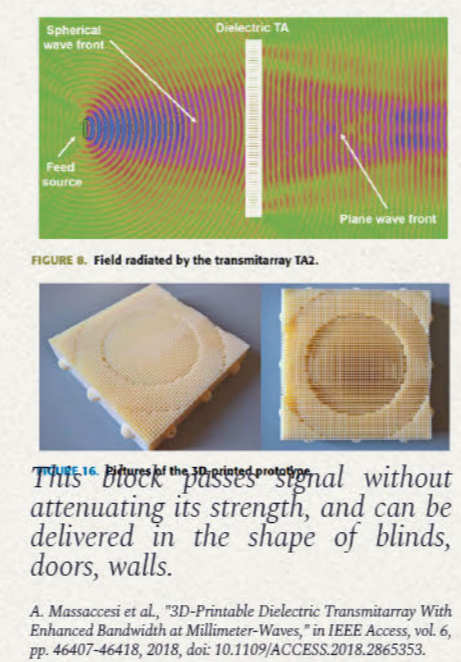
N. Jawad and L. Markley, "A Single-Layer Frequency Selective Surface With Dual Wideband Band-Stop Response," in IEEE Antennas and Wireless Propagation Letters, vol. 19, no. 6, pp. 916-920, June 2020, doi: 10.1109/LAWP.2020.2982132.



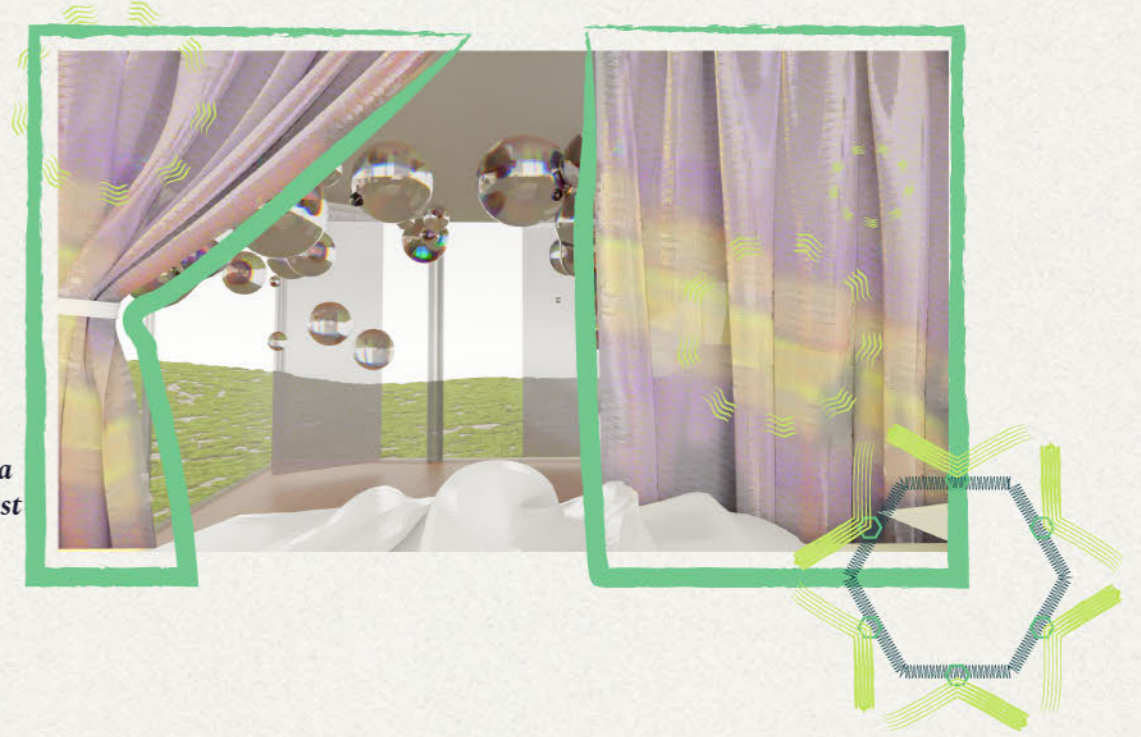
**03**  
**Focus**  
**Signal-focus lamp**  
*Concentrate signals at critical locations*



**02**  
**Transmitter**  
**Wifi-pass byobu**  
*A spatial separation transparent to signals*



**04**  
**Shield**  
**Bed Canopy**  
*Blocking signals for a non-disrupted nice rest*

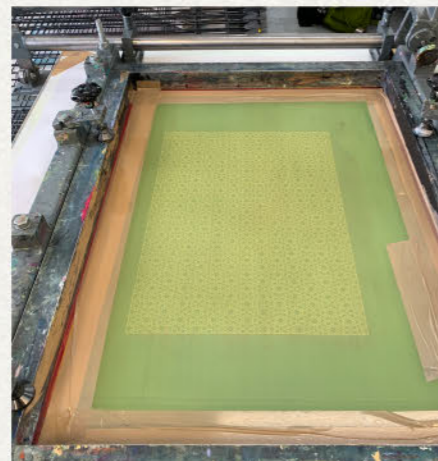




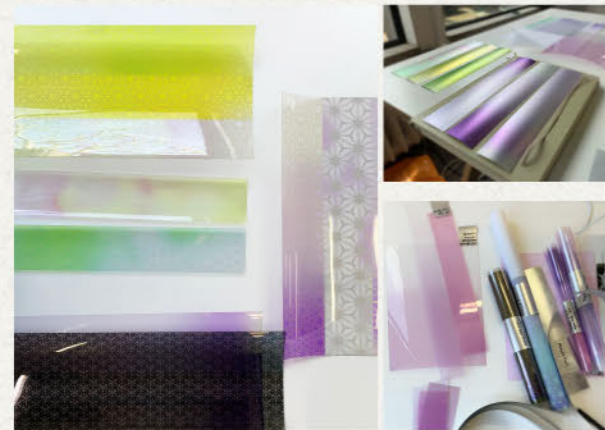
## Single sheet reflector Prototyping



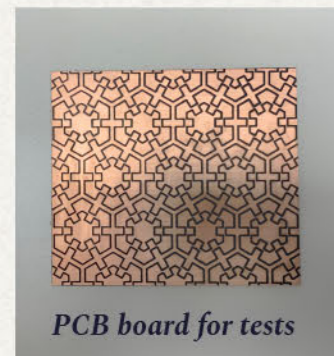
Screen printing



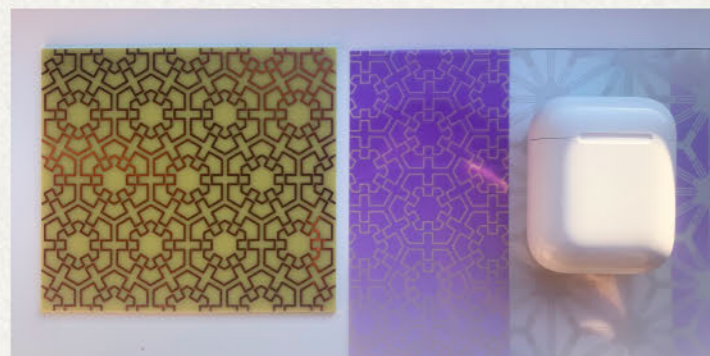
Vinyl cut stencil



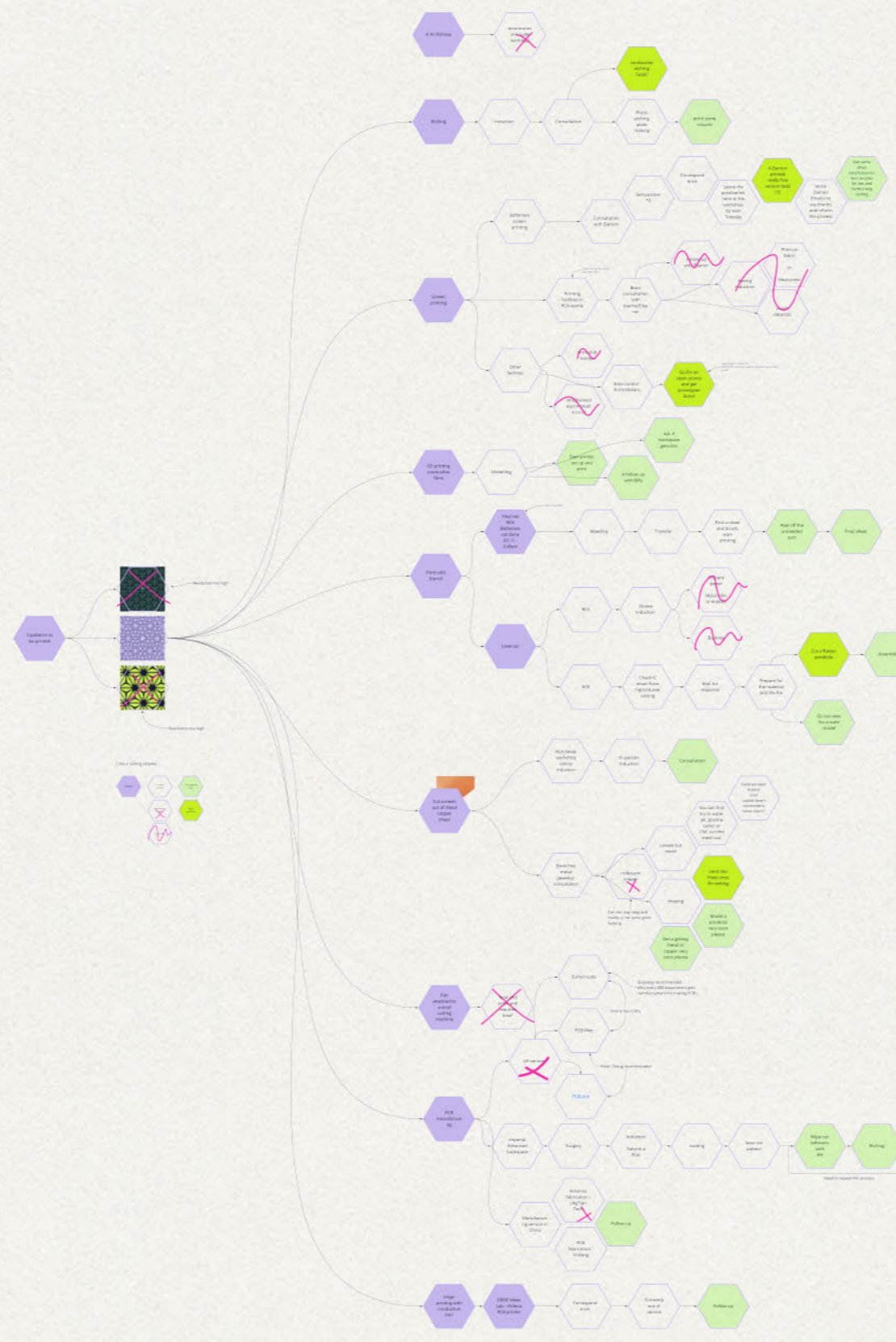
Looklike prototype



PCB board for tests



## Single sheet reflector Fabrication process



## Single sheet reflector Measurement

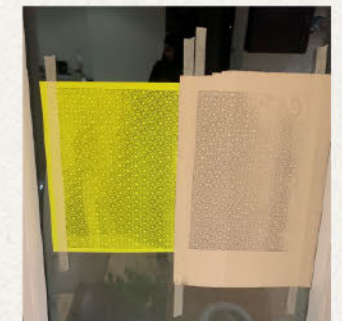
Prototypes fabricated for experimenting the influence of variables on the surface EM performance

variables to be tested	Control group	Experiment group
Substrate thickness	Controlled: [Group 1] Line width: 0.75mm Conductor thickness: 1oz copper Substrate thickness: 0.8mm	Experimented: [Group 2] Line width: 0.75mm Conductor thickness: 1oz copper Substrate thickness: 1.0mm  [Group 3] Line width: 0.75mm Conductor thickness: 1oz copper Substrate thickness: 1.6mm
Conductor thickness	Controlled: [Group 1] Line width: 0.75mm Conductor thickness: 1oz copper Substrate thickness: 0.8mm	Experimented: [Group 4] Line width: 0.75mm Conductor thickness: 1.5oz copper Substrate thickness: 0.8mm  [Group 5] Line width: 0.75mm Conductor thickness: 2oz copper Substrate thickness: 0.8mm
Line width	Controlled: [Group 1] Line width: 0.75mm Conductor thickness: 1oz copper Substrate thickness: 0.8mm	Experimented: [Group 6] Line width: 0.25mm Conductor thickness: 1oz copper Substrate thickness: 0.8mm  [Group 7] Line width: 1.25mm Conductor thickness: 1oz copper Substrate thickness: 0.8mm

### Test plans

- 1 Test the EM property of the surface in a lab setting with 2-horn set up in an anechoic chamber.
- 2 Test if the surface can direct signals.
- 3 Test if the surface can help fix blind-spots with in-situ measurement.

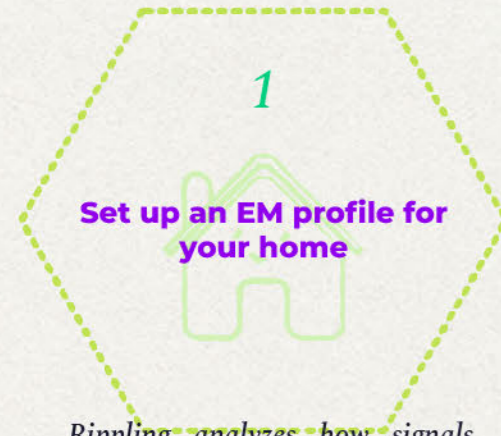
### Trial runs





Deployment process

# How it works



**1**  
Set up an EM profile for your home

Rippling analyzes how signals distribute in your home and identifies the area where the signal strength does not meet your expectation.



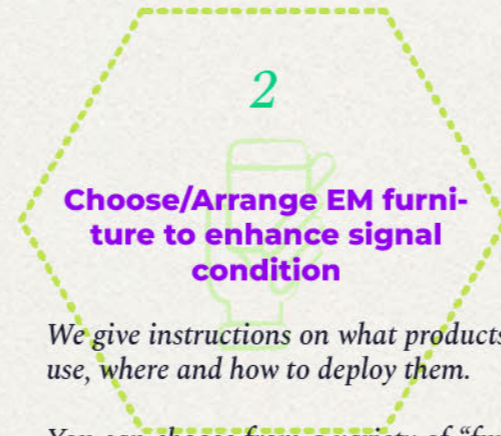
Build a digital twin for your home, input room type, size, surface material, etc.



Set up router location and specification.



Input receiving device type (e.g. laptop/CCTV/IoT tag), location, and their requirements for wireless connection.



**2**  
Choose/Arrange EM furniture to enhance signal condition

We give instructions on what products to use, where and how to deploy them.

You can choose from a variety of “furniturized” reflectors, transmitters, focus, shields, customize the products in terms of location, size, aesthetics, etc. for optimized wireless connectivity.



Select EM product based on our recommendation: reflectors, transmitters, focus, shields, diffusors, etc.



Identify optimal location, orientation, size and other parameters of the product with an AR platform.



Get your bespoke product!



**3**  
Get your products and install

The products come with installation guide. See how your signals are optimized by the new look of your house!



Purchase & get the product



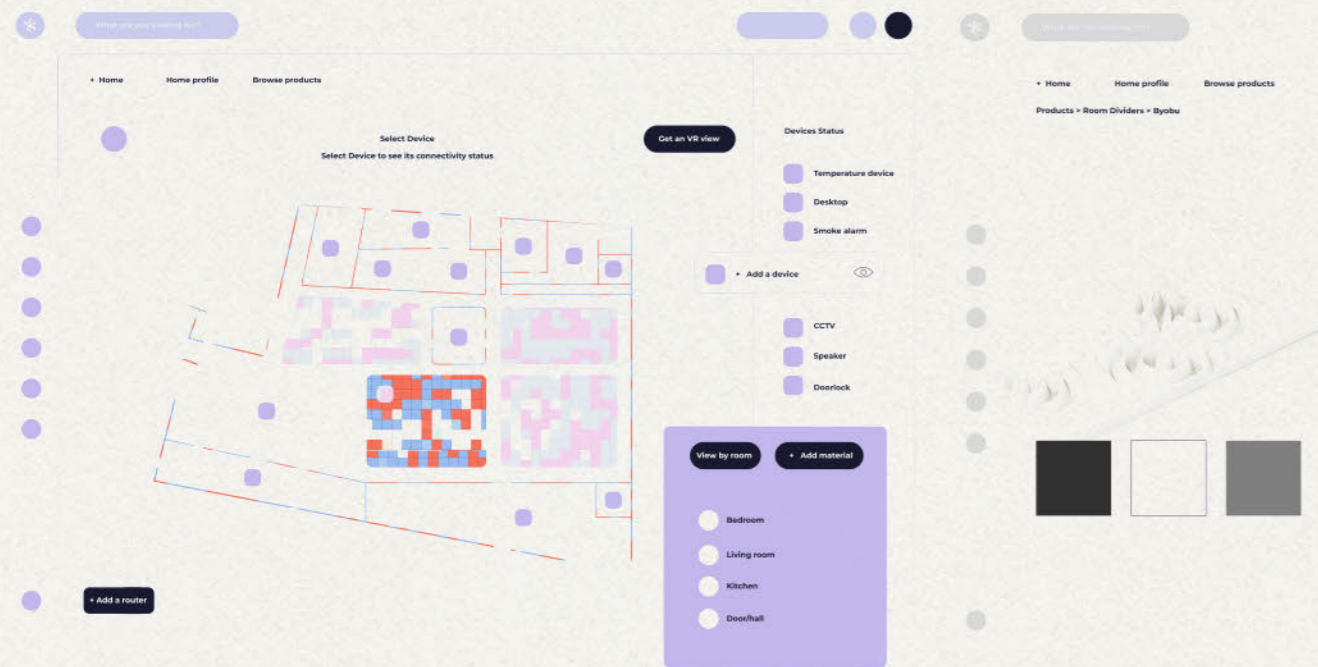
Deploy products with instructions from a user-friendly platform.



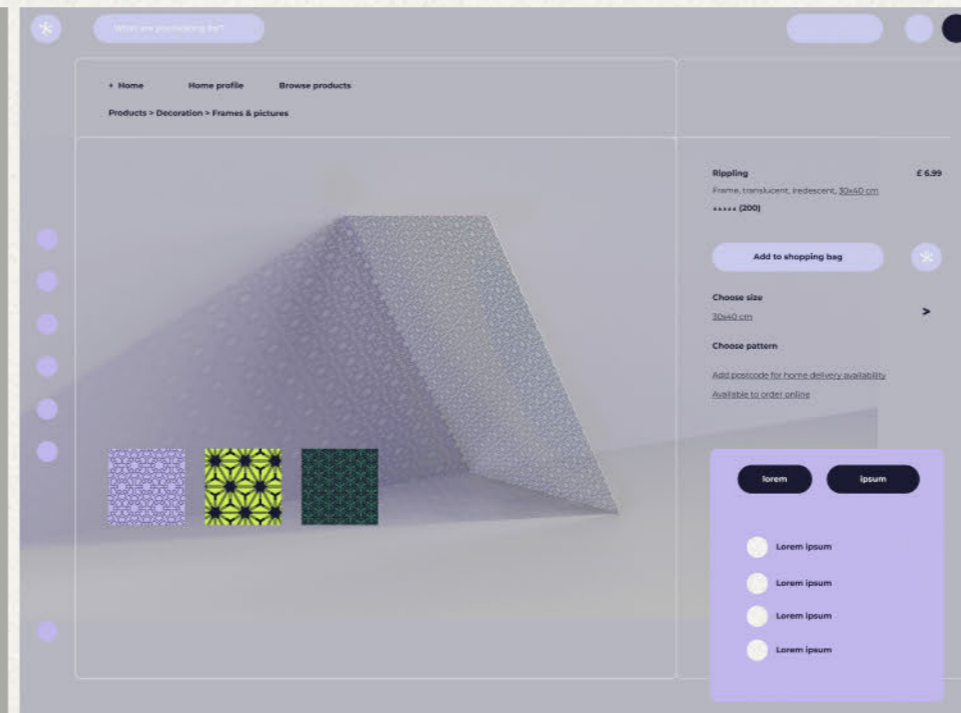
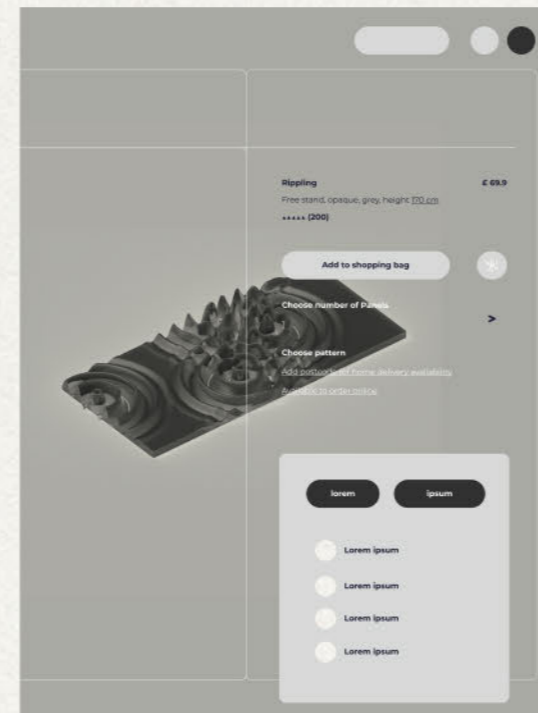
See how your connectivity is enhanced!

# User interface

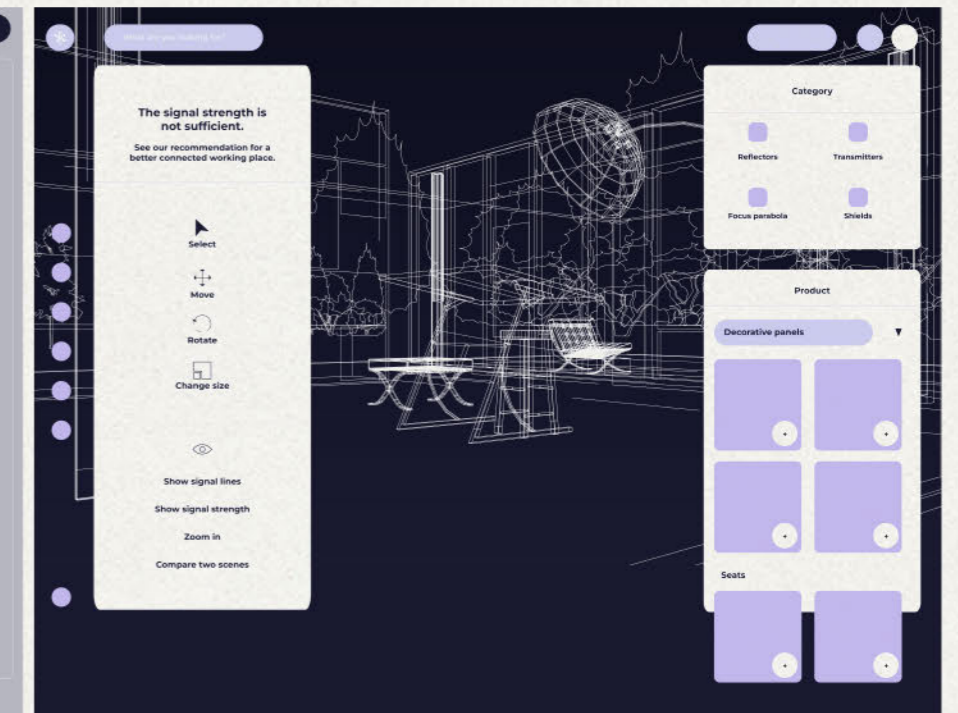
## Digital profile of your home



## Reflector product page



## Transmitter product page





# Workflow Framework



## Workflow I Wave propagation model

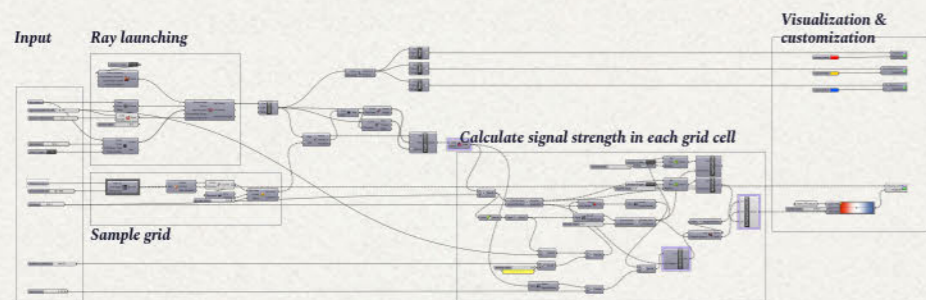
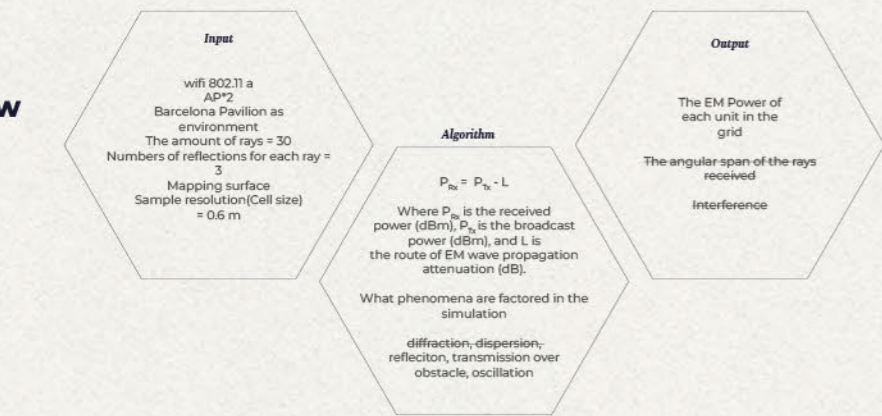
Understand signal distribution with a deterministic model

### Algorithm selection

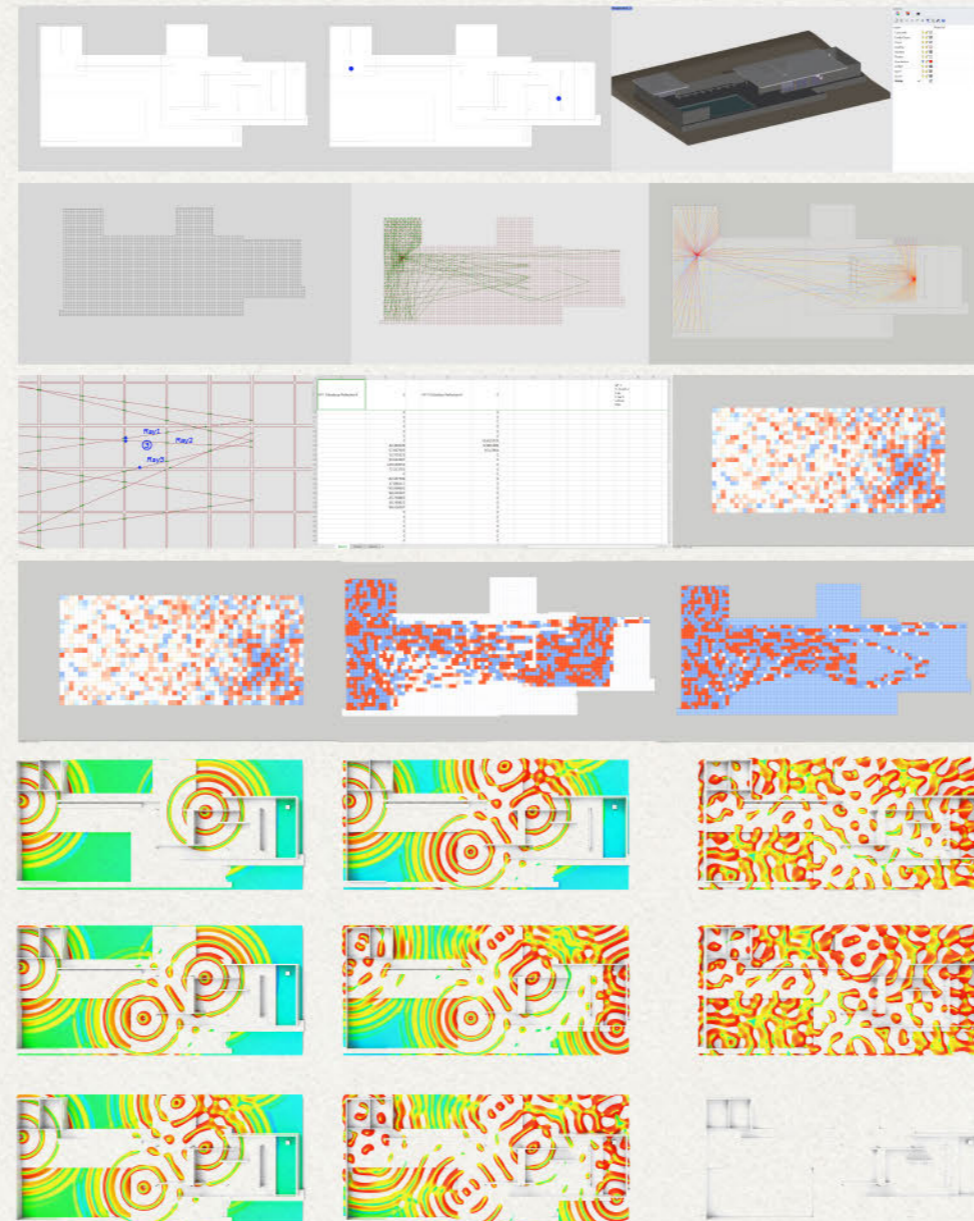
Category	Empirical		Deterministic models are considered to be more accurate in comparison with models of empirical data			
Sub Category	One-Slope (O-S)	Multi-Wall (M-W)	Dominant Path Model (D-P)	FDTD (Finite-Difference time-domain)	GO (geometrical optics)	RFM (ray optical methods)
Limit on interaction times	Yes	Yes	No	No	No	No
Diffraction/reflection	no diffraction and reflection	no diffraction and reflection	with diffraction and reflection	with diffraction and reflection	with diffraction and reflection	no diffraction with reflection
Why/Why not use this method	No walls taken into account	No reflection or diffraction was taken into account, only consider the impact of walls of suppression of the waves on direct route from transmitter to receiver	Complex initial calculations (e.g. F.U. and W) make O-S model difficult to implement.	More precise relative to GO. But requires a large amount of CPU power for fast calculation of the large Maxwell's equations. For this reason, it is rarely used in computer programs that support design of the wireless networks	✓	✓



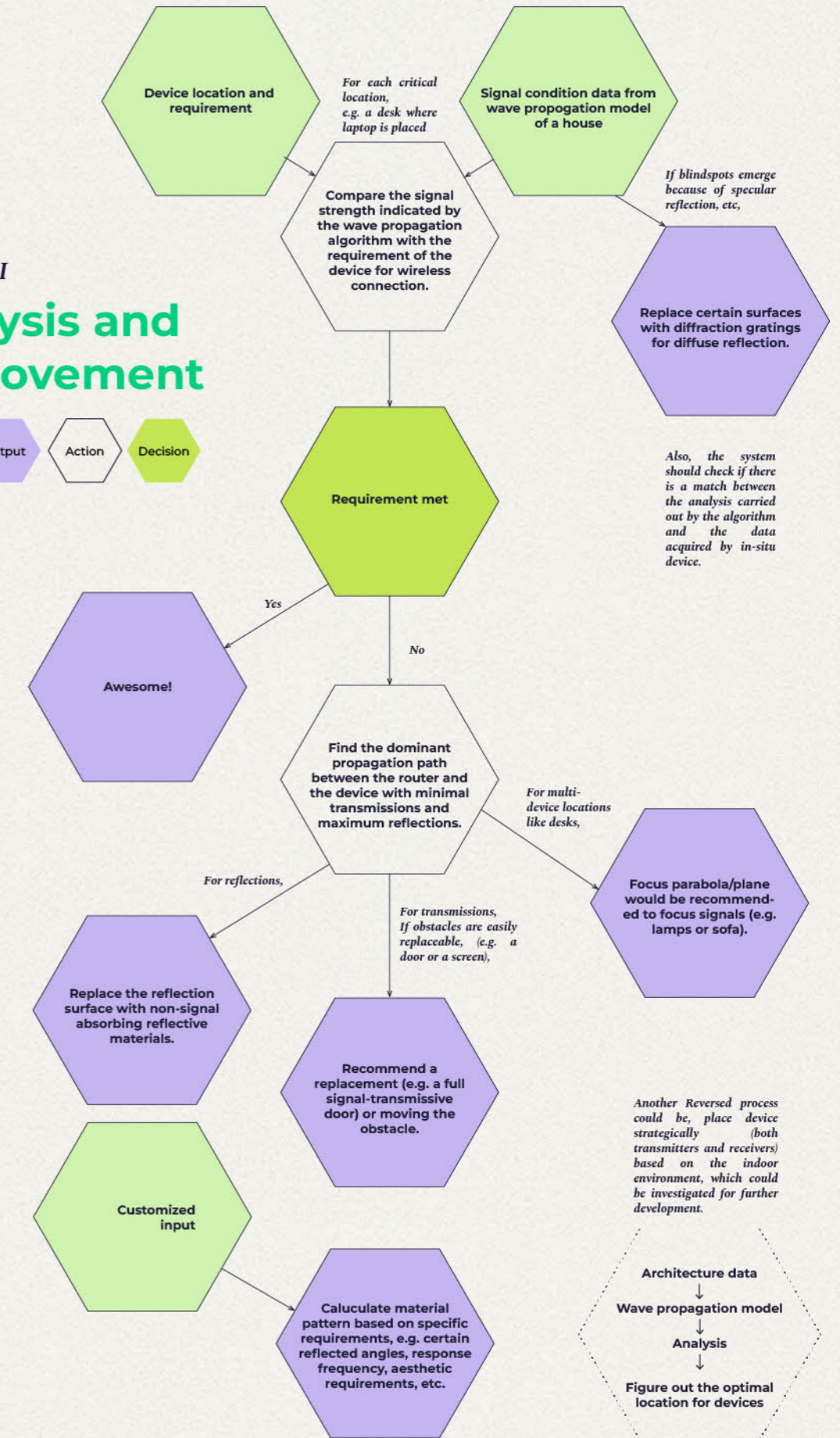
### Workflow



### Experiment result



## Workflow II Analysis and Improvement





## Stakeholder map

# Bring about change with...

### Indoor localisation service providers

- How might we cut down the cost and energy consumed for businesses that utilise signals to provide services?

### Individual Users

- How might we build our home into a wave-guide with on shelf EM products?
- How would a novel signal experience be enabled by a human-wave-interface?

### Companies/Institutions/Commercial groups

- How might we cut down the cost companies spend on the network equipment and electricity they consume with a passive EM material? How might an optimised signal propagation environment provide better communication, higher efficiency and productivity in a working setting? Or even further, how can it bring a sense of connection, belonging, and aid in the team dynamic?

### Furniture/Product designer

- What if a piece of furniture is also a network device?
- How can a network device become appealing, memorable, and indicate the significance of wireless connectivity in our daily lives?
- How do we envision the new affordance of network devices according to human interaction with wireless signals? Can a hotspot become a fireplace?

### Architects/Interior designers/Contractors

- How might we optimise our built environment for better wireless connectivity?
- How might our need for remote connectivity inform the design of our living environment?
- What if we could understand the electromagnetic performance of an architecture before we build it?

### Regulatory stakeholders

- How can we develop a "signal efficiency rate" for an architecture?
- What if a "signal efficiency rate" could be integrated into the current building code system?

### Network providers

- What if an architecture element could serve as a passive network device, and to be integrated into our network infrastructure?
- How to make it a common practice for network providers?

### Manufacturers/ Material suppliers/ Testing facilities

- Conductive ink supplier
- Screen printing service provider
- EM characterisation lab

## Key activities

**Venture Catalyst Challenge Finalist**  
IMPERIAL ENTERPRISE LAB · FEB 2022

**Mayor's Entrepreneur Competition Semi-Finalist**  
MAYOR'S FUND LONDON · APR 2022

**Innovation RCA Shortlisted**  
INNOVATION RCA PATENT SUPPORT · MAY 2022

**Royal College of Art Graduate Show**  
SCHOOL OF DESIGN · JUNE 2022

**Imperial College London Summer Show**  
DYSON SCHOOL OF DESIGN ENGINEERING · JULY 2022

**Candidate of Expert- in- Residence startup support**  
IMPERIAL ENTREPRISE LAB · FEB 2022

## Acknowledge

This project would not have been possible without the generous help from: Chen Li, Huimuk Jang, Ruoqi Wu, Yuanjun Shen, Zixuan Huang.

Deepest appreciation to: Damon Rostron, David Perkins, Oscar Eaton, Tania Bozinovska, Xiaowu Jiang for your knowledge, expertise and reference, and all people who provided insights, feedback, suggestions, encouragement and recognition in the process.



# HYGI-FLAKE

三维跨尺度可  
交互的药理学  
信息可视化工具

## 药理学 可视化工具

### SKILLS

User interaction  
System architecture  
Interdisciplinary  
communication

INFORMATION EXPERIENCE  
*interactive data visualization*

GROUP  
PROJECT

JAN-APR  
2021  
3 MONTHS

“要学药理”是一个以三维人体为载体，在不同尺度上展示药物作用过程及原理的信息可视化工具。可在医疗健康领域下的研发、教学、展示等场景中实现更系统、直观、用户友好的信息传达。

通过与高校及国家企业中的专业人士的交流与合作，团队在项目过程中积累了大量准确、前沿的药理学信息可视化的相关经验（基本视觉单元/交互方式/流程等），项目成果具有极大的延展性与可能性。





## Background

### Data visualisation and knowledge management market

Information management, visualisation and communication plays a crucial part in a variety of educational, industrial, and commercial scenarios. It is getting incredible traction and taking on new forms across varying media with unprecedented human experiences.

### Data visualisation tool



**420,000 ¥**

for premium service per year  
AliyunDataV 3D digital city builder  
[https://cn.aliyun.com/activity/intelligent/datavcitypro?from\\_alibabacloud=](https://cn.aliyun.com/activity/intelligent/datavcitypro?from_alibabacloud=)

### Knowledge management tool

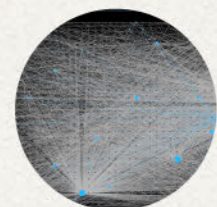
All-in-one workspace



**\$10 Billion**

valuation Notion reaches

<https://www.forbes.com/sites/alexkonrad/2021/10/08/notion-raises-at-10-billion-valuation-boosted-by-remote-work-tiktok/?sh=1372699b6490>



**\$9 Billion**

total funding amount  
of Roam Research

[https://www.crunchbase.com/organization/roam-research/company\\_financials](https://www.crunchbase.com/organization/roam-research/company_financials)



Information communication in pharmaceuticals is more personalised, automated, interactive, multimedia, visual-appealing and has a great potential for growth.

Researchers at the University of British Columbia's The Hive use WebAR to display holographic brains for use in medical school classes.

<https://hive.med.ubc.ca/projects/holobrain/>

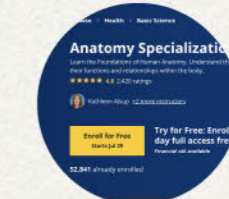
### Data visualisation in pharmaceuticals online courses, classes, & lessons



**558K**

subscribers  
Speed Pharmacology  
Youtube channel

<https://www.youtube.com/c/SpeedPharmacology?app=desktop>



**52,841**

enrolled  
Anatomy Specialization  
course on Coursera

<https://www.coursera.org/specializations/anatomy>



**\$143 billion**

Medical education  
market size to grow

Medical Education Market Growth, Size, Trends, Analysis Report by Type, Application, Region and Segment Forecast 2021-2025

### Technological readiness

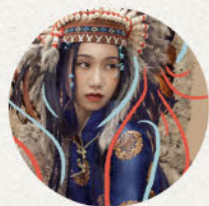
AR/VR that is more inclusive and immediately available will bring more opportunities for data experience.



# Problem discovery

## Persona Medical students

We chose medical students as the main focus group and as the leverage intervention point to understand more about the challenges and opportunities of information visualisation in the pharmaceutical world.



Jialu Cheng

24 Graduate medical student

Peking University Undergraduate  
Columbia University Postgraduate

## Scenario

We focused on their information experience when having their education/doing school work/taking exams:

## Activities



Comprehension



Memorising



Retrieving

“

## Media

The **slides/textbooks** we use at school are still from ten years ago. Teacher's writing on the **blackboard** is also an important way to impart and learn. Currently, medical **animation** is more of an **aid** to methods mentioned above. They are more **intuitive and friendly** to comprehension, but most videos only show **part of a whole process**, the perspective is also **limited**.

## Communication design

For us, **texts** dominate medical information communication. It's quite **linear** and lacks **interconnectivity**. The relationships/links between the knowledge is **ambiguous**.

We also have **2D diagrams** like charts, bars, spreadsheets, etc. I **draw my own ones** most of the time to **organise and arrange** these knowledge, like making comparisons between similar drugs.

## Pain points

It's very hard to tell the relationship between **fragmented** knowledge. I need to spend a lot of time figuring out the relationships between nodes of knowledge, creating a framework of knowledge by making my own drawings, but they are never holistic enough.

Our work is loaded with details and it is very **hard to memorise** them only by rote (the mostly used method).

”



Slides/Textbook



Spreadsheet for review

Textbook diagram



Diagrams

## Pharmaceutical information

Nature of pharmaceutical knowledge

## Multi-scale and location

Drug action is a process on the cell, tissue, organ, and finally organism, the human body.

molecule    cell    tissue    organ    organism

## Chronological arrangement

Drug action is a dynamic process, a biochemical or physiological process that consists of a series of steps that are codependent. **Time course of concentration** is important in drug characterisation as well.

## Comparison between different drugs

Horizontal comparison constructs links between nodes and framework of knowledge.



Pharmaceutical visualisation could become:

**Tangible/Intuitive**

**Systematic  
Interactive/Fun  
Dynamic**

Current information visualisation is:  
**Abstract - hard to understand/memorise**  
**Fragmented**  
**Lack of feedback/monotonous**  
**Static**



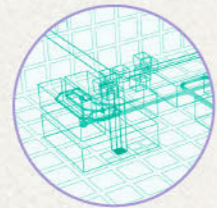


# Hygi-flake

## a tool for pharmacology learning

Interactive, multi-dimensional pharmacology information visualisation for knowledge organisation, comprehension and memorisation.

The abstract, complex and intertwined information is translated into tangible components, distributed and placed in an immersive virtual environment, a human body.



Spatially localised, chronologically organised



Human body as the memory palace

We go on a journey inside the human body with a tablet of Memantine to understand/memorise all aspects of the drug. The motion images are chronological, visually-appealing, intuitive, easy-to-comprehend, delivering knowledge with multiple dimensions, perspectives, and senses.



Component library denoting pharmacology-specific knowledge

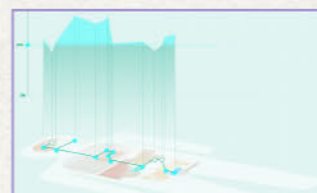


A journey describing the whole process

It is possible for users to engage spatial cognition and muscle memory when learning. Our interaction is based on effective learning techniques like active retrieval, spaced repetition, etc for improved memory.

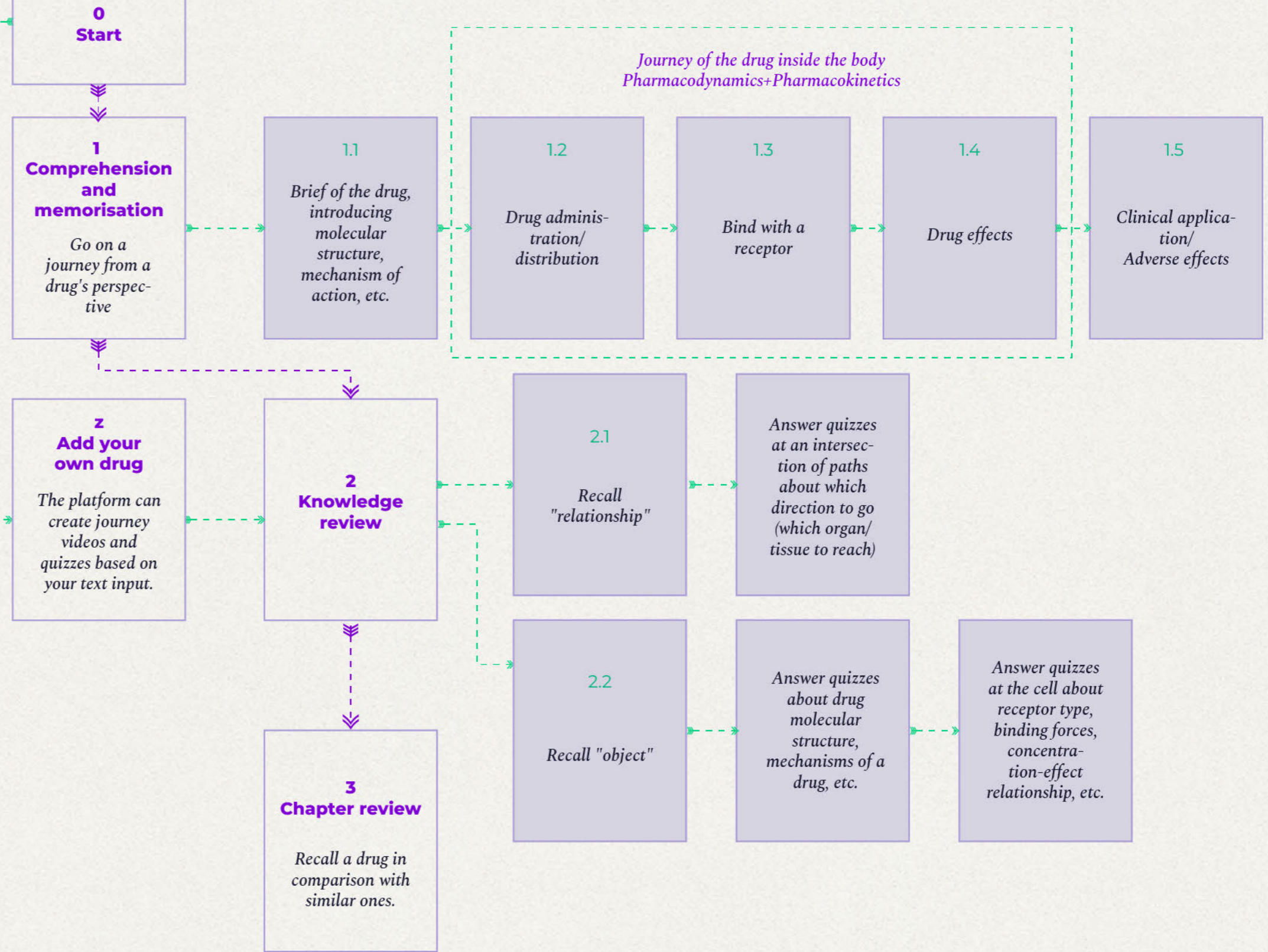


Interaction facilitating memorisation



Integrated science-backed memory techniques

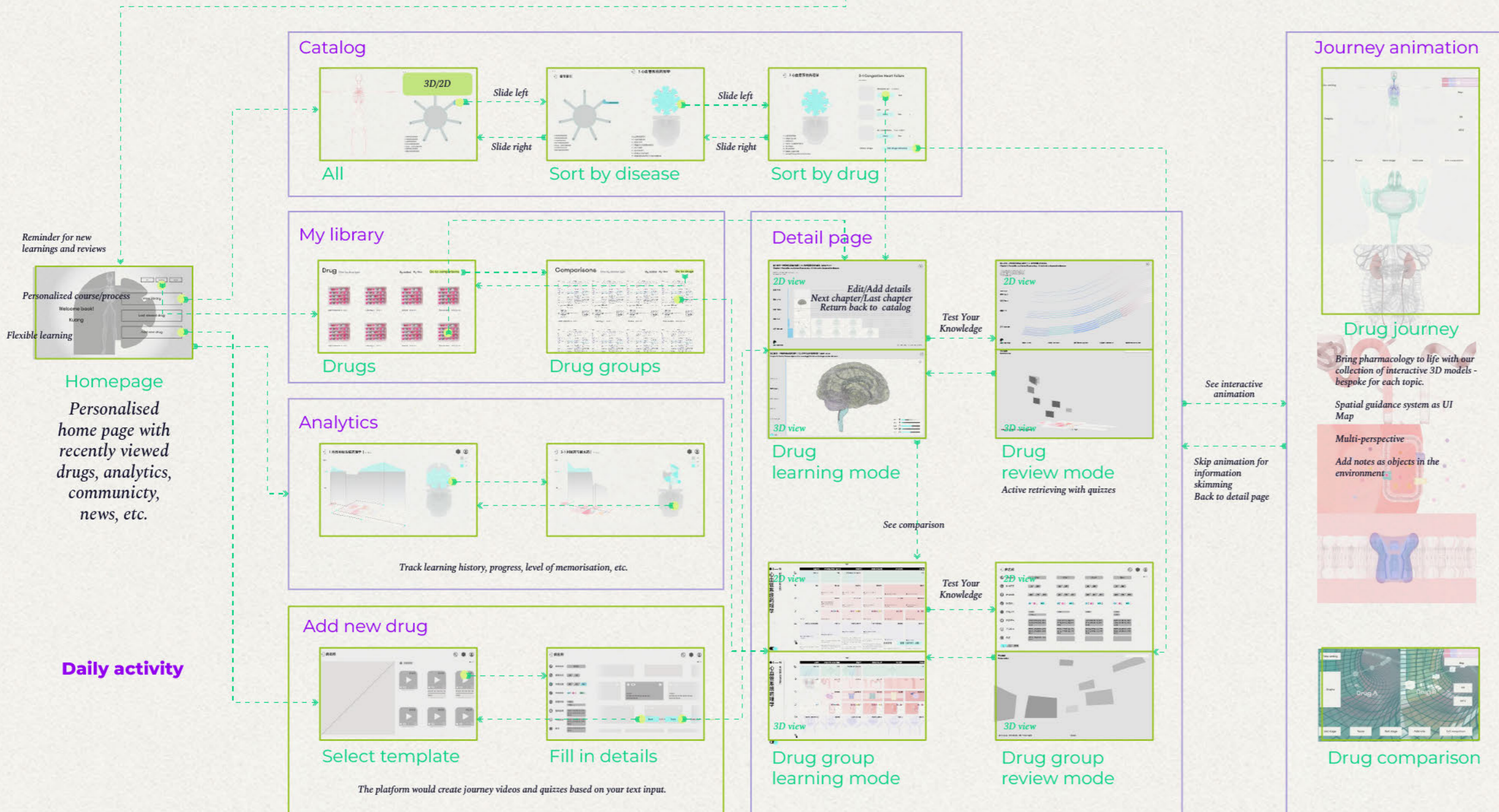
# User journey





# Workflow & Wireframe

Join & Get started



## Drug detail page content

DRUG NAME

MECHANISM OF ACTION

	PHARMACOKINETICS <small>DISTRIBUTION/LIBERATION/METABOLISM/ETC. TIME COURSE OF DRUG CONCENTRATION</small>	PHARMACODYNAMICS <small>EFFECT OF DRUGS ON HUMAN ORGANISM/ CONCENTRATION-EFFECT RELATIONSHIP</small>
Drug administration		
Distribution		
Cellular sites of action		Drug receptor interaction
Excretion		

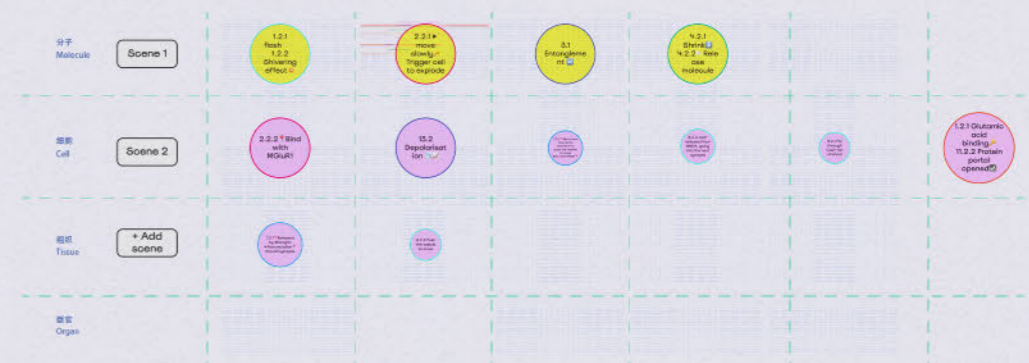
CLINICAL APPLICATION

ADVERSE DRUG EFFECTS

OTHERS

Create video of the journey  
Simplified video editing functions

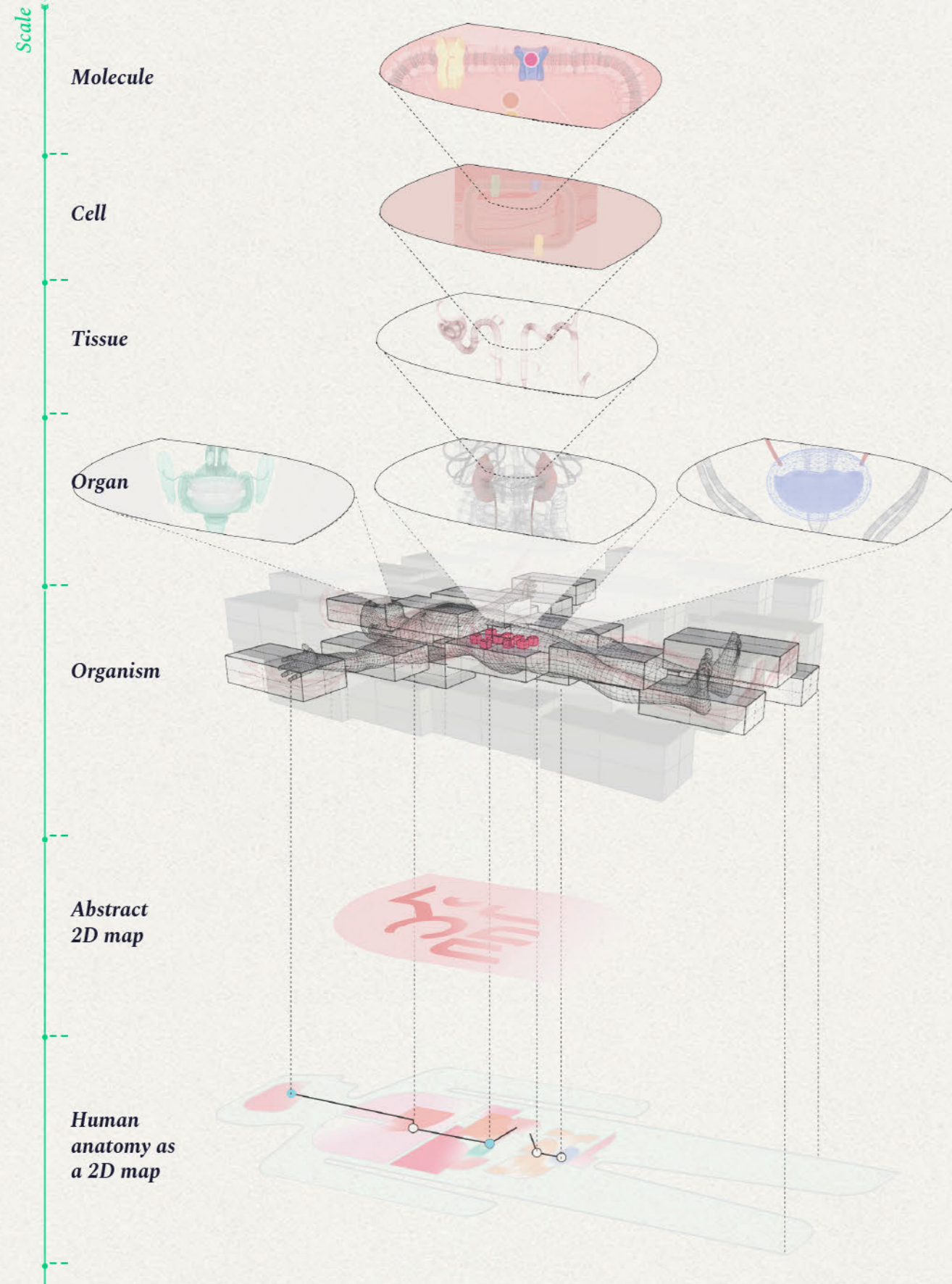
Drag to change order  
Video clip play order from left to right  
Clips in the same row are rendered in the same scene





# Information architecture

Component library and 4D coordinate

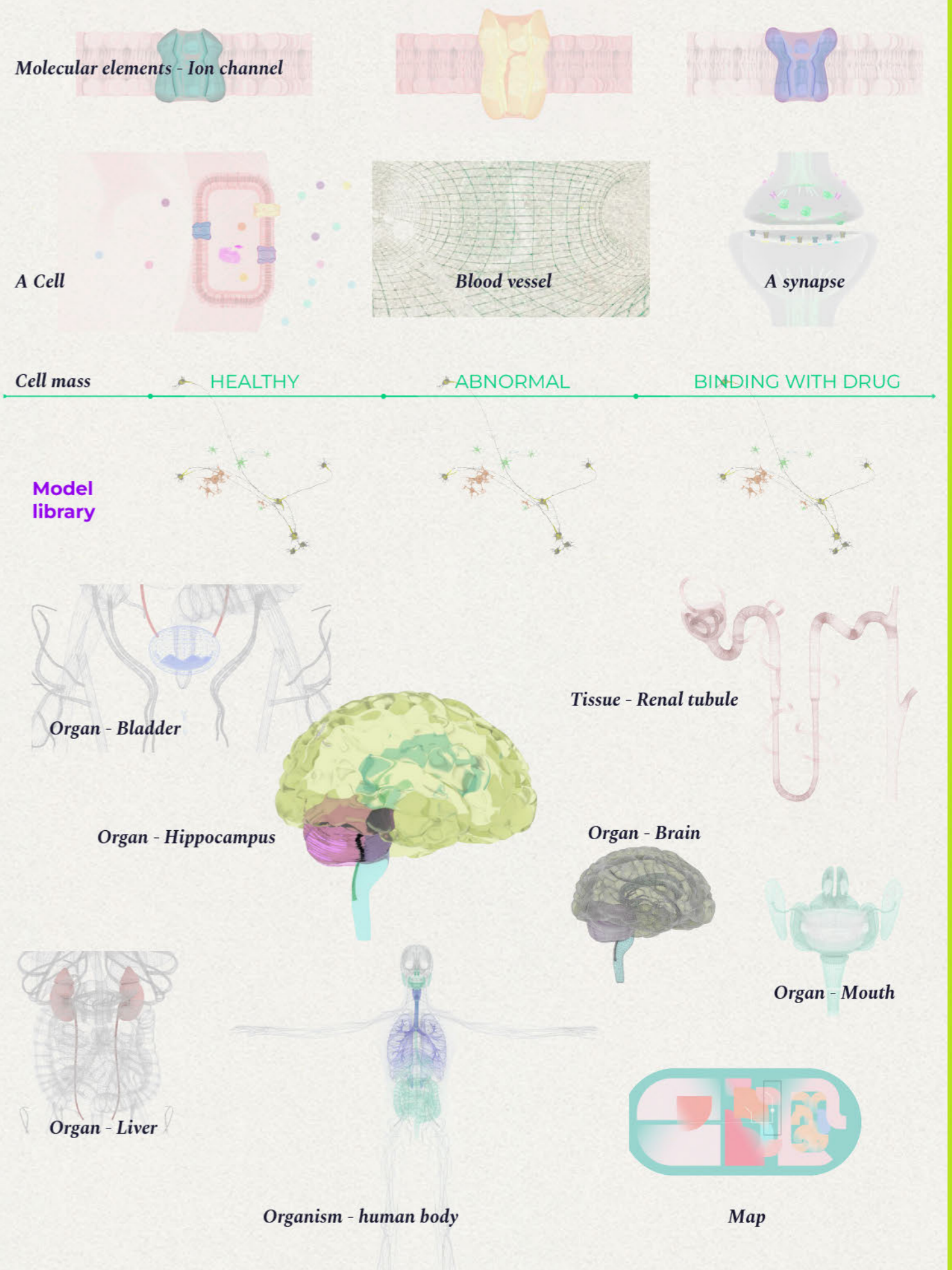
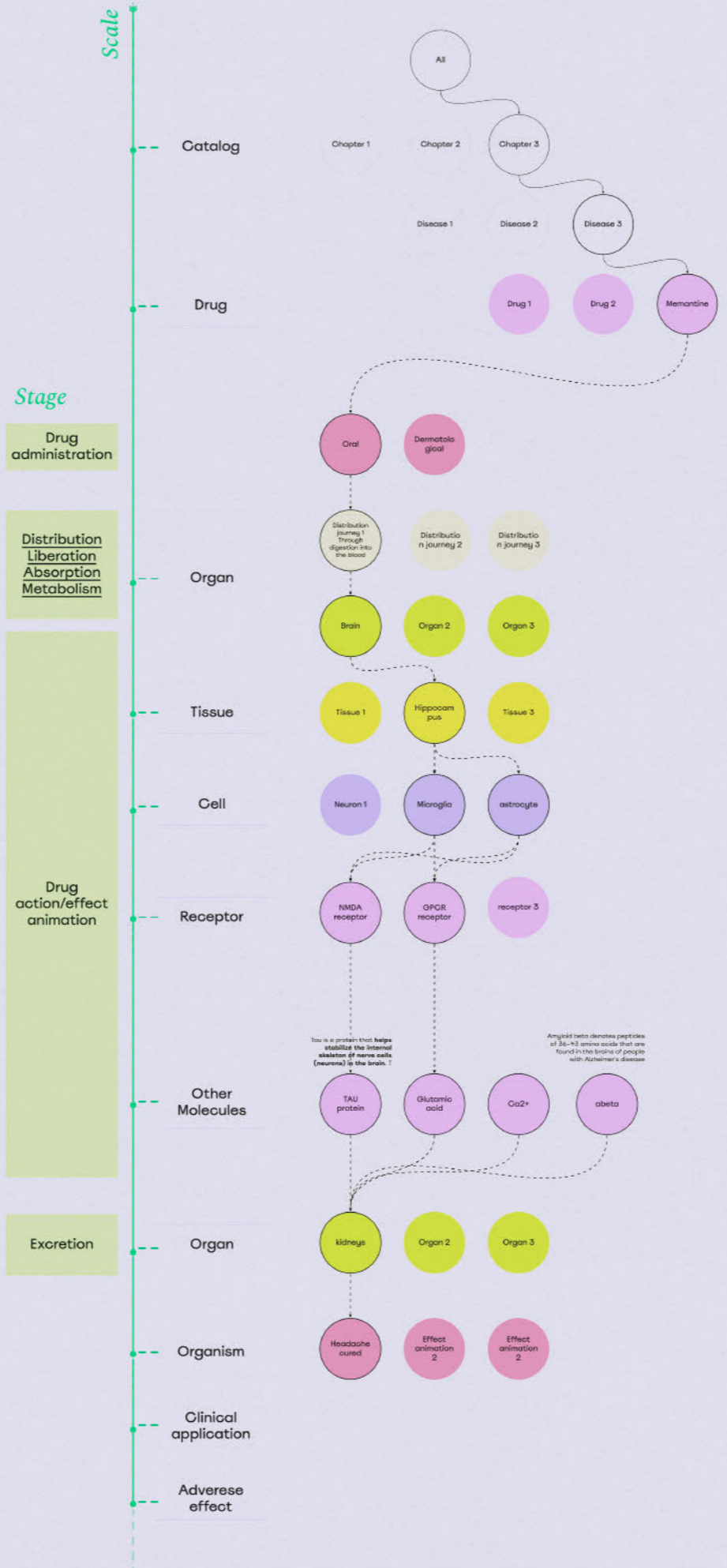


Data structure

BINDING WITH DRUG - MECHANISM

ABNORMAL CONDITION

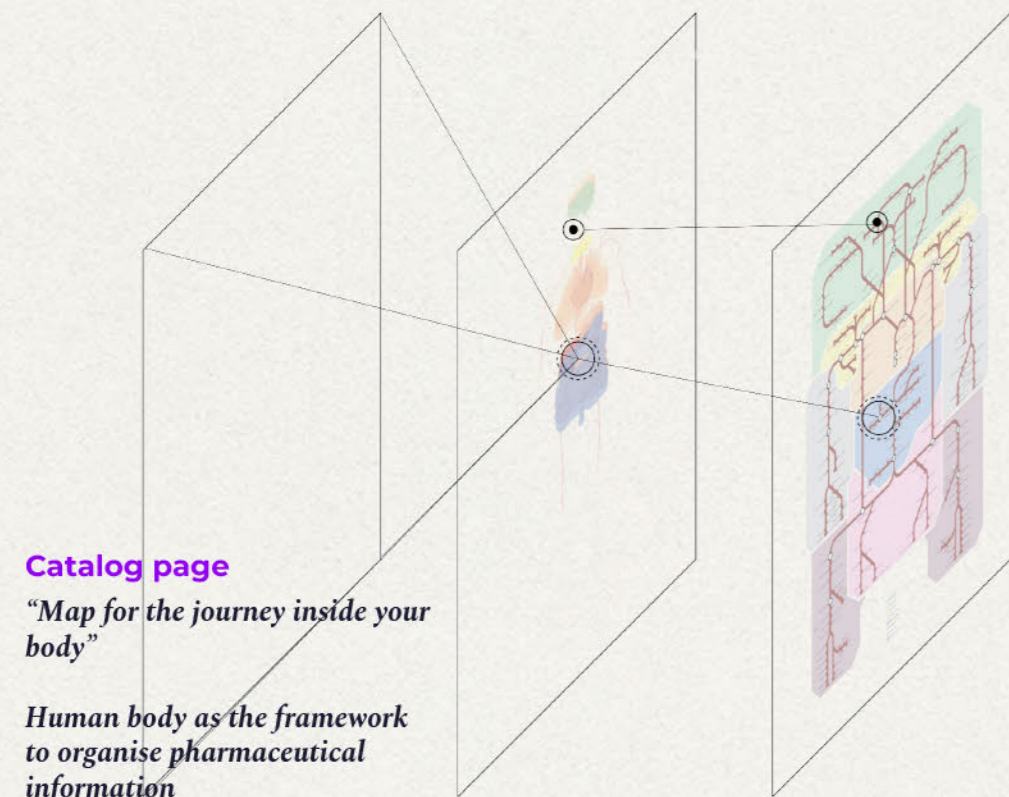
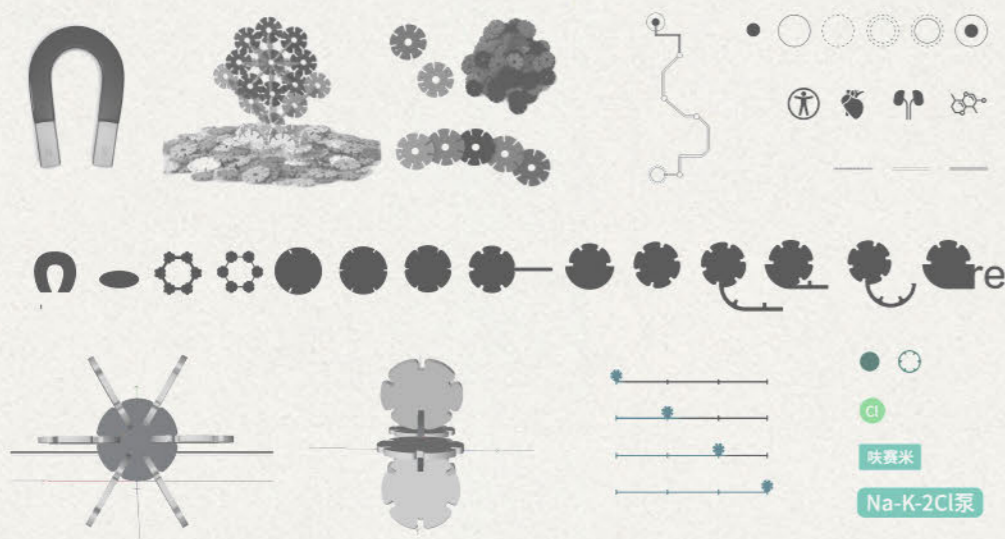
HEALTHY/NORMAL CONDITION





# Graphics

## Visual identity



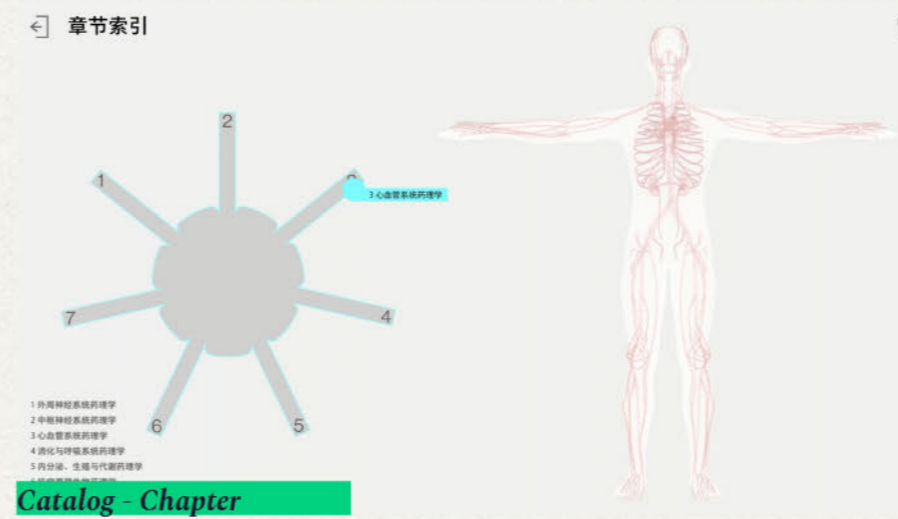
Catalog page  
"Map for the journey inside your body"

Human body as the framework to organise pharmaceutical information

# Interface

## Animation/Transition

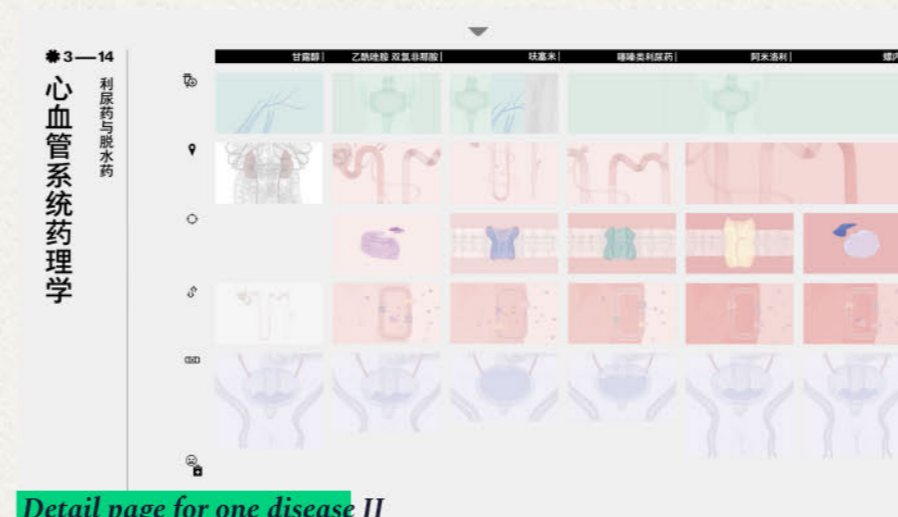
See link  
<https://v.qq.com/x/page/w32492gwigk.html>  
<https://v.qq.com/x/page/l3249r11vd.html>  
<https://v.qq.com/x/page/o3249m117lc.html>



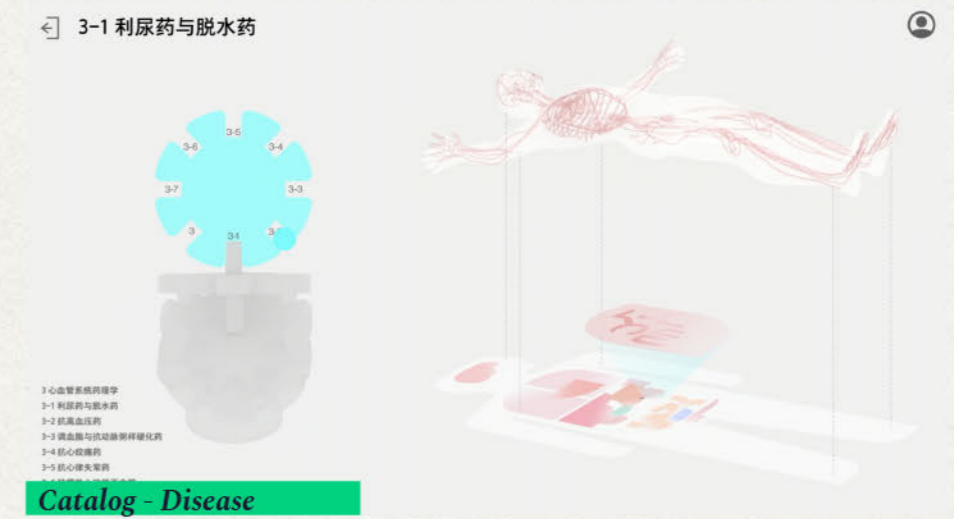
Catalog - Chapter



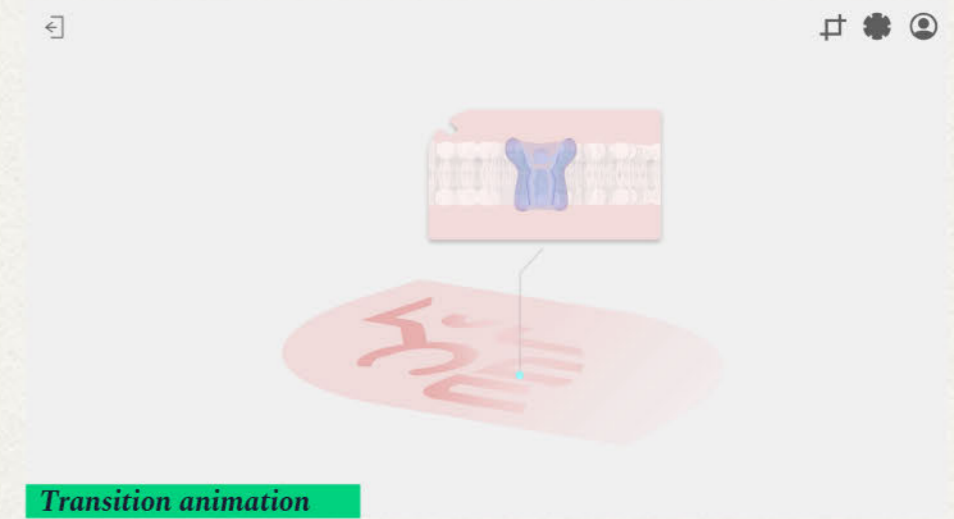
Detail page for one disease



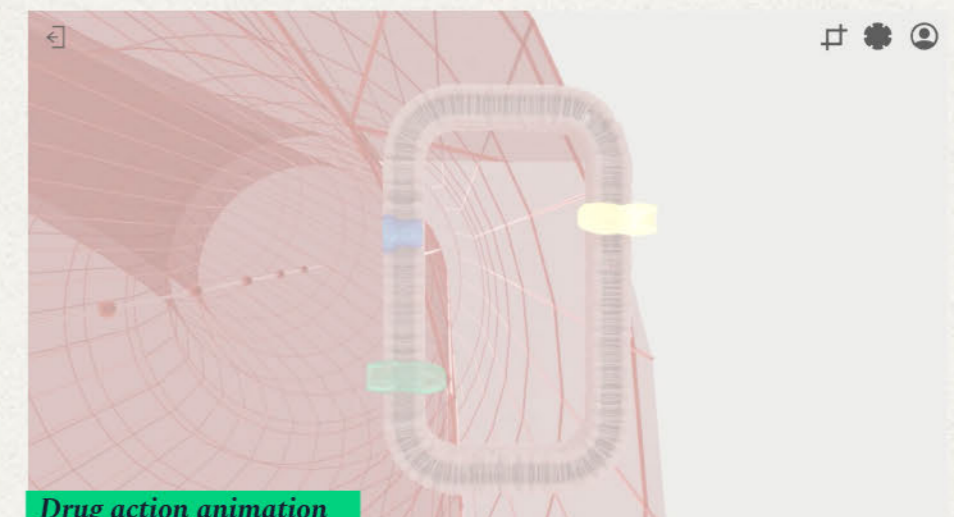
Detail page for one disease II



Catalog - Disease



Transition animation



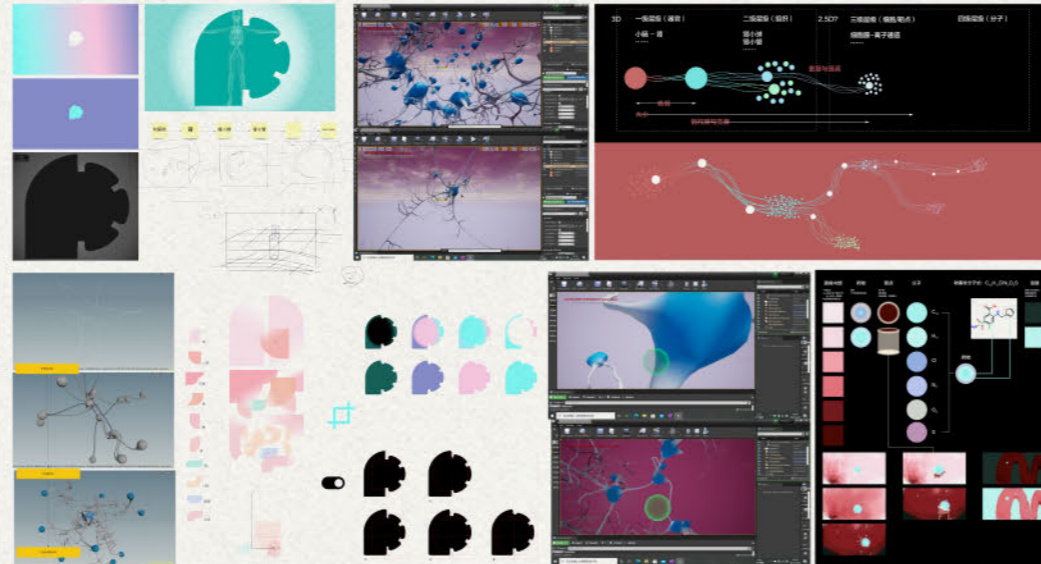
Drug action animation



## Process

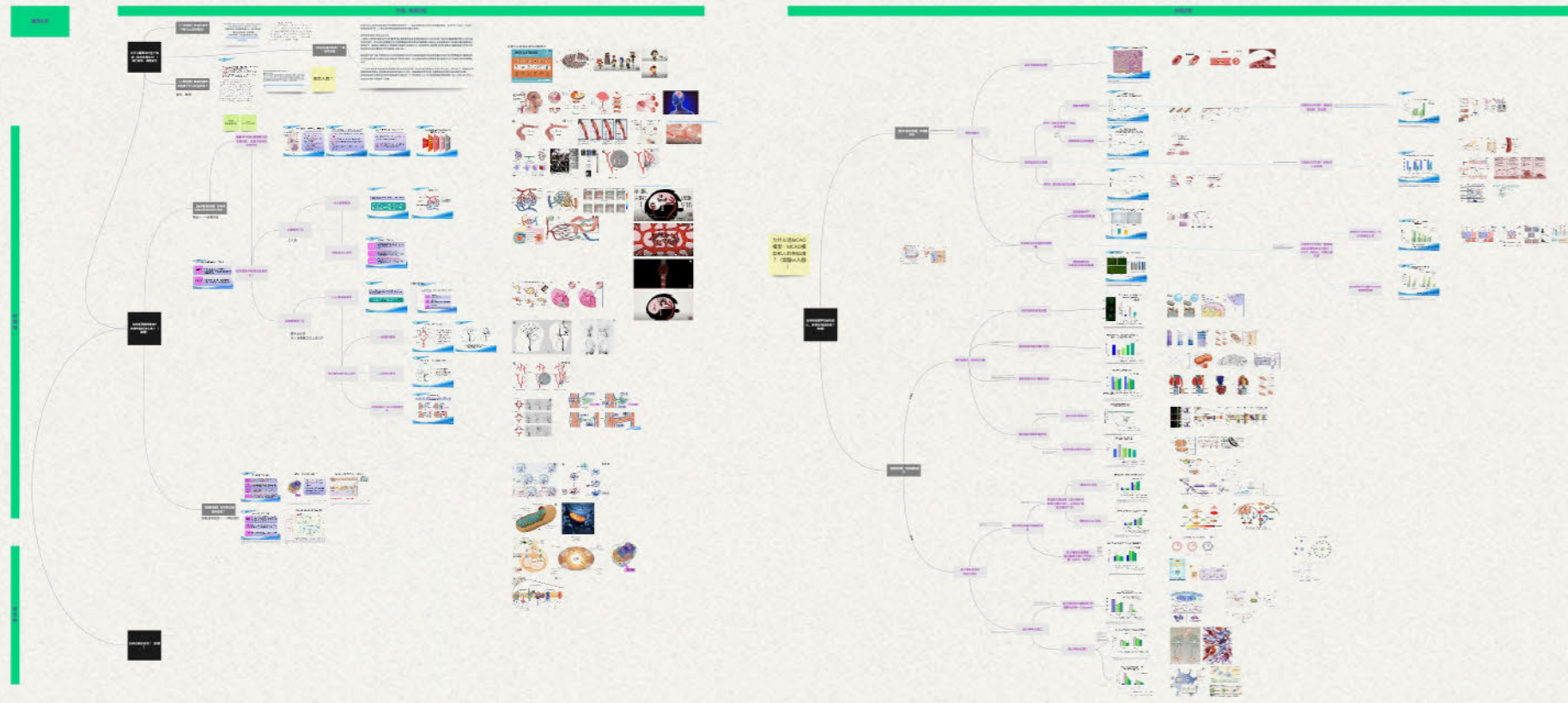
We executed rigorous research, tests, iterations of visual identity, interaction, system structure, etc.

### Iteration of visual identity



### Case study

As a case study, we researched Ischaemic strokes and media/image used to communicate the information, to understand the hierarchy/structure of pharmaceutical knowledge.



## Discussion

Hygi-flake looks forward to becoming a pharmaceutical information management and visualisation platform that is applicable to other stakeholders with various purposes like scientific research, doctor-patient communication in diagnosis and treatment, etc.

### Pharmaceutical company

A communication-aid when promoting products  
For communicating in a concise, intuitive, easy-to-understand way.

### Educational tool for sales people working in the pharmaceuticals

Most sales people do not come with professional background, and training, equipping them with fundamental pharmaceutical knowledge is necessary for Pharmaceutical companies.

### Academic researcher

A tool for information integration/visualisation

### Diagnosis and treatment

For better communication with patients.

## Team

Chen Li  
Jialu Cheng  
Qixin Chen  
Kedan Ai  
Hong Hua

Responsible for:  
User journey/System workflow  
/Data architecture/

Participate in:  
Research/Concept development/  
Business model/Interdisciplinary communication

## Activities

Selected activities include:

China Education Symposium at Harvard Graduate School of Education  
<https://www.linkedin.com/company/hgsecs/about/>

Cooperation with Biotech company Thousand Dimensions  
<http://www.gianchengjx.com/>

Silver Innovation and Enterprise Competition issued by Beijing University Alliance of Art and Design

BSP Innovation and Entrepreneurship Training Program Finalist at Beijing Students' Platform for innovation and entrepreneurship training program

Bronze CAFA Innovation and Enterprise Competition 2021 issued by Central Academy of Fine Arts in China



# CAOCHANGDI TREASURE HUNT

面向草场地城中村中的儿童的教育娱乐服务设计

## 草场地社区儿童

## 服务设计

SERVICE DESIGN  
community engagement

### SKILLS

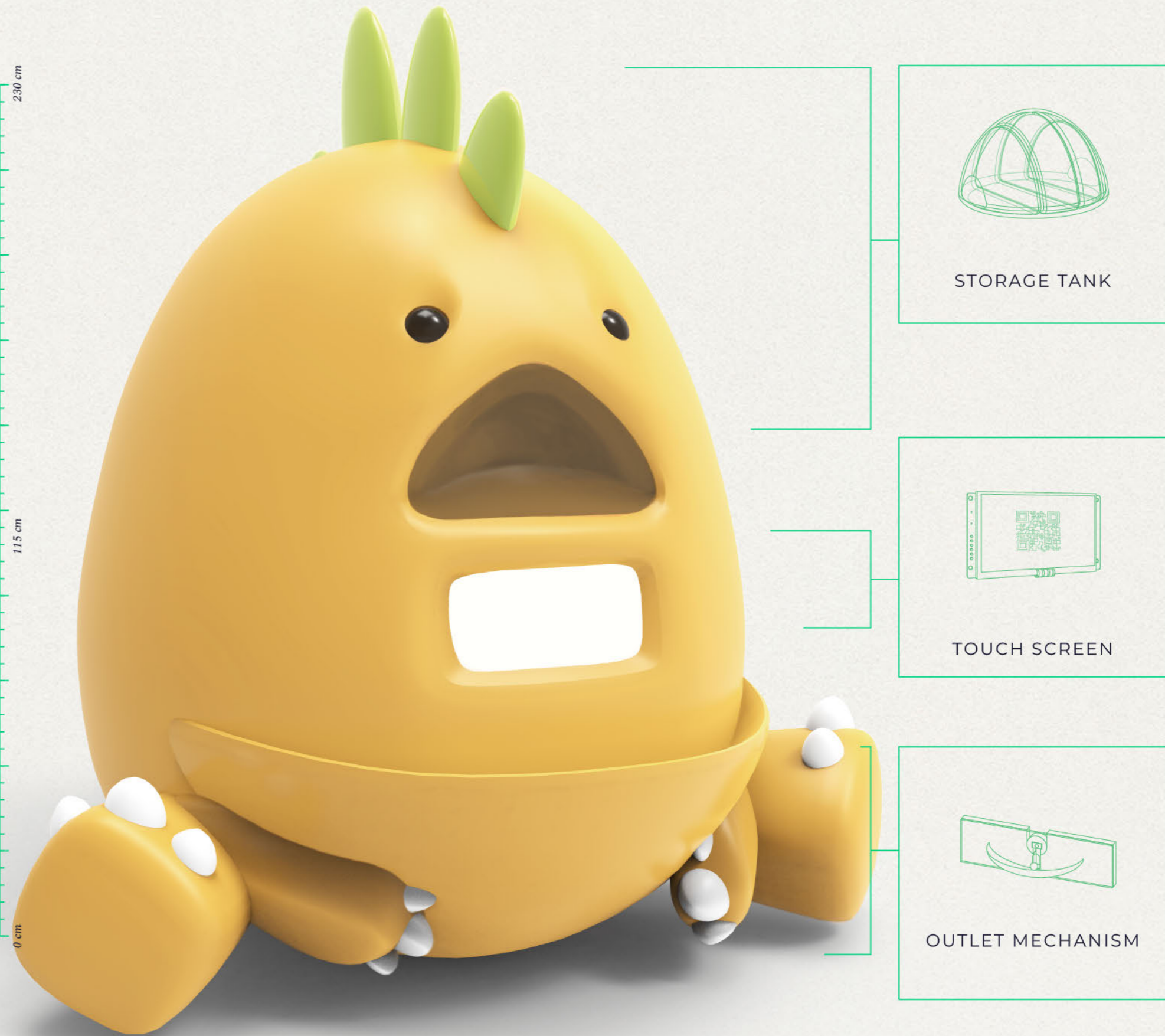
Field research  
User journey  
Blueprint  
User interface  
Storyboard

SOLO  
PROJECT  
JUNE-JULY  
2019  
6 WEEKS

“草场地寻宝图”是一个面向草场地城中村儿童的服务设计项目。

项目由APP交互平台与遍布社区的实体交互装置组成。平台会记录儿童的户外活动情况并据此提供奖励。奖品为需要儿童自己动手制作的、可以改善居住环境的装饰品与小家具。儿童可以借助平台交换零件，分享制作经验并发布自己的作品。

项目希望从儿童入手解决城中村存在的一系列环境、管理问题。这一教育、娱乐服务可以提高草场地儿童的动手制作能力与改善居住环境的意识，作为社交平台，这一服务也可以促进家庭成员间的连接与邻里间的交流。希望这一项目能为国内广大的城中村社区提供管理范例，最终促进城中村社区的发展。





## Background

### “Urban Village”

Urbanization rate rised from **17.9% to 49.9%** in China during 1978-2010.

50 million people migrated to big cities from countries, counties, towns and secondary cities. Urban sprawling rendered original villages ‘urban villages’ during the urbanization process.

#### As labour and concentration camps

These urbanized villages offered affordable houses for migrants, which is the main labour of the city.

#### Challenges and opportunities

Urban villages have very limited area per capita with poor sanitation, sunlight exposure, etc. People spend most of their time on the street as their “public living room”. In the meantime, the district is also inviting and lively because of this. The scale of the construction is more human-friendly than most new built living areas as well.

\*Background image shows the distribution of urban villages in Beijing.

### “Caochangdi” site analysis

#### Location

Caochangdi sitting next to 5th ring road and airport express, 10 minutes by car far from 798 art district. It is one of few districts with low land value in Wang Jing District.

Caochangdi  
Area: 198000 m<sup>2</sup>

#### Population: (2016)

5 thousand, including more than 200 families of original residents, more than 1 thousand permanent inhabitants.

Architecture  
function

Residential /Commercial

Artistic area

Industrial area



Spatial hierachy

Main streets



## ‘Left-behind children’

As the leverage point of a family and the ecosystem, children living in the area are usually left behind by their parents, busy working and unable to care for their children.

### Lack of entertainment

How might we provide children with meaningful entertainment?

### Little time spent with parents

How might we encourage parents to spend more time with their children?

### Indifferent to living conditions

How might we help children develop the initiative to improve their own living environment?

### CCD children are living with

narrow indoor space, monotonous daily routine, most time spent in public space and other distressing difficulties.





Field Research

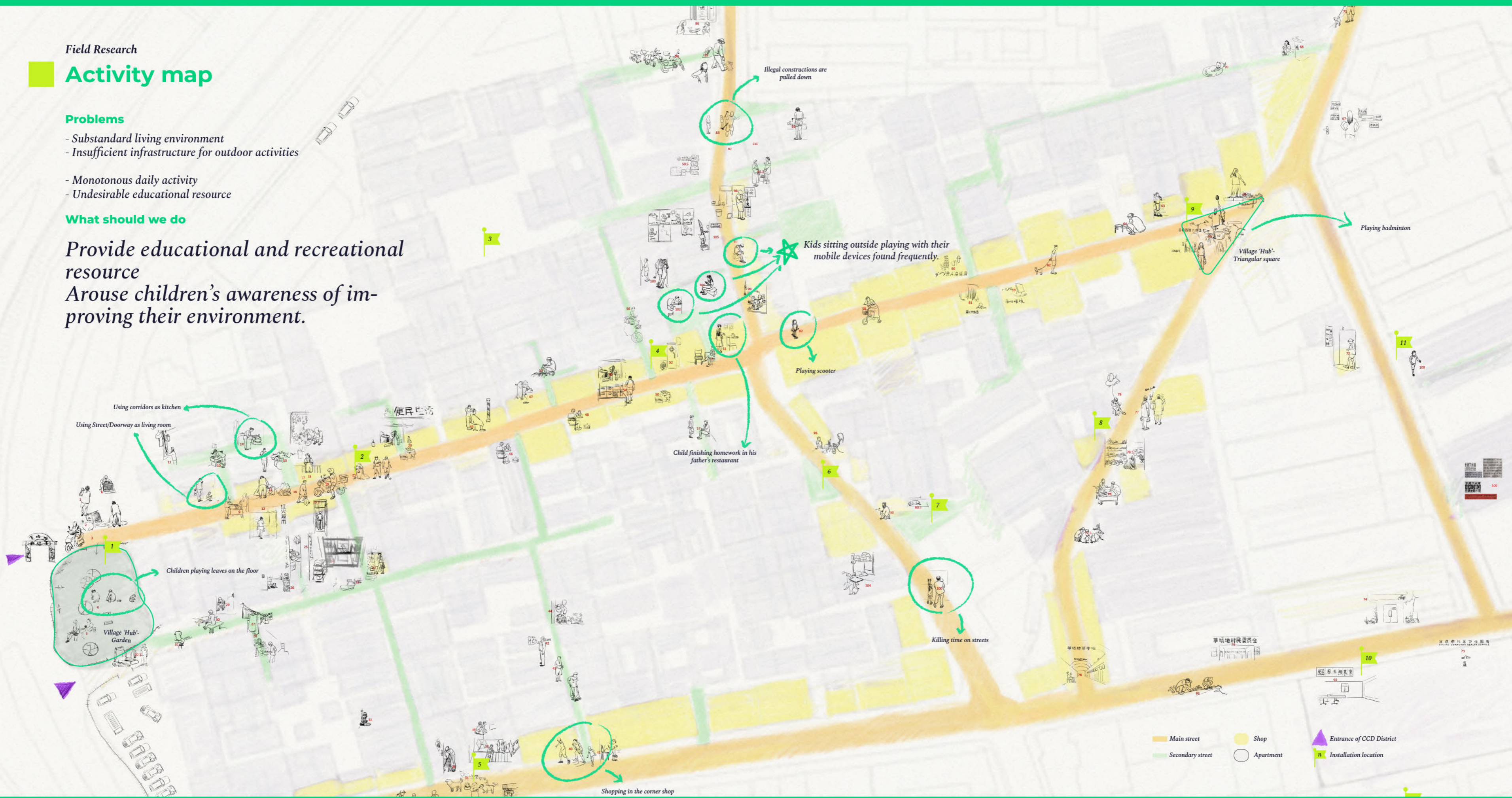
# Activity map

## Problems

- Substandard living environment
- Insufficient infrastructure for outdoor activities
- Monotonous daily activity
- Undesirable educational resource

## What should we do

Provide educational and recreational resource  
Arouse children's awareness of improving their environment.





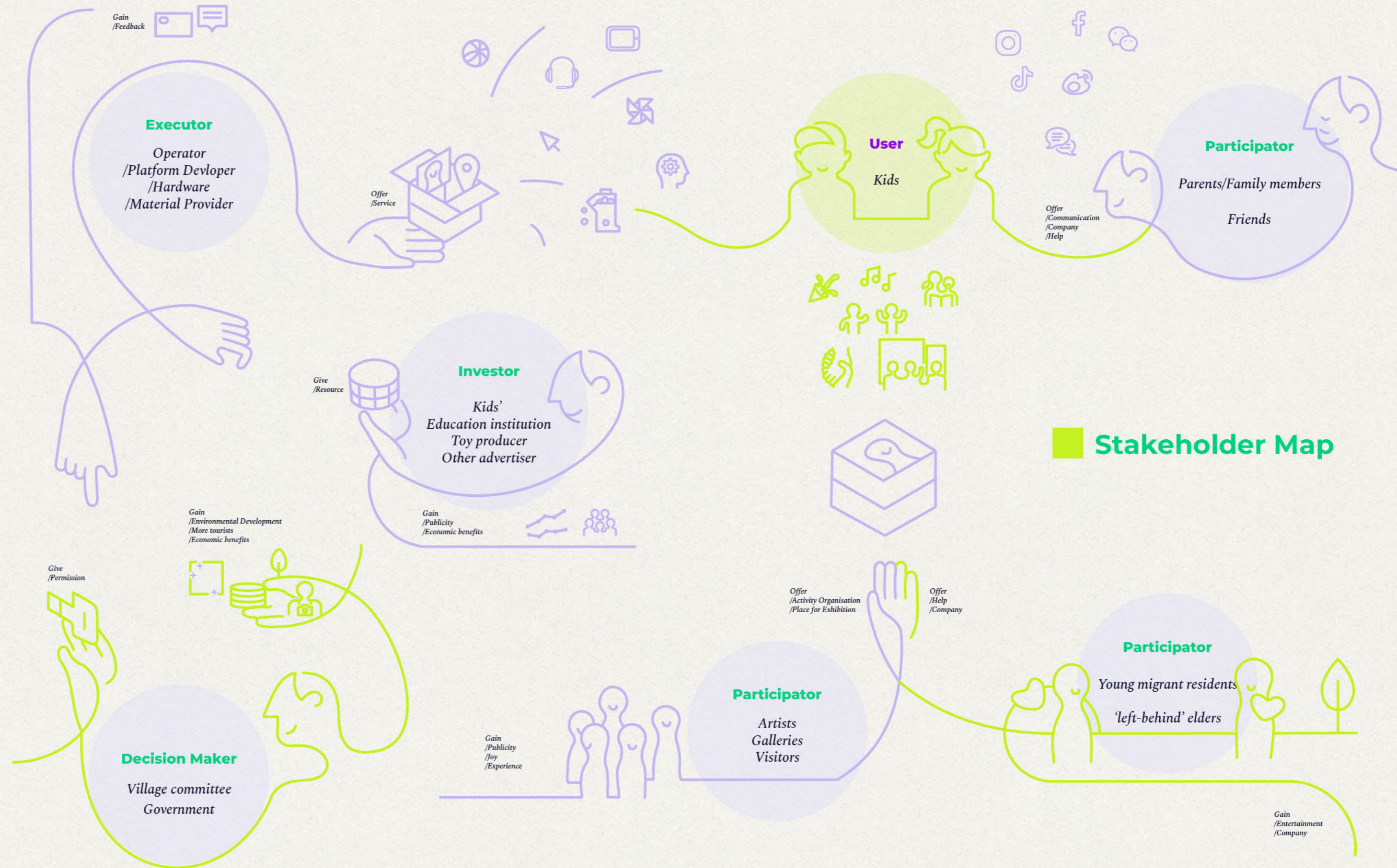
## Design Definition

Outdoor game installations

Make houseware or ornaments using awarded components.

Online tutorial for help.

Publish&Share





# Service Blueprint

## First Time

## Daily Activity

Physical  
vidence



QR code on the installations & Posters



APP on mobile devices



Interactive installation  
Mobile devices  
Aid

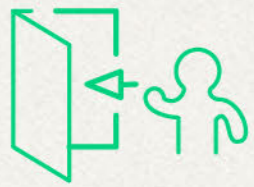


Components  
Tutorial on APP  
Aid



APP on mobile devices

Actions



Get access to the APP



Download APP  
Sign up



Give permission for data access



Get general info



Achieve outdoor activity tasks



Get reward components



Assembling & Installing



Join community  
Publishing & Sharing



Discussing & Exchanging



Help, Feedback & Report

Front Stage

Visual identity

User experience  
User interface

Machine design

UX/UI

Volunteer aid

Material provision

Machine design

Volunteer aid

Volunteer Aid

Tutorial Edition

User experience

User interface

Customer service

Back Stage

Research  
Publicity strategy

Platform development

Machine  
manufacturing  
& provision

Volunteer recruiting & coordinating

Design  
& Production  
& Provision  
& Development  
of reward components

Platform development

Platform & Equipment  
maintenance

Support  
Process

Database

Tracking

Data synchronization  
between devices

Database

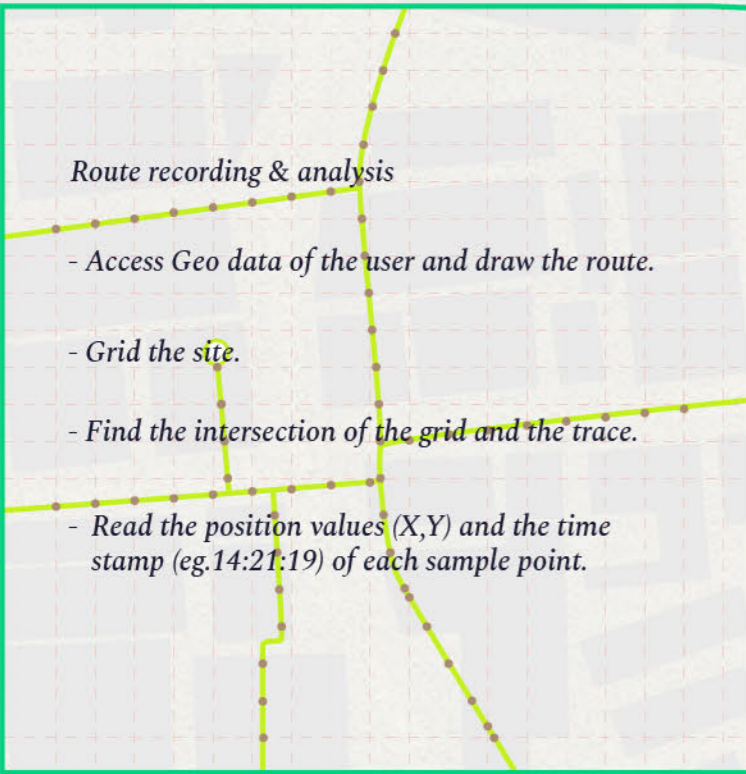
Data synchronization  
between devices

Connection with Social Networks



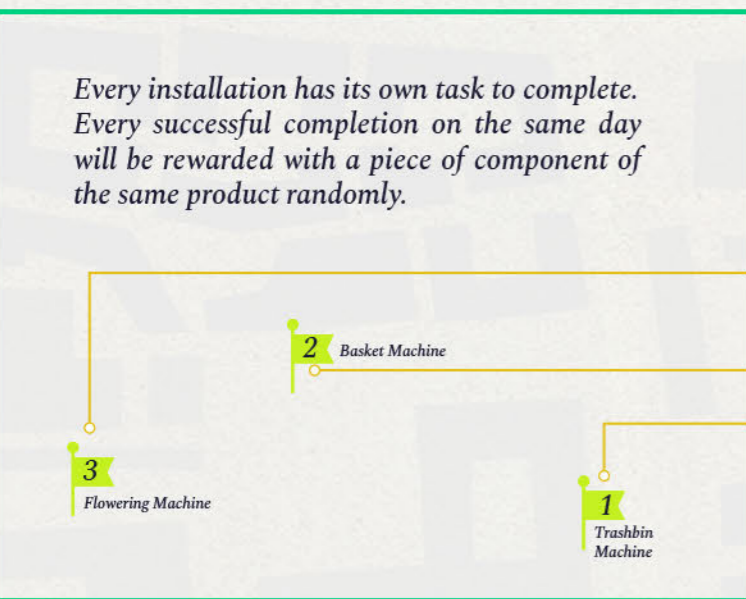
# Information Architecture

## Outdoor activity record



$X:2Y$   
 $X,Y$  eg:  $5 : (2*7.5) = 1/3$  → how many components to give  
 $t$  eg:  $142119 \% 8 = 7$  → which component to drop

## Game installation history



## Modular Components

1				2	
3				4	
5 Curtain			6 Wall		
7 x3 Chair			8 Cabinet		

## 'Furniture' assembled to improve living environment



Publishing Sharing



# Installation map



**Reward toothless**

- ⚙️ Reward retrieving machine
- 📍 Public park
- 👤 Many inhabitants killing time here
- ☆ Central installation located in the district hub, a spot for in-person communication and social activities



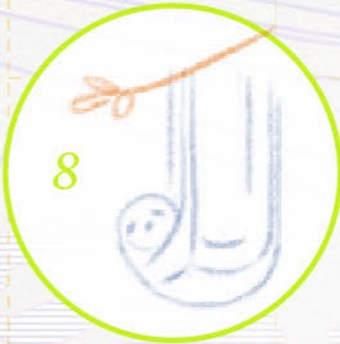
**Trash lizzy**

- ⚙️ Trash bin, weighing the rubbish people throw in to give reward
- 📍 On the main shopping street where the original trashbin is located
- ☆ Encourage kids to clean up the environment



**Squeaky rope**

- ⚙️ Skipping rope, rewarding by counting numbers
- 📍 In the open space facing the main street
- ☆ Persuade kids to do sports



**Slothing**

- ⚙️ Swing, reward for completing one session
- 📍 On the main shopping street where people pass by after shopping
- ☆ For kids to gather around, killing time and having fun



**Basket kitten**

- ⚙️ Hanging basketball basket, rewarding by calculating the target points
- 📍 Open space surrounded by apartments
- ☆ Impelling kids to play sports, defining a new mini basketball court



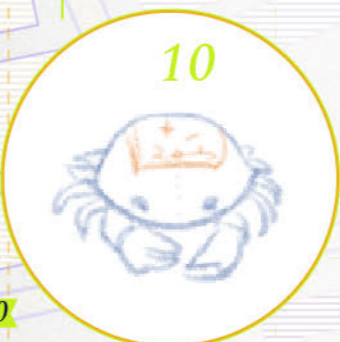
**Skye**

- ⚙️ Squash ball/racket, reward for completing one session
- 📍 Fixed in the triangle square, the district hub where people walk around, chatting, socializing quite often
- ☆ Persuade kids to do sports



**Quoity**

- ⚙️ Quoit, detect the rings landed on the peg, reward by counting the target points
- 📍 On a secondary street, near small restaurants
- ☆ A place for sitting around, killing time, entertainment for kids



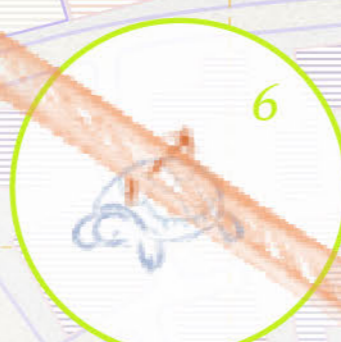
**Puzzle Quiz**

- ⚙️ Game machine, reward when quizzes are answered correctly
- 📍 In the 'community room' yard



**Flowering snakespeare**

- ⚙️ Flower watering hose+ spray gun. One flower-watering task per day, reward when one task is completed
- 📍 Located at the gate of an apartment facing the main street
- 👤 Lots of plants living here
- ☆ Encourage children to cultivate the green



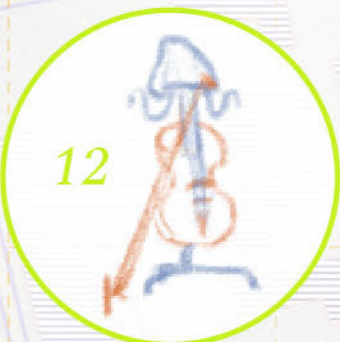
**Shelly seesaw**

- ⚙️ Seesaw, reward for completing one session
- 📍 In the open space facing the main street
- ☆ For kids to gather around, killing time and having fun



**Vacuum cleaner**

- ⚙️ Hand-held vacuum cleaner, reward for one task completed
- 📍 Located in the 'community room' yard
- ☆ Persuade kids to clean up their own space



**Viola**

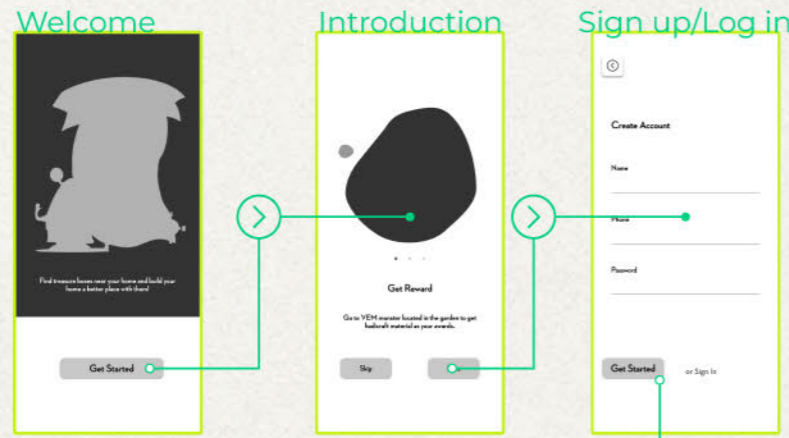
- ⚙️ Instrument, rewarding for completing one session
- 📍 In the art district
- ☆ For art&music educational purposes, encourage kids to visit nearby galleries



# APP

Wireframe and Flow

Join & Get started



Get the general introduction and sign up the platform.

Direct page



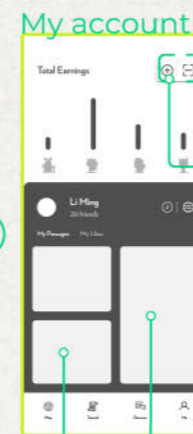
You can check the route and the interactive machine record on the map page.



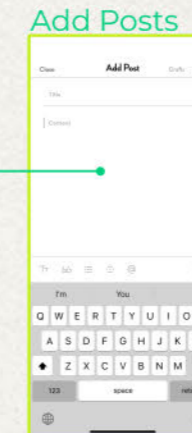
View tutorials by categories.



You can ask for help, help others, ask for exchanges, post your products and share experiences on the discovery page.



Check personal assets and posts here.



Secondary page



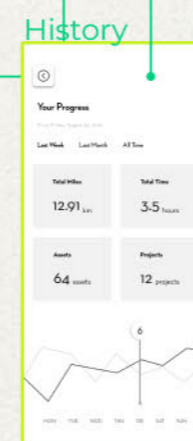
Get details of your route or an installation by clicking on the route mark on the map page.



Follow the tutorial to make products. Join the communication by leaving comments.



Blog detail page.



# Installation interface

Scan QR code to activate the machine

First time

Daily

Downloading the APP

Select the components that you wish to have

Confirm

Take away the components



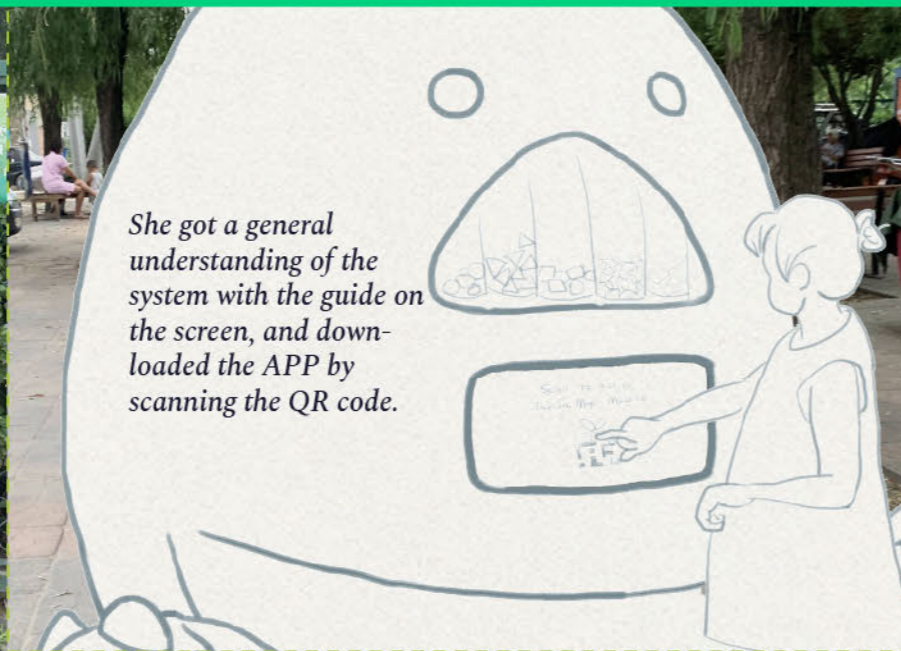




User journey

# Storyboard

Jenjo went to the garden near her house as usual, noticing the reward machine for the first time.



She got a general understanding of the system with the guide on the screen, and downloaded the APP by scanning the QR code.



Jenjo registered, then started the journey with the APP - 'Caochangdi Treasure Map'.



Following the map, Jenjo went to other interactive installations, finished the missions and got rewards.



She was awarded with components that can be assembled into furniture and housewares.



After a week, Jenjo got enough components and made some lamps with her friend.



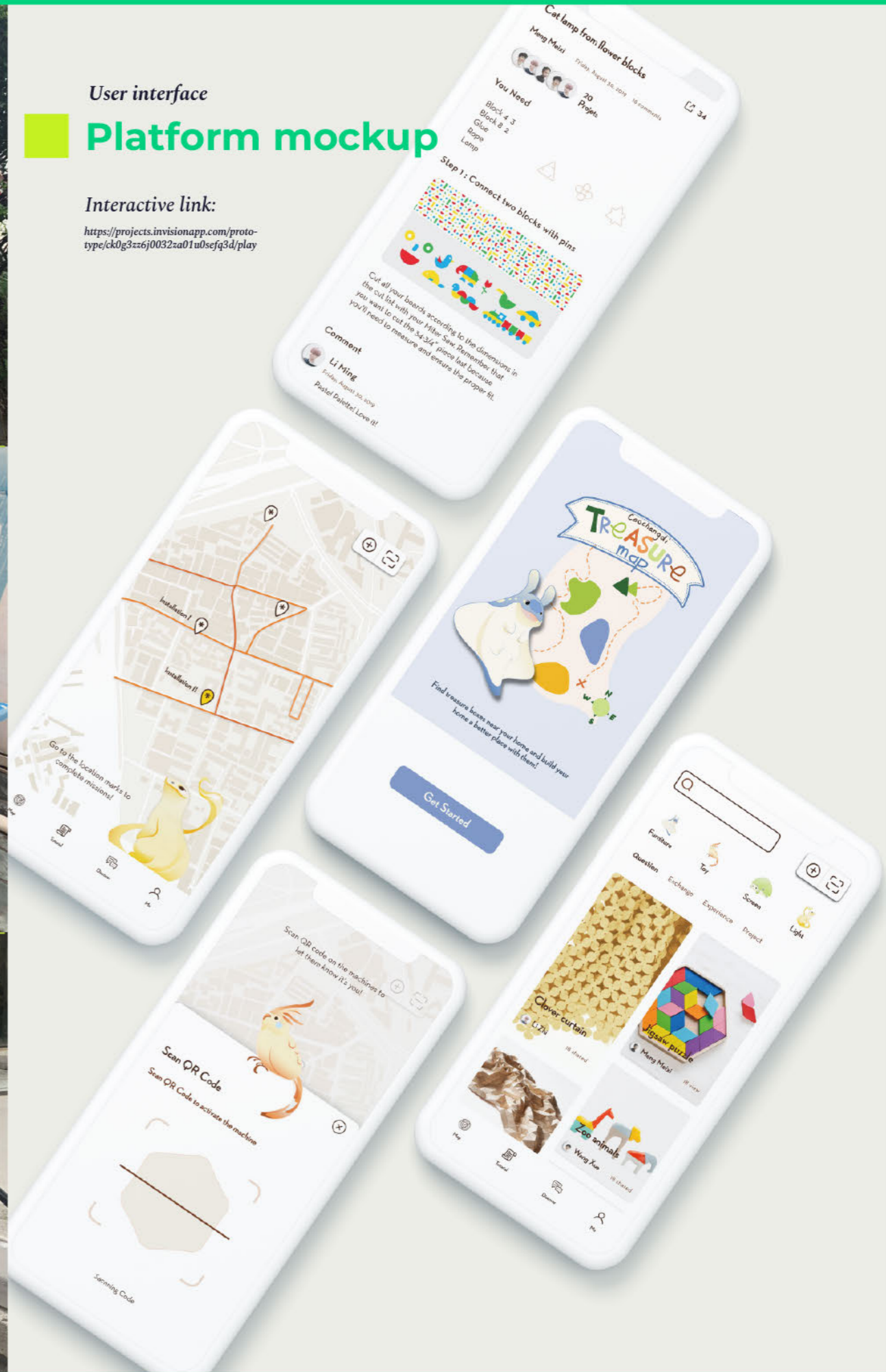
She installed the screen and lamp at her own door facing the main street, creating a place she can comfortably stay in and have fun



Her parents helped her a lot. They had a lot of fun together after the parents come back from work.



She also made friends with other kids, exchanging components and sharing experience with each other.



User interface

# Platform mockup

Interactive link:

<https://projects.invisionapp.com/prototype/ck0g3z6j0032a01u5efq3d/play>



# BEHAVIOURSCAPE

为开放办公环境设计的、区域响应式的室内区隔系统

## 作为交互界面的

## 室内环境

NOVEL INTERFACE  
Interactive/interior design

### SKILLS

Research  
Physical computing  
prototype  
User interaction  
System architecture

空间是把我们与他人隔开又联系起来起来的场所。我们在建筑空间中与人交流、建立联系，也在其中确立不被打扰的个人空间。基于人对空间私密-开放程度变动的需求，我设计了一个用户响应式的，围合程度可变动的室内空间化的交互系统。

通过建立人与建筑之间的对话，我们将自我对外部环境的需求外化为了建筑的形态，而建筑形态也成为了具象化的反映着居住者行为的雕塑。



SOLO  
PROJECT

OCTOBER  
2018  
4 WEEKS



## Background

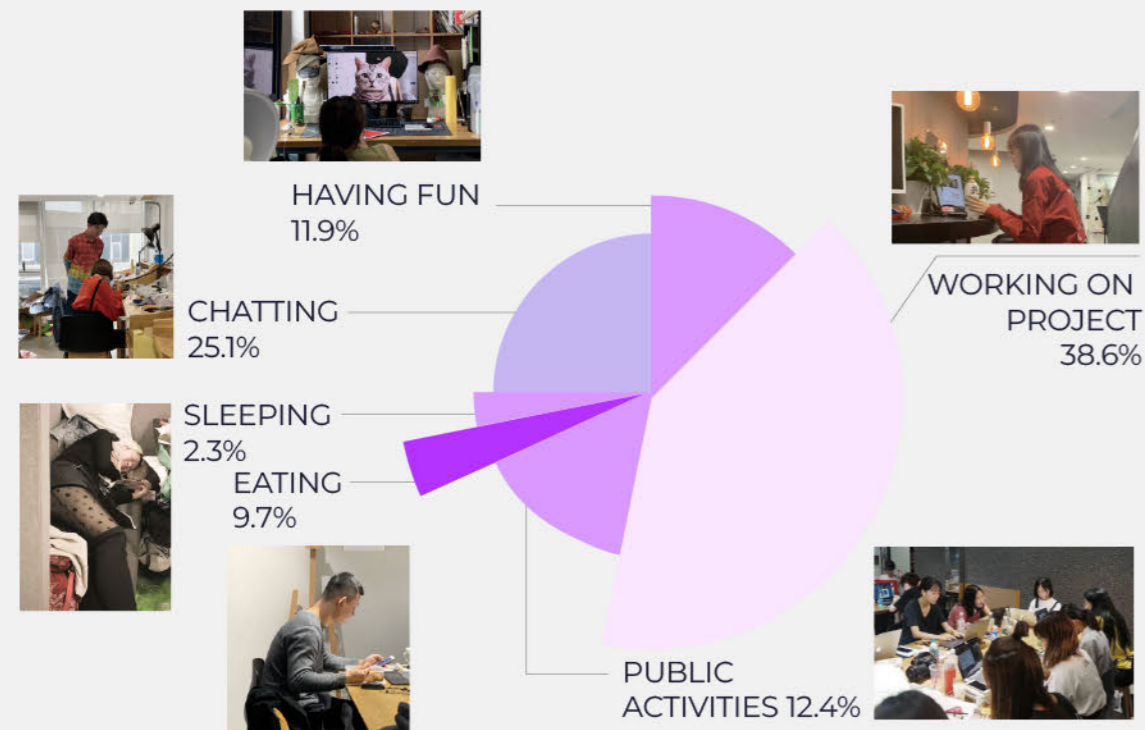
# Life in an open studio/office

We art/design students spend our everyday life in the studio, where we study and live together, bothered and bothering at the same time.

We need to be on our own to focus, to be productive and reflective, or simply to hide away from a social situation that causes anxiety. But not being in the public common space brings a sense of detachment from the crowd. We want to be seen, to keep in physical touch with our friends and a community.

All places like libraries, studios, open offices, are places where we are collectively alone.

## What do students do in their studio?



## Studio environment



## Problem discovery

# User research

of art/design students who are frequent studio visitors with intense schedules and irregular life routine

“ I would rather my friends not disturbing me when I am working on things that I do not know how to do. I also hope they would not ask me for help one after another when I am freakingly busy dealing with my deadline. ”

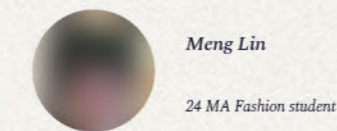


Ye Fan  
22 Architecture student



**Ideal studio:**  
I can see others, but they can not see me.

“ I am talkative. My friends and boyfriend come to my seat quite often. Last time when we held a New Year's party, Lu left the room with a bang on the door because she was upset by the noise I made. I do not mean to be disrupting... ”



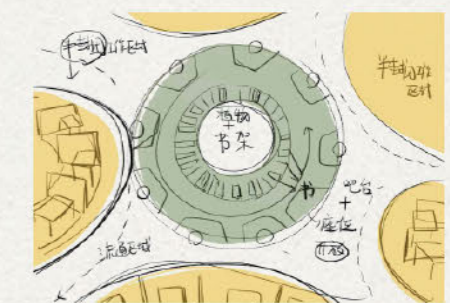
Meng Lin  
24 MA Fashion student



“ I am comfortable staying in an open space without a partition most of the time. We tend to finish our work right before the due. Having no time to go back to the dormitory, I take naps in the studio. I guess no one wants to see me that way, I do not feel safe having no enclosure protecting me as well. ”



Zheng Min  
20 BA Graphic student



## Concept

- People sometimes want to see and communicate with each other, sometimes want to be separated from them.
- People need enclosures of different density at different time.

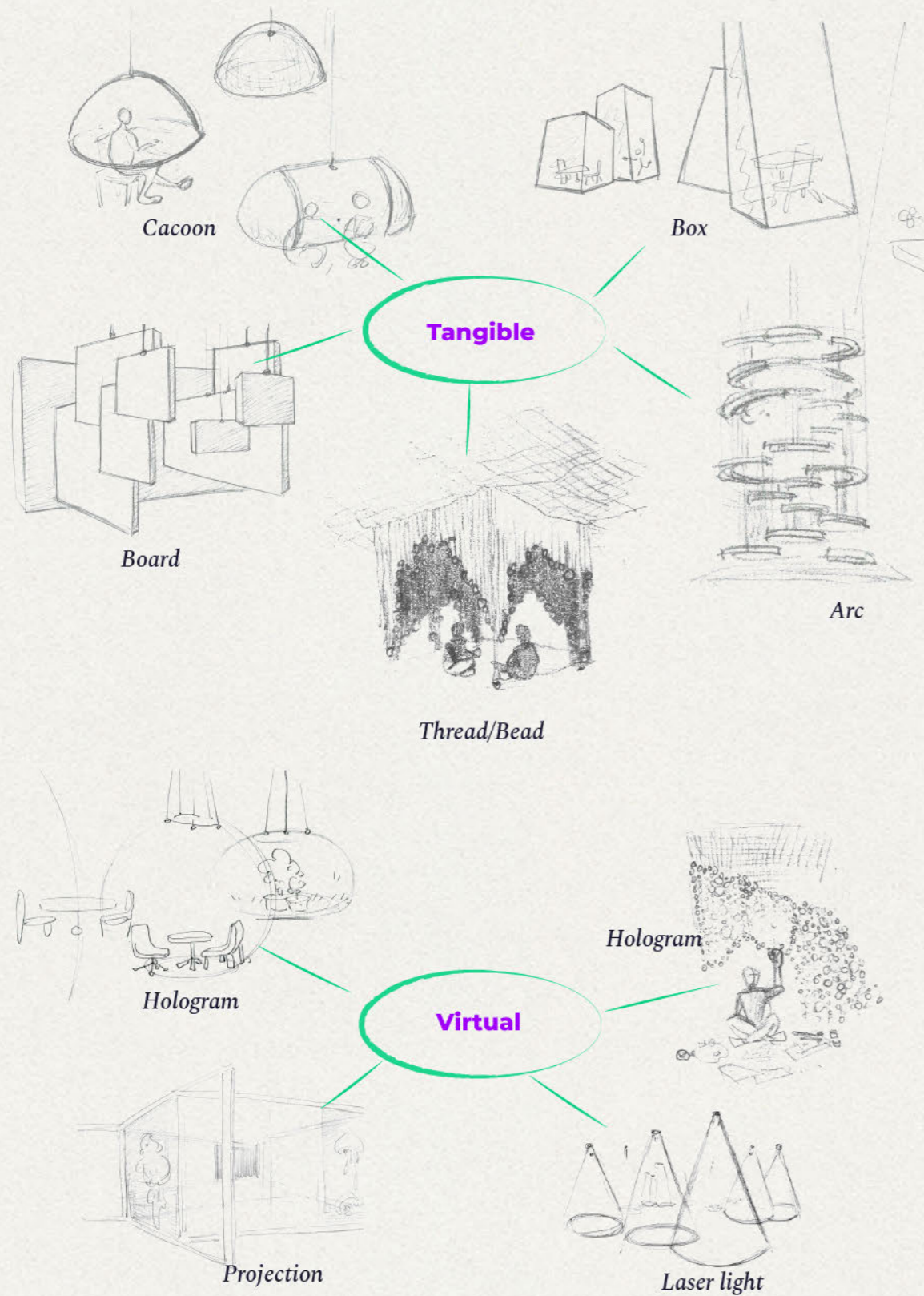


What if we can have an adaptive partition responsive to people's ever changing need for their studio environment?



## Ideation sketch

Forms to divide a space and separate people



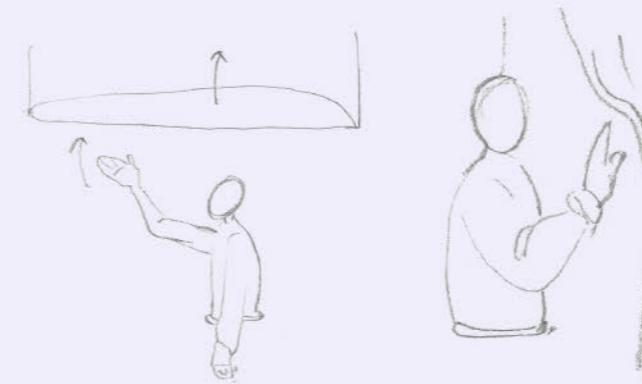
## Concept framework

To develop an interior localised-responsive enclosure system in open studios that could help people build their own space. It can:

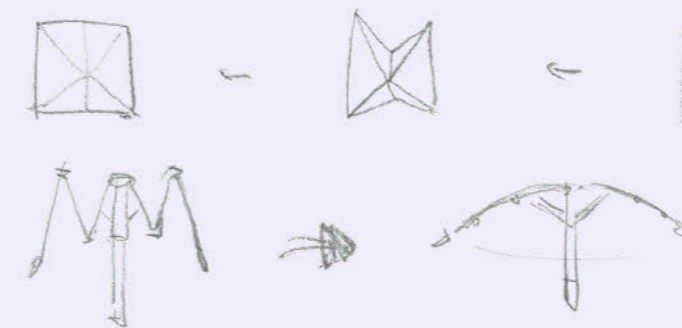
- Understand human instruction
- Change size and density accordingly.

### Interaction

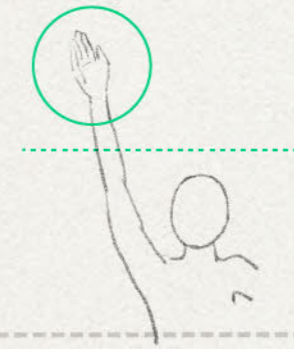
Basic gesture to raise the 'curtain' up at a certain height



### Mechanism structure



Raise hand



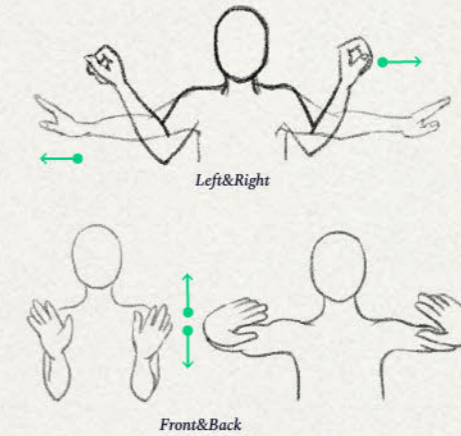
Raise one hand over your head for 4 seconds to activate the system.

Pull down



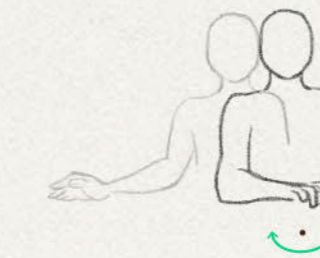
Pull down a partition with a size adjusted to the dimension of the user/users.

Push



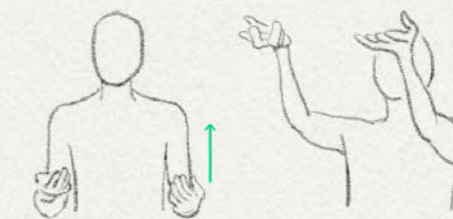
Push or pull the partition for it to be enlarged/narrowed.

Rotate



Rotate the forearm around the elbow to open or close the 'curtain'.

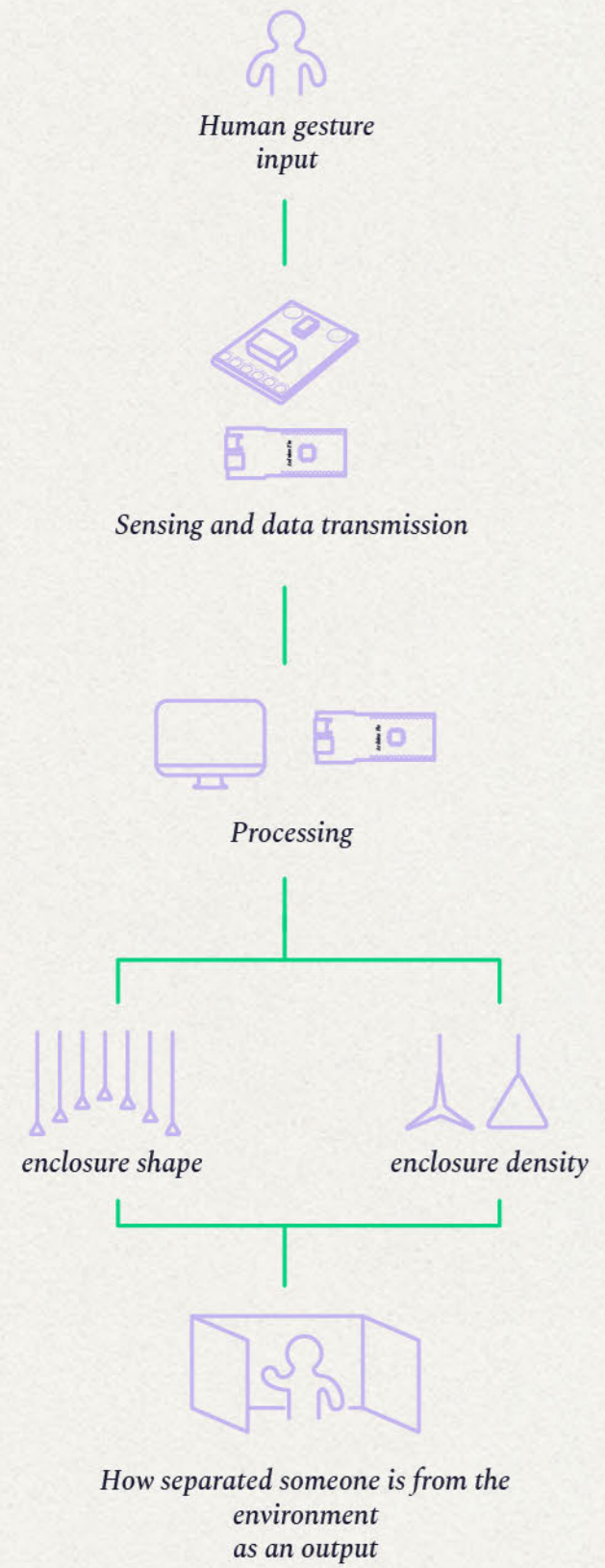
Pull up



Lift up two hands from the chest to above head.



# System architecture

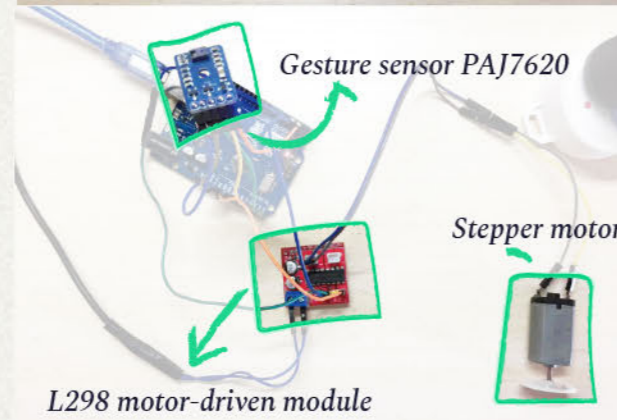
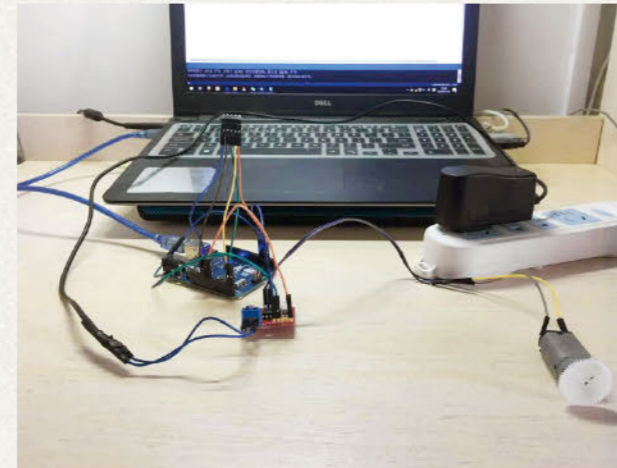


# Experiment

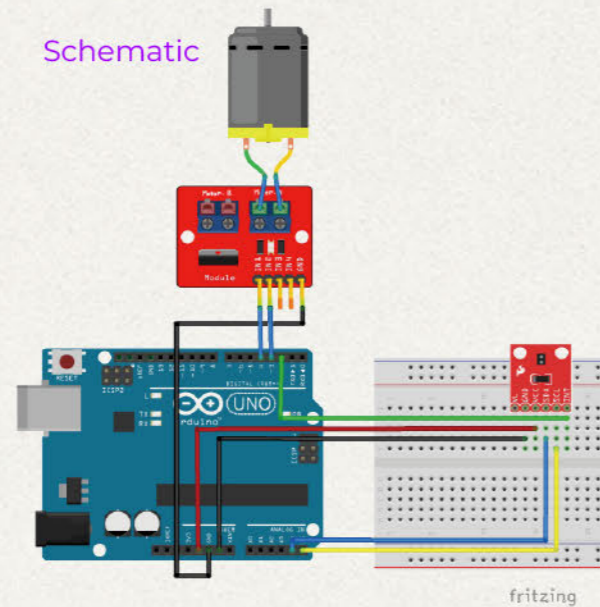
## Experiment I

Motor rotating according to human gesture

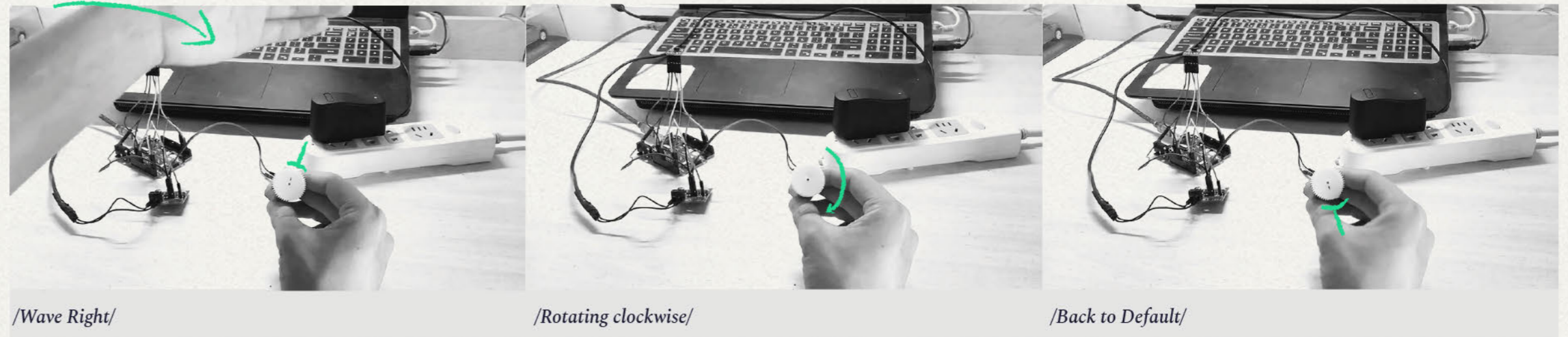
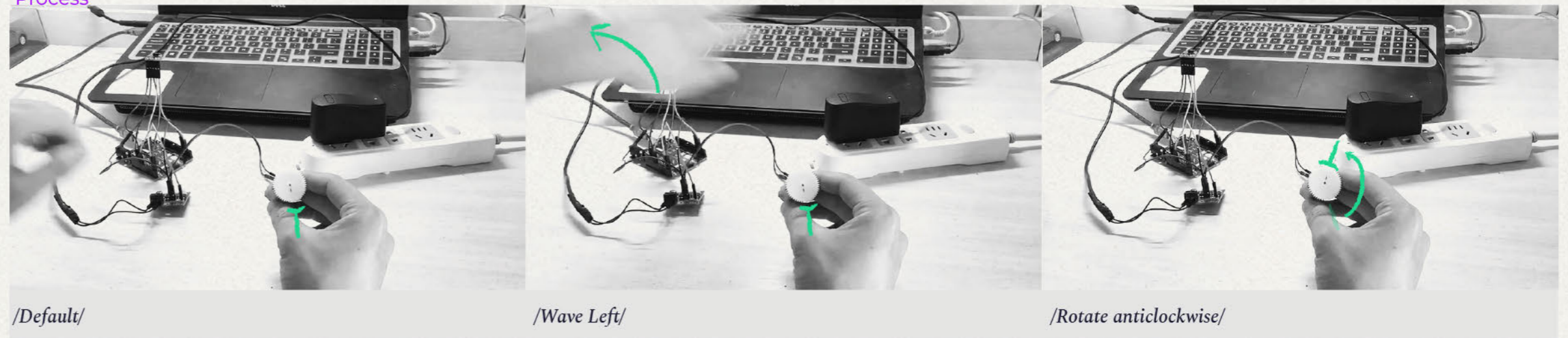
### Hardware



### Schematic



### Process



### Coding

```

    // If a left gesture is sensed, ask the motor to pivot anticlockwise for 5ms.
    if (gesture == 'Left') {
      digitalWrite(DIR_PIN, LOW);
      digitalWrite(STP_PIN, HIGH);
      delay(5000);
    }

    // If a right gesture is sensed, ask the motor to pivot clockwise for 5ms.
    if (gesture == 'Right') {
      digitalWrite(DIR_PIN, HIGH);
      digitalWrite(STP_PIN, HIGH);
      delay(5000);
    }
  
```

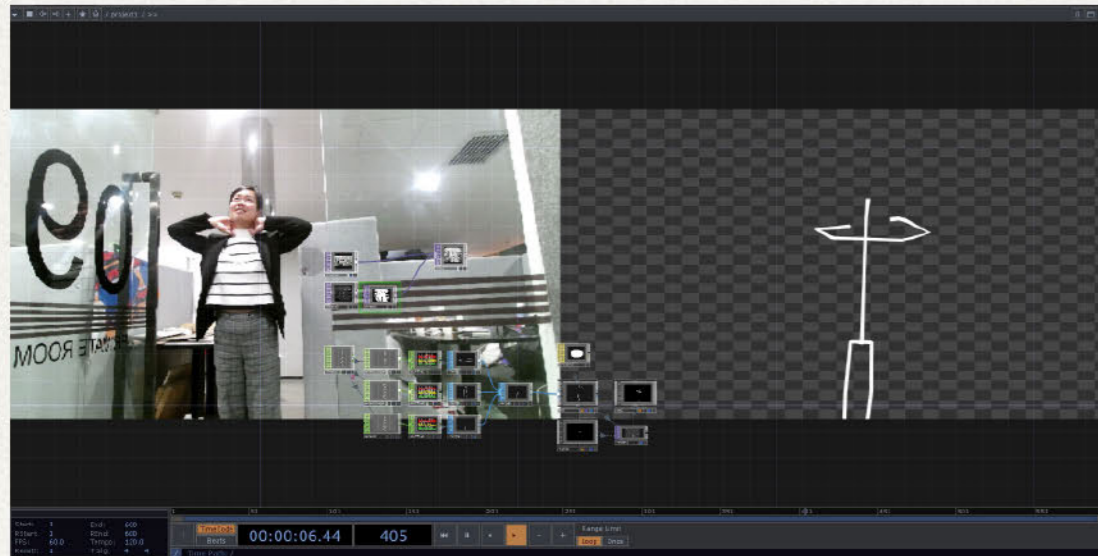
## Result

I experimented the basic mechanism of the system, which are:  
 1) recognising human gesture;  
 2) control the rotation of the motor, further to control the movement of the mechanism.



**Experiment II**  
Pose recognition and dimension measuring

Step 1 Skeleton extraction



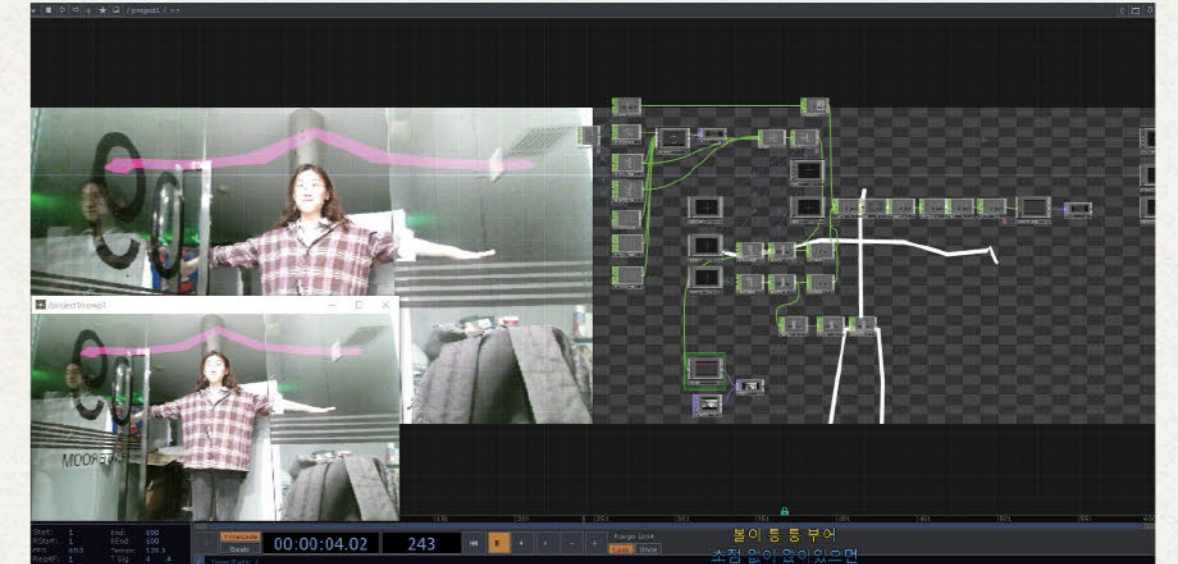
I went further to explore more complex gesture detection with Kinect and Touchdesigner. The first step is accessing joint location data and drawing a skeleton.

Step 2 Pose recognition



Recognise the pose that activates the system, which is raising one hand (left hand for this case) over one's head for 4 seconds. A red sign is shown when the pose is detected.

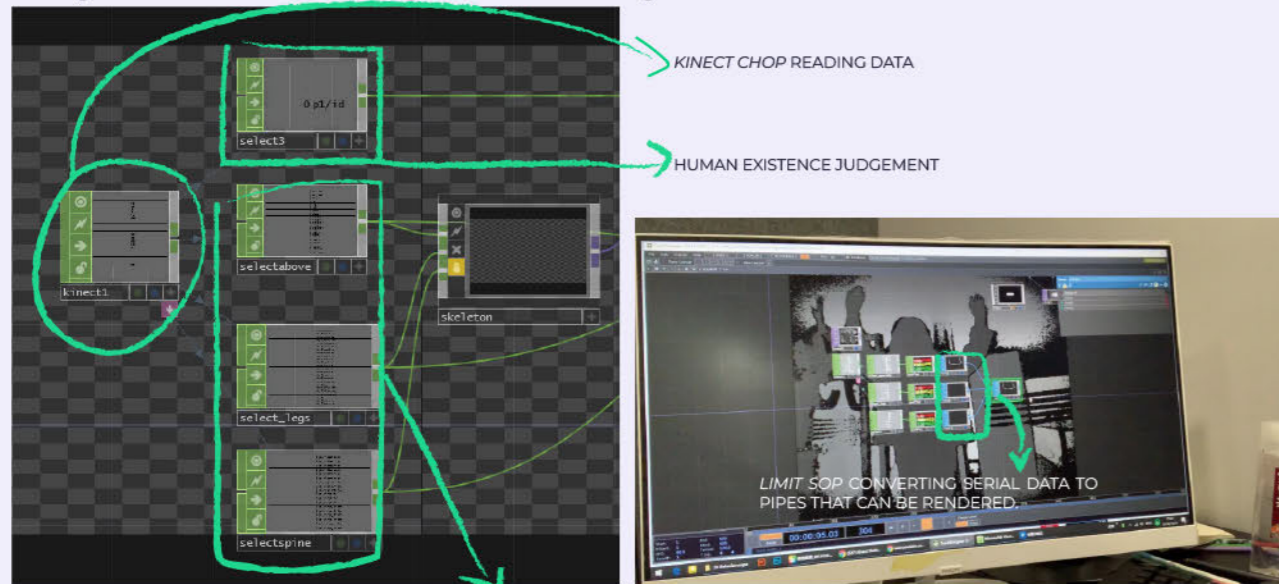
STEP 03 Dimension measurement



Draw a bounding box of one or several people as the input for calculating the dimension of the partition. The partition consists of a grid of particles, the spatial coordinate(z axis) of each particle would inform how many turns each stepper motor rotates.

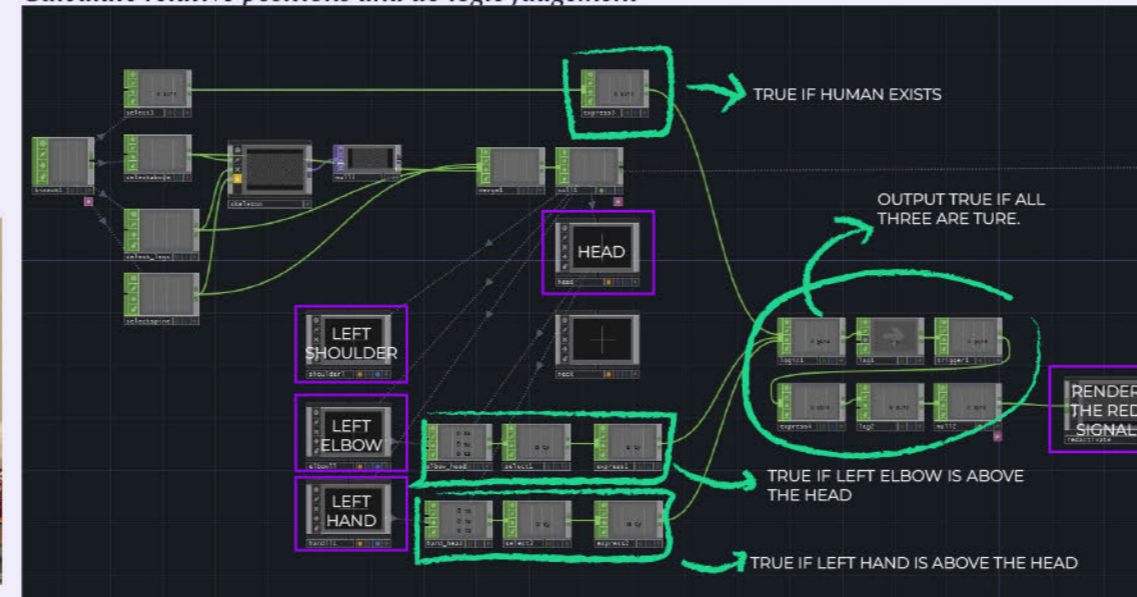
Programming

Read positional & skeletal tracking data in Touchdesigner



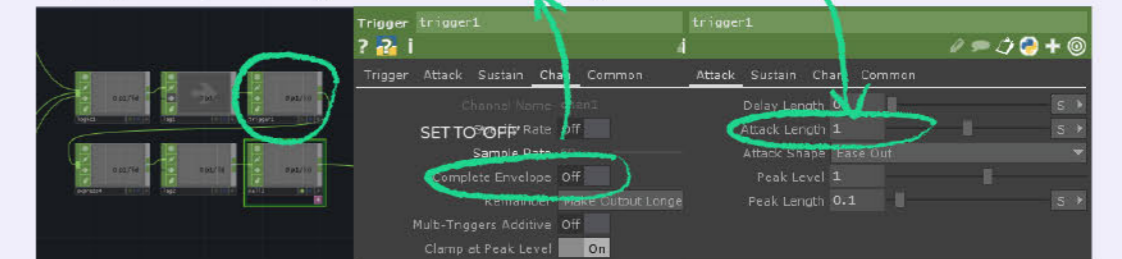
SELECT 3D POSITIONAL DATA OF THE JOINTS IN ORDER Draw skeleton pipe accordingly

Calculate relative positions and do logic judgement



Make sure it is a four-second-long gesture

Trigger chop will only finish climbing up the ramp to output a final true if the input(posture) lasts longer than the 'attack length'.



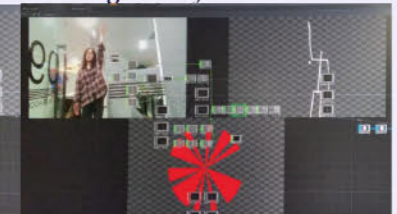
Wave for a second



Start to hold up hand



Holding hand for 4 seconds





## Flowchart

Input/Trigger feeds  
**Gesture sensors**

Collect depth&skeleton  
information

Processing  
**Computer**

Recognise the pose

If the hand is above the  
head for 4 seconds

Determine what kind  
of gesture that is

Collect dimension  
information

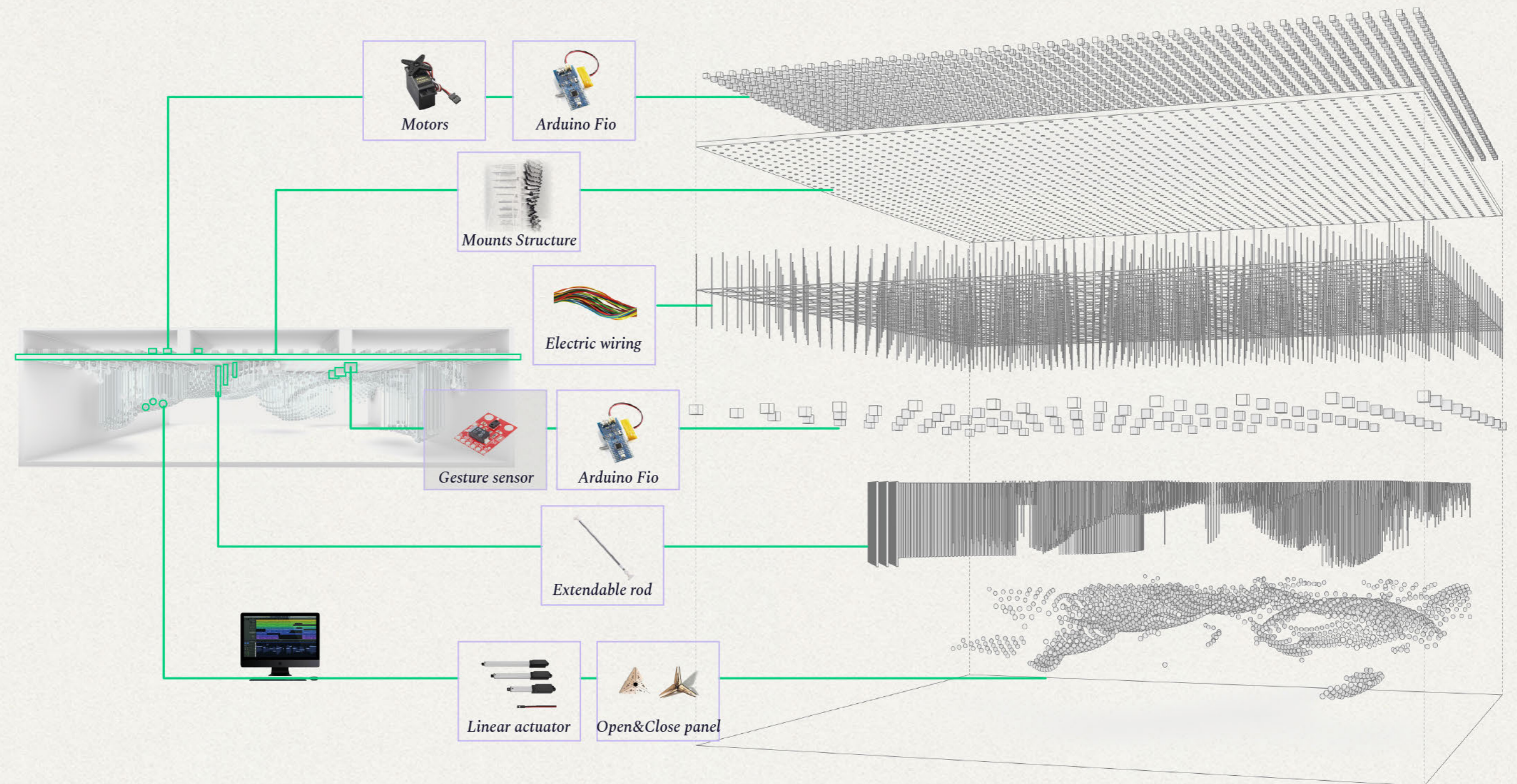
Output  
**Motors&Mechanism**

An array of motors rotate  
at a certain angle

Reshape the enclosure  
&Change the density

## 3d prototyping

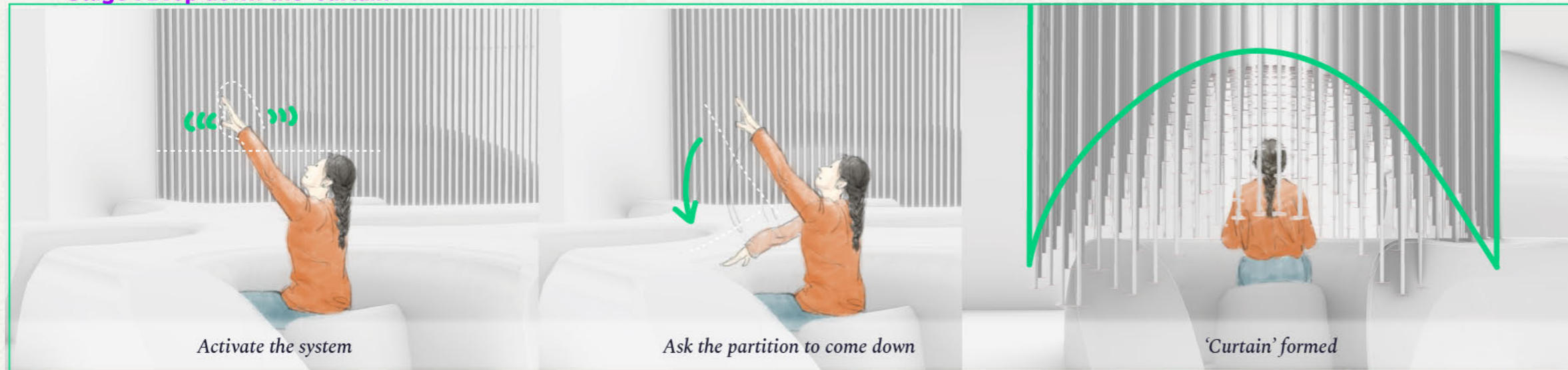
The explosive axonometric drawing showing the structures and components



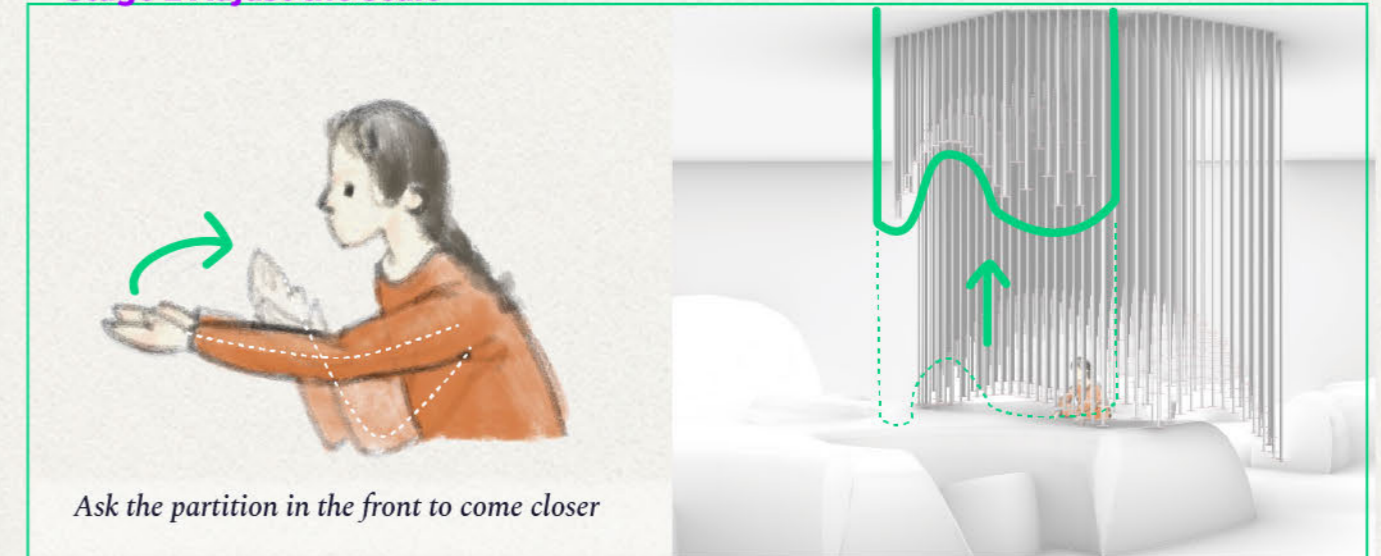


# Storyboard

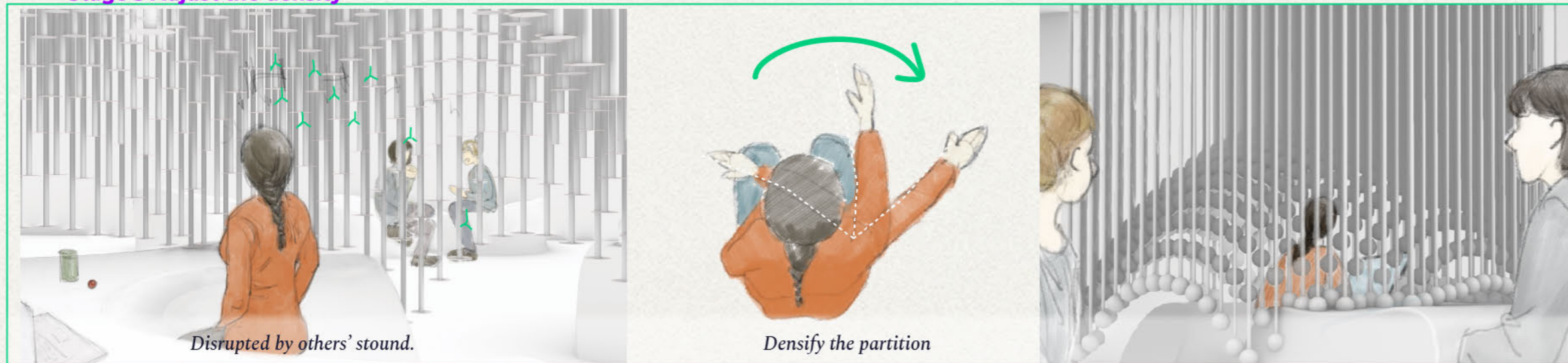
## Stage 1 Drop down the 'curtain'



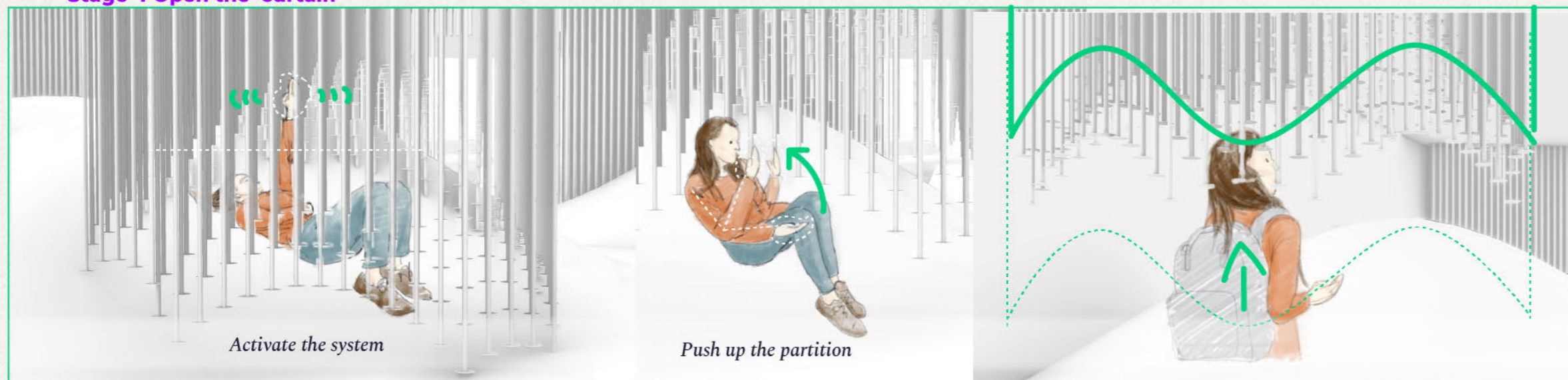
## Stage 2 Adjust the scale



## Stage 3 Adjust the density



## Stage 4 Open the 'curtain'



## Discussion

I named the project 'behaviourscape' as occupants can exteriorize their inner voice as the form of the partition with this system. By having dialogs with the environment, we are sculpturing our interior environment in harmony with our activities and willingness to socialise. This constant information exchange between people and the space shaped the interior into a landscape signifying human behaviour.

The response of the system is localised. It takes into consideration mostly the visual aspect of an architecture.

Beyond this, how might we create a distributed system controlling the acoustics, odour, temperature, air quality that also influence a spatial experience? Can we divide a space by creating an "acoustic wall" that we can see through?



## Other projects

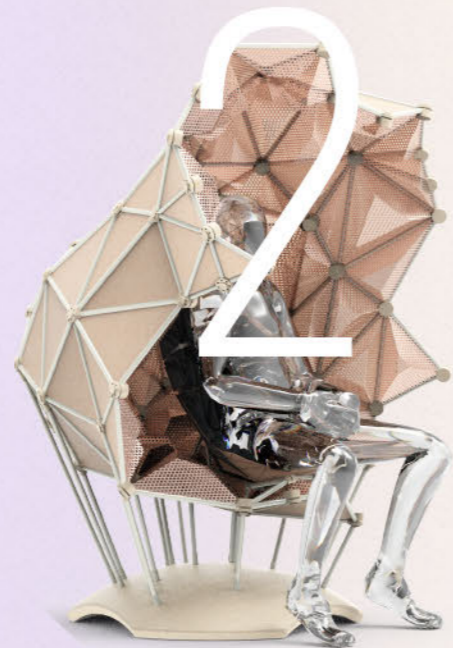


INFORMATION EXPERIENCE |  
USER INTERACTION

### Secret coding

“藏着”心事的首饰

“Secret Coding”是一个可以将用户输入的文字“翻译”为相应的首饰的平台。用户可以借助平台倾诉自己的故事，生成可以作为礼物和回忆载体的物品，并以物品的形式存储、保管自己的回忆。项目构建了一套描述物品外观（形态、颜色等）的文法体系，也搭建了一套完整的用户体验流程及平台界面。



INTERACTIVE ARCHITECTURE

### Acousticform

探索通过座椅创建声音微环境的可能性

物体的形状和材料会决定物品的物理属性及其功能。项目希望探讨通过椅子的围合，在大环境中创建一个适合远程会议的微型声音环境的可能性。项目使用程序化建模工具搭建了一个框架，批量生成了参数不同的围合形态；并使用声模拟软件测试了不同形态对其内部声音状态的影响；经过反复迭代、测试，找到了最满足需求的椅子形态；并探讨了数字化自动化建造的可能性。



INTERACTIVE ARCHITECTURE

### Colour factory

“大地的调色盘”

我们能用光在大地上作画吗？建筑能保管我们有关一片场地的色彩记忆吗？探索交互式建筑作为人与自然间的创作媒介的可能性。



PHYSICAL COMPUTING |  
PRODUCT DESIGN

### Snailing

以幸福回忆为食的  
储藏罐精灵

作为机械电子原理的课程作业，“Snailing”是一个可交互生物，它可以保管、记数放进存储罐里的“开心回忆”，并督促使用者建立定期记录开心回忆的习惯。项目内容涉及交互流程设计，外形设计，3D打印外壳与机械结构，及arduino原型开发与测试。



PRODUCT DESIGN | NOVEL INTERFACE

### BioMe

智能“绿色”人居环境：  
探索植物作为传感器  
和执行机构的可能性

植物可以作为“绿色”元件被嵌入IoT系统。植物体内的电脉冲变化可以反映其所在的环境的变化，作为感应/输入元件被使用。外界的信号也可以刺激植物的反应机构，使其产生微“运动”，作为输出/执行机构被使用。

作为与Logitech的合作项目，项目内容包括底层技术调研，“GloT”系统设计，用户体验及交互界面设计，智能设备产品设计及视频呈现。

