

A Participatory Design Game for social housing configuration in the context of Manaus, Brazil

MSc Architecture, Urbanism and Building Sciences, TU Delft
Building Technology

Vasilka Nahimova Espinosa

Mentors: Dr. Ir. Pirouz Nourian,
Dr. Bruno Amaral de Andrade and
Ir. Shervin Azadi



Research
Framework

Literature
Research

Case Study

Game
Development

Meta Game

Conclusion



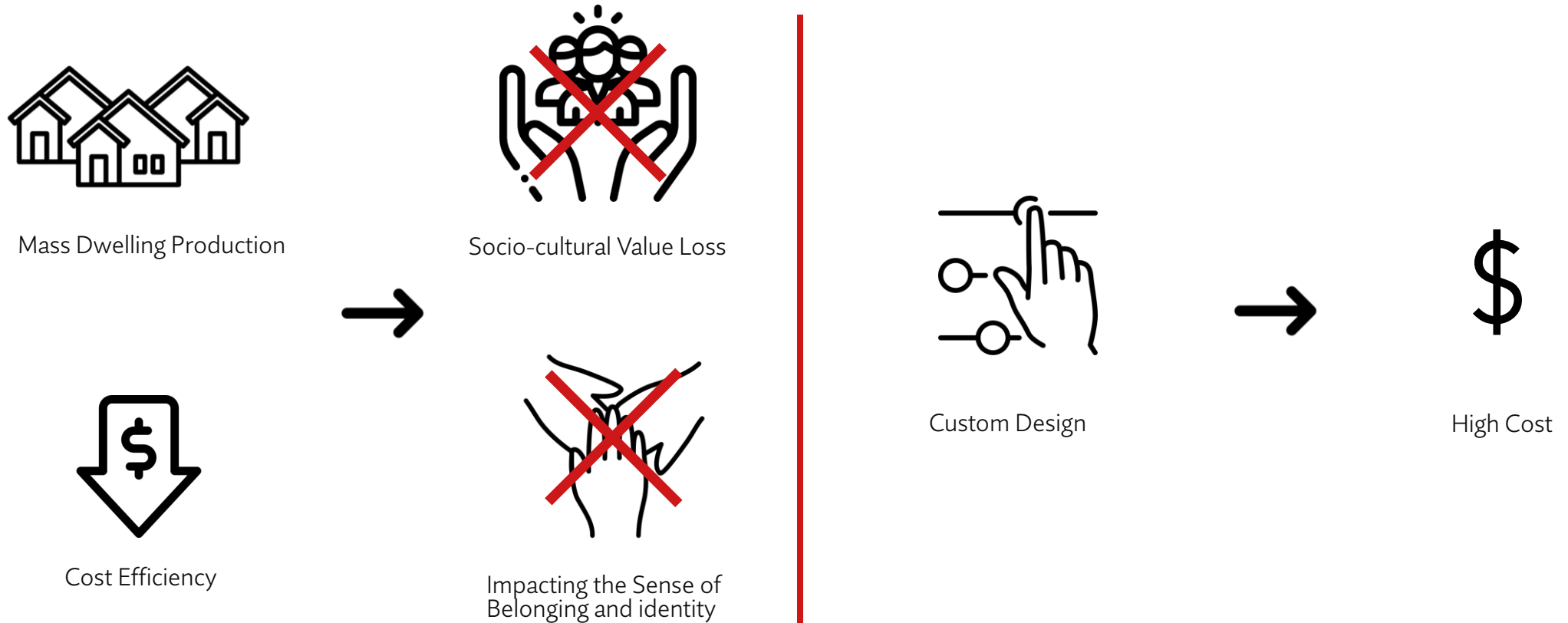




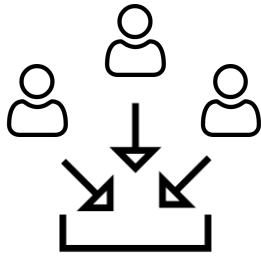
MCMV settlements are established where land is cheap; the repetitive patterns just follow the rules of the current building economy. The lack of integration with existing urban settings makes them prone to becoming ghettos.



Problem Statement



Problem Statement



Participatory Design



Cost Efficiency

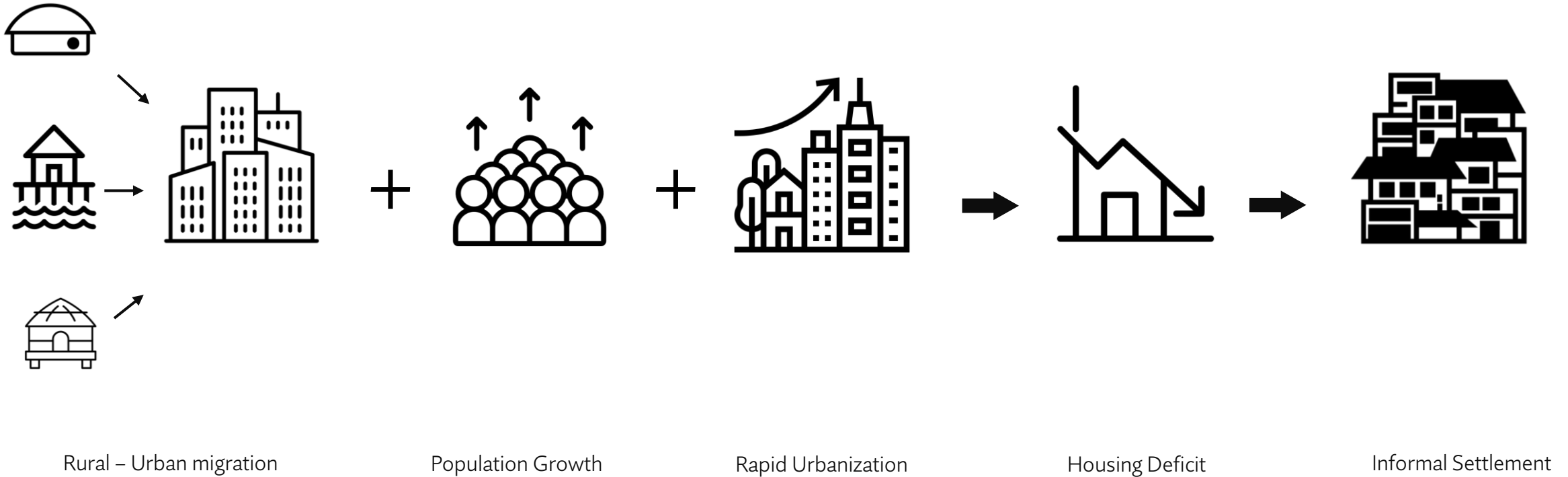


Mass Customization



Socio-cultural Value

Context



Research Question

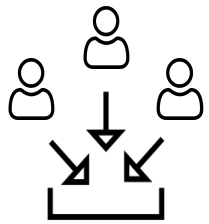
How can we allow future inhabitants to custom design their future affordable homes so their social and cultural patterns of using space can prevail?

- How can we keep the **construction cost down** while providing for **customization**?
- How can we facilitate the discussions of the **multiple actors** in the **design process**?
- How can we keep the **design process simple** and **affordable** while providing for **customization** and expression of **subjective patterns** of using space?
- How can we ensure a certain **level of quality** while allowing for mass customization?

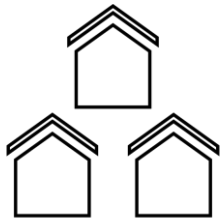
Objective

Create a method for **gamification of design** that can be **adjusted to different realities**, enabling people to take part in the **design decision-making process** and express their **social and cultural patterns of using the space**, without the **obstacle of technical knowledge**.

Scope and Limitation



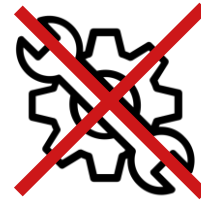
Participatory Design



Social Housing



Socio-cultural Value



Technical implementation

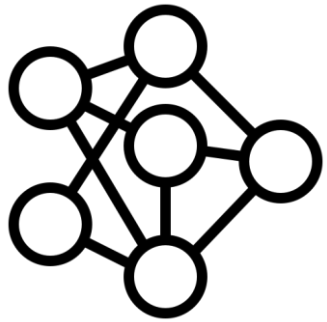


Constructability

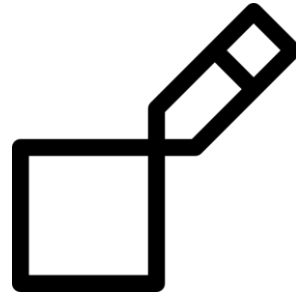


Quantifying Cost

Methodology



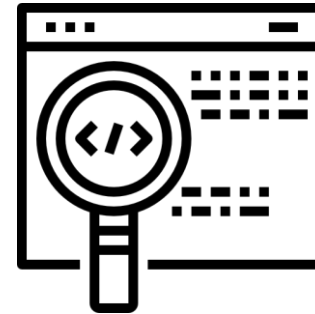
Complexities



Defining Case



Case Study



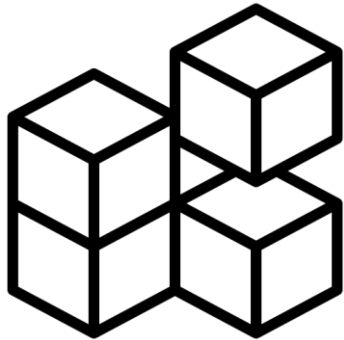
Meta-Game



Testing cases

Literature Research

Mass-Customization

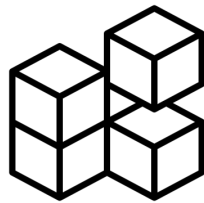


Modularity



Level of Customer Involvement

Mass-Customization



Modularity



In Use
In Production
In Design



Design Rules and Hidden Parameter

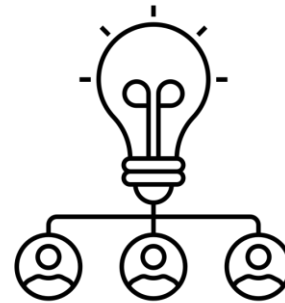
Mass-Customization



Level of Customer
Involvement



Open Building
Participatory Method

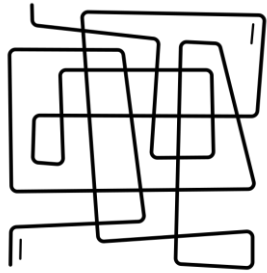


Levels of Decision Making

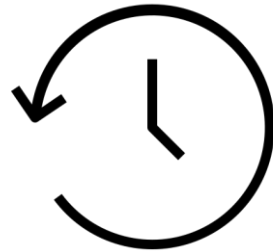


Tissue, Support and Infill

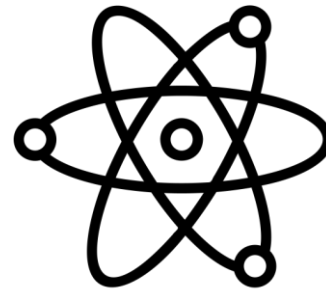
Cultural Values



Aesthetic



Historic



Scientific



Social

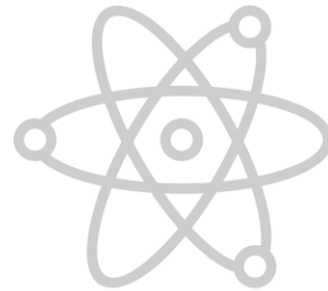
Cultural Values



Aesthetic



Historic



Scientific



Social

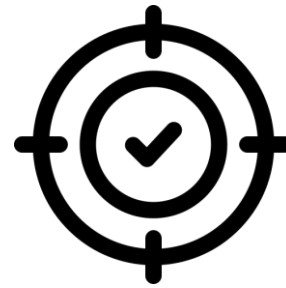
Generative Design



Explore the
Design Space



Optimization

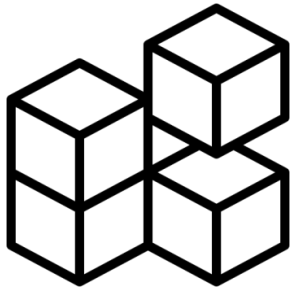


Accuracy



Consistency

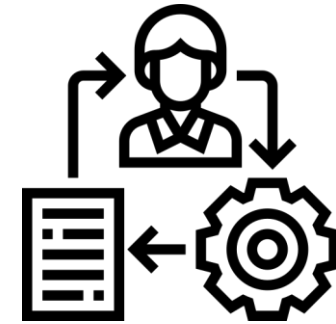
Generative Design: Shape Grammar



Modularity

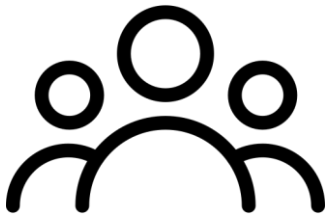


Cost Reduction



Lower Human
expertise

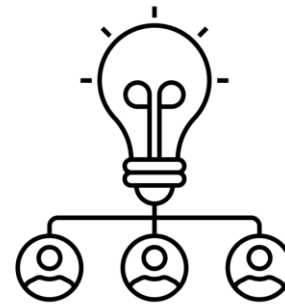
Participatory Design



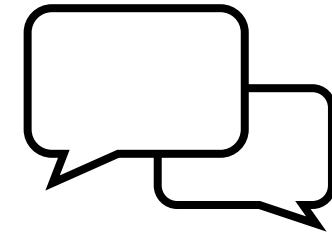
Multiple users



Collaborative Environment

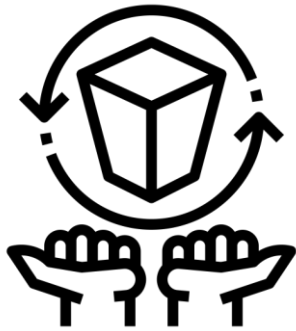


Collective Decision-Making

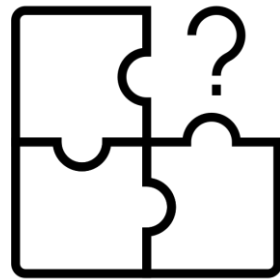


Discussion

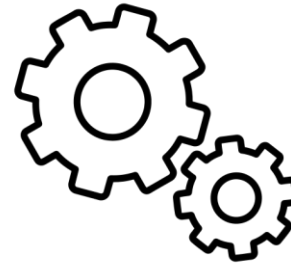
Participatory Design: Game



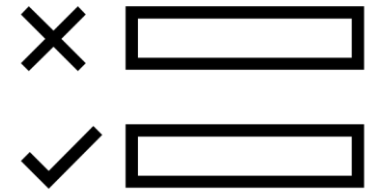
Simulation of a
real-life situation



Solving Problem



Predefined Setting



Constrains as rules
and procedure
methods

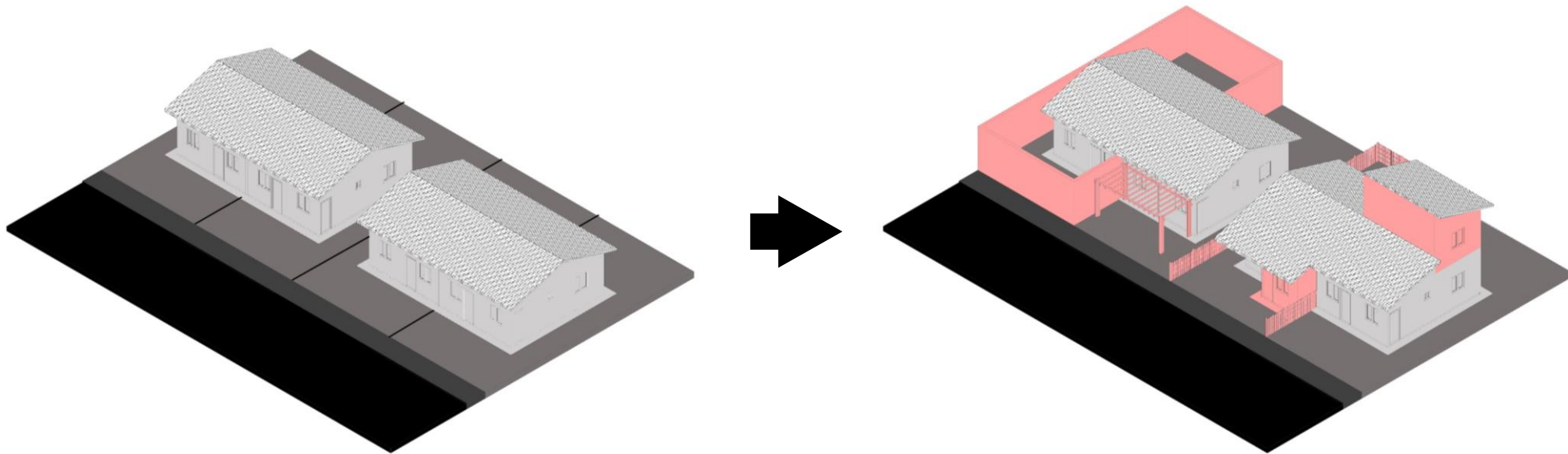
3. Case Study

My Home My Life - PMCMV



Image by Durango Duarte Institute

PMCMV: Post-Occupancy Renovation



Population

Indigenous People

Munduruku, Tikuna, Sateré-Mawé, Desana, Tukano, Miranha, Kaixana, Baré, Kokama, Apurinã, Tuyuka, Piratapuya, Kamaiura, Kambeba, Mura, Maraguá, Baniwa, Macuxi, Wanano, Tariano, Bará, Arara [do Aripuanã], Karapãna, Barasana, Anambé, Deni, Kanamari, Katukina, Kubeo, Kulina, Marubo, Paumari, Arara do Pará e Manchineri.” (COPIME, 2015)

Riverside People



Floating House

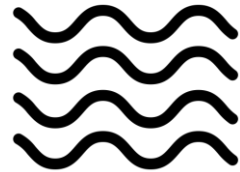


Stilt House

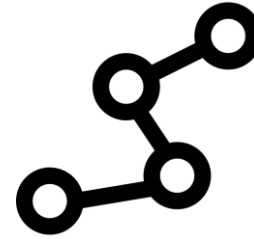
Population: Patterns



Community of 7000
(12th)



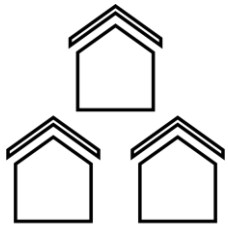
Access to Water
(25th)



Activity Nodes
(30th)



Household Mix
(35th)



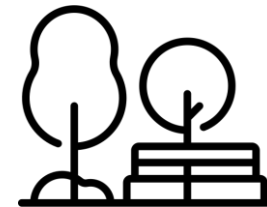
House Cluster
(37th)



Grave Sites
(70th)



Paths
(120th)



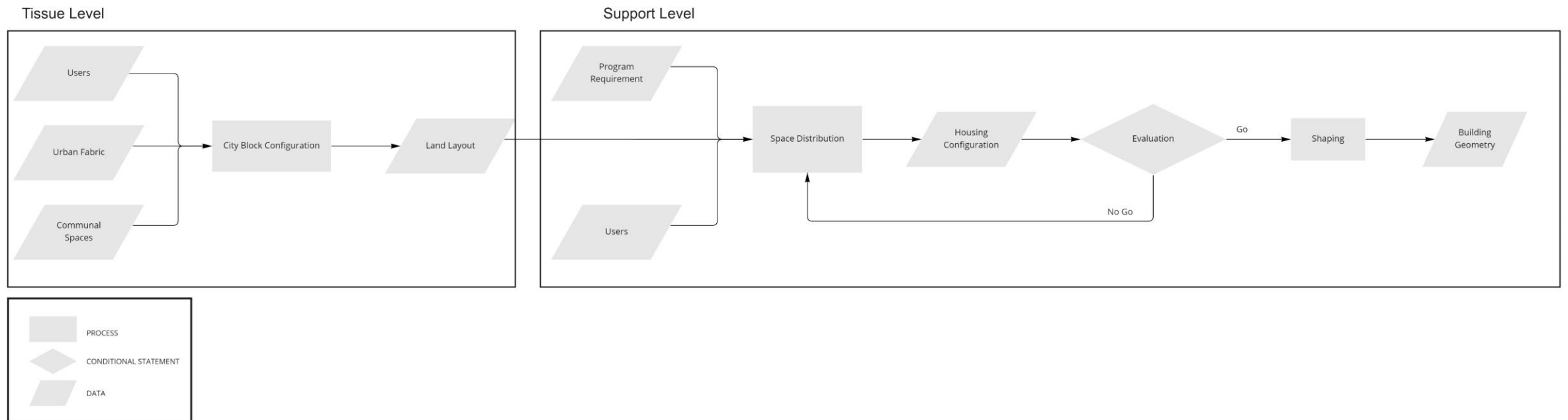
Small Public Square
(61st)

Design Principles

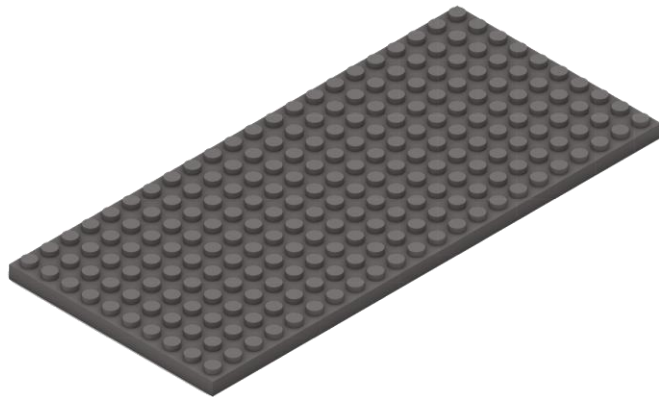
- **End-user participation** during the **design process**.
- Develop a **game** that engages and empowers the user to **express their preferences and needs**.
- Develop **discrete game pieces** that do not limit the user's expression of the configuration of the space.
- **Modularity**.

4. Game Development

Game Flow



Game Component

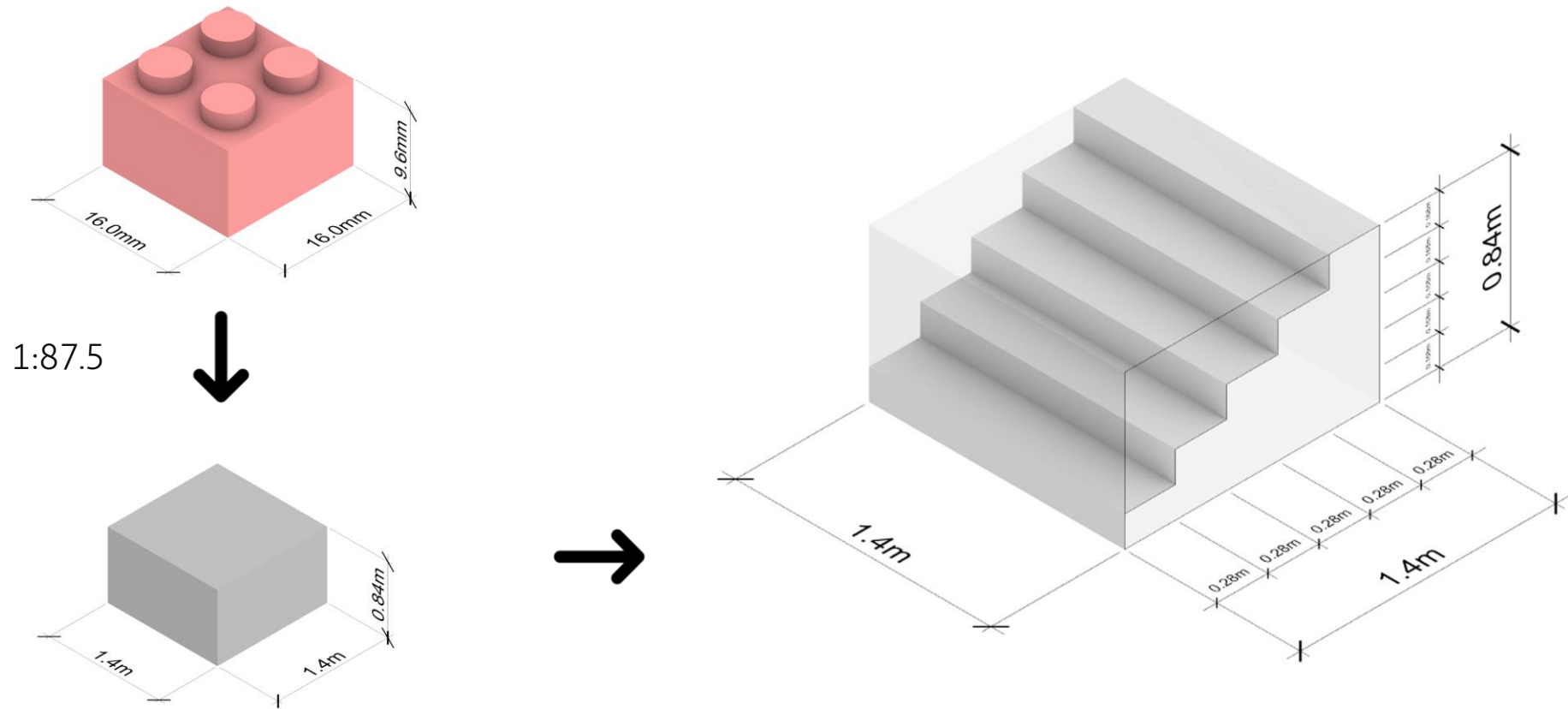


Boardgame

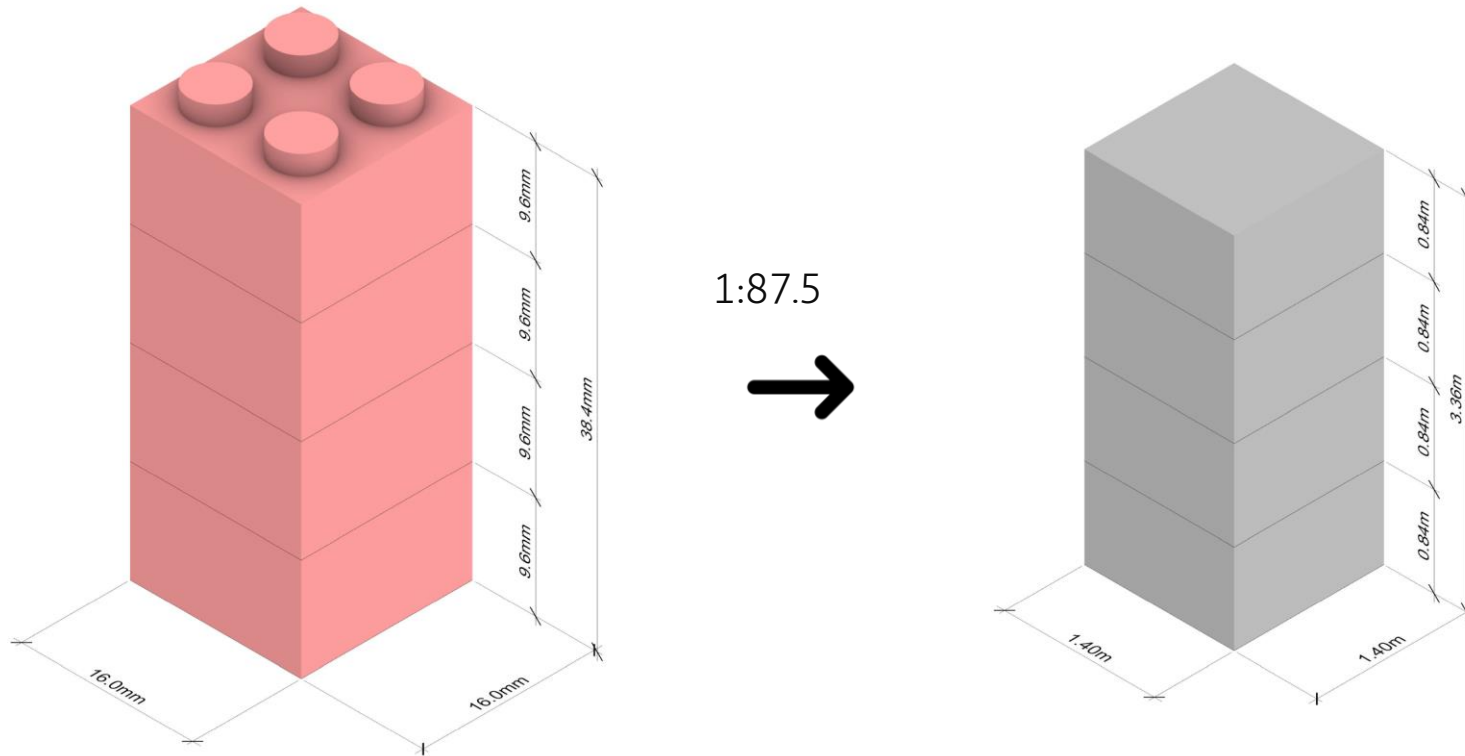


Coin

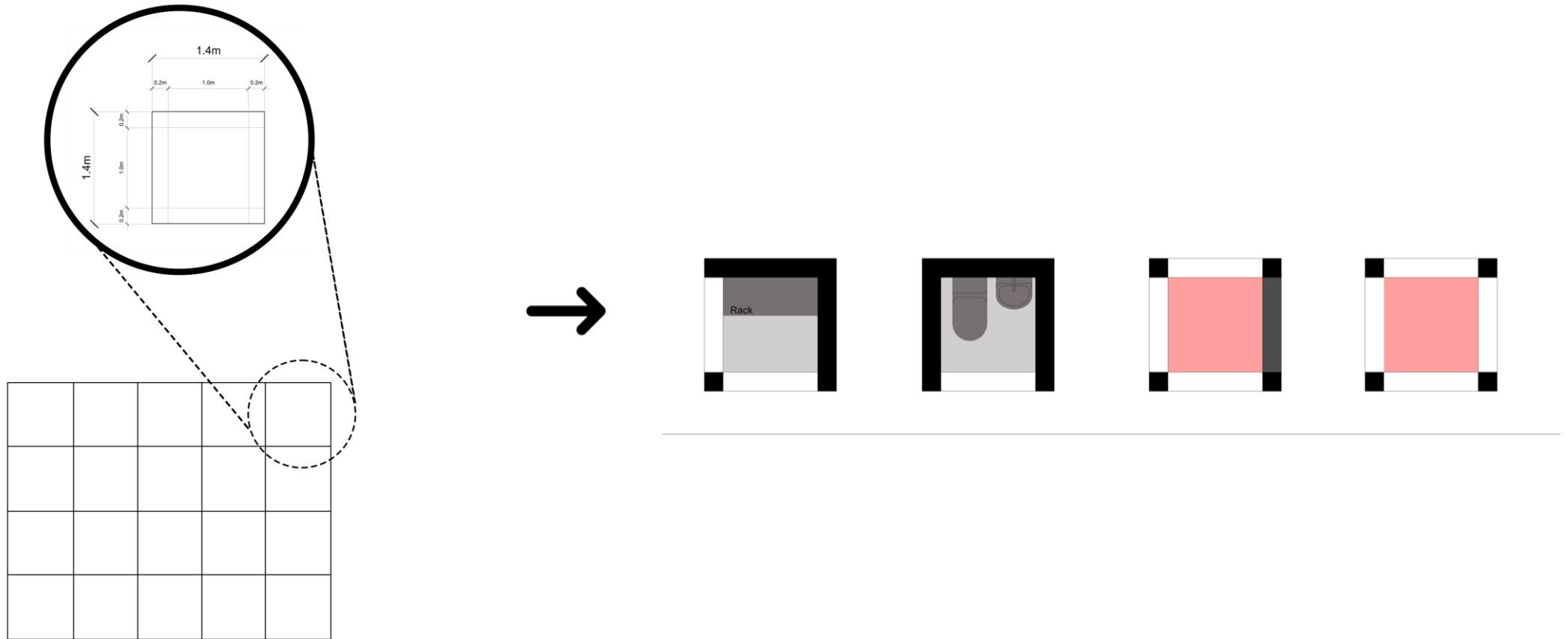
Game Components: Game Pieces



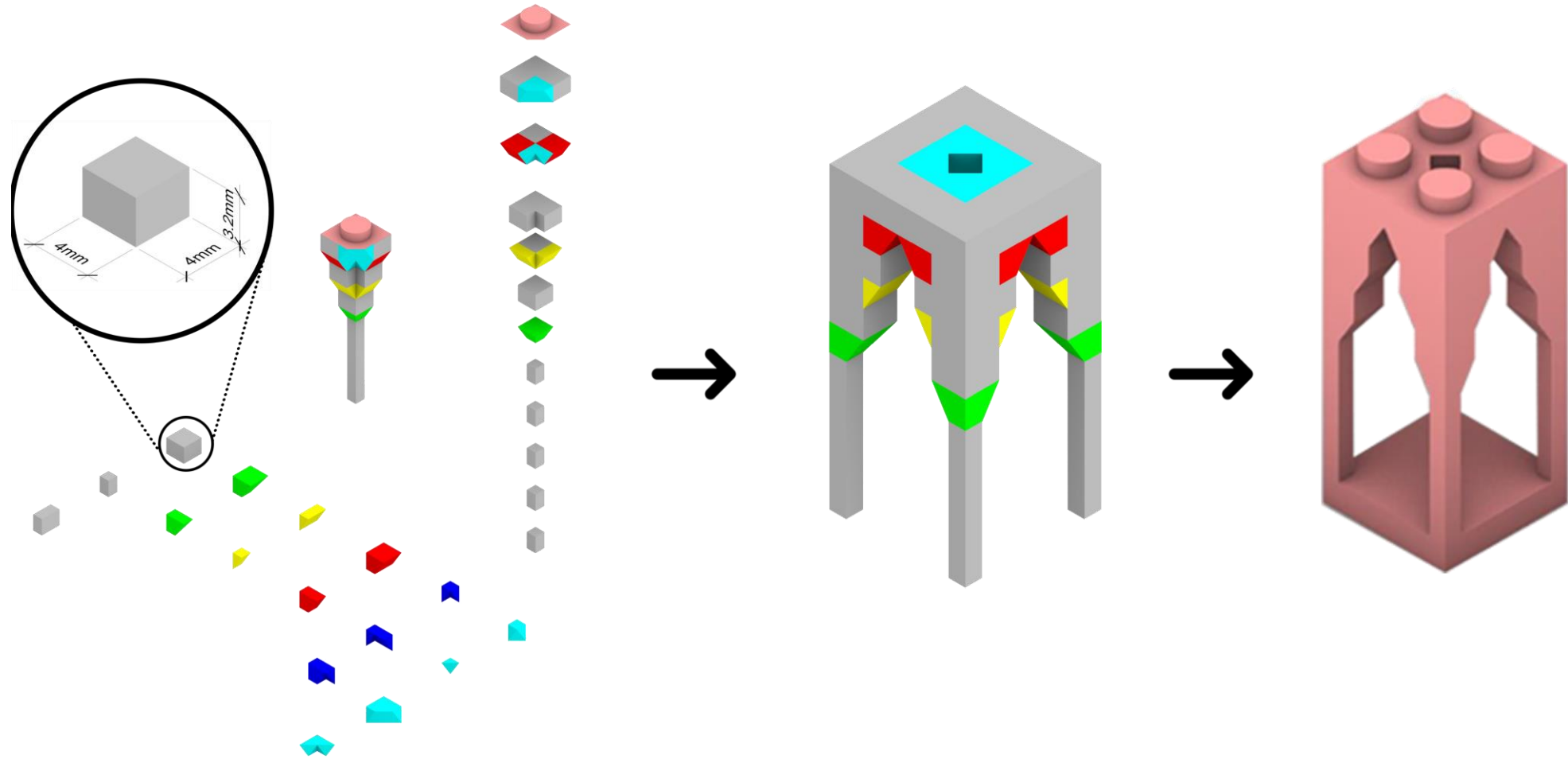
Game Components: Game Pieces





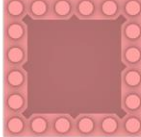



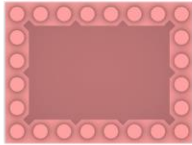
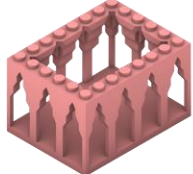



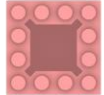


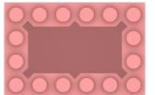
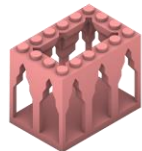
Game Components: Game Pieces



Game Components: Game Pieces

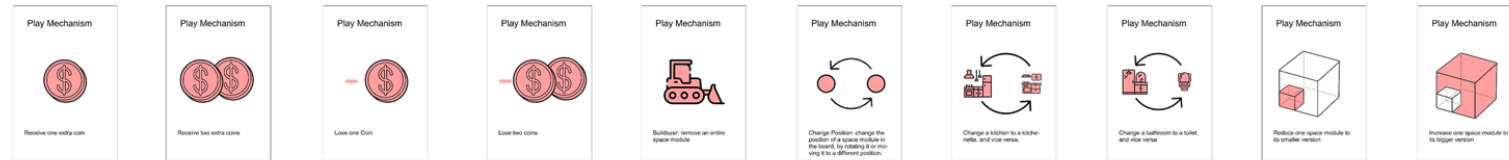


Game Components: Game Pieces

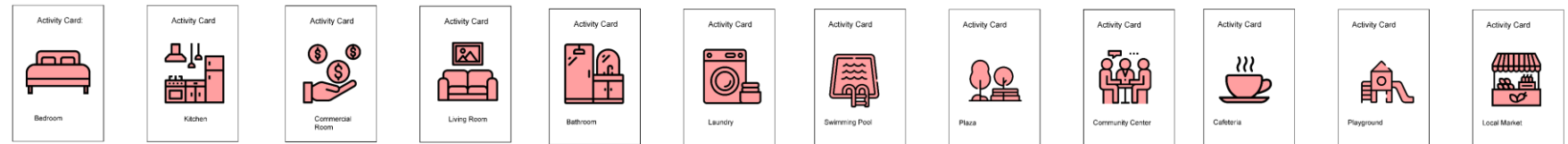
1x1			Corridor Balcony Toilet Storage	3x3			Multipurpose
1x2			Bathroom Laundry Kitchenette	3x4			Multipurpose
1x3			Bathroom Laundry Kitchenette	2x2			Spiral Staircase
2x2			Multipurpose	2x3			U Staircase
2x3			Multipurpose				

Game Components: Cards

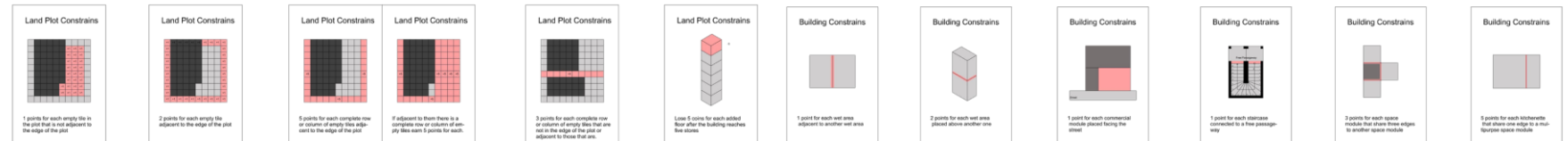
Common and Spatial Cards



Activity Cards



Evaluation Cards



Game Framework

Planning

Zoning

Routing

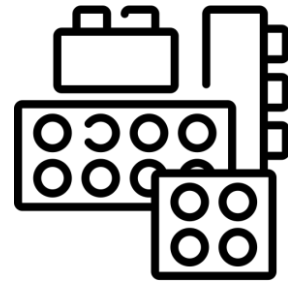
Evaluation

Shaping

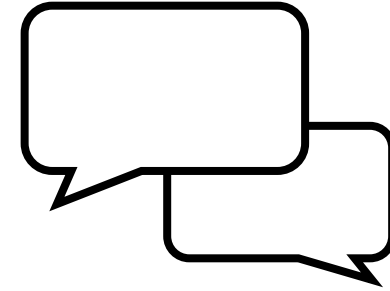
1st stage: Planning



List of Functions



Game Pieces

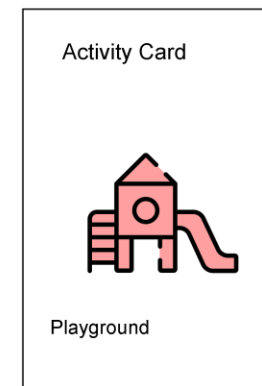
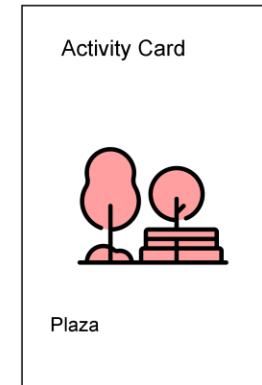
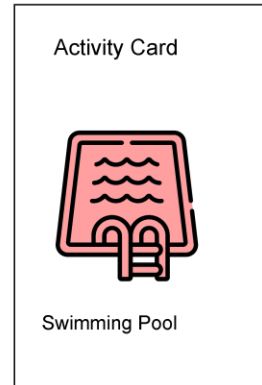


10min Discussion

1st stage: Planning



List of Functions

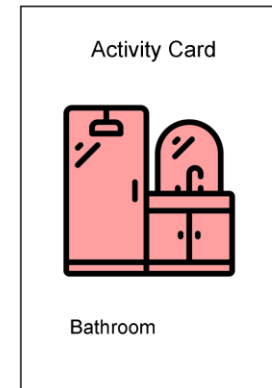
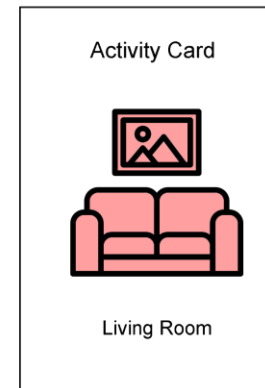
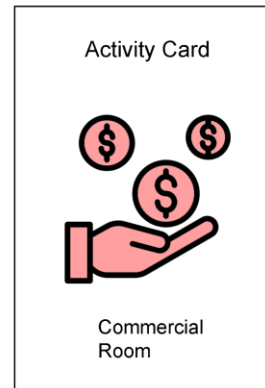
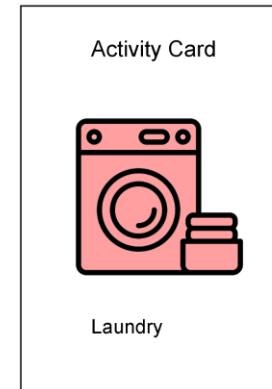
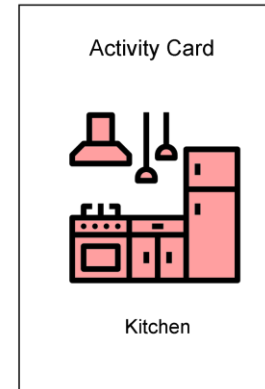


Tissue Level

1st stage: Planning

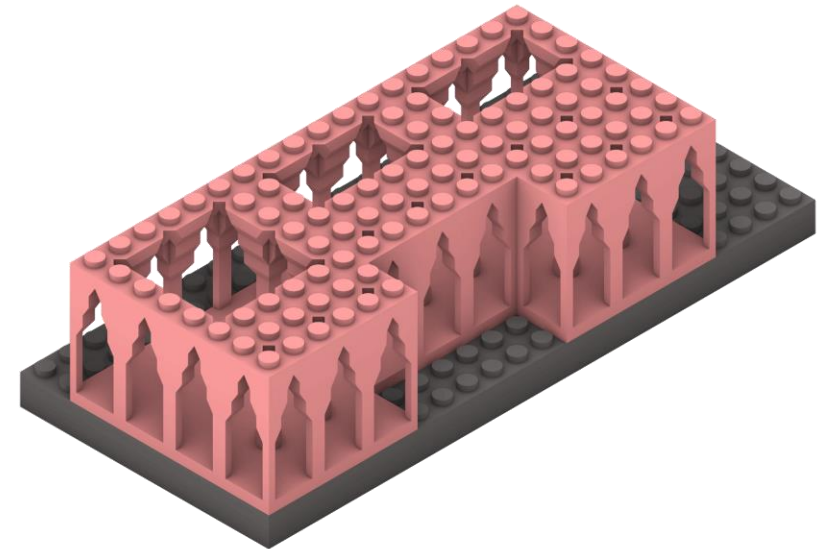


List of Functions

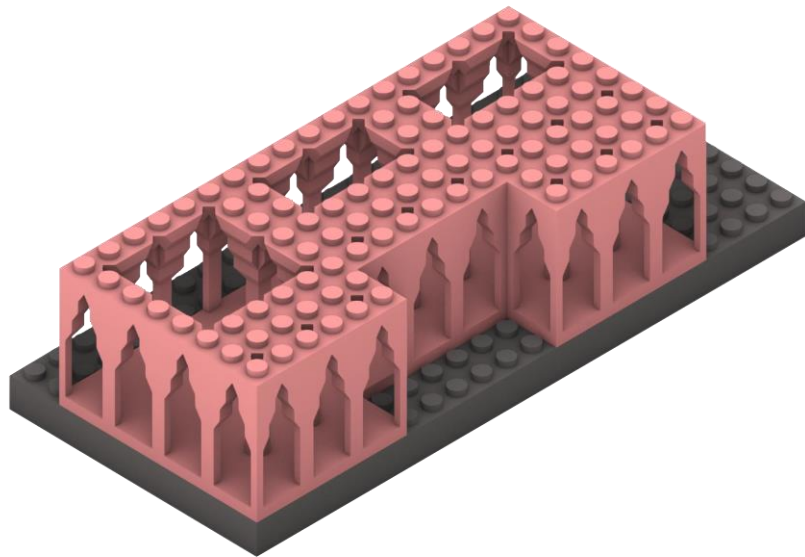


Support Level

1st stage: Planning



1st stage: Planning

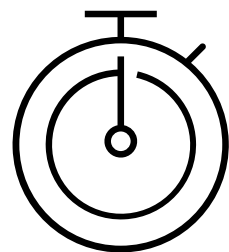


1x1			2 Coins
1x2			3 Coins
1x3			4 Coins
2x2			5 Coins
2x3			7 Coins
3x3			10 Coins
3x4			13 Coins

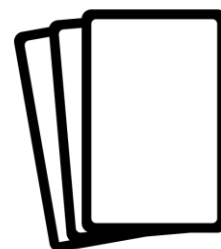


44 x

2nd stage: Zoning



30 min



Game Mechanism

2nd stage: Zoning




Activity Card:



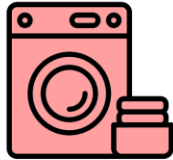
Bedroom

Activity Card




Kitchenette

Activity Card




Laundry

Activity Card



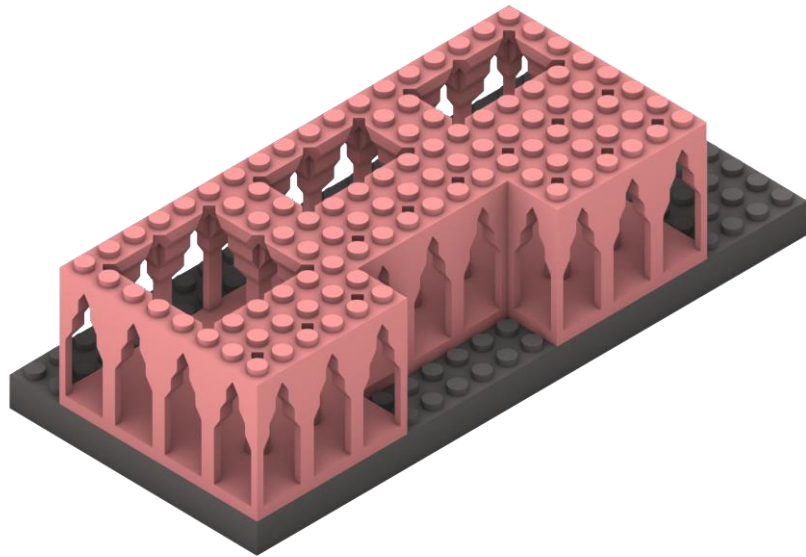
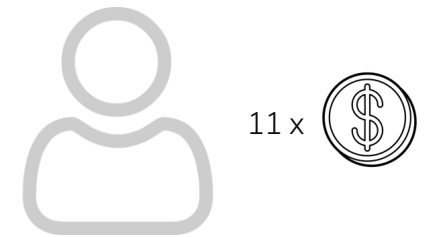
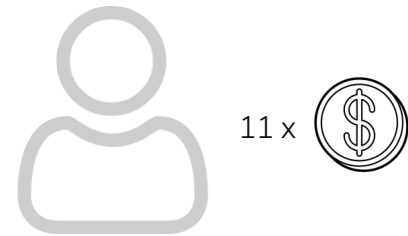
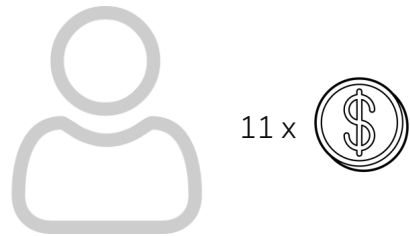
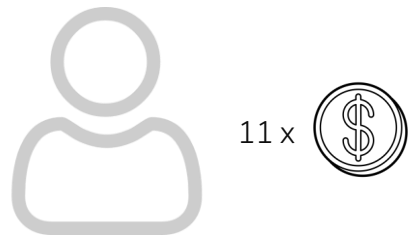
Living Room

Activity Card

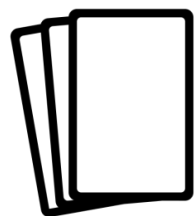
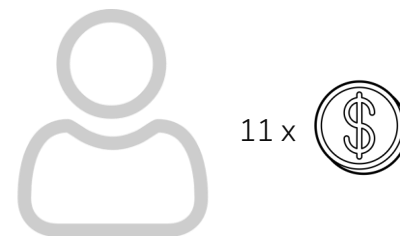
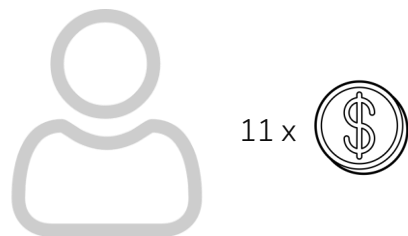
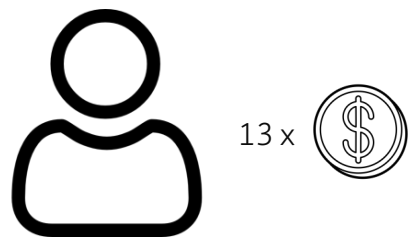









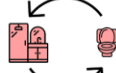
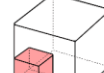
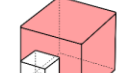
Bathroom

2nd stage: Zoning

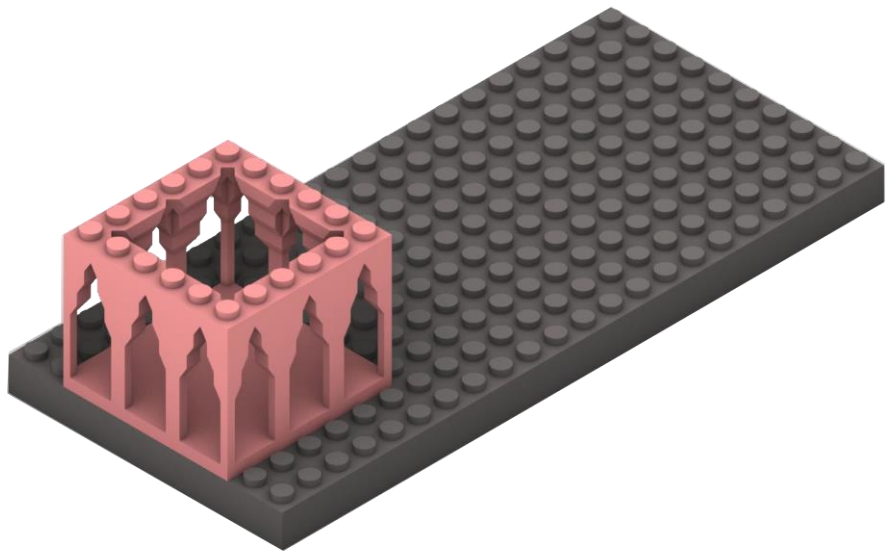
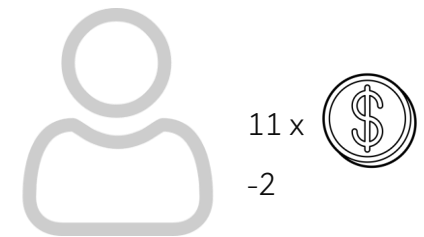
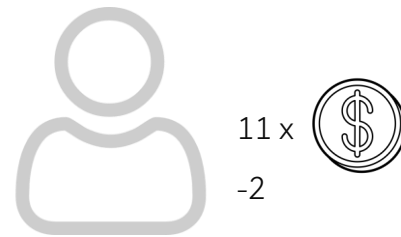
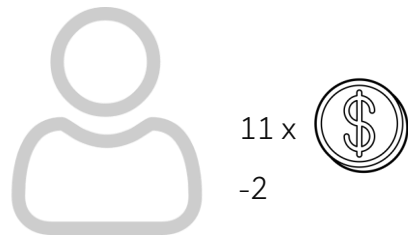
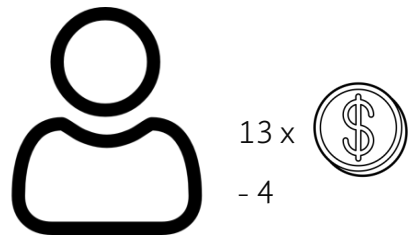


2nd stage: Zoning



<p>Play Mechanism</p>  <p>Receive one extra coin</p>	<p>Play Mechanism</p>  <p>Receive two extra coins</p>	<p>Play Mechanism</p>  <p>Lose one Coin</p>	<p>Play Mechanism</p>  <p>Lose two coins</p>	<p>Play Mechanism</p>  <p>Bulldozer: removes an entire space module</p>	<p>Play Mechanism</p>  <p>Change Position: change the position of a space module in the board, by rotating it or moving it to a different position.</p>	<p>Play Mechanism</p>  <p>Change a kitchen to a kitchenette, and vice versa.</p>	<p>Play Mechanism</p>  <p>Change a bathroom to a toilet, and vice versa</p>	<p>Play Mechanism</p>  <p>Reduce one space module to its smaller version</p>	<p>Play Mechanism</p>  <p>Increase one space module to its bigger version</p>
---	--	--	---	--	--	---	--	---	--

2nd stage: Zoning



10 x 

2nd stage: Zoning



- Play Mechanism**

Receive one extra coin
- Play Mechanism**

Receive two extra coins
- Play Mechanism**

Lose one Coin
- Play Mechanism**

Lose two coins
- Play Mechanism**

Bulldozer: removes an entire space module
- Play Mechanism**

Change Position: change the position of a space module in the board, by rotating it or moving it to a different position.
- Play Mechanism**

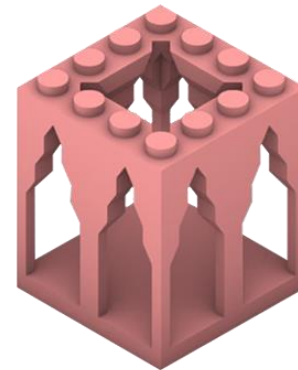
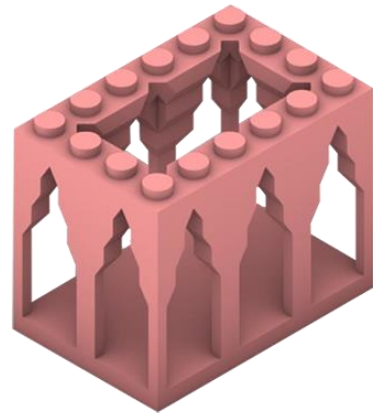
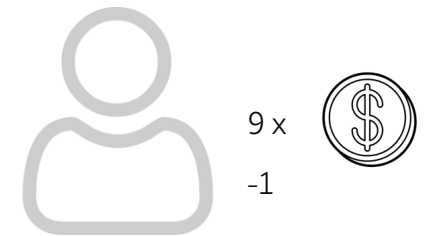
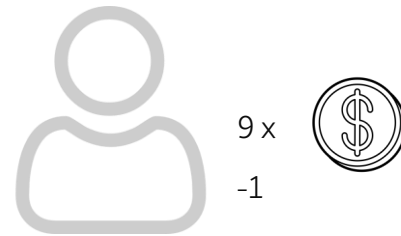
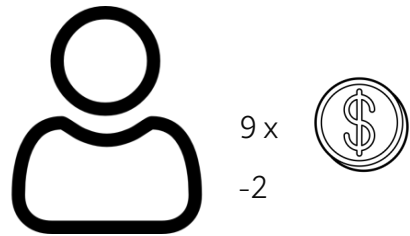
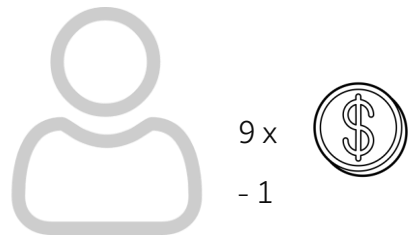
Change a kitchen to a kitchenette, and vice versa.
- Play Mechanism**

Change a bathroom to a toilet, and vice versa
- Play Mechanism**

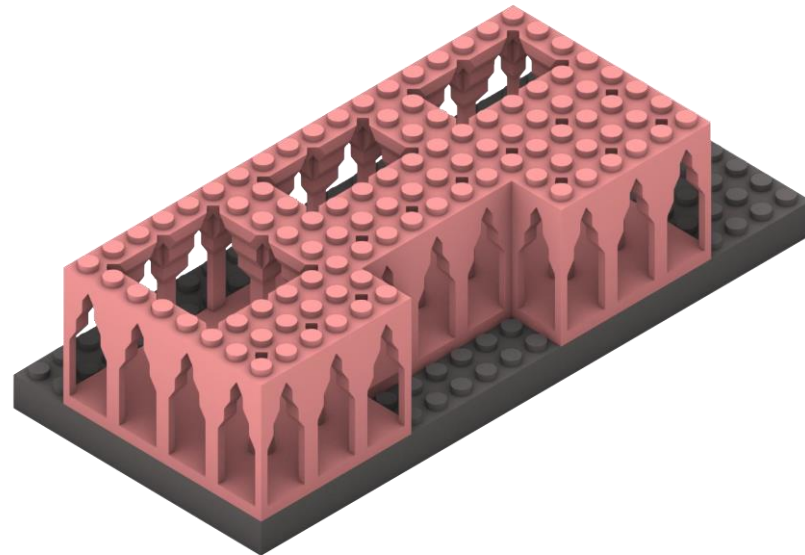
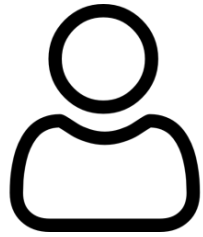
Reduce one space module to its smaller version
- Play Mechanism**

Increase one space module to its bigger version

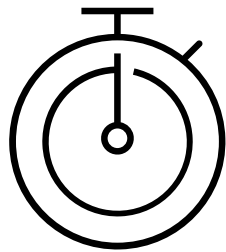
2nd stage: Zoning



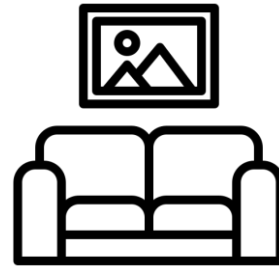
2nd stage: Zoning



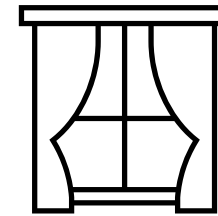
3rd stage: Routing



10-15 min

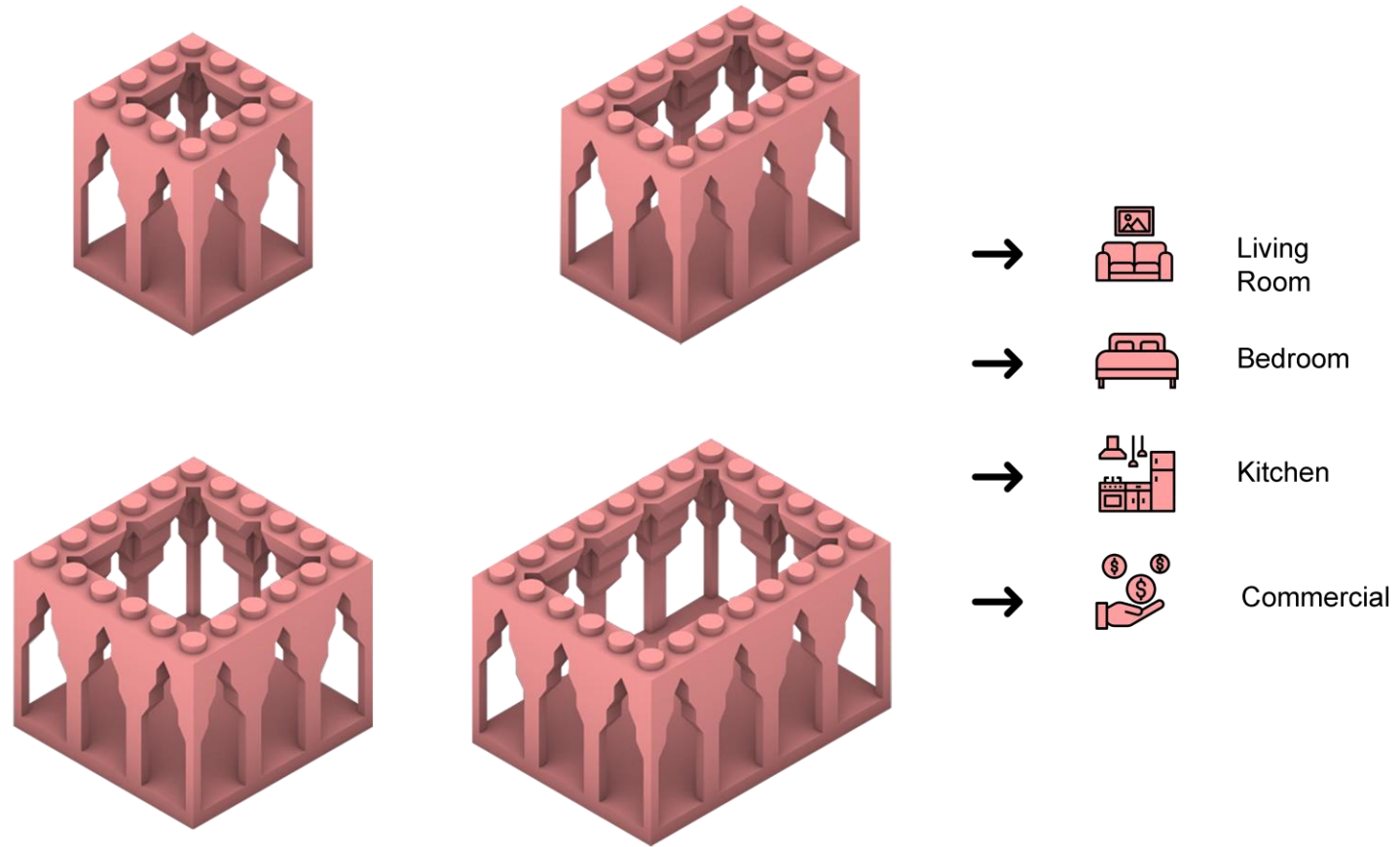


Modular Furniture

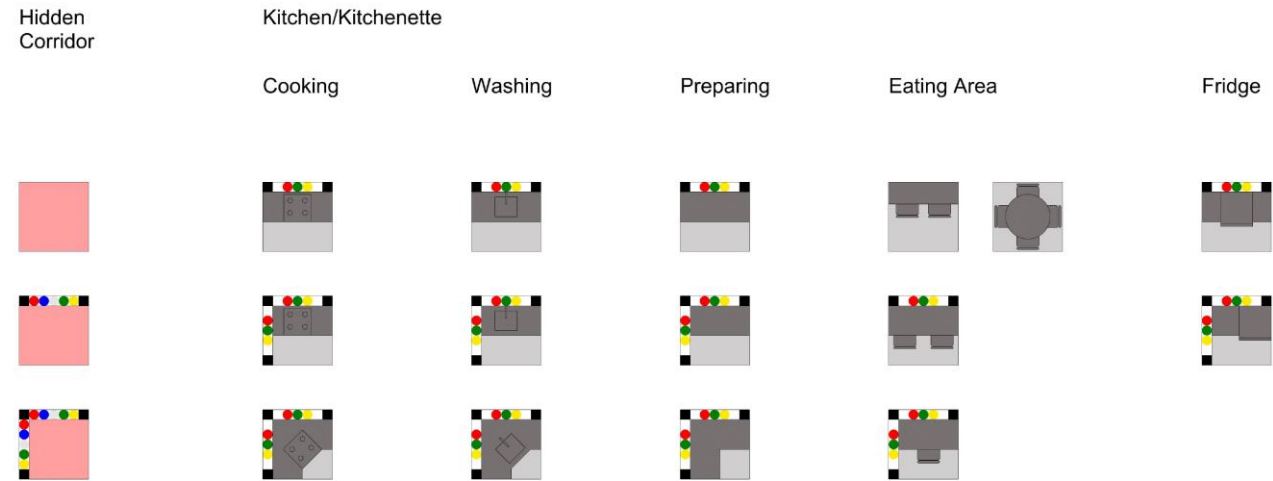


Specify Opening

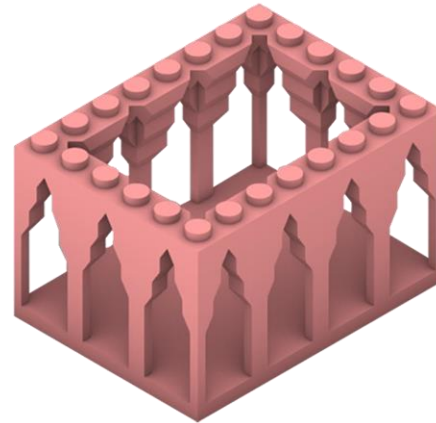
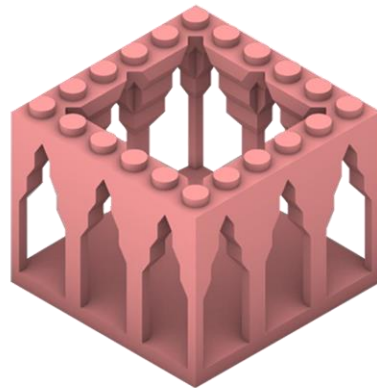
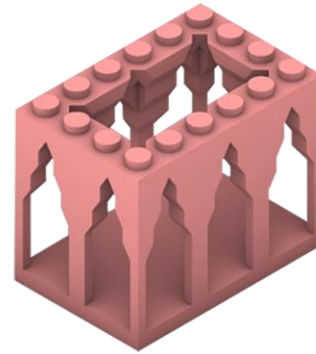
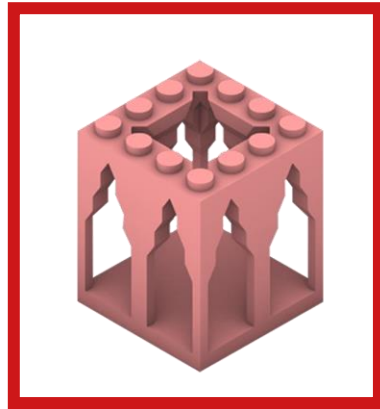
3rd stage: Routing







3rd stage: Routing



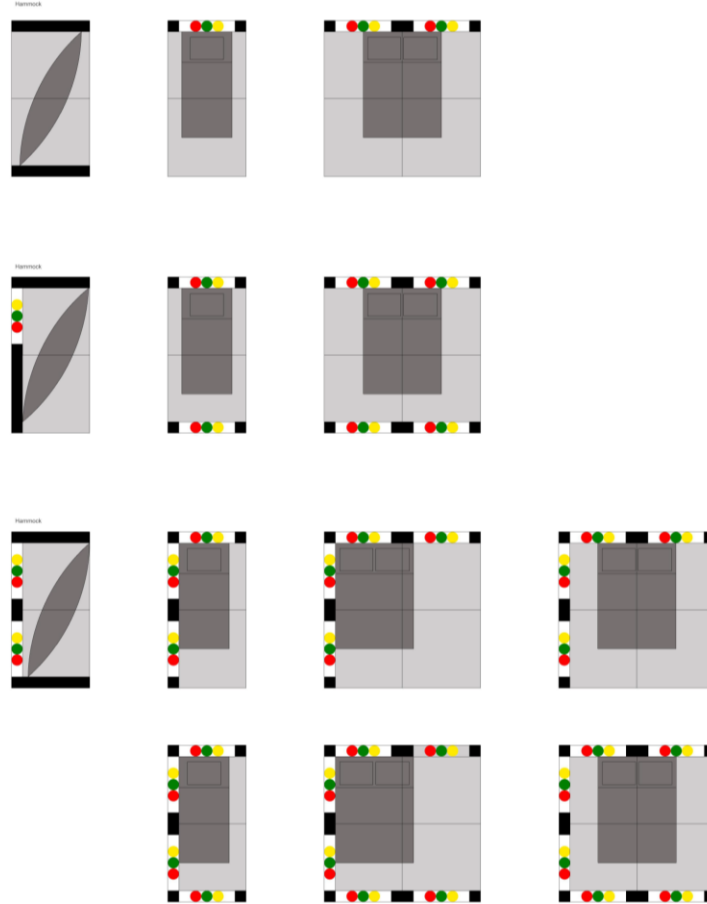
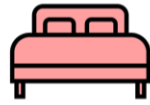
3rd stage: Routing



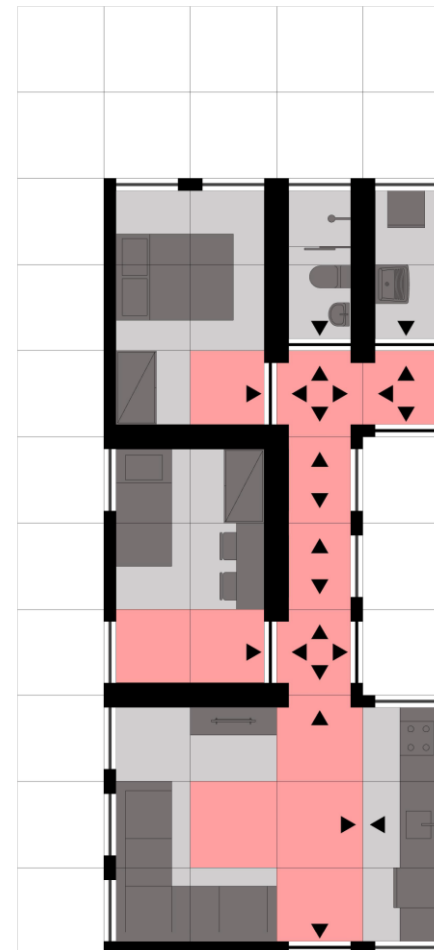
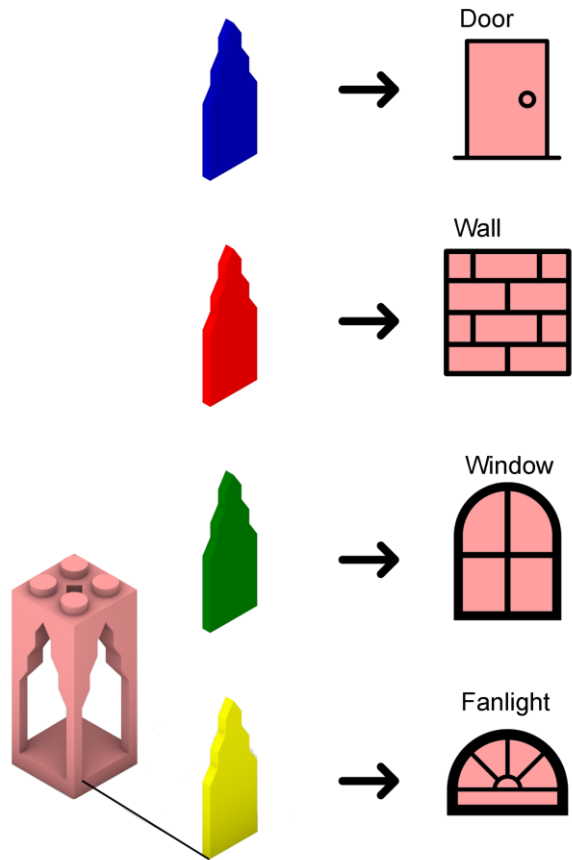
-  Living Room
-  **Bedroom**
-  Kitchen
-  Commercial

3rd stage: Routing

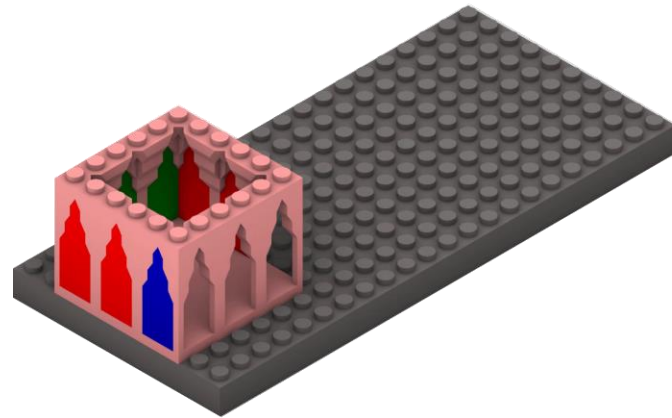
Bedroom



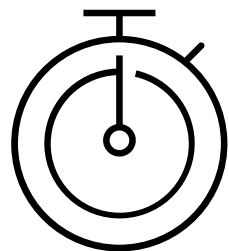
3rd stage: Routing



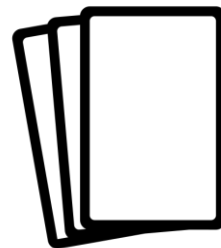
3rd stage: Routing



4th stage: Evaluation



10-15 min



Evaluation Cards

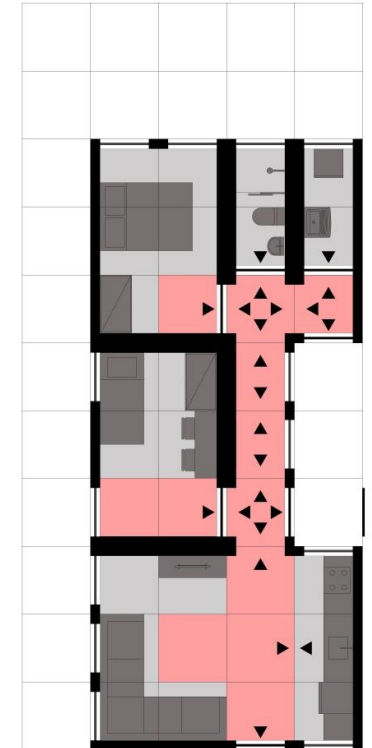


Self Evaluation

4th stage: Evaluation

Validity Check:

Validity Checklist					
Only the space modules used in the configuration of the house must be checked as a GO.					
Piece	Function	Constrains	Go	No-Go	Does not apply
1 x 1	Corridor	At least two of the façades must be a free passageway/doors.	X		
1 x 1	Balcony	At least one façade must be a parapet.			X
		At least one façade must be a door or passageway, to give access to the balcony.			X
1 x 1	Storage	In case of only one tile, the storage must have only one door.			X
		In case of multiple tiles set together, the storage set must have only one door.			X
1 x 1	Toilet	Must have one fanlight connected to the exterior of the building.			X
		Must have one door.			X
1 x 2	Laundry	Must have one fanlight connected to the exterior of the building.	X		
		Must have one door.	X		
1 x 2	Bathroom	Must have one fanlight connected to the exterior of the building.	X		
		Must have one door.	X		
1 x 2	Kitchenette	Must have one fanlight connected to the exterior of the building.			X
		Must connect with a multipurpose room			X
1 x 3	Bathroom	Must have one fanlight connected to the exterior of the building.			X
		Must have one door.			X
1 x 3	Kitchenette	Must have one fanlight connected to the exterior of the building.	X		
		Must connect with a multipurpose room	X		
2 x 2	Multipurpose	Must have at least one window connected to the exterior of the building.			X
		Must have at least one door / free passageway.			X
2 x 3	Multipurpose	Must have at least one window connected to the exterior of the building.	X		
		Must have at least one door / free passageway.	X		
3 x 3	Multipurpose	Must have at least two windows connected to the exterior of the building.	X		
		Must have at least one door / free passageway.	X		
3 x 4	Multipurpose	Must have at least three windows connected to the exterior of the building.			X
		Must have at least one door / free passageway.			X




GO

4th stage: Evaluation

Quality Check: Building Constrains

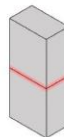
Building Constrains



1 point for each wet area adjacent to another wet area

2 points

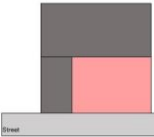
Building Constrains



2 points for each wet area placed above another one

Does not apply

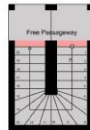
Building Constrains



1 point for each commercial module placed facing the street

Does not apply


Building Constrains



1 point for each staircase connected to a free passage-way

Does not apply


Building Constrains



3 points for each space module that share three edges to another space module

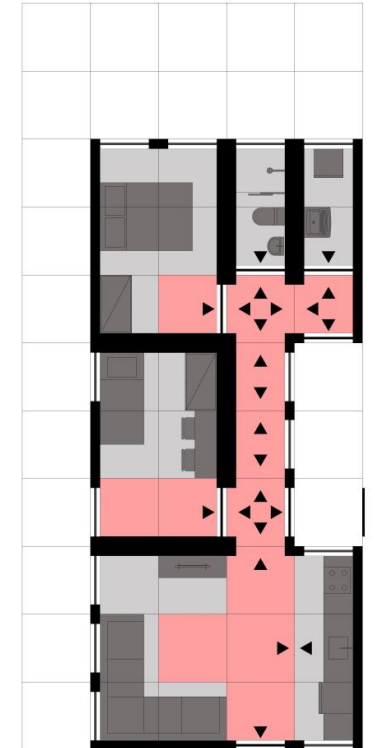
3 points

Building Constrains



5 points for each kitchenette that share one edge to a multipurpose space module

5 points

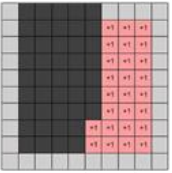


Toral: 10 points

4th stage: Evaluation

Quality Check: Land Constrains

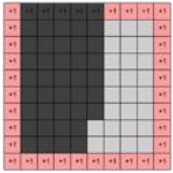
Land Plot Constrains



1 points for each empty tile in the plot that is not adjacent to the edge of the plot

3 points

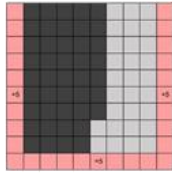
Land Plot Constrains



2 points for each empty tile adjacent to the edge of the plot

38 points

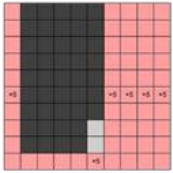
Land Plot Constrains



5 points for each complete row or column of empty tiles adjacent to the edge of the plot

10 points

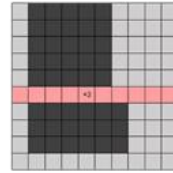
Land Plot Constrains



If adjacent to them there is a complete row or column of empty tiles earn 5 points for each.

5 points

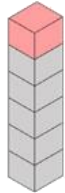
Land Plot Constrains



3 points for each complete row or column of empty tiles that are not in the edge of the plot or adjacent to those that are.

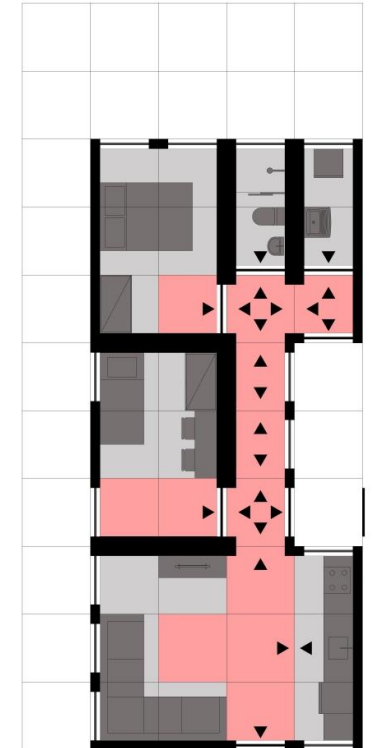
Does not apply

Land Plot Constrains



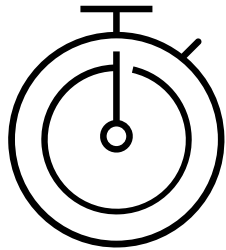
Lose 5 coins for each added floor after the building reaches five stores

Does not apply

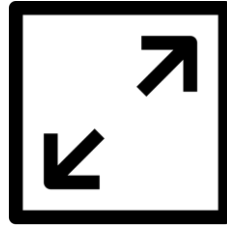


Total: 56points

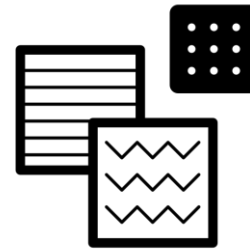
5th stage: Shaping



10-15 min

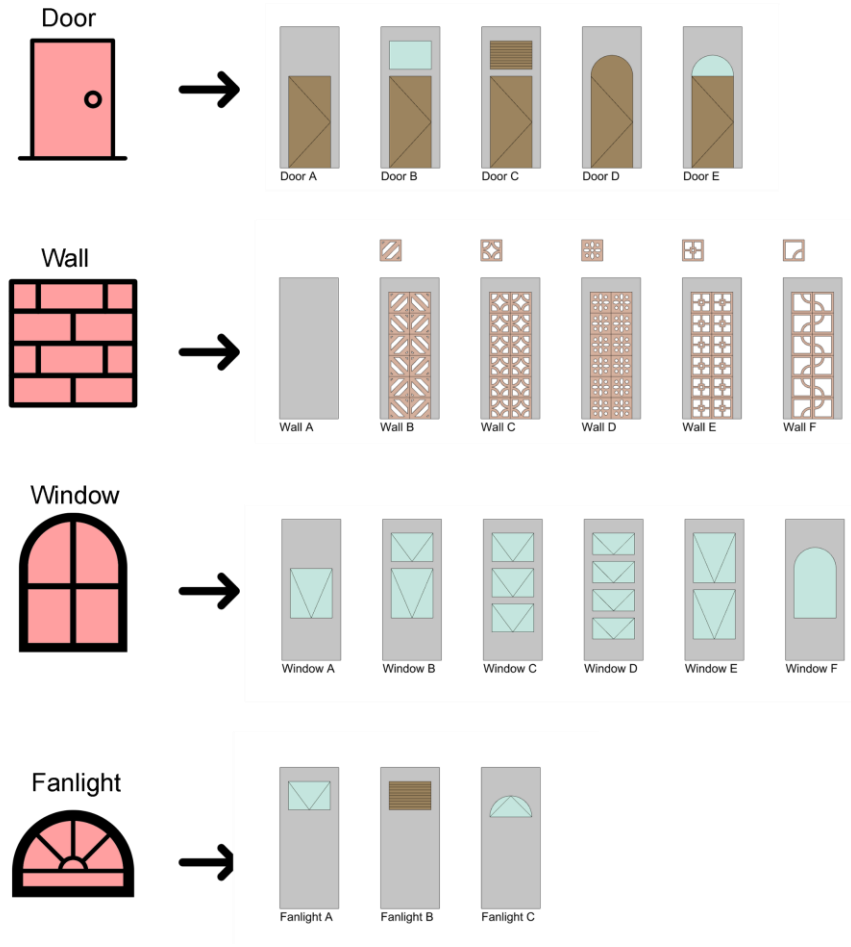


Size and Type of
Opening

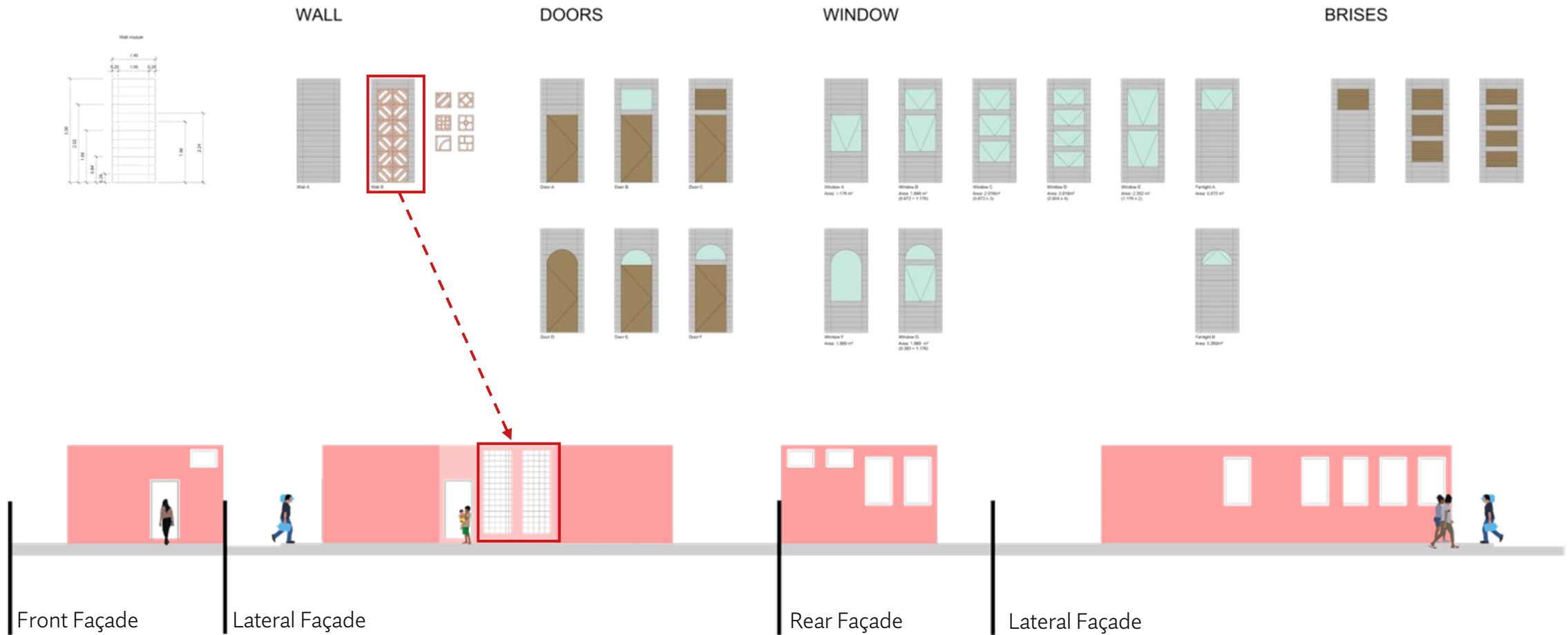


Building Material

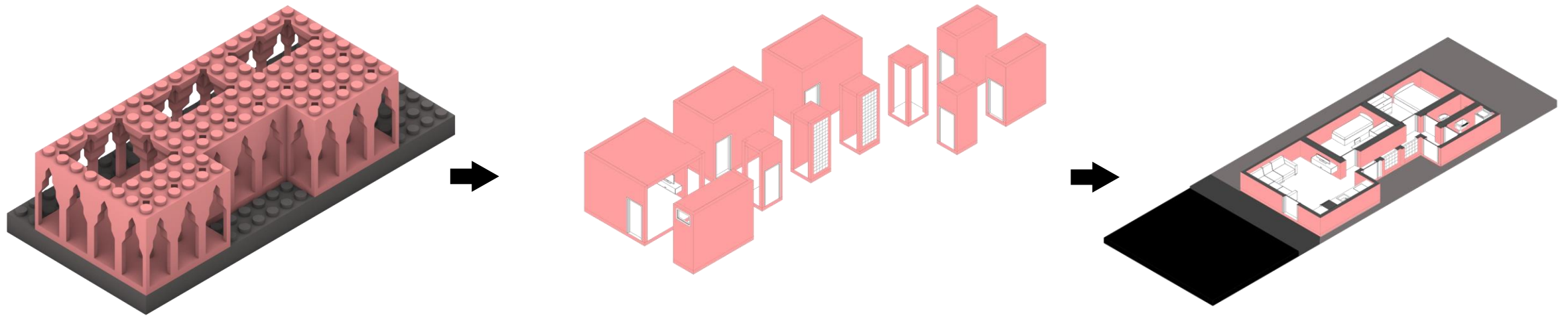
5th stage: Shaping



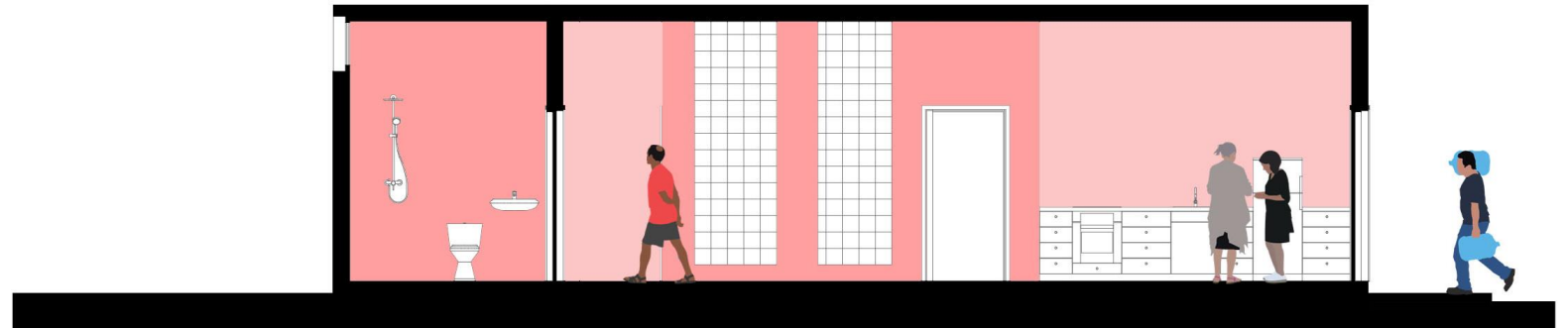
5th stage: Shaping



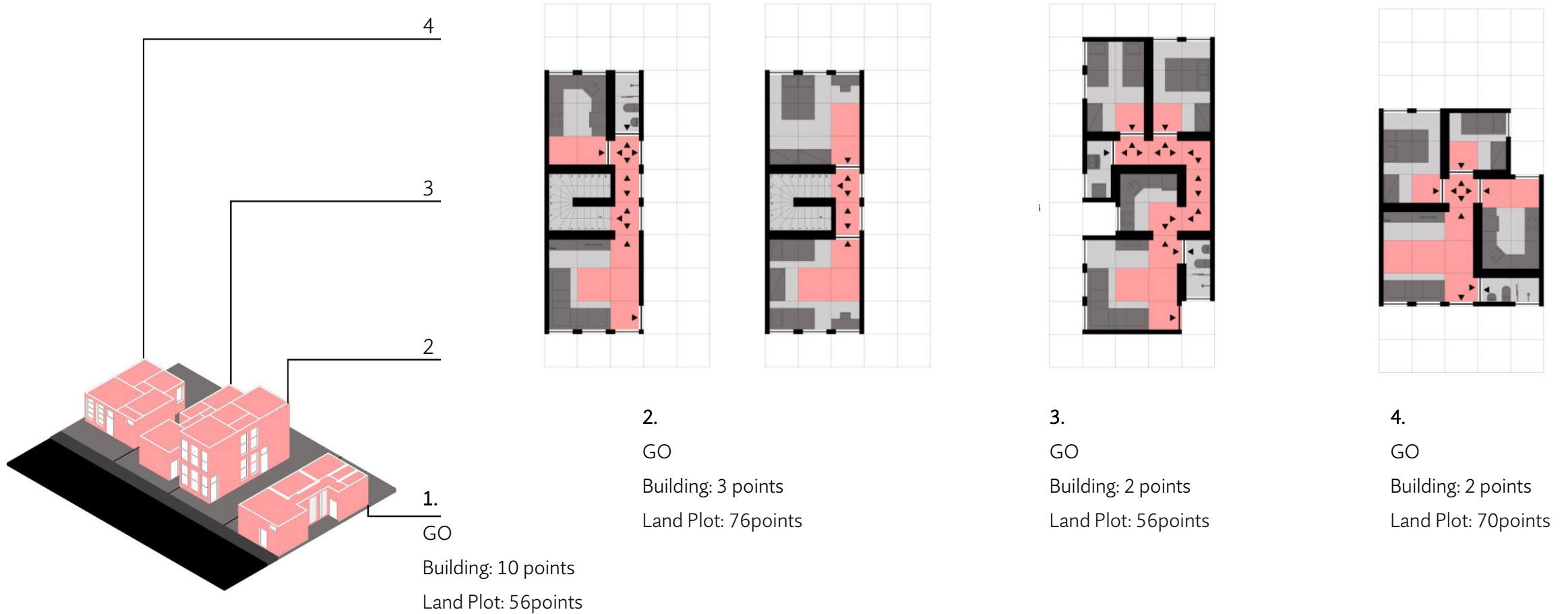
5th stage: Shaping



5th stage: Shaping

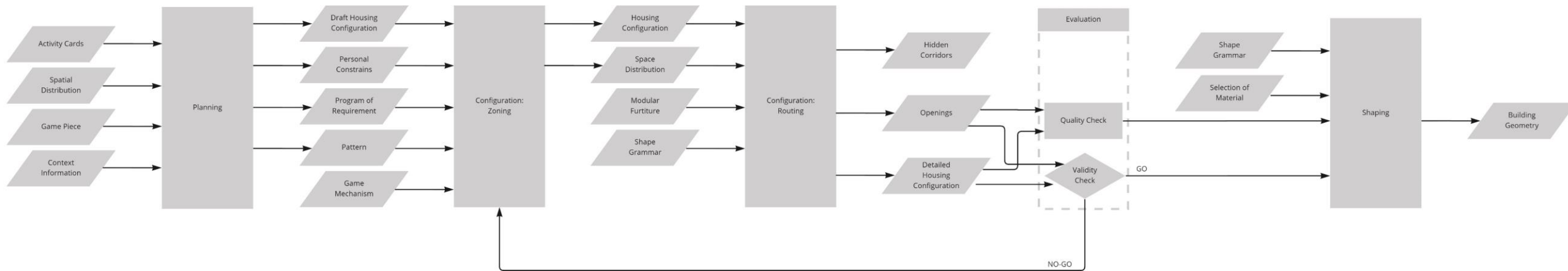


Different Outcome

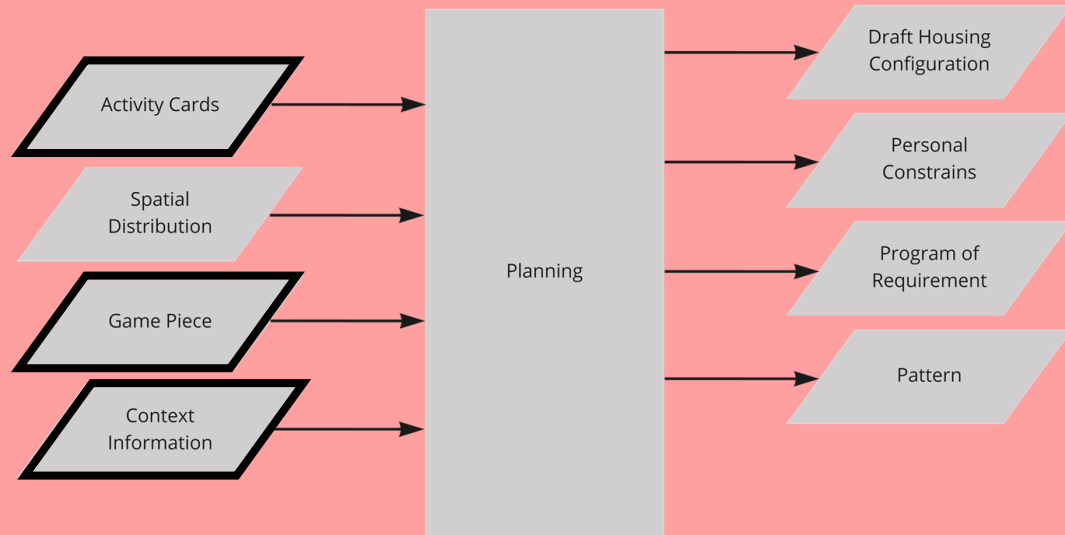


5. Meta Game

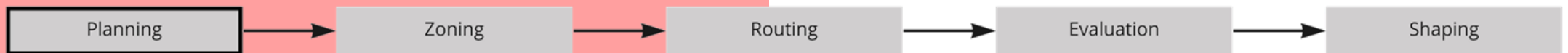
Framework



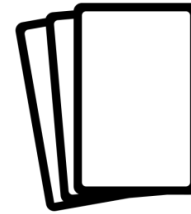
Meta Game



Adaptable



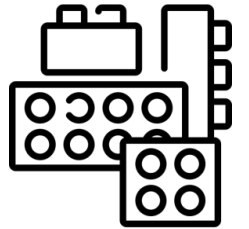
Adaptable



Activity Cards

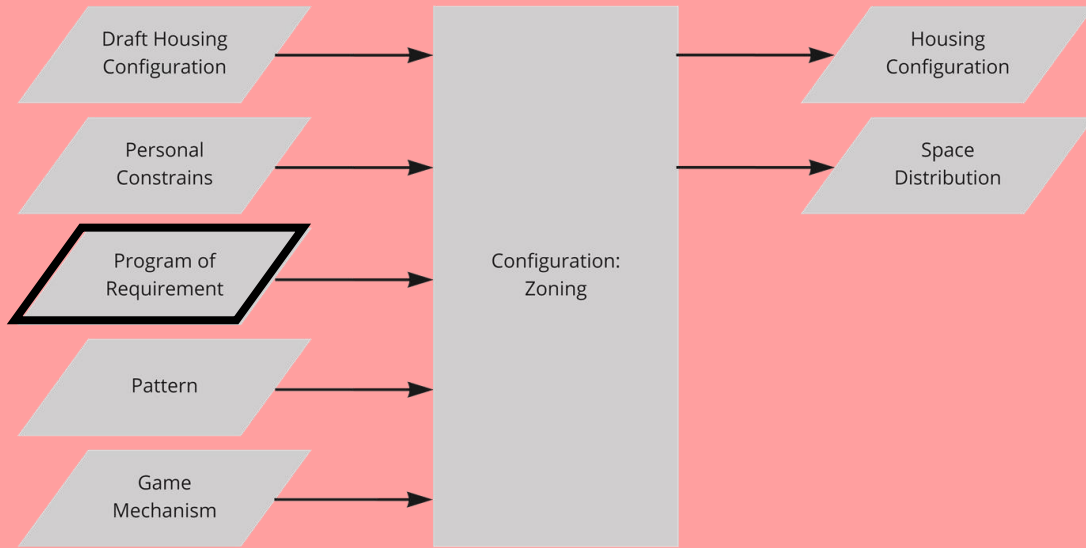


Context Information

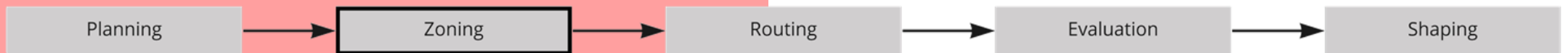


Game Piece

Meta Game



Adaptable

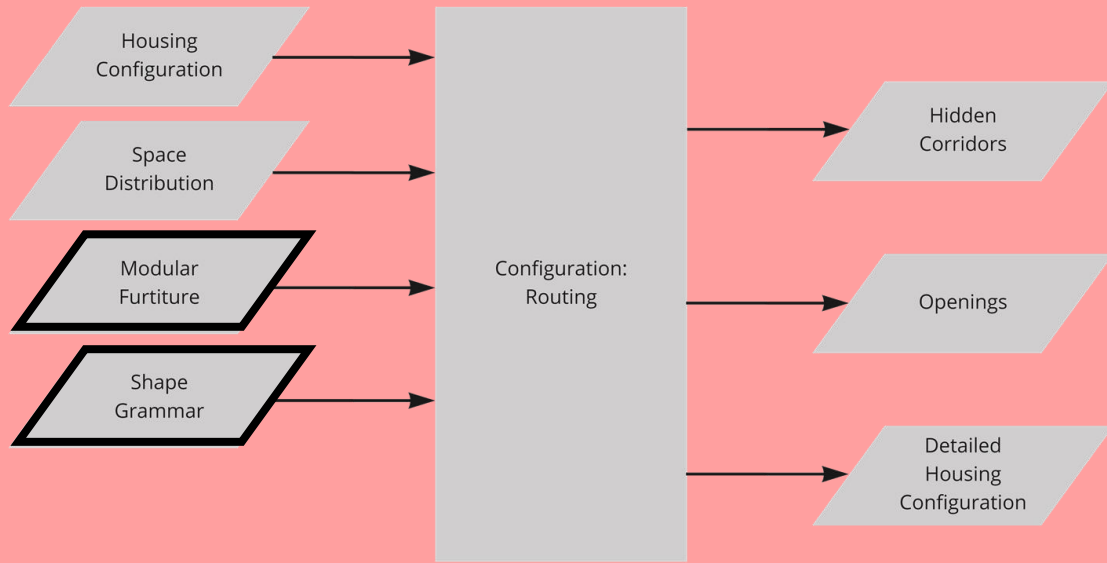


Adaptable

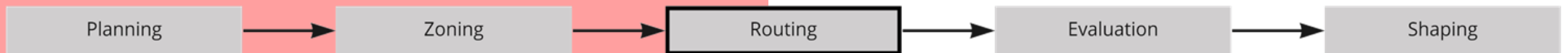


Program Requirement

Meta Game



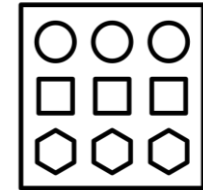
Adaptable



Adaptable

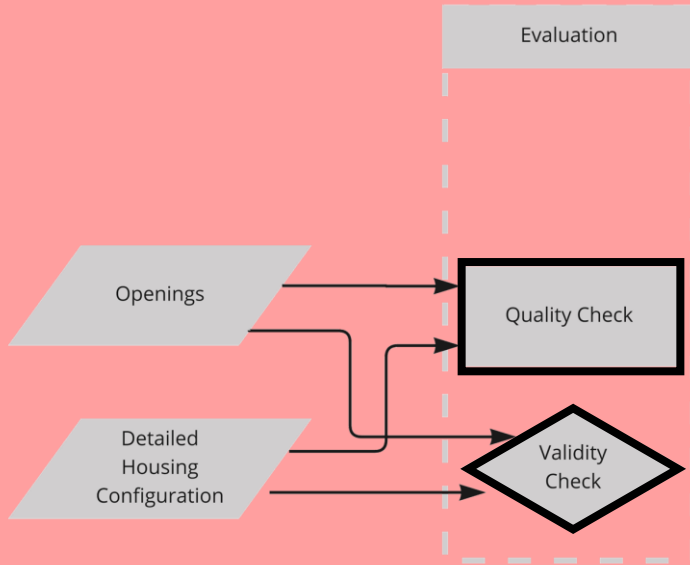


Modular Furniture

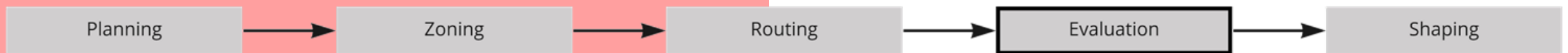


Shape Grammar

Meta Game



Adaptable



Adaptable

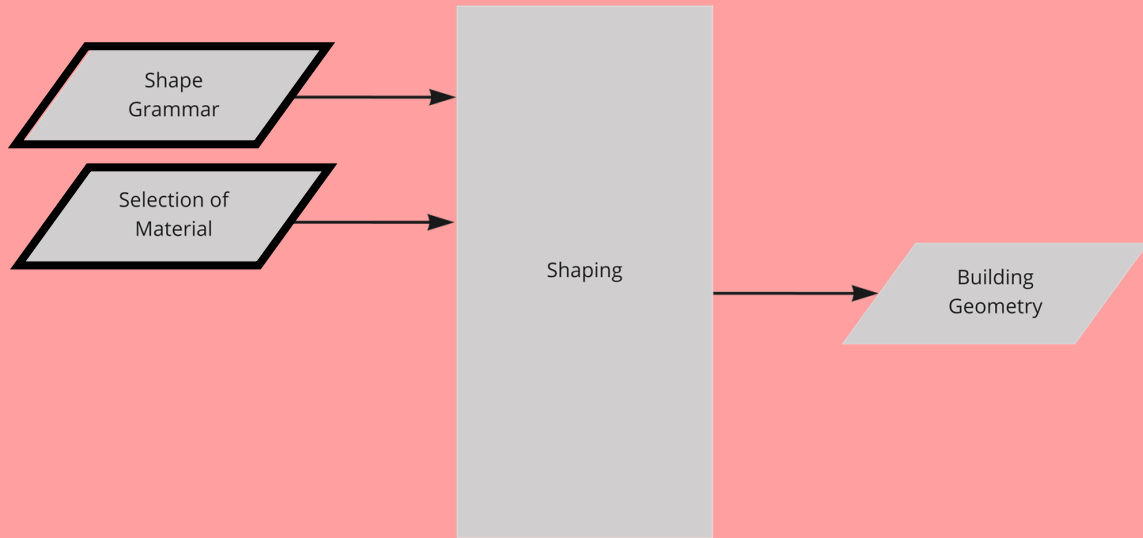


Spatial Quality
Criteria

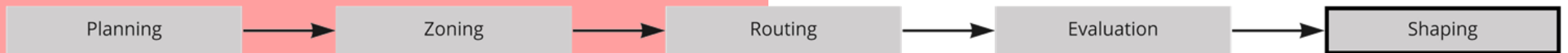


Spatial Validity
Criteria

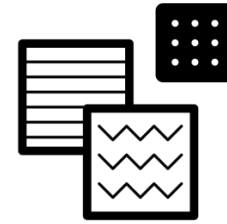
Meta Game



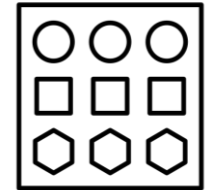
Adaptable



Adaptable



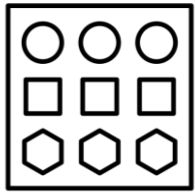
Building Material



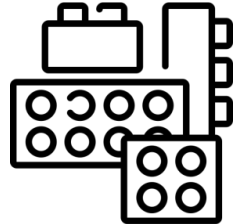
Shape Grammar

6. Conclusion

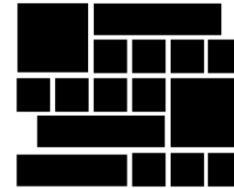
Limitation



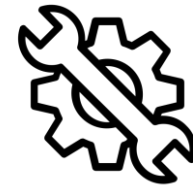
Shape Grammar



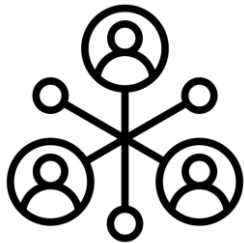
Geometric Design
of Game Piece



Tissue Level



Technological
Framework



Stakeholder



Space Syntax
Analysis

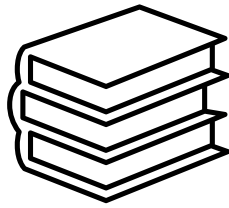


Tests and
Workshop

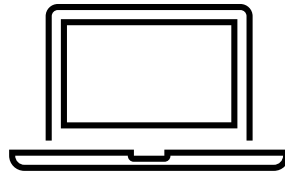


Cost

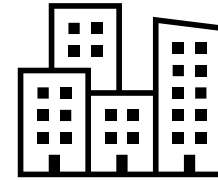
Future Work



Learning
Tool

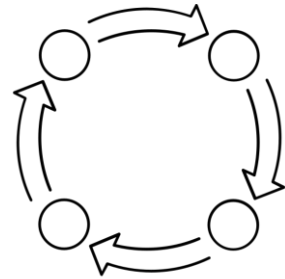


Computational
Tool



Housing
Development

Reflection



Thank you!