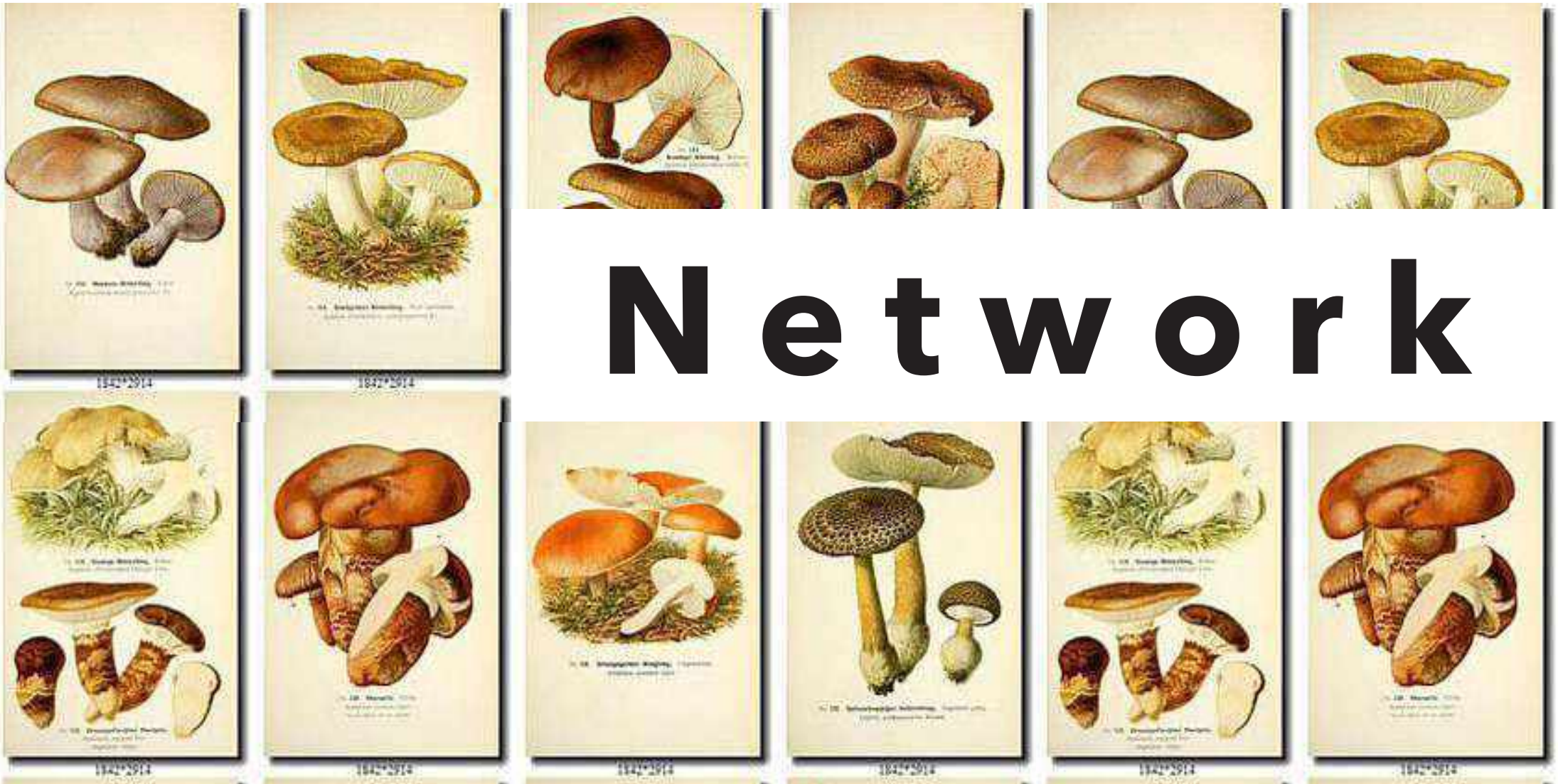


Network

learning with mycelium

BY: FREDERICA BRITO E CUNHA

CONTENTS

BRIEF

An introduction to Funghi

Fungus
"any of a group of spore-producing organisms feeding on organic matter, including moulds, yeast, mushrooms, and toadstools."

Mushroom
"a fungal growth that typically takes the form of a domed cap on a stalk, with gills on the underside of the cap."

Mycelium
"the vegetative part of a fungus, consisting of a network of fine white filaments (hyphae)."

Fungi are responsible for decomposing dead matter and turning it to living organisms, producing mushrooms as their "fruit" as a product. Mushrooms have a variety of properties, some are edible; they contain high levels of protein, vitamin D, immune modulating nutrients etc, some are hallucinogenic, and others are deadly. Fungi have been defined as closer to animals than plants, as they no not photosynthesises. They are organised into their own kingdom; the Fungal Kingdom.

Mycelial networks and mushrooms have been found in fossils dating back to 715, and are thus the oldest surviving species in the world. "The presence of fungi in this transitional area between water and land leads us to believe that these microscopic mushrooms were important partners of the first plants that colonised the Earth''s surface around 500 million years ago."

Can Mycellium really save our planet?

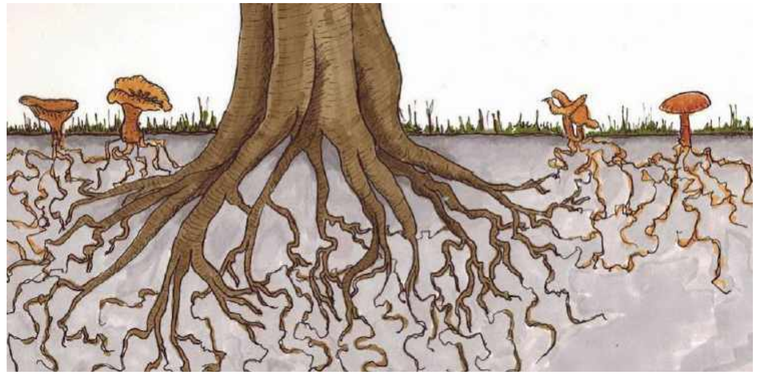
Paul Stamets

Crusading mycologist Paul Stamets says fungi can clean up everything from oil spills to nuclear meltdowns. On an interview, he states that fungi can have incredible benefits like cleaning up oil spills all over the planet, provide a defence against weaponised smallpox or break down toxic chlorine-based polychlorinated biphenyls.

When fungi colonised land a billion years ago, some established a niche as Earth's great decomposers – key to the creation of soil. Their mycelia exude enzymes and acids that turn rock into biologically accessible minerals and unravel the long-chain molecules of organic matter into digestible form. Fungal mycelia hold soil together, help it retain water and make its nutrients available to vegetation.

Mycellium for tree communication

Trees are linked to neighboring trees by an underground network of fungi that resembles the neural networks in the brain. They warn each other of danger, like insects or infection, and share nutrients at critical times to keep each other healthy.
Trees in a forest are often linked to each other via an older tree called a “mother” or “hub” tree, that sometimes help seed growth by sharing carbon and water.



Within the soil roots and mycellium webs, the earth’s carbon levels are controlled...

40% of carbon fuel consumed by plants is taken down to the roots, and leaked out carefully to soil microorganisms in exchange for mineral nutrients. In the process, those soil microorganisms make a sort of carbon glue, to control the flow of air and water within the earth. This glue fixes the carbon within the soil, controlling its levels in the atmosphere. All of this happens within underground mycellium webs.

Mycellium by-products

Insulation...

Leather...

Lamps...

Thermal Capacity

Initial thermal testing indicates that mycelium insulation can outperform the vast majority of market- leading synthetic and ‘organic’ insulation products.
Biohm’s mycelium insulation panels are able to achieve a thermal conductivity of 0.024W/m.K., surpassing the values that can be achieved by market leading but unsustainable materials such as glass fibre (0.032-0.044W/m.K.), mineral wool (0.032-0.044W/m.K), expanded polystyrene (0.036W/m.K) and extruded polystyrene (0.029-0.036W/m.K). We are confident that with our ever-evolving research, Biohm will be able to increase this capacity.

Durability

Creating sustainable and circular materials that consider the entirety of a product’s life is at the heart of Biohm’s approach. We believe that materials should be made to last as long as their intended use and that sustainable and circular end-of-life considerations should be embedded into the product itself.
Research conducted by the Munster Chamber of Crafts on the long-term in situ performance of bio- based materials such as mycelium has demonstrated that they are at least as durable as conventional materials and maintain their insulative properties over the course of their life.

Fire Performance

Mycelium not only outperforms petrochemical/ plastic construction materials in thermal and acoustic insulation, as a natural materials, it is also safer and healthier. Mycelium does not contain the synthetic resin-based materials that cause the harmful toxic smoke and quick spread of flames during a fire.
Initial testing demonstrates that mycelium releases significantly less heat and smoke during burning, with much lower average and peak heat release rates and longer time to flash over synthetic materials owing to its charring behaviour, inhibiting spread when exposed to fire.

The Client - University College London

University College London is a major public research university located in London, United Kingdom. It has been involved in Mycelium research in areas of biology, chemistry, physics, and most recently, architecture.

In November 2019, the College exhibited in London's Design museum, with the title "Design with the living", on how designing with living organisms can respond to today's ecological challenges.

The university has since been more integrated with this research.

On the theme Growing Materials, a Bartlett student wrote

"Intersection of bio-materials with existing architecture could become the driver of the transition from static to organic building. This intersection between fields also accentuates the importance of research being conducted as well as our adaptation to these new environments."

In a time of Climate Crisis, UCL is keen on increasing such useful areas of expertise, and thus, has intentions to build a new building focused on Mycelium research.

The Client - BIOHM

BIOHM is a Mycelium research and production lab based in London.

Their purpose is to venture beyond contemporary approaches that only seek to reduce our impact on the planet and find truly regenerative alternatives for waste management, manufacturing and building.

EHAb sayed | founder & director
of innovation | BIOHM

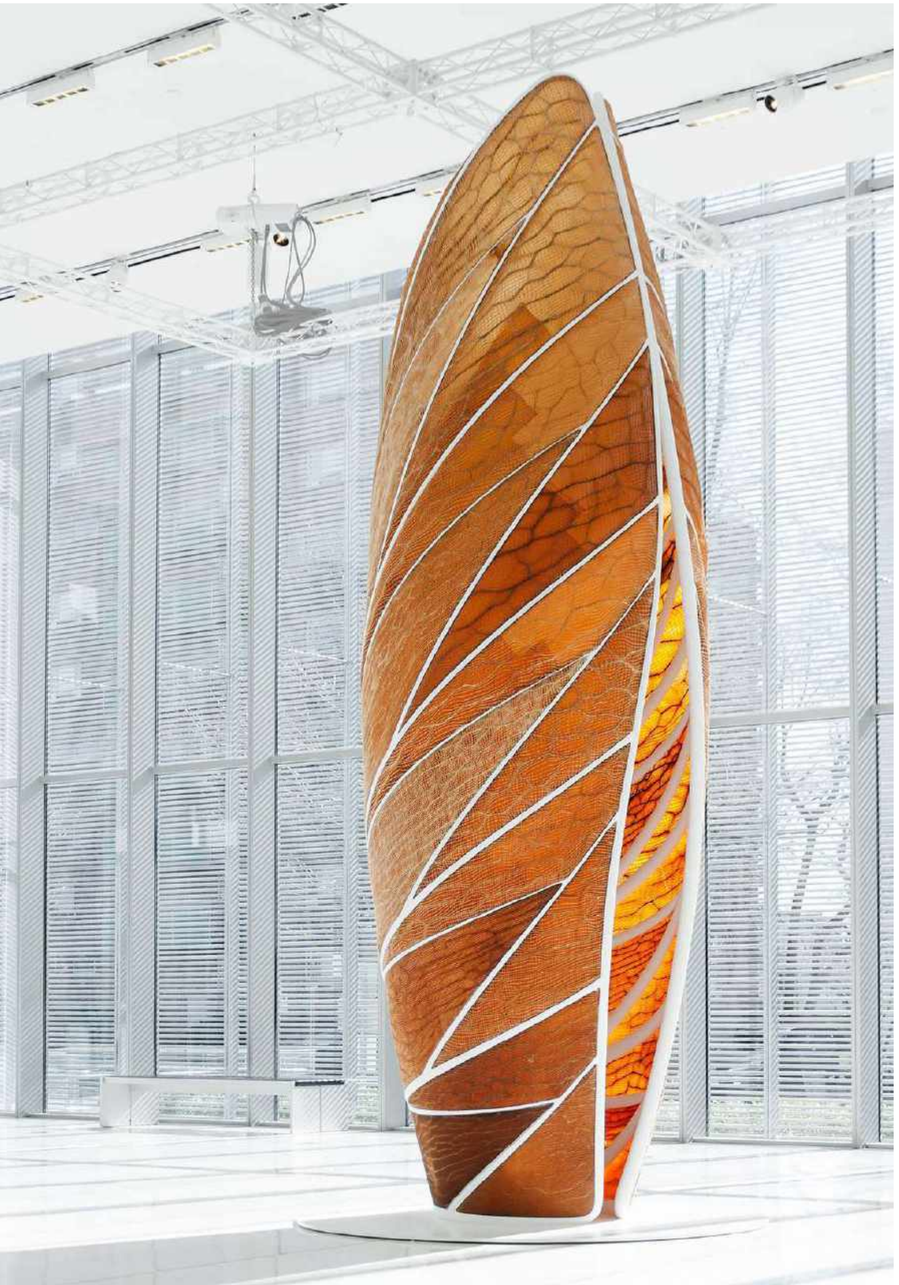
After a speech about the company, Ehab Sayed was asked

“So I'm kind of wondering, why doesn’t everyone do this?”

To which he answered

“Its really difficult to implement such radical technologies without a really strong network. Within the industry, the government, academia. We’re only able to do this through the relationships and collaborations that we have built. So we’re not doing all of this by ourselves, but we’re working with real large corporations, with governments - not just in the UK but outside the UK - as well as six of the top universities in Europe, that are collaborating with us on all of these advances.”

UCL and BIOHM wish to partner up to develop research and increase the web of interest in this new approach to organic living. As a result, they wish to build a research and development lab on UCL campus grounds, providing facilities for students to research. The two corporations are interested in creating something academic oriented both in terms of labs as well as public spaces. University buildings should always be open for students to gather whilst encouraging creative thinking and innovation. The building is also intended to invite passbyers, introducing them to the wonders of mycellium.



Forward-thinking design

Neri Oxman "A skyscraper is not a tree. Not yet."

"Imagine that nature is the single most important client in your architectural practice. What are the values and principles at the core of such a project?

TECHNOLOGY OVER TYPOLOGY
DECAY OVER DISPOSAL
SYSTEM OVER OBJECT
HETEROGENEITY OVER HOMOGENEITY
SYSTEM OVER OBJECT

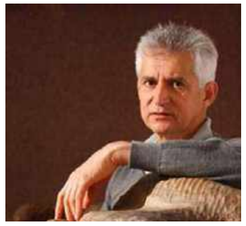
The Network

The project is intended to grow the network of people aware and involved in the mycellium industry, and consequentially, nature oriented design. The building must invite collaborations with nature inspired professionals of the field of architecture & design, and others. Opportunity for multidisciplinarity is key.

The building will act as a platform for this evergrowing community.


Neri Oxman


David Benjamin


Javier Senosiain


Kengo Kuma


Beatrice Galilee


Dr.Agnieszka
Olszewska-Guizzo

Inspired by the Knowledge Quarter, the aim is to design a builiding for ground breaking **innovation**, **gathering** and **multidisciplinarity**.

The architecture must be inviting and most importantly, respecting of its natural environment. In order to enrich the natural fabric of the site, there should be a **"RE-NATURING"** goal in design.

BIOHM wishes to increase the Network of poeple connected to Mycellium. This must be achieved in the project, allowing for a mix of activities and collaborations.

UCL wishes to provide labs for students to freely explore, both with an arts and science perspective. The new labs and multi purpose hall will be a **petri dish for inspiration** and communication, breaking boundaries and developing new tools for living.

INCLUSION must be the driving force of the design for the Camden community. The building must be a home for conversation, debate and **GROWTH**.

As Neri Oxman suggests, the architect must remember to have "**nature as the main client "** for this project. This will be achieved through the research happening on site, as well as nature oriented design.

SUSTAINABILITY is key. In a time of climate crisis, the short and long term carbon impact of the design must be considered, and the embodied carbon should be reduced through the use of organic materials proposed in precedents, and more. **The design should maximise natural reources as an energy source, or as a replacement for it.**

Schedule of Accomodation

- INDUSTRY - MUST COVER **15%** OVERALL SCHEME
BIOHM is a startup within the industry of mycellium. It invests in research and profits off of patents and mycellium products.

- EDUCATION - MUST COVER **20%** OVERALL SCHEME
UCL is ranked as one of the top universities in the world. It is the number one London university for Research Strength (REF2014), recognised for its academic excellence and global impact.

- NATURE - MUST COVER **30%** OVERALL SCHEME
Mycellium is the driving factor of the project. A natural material that has been unravelling in our modern technological era. Nature must be present throughout all of the scheme.

- RESEARCH - MUST COVER **25%** OVERALL SCHEME
Research is what brings the themes above together, inspired and driven by new discoveries and applications of the product.

- COMMUNITY - MUST COVER **10%** OVERALL SCHEME
This project aims to bring the three themes above together, and invite the community to be a part of new discoveries.

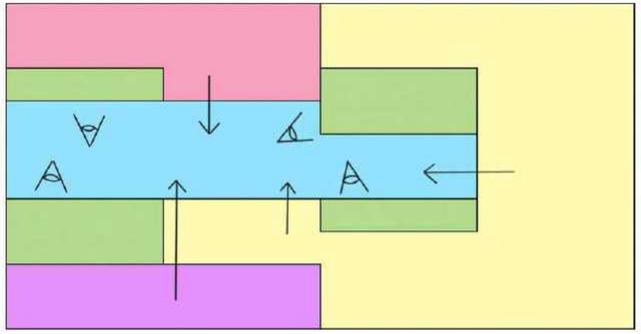
Context Requirements

- Respect The Context Height
- Open up an East-West route
- Respect adjacent architecture

The plot must become a safe space, inhabited with nature and innovation.

Total Area
Buildable area: 2400m2
Number of floors: 3

Public realm: A % of the area should be dedicated to the public realm, specifically pedestrian and cyclist routes.



Shop, production

Auditorium, Library

Enclosed garden(s), Mycellium growing pods

Labs

Multi-purpose hall, Restaurant

\+ Services, Circulation, Plant

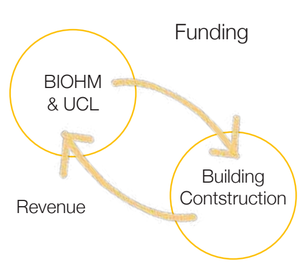
Cost & Funding

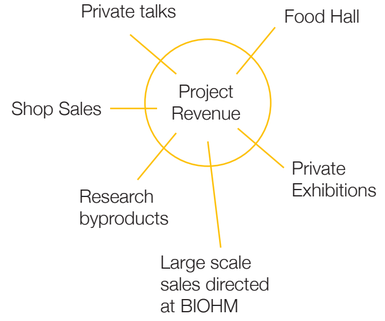
The Project will be funded by BIOHM and UCL.

Private investors will also be allowed to invest, as the project will generate revenue.

Such revenue will be used to pay off investors and cover the running costs of the project.

THE COST	
Building construction: £ 2,750 / sqm	£ 9 652 000
Landscaping £ 100 / sqm	£ 220 000
ESTIMATED TOTAL	£9 875 000





Network is a project about dismistifying the power of funghi,

it aims to bring the local community togehter

to collectively explore future possibilities.

Network is a place to gather, learn and evolve,

a place where science and art to come together as one.

SITE

CITY OF LONDON

N

E

SITE

WC

EC

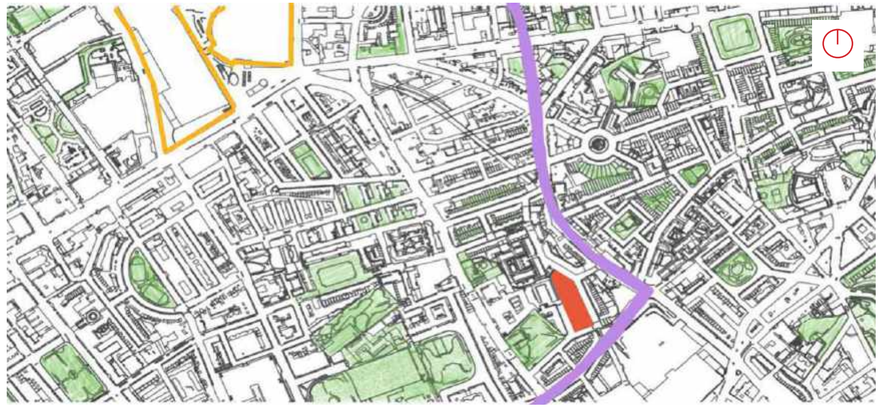
UCL Bartlett

BIOHM
Headquarters

SE

SW

CAMDEN

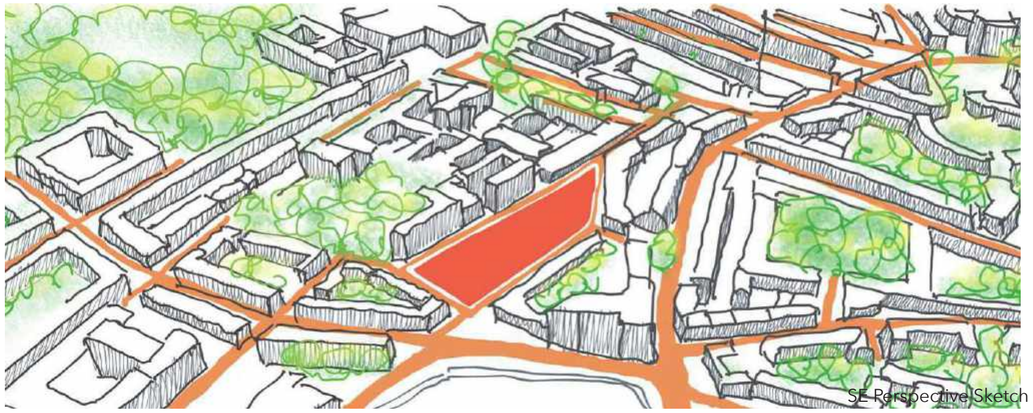


The site is at **1.5km** from UCL, a **20 minute walk**

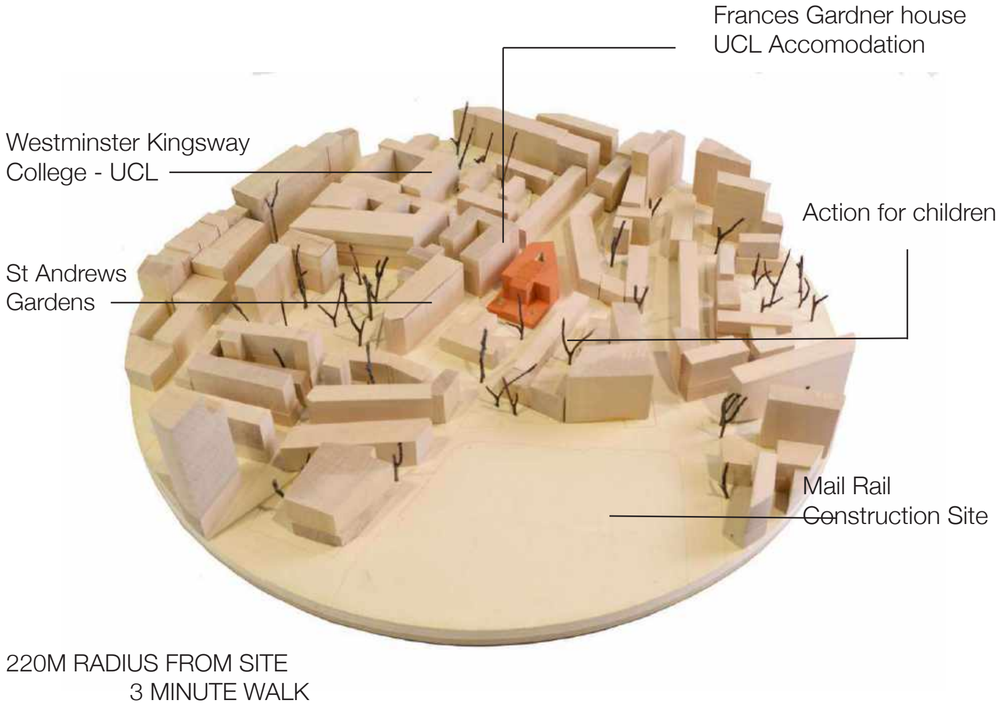
It is at the same distance from **Kings Cross & St Pancras.**

Camden Planning Application

New building must
"Provide replacement light industrial / employment floor space as part of a **mixed-use"** including, amongst others,
"Flexible work space suitable for a range of businesses including **start-up units"**,
"Incorporate new open space and **east-west permeability**" and
"Improve the **pedestrian and cycling environment** on adjacent streets for future occupiers of the site".

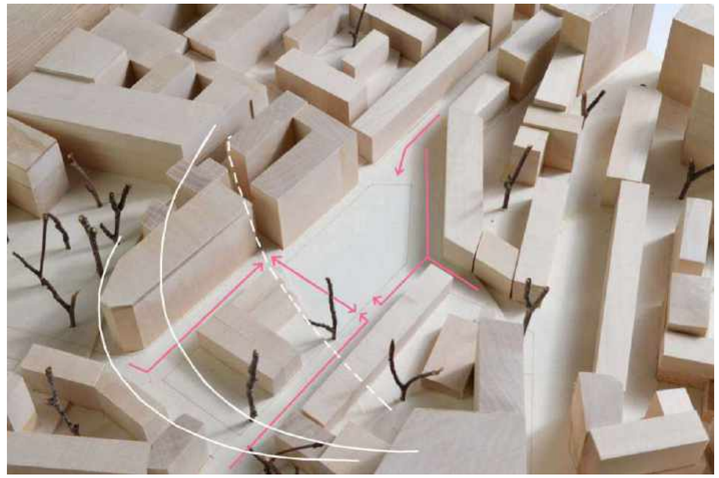


SE Perspective Sketch



220M RADIUS FROM SITE
3 MINUTE WALK

Predominant acess & sun

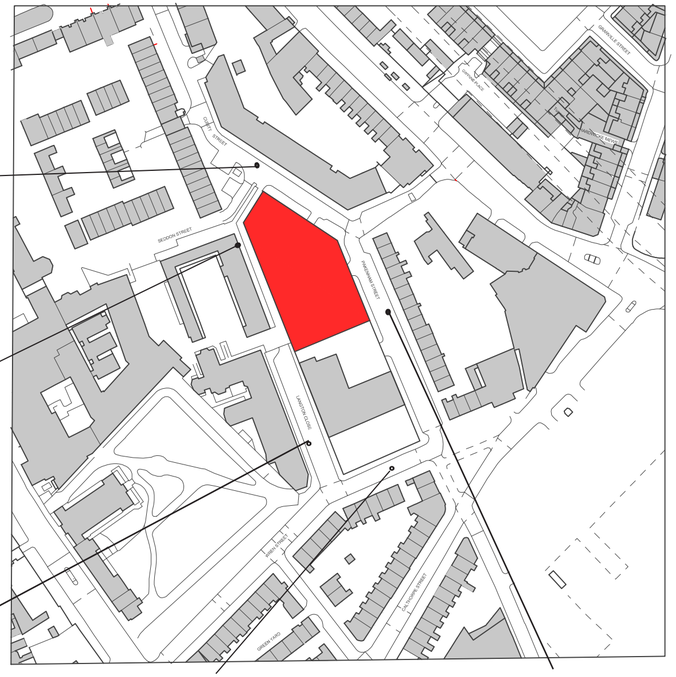


Site map 1:2000 @ A3

Seddon Street
Narrow vehicle circulation
accomodation access

Cul - de -sac - Unused Road

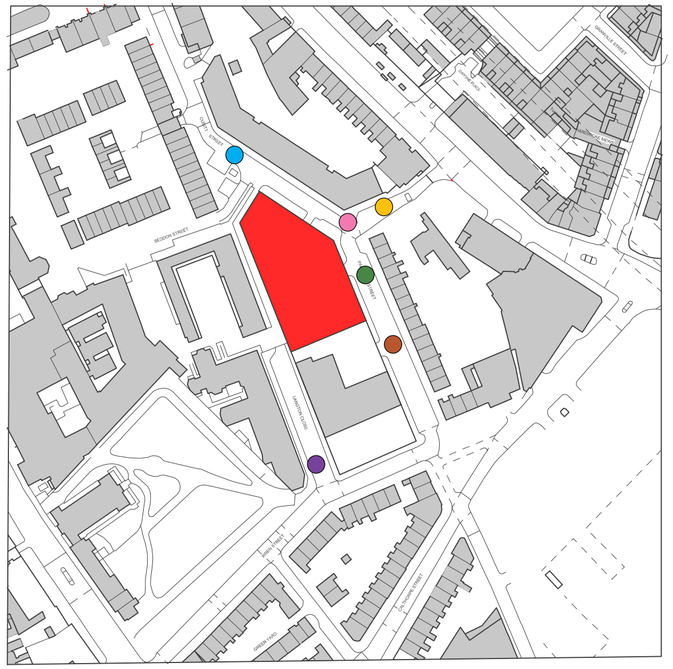
Langton Close
Circulation & parking



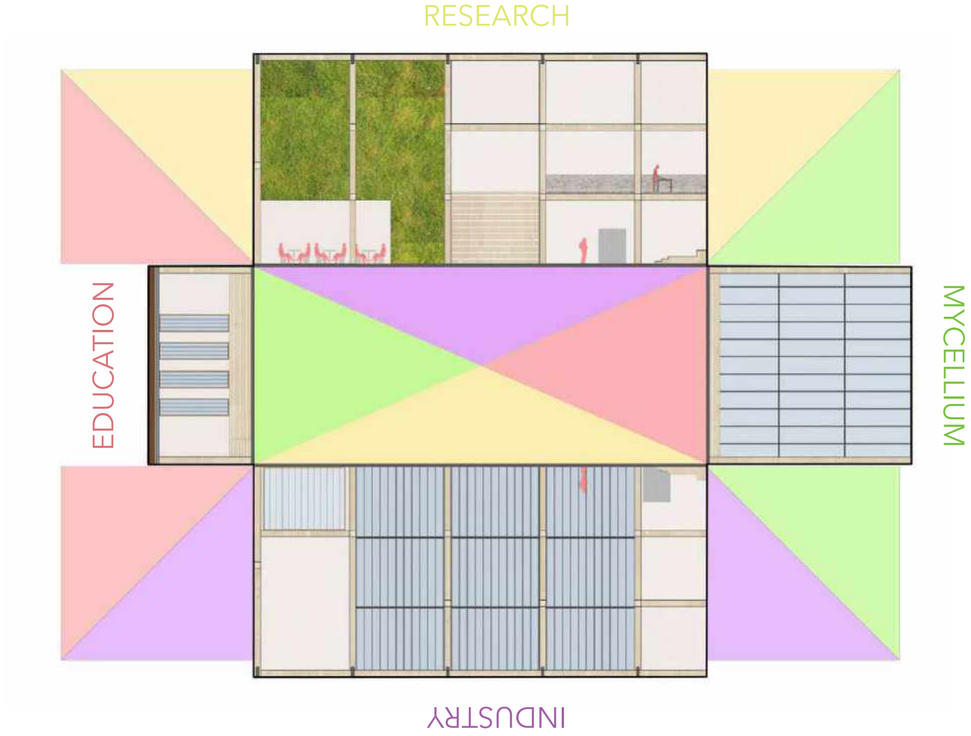
Wren Steet - Circulation

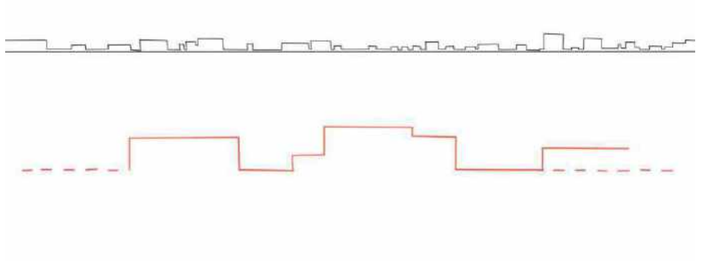
Peckham Street -Circulation & parking

Site map 1:2000 @ A3

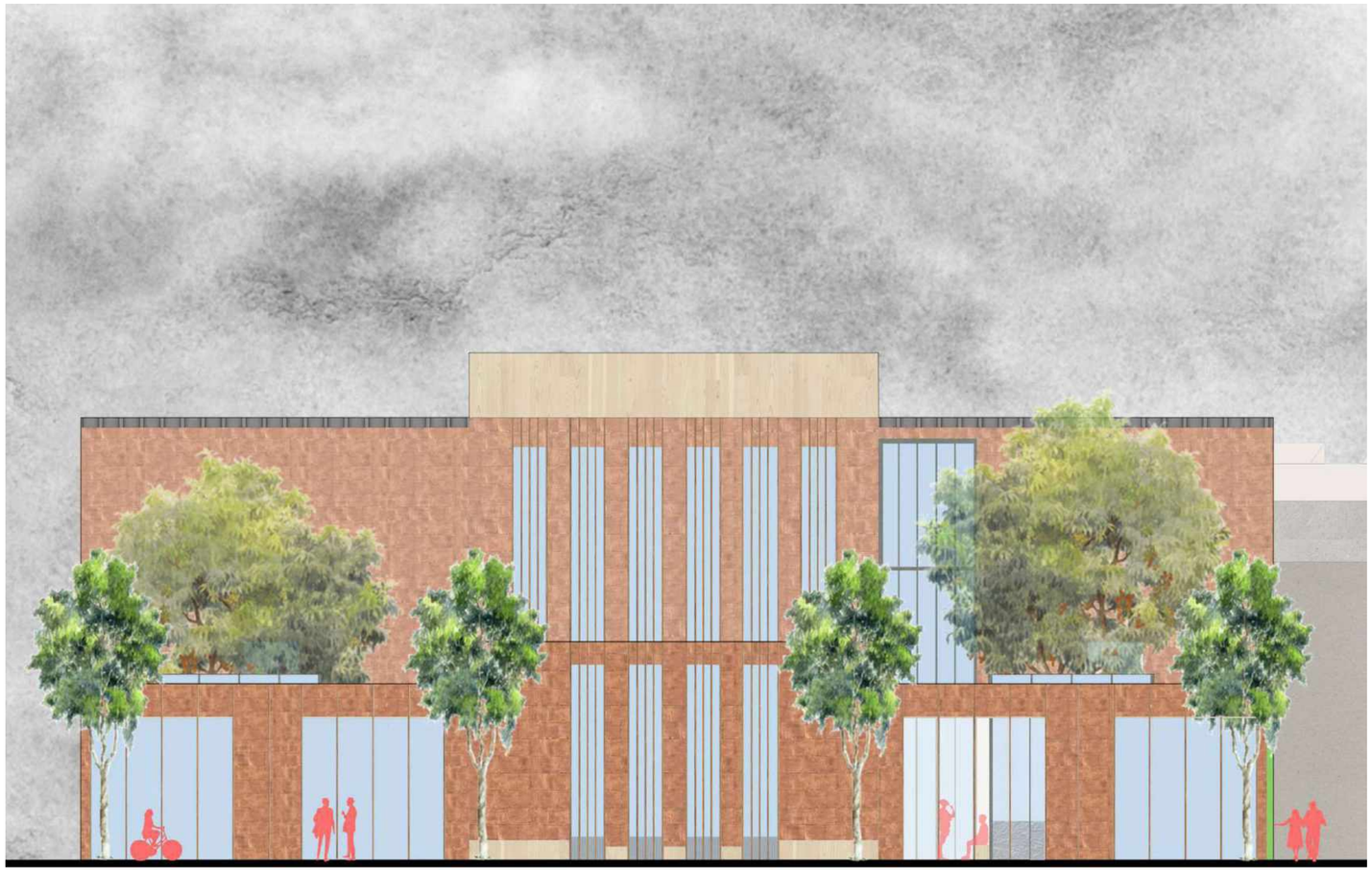


PROPOSAL





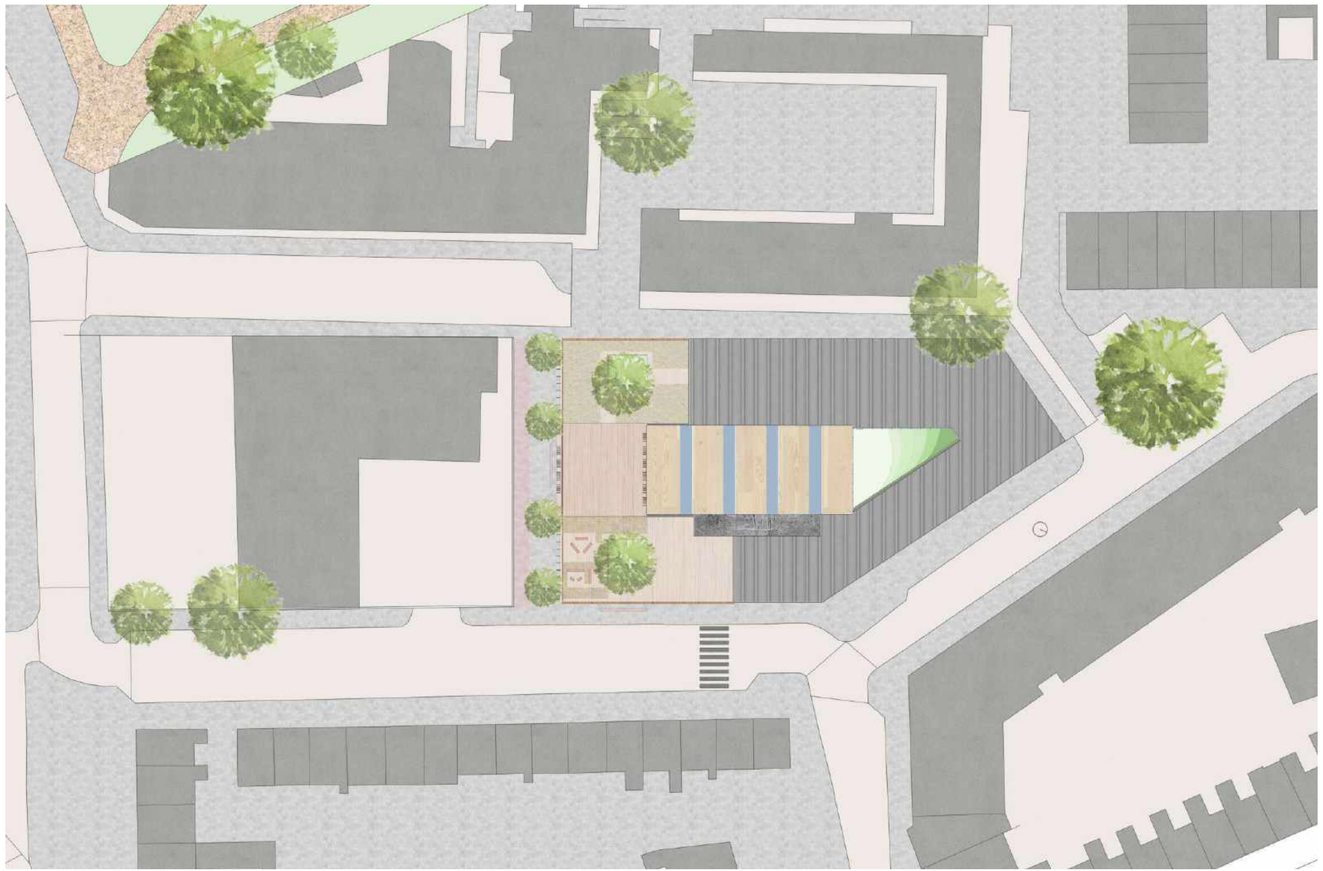
South Elevation
1:100@ A3



Context Plan
1:500 @ A3

Cycle Route Pedestrian Route

Network is designed as an inviting scheme, that interacts with the public realm and the scale of its context. An East West Route is opened, connecting the entrance of the building to UCL accomodation (due East). Benches and a cyclist route have been placed on this 6m wide route, creating a safe space for the comunity to sit and interact. This street is kept lively by the interior cafe and shop, that open and spill out year round.



Ground Floor Plan
1:250 @ A3

1. Reception
2. BIOHM Shop
3. Auditorium
4. Gallery Space
5. Café & Seating
6. Stairs to library
7. Plant (GSHP & Water)
8. UCL Research
9. Research Ecosystem
10. Plant (Lab Ventilation)
11. LAB Core
12. Mycellium Research
13. Buffer
14. Plant (Lab Ventillation)
15. Plant (Water Tank)
16. Public Core

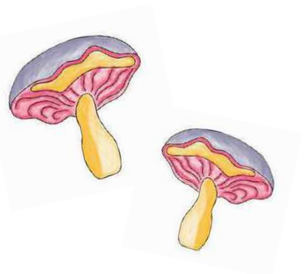
The ground floor revolves around the main gallery space, where the research floods into in the form of sculptures and large scale experiments. By showcasing the innovaition discovered in the labs, the barrier between scientific research and the community is brought down.
The wall that separates the auditorium from the main gallery space is retractable, allowing these spaces to open up to one and other in case of a larder audience or show.

First Floor Plan
1:250 @ A3

1. Green Roof Terrace
2. Library
3. Plant (Lab Ventilation)
4. LAB Core
5. UCL Research
6. Buffer
7. Plant (Lab Ventillation)
8. Plant (Water Tank)
9. Main Core
10. Terrace

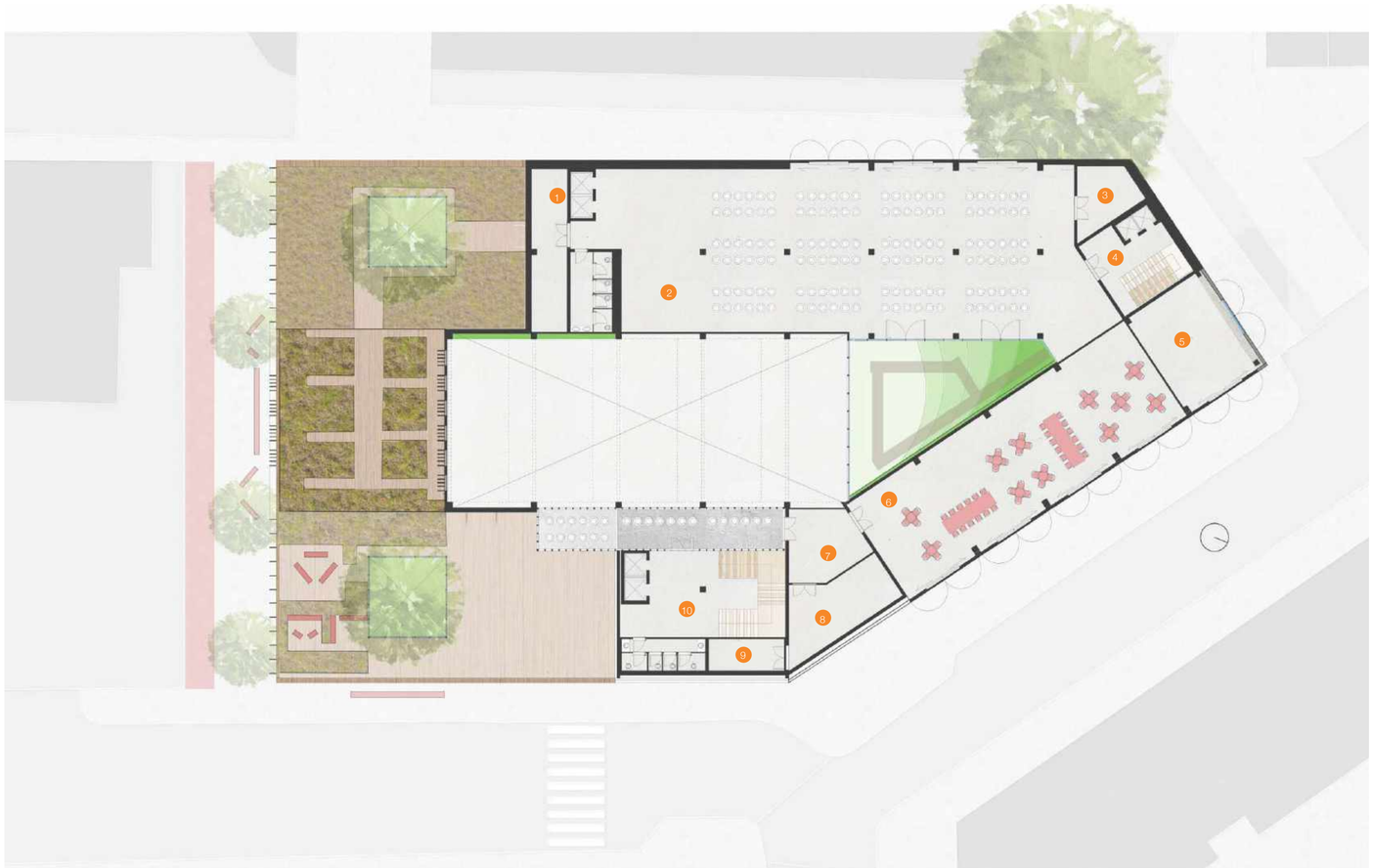
Wide stairs invite the users to ascend into the library, passing by a level of seating provided for reading. To the left, the first terrace is focused on brown roof research, integrated with micellium growth. The labs on this floor are more informal, acting as vessels for research and documenting. Adjacent to the main core is a large terrace enjoying the south facing sun.

Second Floor Plan
1:250 @ A3



1. Storage
2. Mushroom Production Farm
3. Plant (Ventilation)
4. LAB Core
5. Restaurant Kitchen
6. Restaurant
7. Restaurant Entrance
8. Plant (Lab Ventillation)
9. Plant (Water Tank)
10. Main Core

The final floor is dedicated to exploring the culinary wonders of mushrooms. The contained growing pods surrender the restaurant whilst feeding it.



Roof Floor Plan
1:250 @ A3

The roof area is covered with PV integrated roof tiles. Solar tiles have been chosen over solar pannels because their maintencance cost is lower and efficiency higher. Eve though the cost of tiles is more expensive, it pays off in the long run due to higher durability and higher efficiency.

North Elevation
1:100 @ A3

Café

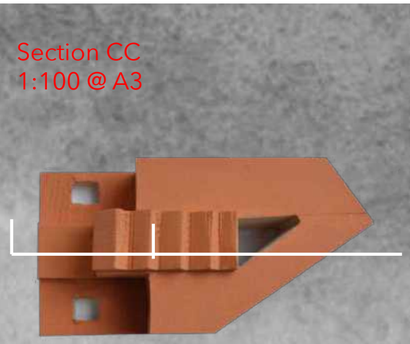
The café has seating adjacent to the enclosed garden. The interior mood is created by the natural light that floods into the space.

Section BB
1:100 @ A3

Entrance

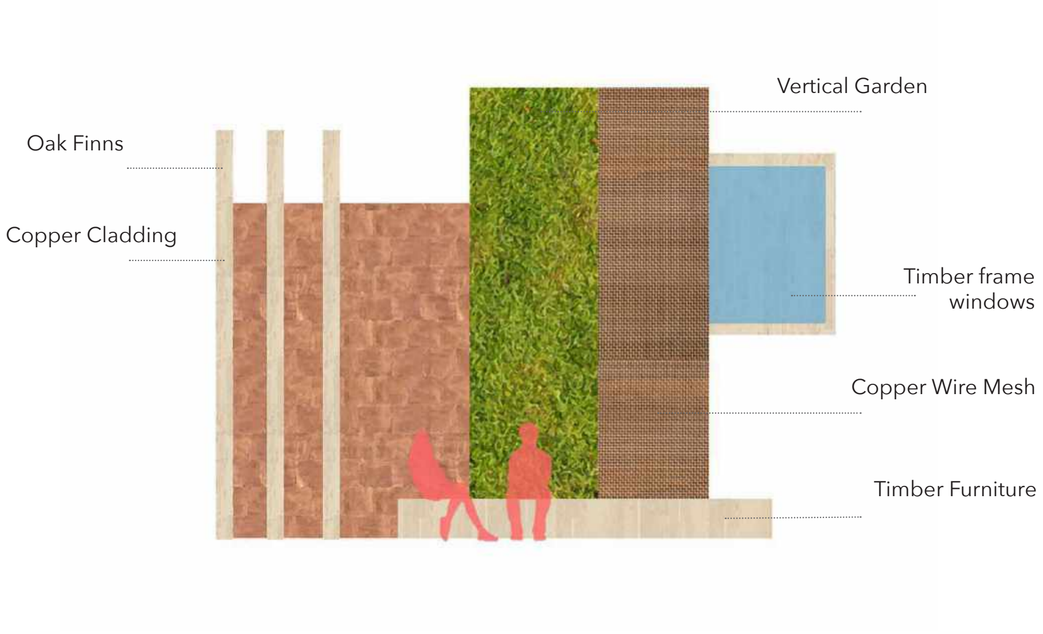
The first view is of a vertical oyster mushroom farm. The mushrooms are grown using the café coffee grounds.

Section CC
1:100 @ A3



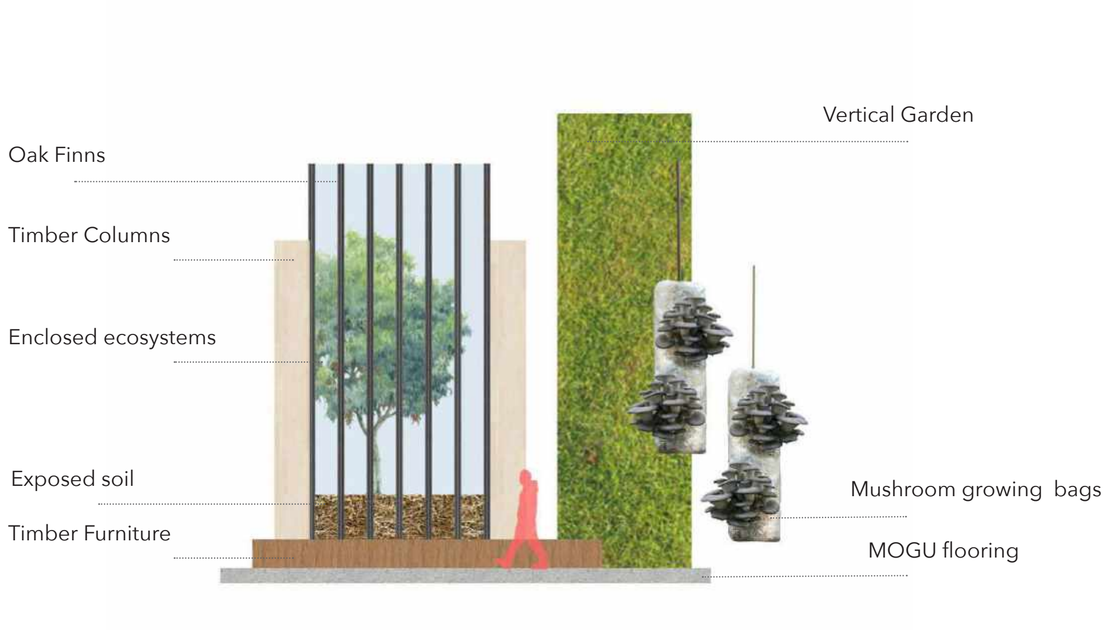
ENVIRONMENTAL

Exterior Materiality



All of the materials were chosen to comunicate with all the senses. The theme of nature prevails, creating changing tones over time.

Interior Materiality



Throughout the scheme, there is always a direct contact with the enclosed ecosystems and exposed timber structure.
Over time, the building will naturally change and evolve.

Ventilation cooling and heating

Public Spaces - **Natural Ventilation**

*aided by the enclosed gardens

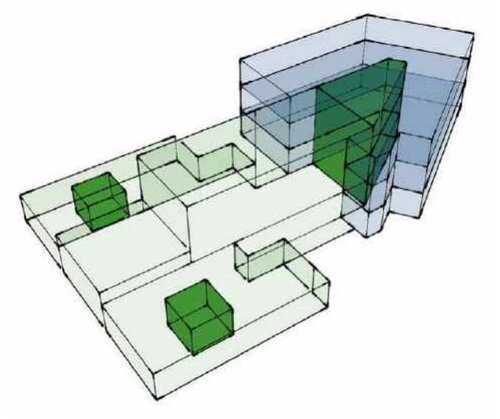
Labs, Research - **Mechanical Ventilation**

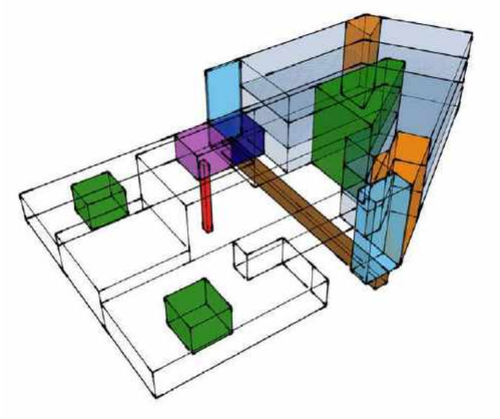
*with exception of the restaurant (2nd Floor)

Trench connecting water systems

Water Tank

Water Riser





Natural Ventilation

Mechanical Ventlation

Gardens

(GSHP)

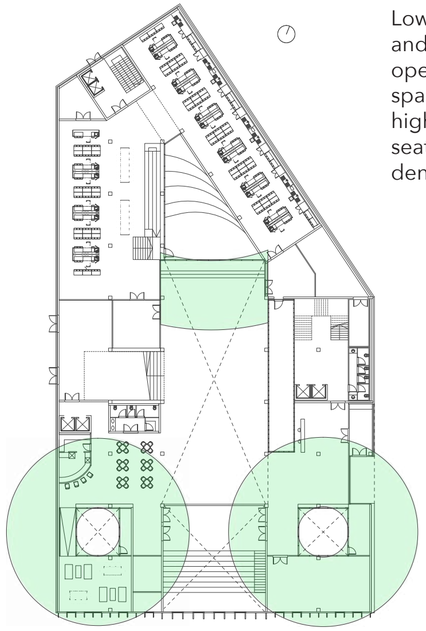
Heat Pumps

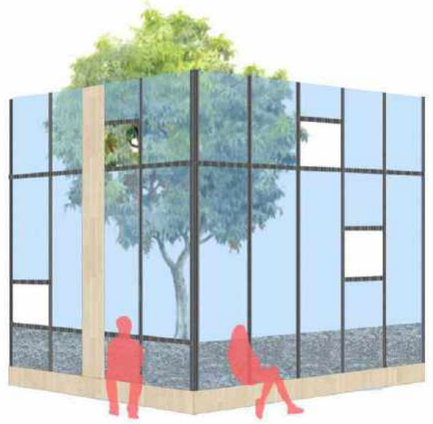
Mechanical Ventlation

Gardens for Natural Ventilation

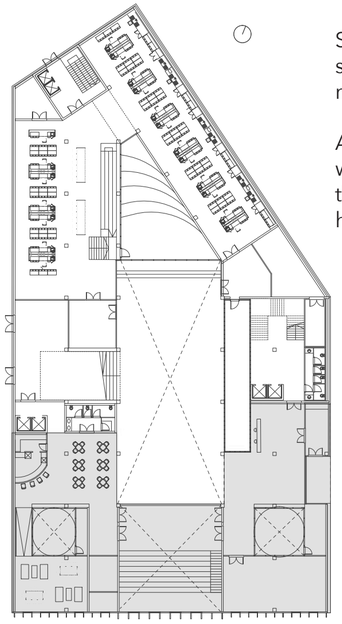
Gardens are used as natural ventilation and ensure fresh air to a radius up to 8 metres from the opening. The timber column arrangement of the building facilitates the natural ventilation.

Low level windows are open in the gardens, rising up and exiting the building through the saw tooth glazed openings. The air travels through the main gallery space beofre exiting. The higher flow of air occurs in the highlighted green areas (shop & entrance in East, café & seating in West and Sitting in North), where the higher density of people will be gathered overall.





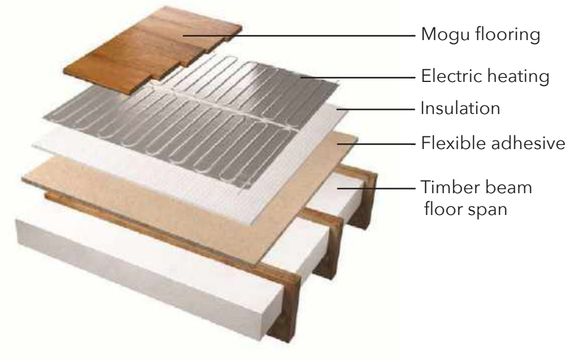
Public Spaces



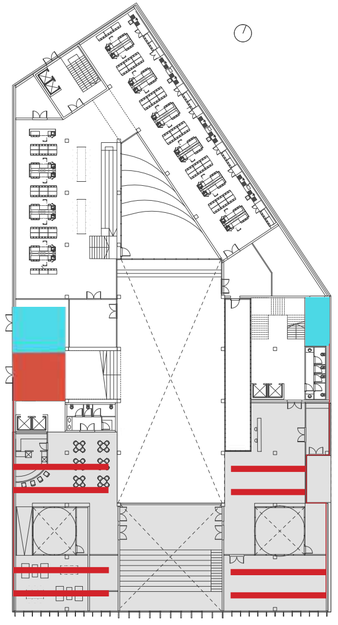
Underfloor Heating (GF)

Solar gains also heat up the space as demonstrated in the previous slide.During the winter months, natural heating is replaced by mechanical.

All of the public spaces are heated with underfloor heating. The warm air rises, heating visitors from ground up whilst stimulating the convection current of the room. Energy for the underfloor heeting is provided by the GSHP located near the water tank.



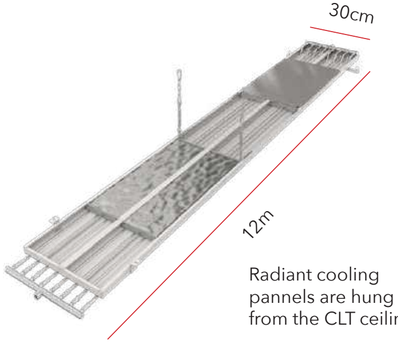
Public Spaces



Cooling (GF)

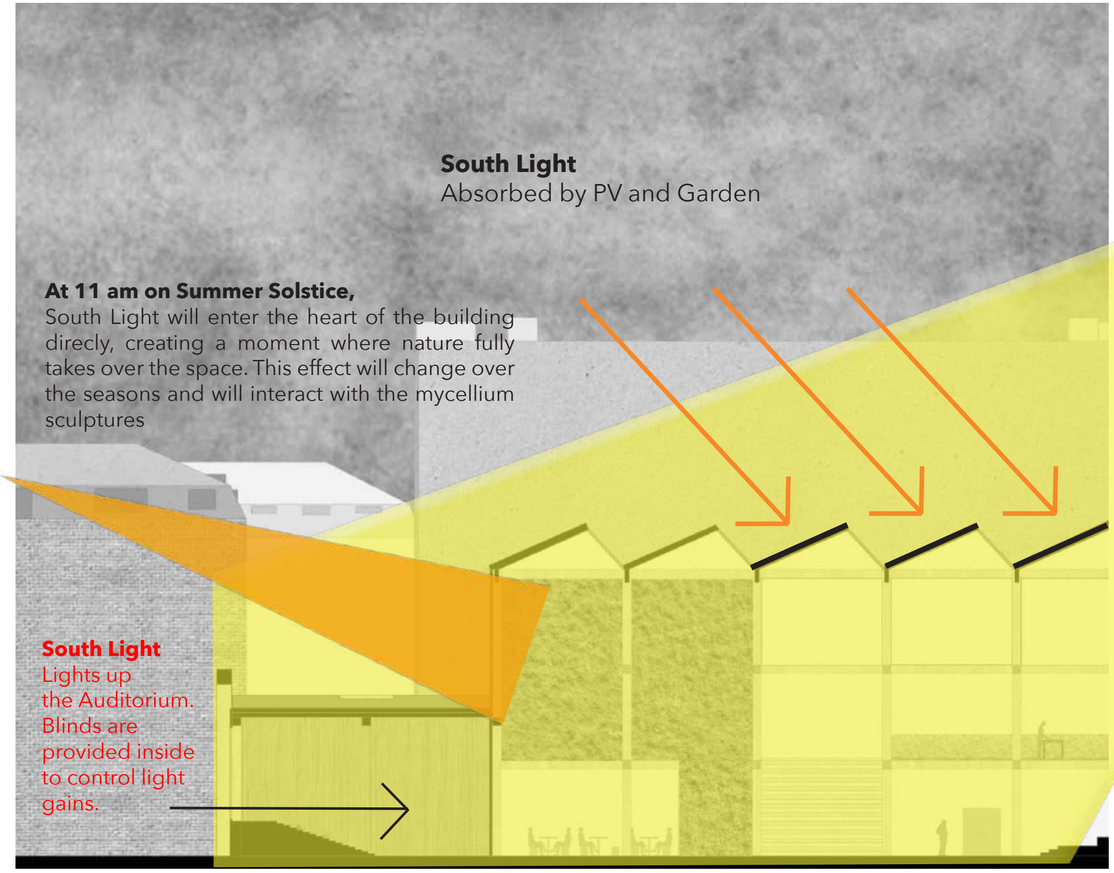
Natural ventilation is provided when needed as demonstrated in the previous slide. When not available, natural cooling is replaced by mechanical.

The Cooling in the public spaces is provided by radiant cooling pannels (sheet metal) , hung from the CLT ceiling. These run cold water extracted from the Ground Source Pump when the heat is turned off. Pushed and pulled by the convection current, the fresh air creates a cooling sensation in the space, reducing the temperature.



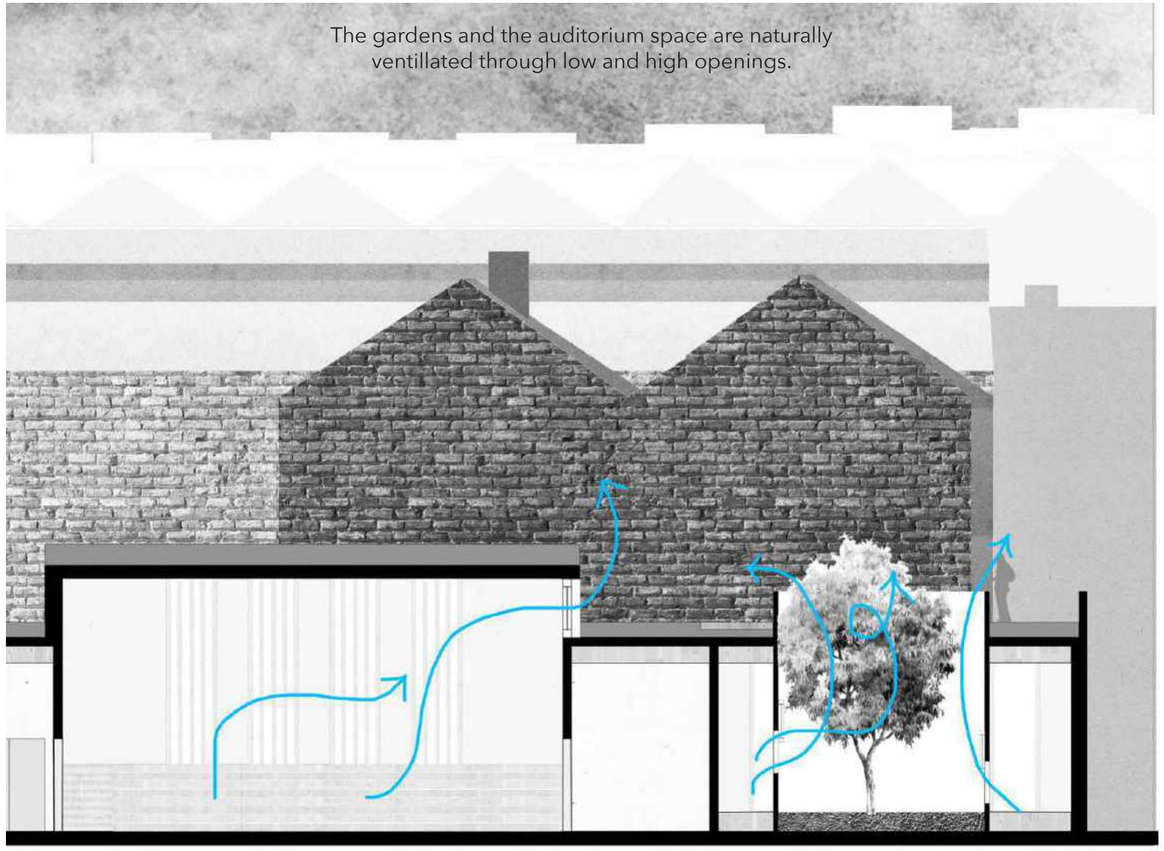
Radiant cooling pannels are hung from the CLT ceiling.

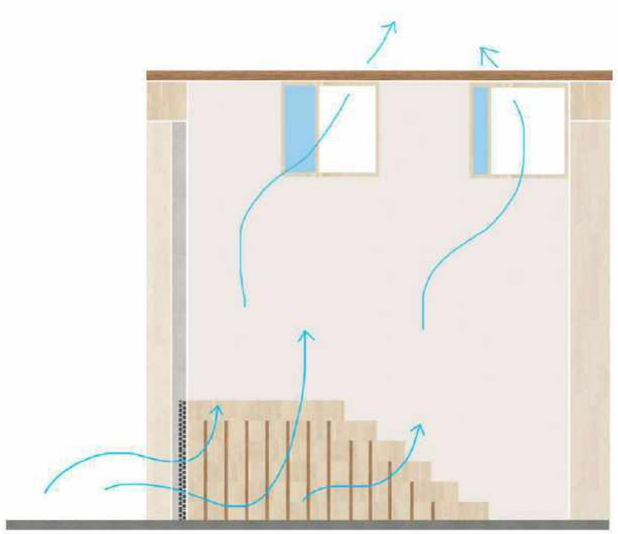
Natural Lighting



North Light
Lights up the
Triple Height Hall

Natural Ventilation





A ventillation pannel under the auditorium steps creates a convection current, naturally ventilating the room.

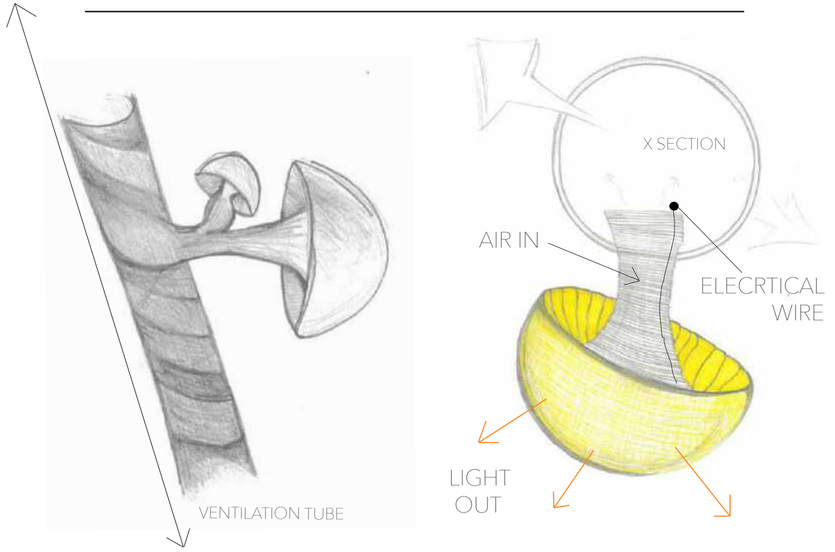
Mechanical Ventilation, Heating and Cooling

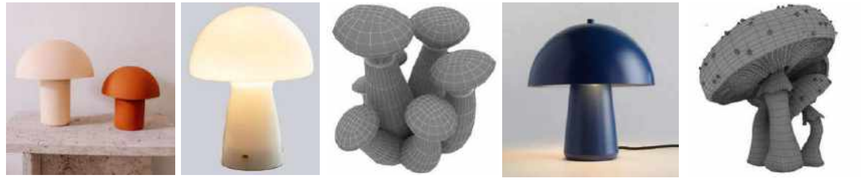
The NE Labs are dedicated to mycellium research. These are controlled environments which require bacteria control and so a buffer must be passed before entering. This area does not have direct access to the gardens.

The NW Labs are dedicated to garden research, growing mushrooms in different conditions with the new-found spores from the Mycellium Lab next door. They also require mechanical ventilation for public health.

There North GF water tank provided water for cooling and heating of the NW labs. It is taken to floors above through the perimeter wall cavity. The water tanks on East Level collect excess water from rain collection in the gardens and feed the East Façade Green Walls at each level. As well as providing water for cooling and heating of the NE Labs.

Ventilation & Lighting Design



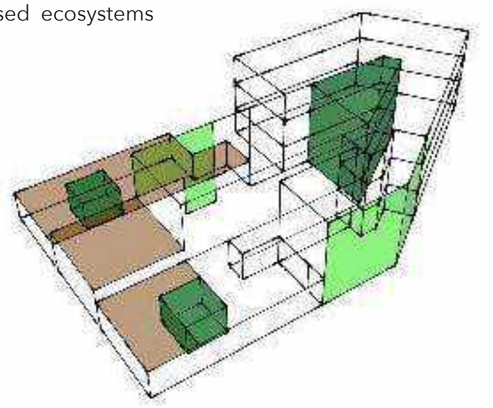


Design specific ducts would be implemented, along with a lighting system for the building. These would be designed in the form of mushrooms. Air would be extracted from the room throught the mushroom stem (made out of wire), and would flow into the ventilation tube. This design would have an implemented electrical wire to carry elecricity to the mushroom head, acting as a lamp.

The presence of nature

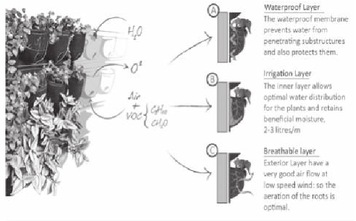
There are 3 ways in which nature intervenes.

- Vertical green wall (Interior & Exterior)
- Green roof
- Enclosed ecosystems



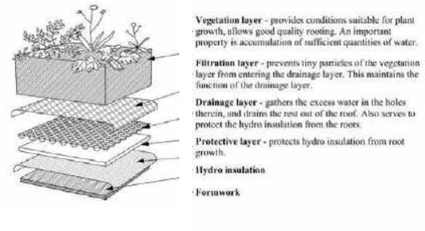
VERTICAL GREEN WALLS

panneling system



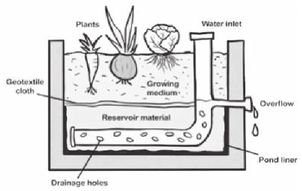
GREEN ROOF

Layering



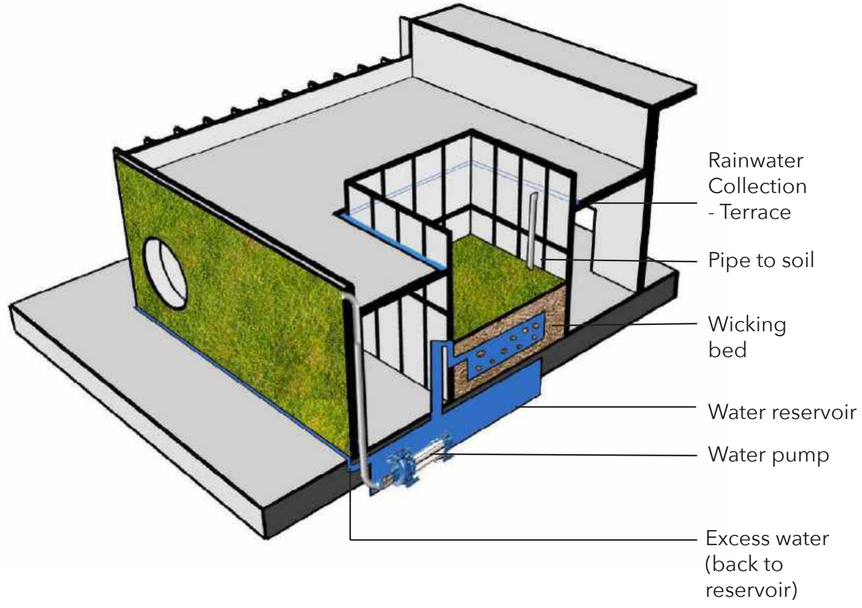
ENCLOSED ECOSYSTEM

Wicking Bed



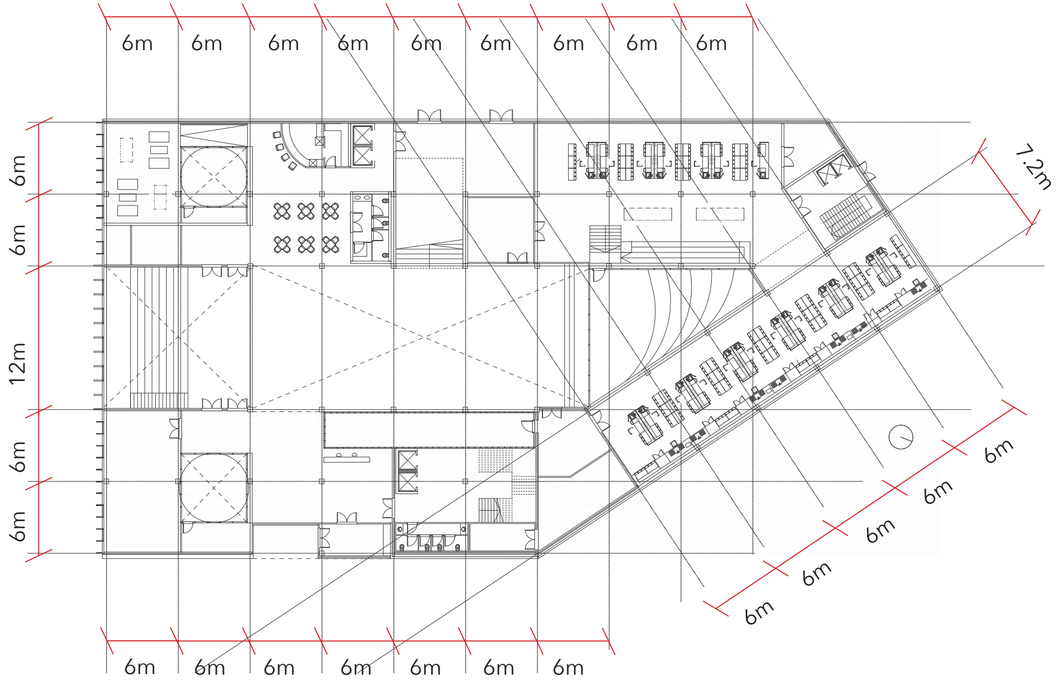
Water collection system

Rainfall is collected and fed to the enclosed ecosystems “wicking beds”.
When the water overflows, it is carried to an underground tank and used for the interior and exterior gardens. In the case of the vertical green walls, the water is pumped to the top plants and trickles down with the force of gravity. In the case of the green roofs, water is pumped with a sprinkler system.




TECTONICS

Structural Grid



Structural Elements

Network is a project about recconnection to and respect towards nature.
The entire structure is made of exposed CLT and Glu lam, connected through joints.
This structure allows for future developments such as additional floors or modular changes. All of the connections are easily removed, and where possible, simple connections are preferable. Steel plates are common to reinforce joints.

PRIMARY STRUCTURE

CLT LOAD BEARING WALLS - 200mm thick. Varying sizes.
GLULAM COLUMNS - 400mm2 cross section, 4m height

Load Bearing walls are commonly used in the corners and cores.
They provide lateral stability.
Columns are placed to support the open space areas.

SECONDARY STRUCTURE

TIMBER BEAMS - 400mm x 800mm deep, 12m length,
- 400mm x 500mm deep, 7.2m length
- Supported by columns

TERTIARY STRUCTURE

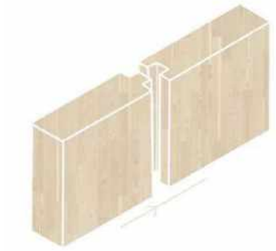
CLT FLOOR SLABS - 200mm thick by 600mm wide. 6m long.
- Supported by beams.

ROOF STRUCTURE

SAW TOOTH ROOF - Supported by central beams and timber joists.
- Flat roof structure - CLT supported by beamns with roof finish.

Primary structure connections

CLT WALL TO CLT WALL

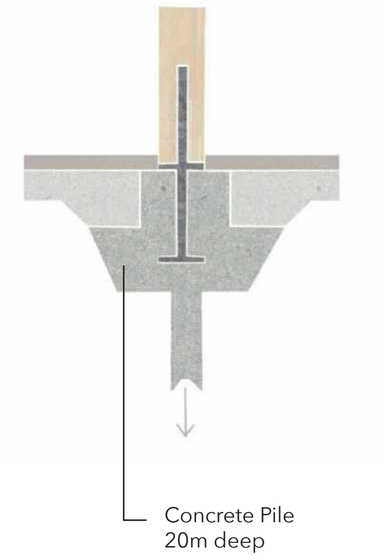


Tongue and groove

Rebbeted wall corner

Cleated intersection joint

CLT WALL & COLUMN
TO FOUNDATION

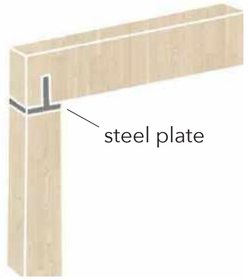


Concrete Pile
20m deep

* Note: the concrete foundation is calculated to bear more weight than required. This is to account for any additional floors or changes made if the brief changes.

Secondary structure connections

BEAM TO COLUMN



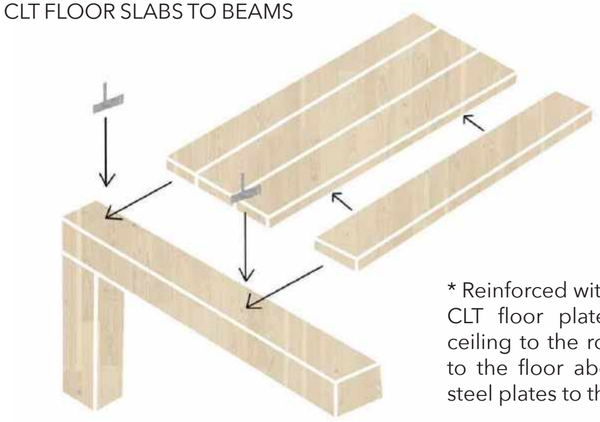
steel plate

BEAM TO CLT WALL

* Reinforced with steel plate

Tertiary structure connections

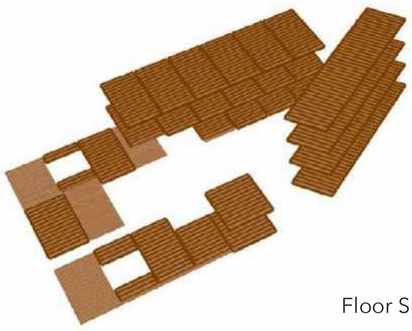
CLT FLOOR SLABS TO BEAMS



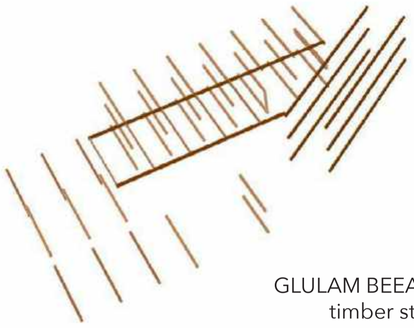
* Reinforced with steel plate
CLT floor plates are exposed as the ceiling to the room below and the floor to the floor above. They are fixed with steel plates to the beams and each other.

Exploded structure & Construction sequence

ROOF
timber studs



CLT
Floor Slabs

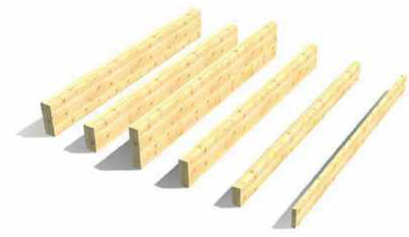


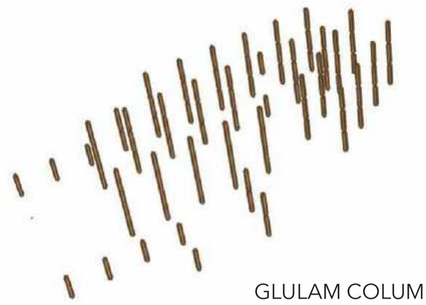
GLULAM BEEAMS
timber studs

Tertiary Structure

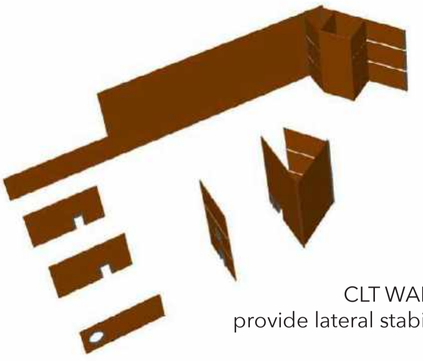
The same occurs with the CLT floor and roof structure. Pieces are put in place according to their numbering.

The GLULAM beams arrive on site numbered by size and allocated to a joint position. This pre organization helps the construction process, ensuring that each piece is correctly allocated. Like a puzzle, the construction team fixes the steel plates to beams and fixes them in place.

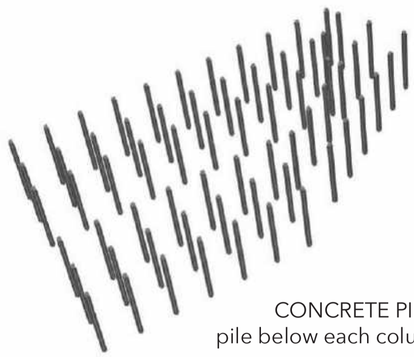




GLULAM COLUMNS
placed directly above pile



CLT WALLS
provide lateral stability



CONCRETE PILES
pile below each column

Secondary Structure

The CLT walls and glulam columns arrive on site and are placed on the concrete piles. A team of experts places them on the structural grid, ensuring all of the elements are securely fit into place. A crane is used to help place the columns and CLT walls.

by sebastian marticorena / nov. 12, 2015

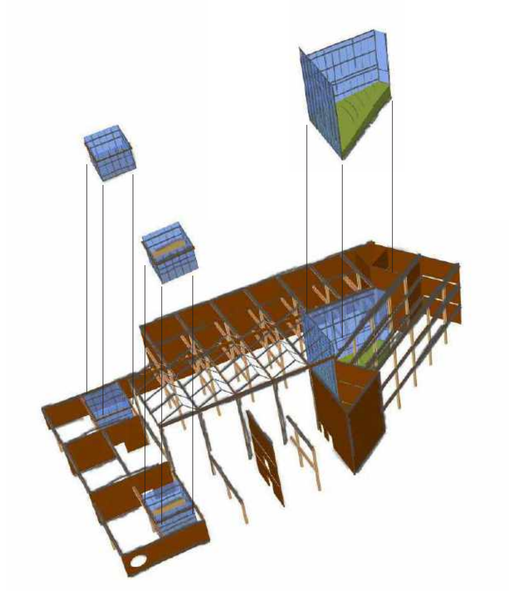
Primary Structure

The **construction sequence** follows the order above, starting with a clearing of the site and pouring of concrete piles.All of the water tanks are accounted for.

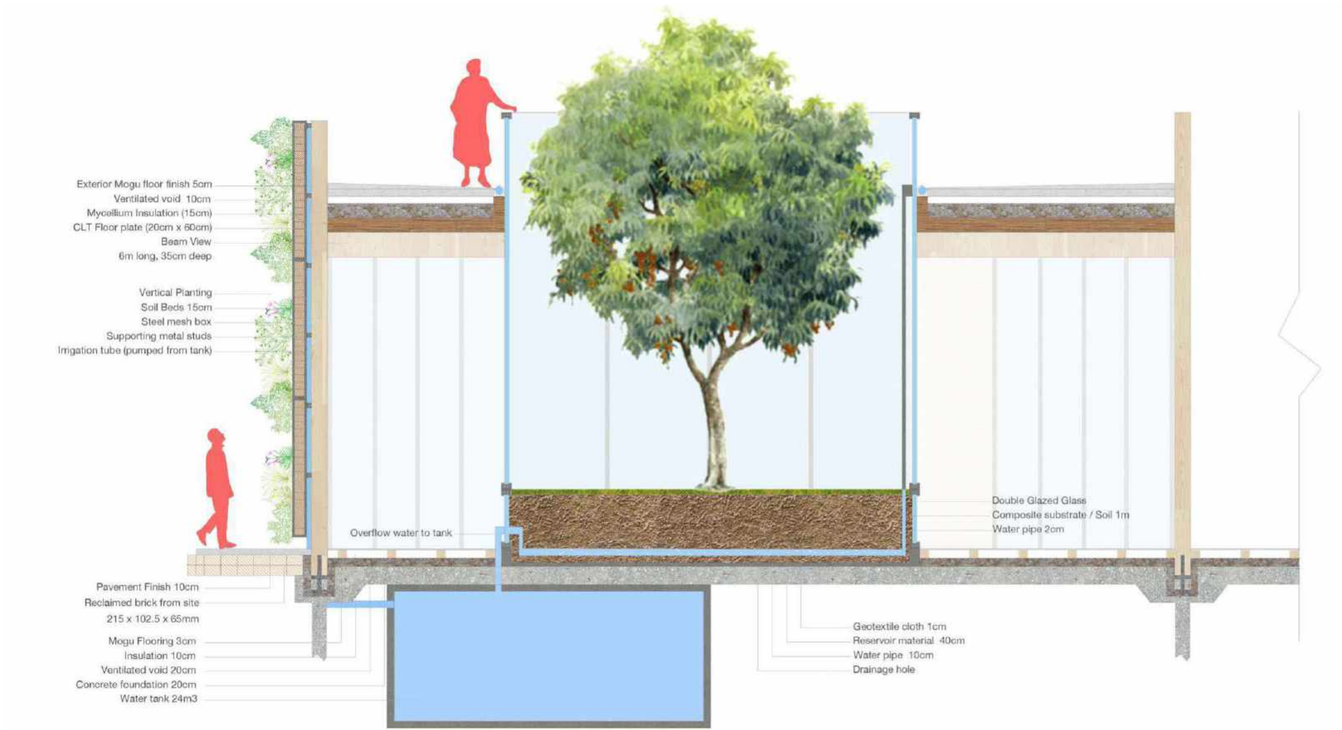
After the roof structure is built, the gardens are placed within the structure. After, the cladding is wrapped around the structure like a skin. The last step is the placement of green walls and green roofs.

Enclosed ecosystems

The enlosed ecosystems are placed within the structure, ensuring no leaks and permitting easy removal (if needed in the future). These glass and steel systems are slotted into the grid once the structure is complete. The water drainage system is connected to the water tanks before earth is poured in.
*Note: A crate will be required to place the cranes.

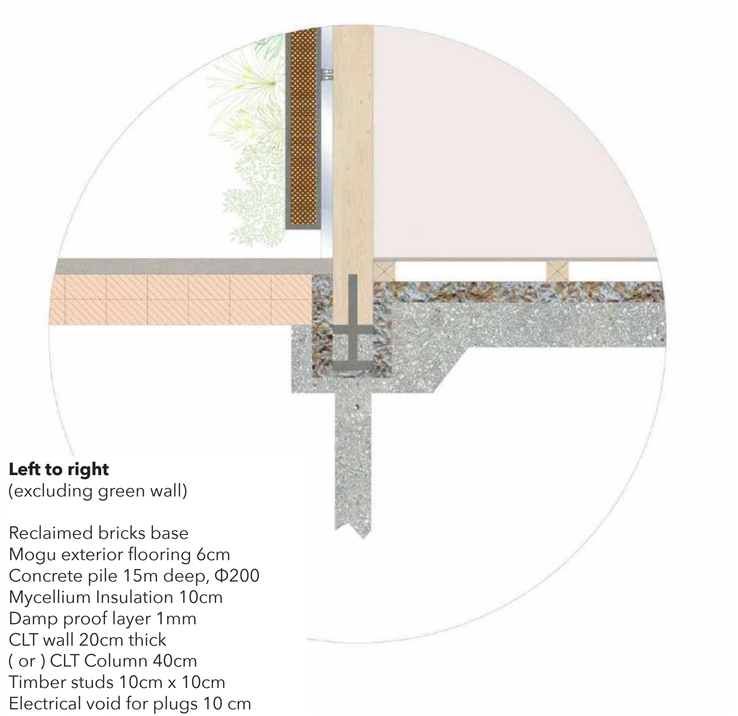


DETAIL (1:50 @ A3)



Typical exterior to interior detail

Scale 1:20 @ A3



Left to right
(excluding green wall)

Reclaimed bricks base
Mogu exterior flooring 6cm
Concrete pile 15m deep, Φ200
Mycellium Insulation 10cm
Damp proof layer 1mm
CLT wall 20cm thick
(or) CLT Column 40cm
Timber studs 10cm x 10cm
Electrical void for plugs 10 cm
Mogu floor finish 2cm

Water Collection Detail

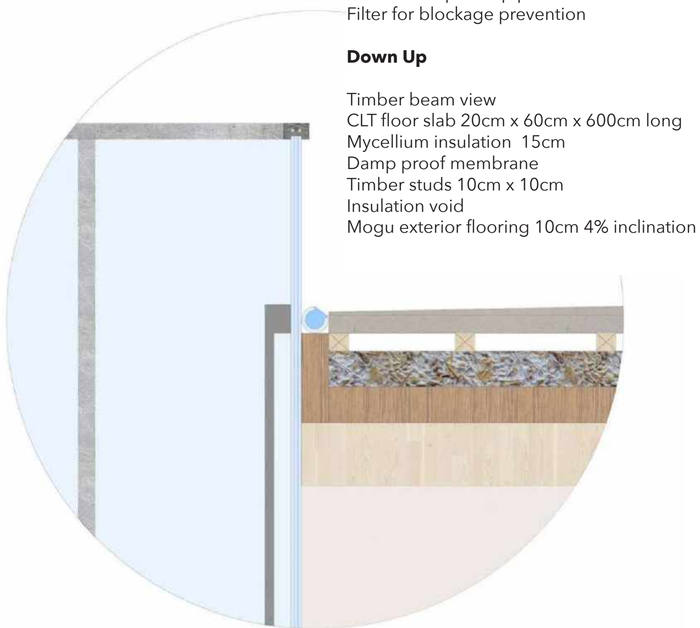
Scale 1:20 @ A3

Left to right

Enclosed ecosystem
Double glazed glass 10cm
Recclaimed plastic pipe Φ10cm
Filter for blockage prevention

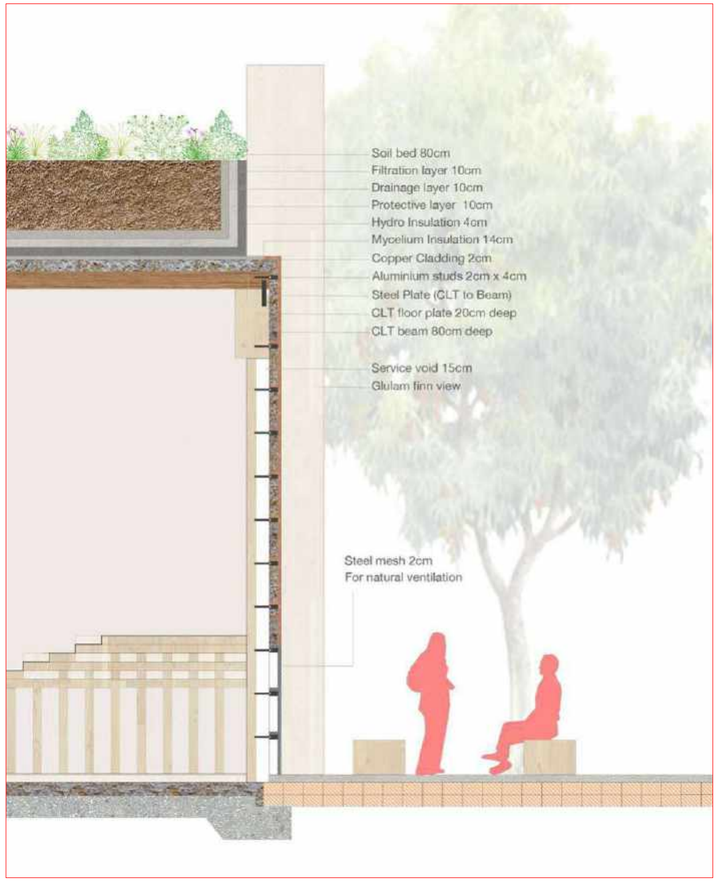
Down Up

Timber beam view
CLT floor slab 20cm x 60cm x 600cm long
Mycellium insulation 15cm
Damp proof membrane
Timber studs 10cm x 10cm
Insulation void
Mogu exterior flooring 10cm 4% inclination

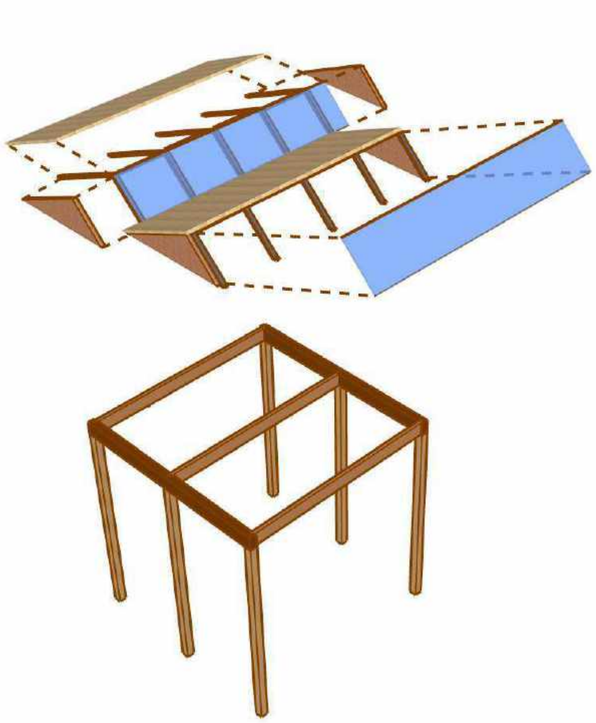


Detail

Scale 1:50 @ A3



Roof Exploded

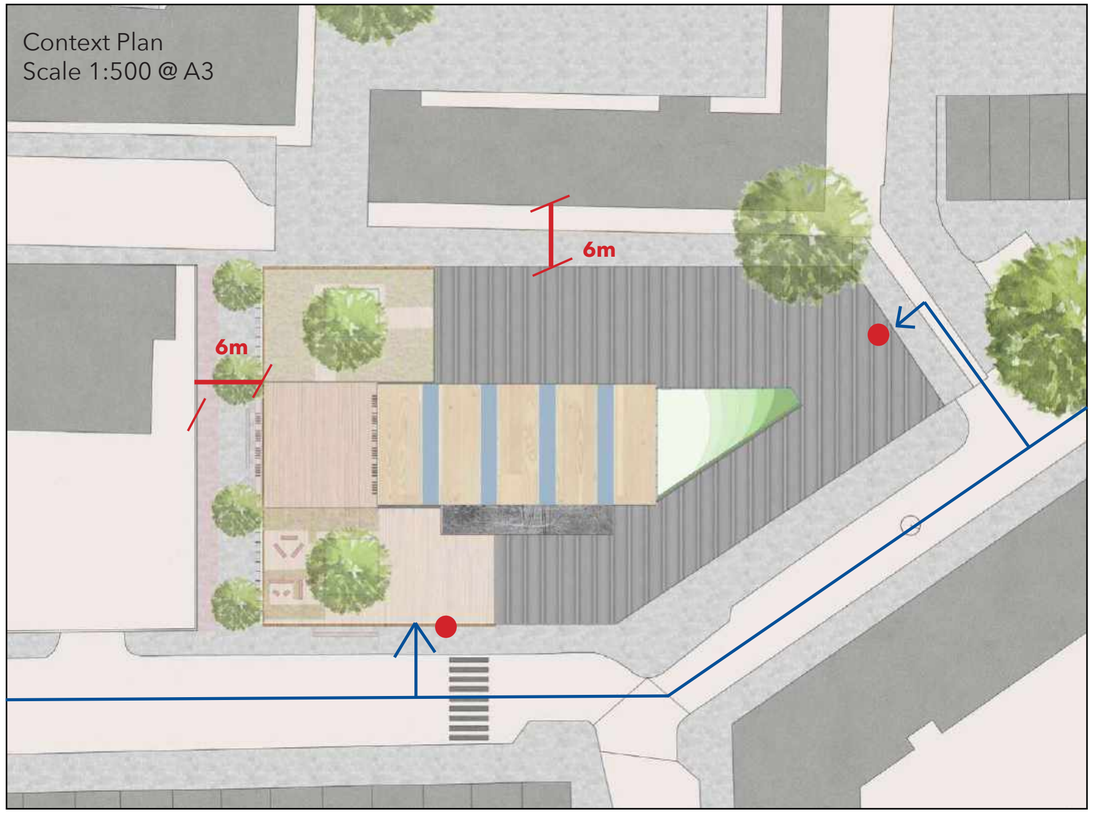


The roof is supported by 800cm deep beams that run across the full width of the exhibition space (12m). Timber studs, with x section 10cm x 10cm support the saw tooth ceiling. The roof is composed of 20cm thick ceiling finish with PV tiles due south and double glazing due north.

CDM REGULATIONS

Fire safety - Part B

Notional Boundary
Network sits adjacent to an existing brick building due South, and an existing building due east, both at a 6 metres distance. The Existing building due South is enclosed by a perimeter brick wall, which defines the boundary between the two buildings. Both 6m paths are cyclist and pedestrian routes. The rest of Network is surrounded by paved road.



FIRE AND RESCUE SERVICE VEHICLE ACCESS.
(building not fitted with fire main)

Network has a total of 5000m2 and a height of 13.5m. For this reason, it has fire and rescue service vehicle access to more than 50% of the perimeter of the building. these acesses must be of High Reach. For this reason, the floor to ceiling height of the internal spaces is 4m and Double Doors are always provided to ensure openings to the street are over 3.1m.

The building will be provided with a Dry Riser Inlet in all of the facades accesible by fire and rescue service vehicle access. These is connected to an underground water tank and an opening is available on ground floor.

Fire escape rutes - Every internal space has a maximum distance of 25 metres to a fire protected core with a fire exit, open to the exterior of the building. The cores are made of CLT, which is treated to be flame retardant. “CLT can be designed to accommodate substantial fire resistance and unlike steel remains structurally stable when subjected to high temperatures.” The LAB core has stairs widht 1.2m and the main core, serving more people, has steps width 2m (guard at either side).

The building’s predominant material is Wood and mycellium pannels. The wood is treated to be flame retardant. Below are some BIOHM facts about Mycelium Insulation Pannels. The area of the building that is over 11m and so will be serviced with sprinklers throughout (LABS & restaurant).

THERMAL CAPACITY

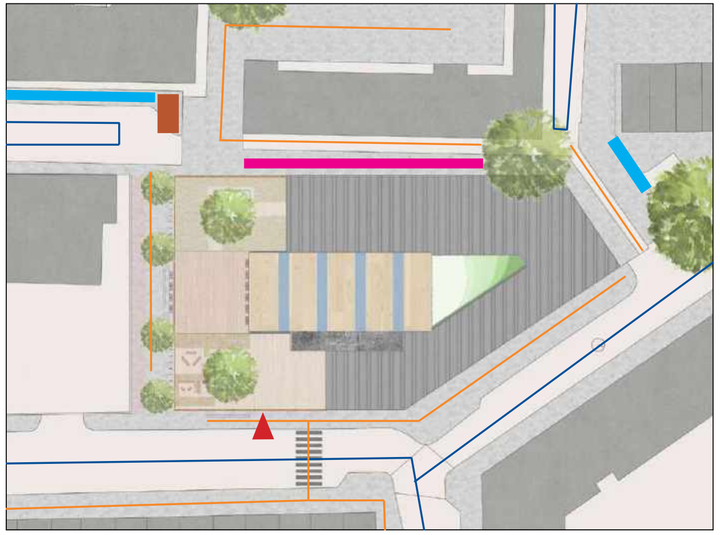
Initial thermal testing indicates that mycelium insulation can outperform the vast majority of market- leading synthetic and ‘organic’ insulation products. Biohm’s mycelium insulation has achieved thermal conductivity as low as 0.024W/m.K., surpassing the values that can be achieved by market leading but unsustainable materials such as glass fibre (0.032-0.044W/m.K.), mineral wool (0.032-0.044W/m.K), expanded polystyrene (0.036W/m.K) and extruded polystyrene (0.029-0.036W/m.K).

FIRE PERFORMANCE

Mycelium not only outperforms petrochemical/ plastic construction materials in thermal and acoustic insulation, as a natural materials, it is also safer and healthier. Mycelium does not contain the synthetic resin-based materials that cause the harmful toxic smoke and quick spread of flames during a fire.

Initial testing demonstrates that mycelium releases significantly less heat and smoke during burning, with much lower average and peak heat release rates and longer time to flash over synthetic materials owing to its charring behaviour, inhibiting spread when exposed to fire.

Accessibility - Part M



Main Entrance

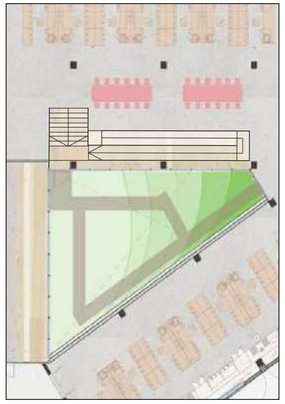
Pedestrian and cyclist routes

Adjacent Vehicle routes

Disabled Parking

Vehicle Parking

Bycicle Parking



MAIN ENTRANCE
The main entrance is made clear by the two vertical walls at either side of it. It also has a circle window, connecting the street to the interior BIOHM Shop. A zebra crossing has been placed outside the main entrance. An electric door buffer delineates the main entrance.

INTERIOR ACCESIBILITY
The entire building is an open floor plan, with no internal glazing or level changes. The only instances where a level change is required is when accessing to the enclosed gardens. In the labs, for example, the garden is accessible by both a ramp (with an inclination of 1:12) and steps (with a guard at either side). The other two gardens are only accessible by steps as they are only accessed for maitenance.

Construction & Design Management

Pre Construction

In order to protect the historic building due South of the building, a team of experts will be hired.

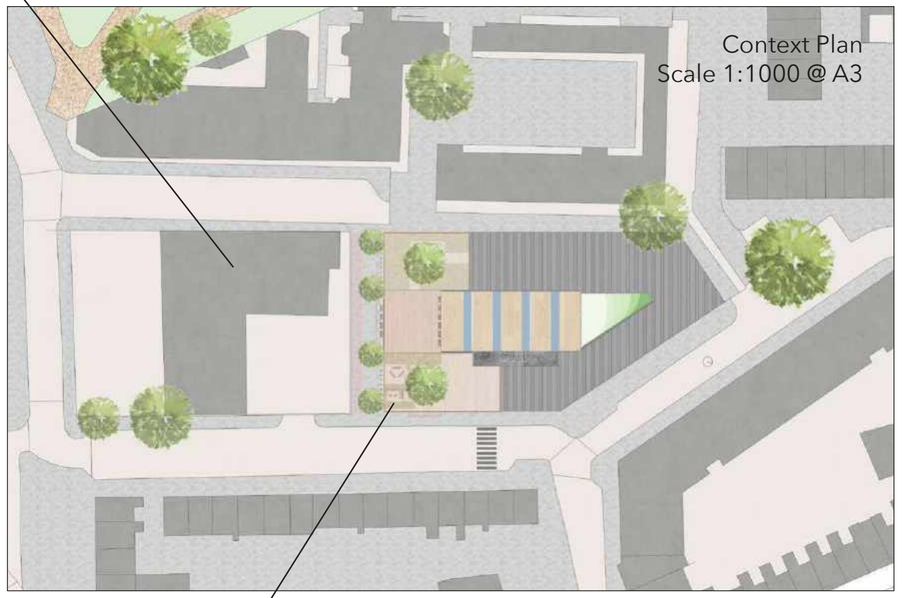
During Construction

Surrounding residents will be warned about the duration of the construction. Road signs for traffic speed reduction will be set up. All of the construction staff will be required to wear personal protective equipment. Scaffoding will be setup where needed. Construction will occur at appropriate hours to reduce neighbourhood noise pollution.

Post Construction
All of the hoardings and setup will be removed, including road blocks and constuction signs. Any damage to the surrounding urban area (pavement cracks etc) will be repaired.

Pre Construction
Urban site requires:

Geological exploration
Ground stability check
Hoardings
Fire Escape Strategy
Information boards
Tree protection

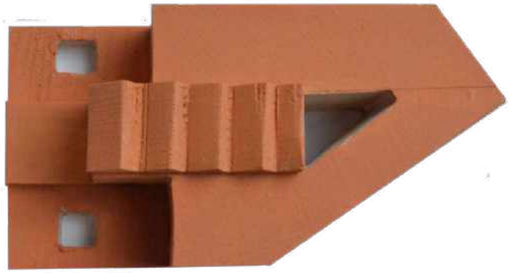


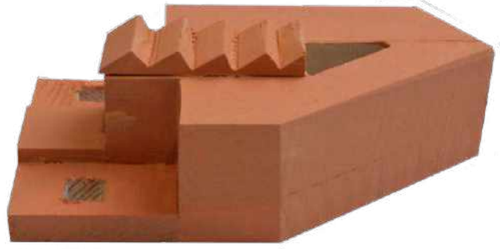
Context Plan
Scale 1:1000 @ A3

Pre Construction - Site Clearing

A team of experts will tear down the exisitng pre fabricated elevations. The materials will be taken apart and sold as parts. When possible, bricks will be taken by parts rather than demolished. In the end, the remaining bricks and stone will be broken down and used as concrete aggregate for the construction of Network.

PROCESS

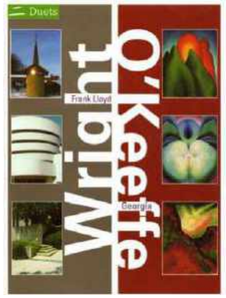




Getting started...

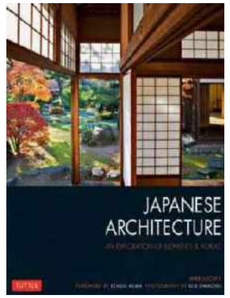
At the beginning there were a lot of possibilites. I was not sure where to begin and so I took inspiration from my bedside table.

Frank Lloyd Wright/
Georgia O'Keeffe: Duets
by: Llorenc Bonet



A book that studies the two artists, arguing the relashionship between their work.

Japanese Architecture:
An Exploration of
Elements & Forms



Understanding organic materials and the beauty in simplicity of form.

"Manual do Arquiteto Descalço"
Barefoot Architect
By: Johan Van Legend

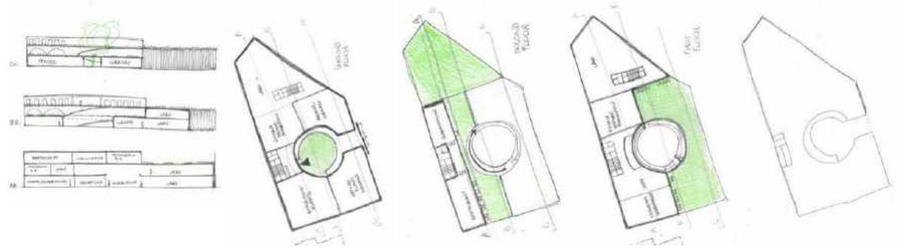
Understanding architecture to 1:1 scale. The importance of detail.

Orthogonal Vs Organic

The driving factor of my project was the design brief. In no particular order, the following thoughts stood out.

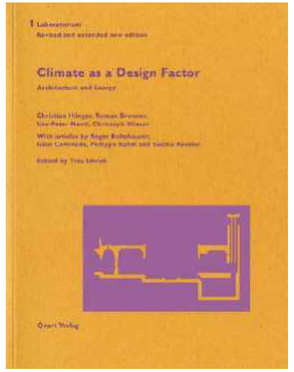
- To design a building that allows nature to thrive hand in hand with research.
- To create a space that invited the public to feel engaged with the research and development persued.
- To demonstrate a new era of architecture where nature plays a vital role in design, and consequentially, design a building that is open to a shifting breif in the future.

Being a project about nature and its importance, my first approach to design was an organic one.
I felt the need to express a curved plan with organic shapes in its facade.
I was also drawn to designing a space that was true to its materials and expressed its structure.

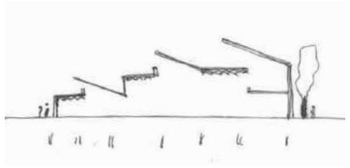


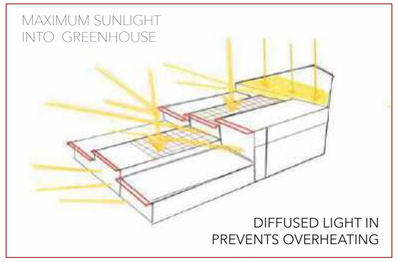
After going down a few rabbit holes, I realized that for my various goals, going for an orthogonal grid was the best bay to proceed. I realized that I did not need to have an organic form to have a nature oriented design.

Climate As A Design Factor



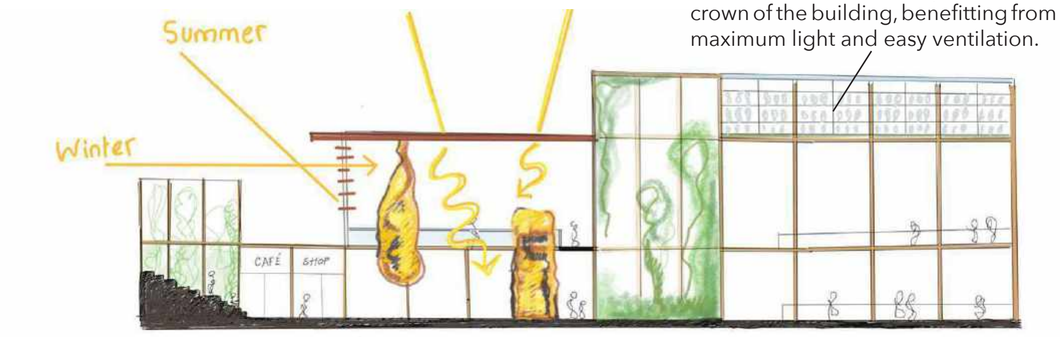
When working out the design, still debating whether the form should have a more organic approach to it versus orthogonal, I decided to stop that thought process and focus on the environmental capacities of the building. At that point, climate became the one and only factor I was focusing on, and that is when my design started evolving. Based on solar studies, I worked out the ideal massing for the building and understood how that would define interior spaces. I questioned the form of the roof and the direct sunlight from all directions.





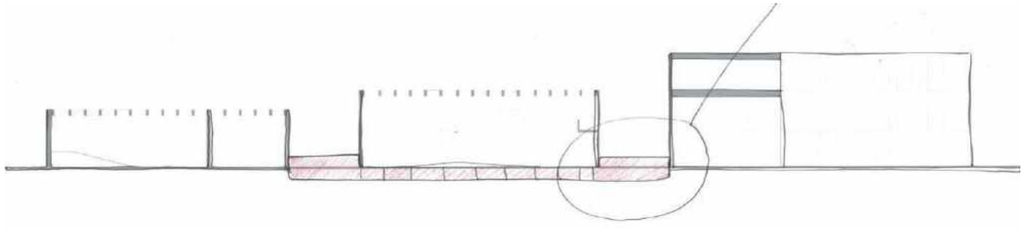
Massing testing was developed, rising from south towards north. During massing tests, I was able to better understand how the building sits in its context and how it interacts with the public realm. The stepping of the massing was a product of climate as a design factor as well as the influence of the neighbouring buildings, that vary in massing and height.

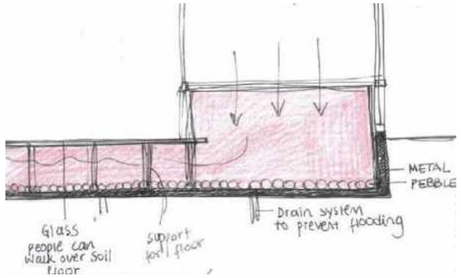
The mushroom farm was placed at the crown of the building, benefitting from maximum light and easy ventilation.



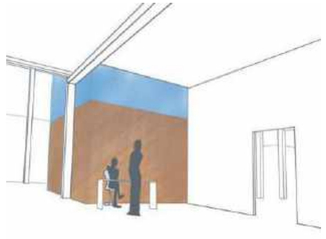
SECTION - WEEK 23 (first crit)

Enclosed ecosystem development

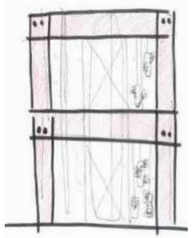




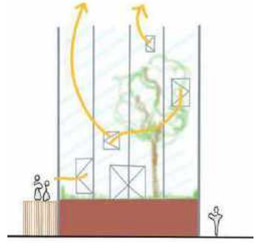
Mycellium grows in microscopic threads and thrives under the soil. When developing the structural aspect of the enclosed ecosystems, I brainstormed about having all of the soil from the gardens connceted under ground floor. This would allow for the mycellium webs to communicate from one garden to another, and researchers would be able to (maybe) witness some tree communication amongst gardens. The reason for not going forward with this approcah was that it was highly complex, and would have to be technically studied to ensure no leaks or problems in the stability of the building. I am very interested in integrated design, where the form and the function coexist. Going forward, I would like to take this thinking process forward and find solutions in which nature and architecture can work together for common good.



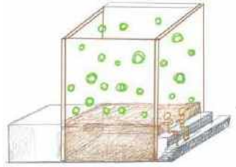
Entrance view - connection to earth



Mushroom greenhouse



Gardens for natural ventilation

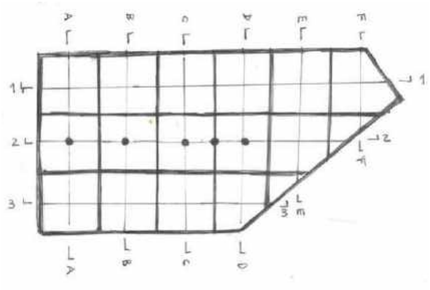


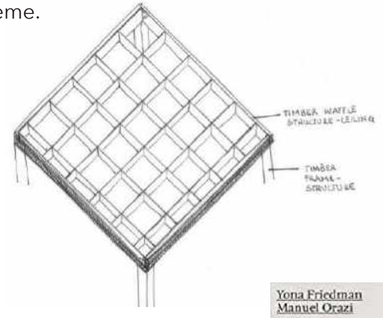
Raised soil beds

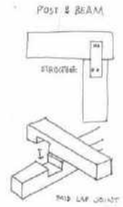
Honesty In Materiality

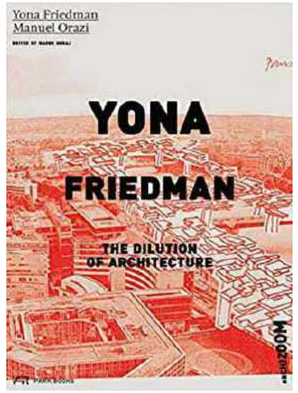
Nature is what my project is about. Our species has developed over centuries within the natural environment, shaping who and what we are today. Mycellium is part of that natural environment, in fact, funghi is believed to have been the reason why once marine bacteria first migrated to land. Mycellium has been found in a fossil dating to at least 715 million years ago.

Due to the theme of nature, and the environment as a design factor, timber was chosen as the main material for the design. It is 100% renewable (reducing its carbon footprint), it has the ability to be modular, which is important for the lifespan of the building, and it has a beautiful finish, benefitting the overall scheme.

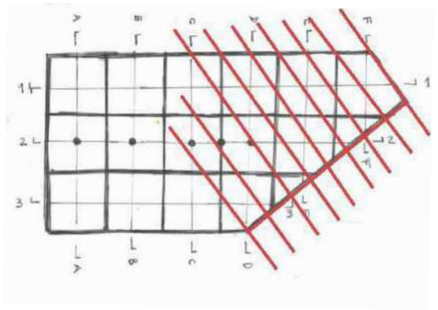








Structural Development



Due to the site, the orthogonal grid was interrupted by an angled line, losing its rhithm and integrity. Ater the first crit I understood that it was better to introduce another grid, and have 2 intersecting grids.

In orer to create lateral stability without requiring steel cables or trusses, I decided to implement CLT load bearing walls where the two grids meet. This allowed me to maintain columns in areas where I wanted open spaces. CLT walls were predominantly places in cores, perimeter walls and corners.

Roof Development

Since the beginning, I wanted to illuminate the double height hall with natural light. I studied the possibility of having a waffle ceiling, however, waffle ceilings have a structural performance as well as an aesthetic one, and in the way my building was structured, this did not make sense. I studied other possibilities, and ended up deciding on a saw tooth roof, that would block south light and allow north light to illuminate the triple height space.

Main hall collage

Timber waffle

Pushing it Further

Overall, I am really pleased with the jouney this project has taken me through. I learned about the principles of design, driven by climate factors and energy requirements. I have changed the way I design, understanding to trust the process and listen to all of the feedback. I understand now that it is important to keep questioning the design, making sure that each element of it is working hard.

Image: Fallen tree displaying its roots - mycellium webs visible

Image: Mushroom farm

With more time, I would contunue to study the possible active interactions between nature and the building, understanding how they can work together. I would also try to develop new ways in which the mycellium could play a higher role in the construction of the building. I would also develop the design of the restaurant, maybe linking it with the mushroom farm next door. However, due to specific conditions required to grow some mushrooms, this would have to be studied in order for visitors to have a pleasant experience.

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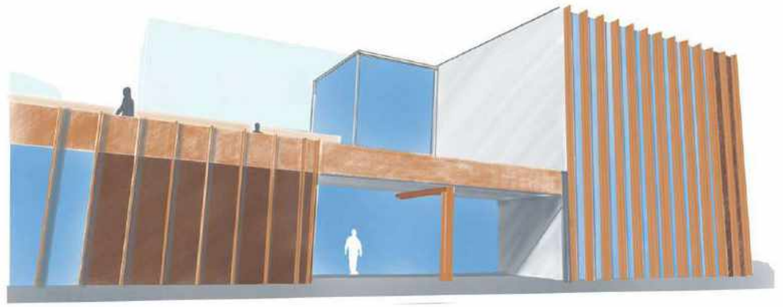


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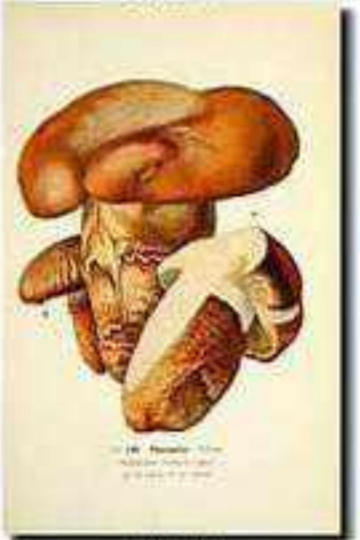
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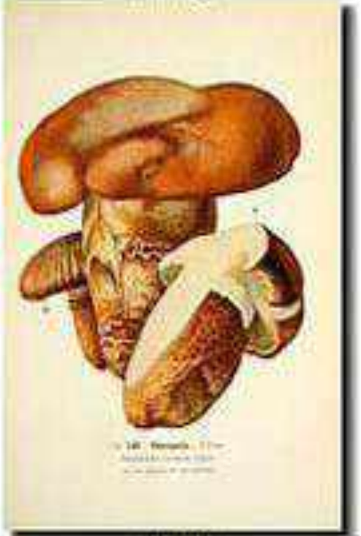
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