R E N
GUANGWEI

2019 - 2020 SELECTED WORK

Columbia GSAPP, M.S.A.A.D 2020'

PROLOGUE

Thank you for reading my portfolio.

This portfolio includes all my work during GSAPP MSAAD program.

It includes three design studios in three semester, the ULI competition project, and three visual studies.

I would like to exoress my sincere gratitude towards all my instructors and teammates.

DESIGN STUDIO

COMPETITION

VISUAL STUDIES

PROJECT 01

Urban Palimpsets

Karla Rothstein Studio Work, 2019 Summer
Group Work
GSAPP ABSTRACT

In addition to receiving the remains of the deceased, buriad grounds have synthesized spiritual conceptions and aesthetic tendencies across time and culture. As such, the urban and architectural spaces of death and remembrance embody evolving priorities, shifting practices, and external presseures, including dramatic displacements, replacements, and renewals. Both physically and figuratively, the urban cemetry has oscillated between central and marginal, celebrated and disregareded, democratic and elitist. Projects in this section translate the existing programs of Sara Delano Roosevelt Part in Manhattan's Lower East Side - interweaving public activities with a new form of sustainable cemetery for the 21st century city. We explore how systems of relationships inform structures of space and social interaction, how complex phenomena emerge out of precise organizations, and how strategic rules function to promote exploration and surpass perceived limits.

Site Analysis

This is an analysis of programs' space and time. Currently the community next to Sara. D. Roosevelt Park is diverse, which leads to the complexity and density of programs. Respecting local culture is important for an urban cemetery.

Current Daily Activities

Current Weekly Activities

Current Annual Activities

Proposed Daily Activities

Proposed Weekly Activities

Proposed Annual Activities

Performance

Museum

Gallery

School

Historical Landmark

Church
Islamic   Catholic   Buddhist

Community Center

History Analysis

The history of Sara. D. Roosevelt Park is mainly composed by four phases: Farmland, Cemetery for African American, Vertical Housing and Playground. Rather than masking the history, the new cemetery should critically tell the old story of the site because the history itself is also about death.

PlayGround

Housing

Cemetery

Farmland

2010
2000
1990
1980
1970
1960
1950
1940
1930
1920
1910
1900
1890
1880
1870
1860
1850
1840
1830
1820
1810
1800
1790
1780
1770
1760
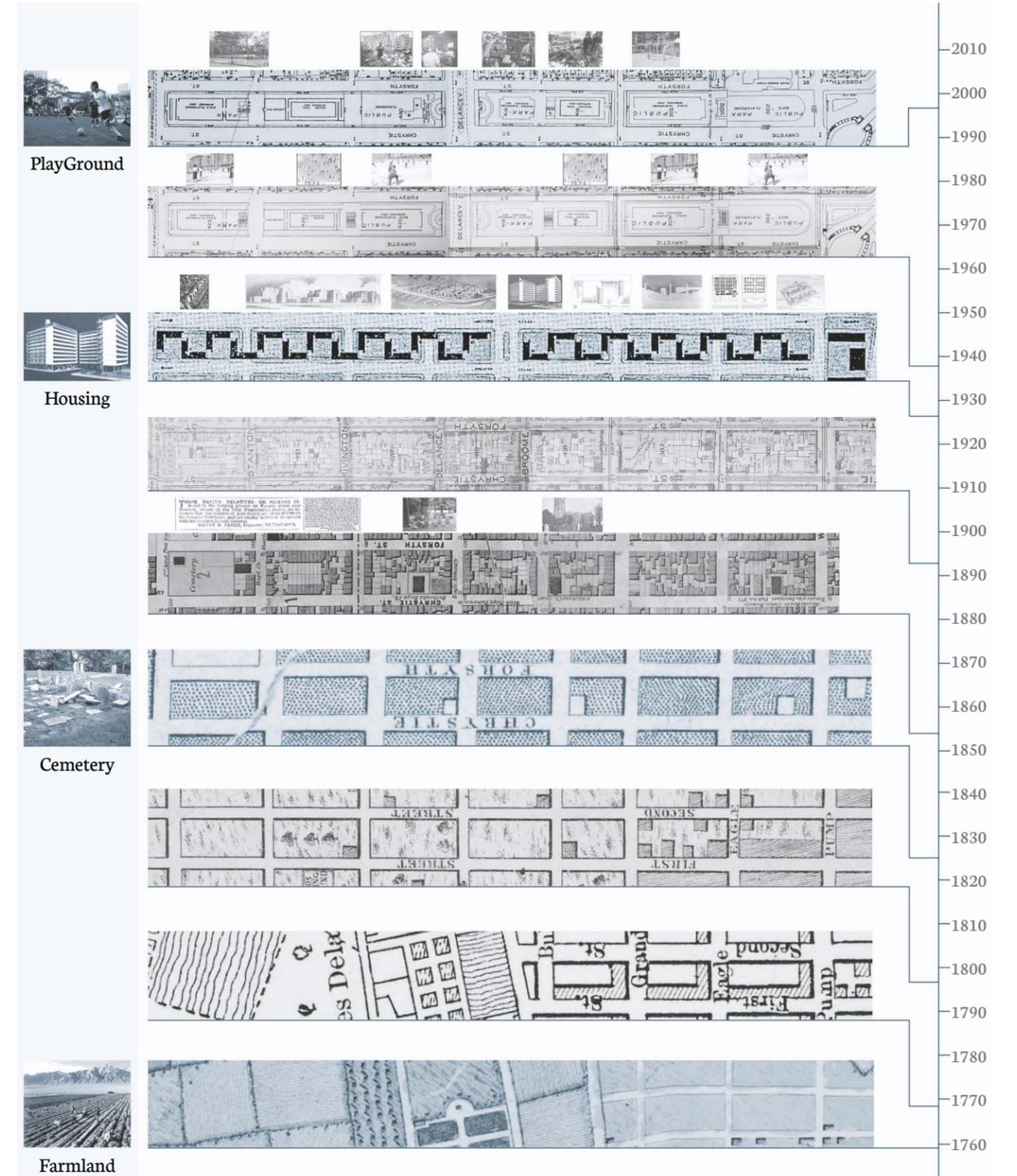
Data Map of Weekly Activities

The Sara. D. Roosevelt Park is divied into four blocks. We datamined the number of people in each block in different times. The axis means Monday to Sunday, while the number of people in 24 hours in a day is the radius of circle. From this we could make sure which parcel of land should be reserved.
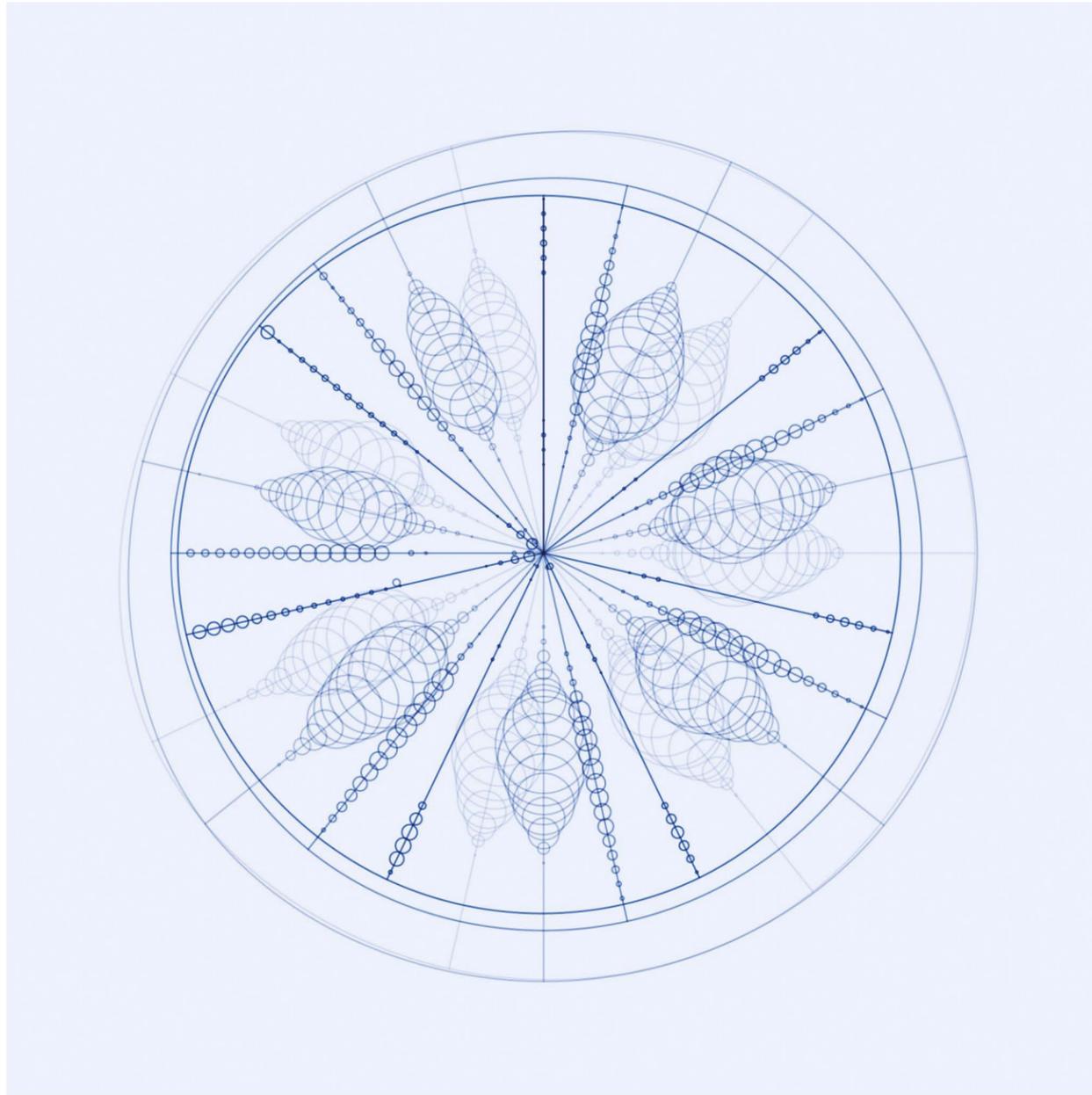
Data Map of Immigration History

Manhattan Downtown has a beautiful history of immigration. During different time, different ethical groups immmigrate here. which are represented by color coding. The bars downside means total volume of immigrants and several important history events.
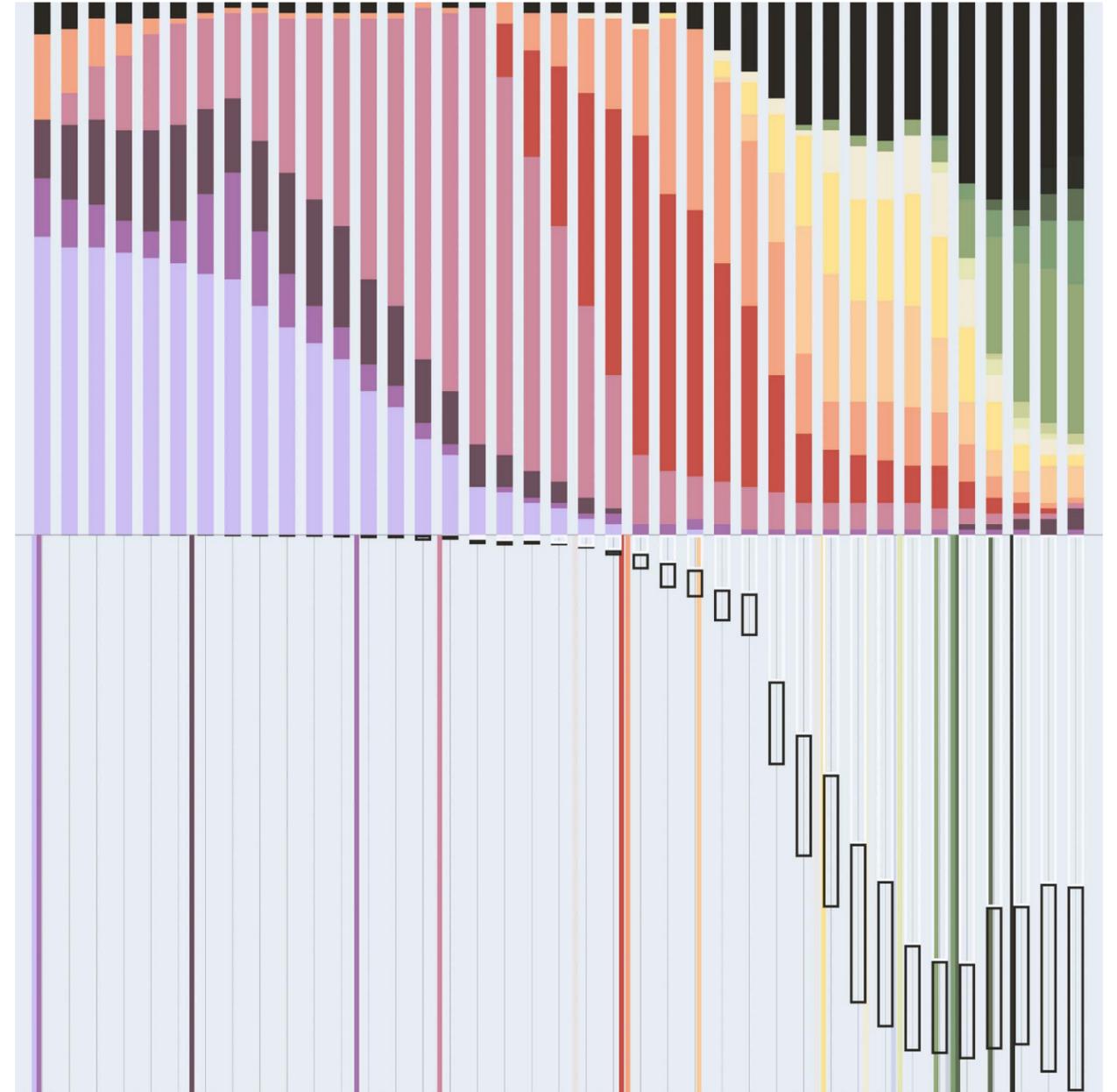
Conceptual Collage

The main concept for this project is to creating a vertical framland of cemetery. It will not only keep the activities currently happening on the site but also benefit the community for its sustaniable method of disposing and creating a notable symbolic system considering the diveristy of Manhattan downtown.

Site Axono

From the collage concept to the concrete urban spatial relationship, it is an infrastructure connecting the whole site of the park. Its verticality evades and respects the current condition. Diversity of programs and diversity of plants' pallet reduces the heaviness of death in urban context.
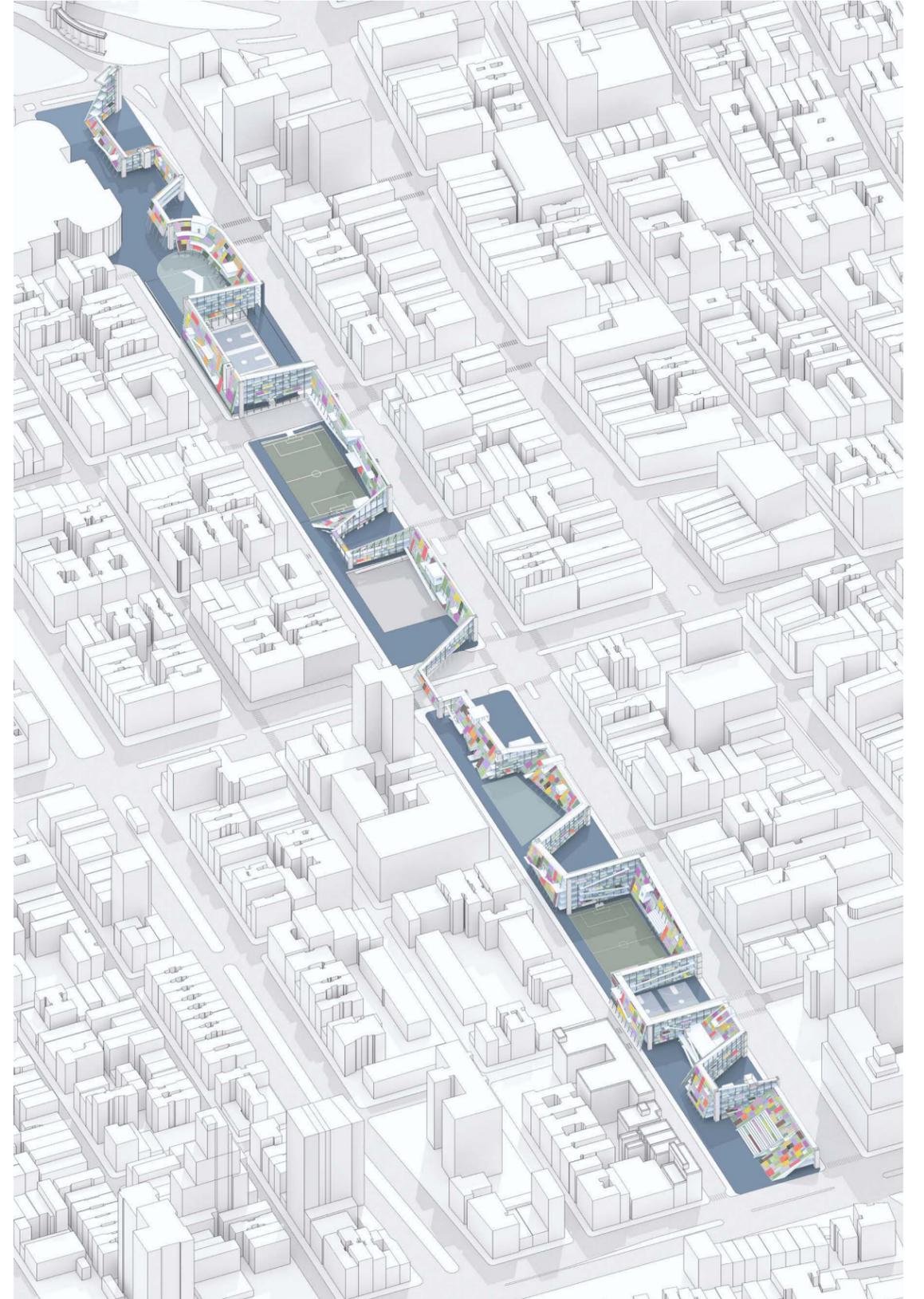
Zoom-in Plan

It is an extremely thin infrastructure. Playgrounds
are kept, and some slopes connecting the circulation
on the grounds and the upper-floor corridors. Pallet
abstractly conceptualizes the plants.
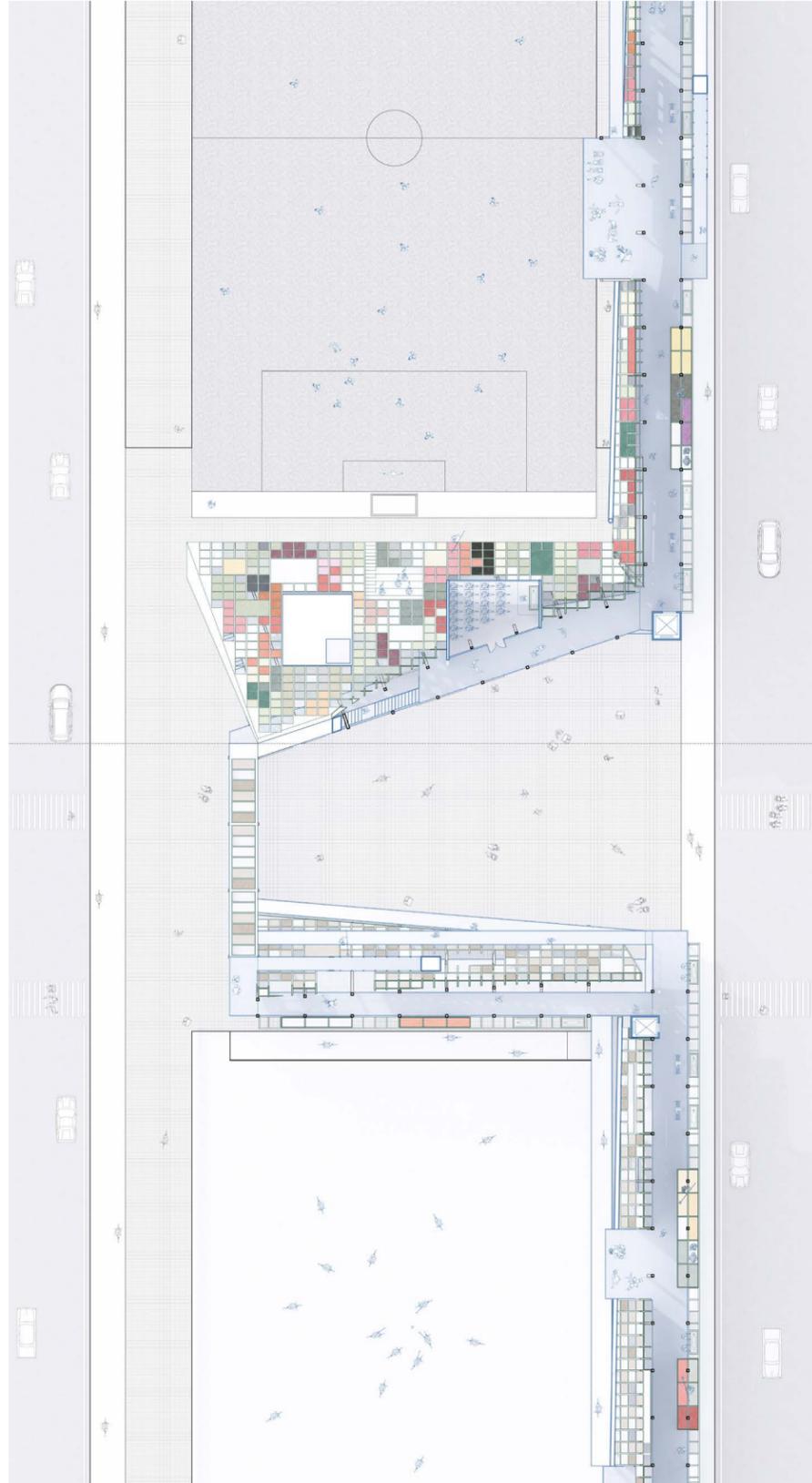
Zoom-in Section

The upper section shows what people do relating with this infrastructure.
Not only people in it perform with the death, but also people in urban context,
whose activities are even benefited from a vertical cemetery. The section below
shows how the seasonal change affects this "farmland".
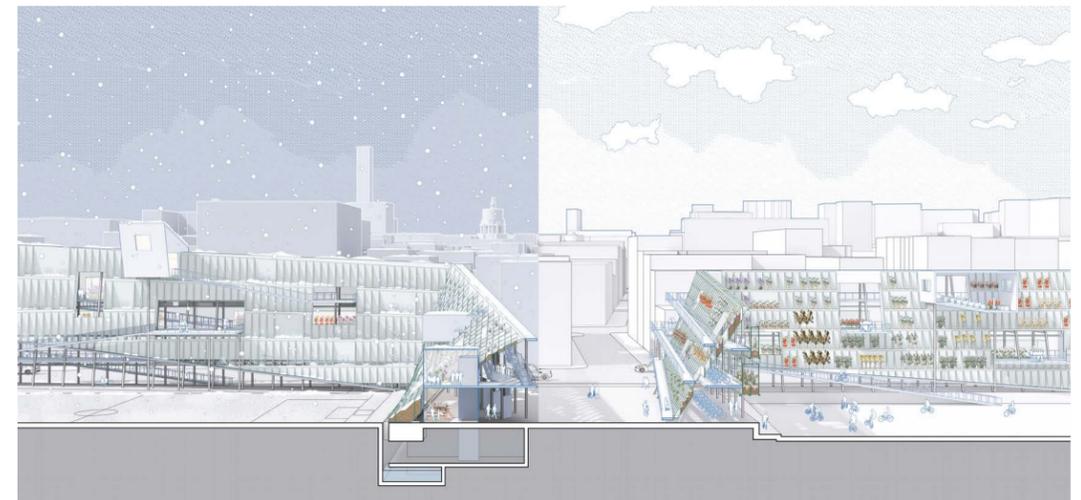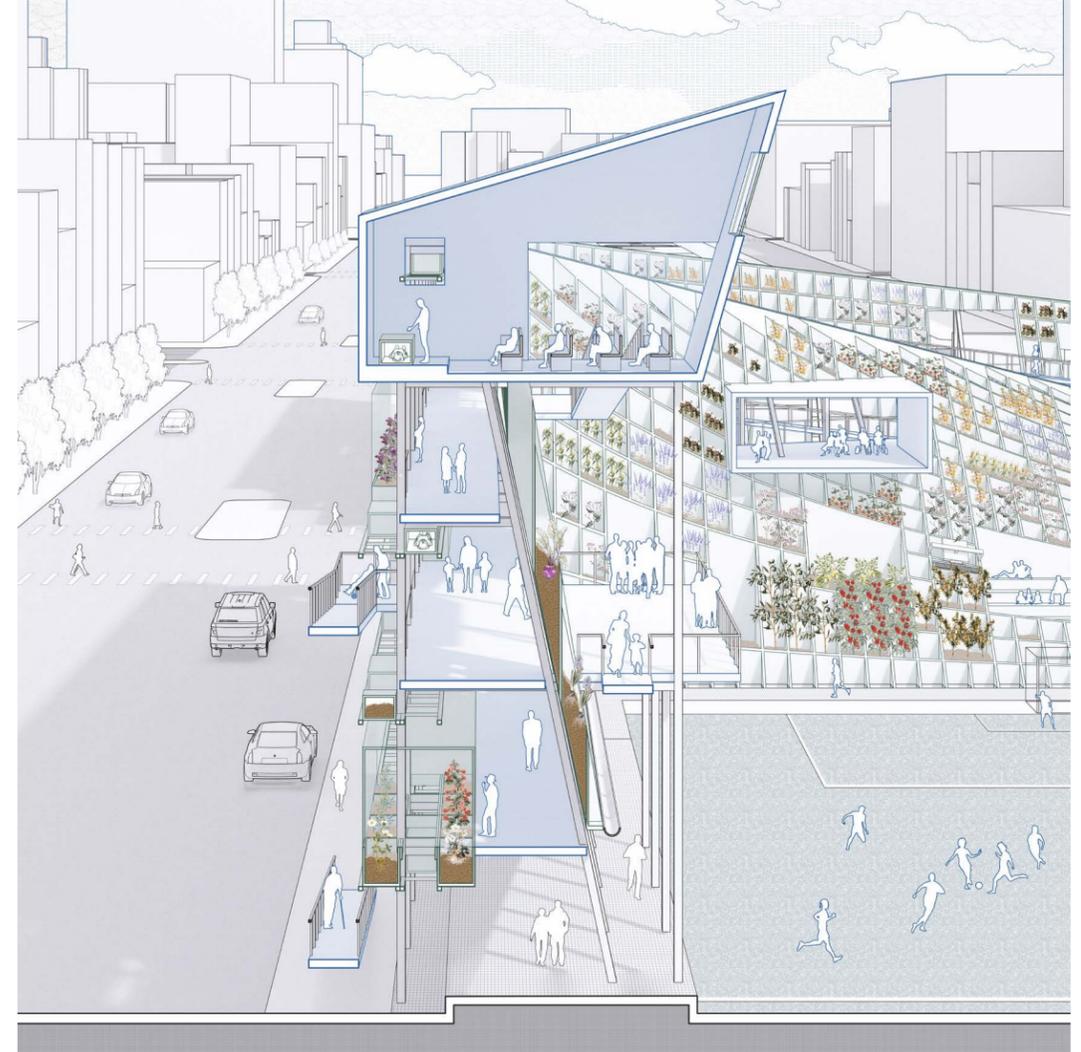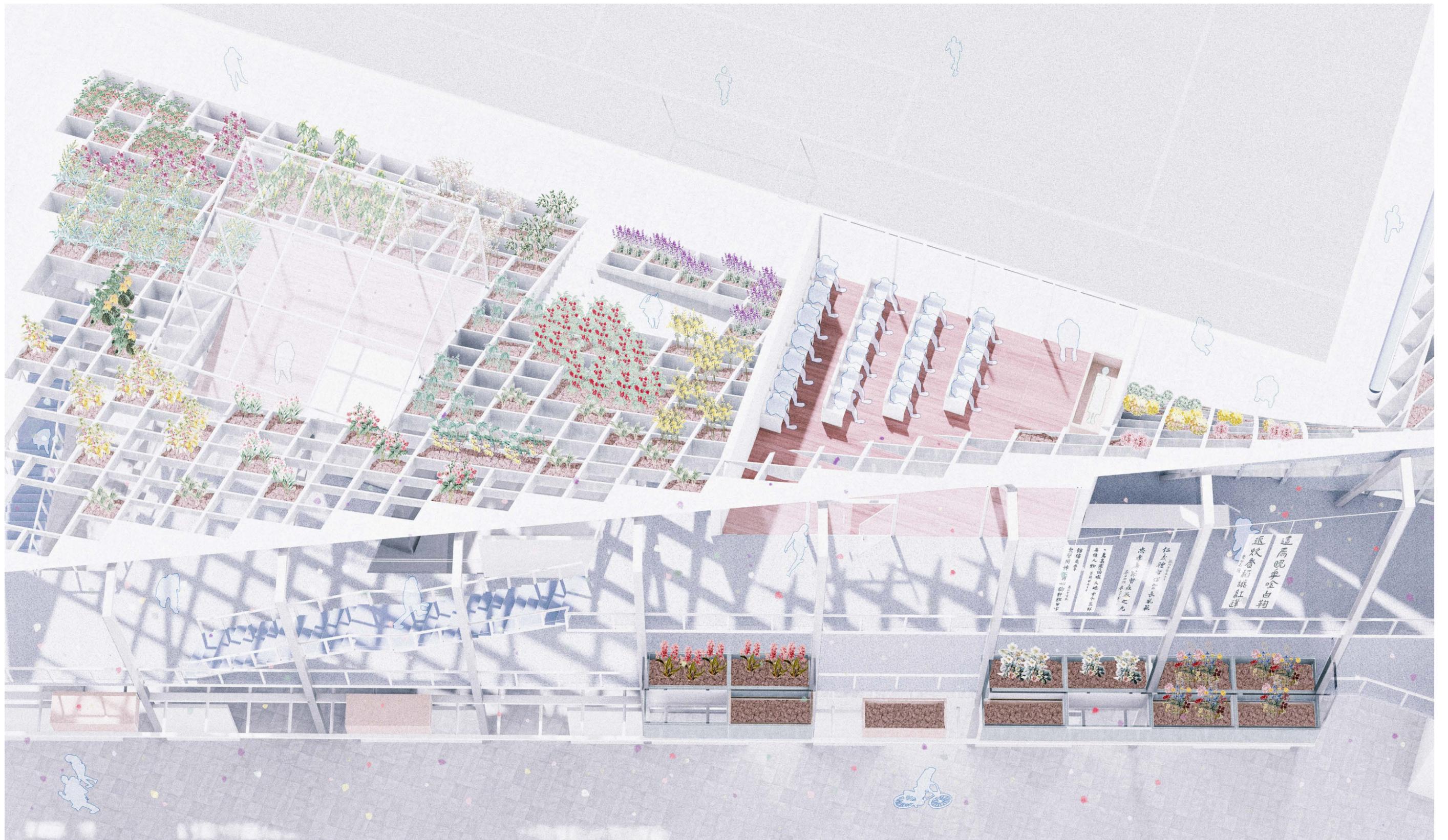
Appeasing the Pain of Death

The affect of the vertical cemetery finally provides a romantic scenery for the site.
Death and lost are pathetic, but the memory is converted to these plants, which then collectively create us this wonderland in city.

PROJECT 02

The Dialogue

Bernard Tschumi Studio Work, 2019 Fall
Group Work
GSAPP ABSTRACT

Relationships between architecture and furniture are explored in two ways:

The first one is that furniture follows architectural element, in which architectural element is axiomatic but use of space is flexible.

The second one is that architectural element follows furniture, in which furniture is axiomatic and use of space is determinate.

Site Strategy

The site of this project is not a real one. It is a typical Manhattan block, with 20 meters wide and 60 meters long. Dividing it into two parts, the dialogue between two strategies can be developed.

Volume   Split   Gap   Transportation
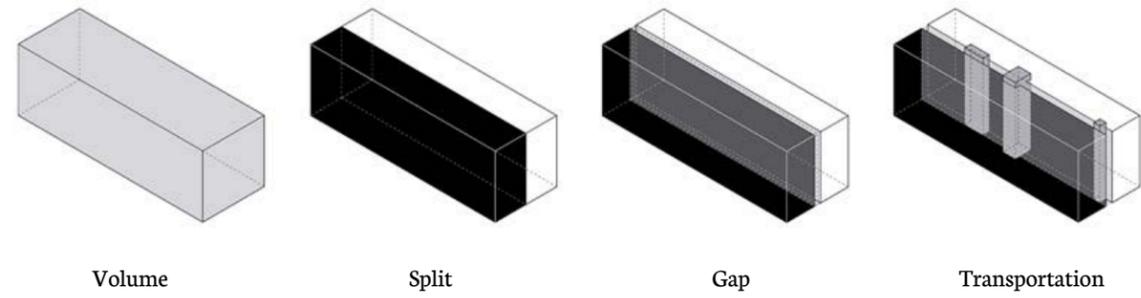
Archive of Furniture

Inspired by the theory of Kolb's Learning Styles, we designed a set of furniture. They are related with different activities of users.
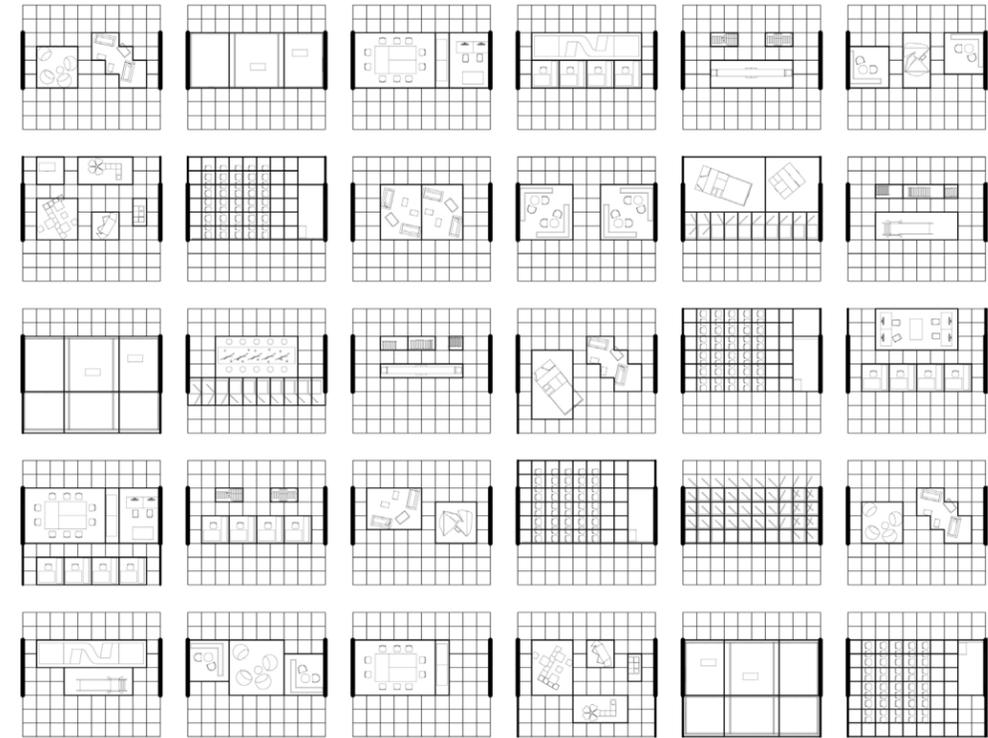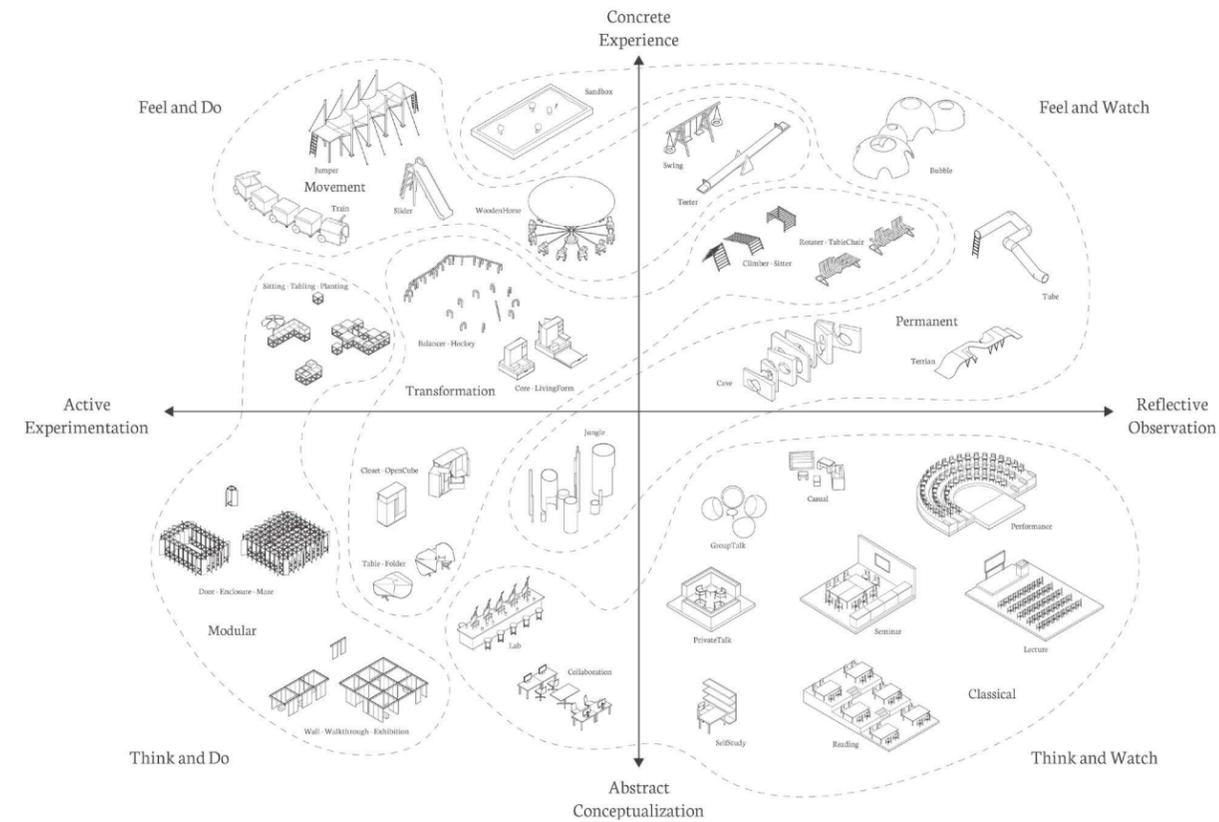
Diagram A - Furniture Follows Architecture
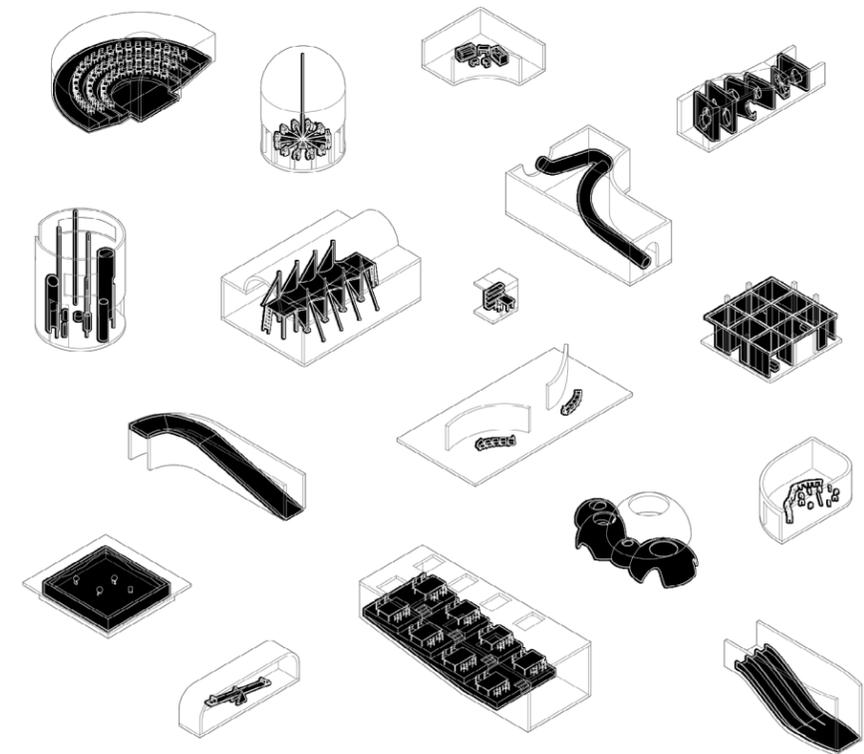
Diagram B - Architecture Follows Furniture
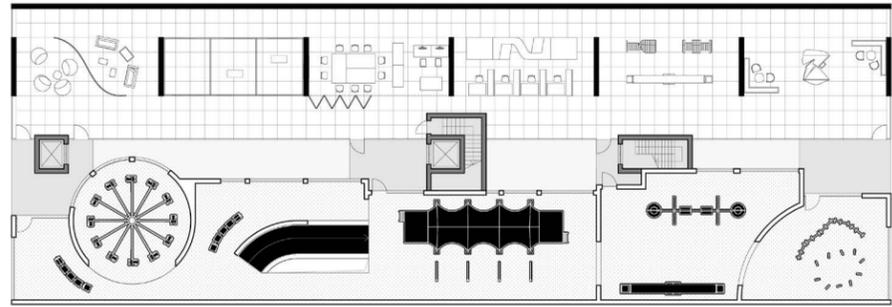
Ground Floor Plan
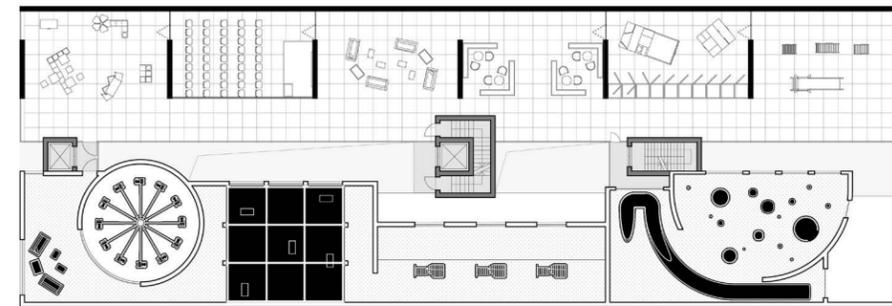
First Floor Plan
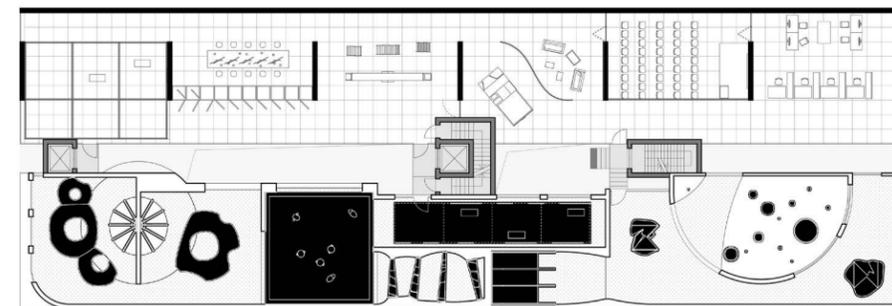
Second Floor Plan
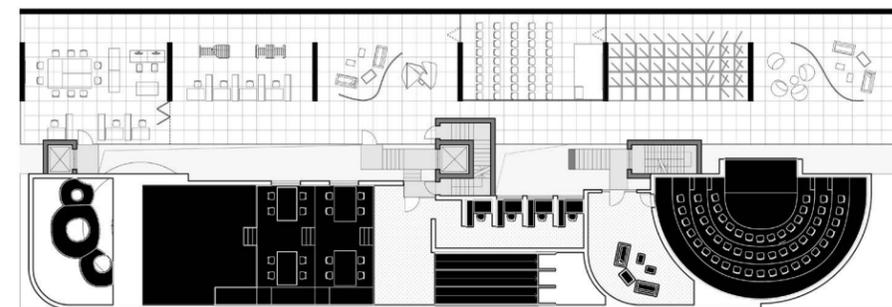
Third Floor Plan
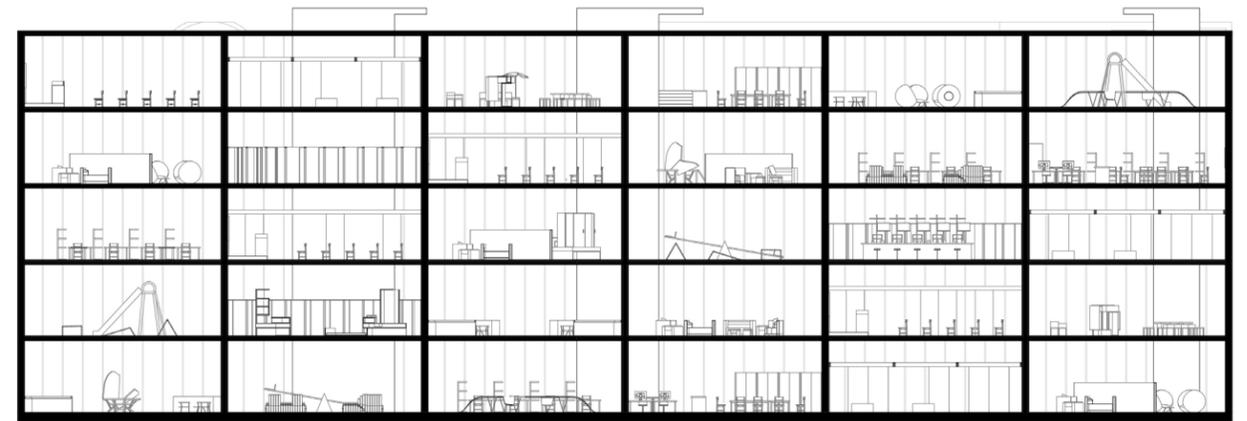
Long Section A - Furniture Follows Architecture
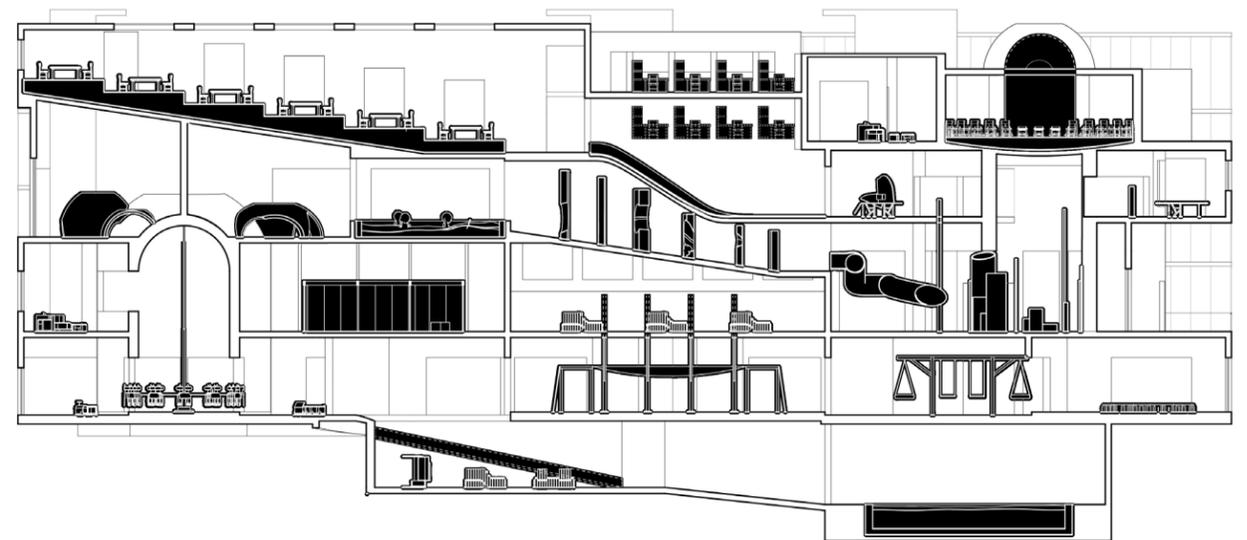
Long Section B - Furniture Follows Architecture
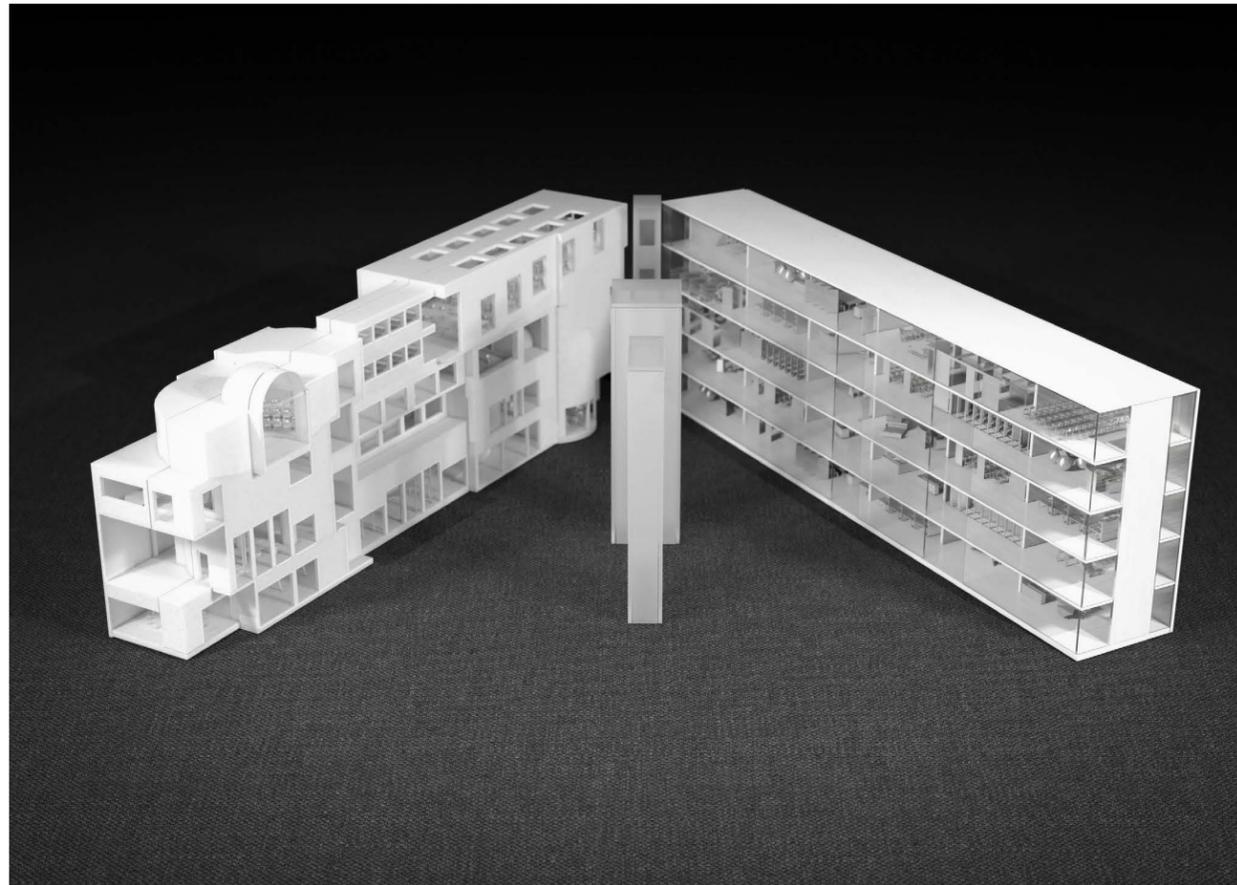
Dialogue

These two relationships between architecture and furniture are both contradictory and complementary with each other.
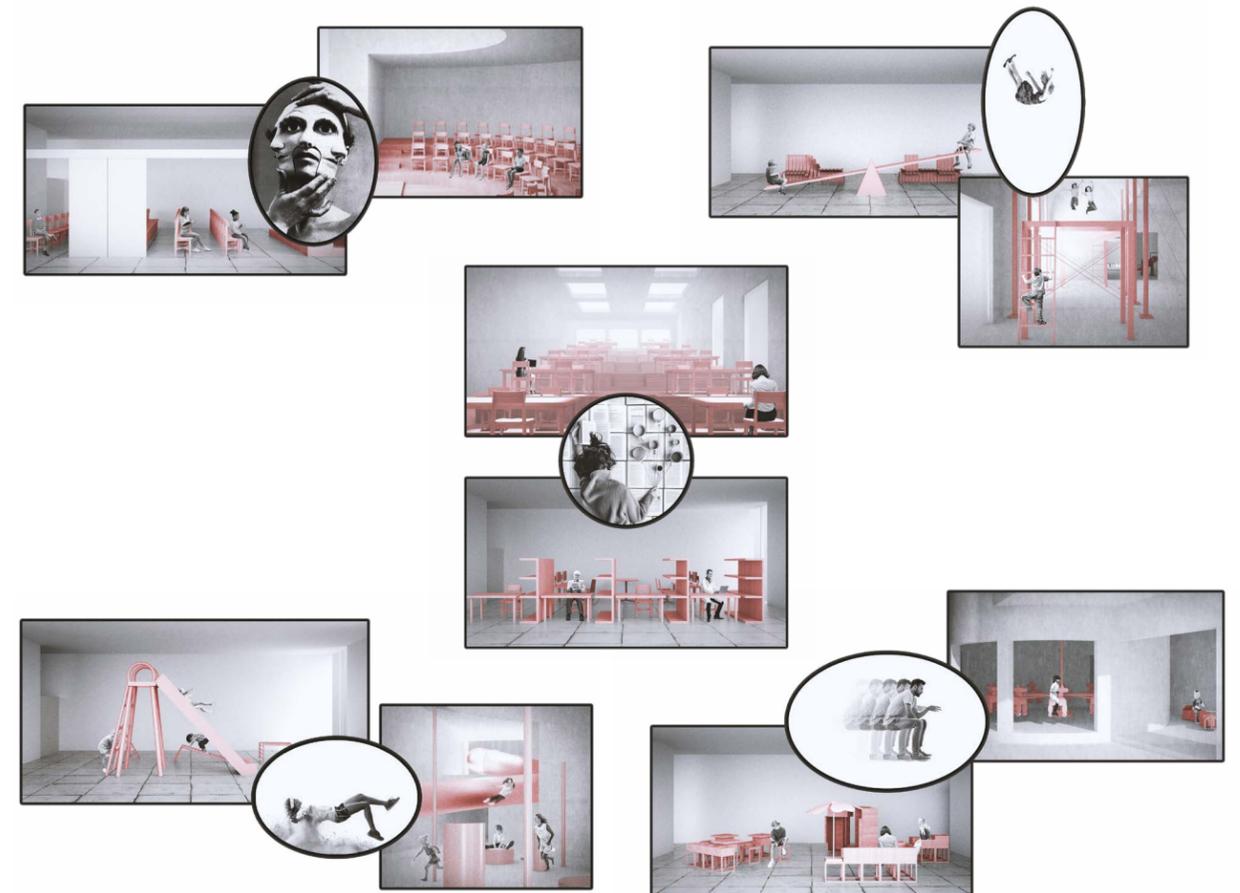
Conclusion

If furniture follows architectural element, although it seems that furniture is not determined by itself, but as the multiple use of space is kept, the combination of furniture is free, and the common notion of furniture is intact. However, if architectural element follows furniture, although it seems that furniture is predominant, but as the form of space and its program is unitary, each type of space is only suitable for certain furniture, the furniture may become a part of architecture.
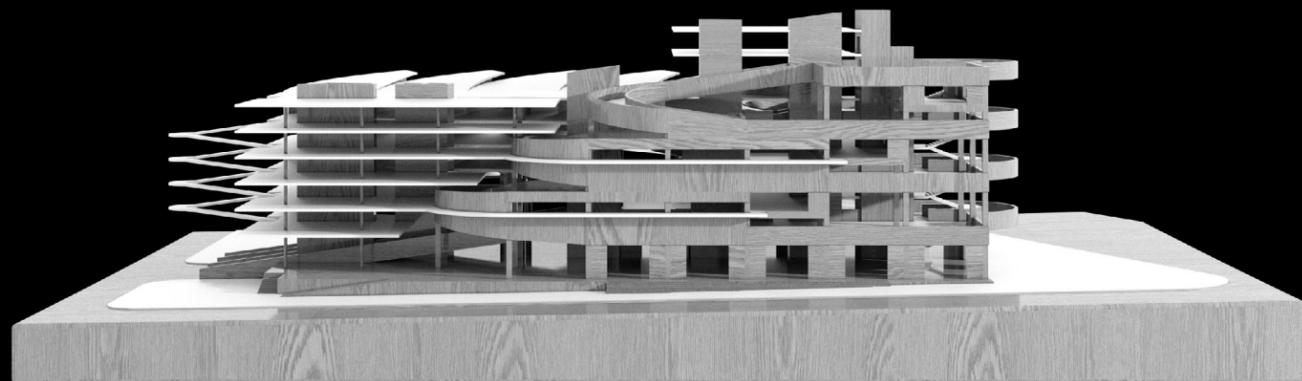
PROJECT 03

Bifurcator

Hilary Sample Studio Work, 2020 Spring
Individual Work

The duality of people and vehicles' movement, and the interaction between them could generate unusual formal/spatial identity.

In the city, they are parallel with each other. While in this building, they are mixing, dividing, interlaying reflecting with each other. By mixing, at some moments the boundary between people and cars are ambiguous. By dividing, one movement is totally hidden from another. By interlaying, the relationships are multiplied to enhance the experience. By reflecting, movement on another layer could be implied rather than directly observed. Since the difference of these two movements are correlating with different architectural language, the building itself is both in geometrical and compositional complexity.

Site - Parking

Main Avenue - Pedestrians and Vehicles
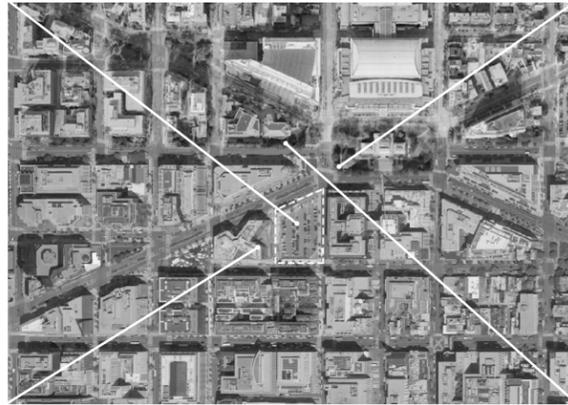
Washington DC Downtown

New - Commercial of Washinton DC

Old - History of Washington DC

Reconstruction of the Duality

Now, the site is a parking area, only accessible for vehicles/drivers.

In the urban space of Washington DC, which case is also similar in other cities, pedestrians are in parallel with vehicles.

This design is simply to reconstruct the relationship between them in three dimensions.

In the city, they are parallel with each other. While in this building, they are mixing, dividing, interlaying reflecting with each other. By mixing, at some moments the boundary between people and cars are ambiguous. By dividing, one movement is totally hidden from another. By interlaying, the relationships are multiplied to enhance the experience. By reflecting, movement on another layer could be implied rather than directly observed. Since the difference of these two movements are correlating with different architectural language, the building itself is both in geometrical and compositional complexity.

Car Slope A
Down
Radius: 32 Feet

Car Slope B
Up
Radius: 23 Feet
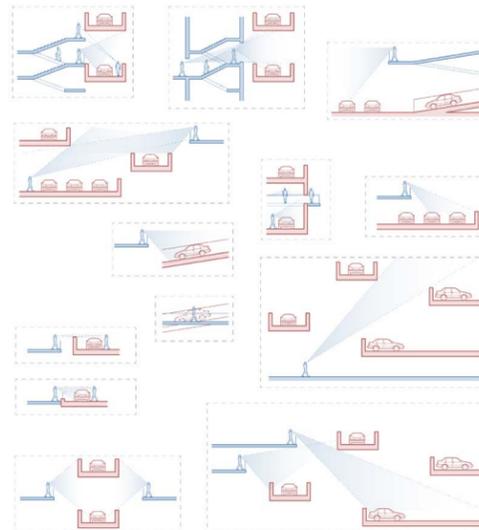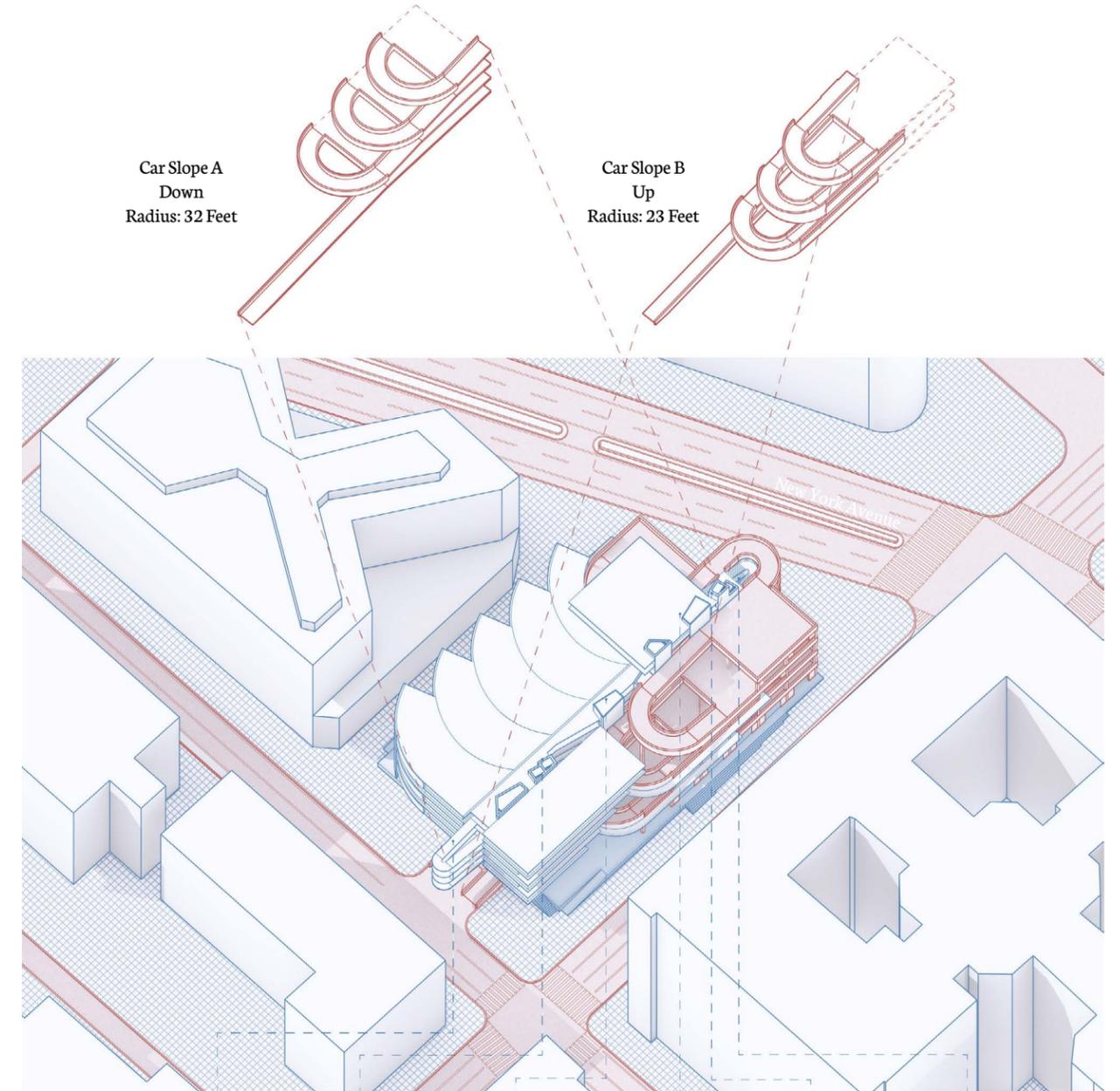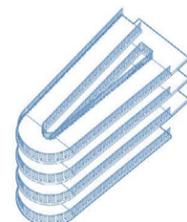
Experiential Ramp
7% Slope
90 Inches Wide
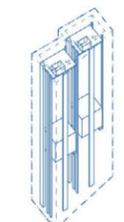
Double Escalators A
For Pedestrian
Ground to 6 Floor

Stairwell A
For Pedestrian
Ground to 6 Floor
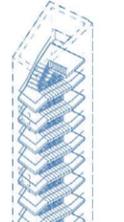
Stairwell B
For Driver
Ground to Top
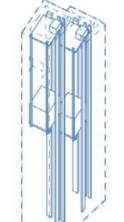
Double Escalators B
For Driver
Ground to Top
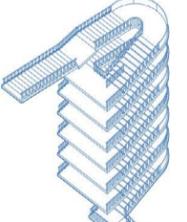
Experiential Staircase
15 Inches Step
90 Inches Wide

Street Corner
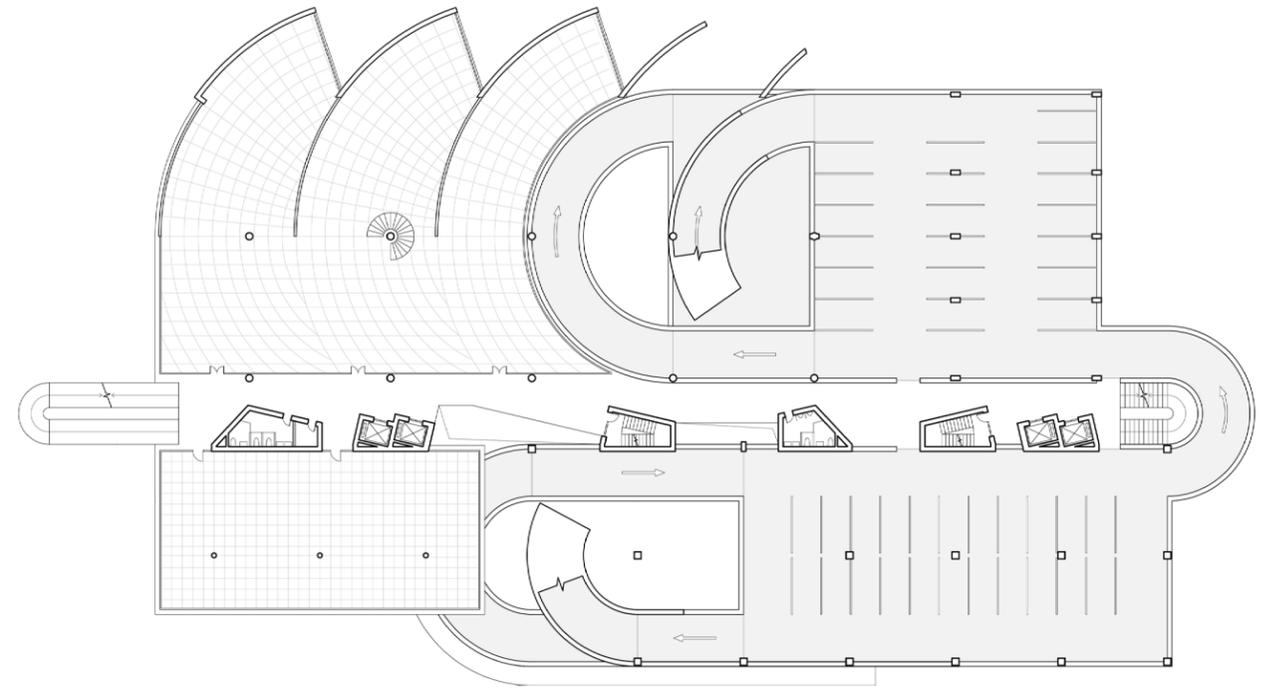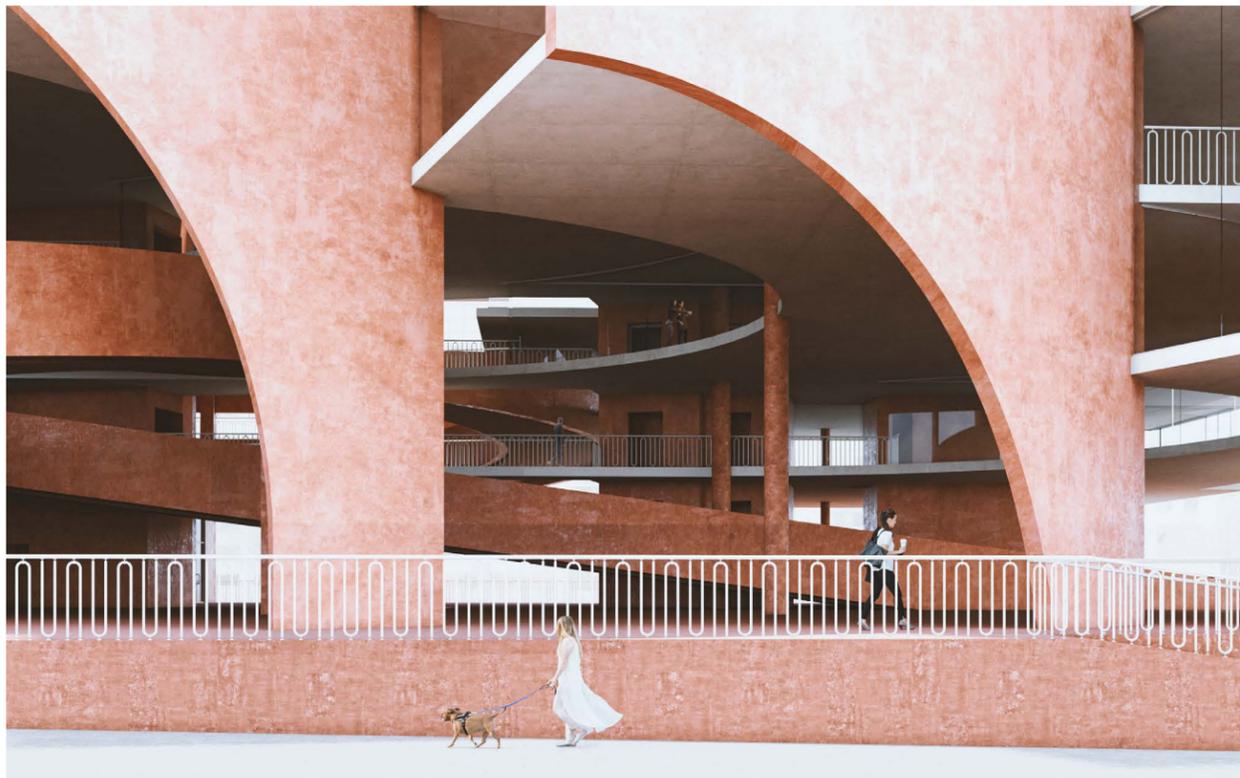
Aisle
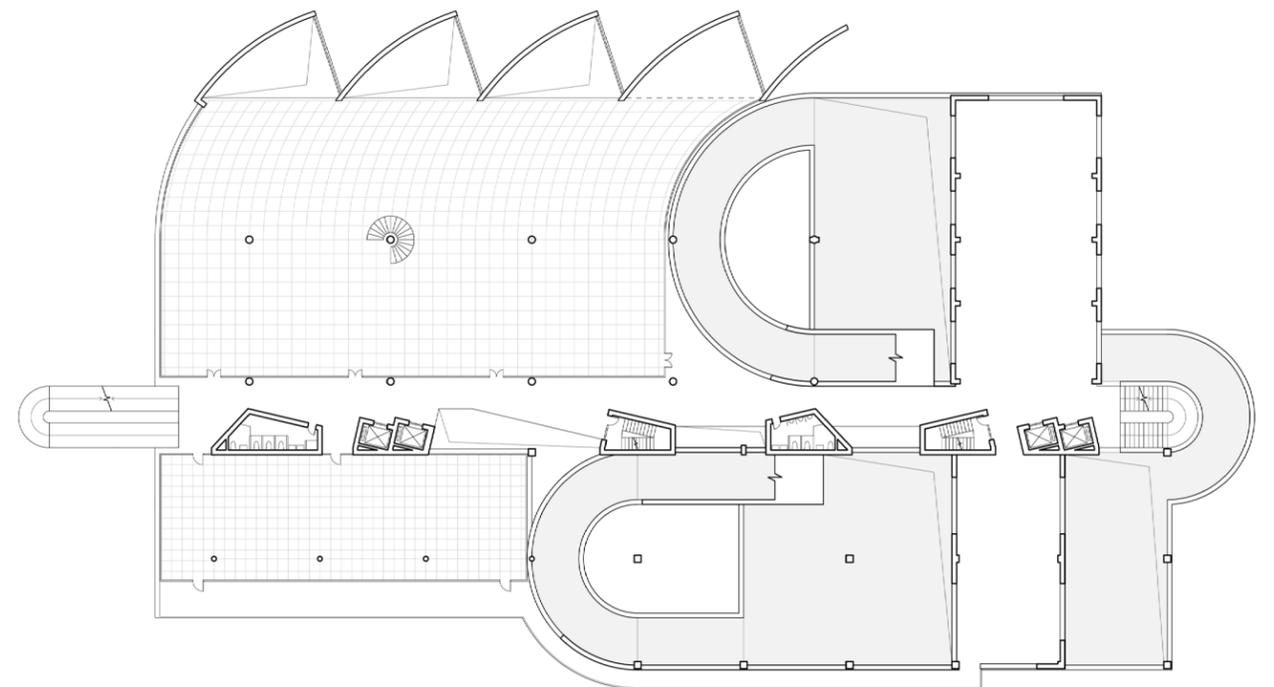
3rd Floor Plan

4th Floor Plan

Parking Space
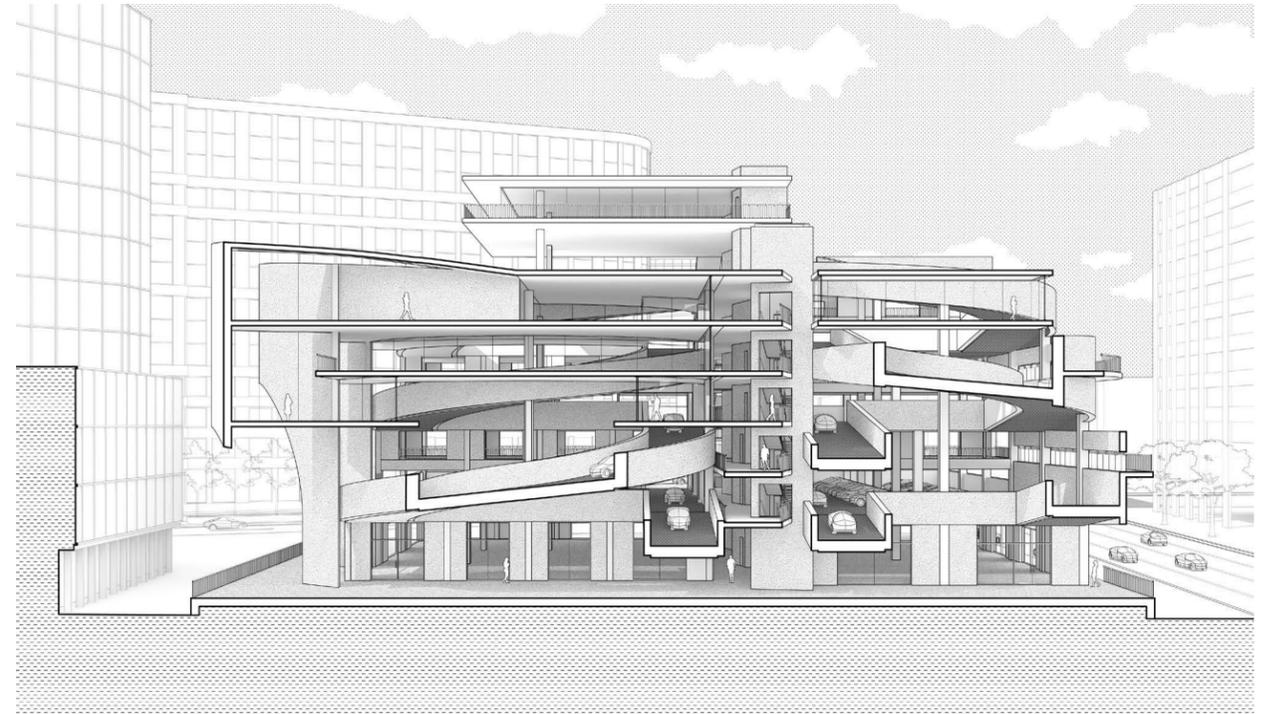
Cross Section
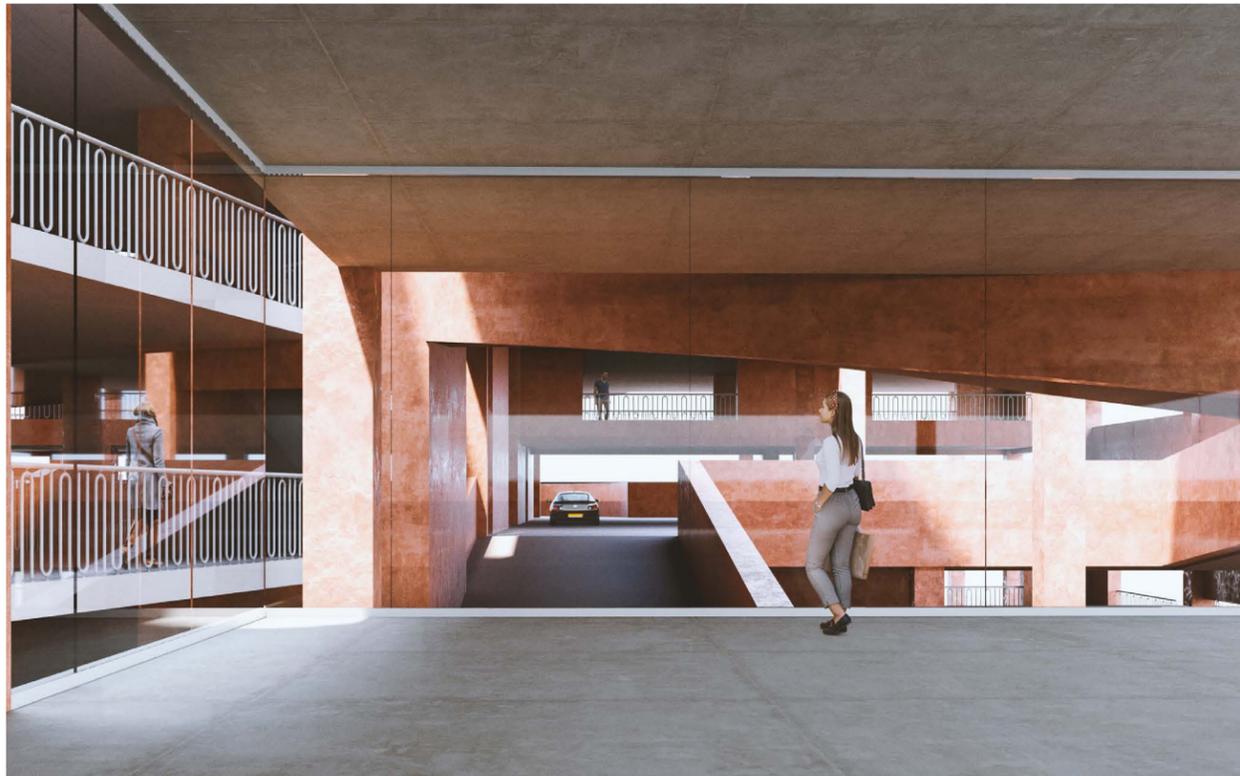
Interior
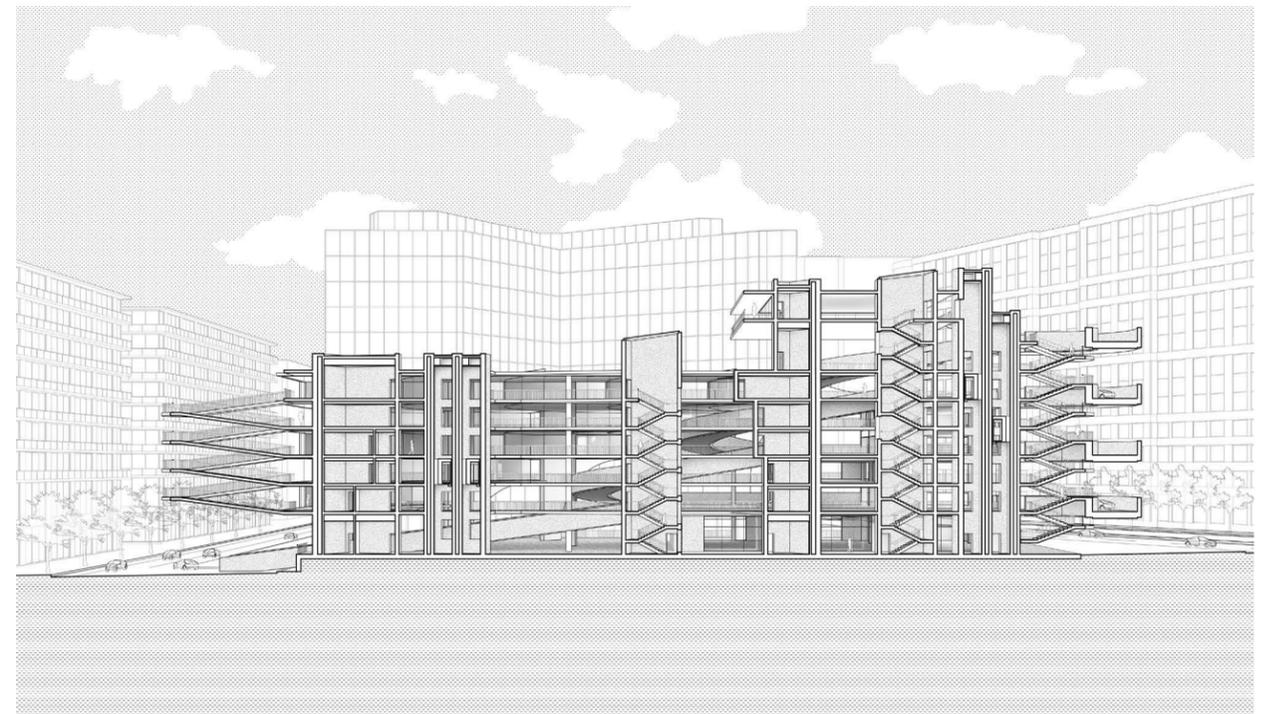
Long Section

Interlayer - East

Interlayer - West
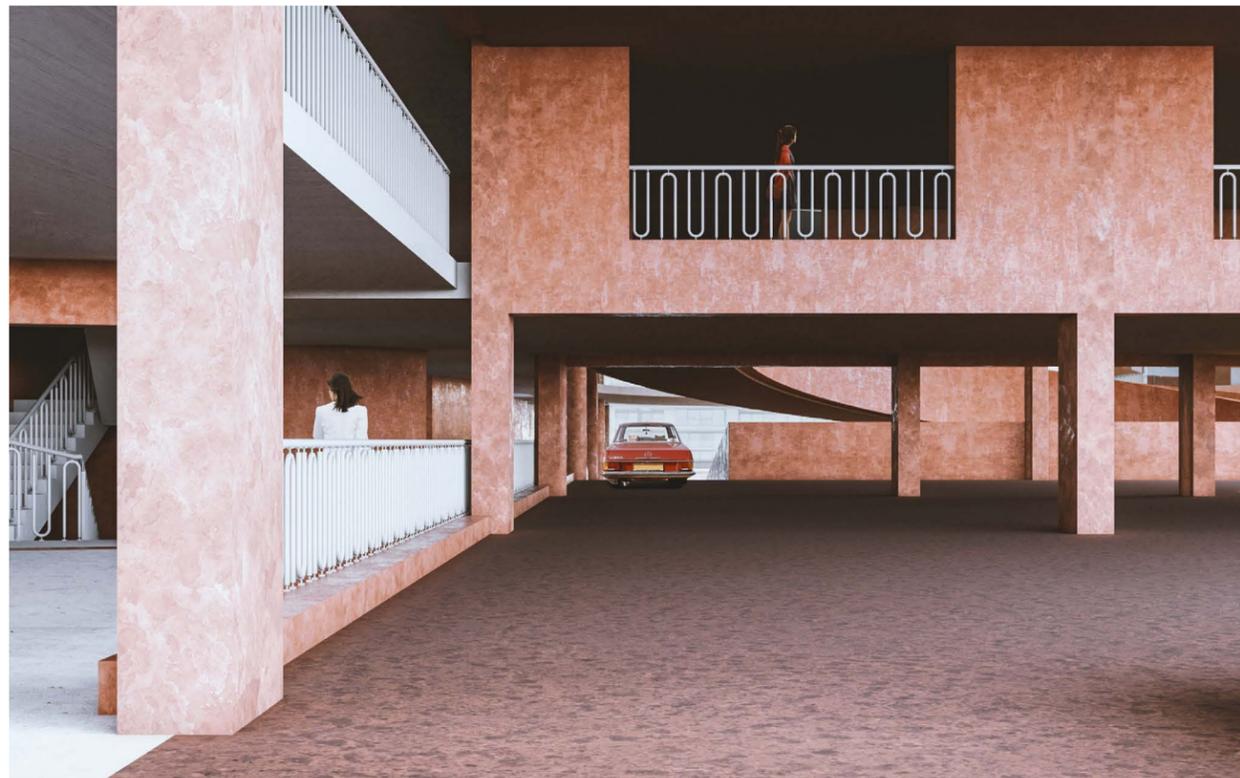
Parking Space

North Facade

Main Elevation

Heavy and light, massing and slab, concrete and glass, signifying not only people and cars, but also two sidedness of Washington DC.

The Corridor

Lost and choice, hidden and found, the intersection of bifurcator is in multiple transitions.

PROJECT 04

Cubikko

ULI Hines Competition Project, 2020 Spring
Group Work with RED, LA and UP Students
Winner of Finalist

This project is a pivotal mixed-use and transit-oriented development aiming to reunite the Wynwood, Midtown Miami and Edgewater communities and to enhance diversity across the region. The site has been an industrial urban neighborhood cut apart by the north-south railway and has been facing gentrification pressures. Cubikko includes a multimodal transportation system which will connect the diverse communities of Wynwood, Edgewater, and Midtown, while enhancing design culture and diversity, and mixed-income communal living to celebrate the vitality and diversity of the city of Miami.
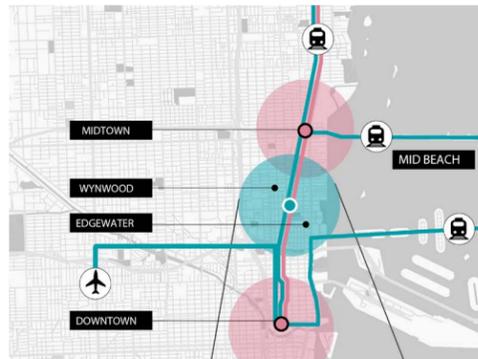
Multi-Transportation Anchor
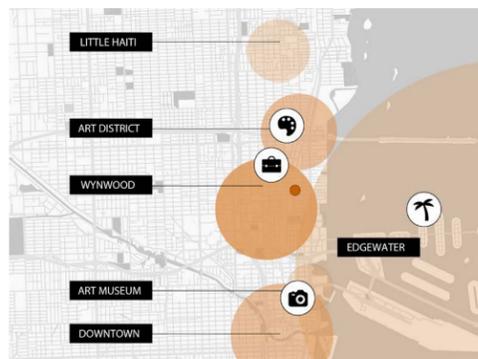
The Gentrification
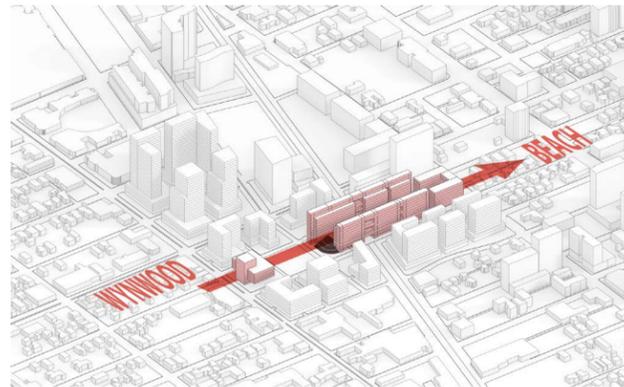
East - West Axis

First, The Ribbon crossing over the rail, connecting west and east side of city, from the Wynwood to seaside area.
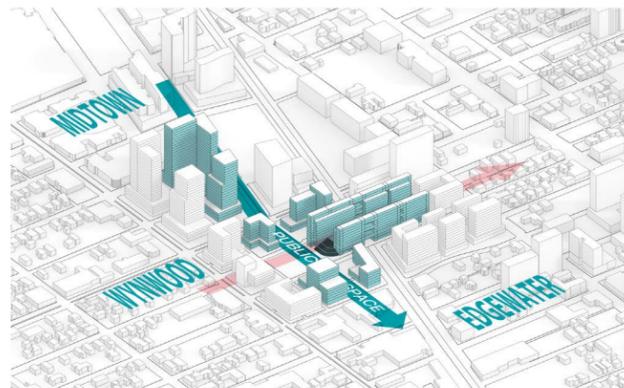
North - South Axis

Second, The north connected with the Midtown Miami and the south connected with the Edgewater, makes another continuous open space.
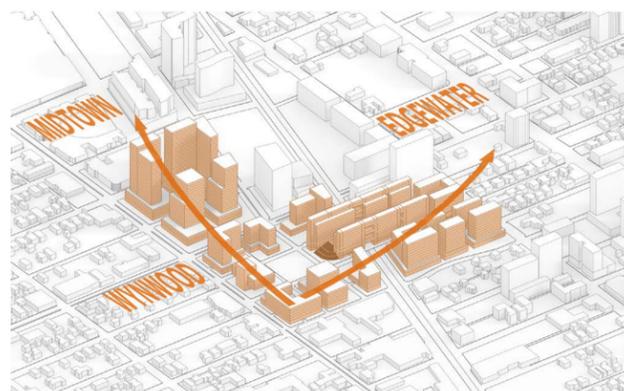
Height Control

Third, to make our development more involved with the urban fabric at the same time follow zoning code and keep high FAR, we make control over the building height.

Plaza
1. El kioskito
2. North Park
3. Condesa Plaza
4. Romita Plaza
5. Cubikko Plaza
6. Ribbon
7. Maya Plaza
8. El Cielito
9. Polankito
10. Diego Plaza
11. Frida Plaza
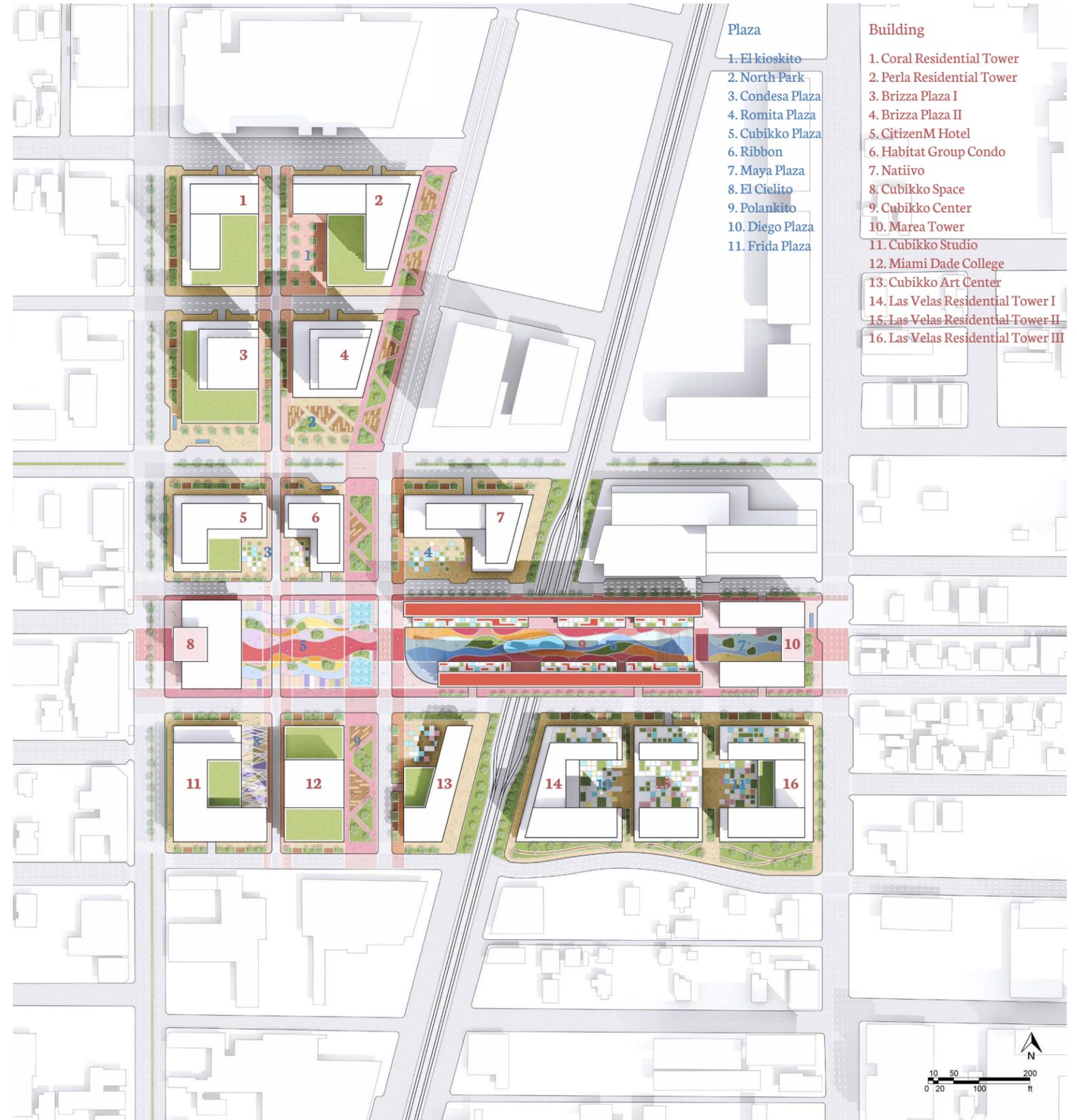
Building
1. Coral Residential Tower
2. Perla Residential Tower
3. Brizza Plaza I
4. Brizza Plaza II
5. CitizenM Hotel
6. Habitat Group Condo
7. Natiivo
8. Cubikko Space
9. Cubikko Center
10. Marea Tower
11. Cubikko Studio
12. Miami Dade College
13. Cubikko Art Center
14. Las Velas Residential Tower I
15. Las Velas Residential Tower II
16. Las Velas Residential Tower III

On the Cross

Cubikko Center

North-South Section

West-East Section

The Bioswale is a space efficient solution for city roads and alleys with layered cobblestones and structured soil because bioswales can withstand rapid surface waterflow without erosion. Plantings are primarily perennials, creating high flexibility in swale width and shape.

CitizenM, creating the new generation of modern travellers a affordable luxury with high-end design.It creates a place for both the local artists and global visitors like weekenders, explorers, affair-havers and fashion-grabbers to meet. It would offers what the modern travellers need; including free wi-fi and movies, super speedy self-service check in, a canteen and bar serving food and drinks 24hrs and luxurious living room style lobbies.

The green roof is a combination of stormwater reuse, outdoor barbecue activities, and recreational gardens. These LEED certified building a collect and filter water to support water reuse where applicable, as well as landscape irrigation on the Ribbon.

Essex Market is a public market made up of native small vendors who pride themselves on getting to know their customers.Vendors offering everything from fresh spices, cheese, meat and fish to fruit, ice cream and pastries fill the walkways of the airy new market, which features a large seating area, custom-built stalls and lots of natural light.

Cubikko Museum is a combination of art and entertainment that characterizes the development. Visitors to the Museum can enjoy the fine dining restaurant and gift shop, 51,000 square feet of office space and art studios, and 32,000 square feet of gallery space dedicated to exhibiting local and international artwork. Open to the public, the Cubikko Museum features rotating curated exhibitions of the work of local artists, including site-specific multi-media installations.

The **Cubikko Auditorium** and **Exhibition Center** is the masterpiece for art and culture, job-creation, and community engagement. Its strategic location within the project enables easy access, as a natural extension of the central Cubikko plaza. Whether it is The Biennale Wynwood, a Cuban music concert, or an annual ULI conference, the 100,000 square foot Cubikko Auditorium and Exhibition Center can adapt to the requirements of myriad local and international events.

Cubikko Central Plaza is intended to bring Wynwood culture to life the and allow those near and far, young and old, to gather and enjoy the best local experiences of art, food, and open-air events.

The **Cubikko Center** at the heart of the development, creates a vibrant mixed-use and mixed-income community, relieving some of the gentrification pressures in Wynwood. The building establishes a neighborhood connection between Wynwood and Edgewater, providing housing, working, and mobility choices. The retail at the base is curated to attract pedestrian traffic while maintaining efficiency and mobility.

Cubikko Station is the result of a close collaboration with city officials and public transport organizations. It provides not only ease of connectivity but also entertainment and lifestyle offerings. Incorporating a long-term vision, the infrastructure of the station will accommodate future increases in traffic and transit and will facilitate the expansion of the line and connections between the Metrorail and Tri-rail services according to the City Tri-Rail expansion plan and Transportation Improvement Program of Miami.

The retention landscape includes pocket parks with flood tolerant plantings. The landscape will be able to absorb as well as hold water during rainstorms and create a wetland-like landscape. During dry days it can accommodate various recreation activities. Such green spaces are primarily located next to NE 1st Ave.

Towards the Plaza

The central Plaza will be a gathering space for different people and various public activities.

Landscape Resilience Toolkit

Bioswale Green Street Landscape Retention

Public Transportation

Non-Auto Transportation

Bike/Scooter lane
Sharrowed lane
Bike/Scooter dock

M2 Every 15 min
T Every 20 min
M3 Every 30 min

5 min walk
3 min walk

Miami Ave Station
29 St Station

Bike rack (proposed)
Bike rack (existing)
E-Scooter rack (proposed)
E-Scooter rack (proposed)

Street Section

NE 28th St.

NE 29th St.

Phasing

Phase I
- Station
- Mixed-Income Housing
- Opportunity Zone
- Transportation Infrastructure
- Affordable Housing (700 units)
- Retail (146,000 sq ft)
- Medical Offices (50,000 sq ft)

Phase II
- Museum & Studio
- Miami Dade College
- Cubikko Space Auditorium
- Food Market (32,000 sq ft)
- Structural Parking (120,000 sq ft)
- Citizen M
- Habitat Group Condos
- Natiivo Condos

Phase III
- Multifamily (780 Units)
- Multistory Office (170,000 sq ft)
- Flex Space (175,000 sq ft)
- Retail (93,000 sq ft)

Pro Forma

Summary Pro Forma	Pre-closing 2020-2021	Phase I 2022	2023	Phase II 2024	2025	Phase III 2026	2027	2028	2029	2030	Sale 2031
Net Operating Income											
Market-Rate Multifamily	-	-	-	1,248,916	2,578,720	2,681,679	2,787,726	2,877,502	9,330,070	16,300,962	16,930,874
Affordable Lease-Purchase Housing[1]	-	-	-	4,284,171	8,707,970	8,849,465	8,992,836	9,138,090	9,285,237	9,434,285	9,585,238
Co-working/Office/Commercial	-	-	-	3,510,195	7,010,568	7,005,583	7,743,531	7,733,161	15,727,504	23,713,787	23,693,866
Retail	-	-	-	5,582,937	6,830,146	6,837,471	6,830,146	8,809,333	10,634,326	10,624,468	10,624,468
Auditorium & Museum Facility	-	-	-	2,422,326	4,838,444	1,495,673	2,991,345	2,991,345	3,140,912	3,140,912	3,140,912
Structural Parking	-	-	-	109,953	223,331	476,970	743,306	759,783	1,567,247	2,417,082	2,477,341
College	-	-	-	-	-	2,237,625	4,475,250	4,475,250	4,922,775	4,922,775	4,922,775
Development Fees	(245,003)	(1,980,439)	(2,053,535)	(2,571,301)	(2,815,611)	(2,170,735)	(2,170,735)	(1,579,873)	(1,579,873)	(1,579,873)	
Total Net Operating Income	(245,003)	(1,980,439)	(2,053,535)	9,004,261	20,543,424	26,159,198	32,400,730	33,225,404	51,203,606	68,984,256	71,375,475
Gross Sale Proceeds (exit & sale of pads)[2]	-	-	-	64,804,595	-	-	-	-	-	-	1,063,663,190
Less: Sales Cost											(21,273,264)
Total Income	(245,003)	(1,980,439)	(2,053,535)	73,808,856	20,543,424	26,159,198	32,400,730	33,225,404	51,203,606	68,984,256	1,113,765,401
Development Costs		Phase I		Phase II		Phase III					Sale
Hard Costs											
Market-Rate Multifamily	20,544	26,058,309	26,068,581	7,392,955	7,403,226	20,715,698	20,715,698	20,715,698	-	-	-
Affordable Lease-Purchase Housing	14,072	17,849,360	17,856,396	5,064,009	5,071,045	14,189,791	14,189,791	14,189,791	-	-	-
Office/Commercial	19,003	24,104,119	24,113,621	6,838,535	6,848,037	19,162,167	19,162,167	19,162,167	-	-	-
Retail	7,863	9,974,157	9,978,089	2,829,750	2,833,681	7,929,203	7,929,203	7,929,203	-	-	-
Gallery & Museum Facility	3,477	4,410,143	4,411,882	1,251,194	1,252,932	3,505,953	3,505,953	3,505,953	-	-	-
Structural Parking	11,922	15,122,403	15,128,364	4,290,349	4,296,310	12,021,929	12,021,929	12,021,929	-	-	-
College	3,119	3,956,381	3,957,941	1,122,458	1,124,017	3,145,223	3,145,223	3,145,223	-	-	-
Land Acquisition	22,613,327	-	81,611,947	-	54,132,991	-	-	-	-	-	-
Station & Other Infrastructure Costs	-	50,067,719	12,047,655	-	-	-	-	-	-	-	-
Soft Costs and Reserves	9,565,441	4,781,208	8,561,837	3,885,650	15,070,696	4,729,742	4,729,742	4,729,742	-	-	-
Total Unlevered Development Costs	32,258,768	156,323,800	203,736,313	32,674,898	102,064,651	85,399,706	85,399,706	85,399,706			
Tax Credits & TIF Subsidies		(26,352,623)	(19,785,127)	(1,980,439)	(5,430,889)	(697,957)	(590,862)	(78,760,442)	(1,579,873)	(1,579,873)	-
TDC Net of Subsidies	32,258,768	129,971,177	183,951,185	30,694,459	96,633,762	84,701,748	84,808,844	6,619,264	(1,579,873)	(1,579,873)	
Financing Costs		8,522,351	8,522,351	3,375,665	3,375,665	10,845,651	10,845,651	10,845,651			
Levered TDC Net of Subsidies	32,258,768	138,493,528	192,473,537	34,070,124	100,009,427	95,547,400	95,654,495	17,464,915	(1,579,873)	(1,579,873)	-
Annual Cash Flow											
Net Operating Income	(245,003)	(1,980,439)	(2,053,535)	9,004,261	20,543,424	26,159,198	32,400,730	33,225,404	51,203,606	68,984,256	71,375,475
Total Asset Value	-	-	-	64,804,595	-	-	-	-	-	-	1,063,663,190
Total Costs of Sale	-	-	-	-	-	-	-	-	-	-	(21,273,264)
Total Development Costs (net of public incentives)	(32,258,768)	(129,971,177)	(183,951,185)	(30,694,459)	(96,633,762)	(84,701,748)	(84,808,844)	(6,619,264)	1,579,873	1,579,873	-
Unlevered Net Cash Flow	($32,503,771)	($131,951,616)	($186,004,721)	$43,114,397	($76,090,338)	($58,542,551)	($52,408,114)	$26,606,140	$52,783,479	$70,564,129	$1,113,765,401
Capitalized Financing Costs	-	(8,522,351)	(8,522,351)	(3,375,665)	(3,375,665)	(10,845,651)	(10,845,651)	(10,845,651)			
Loan Funding and Refinancing	-	84,726,564	100,852,534	63,018,872	33,190,975	83,369,509	97,825,230	19,044,789	127,692,945		
Perm Loan Debt Service, Repayment, & Origination Fees	-	-	-	(18,023,752)	(15,941,945)	(21,517,123)	(20,864,952)	(20,864,952)	(49,256,506)	(45,977,182)	(615,732,042)
Levered Net Cash Flow	(32,503,771)	(55,747,403)	(93,674,538)	84,733,852	(62,216,974)	(7,535,816)	13,706,513	13,940,326	131,219,918	24,586,948	498,033,359

Net Present Value	13%	76,726,326
Blended Perm Loan to Value Ratio (LVR)	60.0%	
Unlevered IRR Before Taxes[7]	13.4%	Current Site Value[7] (start of Year 0)	$188,179,657
Levered IRR Before Taxes	19.5%	
Levered IRR after Public Incentives[3]	26.7%	Projected Site Value (end of Year 10)	$1,063,663,190

1) The revenue from the sale of pads for the condos & hotel are net of sale costs and are projected to fund the art and cultural destinations of the project such as the public art gallery, improved land and open spaces. 2) The proposal for affordable housing development considers a public-private investment partnership with a lease-purchase housing scheme for residents that grants a long-term right of purchase in which a share of the annual rent is allocated for the purchase. The conservative base case assumes that no sales will be done until the 10+ year of lease.

3) Our proposal assumes that the project will participate in a number of public state and federal programs such as the Affordable Housing Innovation Fund, Affordable Housing Loan, Tax Increment Financing (TIF), Opportunity Zone and Property Tax Abatement Programs in order to afford a share of the land and construction costs required to incorporate a significant amount of affordable and below-market-rate housing in the project.
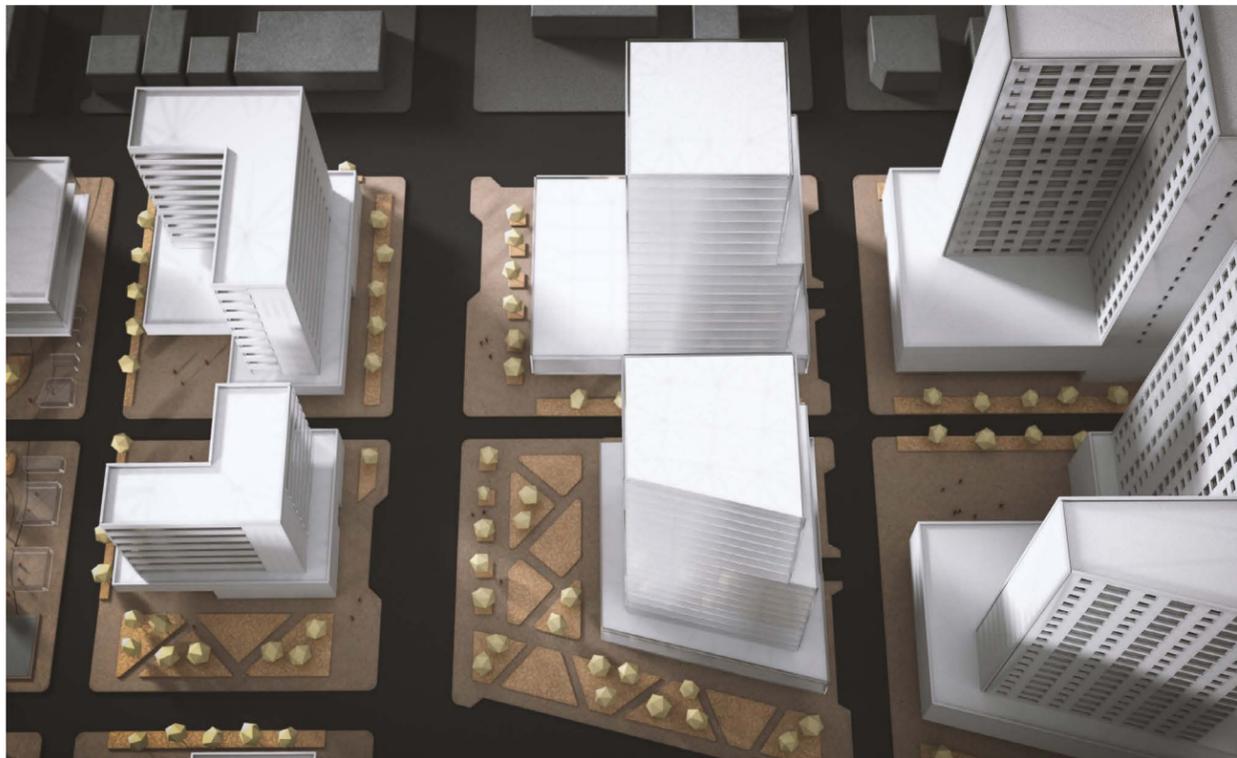
Connected to Urban Fabric
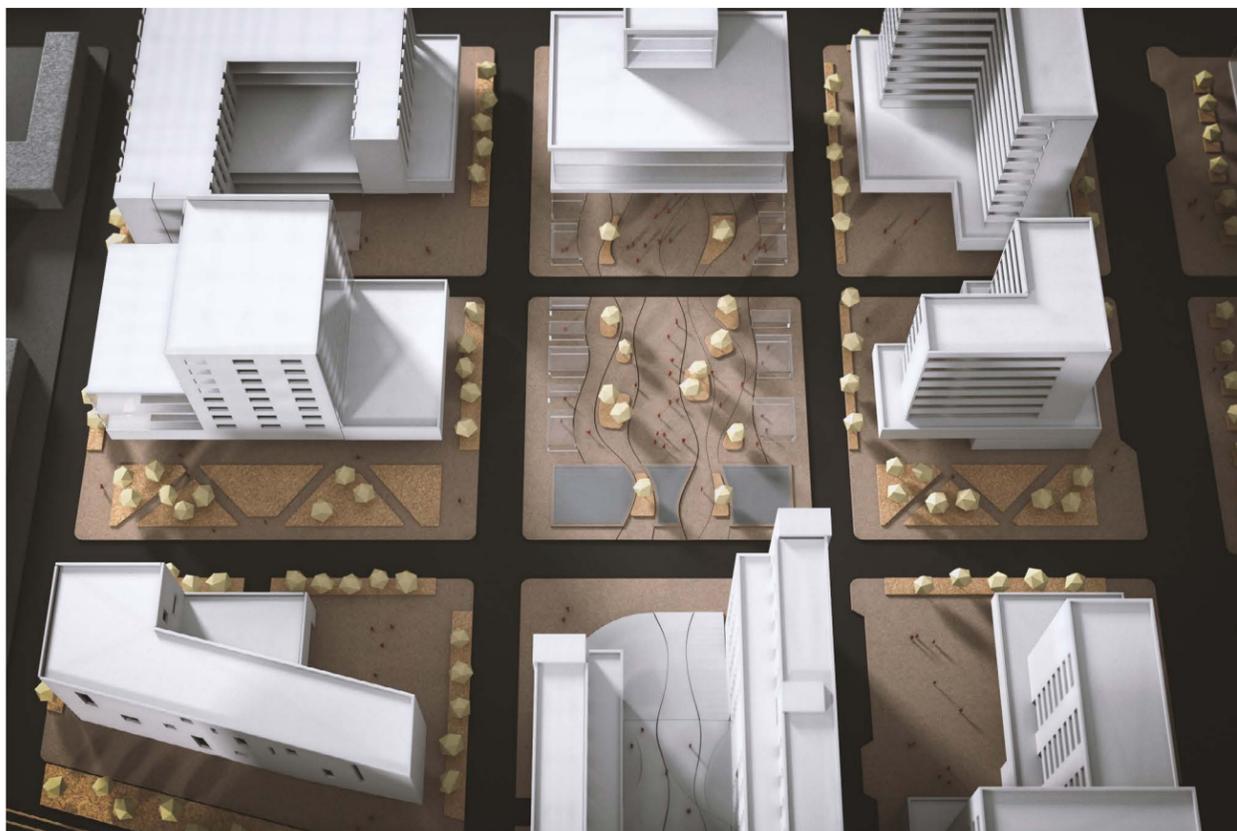
Centered on Open Square

Types

RETAIL	23,309
PARKING	134,101
RESIDENCIAL	247,222

Market-rate Residential
Total 404,632 sqft

RETAIL	26,393
PARKING	160,992
RESIDENCIAL	330,496

Market-rate Residential
Total 517,881 sqft

RETAIL	17,287
PARKING	130,728
OFFICE	166,490

Office Tower
Total 534,505 sqft

RETAIL	13,997
PARKING	99,482
OFFICE	167,206

Office Tower
Total 281,035 sqft

RETAIL	10,764
PARKING	26,910
OFFICE	48,438
STATION	53,040
RESIDENTIAL	54,310

Tri-Rail Hub TOD
Total 193,462 sqft

RETAIL	10,764
PARKING	26,910
OFFICE	48,438
RESIDENTIAL	54,310

Mixed Use
Total 140,422 sqft

| GROCERY | 32,508 |
| PARKING | 121,204 |

Trader Joe's Grocery
Total 153,712 sqft

| PARKING | 15,070 |
| EDUCATION | 150,680 |

Miami Dade College
Total 165,750 sqft

| RETAIL | 22,412 |
| HOTEL | 119,774 |

Citizen M
Total 142,186 sqft

RETAIL	13,724
PARKING	13,724
RESIDENTIAL	53,494

Habitat Group Condo
Total 80,942 sqft

RETAIL	25,339
PARKING	25,339
RESIDENTIAL	109,598

Nativo Condo
Total 161,276 sqft

| EXHIBITION | 91,280 |

Auditorium & Exhibition
Total 91,280 sqft

RETAIL	4,096
OFFICE	10,000
PARKING	13,141
EXHIBITION	59,801

Studio & Gallery
Total 97,083 sqft

RETAIL	8,403
PARKING	55,125
RESIDENTIAL	160,383

Affordable Housing
Total 223,911 sqft

RETAIL	26,209
PARKING	32,130
RESIDENTIAL	91,100

Affordable & Co-living
Total 149,439 sqft

RETAIL	17,812
PARKING	49,140
RESIDENTIAL	139,774

Affordable Housing
Total 206,726 sqft

Towards the Ocean

The result is a mix and interation between capital, local cultural, communal, transportational and urban spatial power.

PROJECT 05

My Street

Datamining the City, 2019 Fall
Group Work

Nowadays, public space in our city is too crowded with advertisements in order to gain commercial value in short time. The depressive feelings given by enormous and shining billboards actually make pedestrians less willing to wander on the street. While a rational street furniture design is always ignored, which could benefit our city in long term. Although it is no wrong to earn money in commercial furniture, a fantastic layout of different kinds of furniture can actually attract more pedestrians and realize city economic growth. So a new method to encourage the street furniture design is in urgent need.

Concept

The layout of street space is conceptualized into grids. Different grids have different types of furniture or material. The attributes are parameterized for programmatical simualtion.
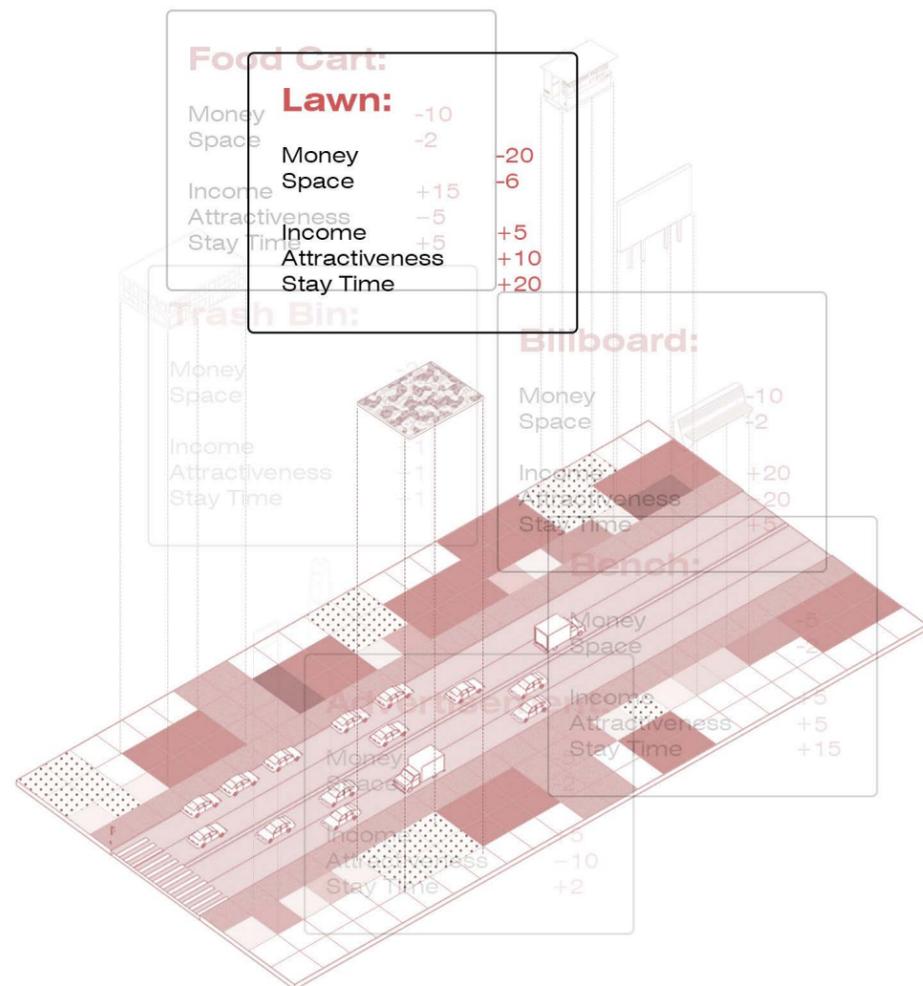
Attractiveness and Street Economy

Commercial Ads on the street generate value if people have interactions with them. In this game, designer should consider how to make more chances for interactions to happen.
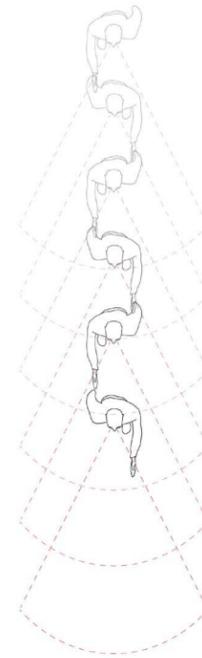
Advertisement Itself Doesn't Attract Attention
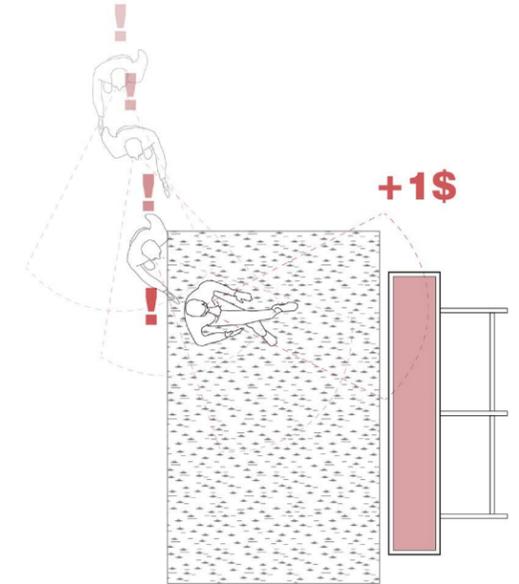
A Lawn Can Attract Pedestrians To Have Attention On Ads
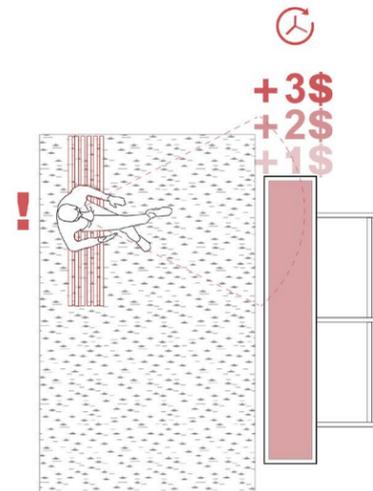
The Longer Ads Attract Attention, More Value Generated
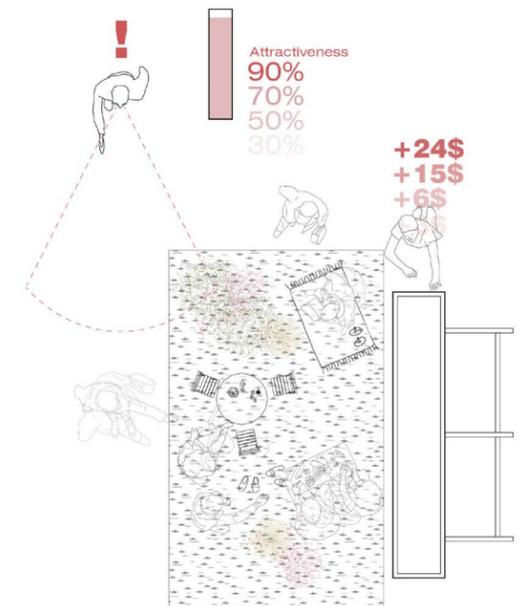
More People Interact With Commercial, More Value Generated

Moving Agents — Pedestrians Navigation Control

The agents of pedestrians are generated randomly outside the boundary of the community. The attractiveness parameter of the street decides how many pedestrians will come to the street. Pedestrians' attention and stay time, are the two things that can interact with commercial programs that generate value for the street.
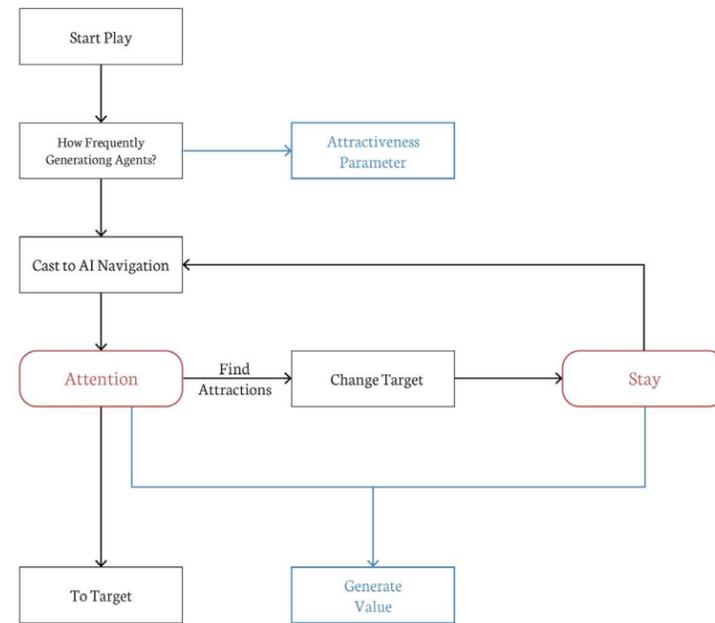
Furniture Agents — Types of Furniture and Effects

We divide the furniture into four categories: Vegetation, Commercial, Convenience. Each of them have child types and they have different affects on the street.

|		Cost	Attractiveness	Income	Attention/StayTime
Vegetation	Tree	-150	+4	0	+2
	Lawn	-350	+5	0	+5
	Pot	-100	+3	0	+1
Commercial	Billboard Ad	-150	-4	+6/Attention* UnitTime	0
	Title Ad	-80	-2	+4/Attention* UnitTime	0
	Retail	-50	-1	+2/Attention* UnitTime	0
Convenience	Table/Bench	-35	+2	0	+3
	TrashBin	-5	+1	0	0
	Spot	-400	+10	0	+4

GUI

Users can drag and drop nine types of street furniture as they want. Information of current money, cost of daily keep, attractiveness and total number of pedestrians is shown on the above middle board. Operatable scene is the axonometirc camera view, while other two cameras showing the how street furniture influence public space.
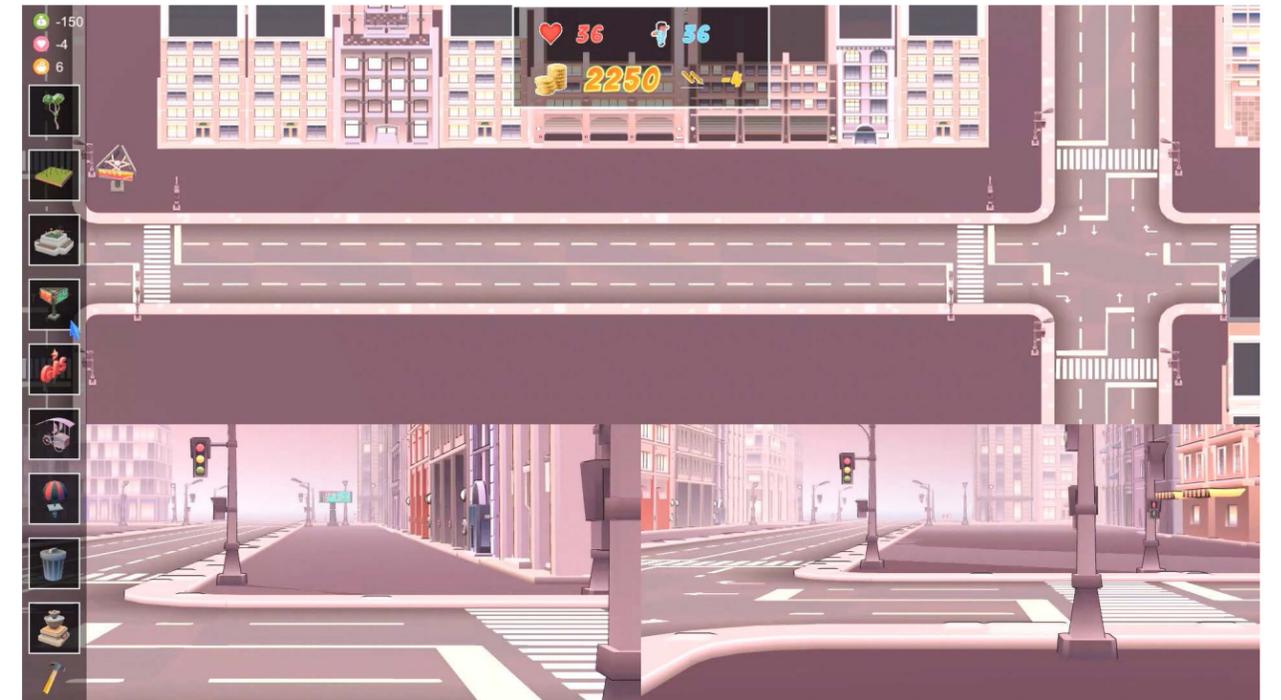
Game Begin Play

Bloom of Street Economy
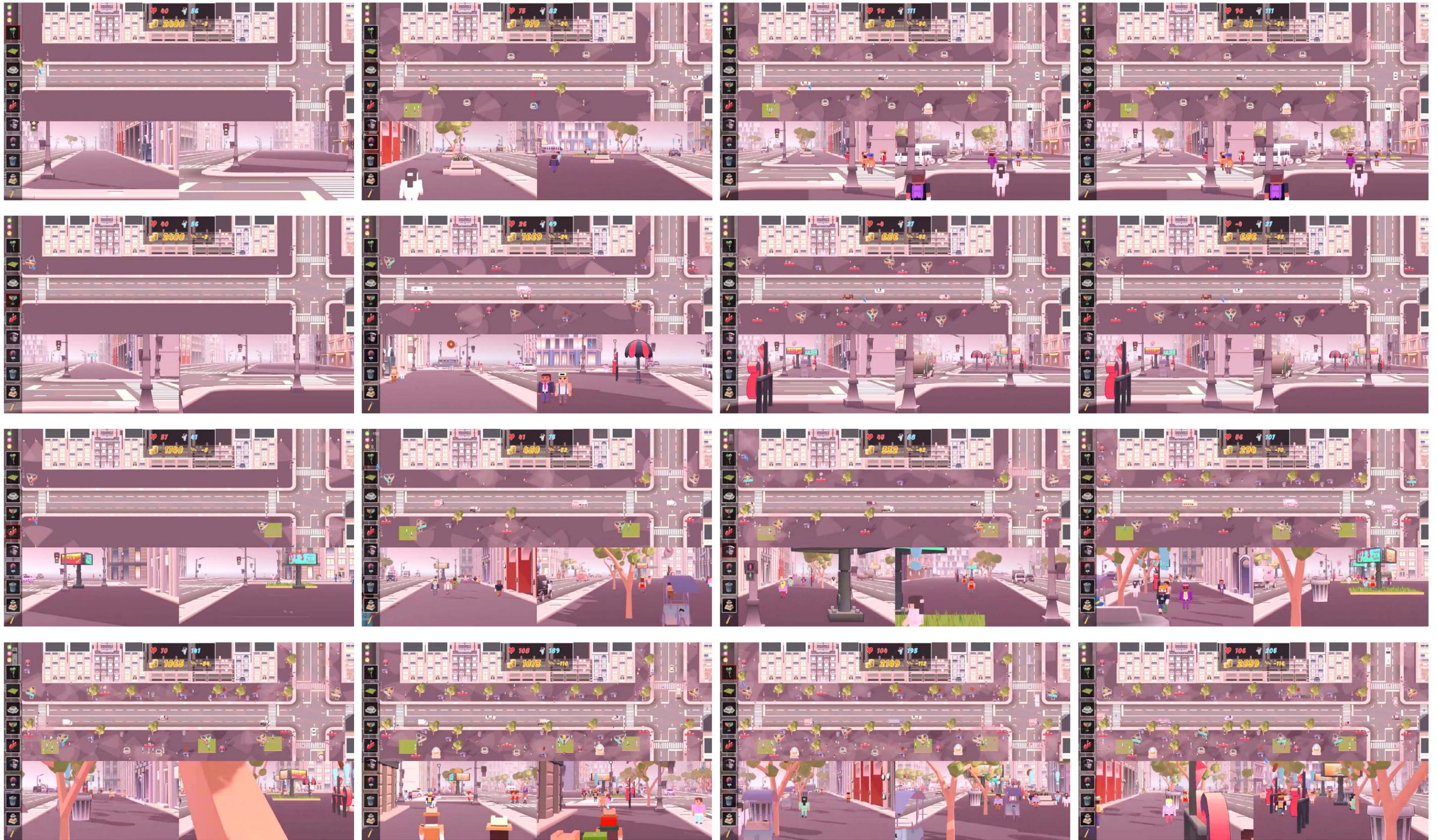
The Gameplay

PROJECT 06

Crowd Simulation of Protests

Realtime, 2019 Fall
Individual Work

Nomarlly in architecture field, the appreciation of spatial quality is always considered in higher priority, but its influence on people's behavior should also be researched. This project is to use Unreal Engine as a tool to explore how certain urban space can influence the behavior of crowds. Concepturally, the form of urban space will change the route of crowds, and thus the time elapsed during a crowd's event may be different. This application takes protest behavior as the prototype of crowds behavior, which could also be extrapolated to other events, such as earthquake, fire disaster and terrorist attack. By this techonology, we can know which spatial solution takes less time for crowds escape from events.

Senarios in Urban Typologies

As the trainning demos of the crowd simulation, this project starts by different urban spatial typologies to calculate the amount of time to repress the protest.
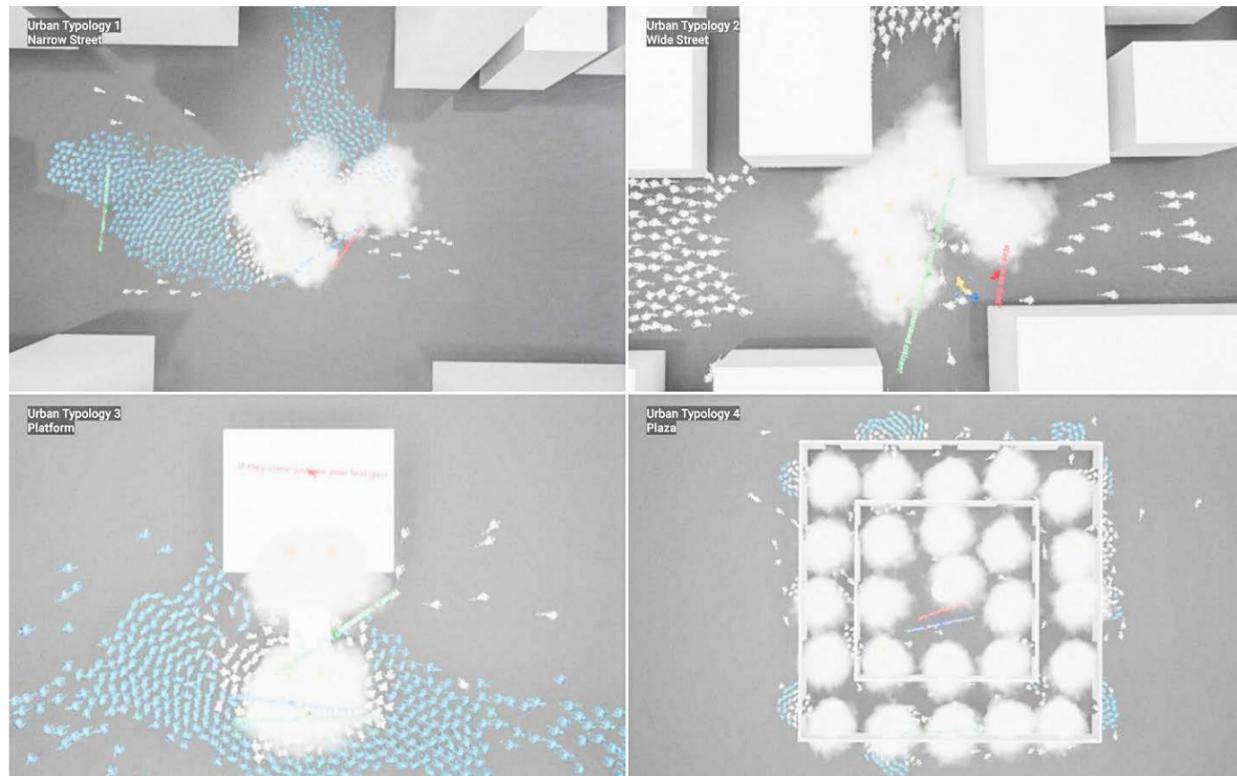
System

Although a virtual urban space is taken into this demo, but as a prototype this application has shown the fasibility of taking algorithms and AI navigation technology into architecture field. To make this simulation more convincing and complicated, four types of agents' bahavior in a protest event has been modeled below.
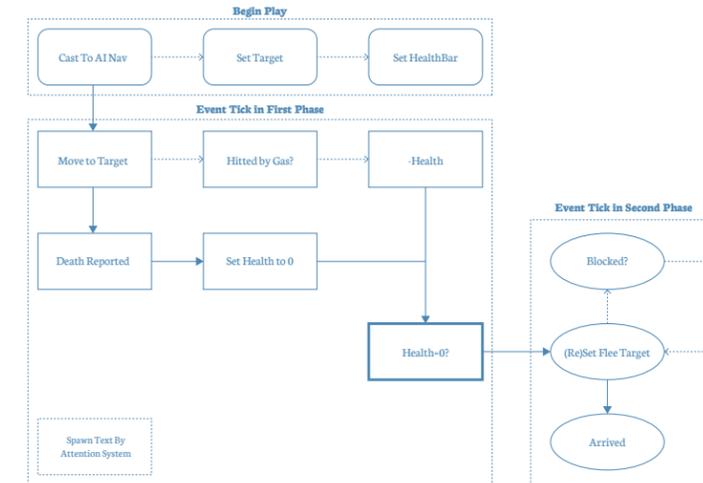
System Diagram: Protestors
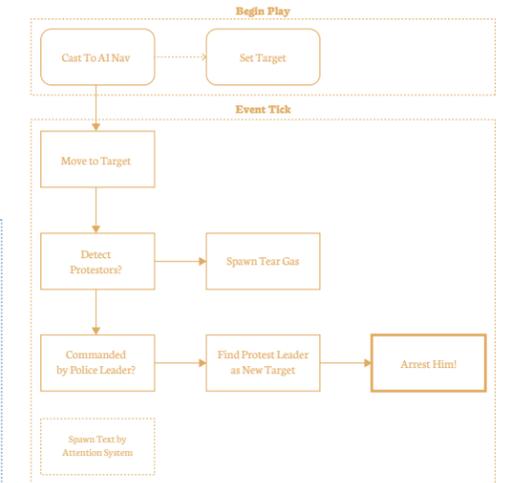
System Diagram: Policemen
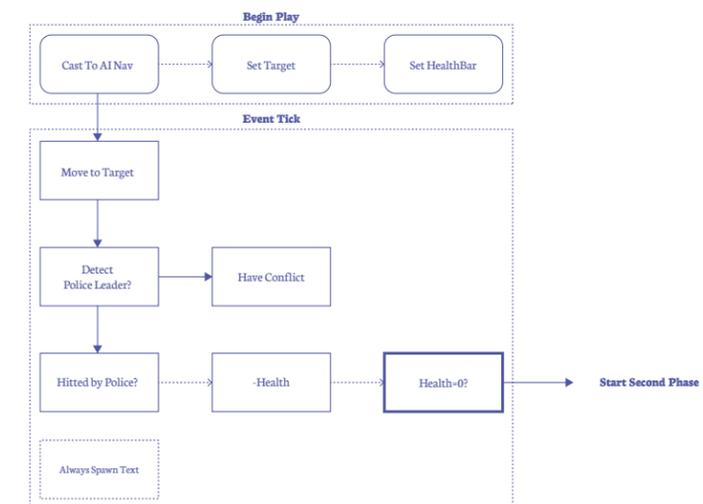
System Diagram: Leader of Protestors
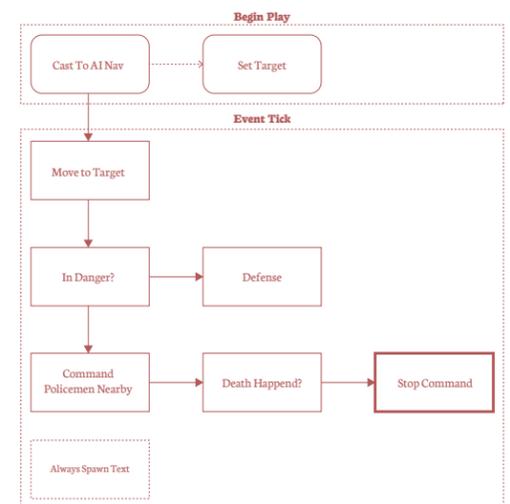
System Diagram: Leader of Policemen

GUI

Firstly, the user design the urban space from the prefabs in UI.

As finished, the simulation begins, the user can see how long does it take to finish the event and how current urban space influence the crowds.
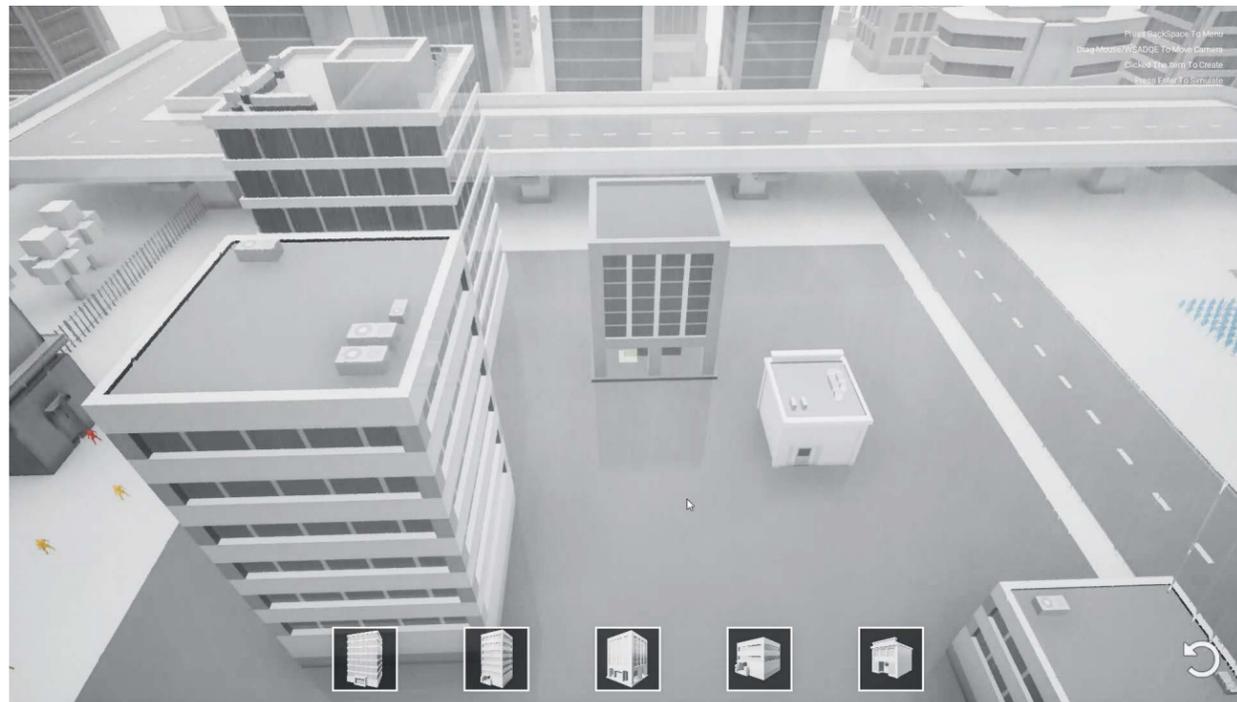
Customize Urban Space
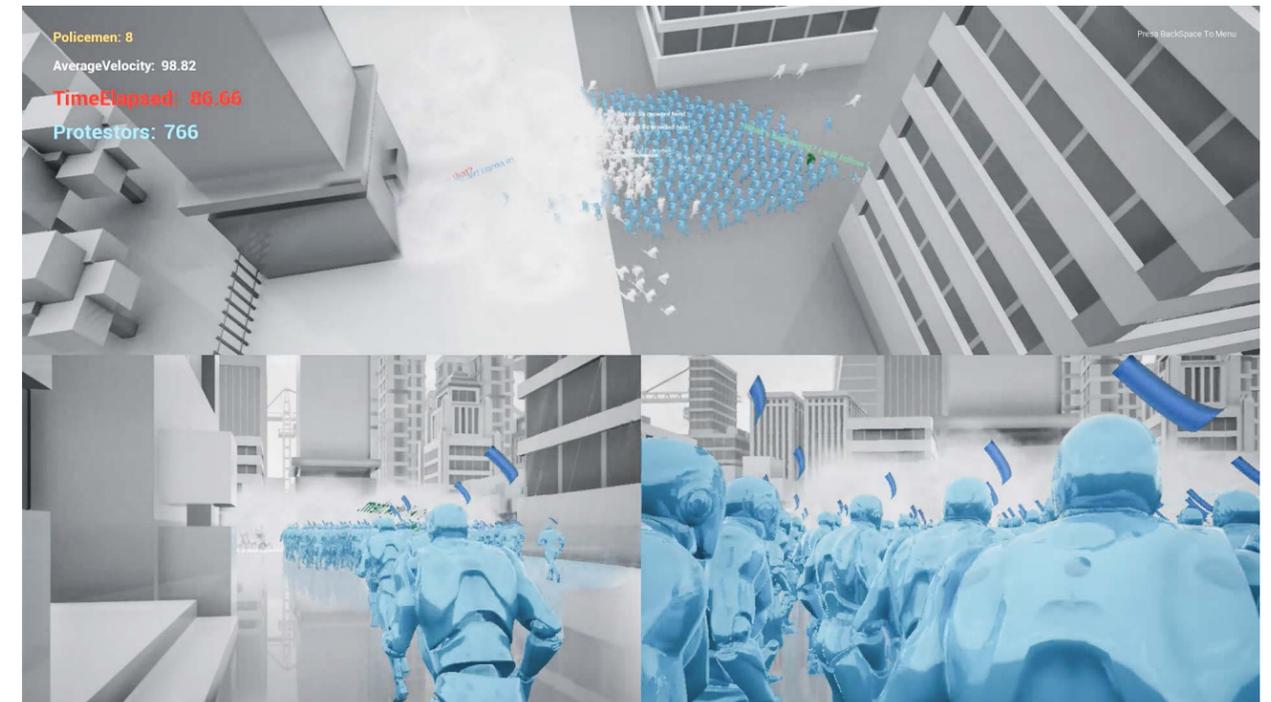
Clash Happens

Start of Simulation
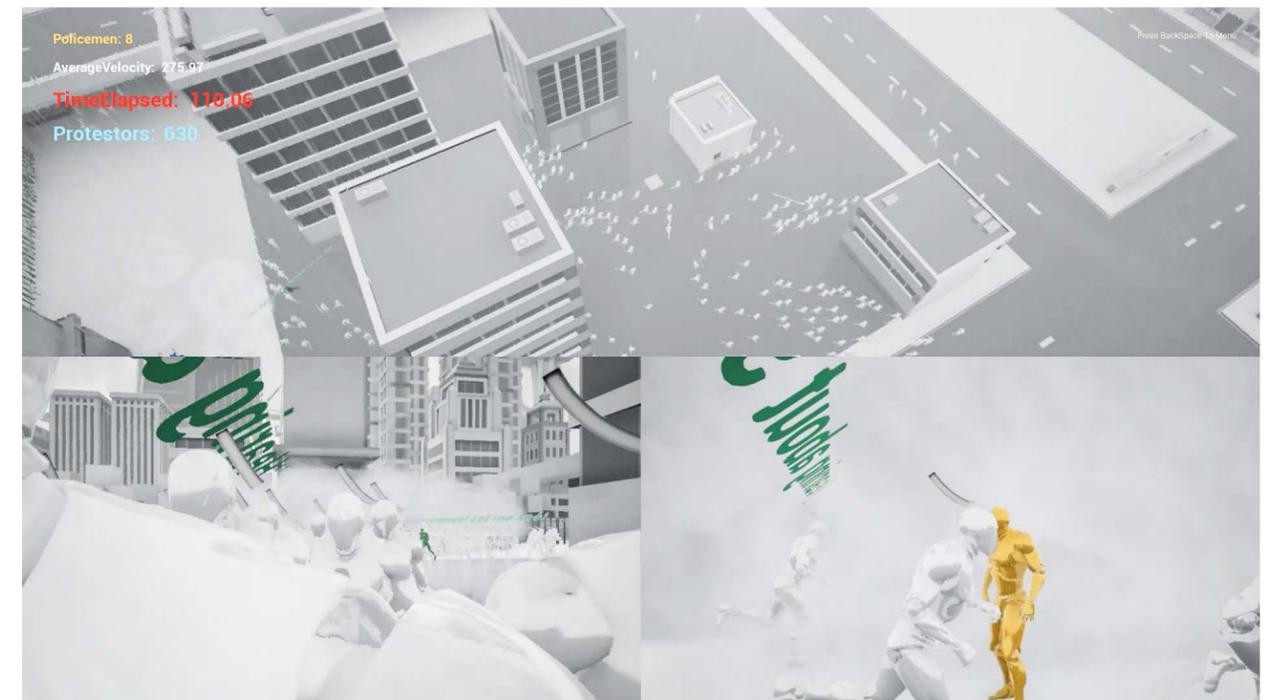
Crowds Escape
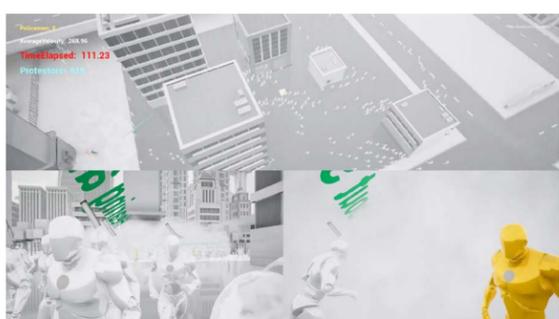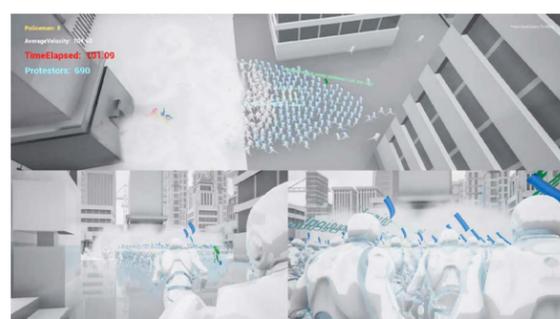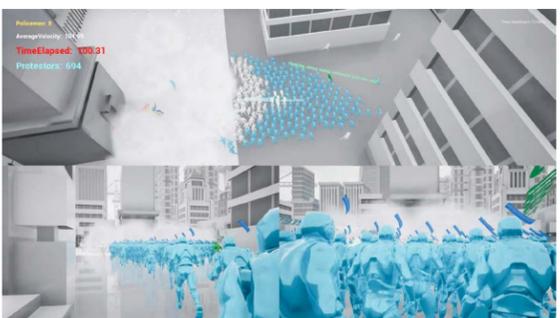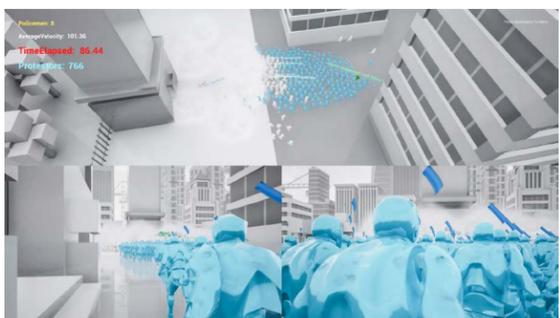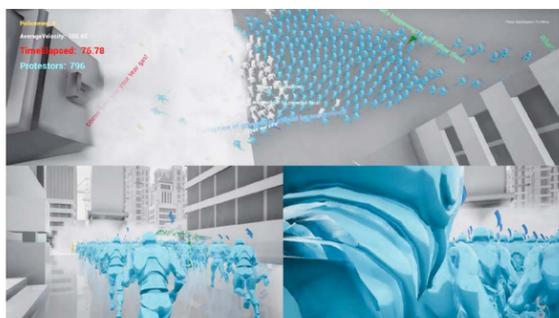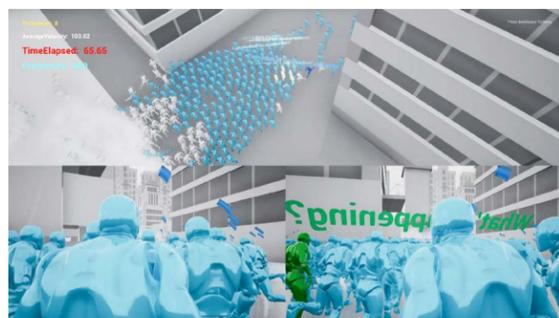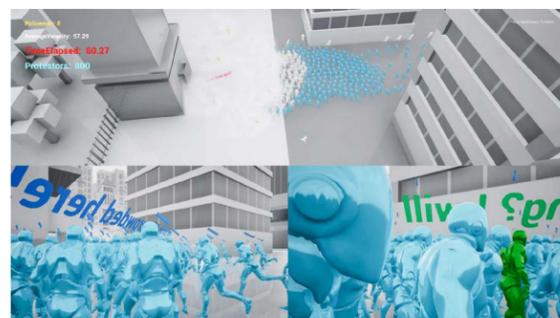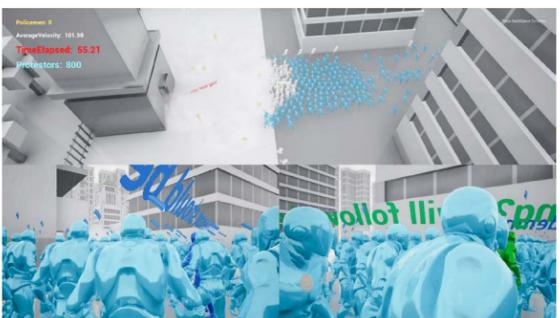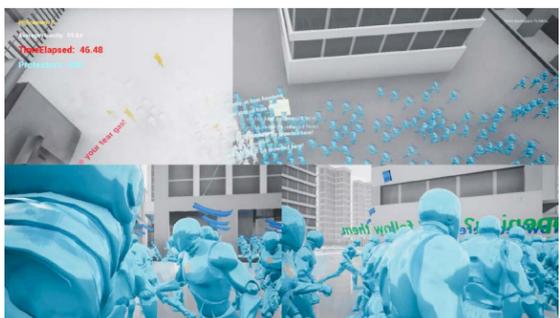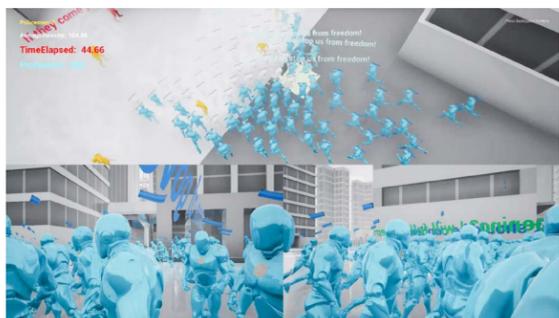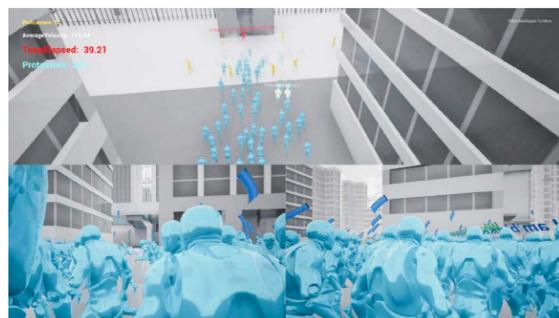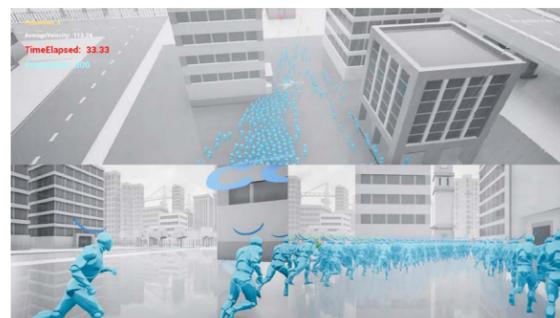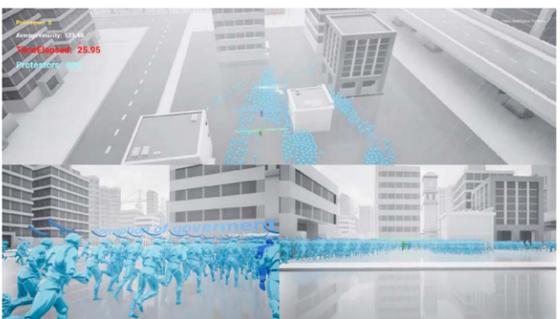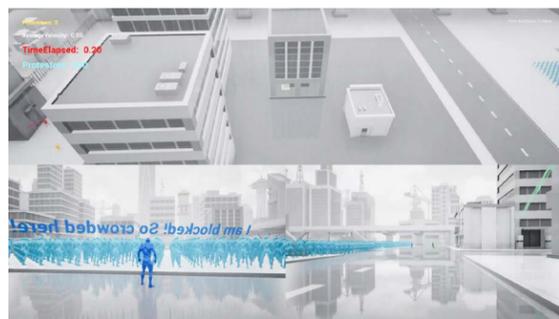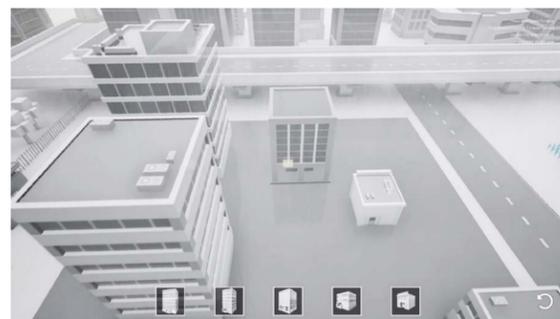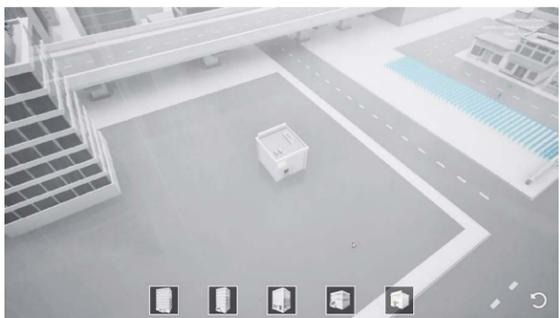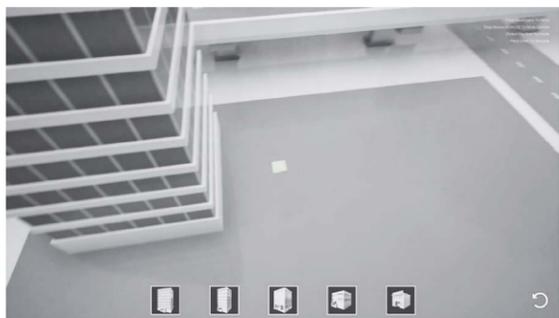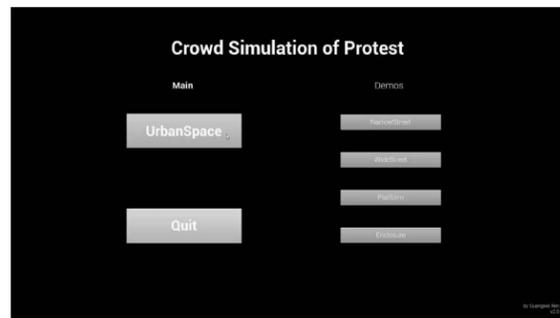
The Gameplay

Post Covid -19 Urbanism

Algorithm and Urbanism, 2020 Spring
Group Work

What if the pandemic does not end this summer?

How can we guide people to carry out AR activities in the context of social distancing to release the pressure of people staying home and reduce the infection?

How can AR be used to mitigate risk when the city starts to open back up?

POST COVID-19

PROBLEM STATEMENT

Data exploration   AR User behavior
& collection   study

> What if the pandemic does not end this summer?

Citywide Analysis   Neighbourhood Analysis

APPLYED STRATEGY

Urban Scale Data Analysis

Street Score

Tree

Population

Public WIFI Hot Sopts

Vacant Land

Lotfront

Outdoor Facilities

Privately Owned Public Space

Built FAR

Bus Stop

Subway Station

Uber Drop Off

Complaint

Residential FAR

Commercial & Office

Retail Area

APPLYED STRATEGY

Citywide Analysis

Stable
Safe Urban area/Daylight/Tree
Uncrowded
Pops/ Vacant Land/Open & Outdoor Recreation/Lot Front
Accessible
Subway station /Bus station/Uber Drop off points
Social
Retail Area/Commercial & Office/Residential FAR/Population density/complaint/WIFI

Neighbourhood Analysis

Bryant Park
Uber drop off, Land use, BuiltFAR, Sunlight
East Village
Uber drop off, Land use, BuiltFAR, Sunlight
Columbus Circle
Uber drop off, Land use, BuiltFAR, Sunlight

Mitigate risk and facilitate social distancing by Predict areas of high crowdedness

TOLICY TARGET

AR Suitability for COVID-19 Risk Area by Typical Time Conditions

Workday(8am-11am)
Stable (17%)
·Safe Urban area(5%)
·Daylight(7%)·Tree(5%)

Uncrowded (20%)
·Pops(5%)
·Vacant Land
·Open & Outdoor Recreation
·Lot Front(15%)

Accessible (25%)
·Subway station(5%)
·Bus station(5%)
·Dropoff points(10%)

Social (36%)
·Retail Area(2%)
·Commercial & Office(10%)
·ResiFAR(10%)
·PPL(10%)
·complaint(2%)
·WIFI(2%)

Workday(11am-4pm)
Stable (32%)
·Safe Urban area(5%)
·Daylight(7%)·Tree(10%)

Uncrowded (24%)
·Pops(10%)
·Vacant Land
·Open & Outdoor Recreation(10%)
·Lot Front(2%)

Accessible (25%)
·Subway station(2%)
·Bus station(2%)
·Dropoff points(5%)

Social (35%)
·Retail Area(5%)
·Commercial & Office(10%)
·ResiFAR(2%)
·PPL(10%)
·complaint(2%)

Workday(4pm-8pm)
Stable (17%)
·Safe Urban area(5%)
·Daylight(7%)·Tree(5%)

Uncrowded (34%)
·Pops(7%)
·Vacant Land
·Open & Outdoor Recreation(10%)
·Lot Front(15%)

Accessible (20%)
·Subway station(5%)
·Bus station(5%)
·Dropoff points(10%)

Social (29%)
·Retail Area(10%)
·Commercial & Office(10%)
·ResiFAR(2%)
·PPL(10%)
·complaint(2%)

Weekend(8am-8pm)
Stable (25%)
·Safe Urban area(5%)
·Daylight(10%)·Tree(9%)

Uncrowded (40%)
·Pops(5%)
·Vacant Land(10%)
·Open & Outdoor Recreation(10%)
·Lot Front(15%)

Accessible (13%)
·Subway station(2%)
·Bus station(5%)
·Dropoff points(3%)

Social (22%)
·Retail Area(6%)
·Commercial & Office
·ResiFAR (2%)
·PPL(10%)
·complaint(2%)

High-risk High AR Suitability in Blue AREA area

Neighborhood Analysis

Columbus Cirle   Bryant Park   East Village

Uber Drop Off | Land use

Safety Score = Land Use Index *(5-Dropoff Points/Side Walk Width)
HIGH RISK IN RED AREAS (HIGH DROP OFF FREQUENCY)

Safety Score = Summer Sunlight Hours/3
SUMMER HIGH RISK IN SHADOW AREA

Safety Score = 5-Winter Sunlight Hours/2
WINTER HIGH RISK IN SUNLIGHT AREA

Citywide Strategies

APPLIED STRATEGIES

City:
Calculate and Predict areas of high crowdedness under specific conditions
eg: Week Day + Commute Hours + Rainy (In Progress)

Uber/Lyft/Taxi Dropoff point suggestion for drivers
Real-Time Pedestrian Navigation indicating sidewalk segments that need to avoid

AR Developer:
Use the data to update the model
Put commercial programs on recommended points to benefit and attract pedestrians

AR APP

In google map, the user could turn on the alert of covid-19. Then the prediction of unsafe area is shaded in google map. In AR mode, the app could alter the user when current area is high risk, and suggest the user to turn left/right for safety.

241 West, 109th Street, Apartment 1C | New York | 10025
646-206-7738
gr2624@columbia.edu
renguangwei-1995@outlook.com