

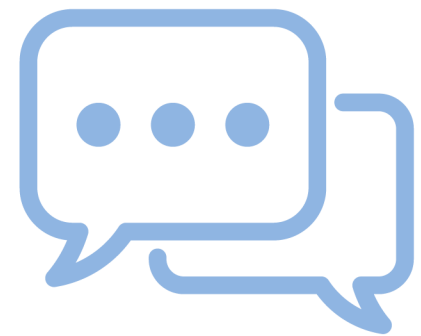
# Adaptive Co-Housing: A Sustainable Framework for Student Residences in Delft's Campus Context





# This presentation

## Introduction



## Research



## Design





An aerial, black and white photograph of a densely packed residential neighborhood. The houses are mostly two or three stories high, with visible roofs, chimneys, and windows. The houses are arranged in a somewhat regular grid-like pattern, with narrow streets and alleys between them. The overall tone is somber due to the monochrome palette.

# Housing Crisis

1 million new homes before 2030





# Student Housing Scarcity

Year	Student houses	Shortage
2021	16 500	1500
2028	22 830	3600

Van der Veld, M. (2021, 12 oktober) Tekort van 1500 studentenkamers in Delft, *TU Delta*



# Loneliness

**51%** of students have psychological complaints

**80%** experience loneliness

*(Dopmeijer et al., 2022)*





# Focus on building Studio Apartments

Students more frequently experience feelings of loneliness in **studio apartments** compared to **shared housing**

*(Scholts et al., 2020)*





# Problem Statement

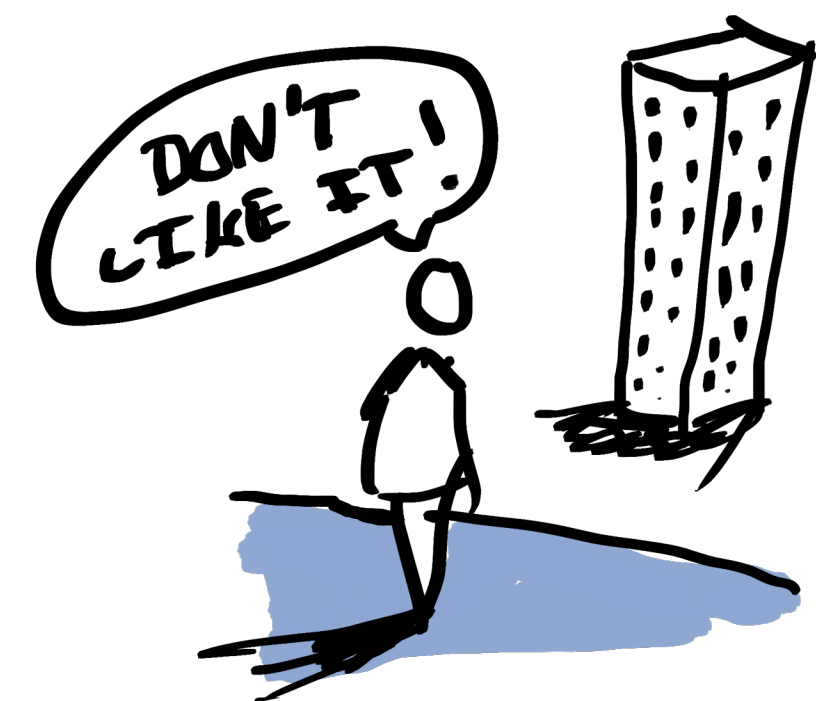
Housing scarcity



Loneliness



Focus on studio apartments

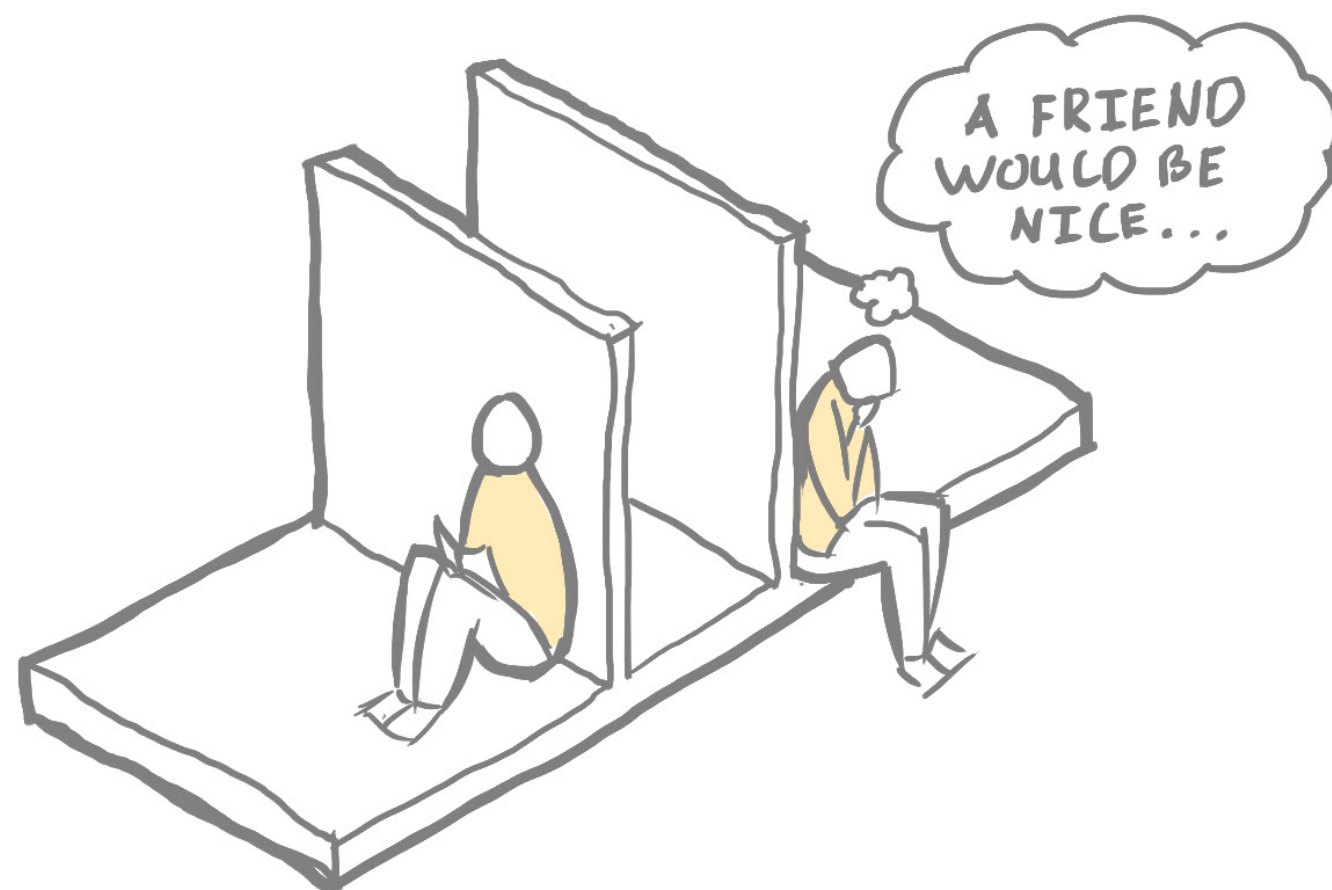




# From **Studio Appartements**

Higher chance of **loneliness** in studio appartaments (Scholts et al., 2020)

Lack of **sharing** resources

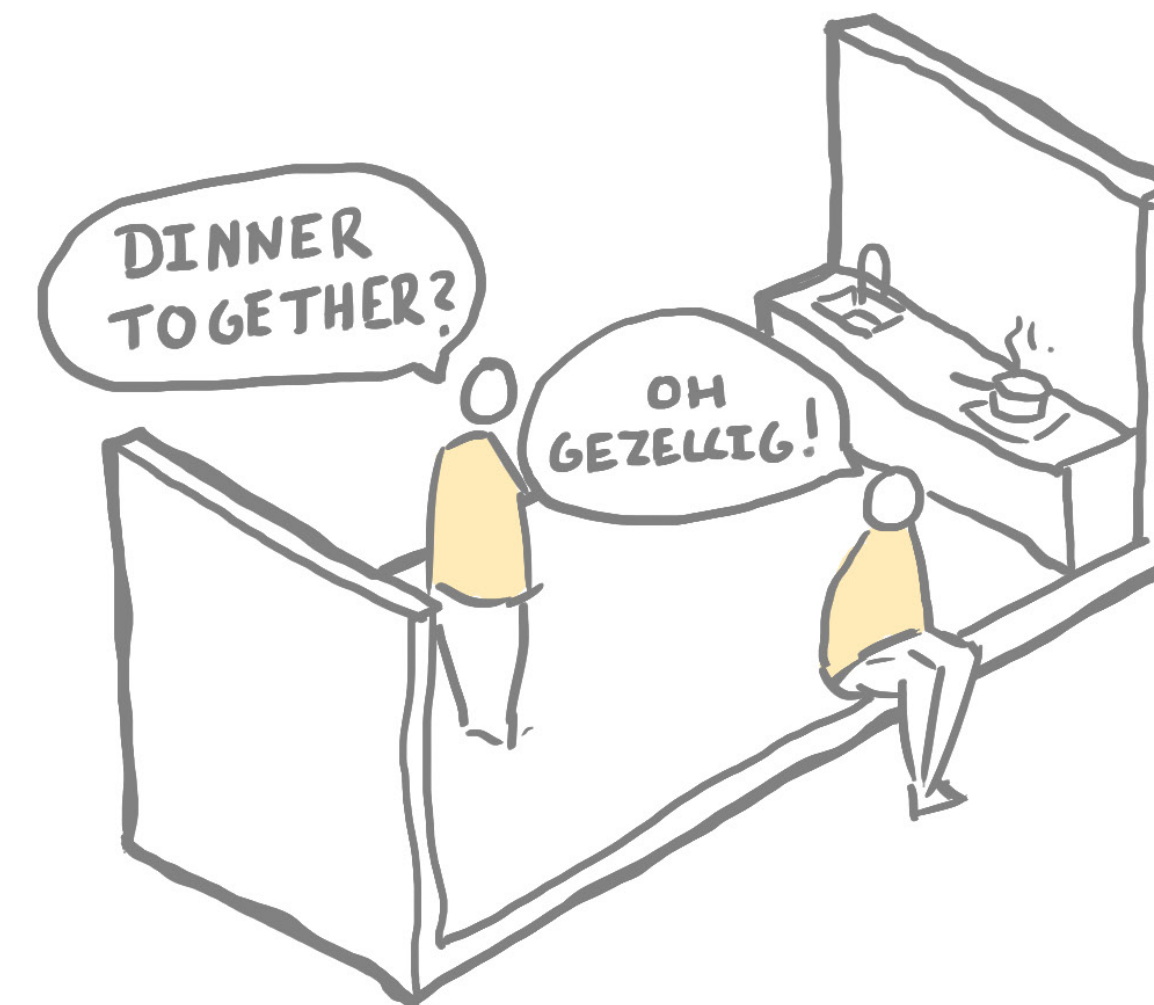


To

# Another direction **Co-housing**

Assumption that the social way of living could reduce **loneliness**

**Sharing** resources as a way to intensify the use of space





# Limitations

Radical sharing could intensify the use of space and therefore would increase the amount of people that could live in the same space.

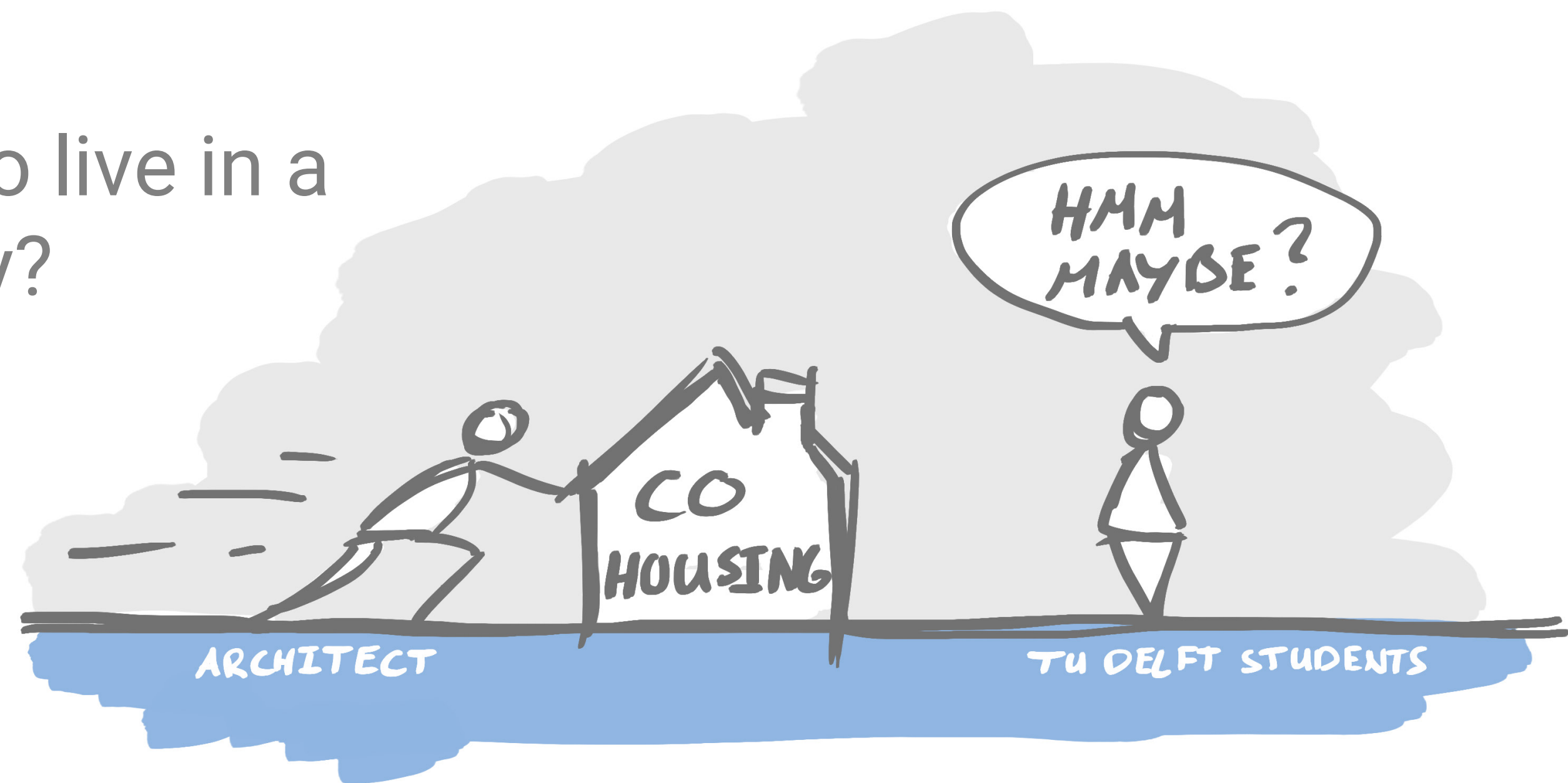


But where is the limit?



# Willingness

Would students be willing to live in a co-housing typology?

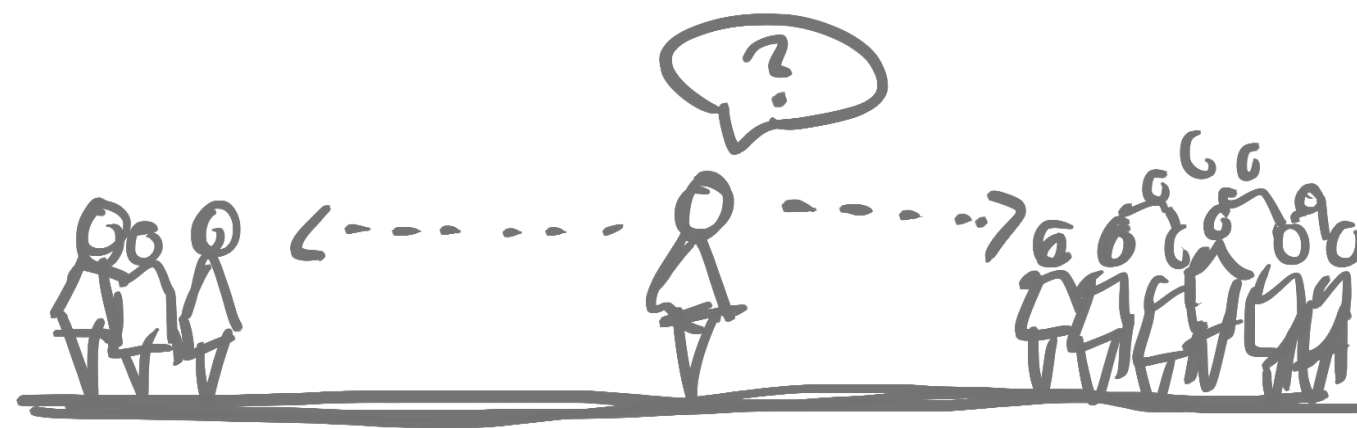




# Willingness

To which extent would TU Delft students be willing to share?

Social boundaries



Spatial boundaries



Nudging towards co-housing



# Research

How can the spatial, social, and emotional preferences of TU Delft students be systematically mapped to inform design decisions related to their loggings?



# Methodology

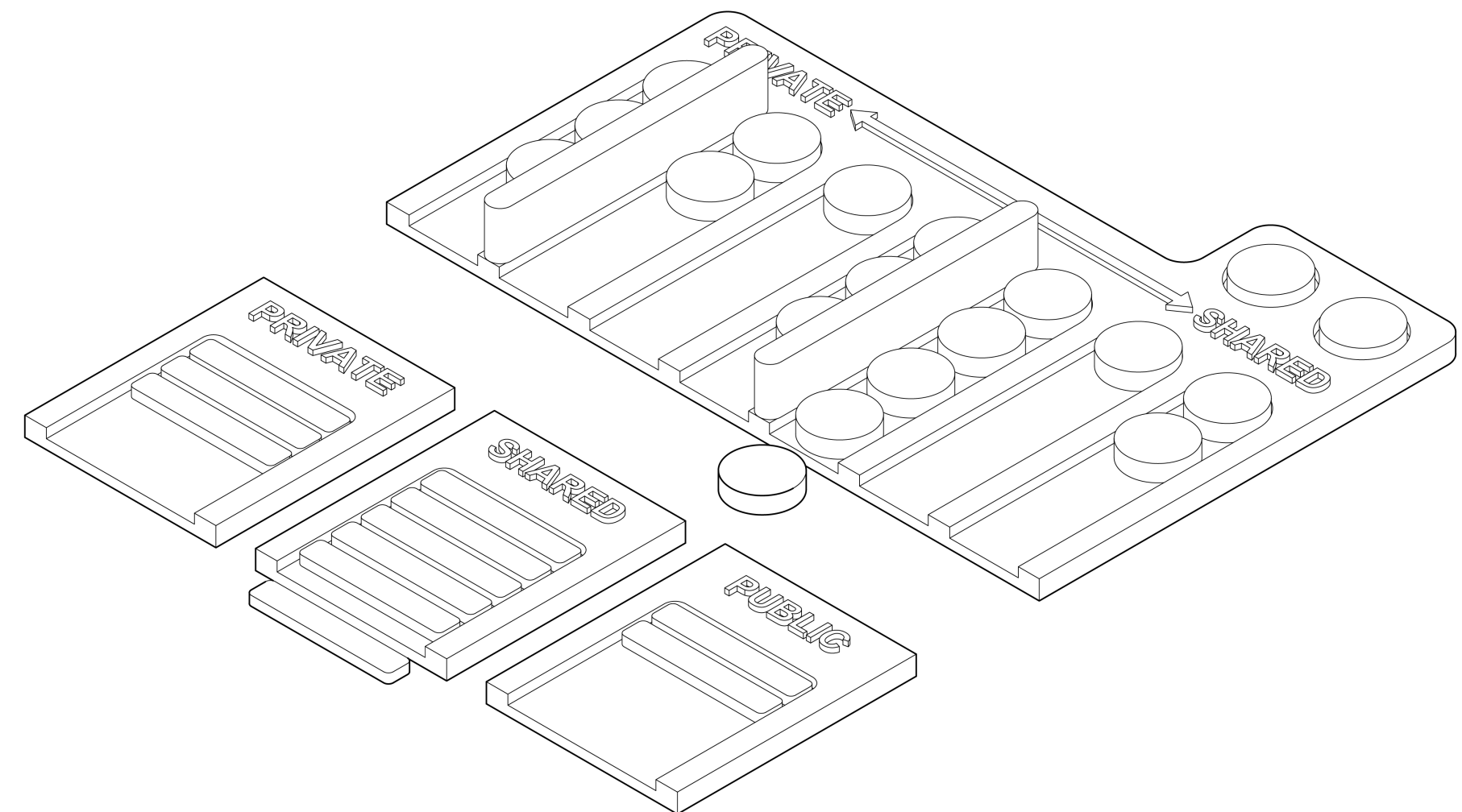
## Research Question

How can the spatial, social, and emotional preferences of TU Delft students be systematically mapped to inform design decisions related to their loggings?

### Co-housing Literature review



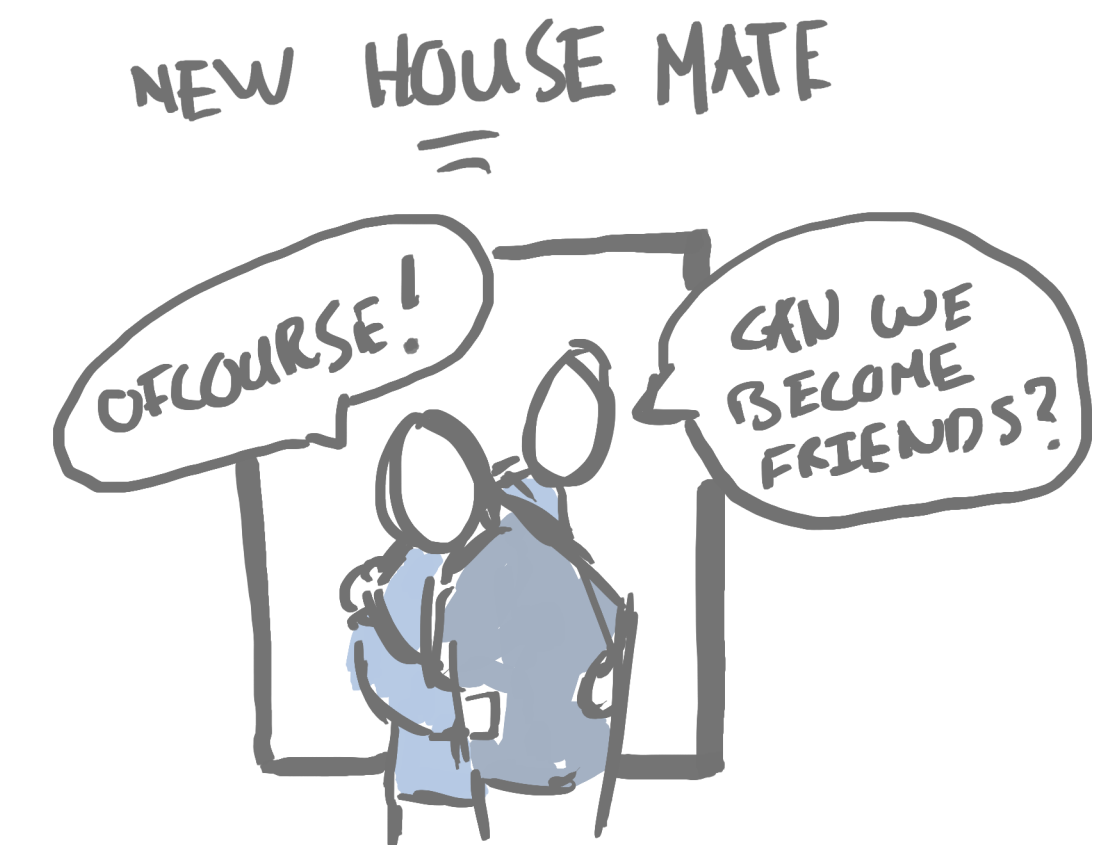
### The Boardgame Interviews



# Co-housing

## Loneliness

Co-housing provides strong **possibilities** to reduce loneliness by fulfilling the social and emotional needs of inhabitants.



## Sustainability

The **sharing** nature of co-housing results in a reduction of the required **space** and amount of necessary goods per individual.

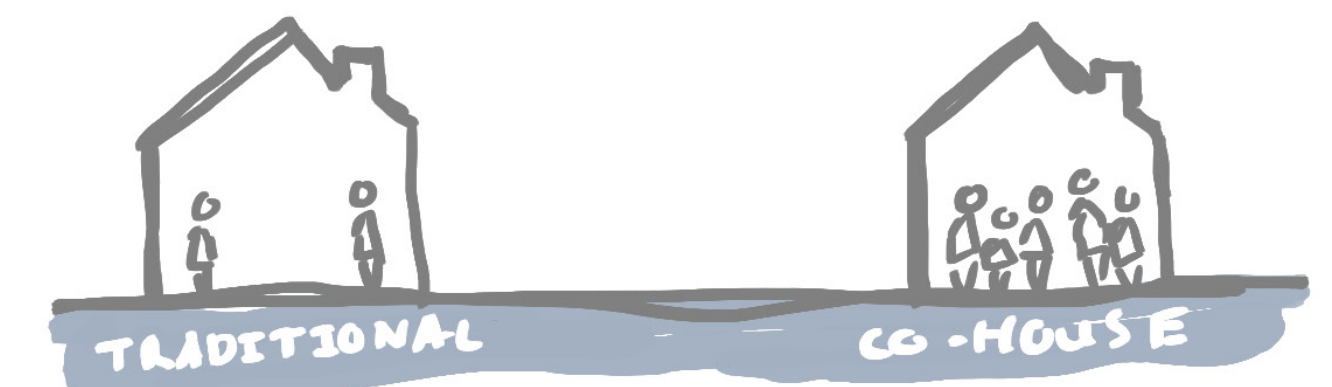
Sharing



Consumerism



Spatial reduction





# The Boardgame

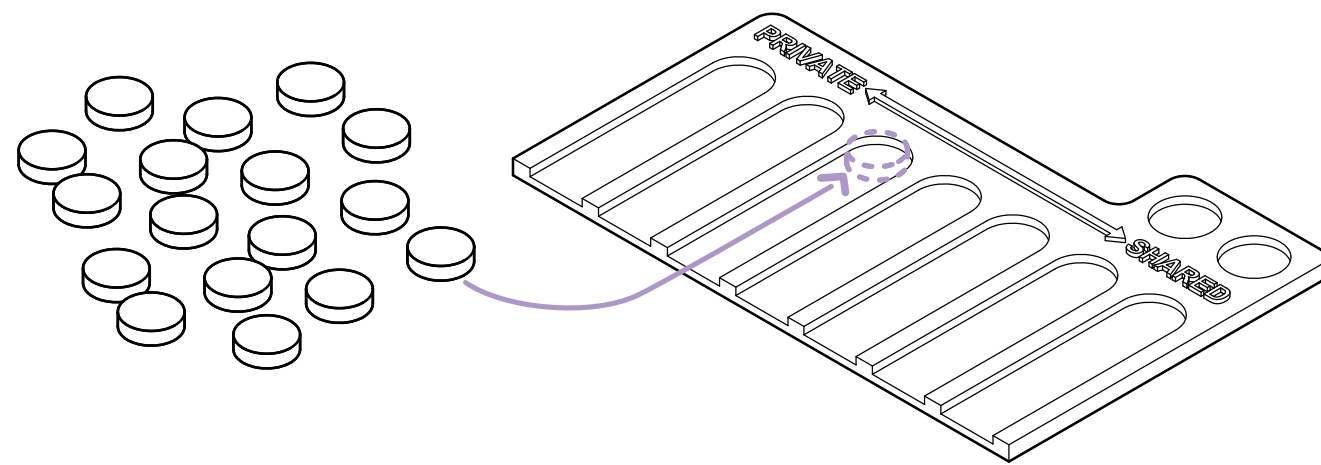
**Interactive** way to scope the **perception** of  
TU Delft students of co-housing





# The Boardgame: conducting the interview

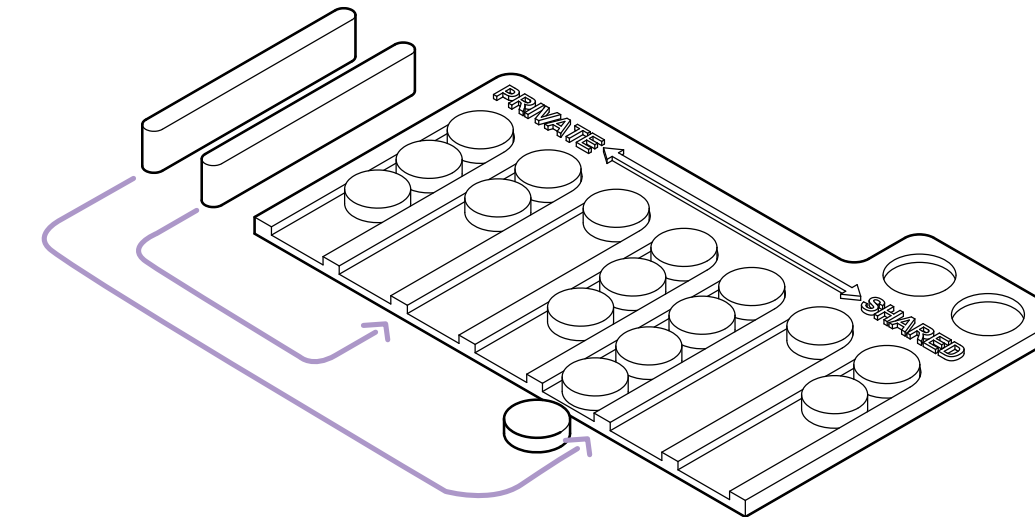
## 1 Activity arrangement



### Activities

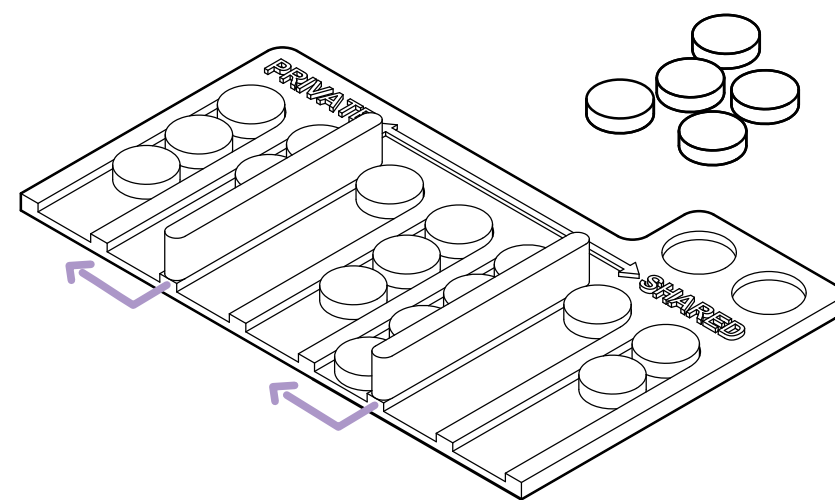
- |                 |              |          |             |           |          |
|-----------------|--------------|----------|-------------|-----------|----------|
| 3x  Eating      | 2x  Relaxing | Sleeping | Cooking     | Showering | Studying |
| 3x  Socializing | 2x  Storage  | Laundry  | Working out | Partying  |          |

## 2 Border placement



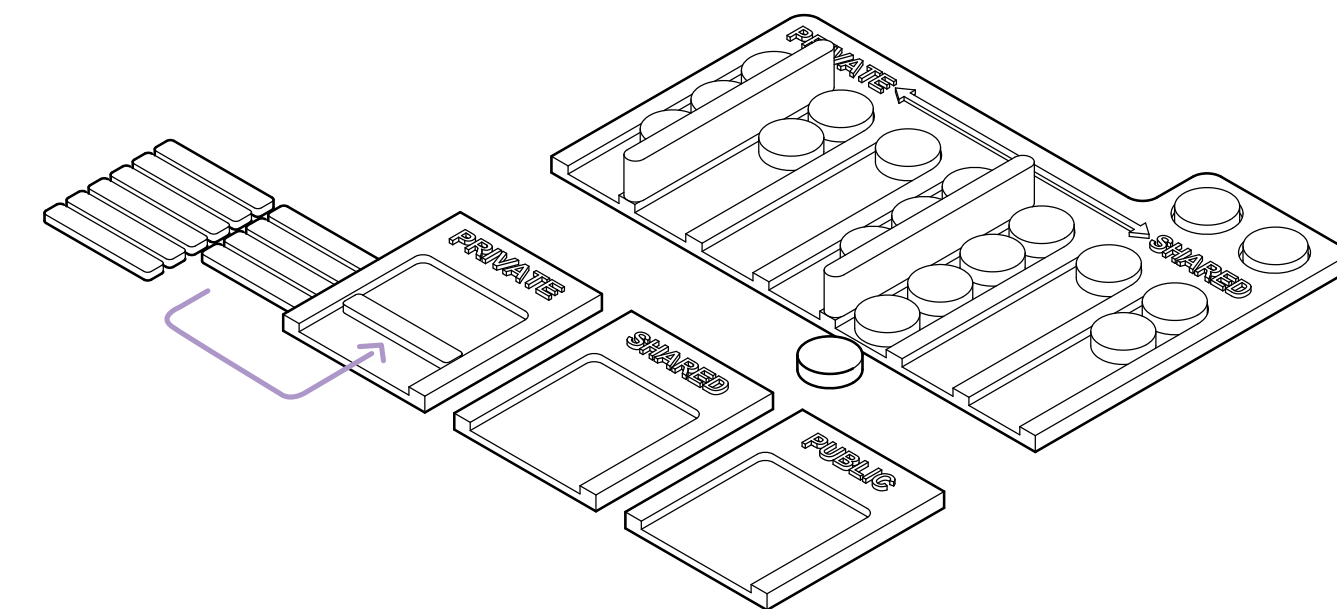
- |   |               |   |               |  |
|---|---------------|---|---------------|--|
| <b>Private space</b><br>a space for oneself as individual | <b>Border</b> | <b>Shared space</b><br>a space shared with housemates | <b>Border</b> | <b>Public space</b><br>a space shared with other inhabitants of the building complex and beyond. |
|---|---------------|---|---------------|--|

## 3 Nudging



- |   |   |   |  |  |
|---|---|---|--|--|
| <b>Reduce</b><br>Your choice helps to reduce the amount of material necessary for the building. | <b>Densify</b><br>Your choice helps to increase the amount of students that can live on the campus. | <b>Social security</b><br>Your choice helps to stimulate your social life | <b>Rent reduction</b><br>Your choice helps to decrease the amount of rent you need to pay every month. | <b>More space/quality</b><br>Your choice helps to increase the size and quality of your shared space |
|---|---|---|--|--|

## 4 Emotion arrangement



### Emotions

- |        |           |                 |           |         |           |
|--------|-----------|-----------------|-----------|---------|-----------|
| Lonely | Motivated | Calm            | Confident | Excited | Irritated |
| Sad    | Happy     | Socially secure | Creative  | Bored   |           |



# Results from the Boardgame

What are our findings?





# Results - Activity Arrangement

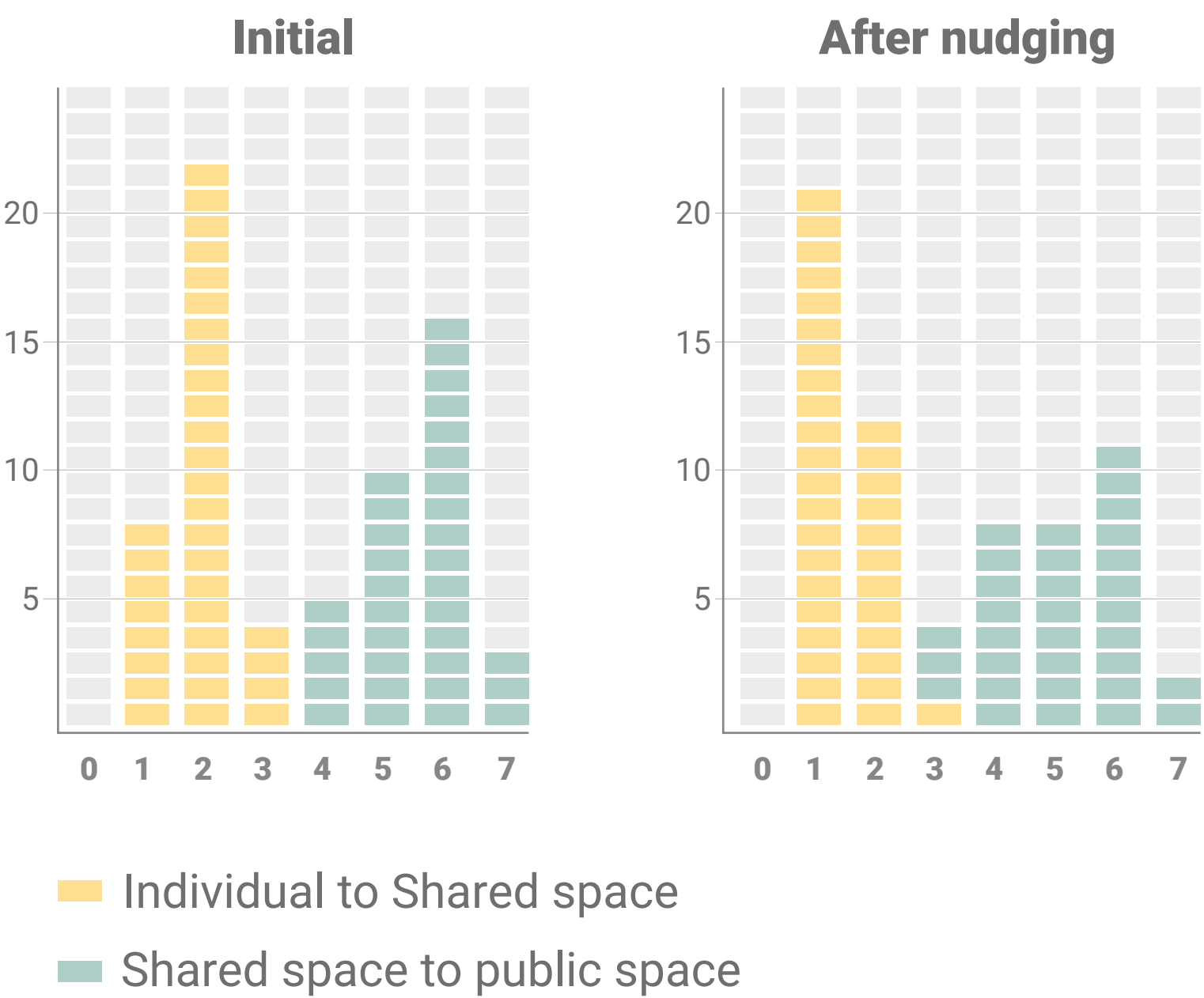
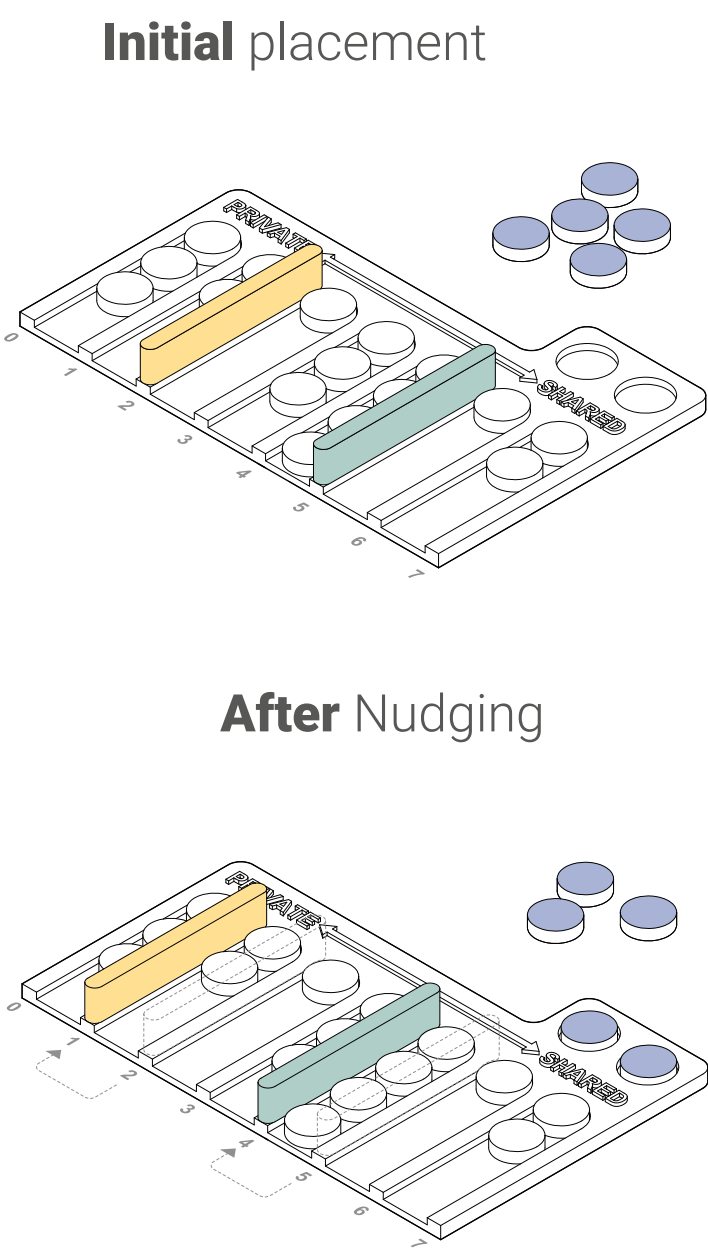




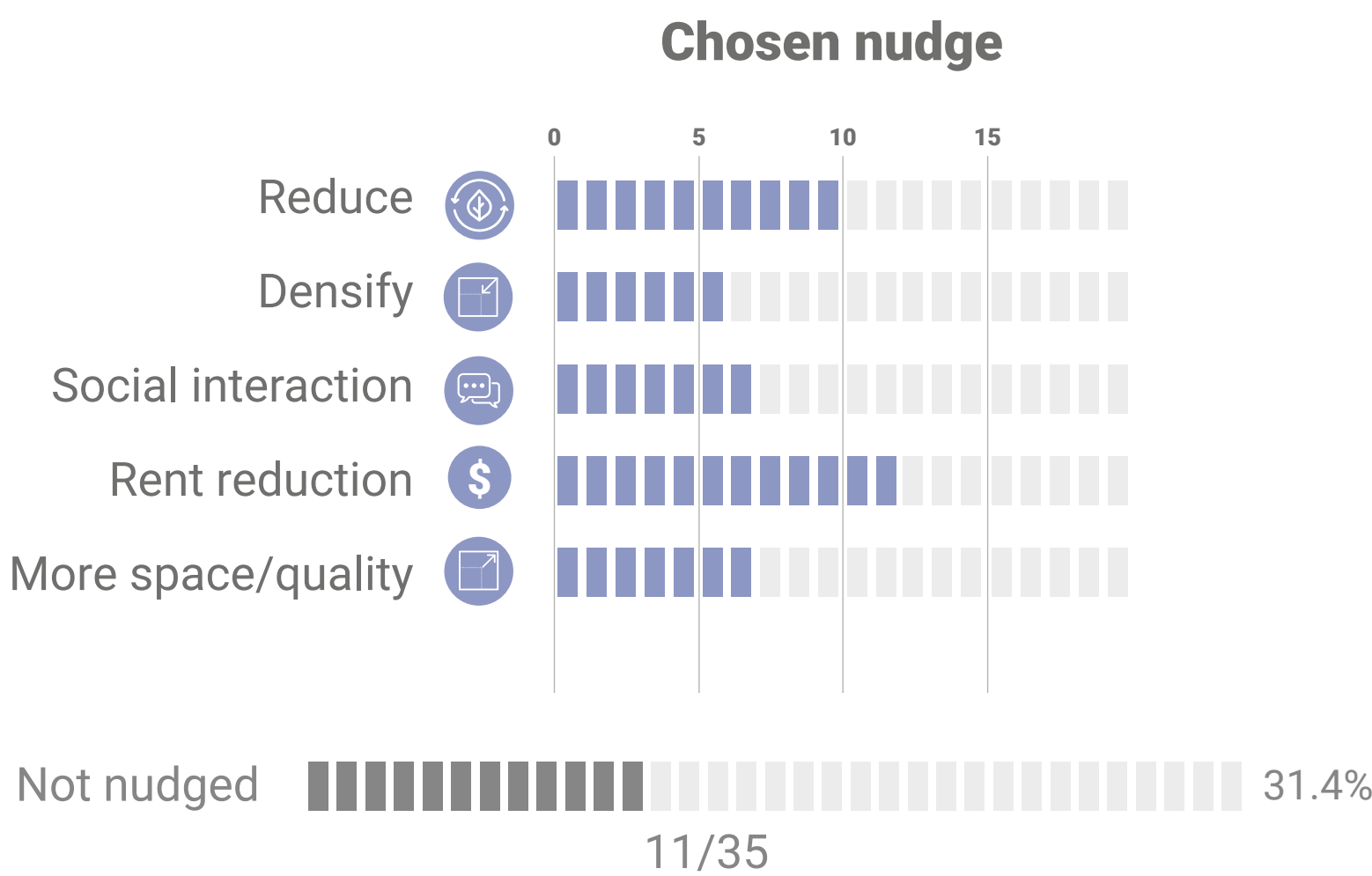
# Results - Activity Arrangement



# Results - Border Placement



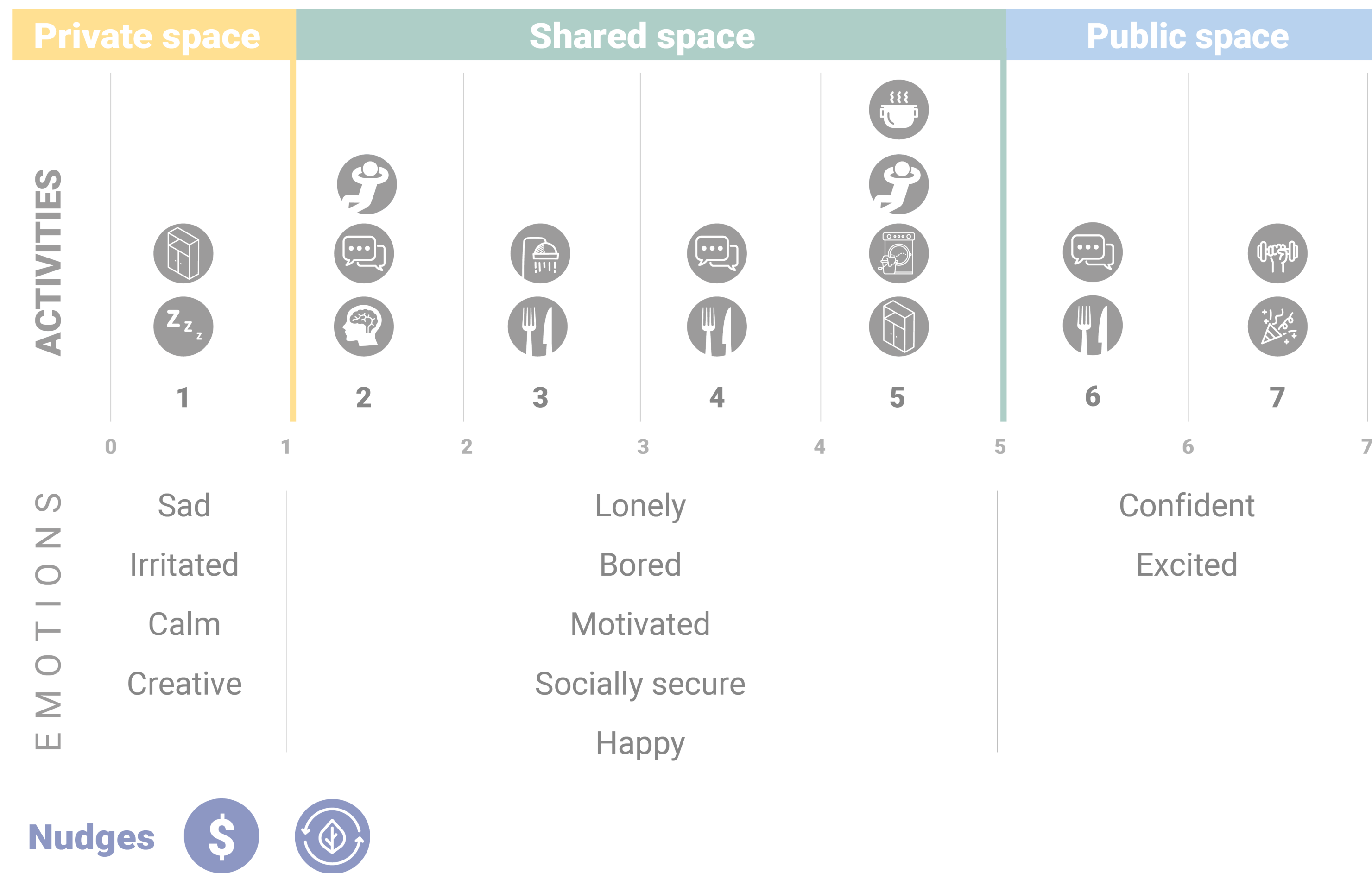
The border from **individual to shared** space is more often moved towards the left than the border from shared to public space



**68.6%** of the respondents were willing to move their border after being presented with the nudges



# Results - Average Lay-out

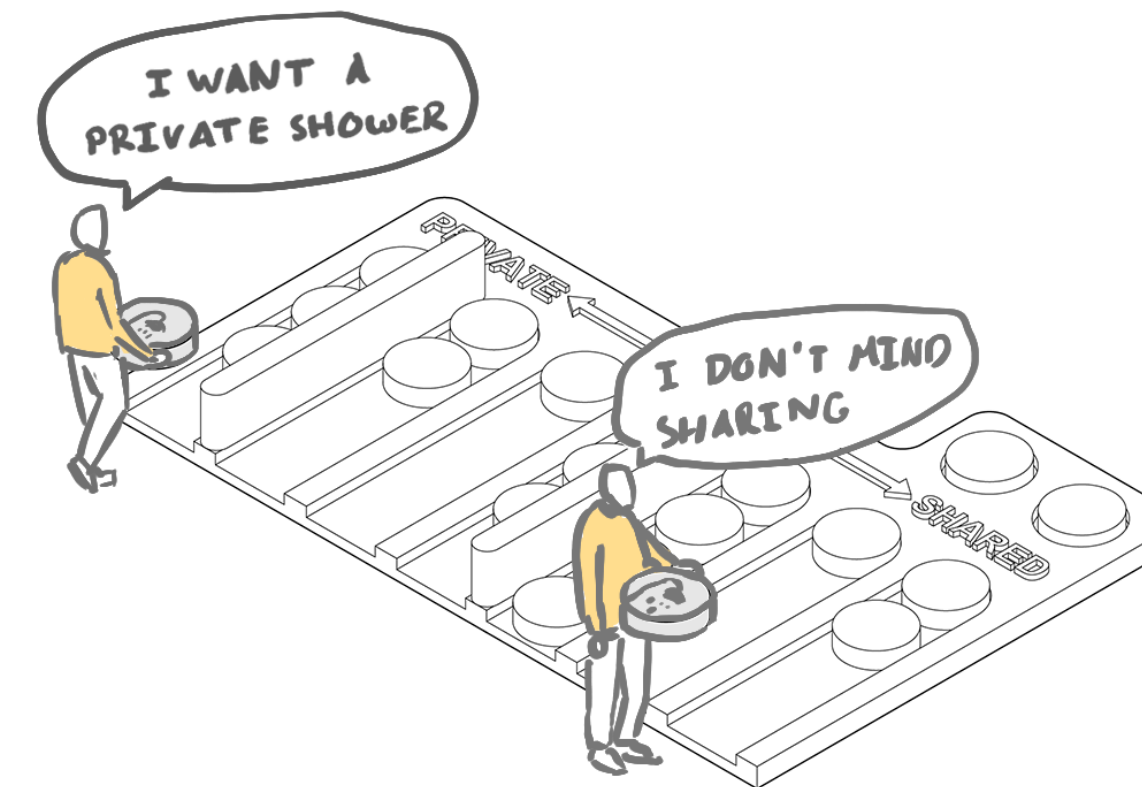


The average layout of the boardgame can function as a guideline for future co-housing design for TU Delft students

# Discussion

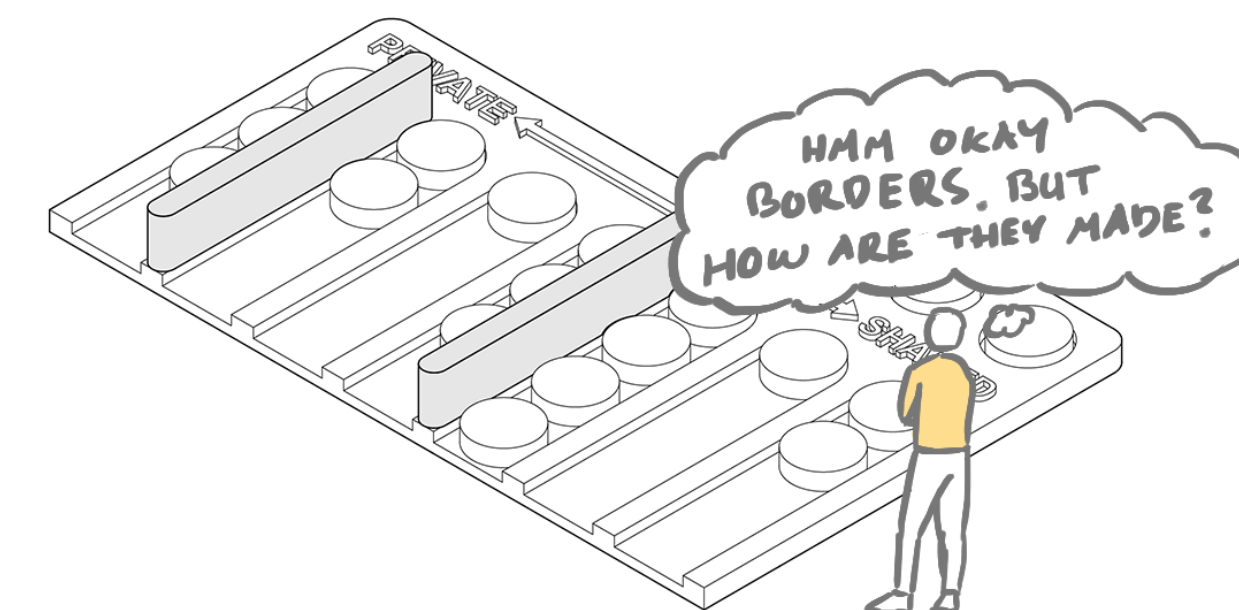
- Lack of consensus over location of certain activities. Mainly in the shared space

Lack of consensus



- Missing the intricacies of design by the abstract way of interviewing

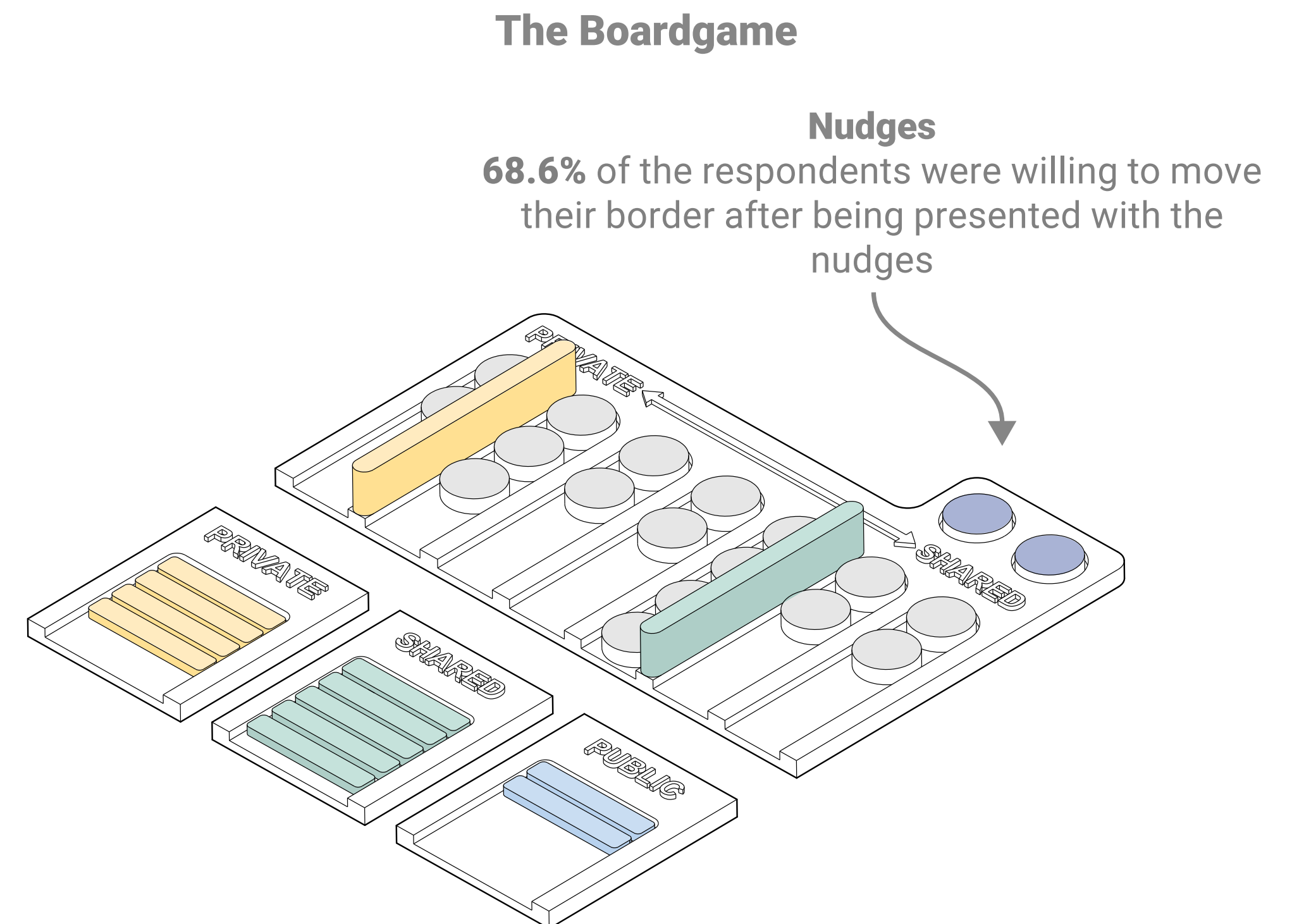
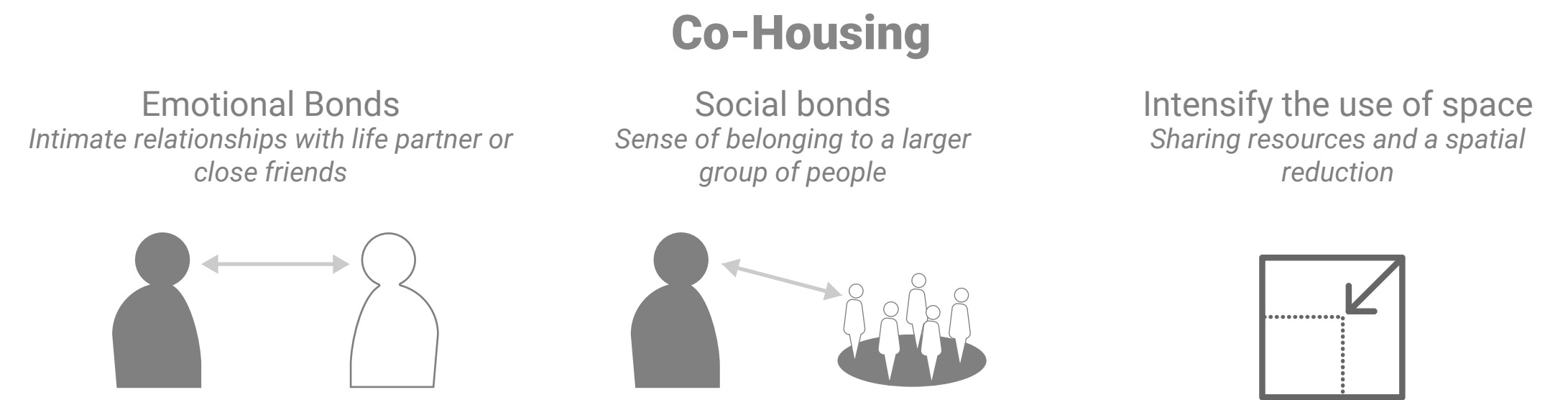
Missing parts





# Conclusions

- **Co-housing** provides strong possibilities to reduce loneliness and intensify the use of space
- There is a **willingness** to move the borders for nudges that are related to co-housing principles
- The average layout can be used as a **guideline** for co-housing design for TU Delft students

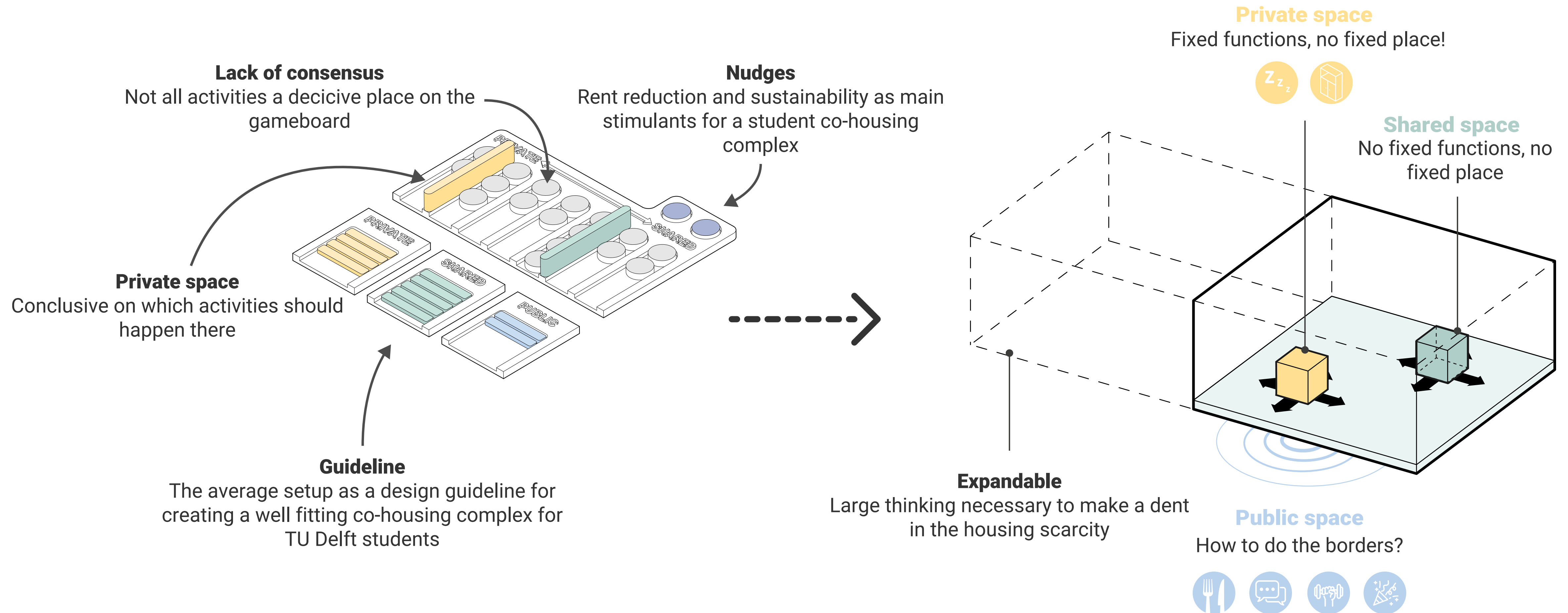


# From research to project



# From Research to Project

How to go from boardgame to building?



# A Large Scale Adaptable Co-housing Complex

Why?

“Large Scale”

**Housing crises**

We need a lot more housing

“Adaptable”

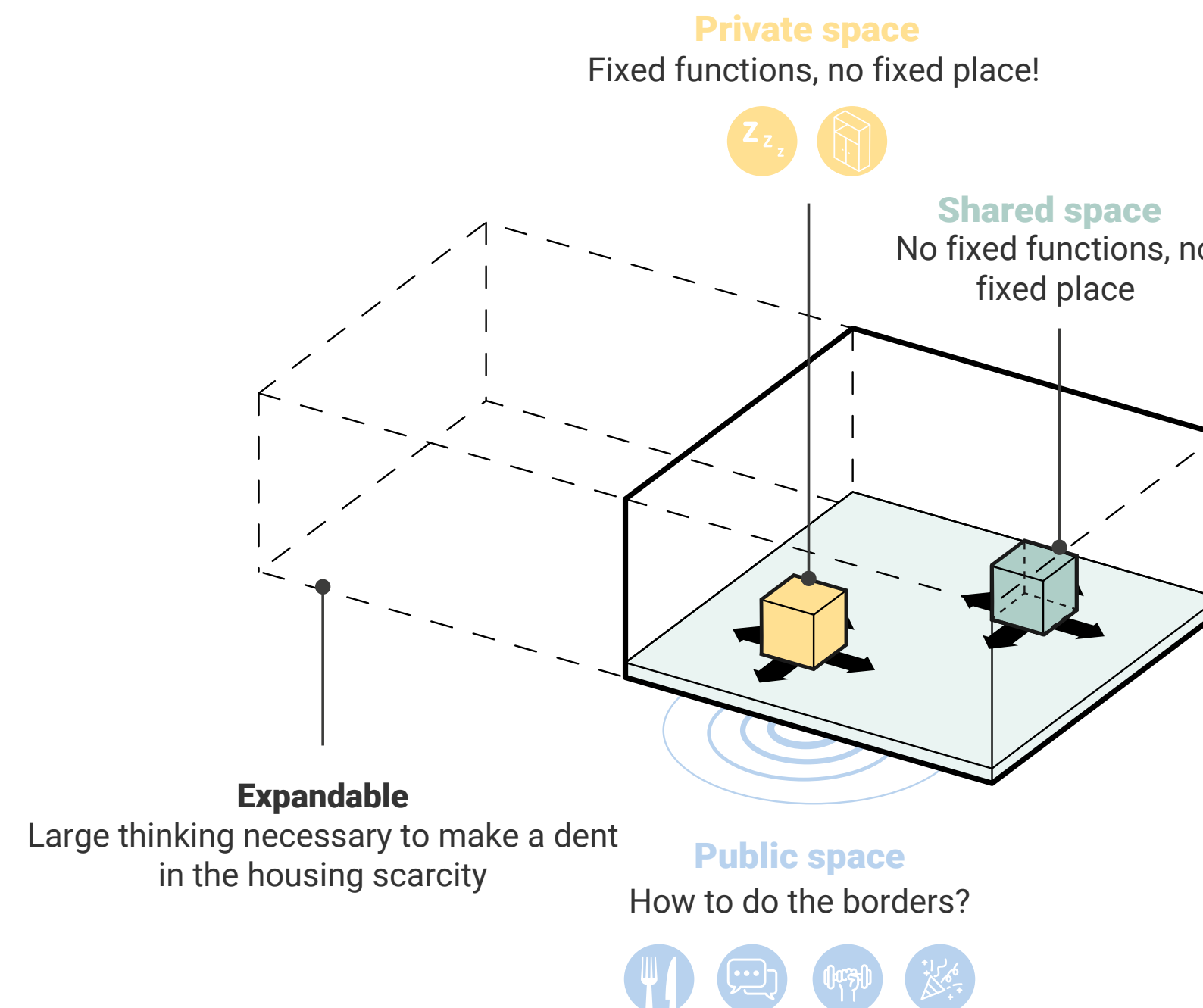
**Lack of consensus**

Different opinions requires different solutions

“Co-Housing”

**Loneliness**

Possibility to reduce loneliness



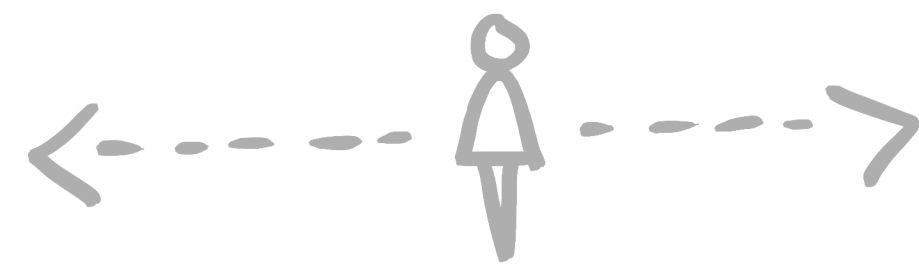


# CONCEPT

Building requirements

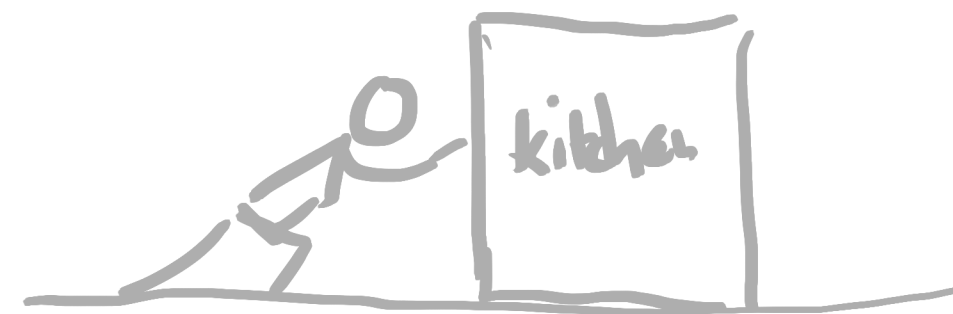
## ADAPTABLE SOCIAL BOUNDARIES

A chance to let the building conform to the social preferences and limitations of its inhabitants



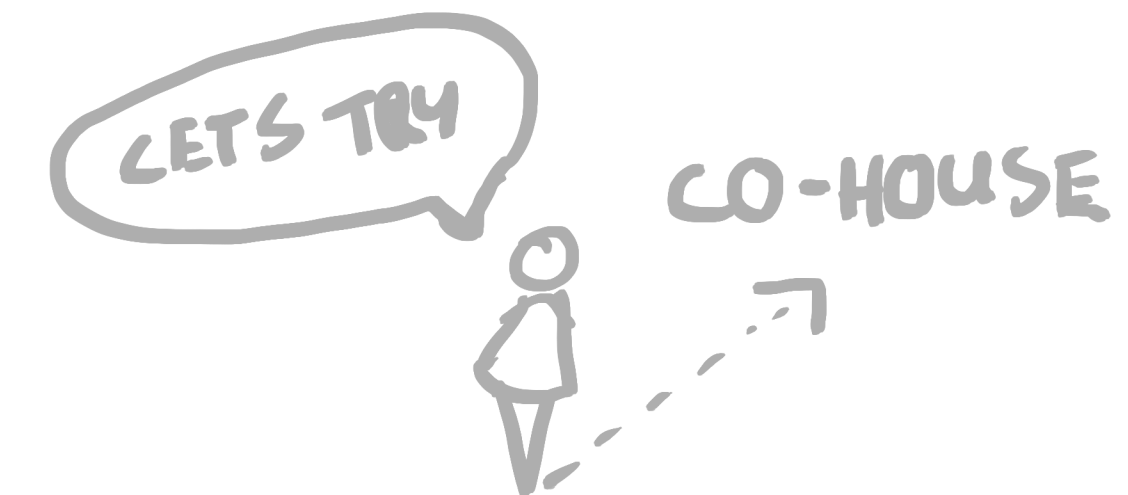
## OWNERSHIP

Letting inhabitants decide to which degree they are willing to share



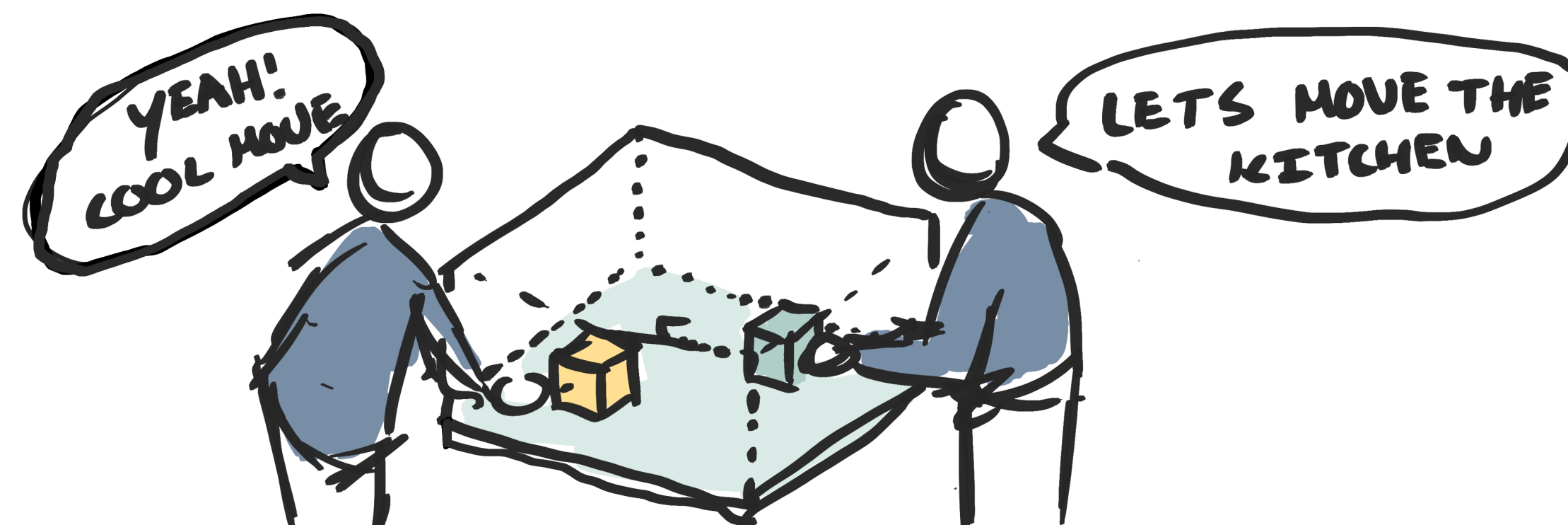
## EXPERIMENT!

The possibility to try out unlimited amount of co-housing compositions



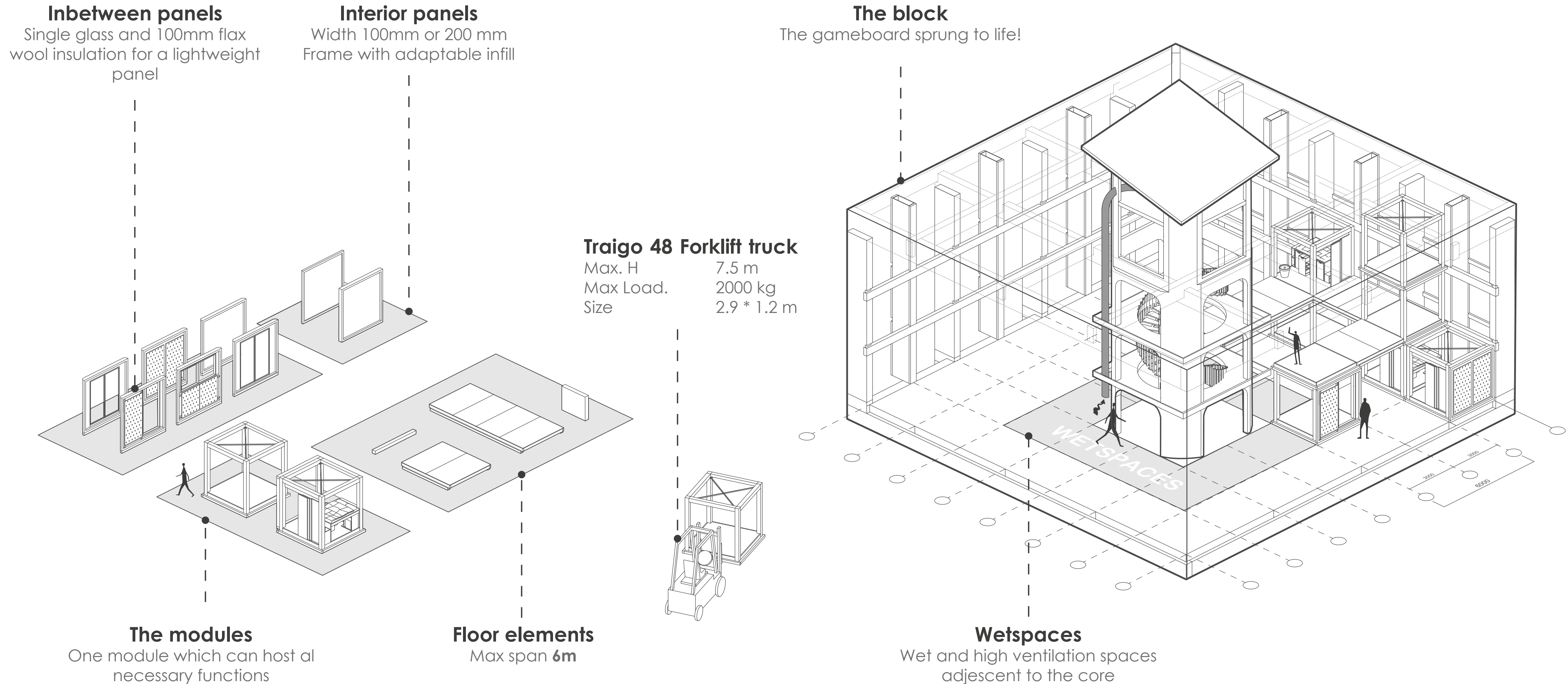
## A LIFE SIZE GAMEBOARD!

The gameboard sprung to life, letting inhabitants **nudge** their own **borders** between **private** and **public**



# Modular Construction Kit

A kit of parts which can be easily moved



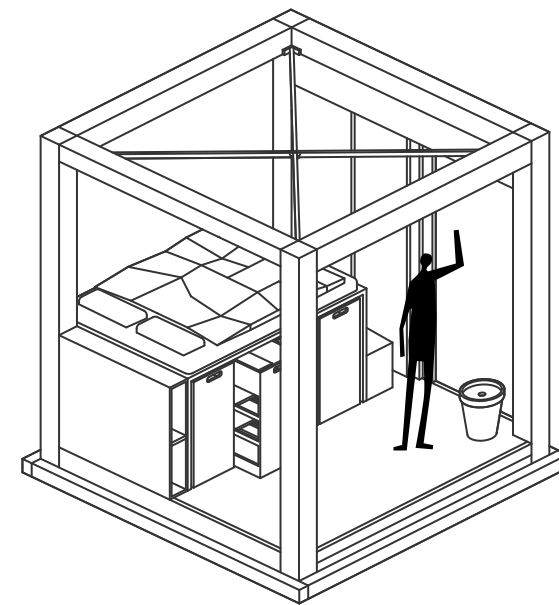
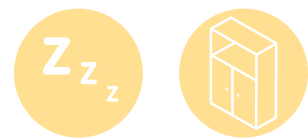


# Modular Construction Kit

## How does this work?

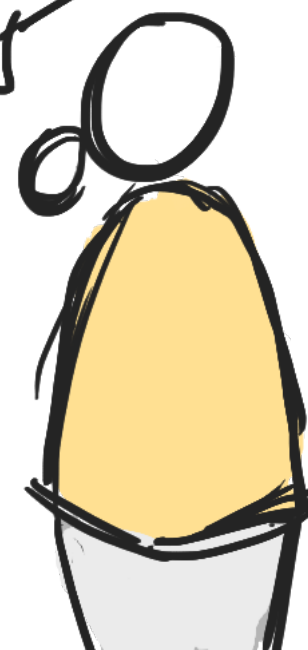
### Private space

Fixed functions, no fixed place!



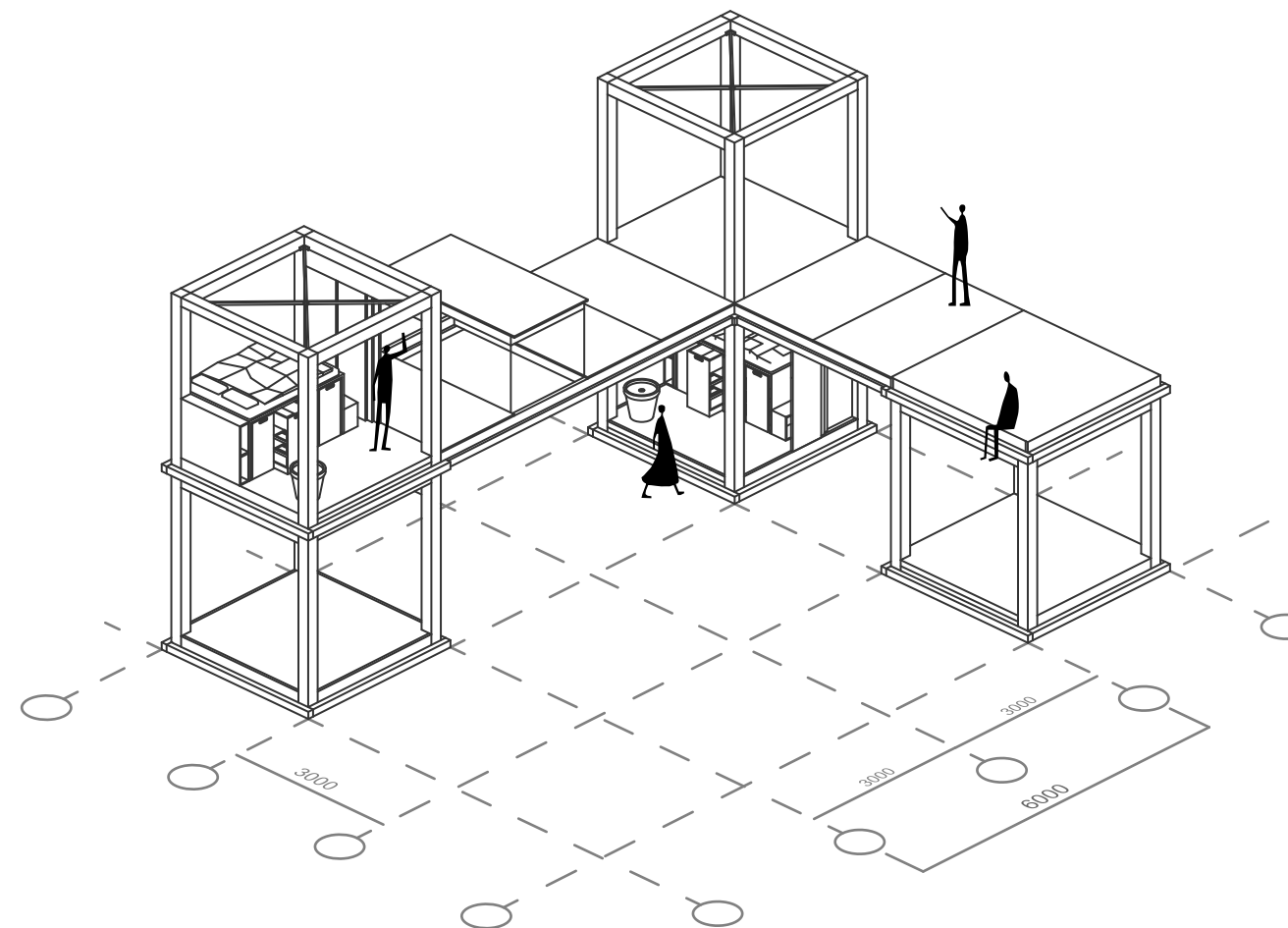
8,4 m<sup>2</sup>

AH OKAY. SO EVERY ONE HAS A SMALL BUT EFFICIENT PRIVATE MODULE.

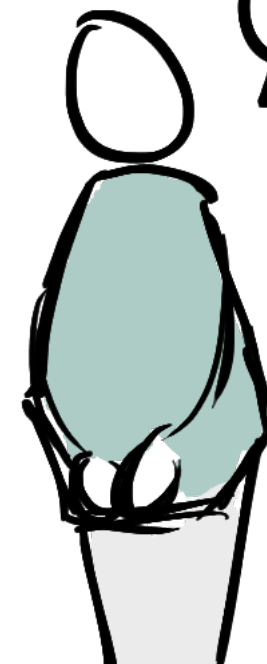


### Shared space

No fixed functions, no fixed place

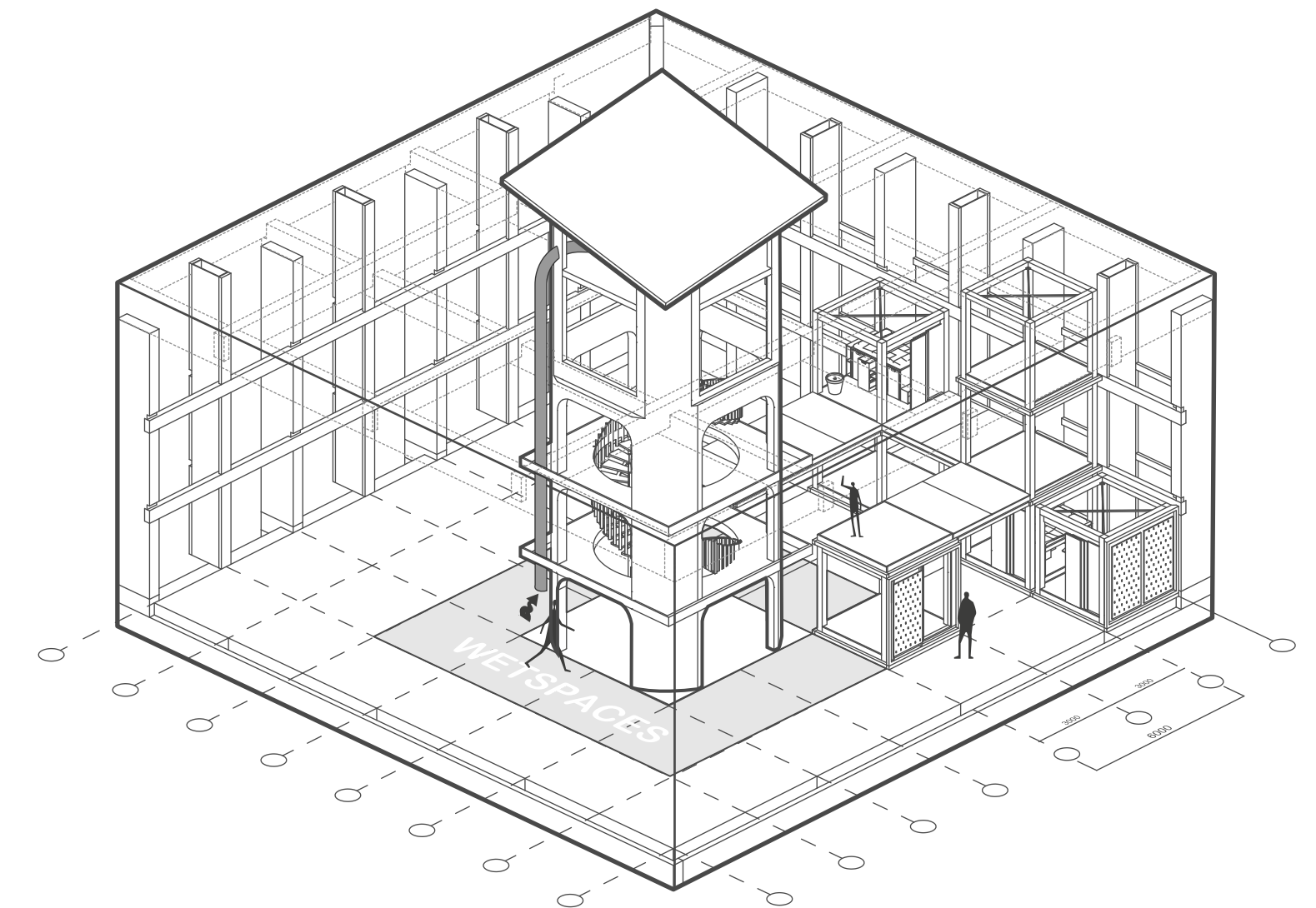


... AND WITH THE SAME MODULES WE COMPOSE THE SHARED SPACE.



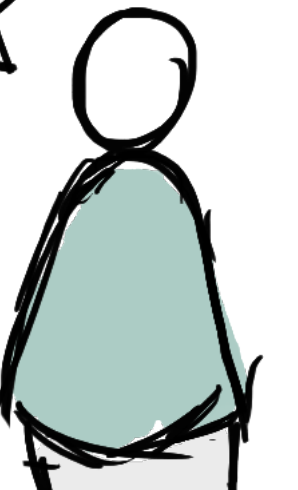
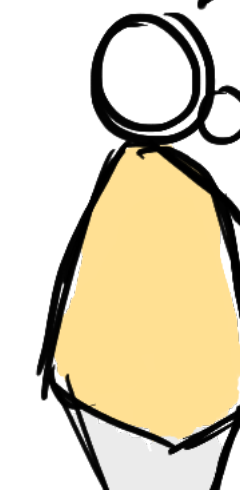
### The "Gameboard"

2 fixed facades and 1 central core



SO TOGETHER WE CAN SHAPE OUR LIVING SPACE IN THIS BLOCK?

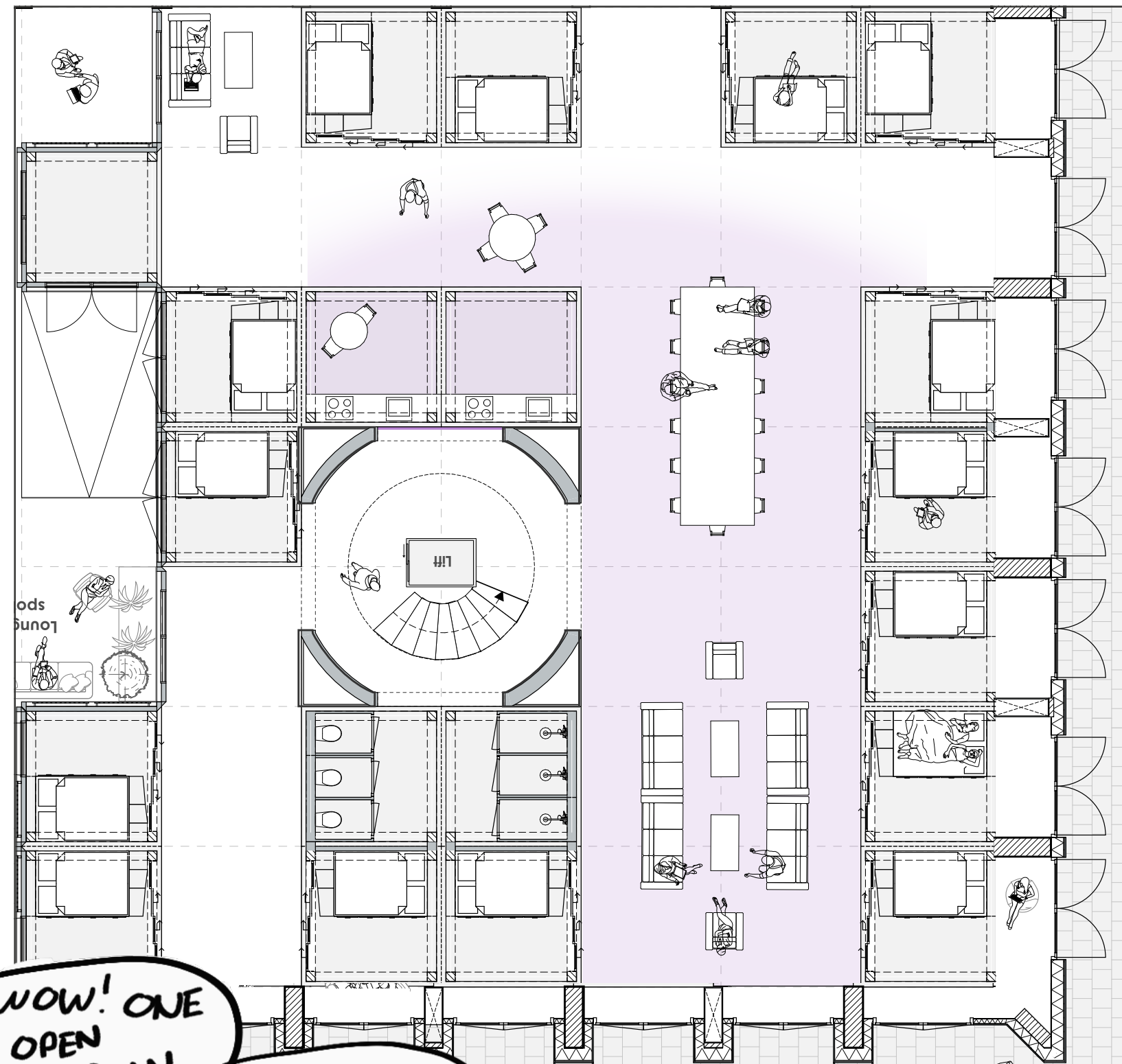
YES! THAT IS THE CONCEPT.



# Modular Construction Kit

How does this work?

1 Cluster



WOW! ONE  
BIG OPEN  
FLOORPLAN.

THAT IS SOME  
SHARING

2 Clusters



WE CAN ALSO  
DECIDE TO MAKE  
MULTIPLE LIVING  
ROOMS.



# CONCEPT

## Adaptability when?

### FACTS & FIGURES

**WHEN** is there a call for **adaptability**?

- Different preference of current inhabitants
- New inhabitants

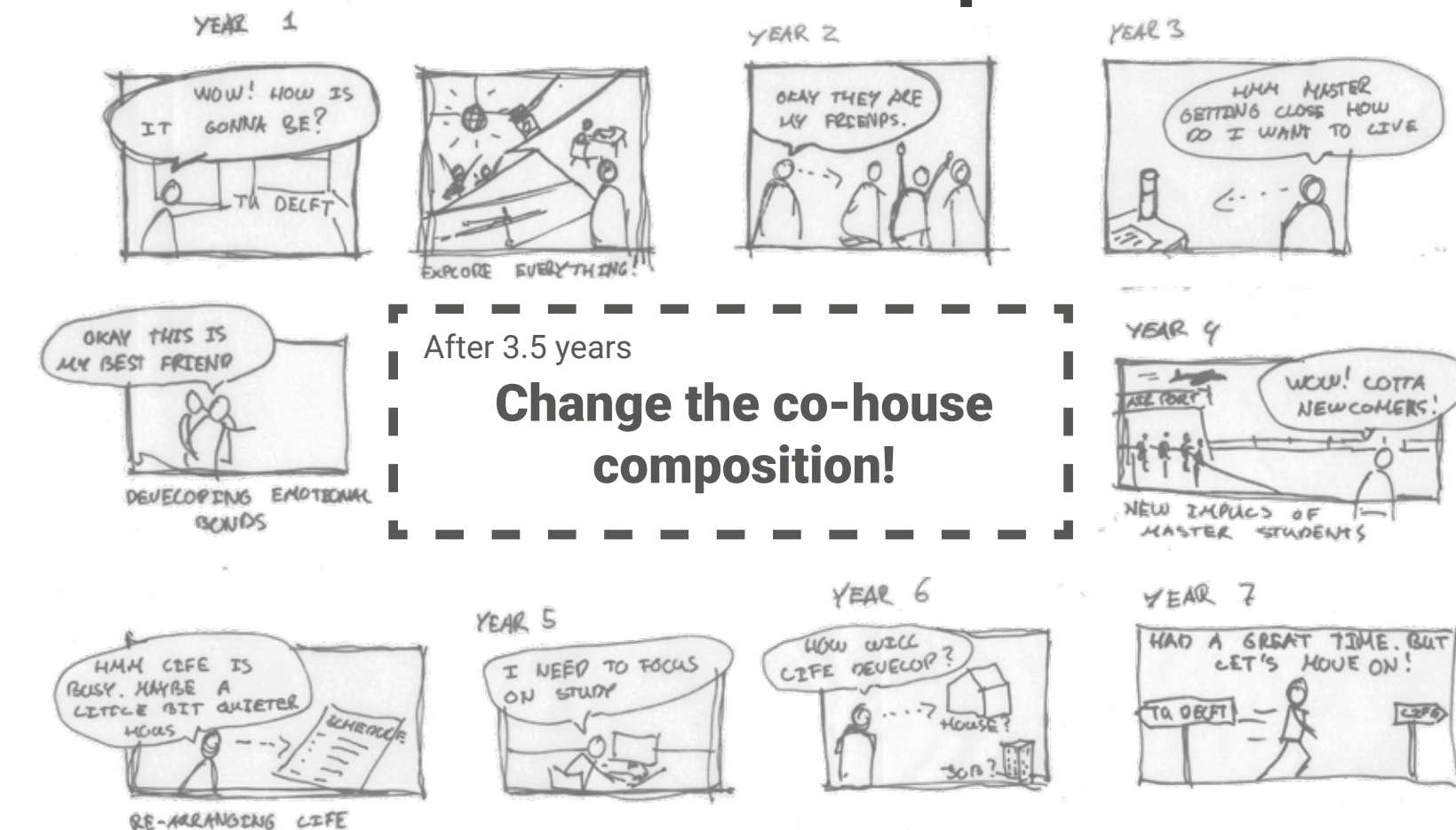
INHABITANTS	<b>40</b>	People
Time in Delft	<b>7</b>	Years

$40/7 = 5.7$  new people per year per block

AFTER 3.5 YEARS **50%** of the block are new inhabitants

**AND** every inhabitant is 3.5 years older

### Student life span



After 3.5 years

**Change the co-house composition!**

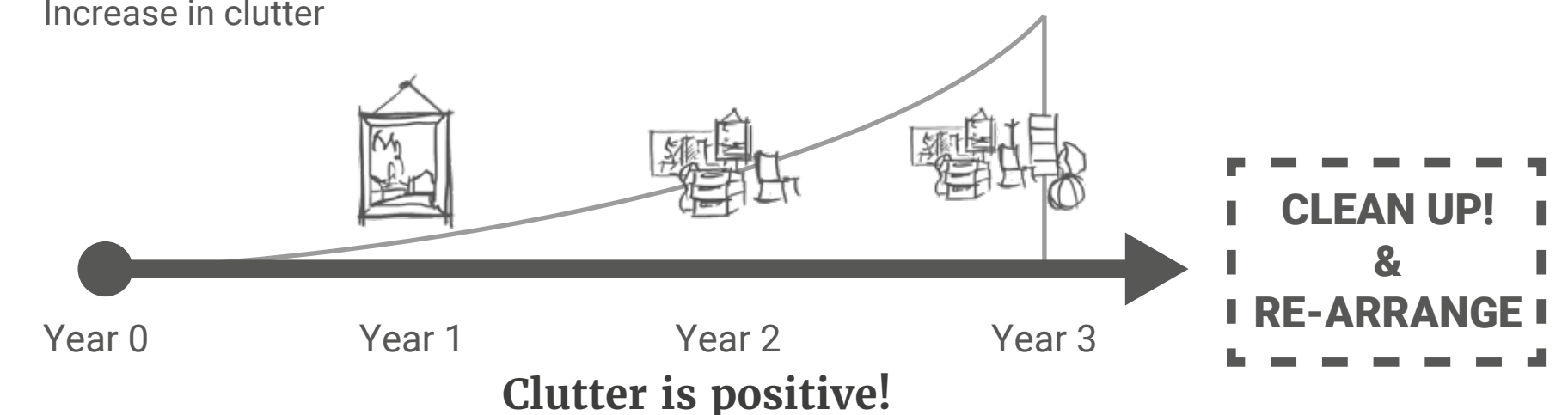
**On average 7 years**

(TU Delft Facts & Figures, 2021)

### Clutter

Allowing time to let people settle and “clutter” the place.

Increase in clutter



**Clutter is positive!**

# CONCEPT

Adaptability when?

## 40 inhabitants per block

- **Scale** matters!
- Push towards more **sharing**!
- I have seen it work!

## Re-arrange after 3.5 years

- Time to **settle** and **clutter** the place
- **50%** of the block new after this period
- 3.5 Year **older** Inhabitants



# CONCEPT

The core of the project

## Technical

A technical project with a **modular** and **adaptable** built system in order to achieve social and environmental goals



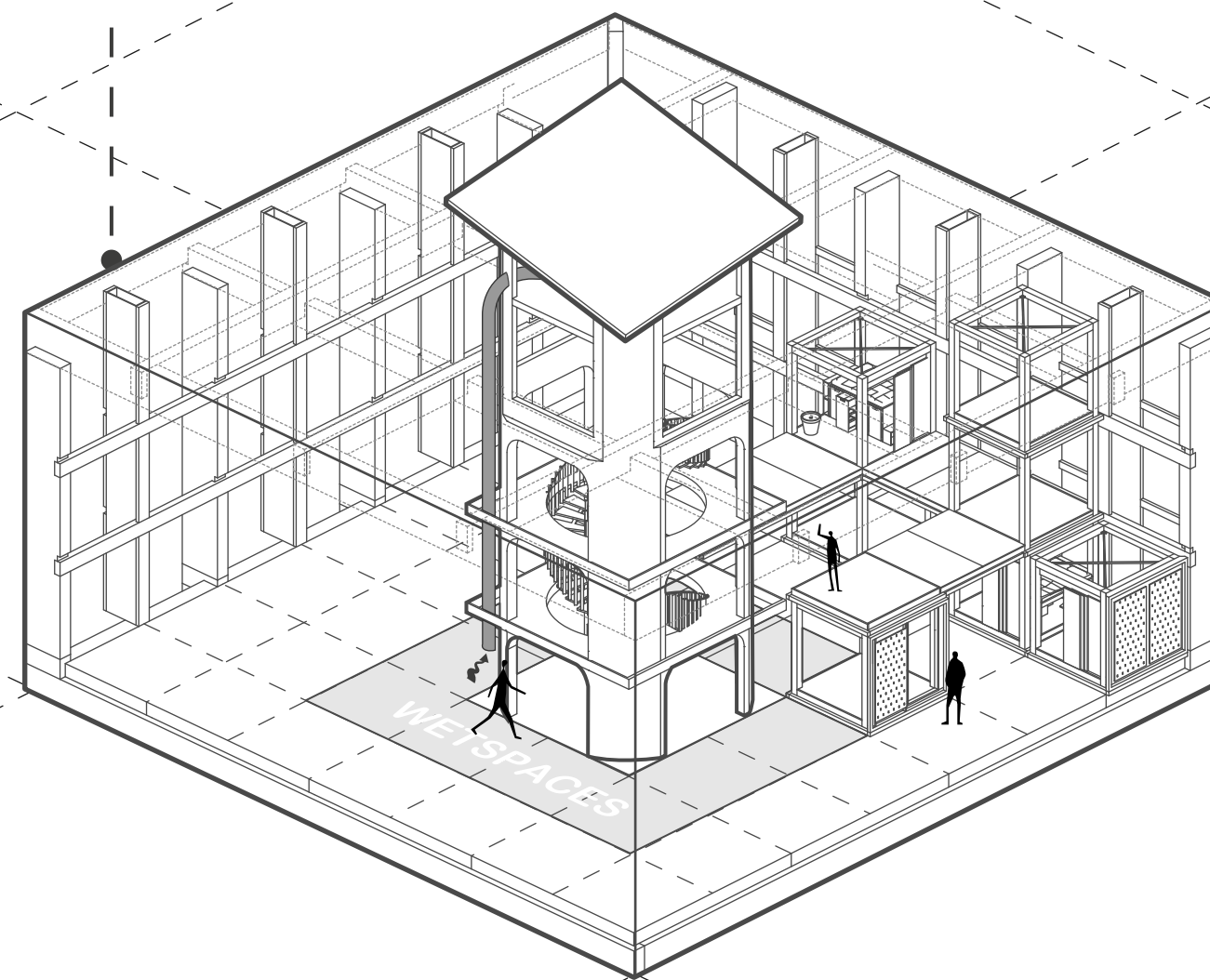
## Social

The freedom to discover your own **boundaries** between **private** and **public** space & take **ownership** over your living space!

# Context?

## Placelessness

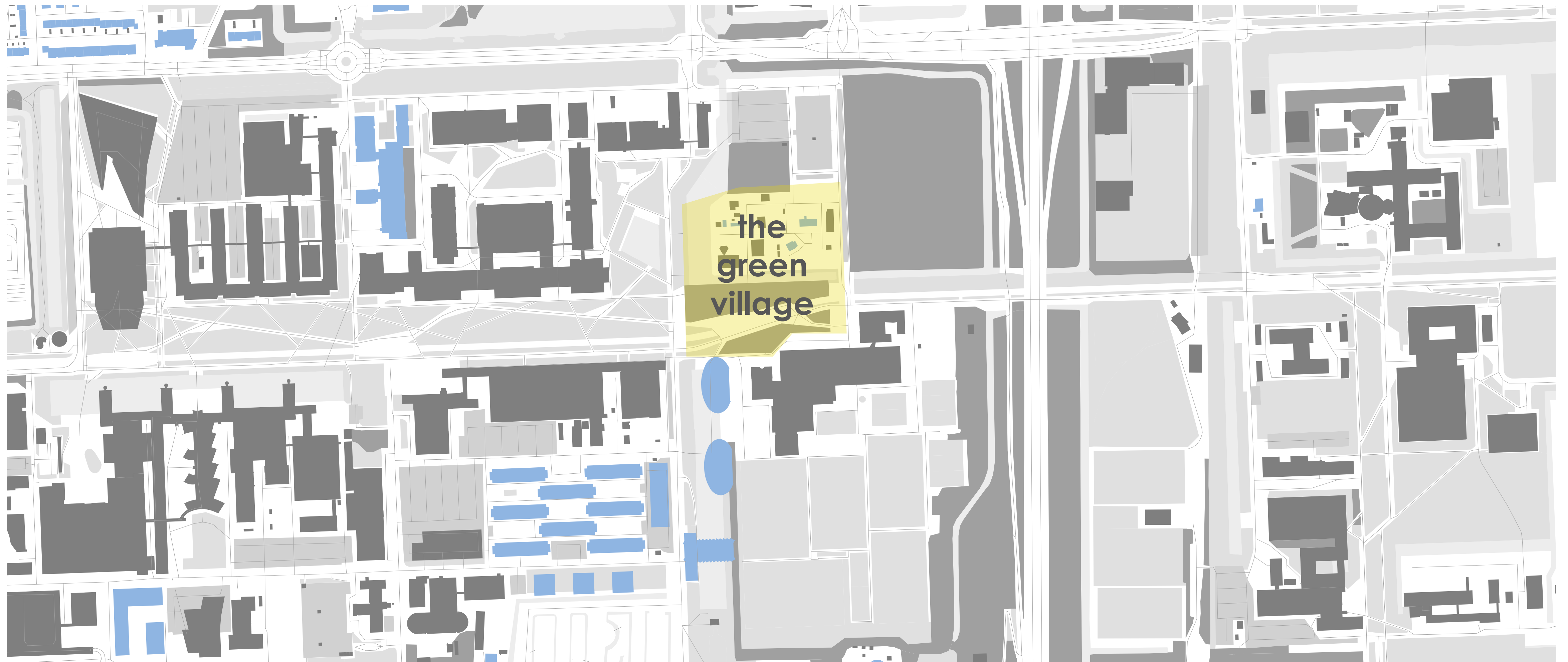
The block is not contextual **yet** and therefore  
could be placed anywhere





# Context

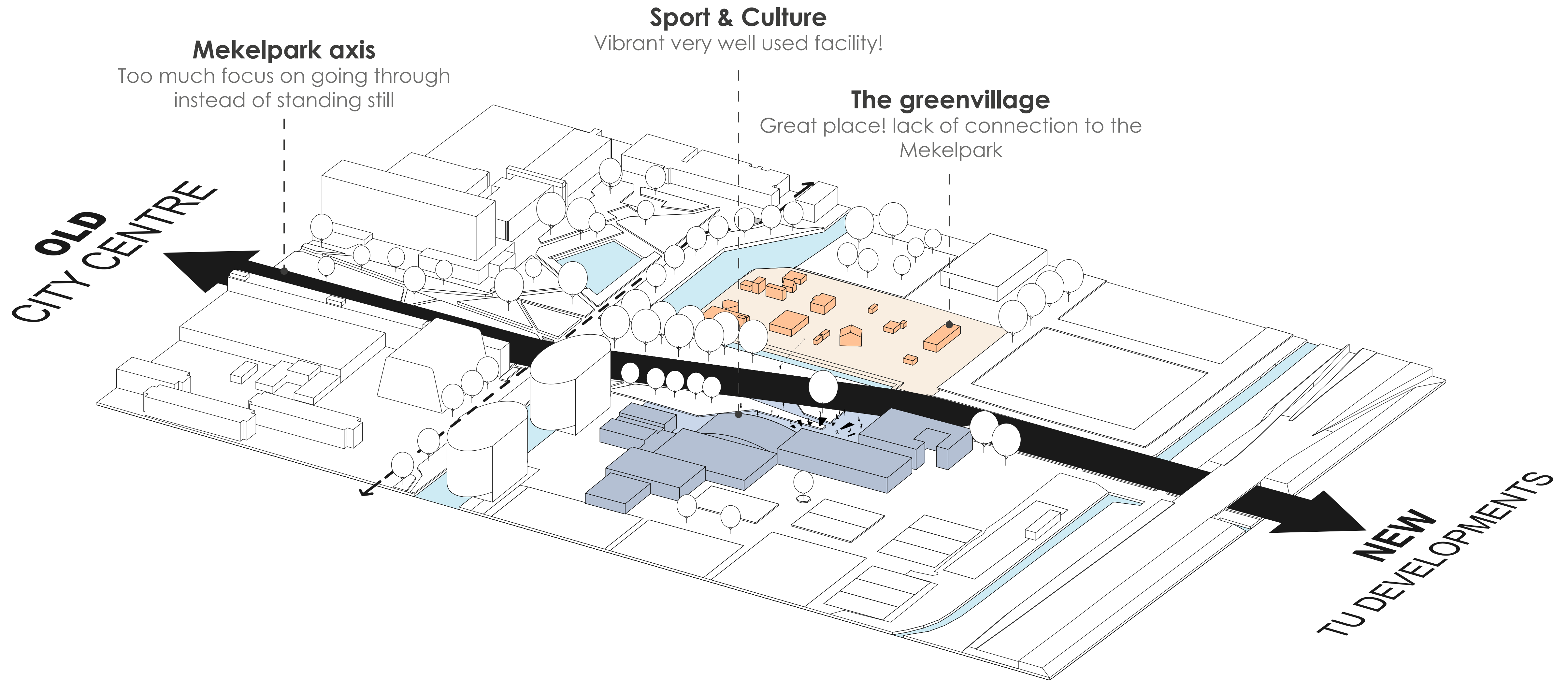
## TU DELFT CAMPUS



■ Housing      ■ Office/University

# Context

## TU Delft campus



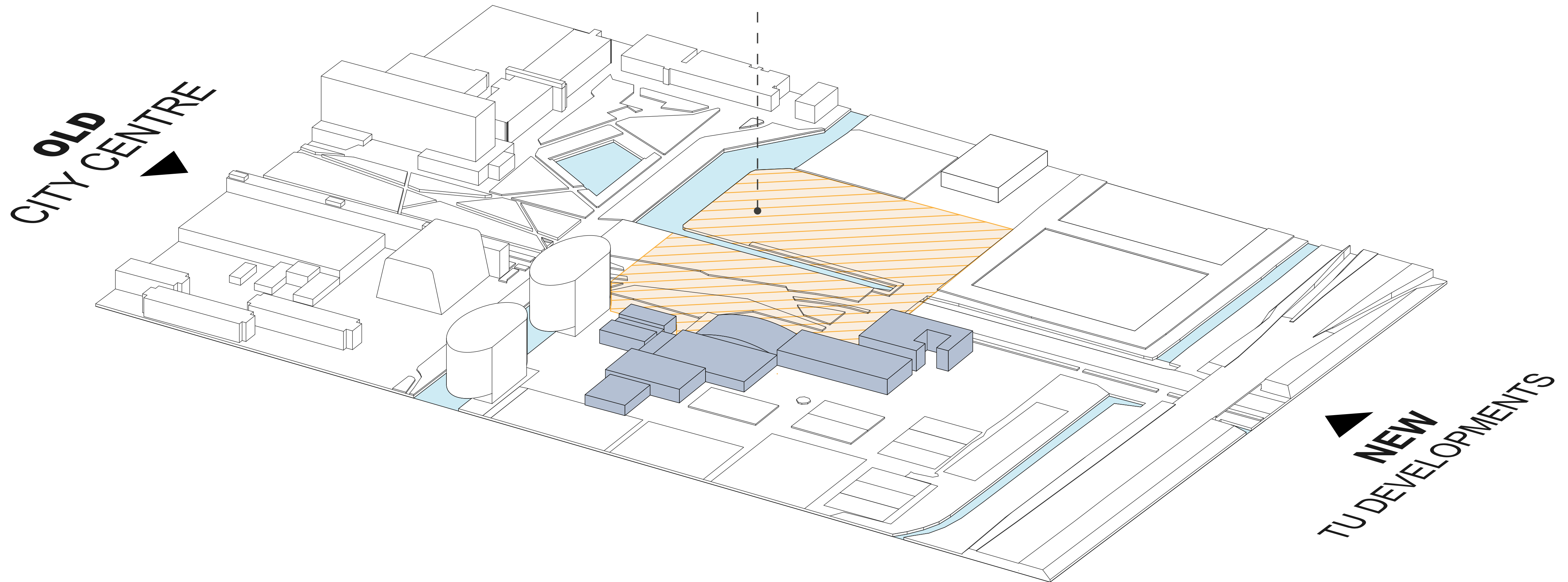


# Context

## TU DELFT CAMPUS

### The Building plot

For a large scale co-housing complex!

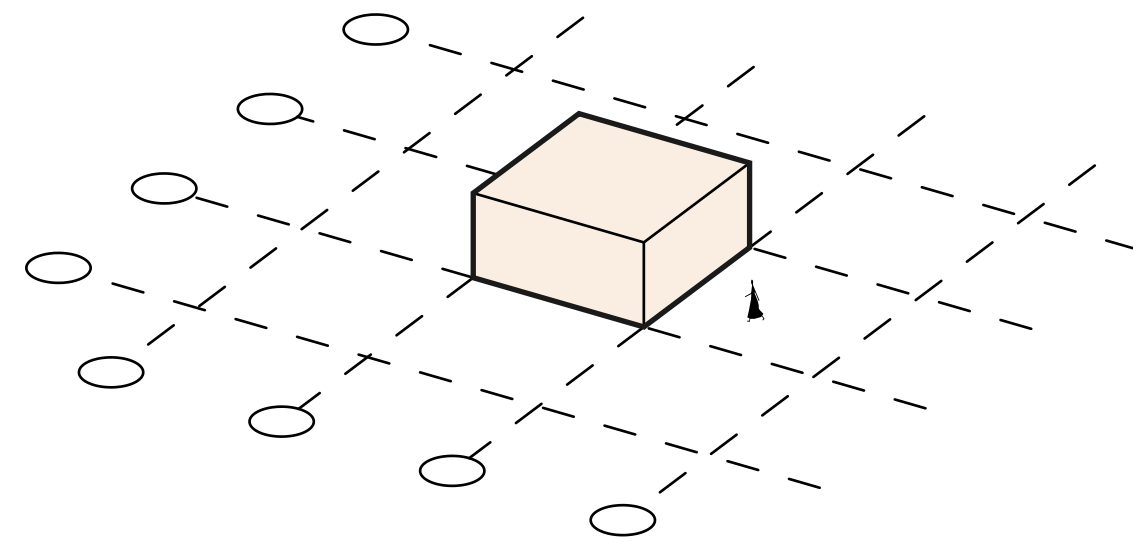


# Context

## Block interaction

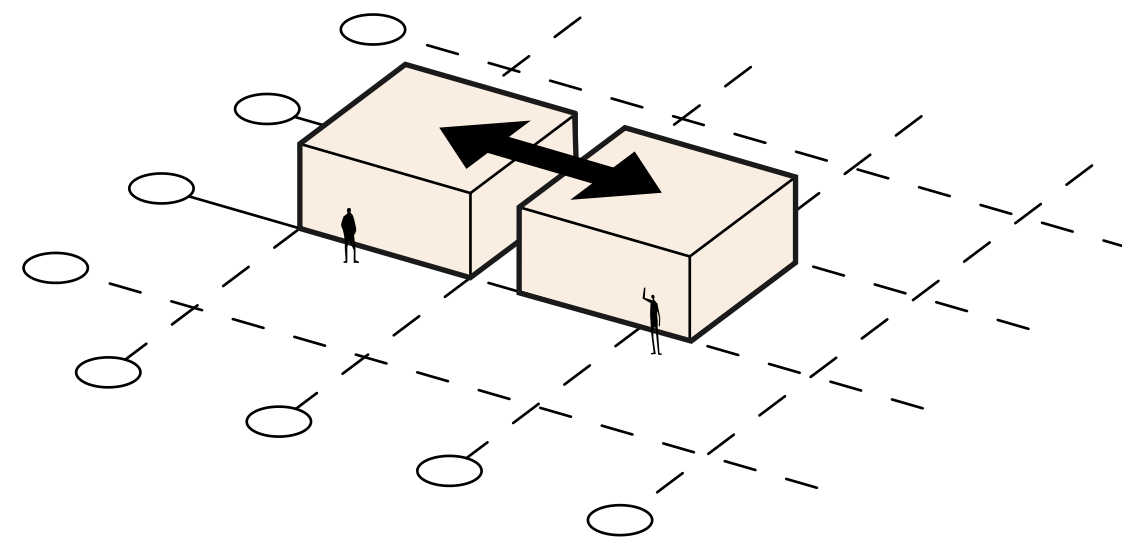
### Single Block

The block could also be a stand alone building



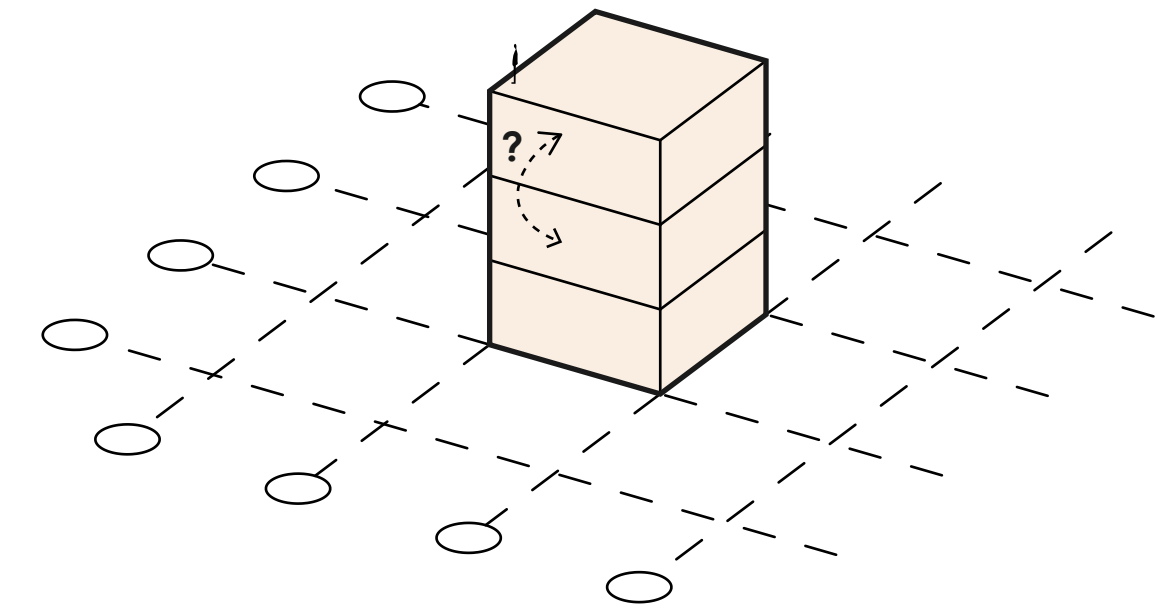
### Conversation

By placing the blocks next to each other there is a interaction appearing



### Barely speaking

High rise is efficient but as a result the blocks do not interact with each other





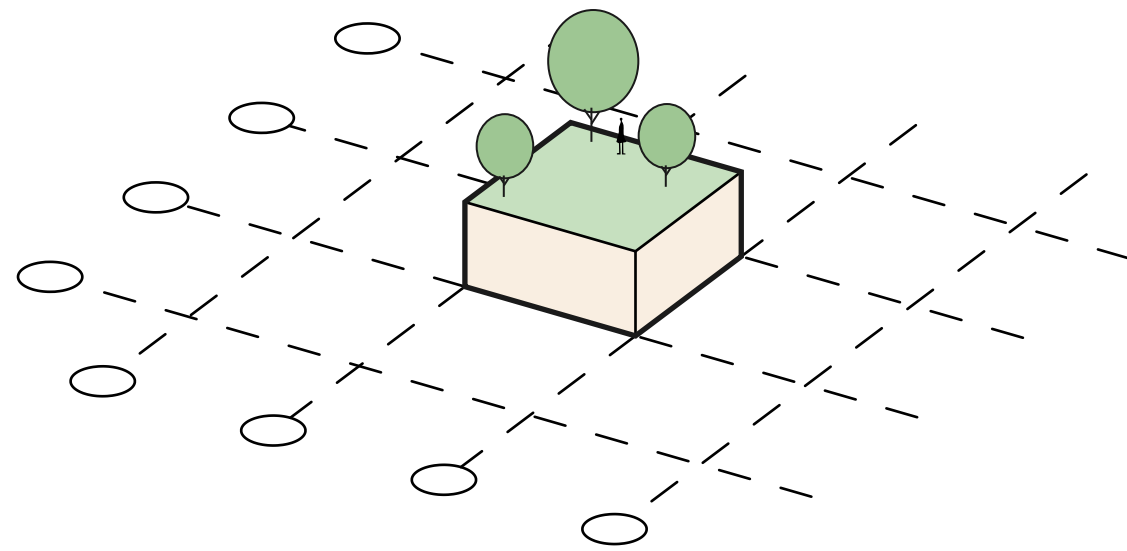
# Context

## Block interaction

Roofscapes are valuable but often neglected spaces

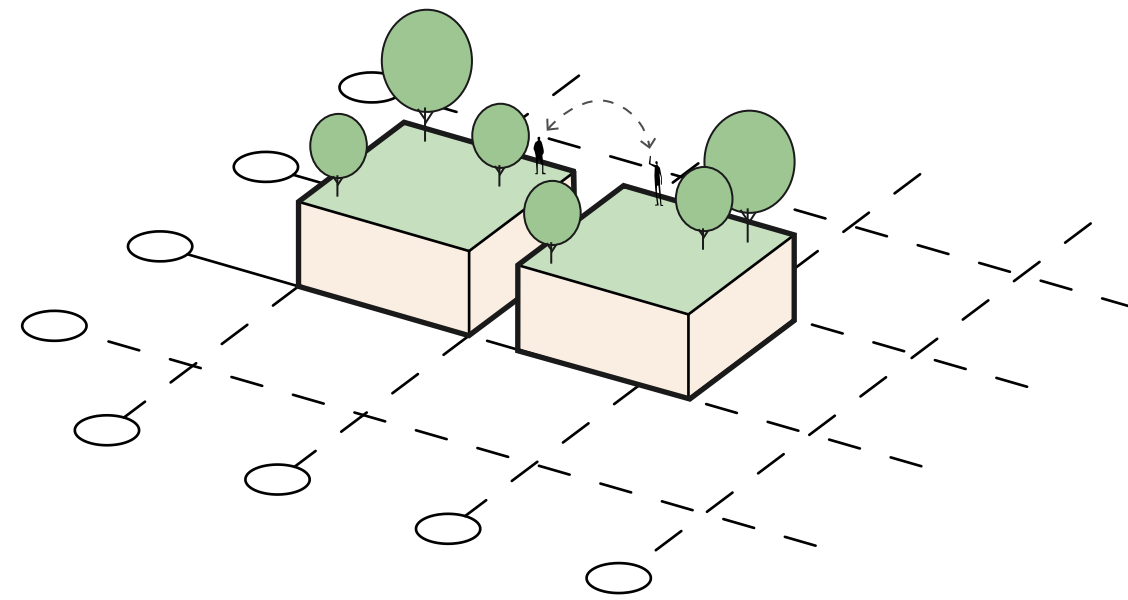
### Single Block

Nice but small



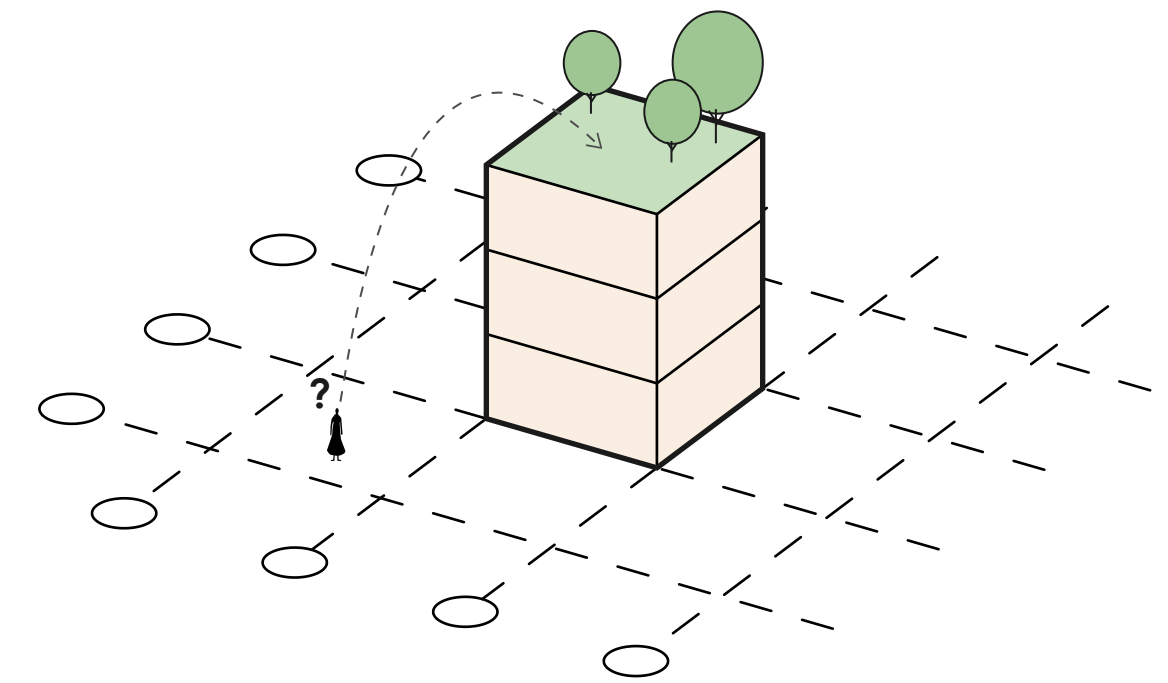
### Conversation

Quickly becomes a large public greenspace



### Hard to reach

Difficult to easily access from groundfloor

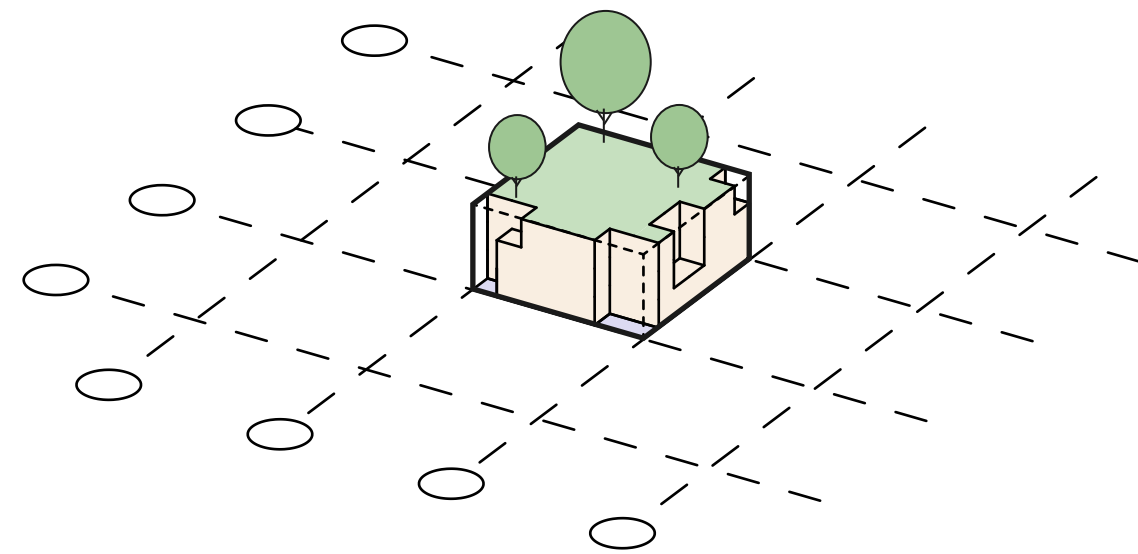


# Context

## Block interaction

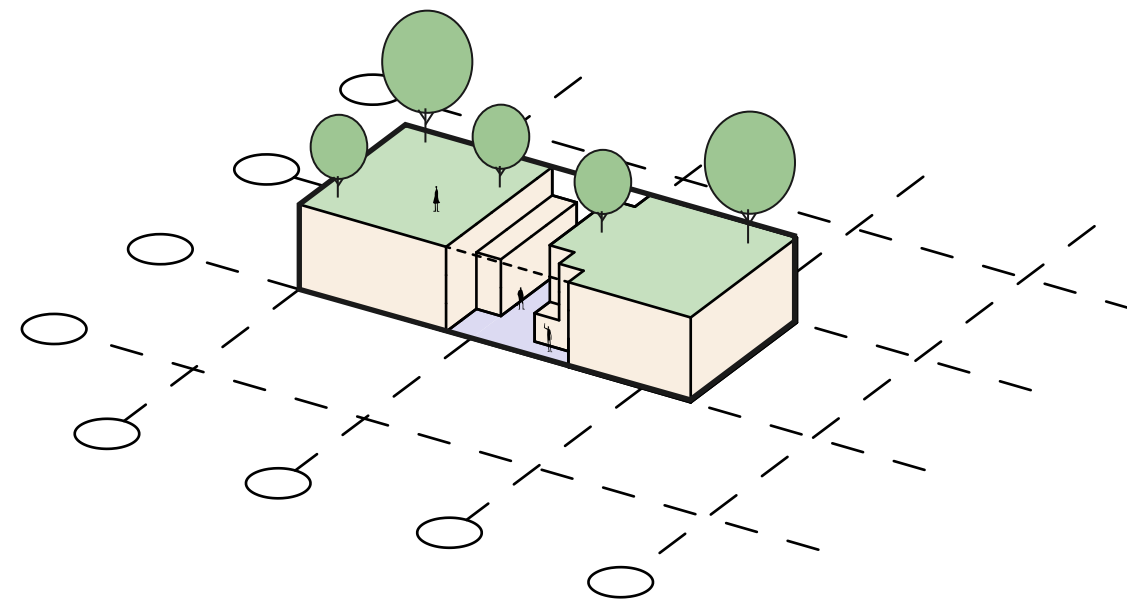
### Single Block

Additional public space



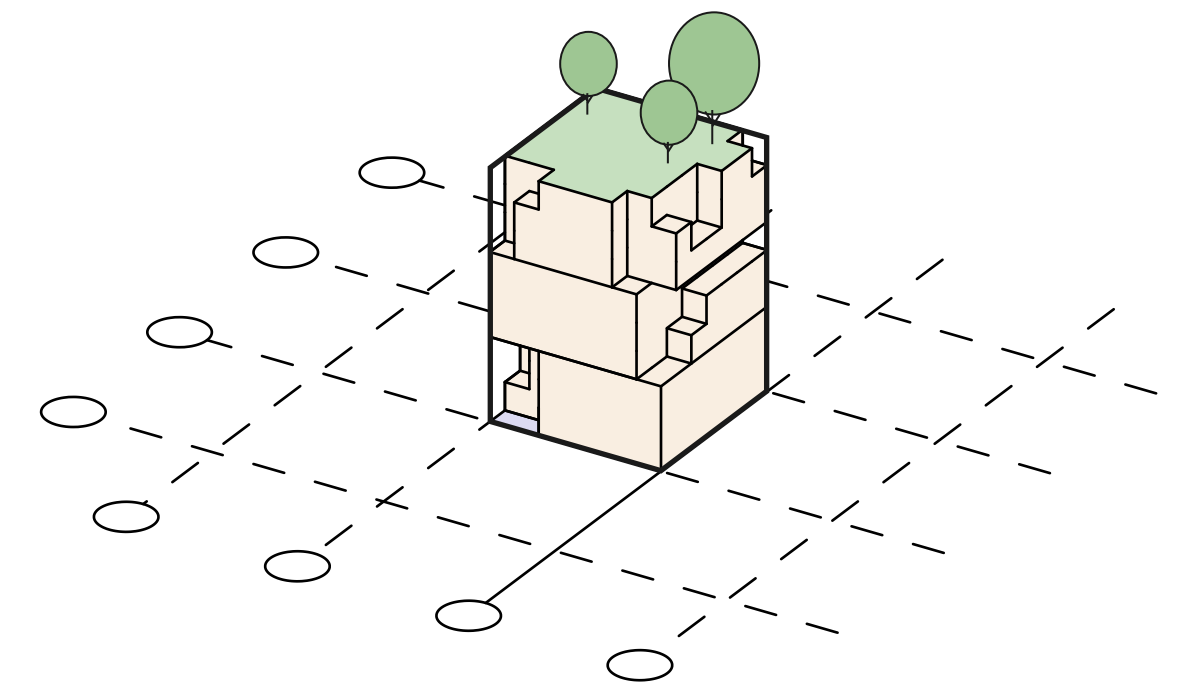
### Conversation

The choices each block make influence the quality of the inbetween space!



### No interaction

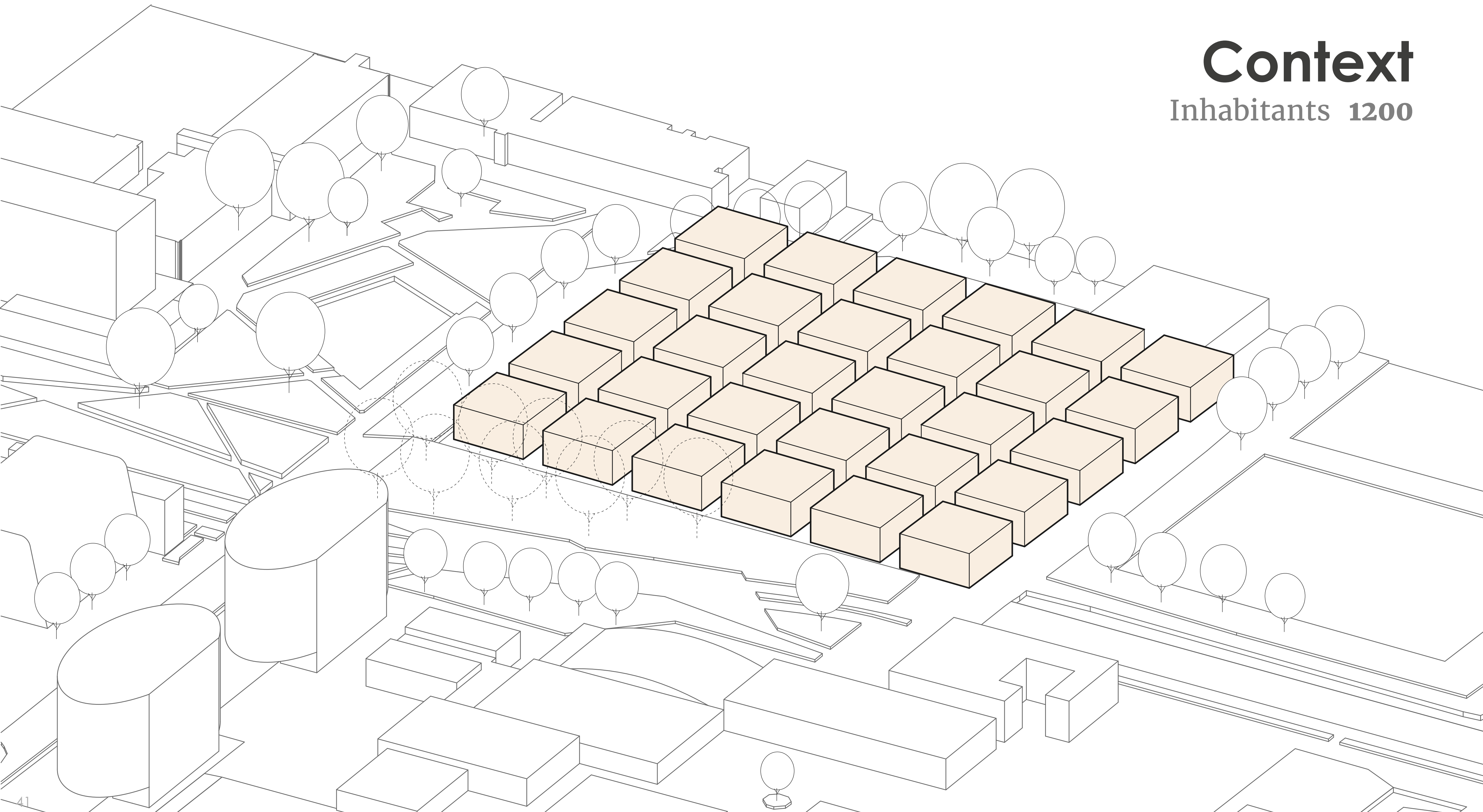
The choices each block make don't interact with each other





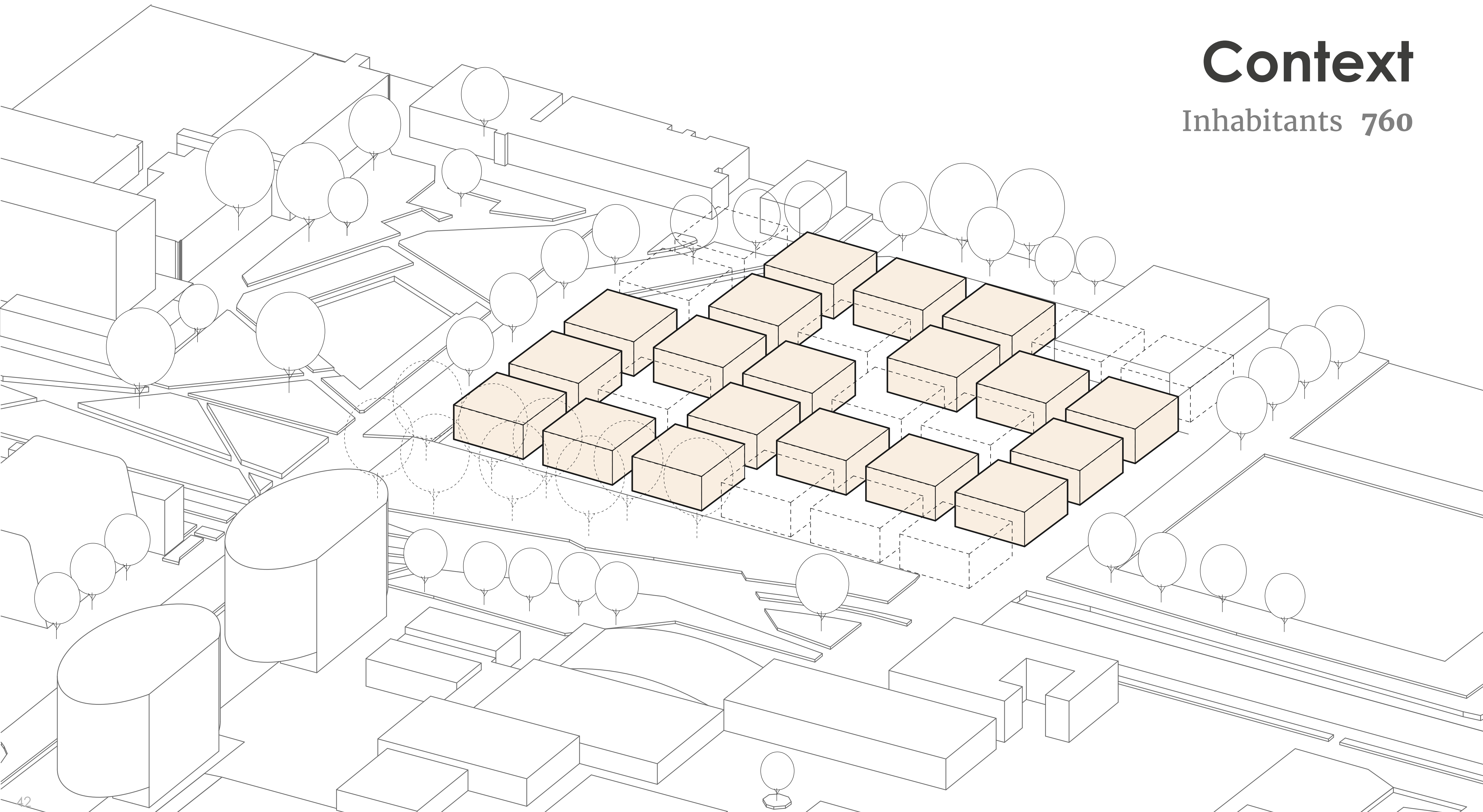
# Context

Inhabitants 1200



# Context

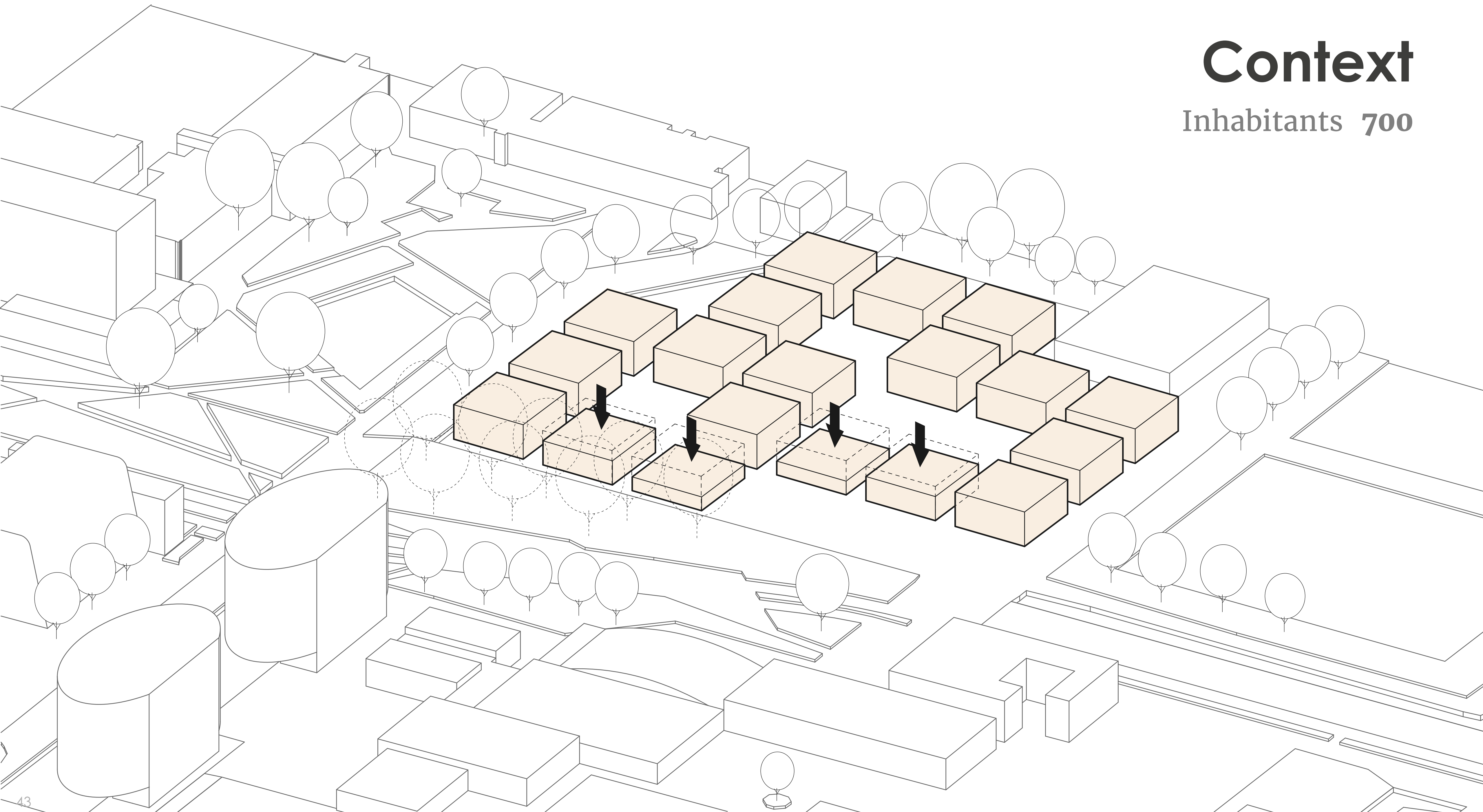
Inhabitants 760





# Context

Inhabitants 700

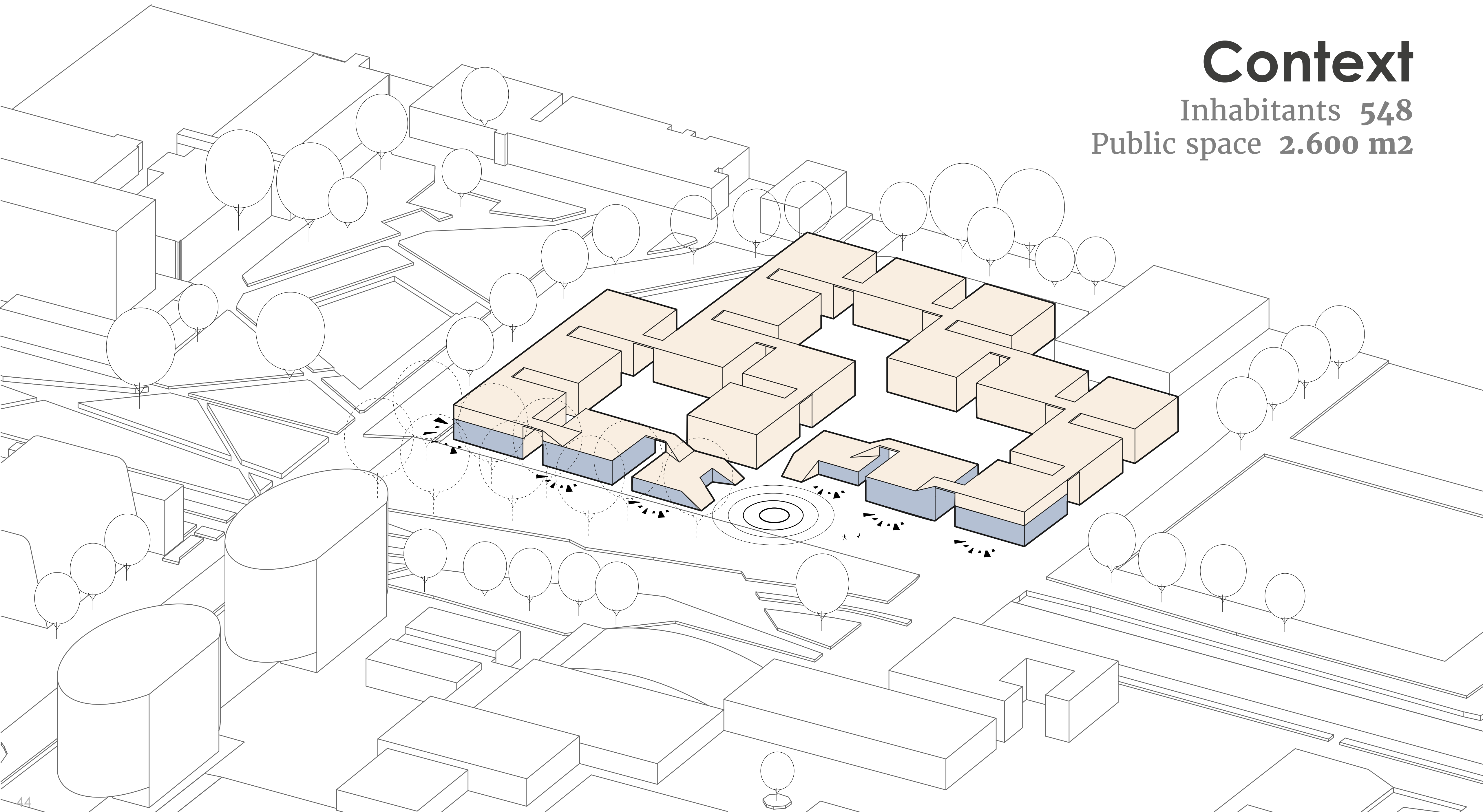




# Context

Inhabitants 548

Public space 2.600 m<sup>2</sup>

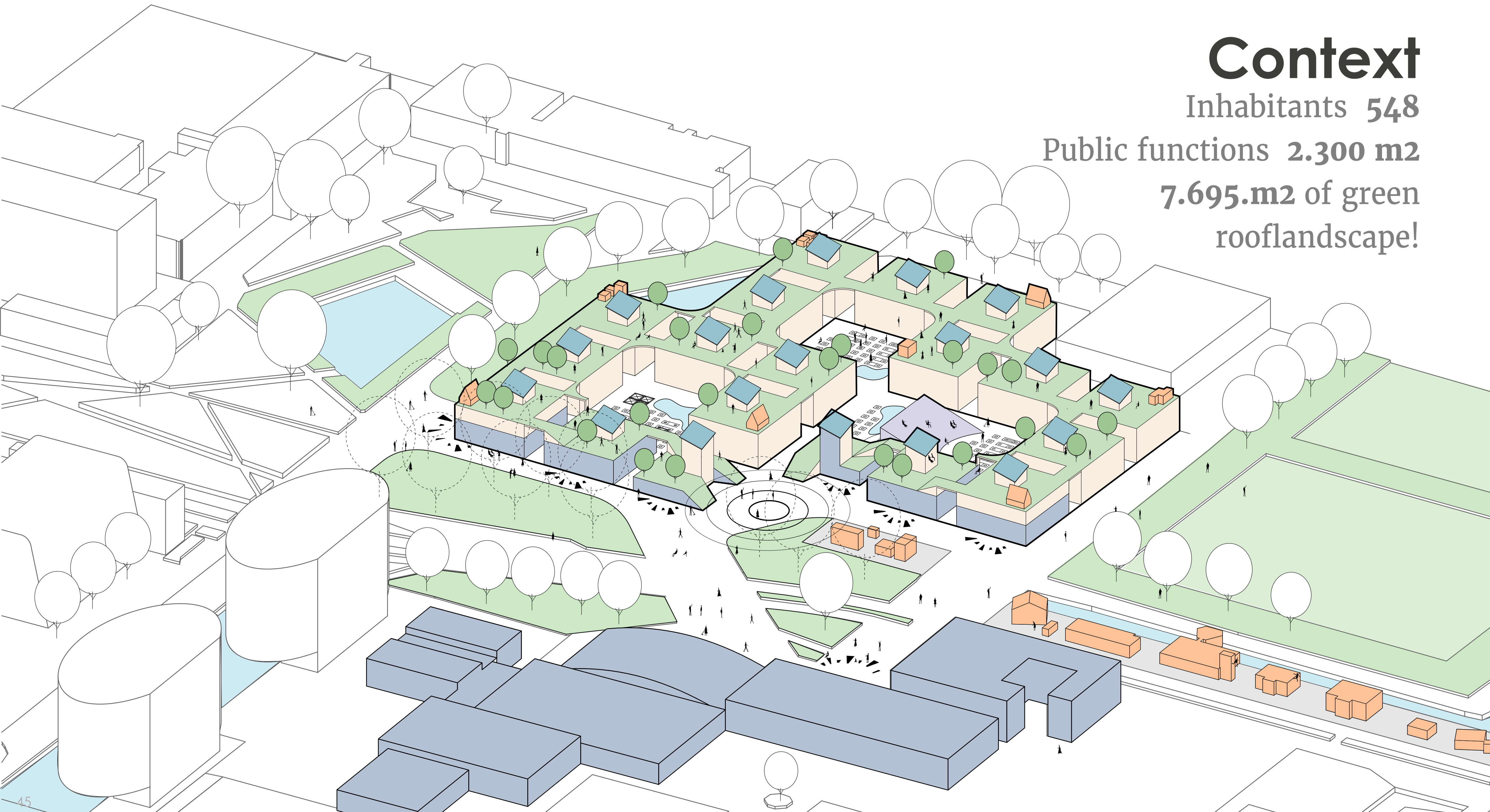


# Context

Inhabitants 548

Public functions 2.300 m<sup>2</sup>

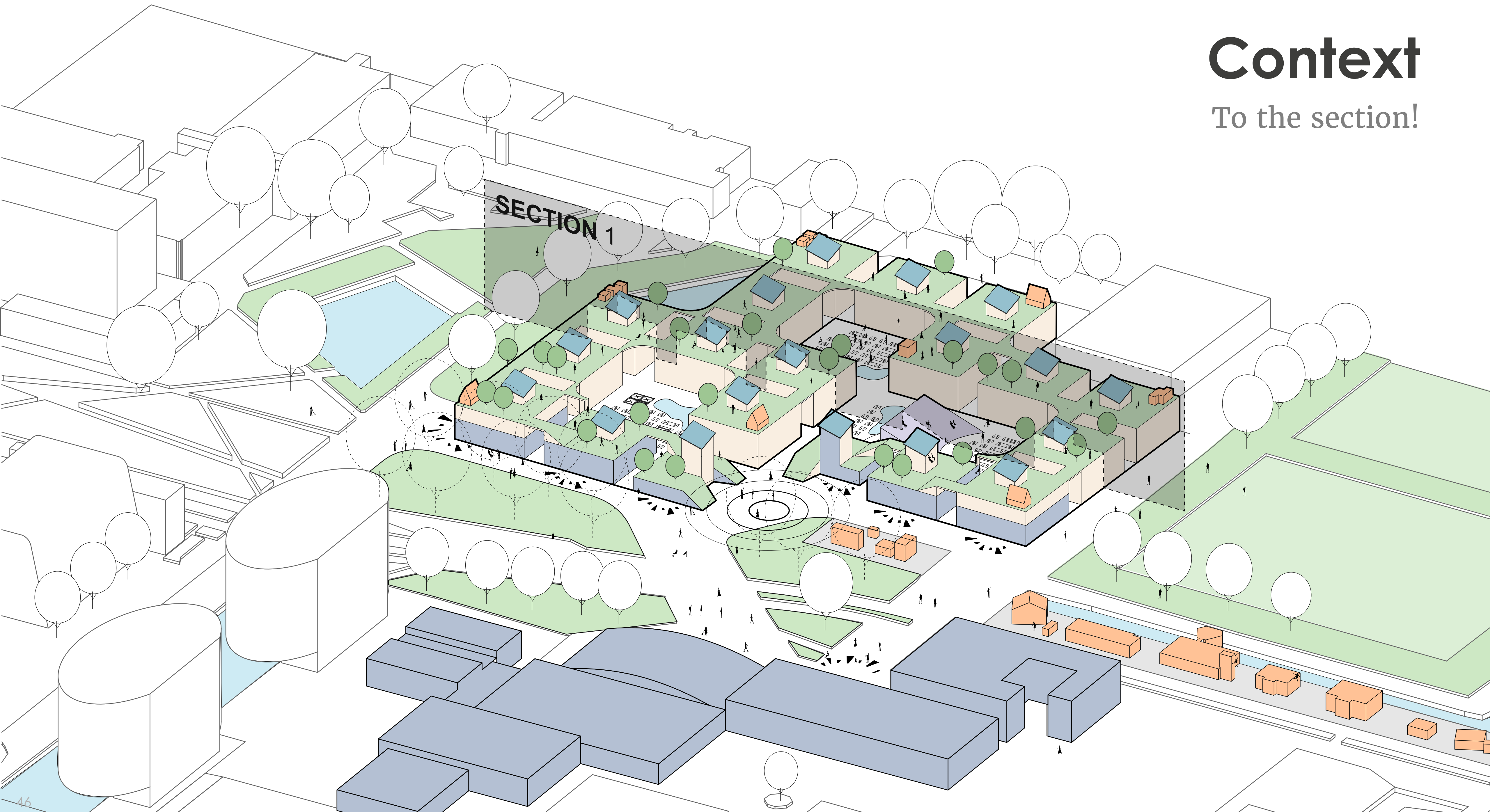
7.695.m<sup>2</sup> of green  
rooflandscape!





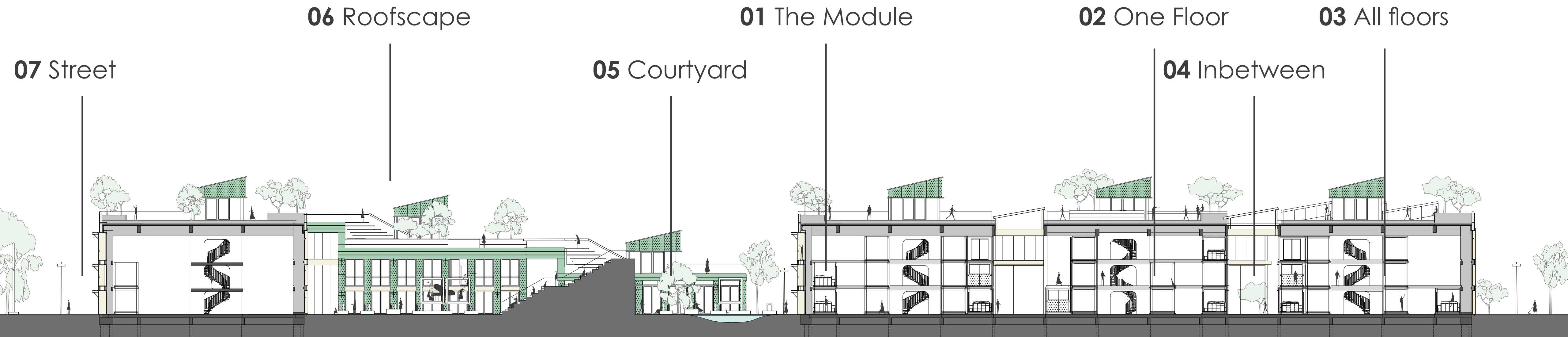
# Context

To the section!



# DESIGN

A walk through all scales.



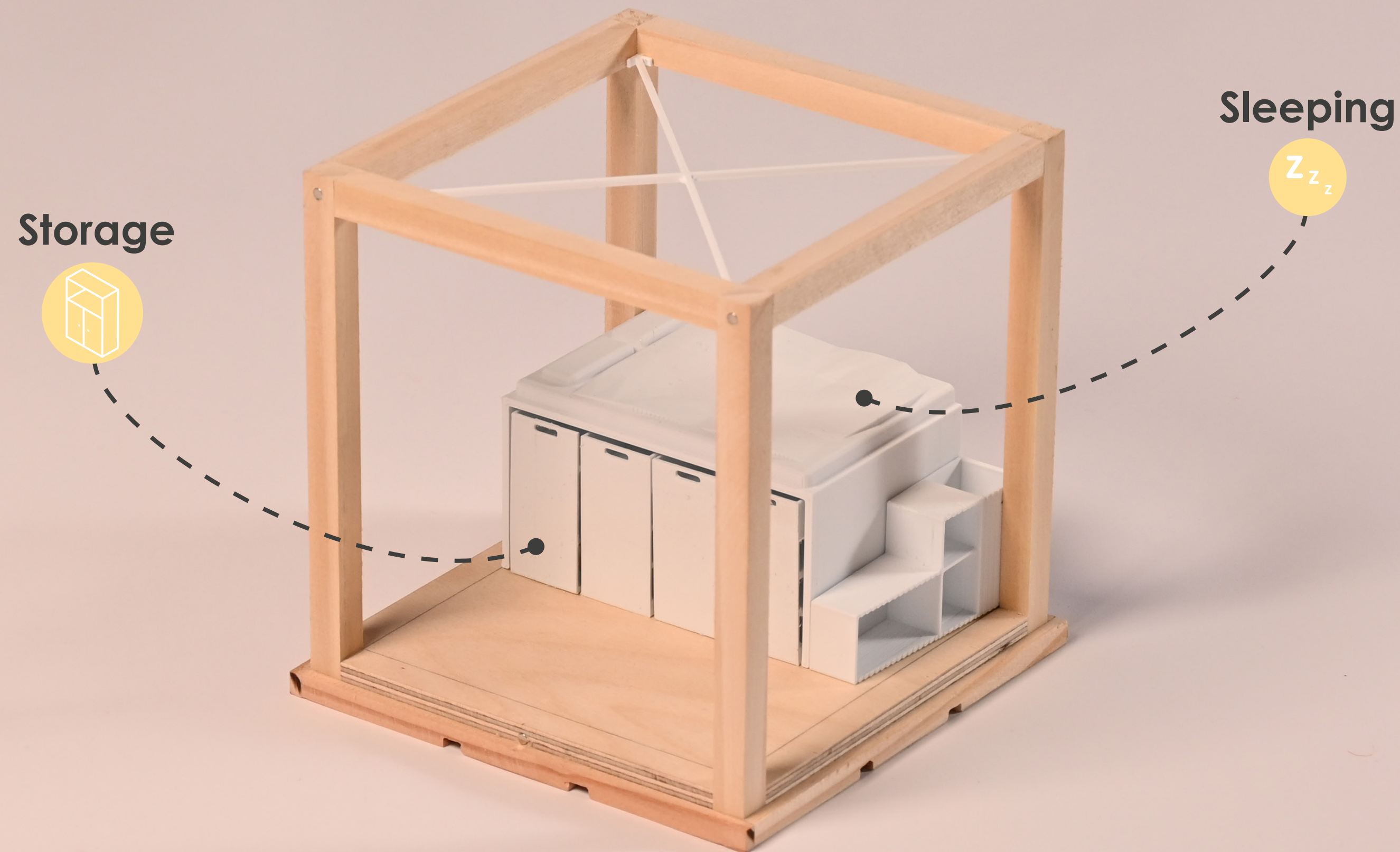
From **Private** ● .....→ to **Shared**



# 01 THE MODULE

## Private space

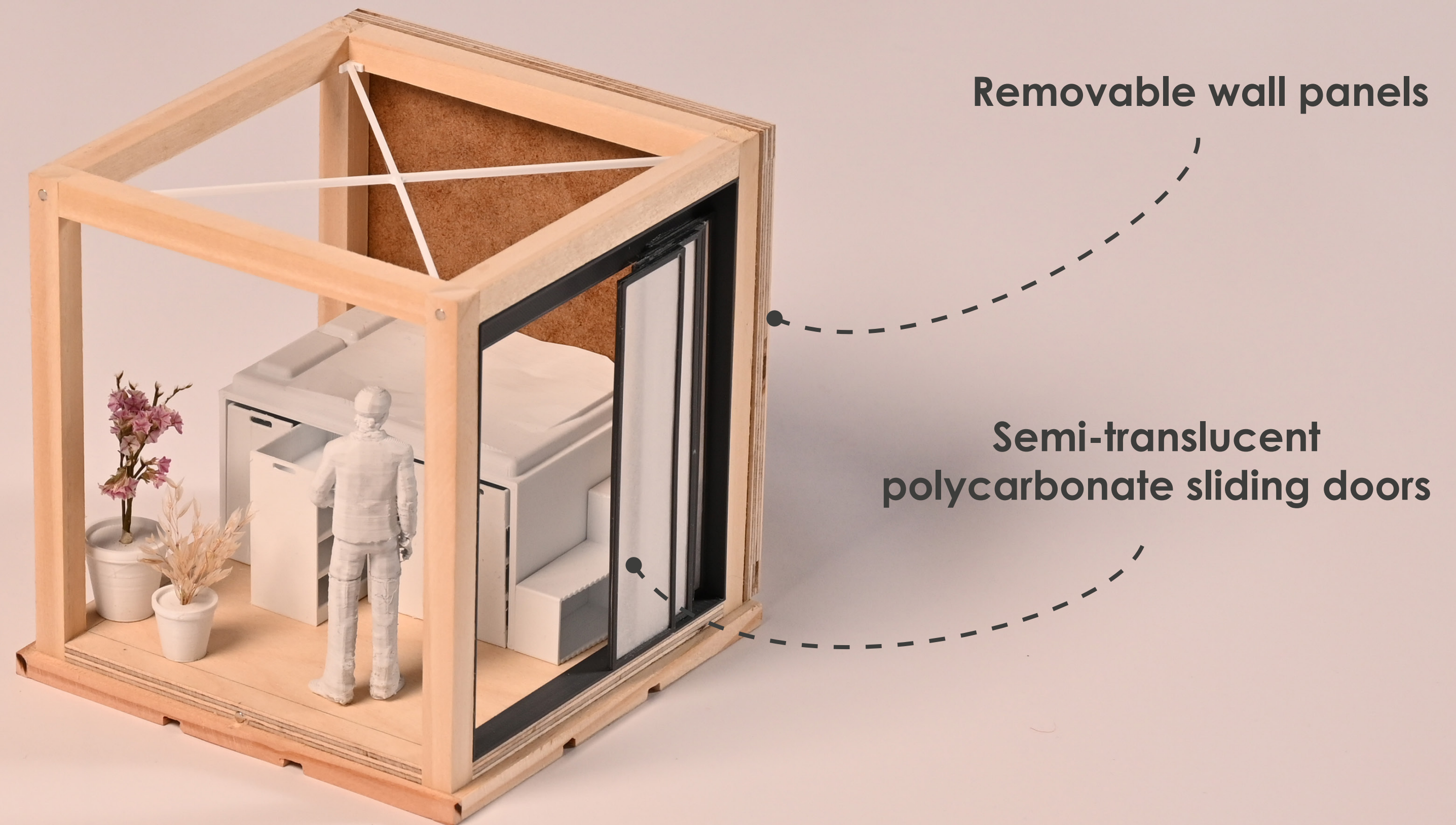
The module is based on the desired functions in the private space **storage** and **sleeping**





# 01 THE MODULE

Wall elements

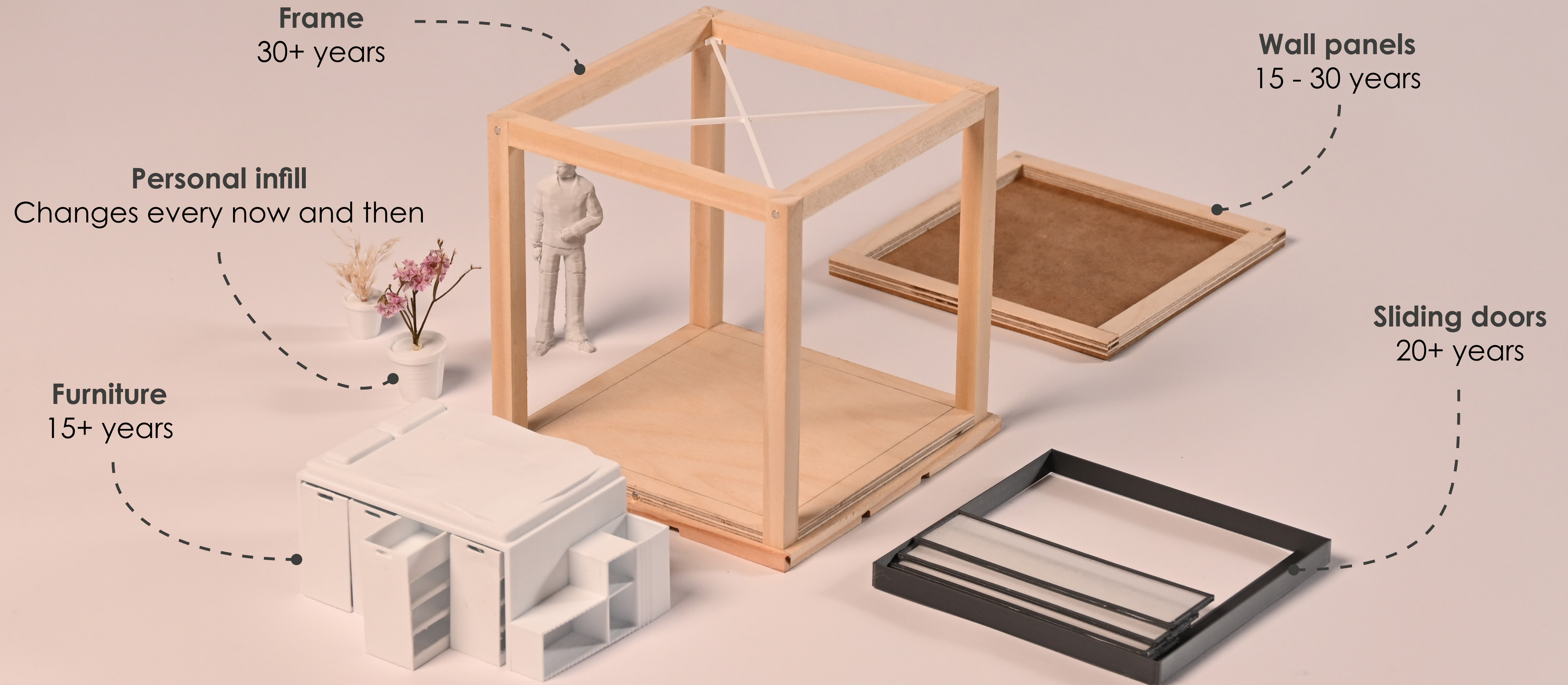




# 01 THE MODULE

## Lifespan

Expected lifespan of various elements

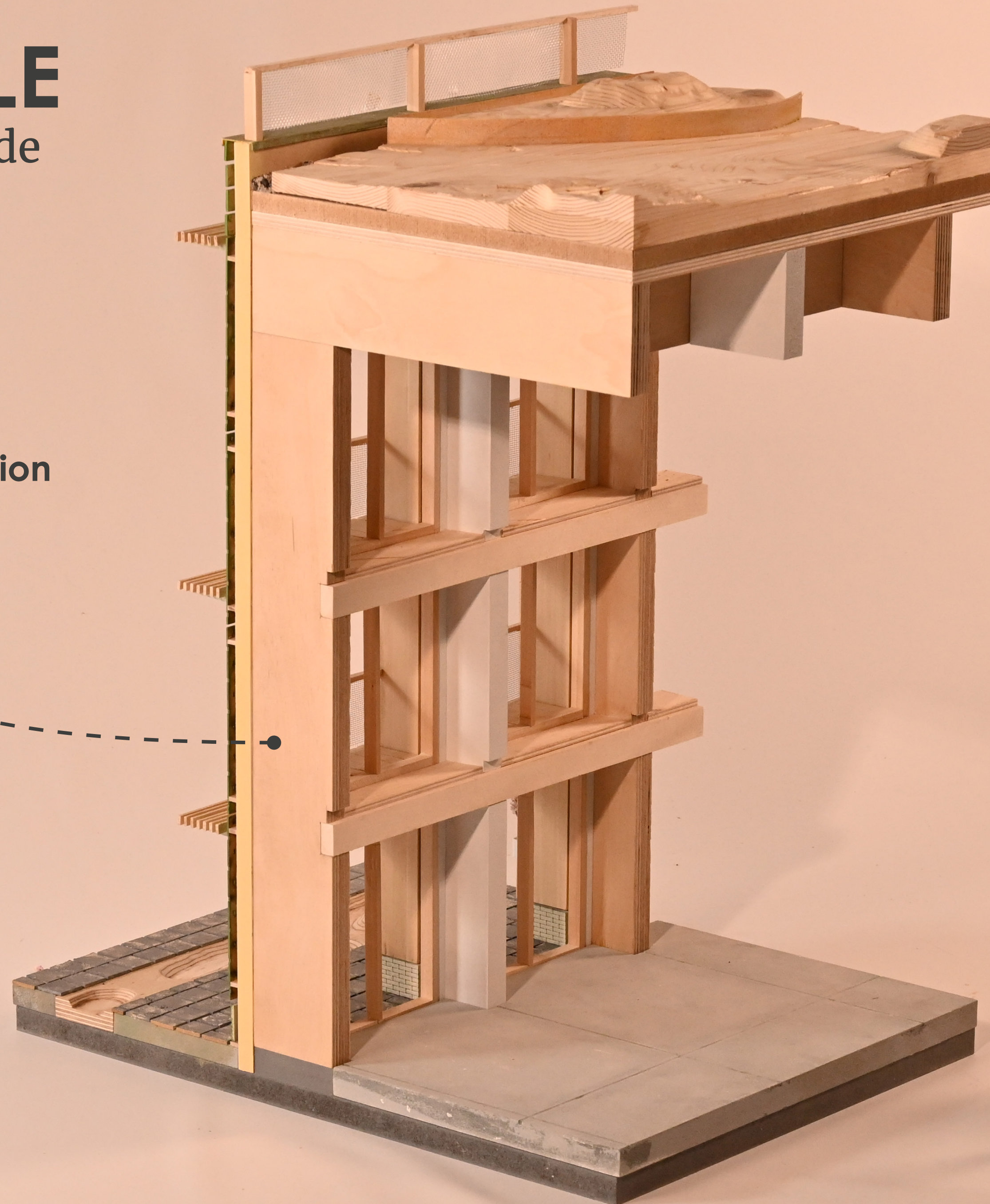
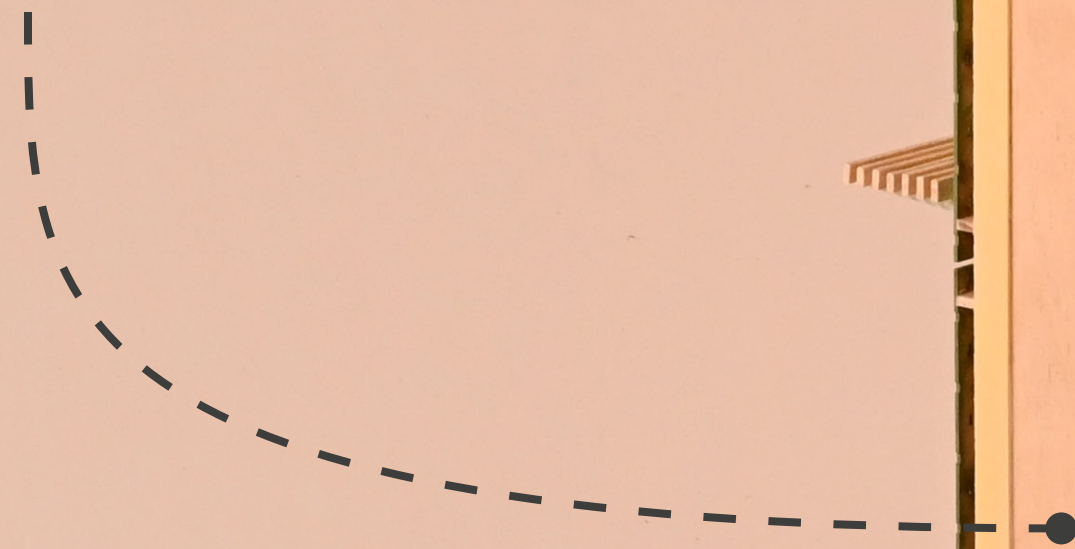




# 01 THE MODULE

Attaching to the facade

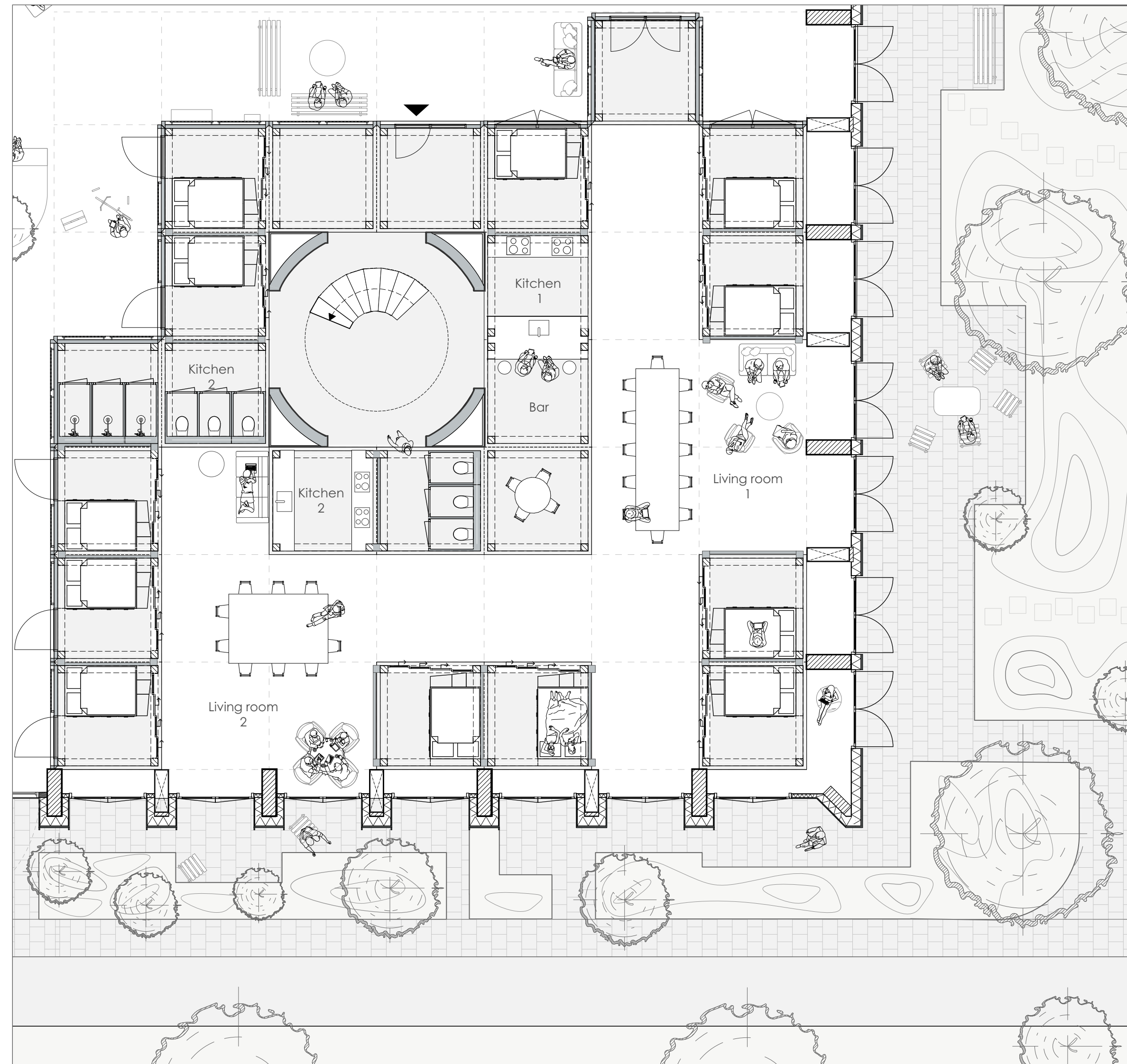
Glulam Timber Construction





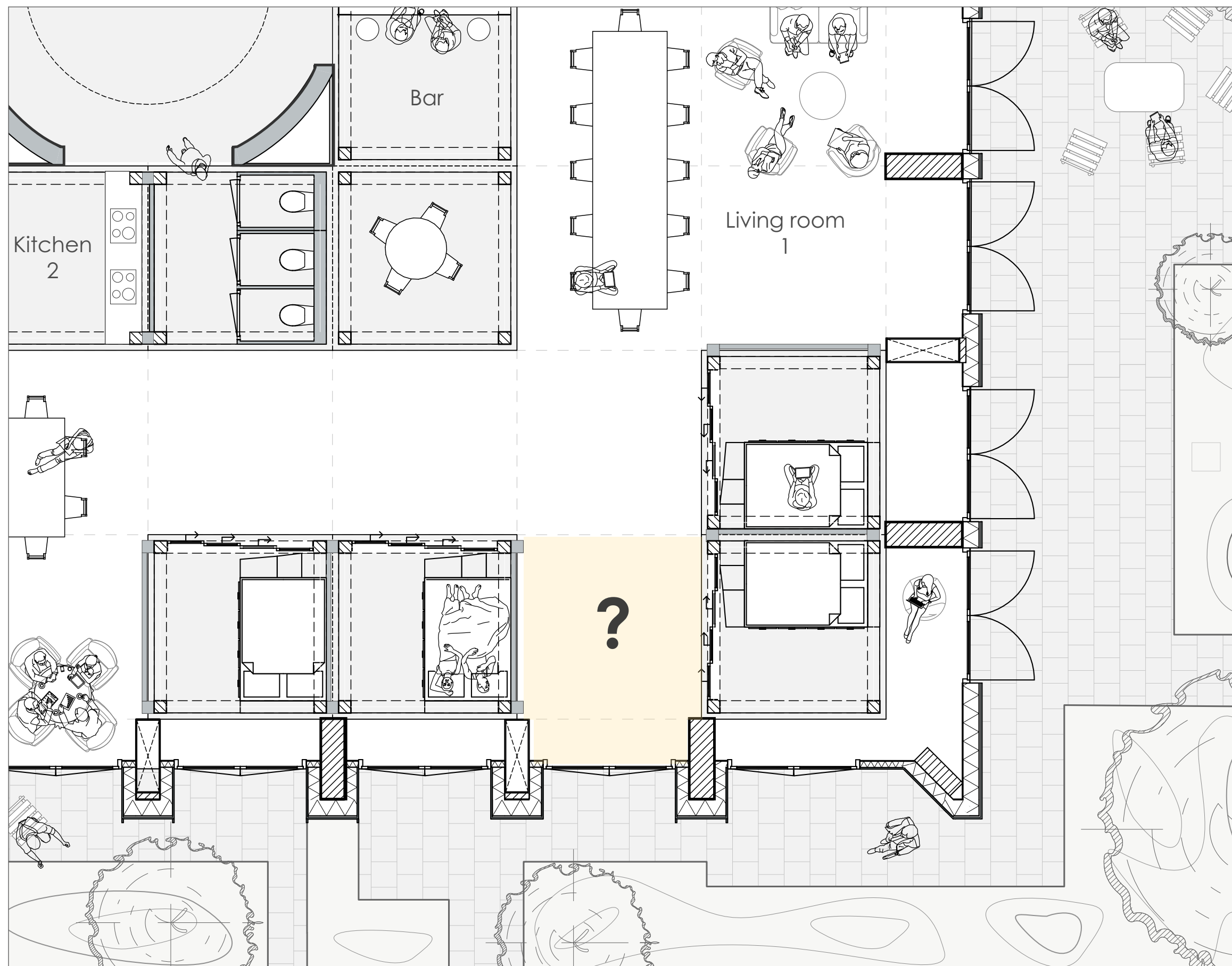
# 02 One Floor

From module to floorplan



# 02 One Floor

## Arranging the floorplan



### Choices to be Made

To whom does this space belong?

To the neighbouring modules  
**2 people**

To the groundfloor inhabitants?  
**12 people**

To the whole block?  
**40 people**



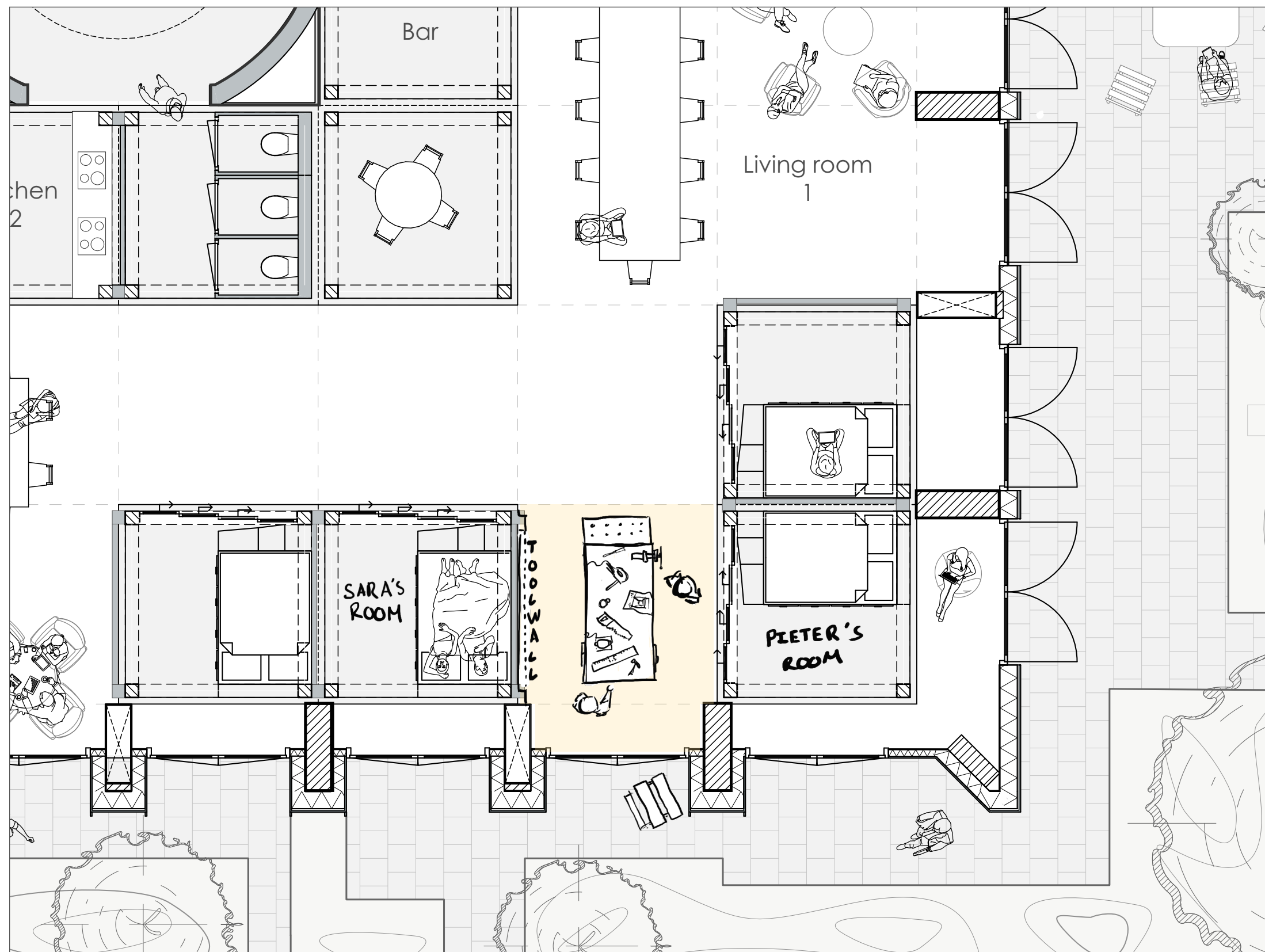
# 02 One Floor

## Choices to be Made

To whom does this space belong?

Together with the block Pieter and Sara decided that they take ownership over the space. Because of their shared passion for woodworking they created a dedicated workbench & tool storage!

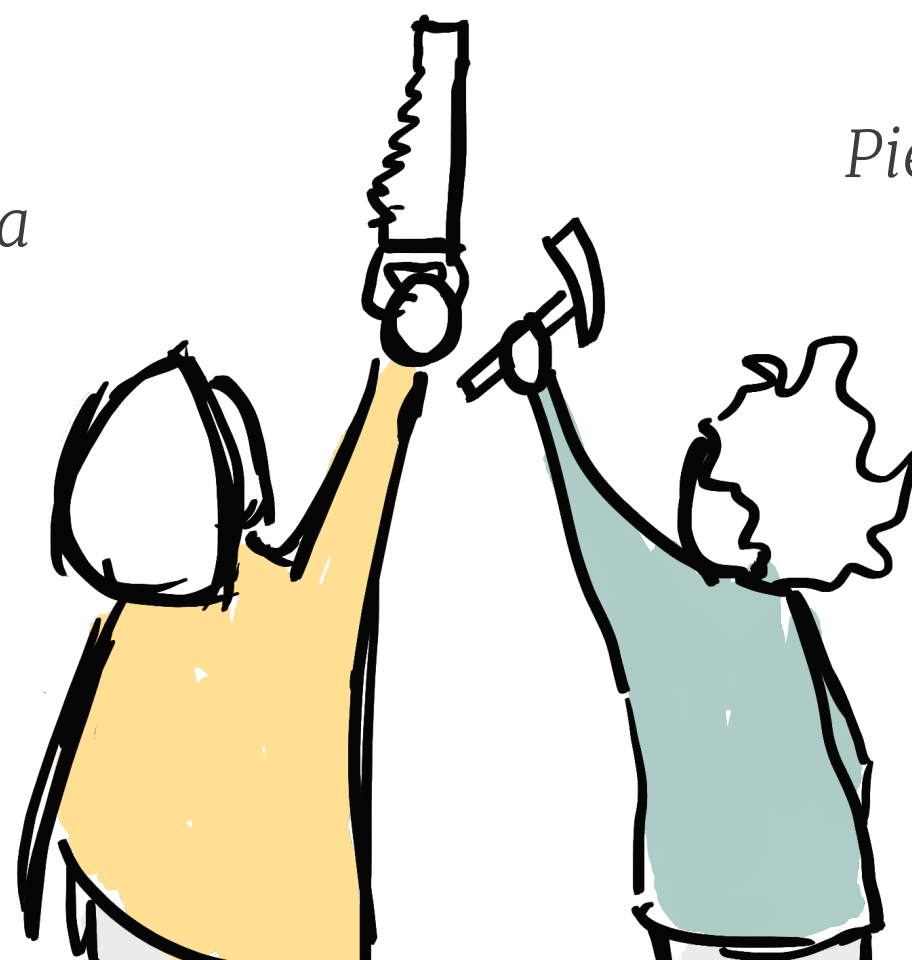
The rest of the house is also more than welcome to use the space.



*“Woodworking is  
the best”*

Sara

*“Yeah I love it too!”*  
Pieter

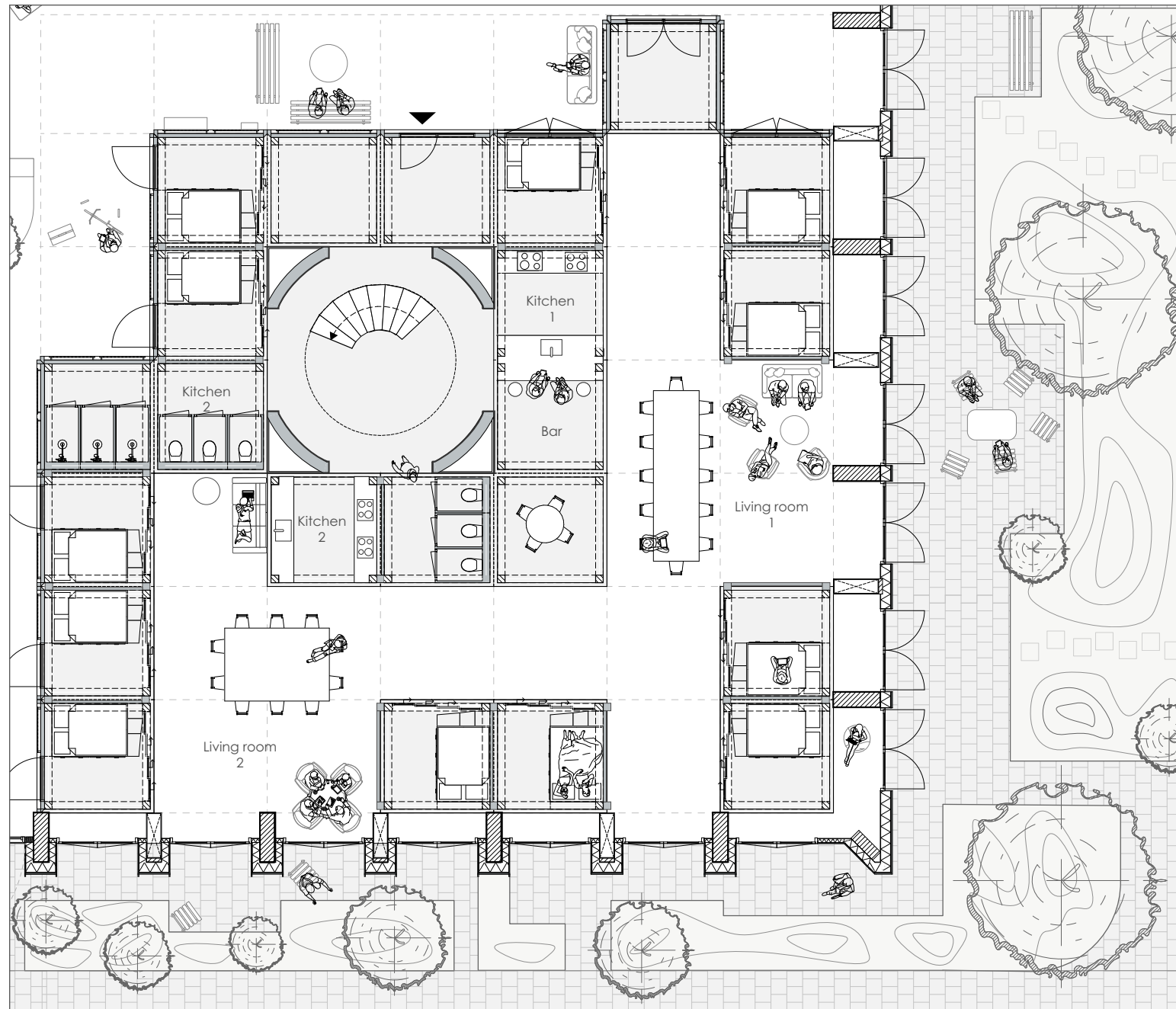


# 02 All Floors

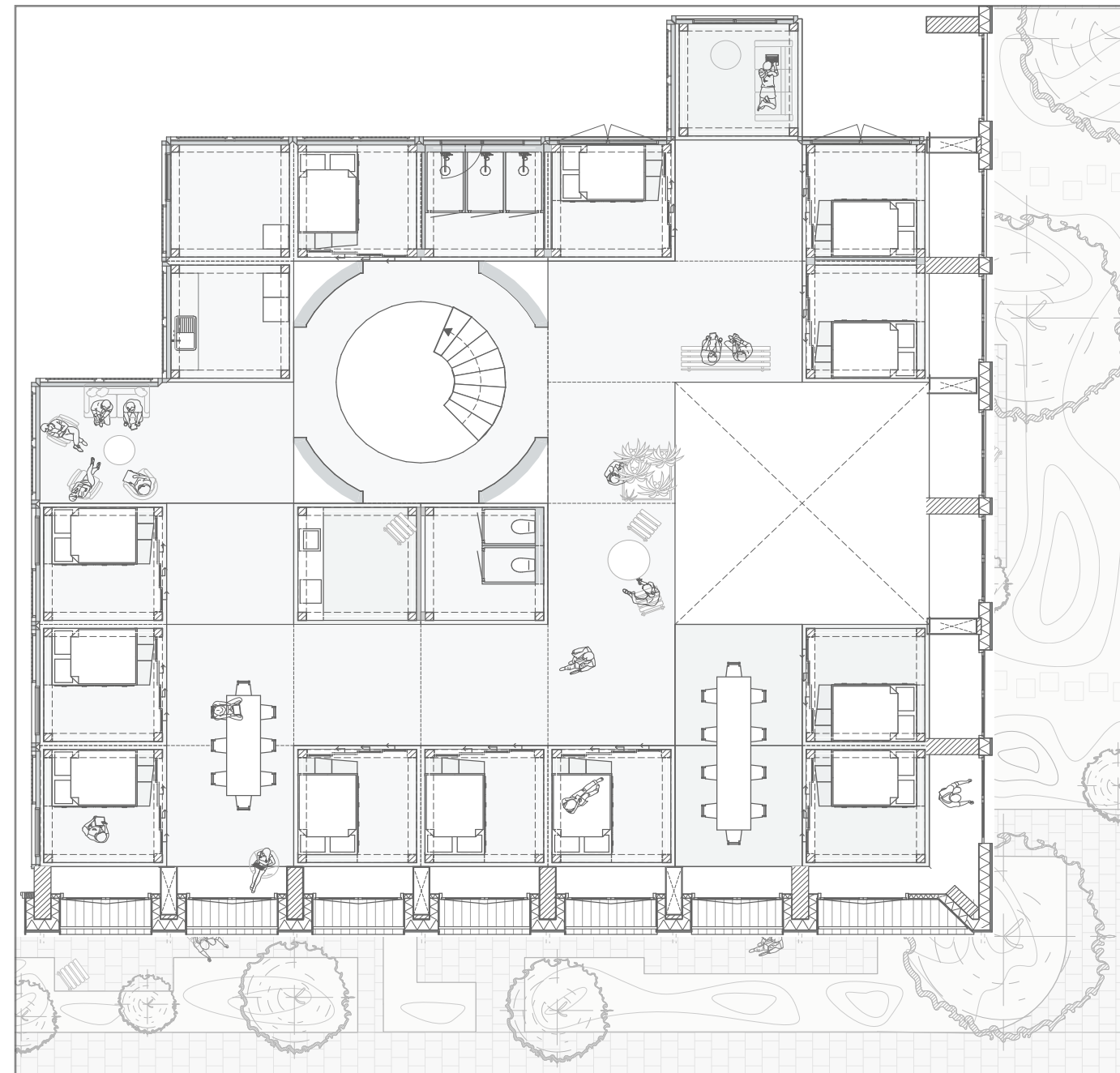
Arranging the floorplan

Each floor a different character

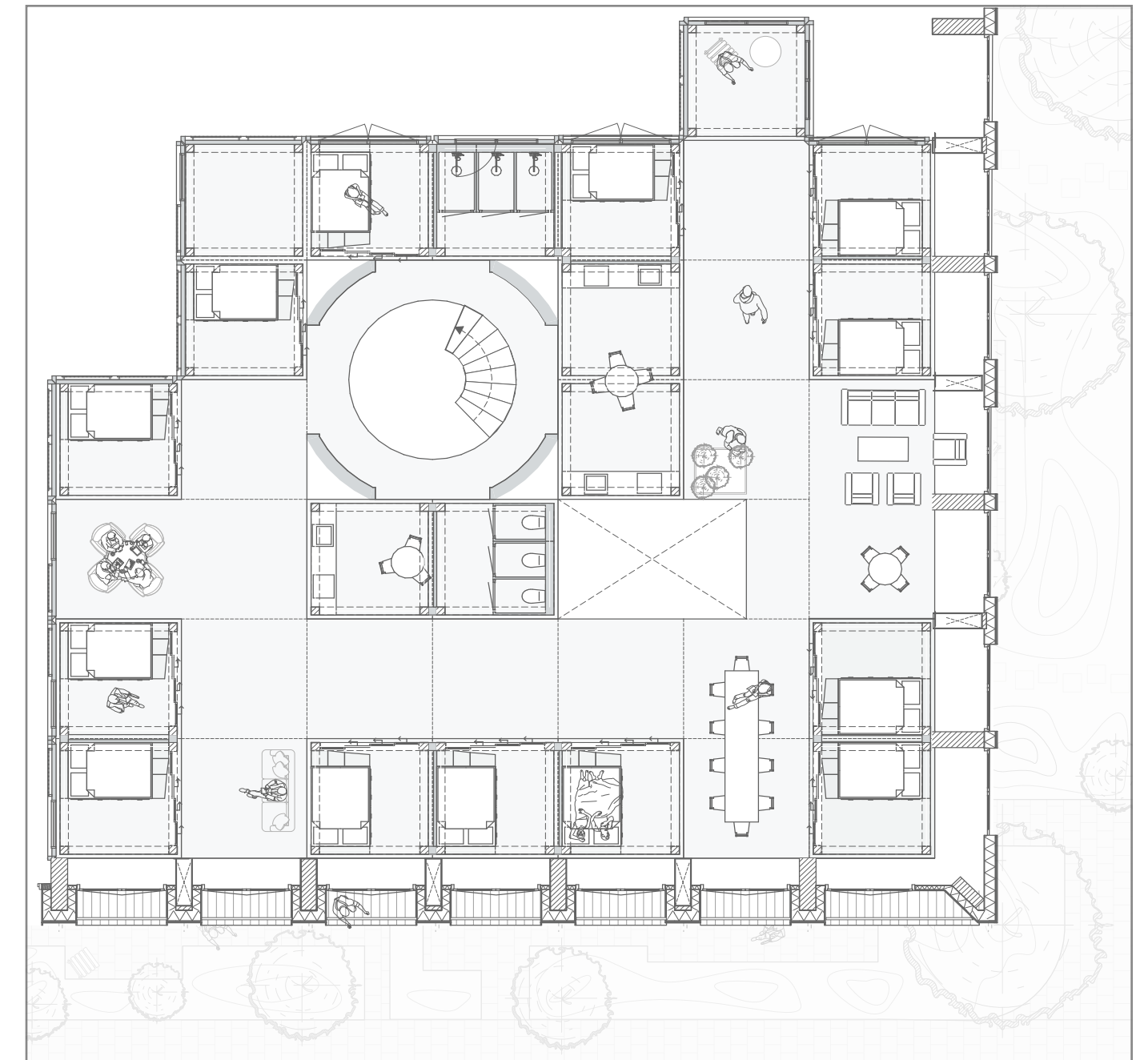
Groundfloor



1st Floor



2nd Floor





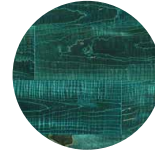
# 03 All Floors

## Facade design





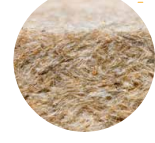
**Accoya Shou sugi Ban**  
Burned and stained hardwood



**Facade panels**  
Pegboard for personal infill



**Flaxwool**  
Insulation d 260mm Rc 7

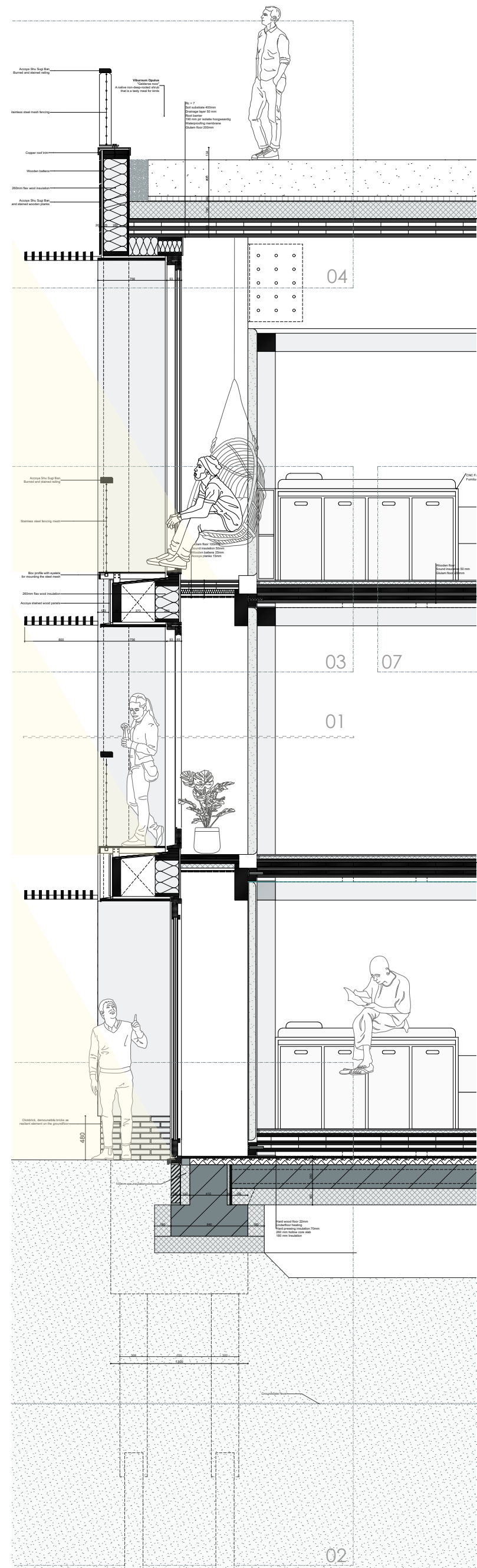


**Clickbrick**  
Démontable dry mounted bricks



**Betonpzetter**  
Waterproofing for the wooden piles

**Wooden foundation piles**  
Sustainable and low CO2 foundation



# 03 All Floors

## Facade design





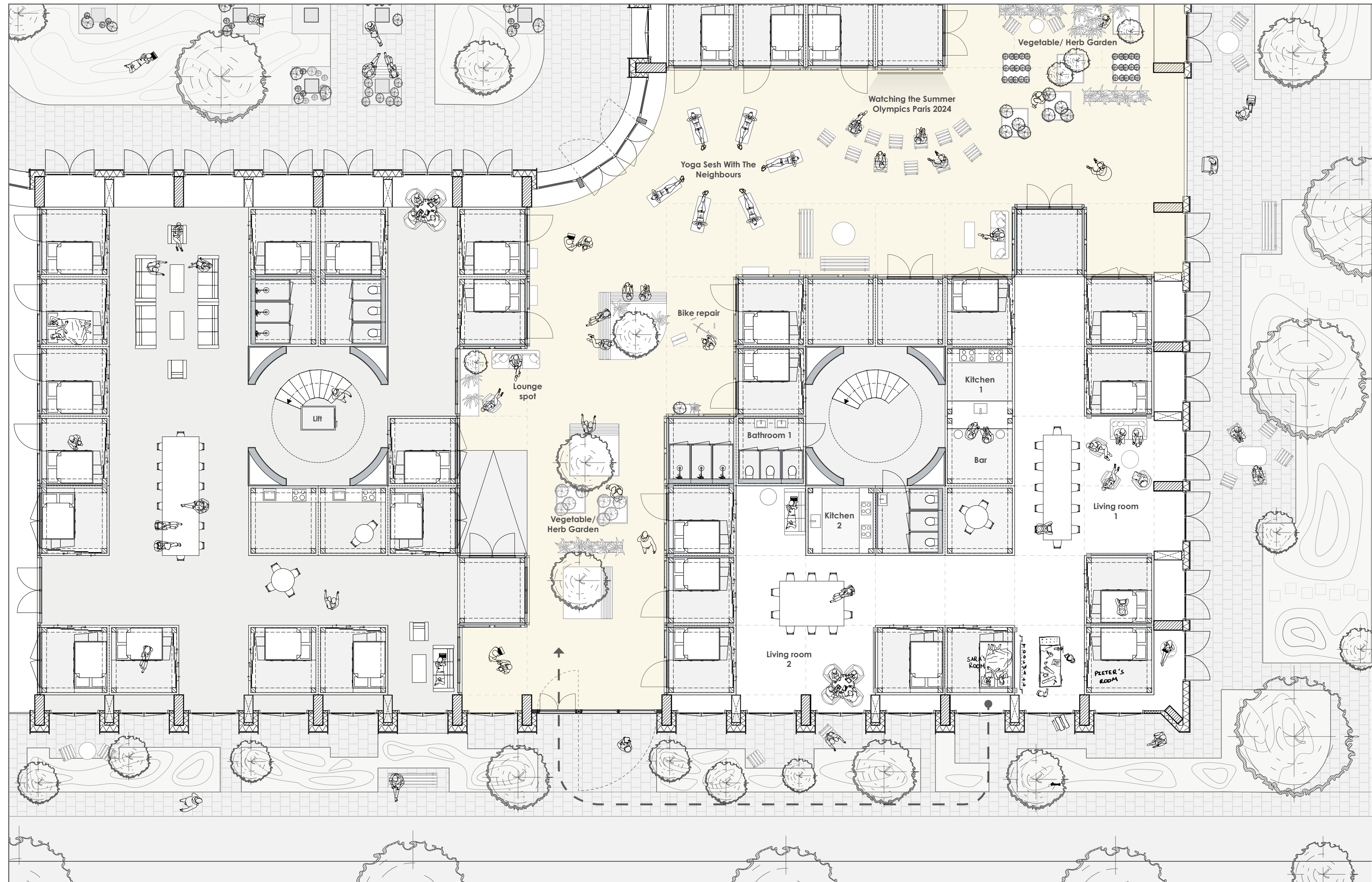








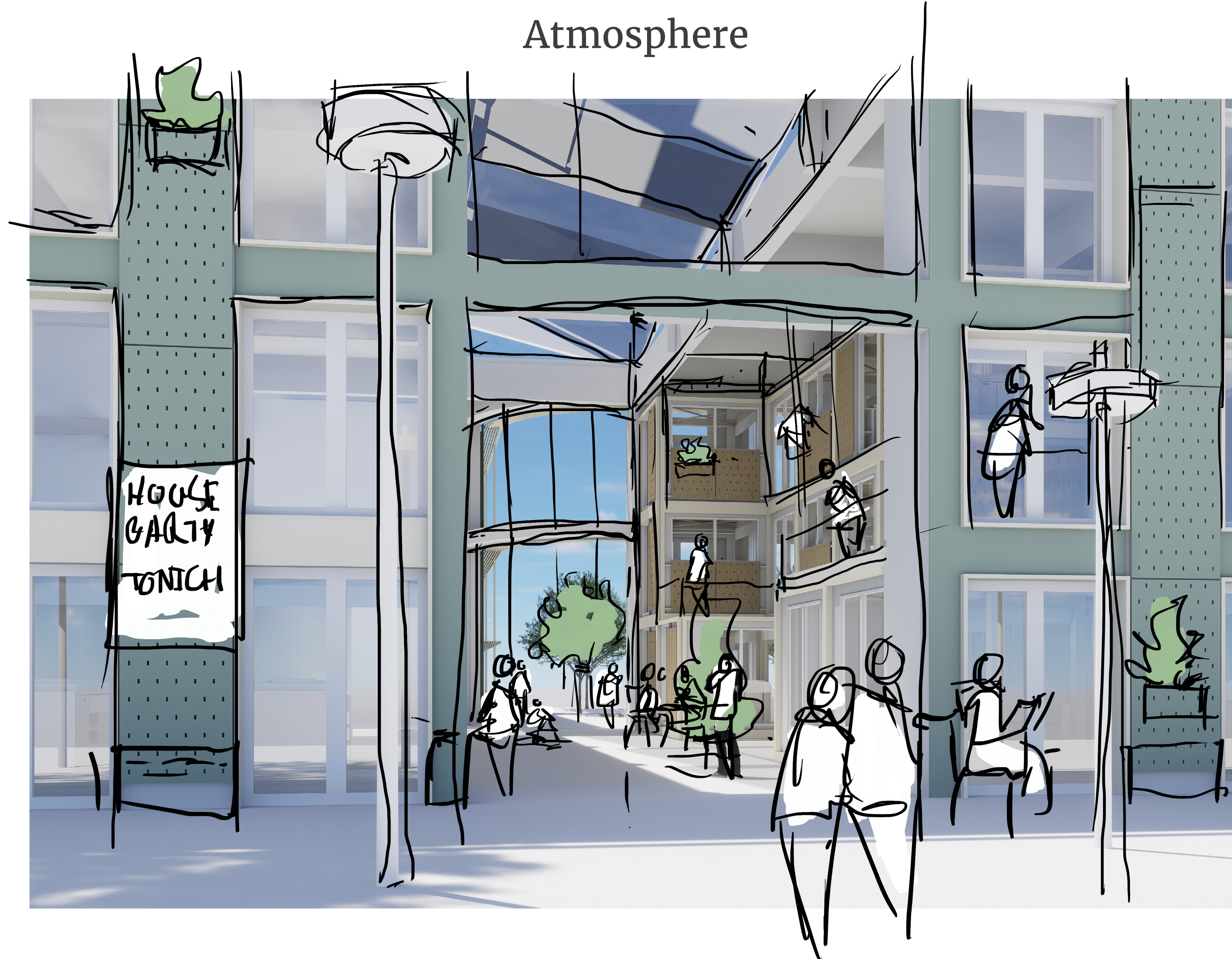
# 04 Inbetween Interaction between the blocks





# 04 Inbetween

## Atmosphere



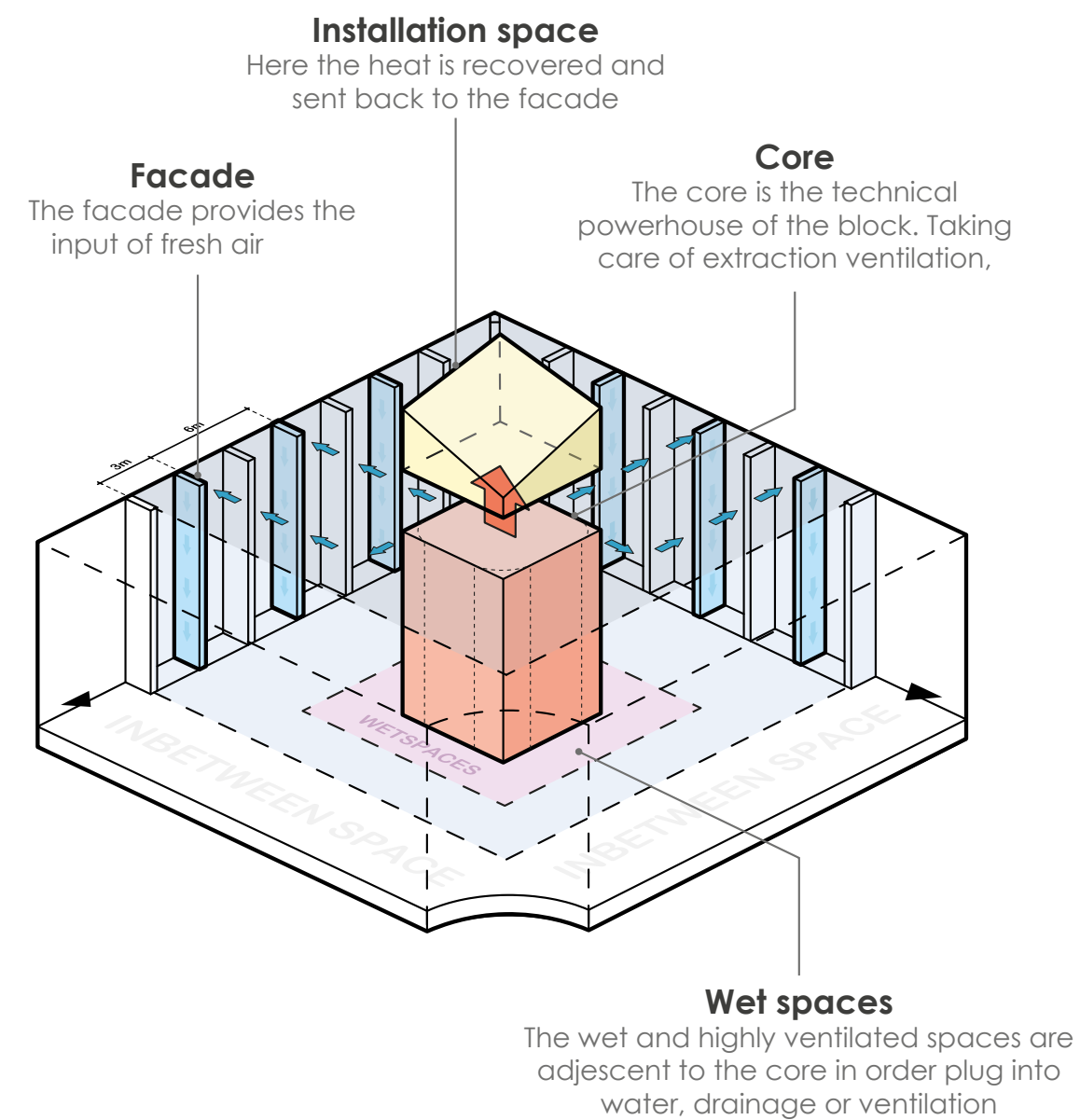


# 04 Inbetween

## Climate design

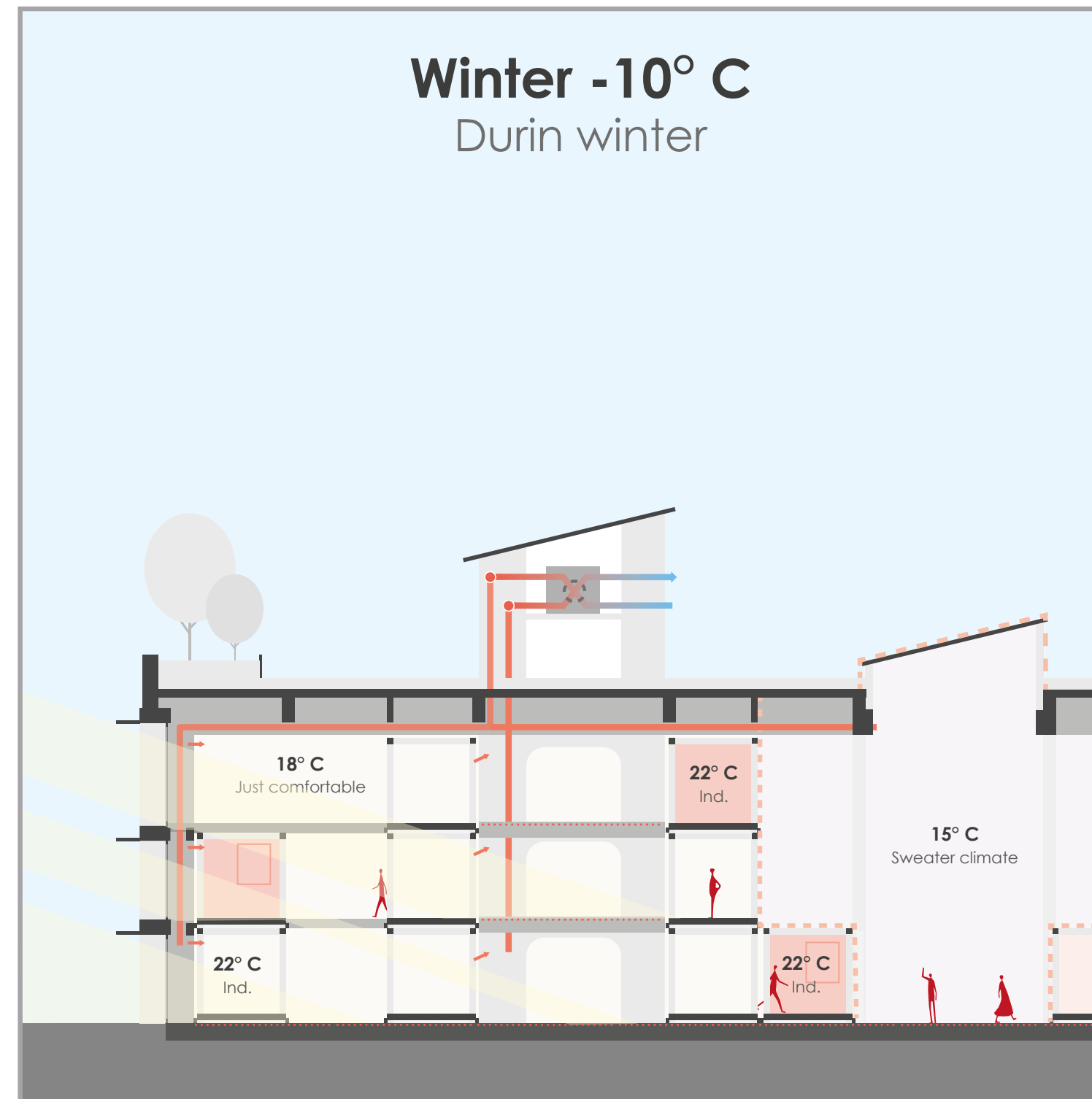
### Concept

Core extraction, facade input!



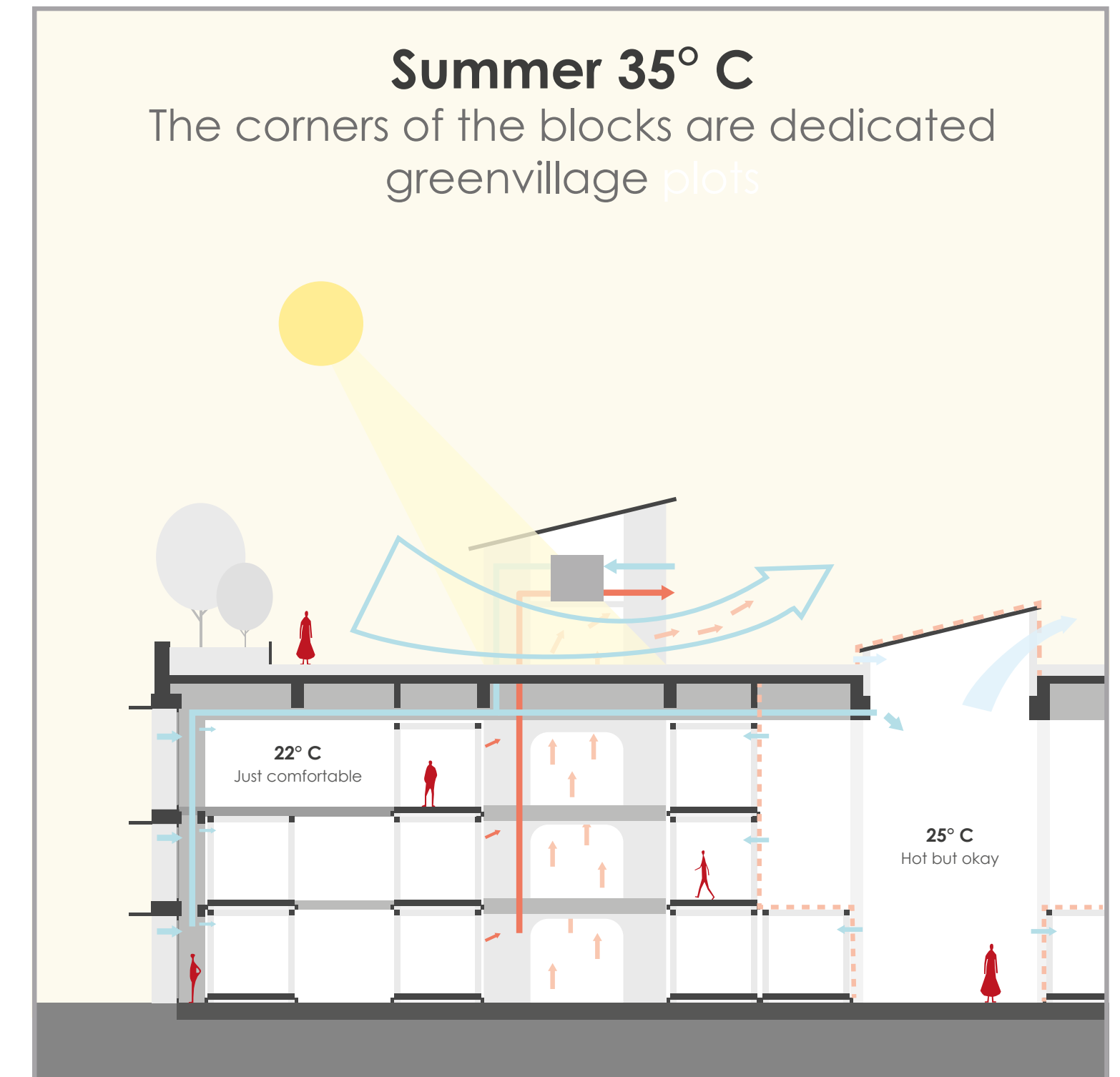
### Winter -10° C

Durin winter



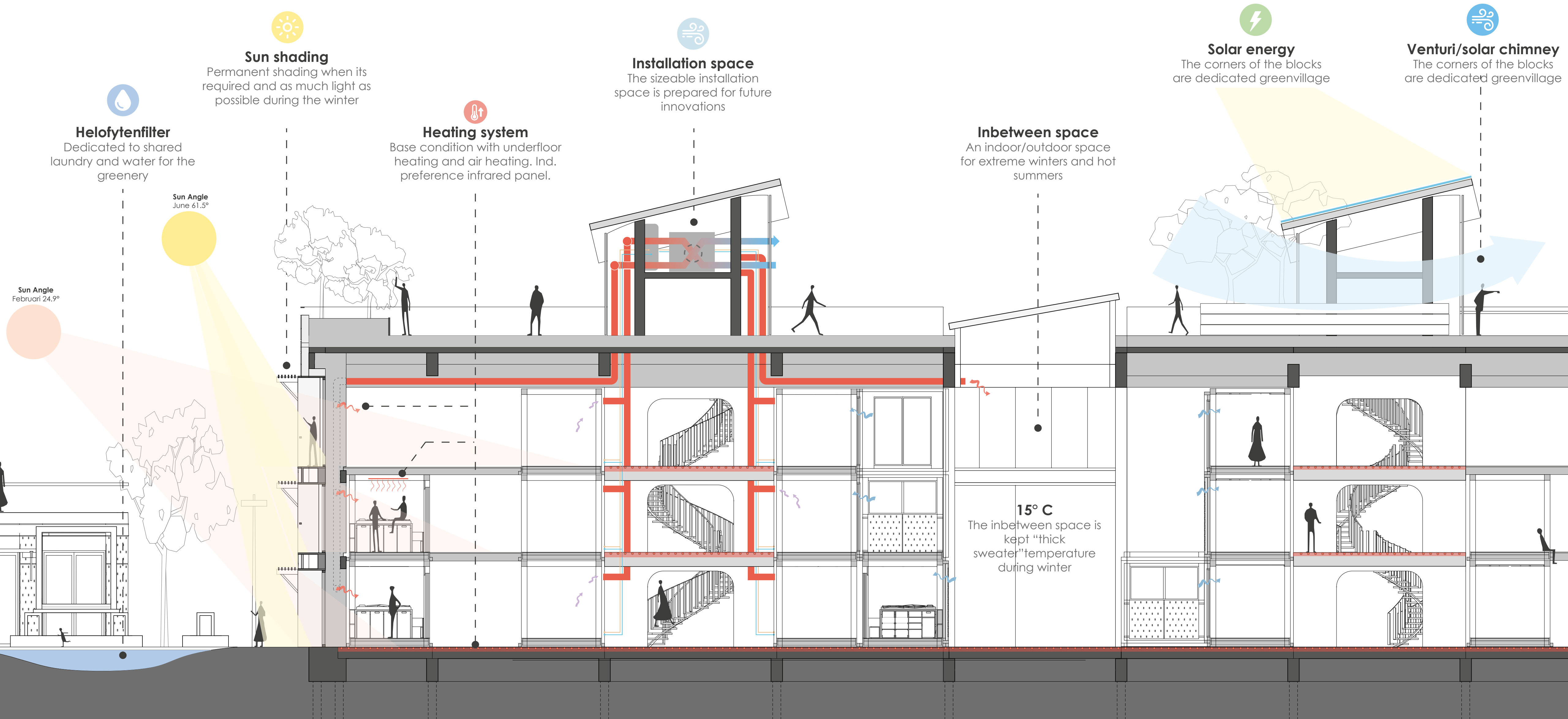
### Summer 35° C

The corners of the blocks are dedicated greenvillage plots



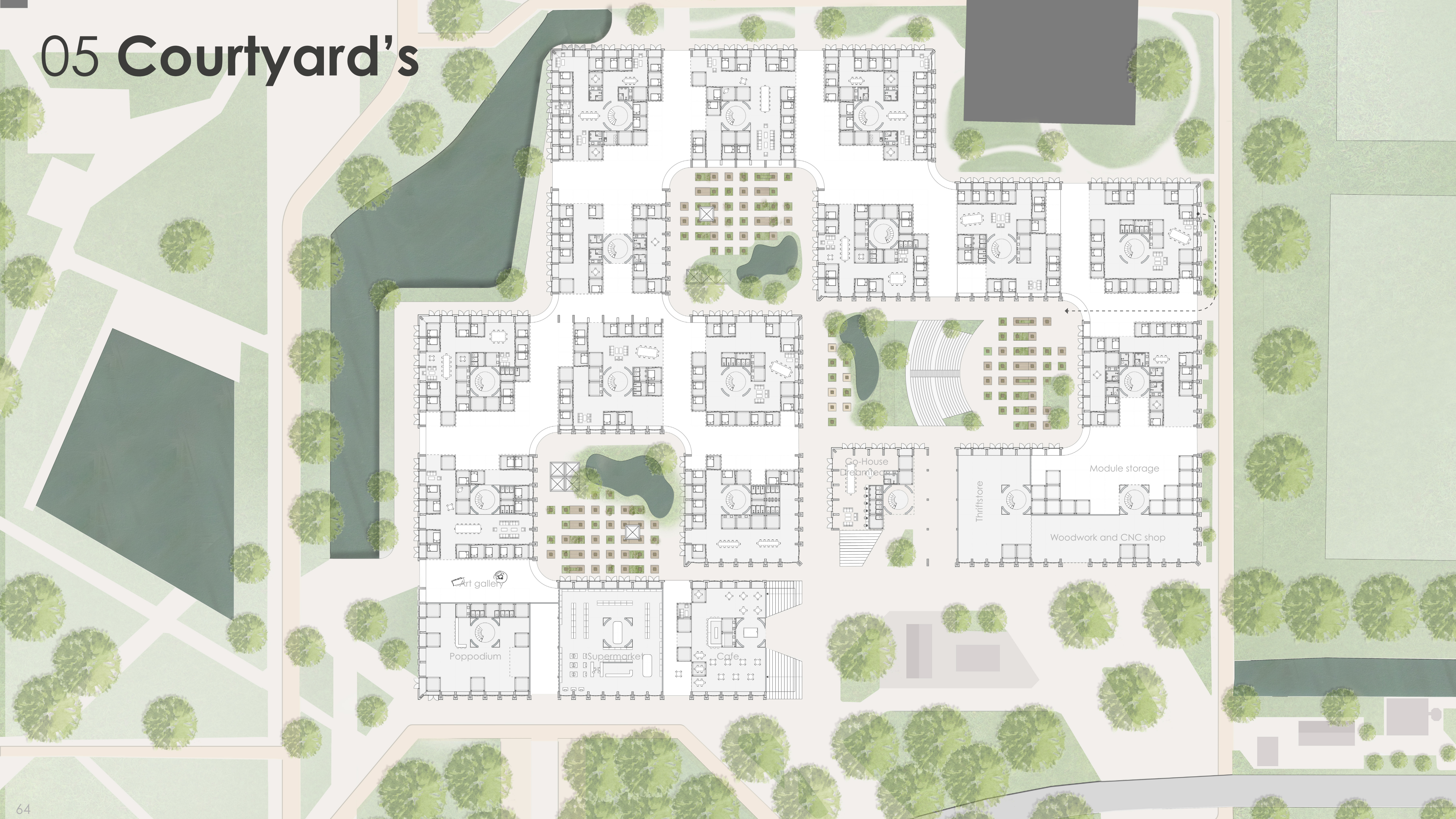
# 04 Inbetween

## Climate design



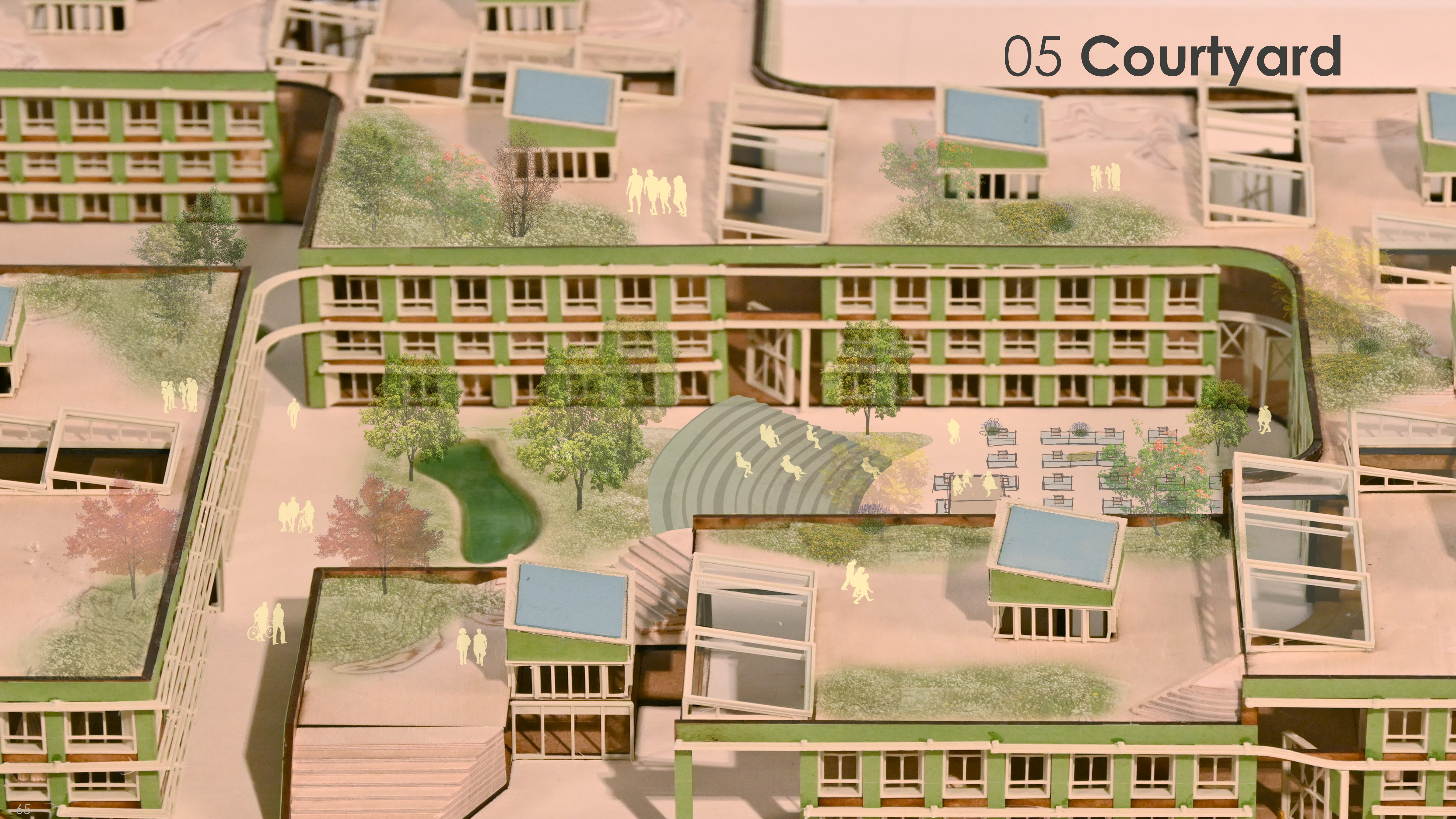


# 05 Courtyard's





# 05 Courtyard





# 06 Roofscape

## Biodiversity & Public greenspace

The chosen greenery was selected to stimulate biodiversity and be able to thrive in relatively shallow soil layer

## Food production

Vegetable gardens mainly as a social activity and awareness creator

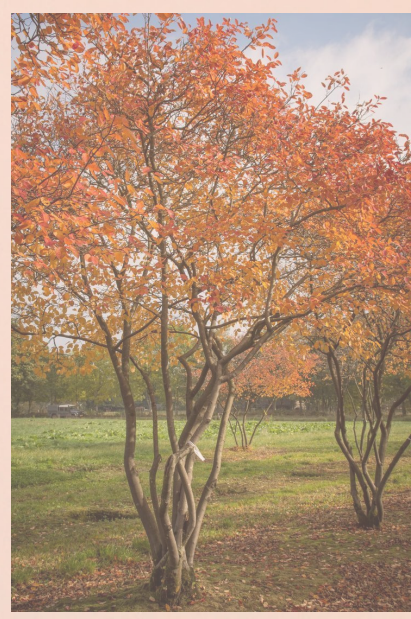
## Greenvillage plots

The greenvillage area that has been taken partly returns on the roof

## Activities

The roof should have enough quality to get people up the stairs!

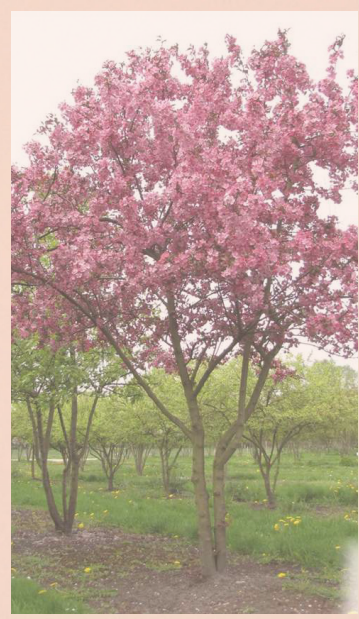
### Small Trees



Amelanchier Lamarki  
"Krentenboompje"



Acer Campestre  
"Veldesdoorn"

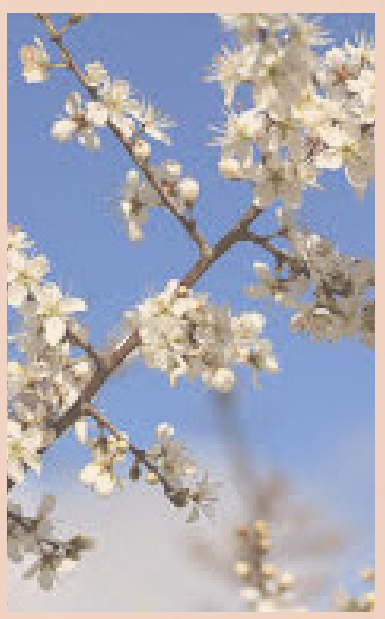


Malus Rudolph



Sorbus Aucuparia  
"Lijsterbes"

### Bushes/ Small Greenery



Prunus Spinosa  
"Sleedoorn"



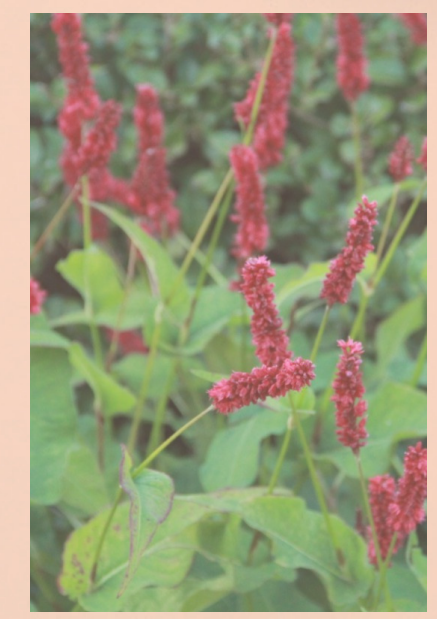
Sambucus Nigra  
"Vlierbes"



Viburnum Opulus  
"Gelderse Roos"



Forsythia Intermedia  
"Chinees klokje"



Persicaria Amplexicaulis  
"Duizenknoop"



Persicaria Amplexicaulis  
"Duizenknoop"





# 06 Roofscape

Malus Rudolph

Viburnum Opulus  
"Gelderse Roos"

Acer Campestre  
"Veldesdoorn"

Forsythia Intermedia  
"Chinees klokje"

OEH NICE  
GREENERY!

Vegetable garden



# 07 Street

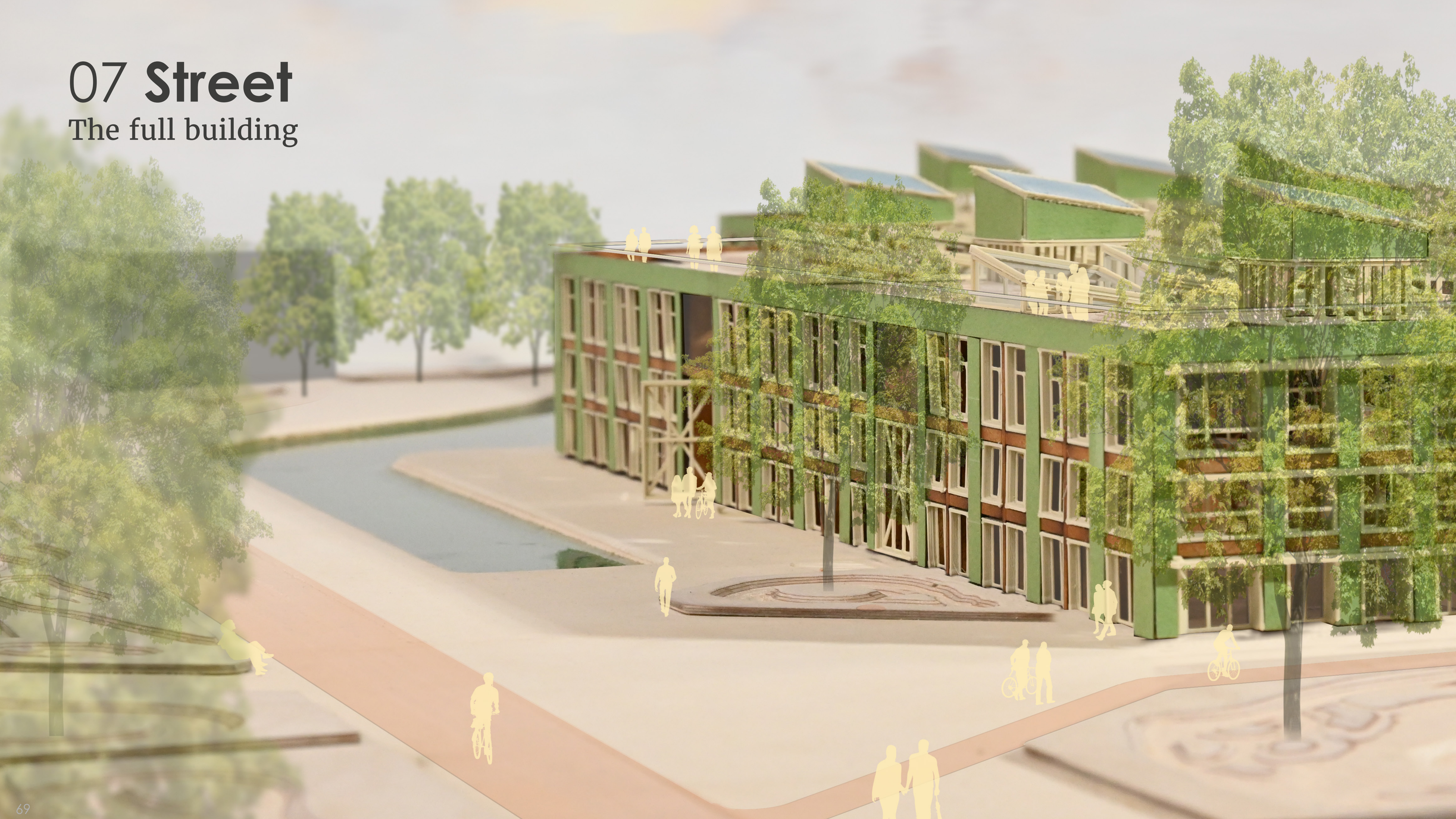
## The full building





# 07 Street

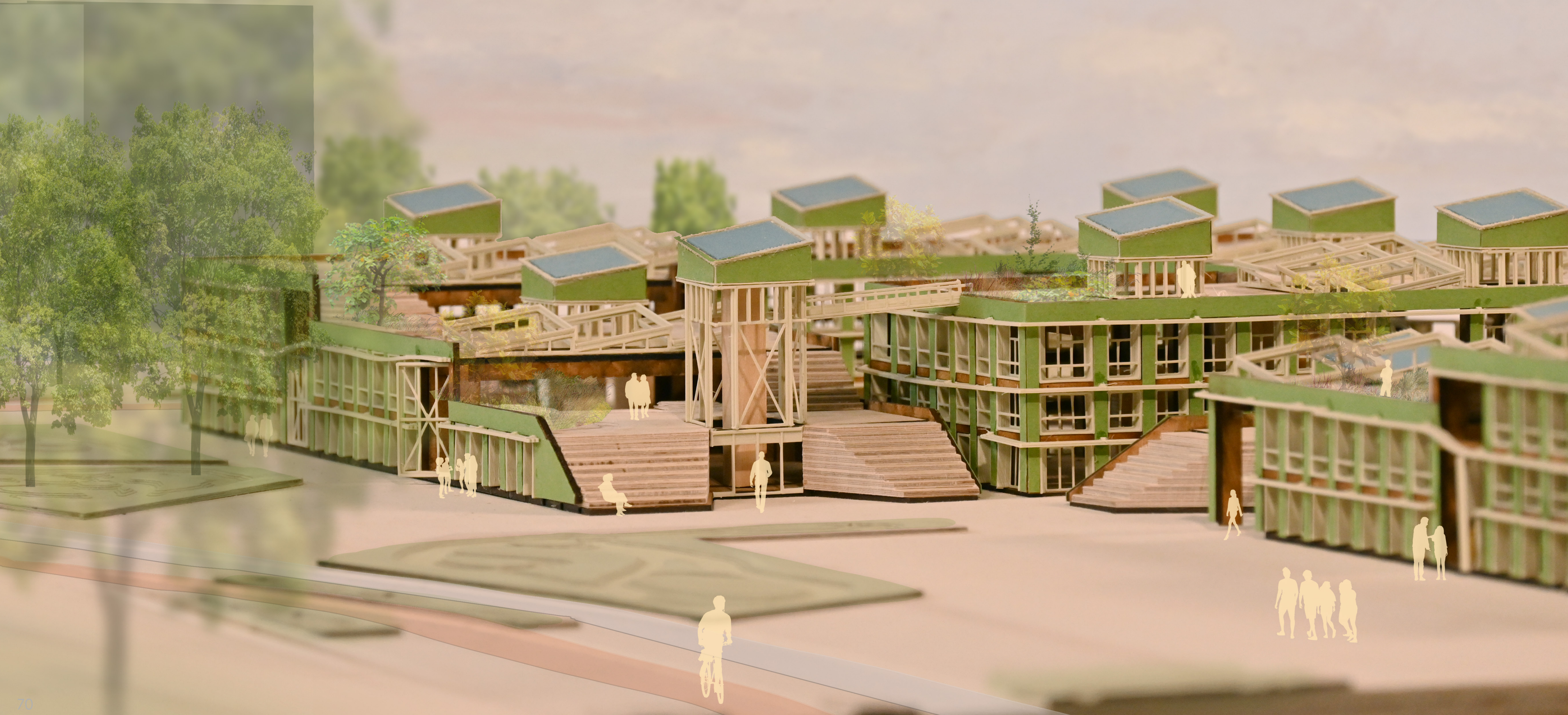
The full building





# 07 Street

The full building





# Looking backwards

## Technical

A technical project with a **modular** and **adaptable** built system in order to achieve social and environmental



## Social

The freedom to discover your own **boundaries** between **private** and **public** space & take **ownership** over your living space!

“A balancing act!”

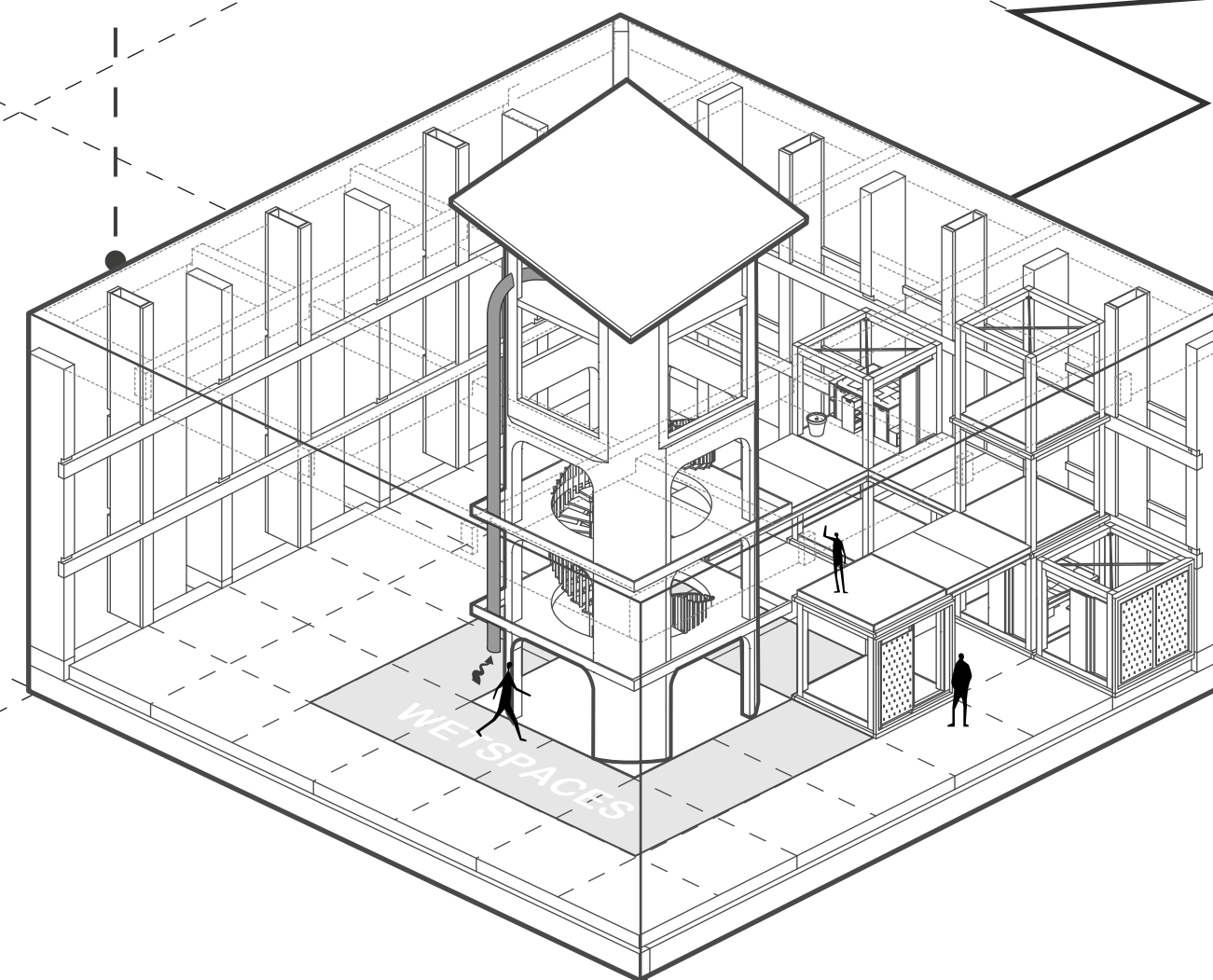


# Looking to the future

## Placelessness

The block is not contextual **yet** and therefore could be place anywhere

“So excited to see what the future brings!”



“Where are we going?”

“I hope forwards”





# Questions?

