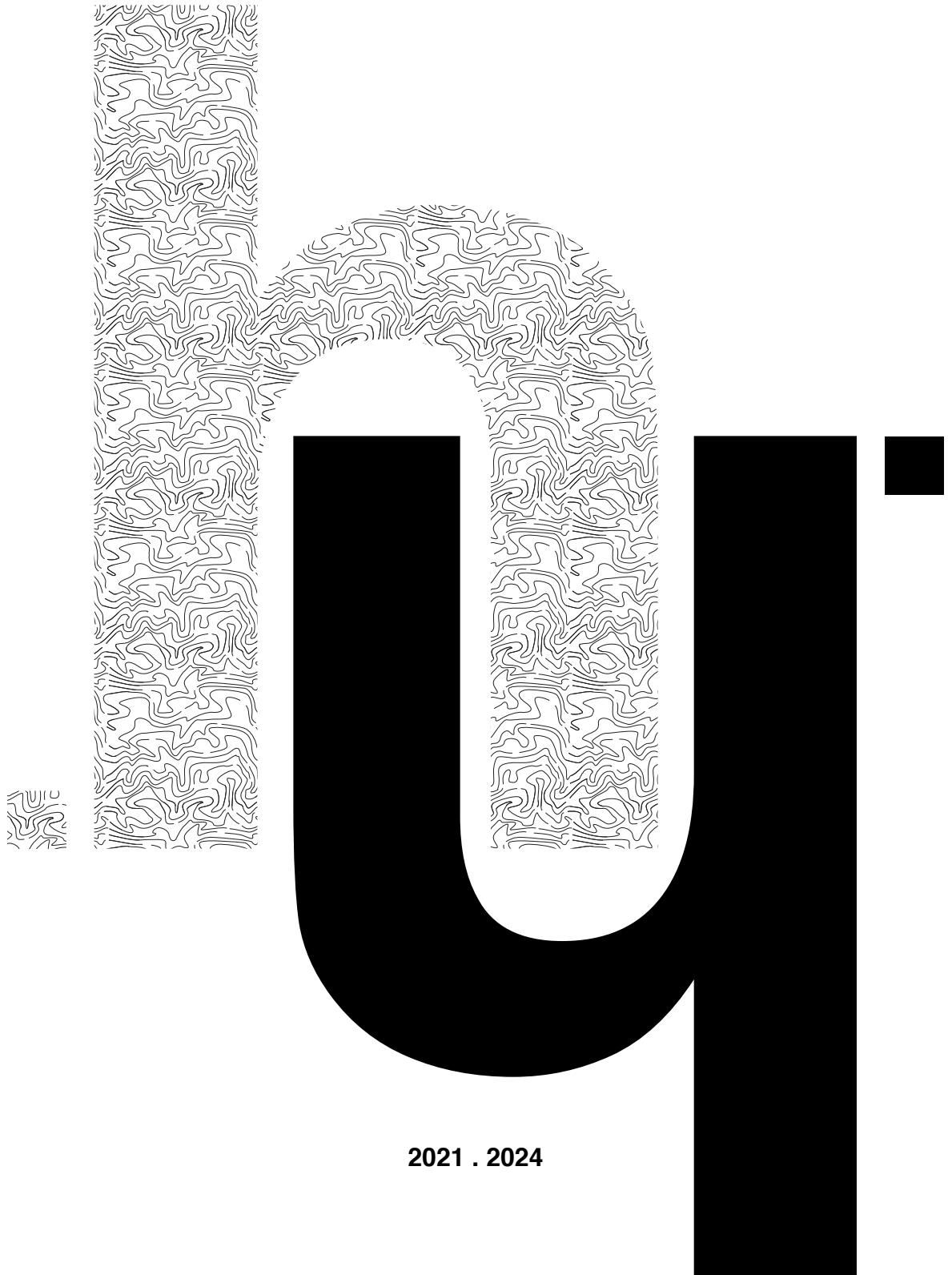


cheah hao yuan._

_.arch



2021 . 2024

selects._

_.arch

_cheah hao yuan

_nus architecture undergraduate

phone +65 8183 2995
email hao.yuan.cheah@gmail.com
location singapore

_education

2021 **B.A. (Architecture), M.Arch**
pres. *NUS, Department of Architecture (DoA).*

2023 **Architectural Studies**
aug *University of Strathclyde, Glasgow.*
dec *Student exchange programme, fall 2023.*

2021 **University Town**
2023 **College Programme.**
National University of Singapore (NUS).
College of Alice and Peter Tan.

2017 **Singapore-Cambridge**
2018 **GCE 'A' Levels.**
Temasek Junior College.

_software

Adobe.
Photoshop CC.
Illustrator CC.
Premiere Pro CC.

Modelling.
Rhino 7.
Grasshopper 3D.

Mapping.
Qgis

Office.
Microsoft Word.
Microsoft PowerPoint.
Microsoft Excel.

_experience

2024 **Concrete 3D Printing Computational Design Engineer (contract)**
may *CES_Innovfab.*
pres. *developing medial-axis slicing algorithm in Grasshopper 3D for toolpath planning; non-planar 3D printing; integrating 6-axis kinematics; exploring additive manufacturing in architecture.*

2024 **AR1101: Design Studio 1 Teaching Assistant.**
aug *NUS, DoA.*
dec *conduct technical workshops; assist studio tutors for year 1 design studios; consultations.*

2024 **AR2524: Spatial Computational Thinking Teaching Assistant.**
jan *NUS, DoA.*
april *conduct tutorials, consultations for year 1 & 2 students in NUS using Rhino, Grasshopper 3D to practice computational architecture.*

_languages

English.
native.

Mandarin.
basic.

Python.
basic.

_awards

2024 **NUS DoA Design 6 Most Visionary Project**
NUS DoA, at ArchiFest 2024.
awarded for Y3S2 Design Studio 6: emergent systems in biomimetic design.

2021 **NUS Merit Scholarship.**
NUS DoA.

select._

1. string theor {e}

wet threads; computed biomemtic; eco_geo-logics._

2. dérive

computed circulation; micro living._

3. the 20/20 experience

climatic; reactive; performative; kinetic facade._

4. potter's corner

structure practice; reinforced concrete._

5. the grapevine

voidable; eccentricism aggregation._

select._

.string theor {e}

wet threads; computed biomimetic; eco_geo-logics.

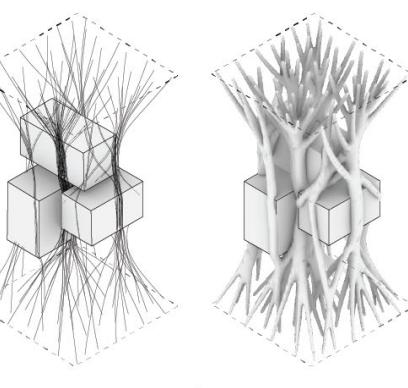
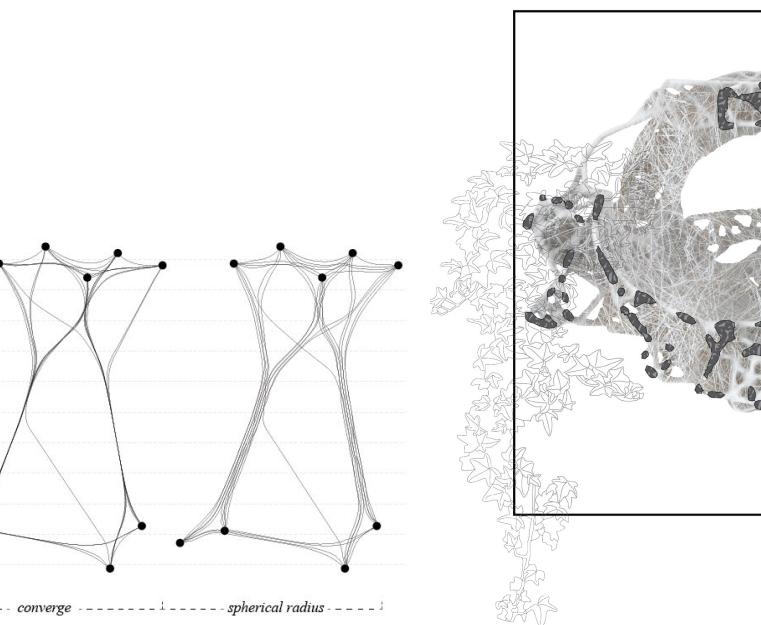
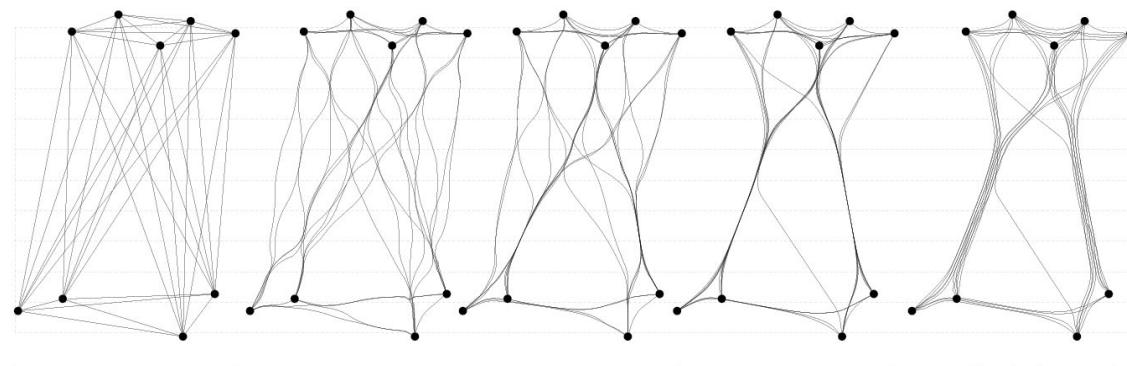
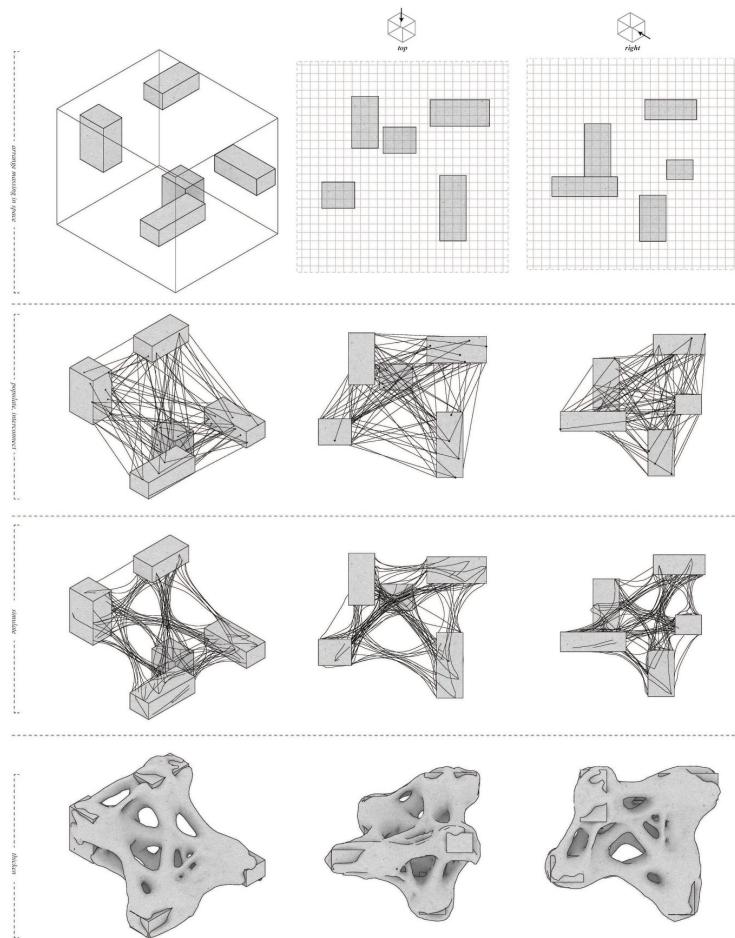
In other words, the emphasis here is not only, on the spontaneous generation of form, but on the fact that this morphogenetic potential is best expressed, not by the simple and uniform behaviour of materials, but by their complex and variable behaviour.

—Manual Delanda.

to study a biomechanism is to study its principles, rather than formal complexity. the simple principle defines the base block of life and its directive. it is from simple principles that automata emerge {think: Conway's Game of Life}. the simplest principle of particulate attraction and particulate distance rigidity form the basis of the wet thread automata, computing surface and string tension at its essence. to compute life in its entirety is bold, unpredictable and emergent. this project strives to understand the biomimetic properties of the wet thread in computational architecture, humbled by the effortless spider and silkworm. the idea is not to mimic but to emerge with an architecture from a core automata, organising formality, structure and environmental response in a single emergent solution.

*2024 spring semester design studio.
advised under Dr. Frederico Ruberto.*

*Awarded Design 6's Most Visionary Project
at ArchiFest 2024.*

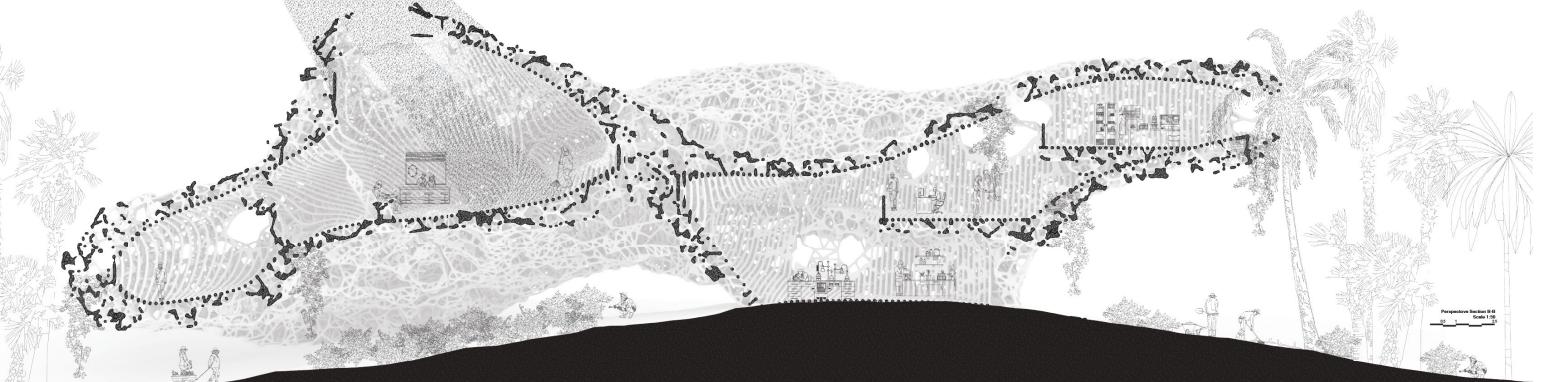


work floor a

the meeting floor

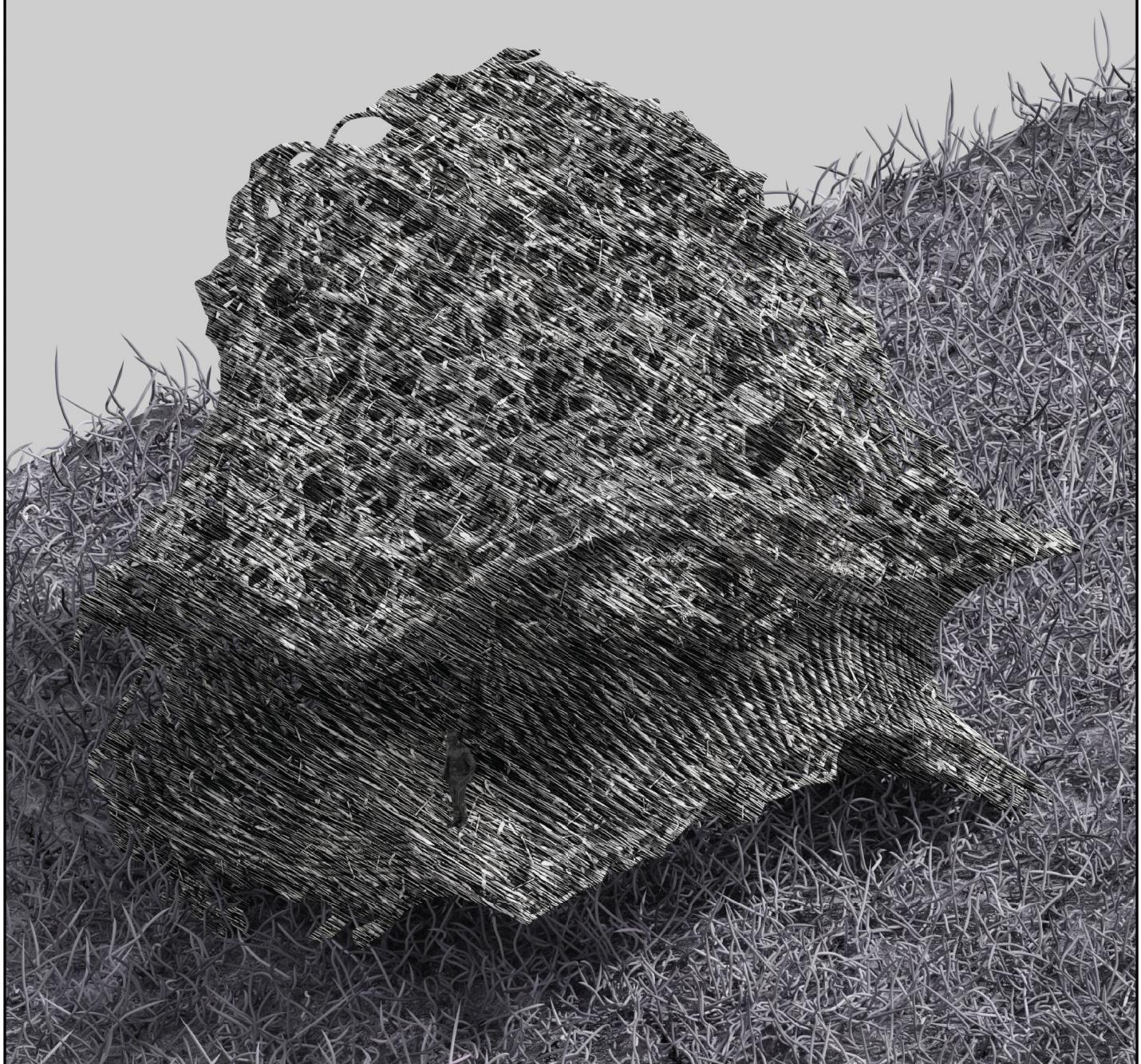
work floor b

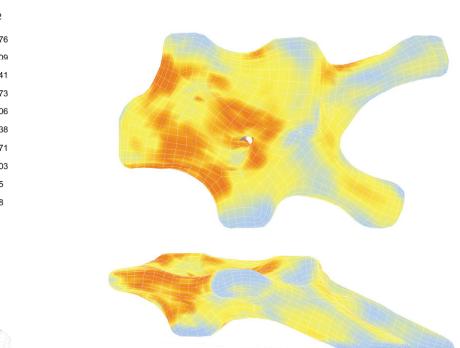
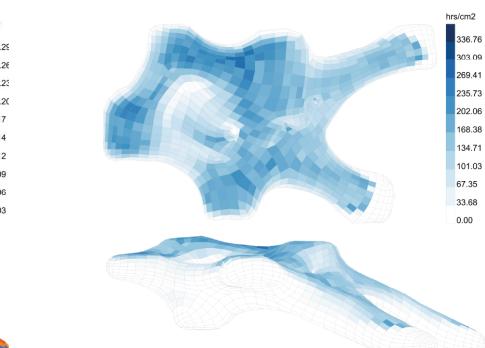
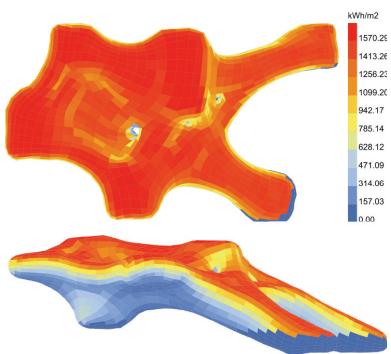
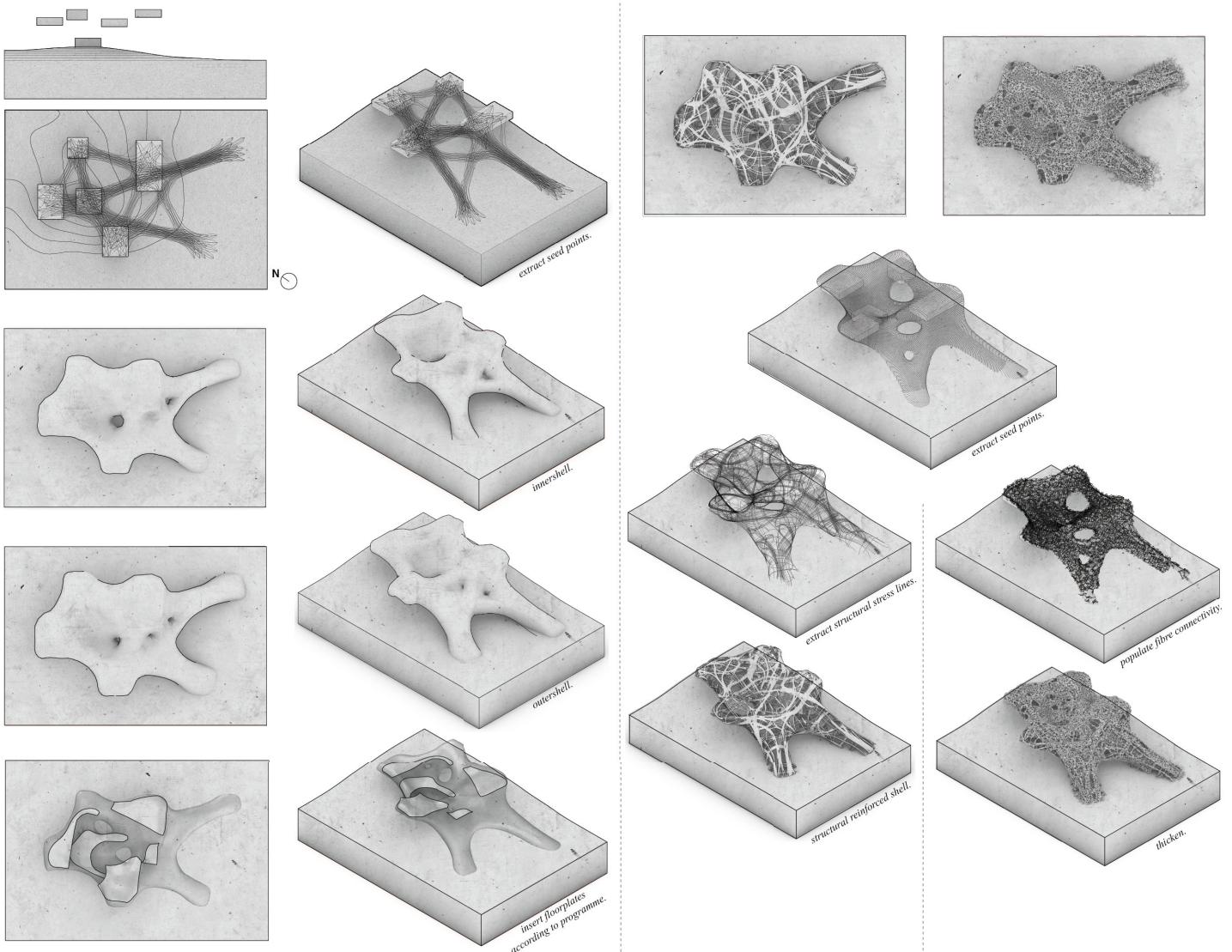
the laboratories



pulling strings to get there

recursive wet threads





.dérive

computed circulation; micro living._

dérive paths._ the desired path._

the idea of social networking as a humanistic endeavour, begging for an architecture organised around the desire to be with another, emerging from a network of anchors and attractor threads.

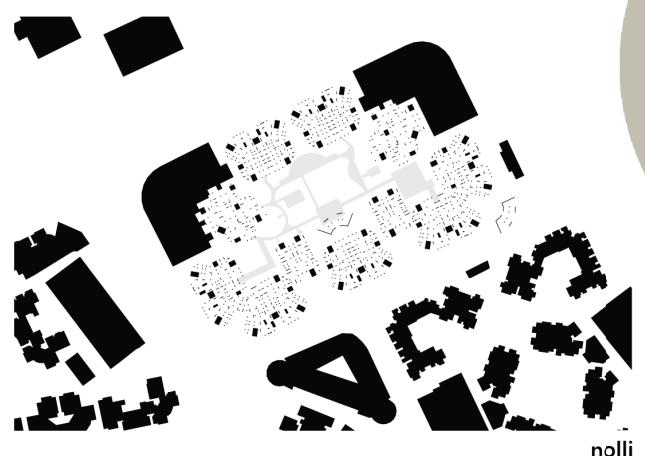
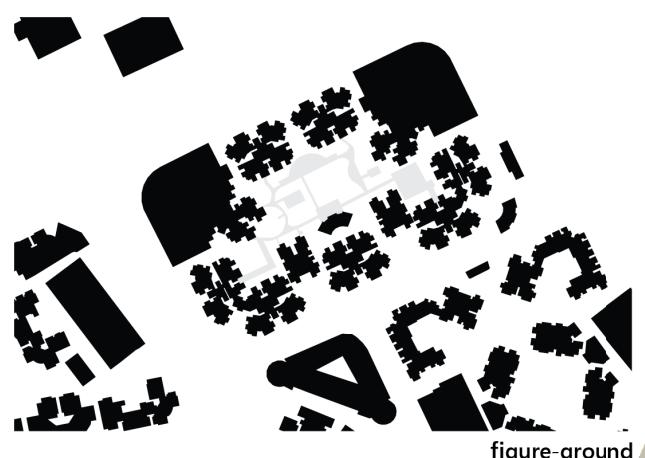
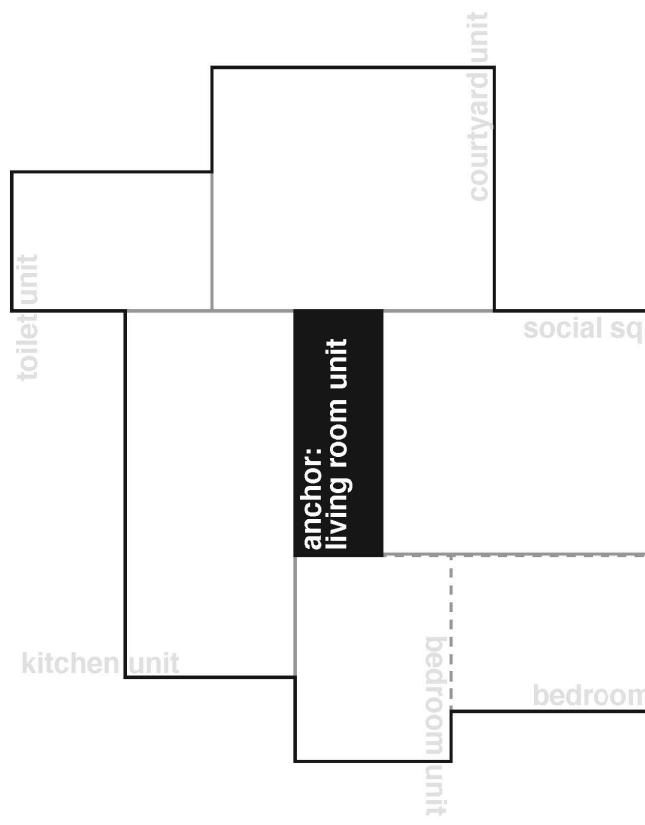
existing student housing in the University of Strathclyde exists simply as bedroom-packed tenement-style flats, uninspiring to the social fabric and unresponsive to the daylighting needs of the studying university student.

the self-proclaimed ‘student village’ feels more like an existing dense housing typology borrowed to serve accommodation needs of the student body, resulting in more of a ‘student tenement’. a village insinuates the concept and promotion of social and community living, including a self-sufficiency of sorts, both that i feel are lacking in the current implementation. the incredible proximity of the site to the University of Strathclyde begs an intervention.

cross-studying with the singapore context, the standard hdb void deck offers opportunities for social interaction and self-organised community events, emerging from natural interaction between residents.

the wet thread excels here in its intrinsic minimal-network seeking automata, deriving the dérive paths. the nuance of attraction and anchorage extend into architectural massing, deriving the shapes, micro-organising principles of the unit rooms to be clustered around the minimal-network path.

*2023 fall semester design studio.
exchange semester at the University of
Strathclyde, Glasgow.
advised under Ar. Alastair Cassell.*



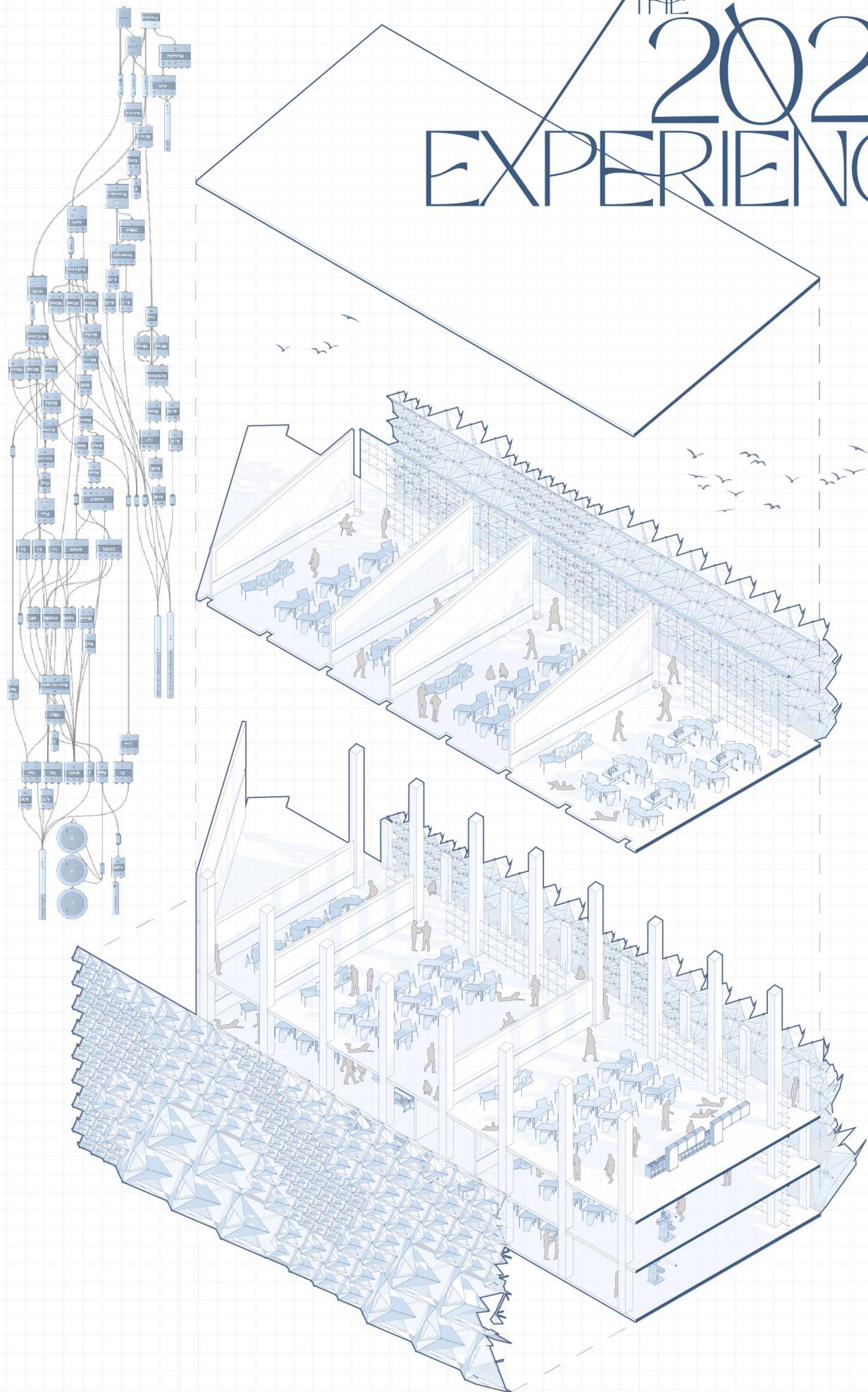
to dérive

to derive forms, circulations, massings, desired paths (dérive paths) from organic, physical-inspired mimicry, learning to live and work in a break from the Glasswegian norm. Designed with Grasshopper 3D, scripting and simulating physical experiments of gravitational grouping and wet thread simulations, oriented for the oh so annoying early sunrises of summer, and the oh so depressing early sunsets of winter.

CHEAH Hao Yuan
AB317: to live / to work
urban student housing
To Dérive



THE 2020 EXPERIENCE



.the 20/20 experience

climatic; reactive; performative; kinetic facade._

The 20/20 Experience designed for Hillgrove Secondary School recognized the need for a climatic kinetic facade that can efficiently mitigate the challenges posed by Singapore's tropical climate. With an emphasis on harnessing the power of natural sunlight, the kinetic facade of this project acts as a living organism, dynamically adjusting its form and properties to optimize the internal environment in contrast to seeming unpredictable weather conditions.

Using advanced sensors and smart technologies, the kinetic facade adapts in real-time, responding to the intensity and angle of sunlight. A series of configurations of each cubic module plays with translucency and reflection to redirect natural light into the otherwise inadequately lit rooms, according to the various needs of the individual classrooms, workshops, artrooms and computer rooms within. This dynamic response ensures optimal daylight penetration into the building while simultaneously preventing excessive heat gain and glare.

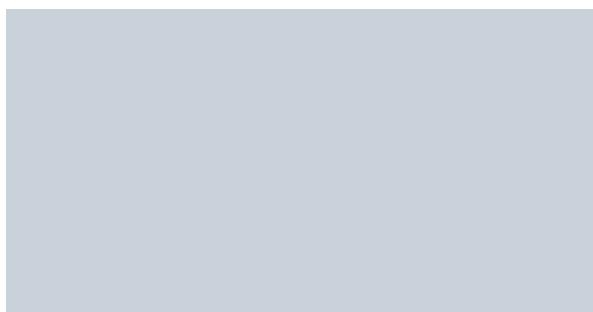
The design process was inspired by the precedent study of the Institut De Monde Arab which implements a series of kinetic apertures that are sensitive to sunlight and programme of the building. Taking into consideration the fundamental concept of a mashrabiya, a type of facade design implemented in the Middle East to ensure privacy while still allowing cross ventilation, The 20/20 Experience aims to reinvent the classroom experience in order to create dynamic and engaging learning opportunities.

Adapting a parametric design through the use of Grasshopper 3D to automate and arrange the modules according to the programmatic needs of the spaces within, the facade is aggregated as a kinetic skin unto the block.

The final facade design was realised through a semester-long process of design sprints and ideation, generating and performing real-life testing and measurements of scale facade models, improving from preceding design iterations with a focus on climatic performance, kinetic functionality and overall aesthetic.

The 20/20 experience aims to elevate classroom pedagogy, going beyond just a climatic facade into a spatial aggregate to introduce opportunities for both isolation and interaction through the exploration of scale and its relation to spatial opportunities while achieving a climatic performance.

*2023 spring semester design studio._
in collaboration with Jamie Foo._
advised under Dr. Florian Heinzelmann._
exhibited at ArchiVAL 2023._
nominated for NUS BOA Submission 2023._*



video journal: <https://www.youtube.com/watch?v=-5vmov2IzpU>

Previous Designs

Jet Butt

Clock

DP

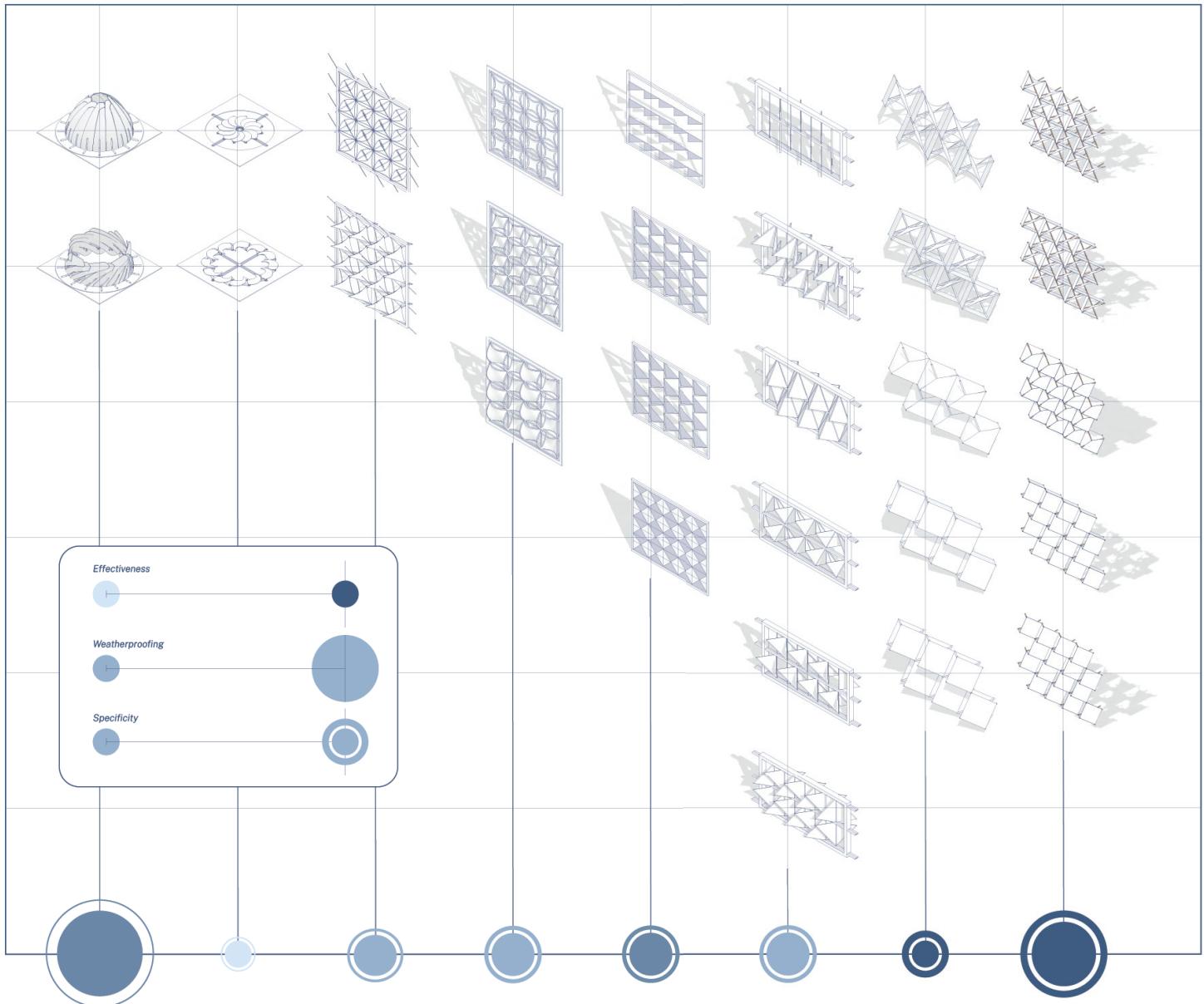
Kopi Sock

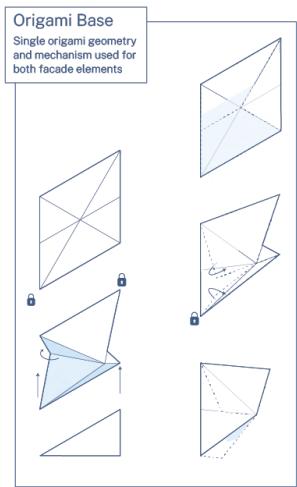
Peter

PTKI

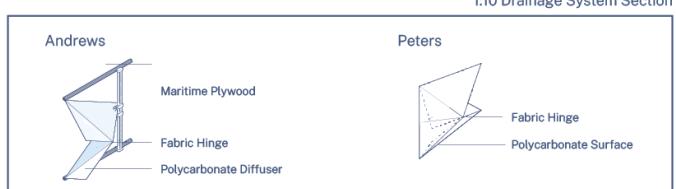
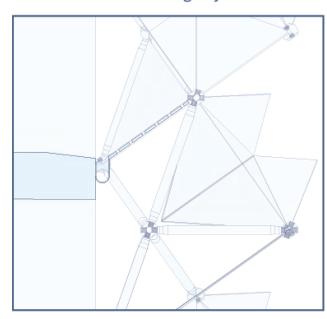
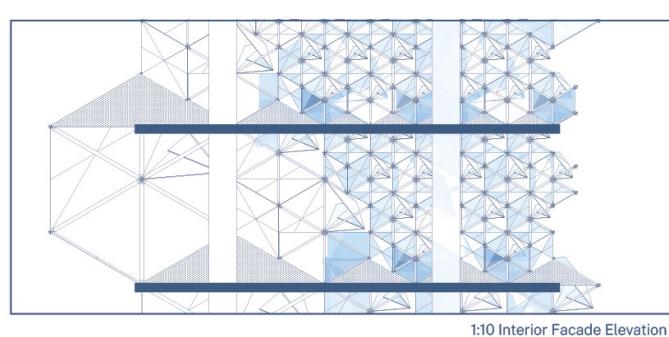
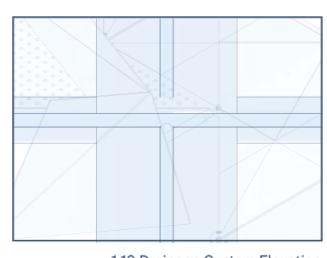
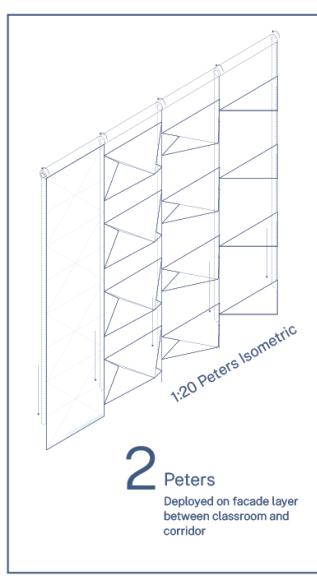
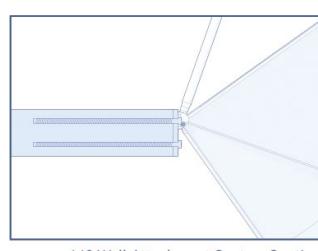
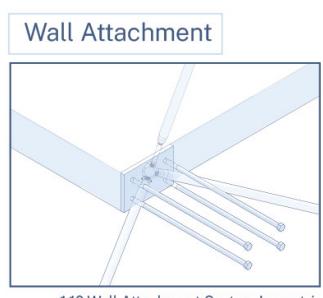
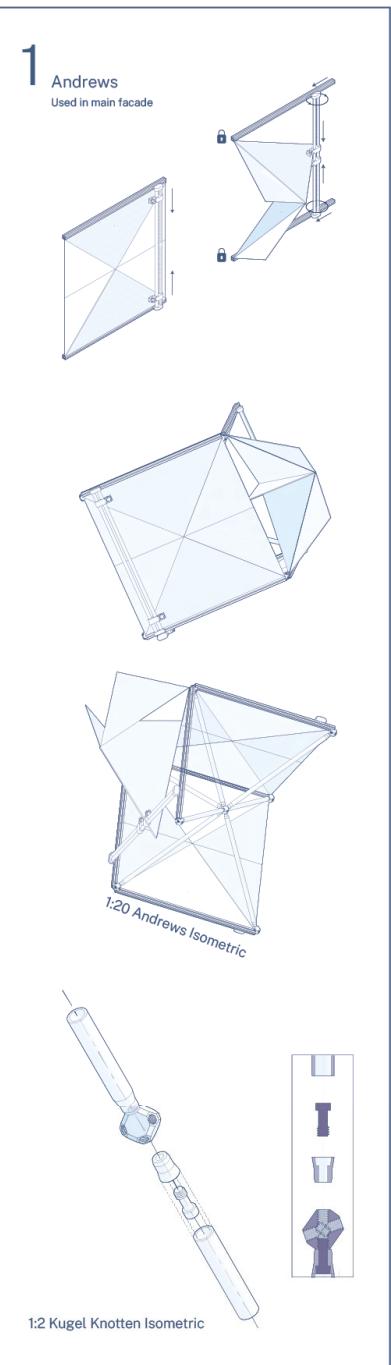
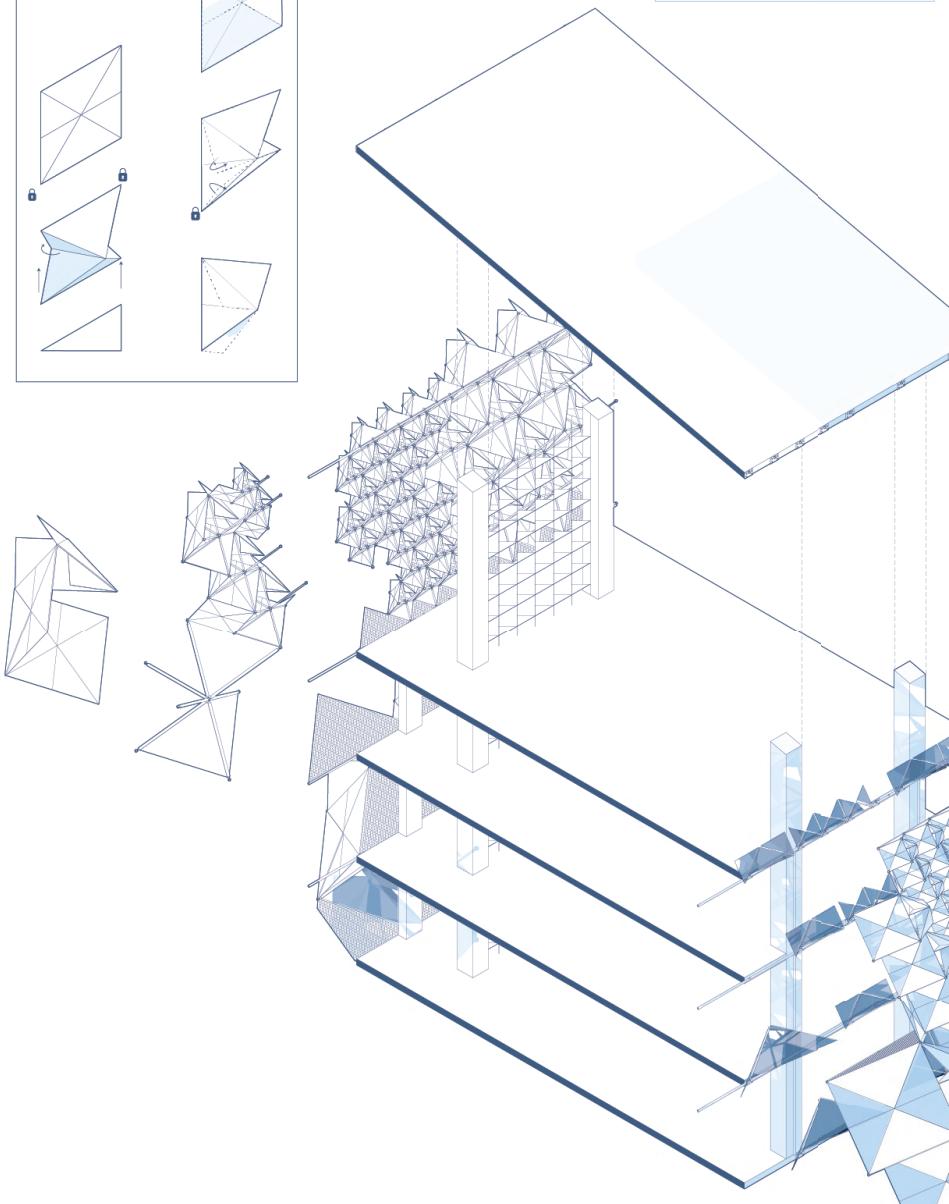
MPRB 1.8

Mojang

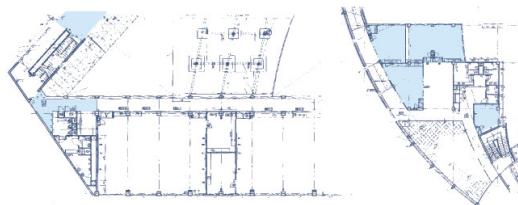
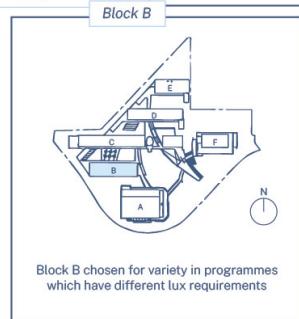




Construction Details

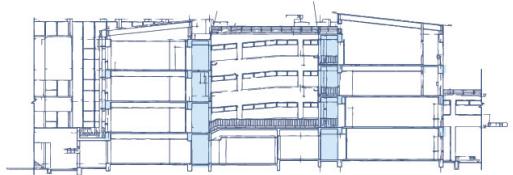


Target Zone



1 Irregular plan

Irregularly shaped school plan results in the need for creating oddly shaped classrooms when needed, and also results in deadspace
Subject based banding- the need for smaller clasrooms for more specific class demograph- ics



2 Stacked classroom layout

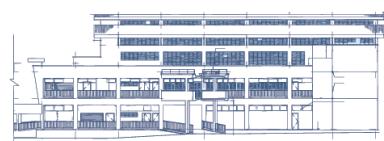
Classrooms on lower floors not being able to receive sufficient natural light and ventilation.
2m wide corridor space results in classrooms being inset which results in a high reliance on artificial lighting

Existing Interventions

1 Large overhang

Stacked classroom layout with wide corridors acts as a large overhang which greatly reduces lux levels in classroom

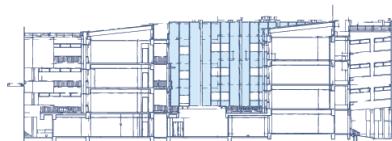
Resultant Lighting Condition:
Direct sunlight comes in at steep angle during late afternoon



2 Horizontal corridor louvres

Horizontal louvres are deployed on the facade of every classroom, louvres observed to make classroom stuffy and hot

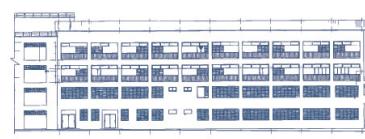
Resultant Lighting Condition:
Uneven spread of lighting between classroom and corridor



3 Perforated aluminium sheet

Perforated aluminium sheets as overhangs and balustrades along corridors which reduces heat gain and lux levels but allows airflow

Resultant Lighting Condition:
Lux levels significantly reduced

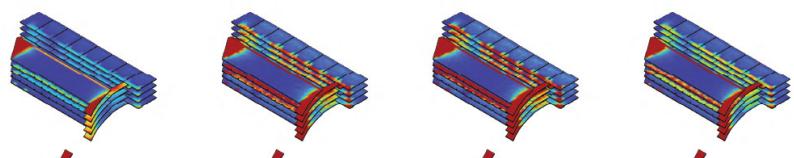


4 Horizontal classroom louvres

Column of 6 louvres that are a mix of both translucent and opaque.

Resultant Lighting Condition:
Low lux levels in classroom, uneven spread of light between facade and interior

Lux Simulations

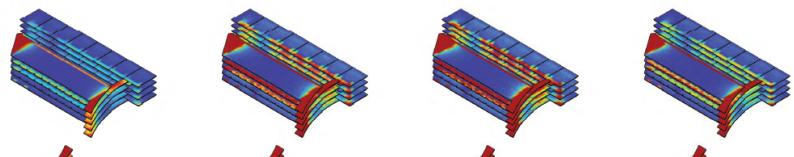


March/ Sept, 8am

March Sept, 11am

March/ Sept, 2pm

March/ Sept, 5pm

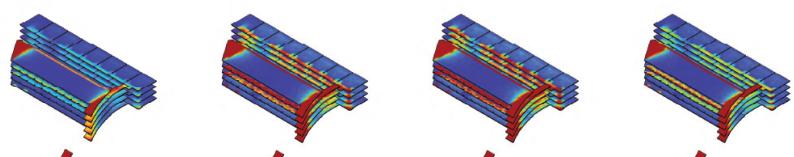


June, 8am

June, 11am

June, 2pm

June, 5pm



Dec, 8am

Dec, 11am

Dec, 2pm

Dec, 5pm

Northeast and Southwest Projection, Plan



N



S



E



W



U



D

0 lux

3200 lux

Testing

8am
Classes start 0730,
More light needed from the East

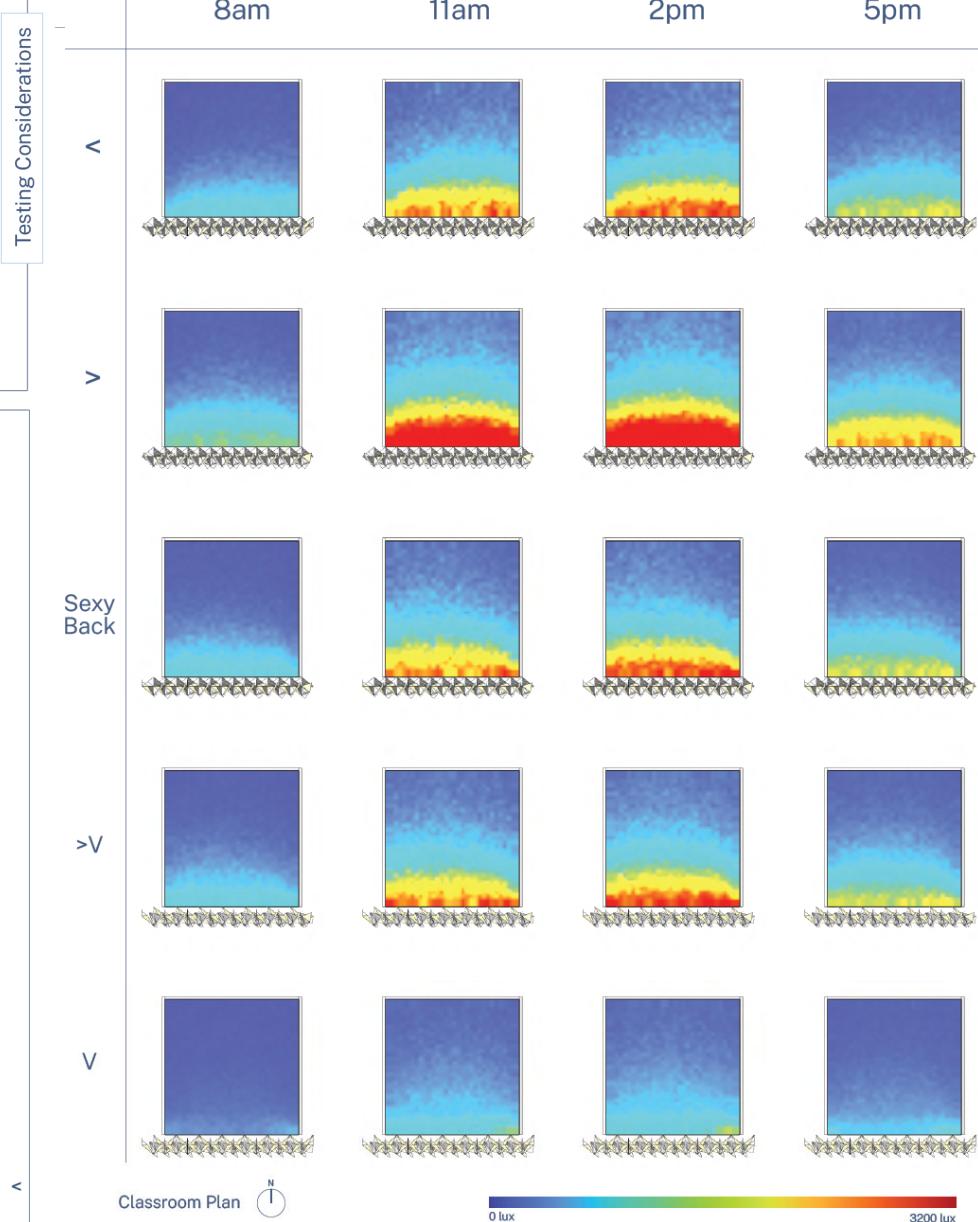
11am
Before Solar noon
Classes continue
Less light needed from overhead to reduce glare and heat gain

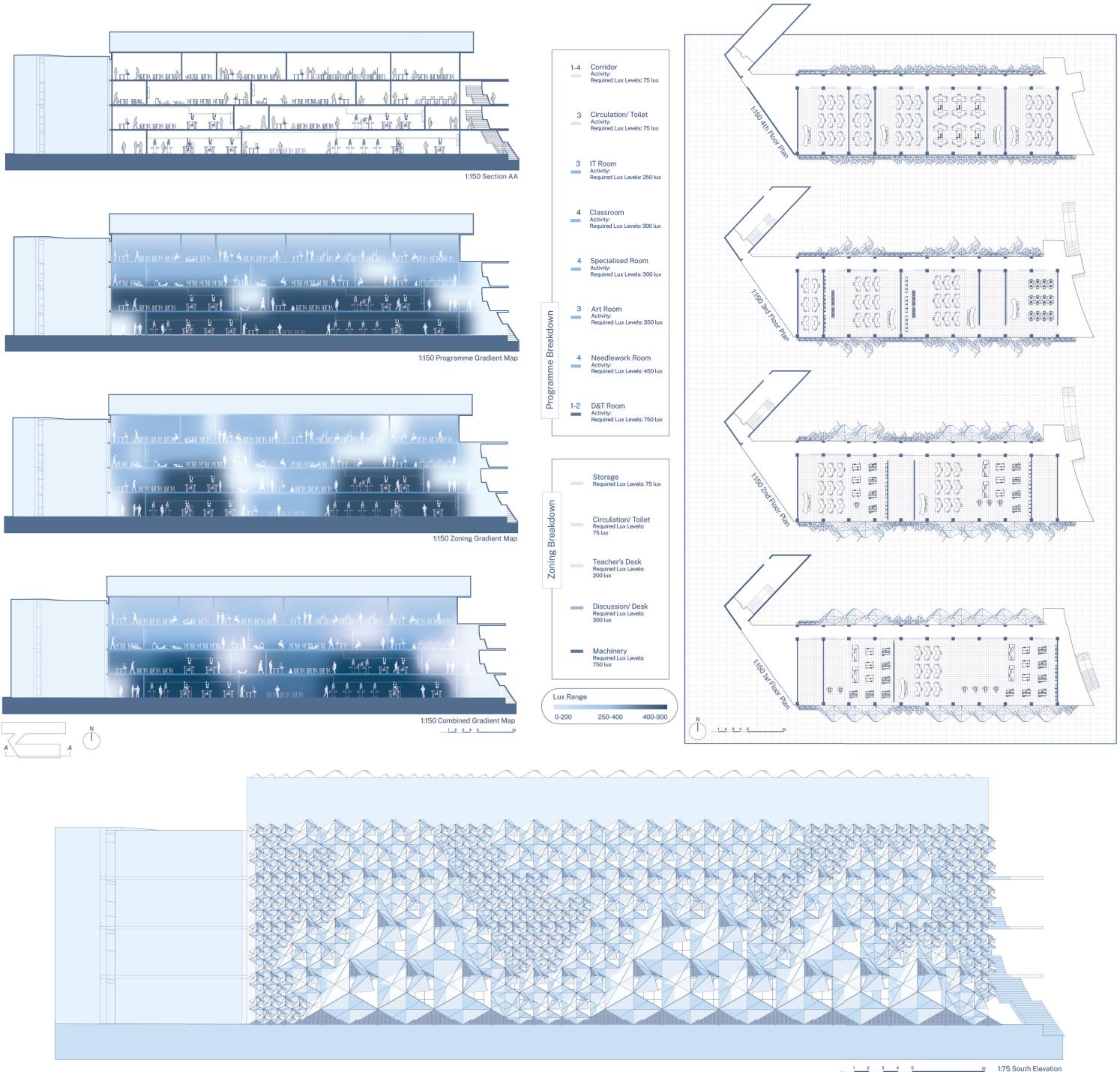
2pm
After Solar noon
Classes continue ~1500,
Less light needed from overhead and West

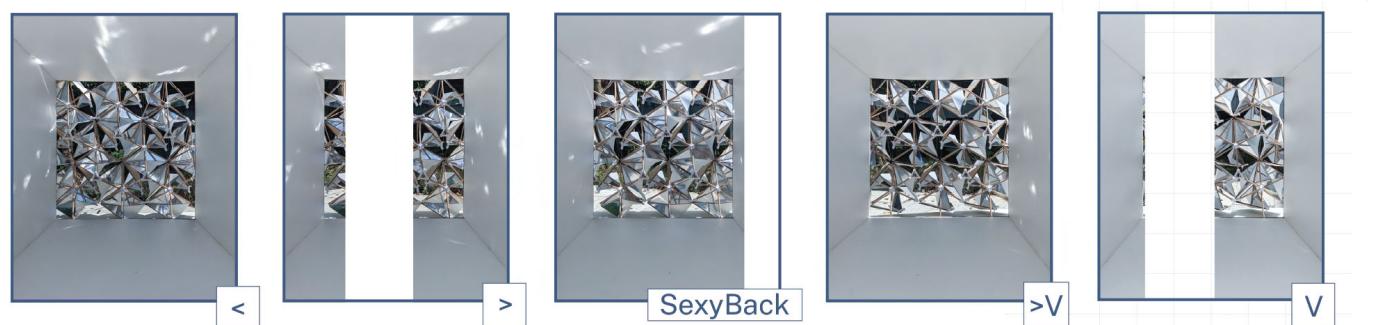
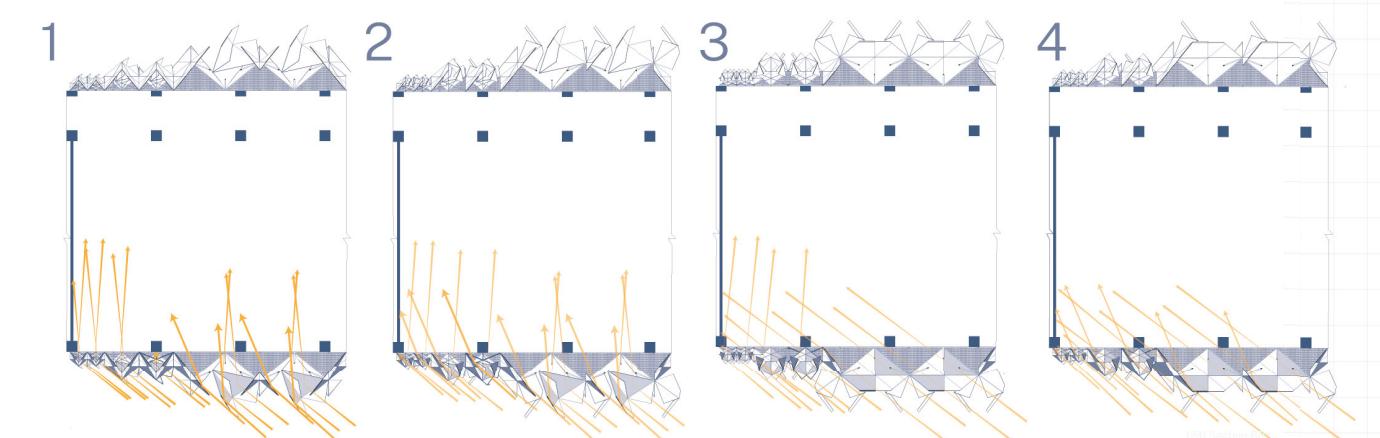
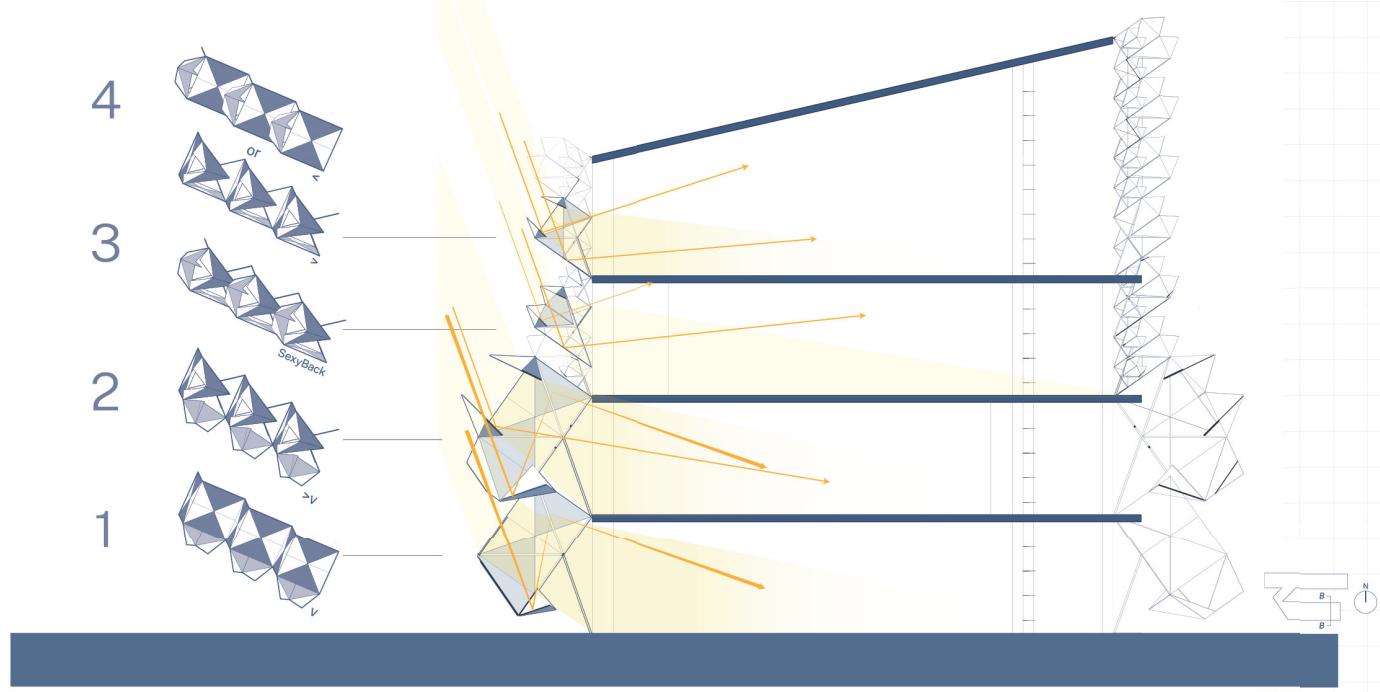
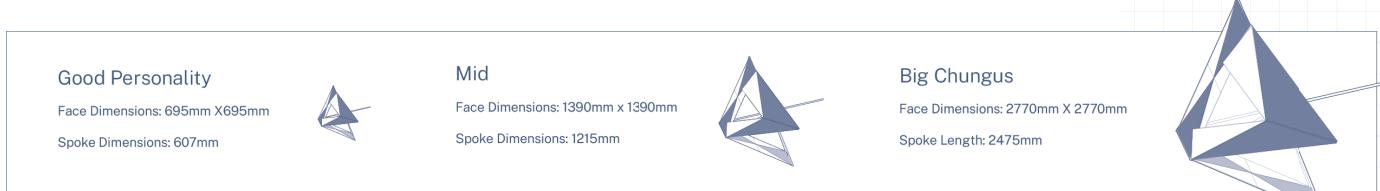
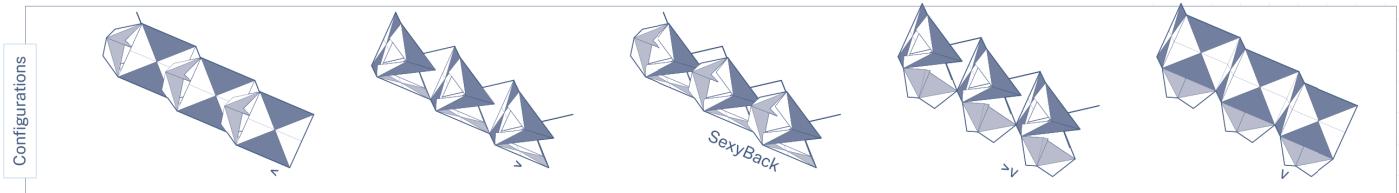
5pm
After school activities commence ~1800, largely occupying multi purpose halls and air conditioned rooms, D&T classrooms still in use
More light needed from the West

Evaluation

The figure consists of eight 3D surface plots arranged in a 4x2 grid. The columns represent 'Sunny' (left) and 'Overcast' (right) conditions. The rows represent time points: 8am, 11am, 2pm, and 5pm. Each plot displays a series of overlapping, tilted pyramids. In the 'Overcast' plots, the pyramids appear more vertically aligned and densely packed than in the 'Sunny' plots, particularly at the later time points (2pm and 5pm). The plots are set against a background with vertical grid lines and horizontal axis labels (> and <) pointing along the diagonal of each plot.







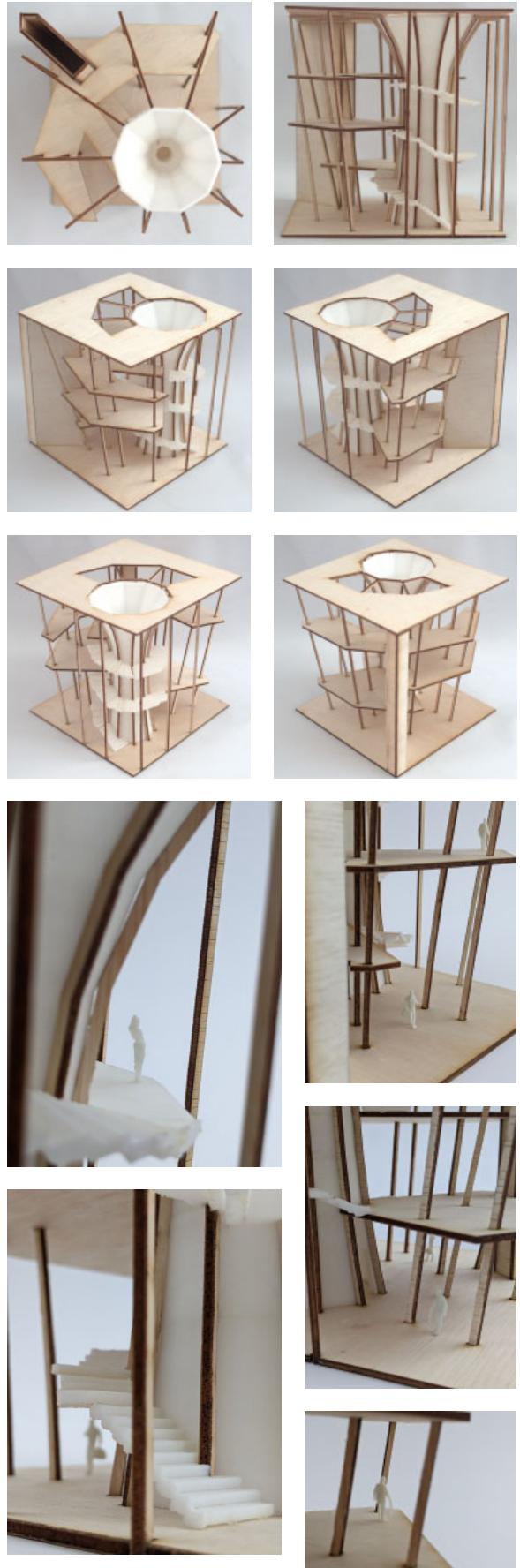
.potter's corner

structure practice; reinforced concrete.

the potter's corner is a team structural design and drawing exercise in reinforced concrete and steel.

it functions as both a pottery studio and gallery for display. The concave-shaped kiln, located nearest to the park and facing the sidewalk serves to attract visitors to the gallery and acts as the centrepiece in this gallery. The first level houses a pottery studio where visitors can observe the potters in their workspace. The second level is a retail space, followed by the gallery located at the third and fourth level. The circulation upwards is integrated with the kiln through a series of staircases to celebrate walking up the kiln. This also facilitates visual interaction with the pottery displayed.

The facade columns follow a self-imposed grid radiating from the concave-shaped kiln. The facade columns are slanted outwards to emphasise the upward-outward growth of the floor slabs, and secondary columns are erected in the inner radial grid to support the Level 2, 3 and 4 floor slabs, according to both the radial grid and the structural support requirements. Beams are inserted between the columns and kiln, extending into the slight cantilevers of each floor slab.



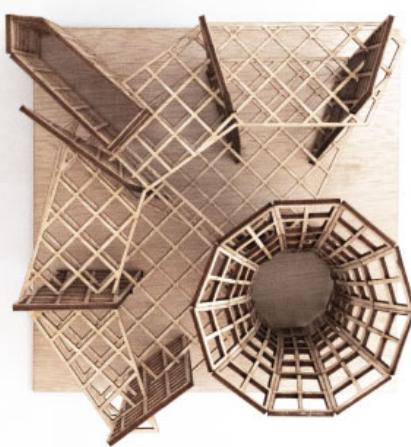
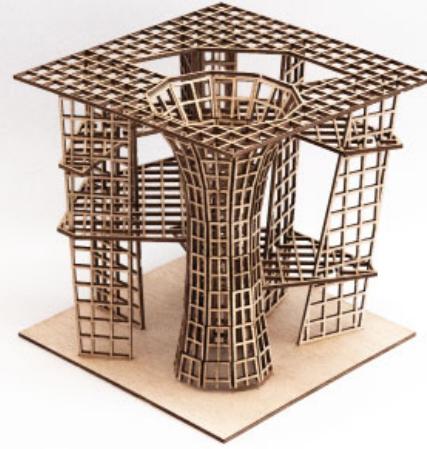
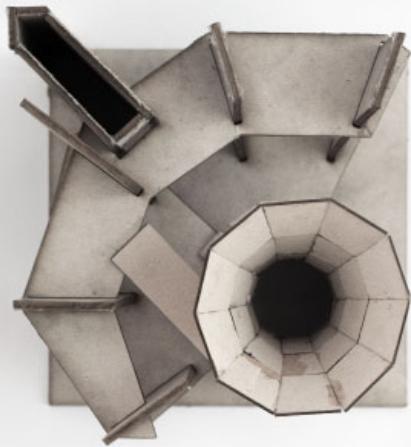
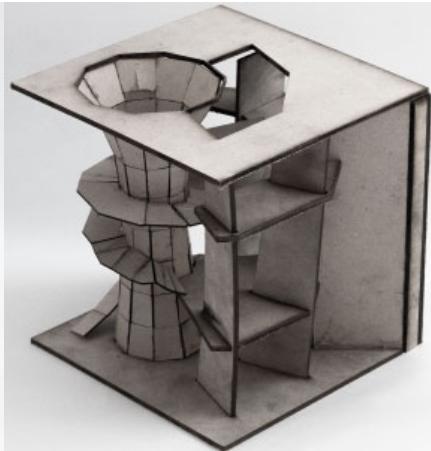
*2022 fall semester structural studies.
in collaboration with:*

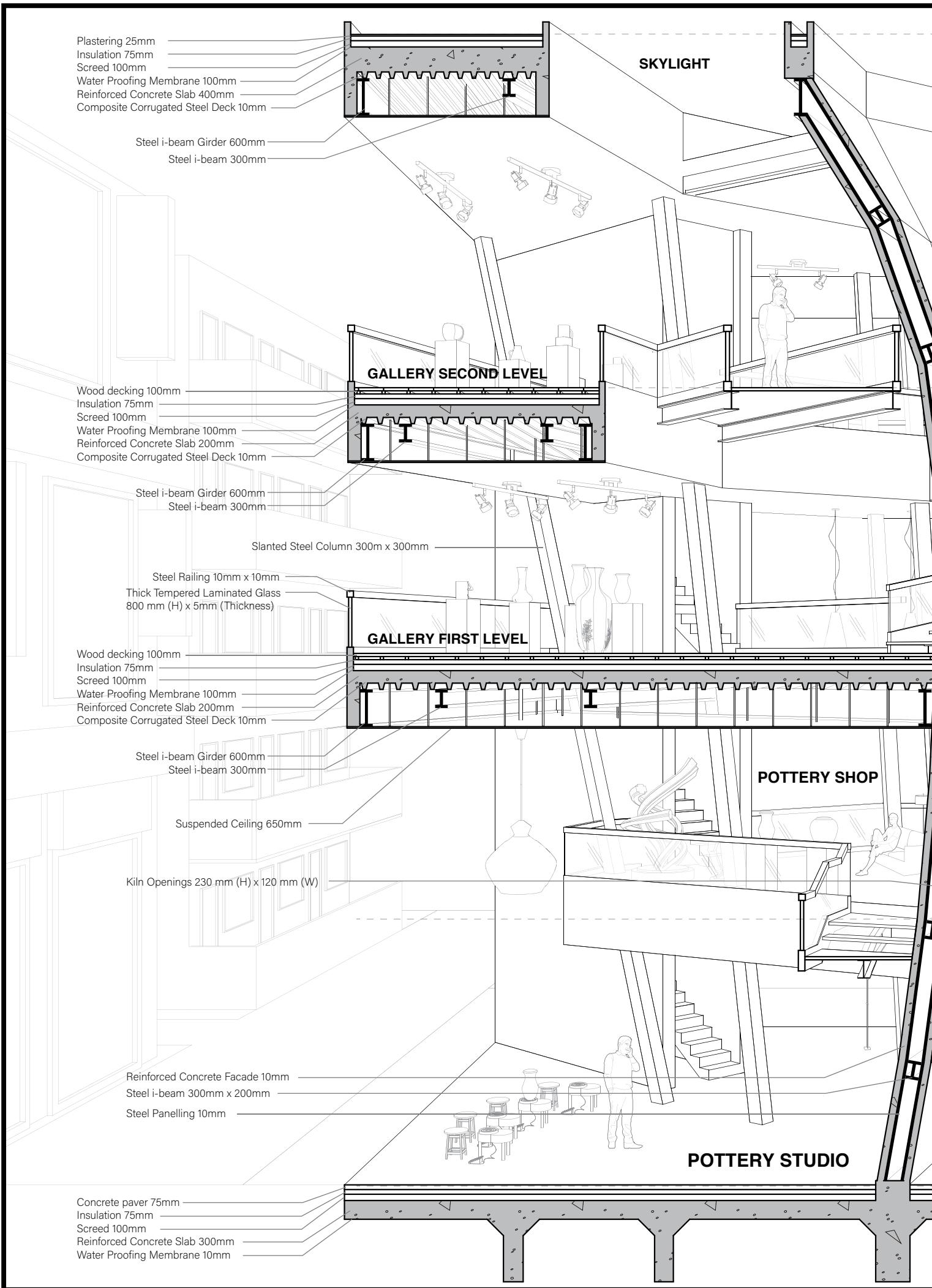
Nellie Leong.

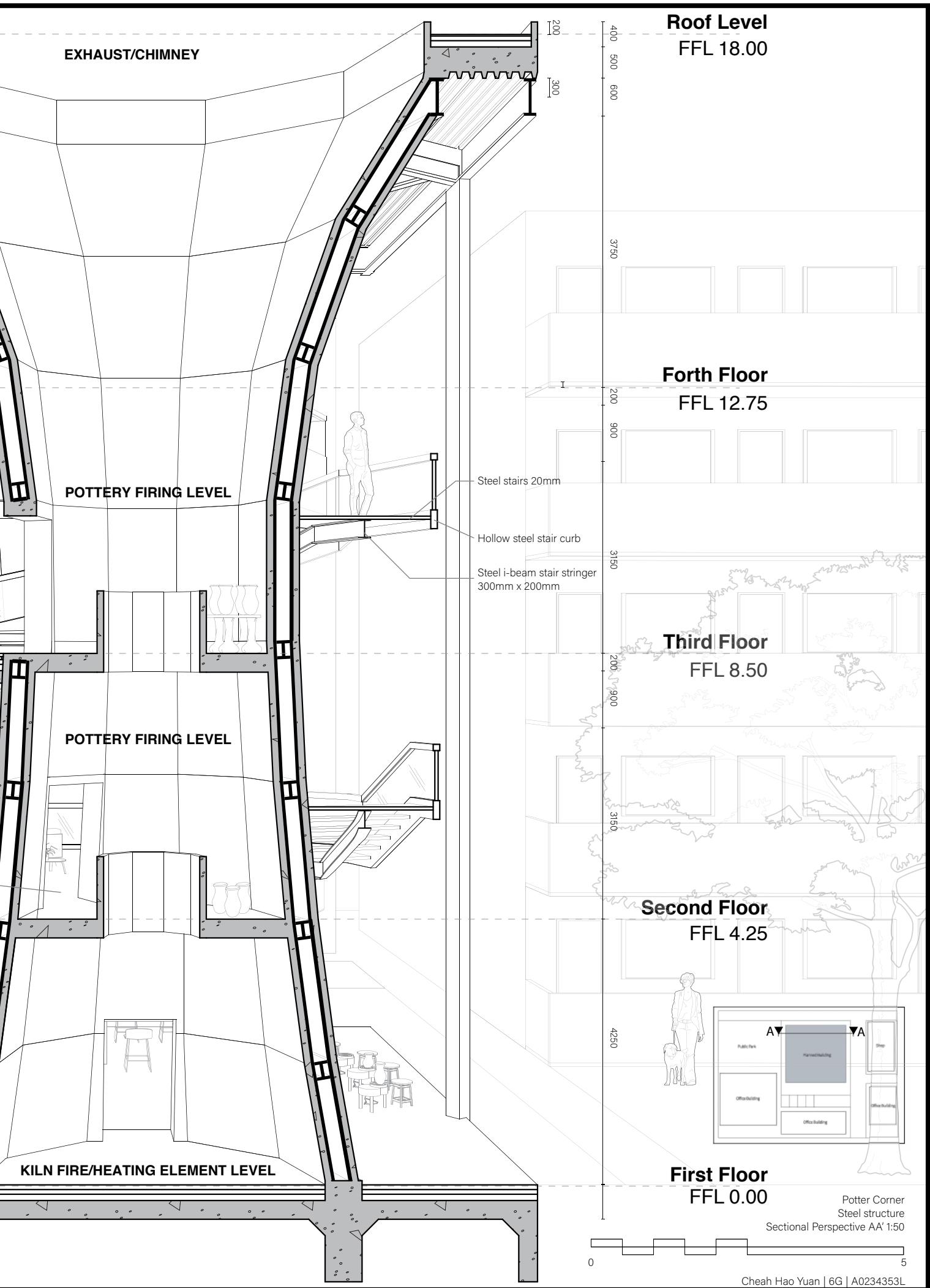
Wu Chenyu.

Rachel Ariella Saly.

*advised under Ar. Huey Wen Jun.
exhibited at ArchiVAL 2023.*







.the grapevine

voidable; aggregation eccentricism.

this project takes precedence from David Umemoto's concrete cubic exploration in his concrete art projects "Cubic Six-24" and "Primitive-02", explored in the diagrams in the lower half of this board.

a series of operations, permutations and aggregations of these two seemingly simple cubes result in complex aggregations of space and liveability. the cubes were morphed from their 6-inch concrete sculptures into human-scale modular spaces. Its cubic arrangement break free beyond face joinery and planar arrangements between cubic masses, resulting in an organic permutation within a cubic brutalism, aggregating into a series of floating masses nested amongst one another, providing an intershade and hugging of one another's spaces, creating meaning from remnant spaces and protecting naked voids.

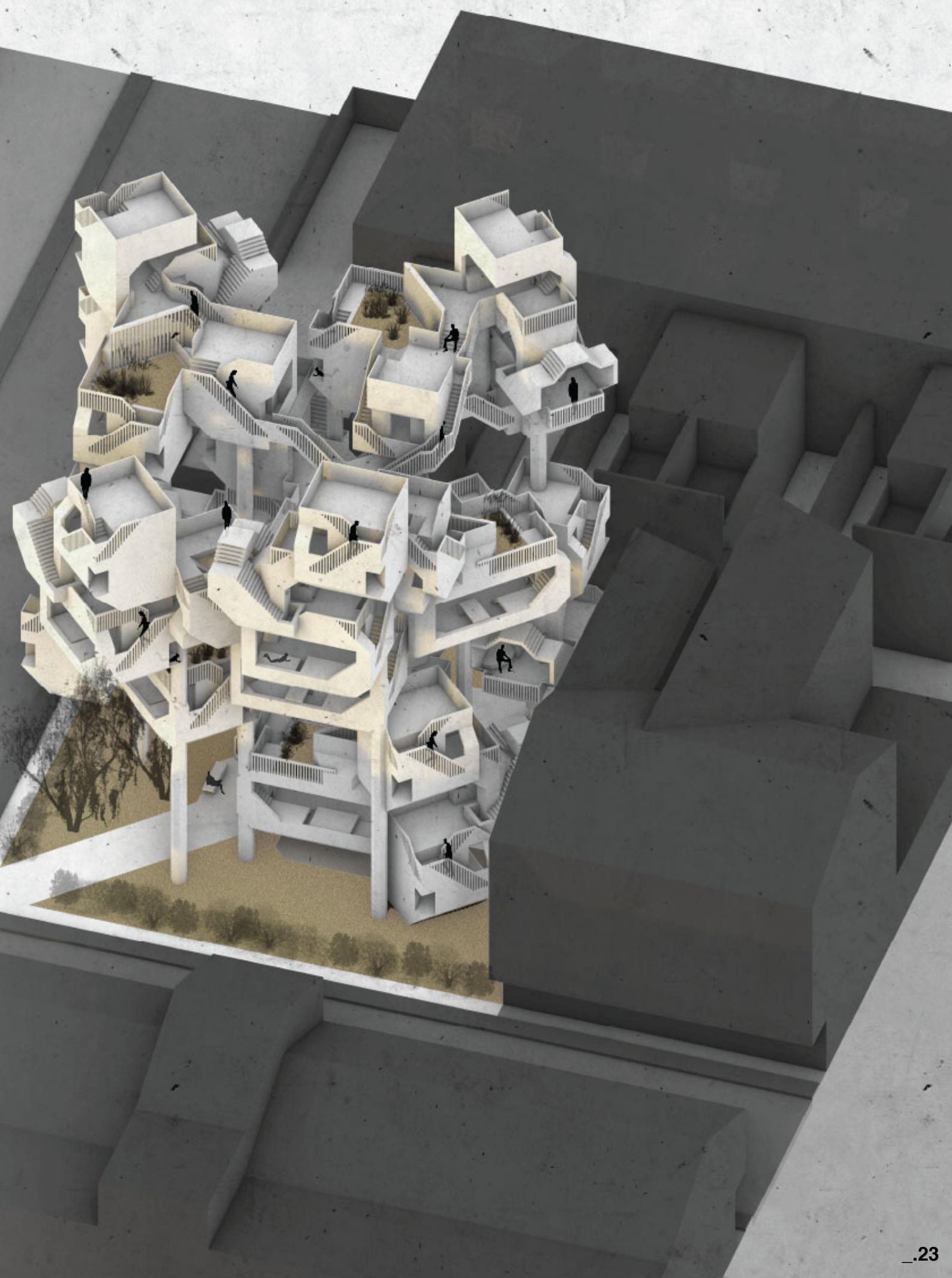
overlooking the intersection of rowell rd and kampong kapor rd, the collection of cubic masses react to simple site factors of sun, height and density, responding with direction, height and void spaces within the collective, creating airy playful cubic masses suspended mid-air, in an open flow of wind, sun and the environment.

preserving and rejuvenating the existing square park at the junction of the intersection, the cubic masses rise towards and overlook the intersection, safekeeping the green space beneath it.

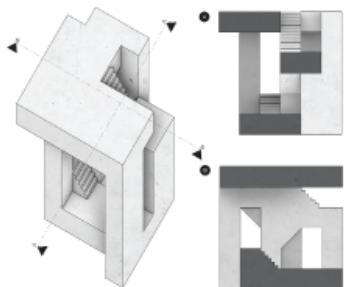
2022 fall semester design studio.

advised under Ar. Yang Han.

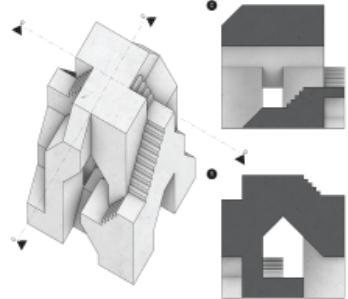
exhibited at 2023 ArchiVAL.



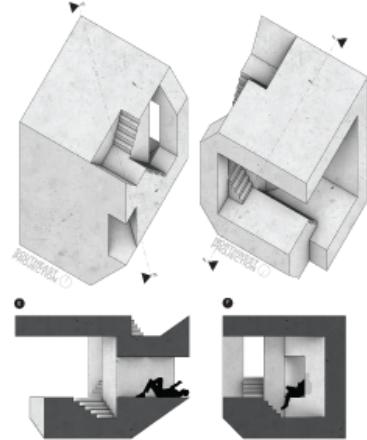
**UMEMOTO'S
CUBIC SIX-24**



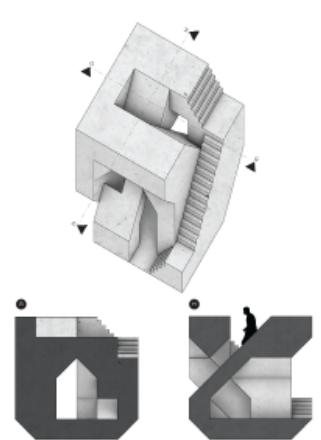
**UMEMOTO'S
PRIMITIVE 02**



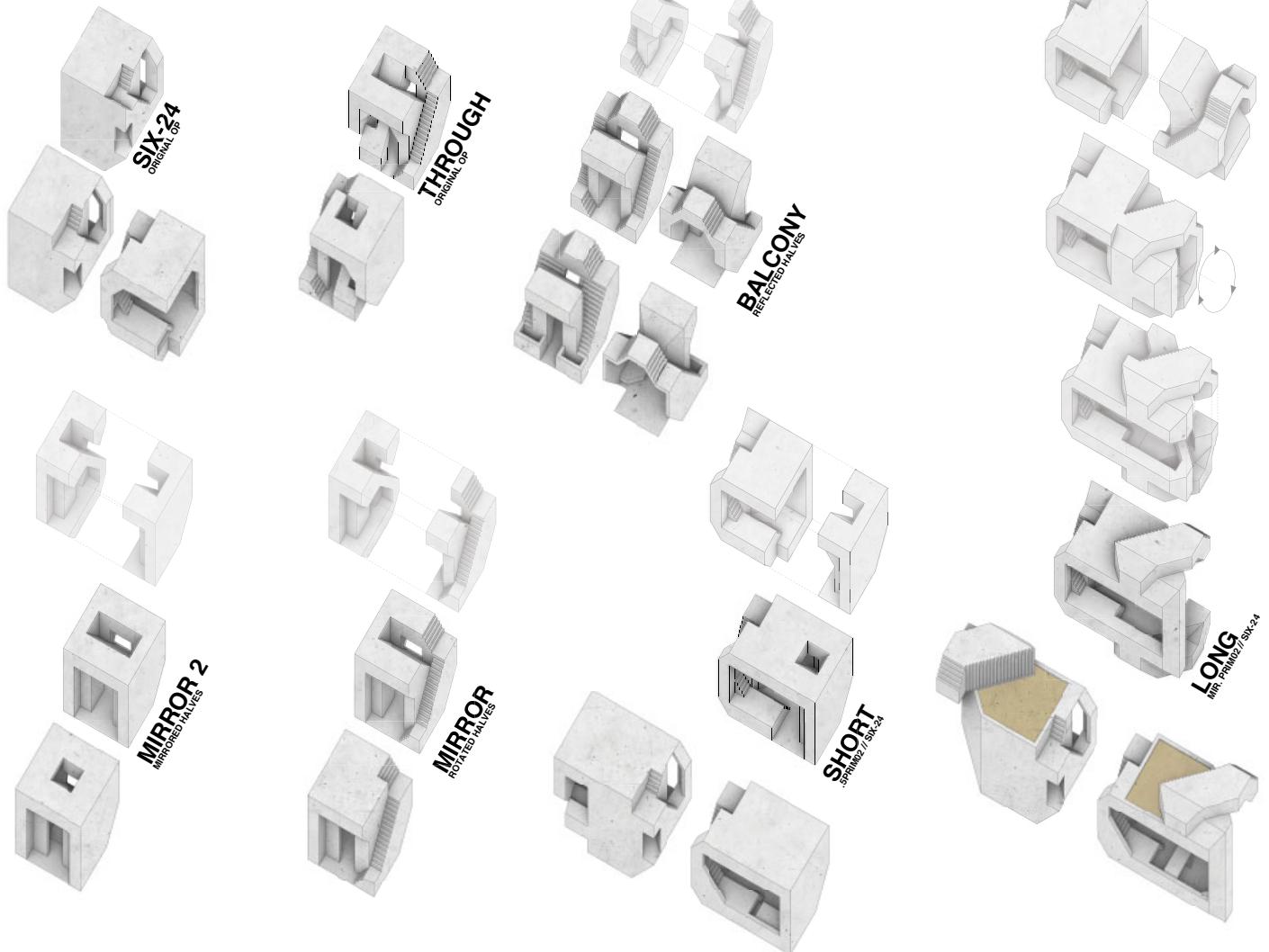
**POST-OP A3:
CUBIC SIX-24
CONTINUOUS BIG/SMALL**

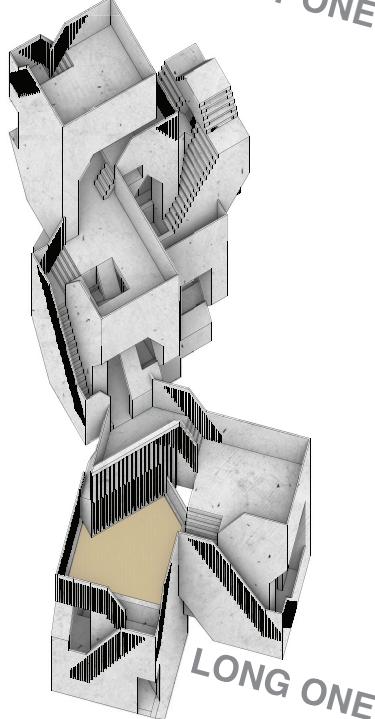
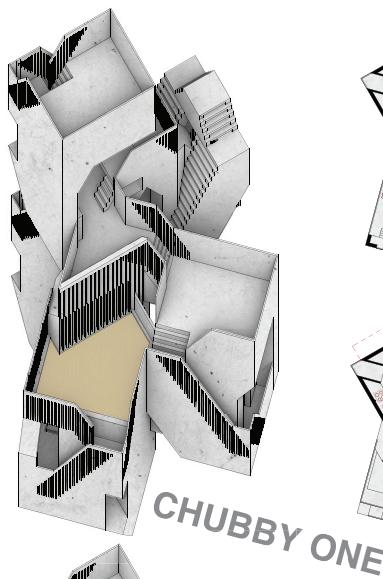
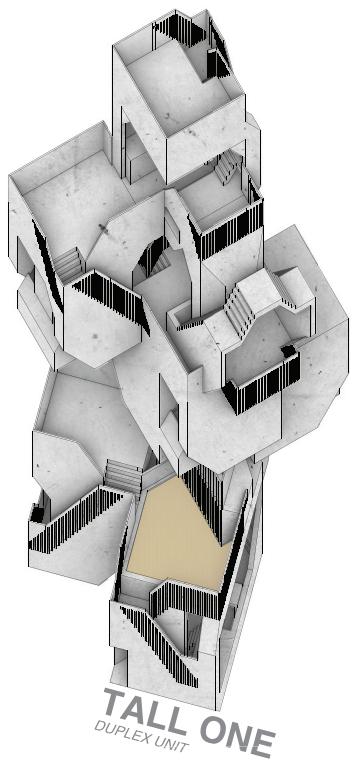


**POST-OP C1:
PRIMITIVE 02
REPEATED OPEN/CLOSED**



**FRANKENCUBES
CUBIC PERMUTATIONS**



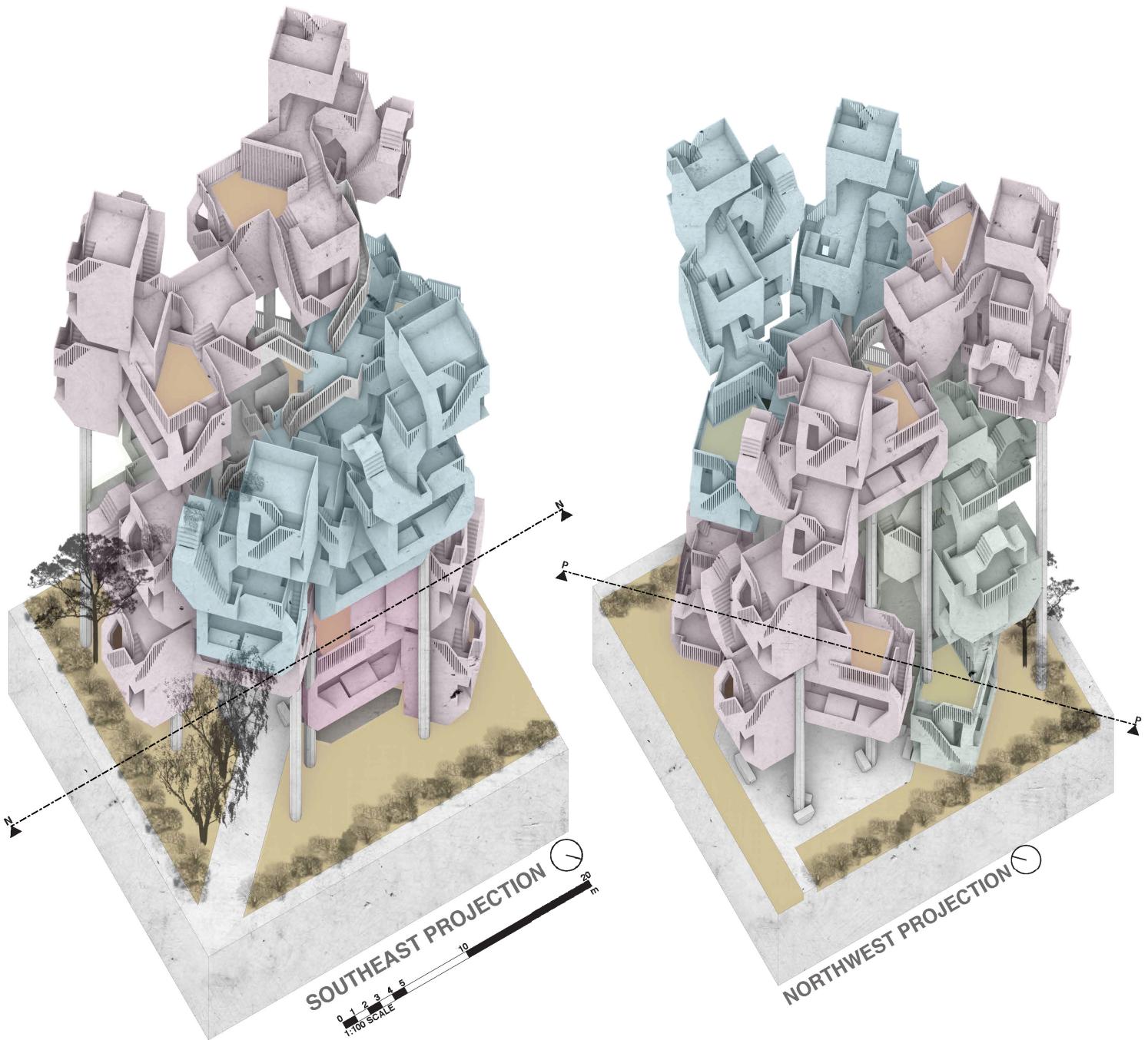


.playful aggregates

the frankencubes are then aggregated together, largely in corner-to-corner joinery, developing void spaces above, next and beneath the cubes for further interpretation as expansions of the living space.

three aggregates are developed, each with their own character. One dense, 'chubby' unit with selfcontained spaces and voids; one lengthy 'long' unit that reaches out and over; and one vertical, narrow stack of cubes subdivided into two apartments in a 'tall' aggregate.

off-angled faces in the 'long cube' give rise to 45-degree joinery between cubes, introducing a layer of playfullness and eccentricity about the aggregates, breaking from conventional planar cubic stacking and arrangements.

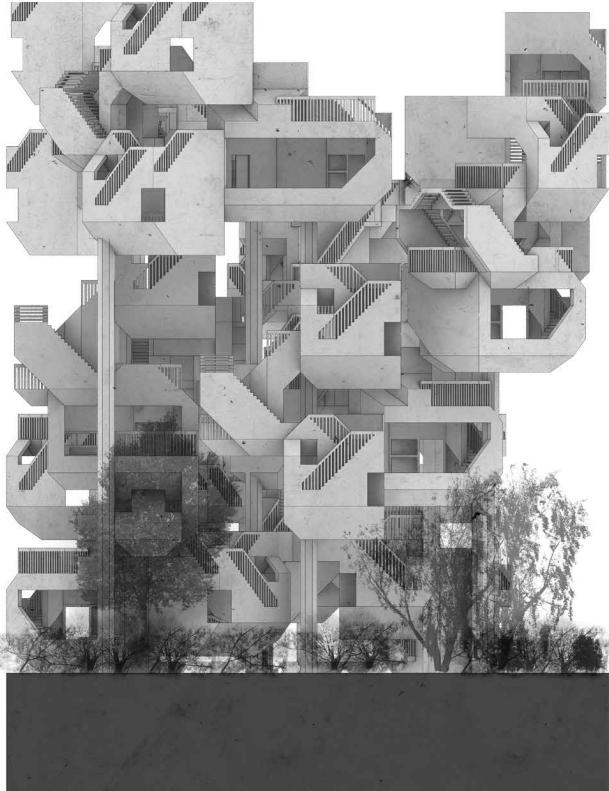


.arranging in site

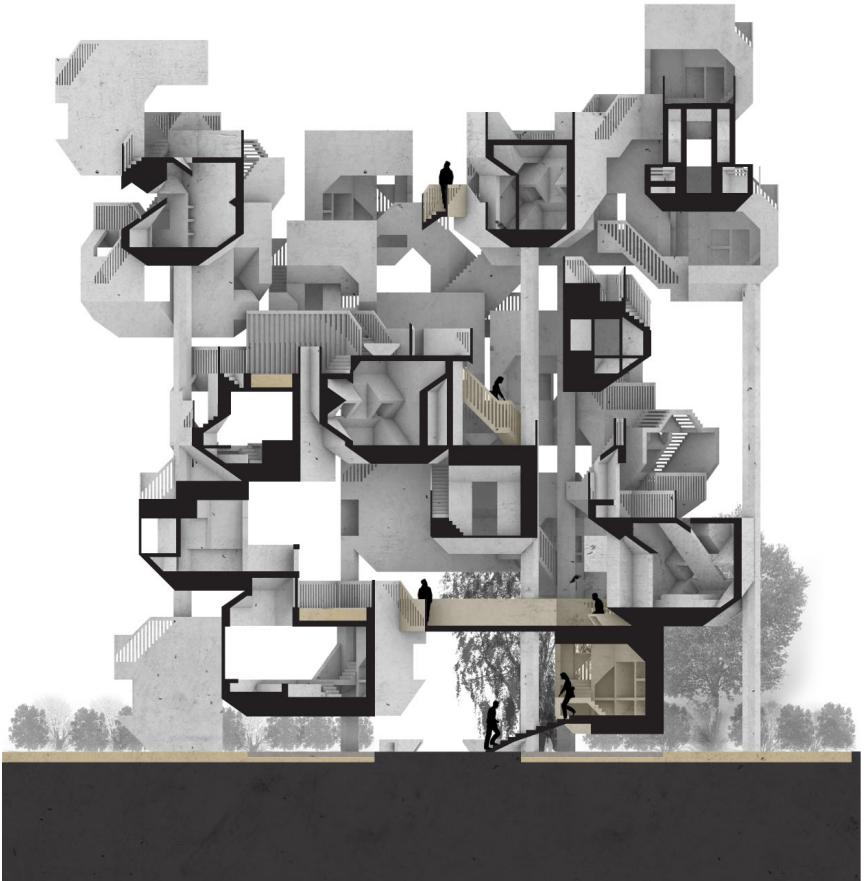
reacting to simple, basic site factors of density, height and sun direction, the aggregates are arranged in a collection, responding to these factors primarily with directionality and height.

the aggregates' formation of void spaces beneath and about its cubes provide another basis of aggregation, as the chubby, long and tall aggregates stack and interlock over one another, resting in each other's voids and shelters, socially distant from one another, providing each other with space and protection.

this arrangement of aggregates create playful cubic masses suspended in mid-air, in an open flow of wind, sun and the environment, protecting each other's inside spaces in a collective huddle of cubes, while preserving much of the former park at the street level, as the Grapevine grows out of the soil, winding around the columnal trellis the aggregates 'slot' into, a la prefabricated, slotable units.



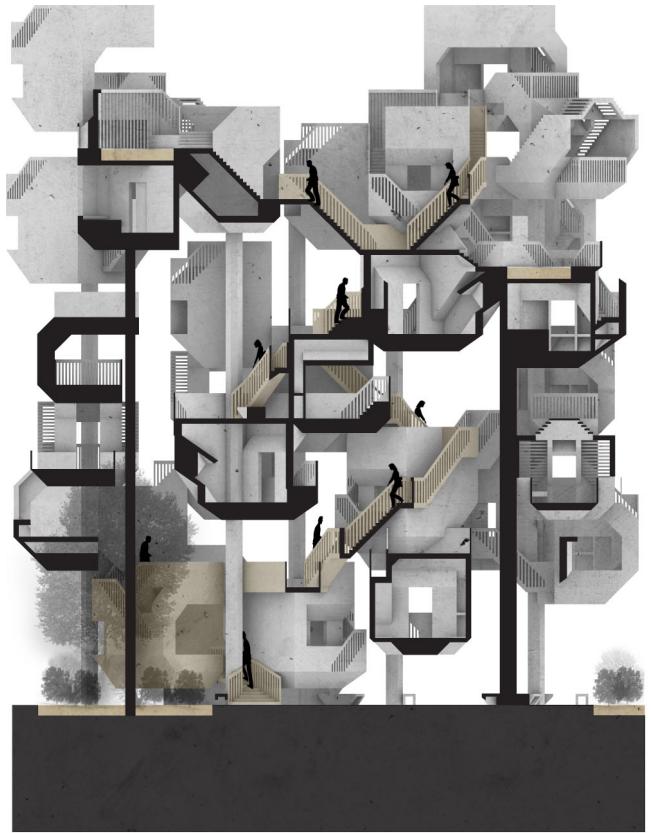
KAMPONG KAPOR RD ELEVATION
SOUTHWEST



SECTION N-N
ENTRANCE FROM GROUND FLOOR



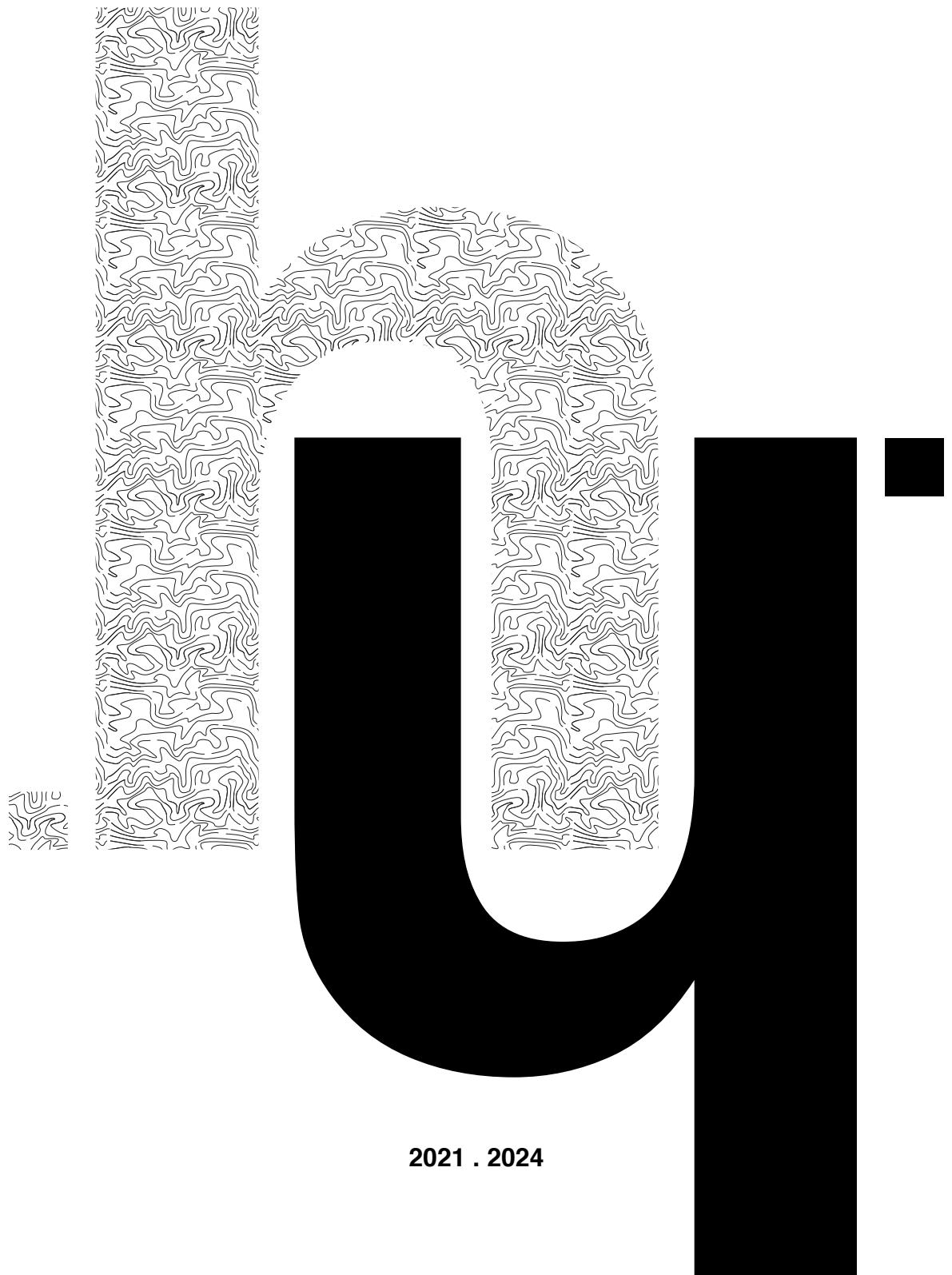
ROWELL RD ELEVATION
SOUTHEAST
0 1 2 3 4 5 10 20 m
1:100 SCALE



SECTION P-P
WALKING UPWARDS ALONG CUBES
0 1 2 3 4 5 10 m
1:50 SCALE

cheah hao yuan._

_.arch



2021 . 2024

selects._

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