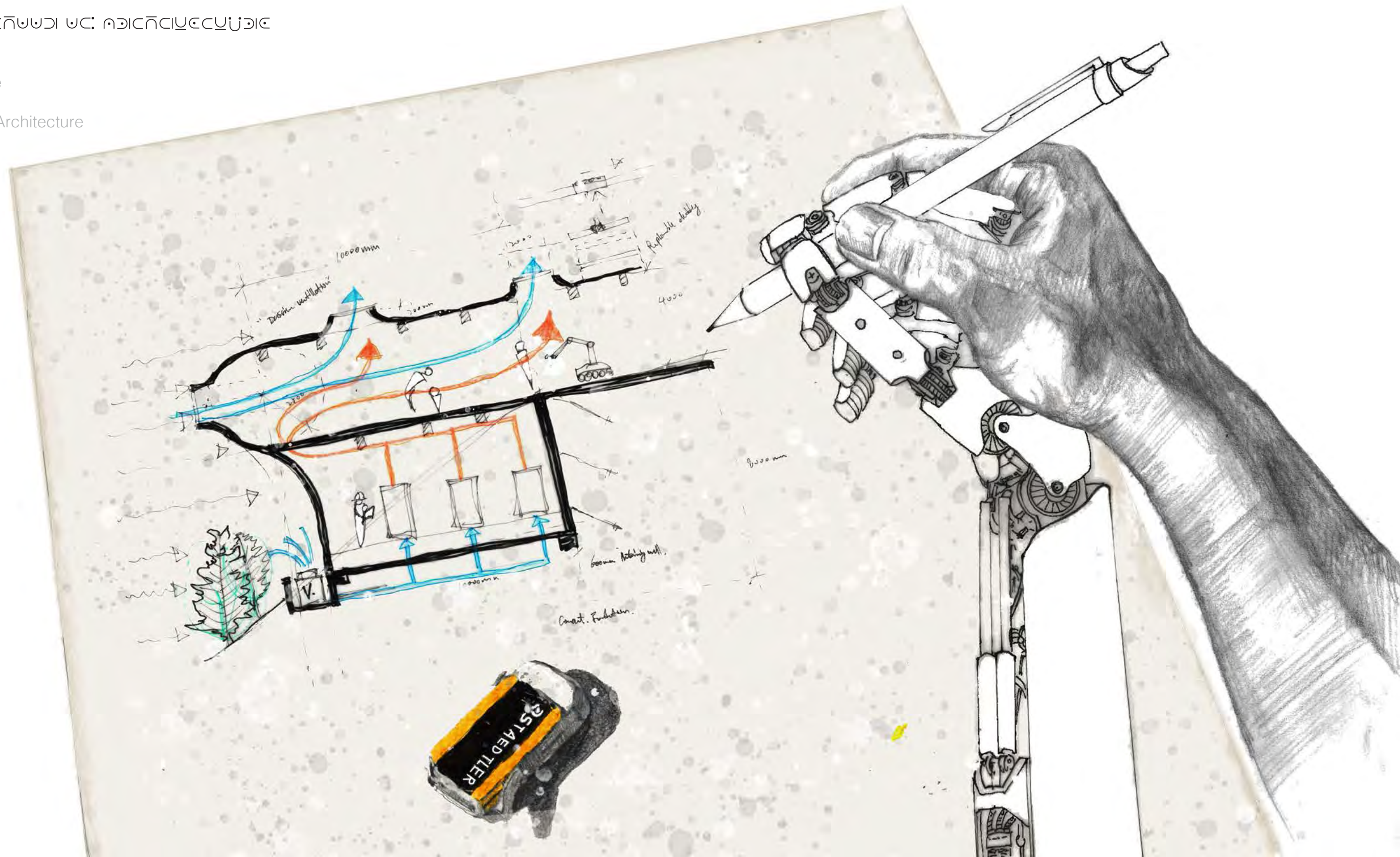


# סאימביוטיק צ׳יפּינג SYMBIOTIC FUTURE

דא לאן  
סא-אַרקיטעקטור  
פּראָגראַם  
סא-אַרקיטעקטור פּראָגראַם

Da Lan  
BA3(Hons)Architecture  
22586204  
Manchester school of Architecture







VISITING CUMBRIA



Sellafield, a major nuclear decommissioning Site Licence Company in Cumbria, plays a vital role in the local economy by providing thousands of jobs and supporting regional businesses. It drives investment, skills development, and infrastructure in West Cumbria, making it a key economic anchor in an otherwise remote and rural area.

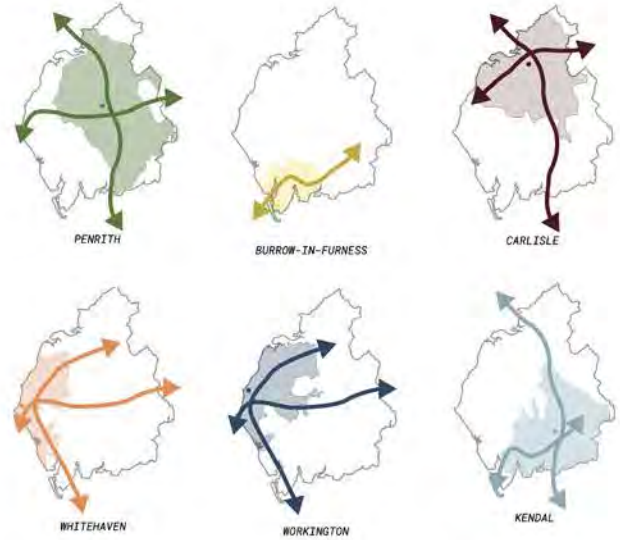
HOT robotic research center

RAICo Robotic testing center

West lake science park

Sellafield engineering of excellence

National nuclear lab



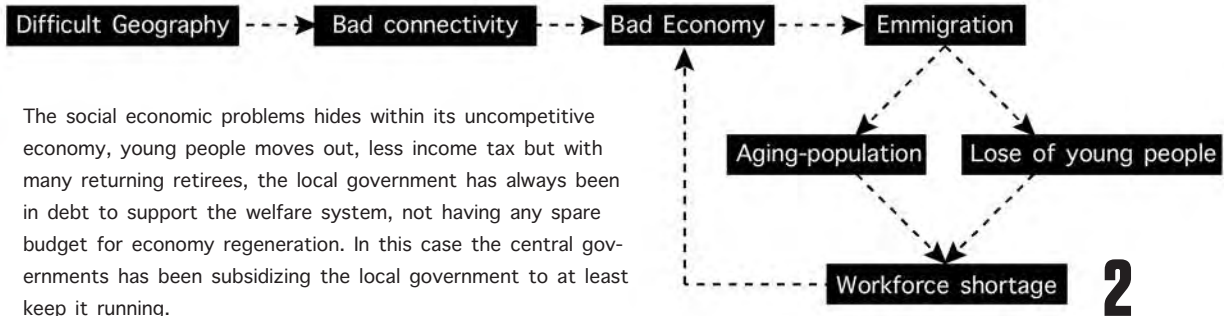
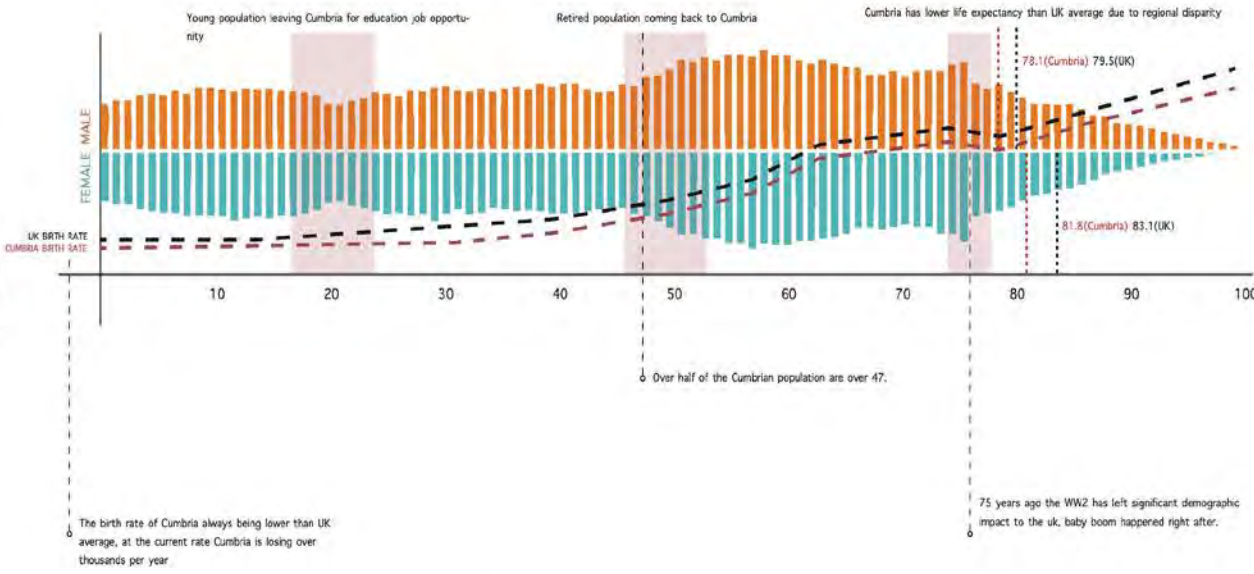
Due to the rough terrain in lake district, traffic has always been an issue, the diagram on the left demonstrate how far you can travel by car within 1 hour, train are very inefficient due to scattered town in the county.

- Tyne valley line
- West coast line
- Settle-Carlisle line
- Cumbria coast line
- Furness line



Cumbria is the second largest county in the UK but with less than half a million population, benefited from this is has a lots of energy generation and agricul-ture output, but scattered population has caused significant regional disparity, making Cumbria one of the few least productive counties.

However with such geographical gift, har-vesting its substantial natural resources can easily leverage the regional disparity, E.g.: Agriculture, Clean energy, housing, ecological diversity. The only problems is that the county doesn't have much human power, and on top of that the economy of Cumbria are very monocul-tural, the Lake district tourism industry in vital for many people's employment in Cumbria, yet most of the skilled labours are either employed in Sellafield or emi-grated out.



The social economic problems hides within its uncompetitive economy, young people moves out, less income tax but with many returning retirees, the local government has always been in debt to support the welfare system, not having any spare budget for economy regeneration. In this case the central governments has been subsidizing the local government to at least keep it running.



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GLOBAL AI RACE

AI IN PRODUCTIVITY

Without a question everyone has probably used AI to increase their productivity in their day to day work, who ever dominate the AI industry would greatly overpower other nations economically, people whom adapt AI early get great advantages on career aspect

AI IN MILITARY

With integrated AI technology in military use, weapon becomes intelligent, nations can go to war without sacrificing a single blood of their soldier, it sounds nice since no one has to die, but the truth is that without the deterrence of death in modern warfare, the cost for developed nation to invade developing country also drastically decreases

AI IN TECHNOLOGY

Imagine the future of technology advancement when academic AI are created, such AI is smarter than everyone, has more knowledge than everyone, it would even improve upon itself, exacerbating the technological gap between developed and developing nations.

AI IN ARCHITECTURE

What about architecture? Is AI only going to replace architect’s job or will it co-exist with architect, can we tame the AI in design industry to generate more well beings instead of inequality and warfare? Can we train AI to be better at building rather than destroying, do architect have a future with AI, or are they nemesis of each other from the beginning.

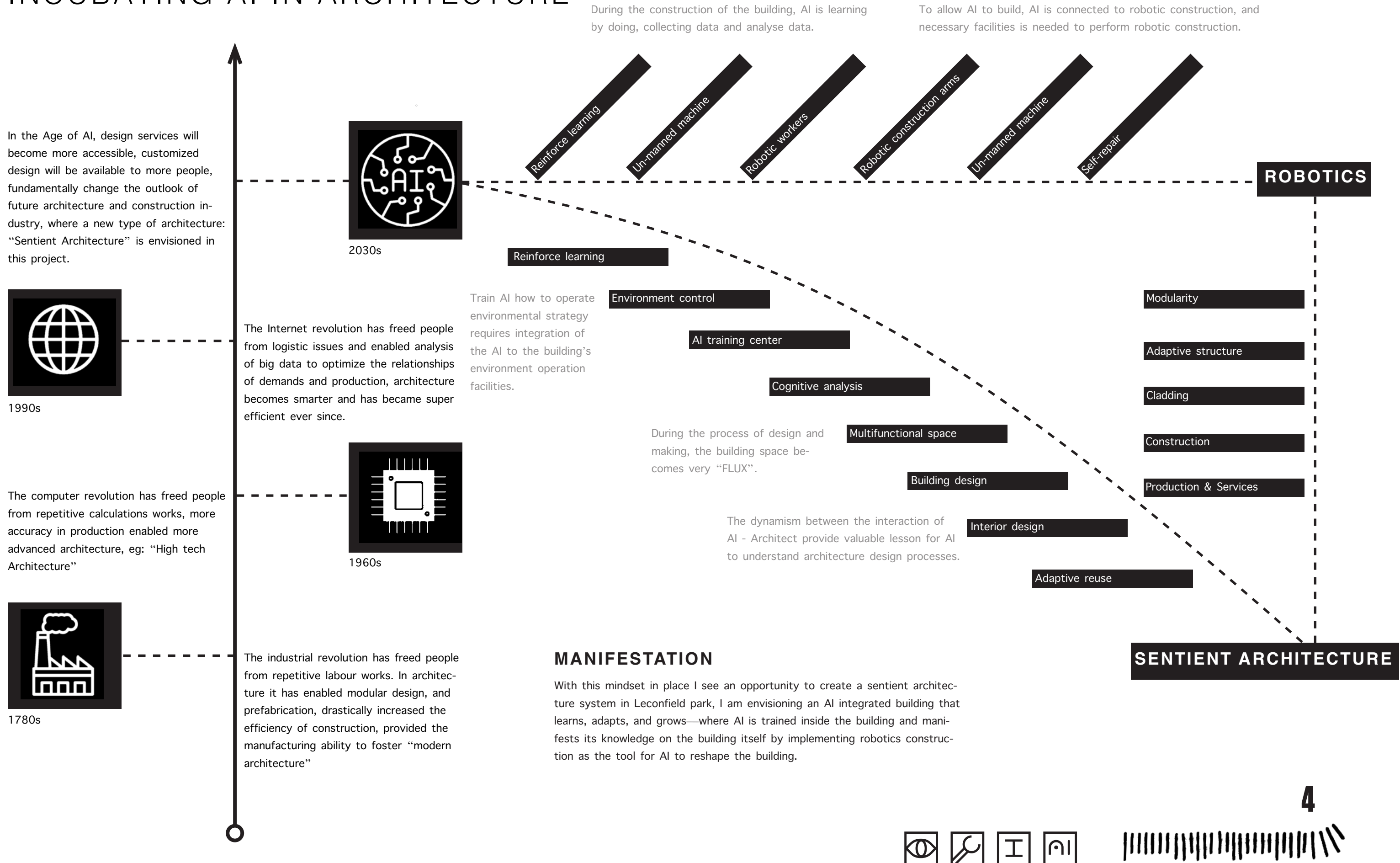


Source from: DAIN STUDIO, Jan, 2024.





# INCUBATING AI IN ARCHITECTURE





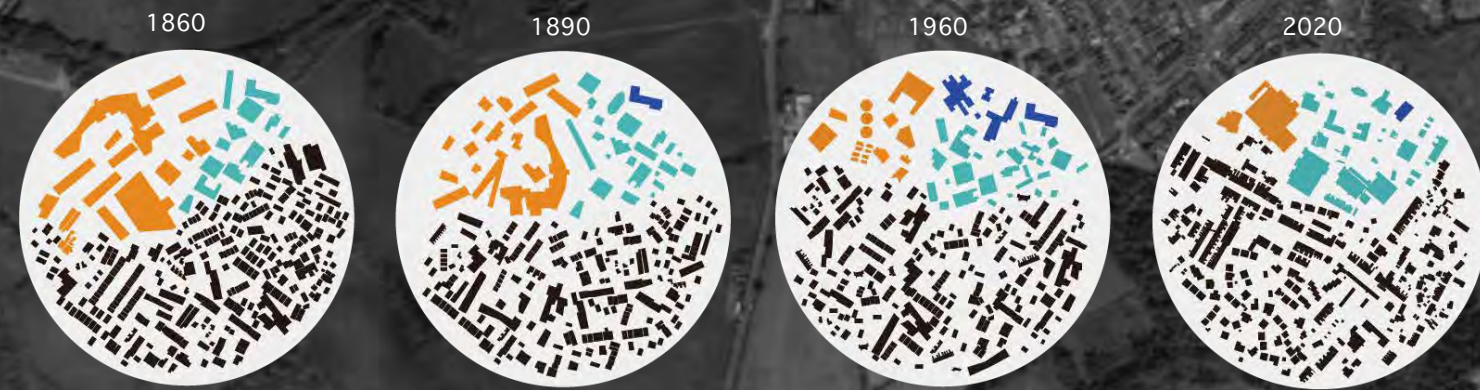
# UCLUE DUCUCU SITE REVIEW



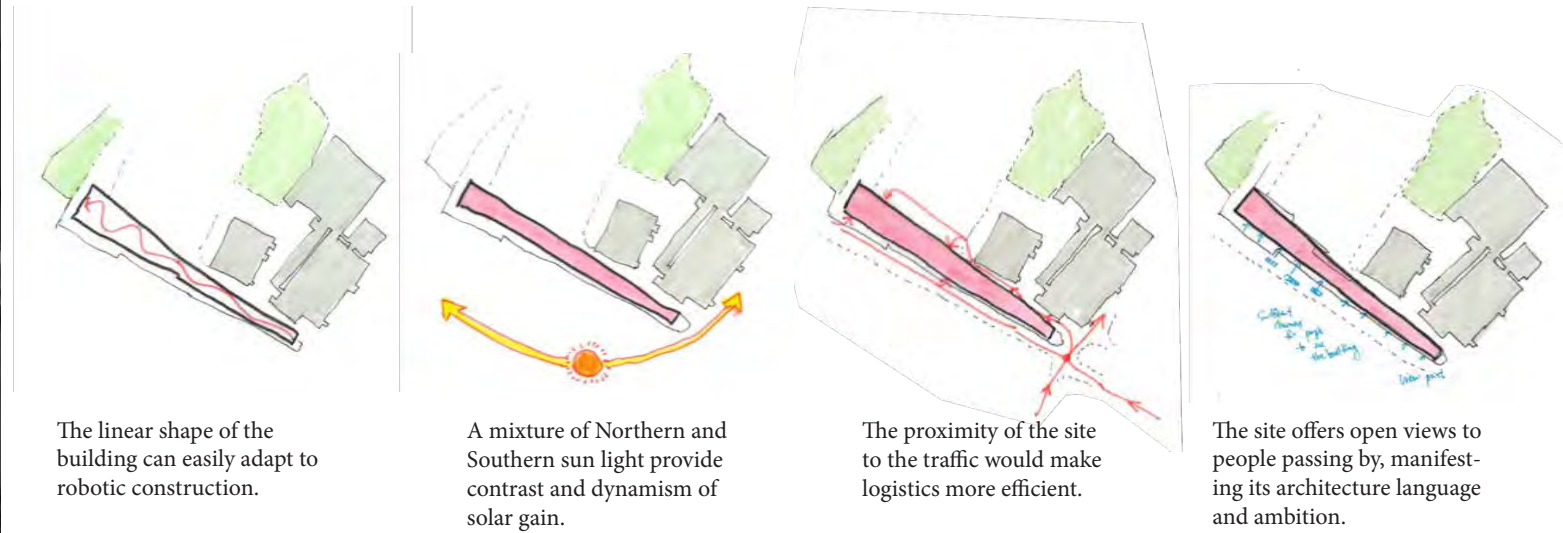
The project is proposed to situate at Cleator as a part of the town regeneration plan to boost local economy and population.

The design will be built within the Leconfield industrial park, it used to have many manufacturing.

The existing site has a established supply chain for Sellafeld s robotic research facility.



The town used to be prosperous as it provides manufacturing services within UK markets, but as most of the factories were moved to south east Asia many people lost their jobs.



Sellafeld existing human/infrastructure capital + Governmental subsidize + Investors

With all the information in mind Cleator is a suitable site to establish an Architectural AI training center, with helps from the government and Sellafeld for the start-up funds, this project has the potential of transforming west Cumbria into a prosperous and healthy economy of the future.

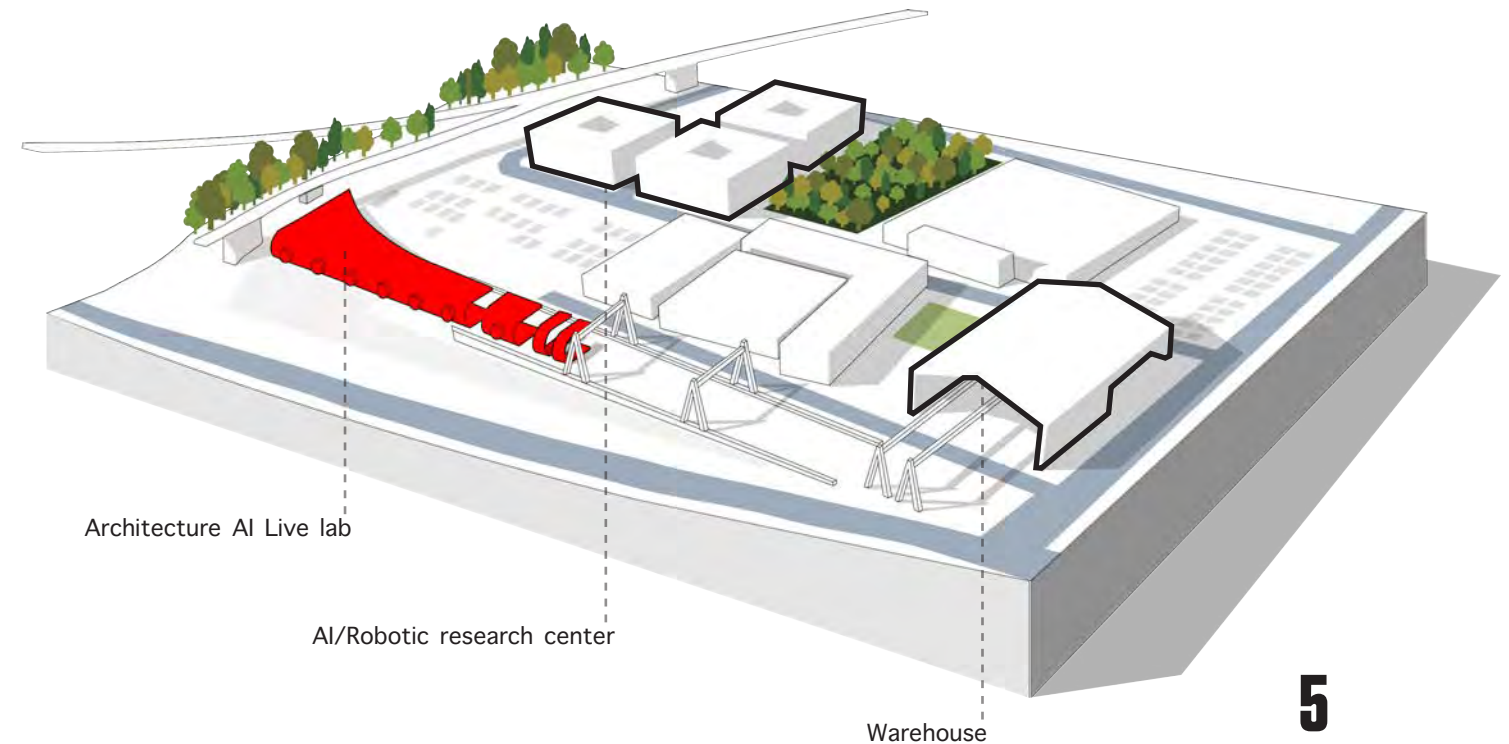
High tech industry

Boosting local economy

More employment opportunity

Retain and attract immigration

Regenerating Cleator



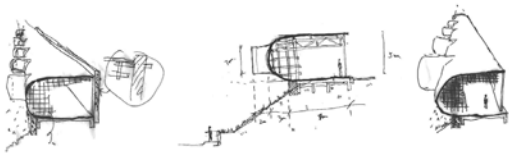
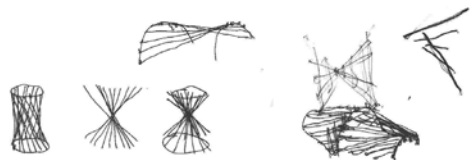
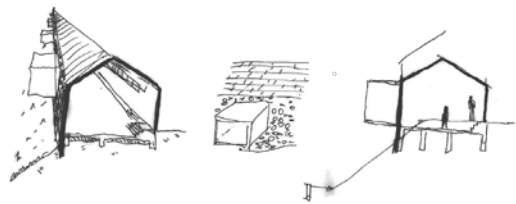


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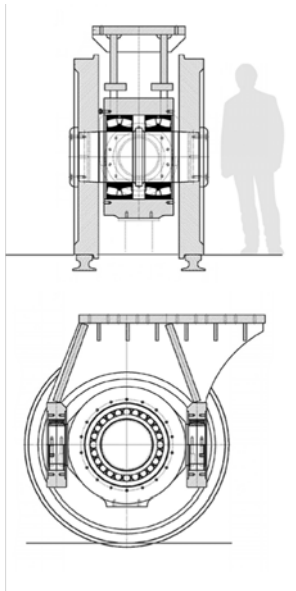
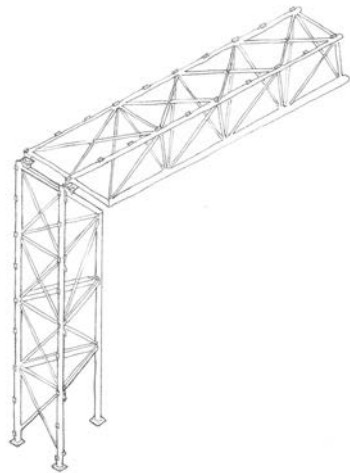
DESIGN BY HUMAN

DESIGN PHASE

The form of my building has basically stayed the same since the last term, a bit more feature has been added as a response to the manifestation changes.



Design development from last term



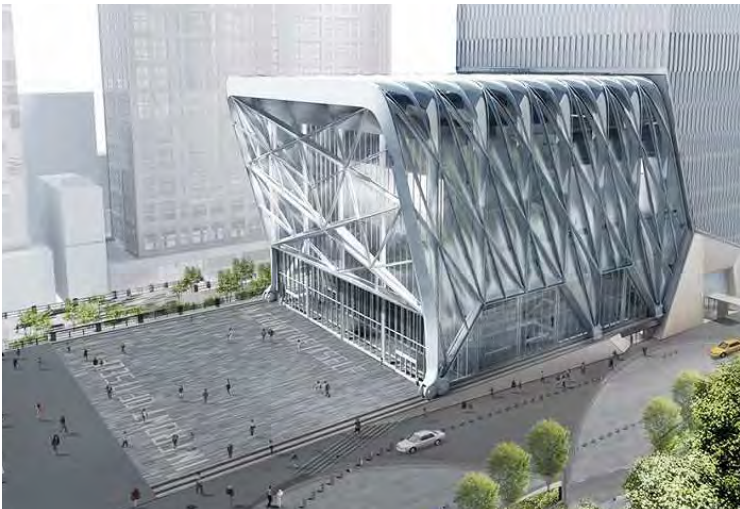
Despite the building is celebrating its 47h birthday in 2025, but the architectural ethos is still regarded as highly advanced even in modern standard.

The modular structure allows ease in construction and its modular panel system permits great adaptability in different environmental context



Sainsbuey Centre/Norman Foster/Norwich/1978

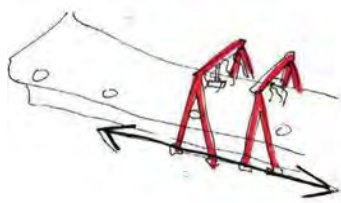
This new building has a 34 meter shed expand when more space is needed for public event, this flux space architectural idea greatly increases the rate of the use of space in a highly dense urban area,.



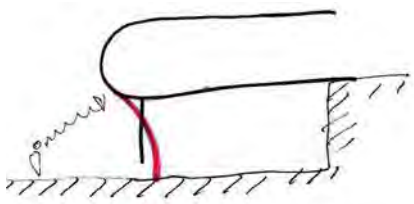
The Shed/Diller Scofidio + Renfro & Rockwell Group/New York/2019



Turning the land filling into a well constrained space for AI training.



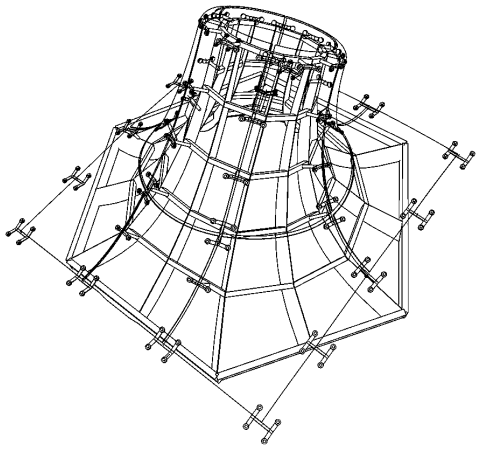
Installing robotic crane for cladding changes and construction of new buildings.



Remoulding the form to make it more organic.



Reshaping the structural wall to make it stronger.



The architect simply loves the futuristic organic design, the alien like sky window permits passive ventilation, while also manifest an interesting architectural language



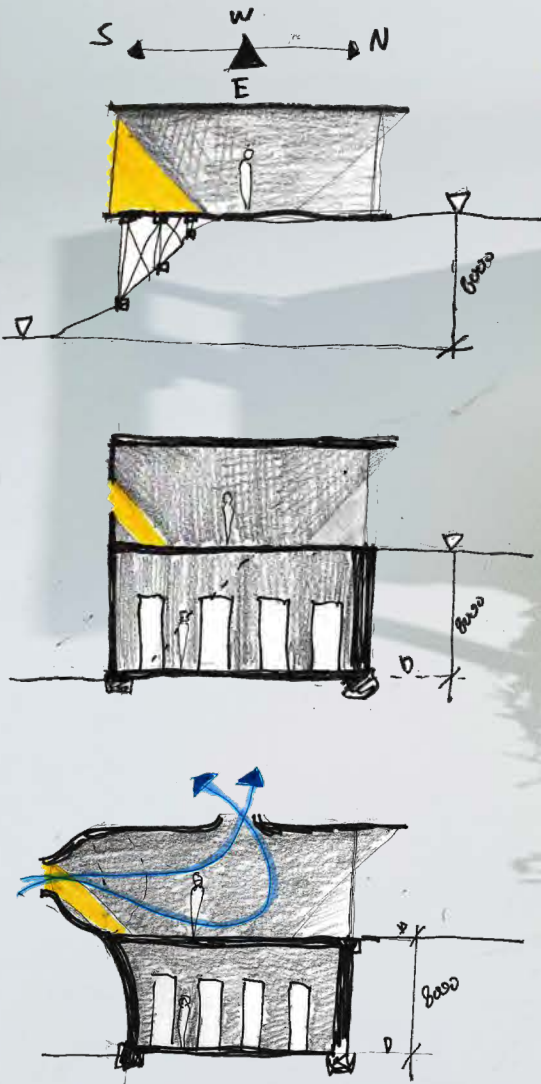
Kunsthaus Graz/Peter Cook & Colin Fournier/Graz/2003





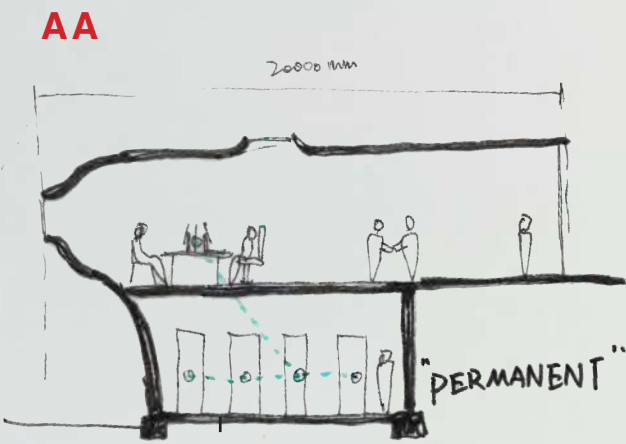
# DESIGNED BY HUMAN

The building itself consists of duplicates of a standard module aligned on a straight direction for the ease of robotic construction, there are essentially 2 different types of module here, one is a permanent section where AI training facilities locates, the building stays the same, on the other side the building evolves as AI design better buildings, the function of these module are flexible, it changes depending on the needs.



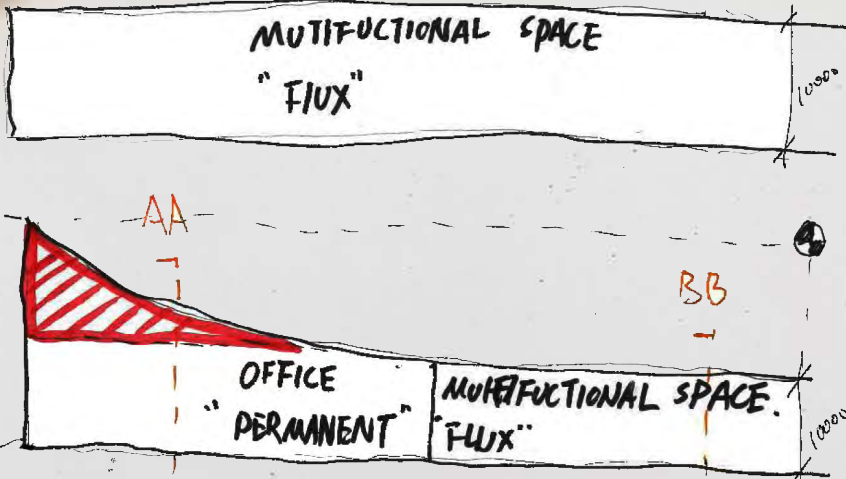
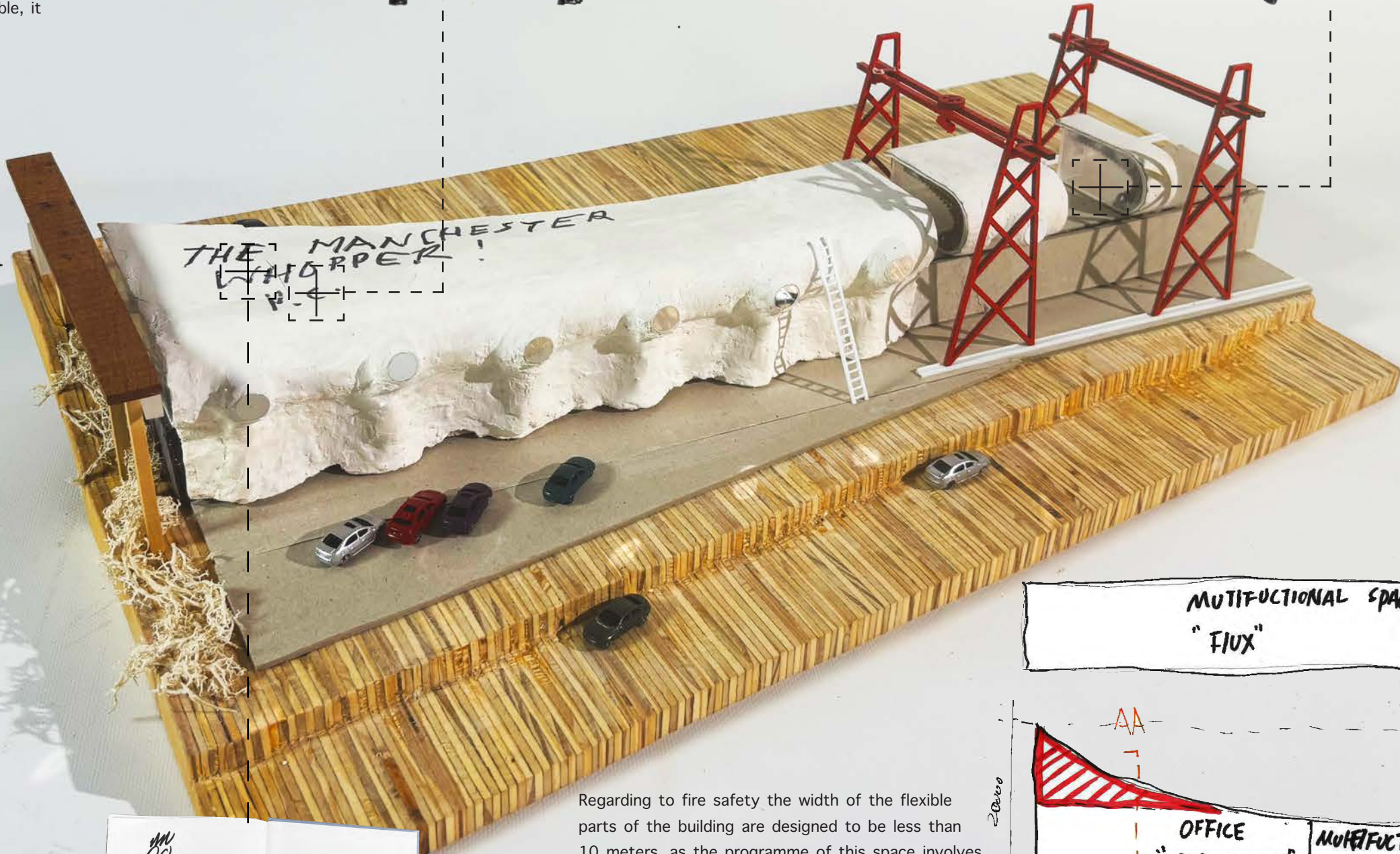
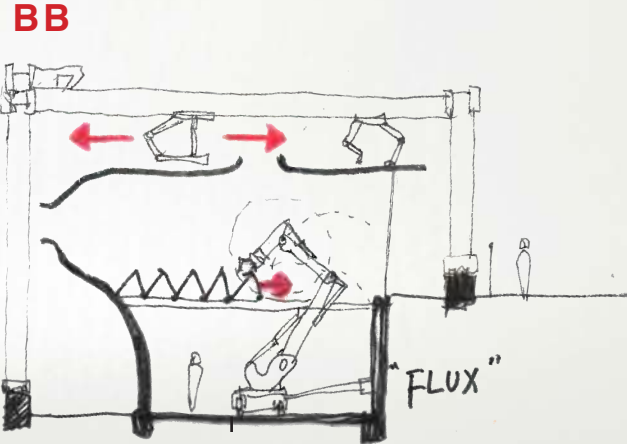
The design of the basic module follows the external environment condition e.g.:

- 1:Use of retaining wall for the ground floor,
- 2:Reducing the size of the south facing window,
- 3: abstract the form of the building so it manifest an appearance of future architecture.



**Permanent:**  
Has office space on the first floor and AI training centre on the ground floor, projected to stay unchanged for minimum 50 years

**Flexible:**  
The function of the space changes depending on the needs of user, the architecture evolves as AI learns how to design and construct.



Regarding to fire safety the width of the flexible parts of the building are designed to be less than 10 meters, as the programme of this space involves with constant construction. On the permanent section it doe has more freedom, a bigger floor area is proposed.

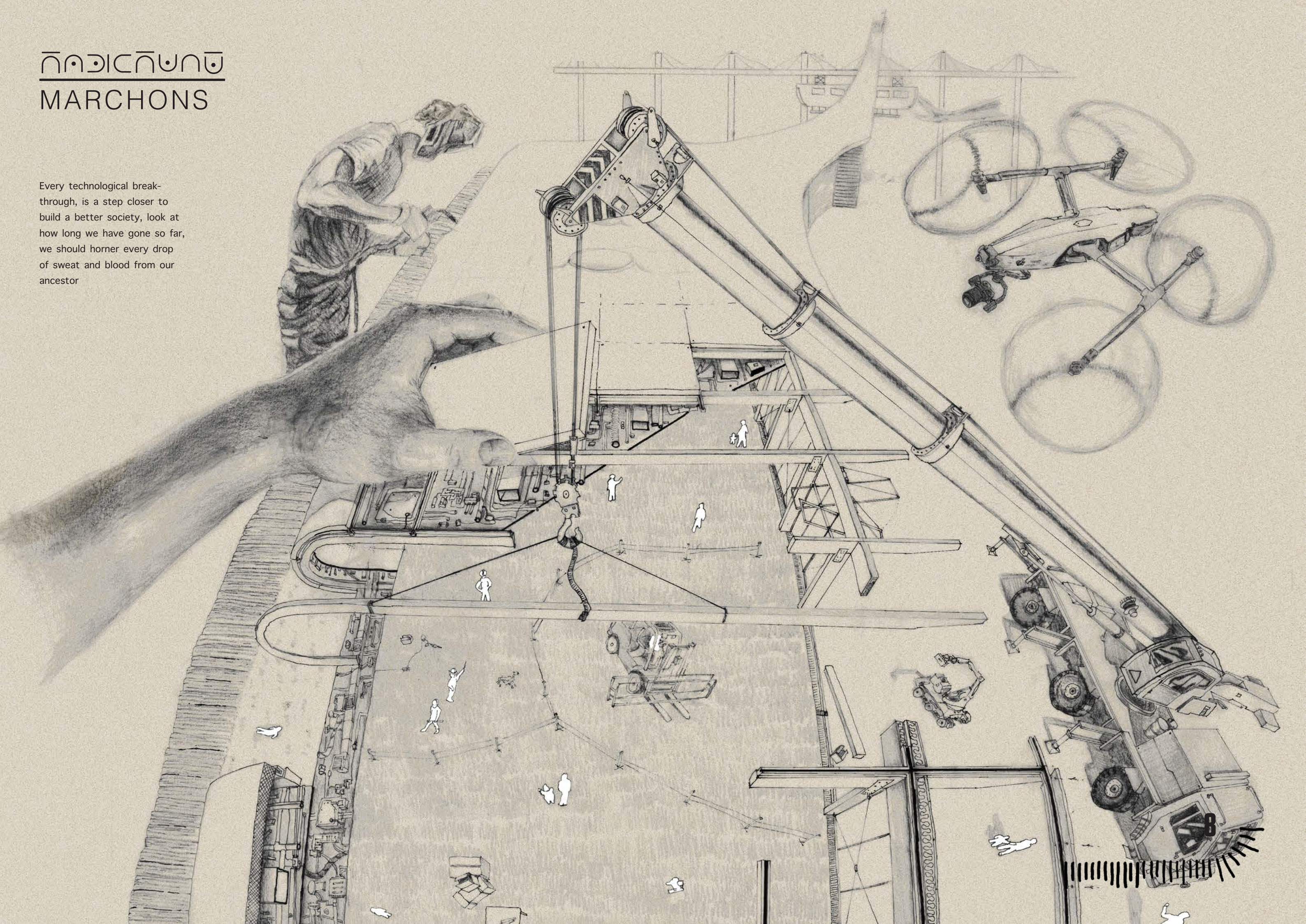
Peter Cook loves this architect's design and ambition so much he even signed his signature on his 1:200 model





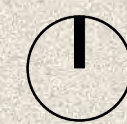
# កំណើនកម្ពុជា MARCHONS

Every technological breakthrough, is a step closer to build a better society, look at how long we have gone so far, we should honor every drop of sweat and blood from our ancestor





# מארח ומארח MASTER PLAN



Proposed Robotic Research  
Centre

Ecology Research Lab

Warehouse



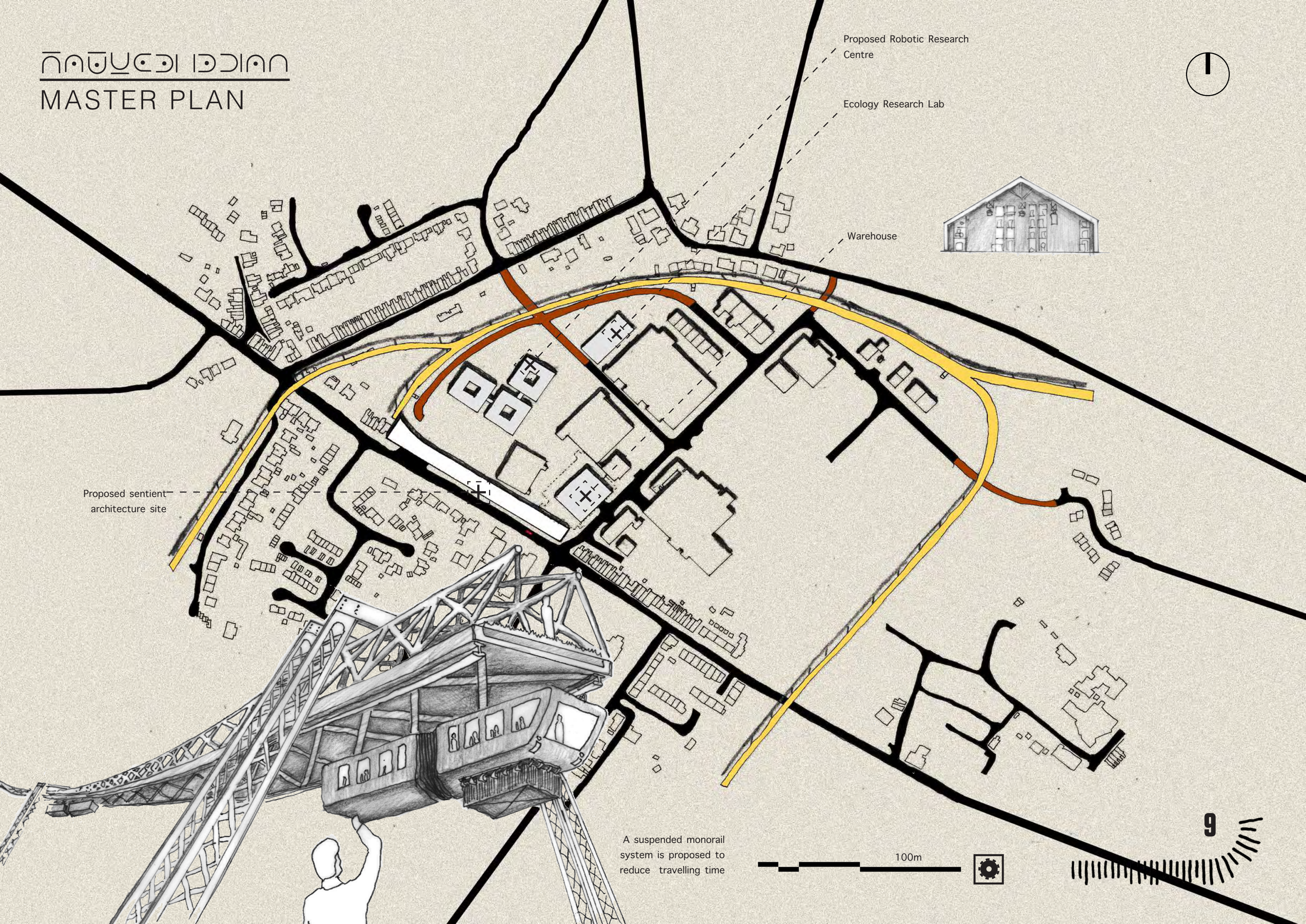
Proposed sentient  
architecture site

A suspended monorail  
system is proposed to  
reduce travelling time

100m

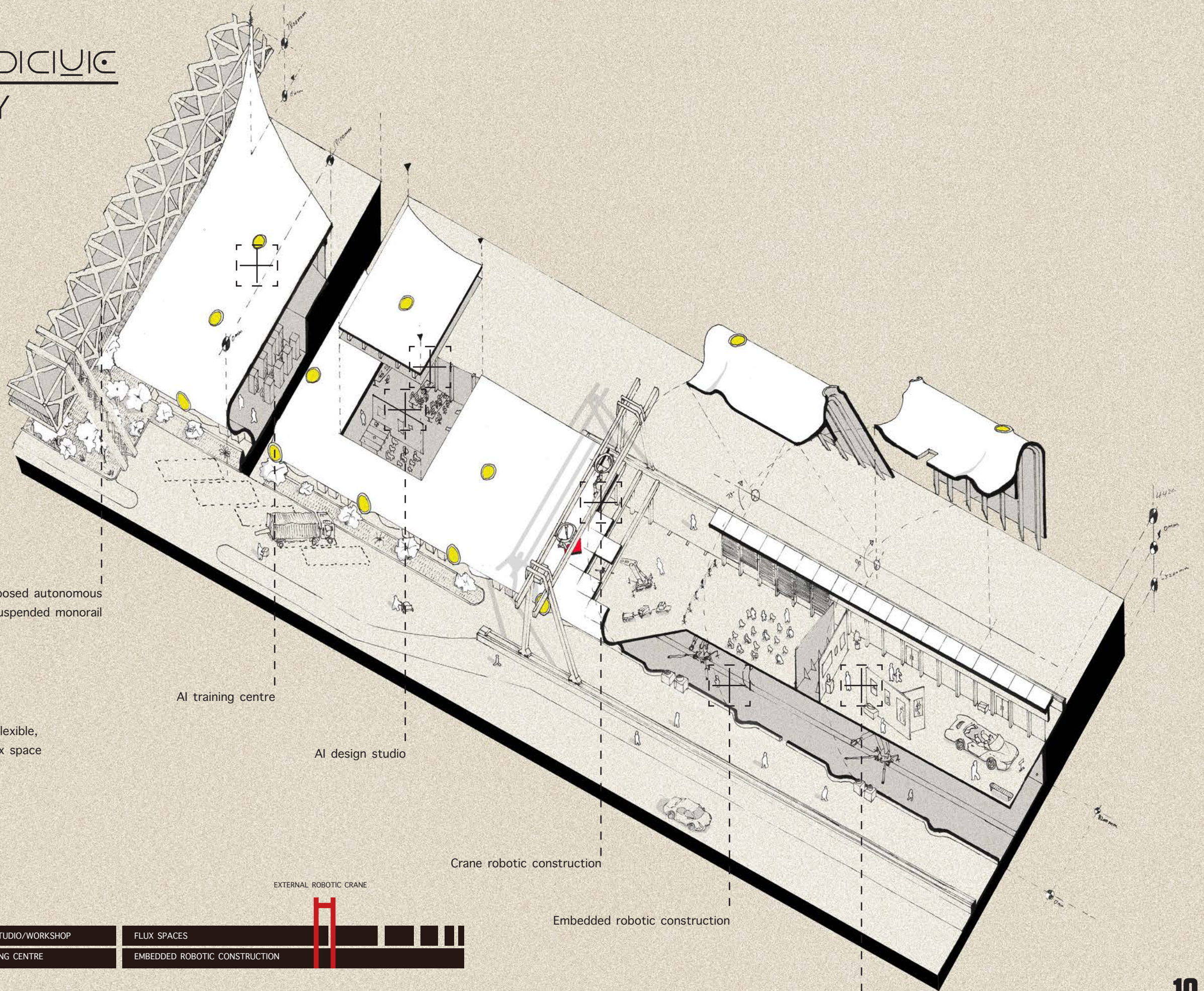


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# ADAPTABILITY



As sentient architecture are very flexible, especially on the first floor the flux space can grow when there is demand.

## FLUX SPACE

- ART GALLERY
- EXHIBITION
- CONFERENCE
- HIGH-TECH EXPO
- EDUCATION CENTRE
- COMMUNITY CENTRE

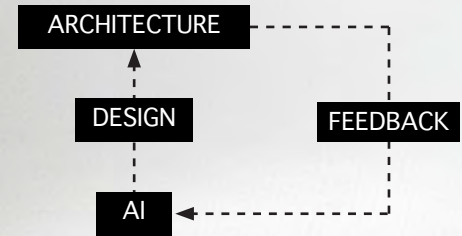
OFFICE/STUDIO/WORKSHOP	FLUX SPACES
AI TRAINING CENTRE	EMBEDDED ROBOTIC CONSTRUCTION



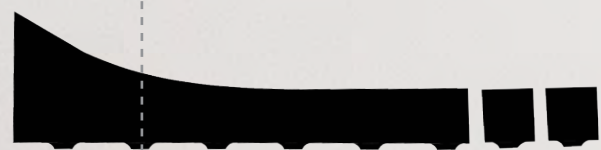
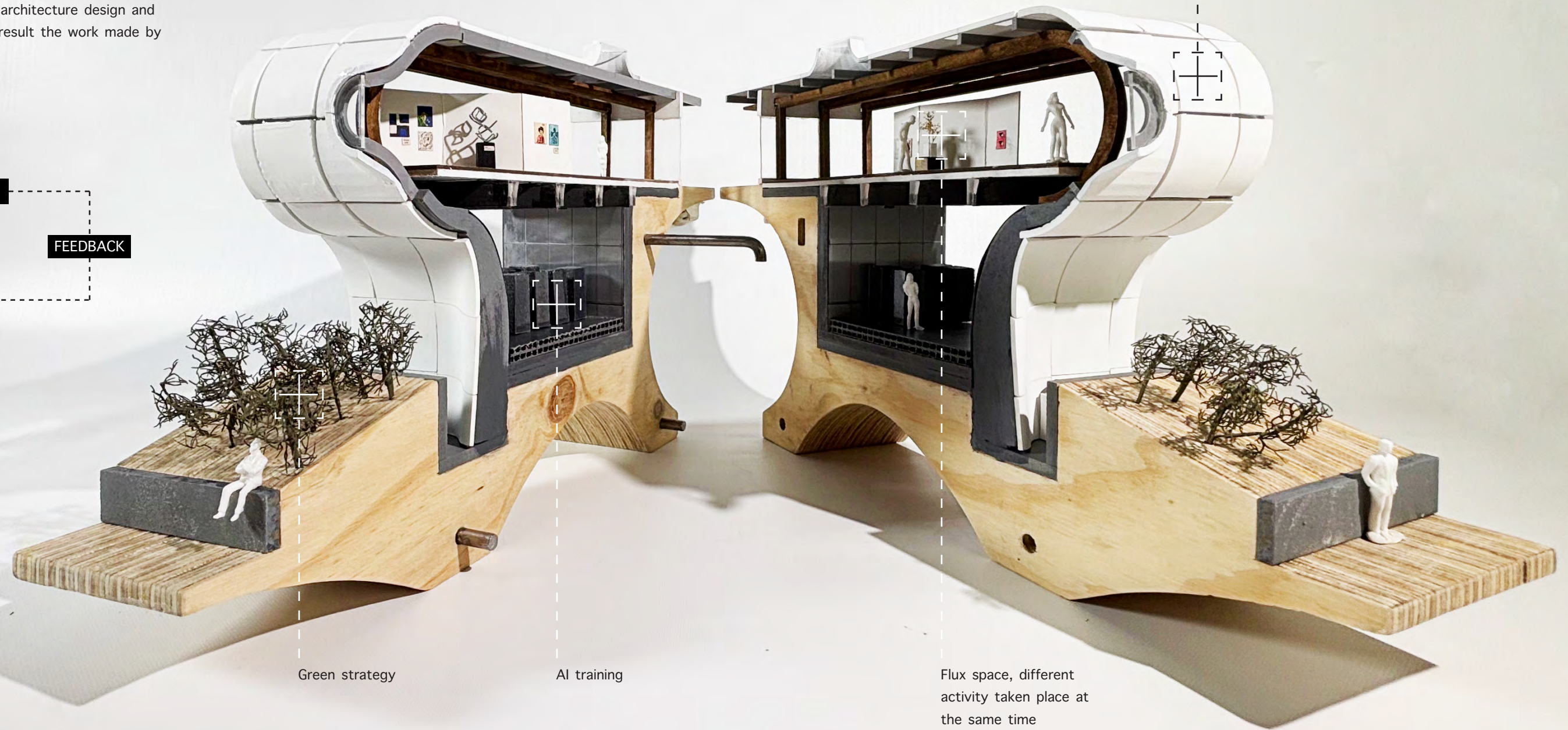


# PARALLEL SPACES

The learning space of AI is parallel to the human inhabitant, as AI facilitate more changes of the function of the space, AI becomes better in architecture design and construction, as a result the work made by AI gets better,



Ceramic cladding proposal, creating this clean and futuristic finish





# C:יִסְיֹוֹן סִפּוֹרֵס FLUX SPACE



Due to the convenience from robotic construction, the reconfiguration of the function of the space became easy, drastically increasing the efficiency of the use of spaces. A space can have different function at the different time, and as the building has different spaces, which means different function can co-exist at the same time.

Merely 100<sup>2</sup> modular spaces can provide double or triple among of economic output, and the best part is, all the work are done by AI and robotics, liberating humanity from Sisyphean works.

10:00am  
Urban Garden exhibition

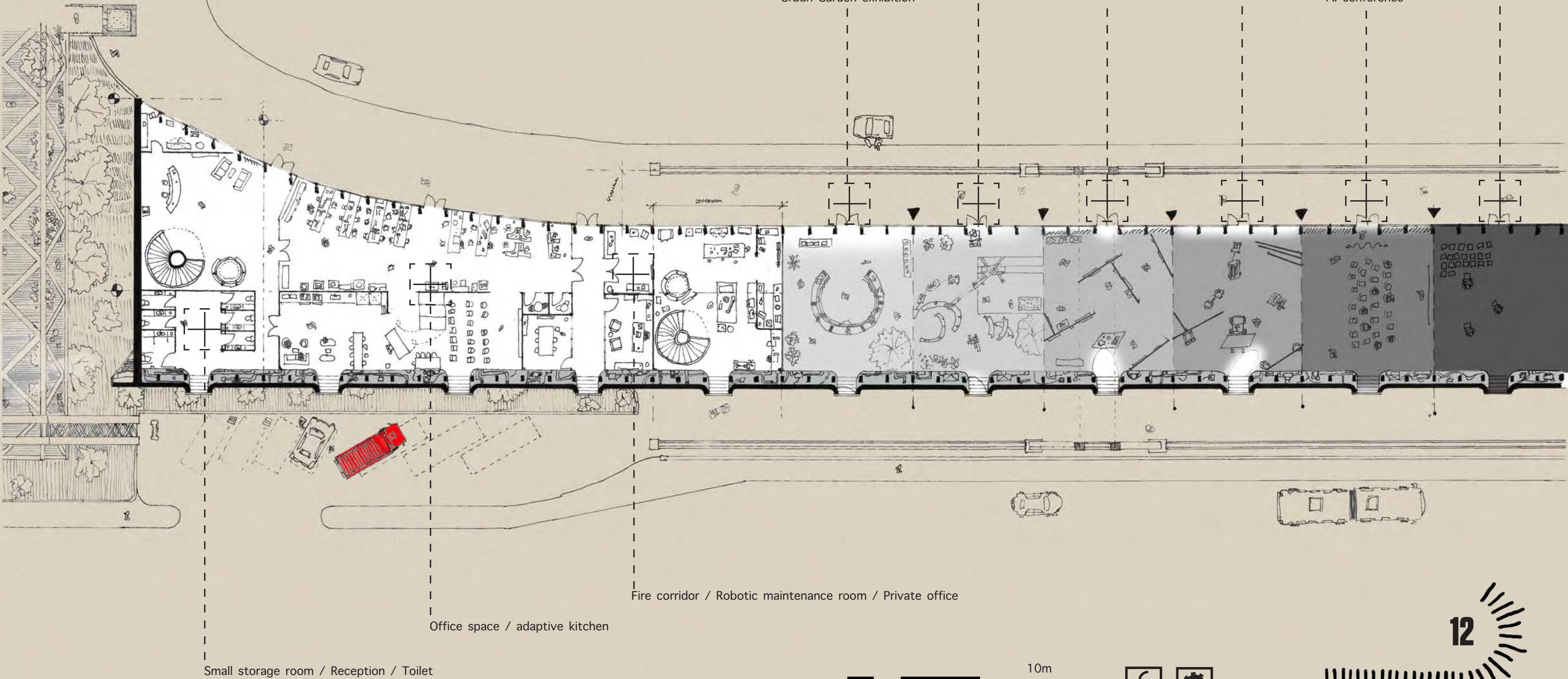
12:00am  
Reconstructing the space

15:00pm  
Modern art exhibition

17:00pm  
Uninstalling the space

19:00pm  
AI conference

23:00pm  
Cleaning up the space.

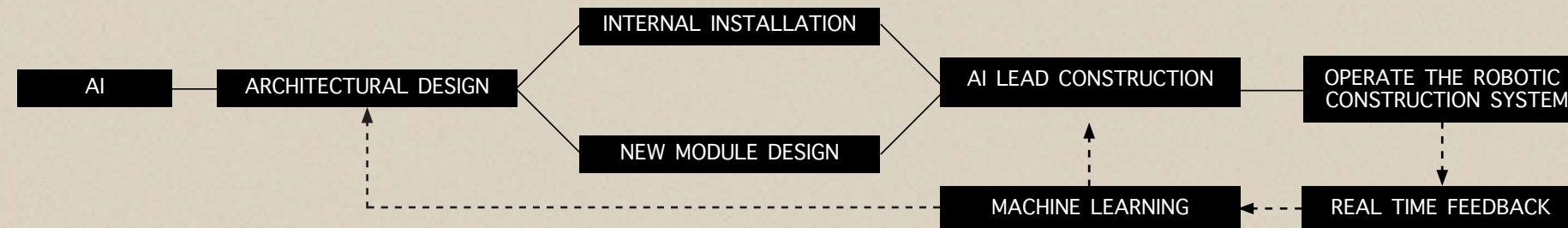


10m

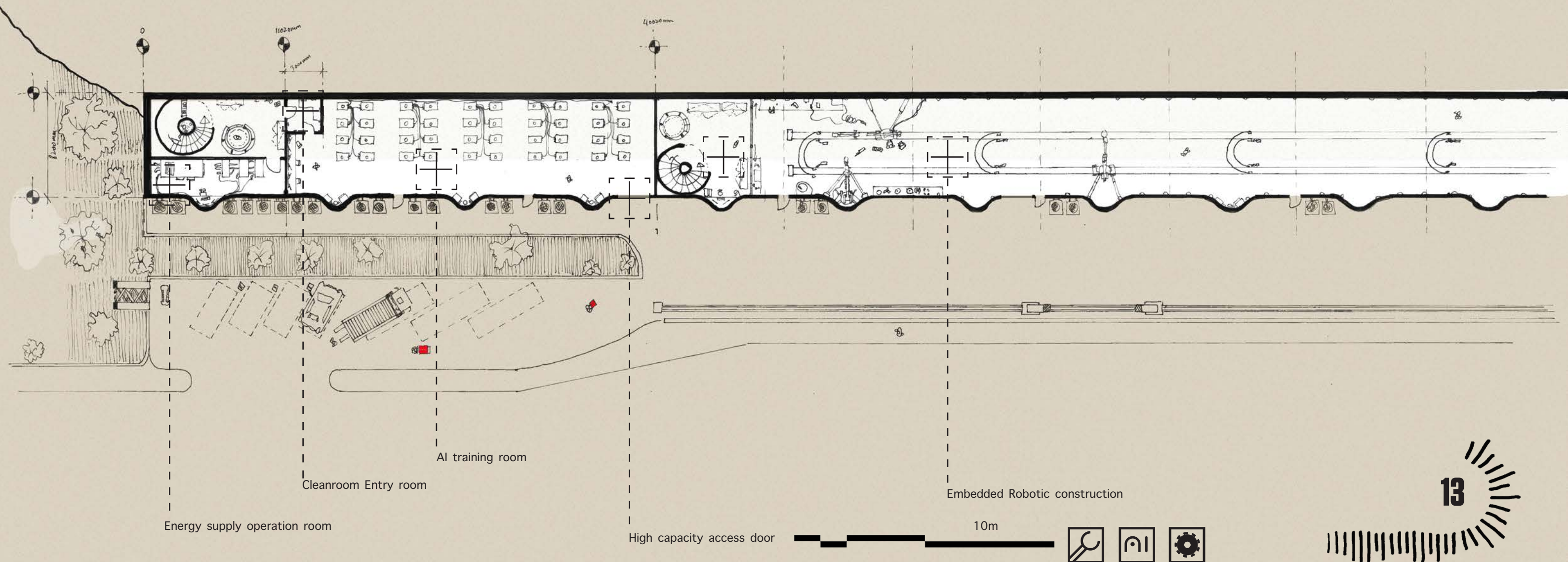




# מַחְשֵׁב וְיָד וְכֹחַ וְיָד THE MIND AND THE HAND



The ground floor has been divided into 2 spaces, facilitating 2 different function, one represent the growth of artificial intelligence, another one represent the growth of robotic industry.

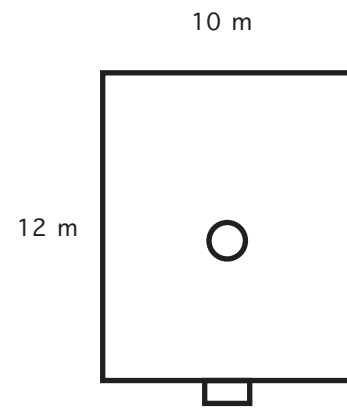




# מודולריות MODULARITY

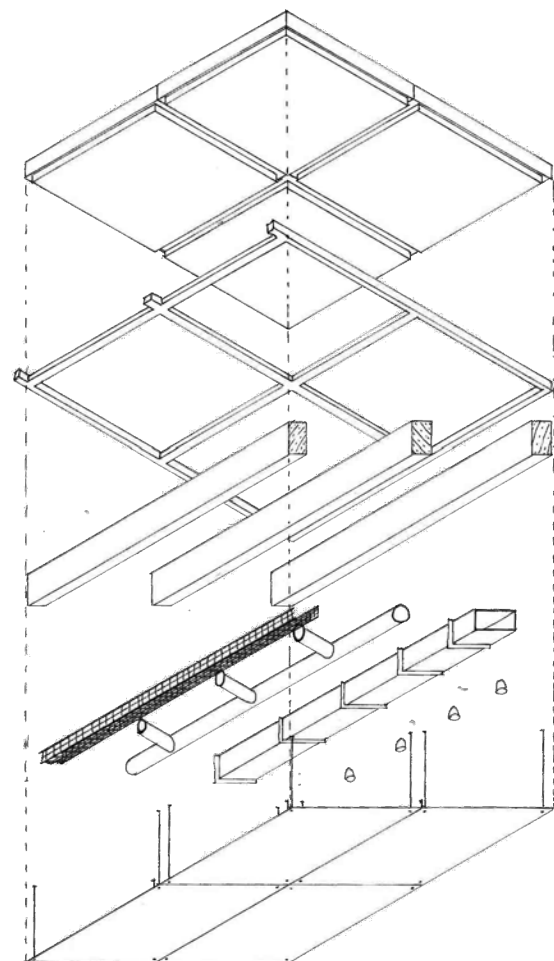
## BLANK CANVAS

This building can be seen as a multiplication of a module designed by initial architect to facilitate the basic function, as AI takes lead in the future design and construction, the module will evolve toward a direction of what AI thinks human habitat should be like.



## SANDWICH ROOFING

The roof are composed with layers of components, all the weight is directed onto the glulam structure.



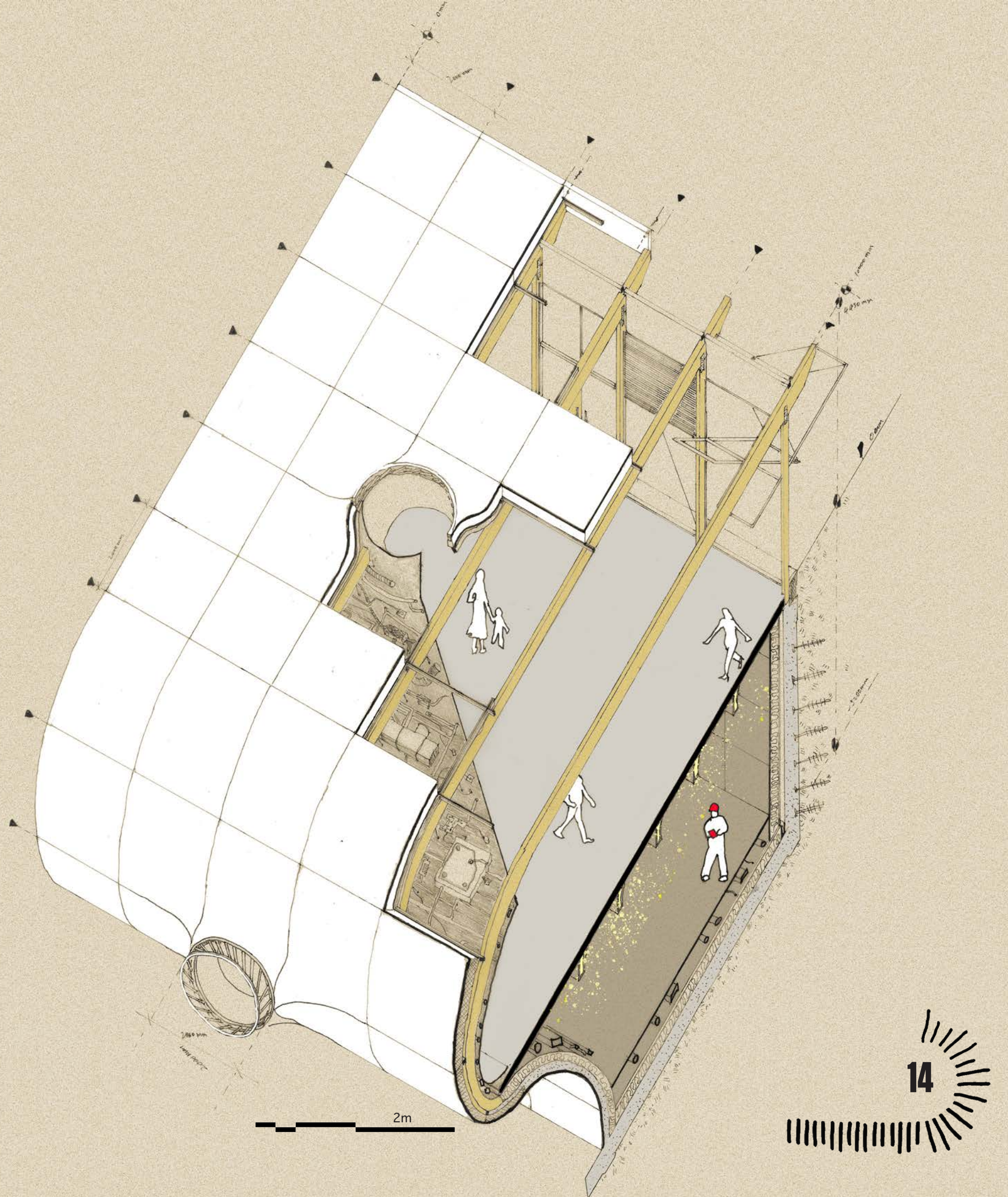
Modular panel

Rubber gasket system

Glulam structure

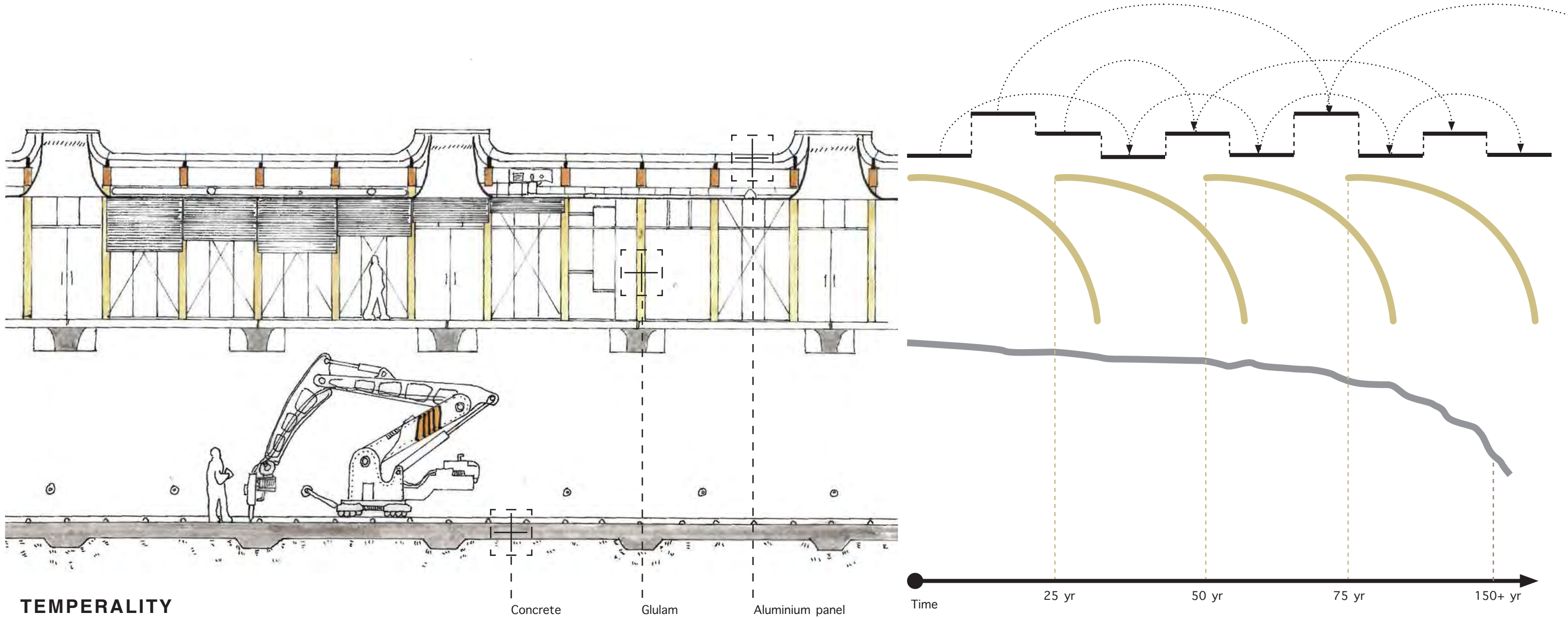
Ducts / Cable trays/ Lighting

Ceiling panel





# PARALLEL TIMELINE



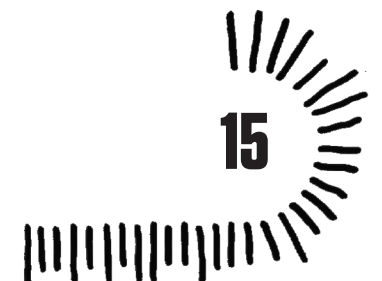
## TEMPERALITY

Different spaces use different materials to maximize the efficiency of material use, we need a strong and durable foundation that needs to last for at least decades, concrete is the way to go. The flux space experiences regular alternations so timber structure might be the best to reduce carbon footprint, although the panels are regularly changed, but it can be reused, therefore a more durable and water resistant material like aluminium is recommended. By following this logic the building can make sure no waste in carbon footprint against use time.

SPACE	TEMPERALITY	MATERIAL
MODULAR PANELS	SHORT TERM BUT REUSEABLE	ALUMINIUM
FLUX SPACE	FAST ITERATIVE IN YEARS	WOOD
CONCRETE FOUNDATION	DACADES	CONCRETE



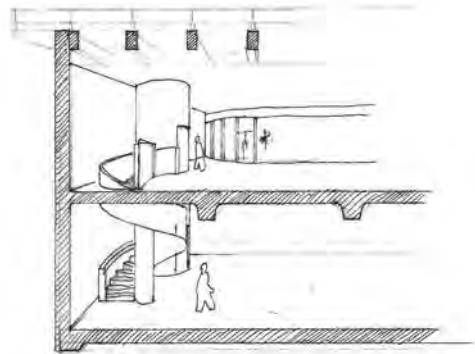
2m





# REGULATION

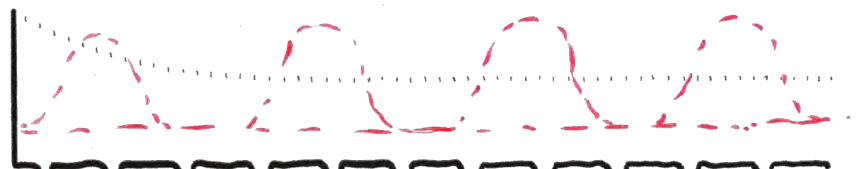
## ACCESSIBILITY



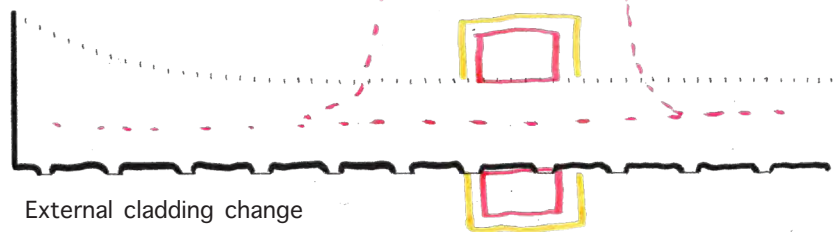
Accessible toilet

Accessible circular stair cases and circular elevator are proposed in the building to save more utility spaces.

## CONSTRUCTION REGULATION



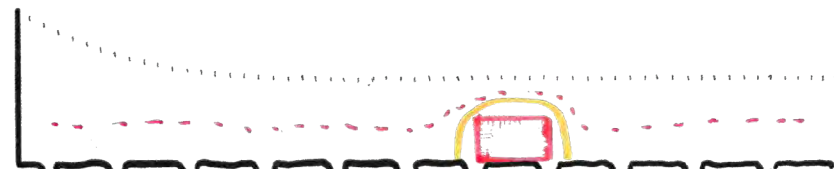
No on-going operation



External cladding change



Fully internal operation



Partial internal operation



Health and Safety at Work etc. Act 1974

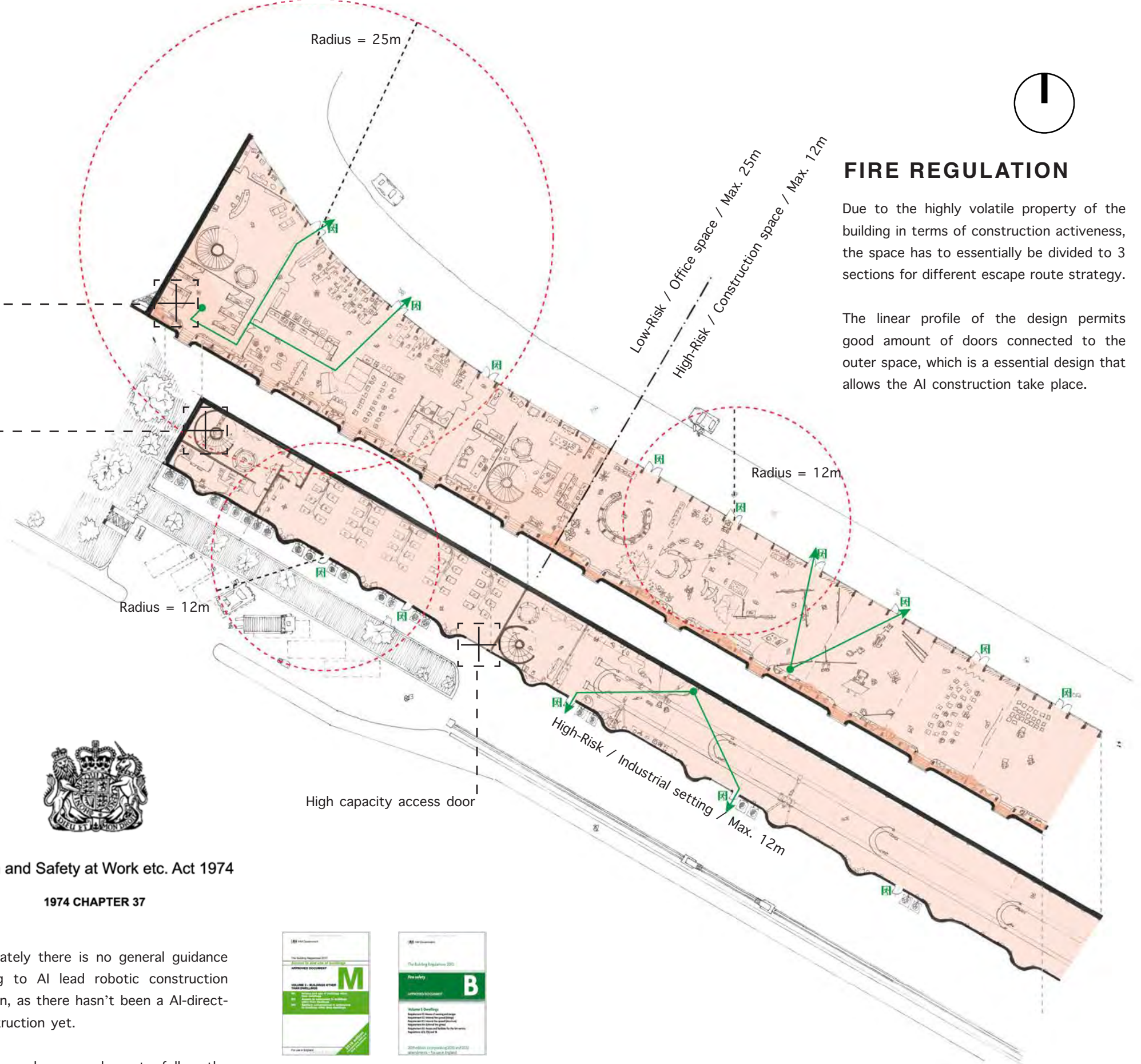
1974 CHAPTER 37

Unfortunately there is no general guidance regarding to AI lead robotic construction regulation, as there hasn't been a AI-directed construction yet.

However we know we have to follow the "Health and Safety Executive" Act 1974 guidance for using heavy machineries in construction, therefore, we have classified 4 types of potential robotic construction that might happen in space and marked our suggested routine.



- Longest fire escape route in space
- Safe region
- Respective minimum distance from fire escape



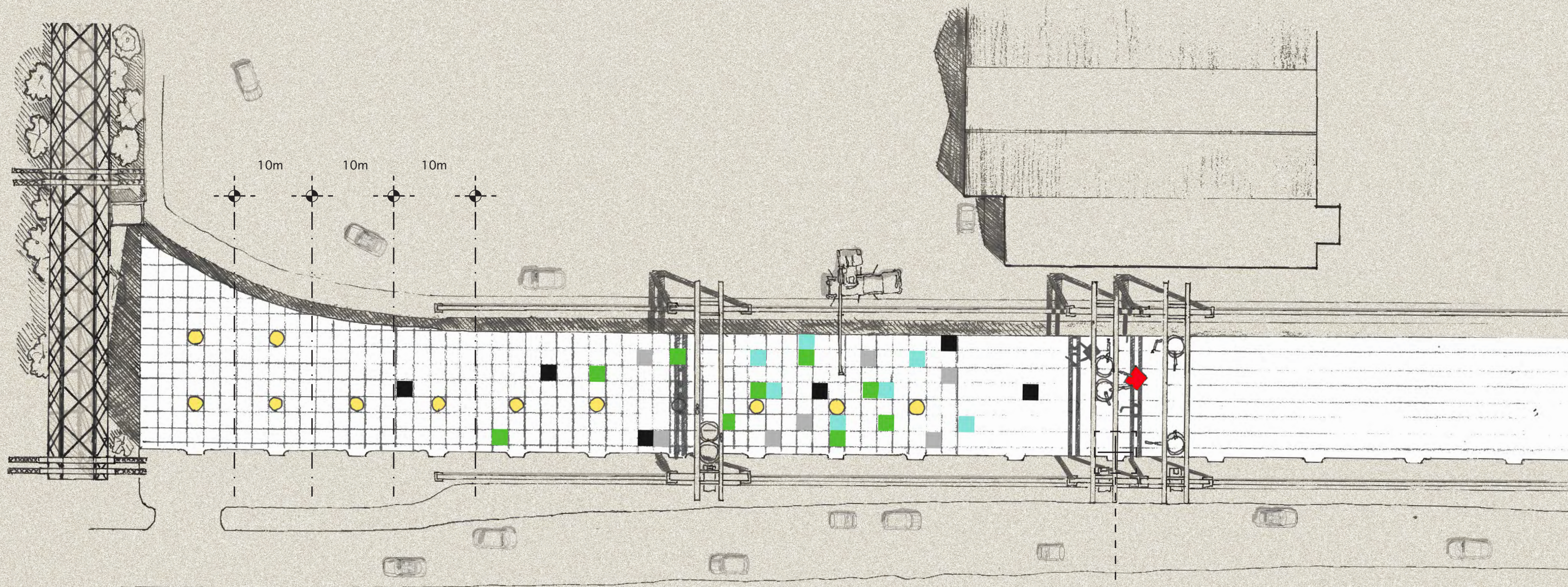
## FIRE REGULATION

Due to the highly volatile property of the building in terms of construction activeness, the space has to essentially be divided to 3 sections for different escape route strategy.

The linear profile of the design permits good amount of doors connected to the outer space, which is a essential design that allows the AI construction take place.



# ՀԱՅԿԱՎԵՐՈՒԹՅԱՆ ԲԻՆԱԿԱՆ FASHION SHOW



The robotic crane can easily replace the modular panels in minutes

## ADAPTIVE SKIN

What if a building doesn't have a fixed cladding? And the building dresses itself like a human does? Yes, this is the concept of adaptive skin system, this allows the building to facilitate a lot more function with its cladding, for instance the replaceable panel system provide great condition for a live lab, where investors can explore the performance of new construction material and cladding system.

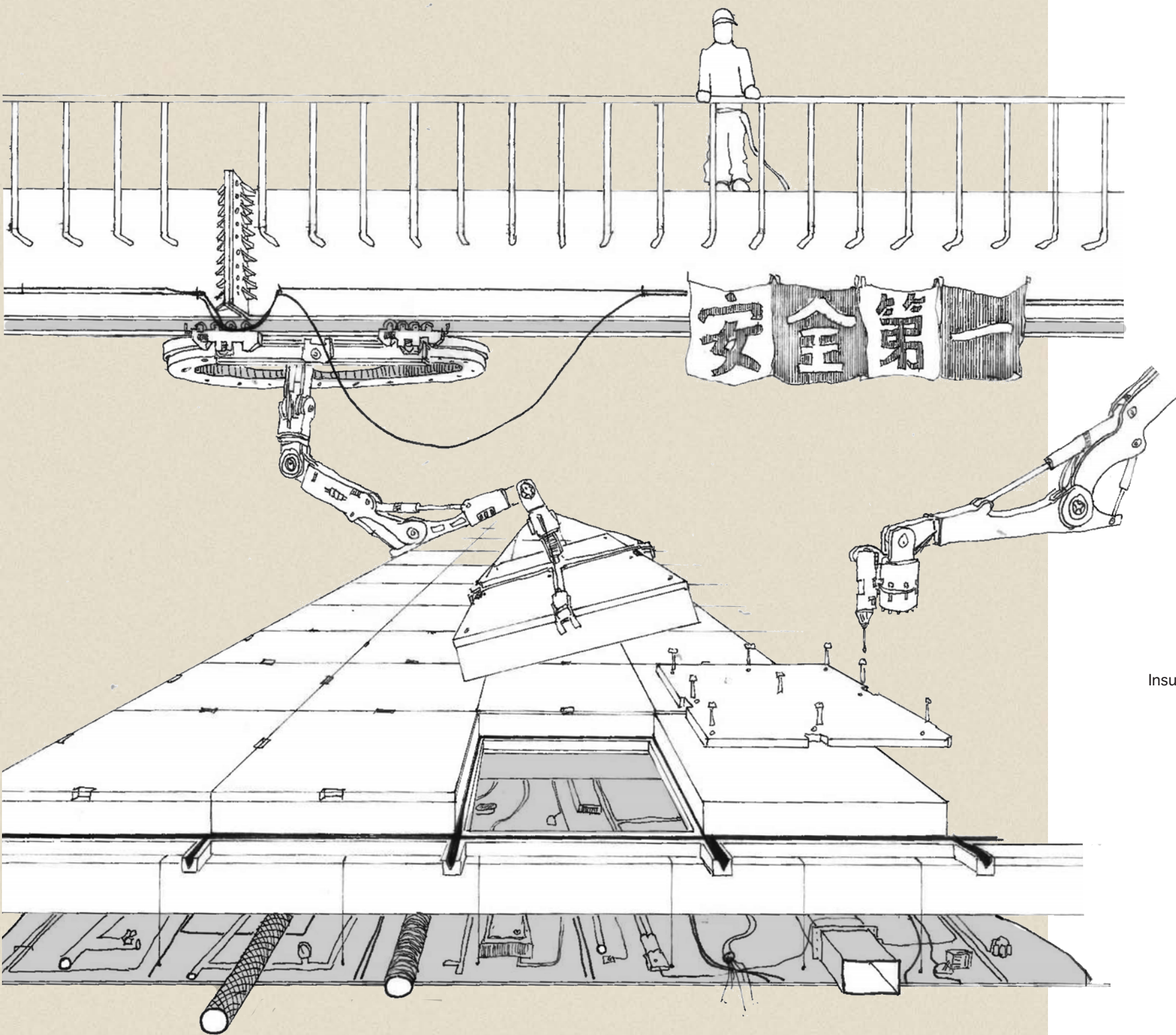
Further more, during summer the internal space might get too hot, then why don't we wear something thinner?, The robotic arm can replace all cladding with variants without the insulation layer, increasing the rate of dissipation of heat.



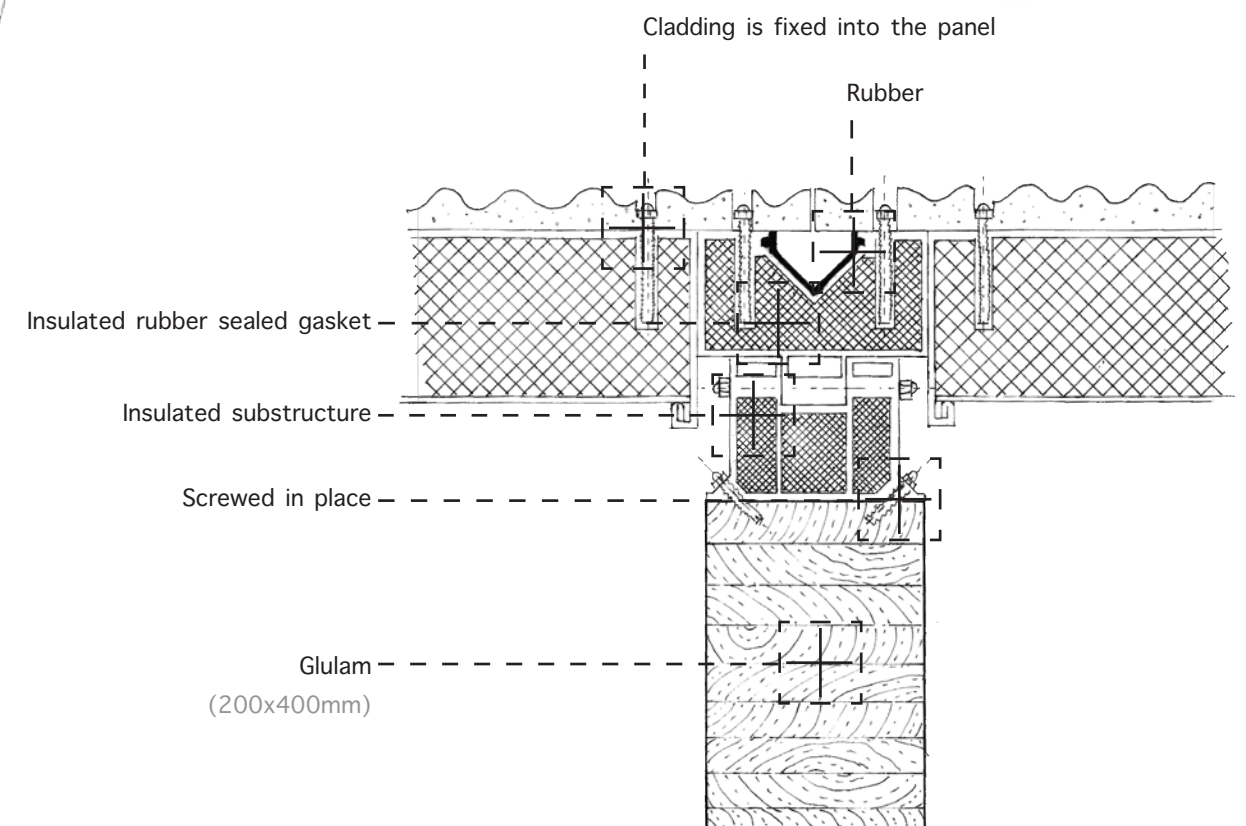
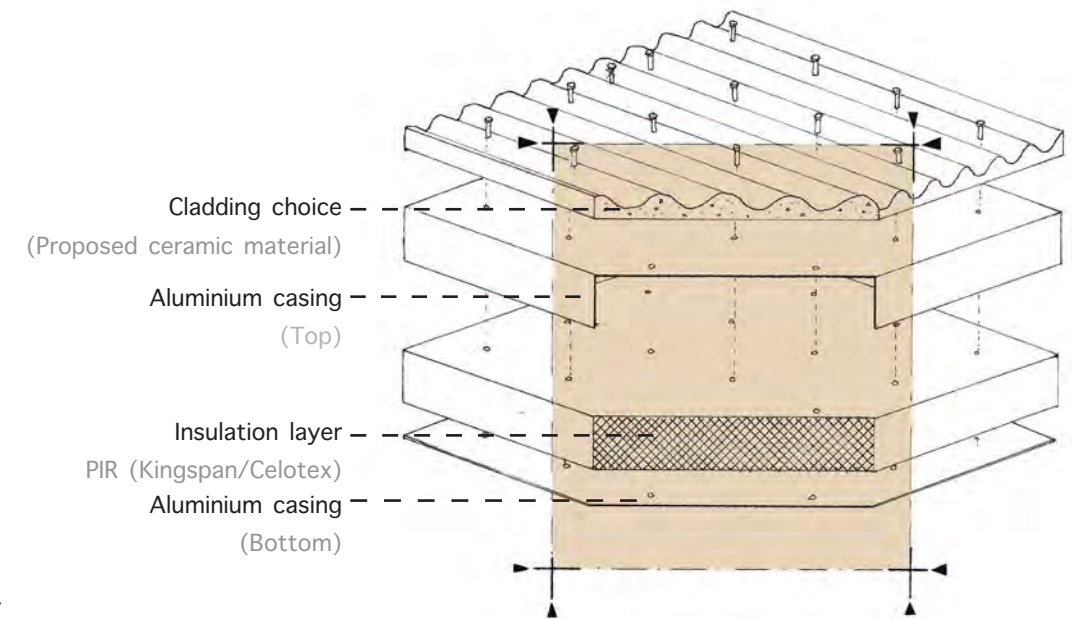


# UACUCICADI DEUACIDI

## 1:5 TACTICAL DETAIL



Working in high places needs to comply with heavy regulations, so instead of human doing dangerous things, let the robotic do it instead.

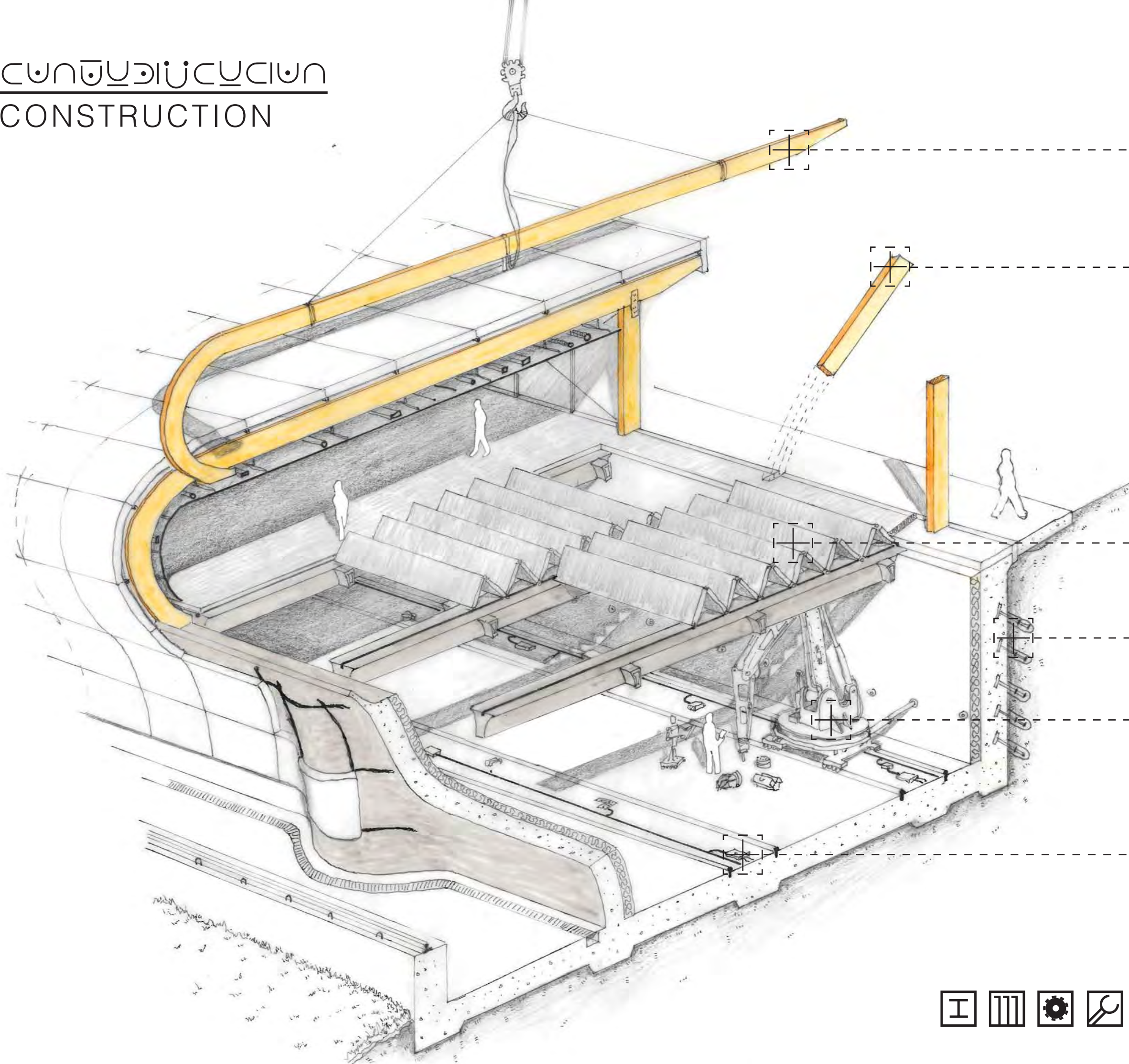


20cm



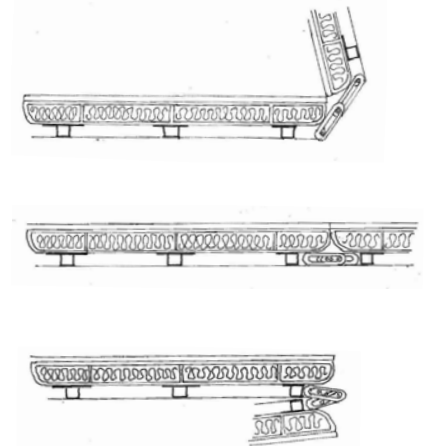


# ԸՄՈՒՆԻԿԱԾԻՈՒՆ CONSTRUCTION



With the help of robotic crane construction Glulam beam can be easily installed onto the concrete foundation

Timber columns can be installed with the embedded robotic arm.



The floor slab are designed to be foldable to leave spaces for operation of Embedded robotic arms.

Soil nail anchored into the soil to strengthen the earth.

Embodied robotic arm is the key mechanism that allows the change of internal spaces, it enables heavy changes in short amount of time.

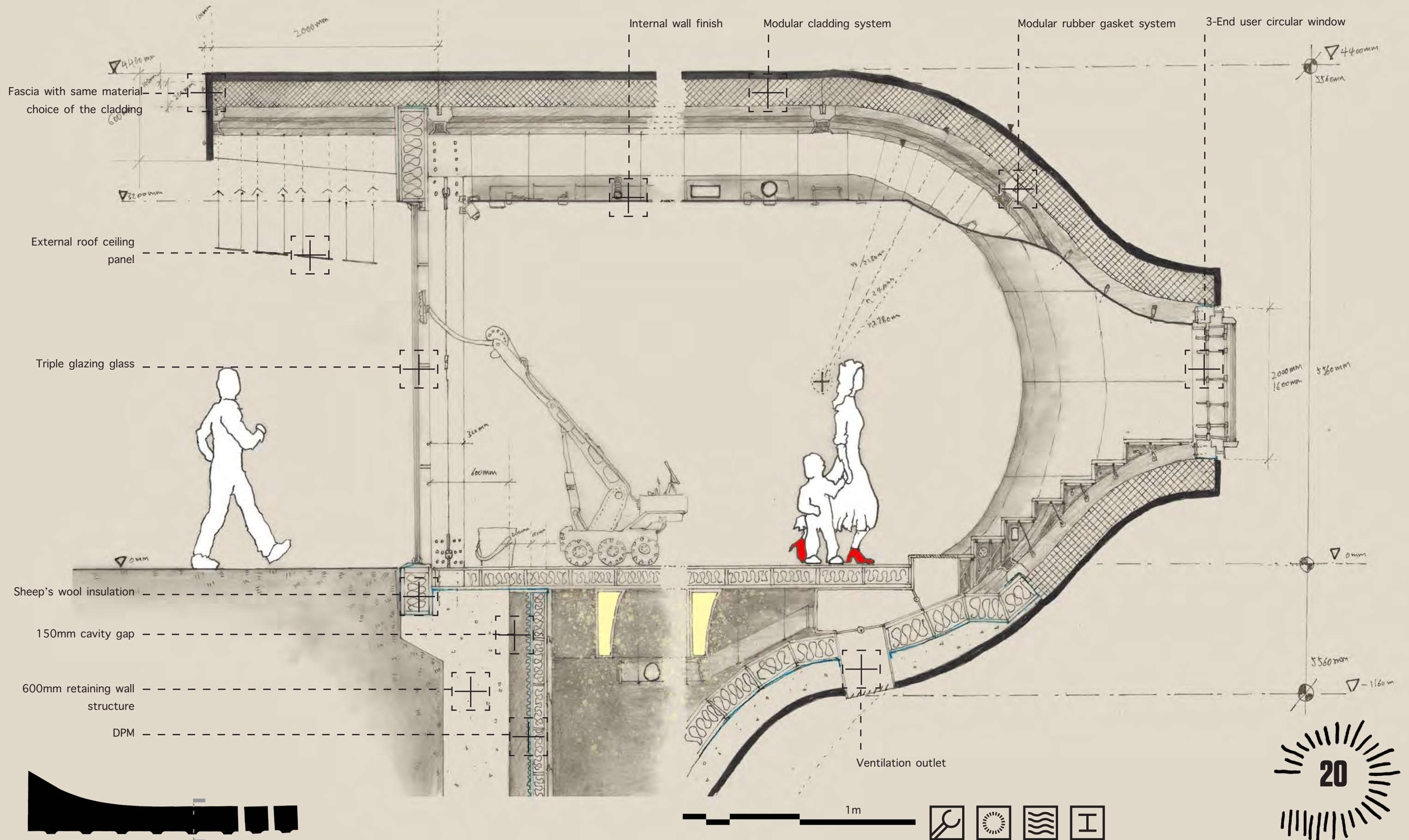
Robotic railing system that permit robotic arm moving along the basement





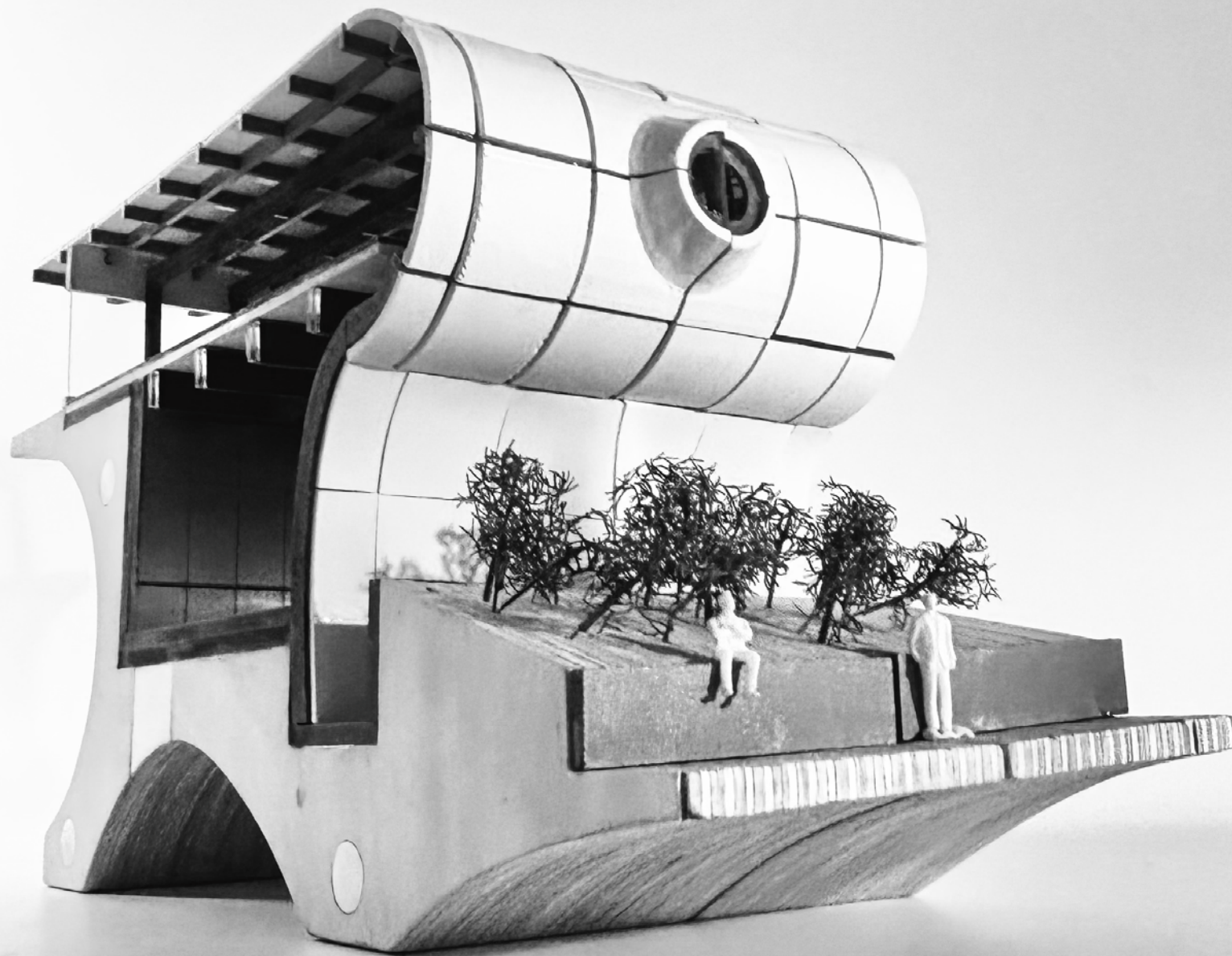
# UACUCICADI DEUACIDI

## 1:20 TACTICAL DETAIL





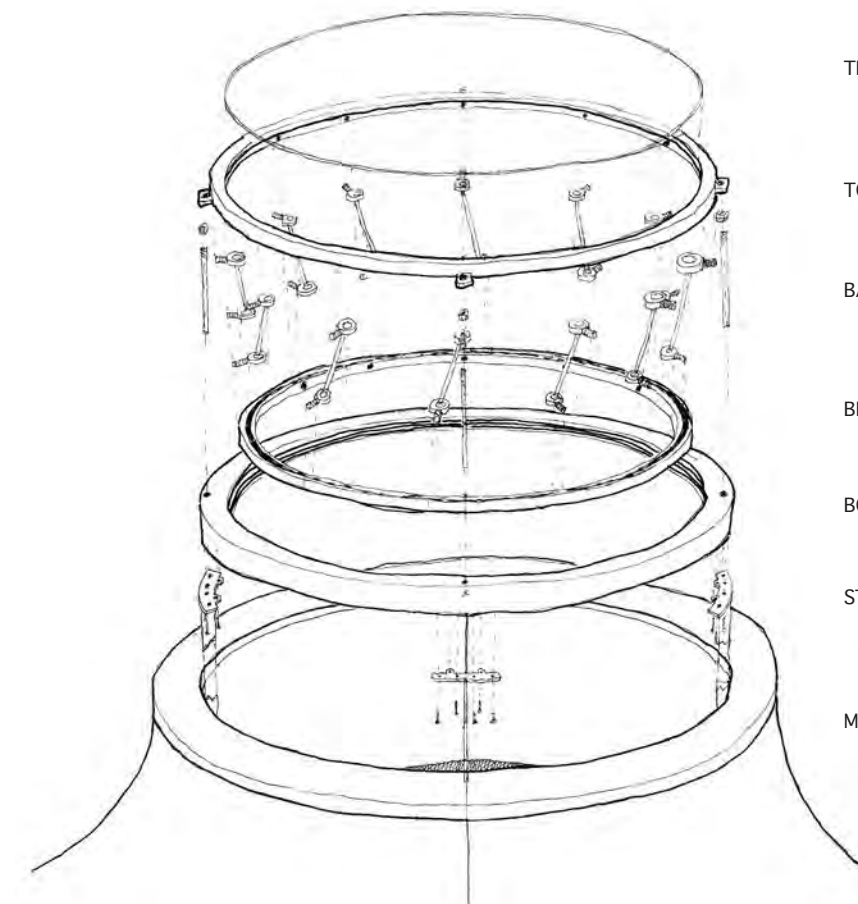
# ARCHITECTURAL LANGUAGE



The circular window of this building might be the identity of this building, it was designed to be operable by 3 users; human, robots and AI. Considering the difficulty of operating a 2 meter wide circular window, yet there is no existing products in the markets,

So I have taken this window design as my focus for my Technology Part C project. The end result involves a so called "Radial hinge" mechanism, allowing the movement of the window by rotating the frame.

Additionally the extension of the window are set to be 10cm by doing air dynamic calculation, at this opening distance the window allows 6 ACH per 100m<sup>2</sup> space, roughly the size of each modular units



TRIPLE GLAZED GLASS LAYER

TOP WINDOW FRAME

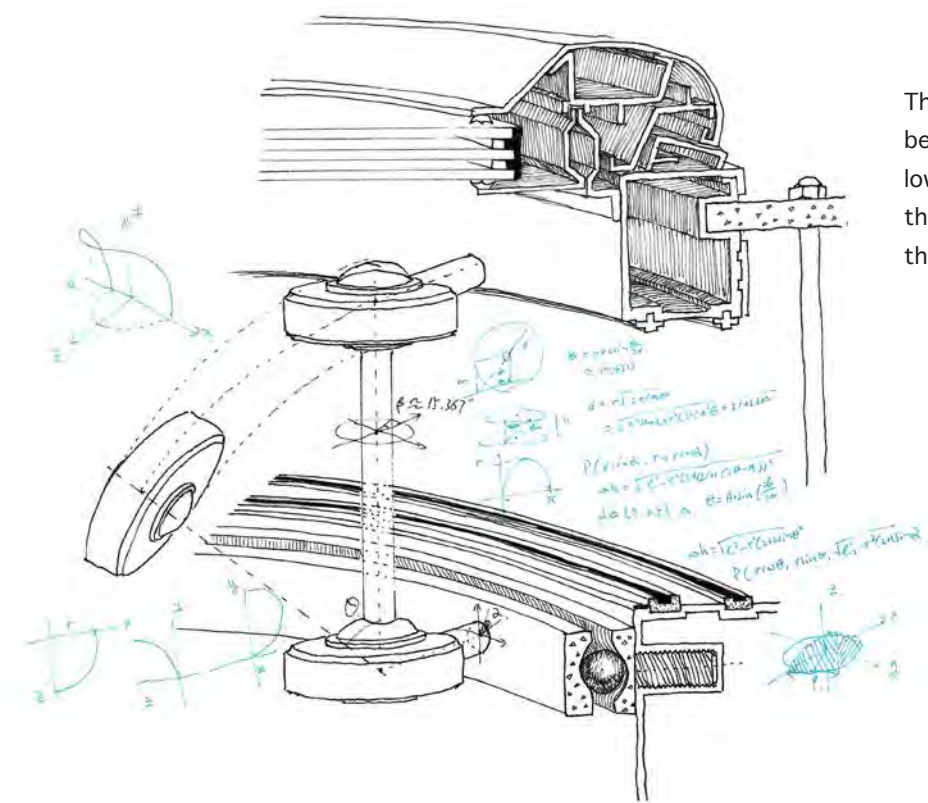
BALL JOINT SYSTEM

BEARING FRAME

BOTTOM WINDOW FRAME

STRUCTURE CONNECTOR

MODULAR PANEL WALL

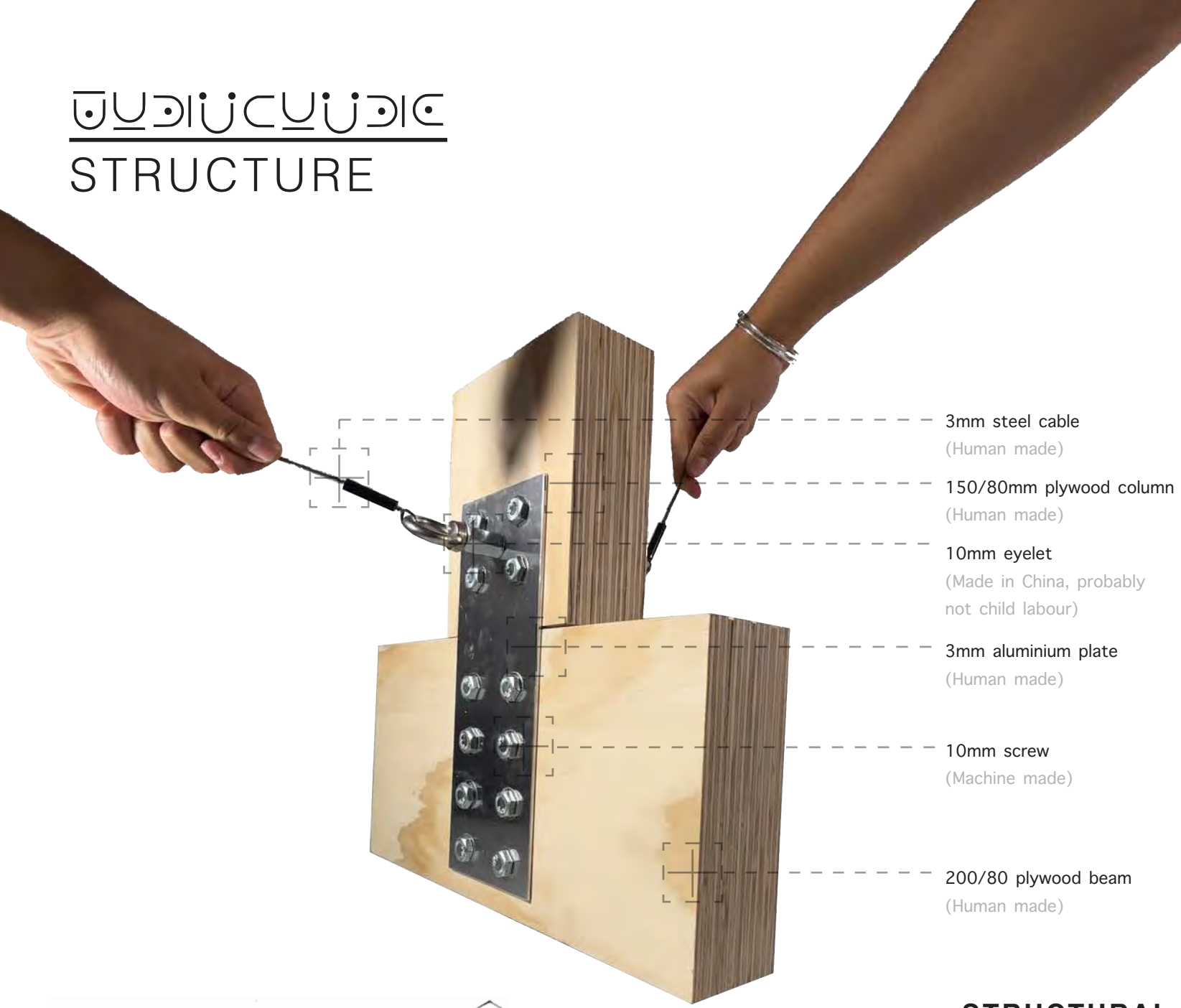


The movement of the joint has been mathematically proven to allow the movement of the window, the blue text demonstrate a bit of the mathematical induction.

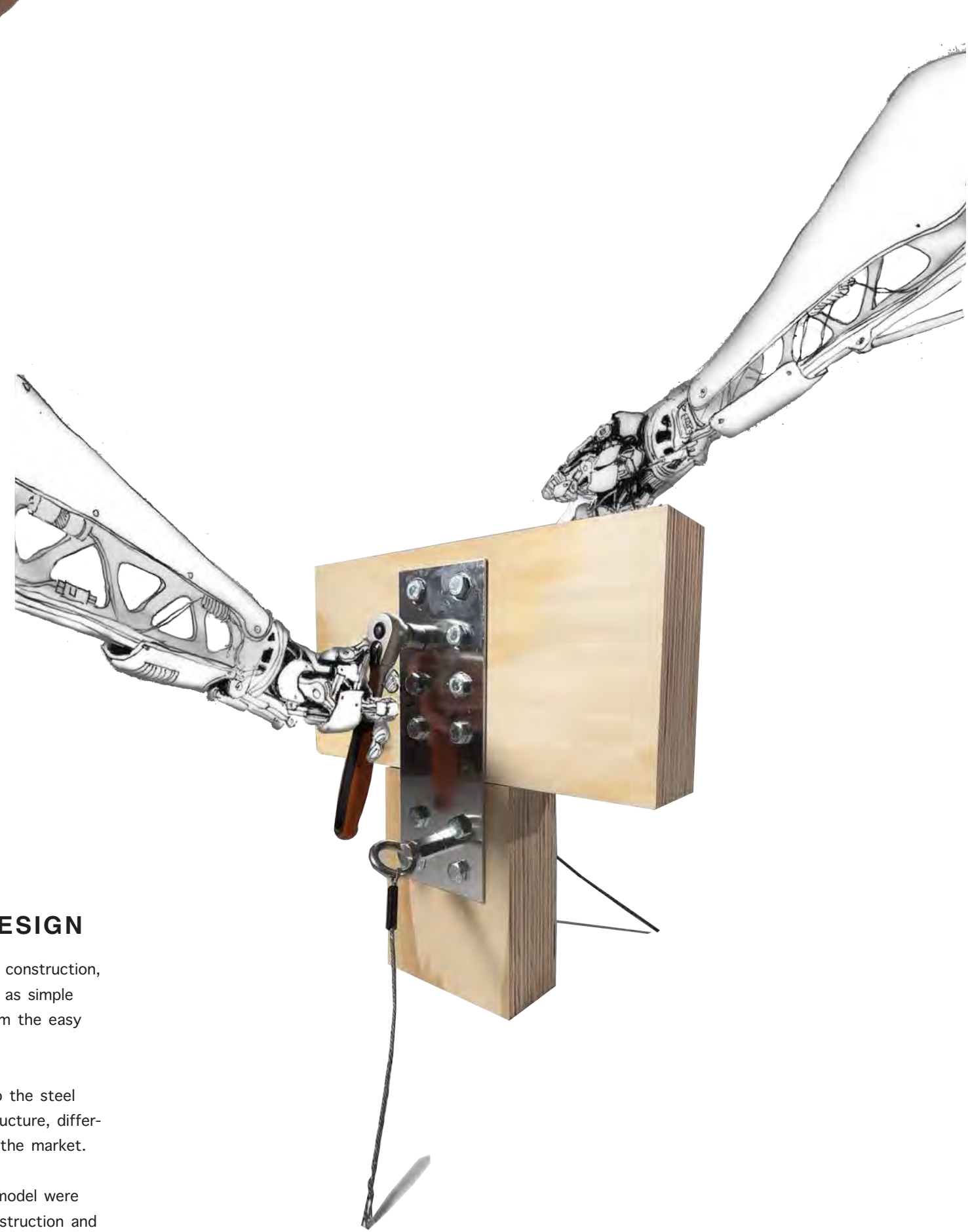




# STRUCTURE



- 3mm steel cable  
(Human made)
- 150/80mm plywood column  
(Human made)
- 10mm eyelet  
(Made in China, probably not child labour)
- 3mm aluminium plate  
(Human made)
- 10mm screw  
(Machine made)
- 200/80 plywood beam  
(Human made)



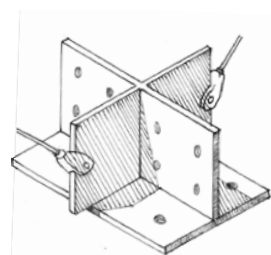
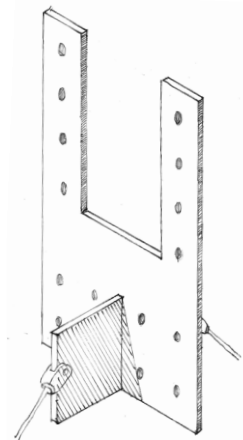
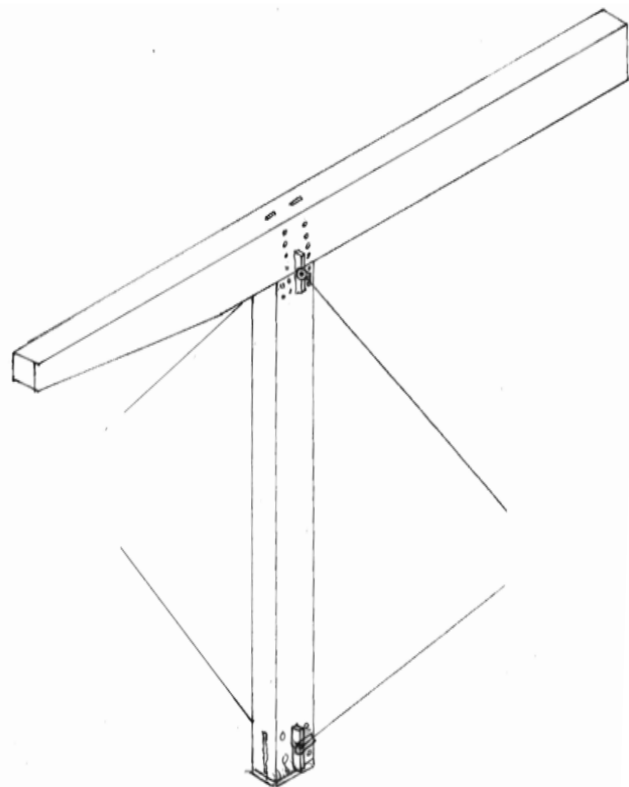
## STRUCTURAL DESIGN

For the purpose of training AI construction, structural joint needs to start as simple as possible for AI to learn from the easy assembly.

A bracing cable is attached to the steel plate to strengthening the structure, different variations are available in the market.

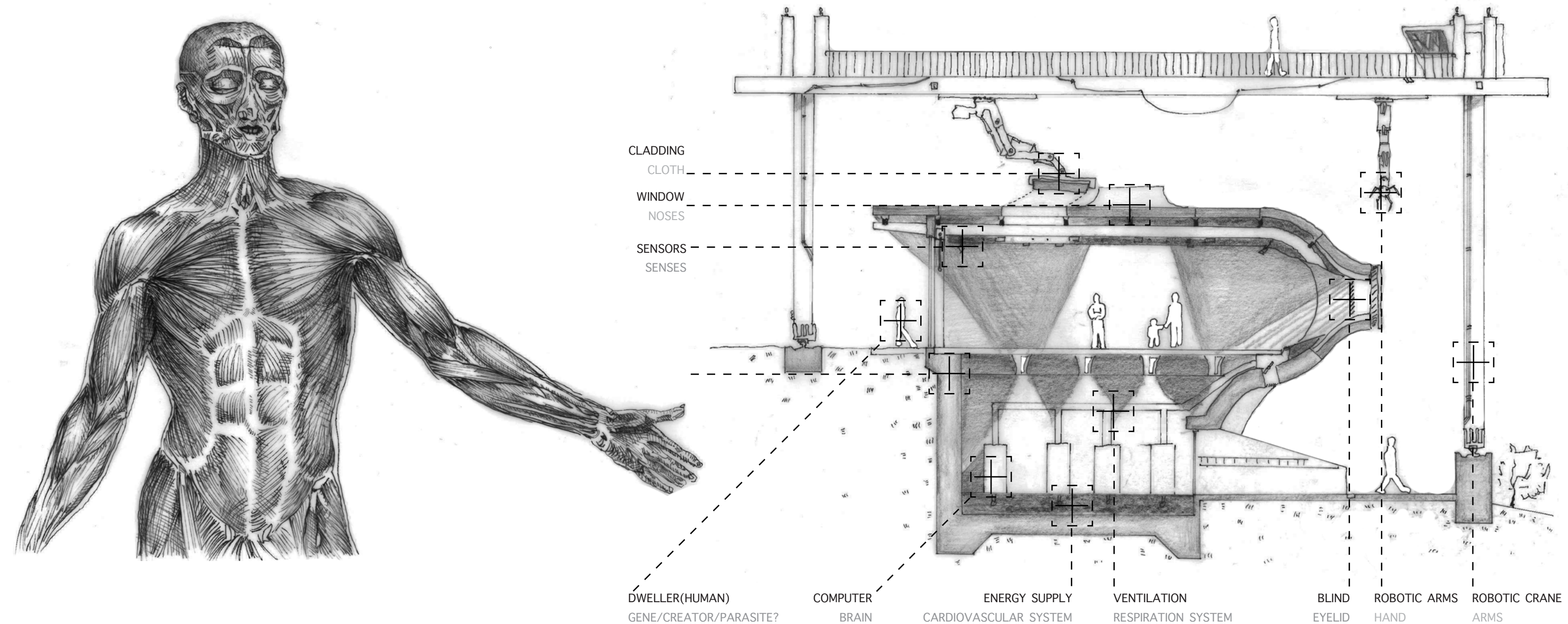
A simple 1:2 scale structure model were made to test the ease of construction and the structural integration.

As a result this simple sandwich design allows robotics to easily replace old structure to new structure when the life span of glulam approaches the end, 2 spanners would get the job done.





# 人 · 建筑 HUMAN & BUILDING



## SENTIENT ARCHITECTURE

A sentient architecture should be able to sense the environment, making responses to the change of environment, self adapt to the environment, upgrade it self to fit into the environment.

HUMAN BODY = SYSTEM + BIOMECHANICAL SYSTEM

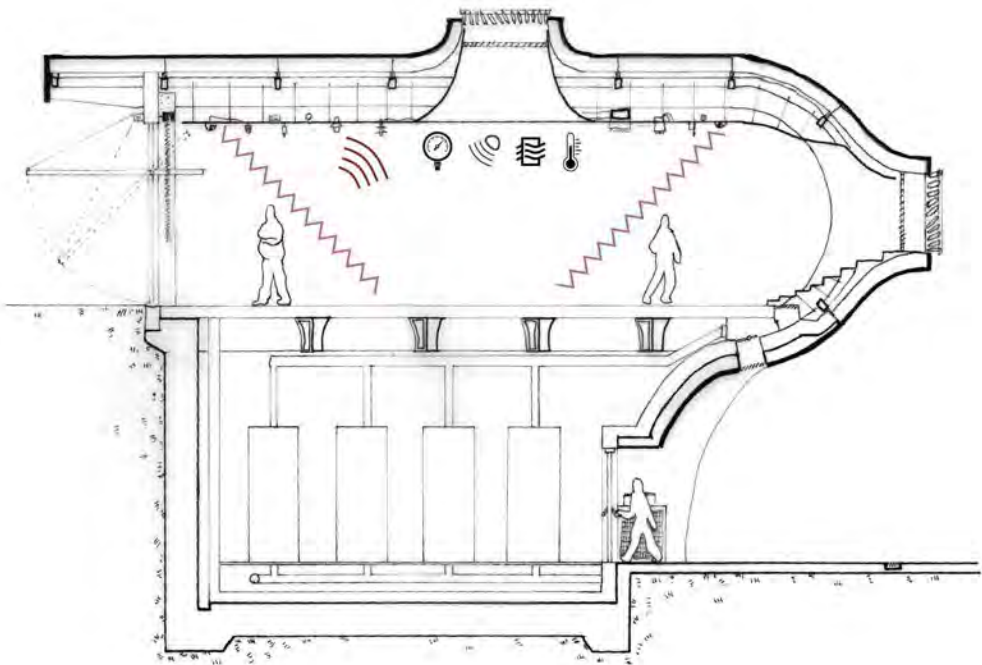
ROBOTIC ARCHITECTURE = SENSORS SYSTEM + MECHANICAL SYSTEM

HUMAN BODY :::: ROBOTIC ARCHITECTURE





# ოცნების არქიტექტურა SENTIENT ARCHITECTURE



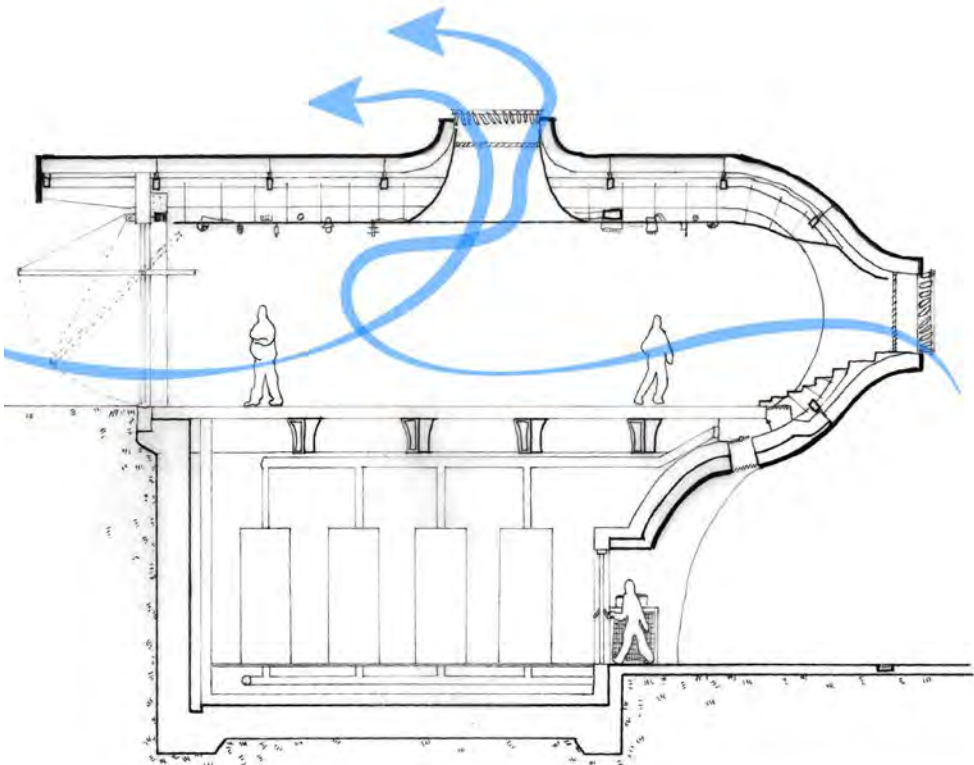
## UNDERSTANDING THE SPACE



The building is the physical representation of the AI, it needs to understand it self and the surrounding context to provide suitable living condition for the dweller.

Possible sensors include:

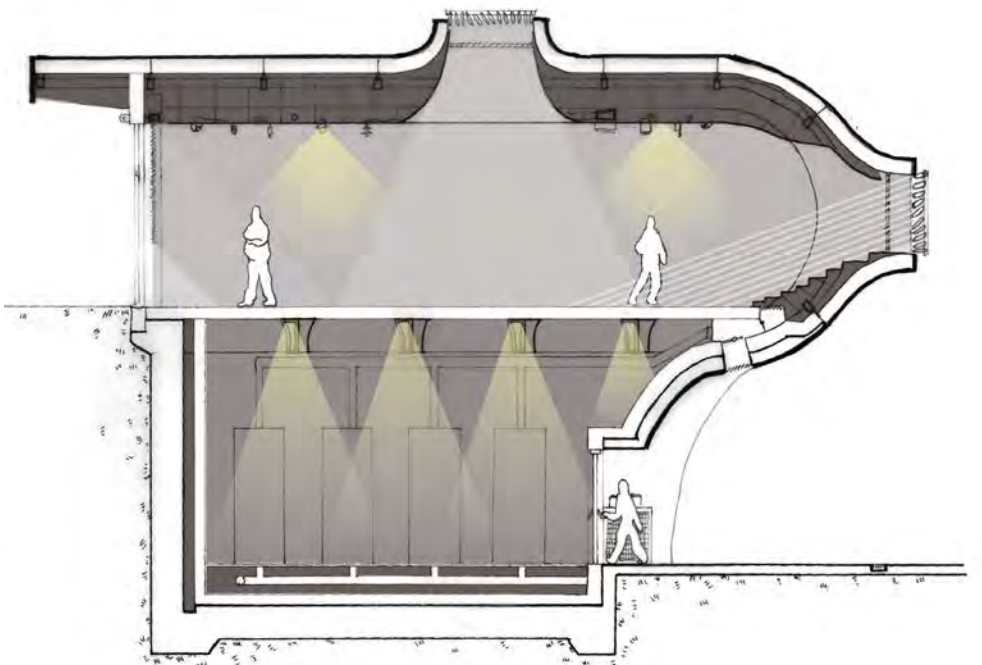
- Camera (Facial recognition)
- Audiometer (Analysing the verbal context)
- Pressure-meter/Humidity detector(Weather prediction)
- Radar (Spatial reconstruction)
- Thermometer Air quality detector(Data input for ventilation)



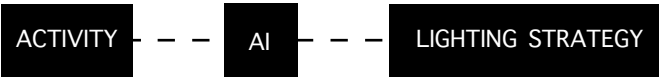
## PASSIVE VENTILATION



The rate of ventilation is monitored by AI integrated environmental system, so it can smartly analyse the current room temperature and air quality and make responses accordingly, for example in summer when the building gets too hot whether due to crowd or AI training centre, 2 op-enable window on both side of the building and the sky window above can provide superb passive ventilation, with more contacting surface with the external environment, the human & building relationship appeared once again, the building would act as the “skin” of human, evaporate the heat generated by the “organism”.



## CONTROL



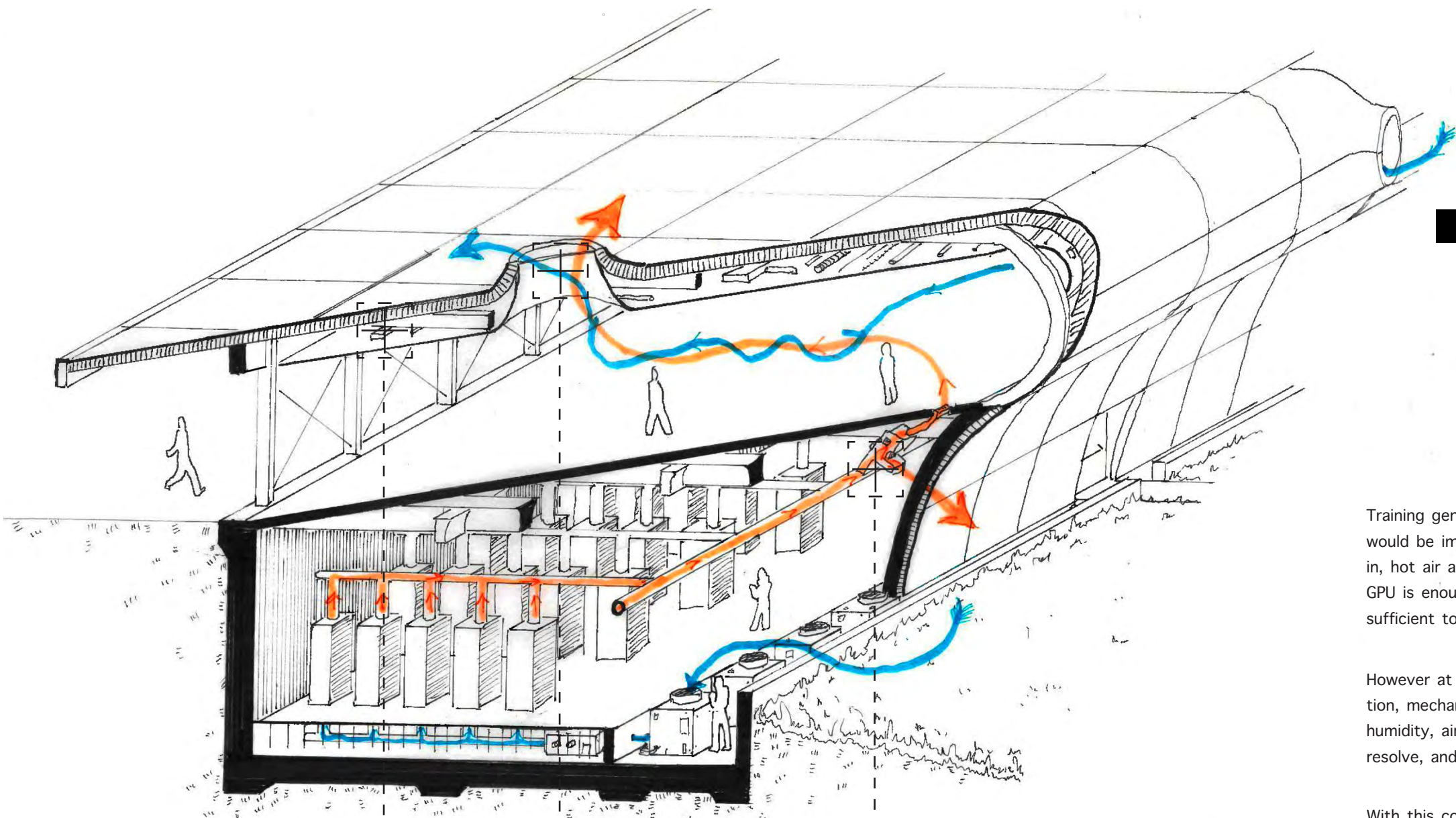
To facilitate a multifunctional space, diversified solar condition is needed to provide optimal light-ing environment, the AI integration environment system operate the mechanical blind so it can offer the most up to date decision according to the on-going activity.

Artificial lighting is monitored by AI, it “sees” the space, if there is no one in the space, all light would be shut off to save energy.





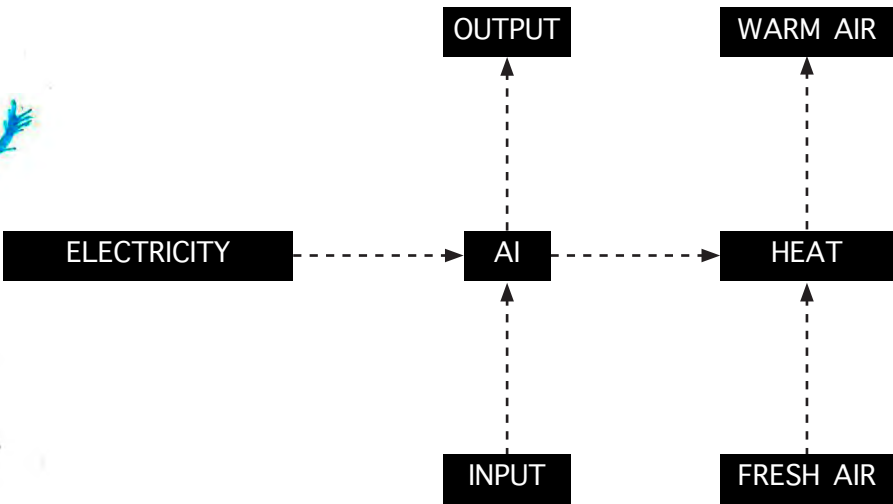
HEAT RECOVERY



PASSIVE VENTILATION

MECHANICAL VENTILATION

AI HEAT RECOVERY



Training generative AI takes a lots of energy, but we can recycle the energy, we would be implementing air cooling mechanism for the AI training, as cold air circulate in, hot air are recollected and sent back to the room space above, 17 Nvidia A100 GPU is enough to power 100 m<sup>2</sup> in the UK, in our facility we have 2000 of them, sufficient to power the maximum extension of the building, (2200m<sup>2</sup>)

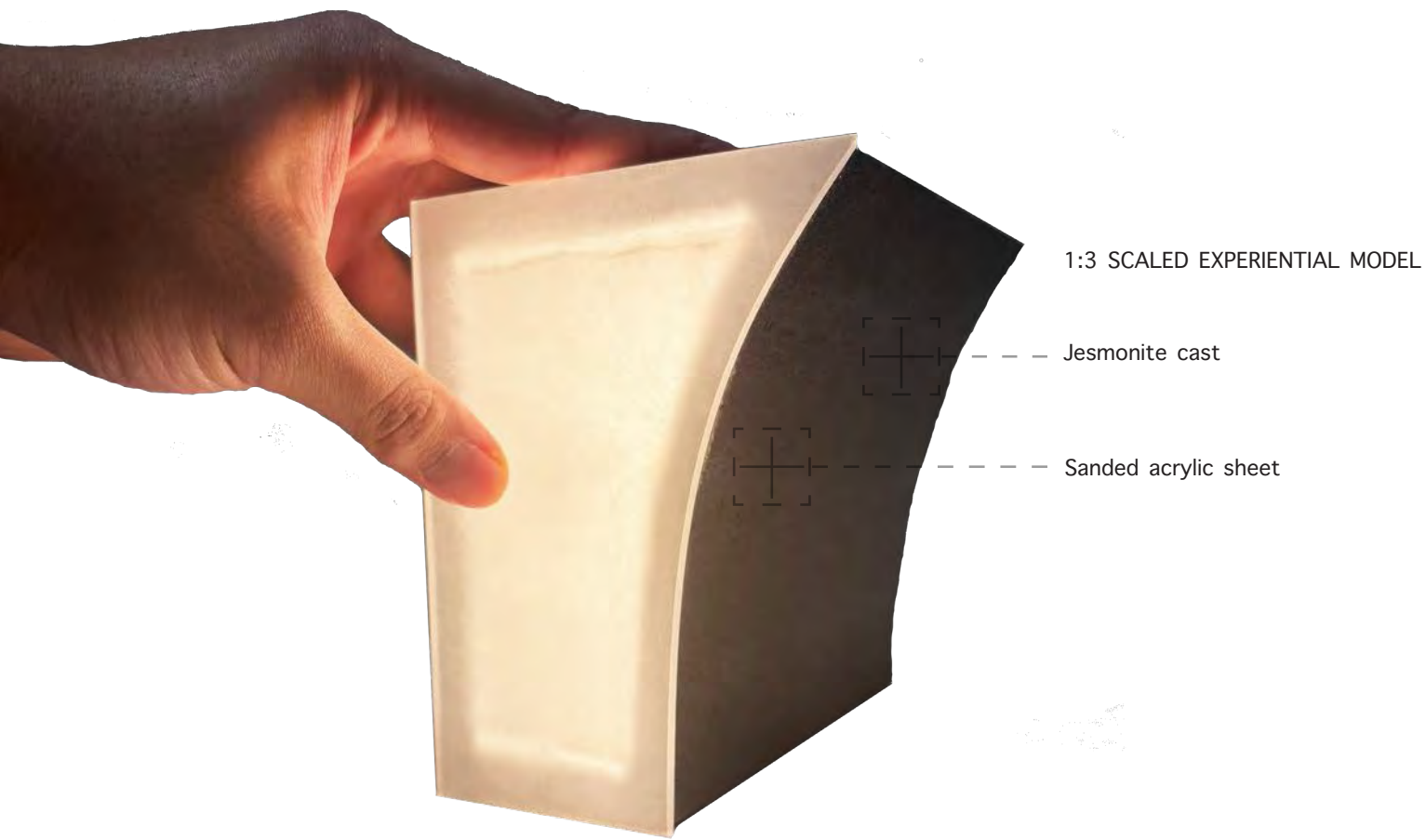
However at the same time there is a intriguing relationships between passive ventila- tion, mechanical ventilation and heat recycling, plus the variation in weather, season, humidity, air temperature, current on going activity, it becomes humanly impossible to resolve, and here is where take place in the future.

With this concept in mind, the by product of computing is heat, the computer is a heater, while it is heating the room, it is also providing services. In the future, if all building becomes AI integrated, heating would essentially be free.

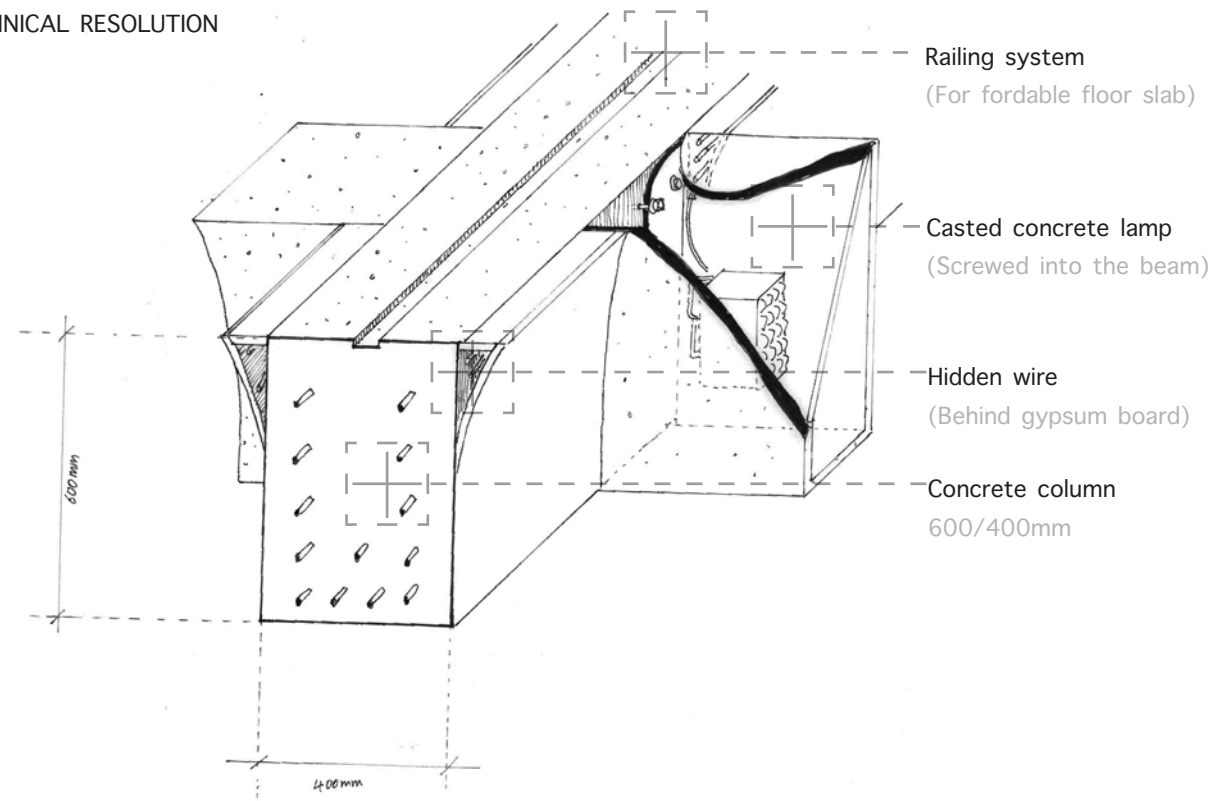




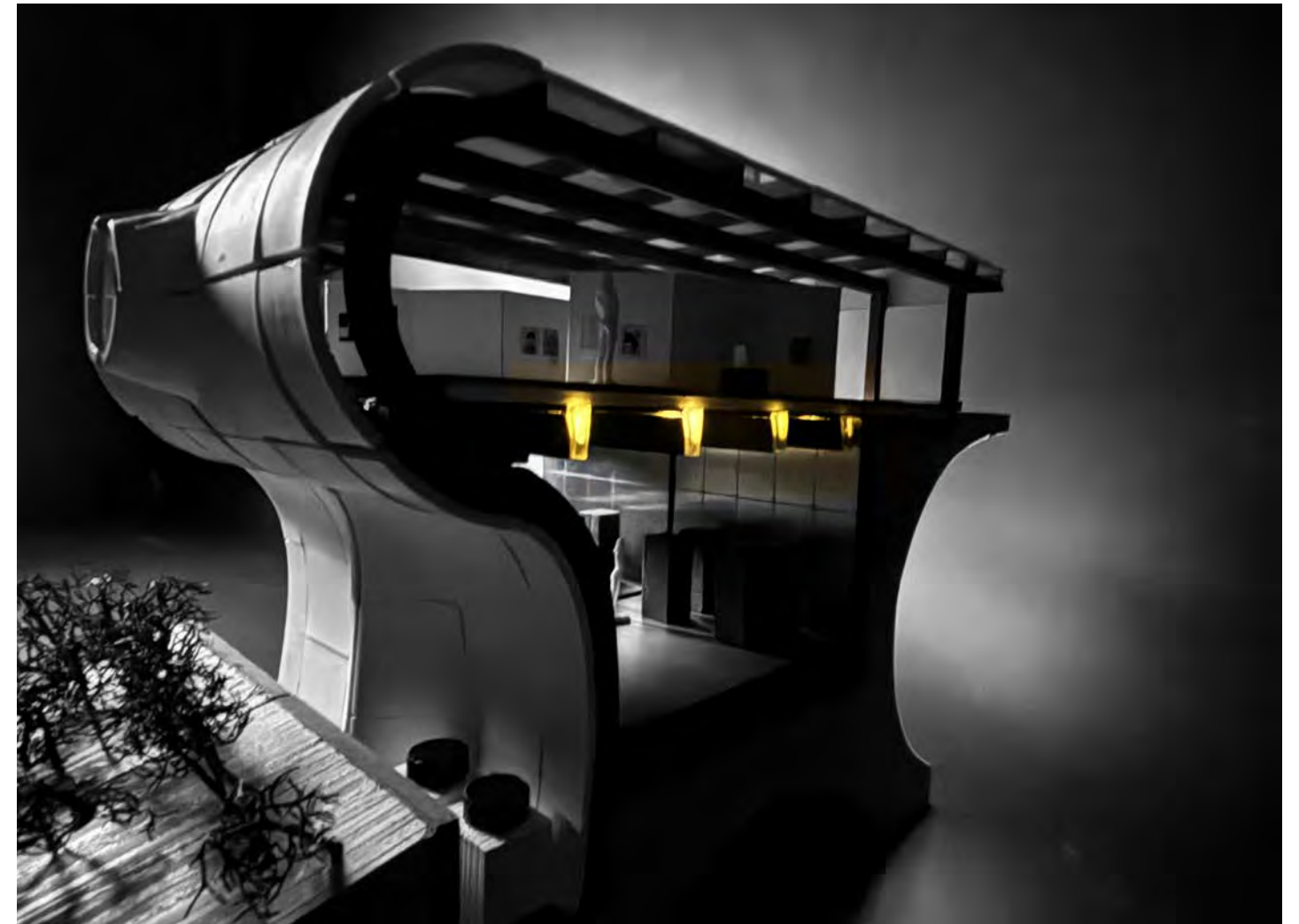
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 EMBODIED ILLUMINATION



## TECHNICAL RESOLUTION



### 1:50 SCALED SECTIONAL MODULE MODEL



## THE POSSIBLE FUTURE

As Generative AI becomes better and better in the Symbiotic future program, a product design were created under the collaboration between the AI and the architect. One architect works for sentient architect program is looking for a aesthetic lighting solution, he has taken some inspirations from the aerial view of the building, and made a sketch of a lamp design that looks like a magic orb embedded into the concrete. Then he used AI to resolve the rest as he is not familiar with product design or electrical layout.

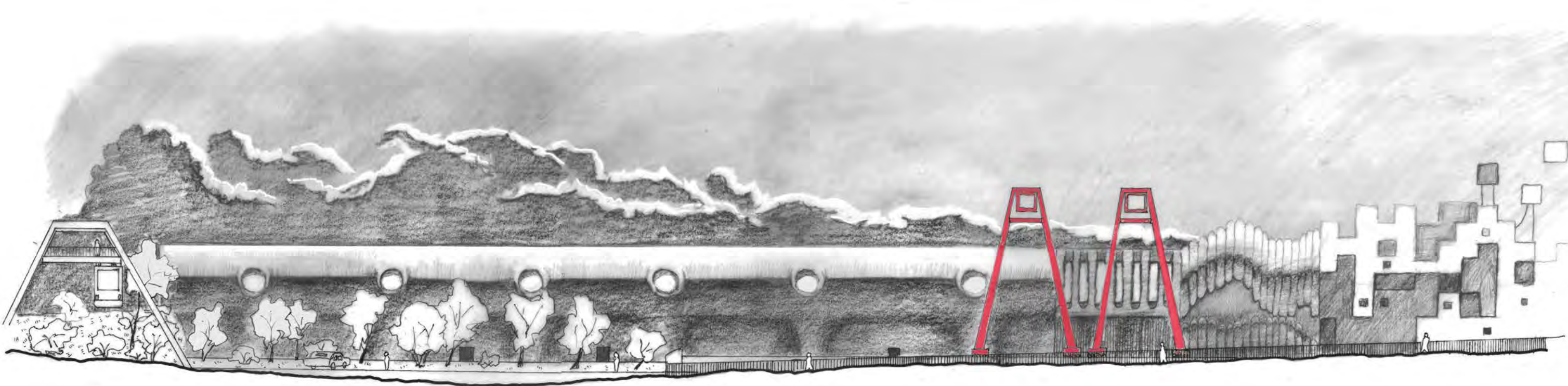
With the help of AI, material selection, 3D model and production solution were quickly determined, over night the unmanned factory started to work, the product were delivered to site the next morning and installed by on-site robotics, all planed out by AI.

What used to be a month projects now only takes a few day to turn an idea to reality.

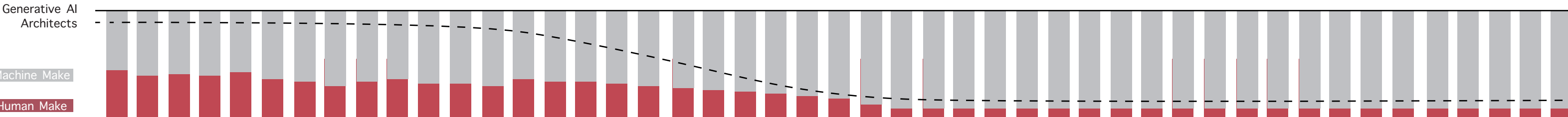




מָה אֵלֵךְ אֵחָד  
WHAT LIES AHEAD



TODAY TOMORROW



The AI will learn from human architects, it will learn how to design a good architecture, it will learn how to turn design to a constructable scheme, it will learn how to operate all environmental strategies, and eventually AI will take over the design and construction industry, if that happens, where do architects go?





# DIEC:DIECUCIUN

## REFLECTION

In Studio 3.2, I came to a humbling realization: no matter how passionate or capable one individual may be, architecture is not a solitary pursuit. As Mao Zedong once noted, “The more people you have, the more power you have.” This resonated deeply with me as I worked tirelessly on an ambitious and idealistic proposal—only to face the limits of what I could achieve alone. The complexity of the project made it clear: with a strong team or even a competent AI collaborator, the vision could have been carried further, faster, and with greater depth.

Through this experience, I’ve come to understand both my strengths and limitations as a designer. I’ve learned that working with my personality—not against it—is essential to designing effectively. Architecture is not just about form and function; it’s a collective process involving diverse skillsets and perspectives. The idea that one person can carry a project entirely on their own is a myth. Teamwork isn’t just useful—it’s necessary, in architecture and in almost every professional discipline.

This final year of study has helped me clarify what I enjoy, what I excel at, and what doesn’t come naturally to me. That self-awareness has been just as important as any technical skill I’ve acquired. Understanding who I am—and how I work—is the foundation for building a meaningful future in this field. It’s about finding your position in the world and contributing where your voice is most needed.

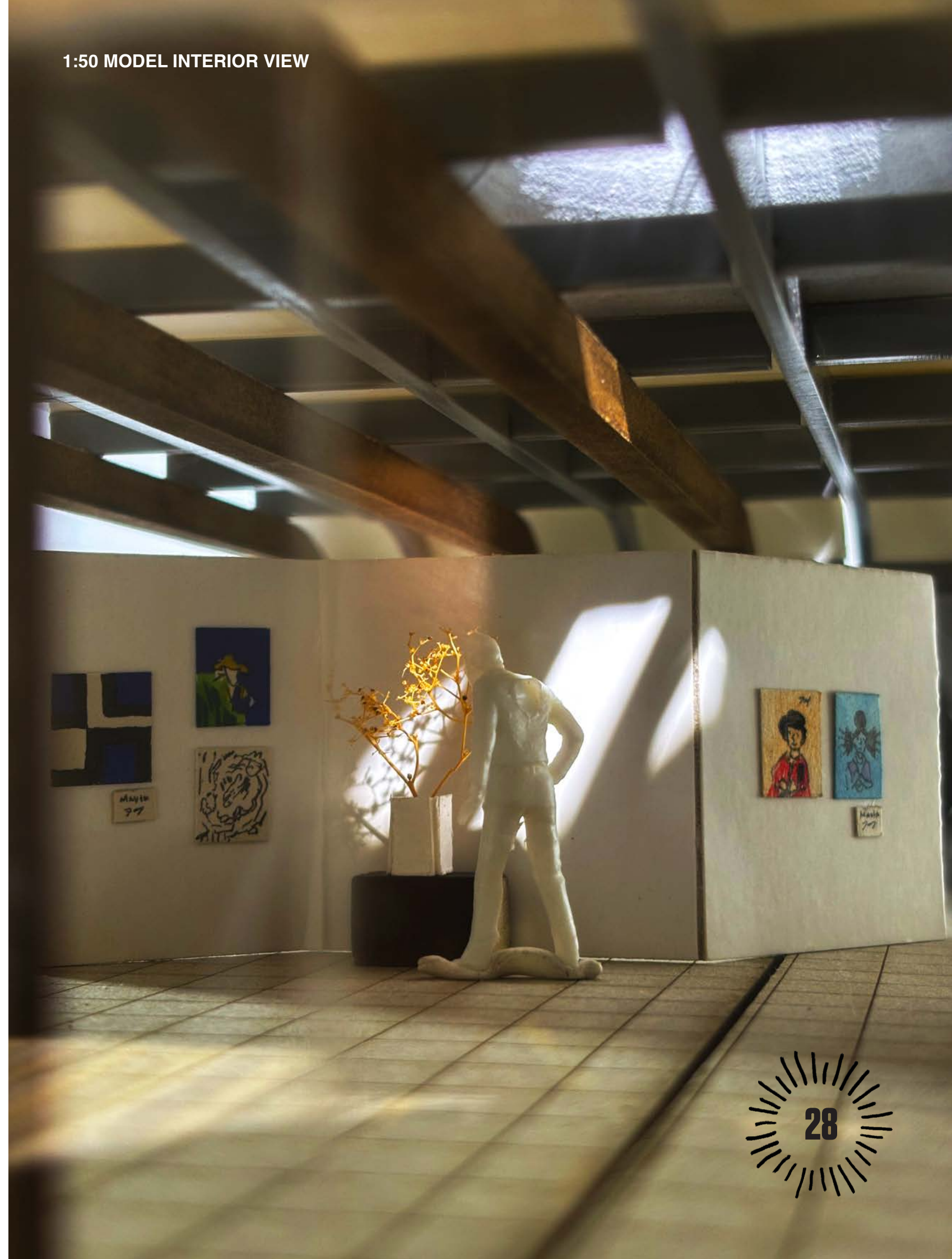
My studio project is intentionally poetic, speculative, and abstract. It doesn’t offer a conventional solution, but instead proposes a provocation: a vision of a future where generative AI and robotics have become integral to architecture. It challenges the idea of buildings as passive structures, instead imagining architecture as sentient—able to sense, respond, and even emote. In this imagined future, buildings evolve beyond function; they become participants in the environments they inhabit.

While this work may not align with traditional architectural expectations, I believe it speaks to what lies ahead. This project opens a dialogue—one that may inspire future students to explore the role of AI in design more deeply. They may build upon my ideas, improve them, and take them further. I may not be the best, but perhaps I am among the first to imagine this specific path. I take pride in sparking that conversation.

This is not just a vision of the future. It is already unfolding.

It is happening—and it is happening now.

1:50 MODEL INTERIOR VIEW





# DIEC:DIECUION

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## REFLECTION

One of the most unexpected but profound inspirations this term came from a personal project: making a chair. What began as a simple exercise quickly evolved into a deep reflection on design, sustainability, and the role AI might play in shaping our creative futures.

The challenge was deceptively technical—fitting my chair design within the constraints of a standard 1220x2400mm, 24mm plywood sheet for CNC cutting. Wanting to minimise material waste, I found myself redesigning to serve the material, rather than asking it to serve the design. What seemed like a simple task ended up consuming over 30 hours, spanning everything from geometric theory to case study research. I even turned to generative AI, hoping it might help resolve the puzzle—but quickly realised that, for now, such tools still lack the design sensitivity and adaptability required.

Eventually, it was human intuition that led me to a solution. But the process raised a powerful question: what if generative AI did evolve far enough to help everyone design a chair tailored to their body, needs, and character? What if AI design provide a more personal, accessible design? Suddenly, the idea of art as luxury begins to dissolve—replaced by a future where individuality and creativity are for everyone.

A quote I once read stays with me: “The purpose of human development is that everyone should live their desired life.” For me, that desired life includes meaningful, intimate connections between people and their surroundings—whether it’s the chair we sit on, the clothes we wear, or the space we inhabit. Design can help build those connections, and AI could be the tool that brings them within reach.

When I once asked Thomas Heatherwick, “If everything becomes interesting, wouldn’t that mean nothing is interesting anymore?” He smiled and replied, “We’ll see then.”

I think we’re beginning to see now.

And this is the future I want to design.

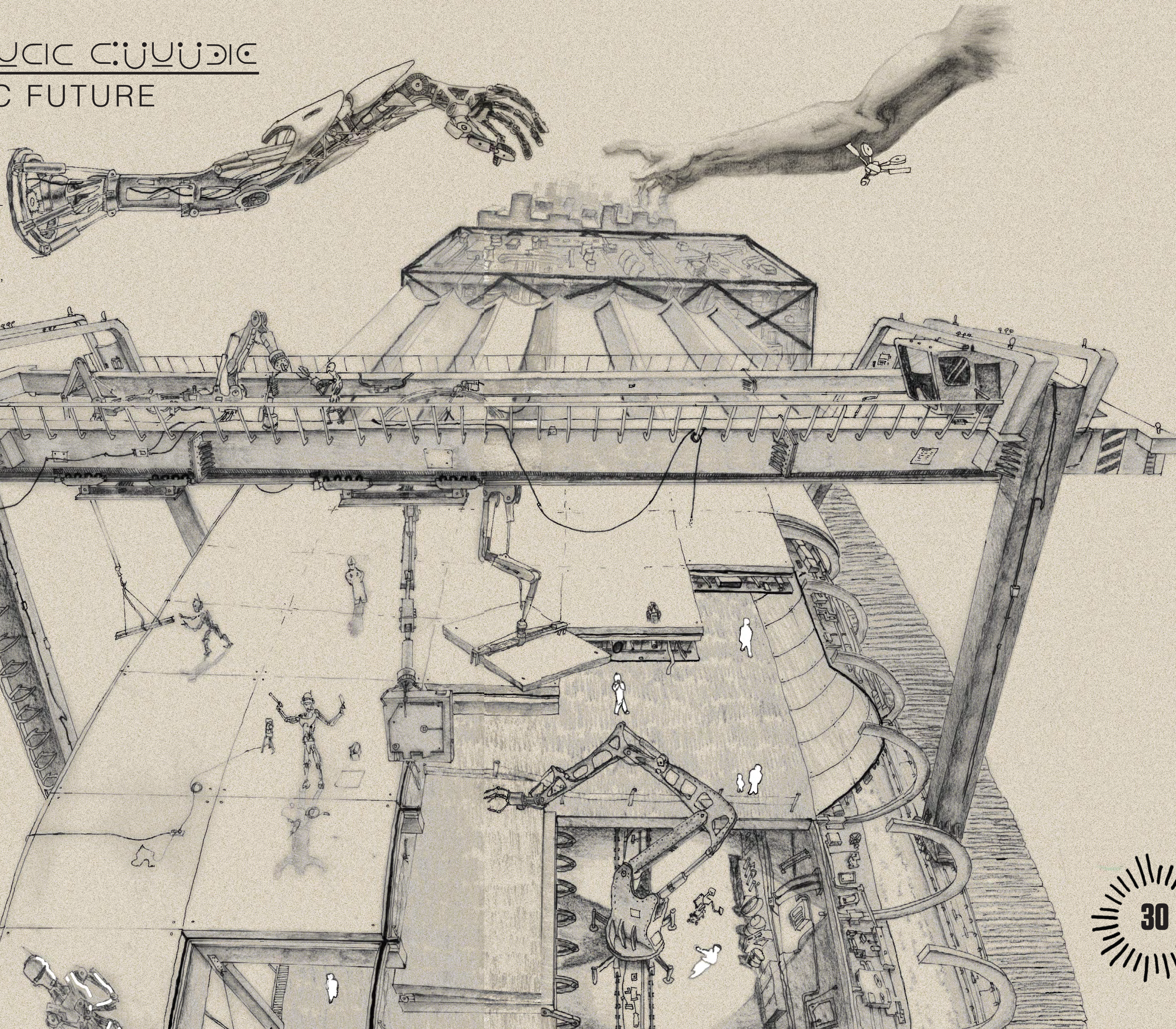
### 1:1 SCALED CHAIR





# סימביוטי עתיד SYMBIOTIC FUTURE

And here we are, stepping at the front door of the “Singularity”, it is a “Blackhole” where we can’t see what’s inside the Pandora’s box, a step forward, we might enter an era of utopia, or dystopia. We don’t know what the future will be like, no body knows.



סימביוטי עתיד

הטוב ביותר שיש לנו לחזות את העתיד הוא להמציאו.

— אלן קיי (1971) —

The best way to predict the Future is to invent it.

— Alan Kay (1971) —

