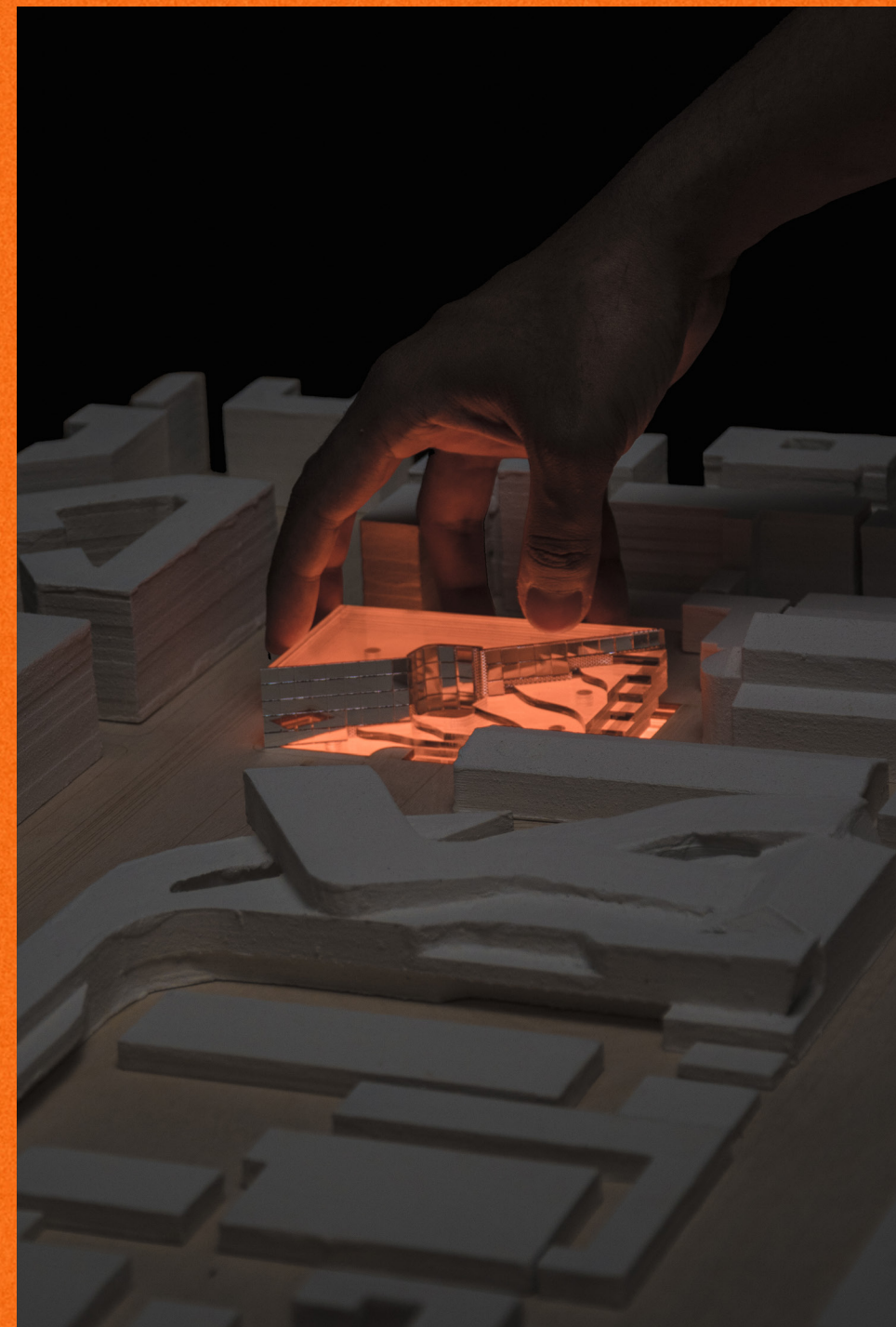
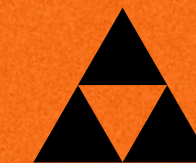


# Tuesday <sup>VI / MMXXIII</sup>



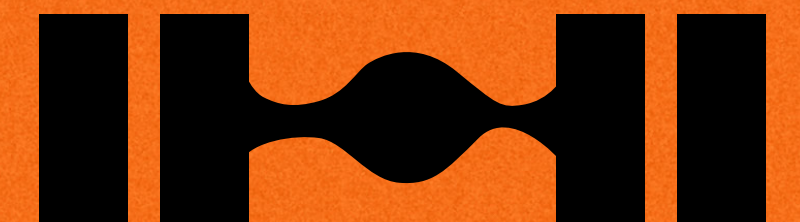
PRESENTATION  
OF THE DAY

< P5 >  
TARIQUE ALI  
5498198  
ROOM T, BK



RESEARCH AND  
DESIGN TEAM

SEYRAN KHADEMI  
GEORG VRACHLIOTIS  
RUFUS VAN DEN BAN  
CASPER VAN ENGELBURG



27.06.2023  
12:45:00 / 14:30:00

 **TU**Delft  
**BK**Bouwkunde





*design for a museum building right next to the MAXXI museum by Zaha Hadid in Rome, which features ai explaining art and architecture within its spaces, 4k*

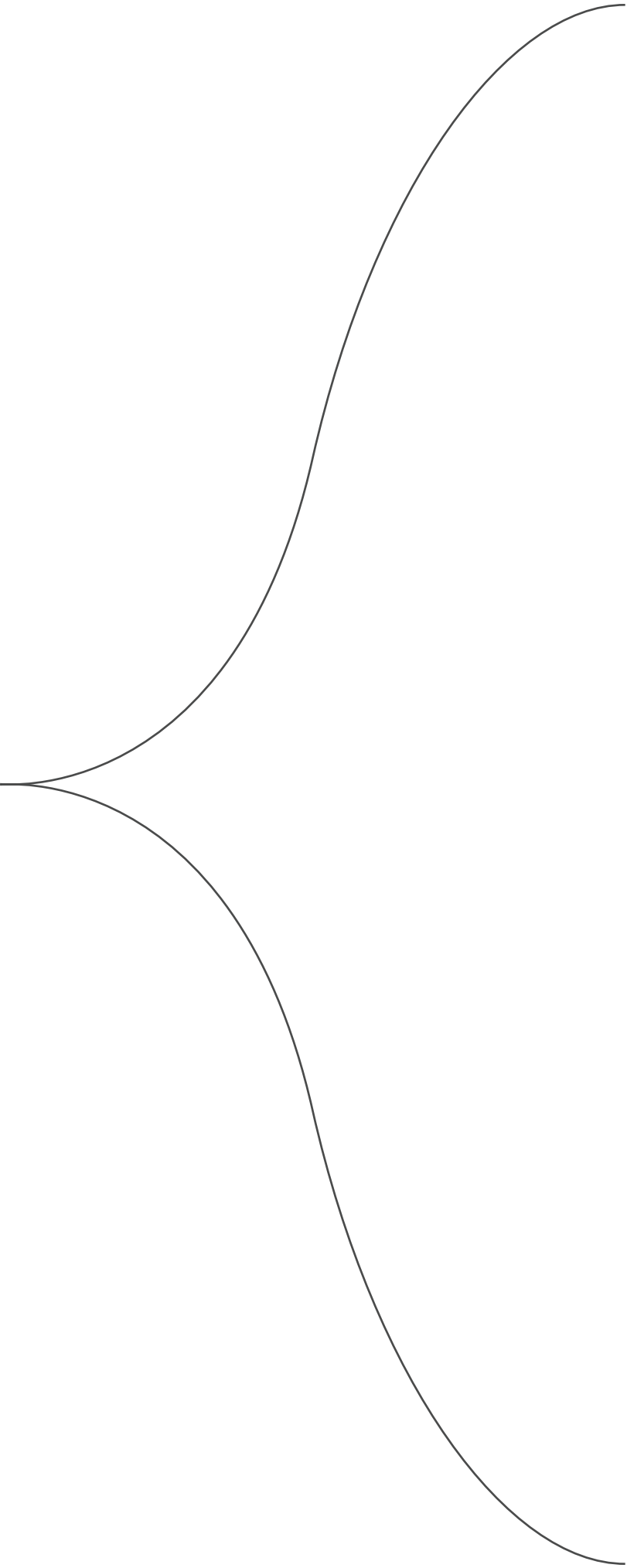


*generated using MIDJOURNEY, an 'image to text' model*





# Context ?



day light availability

site responses

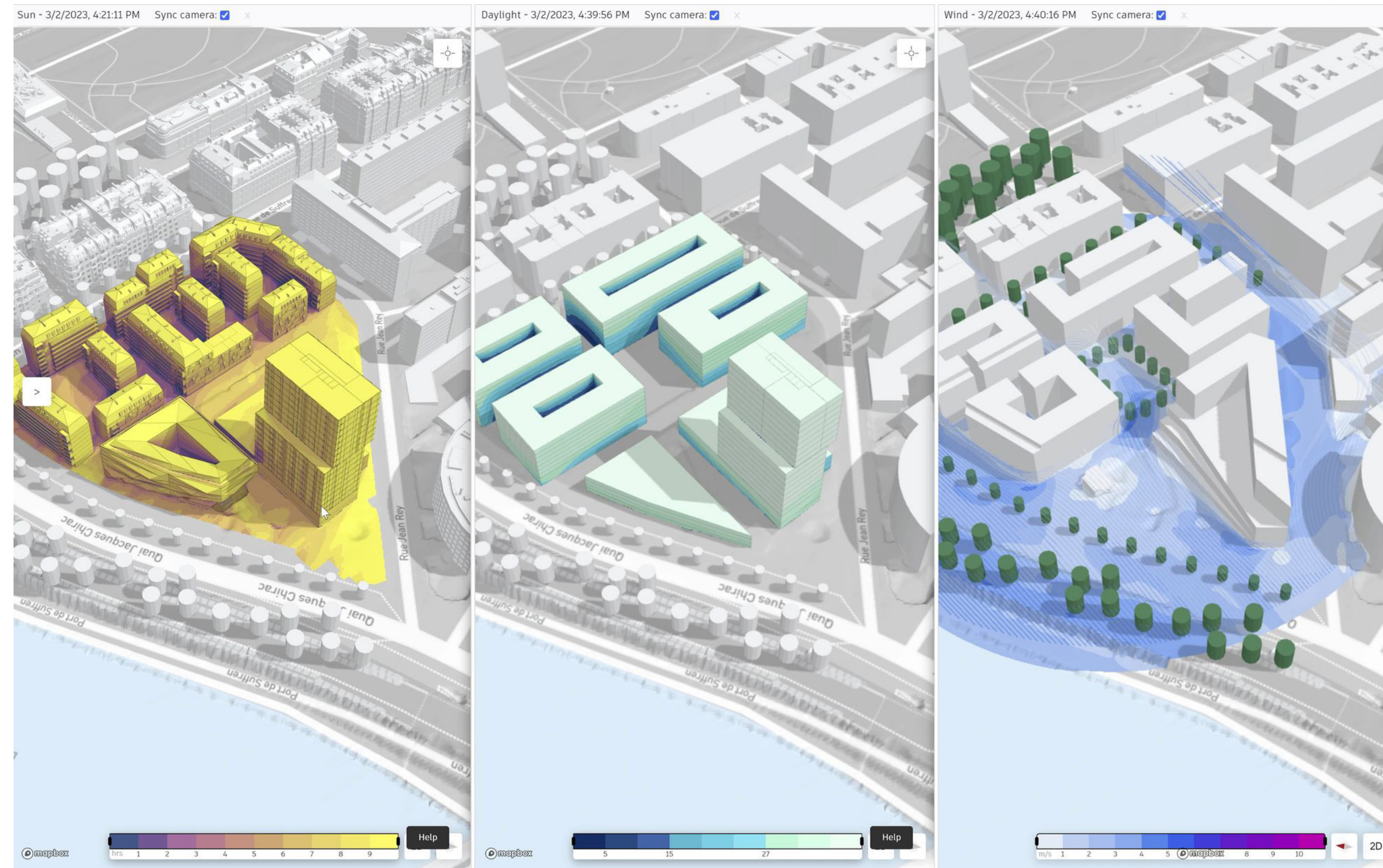
safety

materiality

structural sensibility

energy considerations

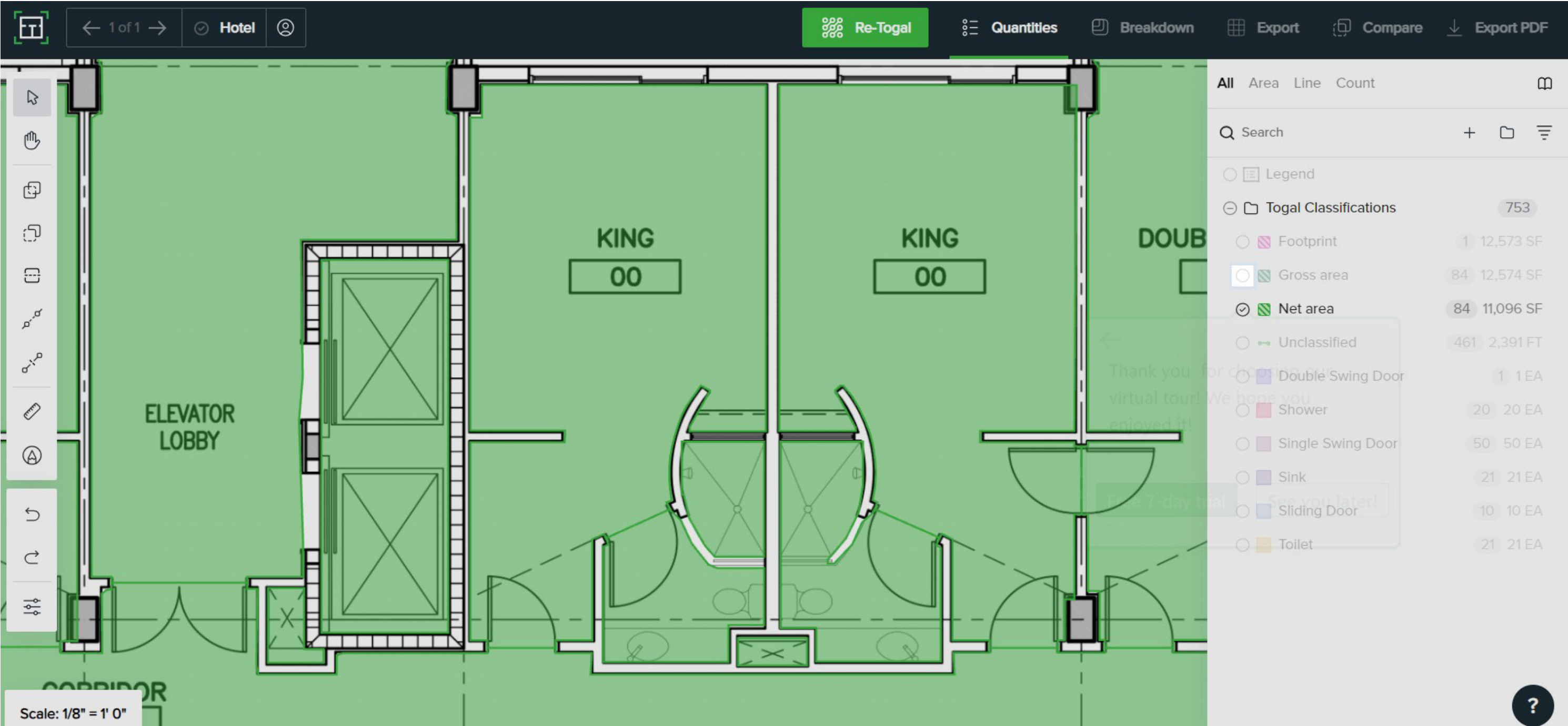




## Autodesk Forma (formerly spacemaker.ai)

"AI powered" co-creation tool for cloud based design analysis

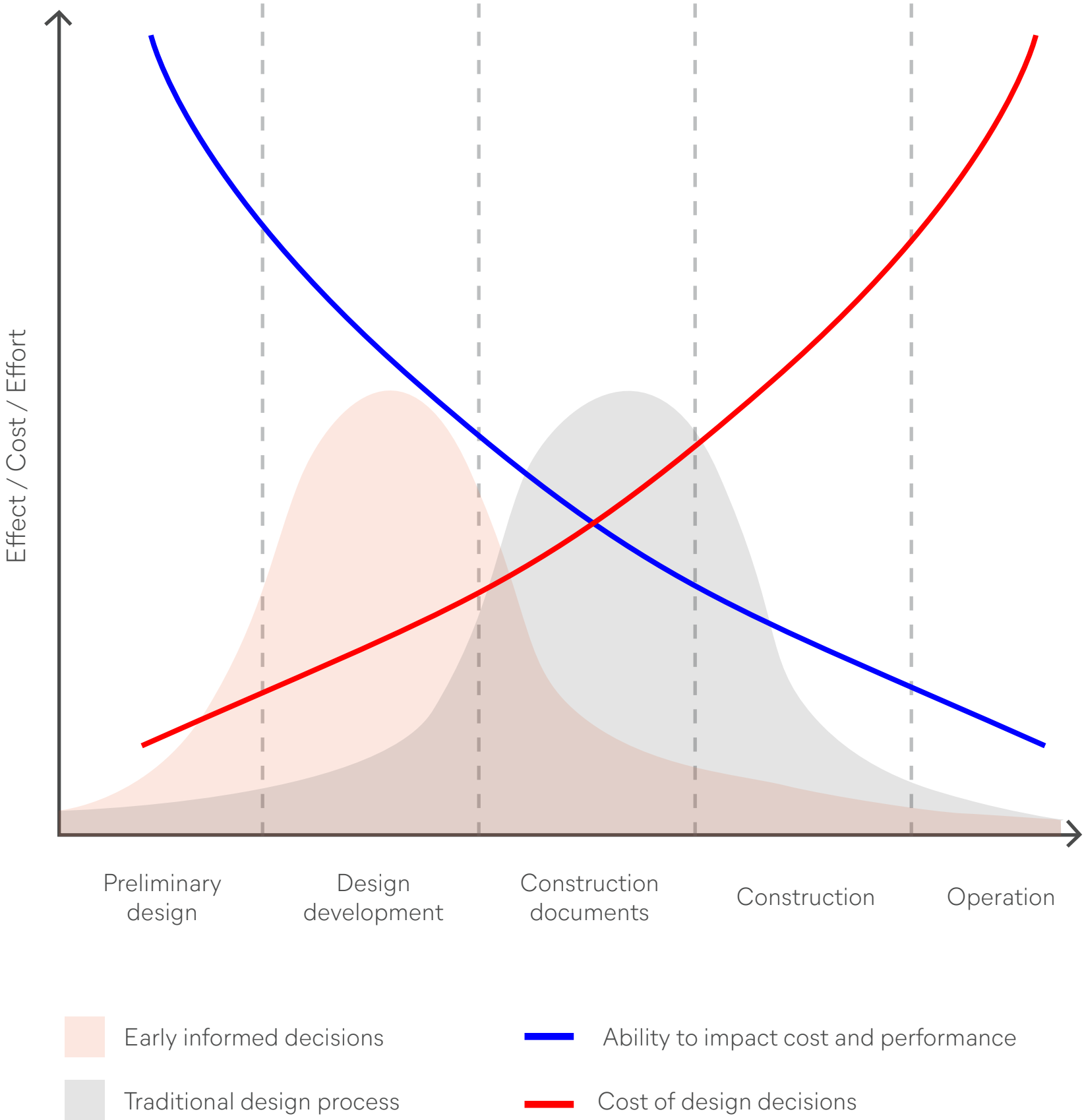




# Togal.Ai

Estimation takeoff software powered by "Deep"Machine learning





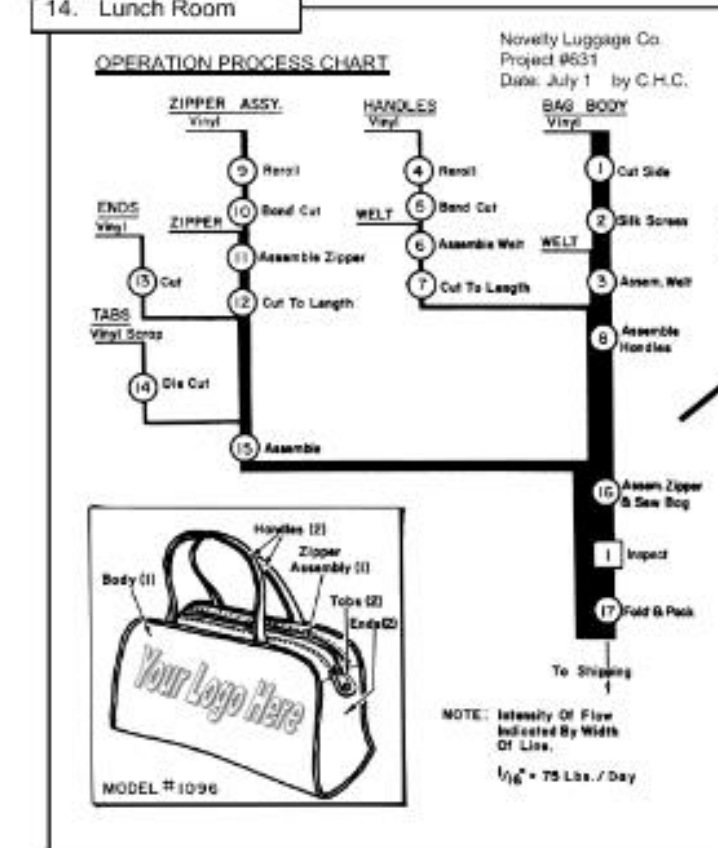


### EXAMPLE OF SYSTEMATIC LAYOUT PLANNING, PHASE II

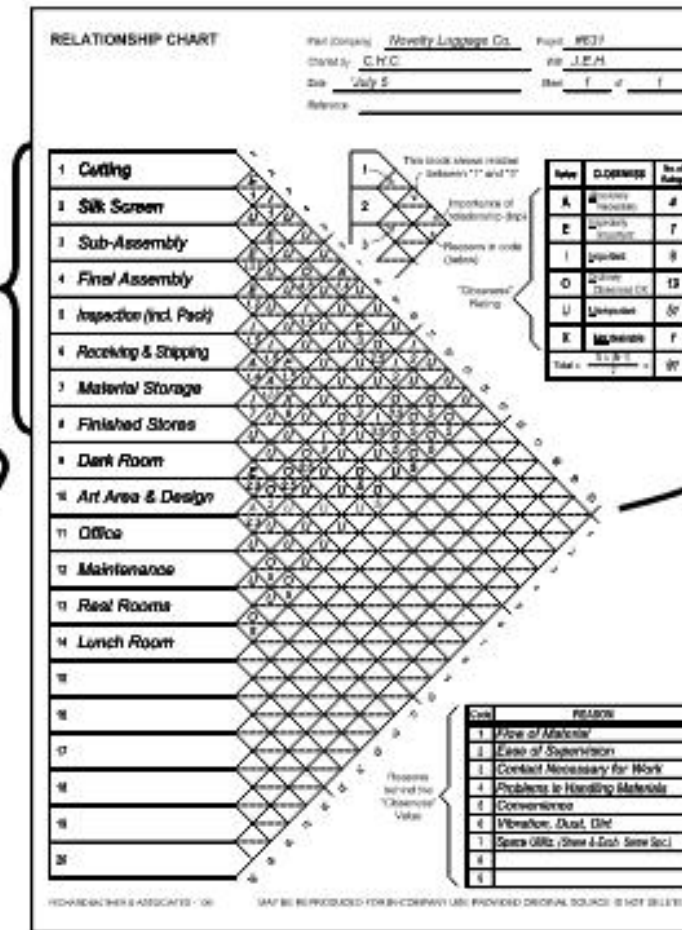
**Key Input Data: P, Q, R, S, T**

- | List of Activity Areas |
|------------------------|
| 1. Cutting             |
| 2. Silk Screen         |
| 3. Sub-Assembly        |
| 4. Final Assembly      |
| 14. Lunch Room         |

### 1. Activity-Areas

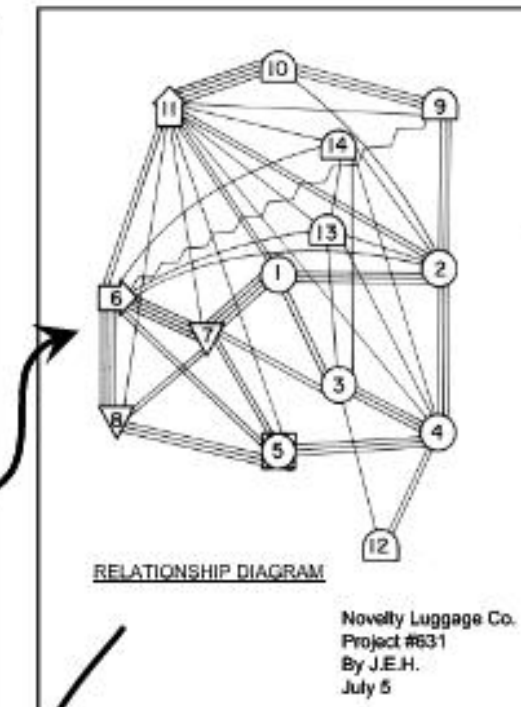


## 2. Flow of Materials



## 2. Relationship Chart

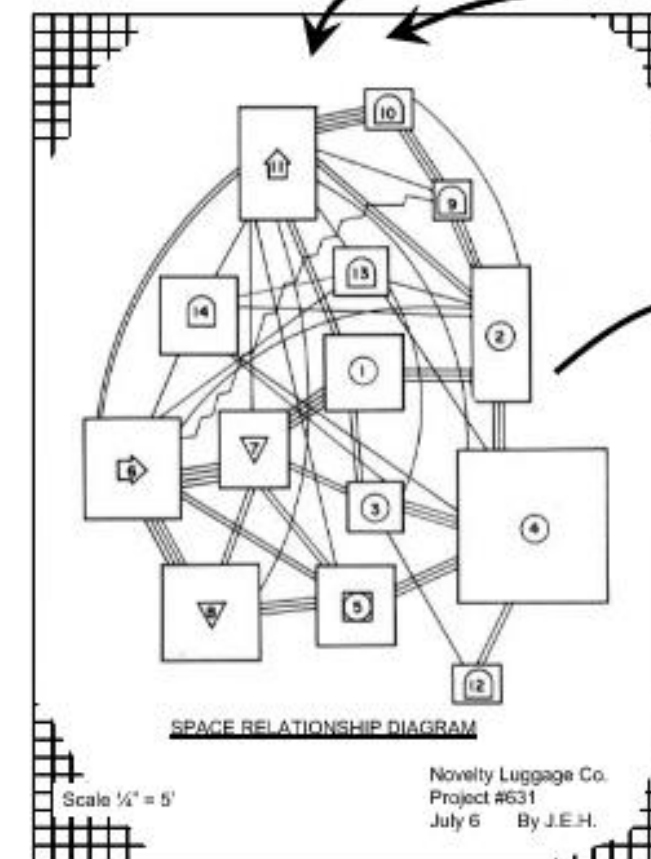
(Flow & Other Activity Relationships)



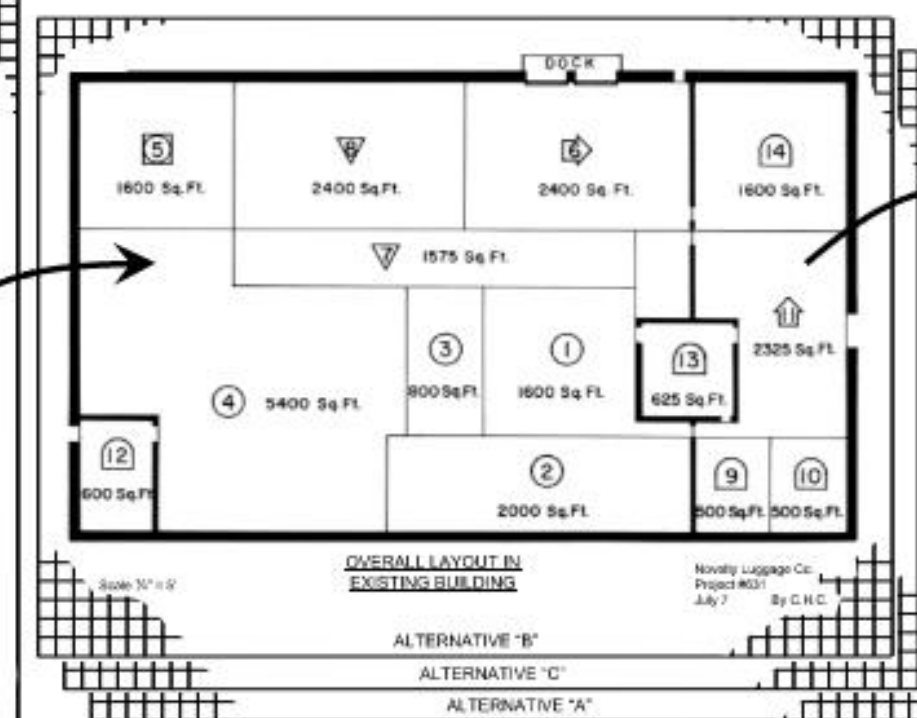
## 2. Relationship Diagram



### 3. Space Requirements



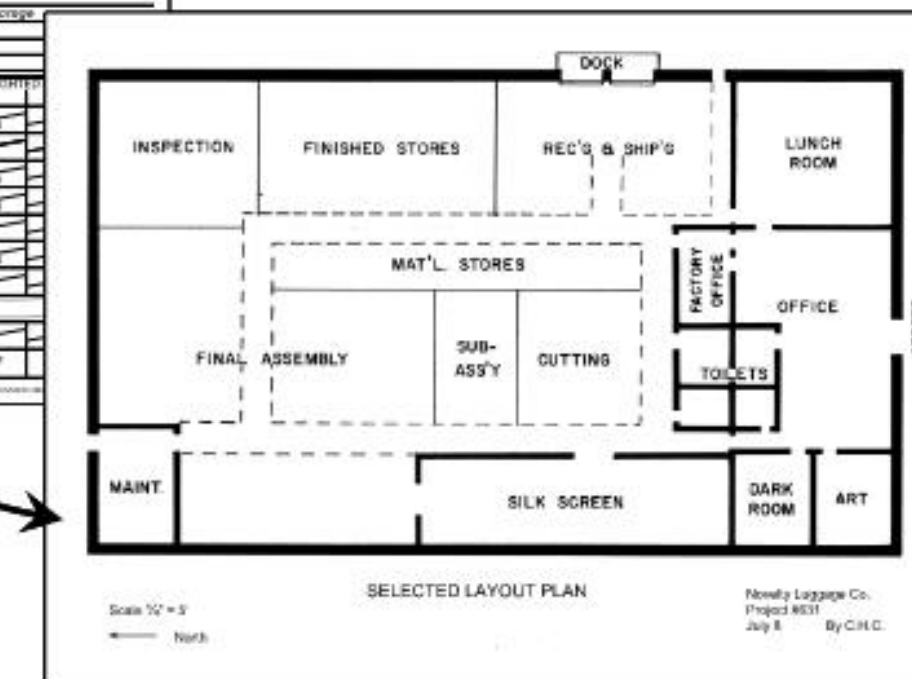
### 3. Space Relationship Diagram



#### 4. Alternative Layouts based on Modifying Considerations and Practical Limitations



## 5. Evaluation



## 5. Selected Layout Plan

### Phase II – Overall Block Layout



archdaily

Search in Projects

ProjectsImagesProducts & BIMProfessionalsNews

Museum

Italy

Architects

Manufacturers

Year

Materials

Area

Color



MUSEUM  
MUSE / Renzo Piano Building Workshop



SOUTH TYROL  
Messner Mountain Museum at Plan de ...



MUSEUM  
Renovation and Reconstruction of the ...



MUSEUM  
Enzo Ferrari Museum / Future Systems ...



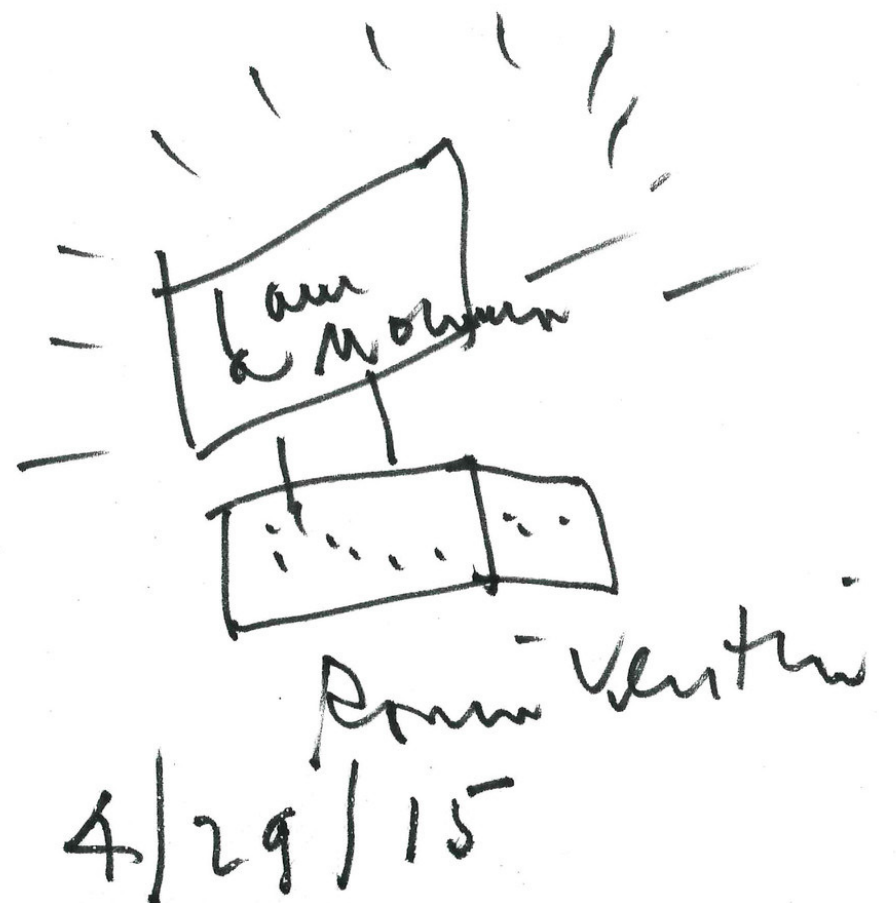
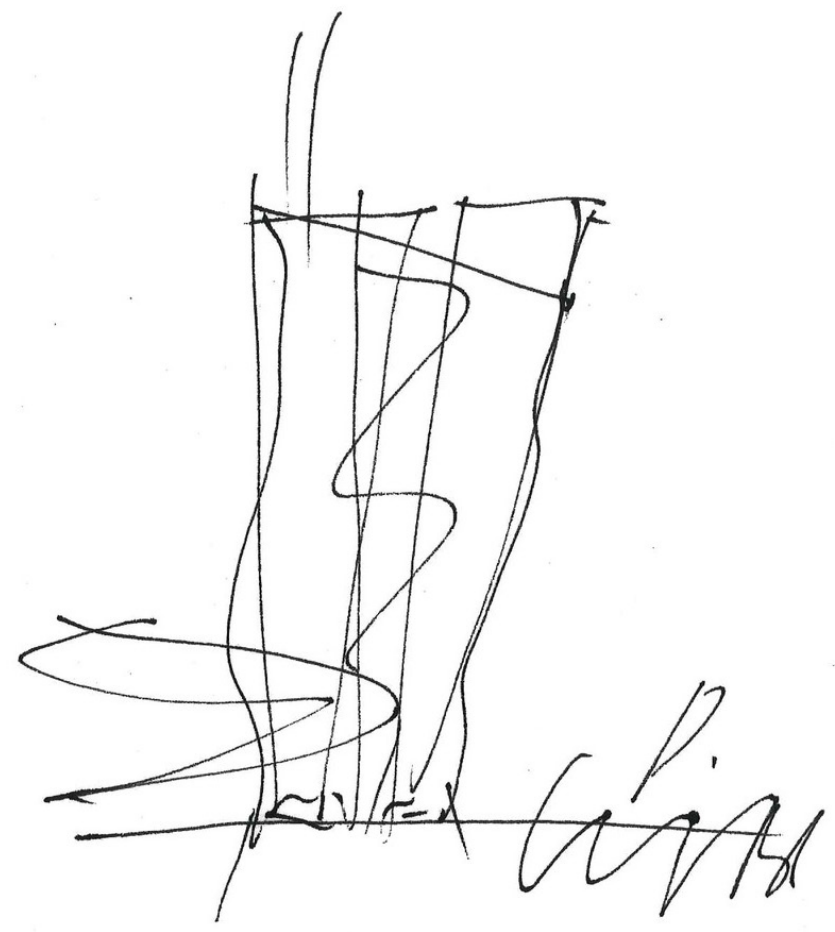
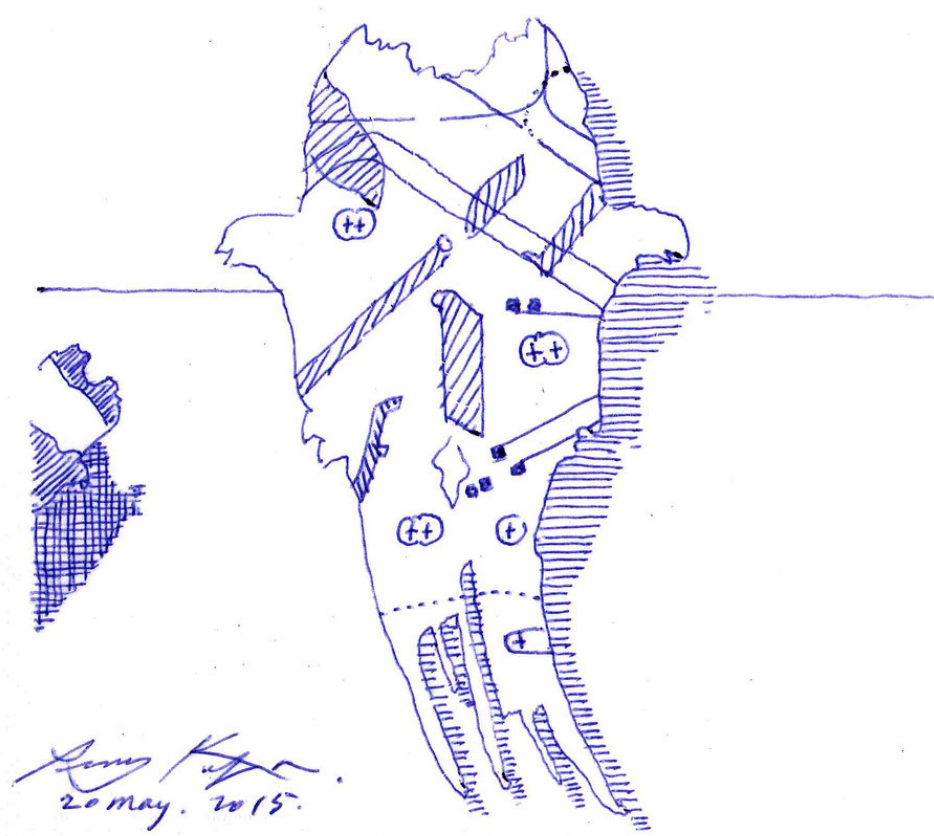
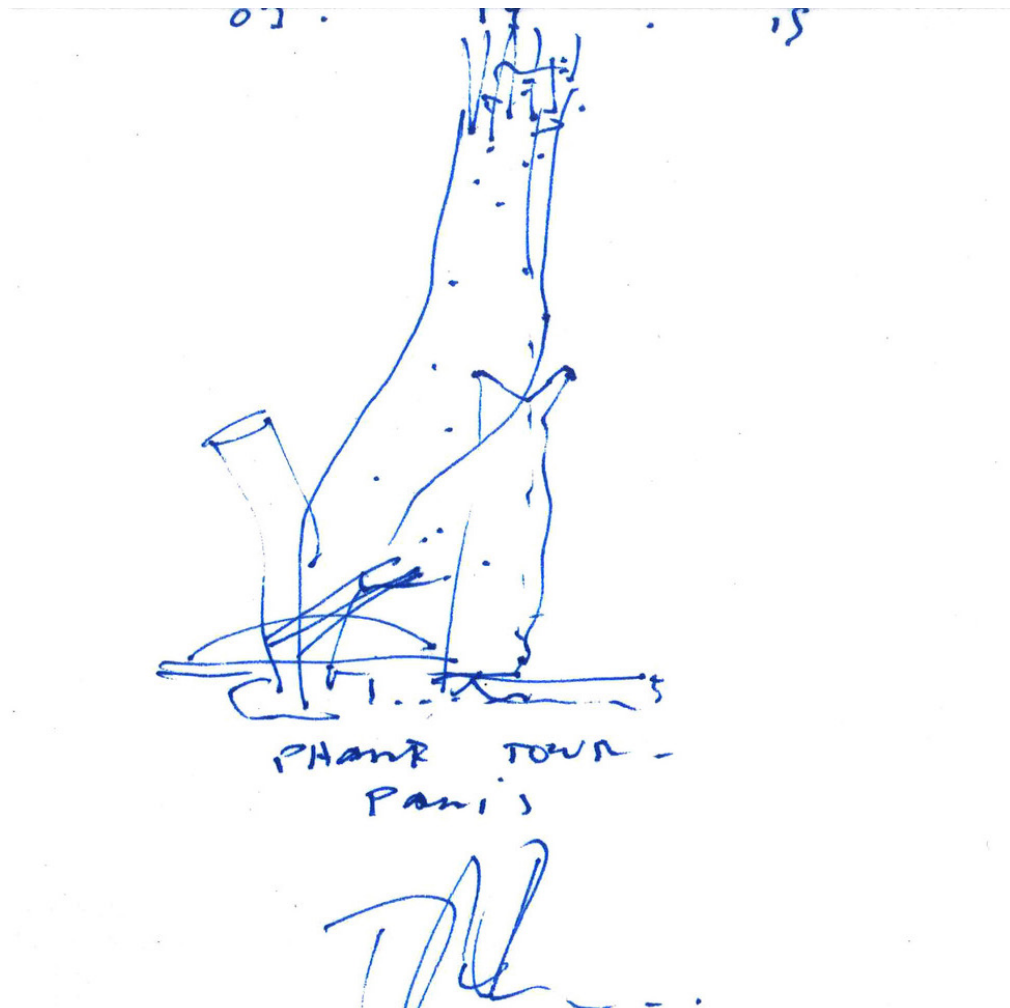
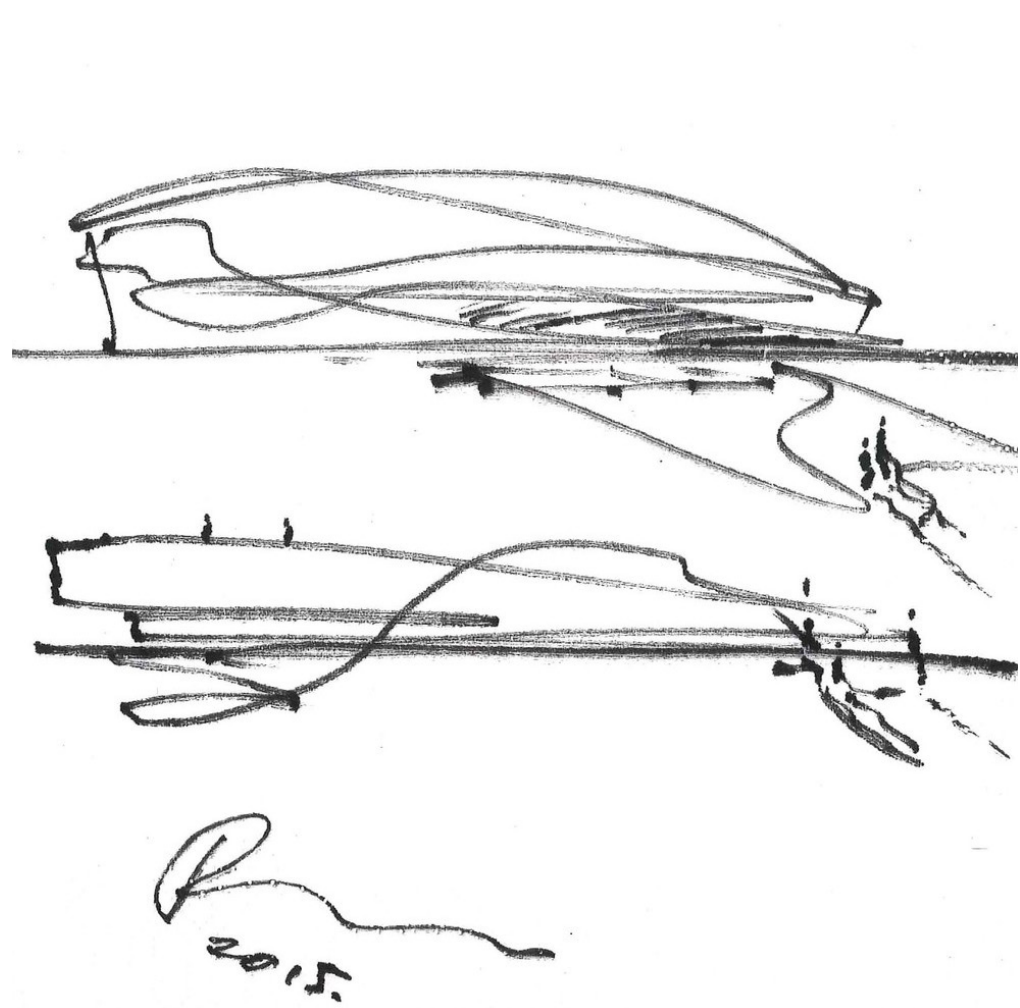
MUSEUM  
The Savings Museum / Migliore + Serve...



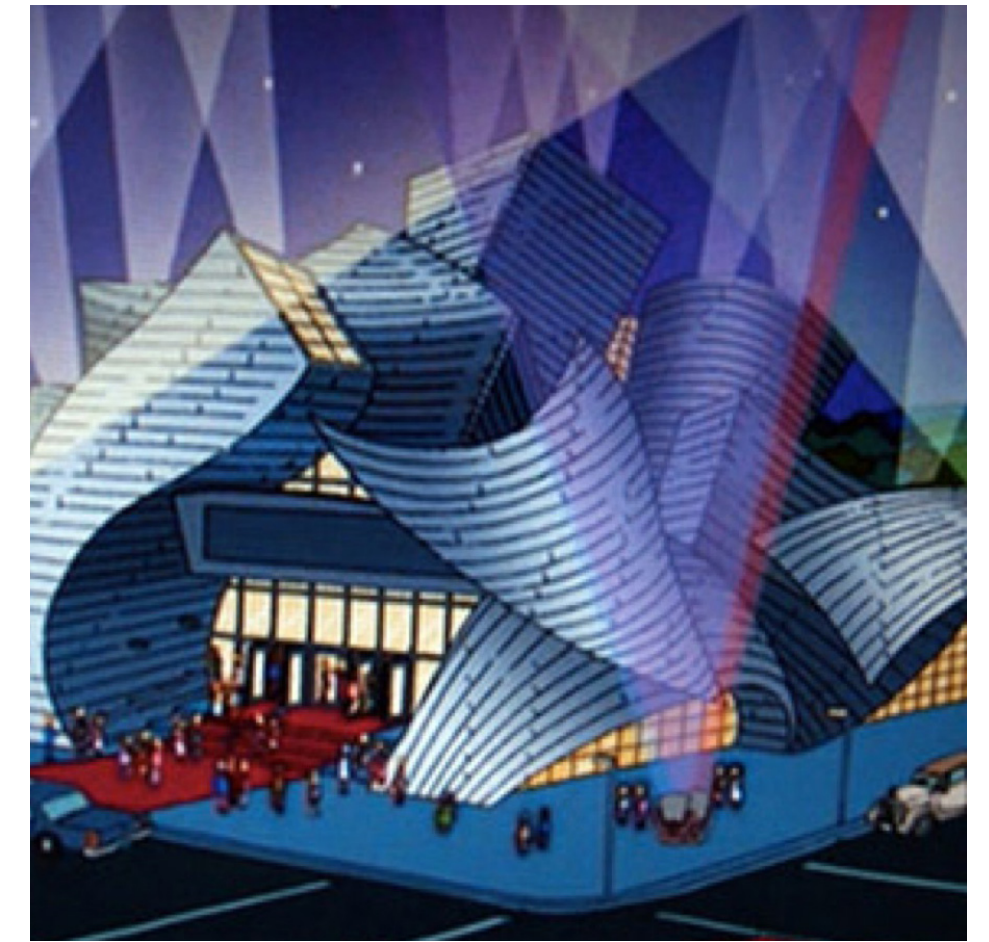
MUSEUM  
National Automobile Museum / Cino Zu...

we do love our precedences ❤️









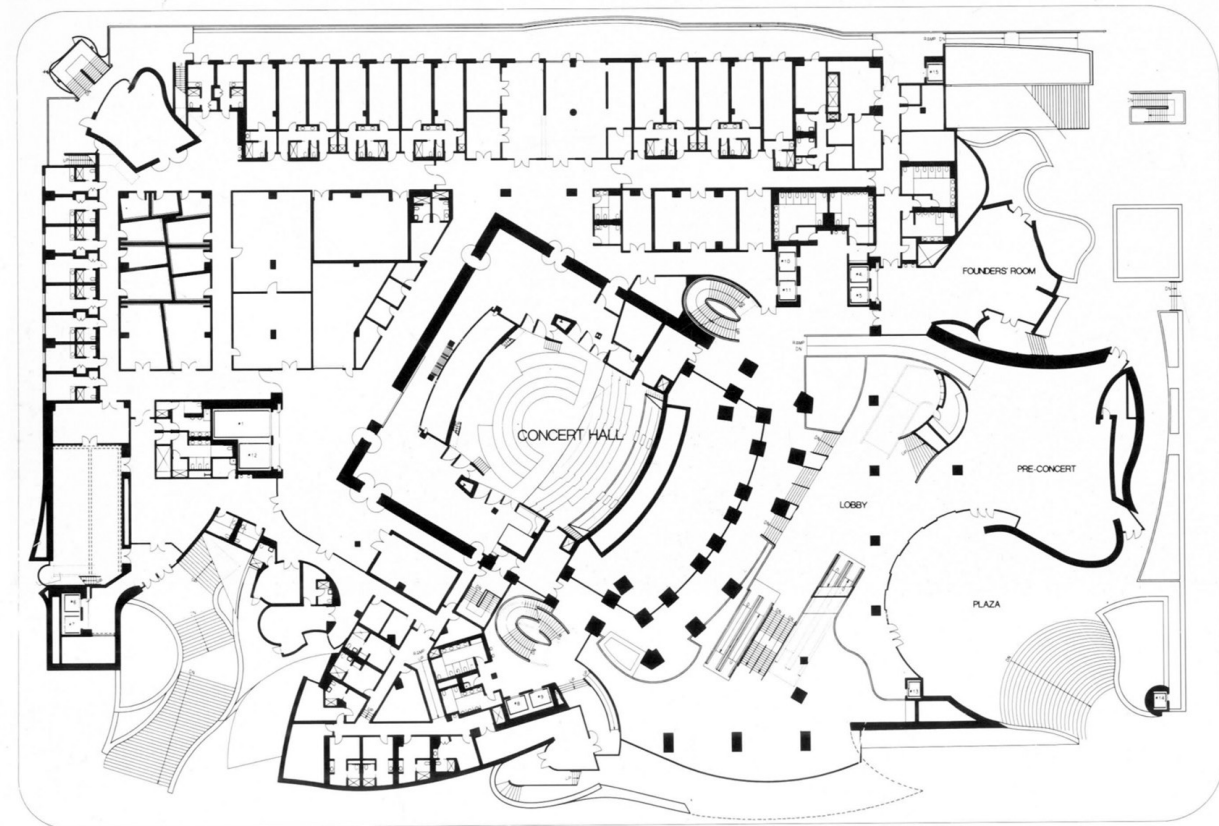
The Simpsons - "The seven beer snitch"  
Season 16, Episode 14, 2005



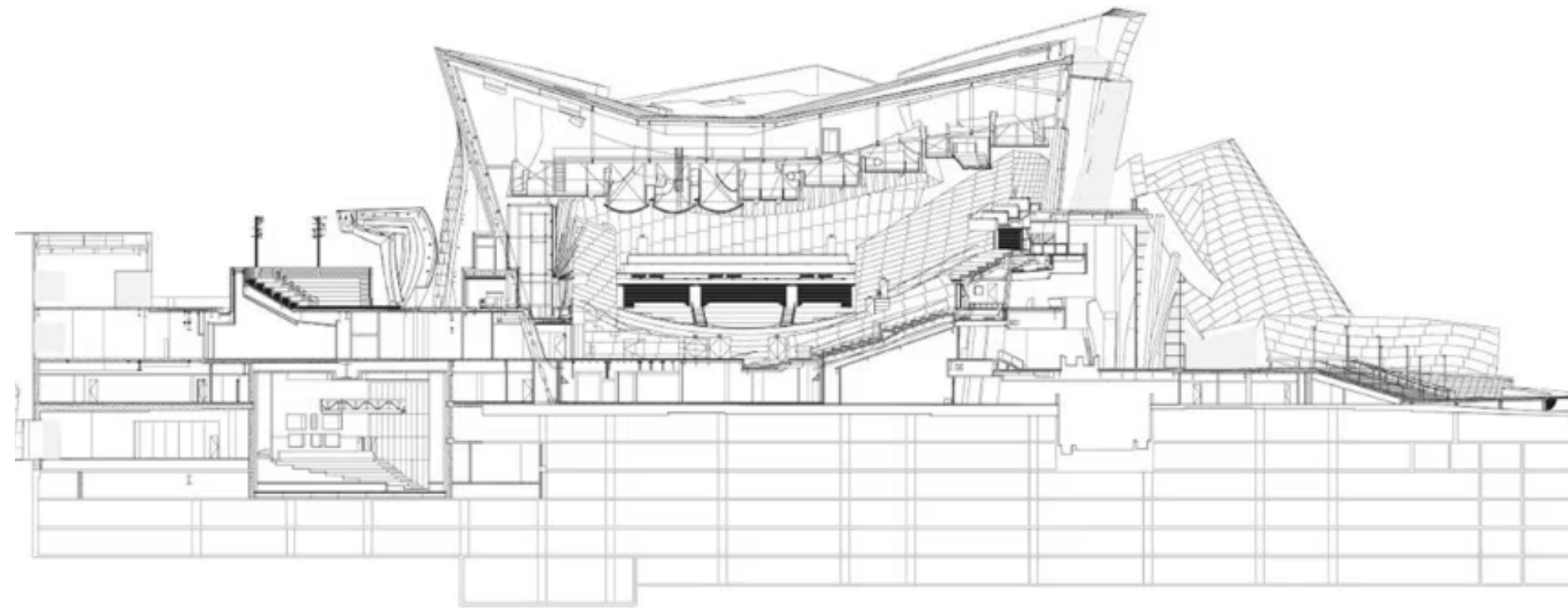
To understand precedences, we mainly  
stick to one of the following

3 ways of knowledge acquisition

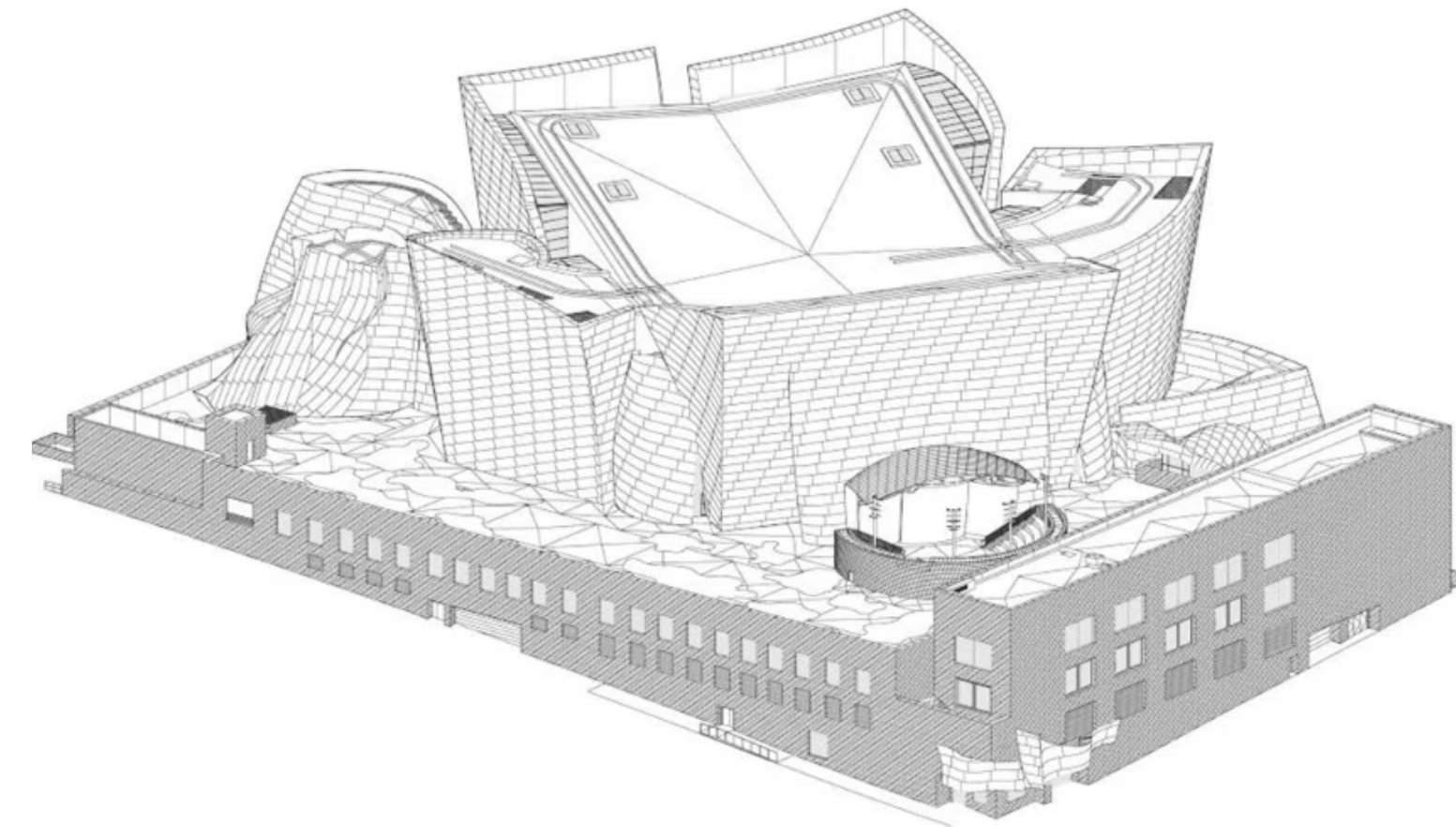




**plan**



**section**



**axon**





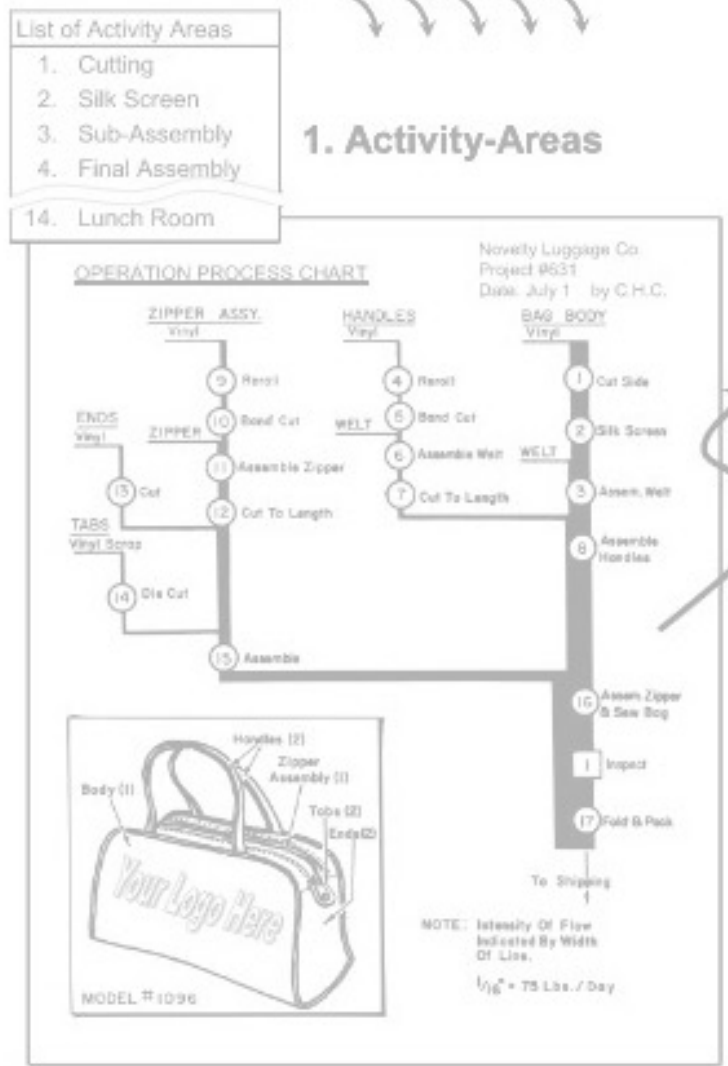
imagery/renders



maps/3D data

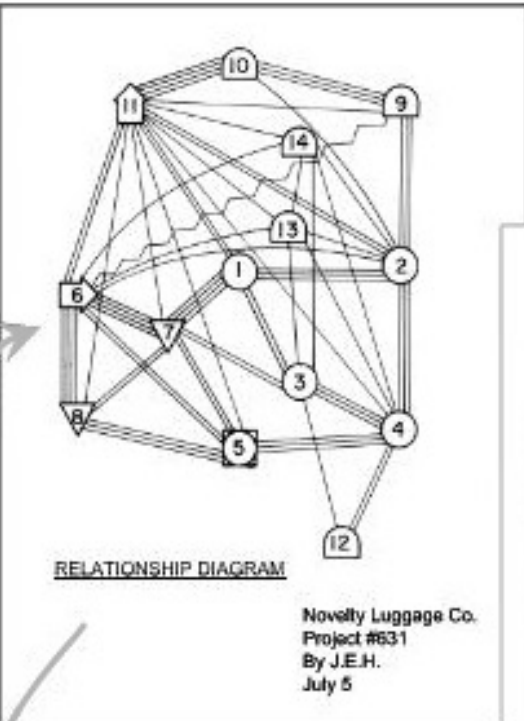


Key Input Data: P, Q, R, S, T



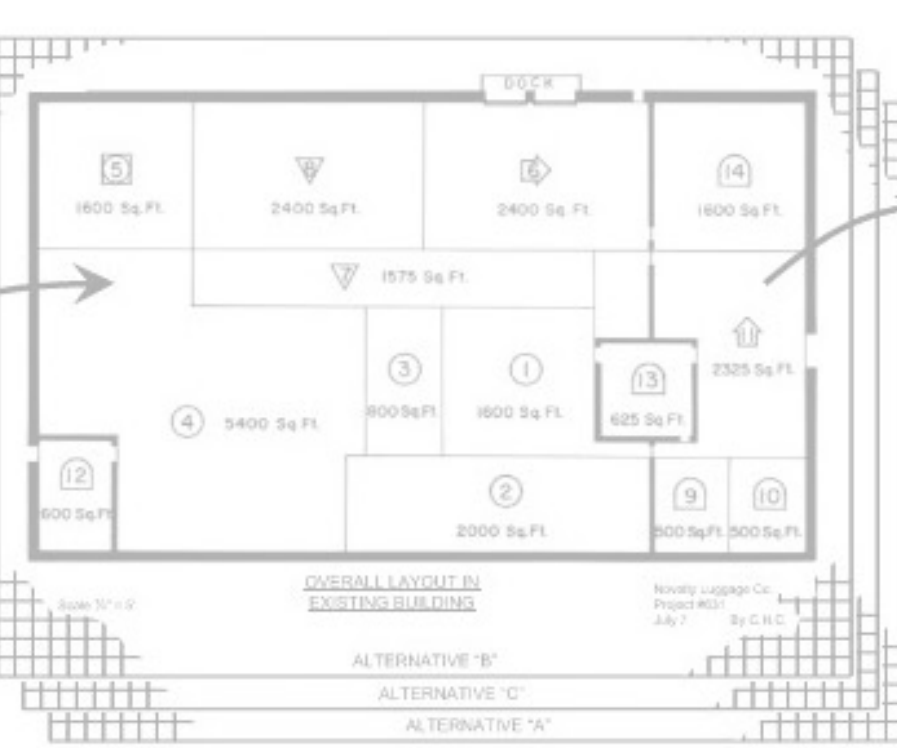
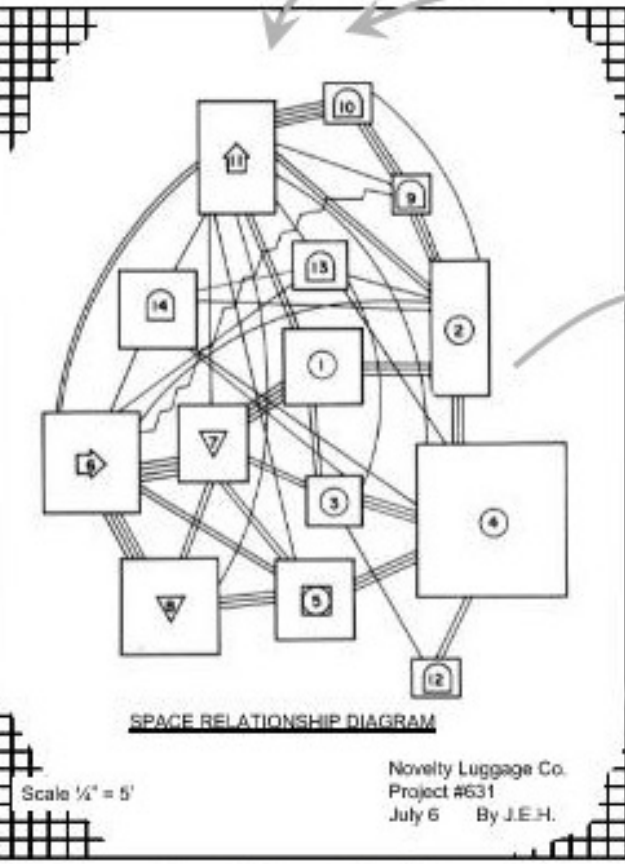
2. Flow of Materials

EXAMPLE OF SYSTEMATIC LAYOUT PLANNING, PHASE II



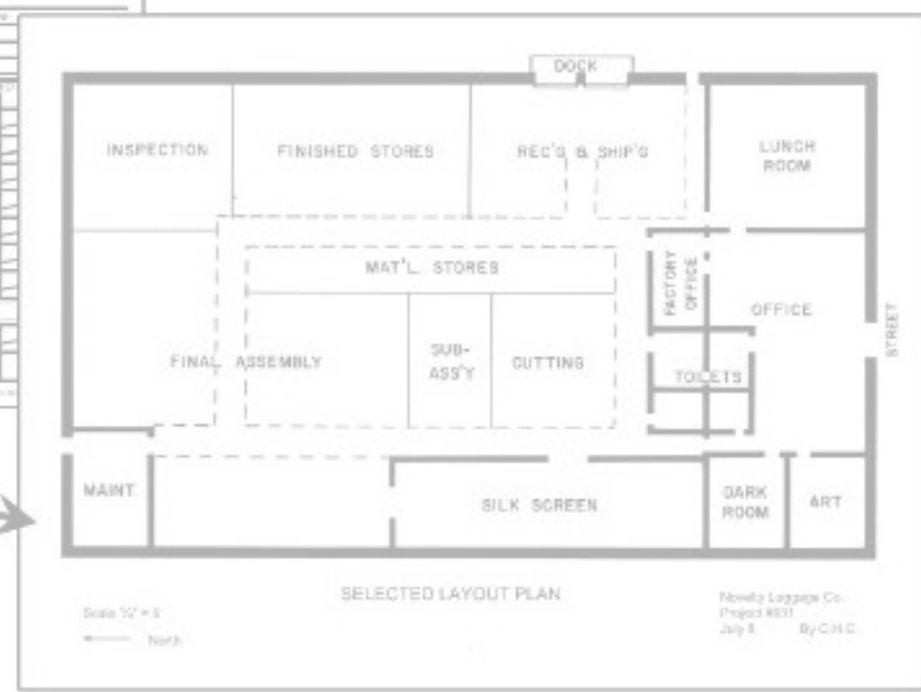
**3. Space Requirements**

| Activity                | Area  | Volume | Weight | Height | Temperature | Humidity | Light | Sound | Security | Access | Other |
|-------------------------|-------|--------|--------|--------|-------------|----------|-------|-------|----------|--------|-------|
| Cutting                 | 1,600 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Silk Screen             | 2,100 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Sub-Assembly            | 800   | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Final Assembly          | 5,400 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Inspection (incl. Pack) | 1,700 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Rec'g & Ship'g          | 2,000 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Mat'l. Storage          | 1,600 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Finished Stores         | 2,600 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Dark Room               | 400   | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Art Rm. & Design        | 500   | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Office                  | 2,300 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Maintenance             | 500   | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Rest Rooms              | 700   | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |
| Lunch Room              | 1,600 | 12,000 | 12     | 12     | 12          | 12       | 12    | 12    | 12       | 12     | 12    |

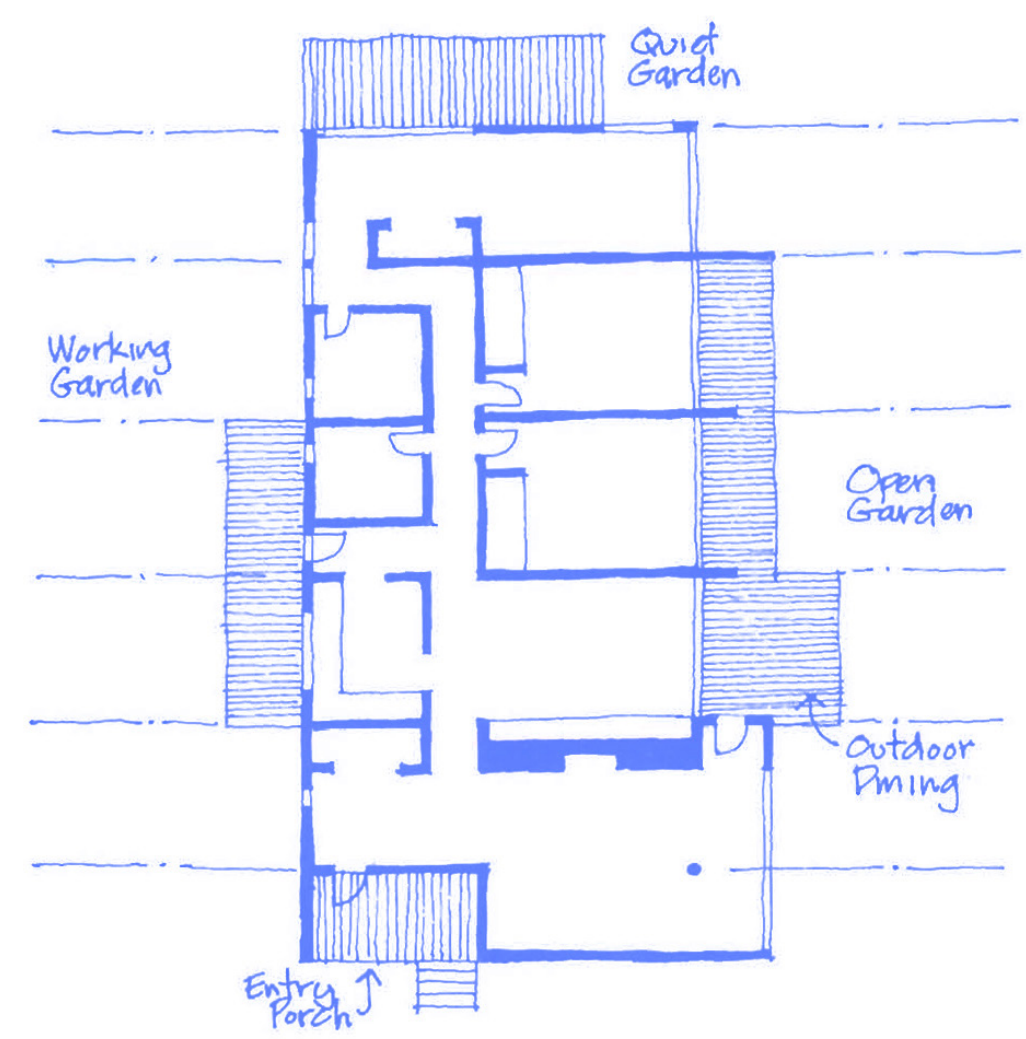
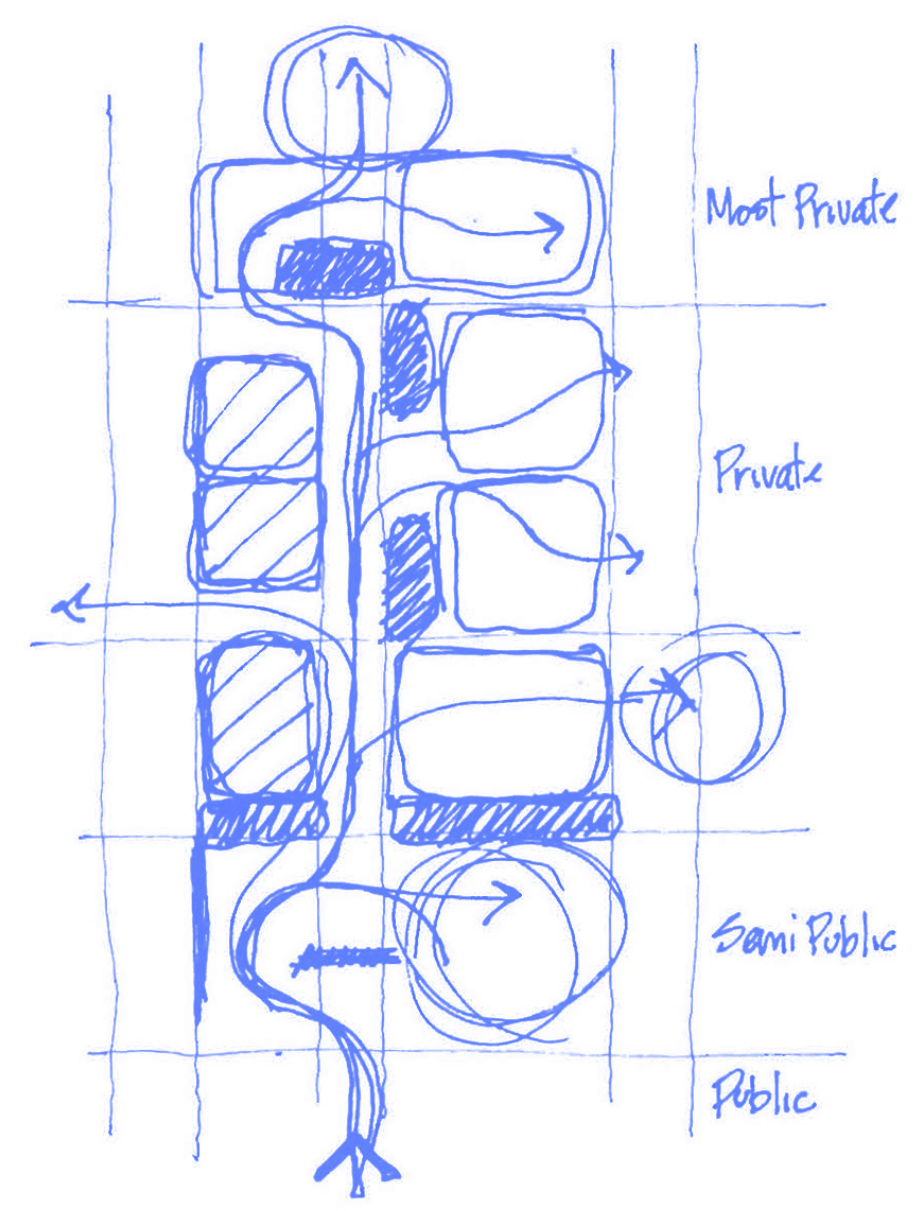
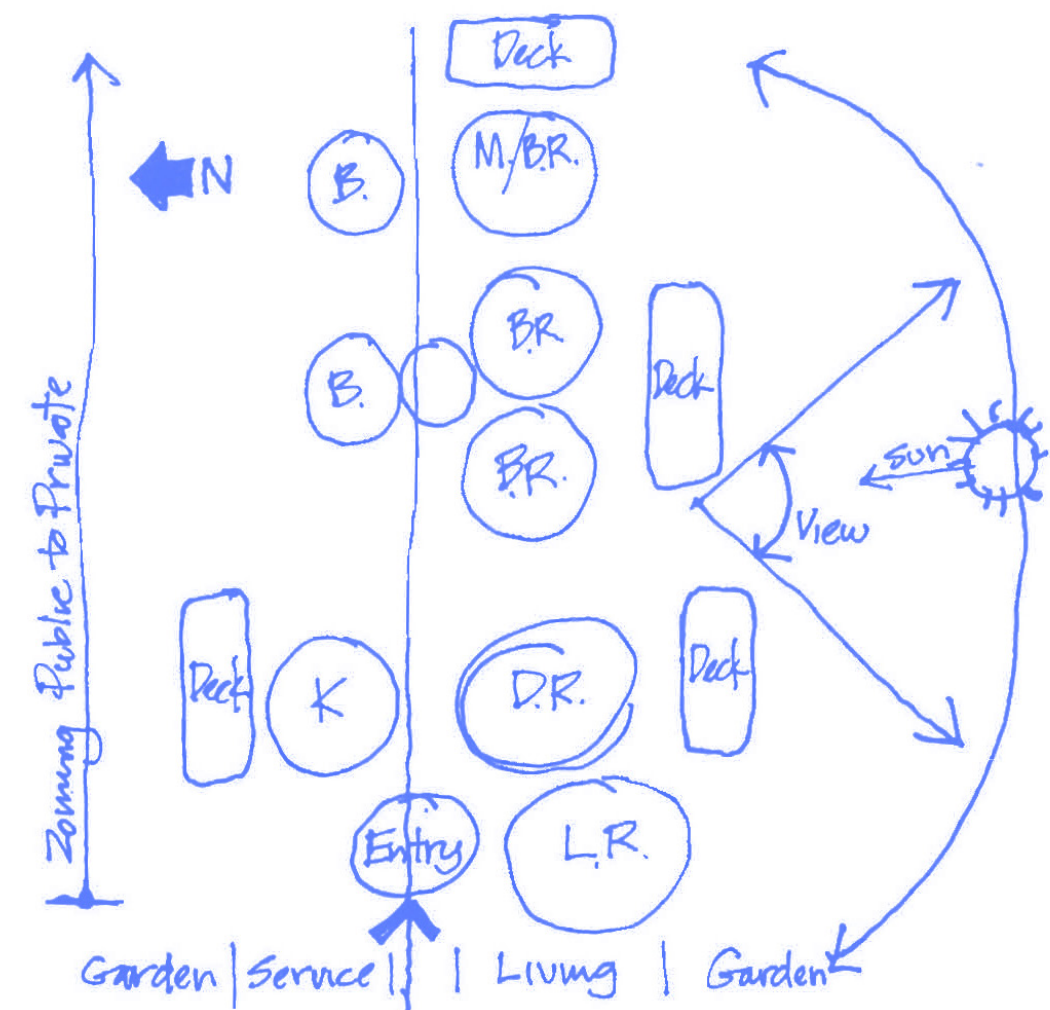
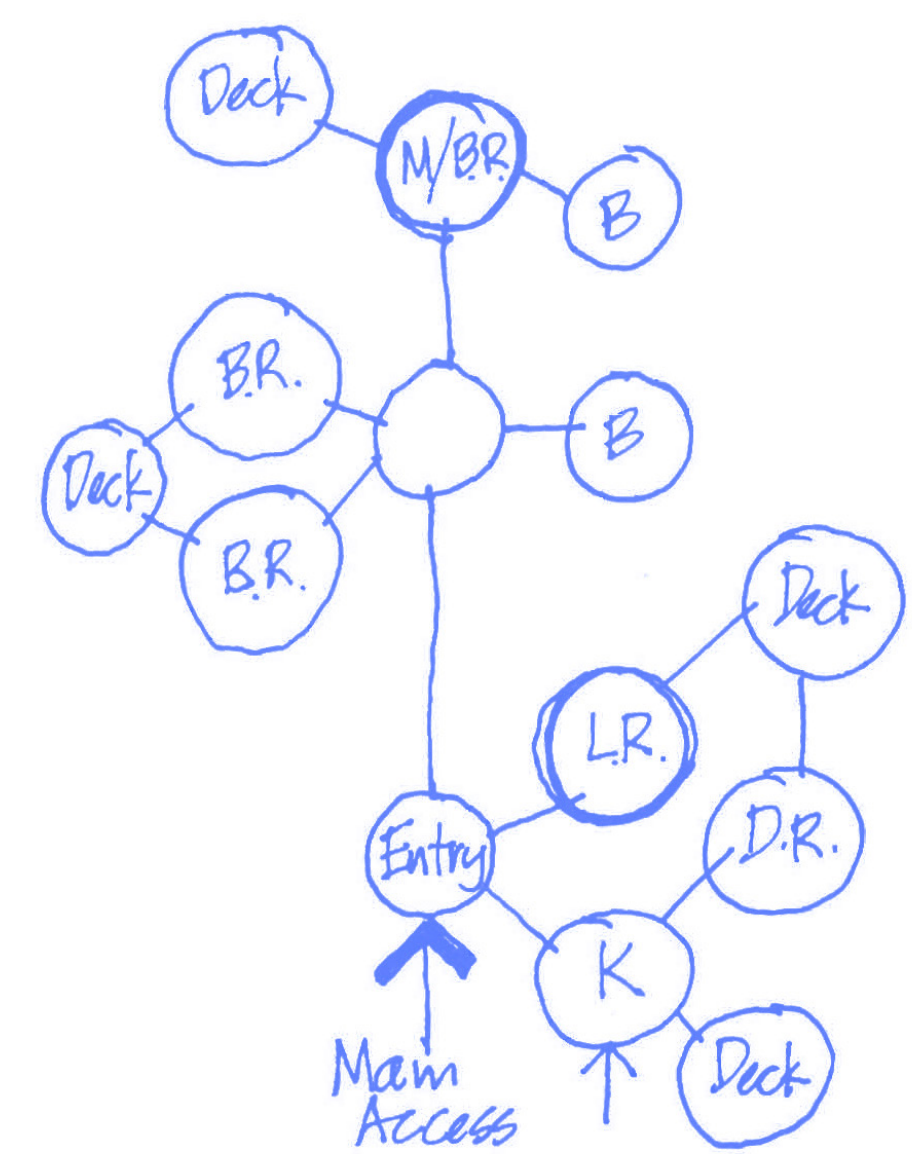


**5. Evaluation**

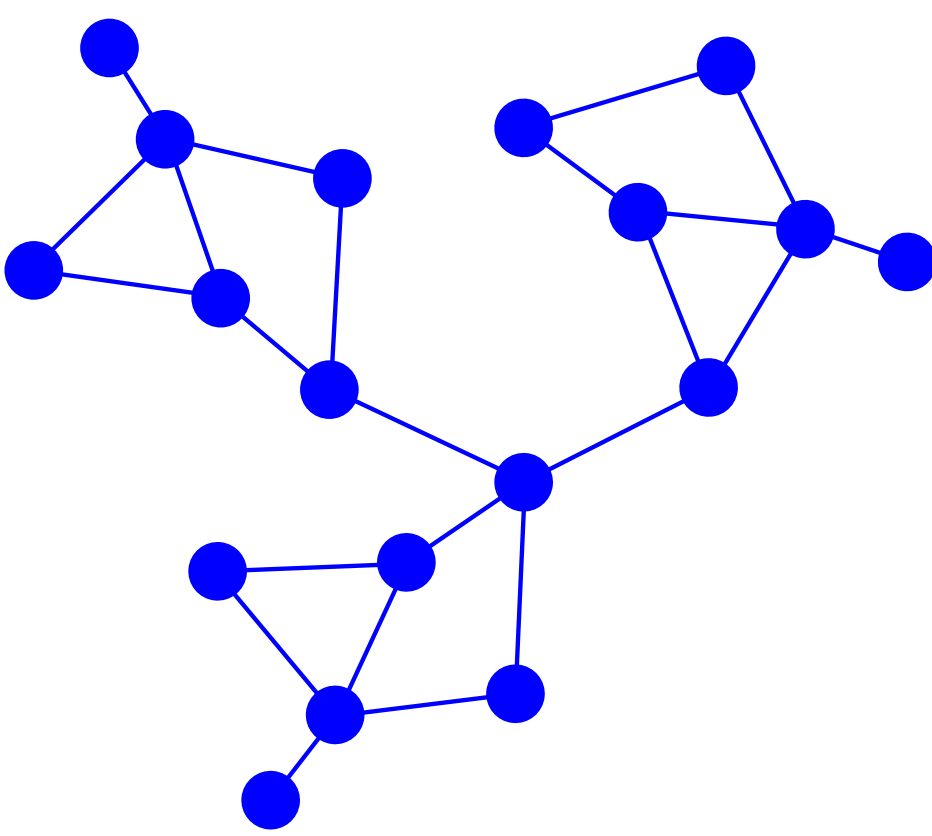
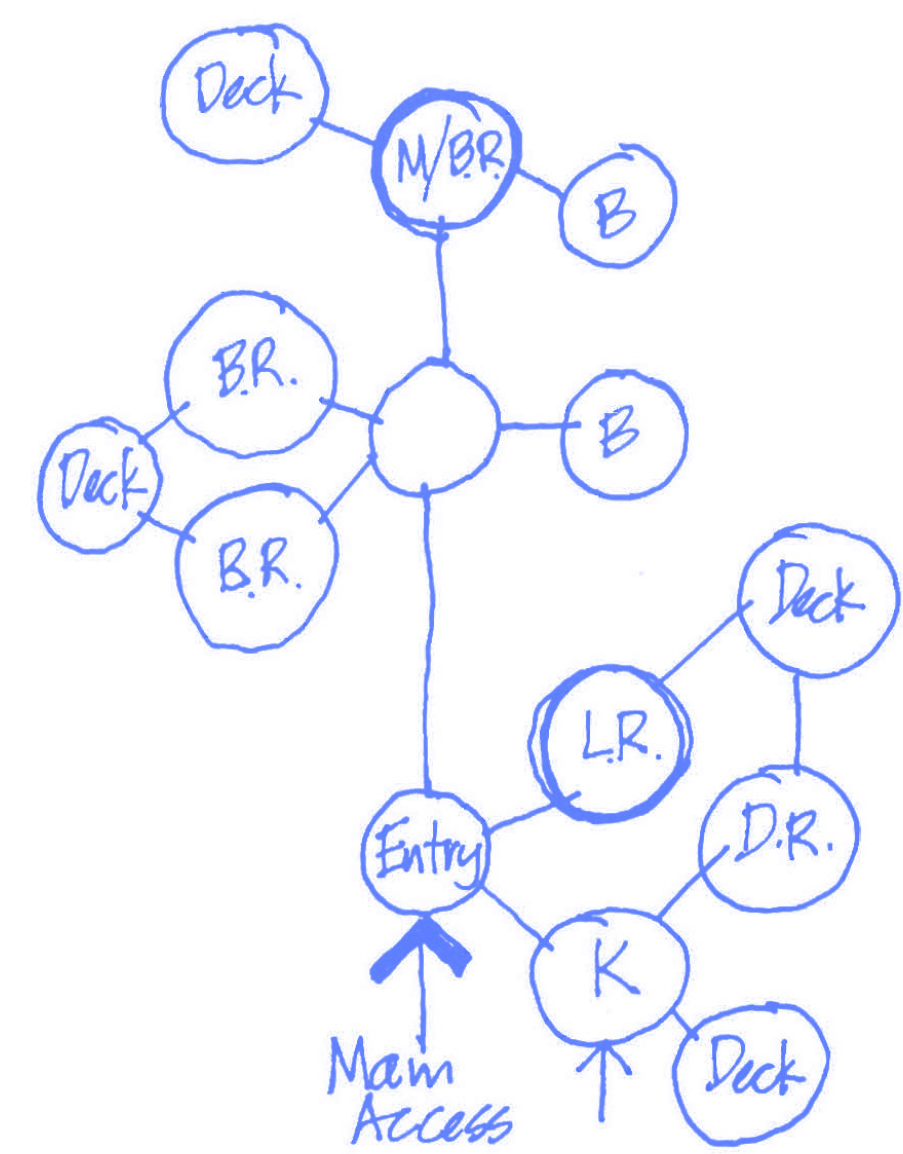
| Factor                           | Weight    | Rating    | Score     |
|----------------------------------|-----------|-----------|-----------|
| 1. Row of Mtl & Handling Economy | 10        | 4         | 40        |
| 2. Ease of Supervision           | 5         | 4         | 20        |
| 3. Flexibility                   | 4         | 4         | 16        |
| 4. Convenience of Personnel      | 6         | 4         | 24        |
| 5. Least Investment              | 3         | 4         | 12        |
| 6. Ease of Expansion             | 5         | 4         | 20        |
| <b>Totals</b>                    | <b>33</b> | <b>22</b> | <b>87</b> |





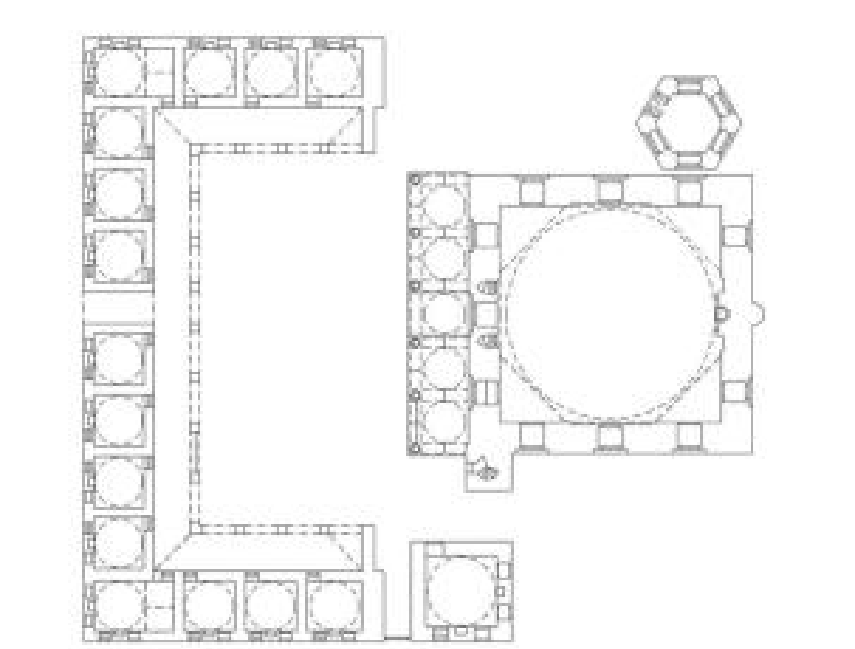




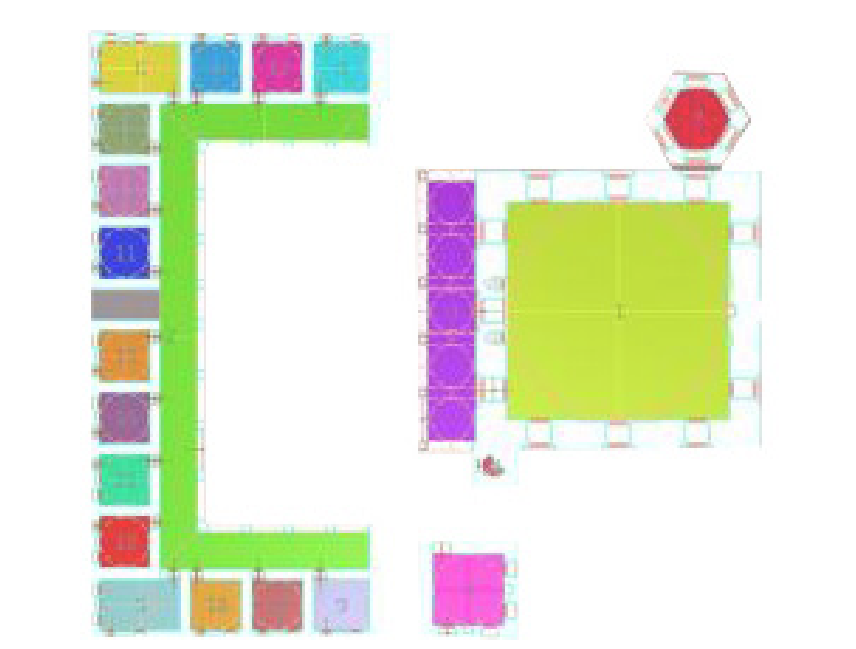


< topological maps as a medium of knowledge sharing 🧠 >

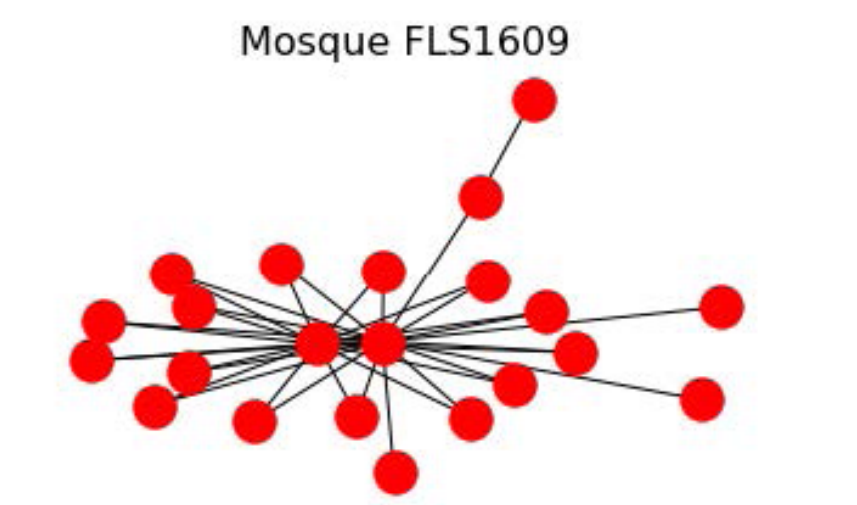




floor plan



segemented plan

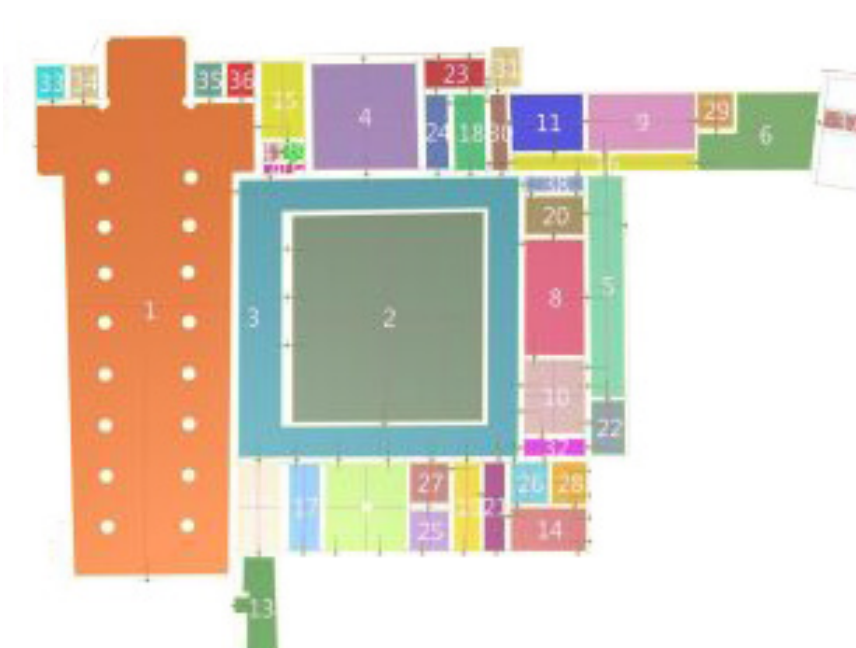


Mosque FLS1609

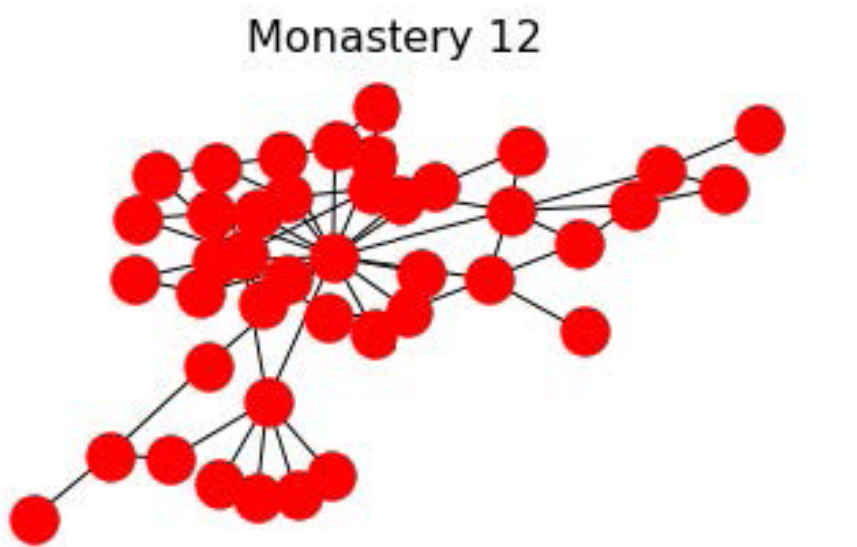
topological map



floor plan



segemented plan



Monastery 12

topological map



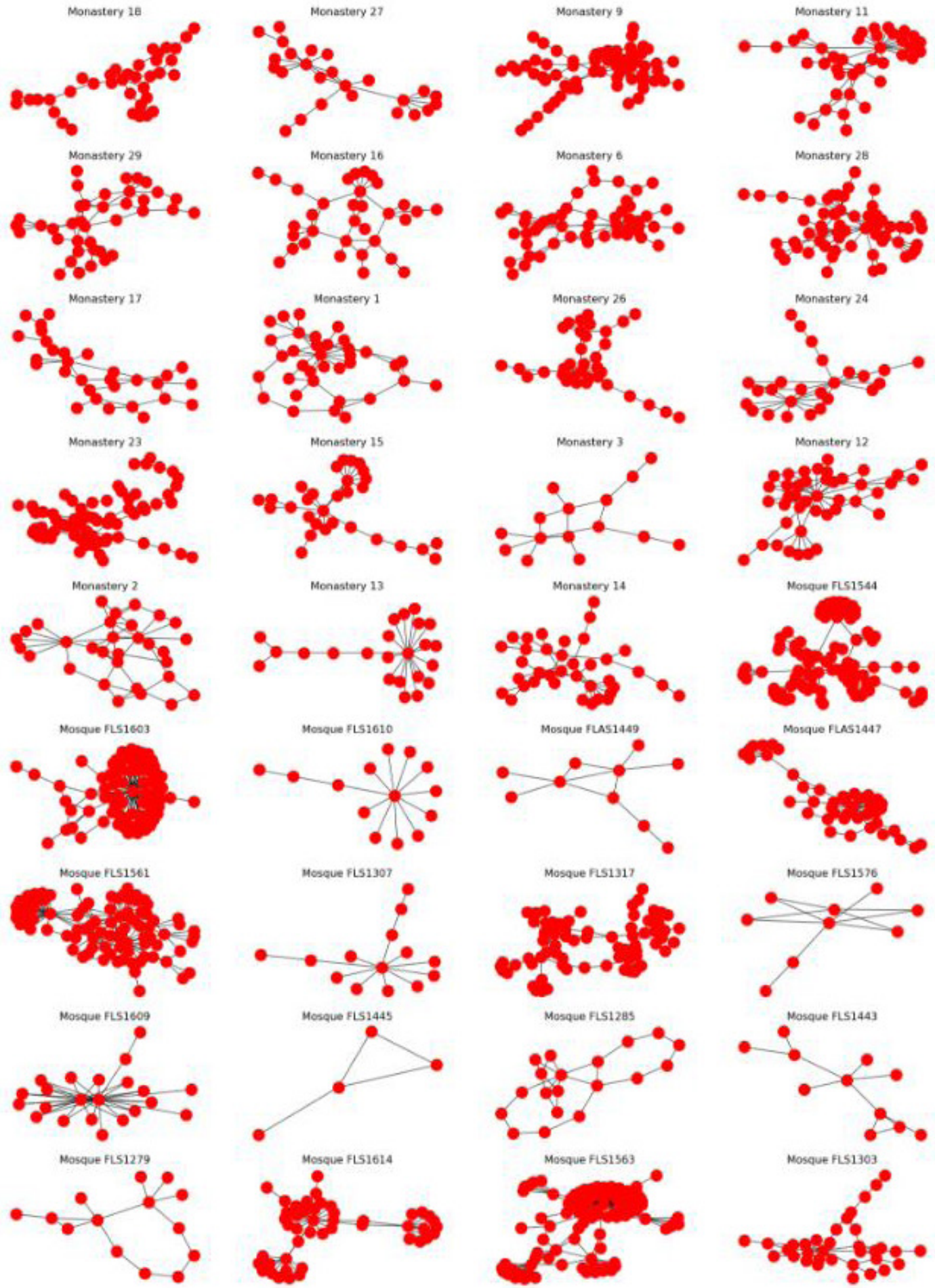


Fig. 5. Graph representation of the architectural plans of all the 36 correctly classified graphs.

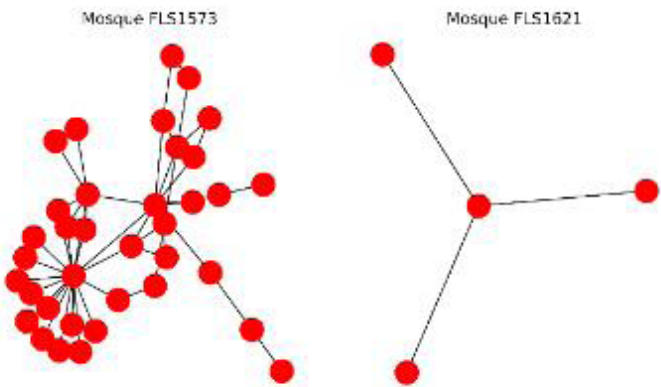


Fig. 6. Graphs of the mis-classified buildings by Kernel SVM, both of which are mosques.

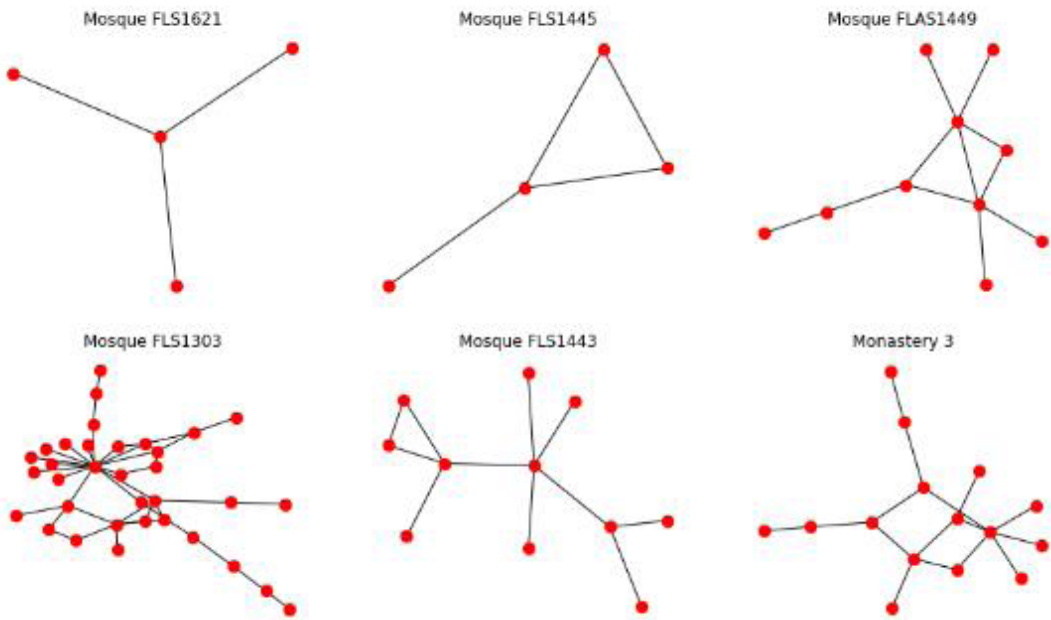


Fig. 7. Closest graphs to the decision boundary of the Kernel SVM, five mosques and one monastery. The top two left graphs are the support vectors.



If the machine is able to predict the typology based on topology (mosque & monasteries), this can certainly have some use cases in design, right?



and nothing can be  
more satisfying than  
proving a starchitect  
wrong

mediums that require more space. The Pompidou in Paris has an outpost, but again the argument is that it is bigger.

As architects we are constantly wondering where architecture is going and how relevant it is. Museums are under similar pressure, yet constantly repeat the same formula. Why is there not more adjustment and more creativity on every level, from physical conception to programming? If you look at the typology of museums, there is stagnation.

This is where OMA's interest in museums potentially



creativity on every level, from physical conception to programming? If you look at the typology of museums, there is stagnation.

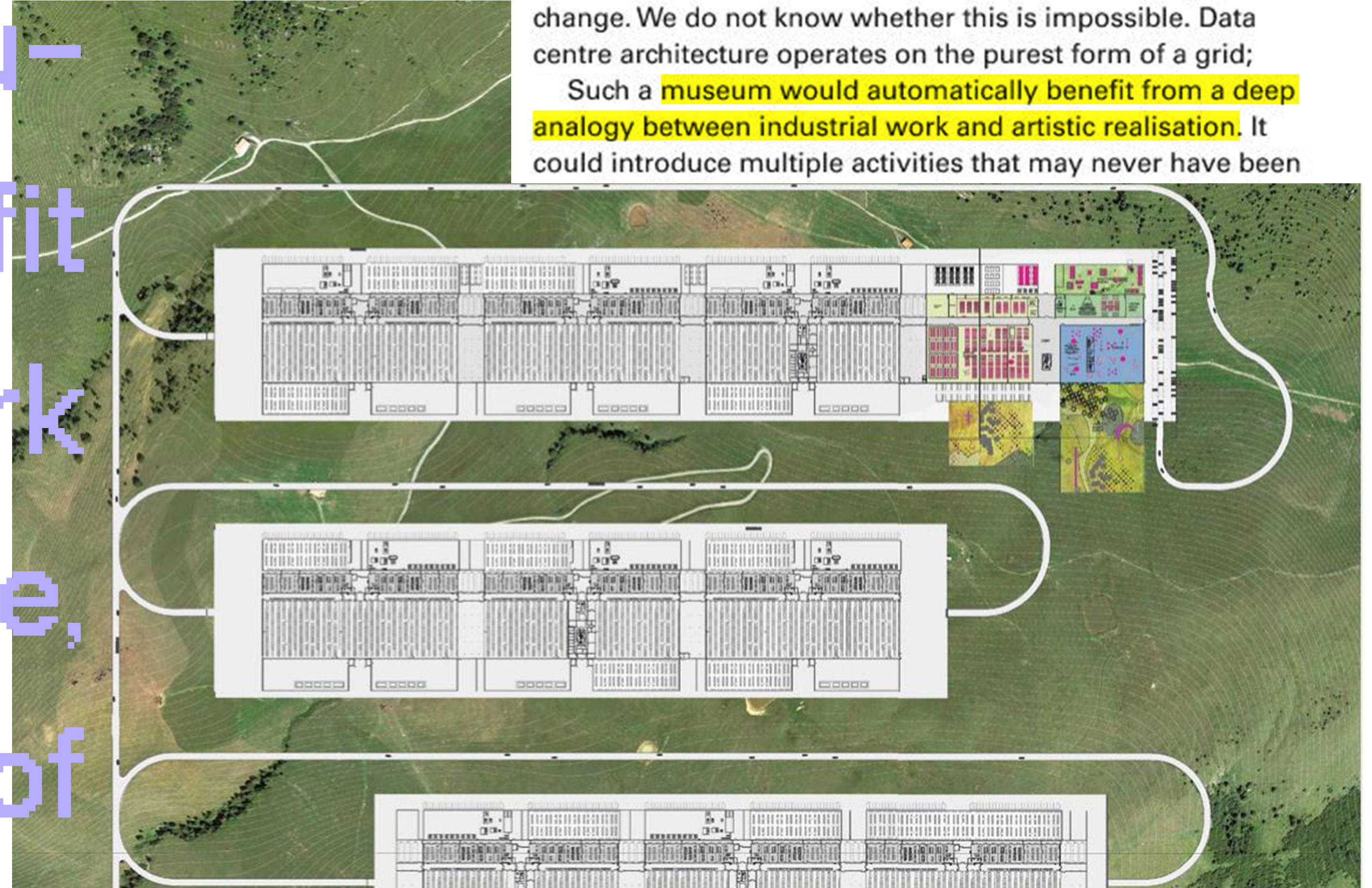


He quotes < the museum would automatically benefit from industrial work of a data centre, also being a form of storage >

you maintain the same grid and use it as a place where storage and exhibition can coexist (data and art are both forms of storage).

The proposition is to use the architectural configuration of the data centre for a museum, almost without any change. We do not know whether this is impossible. Data centre architecture operates on the purest form of a grid;

Such a museum would automatically benefit from a deep analogy between industrial work and artistic realisation. It could introduce multiple activities that may never have been

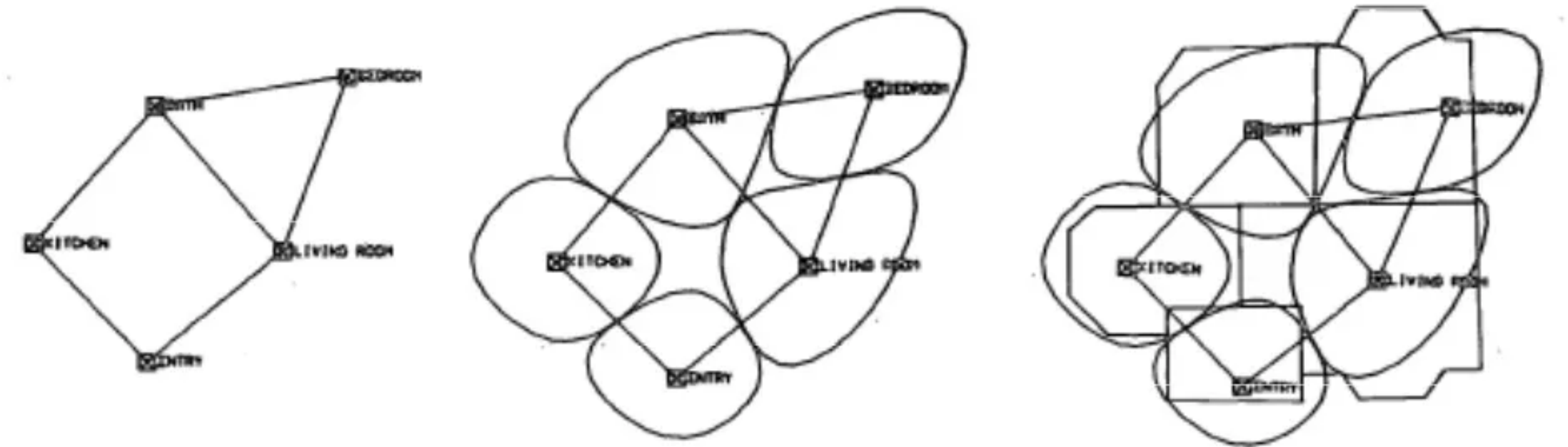




< possibility to acquire  
architectural knowledge  
in a  
simple medium, under-  
stand and manipulate it >

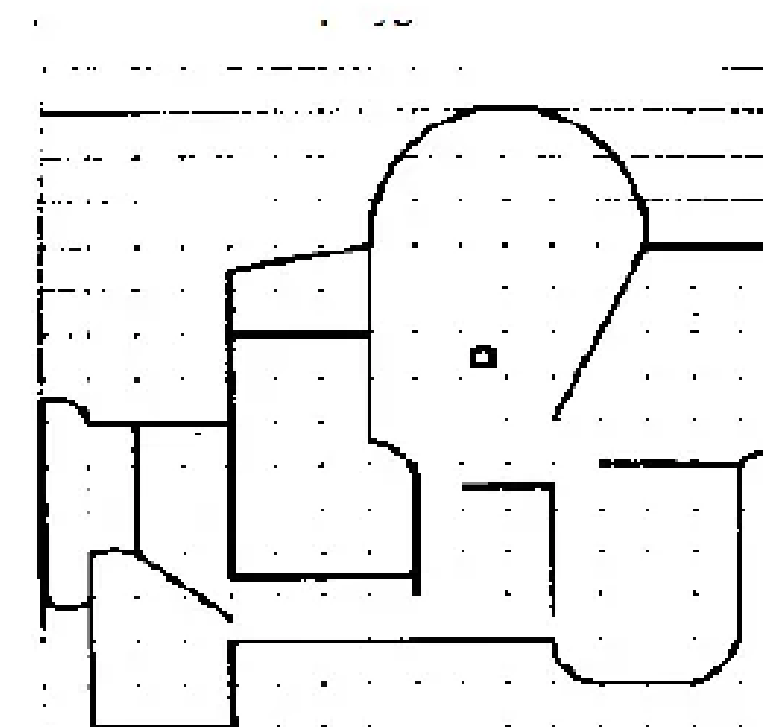
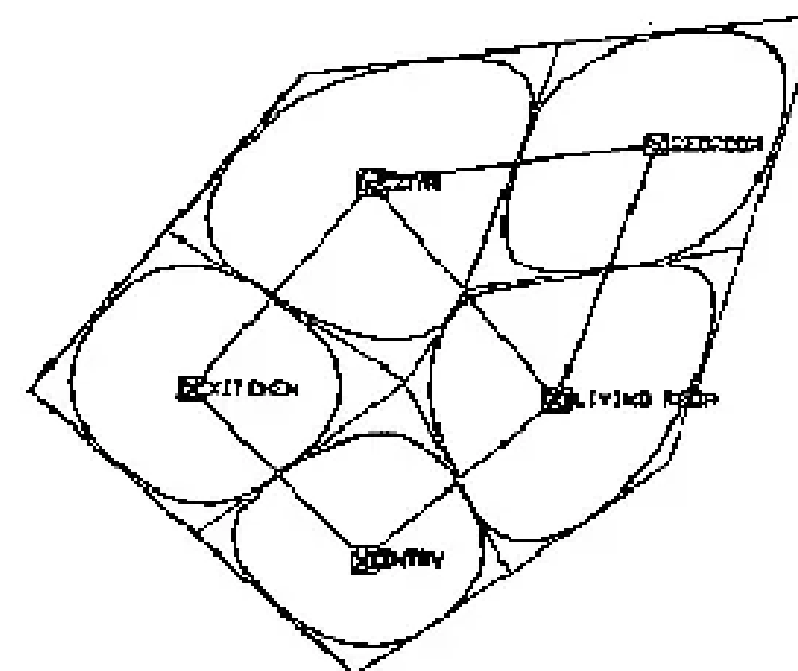
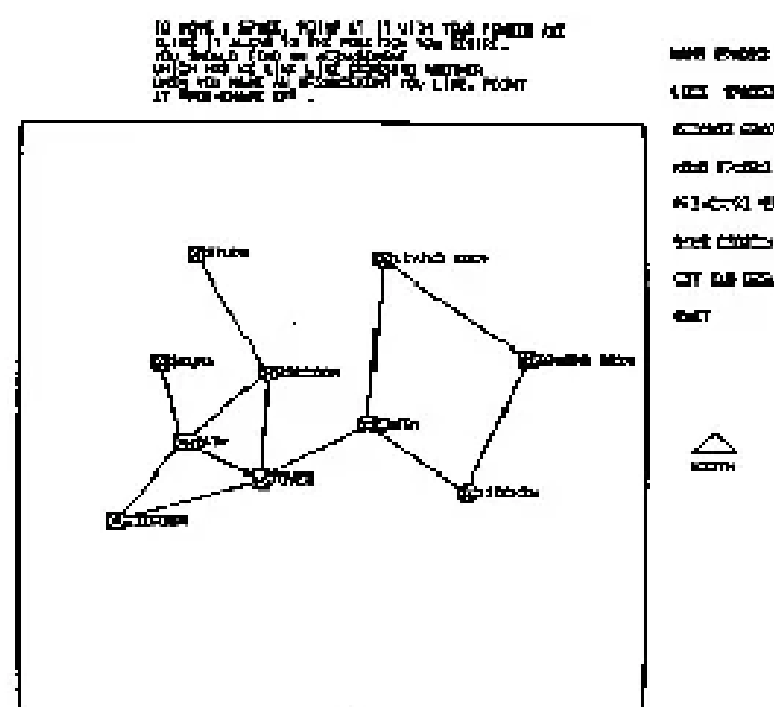
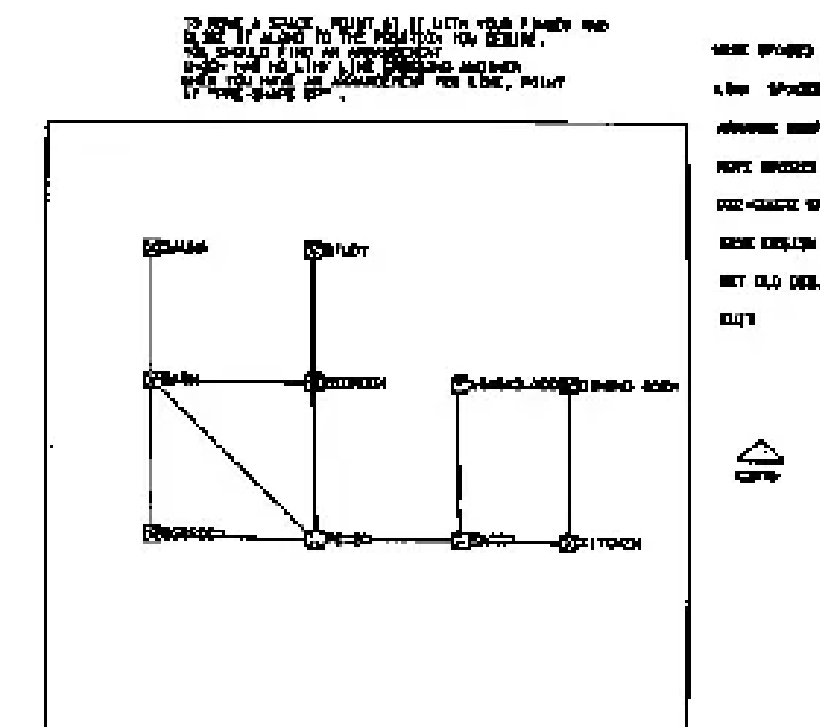
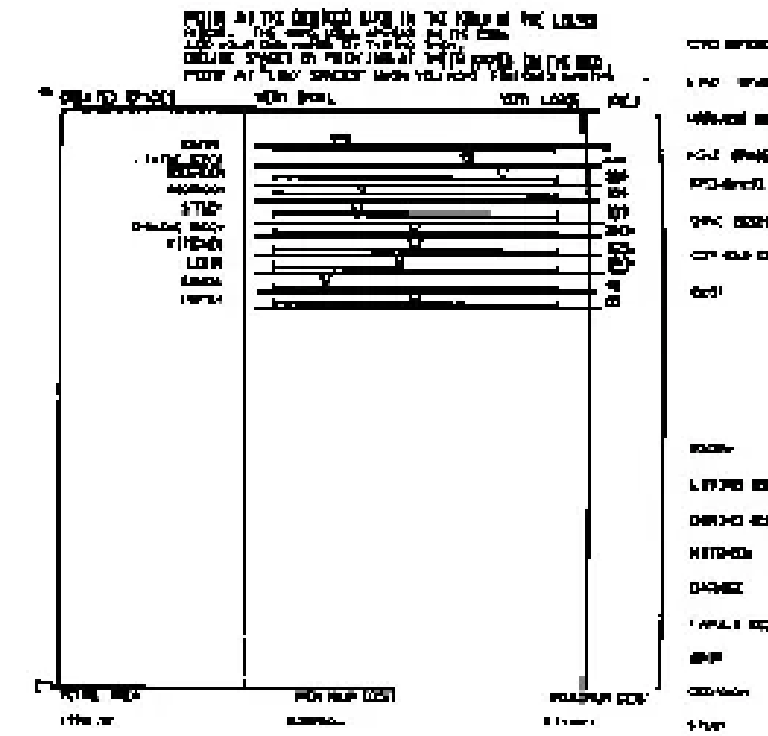
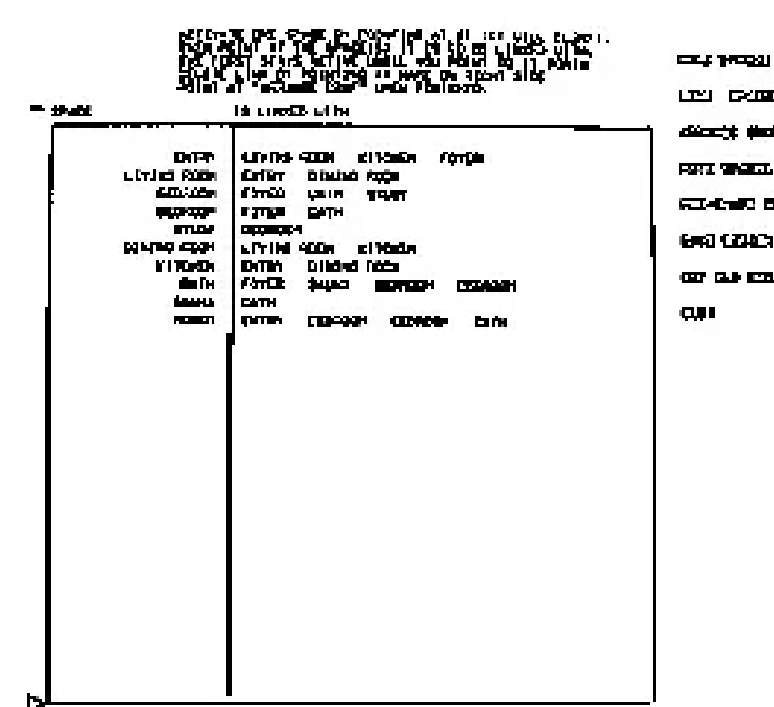


YONA's interface  
SIGGRAPH '76 - "ARCHITECTURE-BY-YOURSELF"



Graph processing from linkages to space bubbles,  
source: Vardouli





## steps of design interface



## 5. Selected Layout Plan

### Phase II – Overall Block Layout



## 5. Selected Layout Plan

### Phase II – Overall Block Layout



Grande MAXXI

came into existence  
to bring the  
museum's master-  
plan into the future





Brining the testing  
ground to this  
experiment to  
Rome, Italy



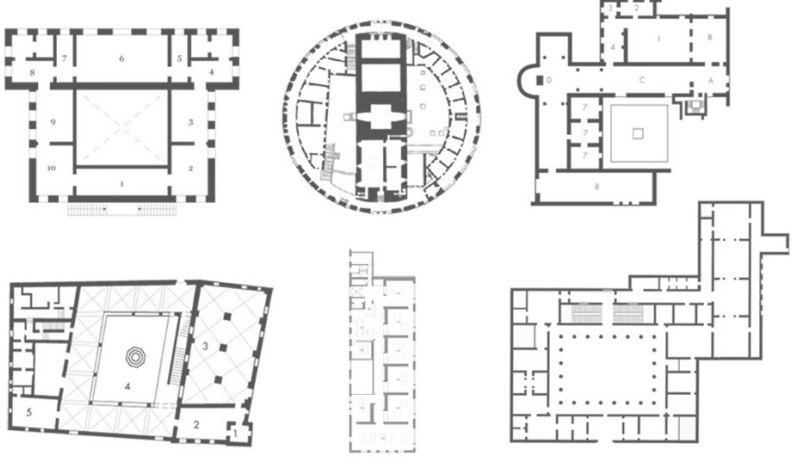








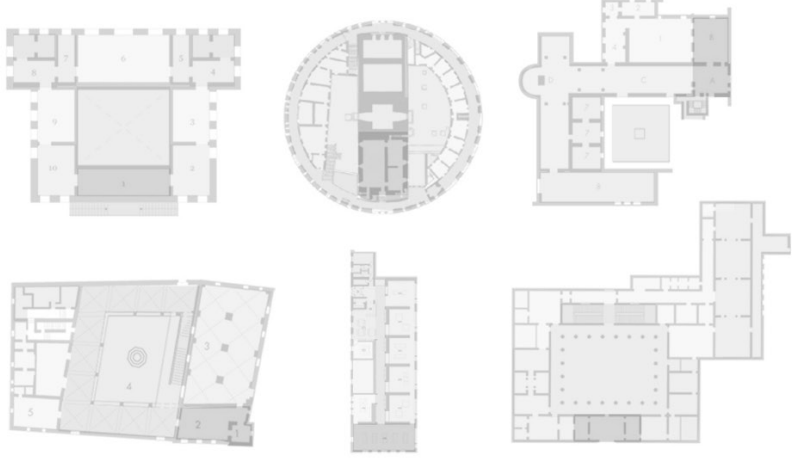
Raster floor plan images



Creating/accessing a data-set of floor plan images of a similar building type



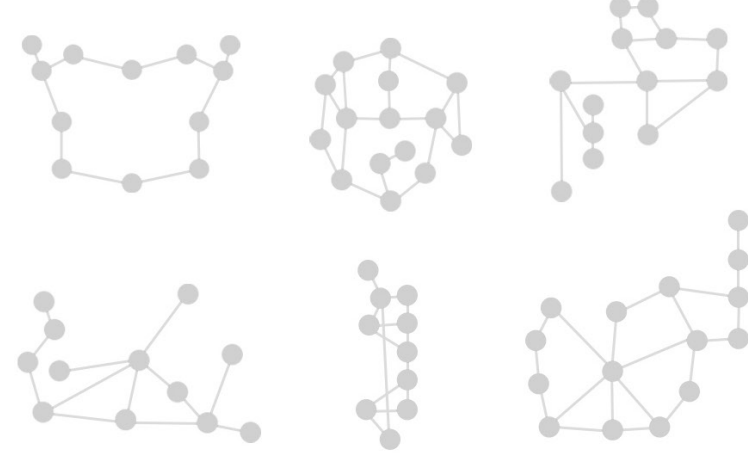
Vectorisation of floor plans



Vectorisation of the raster images of the plans with space recognition



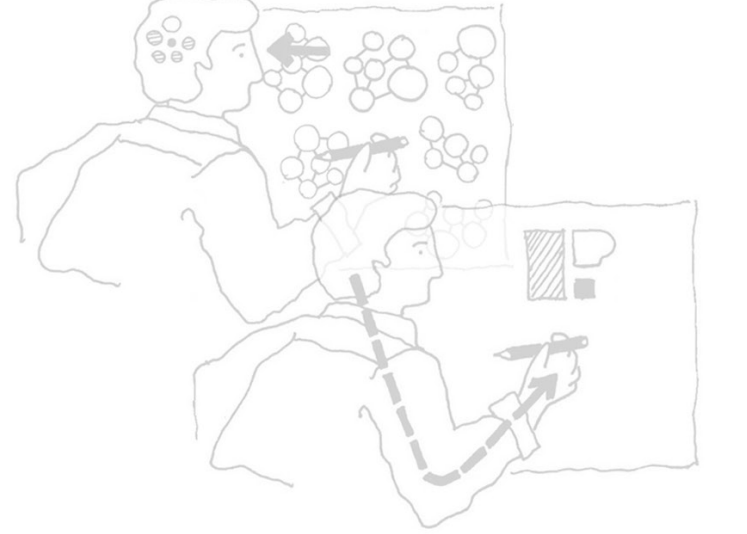
Generation of topological maps



Respective topological maps of the images extracted from its vector format



Analysis and design decision making

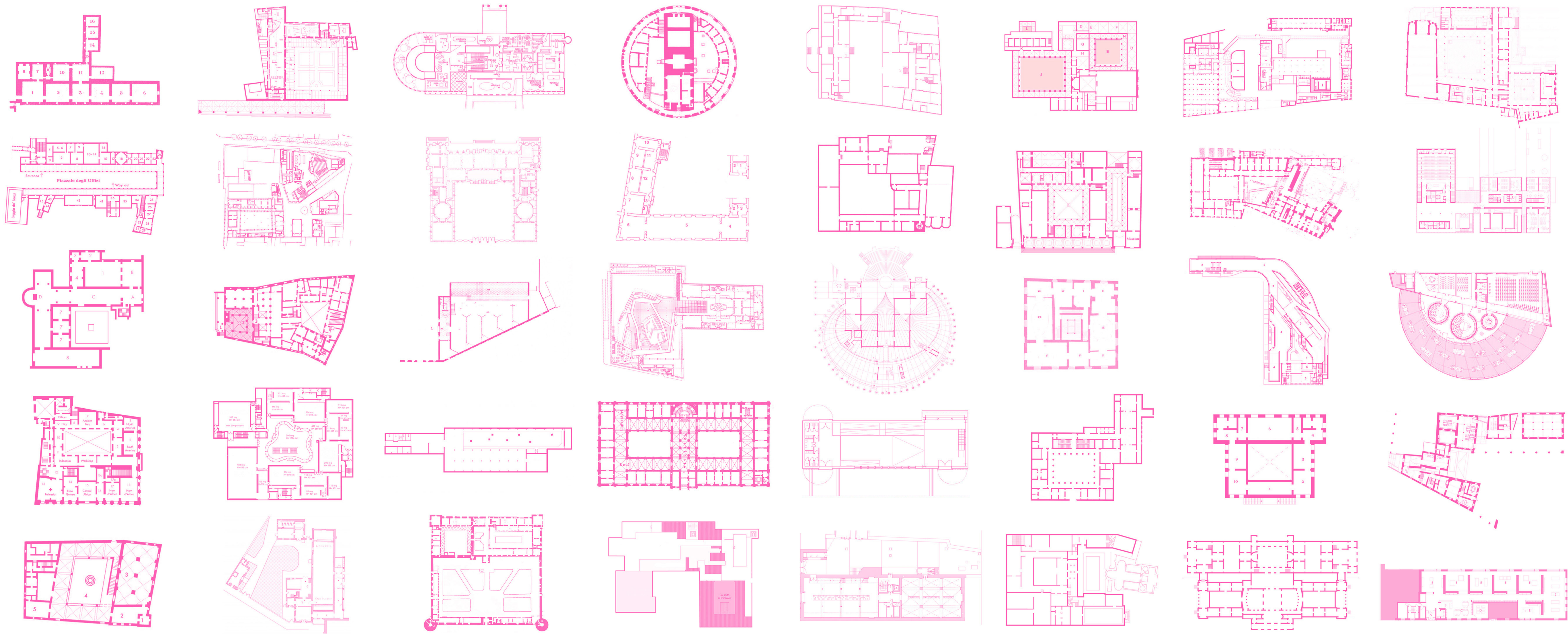


Respective topological maps of the images extracted from its vector format

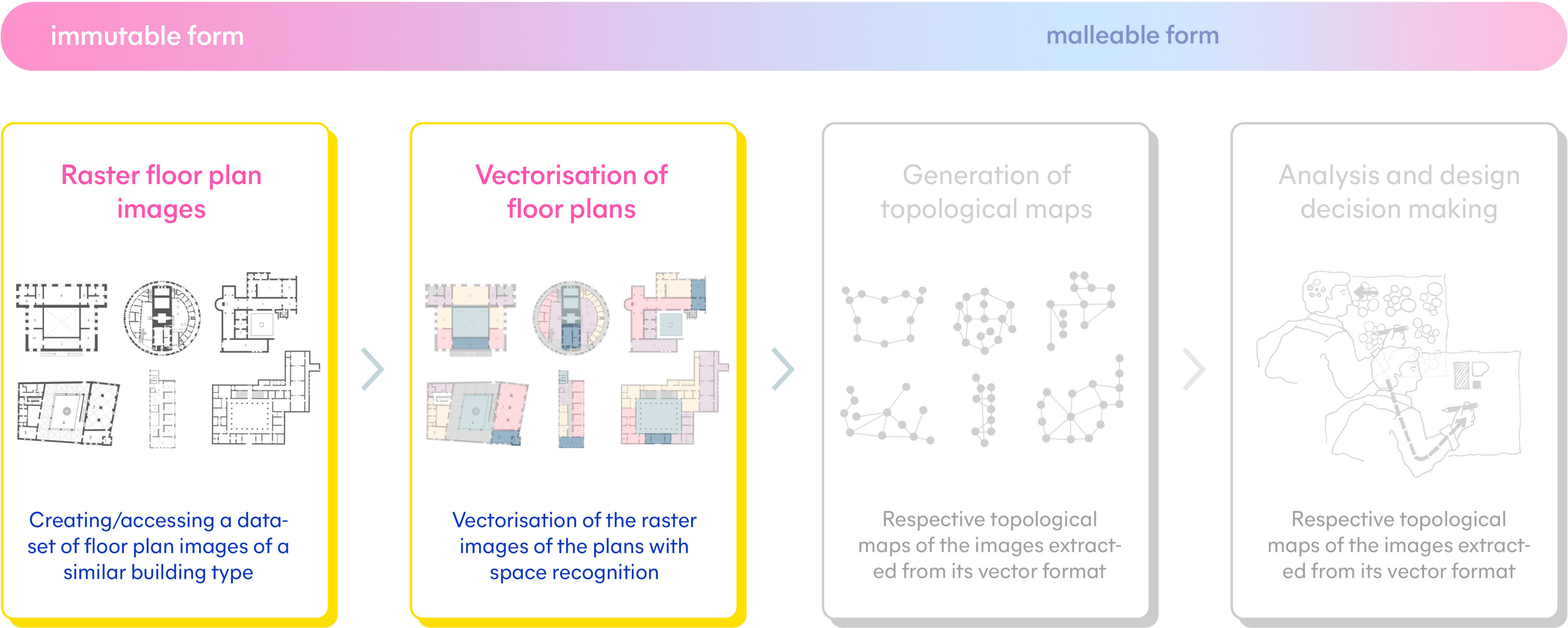


| S. No | Name of Museum                         | Display                                 | Year           | Location            | Country | Repurposed/New | Link to Floor plans                                                                                                                                                       | alt                                                                       |
|-------|----------------------------------------|-----------------------------------------|----------------|---------------------|---------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 1     | Palazzo Pitti                          | 5 museums incl. Modern Art and Fashion  | 1446           | Florence            | Italy   | Repurposed     | <a href="https://commons.wikimedia.org/wiki/Category:Maps_of_Palazzo_Pitti">https://commons.wikimedia.org/wiki/Category:Maps_of_Palazzo_Pitti</a>                         | <a href="http://www.musei.florence.it/">http://www.musei.florence.it/</a> |
| 2     | Uffizi Gallery                         | Renaissance masterpieces                | 1581           | Florence            | Italy   | Repurposed     | <a href="https://commons.wikimedia.org/wiki/Category:Plans_of_the_Uffizi_Gallery">https://commons.wikimedia.org/wiki/Category:Plans_of_the_Uffizi_Gallery</a>             | .                                                                         |
| 3     | Galleria dell'Accademia                | Michelangelo works + Florentine art     | 1784           | Florence            | Italy   | Repurposed     | <a href="http://www.museumsinflorence.com/foto/Accademia/Small/accademia-plan">http://www.museumsinflorence.com/foto/Accademia/Small/accademia-plan</a>                   | .                                                                         |
| 4     | Museo di Antropologia                  | Anthropology                            | 1593           | Florence            | Italy   | Repurposed     | <a href="http://www.museumsinflorence.com/foto/Antropologia/thumbnails/plan.html">http://www.museumsinflorence.com/foto/Antropologia/thumbnails/plan.html</a>             | .                                                                         |
| 5     | Museo Nazionale del Bargello           | Renaissance sculptures                  | 1255           | Florence            | Italy   | Repurposed     | <a href="http://www.museumsinflorence.com/foto/bargello/image/BARGELLO-PLAN">http://www.museumsinflorence.com/foto/bargello/image/BARGELLO-PLAN</a>                       | .                                                                         |
| 6     | Museo del Convento di San Marco        | Fra Angelico works                      | 1678           | Florence            | Italy   | Repurposed     | <a href="http://www.museumsinflorence.com/foto/san%20marco/thumbnails/san-marco">http://www.museumsinflorence.com/foto/san%20marco/thumbnails/san-marco</a>               | .                                                                         |
| 7     | Galleria dello Spedale degli Innocenti | Botticelli and Ghirlandaio              | 1419           | Florence            | Italy   | Repurposed     | <a href="http://www.museumsinflorence.com/foto/ospedale%20degli%20innocenti/th">http://www.museumsinflorence.com/foto/ospedale%20degli%20innocenti/th</a>                 | .                                                                         |
| 8     | Galileo Museum                         | Navigation, astronomy, Physics etc.     | 1593           | Florence            | Italy   | Repurposed     | <a href="https://www.museogalileo.it/istituto/en/emuseostoriascienza19451961/muse">https://www.museogalileo.it/istituto/en/emuseostoriascienza19451961/muse</a>           | .                                                                         |
| 9     | Museo Novecento                        | XX and XXI century Modern Art           | 1459           | Florence            | Italy   | Repurposed     | <a href="https://www.archdaily.com/769803/the-museum-of-the-twentieth-century-av">https://www.archdaily.com/769803/the-museum-of-the-twentieth-century-av</a>             | .                                                                         |
| 10    | M9 Museum District                     | History of 20th century                 | 2018           | Venice              | Italy   | Nieuwe         | <a href="https://arquitecturaviva.com/assets/uploads/obras/46133/av_medium_av">https://arquitecturaviva.com/assets/uploads/obras/46133/av_medium_av</a>                   | .                                                                         |
| 11    | Palazzo Vecchio                        | Sculptures                              | 1314           | Florence            | Italy   | Repurposed     | <a href="http://www.museumsinflorence.com/foto/palazzo%20vecchio/thumbnails/pl">http://www.museumsinflorence.com/foto/palazzo%20vecchio/thumbnails/pl</a>                 | .                                                                         |
| 12    | Museo delle Culture (MUDEC)            | Cultural preservation, non-EU           | 2015           | Milan               | Italy   | Nieuwe         | <a href="https://www.archdaily.com/617947/museum-of-cultures-completes-in-milan/">https://www.archdaily.com/617947/museum-of-cultures-completes-in-milan/</a>             | <a href="https://davidchipp.com/">https://davidchipp.com/</a>             |
| 13    | Cenacolo Vinciano Museum               | Leonardo da Vinci's works (last supper) | 1463           | Milan               | Italy   | Repurposed     | <a href="https://cenacolovinciano.org/wp-content/uploads/2019/12/Map-Cenacolo-Vi">https://cenacolovinciano.org/wp-content/uploads/2019/12/Map-Cenacolo-Vi</a>             | <a href="https://tsw.r.world">https://tsw.r.world</a>                     |
| 14    | Brera Art Gallery                      | 13th and 14th centruy Italian paintings | 1776           | Milan               | Italy   | Repurposed     | <a href="https://www.behance.net/gallery/9290645/Brera-Art-Gallery-Milan/modules/">https://www.behance.net/gallery/9290645/Brera-Art-Gallery-Milan/modules/</a>           | .                                                                         |
| 15    | Ambrosiana Gallery                     | Renaissance paintings                   | 1607           | Milan               | Italy   | Repurposed     | <a href="https://www.ambrosiana.it/wp-content/uploads/2018/12/Ambrosiana-map-fir">https://www.ambrosiana.it/wp-content/uploads/2018/12/Ambrosiana-map-fir</a>             | .                                                                         |
| 16    | Fondazione Prada                       | Contemporary art and culture            | 2015           | Milan               | Italy   | Nieuwe         | <a href="https://cdn.ca.emap.com/wp-content/uploads/sites/12/2015/09/Prada-OMA-">https://cdn.ca.emap.com/wp-content/uploads/sites/12/2015/09/Prada-OMA-</a>               | .                                                                         |
| 17    | Triennale di Milano                    | Design and art museum                   | 1933           | Milan               | Italy   | Nieuwe         | <a href="https://commons.wikimedia.org/wiki/File:Milano_Palazzo_dell%27Arte_pian">https://commons.wikimedia.org/wiki/File:Milano_Palazzo_dell%27Arte_pian</a>             | .                                                                         |
| 18    | Galleria d'Arte Moderna                | 14th to 20th century works              | 1796           | Milan               | Italy   | Repurposed     | <a href="http://www.gam-milano.com/en/collections/exhibition-itinerary/">http://www.gam-milano.com/en/collections/exhibition-itinerary/</a>                               | .                                                                         |
| 19    | PAC - Contemporary Art Pavilion        | Contemporary art                        | 1947           | Milan               | Italy   | Repurposed     | <a href="https://archidiap.com/opera/pac-padiglione-darte-contemporanea/#gallery-1">https://archidiap.com/opera/pac-padiglione-darte-contemporanea/#gallery-1</a>         | .                                                                         |
| 20    | Pirelli HangarBicocca                  | Contemporary art and exhibitions        | 2004           | Milan               | Italy   | Repurposed     | <a href="https://www.culturalheritageonline.com/location-3618_Pirelli-HangarBicocca">https://www.culturalheritageonline.com/location-3618_Pirelli-HangarBicocca</a>       | .                                                                         |
| 21    | Castello Sforzesco                     | Music, furniture, art, sculpture, etc.  | 1360           | Milan               | Italy   | Repurposed     | <a href="https://passipermilano.com/tag/sala-della-balla/">https://passipermilano.com/tag/sala-della-balla/</a>                                                           | <a href="http://www.ar-co.it/">http://www.ar-co.it/</a>                   |
| 22    | Capitoline Museums                     | art and archaeology                     | 1471           | Rome                | Italy   | Repurposed     | <a href="https://ars.els-cdn.com/content/image/1-s2.0-S2095263515000205-gr6.jpg">https://ars.els-cdn.com/content/image/1-s2.0-S2095263515000205-gr6.jpg</a>               | <a href="https://www.labor">https://www.labor</a>                         |
| 23    | MAXXI - National Museum of 21st c. art | Contemporary art and architecture       | 2009           | Rome                | Italy   | Nieuwe         | <a href="https://www.archdaily.com/43822/maxxi-museum-zaha-hadid-architects/50">https://www.archdaily.com/43822/maxxi-museum-zaha-hadid-architects/50</a>                 | <a href="https://www.maxxi">https://www.maxxi</a>                         |
| 24    | Galleria Borghese                      | Art and sculptures                      | 1660           | Rome                | Italy   | Repurposed     | <a href="http://asd.courses.sutd.edu.sg/option-studio-one/wp-content/uploads/2020/">http://asd.courses.sutd.edu.sg/option-studio-one/wp-content/uploads/2020/</a>         | <a href="https://aetrua.wo">https://aetrua.wo</a>                         |
| 25    | Museo Nazionale di Castel Sant'Angelo  | Roman artefacts                         | 135 (not a mis | Rome                | Italy   | Repurposed     | <a href="http://forgottendm.blogspot.com/2013/11/castel-santangelo-hadrian-final-re">http://forgottendm.blogspot.com/2013/11/castel-santangelo-hadrian-final-re</a>       | .                                                                         |
| 26    | Palazzo Colonna                        | 1300s Baroque                           | 1700           | Rome                | Italy   | Repurposed     | <a href="http://www.icra.it/Get_to/Get_to_rome/Banquet/Palazzo_Colonna.htm">http://www.icra.it/Get_to/Get_to_rome/Banquet/Palazzo_Colonna.htm</a>                         | .                                                                         |
| 27    | Museum of Contemporary arts, Roma      | Contemporary arts                       | 2007           | Rome                | Italy   | Nieuwe         | <a href="https://www.archdaily.com/476869/museum-of-contemporary-art-in-rome-st">https://www.archdaily.com/476869/museum-of-contemporary-art-in-rome-st</a>               | .                                                                         |
| 28    | National Museum of Rome                | Marble and stone statues                | 1998           | Rome                | Italy   | Repurposed     | <a href="https://www.ebay.com/itm/272596311903">https://www.ebay.com/itm/272596311903</a>                                                                                 | .                                                                         |
| 29    | Centrale Montemartini                  | Aancient sculptures                     | 1997           | Rome                | Italy   | Repurposed     | <a href="https://images.slideplayer.com/16/5029337/slides/slide_7.jpg">https://images.slideplayer.com/16/5029337/slides/slide_7.jpg</a>                                   | <a href="https://www.cent">https://www.cent</a>                           |
| 30    | Nazionale d'Arte Moderna e Contemporar | Modern Art                              | 1883           | Rome                | Italy   | Repurposed     | <a href="http://cms.lagallerianazionale.com/wp-content/uploads/2022/01/mappa-gall">http://cms.lagallerianazionale.com/wp-content/uploads/2022/01/mappa-gall</a>           | <a href="http://cms.lagalle">http://cms.lagalle</a>                       |
| 31    | Santa Caterina Museum                  | Frescoes and excavated artefacts        | 2018           | Treviso             | Italy   | Repurposed     | <a href="https://www.italian-architects.com/it/projects/view/santa-caterina-museum#i">https://www.italian-architects.com/it/projects/view/santa-caterina-museum#i</a>     | .                                                                         |
| 32    | MAST Foundation                        | Art technology innovation               | 2013           | Bologna             | Italy   | Nieuwe         | <a href="https://www.archdaily.com/441245/mast-foundation-labics/5265d9a9e8e44e">https://www.archdaily.com/441245/mast-foundation-labics/5265d9a9e8e44e</a>               | .                                                                         |
| 33    | Peggy Guggenheim Collection            | Personal collection                     | 1951           | Venice              | Italy   | Repurposed     | <a href="https://www.tickitaly.com/images/tickets/guggenheim/guggenheim-venice-m">https://www.tickitaly.com/images/tickets/guggenheim/guggenheim-venice-m</a>             | .                                                                         |
| 34    | Gallerie dell'Accademia                | Fine Arts, 15-18th century              | 1817           | Venice              | Italy   | Repurposed     | <a href="https://www.planetware.com/i/map/l/venice-galleria-dellaccademia-map.jpg">https://www.planetware.com/i/map/l/venice-galleria-dellaccademia-map.jpg</a>           | .                                                                         |
| 35    | Luigi Pecci Contemporary Art Museum    | Contemporary art                        | 1988           | Prato               | Italy   | Nieuwe         | <a href="https://divisare.com/projects/327993-nio-architecten-lucia-giannecchini-cen">https://divisare.com/projects/327993-nio-architecten-lucia-giannecchini-cen</a>     | .                                                                         |
| 36    | Mostra d'Oltremare                     | Pavillion space                         | 2004           | Napoli              | Italy   | Nieuwe         | <a href="https://divisare.com/projects/4512-cherubino-gambardella-peppe-maisto-nu">https://divisare.com/projects/4512-cherubino-gambardella-peppe-maisto-nu</a>           | .                                                                         |
| 37    | Tuscolano museum                       | Archeology and art exhibiton            | 2000           | Frascati            | Italy   | Repurposed     | <a href="https://divisare.com/projects/326374-fuksas-giovanna-piemonti-tuscolano-n">https://divisare.com/projects/326374-fuksas-giovanna-piemonti-tuscolano-n</a>         | .                                                                         |
| 38    | Dallara Academy                        | Gallery                                 | 2018           | Varano de' Melegari | Italy   | Nieuwe         | <a href="https://www.archdaily.com/904692/dallara-academy-atelier-s-alfonso-femia/">https://www.archdaily.com/904692/dallara-academy-atelier-s-alfonso-femia/</a>         | .                                                                         |
| 39    | La corte cultural and civic centre     | Exhibitions, library and                | 2006           | Parma               | Italy   | Repurposed     | <a href="https://www.natoffice.it/images/project/CCLC/CCLC_04.jpg">https://www.natoffice.it/images/project/CCLC/CCLC_04.jpg</a>                                           | <a href="https://www.natof">https://www.natof</a>                         |
| 40    | Le Stanze del Vetro                    | 20-21st century glassmaking             | 2012           | Venice              | Italy   | Repurposed     | <a href="https://www.italian-architects.com/it/projects/view/le-stanze-del-vetro#image">https://www.italian-architects.com/it/projects/view/le-stanze-del-vetro#image</a> | .                                                                         |











# CubiCasa5k

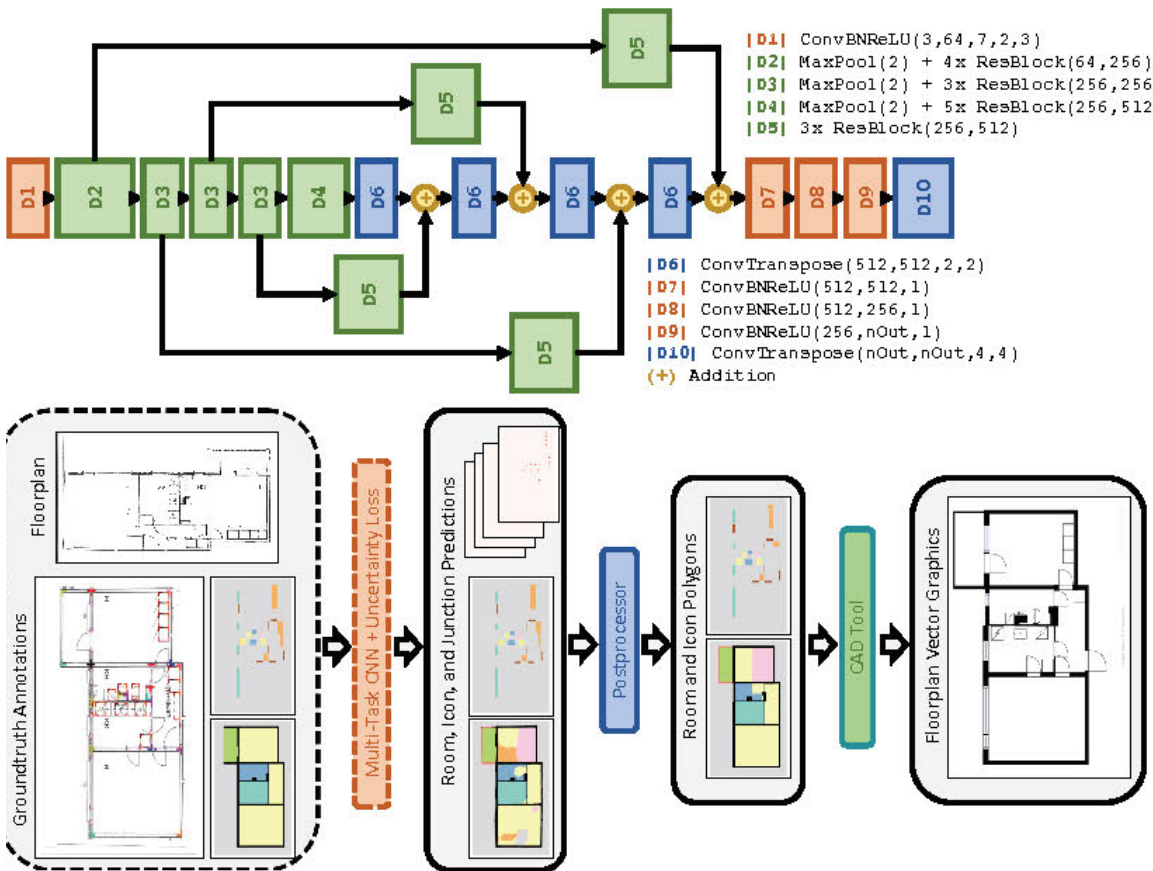
# Robust AAG

## CubiCasa5K: A Dataset and an Improved Multi-Task Model for Floorplan Image Analysis

Ahti Kalervo<sup>1</sup>, Juha Ylioinas<sup>1</sup>, Markus Häikiö<sup>2</sup>, Antti Karhu<sup>2</sup>, and Juho Kannala<sup>1</sup>

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{firstname.lastname}@aalto.fi  
<sup>2</sup> CubiCasa Inc., Oulu, Finland  
{firstname.lastname}@cubicasa.com

**Abstract.** Better understanding and modelling of building interiors and the emergence of more impressive AR/VR technology has brought up the need for automatic parsing of floorplan images. However, there is a clear lack of representative datasets to investigate the problem further. To address this shortcoming, this paper presents a novel image dataset called CubiCasa5K, a large-scale floorplan image dataset containing 5000 samples annotated into over 80 floorplan object categories. The dataset annotations are performed in a dense and versatile manner by using polygons for separating the different objects. Diverging from the classical approaches based on strong heuristics and low-level pixel operations, we present a method relying on an improved multi-task convolutional neural network. By releasing the novel dataset and our implementations, this study significantly boosts the research on automatic floorplan image analysis as it provides a richer set of tools for investigating the problem in a more comprehensive manner.



## ROBUST ATTRIBUTED ADJACENCY GRAPH EXTRACTION USING FLOOR PLAN IMAGES

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<sup>1</sup>chen.jielin@u.nus.edu, 0000-0003-0666-8725  
<sup>2</sup>stouffs@nus.edu.sg, 0000-0002-4200-5833

**Abstract.** Architectural design solutions are intrinsically structured information with a broad range of interdependent scopes. Compared to conventional 2D Euclidean data such as orthographic drawings and perspectives, non-Euclidean data (e.g., attributed adjacency graphs) can be more effective and accurate for representing 3D architectural design information, which can be useful for numerous design tasks such as spatial analysis and reasoning, and practical applications such as floor plan parsing and generation. Thus, getting access to a matching attributed adjacency graph dataset of architectural design becomes a necessity. However, the task of conveniently acquiring attributed adjacency graphs from existing architectural design solutions still remains an open challenge. To this end, this project leverages state-of-

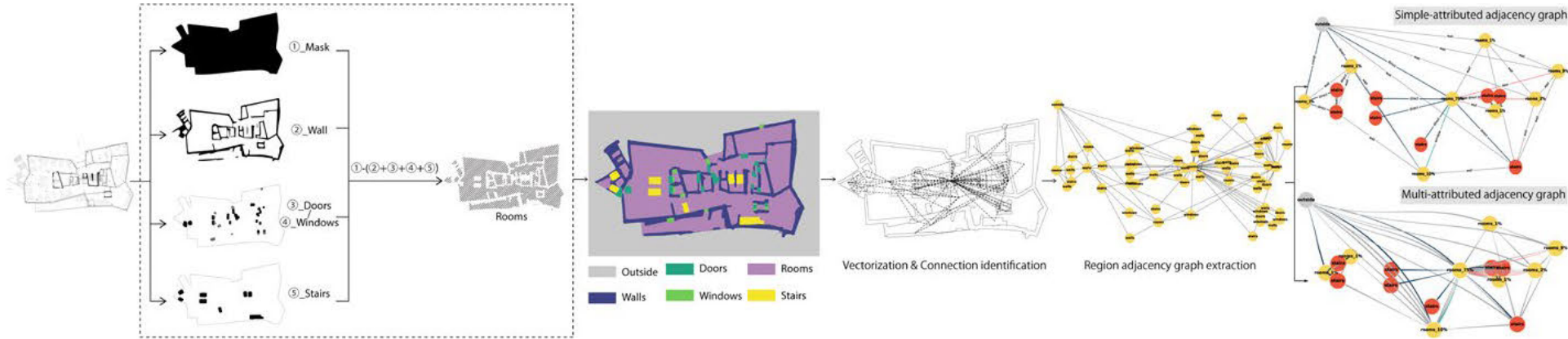
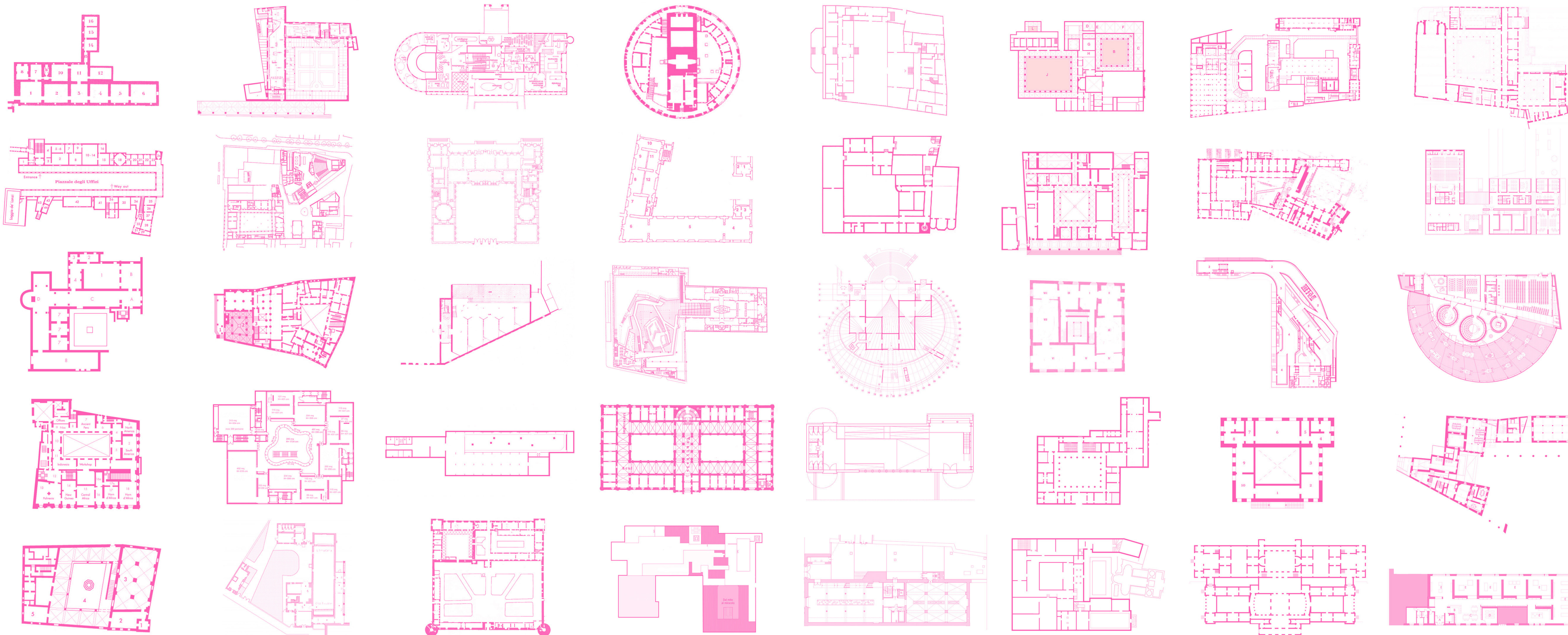
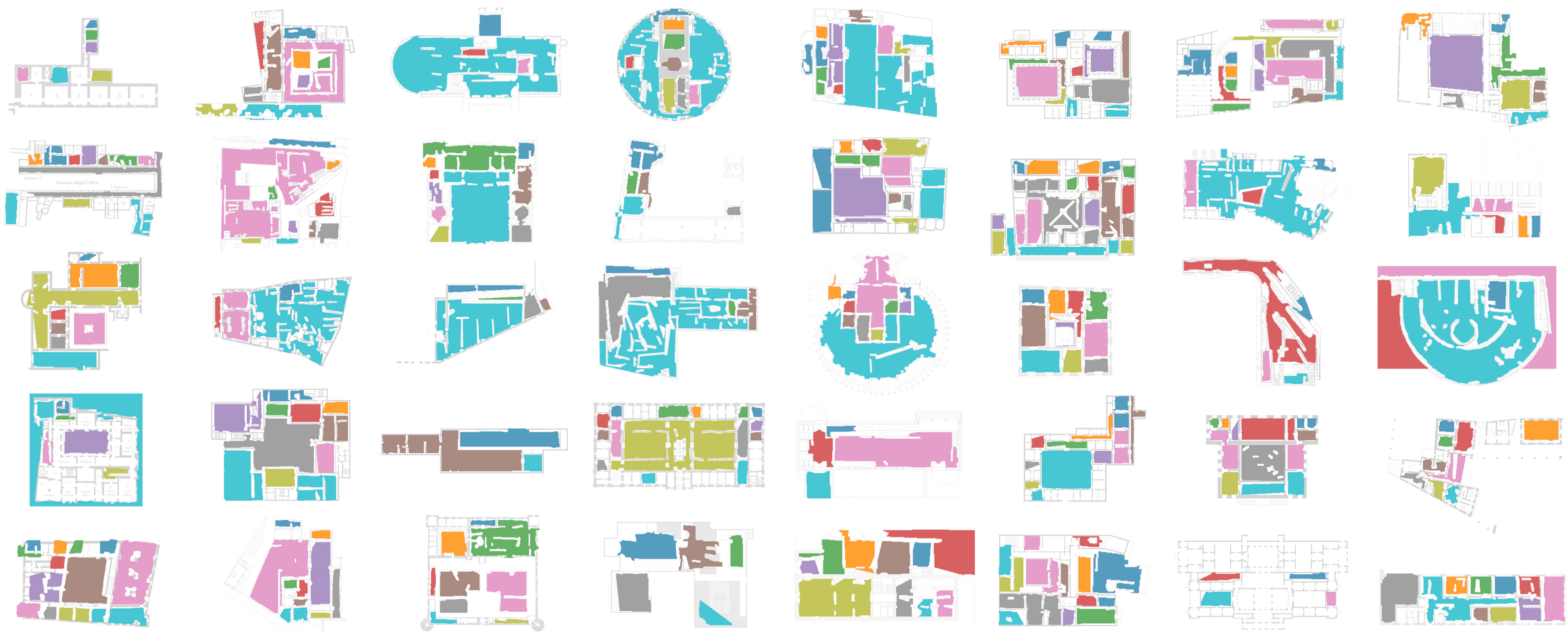


Figure 3. An implementation example of the attributed adjacency graph extraction framework.

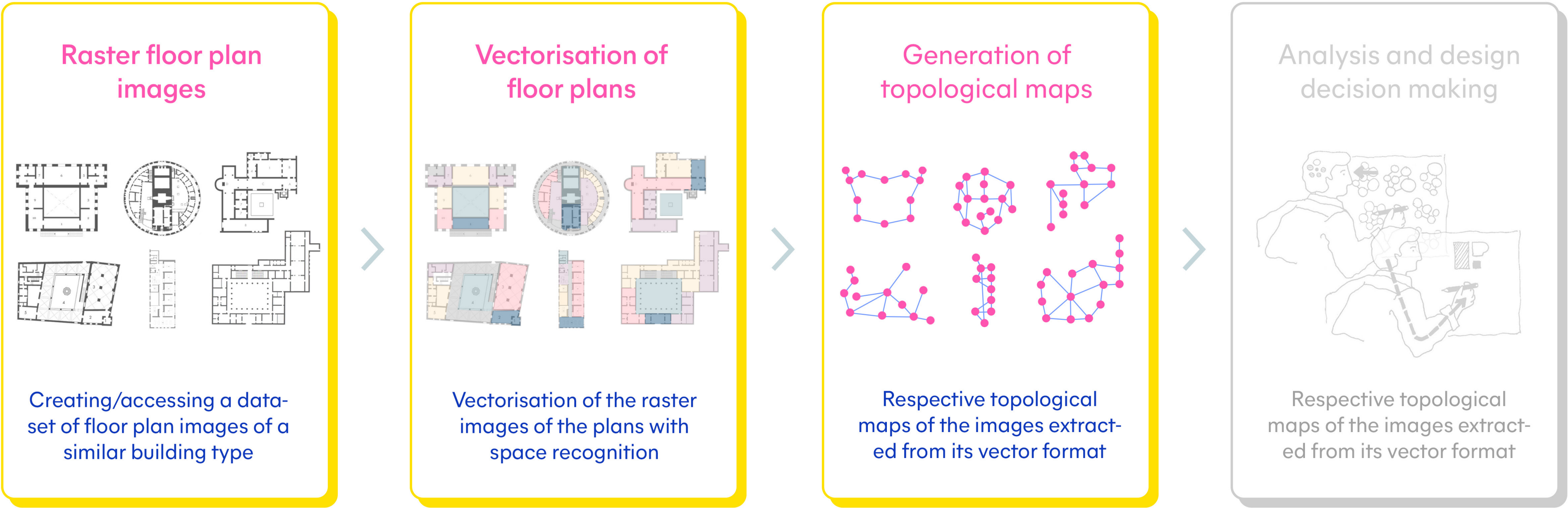




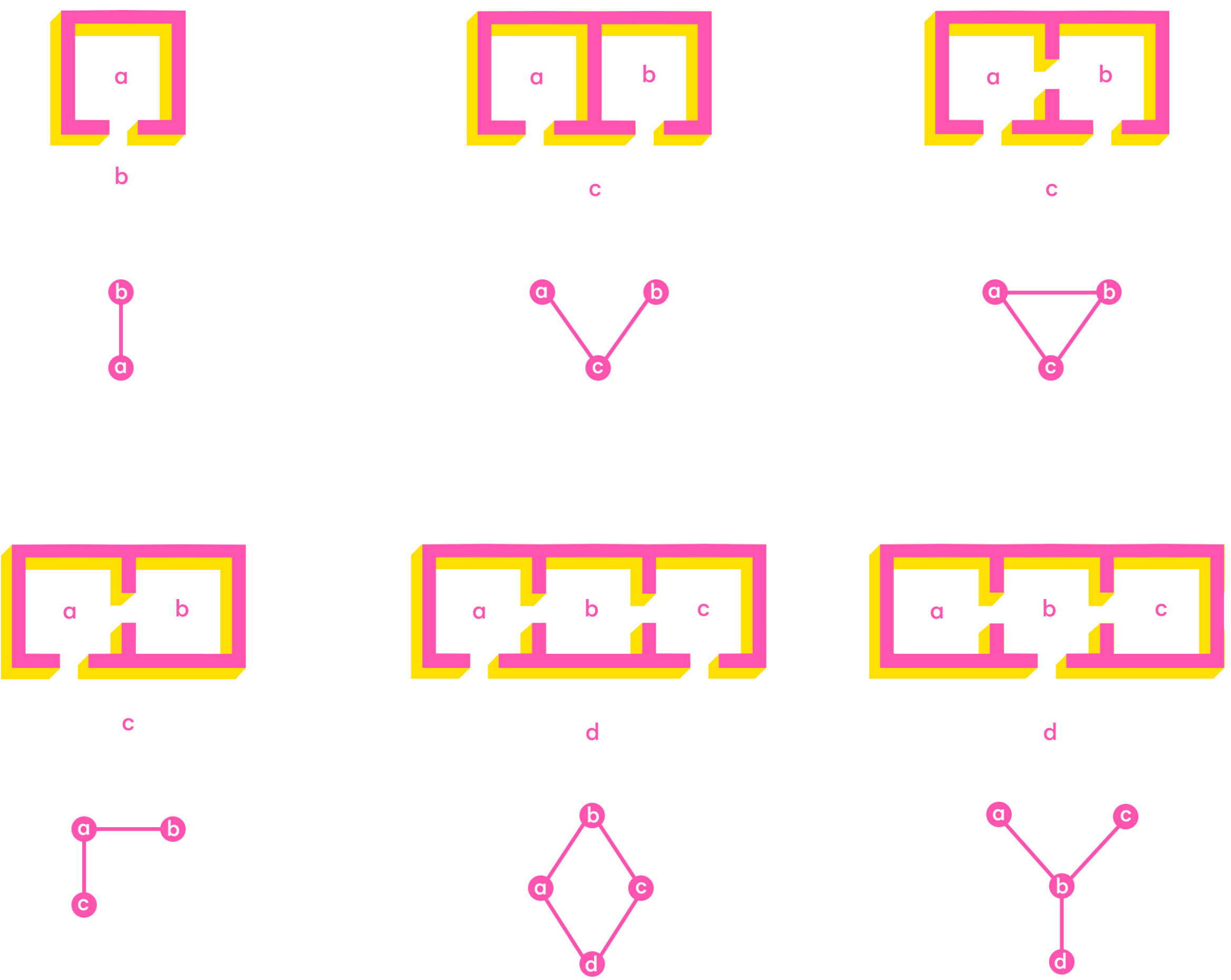




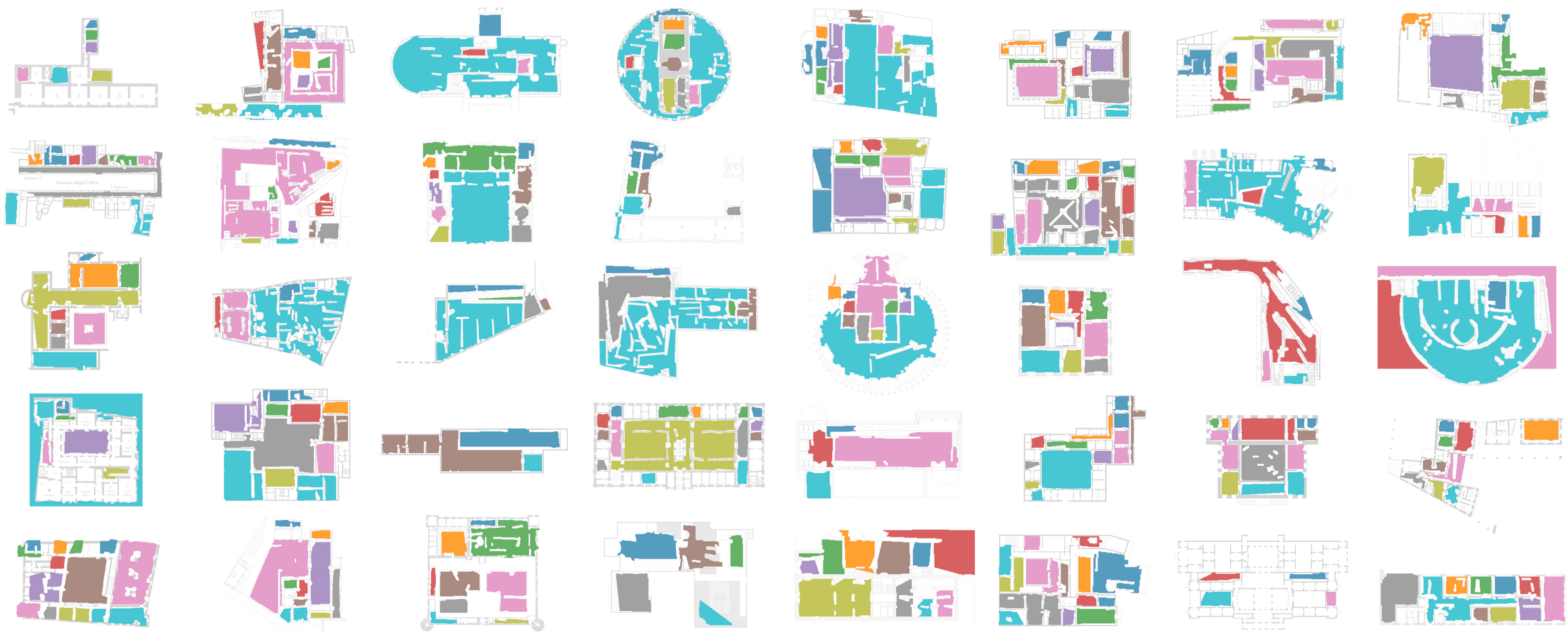




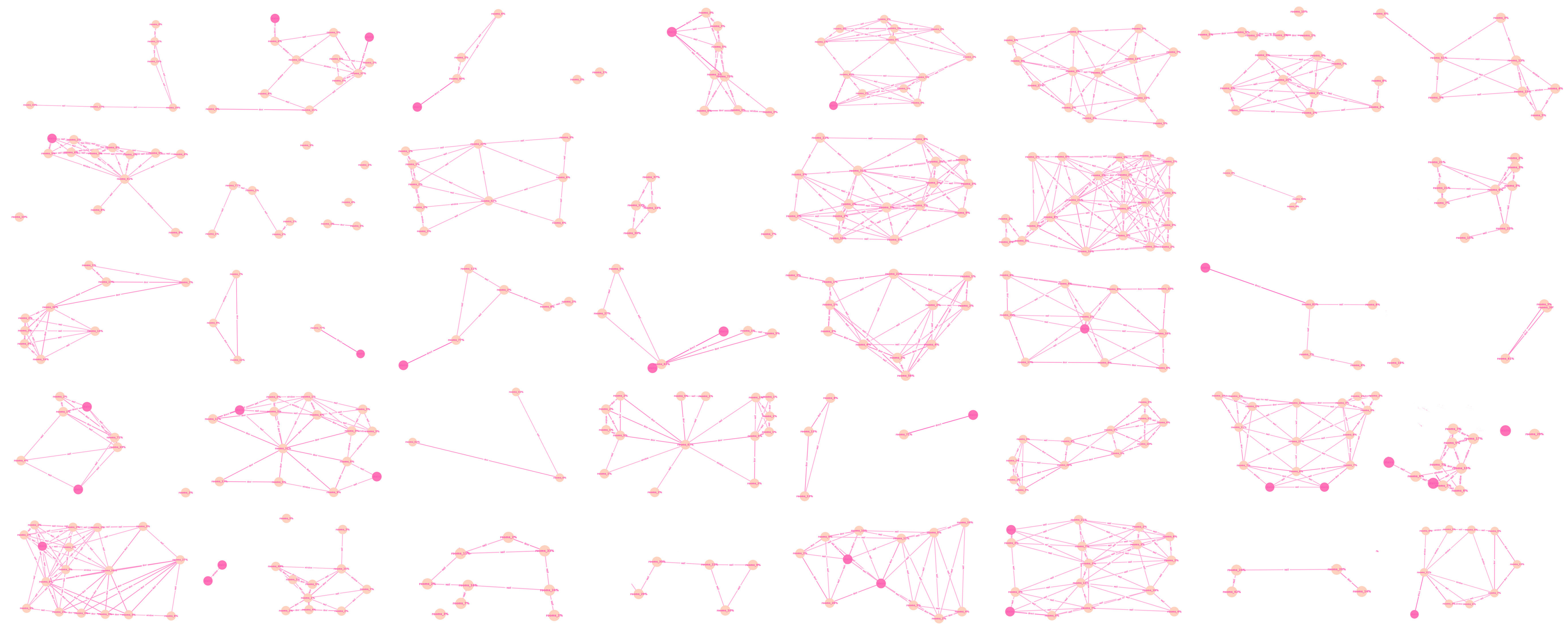




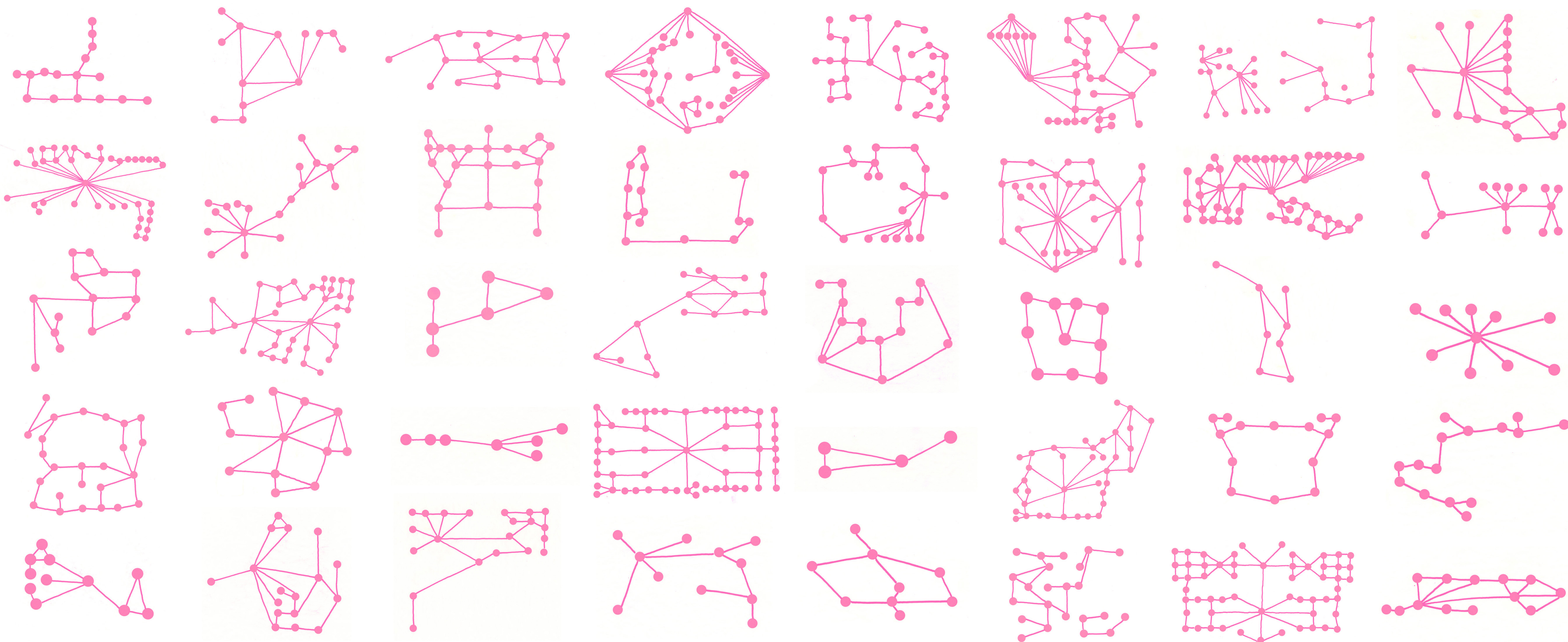




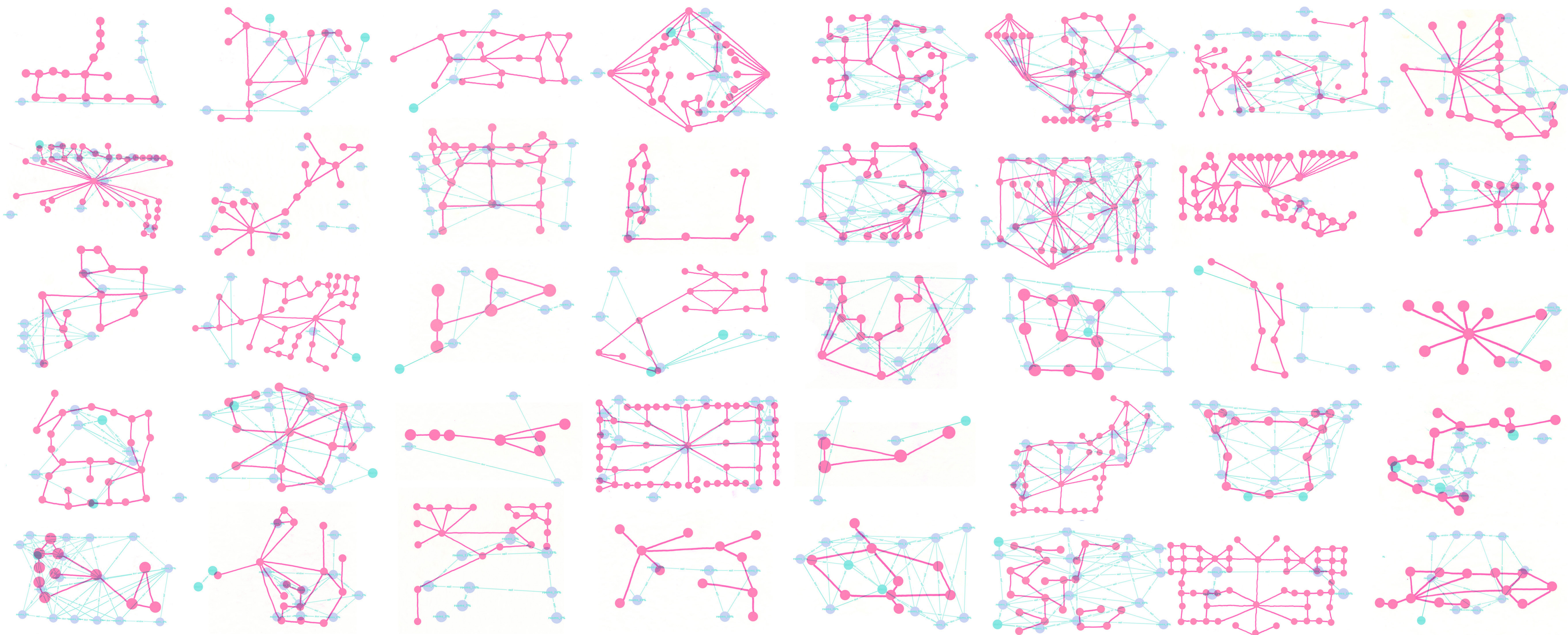








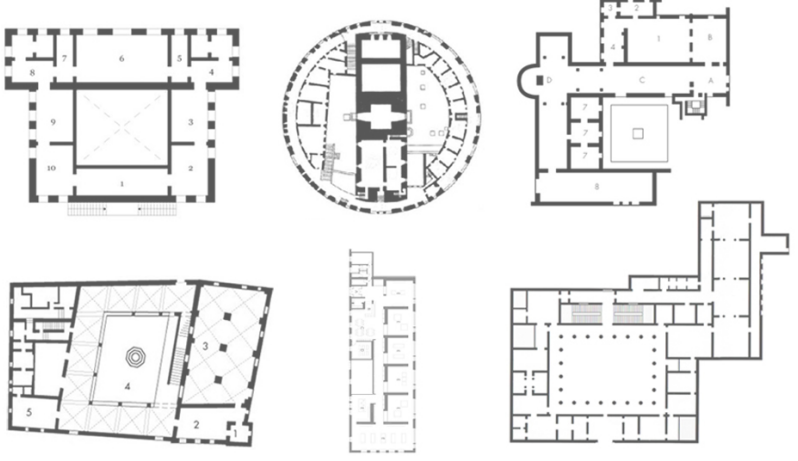






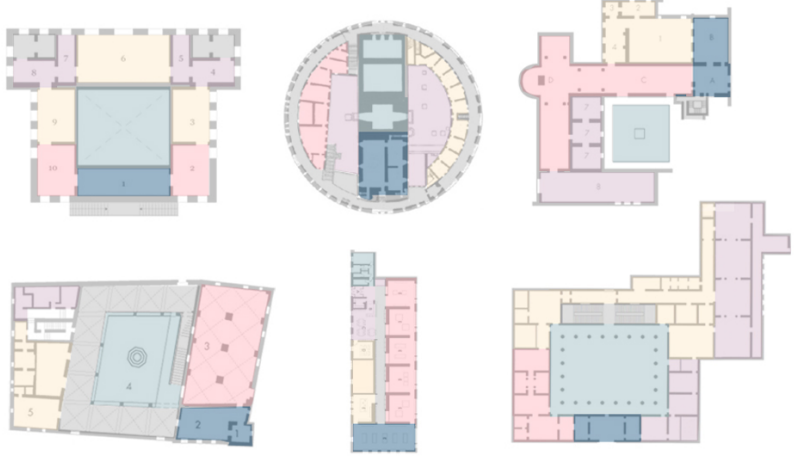


Raster floor plan images



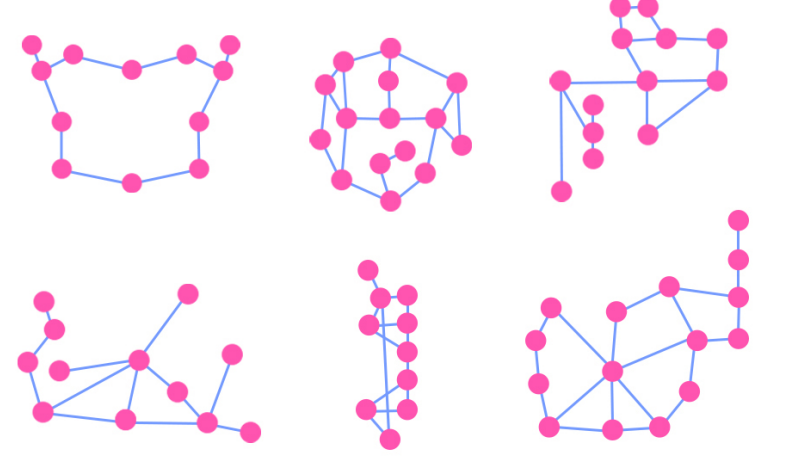
Creating/accessing a data-set of floor plan images of a similar building type

Vectorisation of floor plans



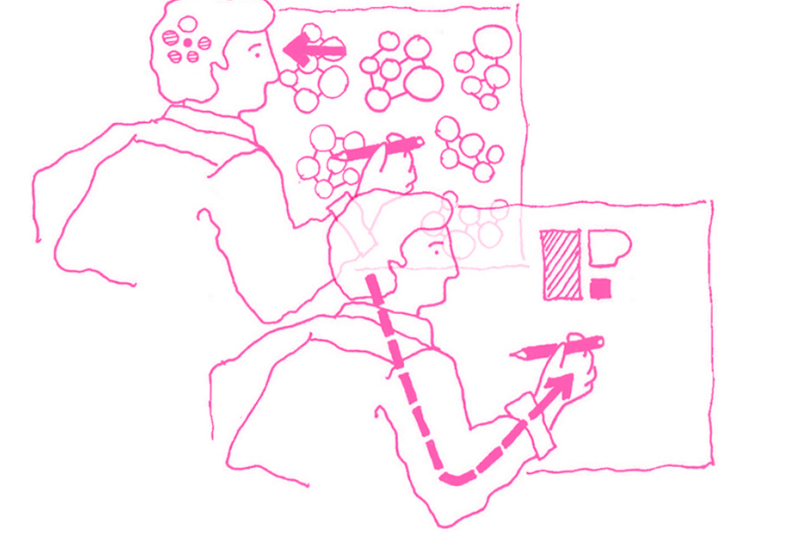
Vectorisation of the raster images of the plans with space recognition

Generation of topological maps



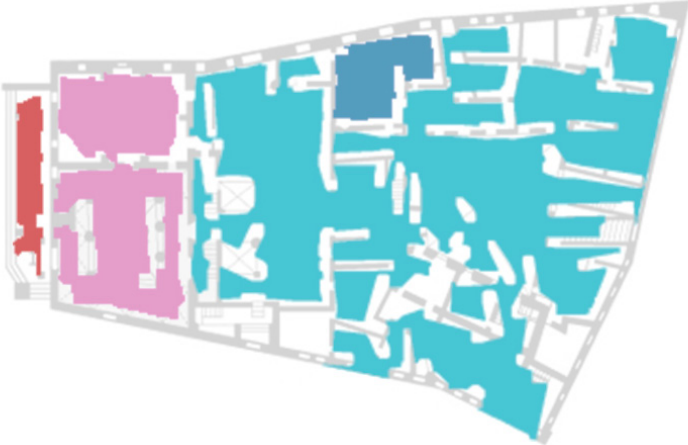
Respective topological maps of the images extracted from its vector format

Analysis and design decision making

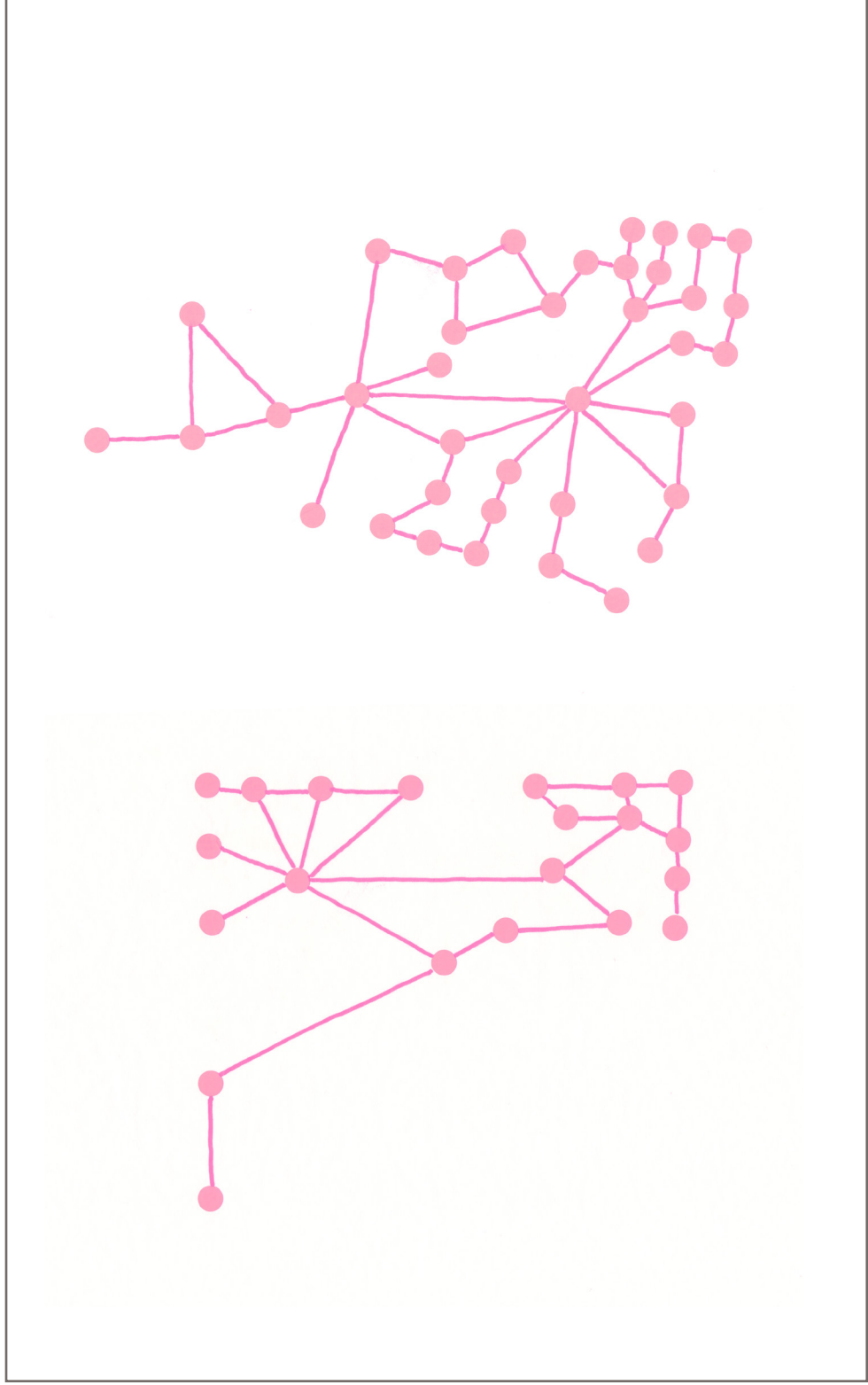
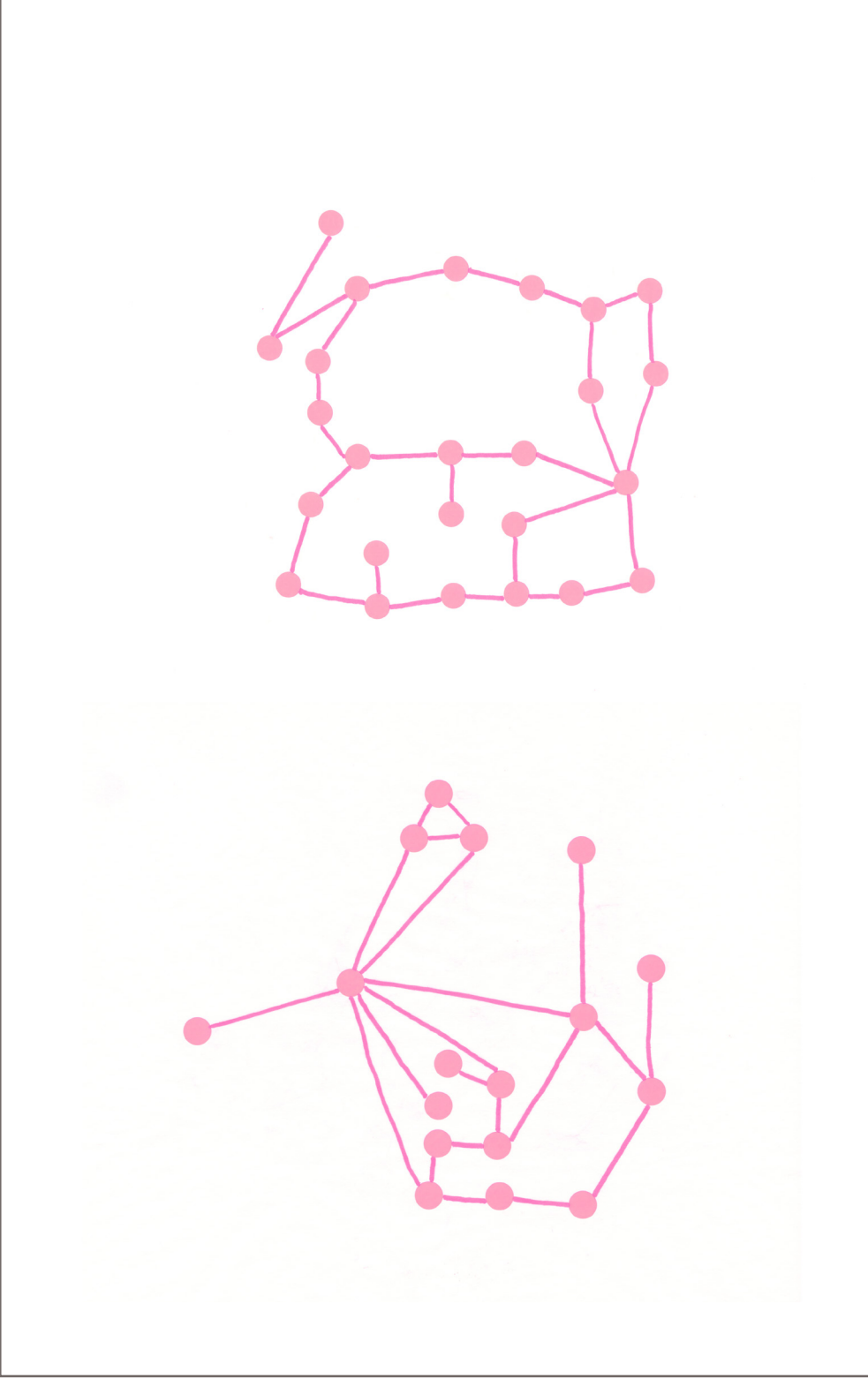
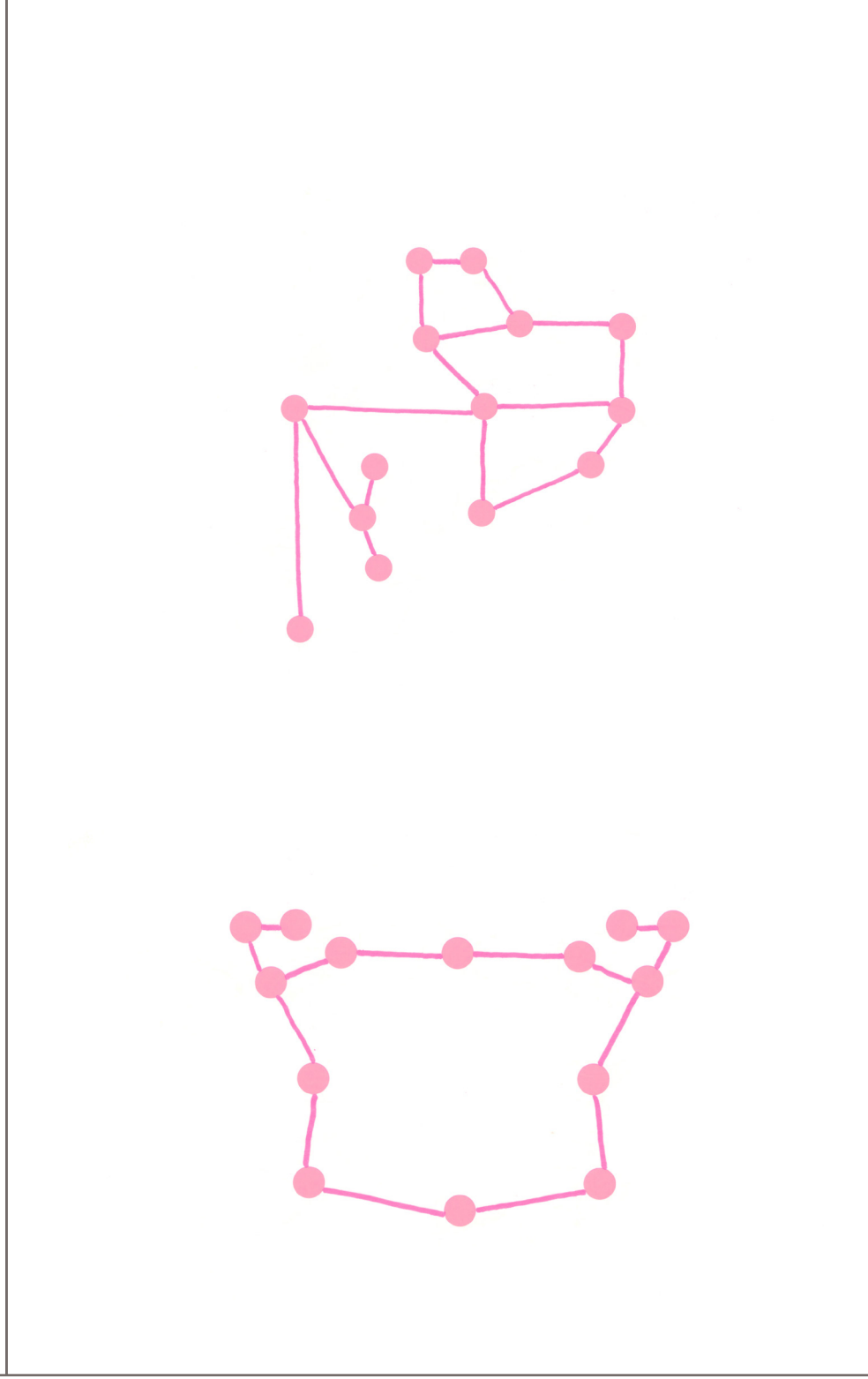
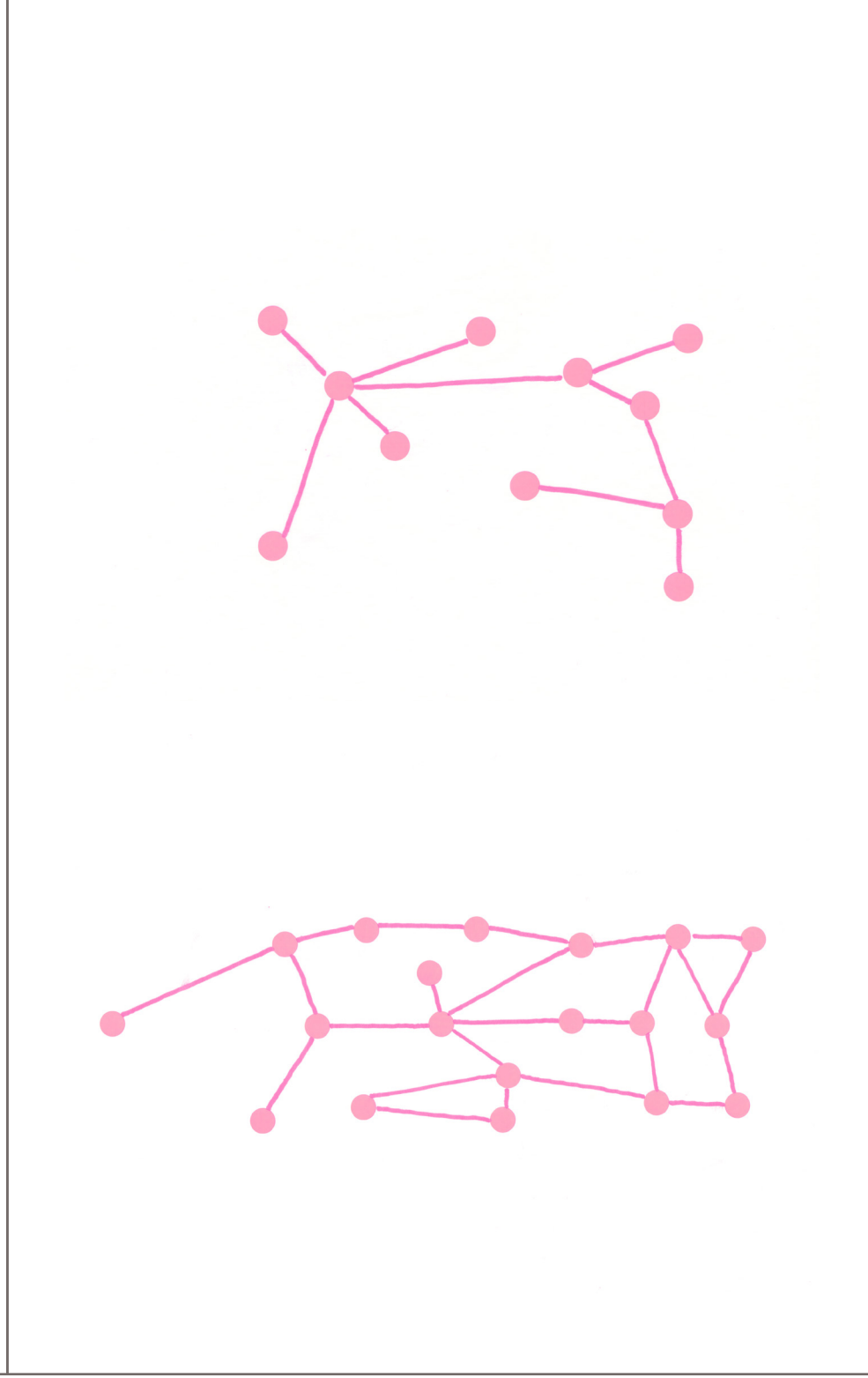
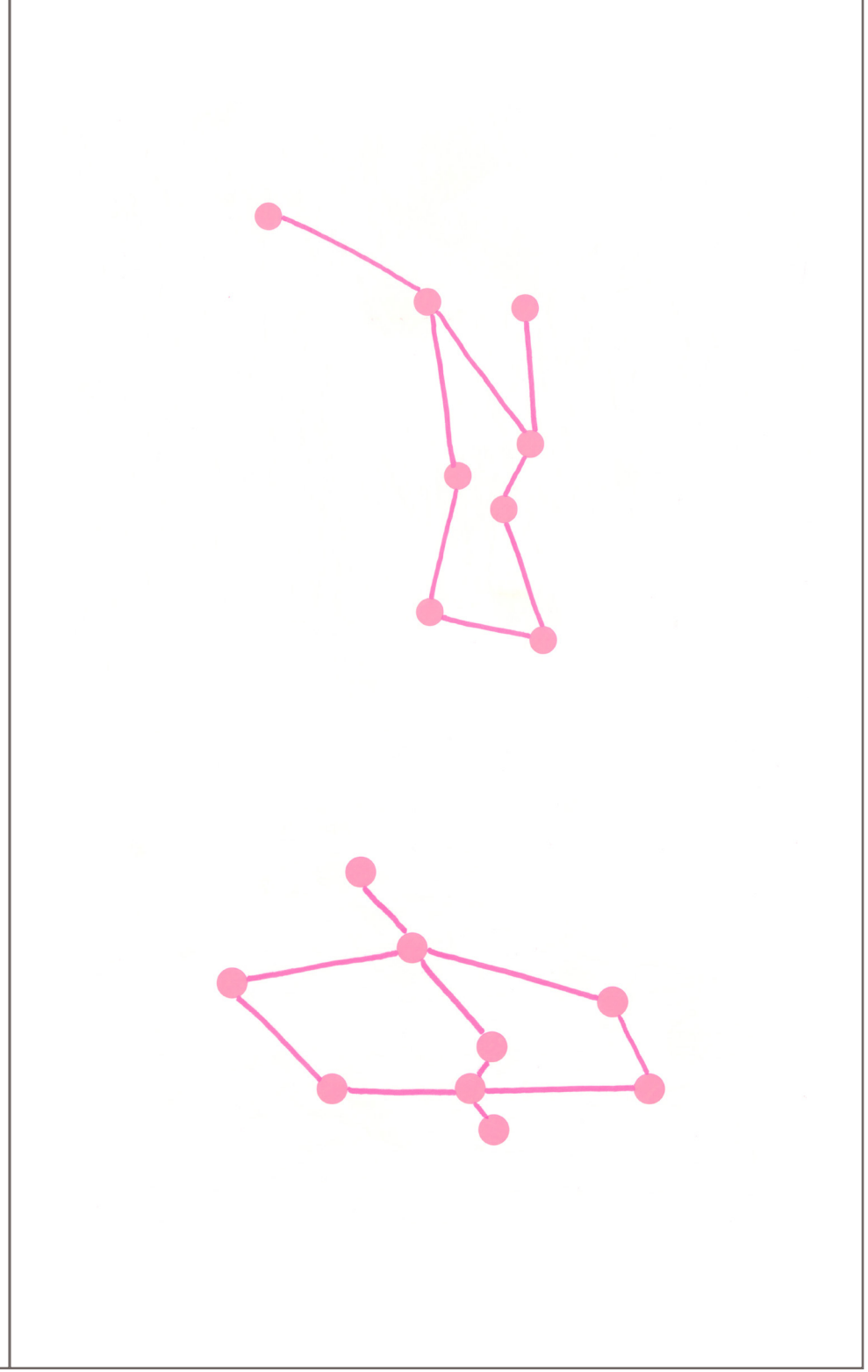


Respective topological maps of the images extracted from its vector format



| < 1400                                                                                                                                                                   | 1400-1600                                                                                                                                                                   | 1600-1800                                                                                                                                                                     | 1800-2000                                                                                                                                                                    | > 2000                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> | <br> | <br> | <br> | <br> |



| < 1400                                                                            | 1400-1600                                                                           | 1600-1800                                                                            | 1800-2000                                                                            | > 2000                                                                               |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |  |  |  |



63%

single courtyard in the design

52%

entrance to final room  
depth >5

1980

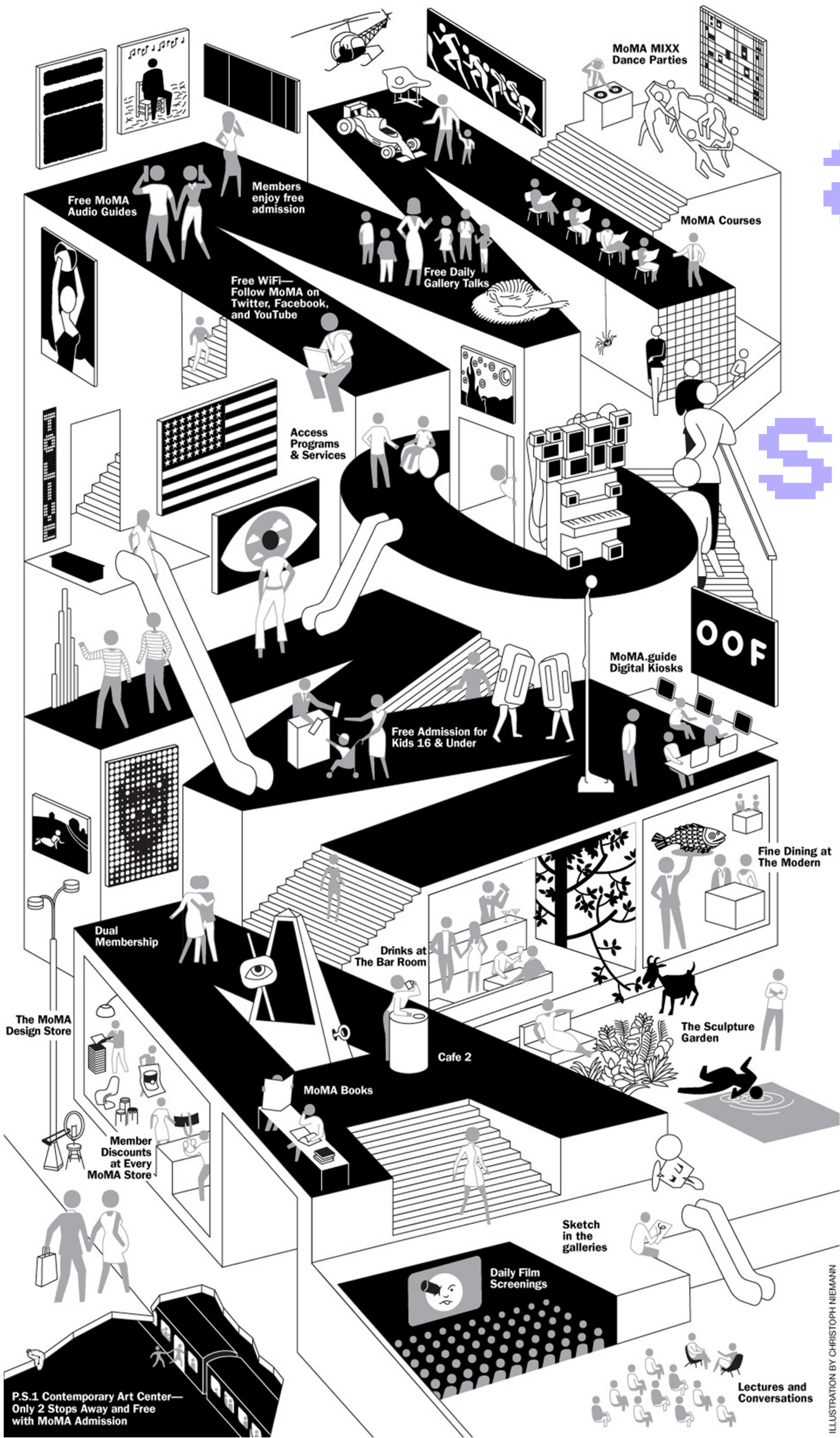
largest singular depth of  
room from entrance

2000

least number of nodes relative to area

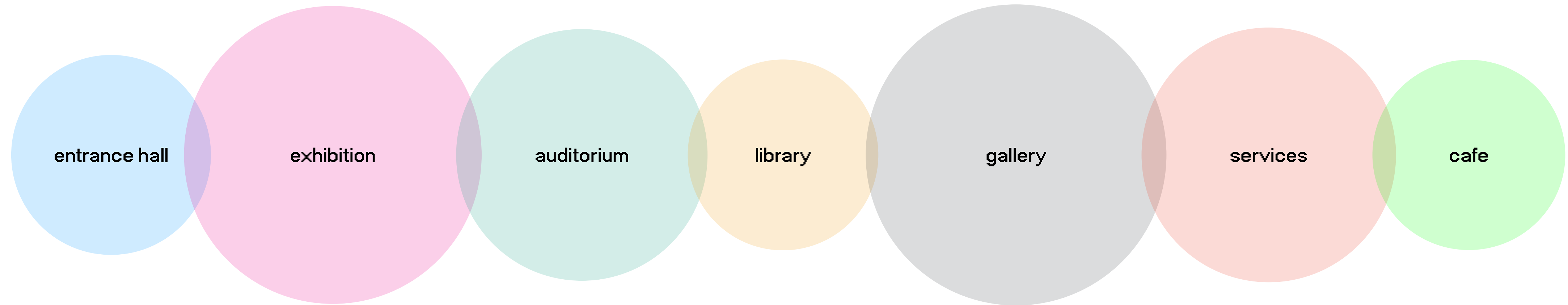


< And while we  
conclusions on  
in museums, it  
there is an  
commonality in



are able to draw  
spatial hierarchy  
is clear that  
inherent lack of  
the designs >





the spatial programming of a museum  
is inconsequential to the working of the  
typology

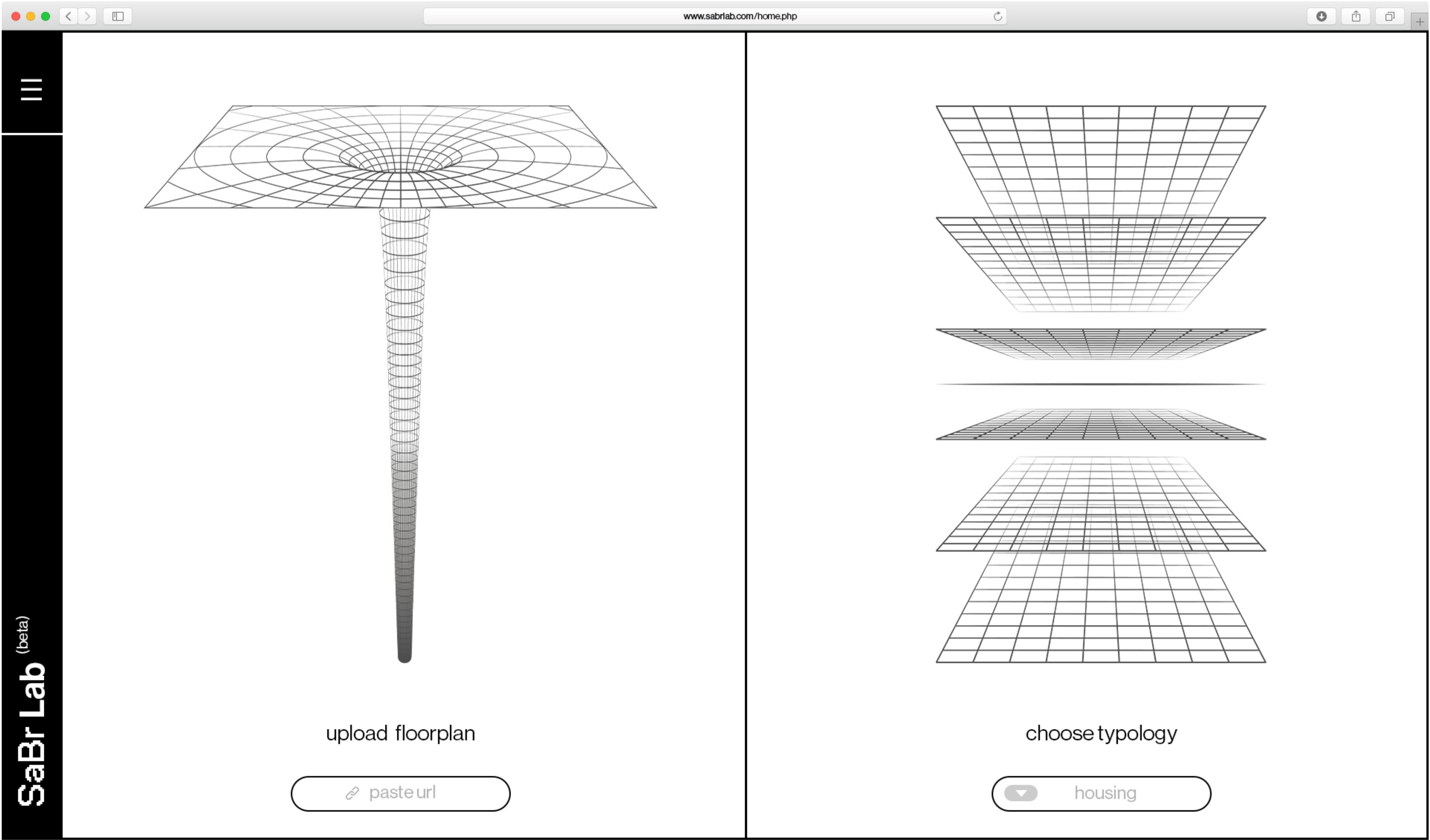






and while the suspicion remains  
from the research that this  
methodology could very well  
replicate in the presence of an  
intuitive UI

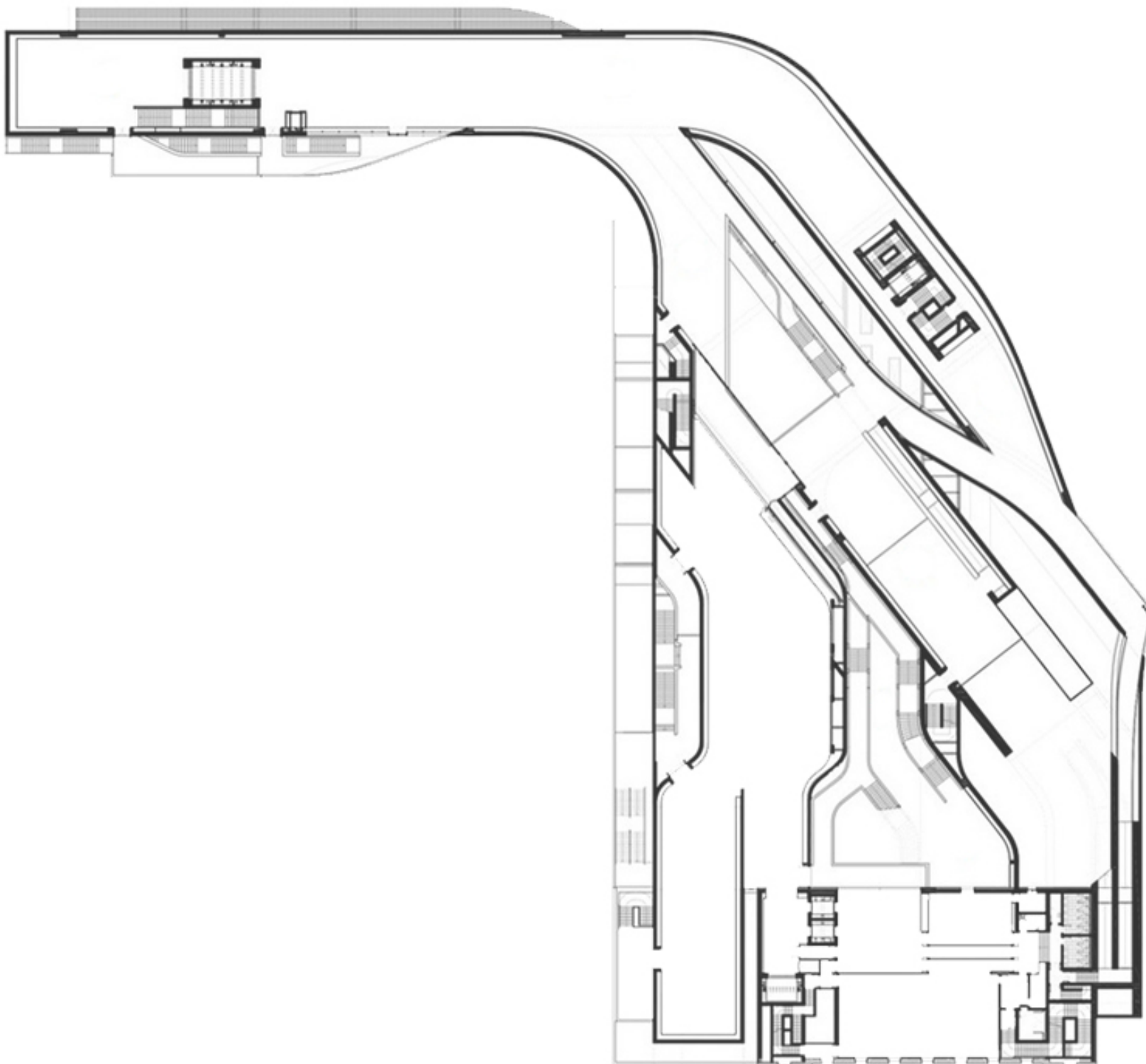


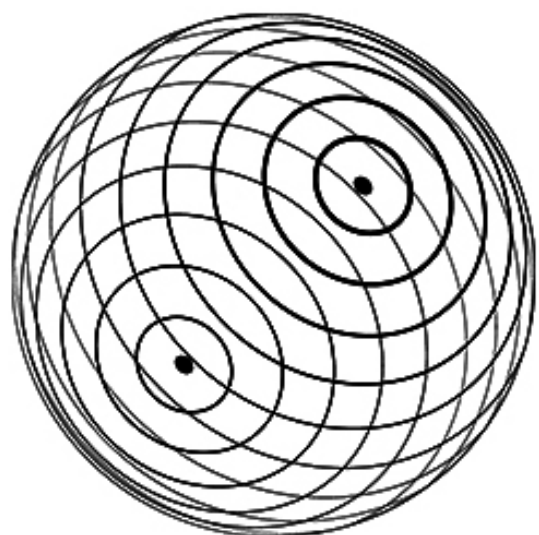




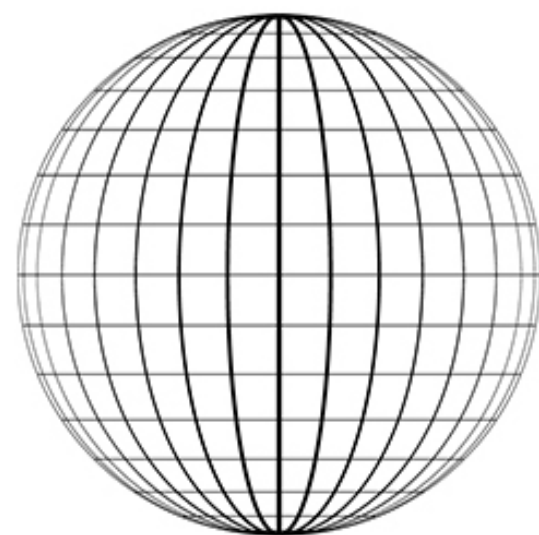
⋮

SaBr Lab (beta)

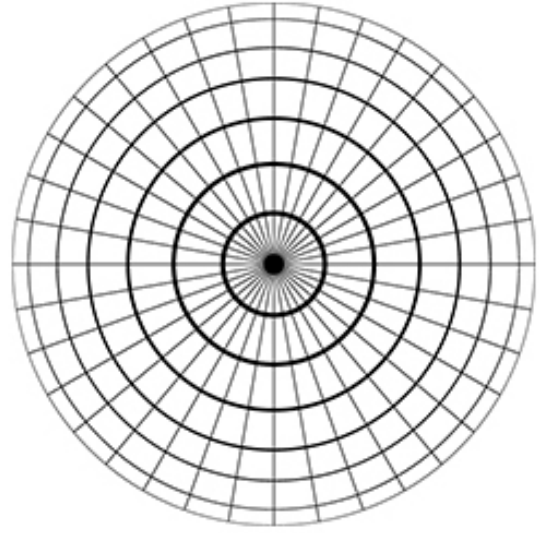




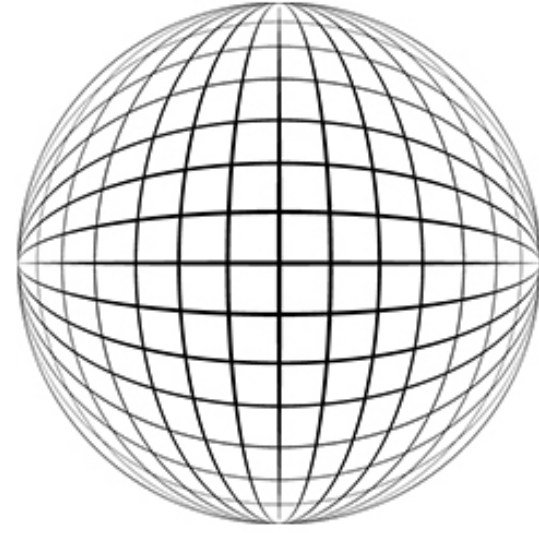
segment



analyse

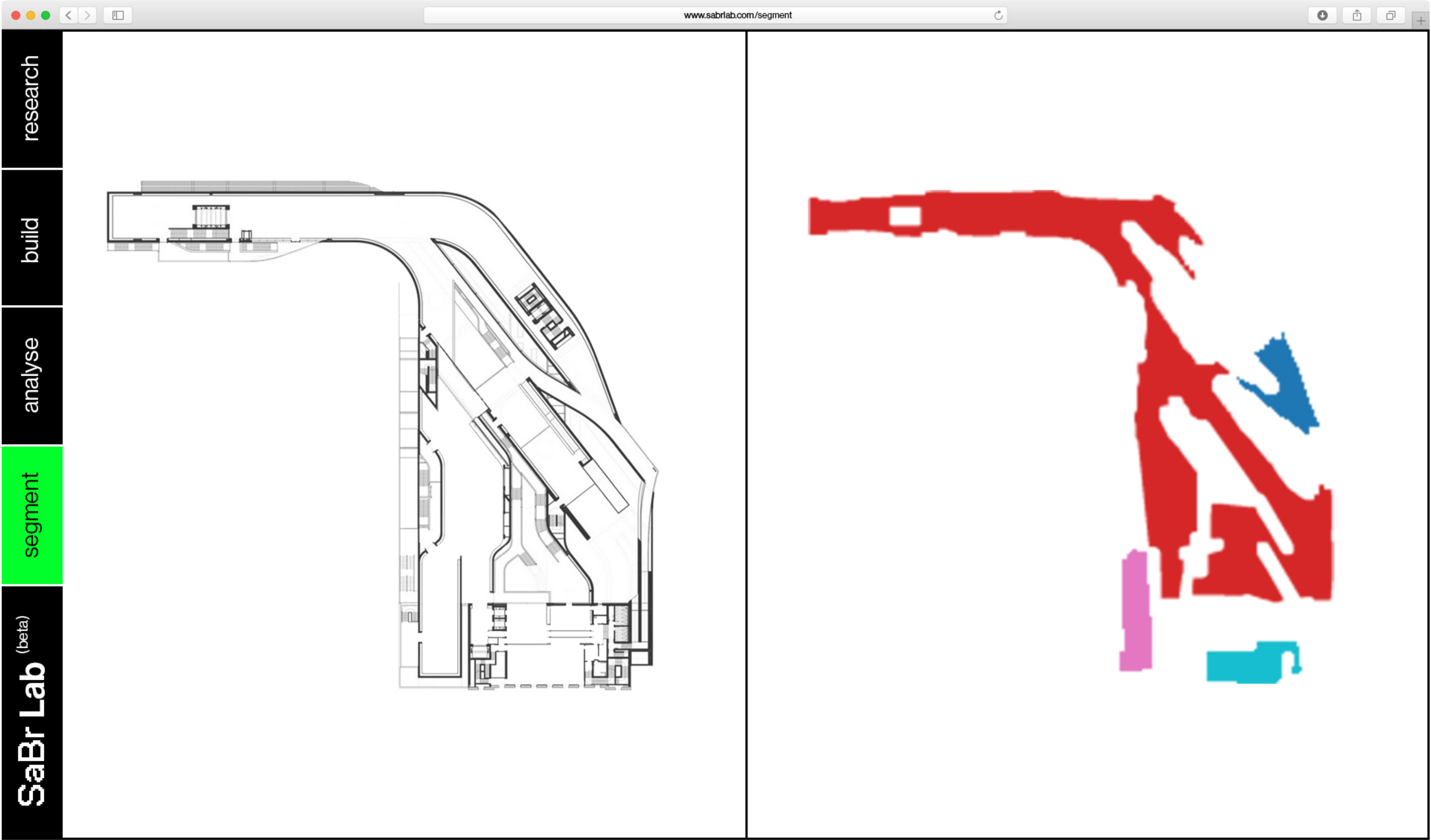


build

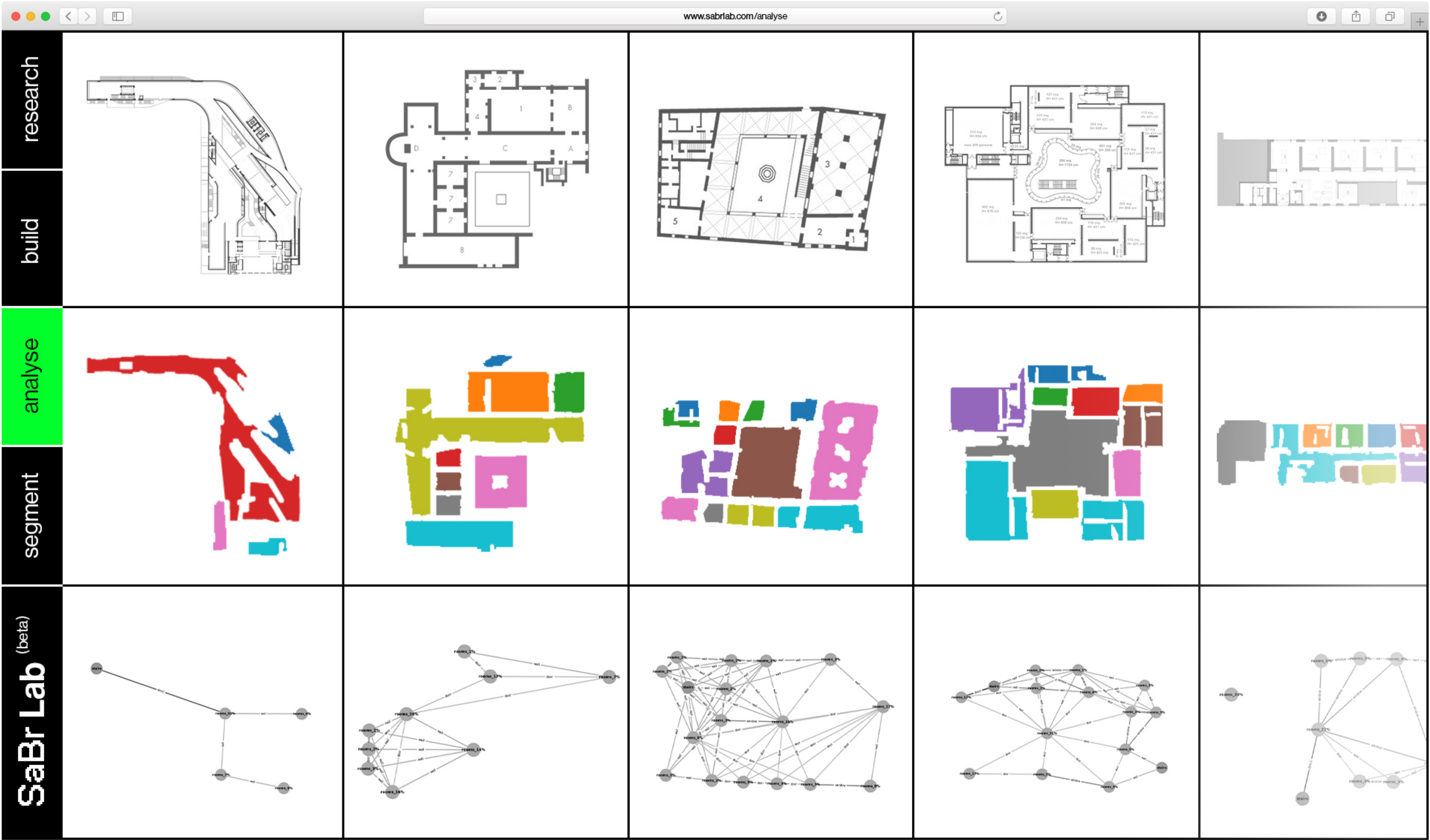


research











research

build

analyse

segment

SaBr Lab

(beta)

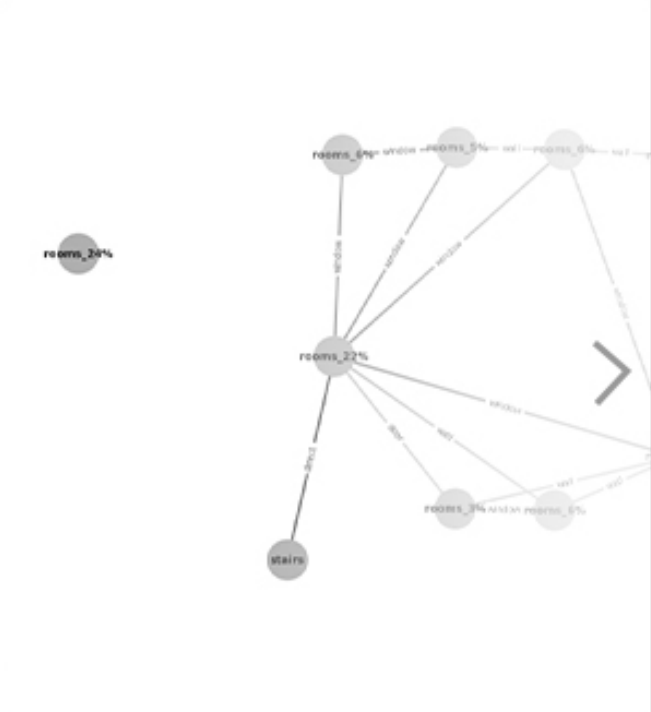
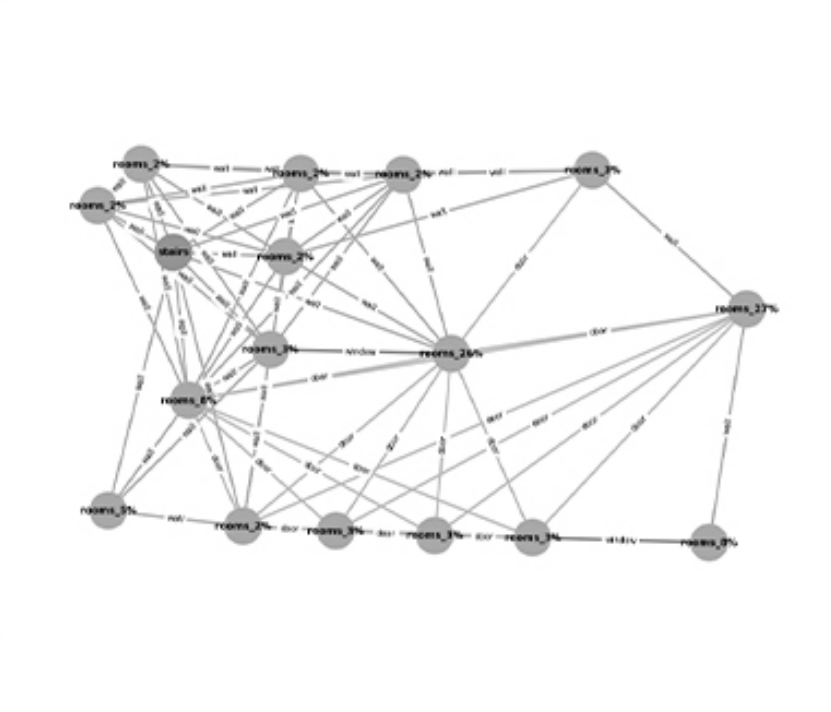
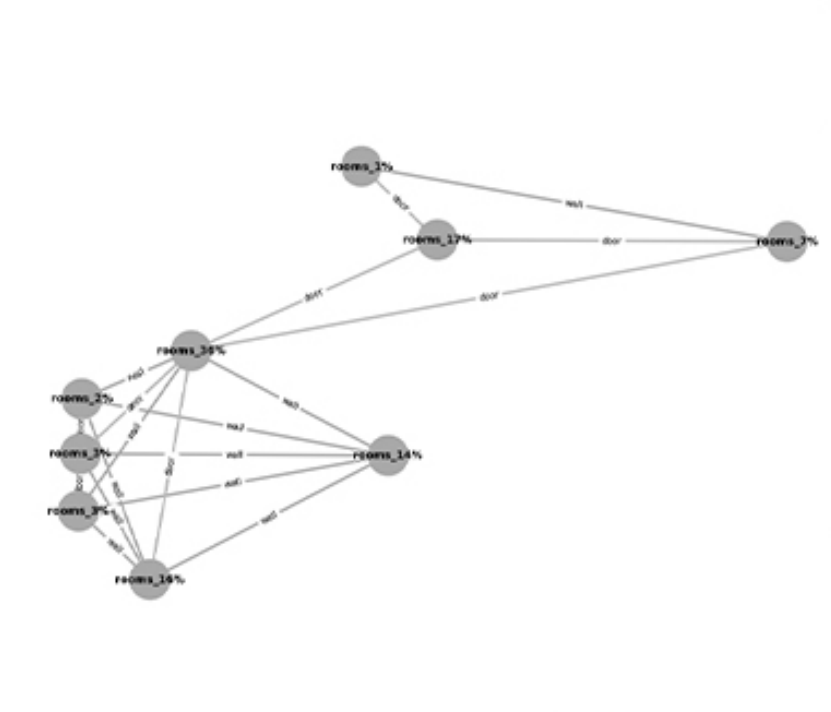
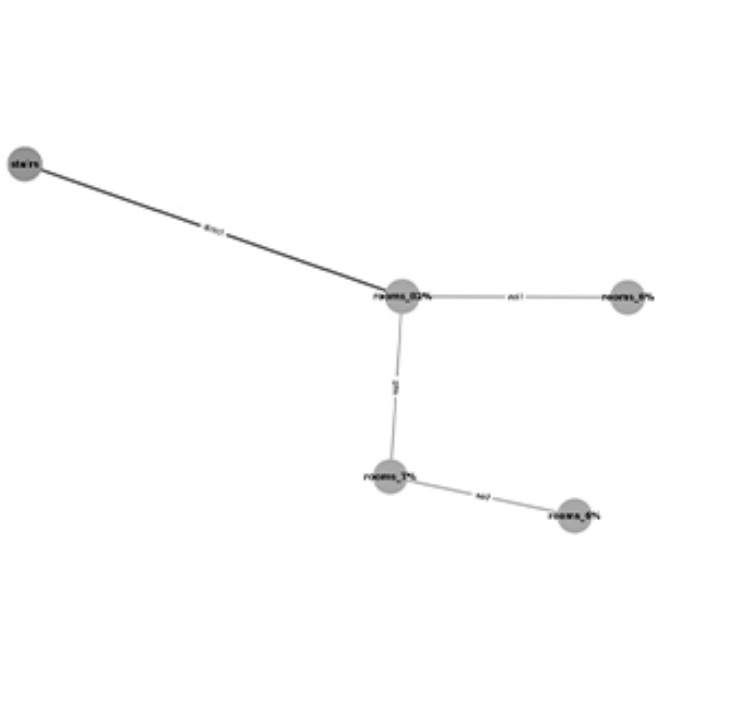
edit

arrange

floorplans

segmentations

topological maps



entrance

reception

exhibition hall 01

gallery 01

search site

draw boundary

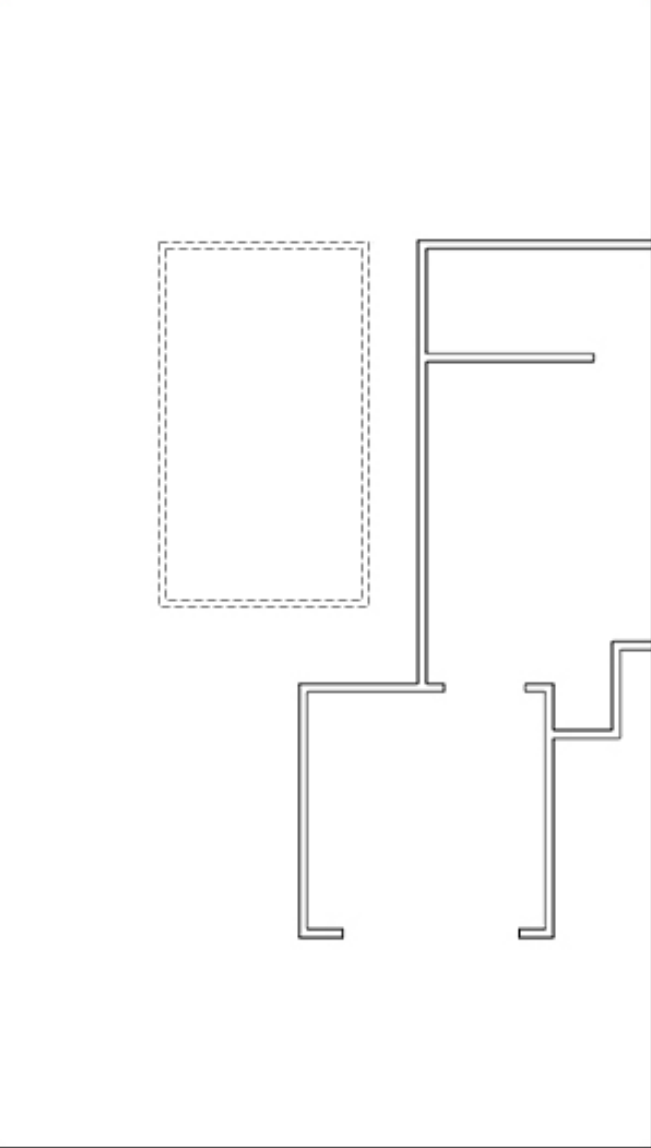
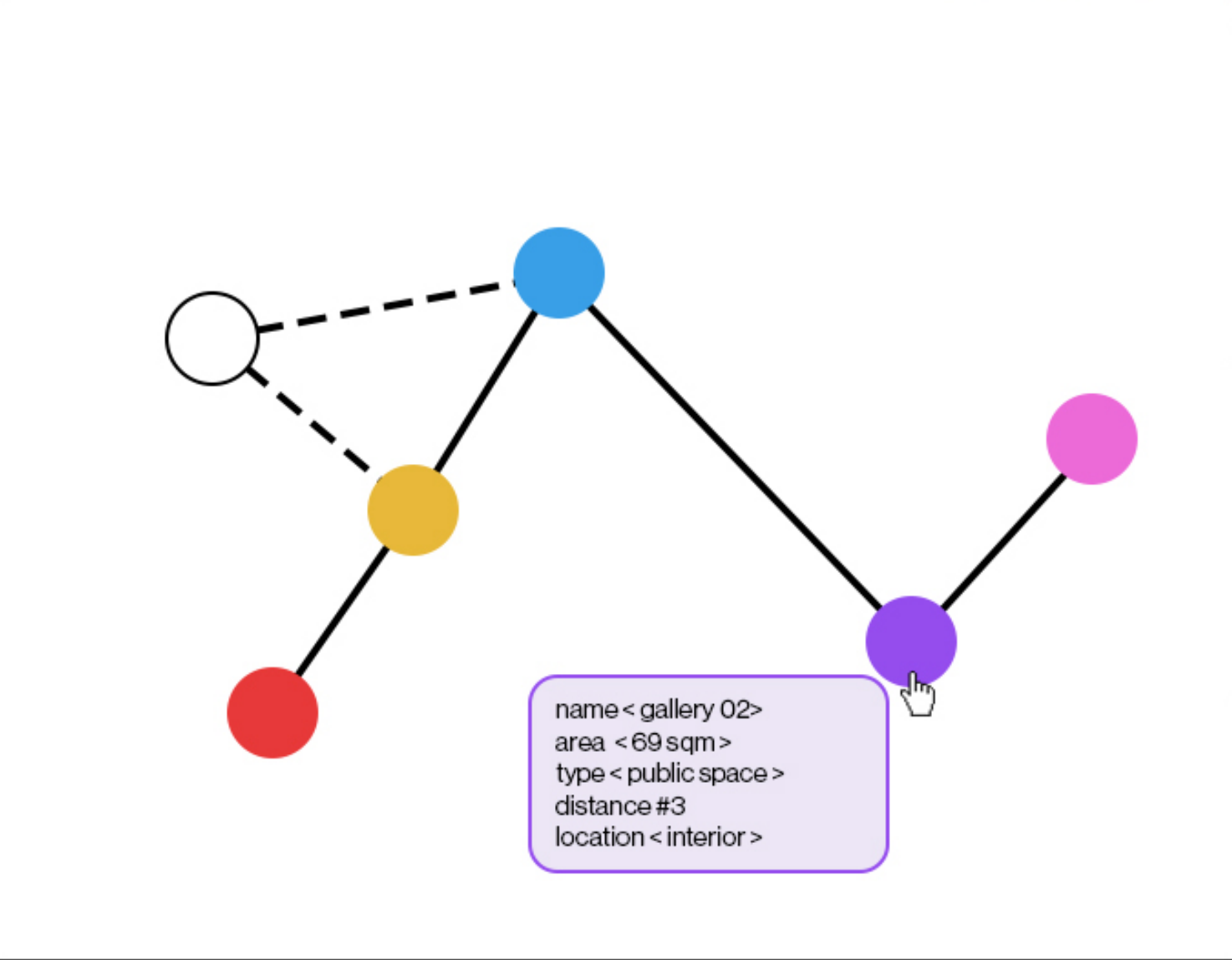
randomize area

search furniture

reconstruct

edit

arrange



name < gallery 02 >  
area < 69 sqm >  
type < public space >  
distance #3  
location < interior >



research

build

analyse

segment

SaBr Lab (beta)

floorplans

segmentations

topological maps

#01

#02

#03

#04

#05

#06

#07

#08

#09

#10

#11

#12

#13

#14

#15



Considering a project typology to the likes of a hospital where the functioning relies primarily in how the programs are placed and optimised, the research findings could have had a larger direct impact on the design



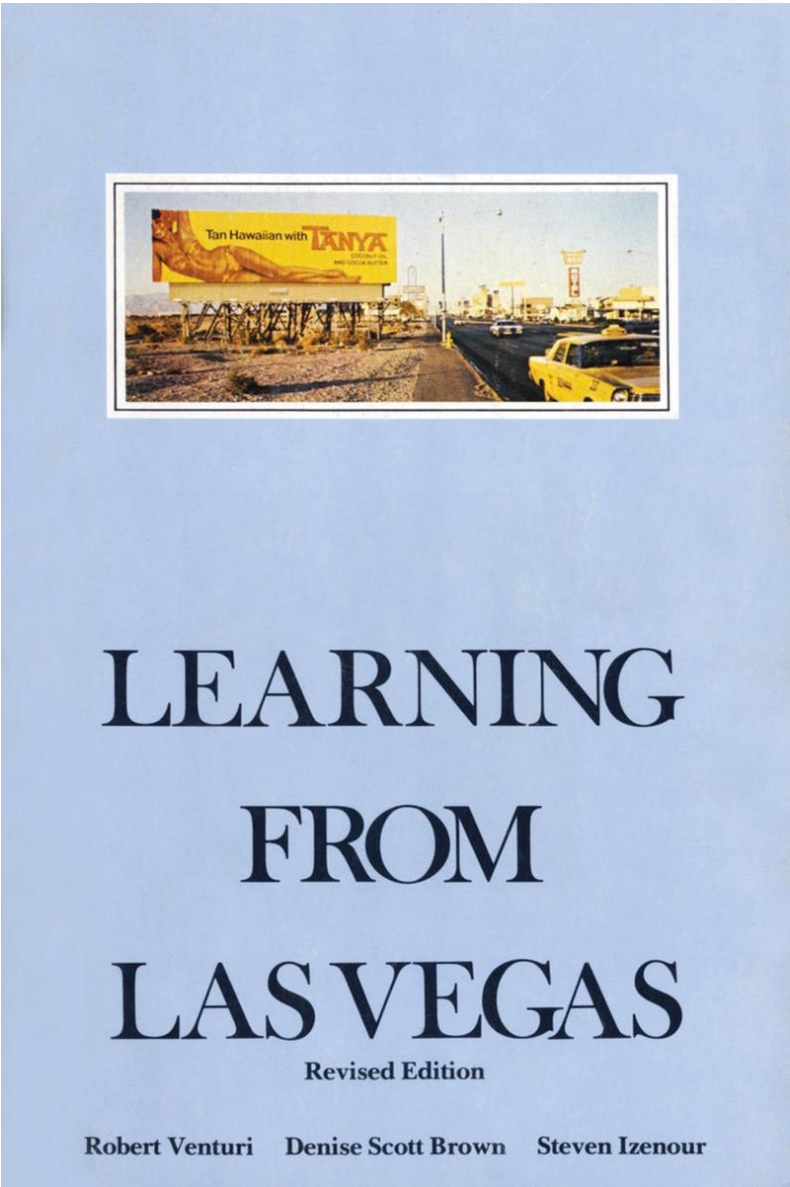
of ducks,  
decorated sheds,  
and other minds







Original Cover of the book  
by Muriel Cooper, 1972  
typeface: Caslon 540 caps  
with jacket in Univers (both font sizes)



Republished 1977  
with an altered cover  
typeface: Baskerville Old Face



As an analytical tool for examining the relationships between architectural form and symbol Venturi defines two archetypes of symbol-form relationship. First, when architectural systems of space structure and program are distorted by buildings overall symbolic significance the building belongs to the category of Ducks (in honour of “The Long Island Duckling”). Second, if the architectural systems of space are directed at the service of the program and symbols are applied independently from the form, the buildings belongs to the category of decorated sheds.



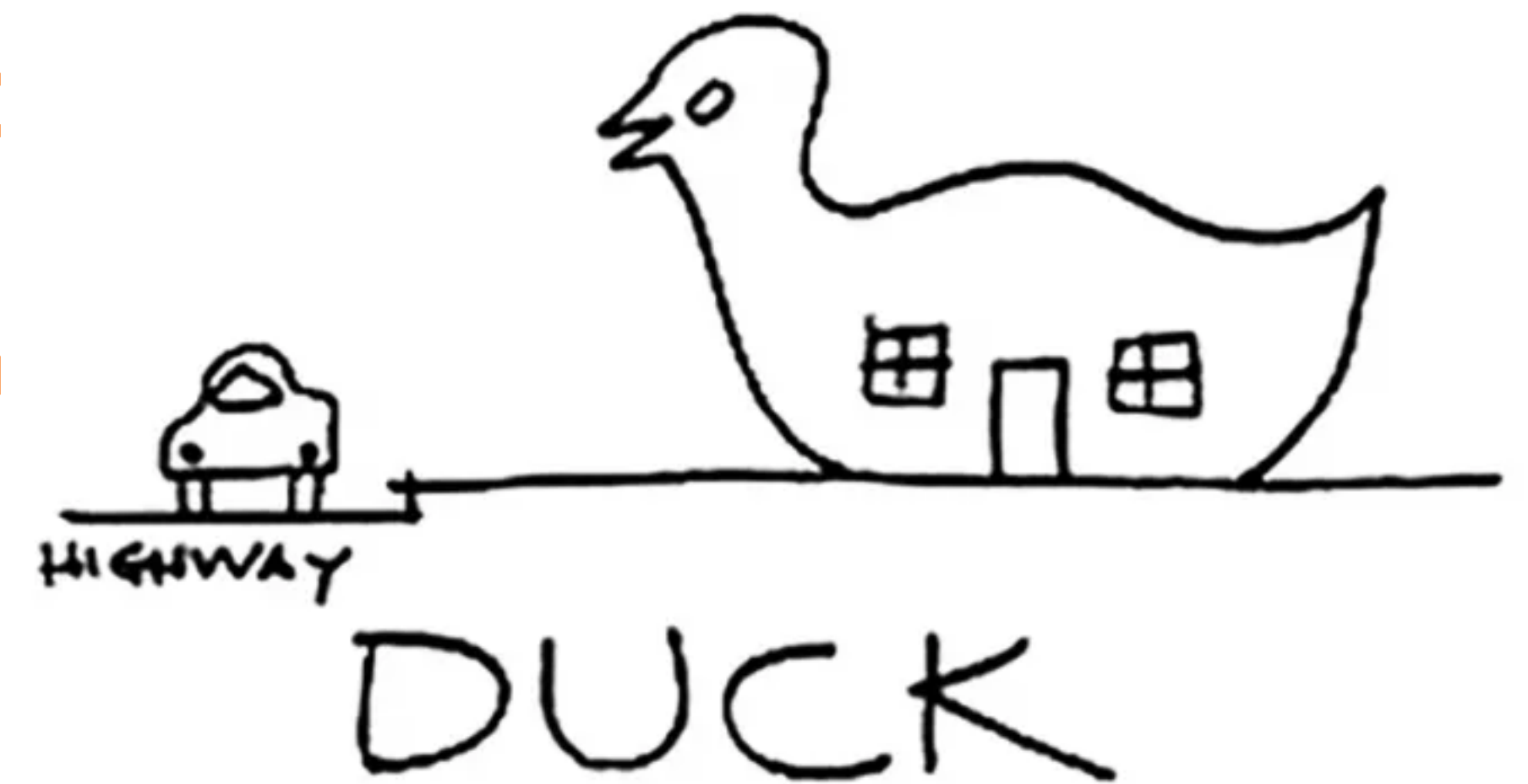
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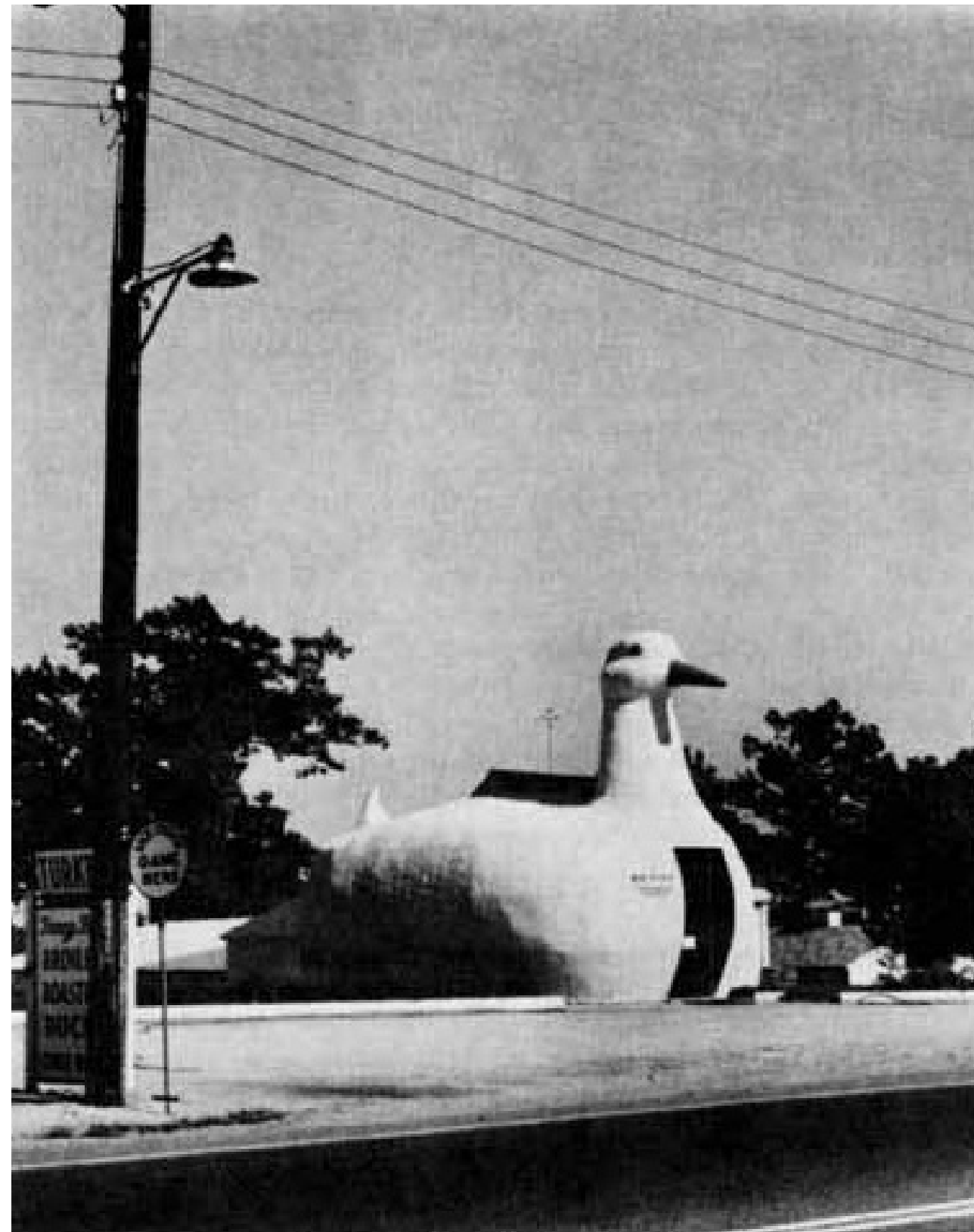
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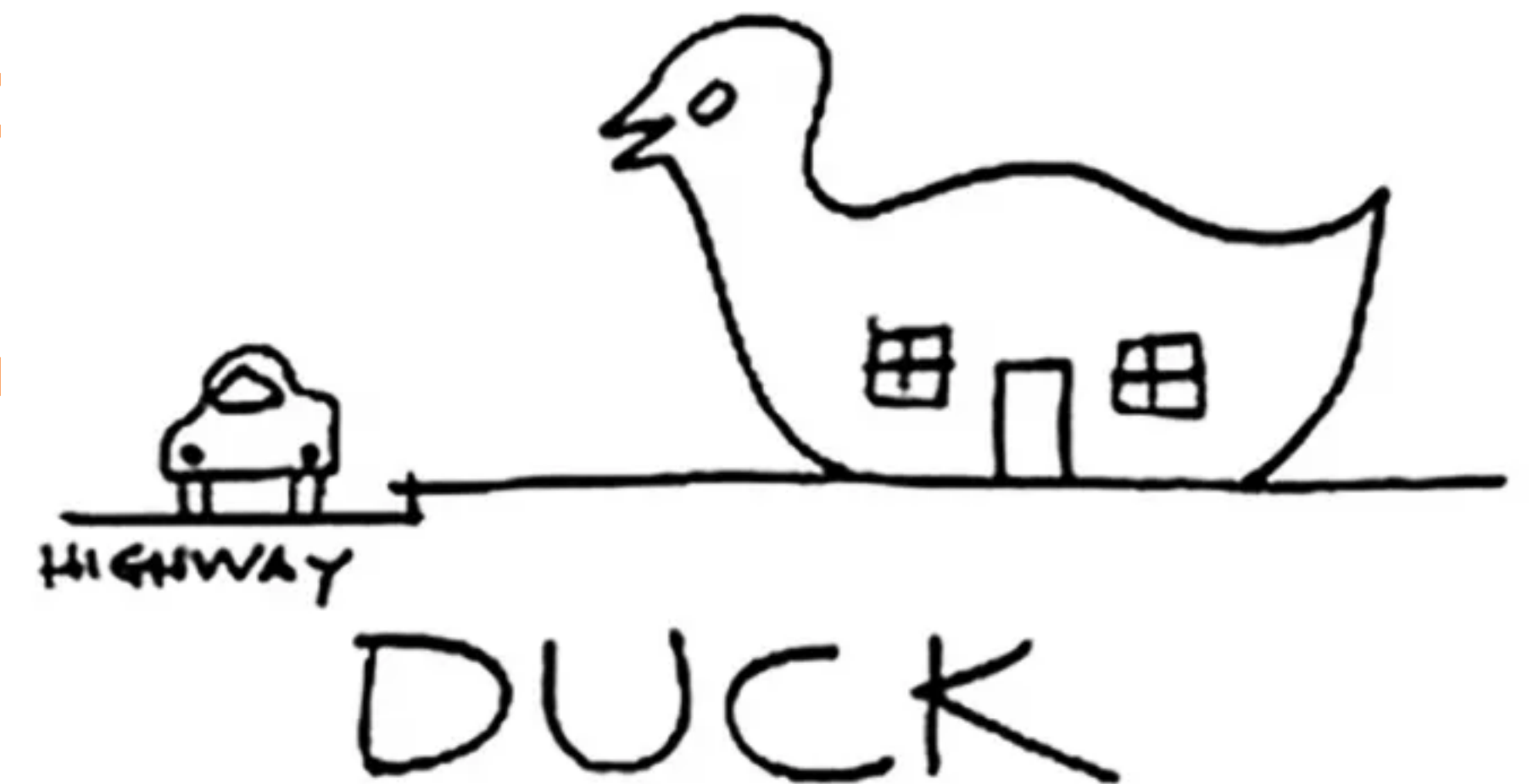
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Venturi defines two archetypes of symbol-form relation-  
architectural systems of space structure and program are  
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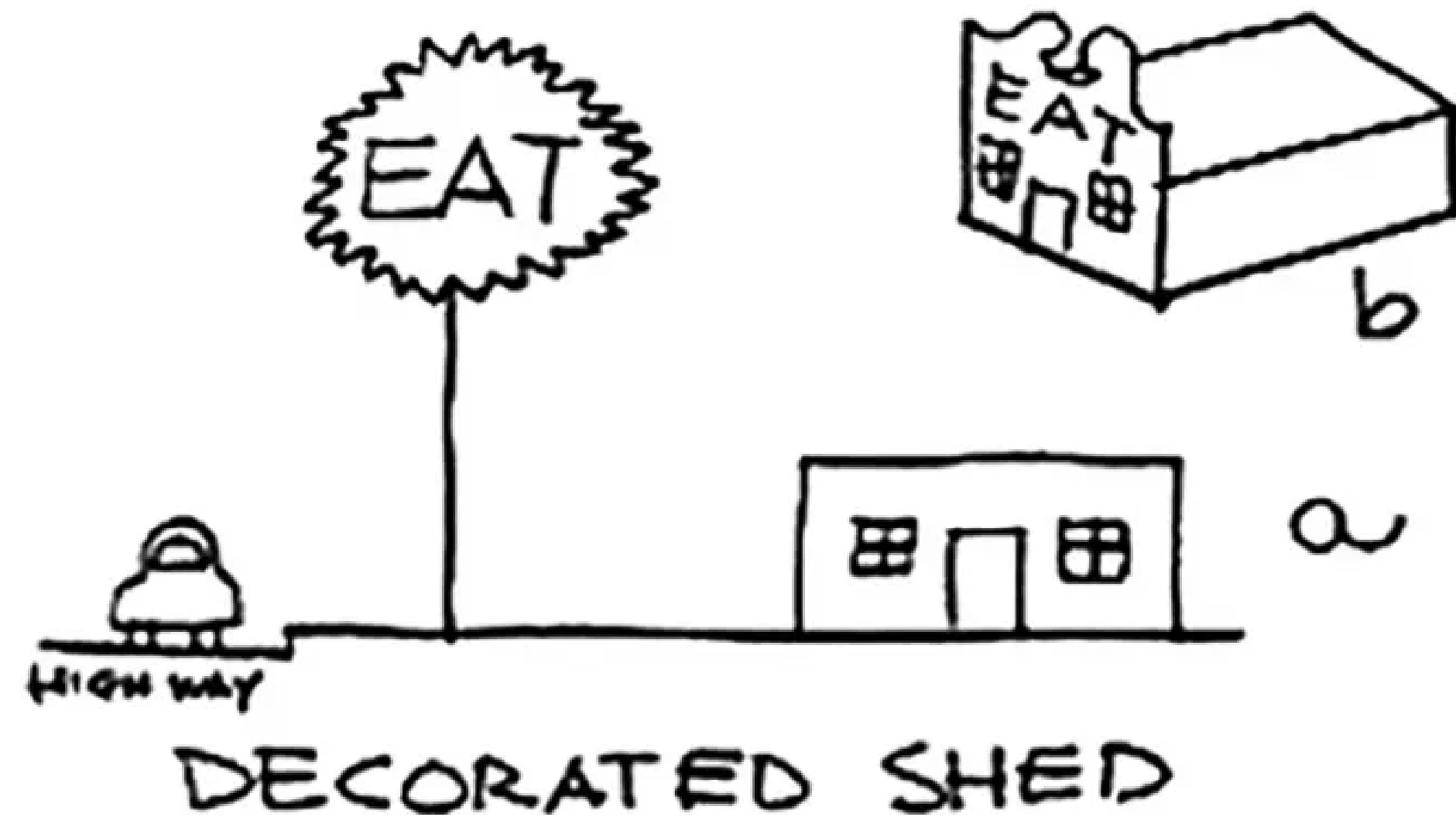
As an analytical tool for examining the relationships between architectural form and symbol Venturi defines two archetypal relationships. First, when architectural systems of space are distorted by buildings overall symbolic significance belongs to the category of Ducks (in honour of "The Long Duck Store"). If the architectural systems of space are directed at the service of the program and symbols are applied independently from the form, the buildings belong to the category of decorated sheds.





As an analytical tool for examining the relationships between architectural form and symbol Venturi defines two archetypes of symbol-form relationship. First, when architecture and program are

distorted by building the category of "Duckling" (the architectural symbol is at the service of the program and symbols are applied independently from the form, the buildings



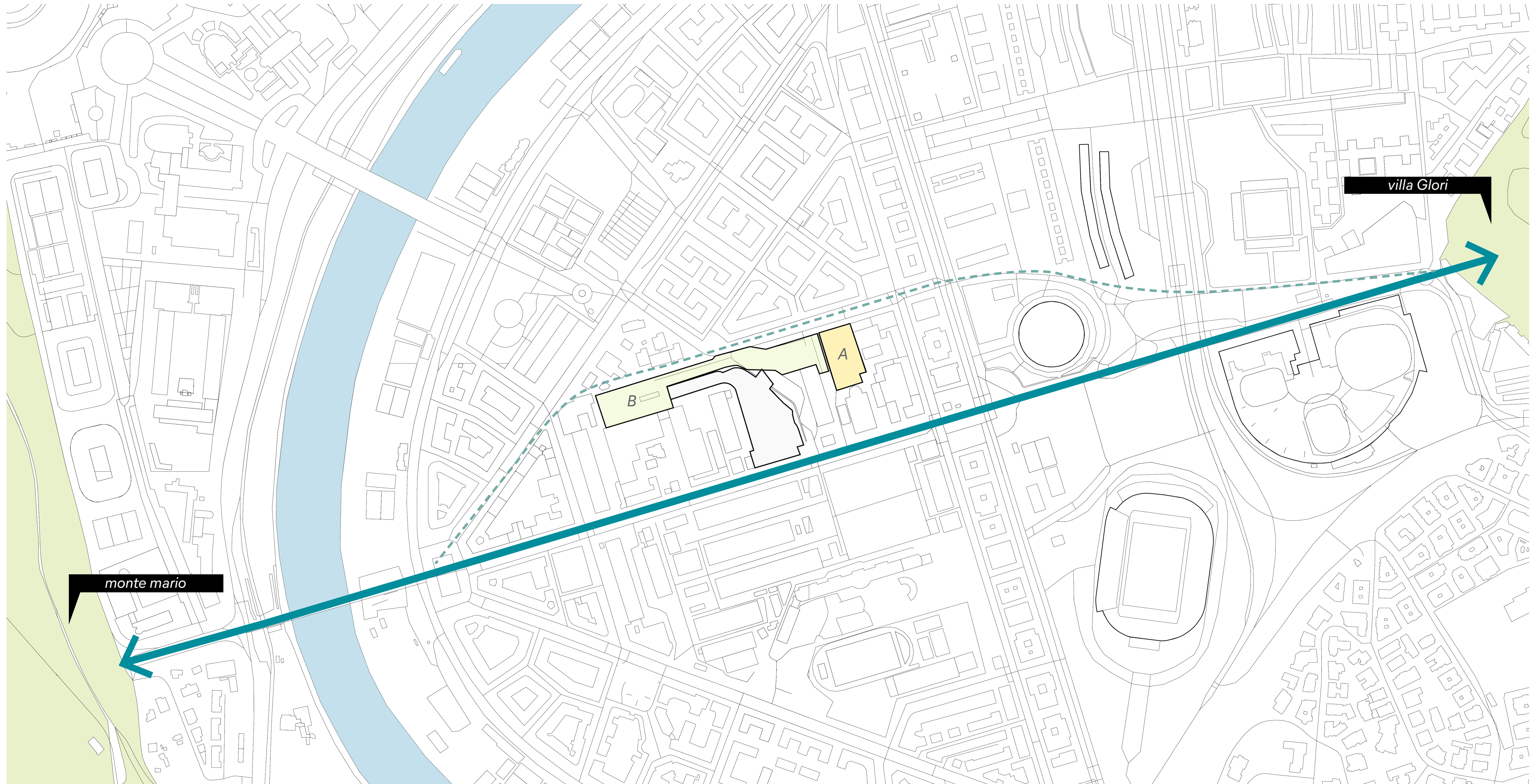
since the building belongs to the category of "Duckling"). Second, if the building is at the service of the program and symbols are applied independently from the form, the buildings

belongs to the category of decorated sheds.

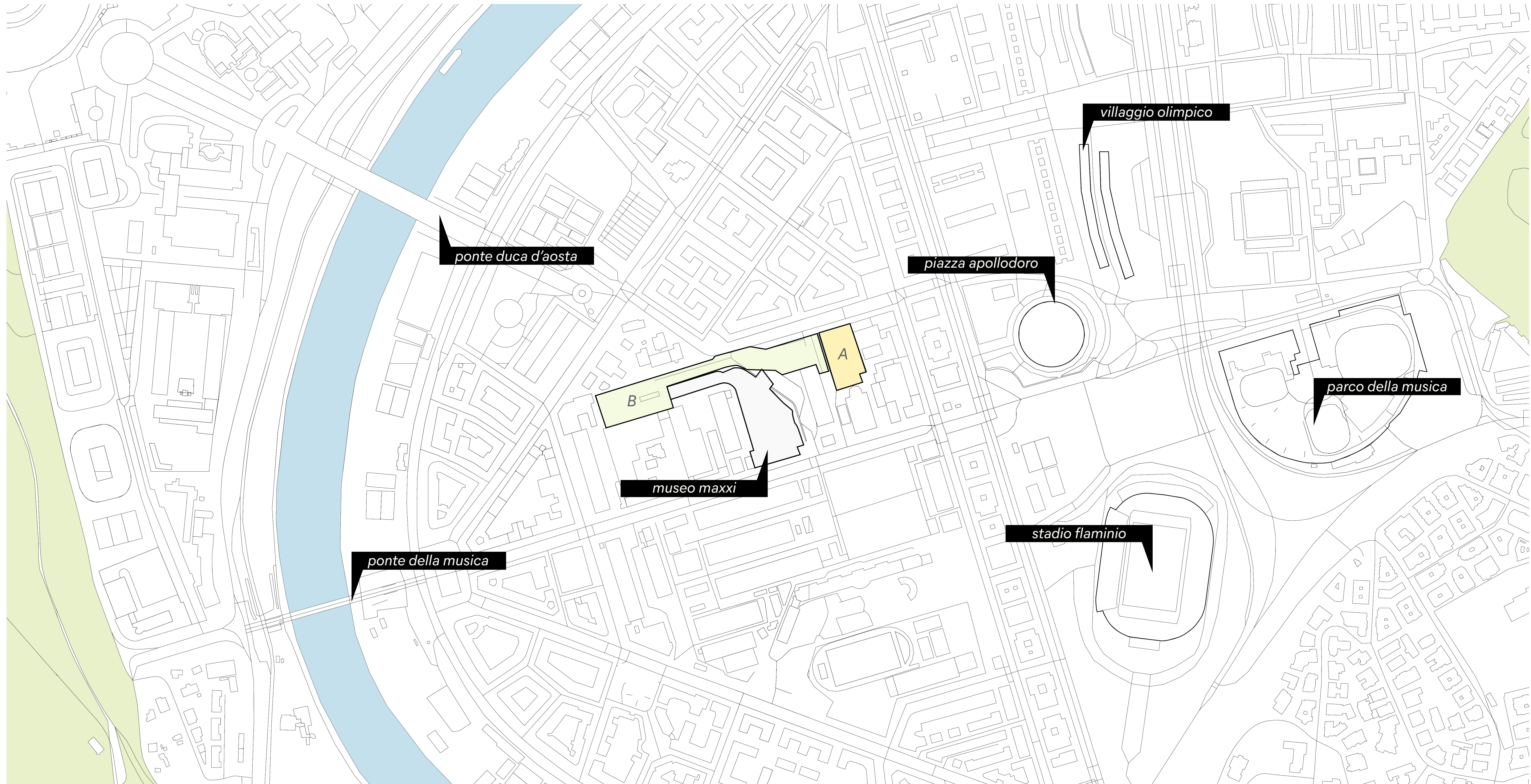
















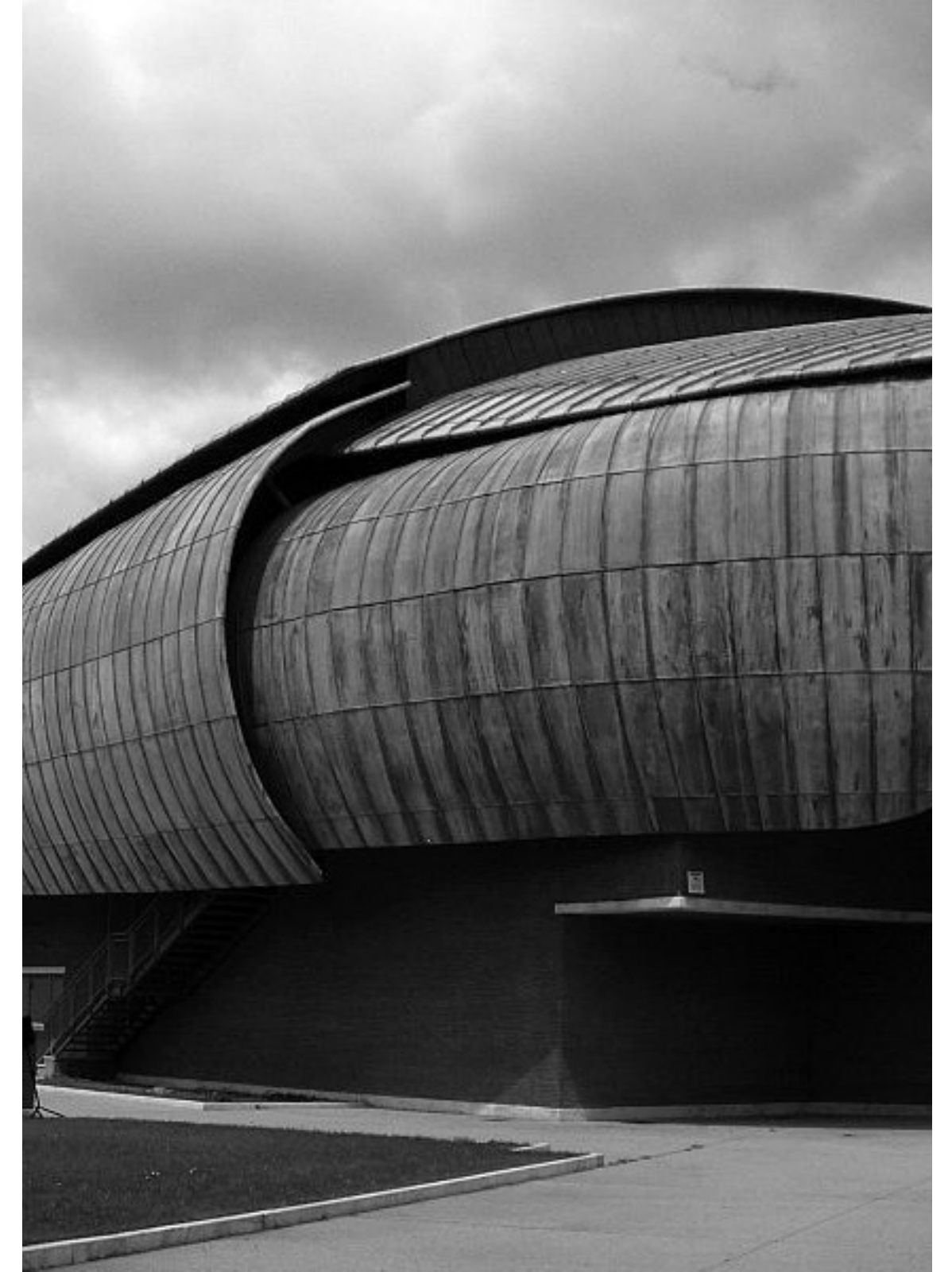
piazza apollodoro



stadio flaminio

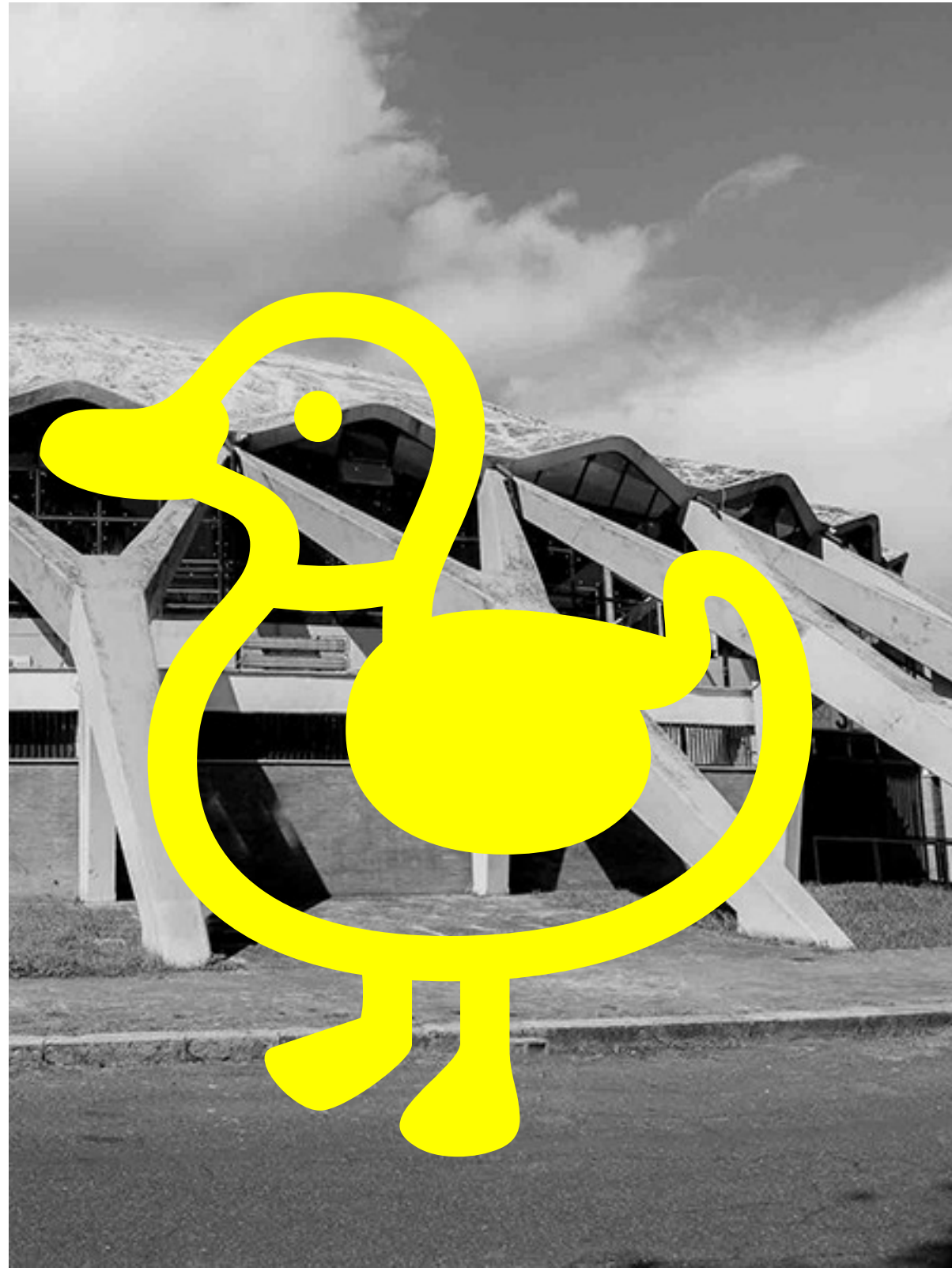


villaggio olimpico

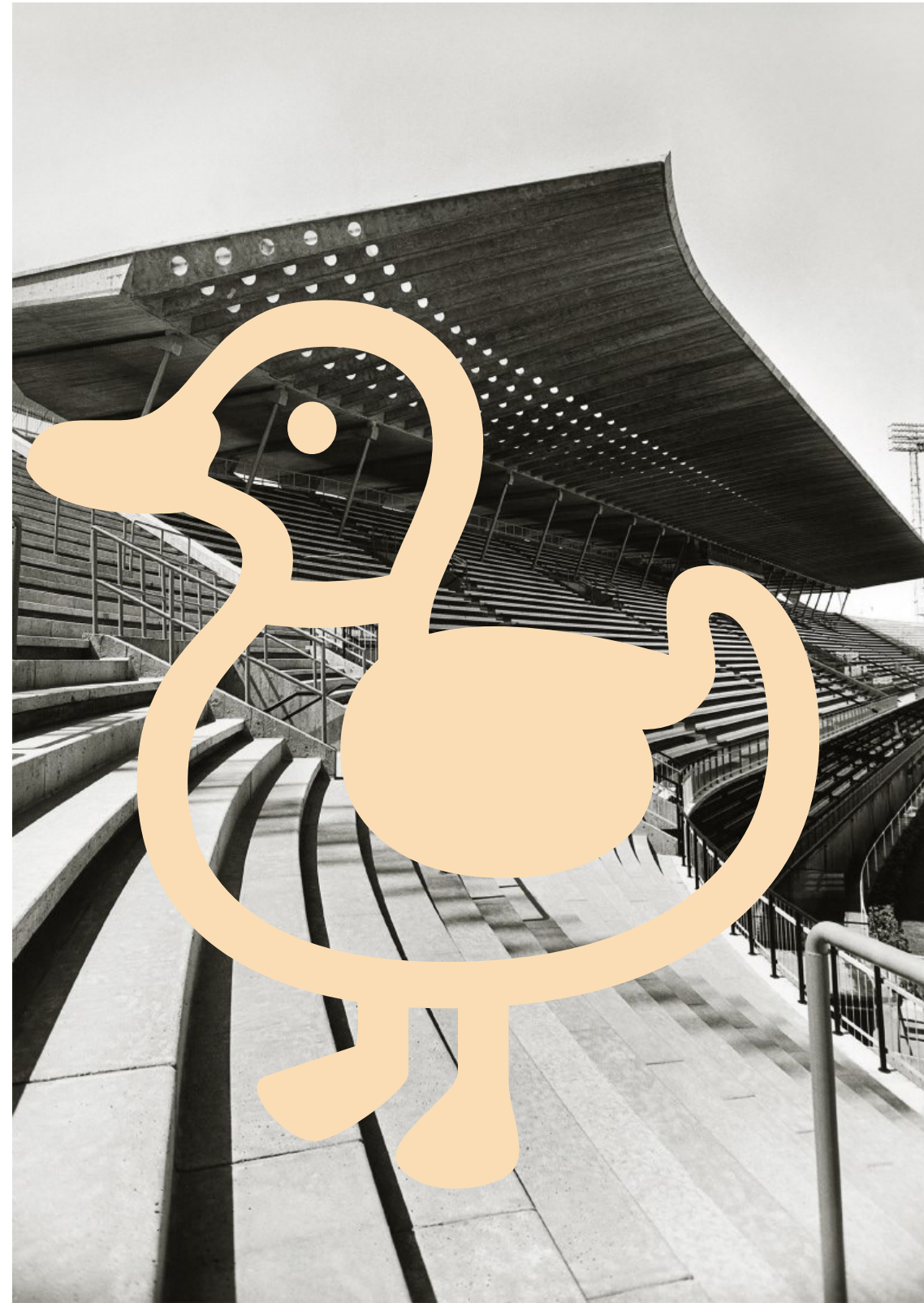


parca della musica





piazza apollodoro



stadio flaminio



villaggio olimpico



parca della musica



Google satellite view  
April 2004  
via Guido Reni



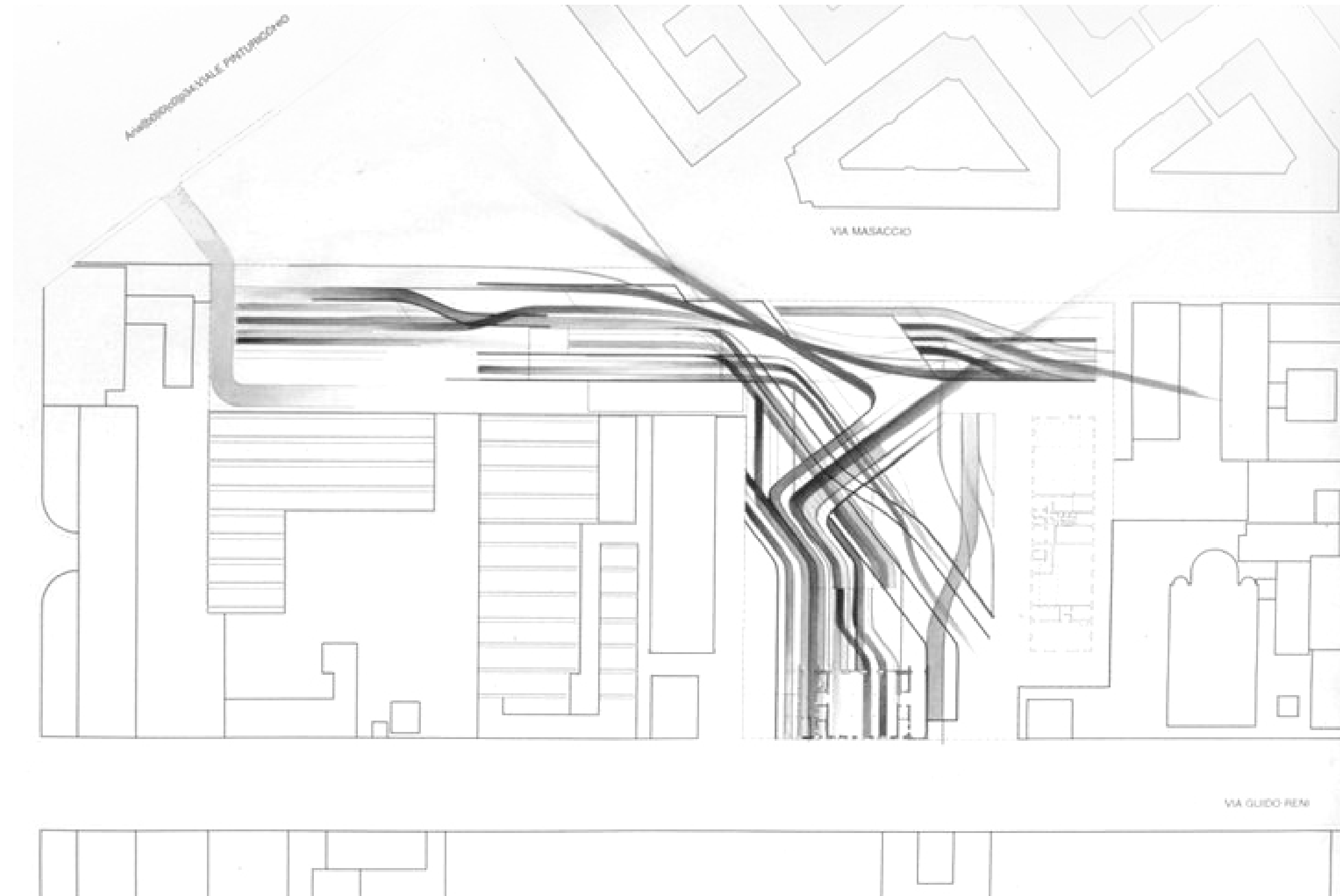
Barracks opposite the site on via Guido Reni  
Basilica di Santa Croce al Flaminio in the back



*Ministry of Defence transferred the site to the Ministry of Culture in 1998, with them hosting a competiiton for a museum*



# urban fabric integration



project was awarded to Zaha Hadid Architects from the 15 shortlists from a list of 273 candidates





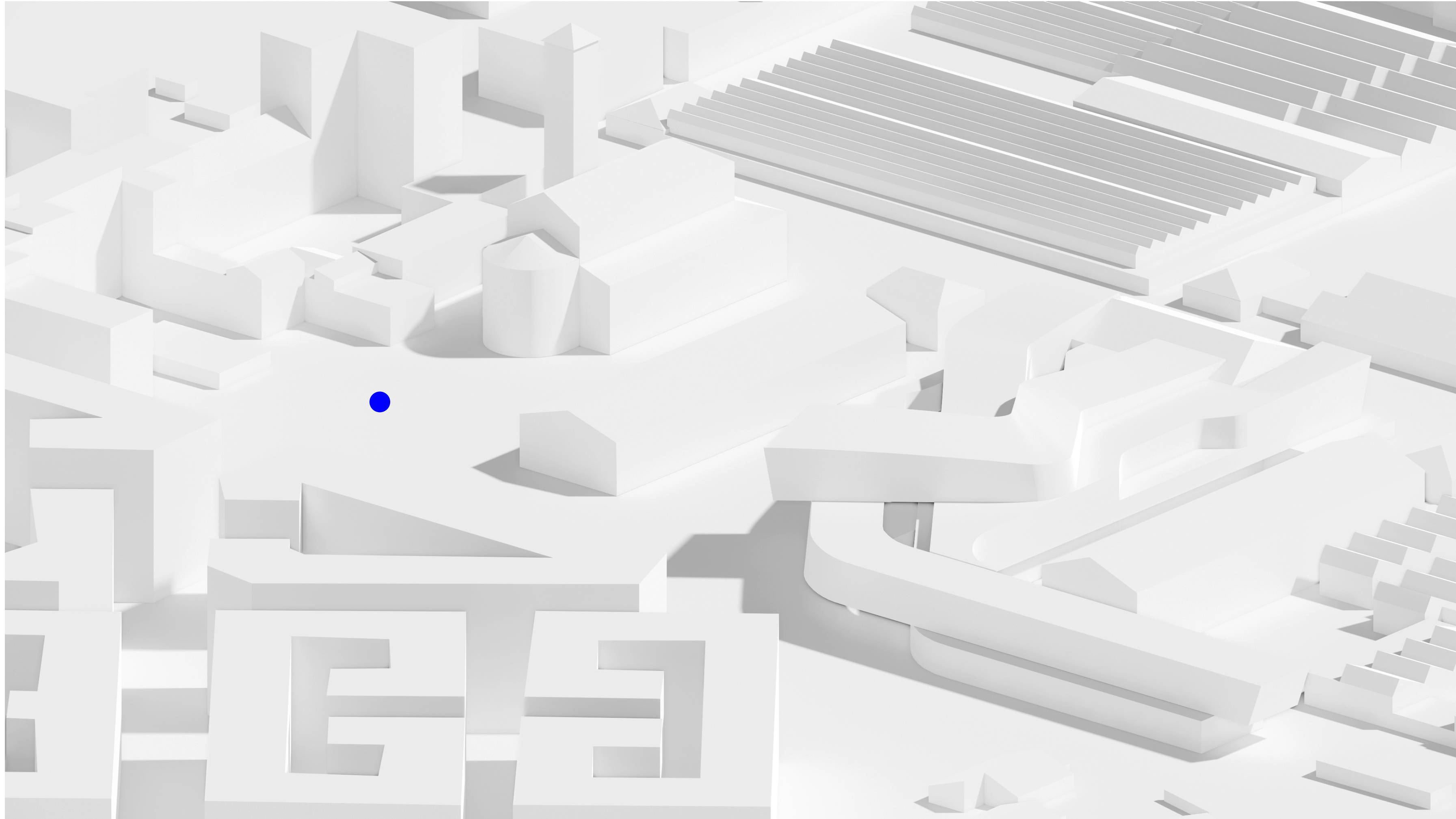








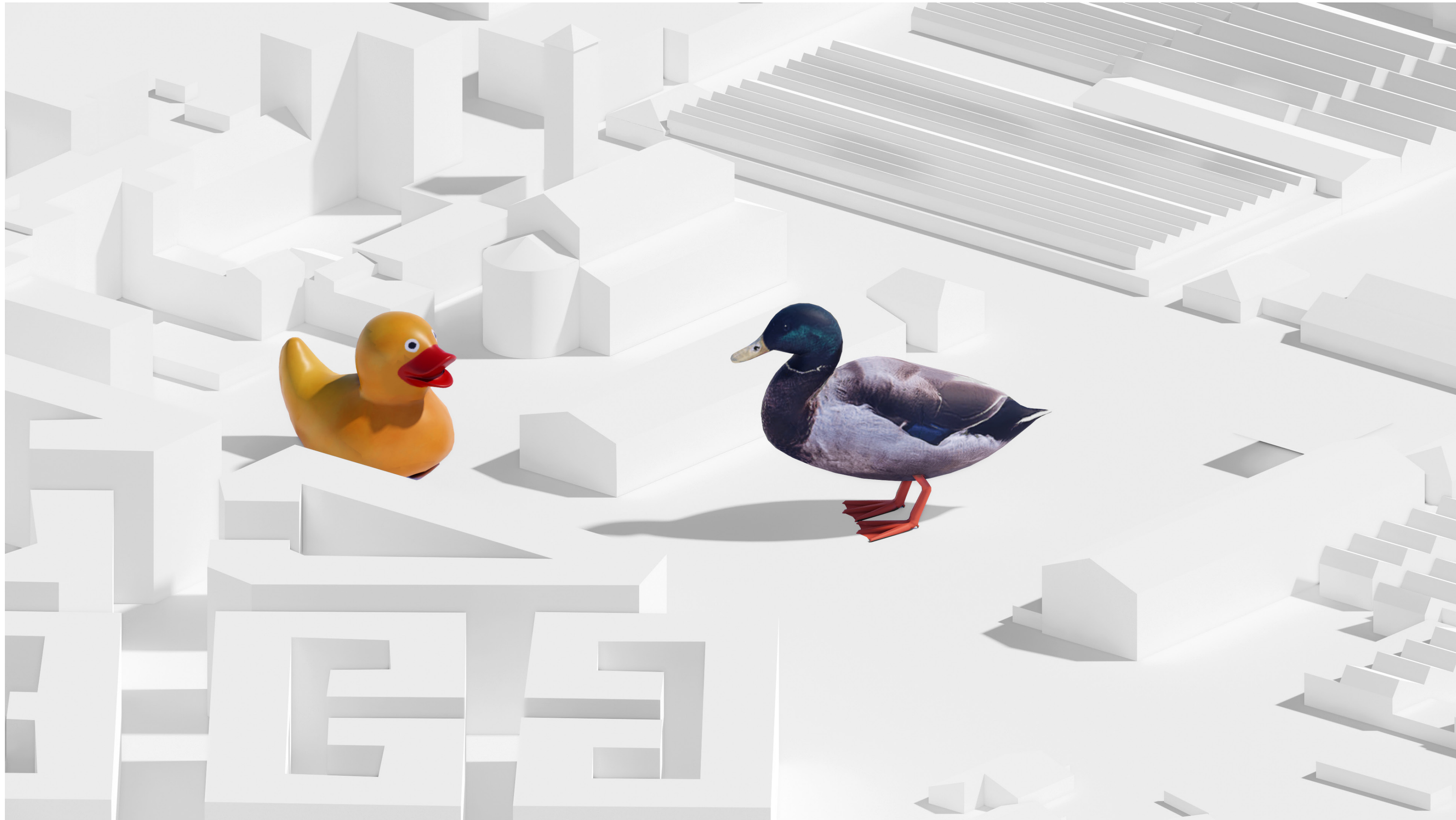












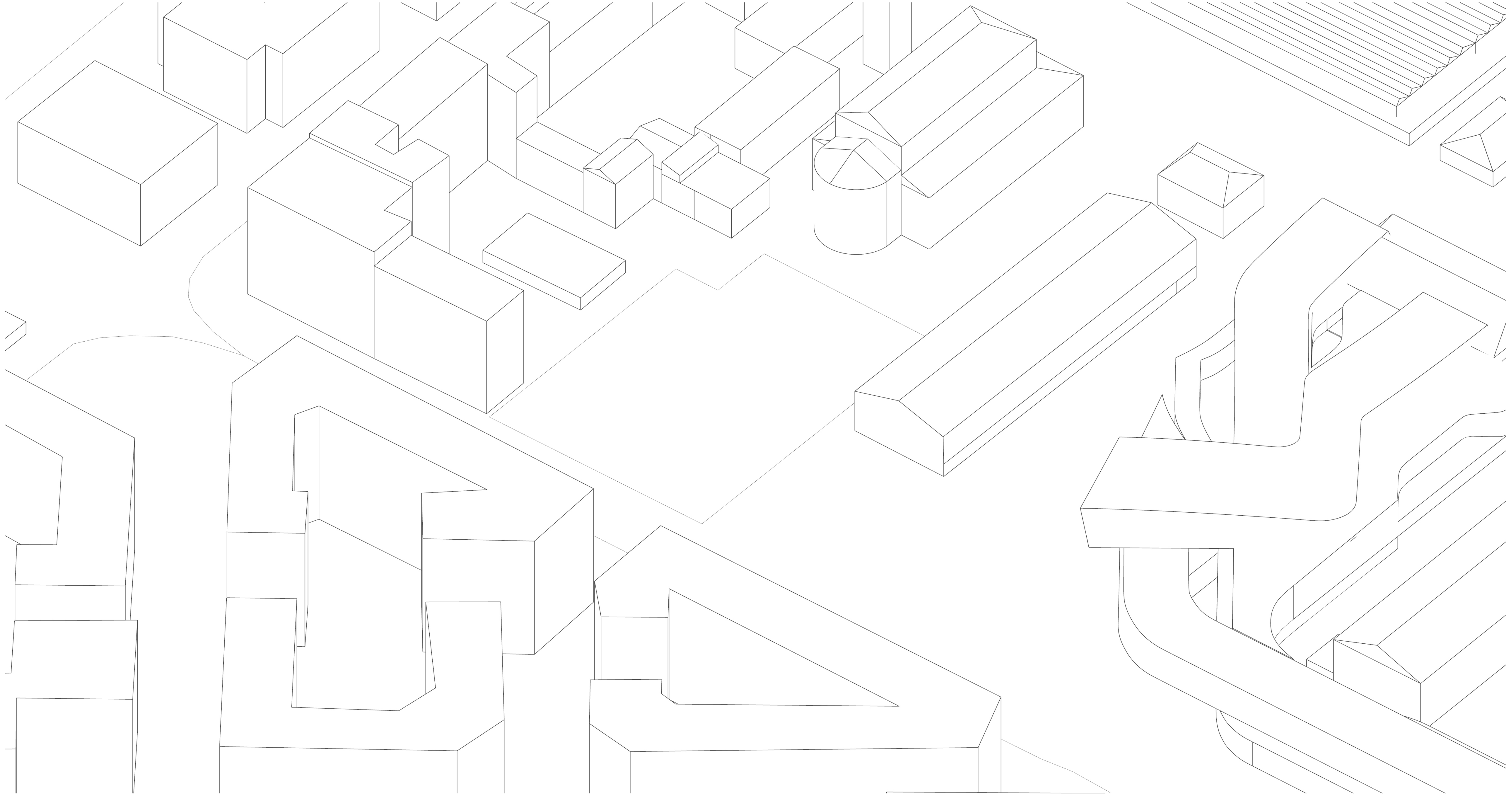


SOFT (sharp edges do not count)

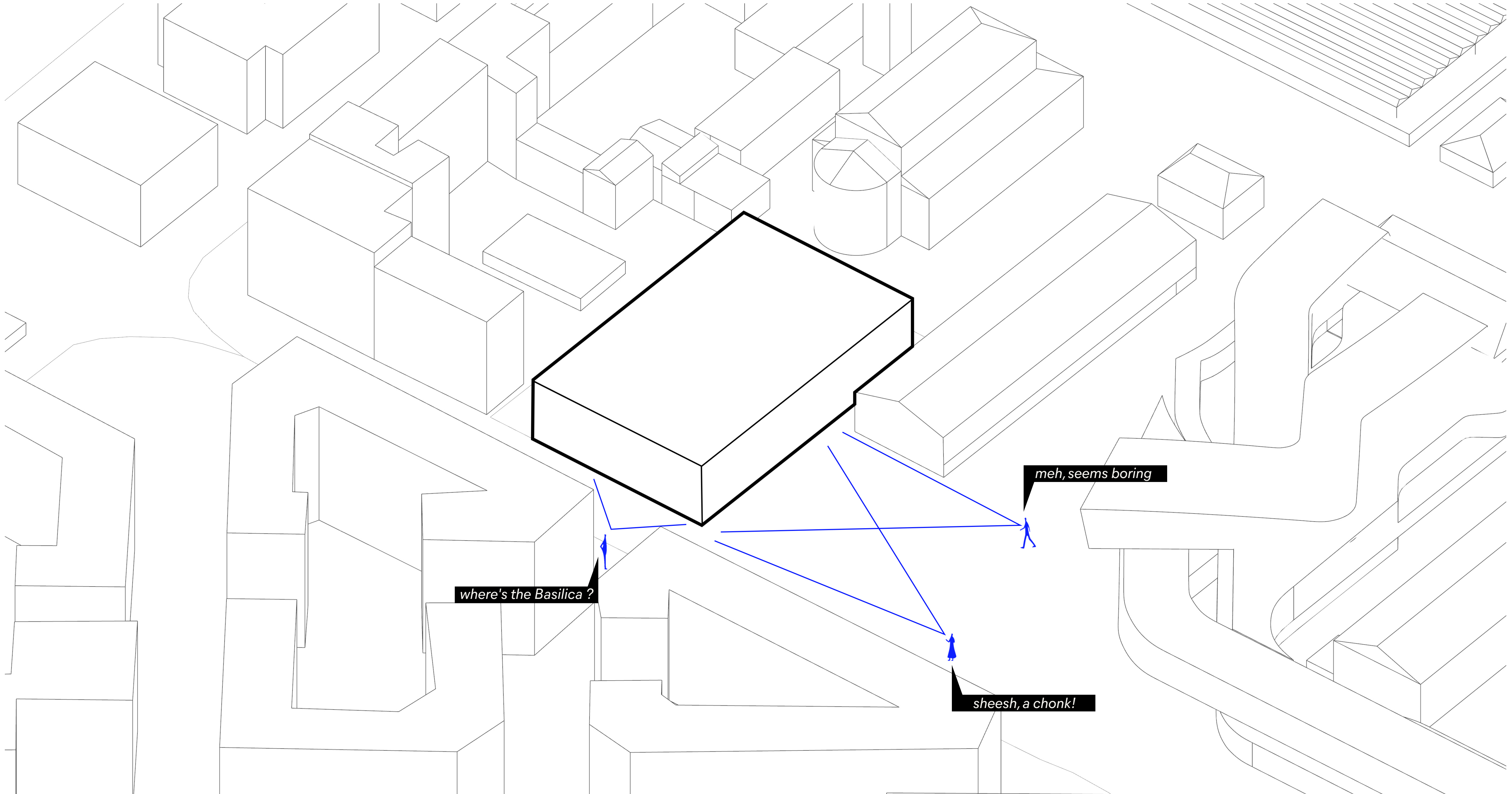
SUBTLE

CONTEXTUAL

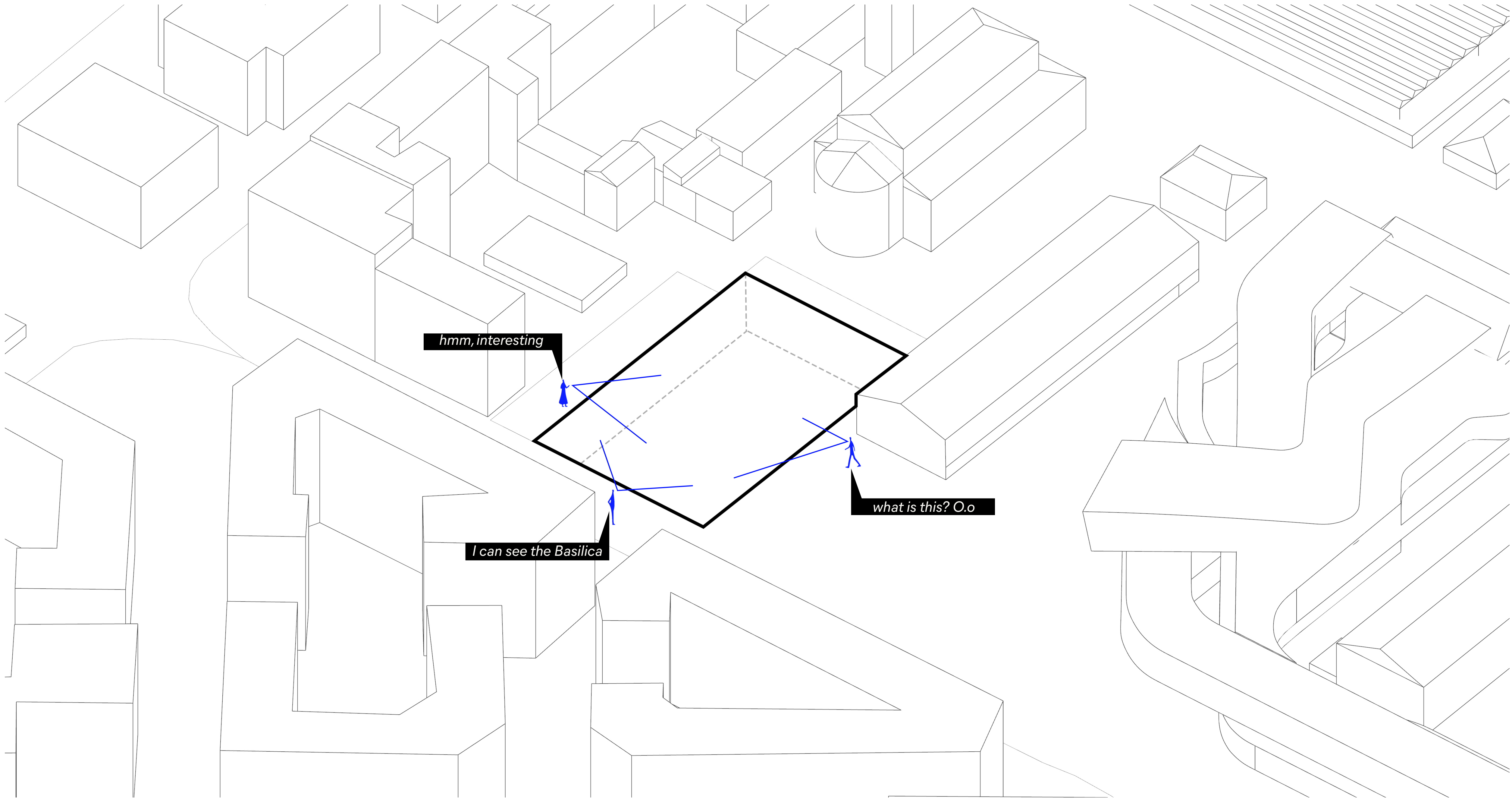




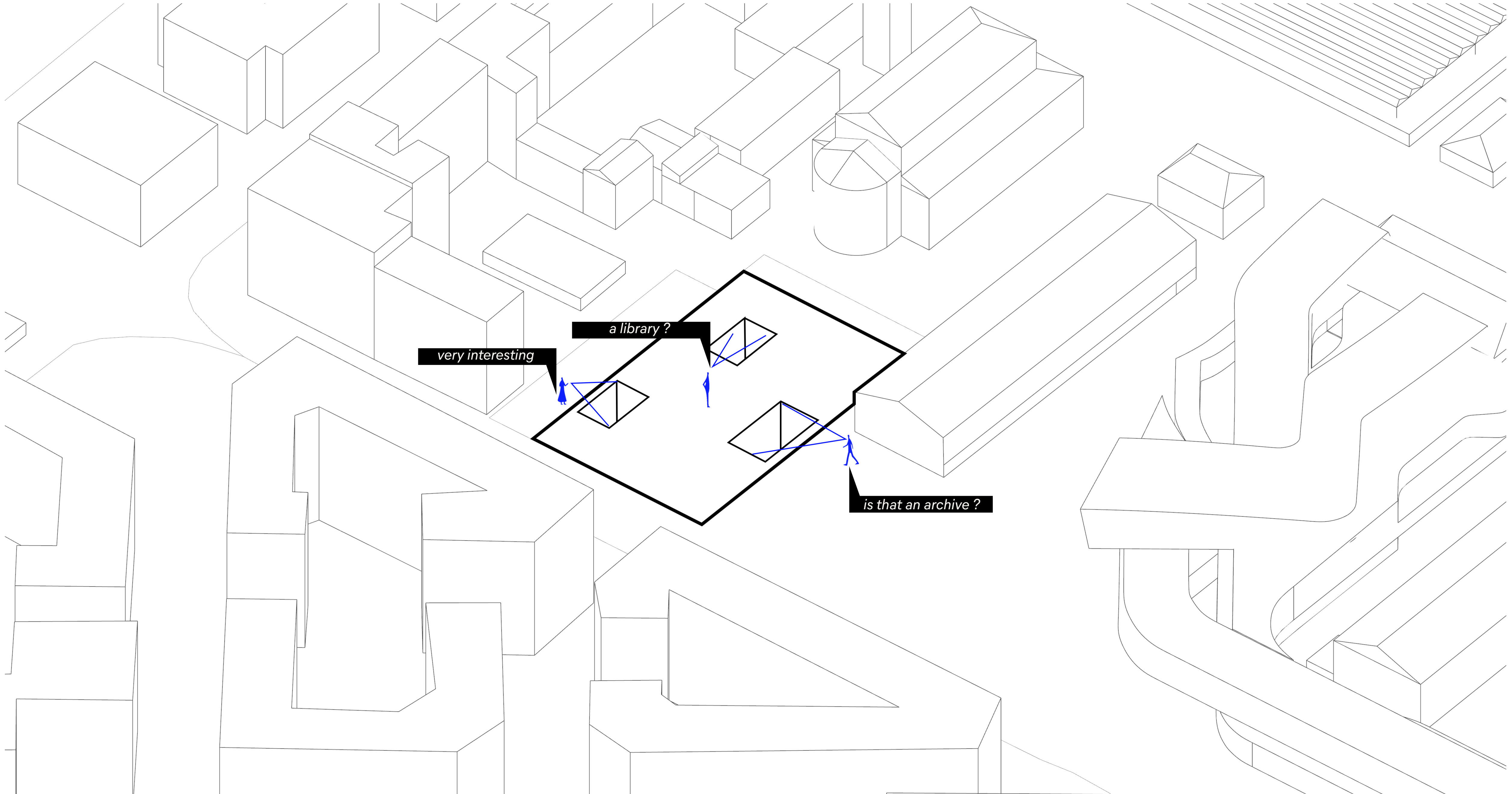




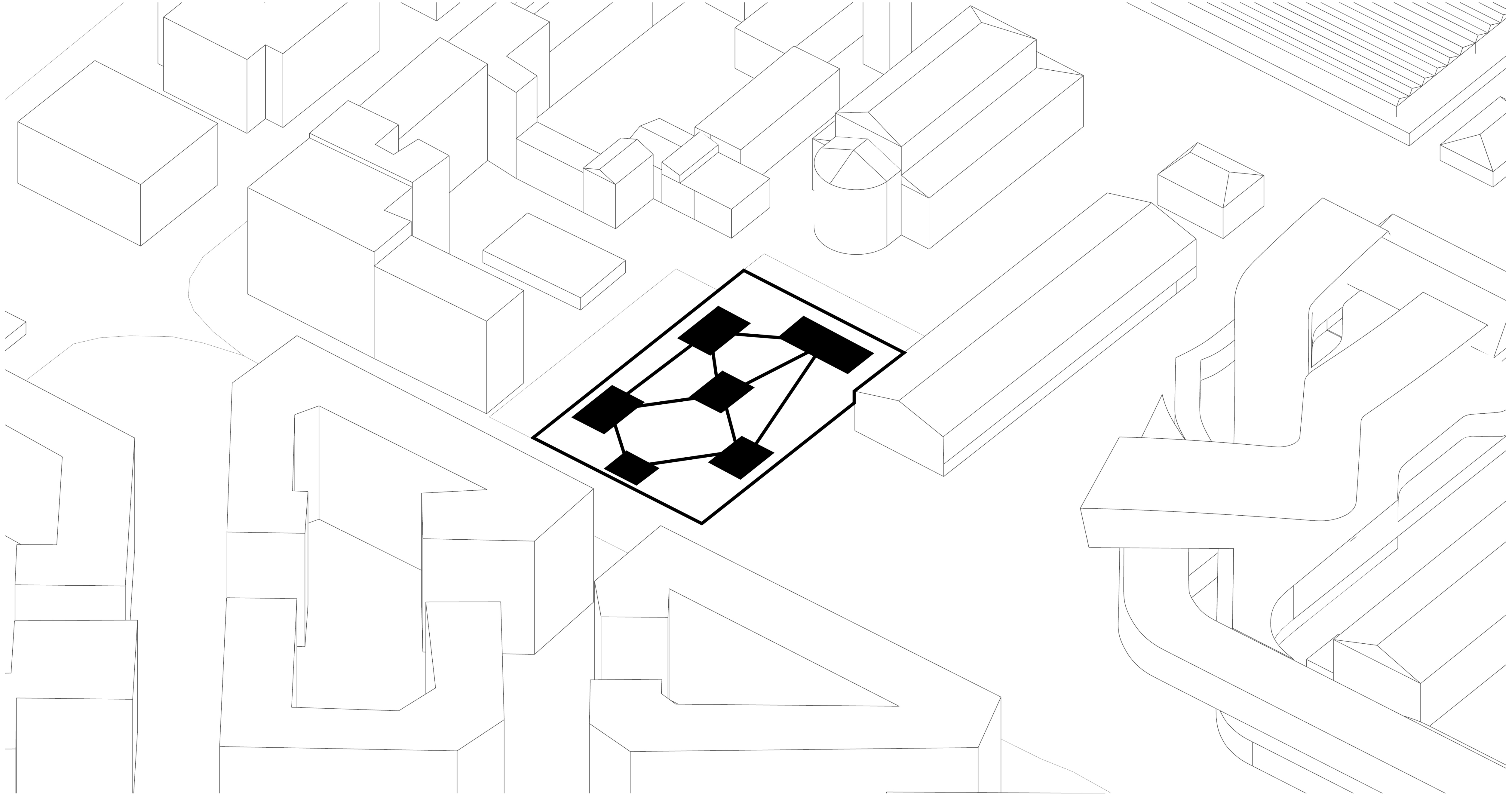




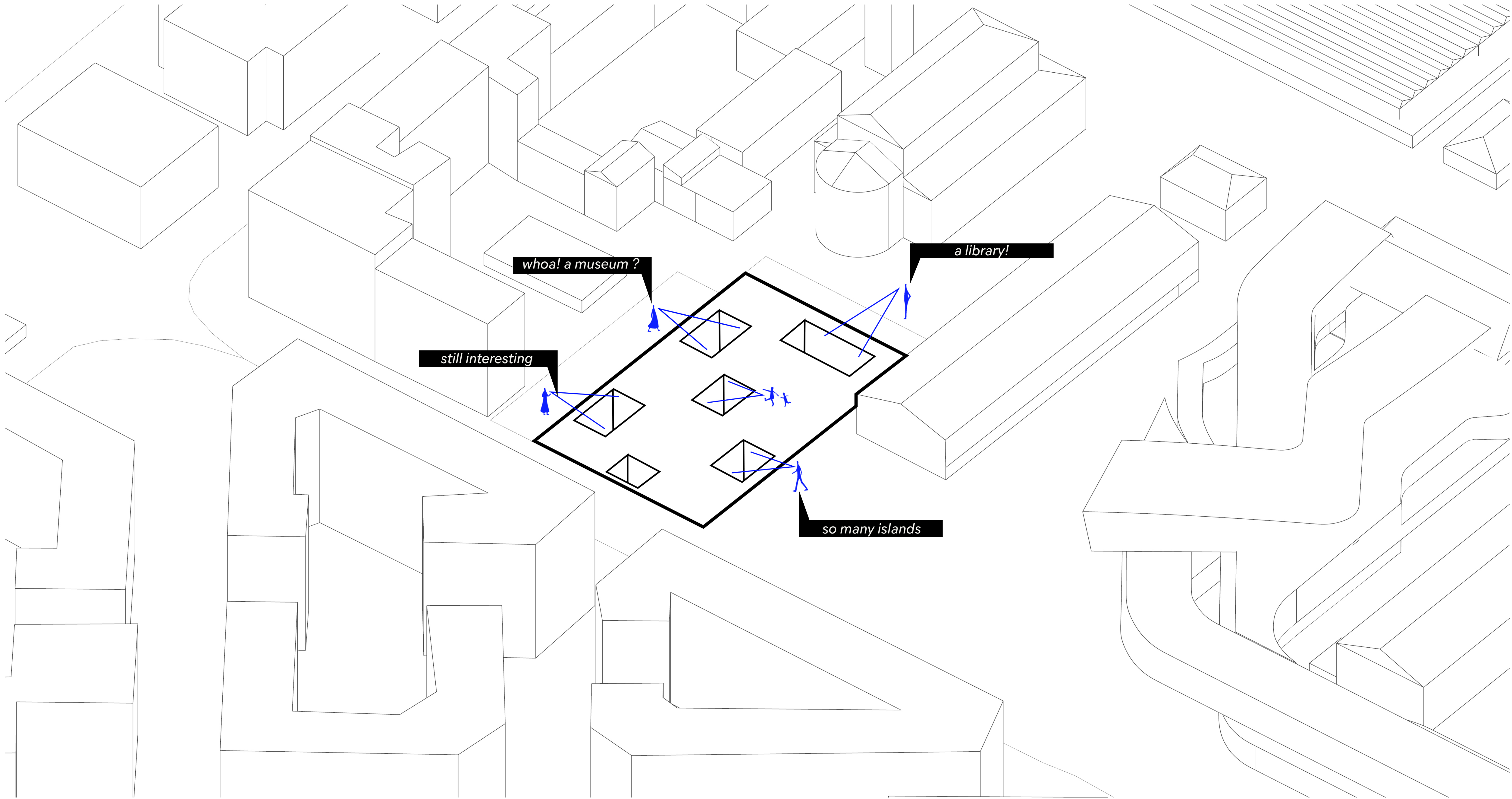




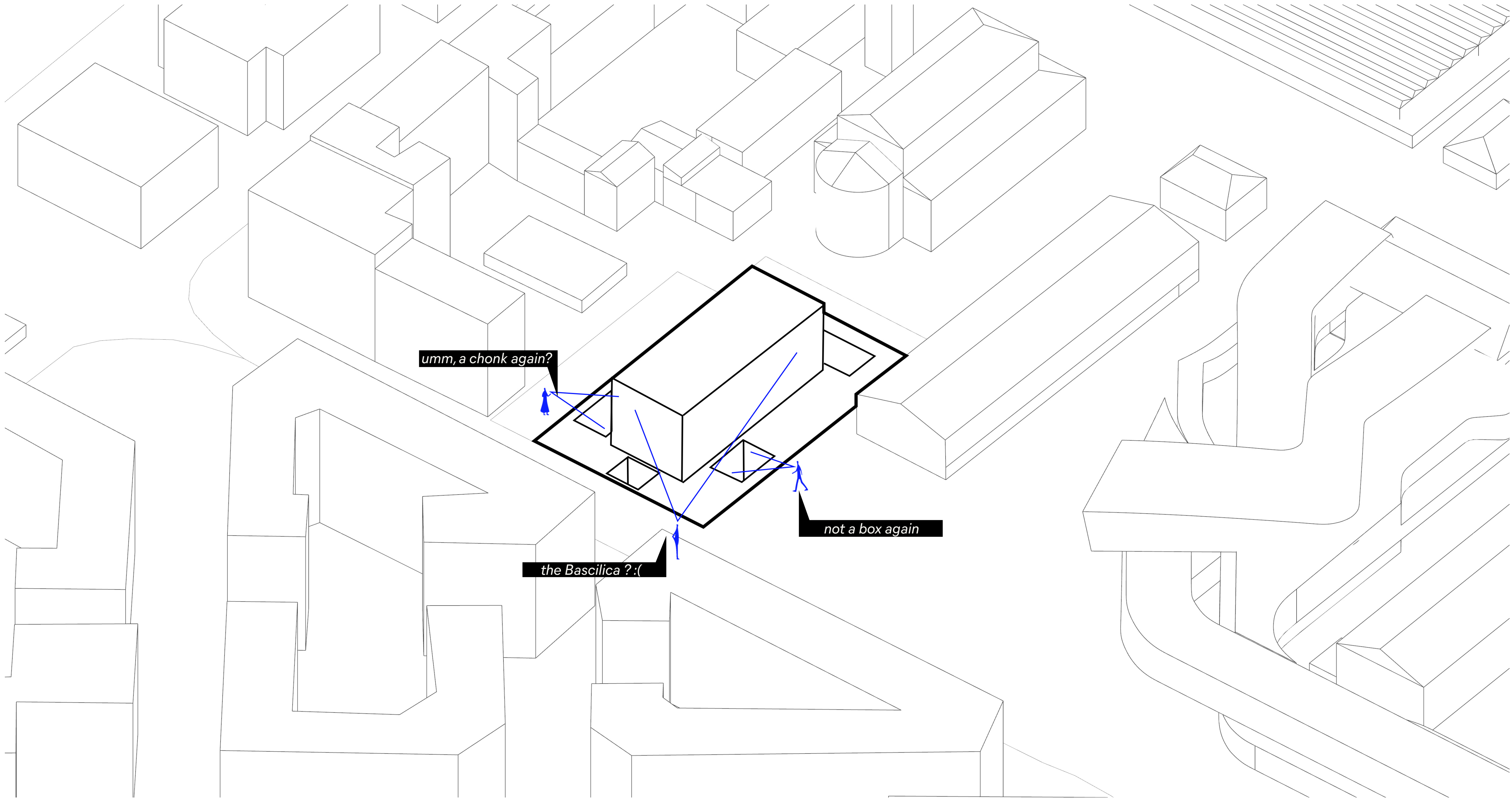




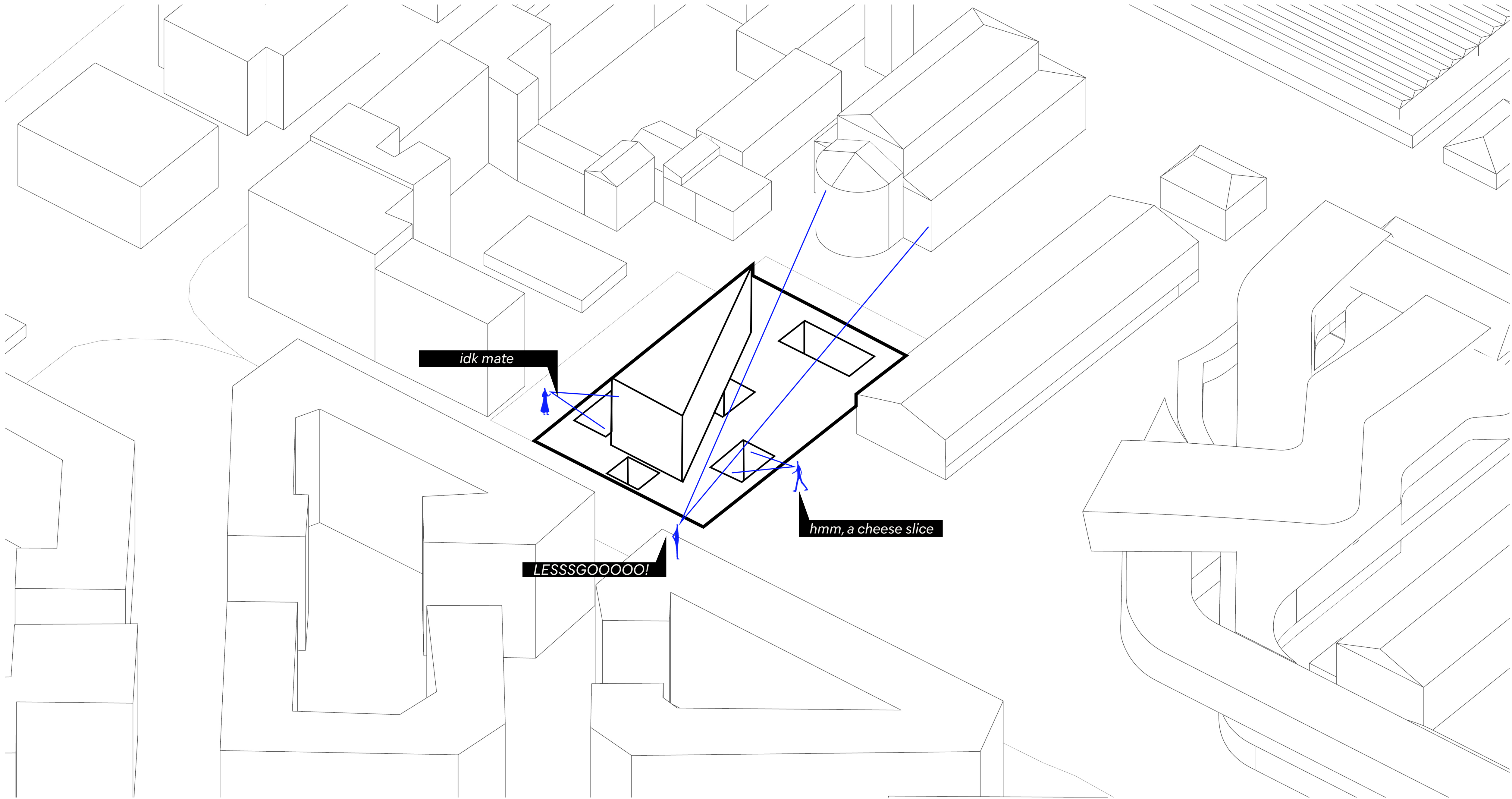




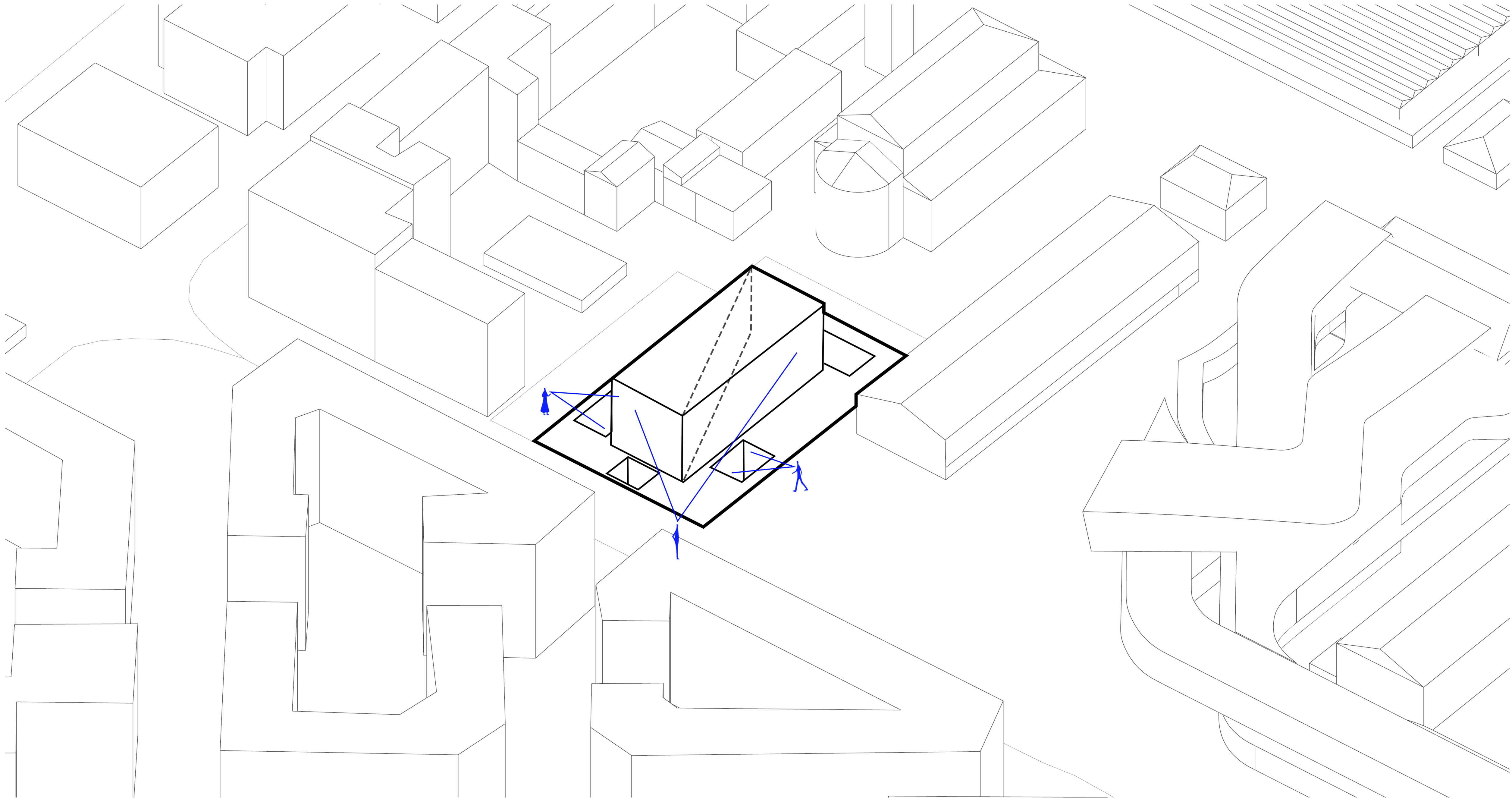




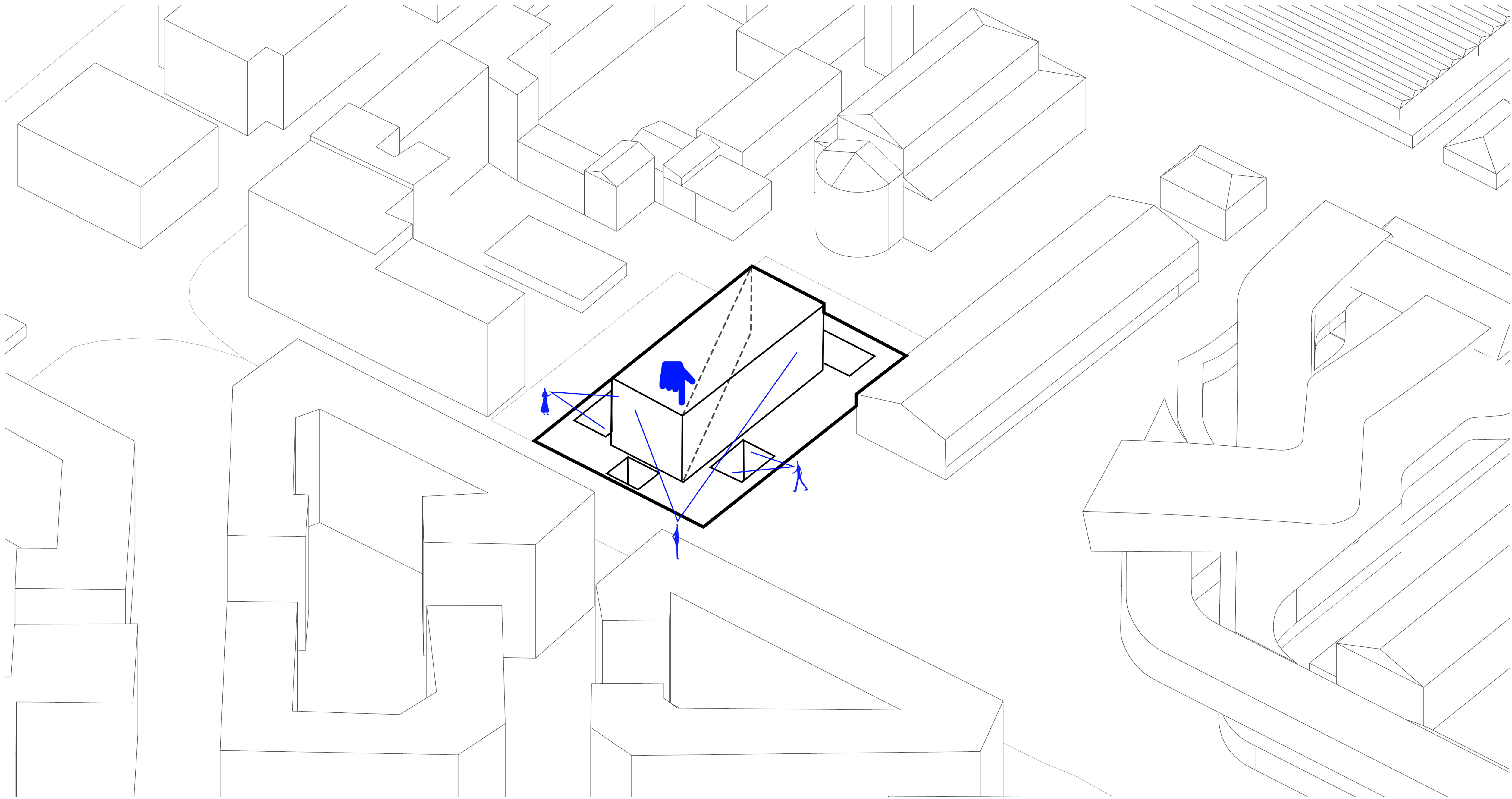




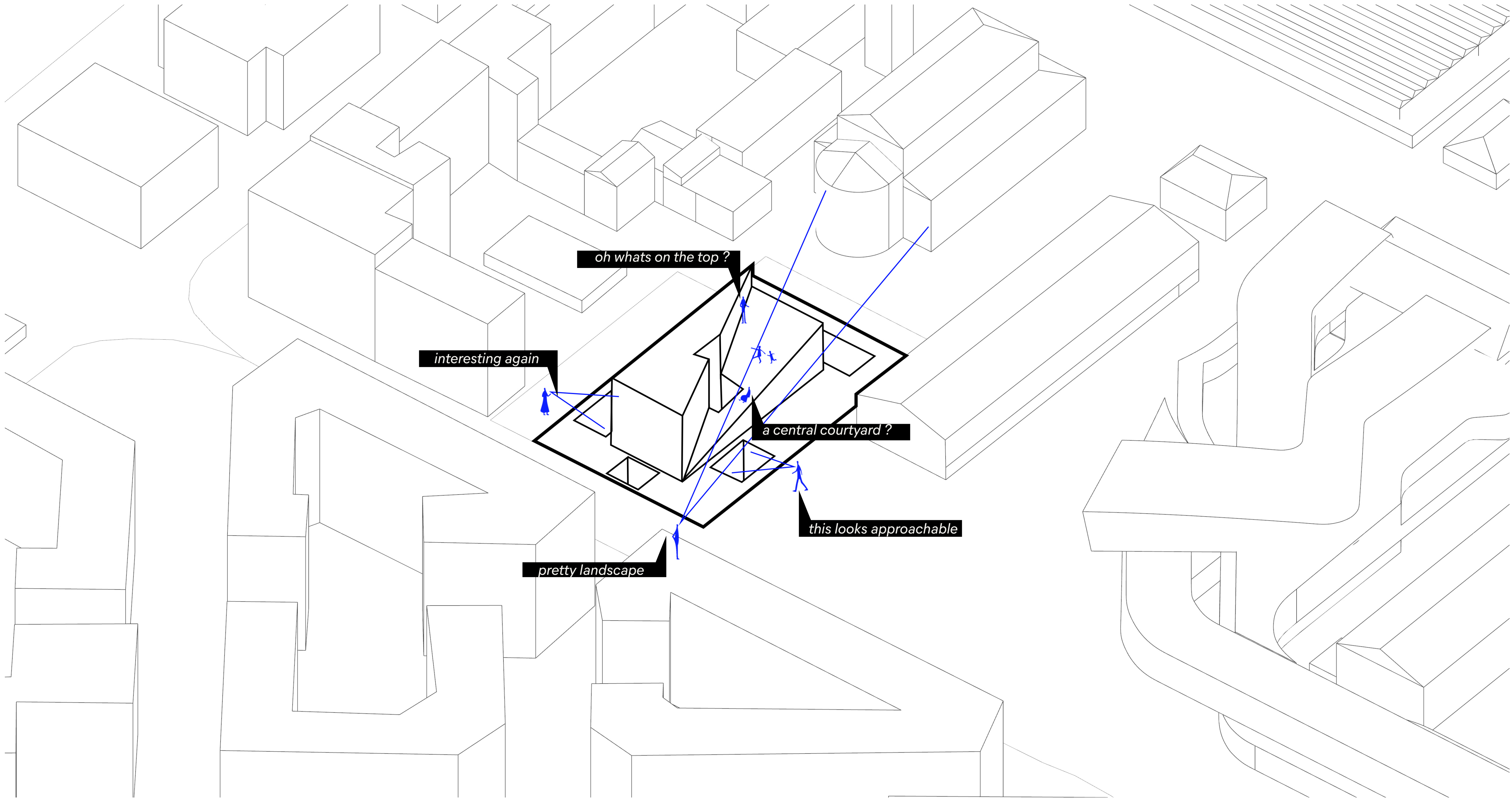














# PART B - PART B



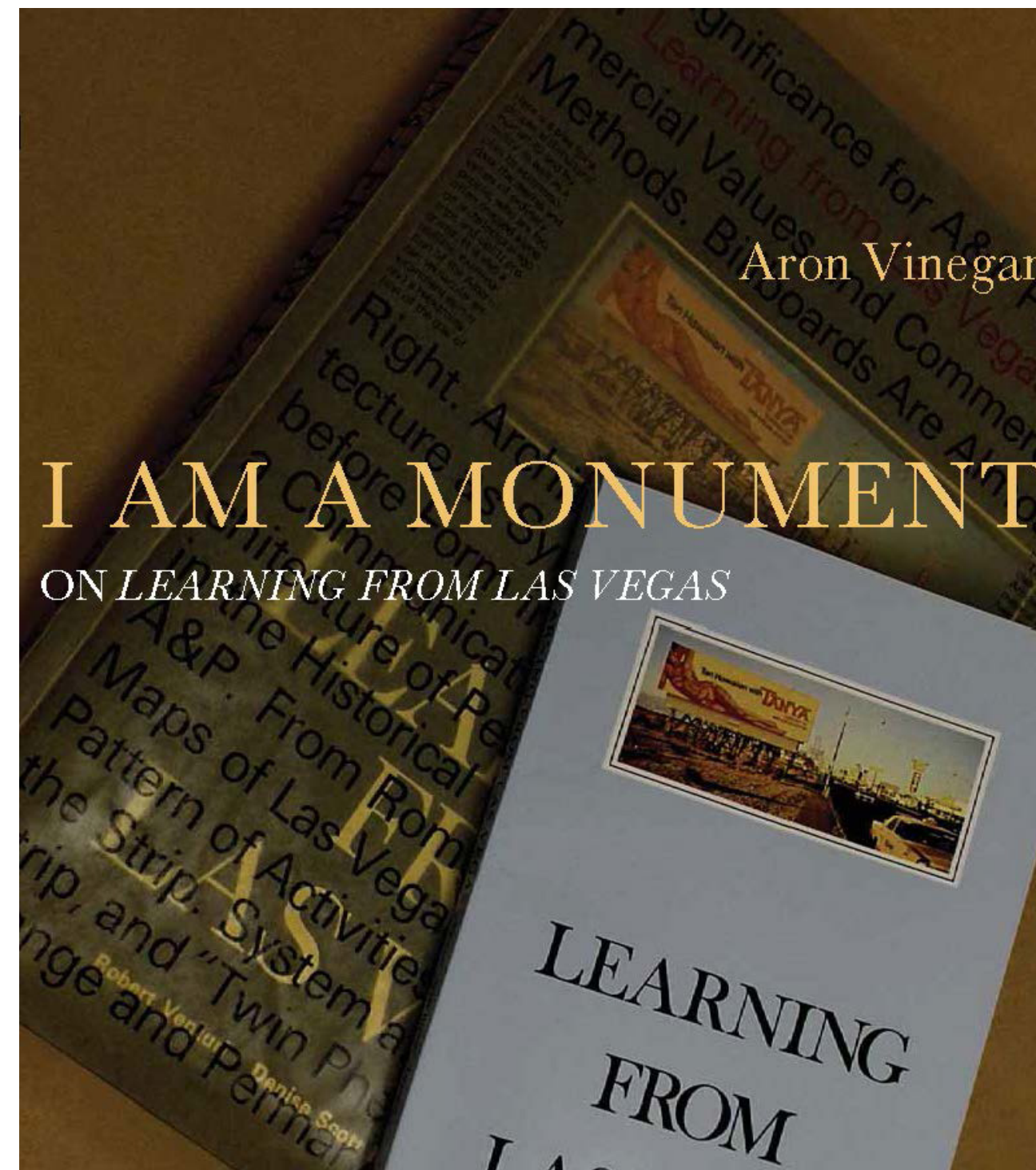
Alas, within the context of a museum and  
more so in  
Contemporary

architecture

cult to justify

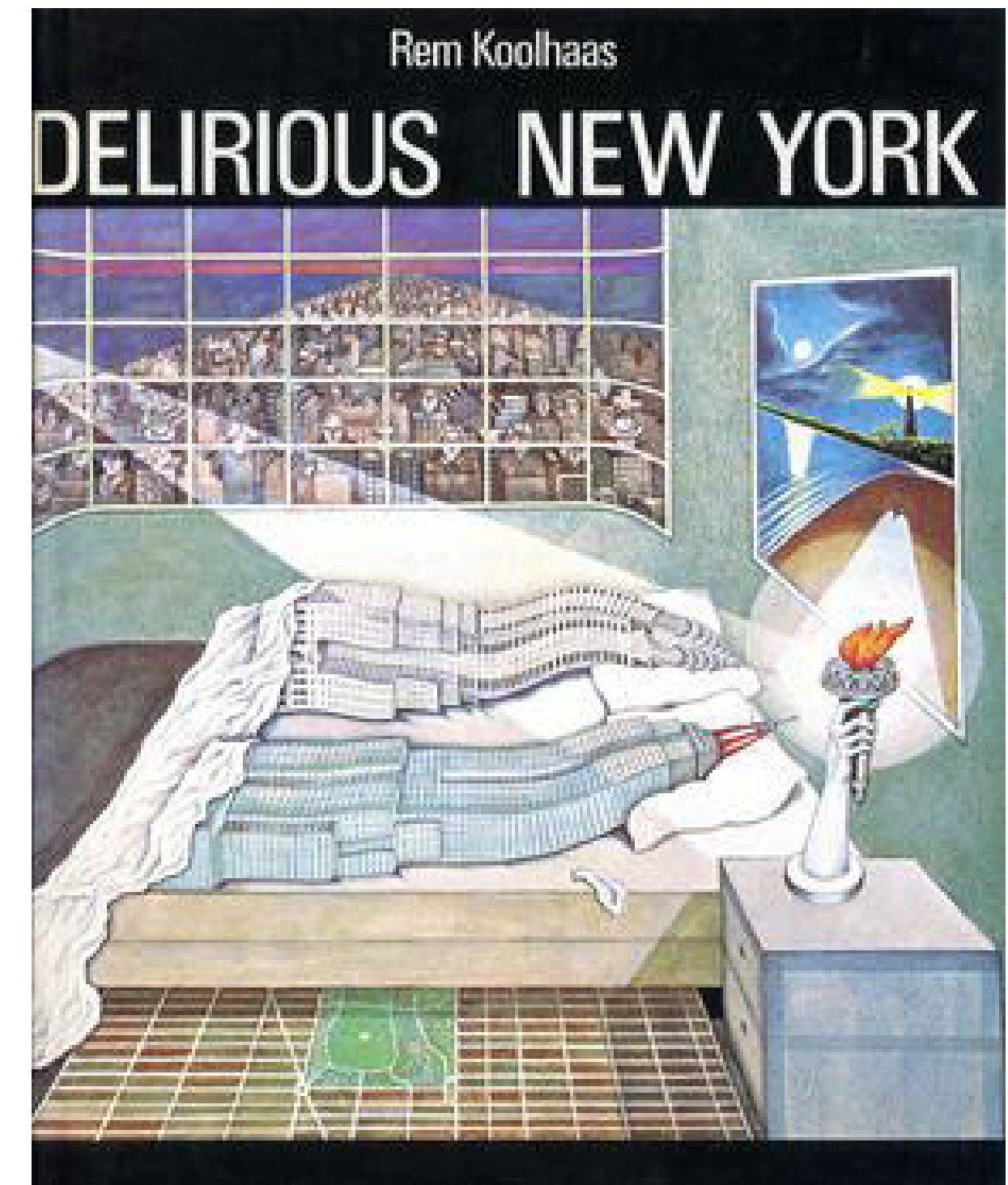
figuration without acknowledging the drive

towrds < Expressive Transparency >





“In Western architecture there has been the humanistic assumption that it is desirable to establish a moral relationship between the two, whereby the exterior makes certain revelations about the interior; That the interior corroborates

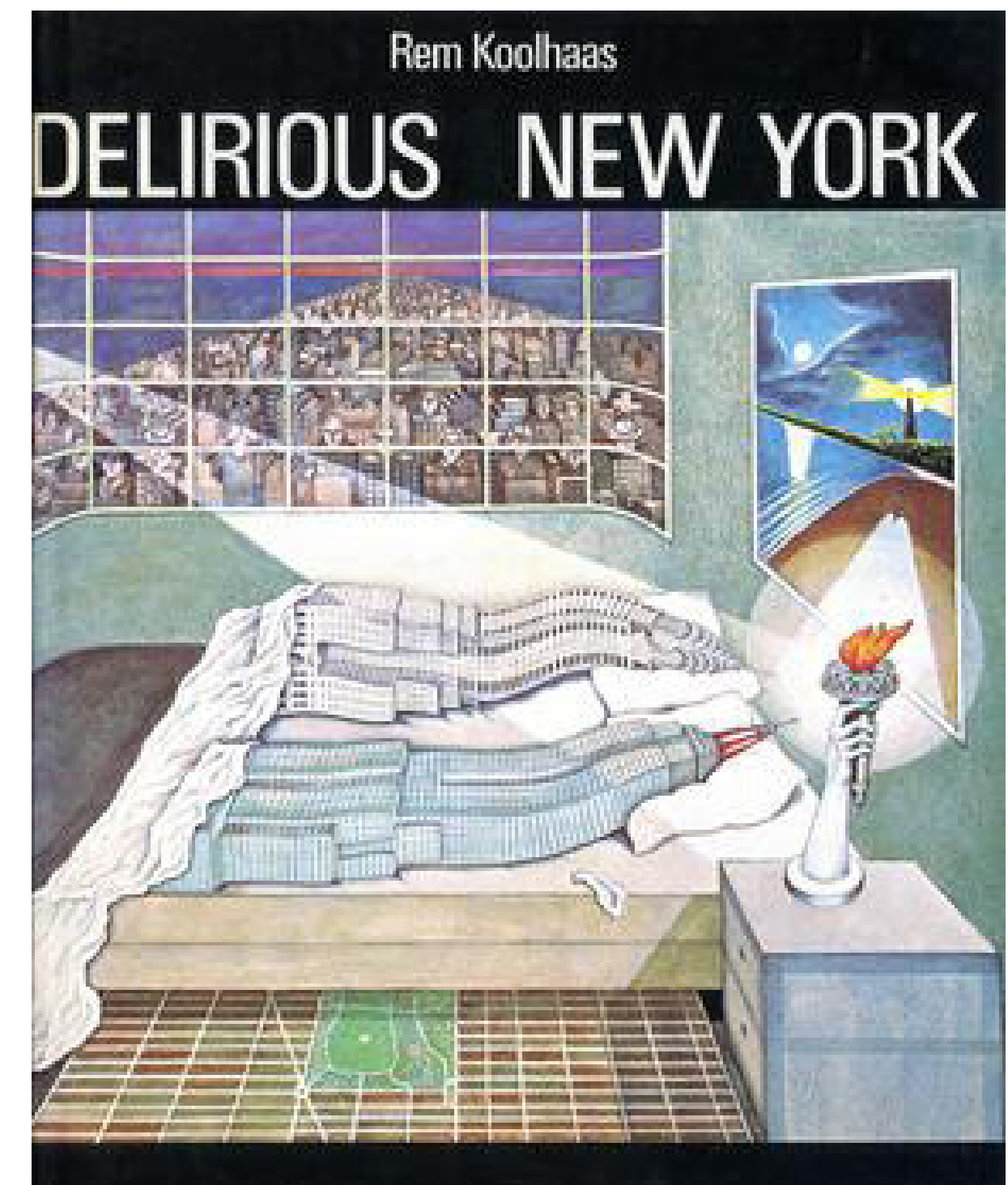




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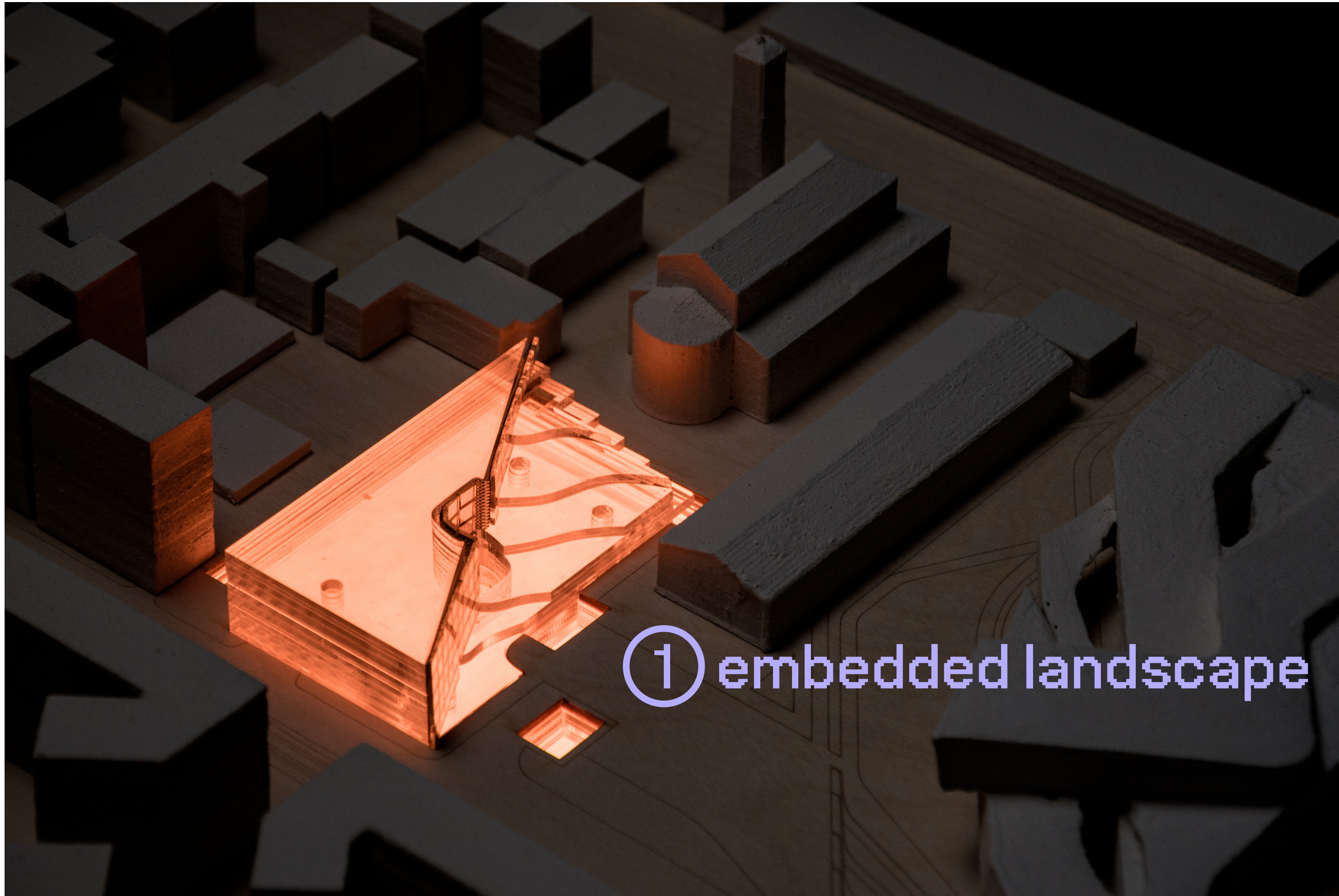


BUT what's AI about the  
building ?

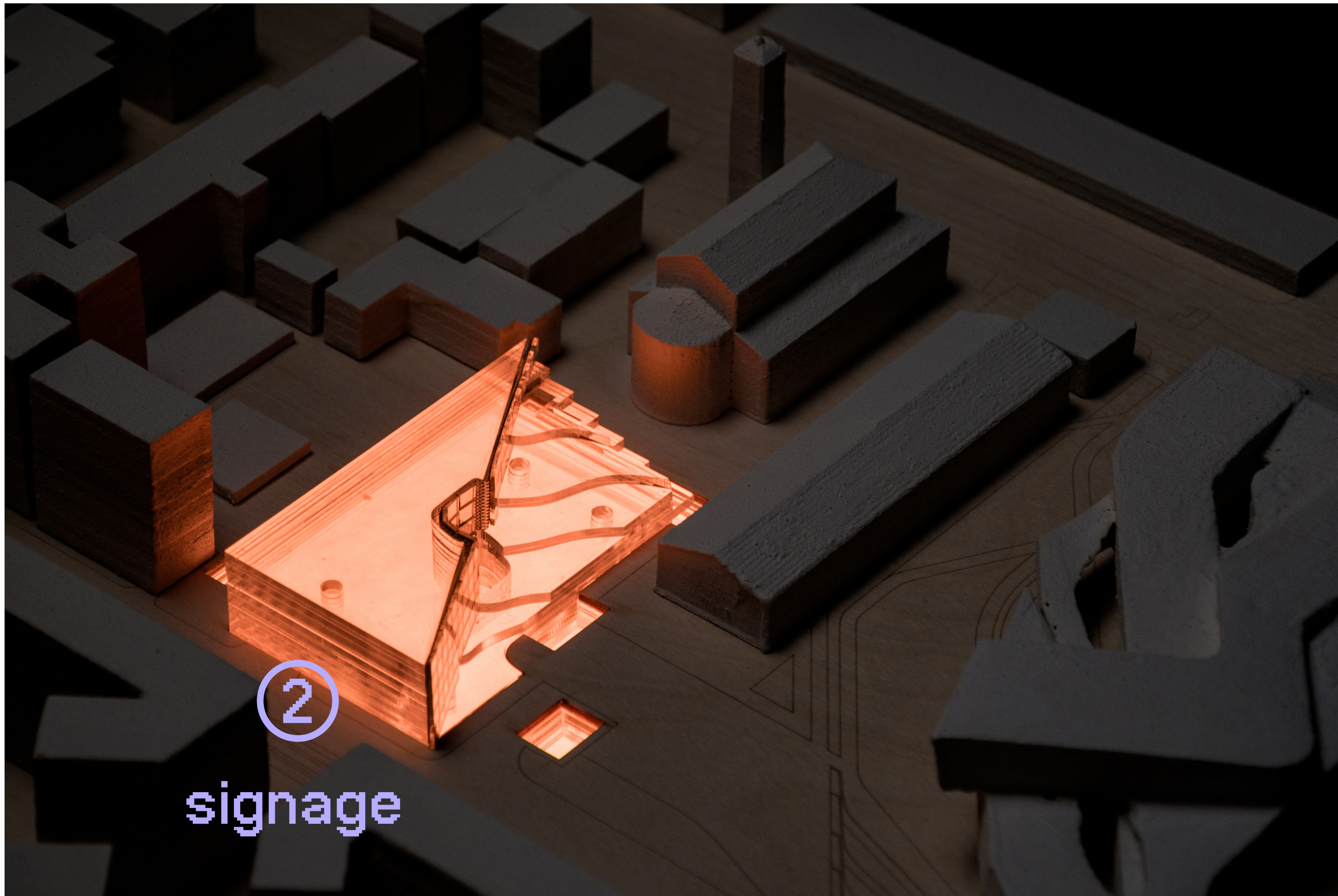














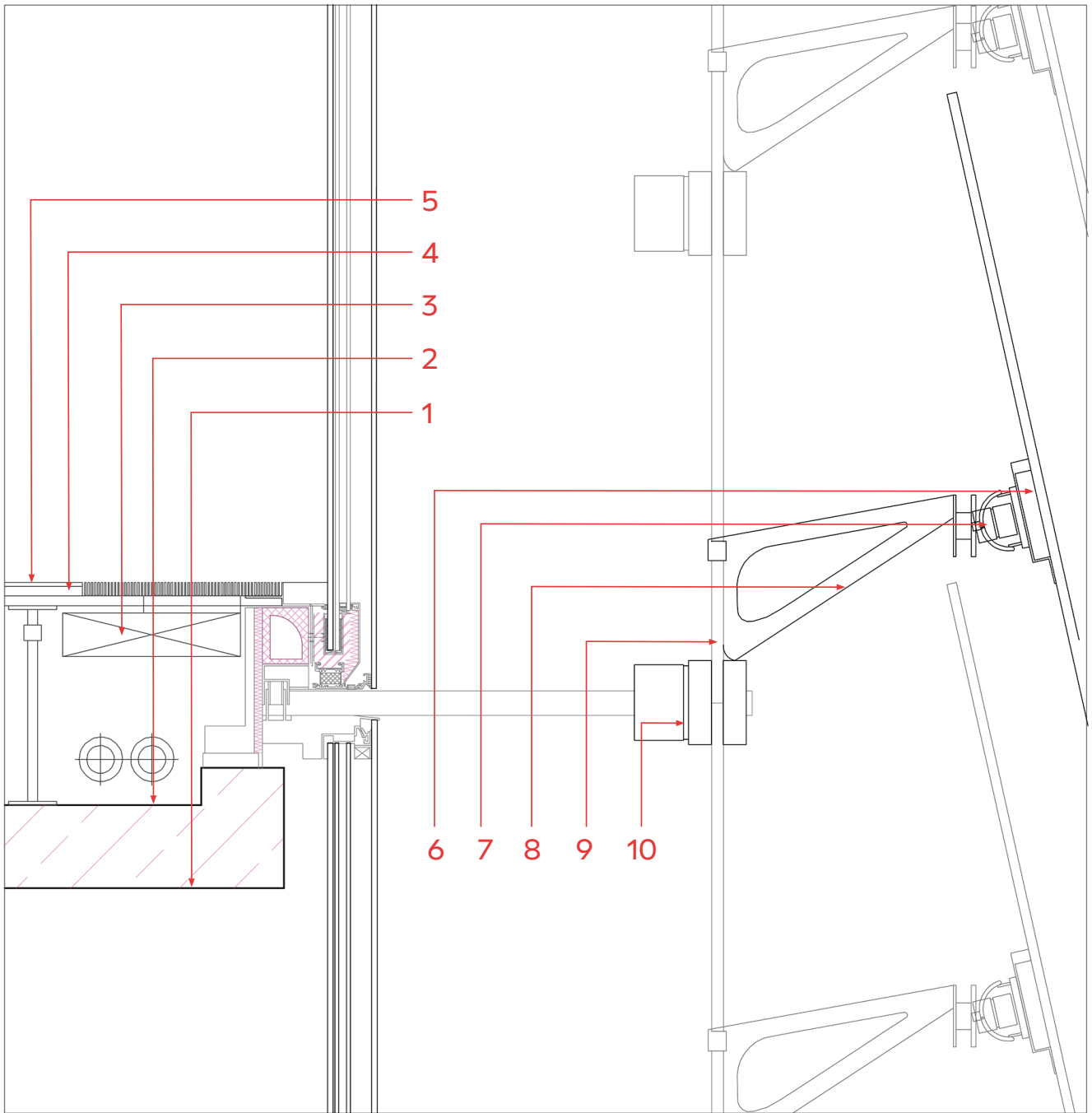
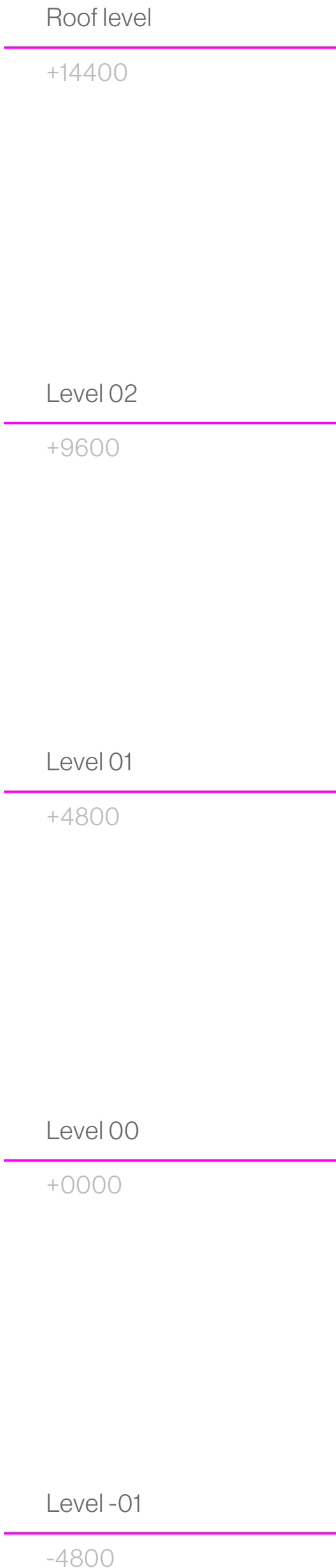
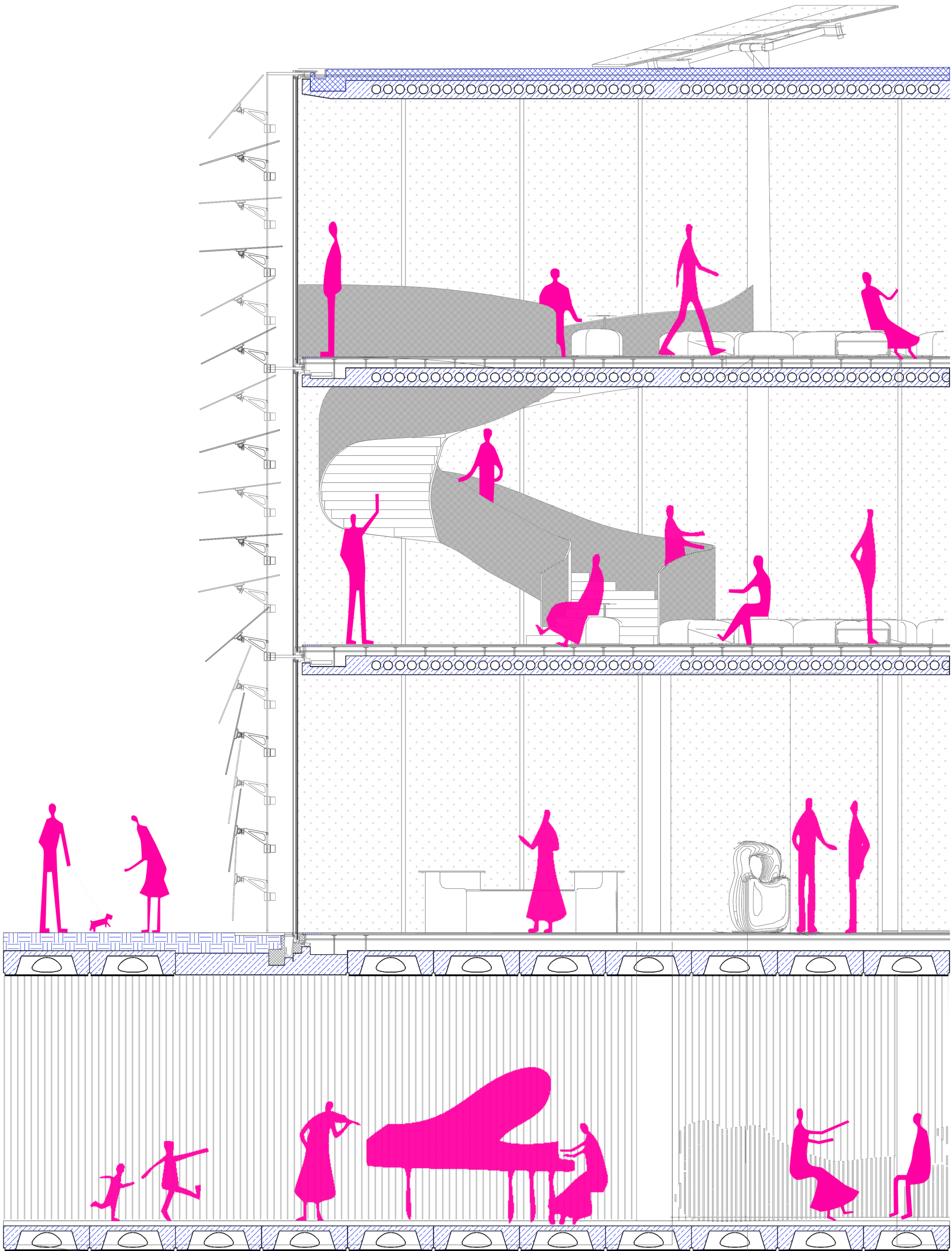






NED KAHN  
Articulated Cloud  
Pittsburgh Children's Museum, Pittsburgh,  
PA. 2004

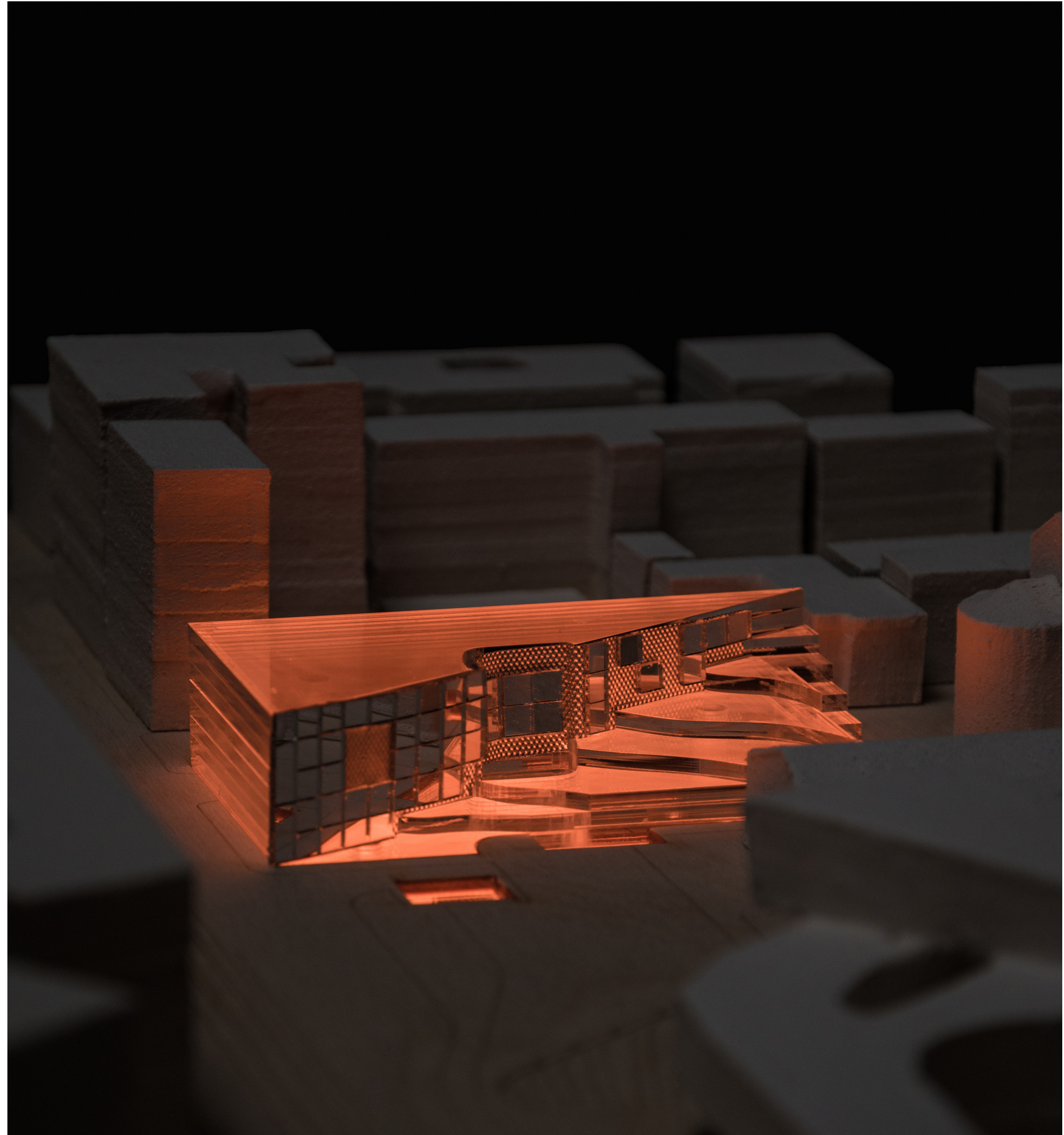
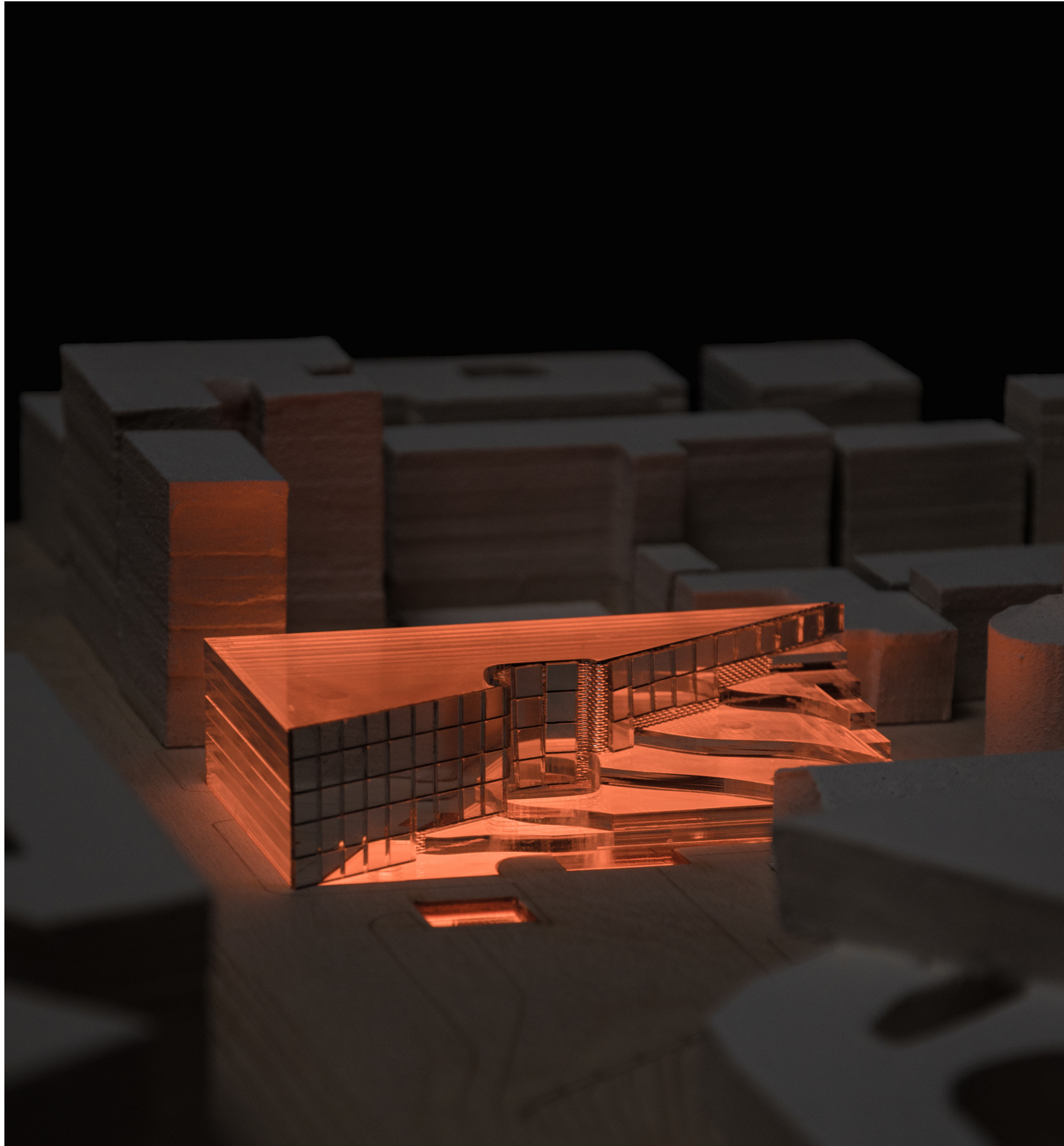




Facade Detail

- 1. Exposed concrete finish
- 2. Hollow concrete slab 300
- 3. Cooling heating system
- 4. Raised floor panel
- 5. Carpet 6mm
- 6. PV Panel & sensor
- 7. Bracket on actuators
- 8. Cantilever bracket
- 9. Steel rod structure
- 10. Pneumatic control











and just to reiterate, THE TAKE AWAY FROM  
THE RESEARCH HERE WAS THAT THE MU-  
SEUM DOES NOT FOLLOW A COMMON  
LANGUAGE IN PATTERNING OUT THE PRO-  
GRAM, SO THE ONLY COMMONALITY IS THE  
UNCOMMONALITY IN HOW THINGS FLOW



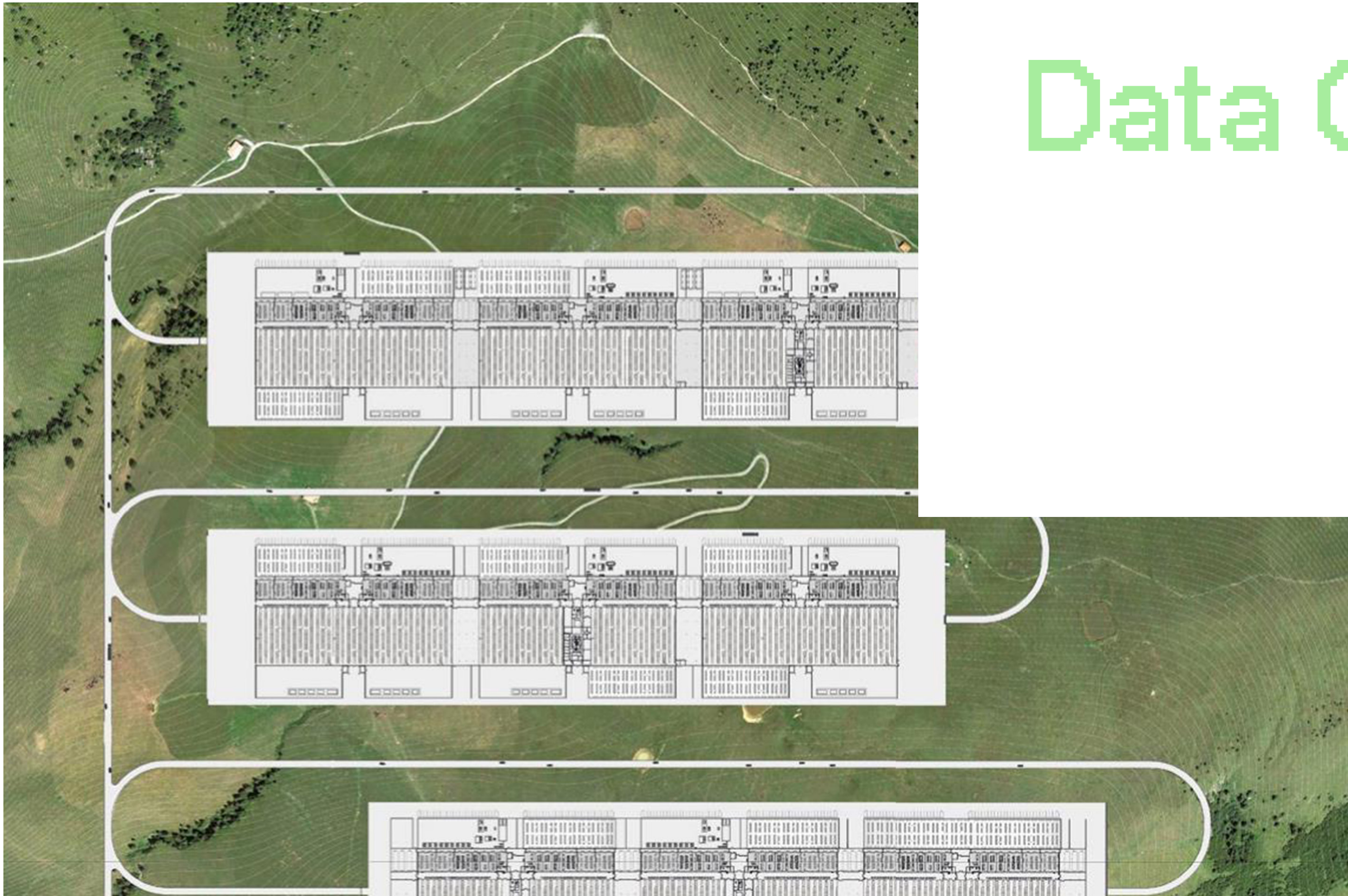
Unveiling the design's direct influences, the  
"expressive transparency" was achieved  
through the flow of the space  
as inspired from the MAXXI (OG) and the  
Kunsthal, Rotterdam





# Talking about the Kunsthall



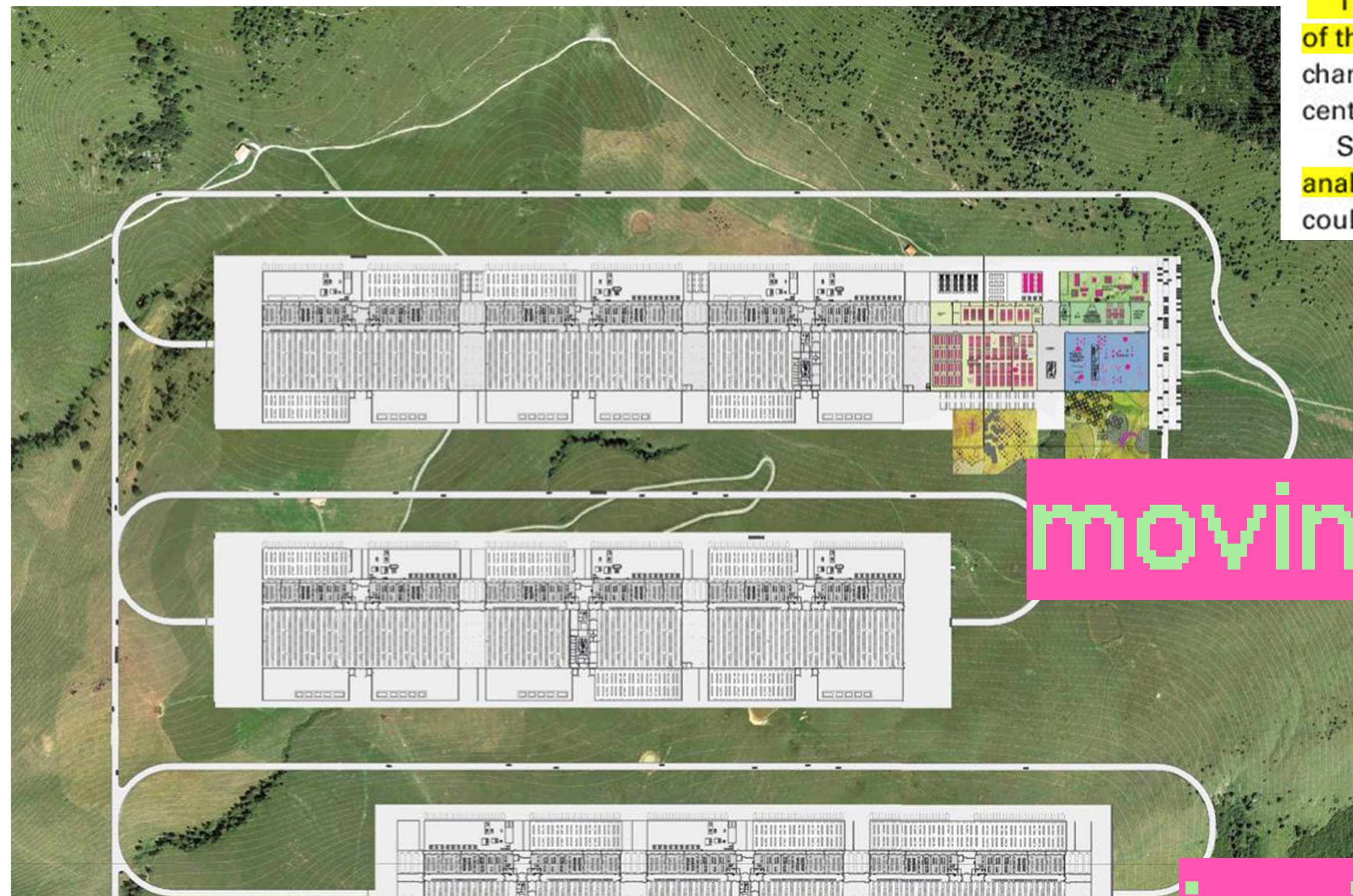


# Data Center ?

to the countryside any more, but theoretically we know more about it than ever before. The digital is perhaps used more to affect the non-urban condition than the urban one.

And the countryside is where this digital power emanates and is stored. **Looking at the countryside today, there is an emergence of a new kind of architecture, the aesthetic of the data centre.** You could be upset that huge facilities are appearing across such beautiful landscapes, unimaginably





you maintain the same grid and use it as a place where storage and exhibition can coexist (data and art are both forms of storage).

The proposition is to use the architectural configuration of the data centre for a museum, almost without any change. We do not know whether this is impossible. Data centre architecture operates on the purest form of a grid;

Such a museum would automatically benefit from a deep analogy between industrial work and artistic realisation. It could introduce multiple activities that may never have been

Rem proposed

moving the museum to

the country side

inside a Data centre



Is there something more to a Data center  
other than the analogy of  
data and art  
both being a  
form of storage?



**Google Dalles  
data center in  
Oregon**





**Server Manifesto**  
Data Center  
Architecture  
and the Future  
of Democracy  
Niklas Maak

HATJE  
CANTZ

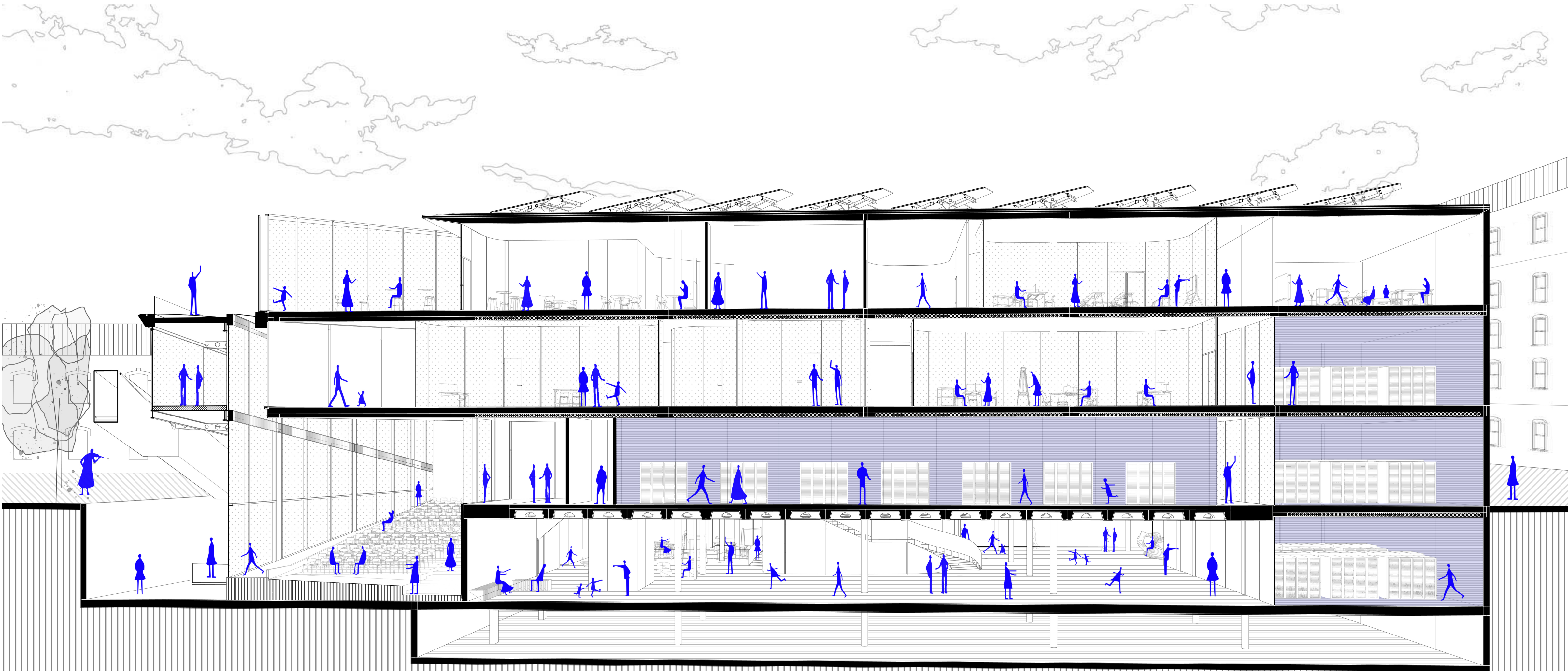
digital sovereignty & data awareness





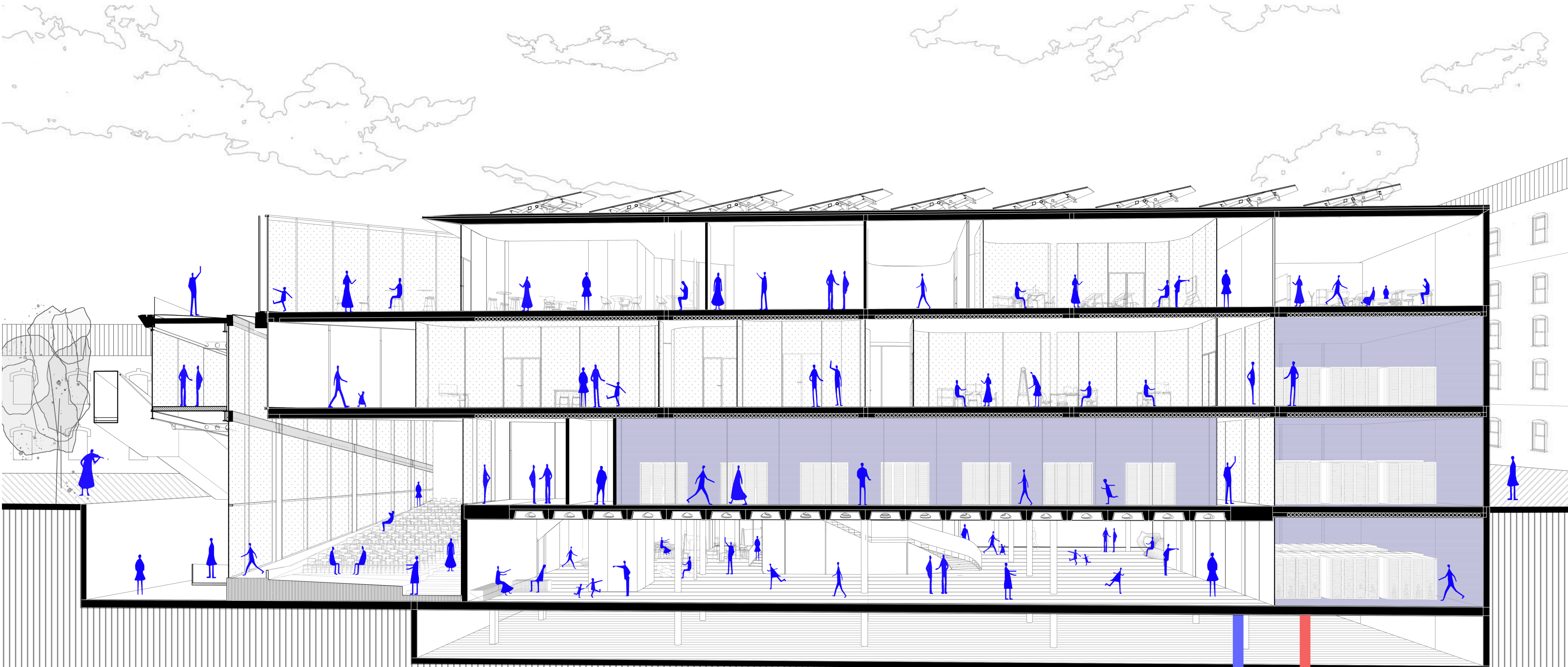
AM3&4 use thermal energy storage systems allowing the heat to be used by other buildings on Science park



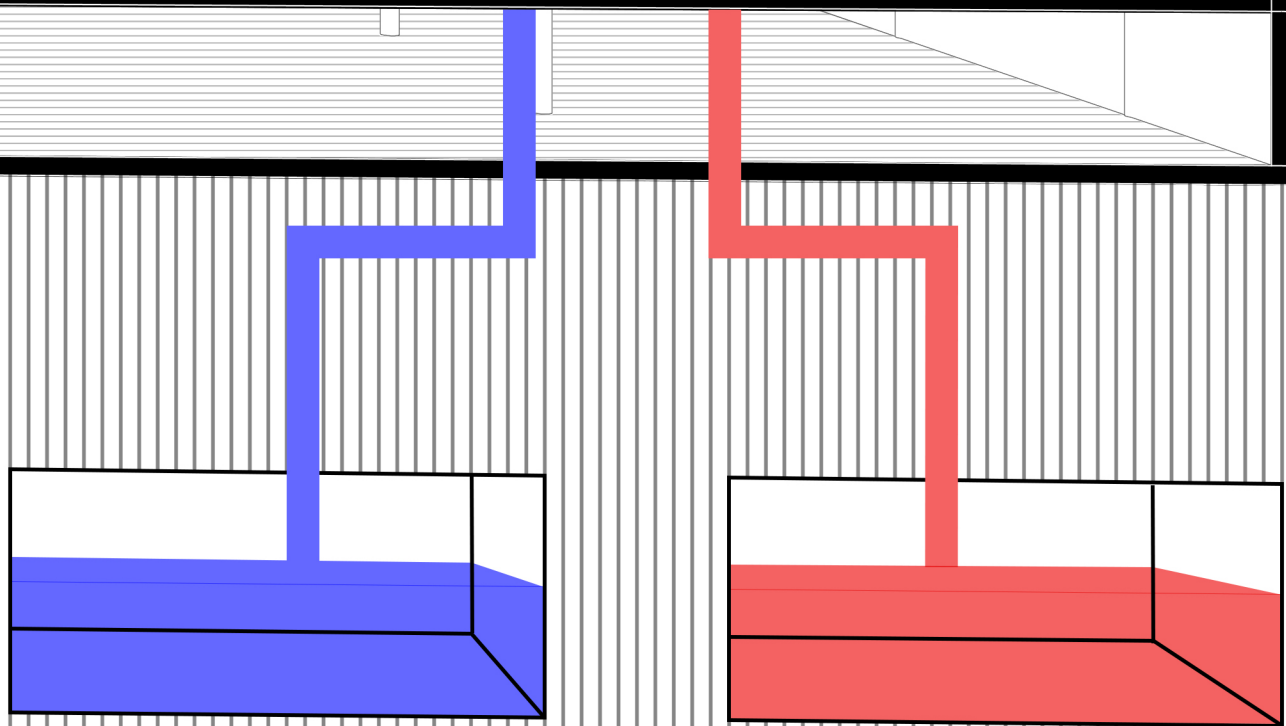


MAAAXXI has 26% of its program under the Data Center





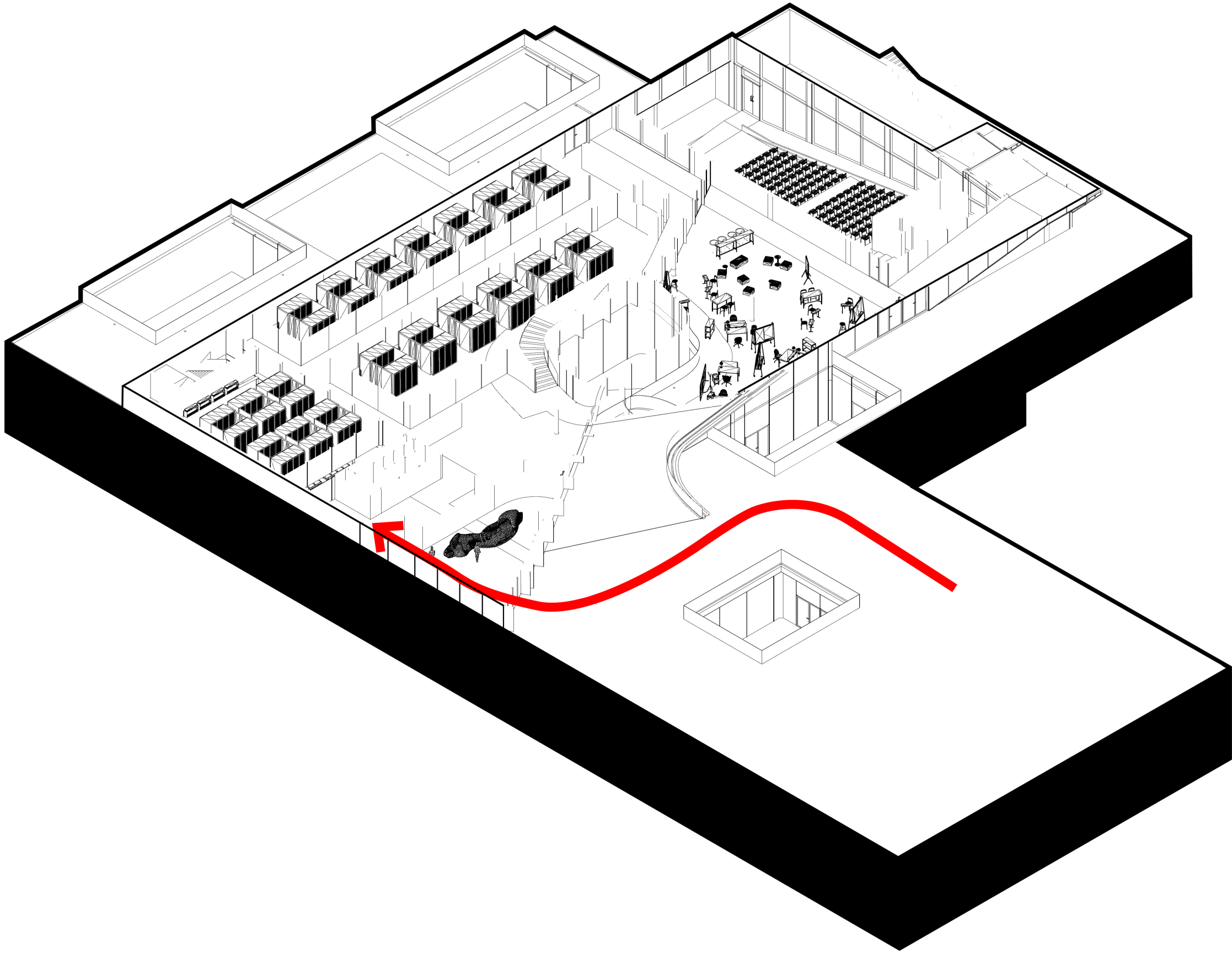
utilising aquifer thermal  
energy storage systems





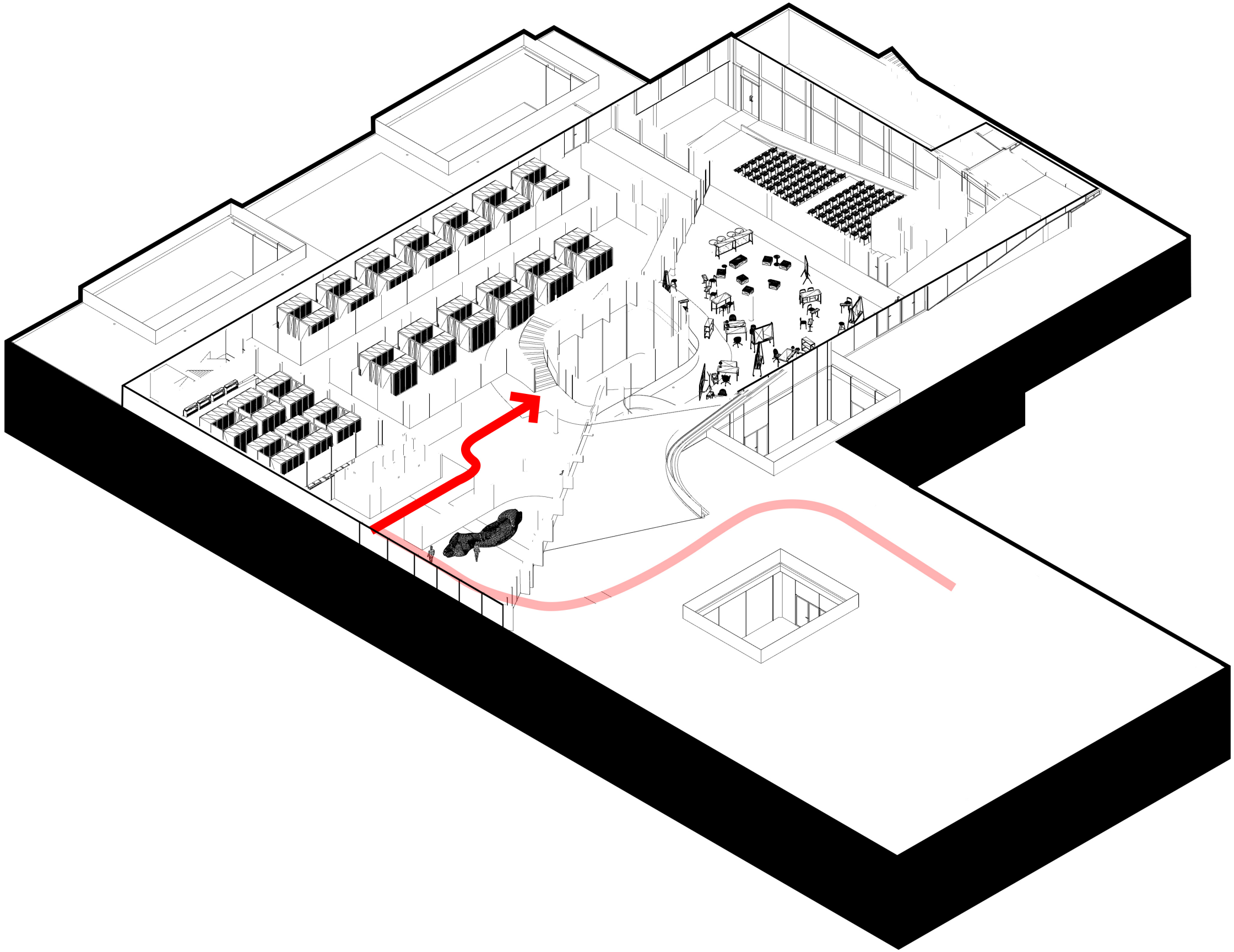
# Flow-Data centre-pipeline





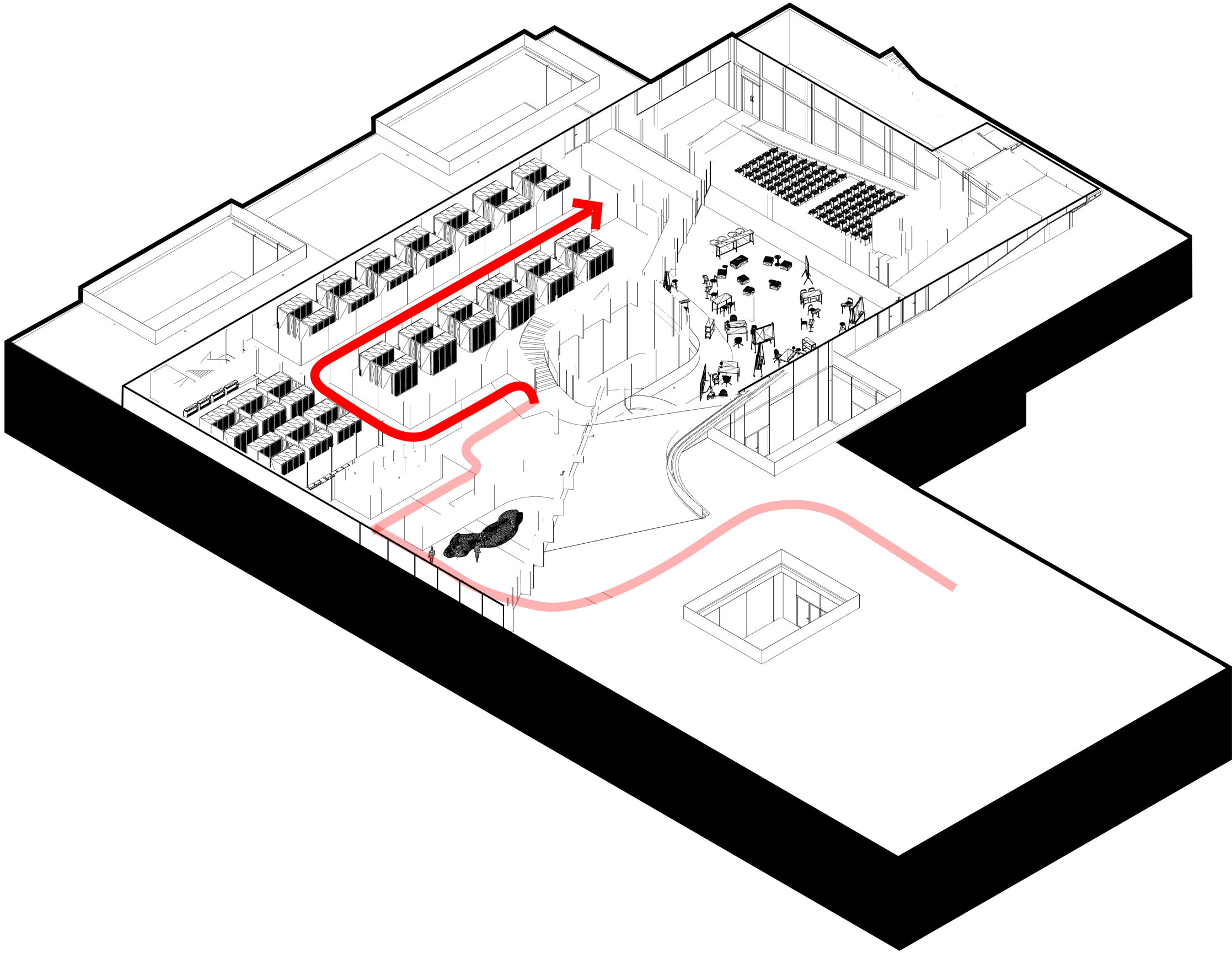
Entrance





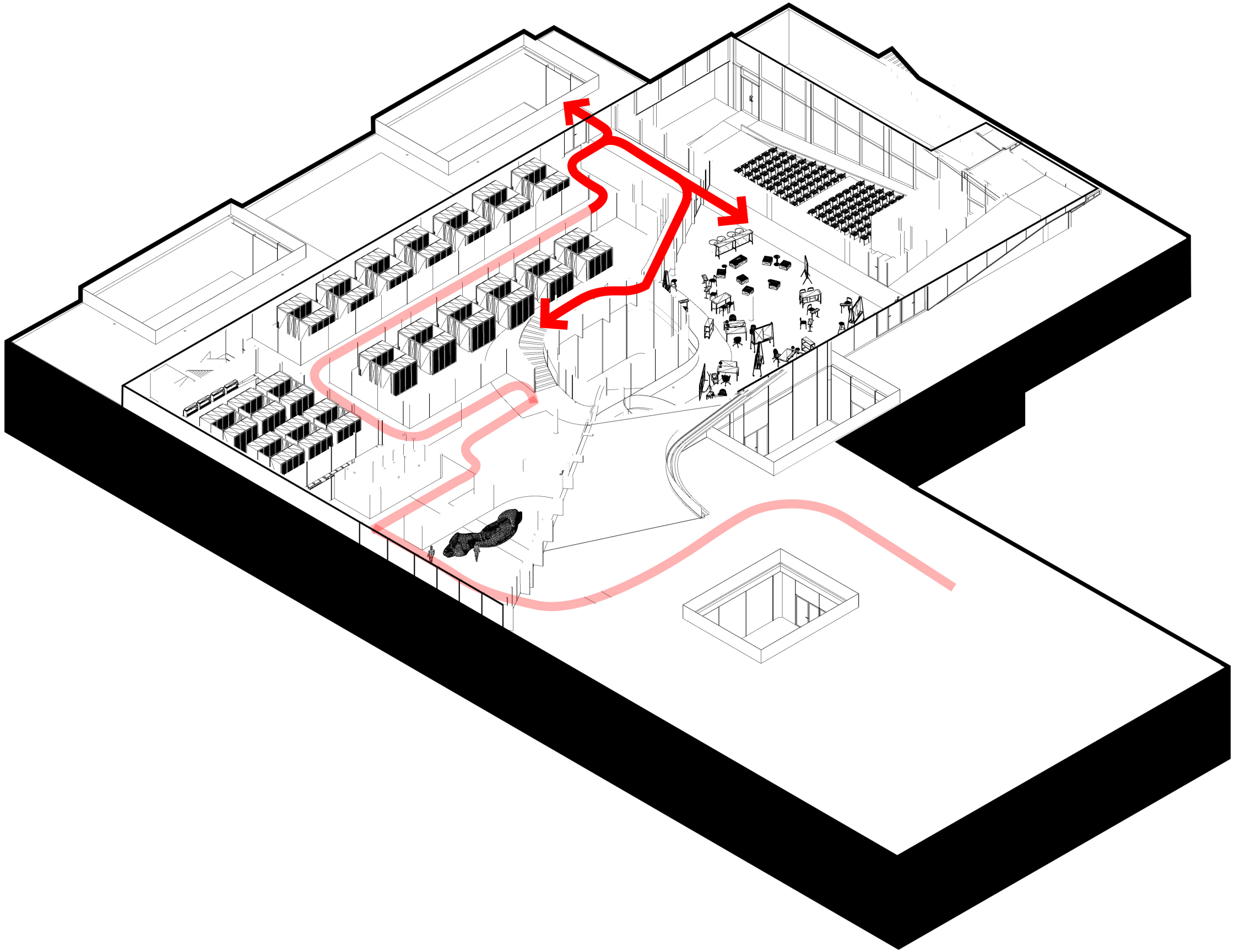
Navigation space





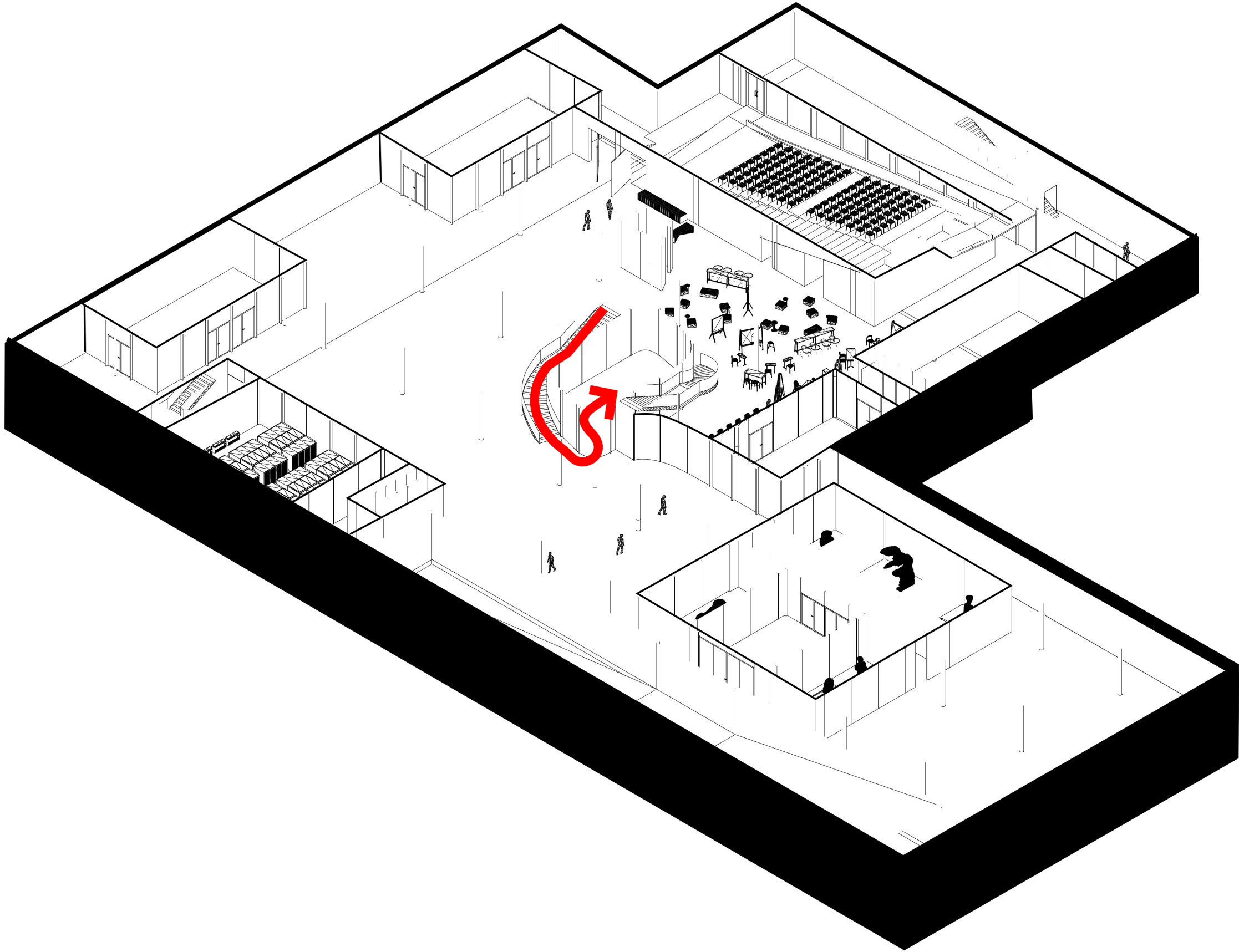
Data Gallery





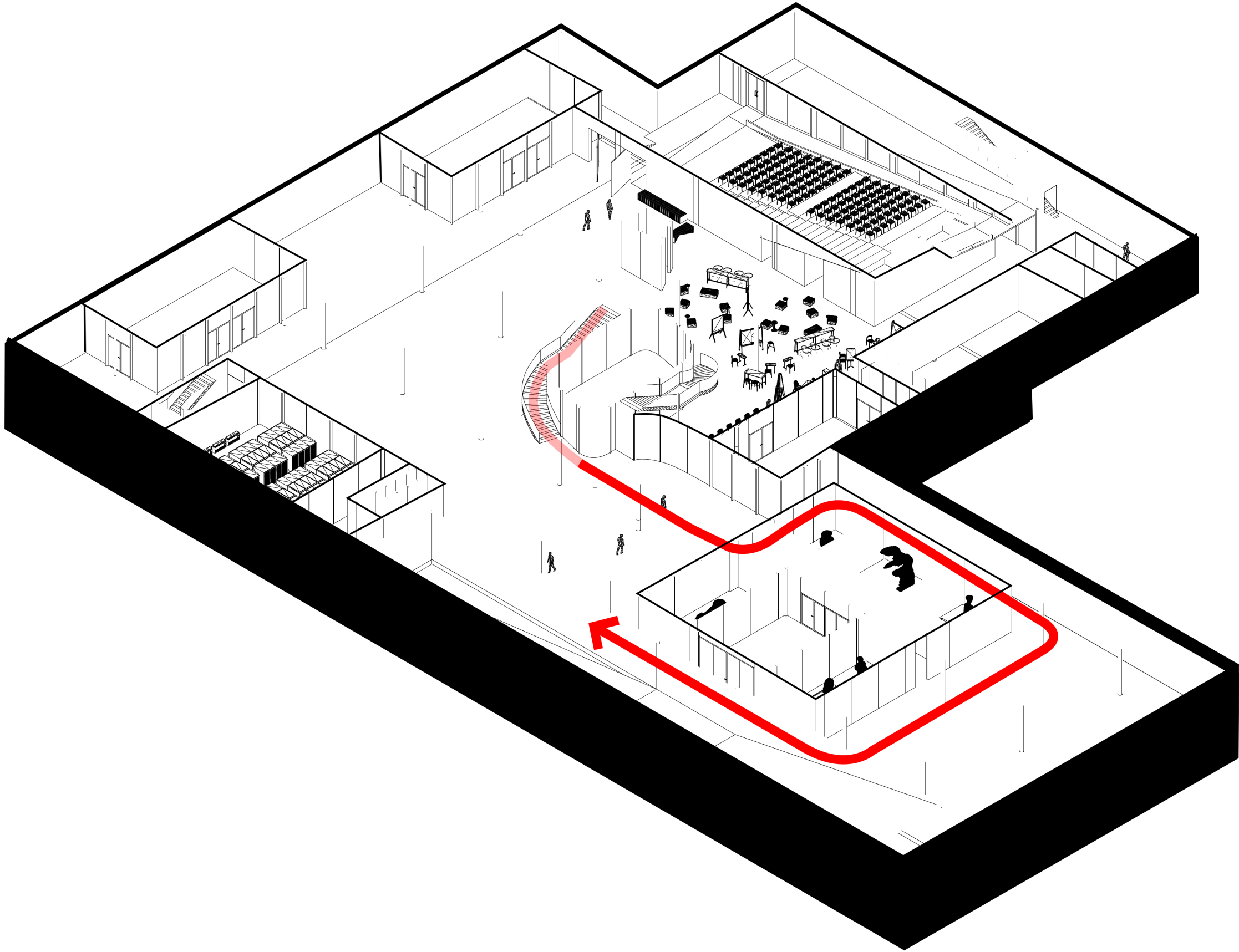
Garden + Library





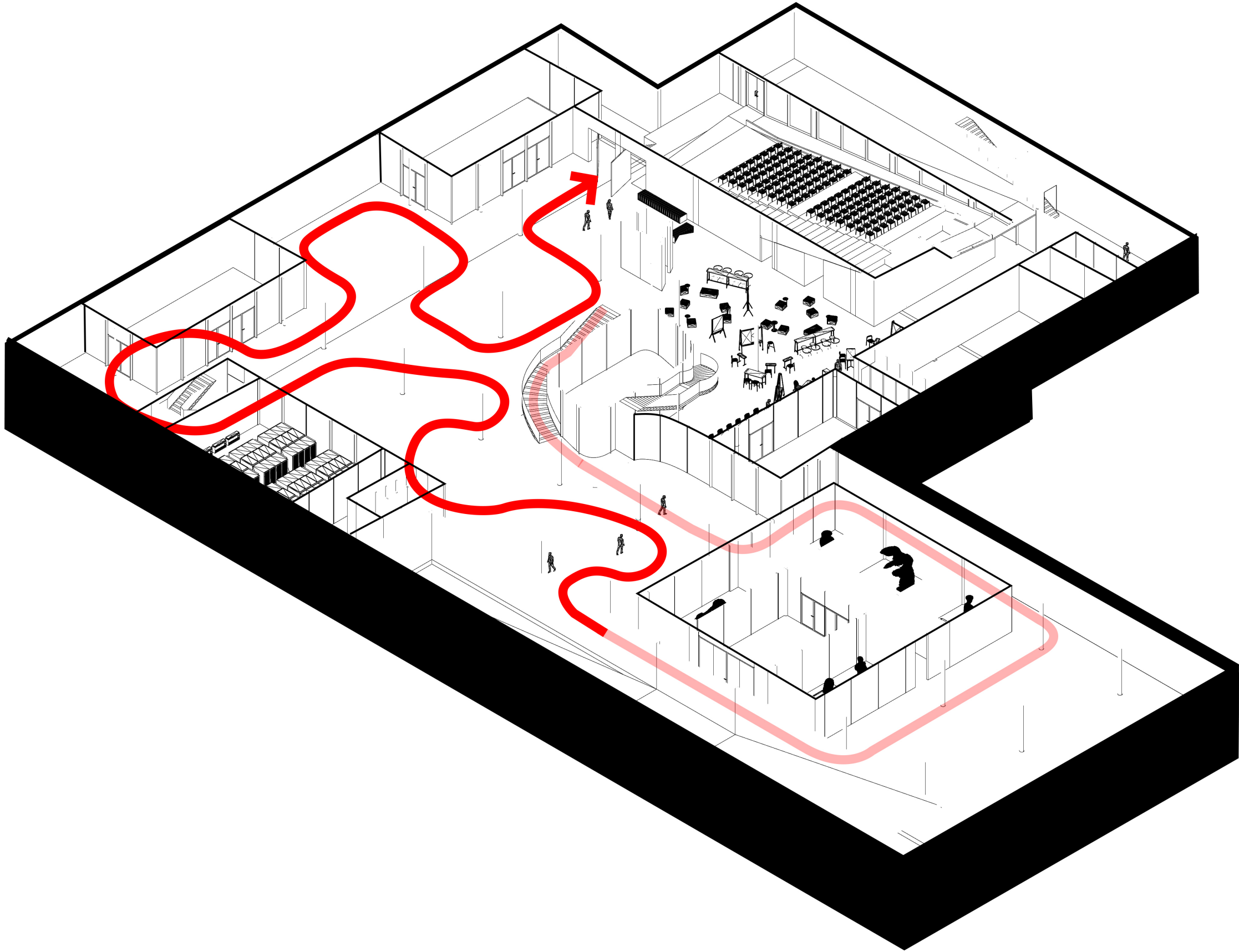
Central Courtyard





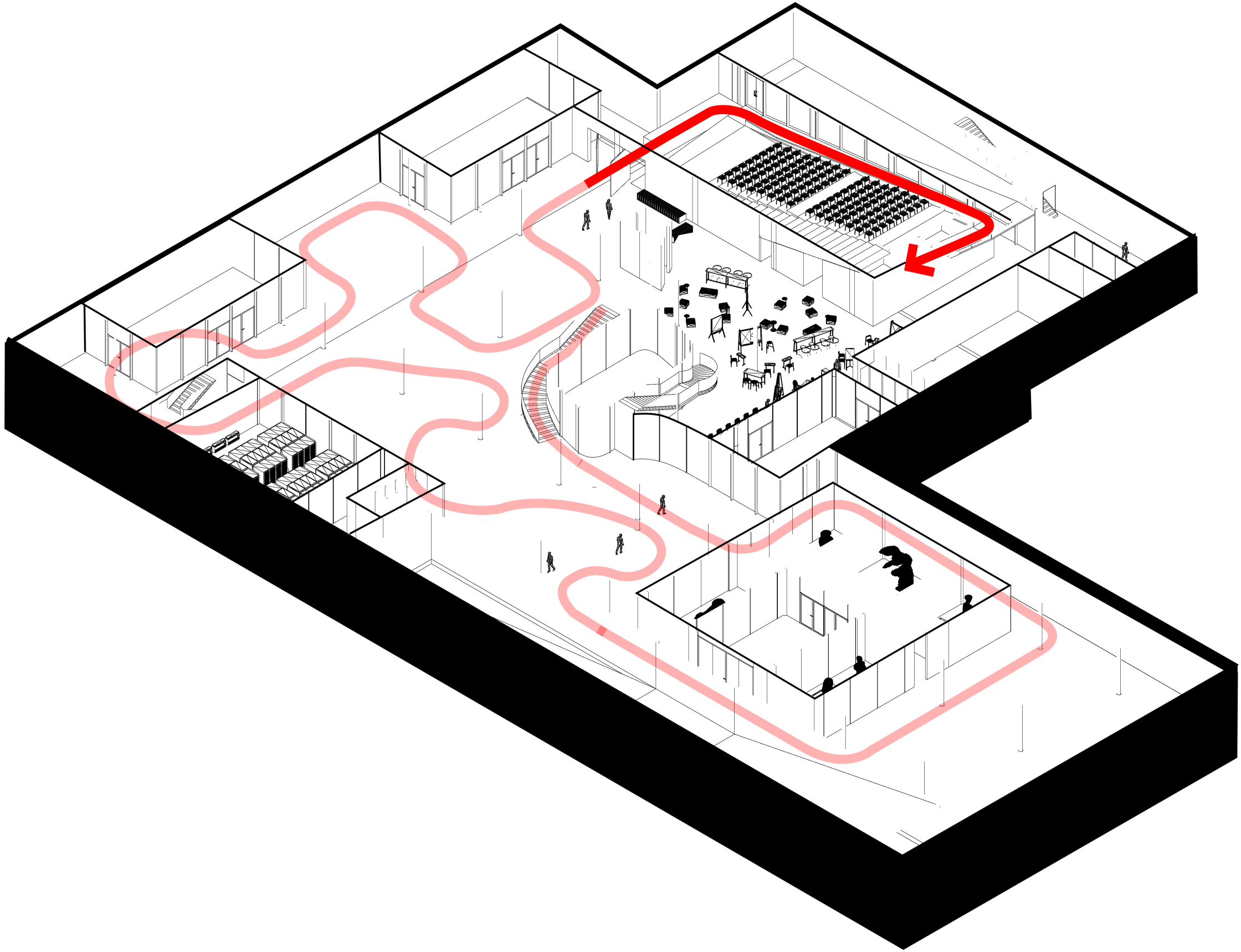
Restoration labs + Archive





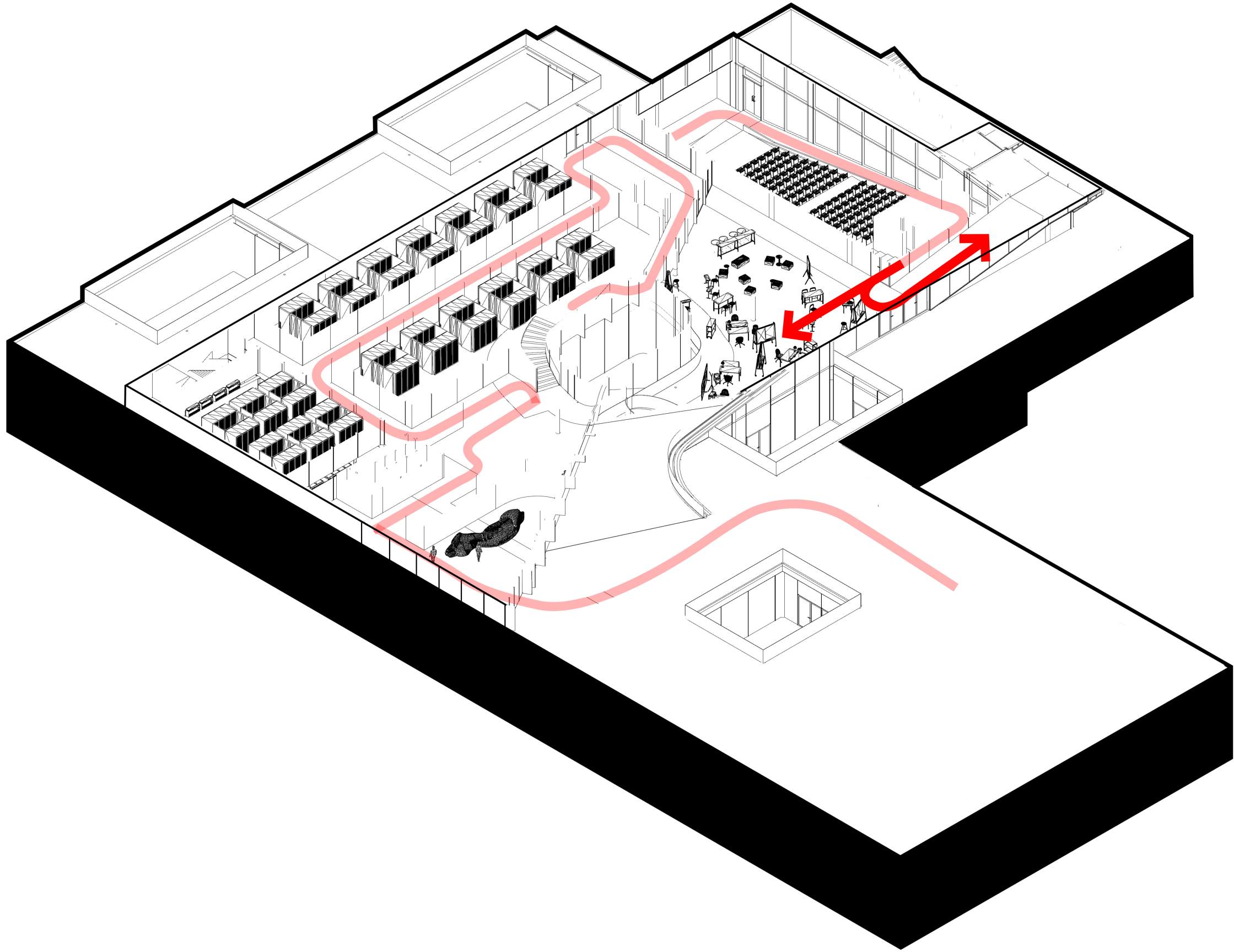
Museum of Data





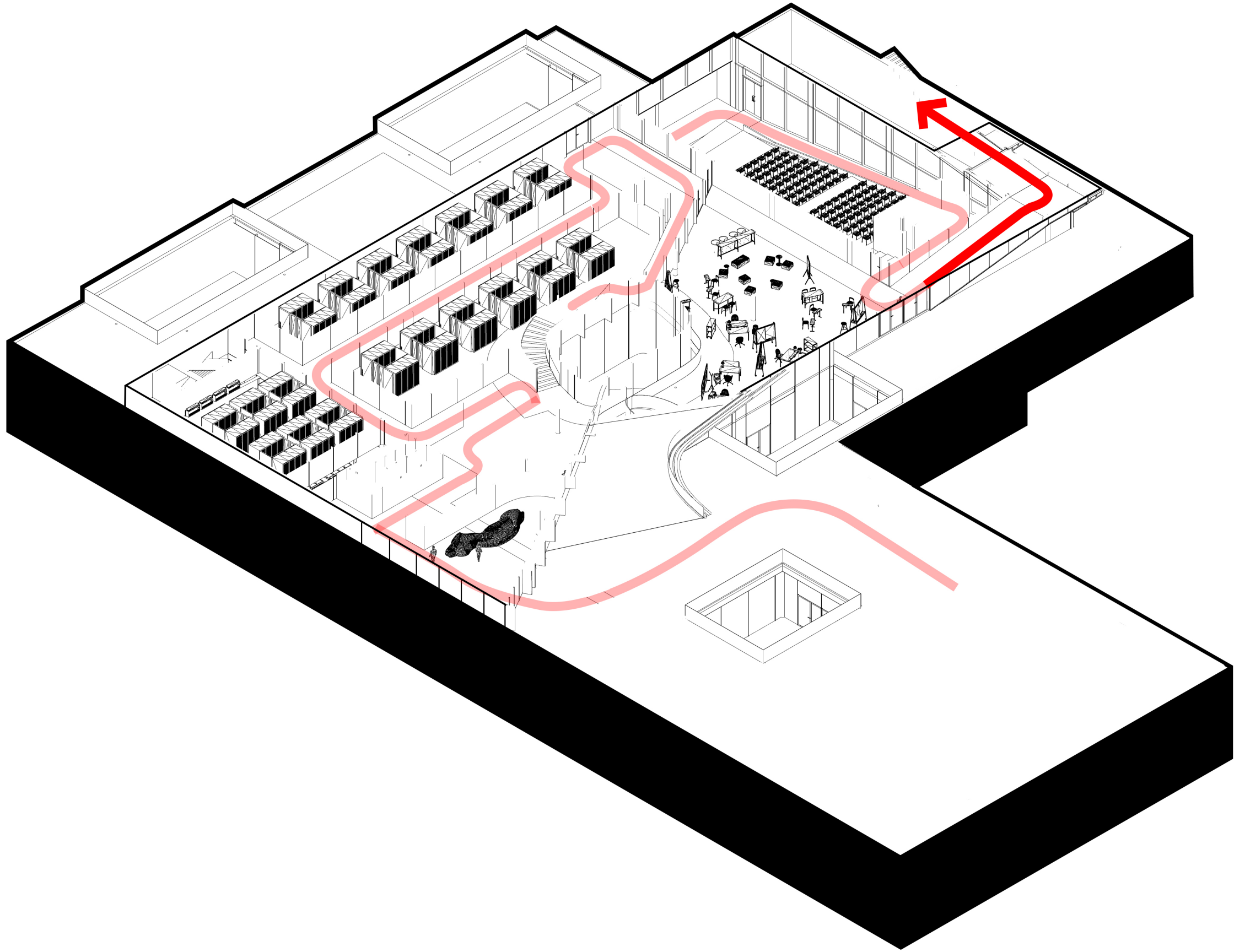
Auditorium





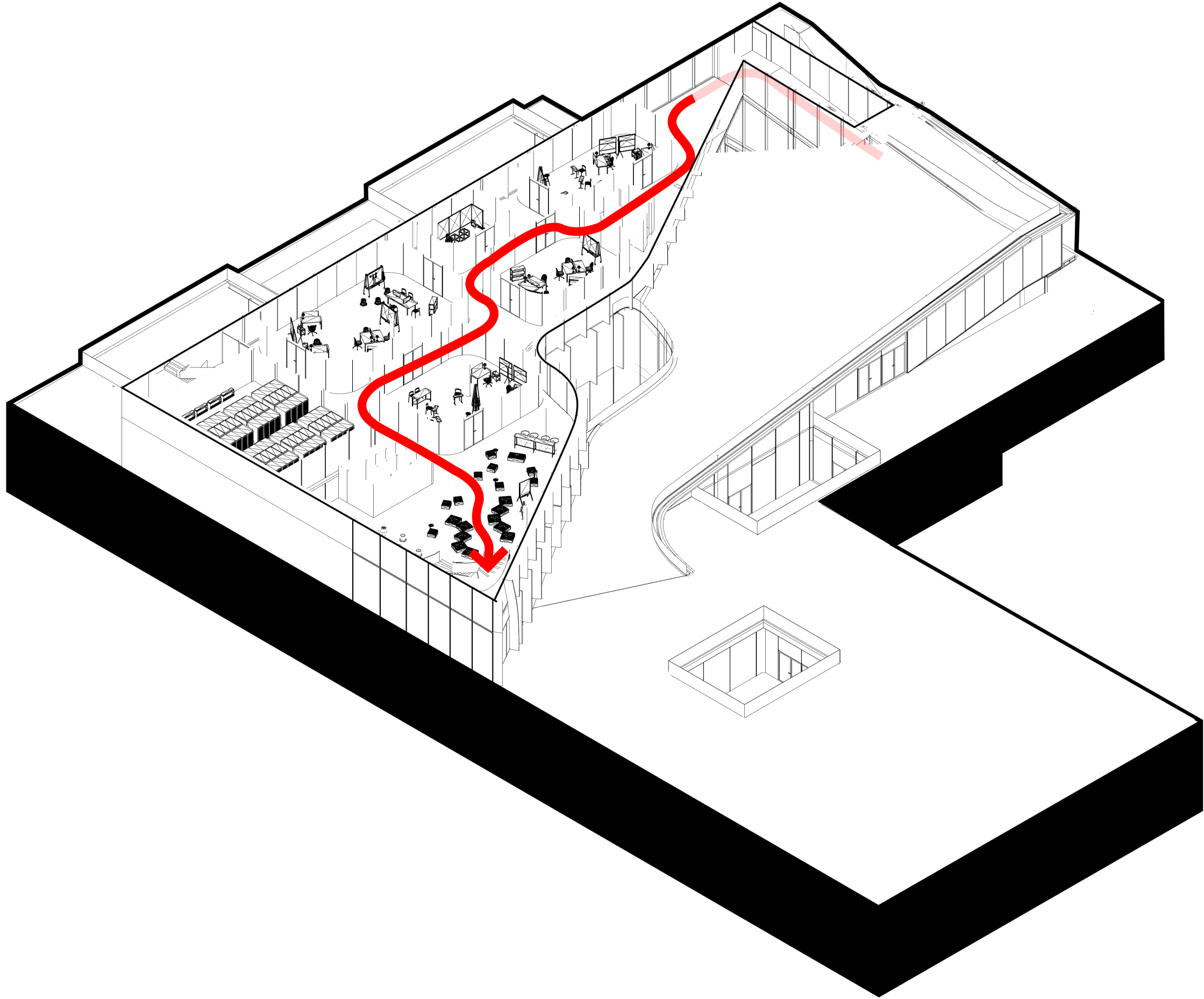
Library





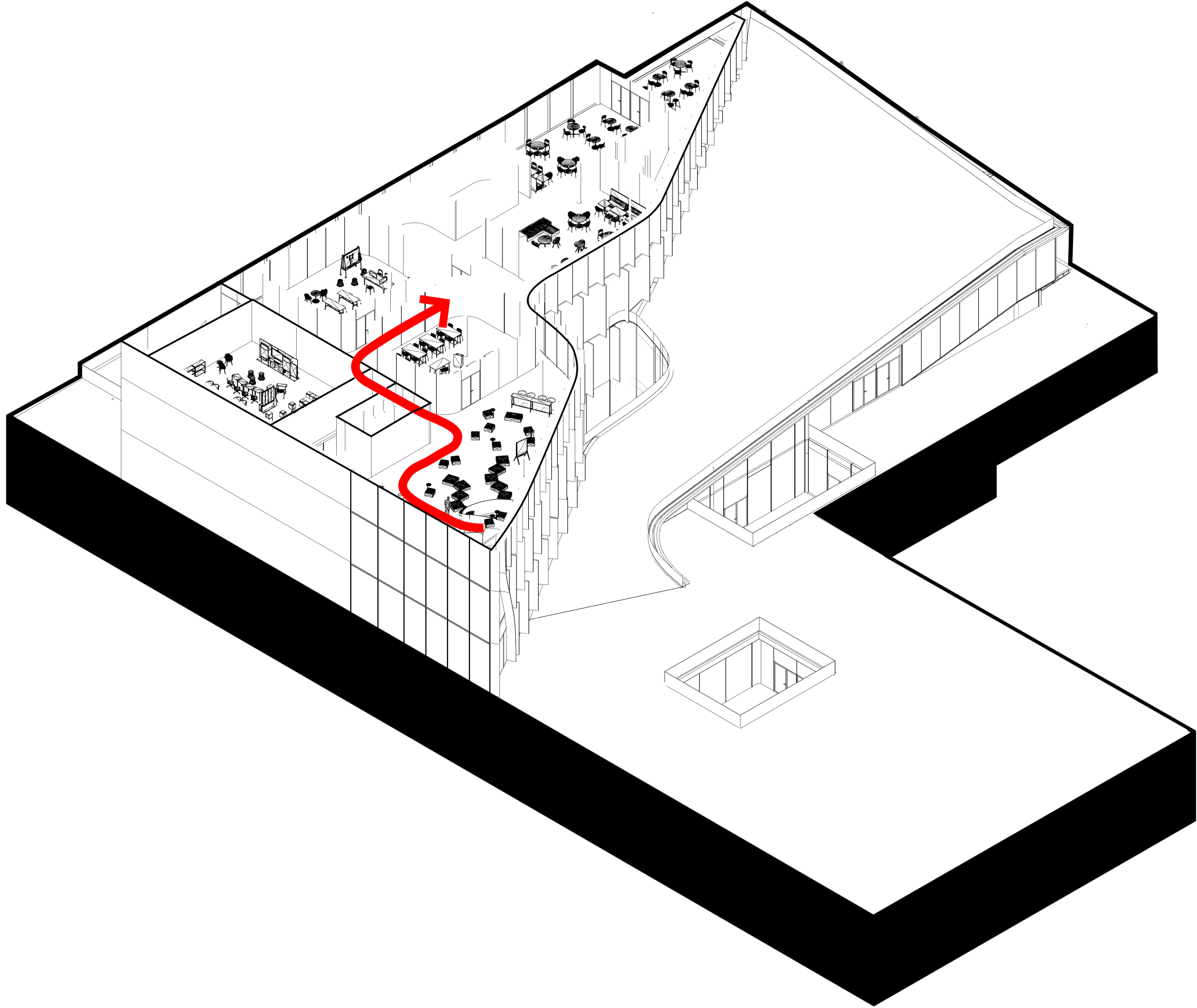
Gallery Bascilica





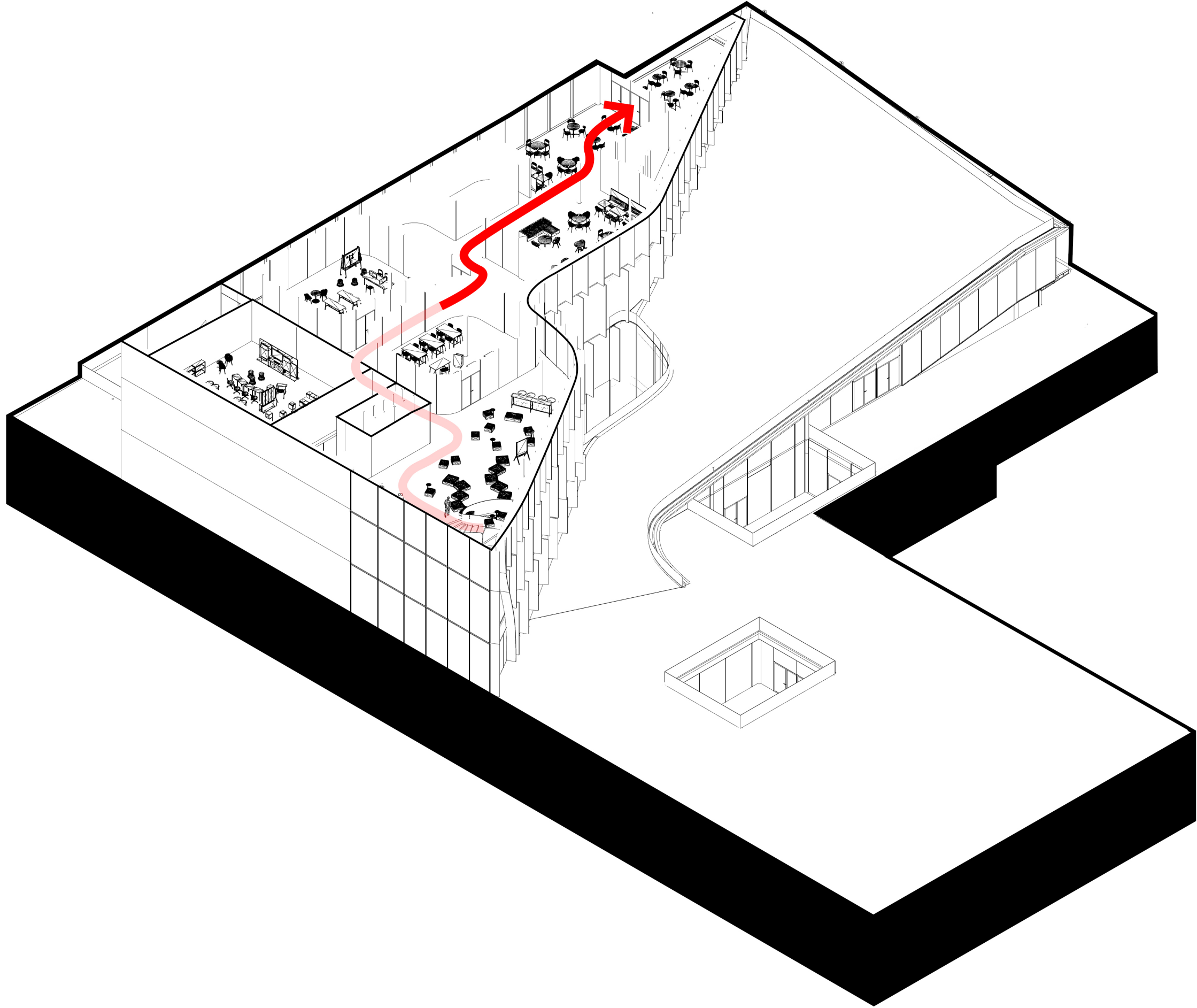
R&D labs





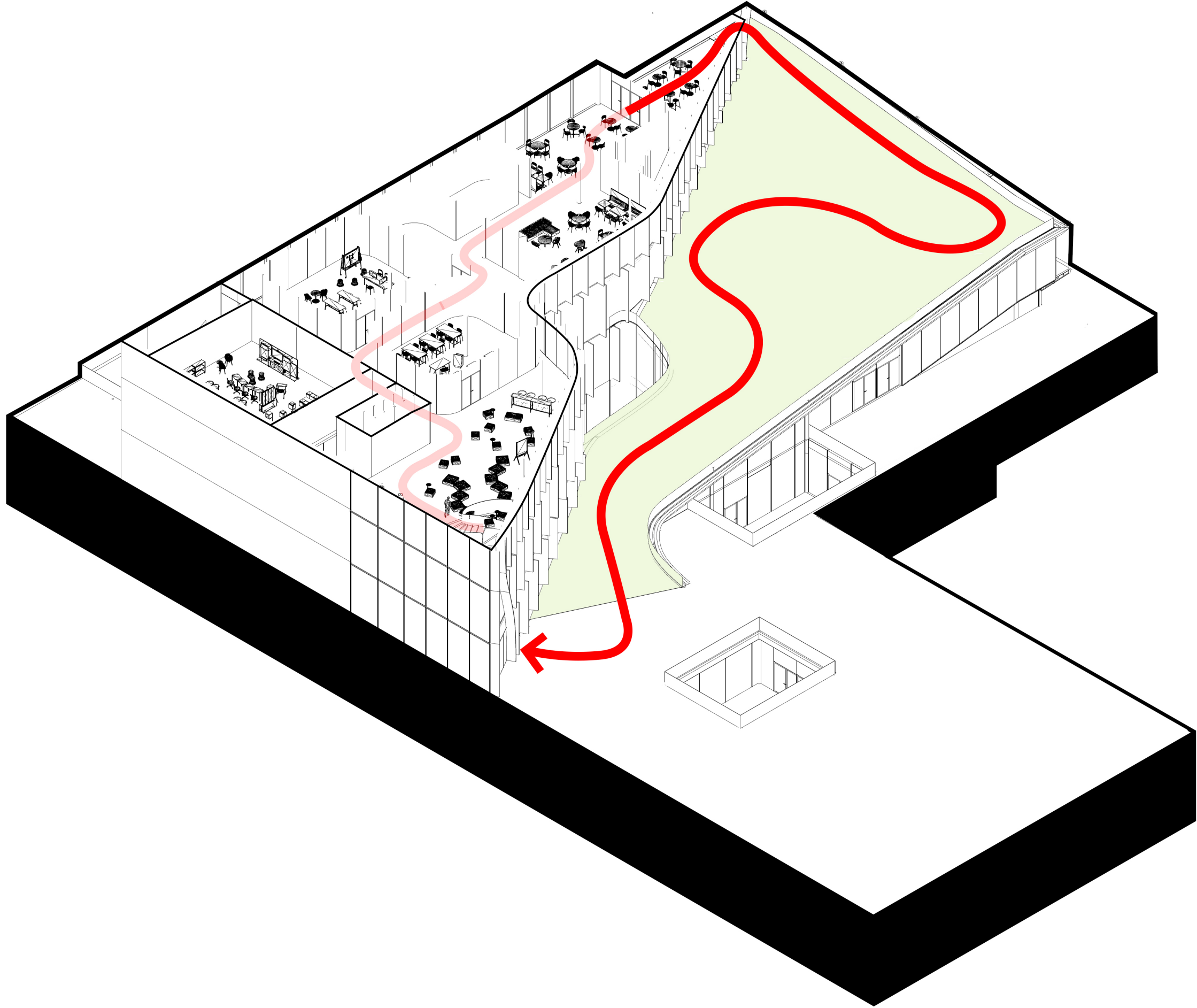
Education labs





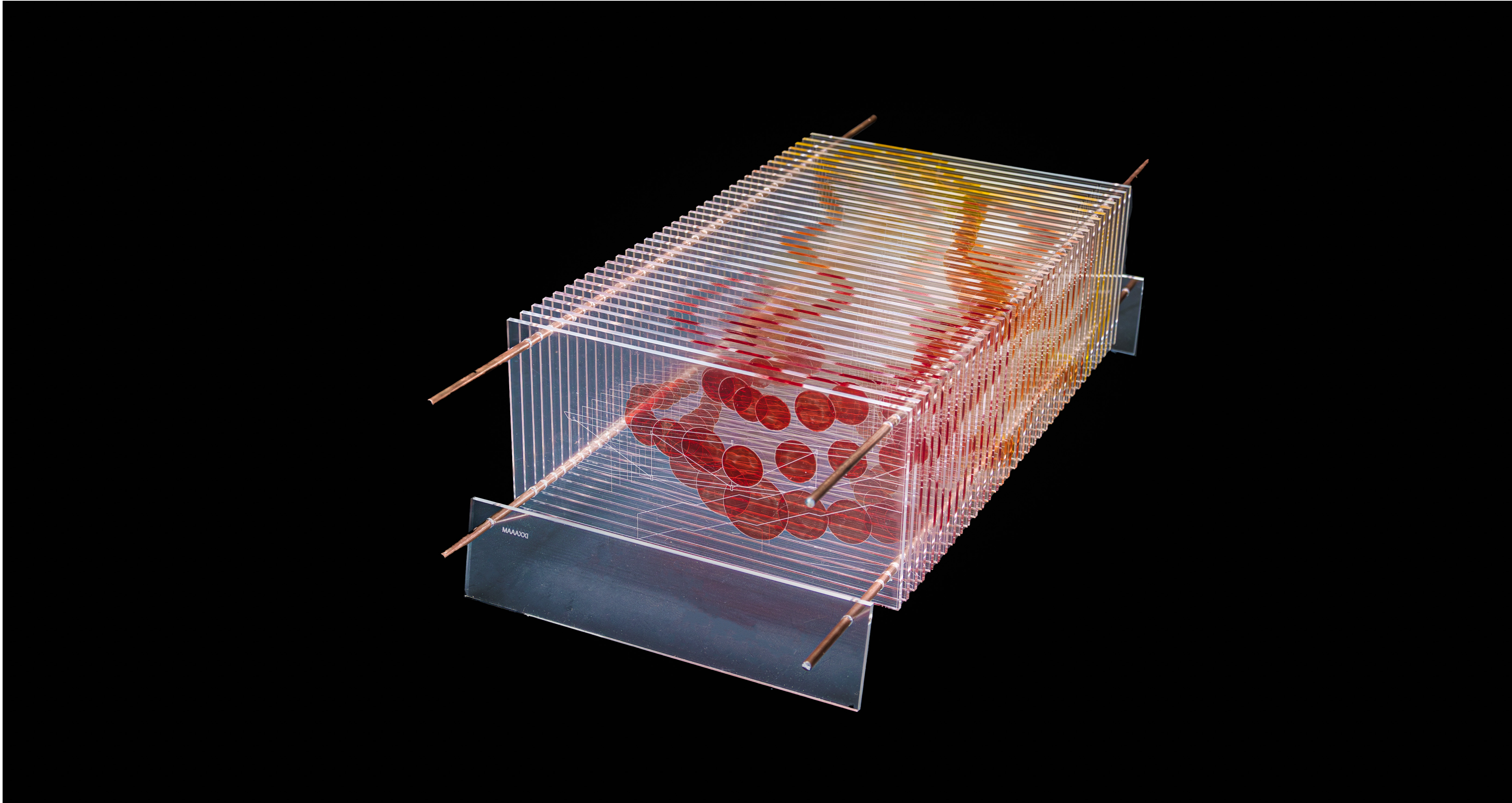
Restaurant





Cascading landscape





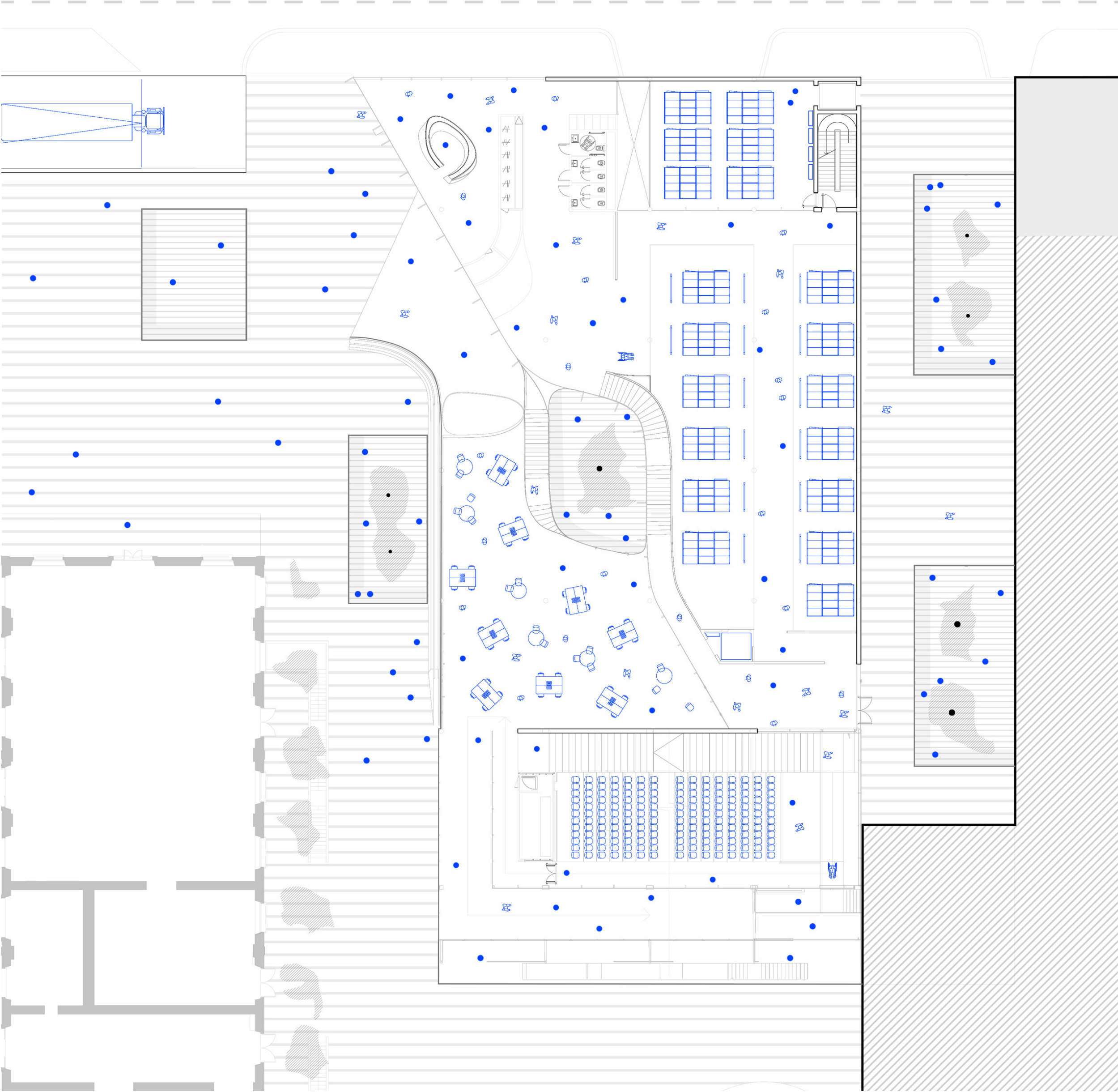


# PART B(3) – Expressive transparency







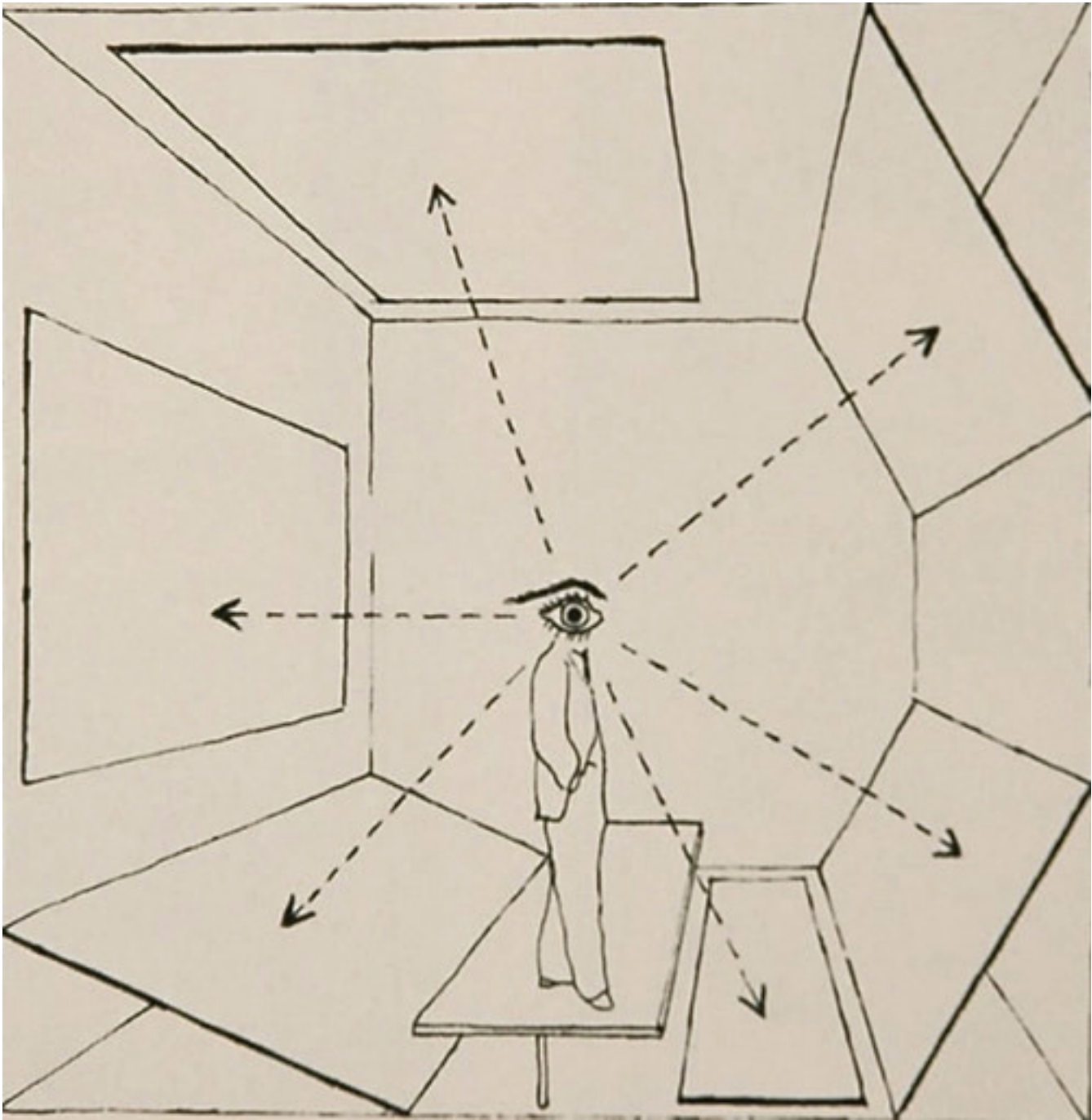
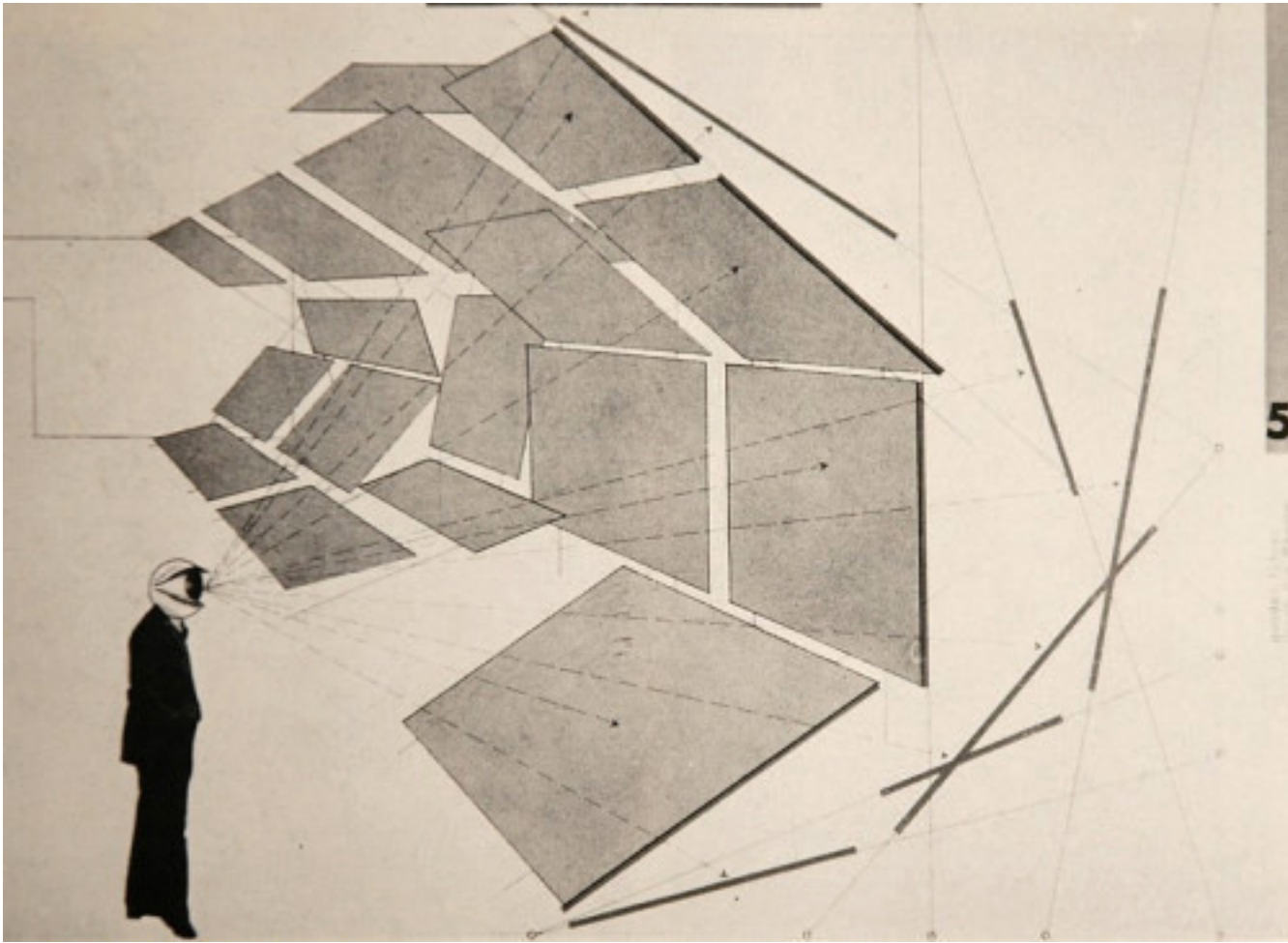


00\_Ground

LEGEND

- 1. Reception
- 2. Lockers
- 3. Lobby & Map
- 4. Data Centre
- 5. Elevator lobby
- 6. Gardens outside
- 7. Library
- 8. Central Garden
- 9. Auditorium
- 10. Gallery





Herbert Bayer, Diagramm erweiterte Sichtfeld  
(Diagram - extended Field of Vision), 1935





this sca  
the vision out of the normal world and transcend them th  
them feel having entered something completely different









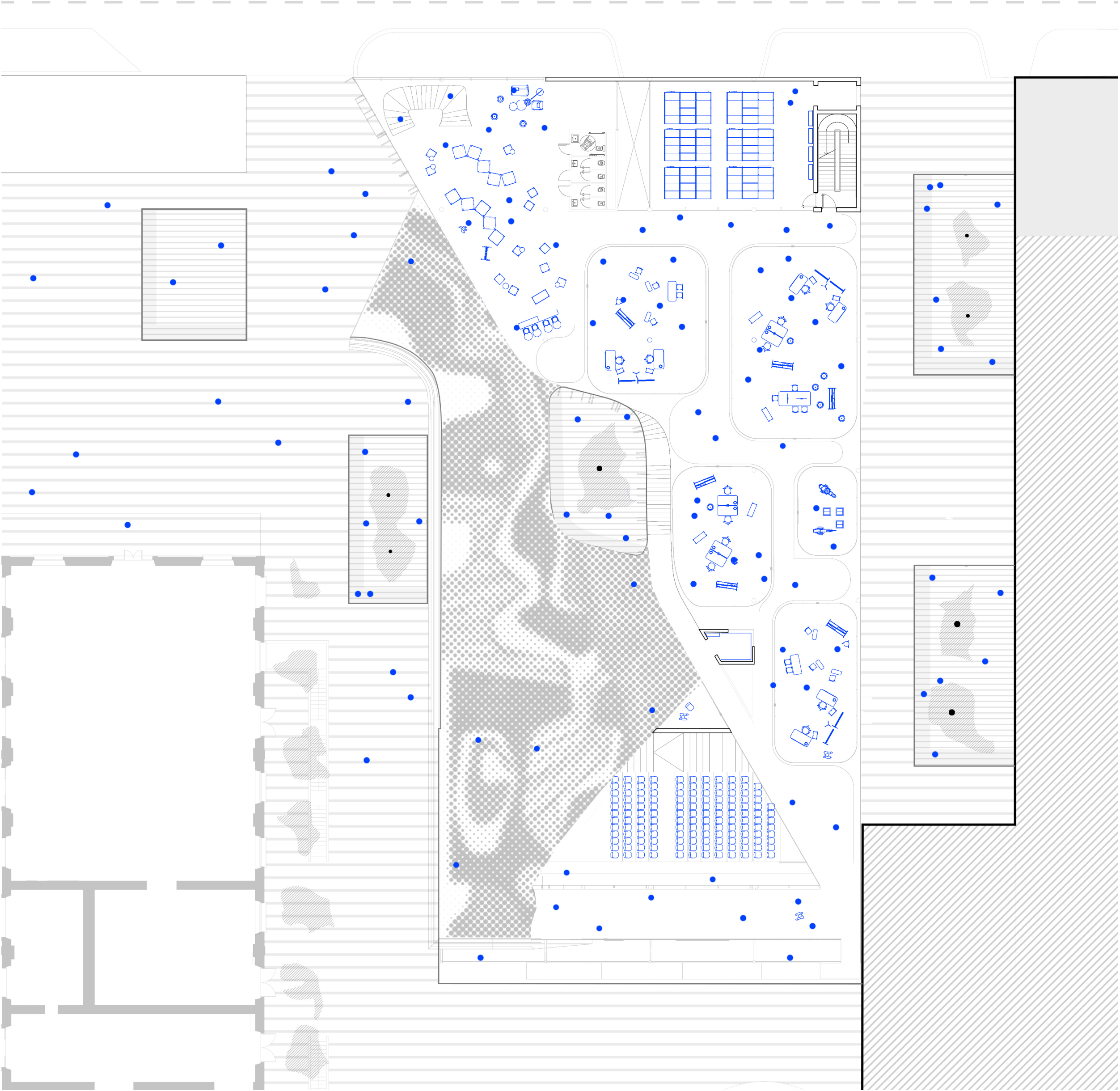
-01\_Basement

- LEGEND
- 1. Central courtyard
  - 2. Library
  - 3. Restoration labs
  - 4. Conservation Labs
  - 5. Archive
  - 6. Drop-off Courtyard
  - 7. Data Centre
  - 8. Museum
  - 9. Auditorium









01\_First

LEGEND

- 1. Gallery
- 2. Intro Space
- 3. R&D Art
- 4. R&D Architecture
- 5. Machine room
- 6. R&D Science
- 7. R&D AI
- 8. Data Centre
- 9. Open lab





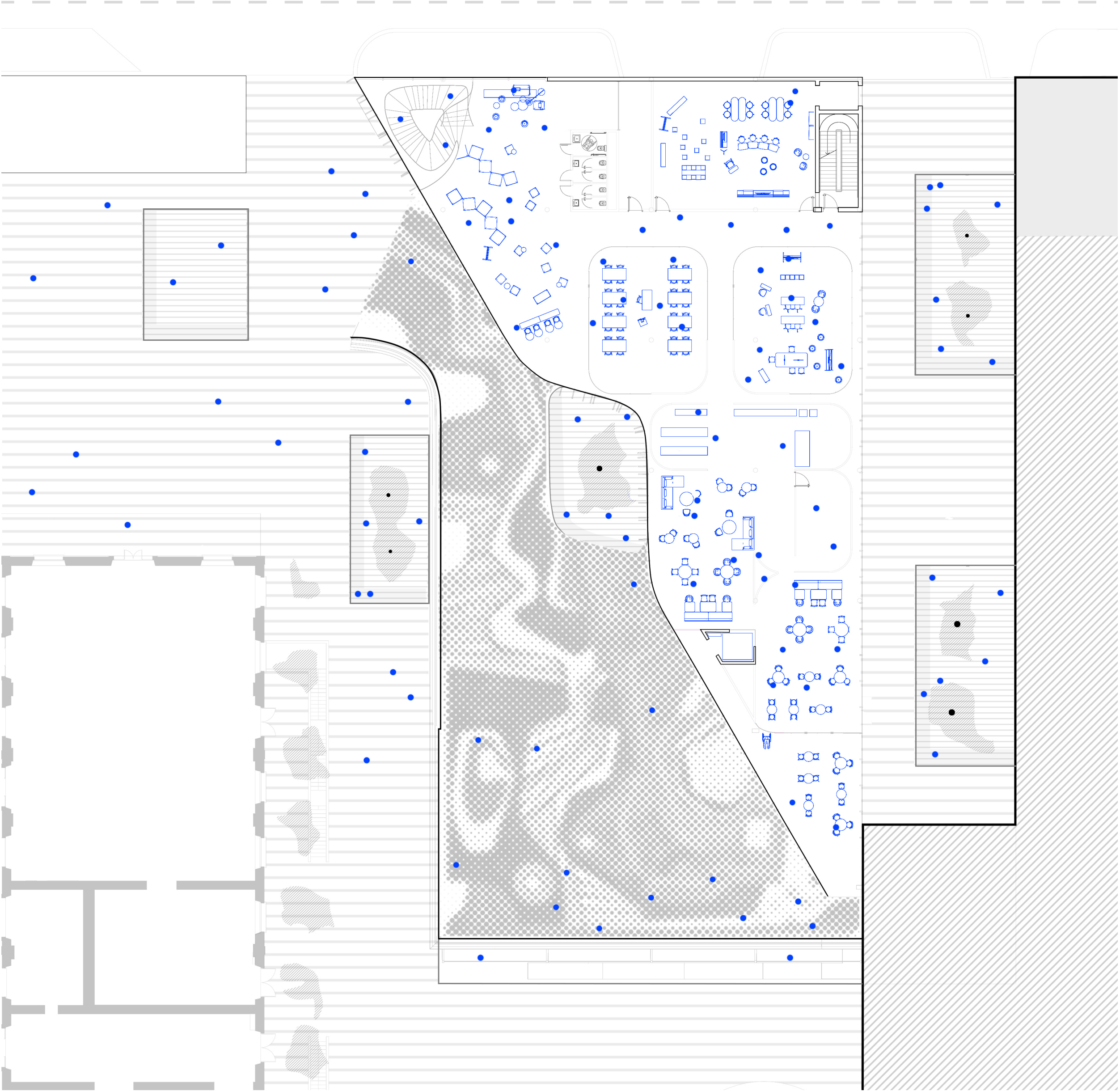












02\_Second

- LEGEND
- 1. Lounge
  - 2. Classrooms
  - 3. Debate rooms
  - 4. Storage
  - 5. Museum Store
  - 6. Restaurant
  - 7. Cafe
  - 8. Exit/Entrance
  - 9. Landscape

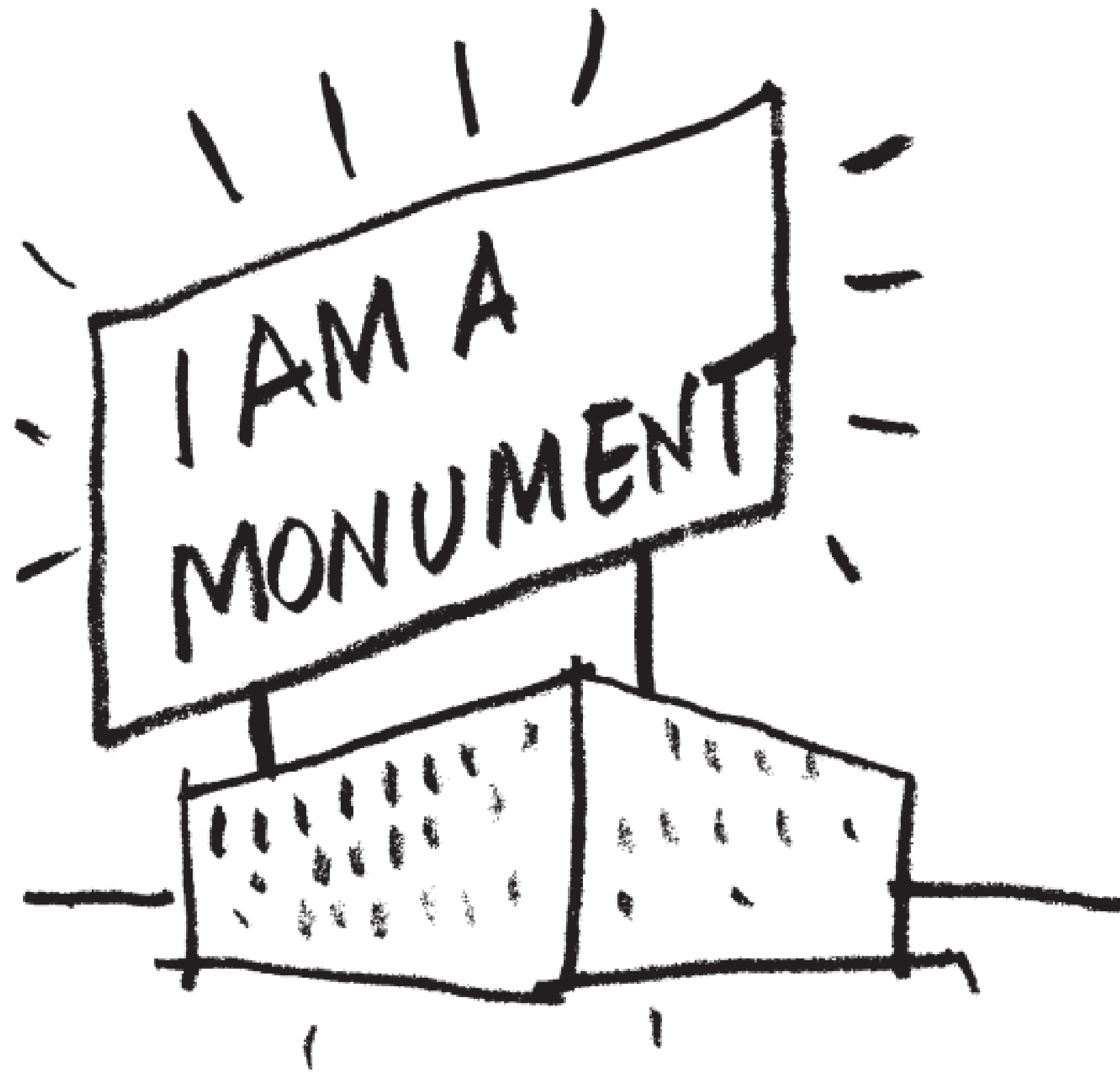






And if this does not justify the design





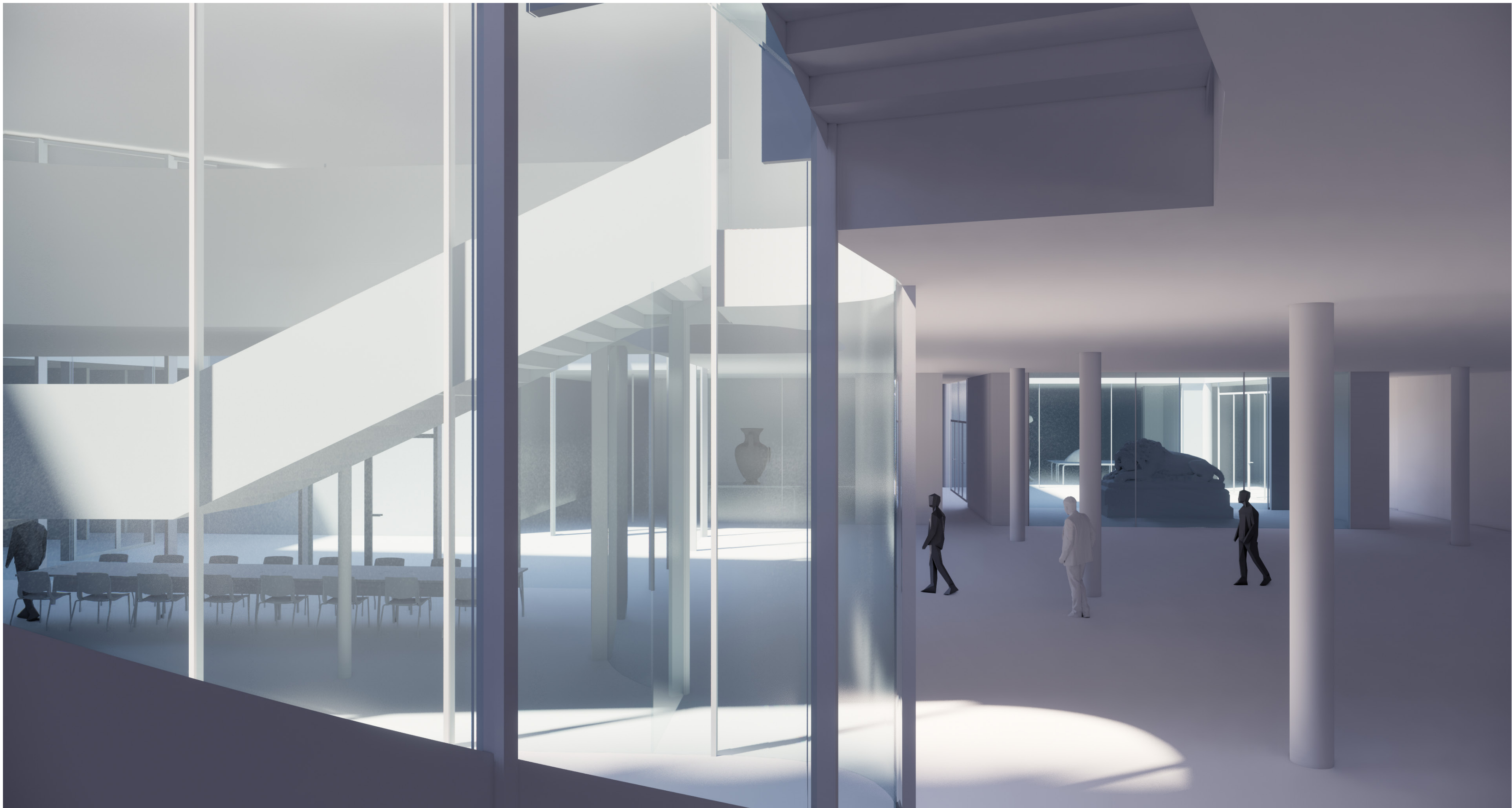


**Archive**













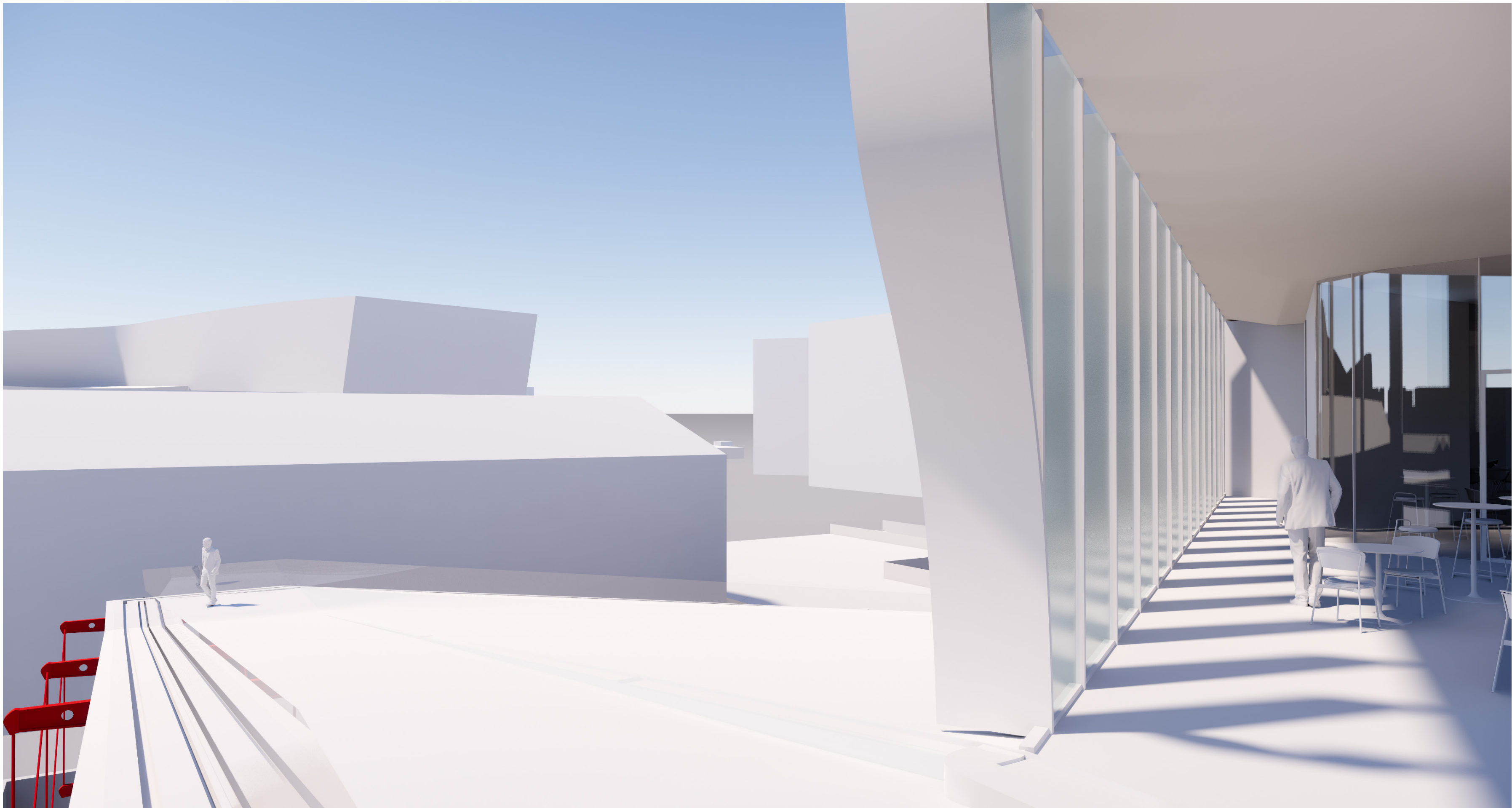




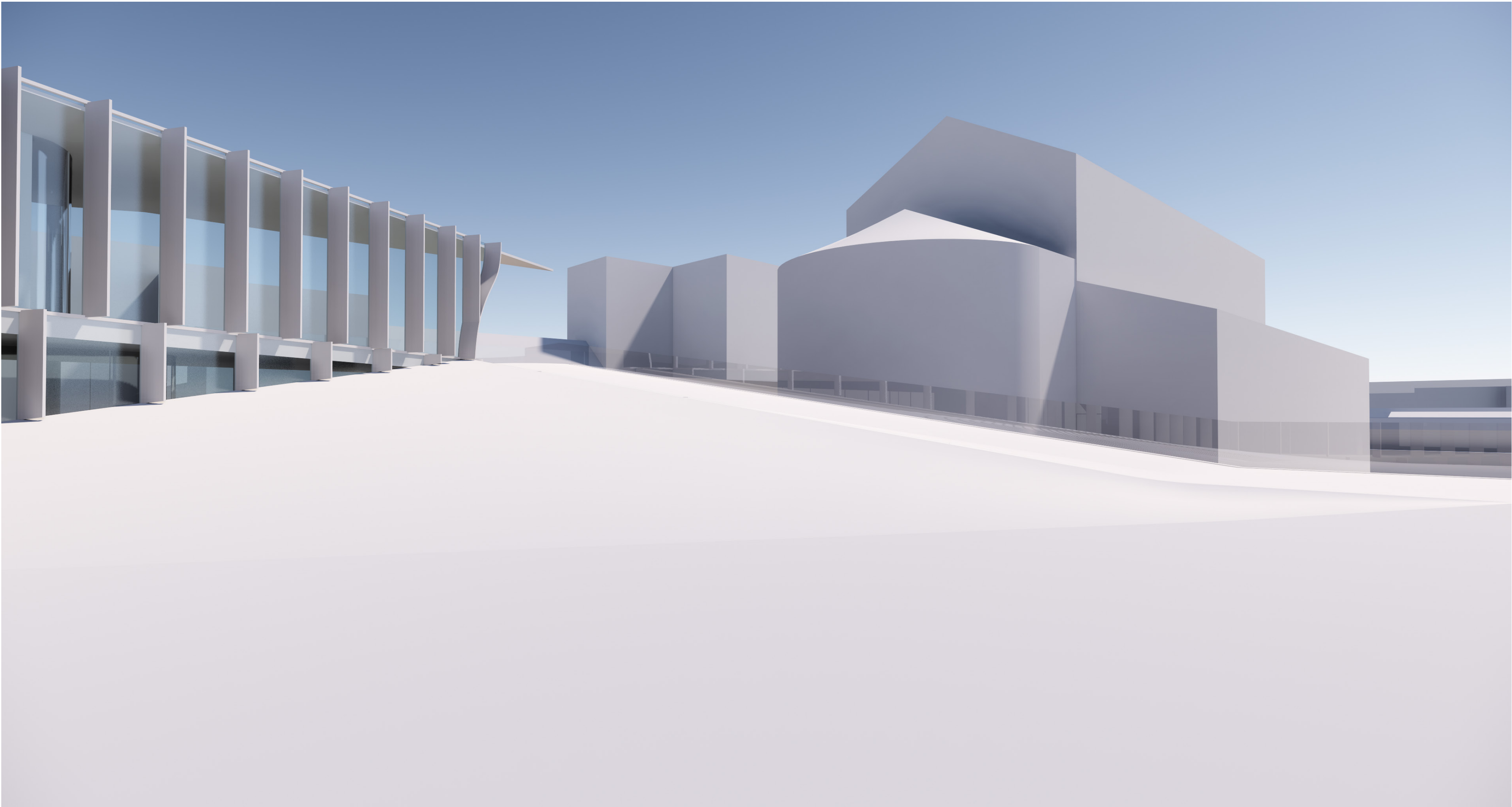




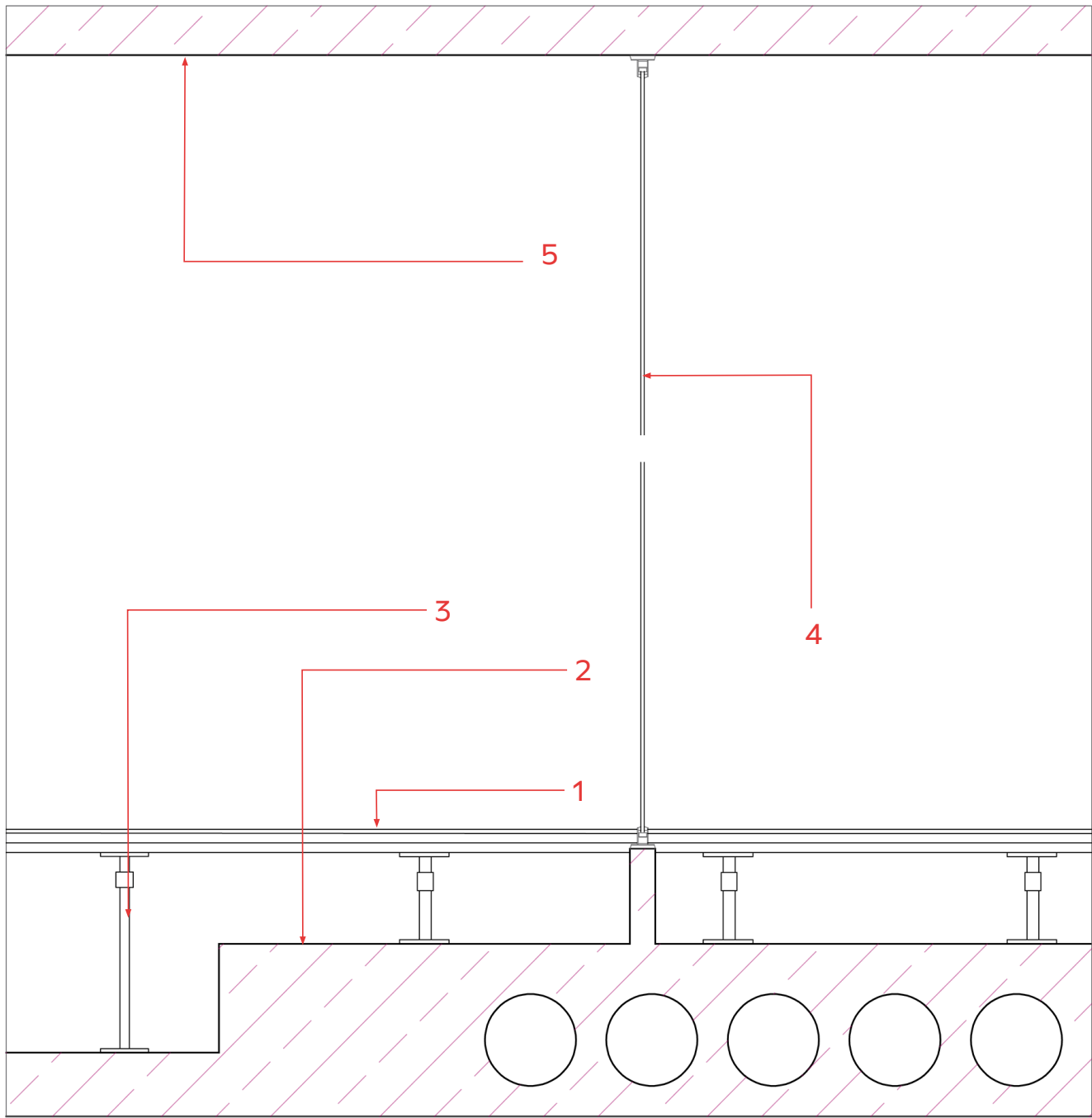






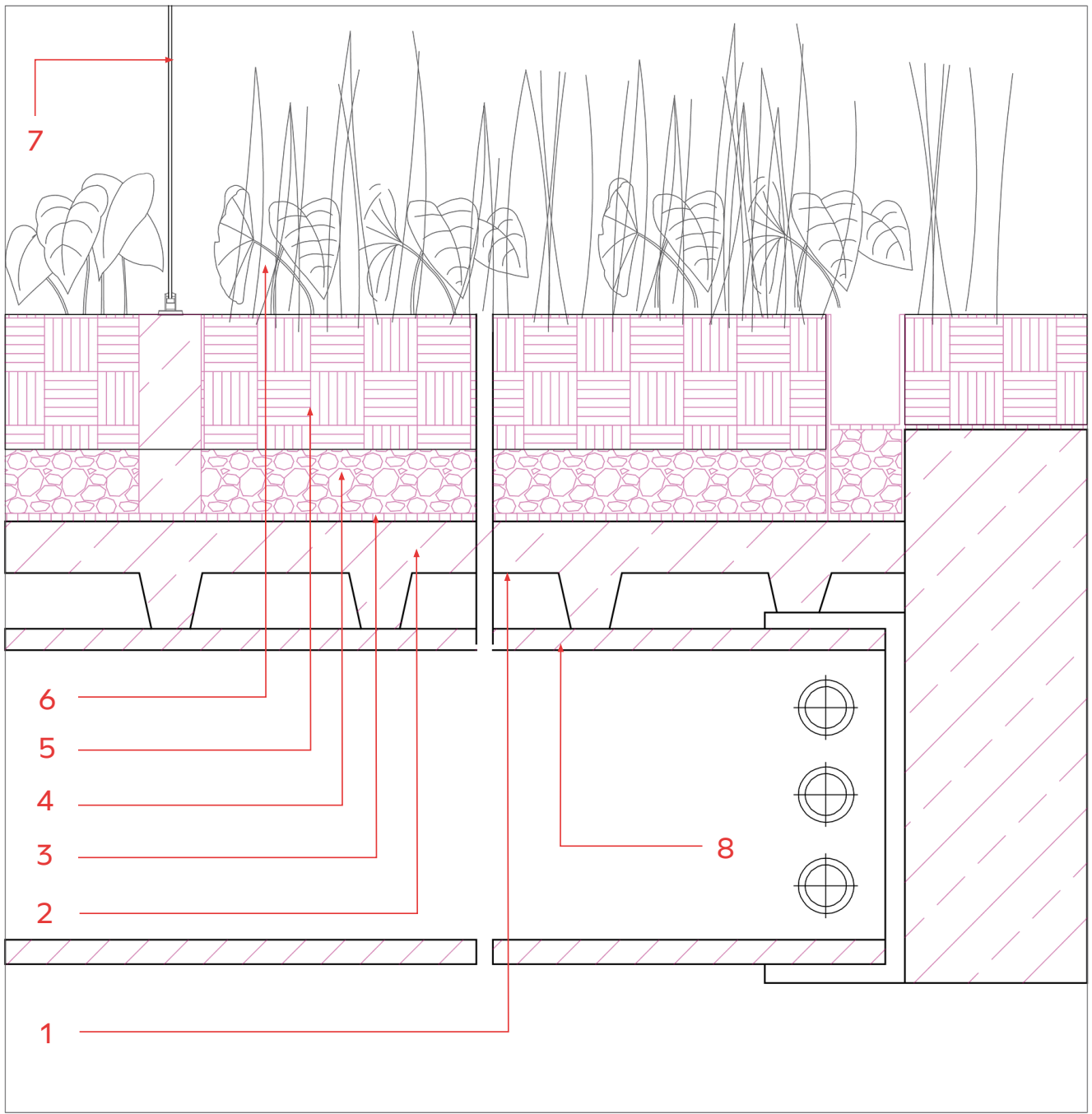






Interior Glass wall

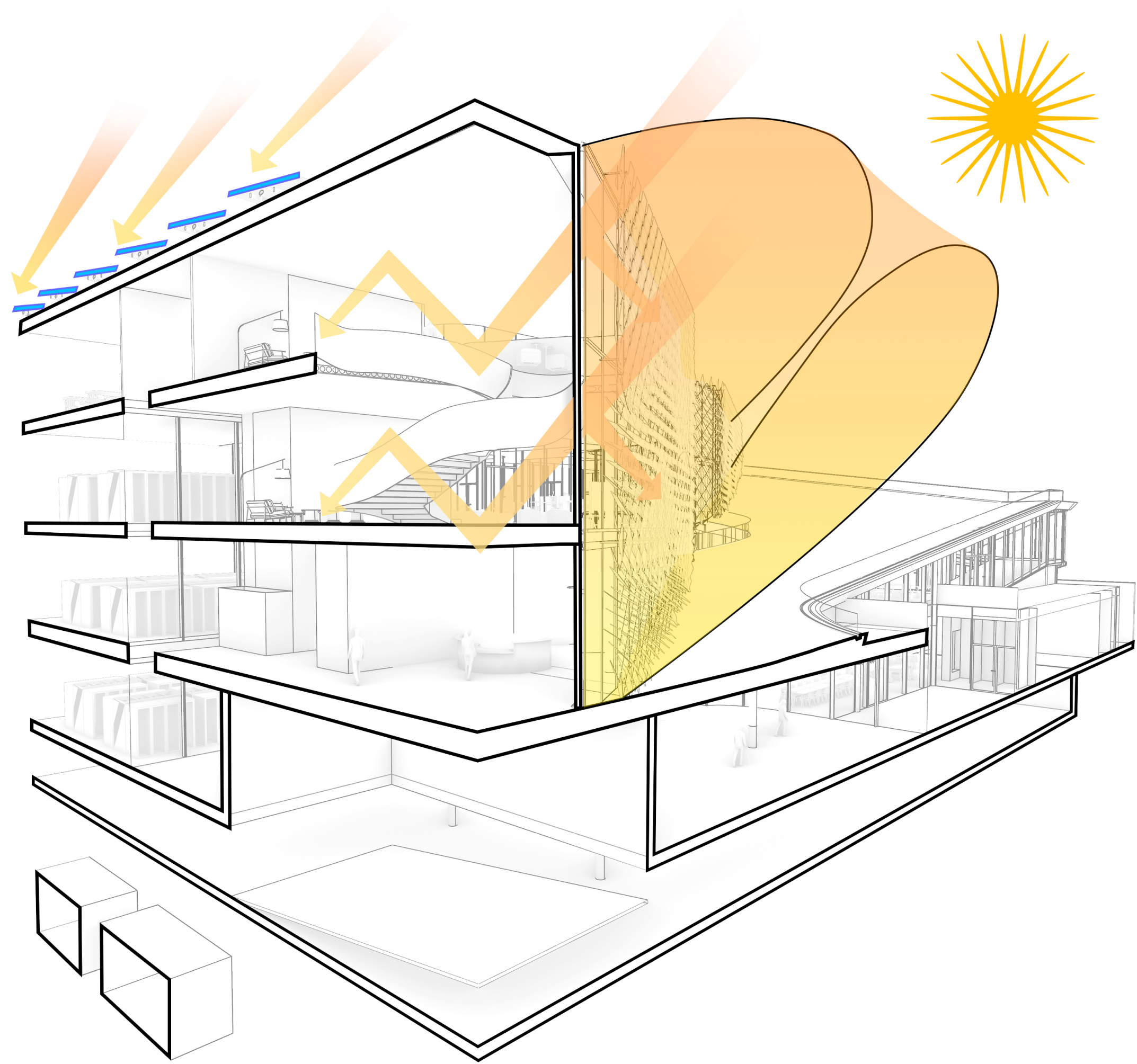
- 1. Raised floor system
- 2. Concrete slab 300
- 3. Adjustable pedestals
- 4. Tempered Glass for interiors
- 5. Concrete floor slab



Green roof slab

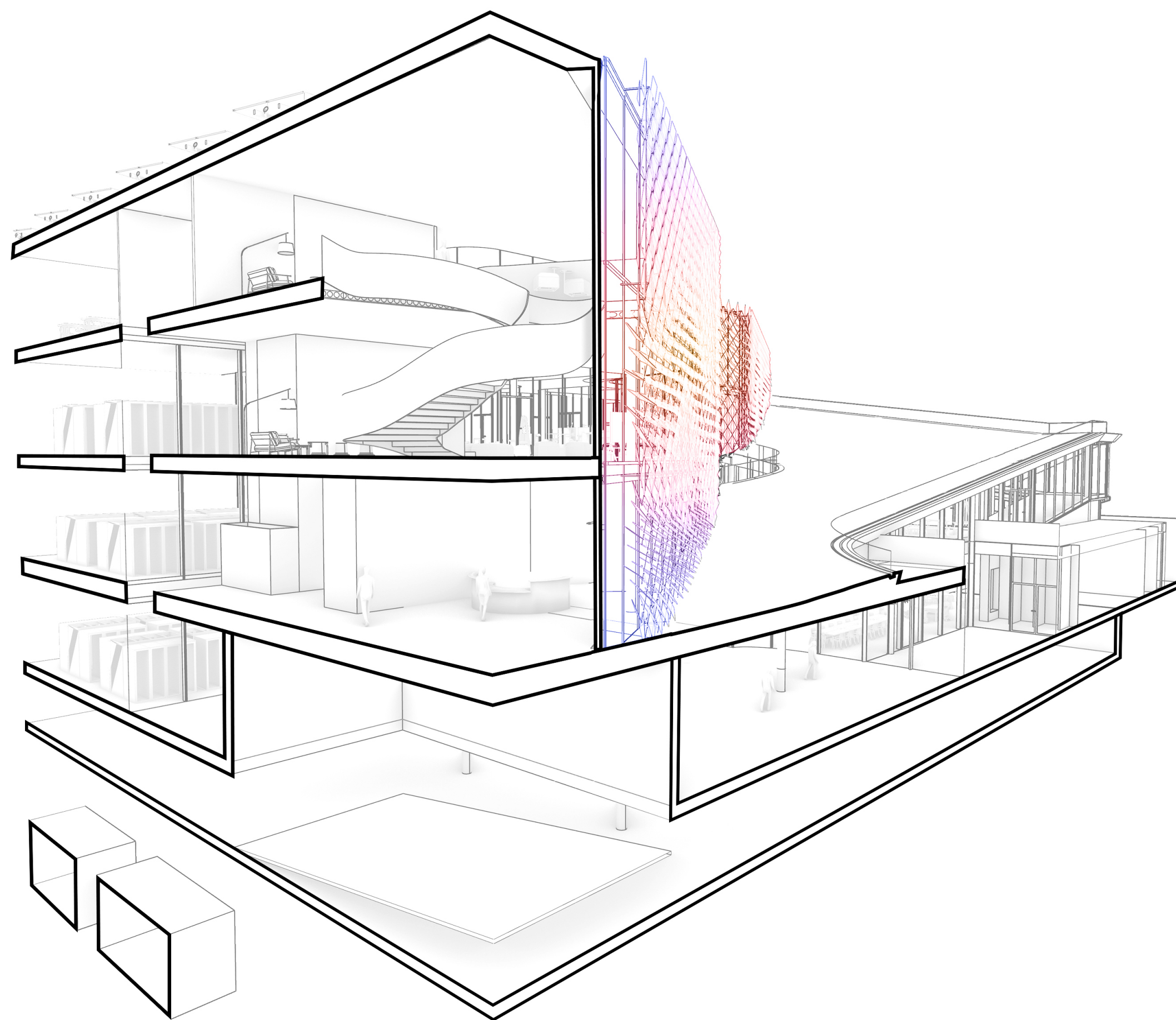
- 1. Steel decking
- 2. High performance concrete
- 3. Waterproof membrane
- 4. Drain filling
- 5. Growth medium
- 6. Plant cover
- 7. 12mm tempered glass balustrade
- 8. Steel bream connection





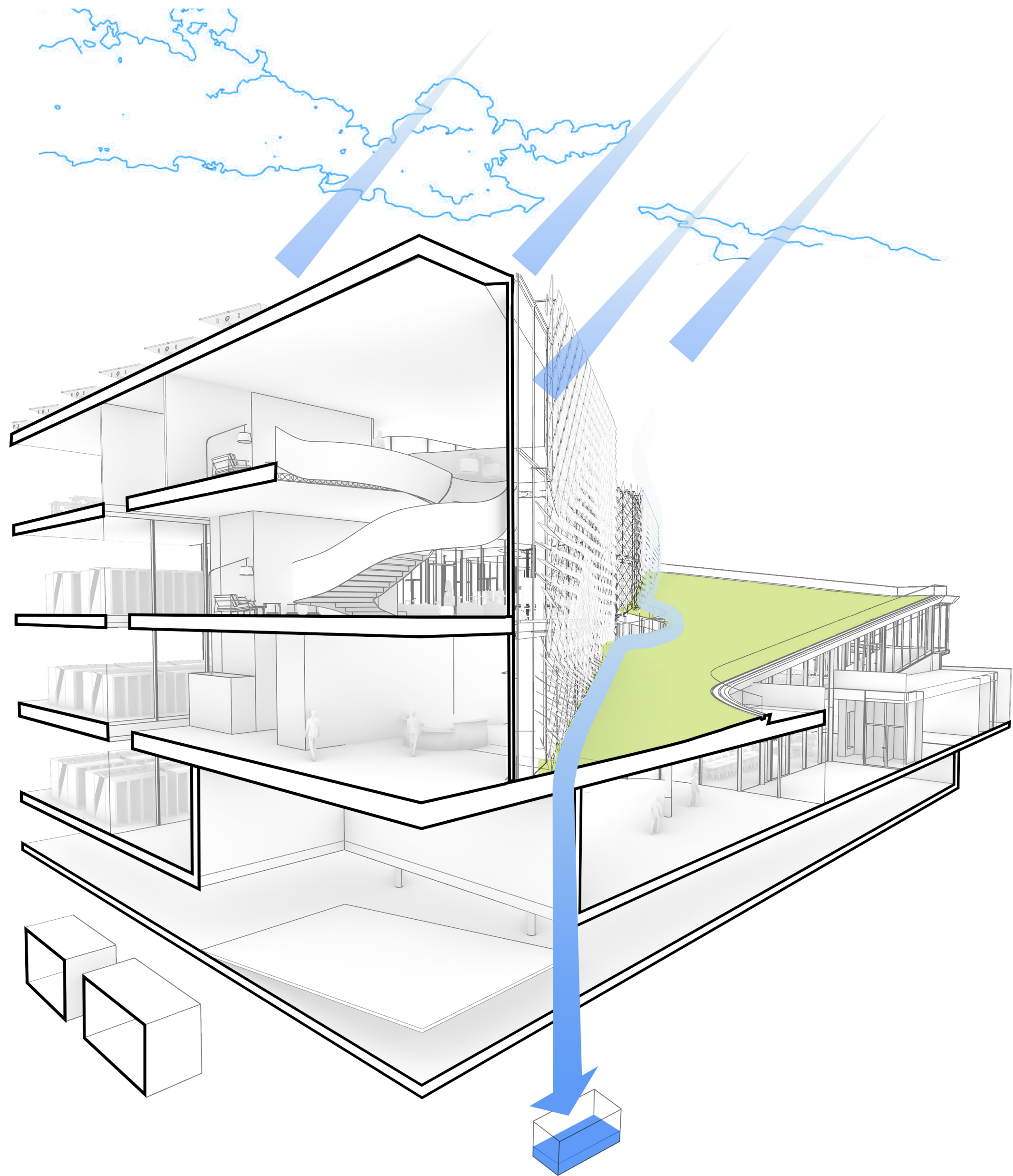
600 Sq. meters of photovoltaic panels are placed on the rooftop oriented based on the sun angle to maximise energy gain. Energy produced shall be used by the building's HVAC and lighting systems





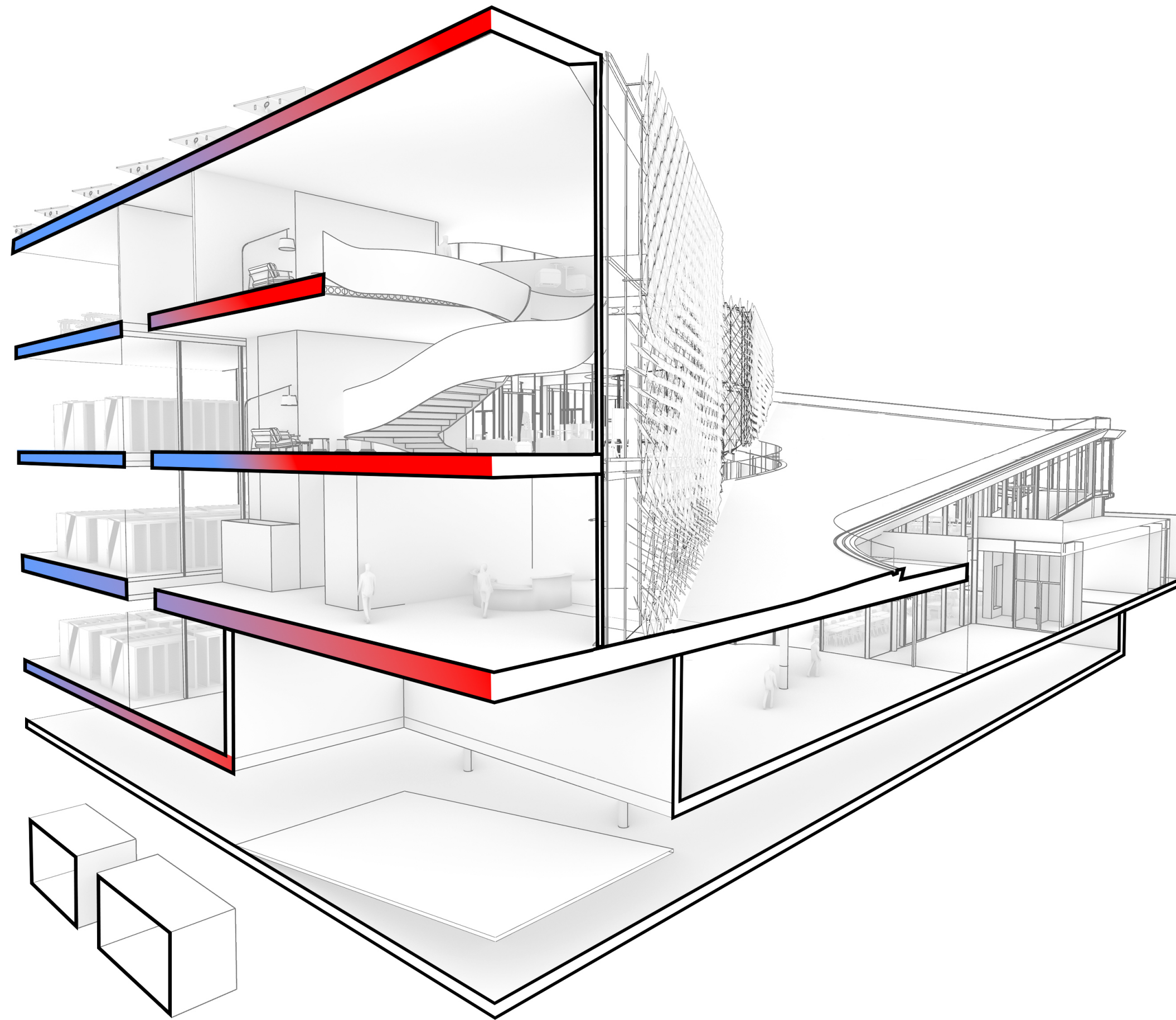
The facade panelling system was parametrically designed to densify the glass facade being exposed directly to the south sun. From top to bottom the panelling are randomly arranged based on the azimuthal angle of the sun





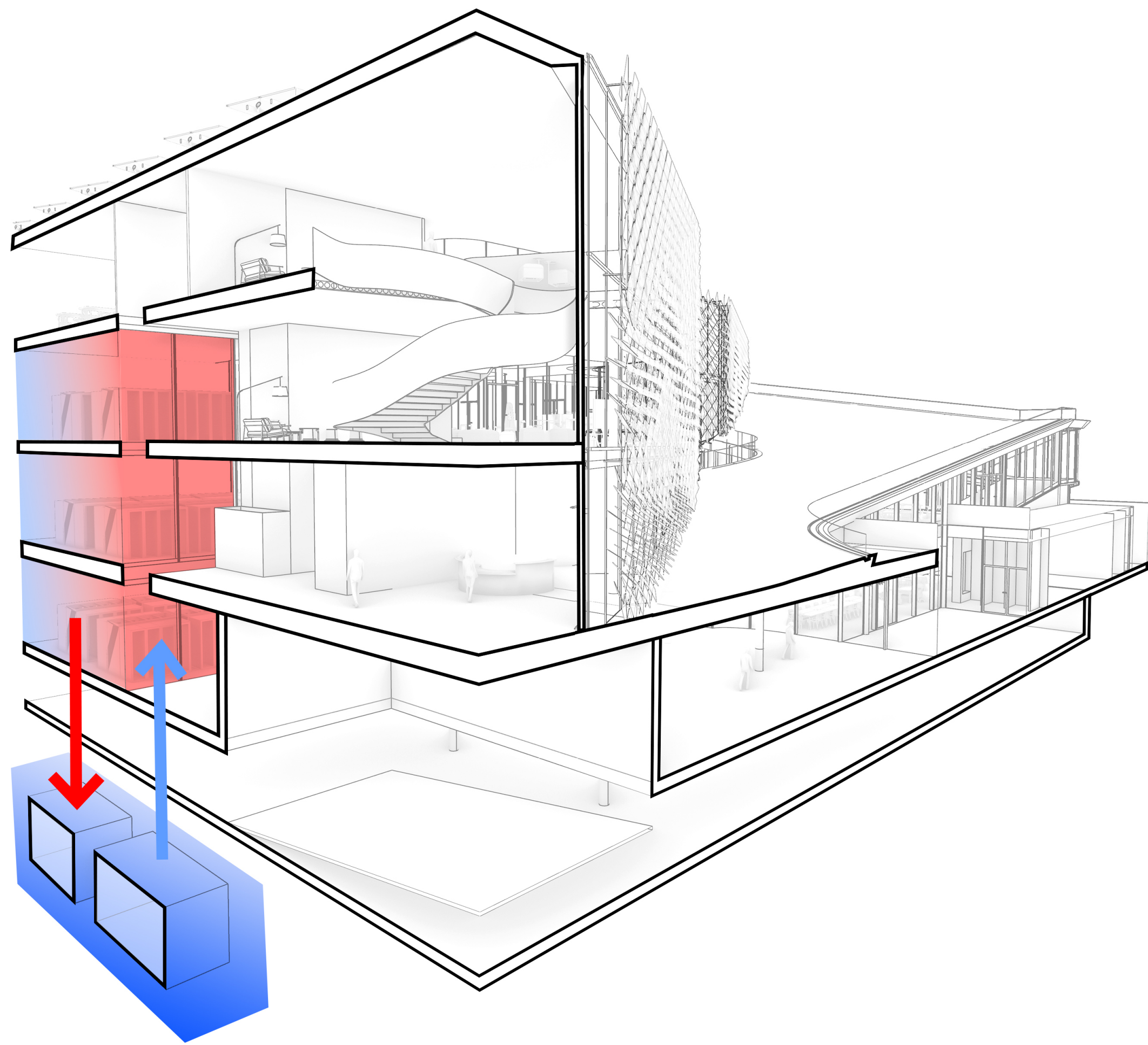
The rainwater system is designed to have the water runoff along the curved landscaped rooftop on both the edges next to the railings. The natural inclination of the roof also allows for water to be collected for usage as gray water





The concrete massing of the floor slabs and walls allow for the emission of heat/cold through the day, reducing the energy consumption required for cooling and heating





The data center's hot air is used as a form of heating during the winter through the aquifer energy storage system that reaches deep below the ground and is temperature controlled with water





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Explore Lab 35  
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