TU Delft

PARIS 2024

A cyclist's reinterpretation of movement at

the Olympic Games

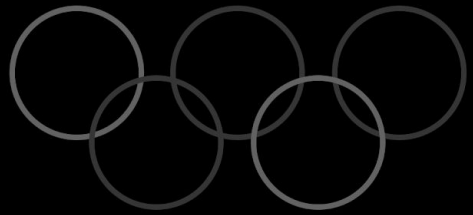
P2

Emma Chris Avramiea
Robotic Lab+ ExploreLab

“Managers are not confronted with problems that are independent of each other, but with dynamic situations that consist of complex systems of changing problems that interact with each other. I call such situations messes...

Managers do not solve problems, they manage messes.”

Russel Ackoff, operations theorist
Book: Thinking in Systems”, Donella Meadows



SOCIAL

POLITICAL

ECONOMIC

CULTURAL

URBAN CHANGE

TECHNOLOGY

local disruption during construction

improved safety for the city

it can relaunch city
as tourist destination

temporary crowding

infrastructure is not needed
after the event

development of sustainable transport net-
(works (railways, tramways, terminals

huge stadiums - at odds with residents'
needs

energy intensive and heavy pollution ex-
pected to be eliminated

URBAN CHANGE

urban sprawl

Urban Development for the Rio Olympics
Source: The Wall Street Journal

temporary

white elephants

Rio’s Olympic Venues, 6 months on
Source: The Guardian

sucess is measured by media audience engagement

power to engage people wordldwide

organizers promote it as a party

doping scandals

focus on refugee crisis: 2016 Rio Olympics had a refugee team

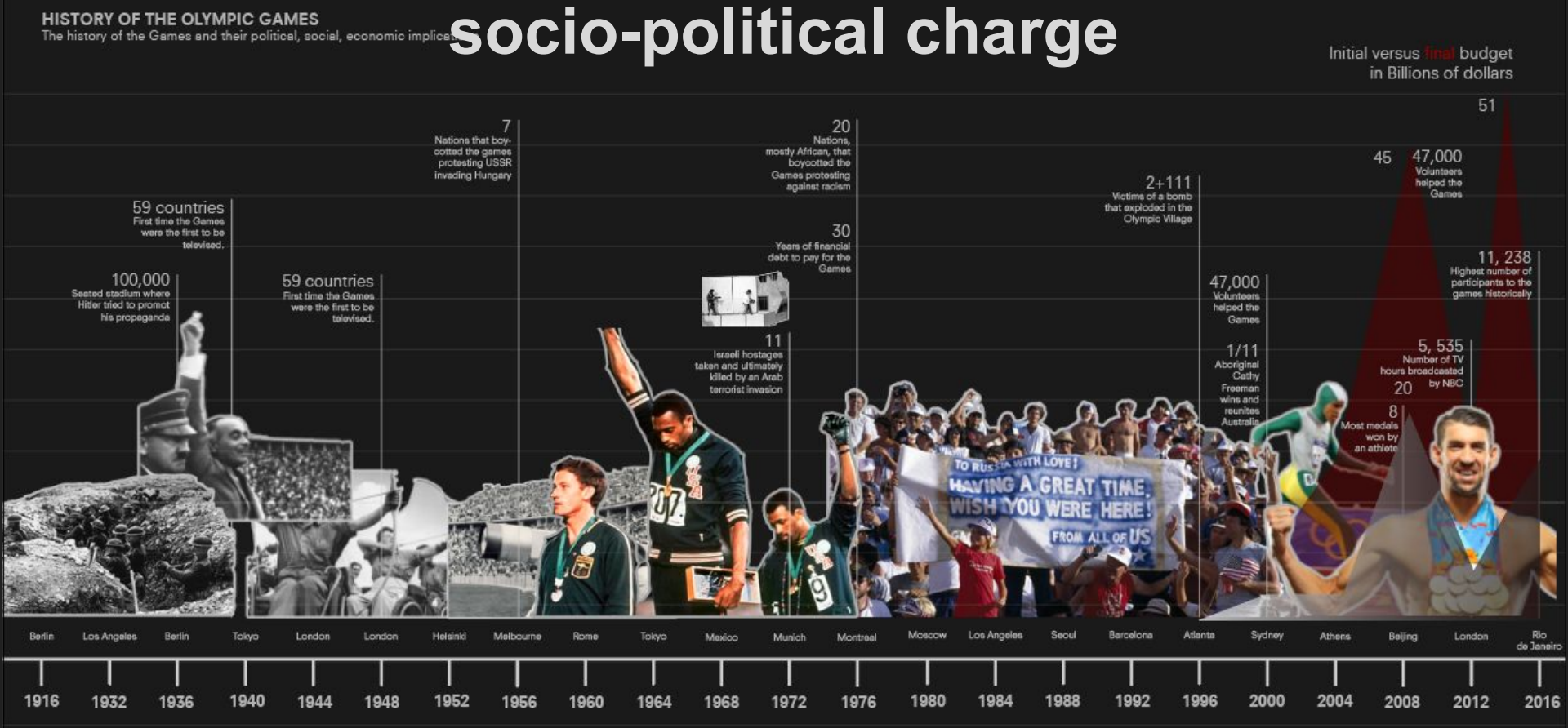
telecommunication revolution has greatly contributed to the economic value of the Olympics

locals feel misused

media favors athletes from host nations by amount of tv time

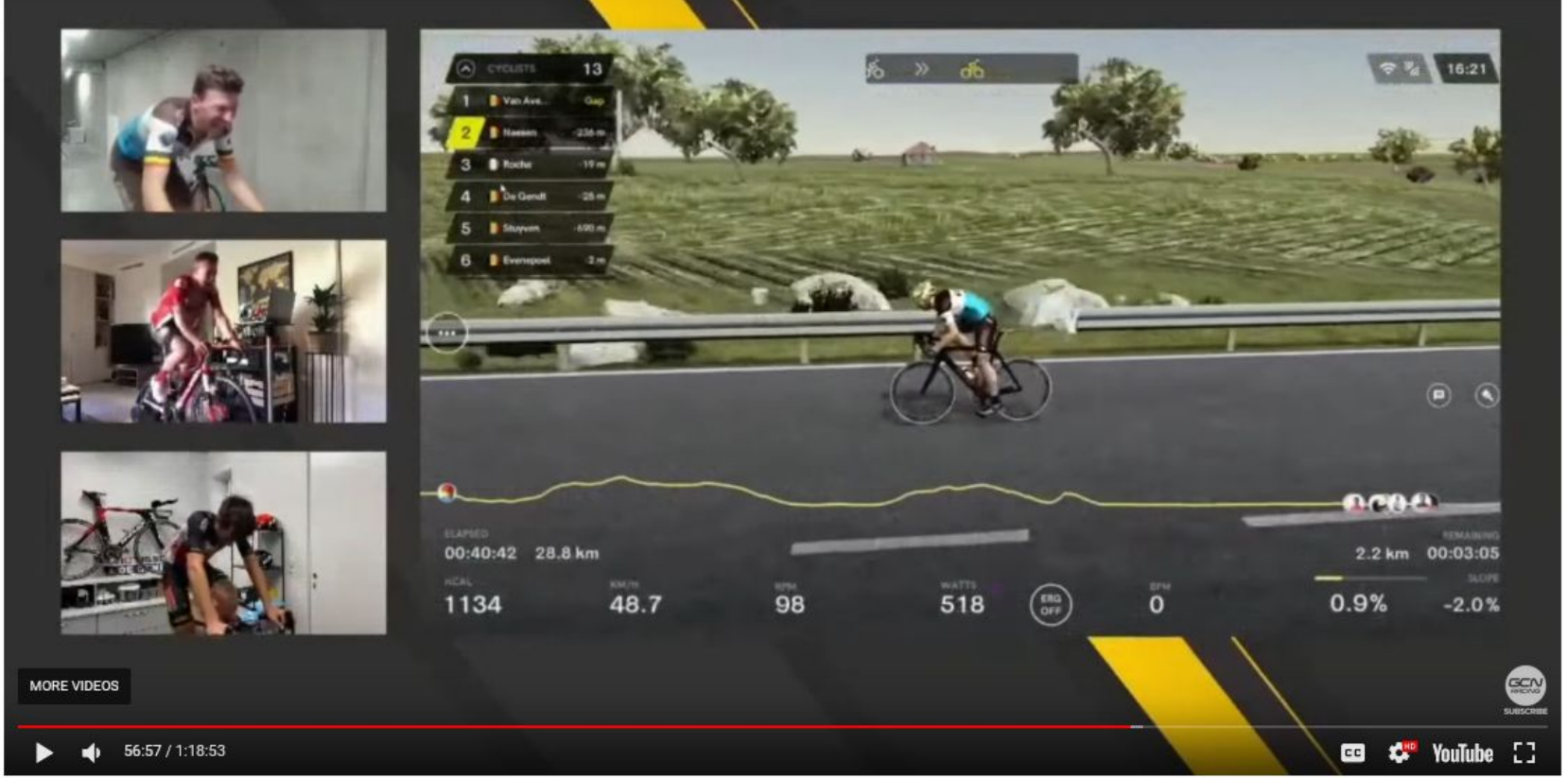
SOCIAL

socio-political charge



Implications of the Olympics beyond sport
Source: Emma Chris

new physicality



VIRTUAL TOUR OF FLANDERS LIVESTREAM – LOCKDOWN EDITION

SUBSCRIBE ON YOUTUBE

BY CYCLINGTIPS

PARIS 2024
OLYMPIC VENUE MASTER PLAN

Aquatics Centre #1	Aquatics (Swimming) Aquatics (Water-polo)
Aquatics Centre #2	Aquatics (Artistic Swimming) Aquatics (Diving) Aquatics (Water-polo)
Champs-de-Mars Arena	Judo Wrestling
Château de Versailles	Equestrian (Jumping/Dressage/Eventing) Modern Pentathlon
East Paris Arena	Basketball
Eiffel Tower Stadium	Volleyball (Beach)
Elancourt hill	Cycling (Mountain Bike)
Grand Palais	Fencing Taekwondo
Jean-Bouin Stadium	Rugby
La Chapelle Arena	Badminton
La Défense Arena	Gymnastics (Artistic/Rythmic/Trampoline)
Le Bourget Arena	Volleyball
Le Golf National	Golf
Le Pont d'Iéna	Acquatics (Marathon Swimming) Athletics (Marathon, Race Walk) Triathlon Cycling (Road)
Les Invalides	Archery
Olympic Stadium	Athletics Ceremonies
Parc des Princes	Football
Roland-Garros Stadium	Tennis Boxing
Saint-Quentin-en-Yvelines BMX Stadium	Cycling (BMX Race)
Saint-Quentin-en-Yvelines Velodrome	Cycling (Track) Modern Pentathlon (Fencing)
Shooting Range	Shooting
South Paris Arena #1	Handball
South Paris Arena #4	Table tennis
Vaires-sur-Marne Nautical Stadium	Rowing Canoe (Slalom/Sprint)
Vues-du-Planoir Stadium	Hockey
Zenith Arena	Weightlifting
Bordeaux Stadium	Football
Lille Stadium	Football
Lyon Stadium	Football
Marseille Marina	Sailing
Marseille Stadium	Football
Nantes Stadium	Football
Nice Stadium	Football
Saint-Etienne Stadium	Football
Toulouse Stadium	Football

10 km from the Olympic Village

Paris - Charles De Gaulle airport

Le Bourget

Olympic Village

GRAND PARIS ZONE

PARIS CENTRE ZONE

LILLE

PARIS

NANTES

LYON

ST-ETIENNE

BORDEAUX

TOULOUSE

NICE

MARSEILLE

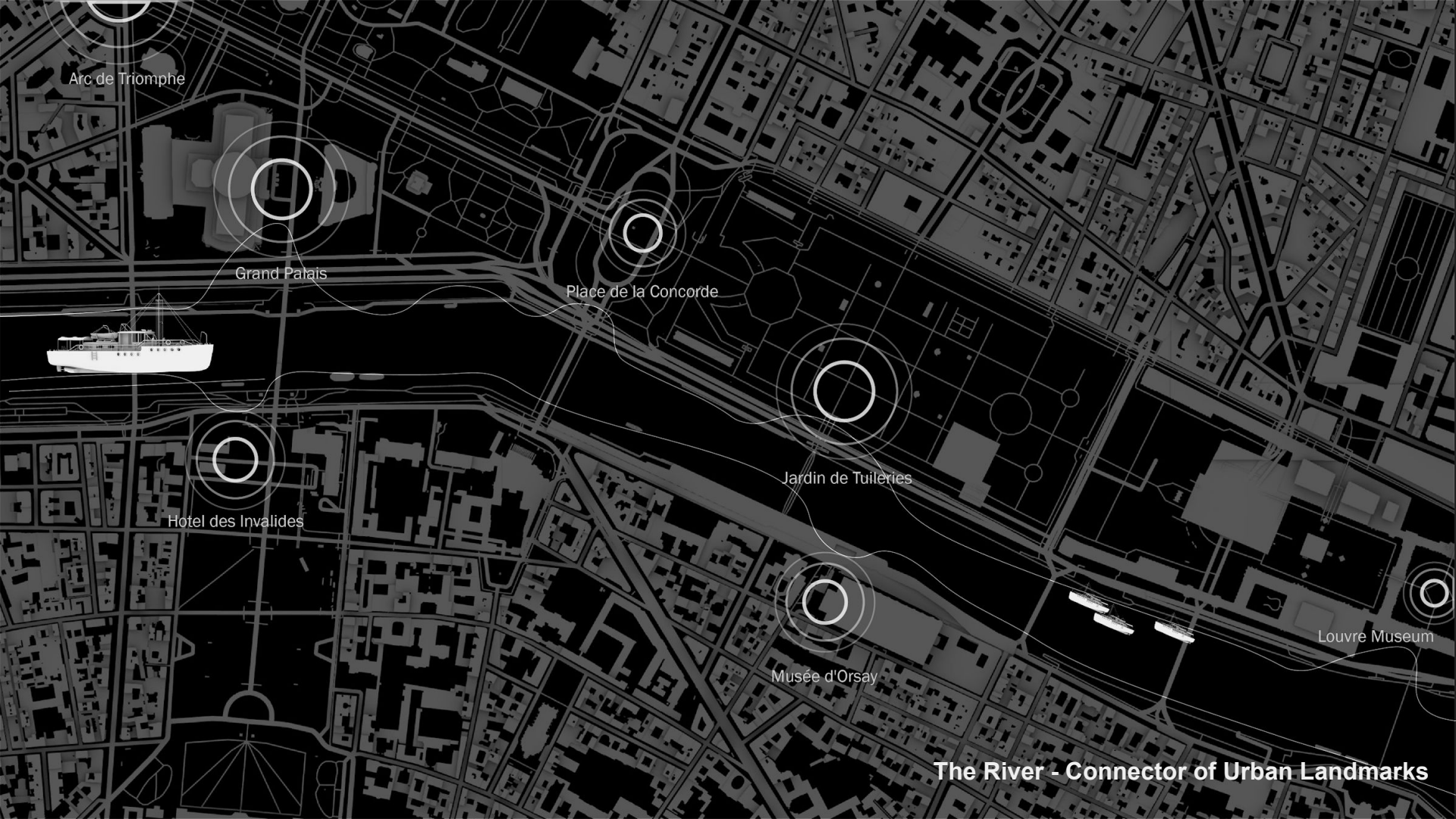
Paris - Orly airport

N W E S

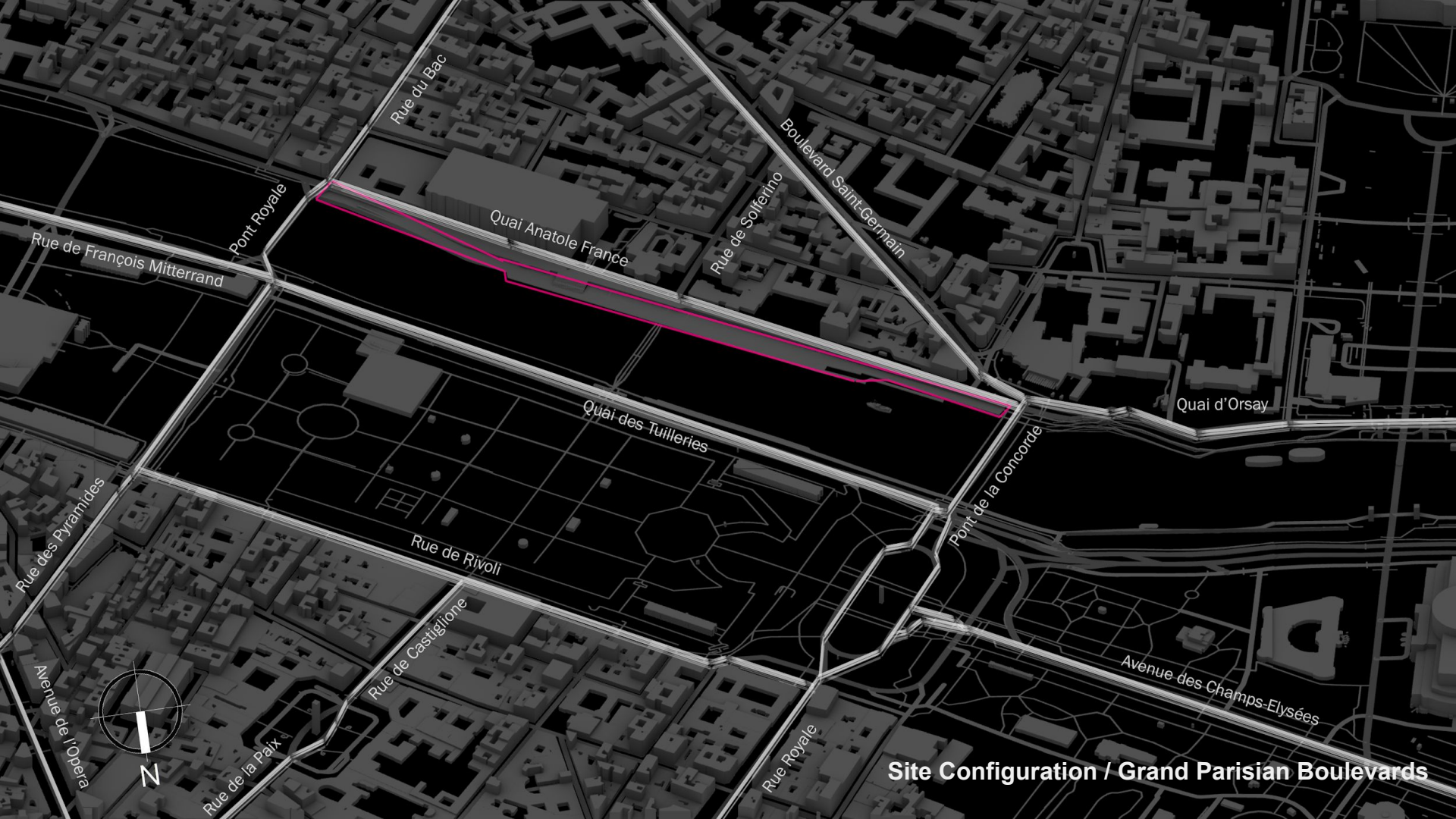
0 1 2 3 4 5 km

19-10-21

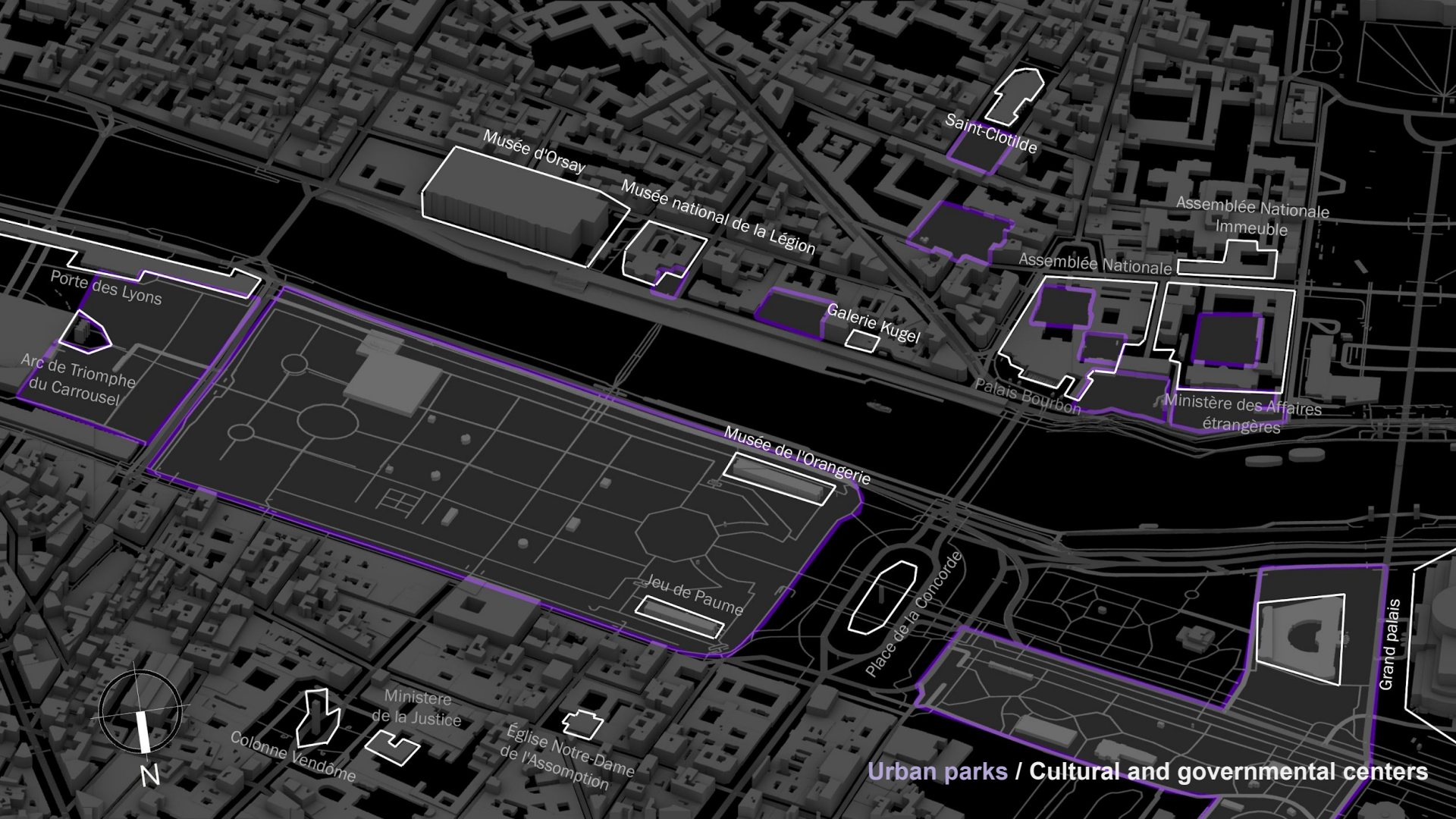

Paris,France
Courbevoie
Levallois-Perret
Pantin
Neuilly-sur-Seine
Issy-les-Moulineaux
N
250m
1000m
Quai d'Orsay

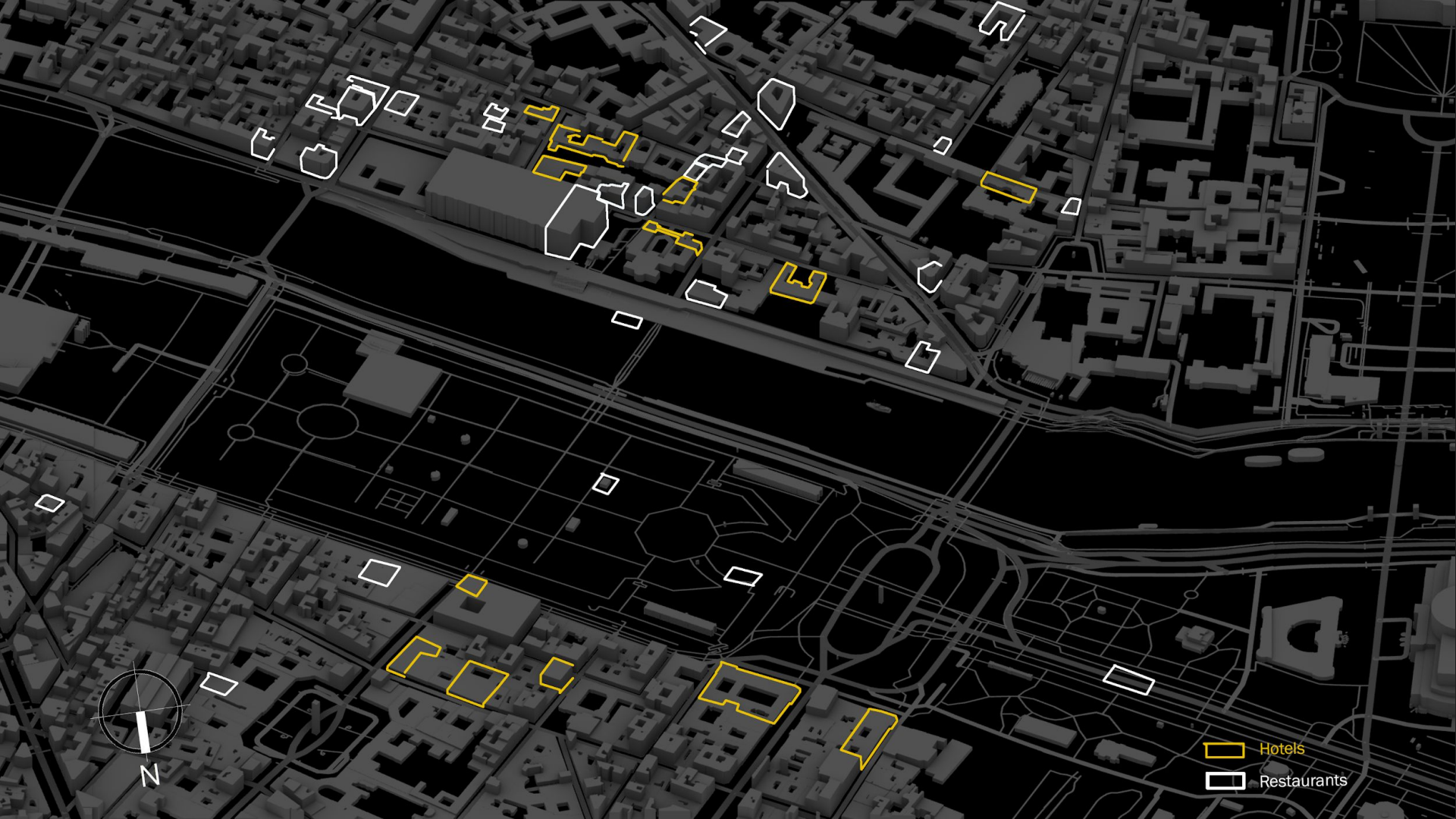


The River - Connector of Urban Landmarks

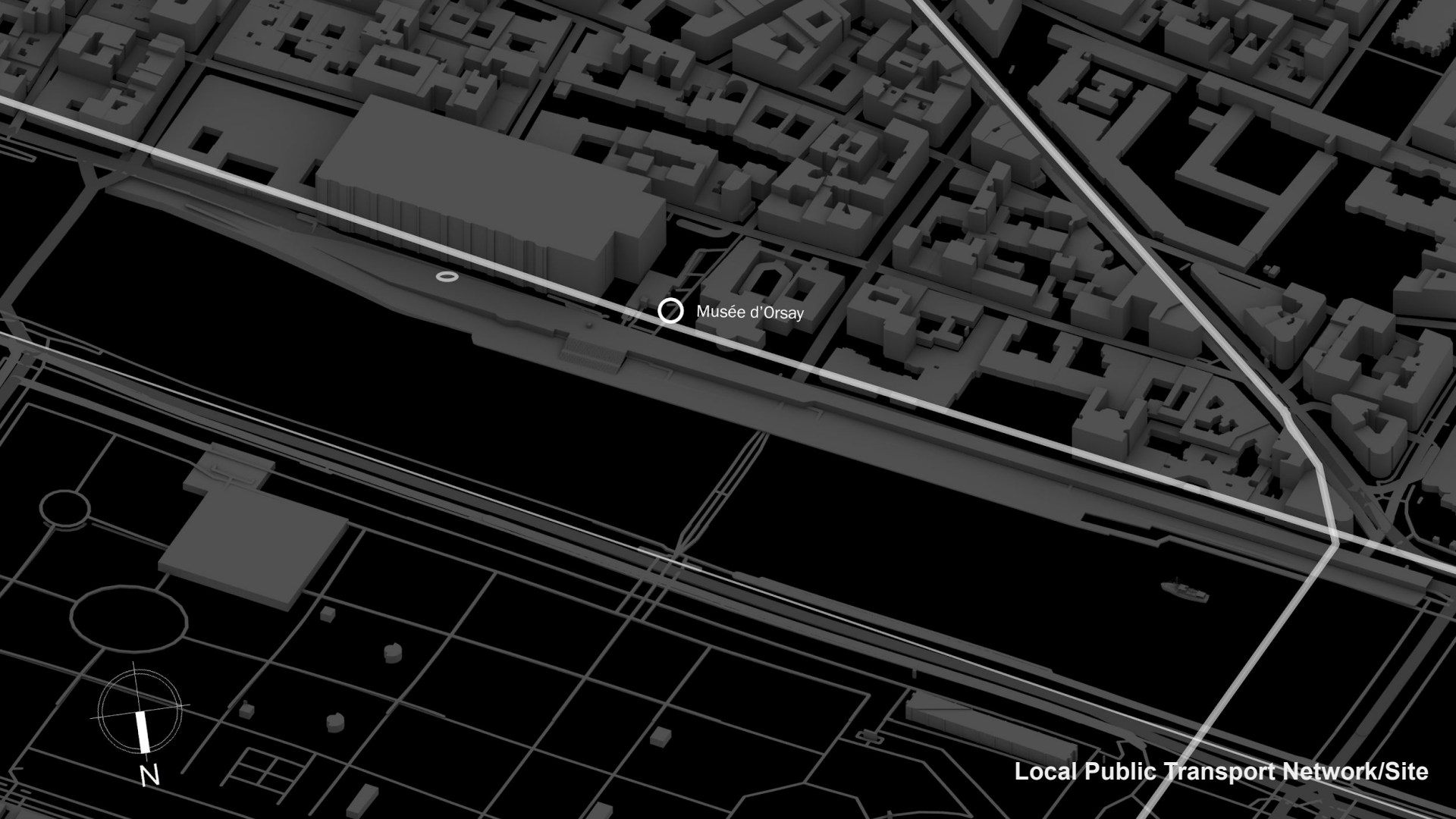


Site Configuration / Grand Parisian Boulevards

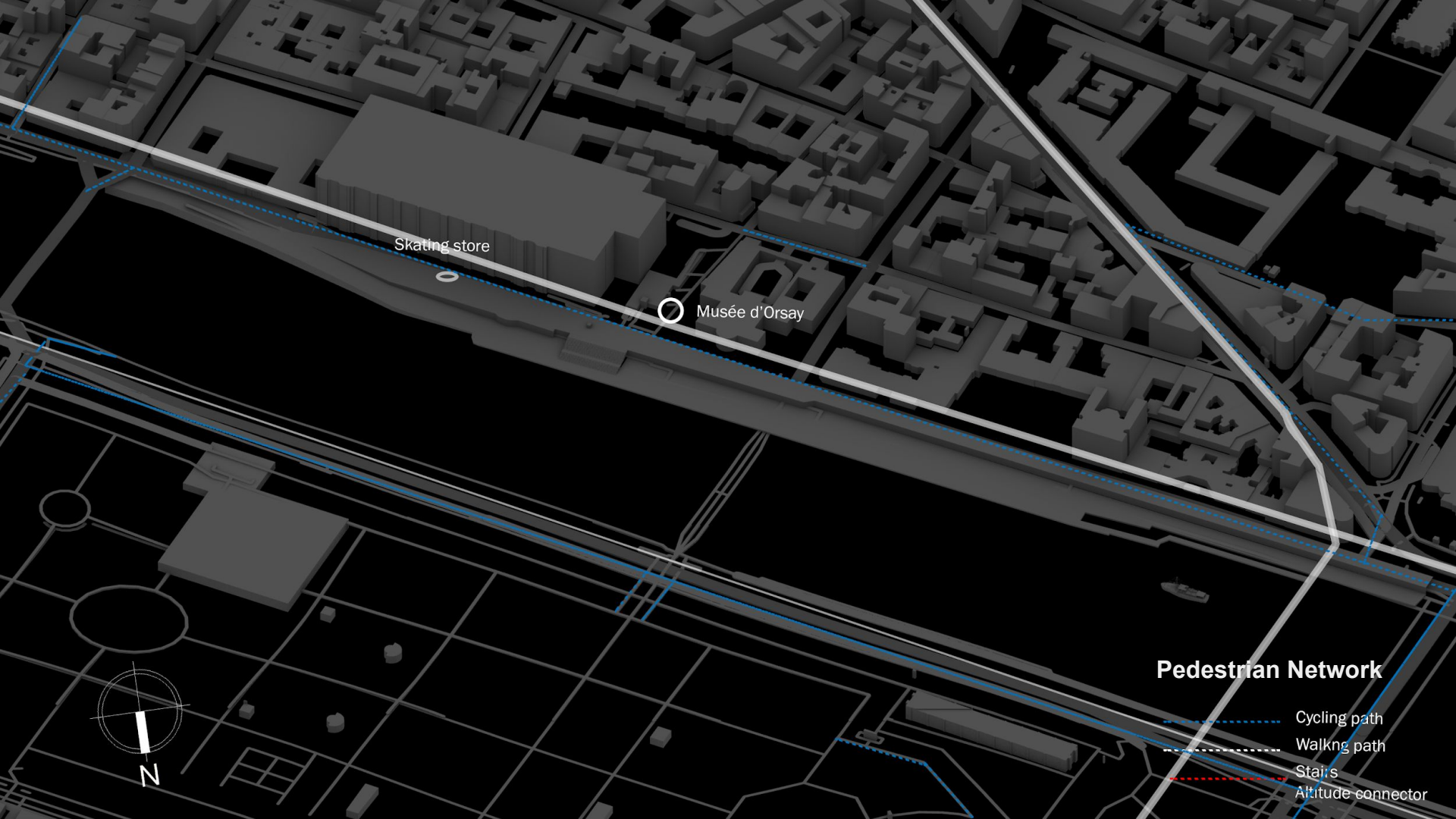

Saint-Clotilde
Musée d'Orsay
Musée national de la Légion
Assemblée Nationale Immeuble
Assemblée Nationale
Porte des Lyons
Galerie Kugel
Arc de Triomphe du Carrousel
Palais Bourbon
Ministère des Affaires étrangères
Musée de l'Orangerie
Jeu de Paume
Place de la Concorde
Grand palais
Ministère de la Justice
Église Notre-Dame de l'Assomption
Colonne Vendôme
N
Urban parks / Cultural and governmental centers


N
Hotels
Restaurants


Solferino
Musée d'Orsay
Assemblée nationale
Invalides
Tuilleries
Concorde
N
Local Public Transport Network

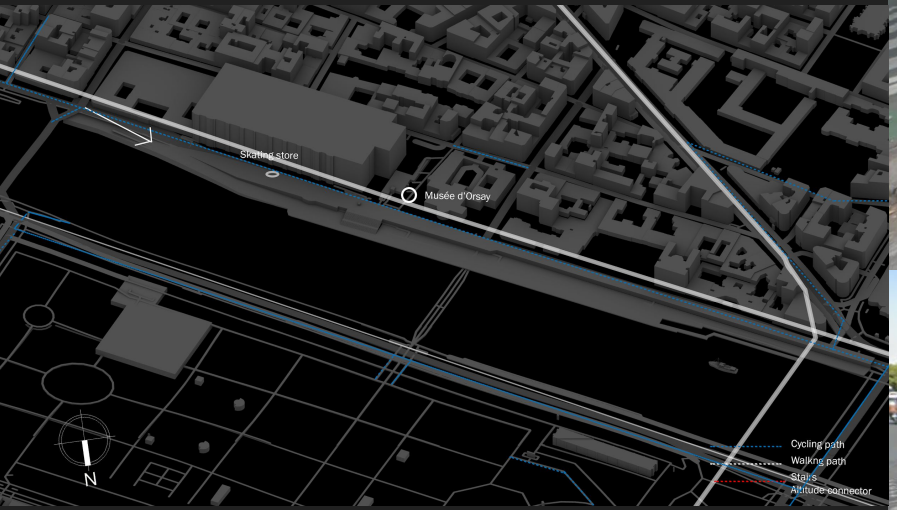


Local Public Transport Network/Site


Skating store
Musée d'Orsay
N
Pedestrian Network
Cycling path
Walkng path
Stairs
Altitude connector

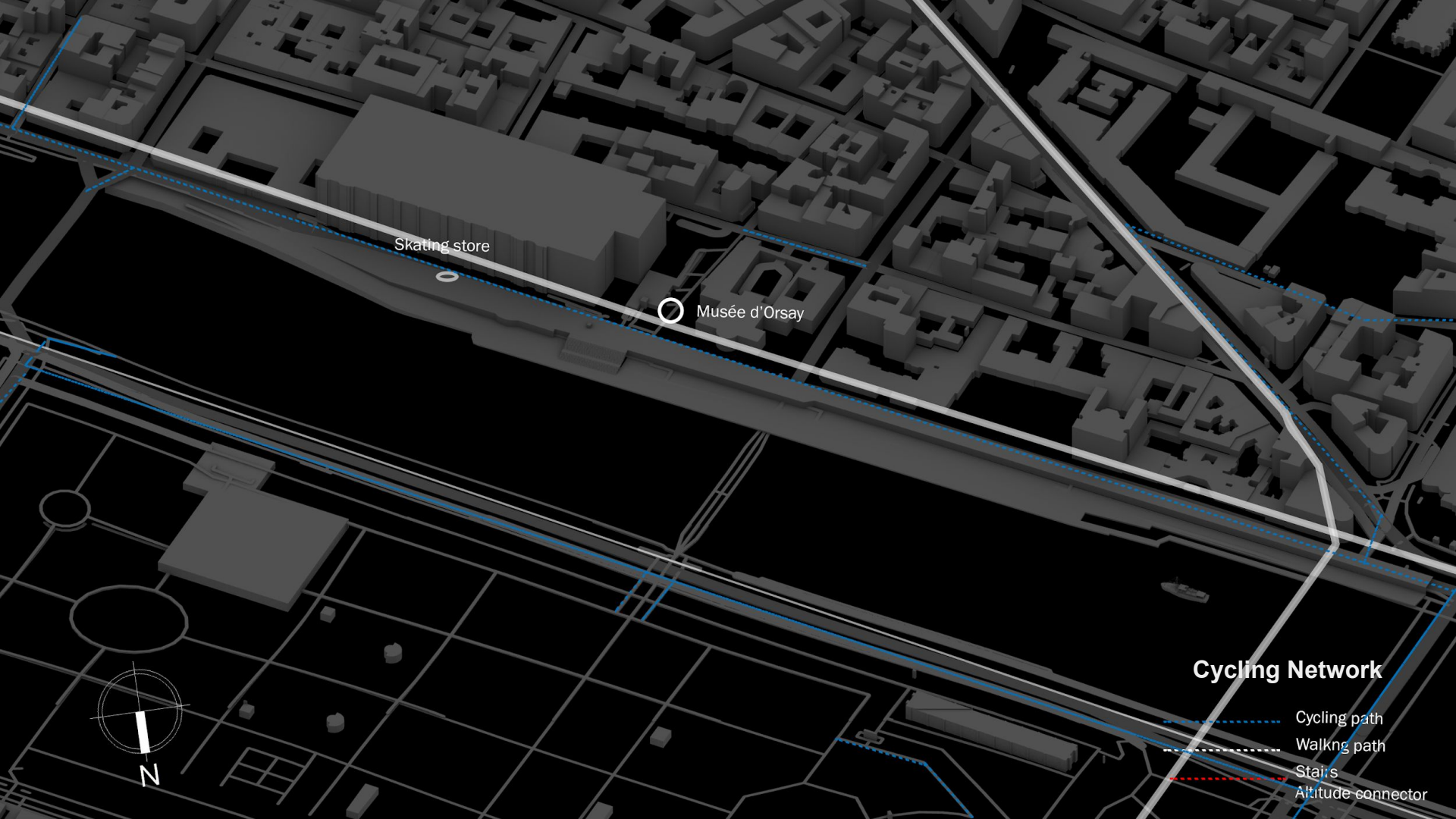

Skating store
Musée d'Orsay
N
Pedestrian Network
Cycling path
Walkng path
Stairs
Altitude connector

2013

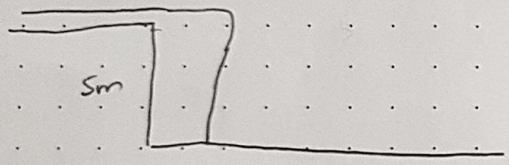


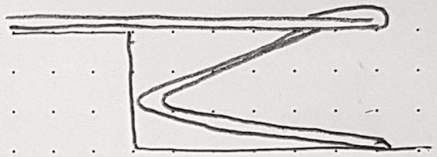
2020

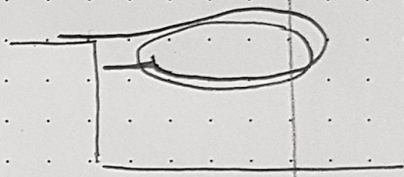
Pedestrianization Project

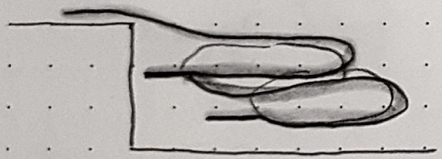

Skating store
Musée d'Orsay
N
Cycling Network
Cycling path
Walkng path
Stairs
Altitude connector

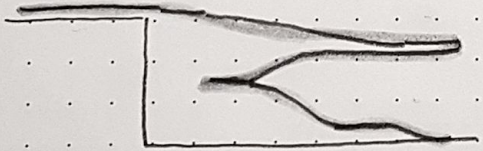

Skating store
Musée d'Orsay
N
Cycling Network
Proposed Cycling
Cycling path

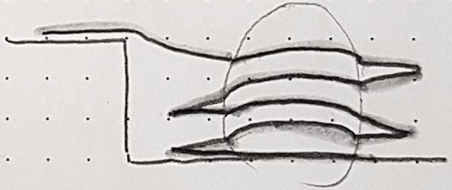


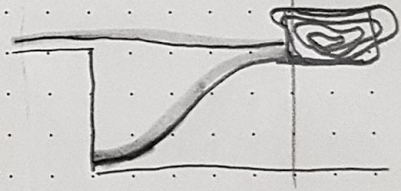


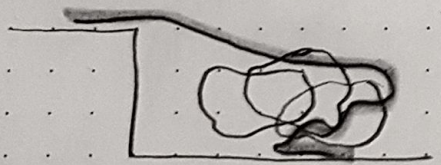








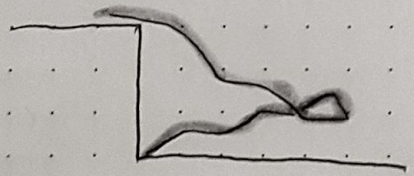


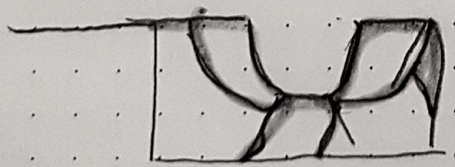


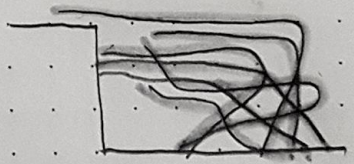
ramp along architecture

ramp on top of archit.

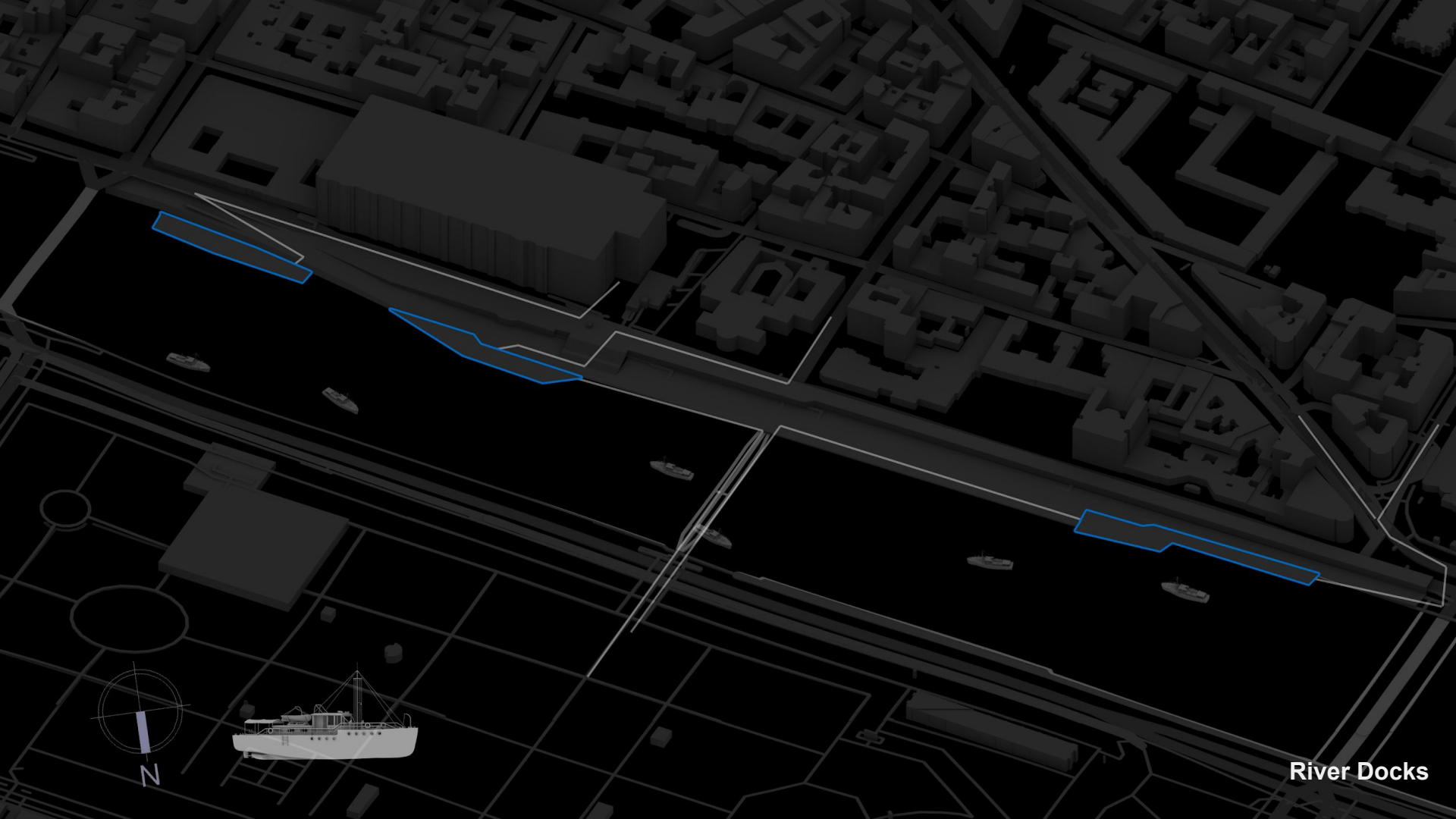
MAXXI







Site/City Vertical Connections


N
River Docks

I. CONTEXT

II. ANALYSIS AND URBAN STRATEGY

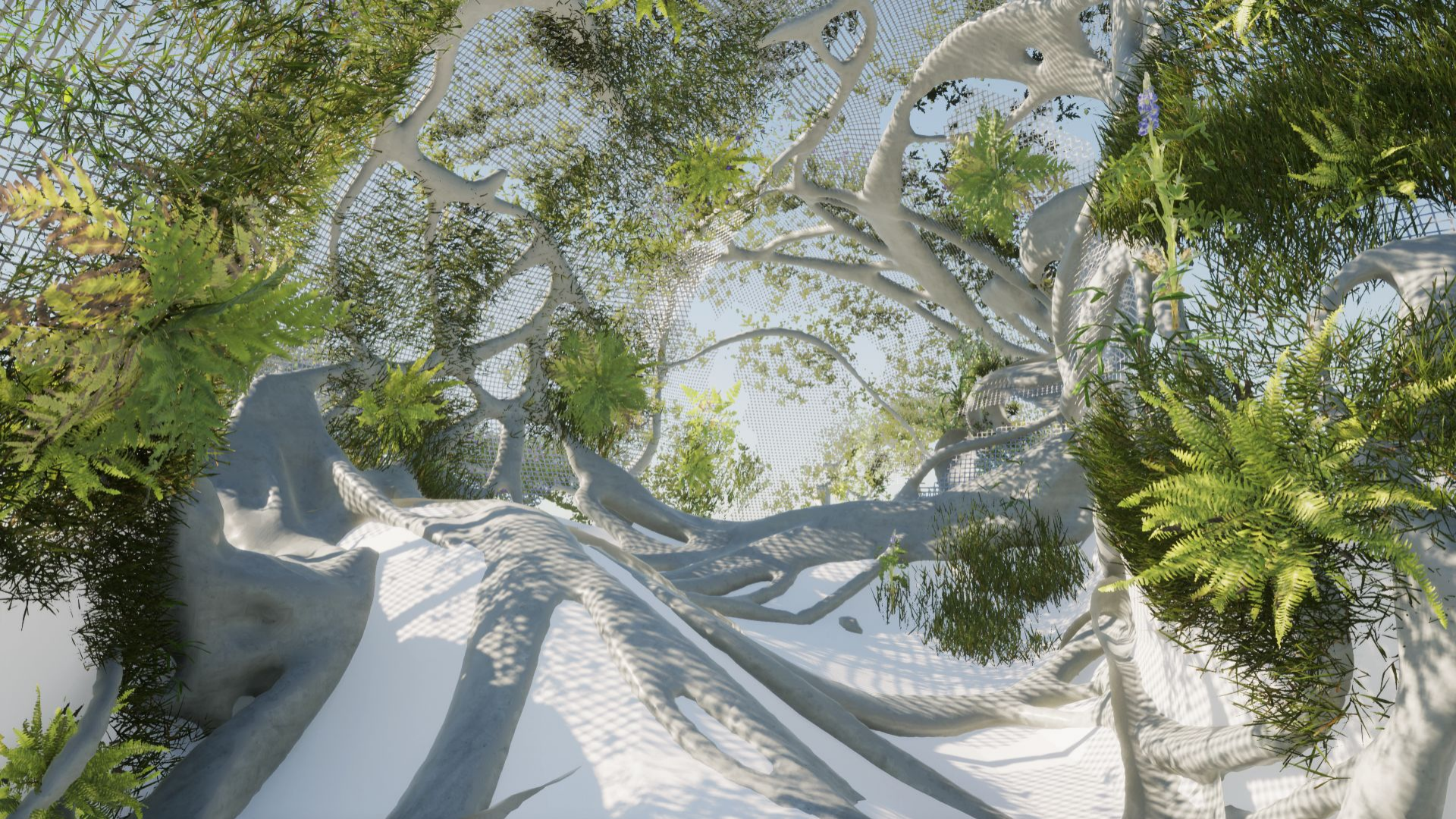
III. KEY WORKSHOP

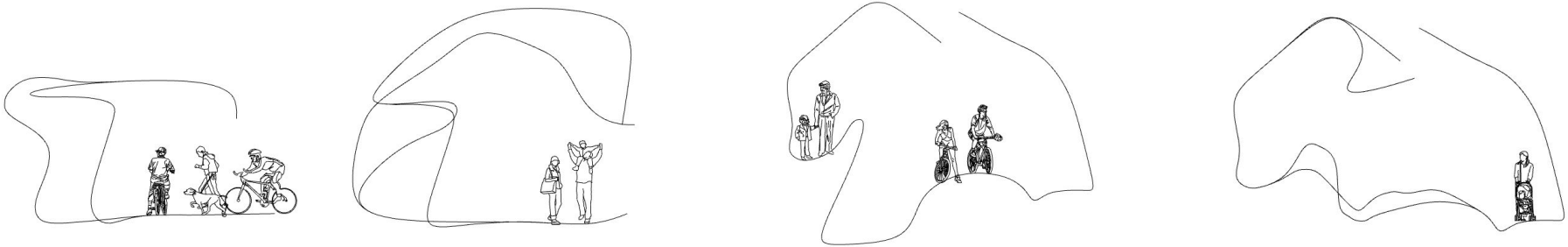
IV. MATERIAL RESEARCH. MANUFACTURING

V. PROPOSED INTERVENTION

VI. CONCLUSION

Exploring a design
methodology involving Computational Design

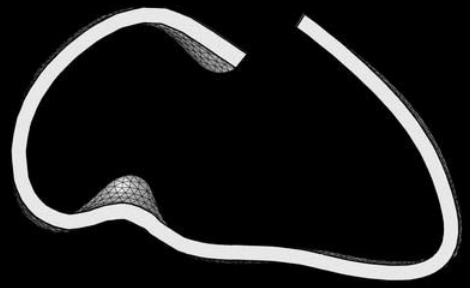


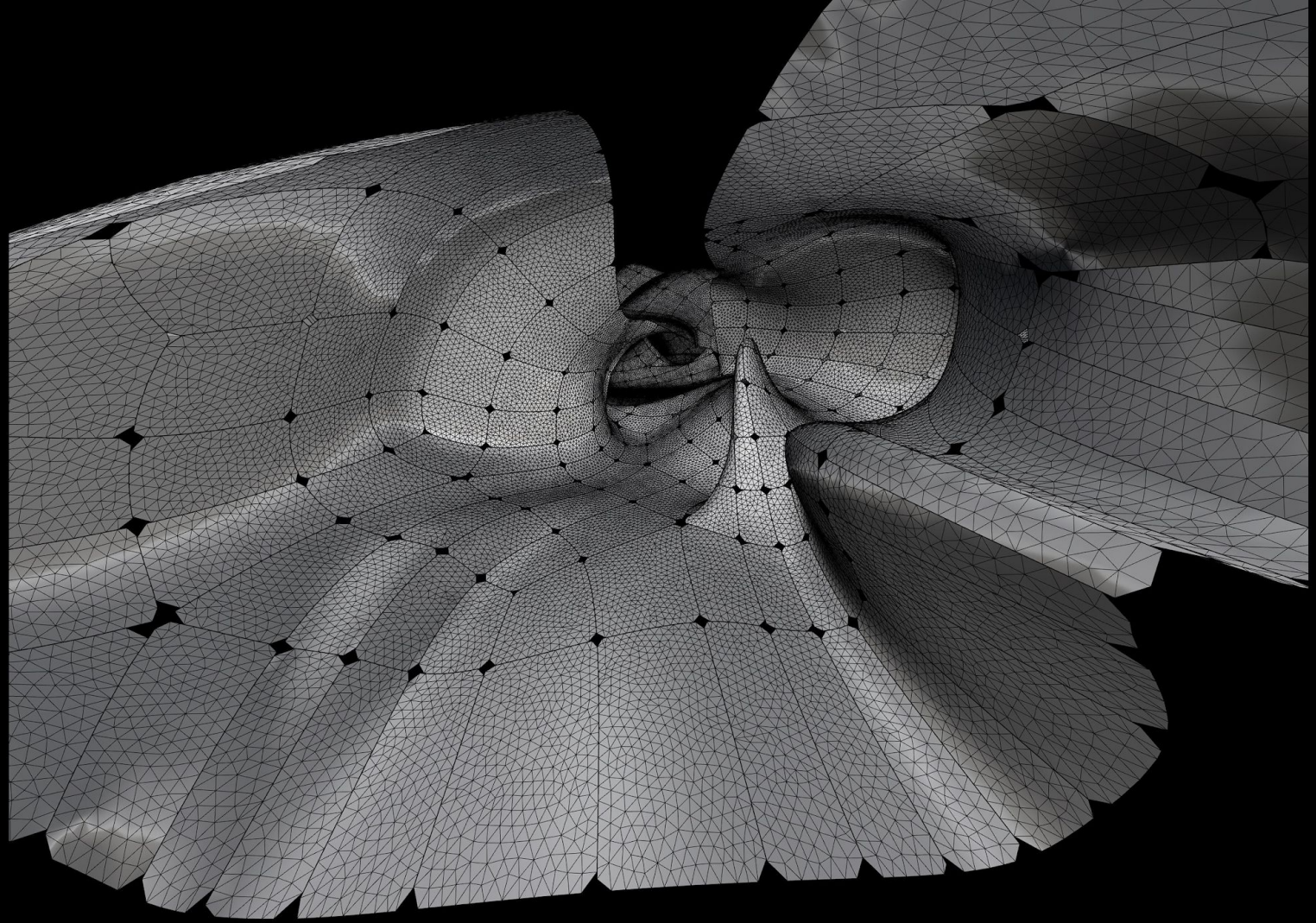


Architectural Cross-section - conceptual

multi-layered

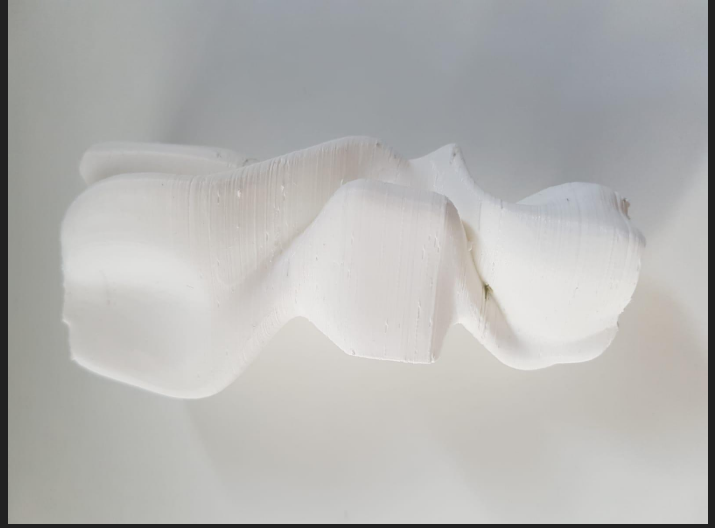
Yokohoma Terminal, FOA

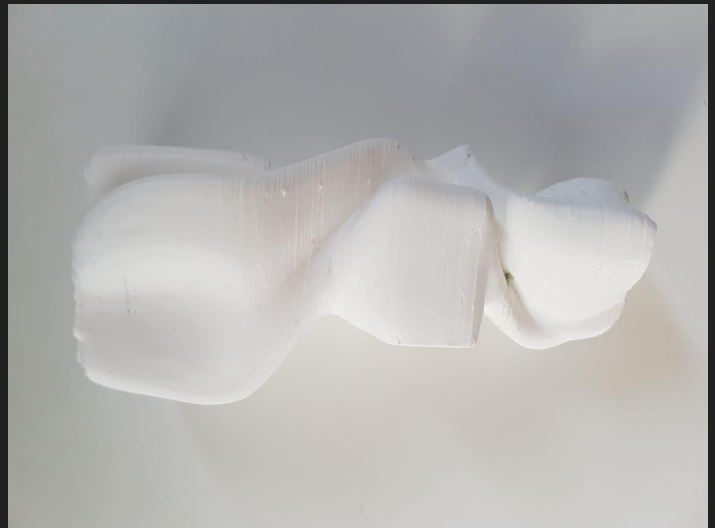




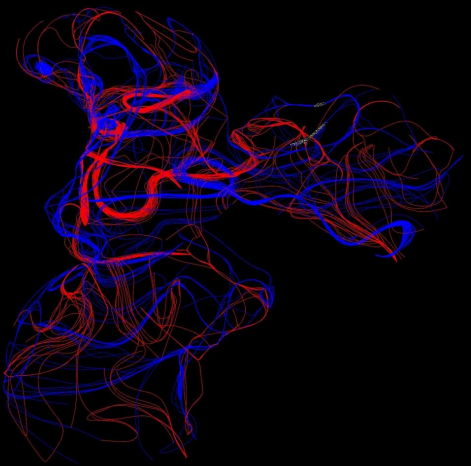
“motion implies movement and action,
animation implies the evolution
of a form and its shaping forces”

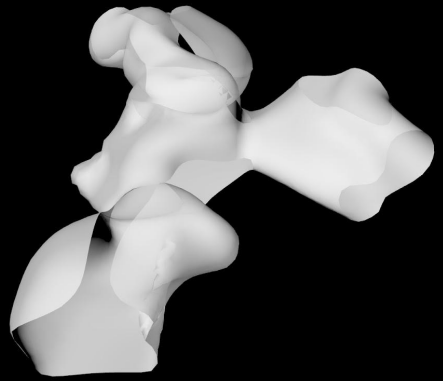
Greg Lynn, Animate Form

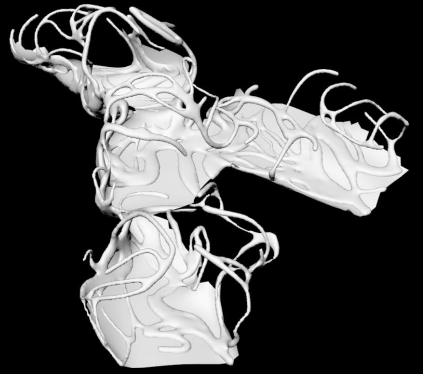




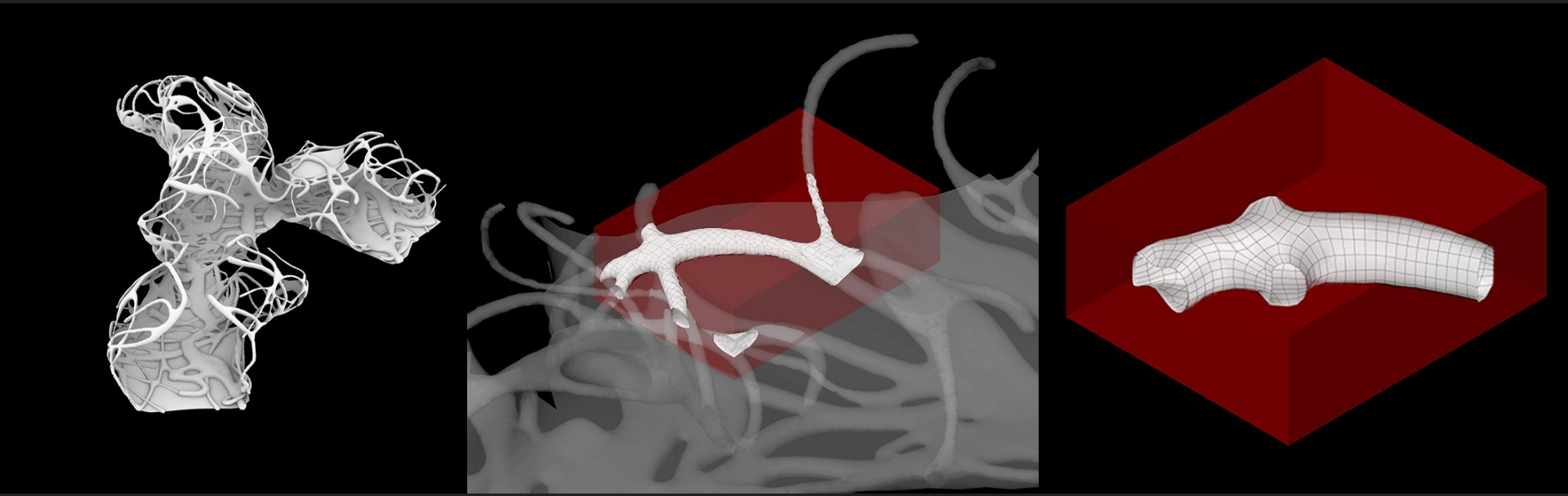
3d printed prototype (PLA)
Source: own work



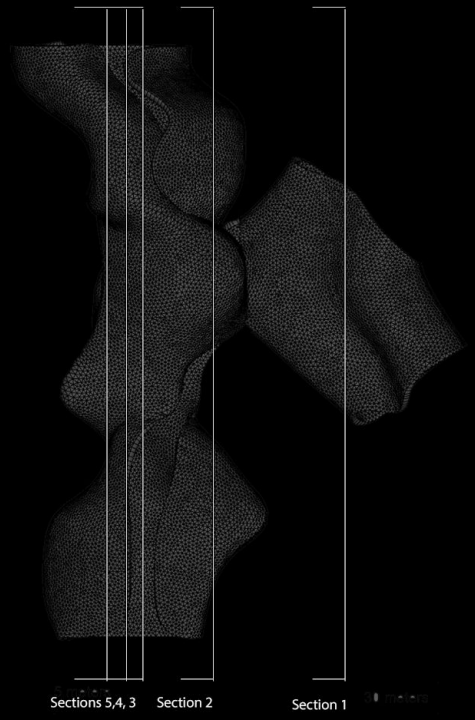


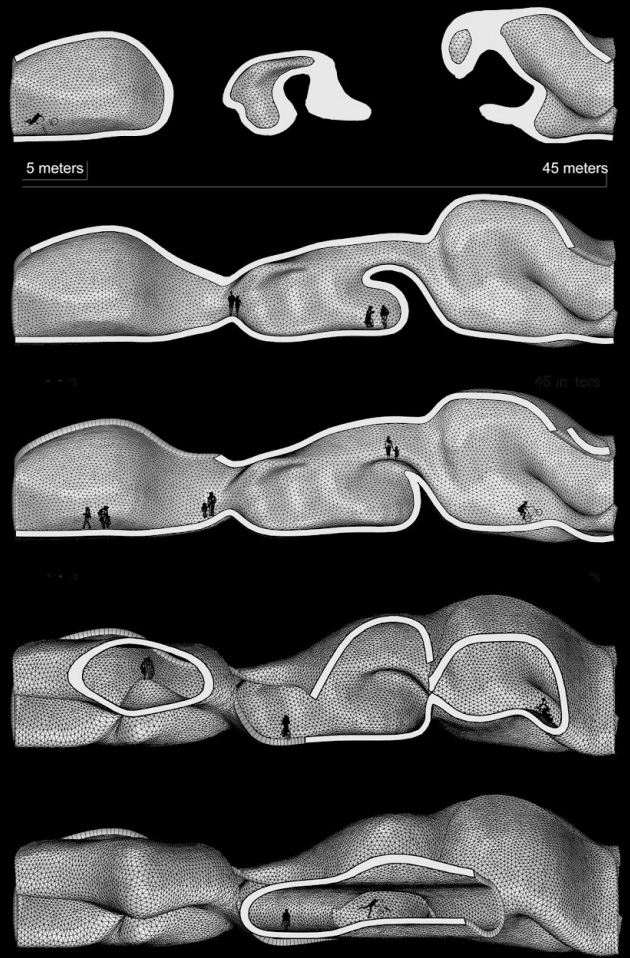


Structural Optimization



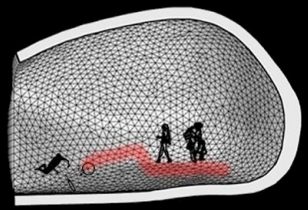
Macro/Mezo/Micro

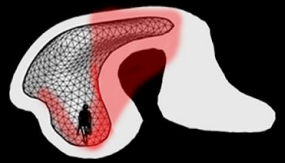


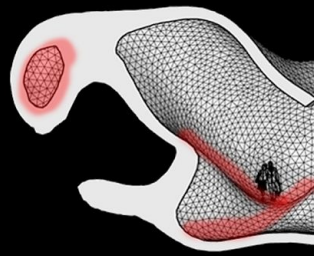


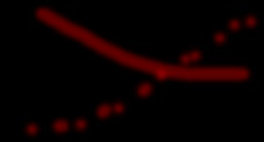
Longitudinal Section Studies

Section 1



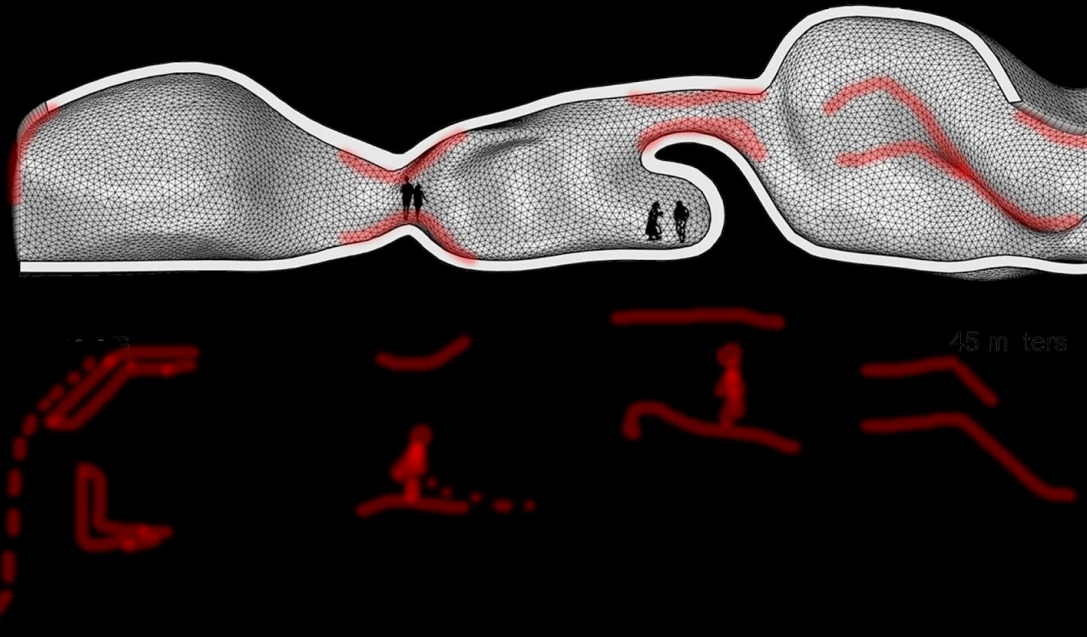






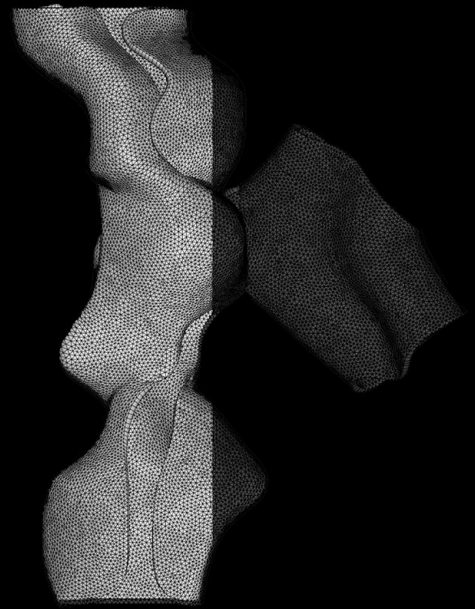
Spatial Optimization Studies

Section 2

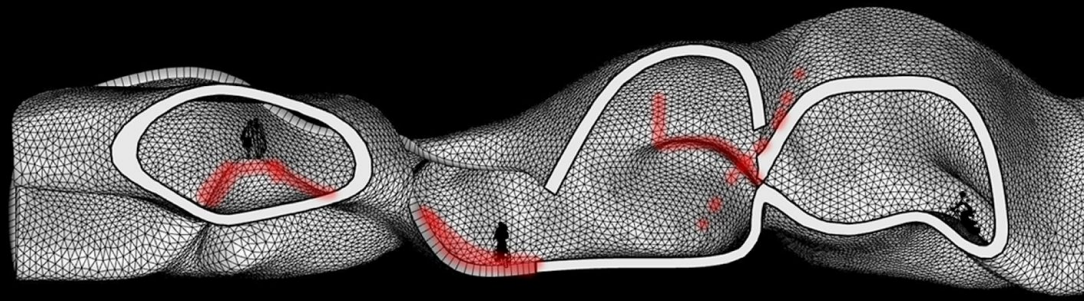


45 m ters

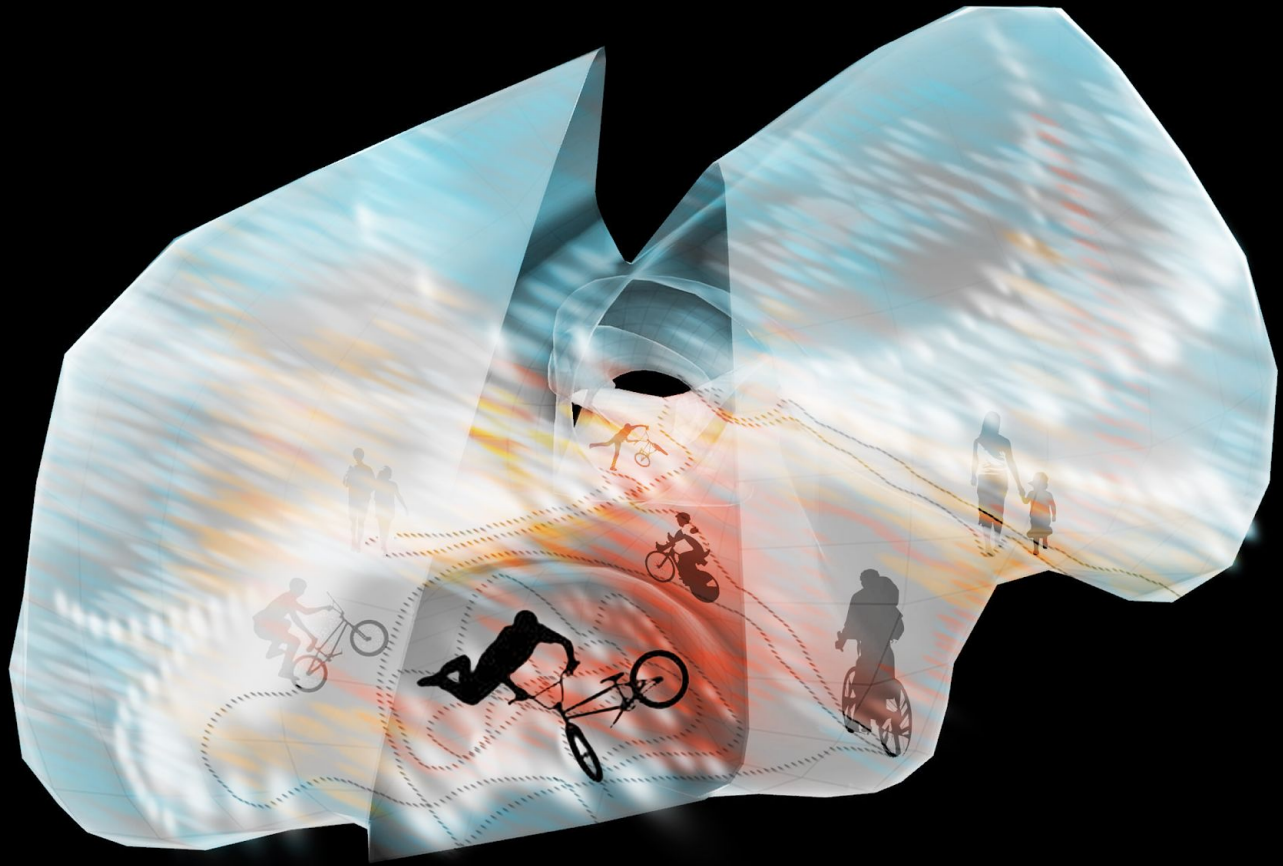
Spatial Optimization Studies

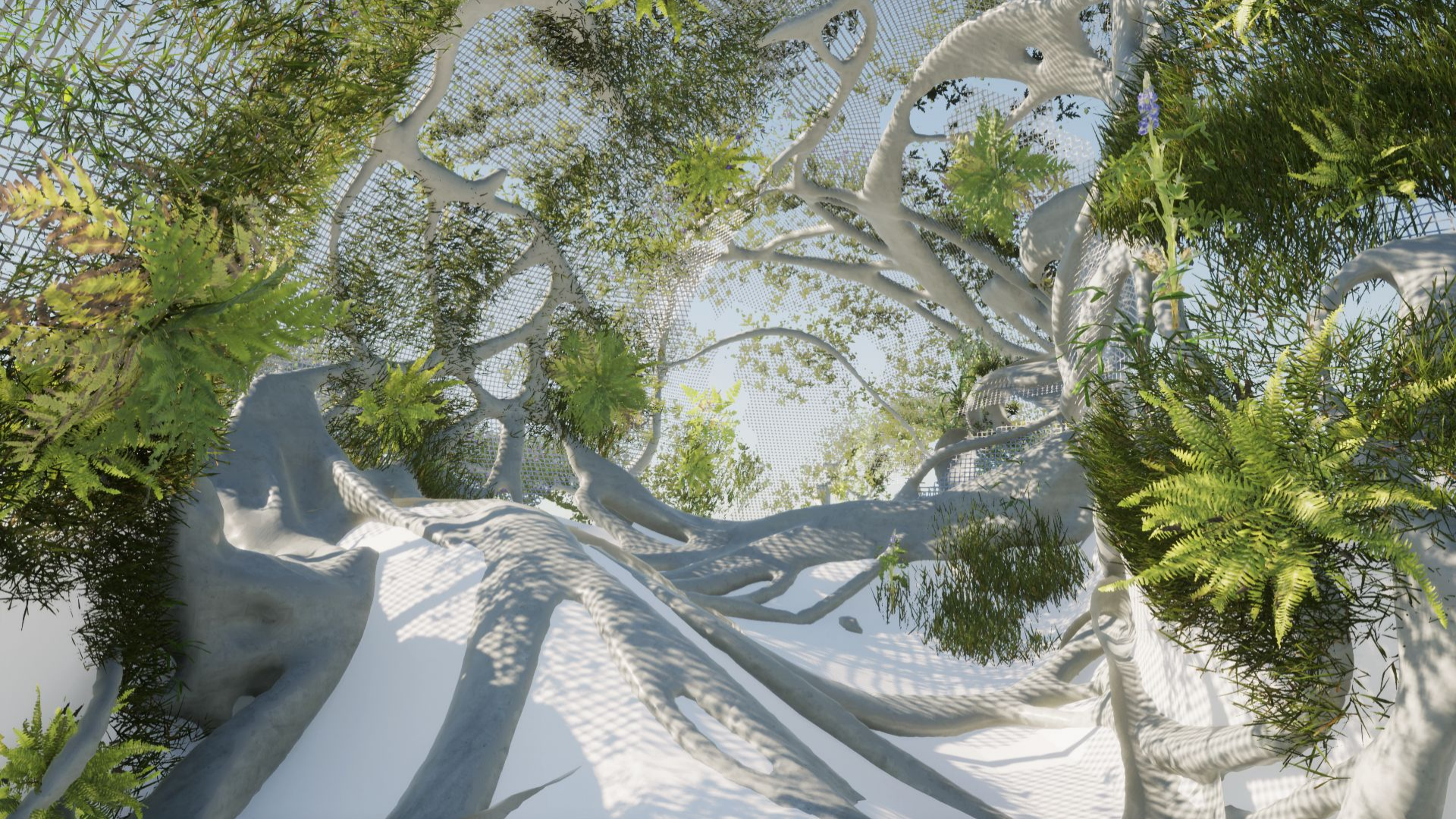


Section 4

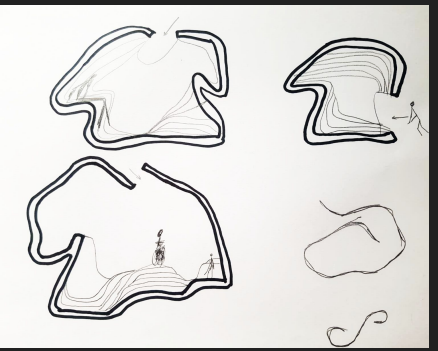


Spatial Optimization Studies



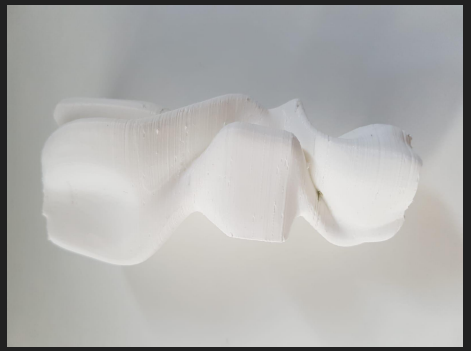


1. What is the input?



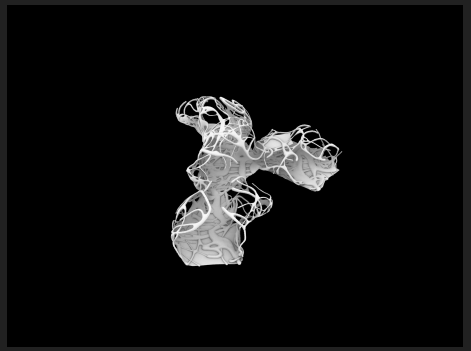
A series of architectural cross-sections based on users activities.

2. What is the result?



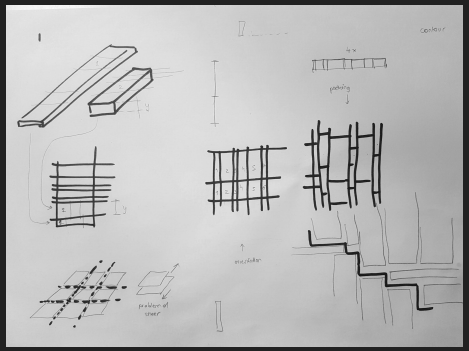
A differentiated volume, constantly dynamic in design.

3. What is the computational technique?



By applying a structural analysis, a system of optimized beams is created.

4. What is the robotic process explored?



Stacking of circular wood and preparing the milling toolpaths to prototype a fragment of a double-curved geometry.

Stacked wood prepared for milling

Robotic Arm

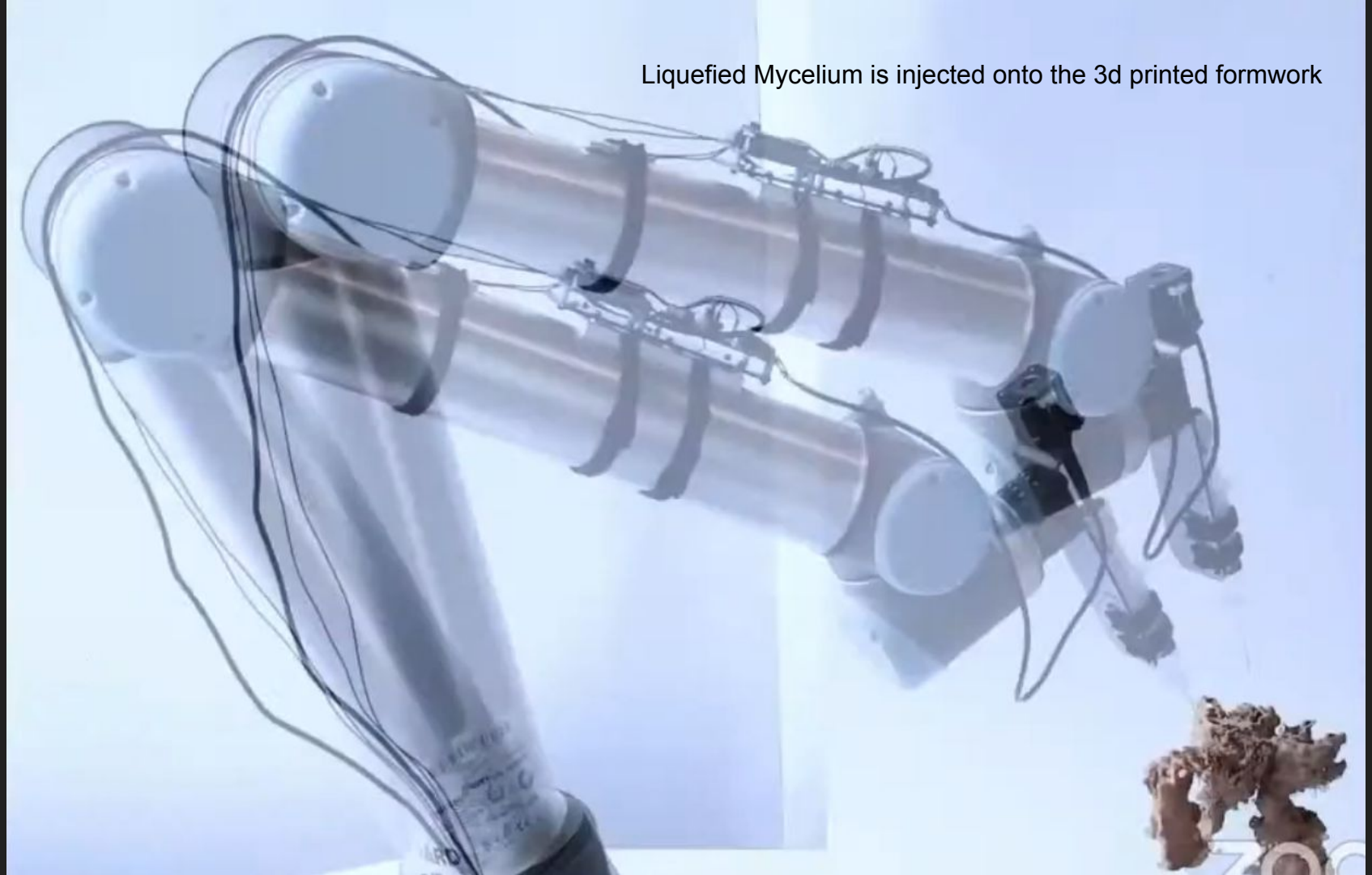
Milled wood

Wood powder

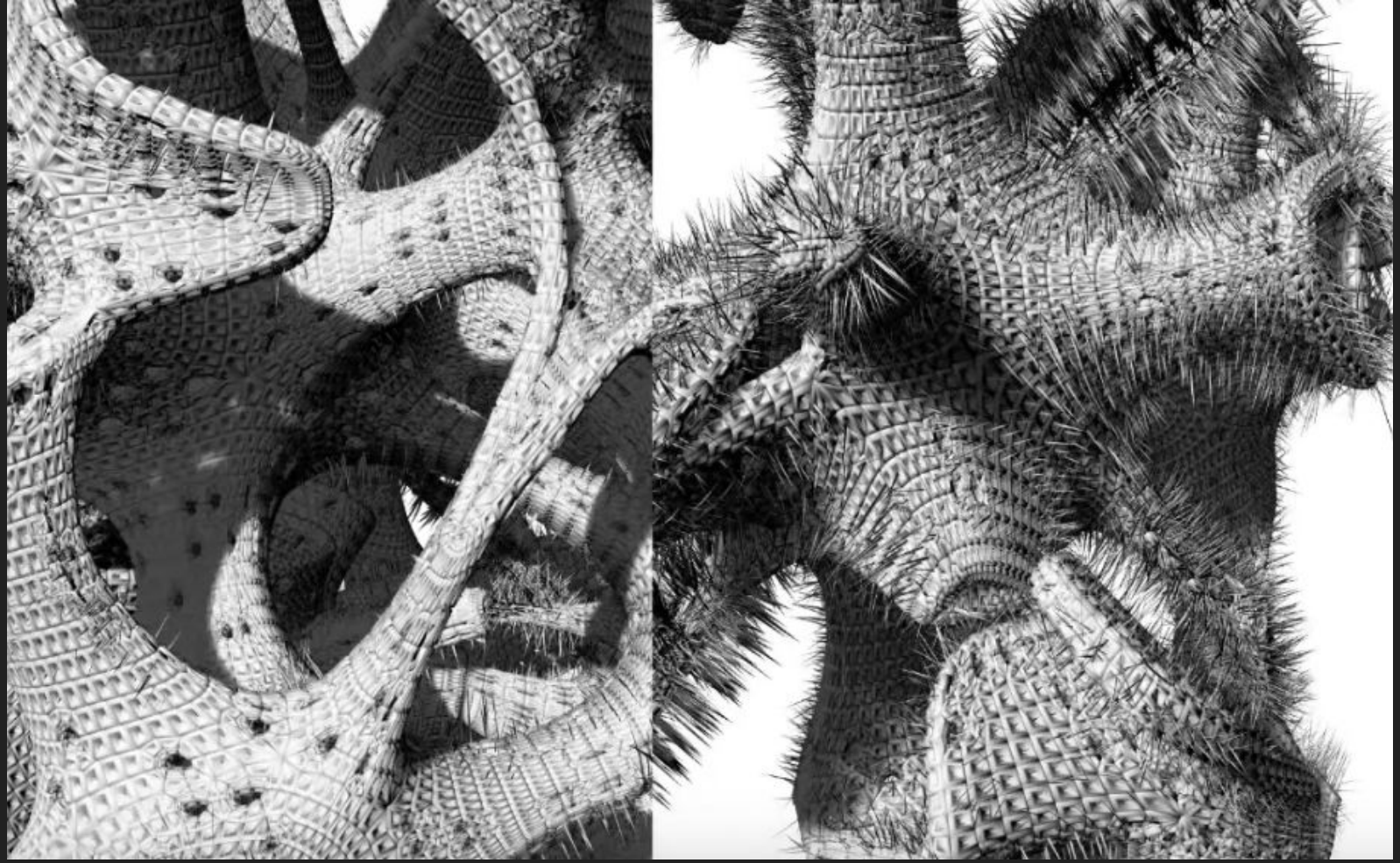
The Material components of Circular Milling

Prototype - Stacking and Milling
Source: cs.roboticbuilding.eu

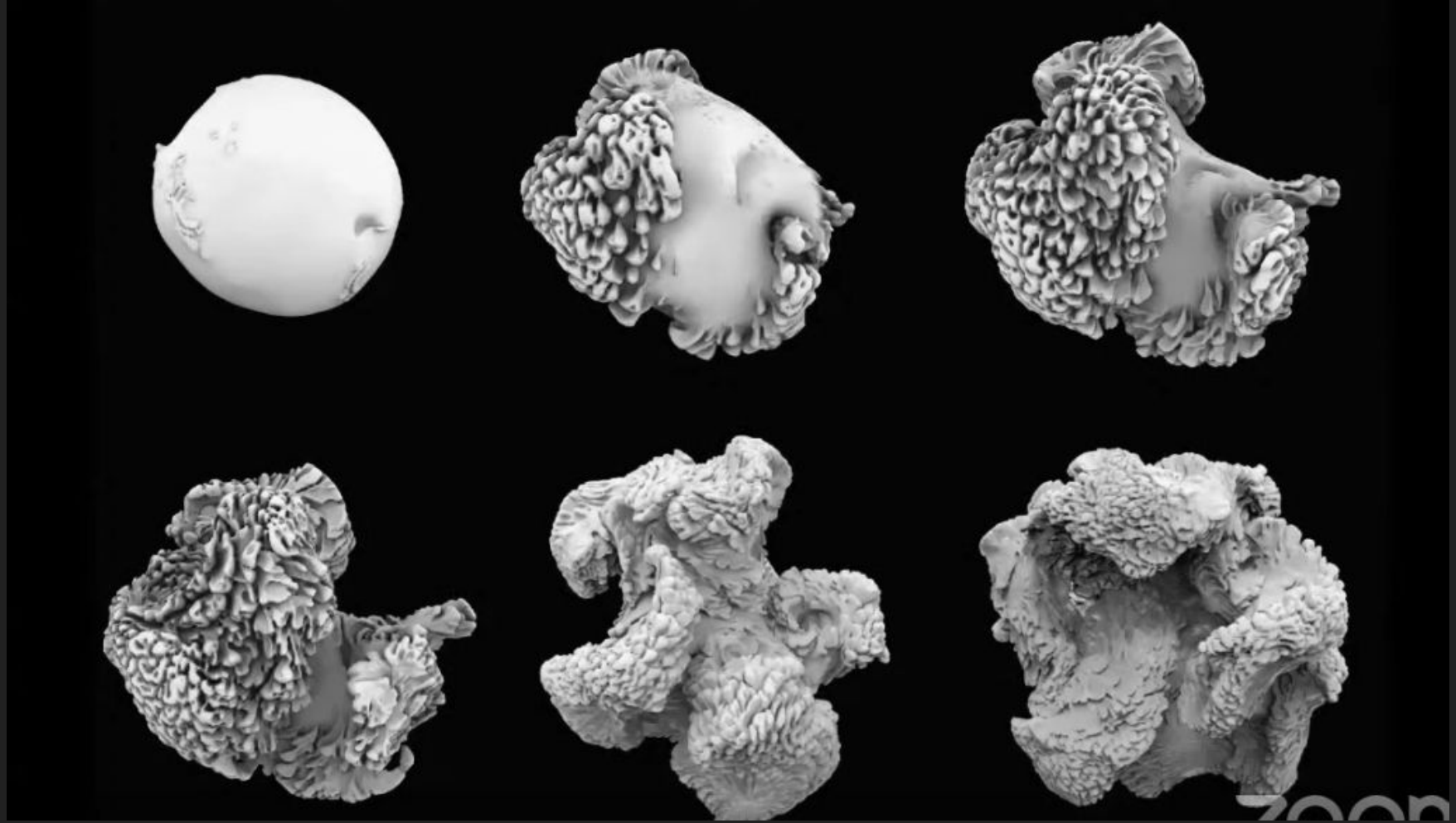
Heterogeneous structure 3d printed with the wood filament


Liquefied Mycelium is injected onto the 3d printed formwork

Mycellium is inserted into the form according to previous analysis.



Mycellium growth test. Mycellium is attracted to fibrous and porous structures.



Mycellium growth test. Smooth surfaces would prevent mycellium to grow vs porous surface encouraging growth.

Mycellium grows and degrades the entire structure adopting an overall geometry.

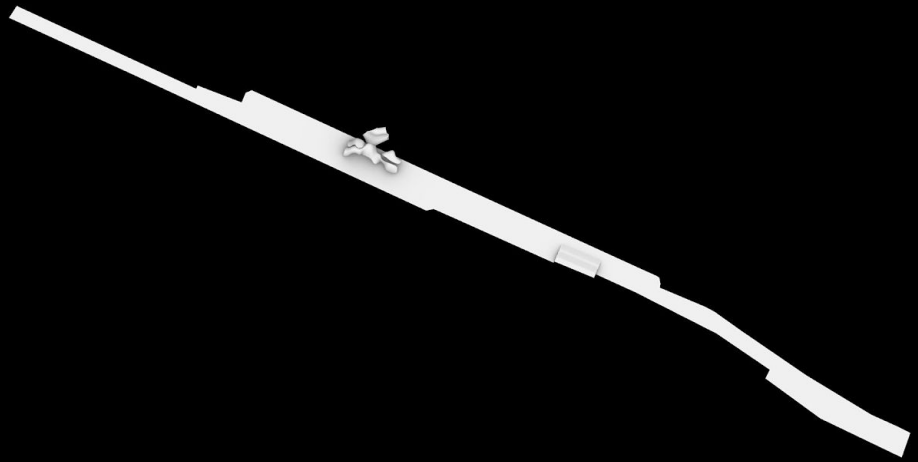
temporary

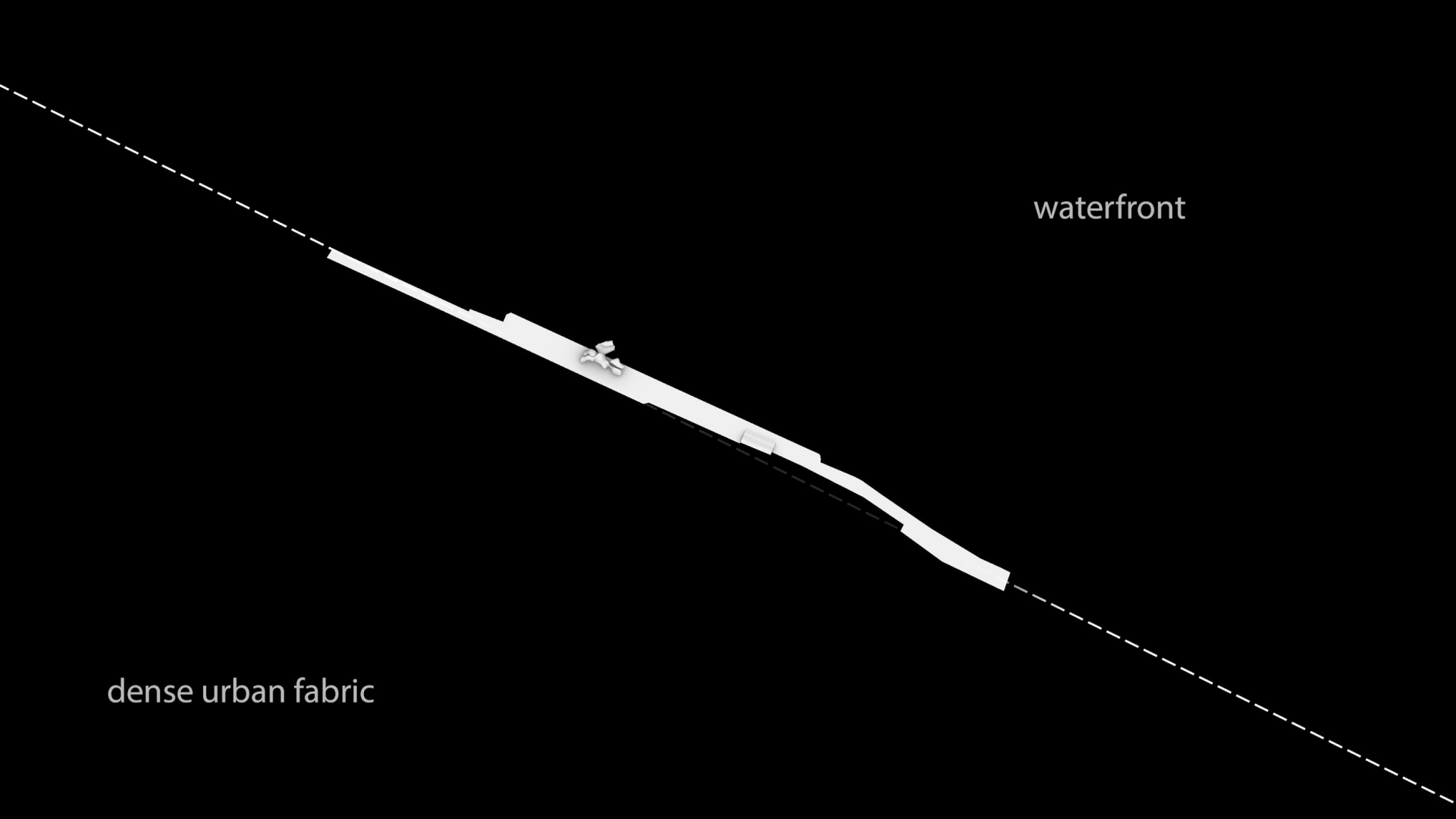
Street vendors, Paris

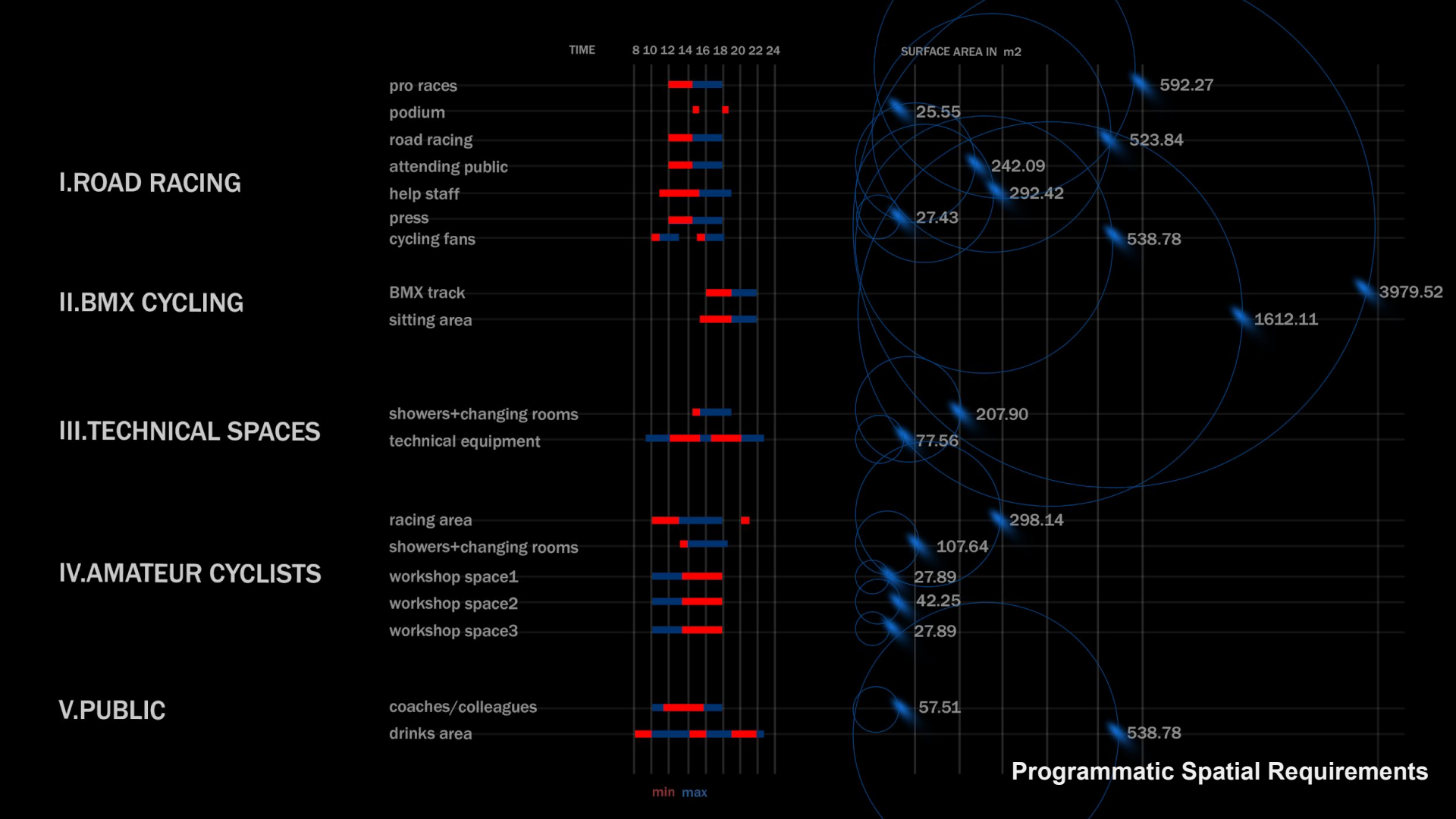
scalable porosity

Bio-Cyber-Physical Planetoid, Robotic Building Lab, TU Delft

site

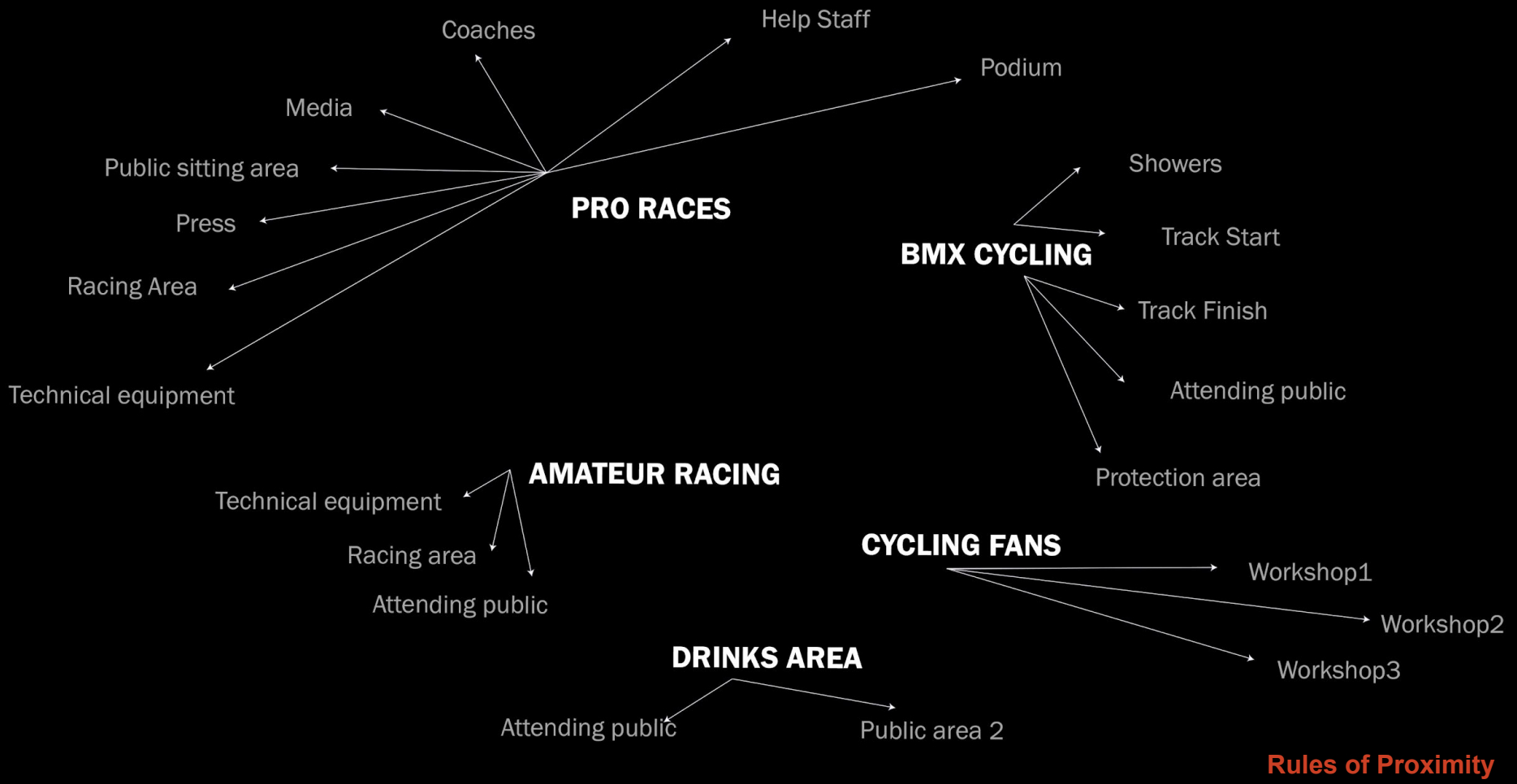



waterfront
dense urban fabric

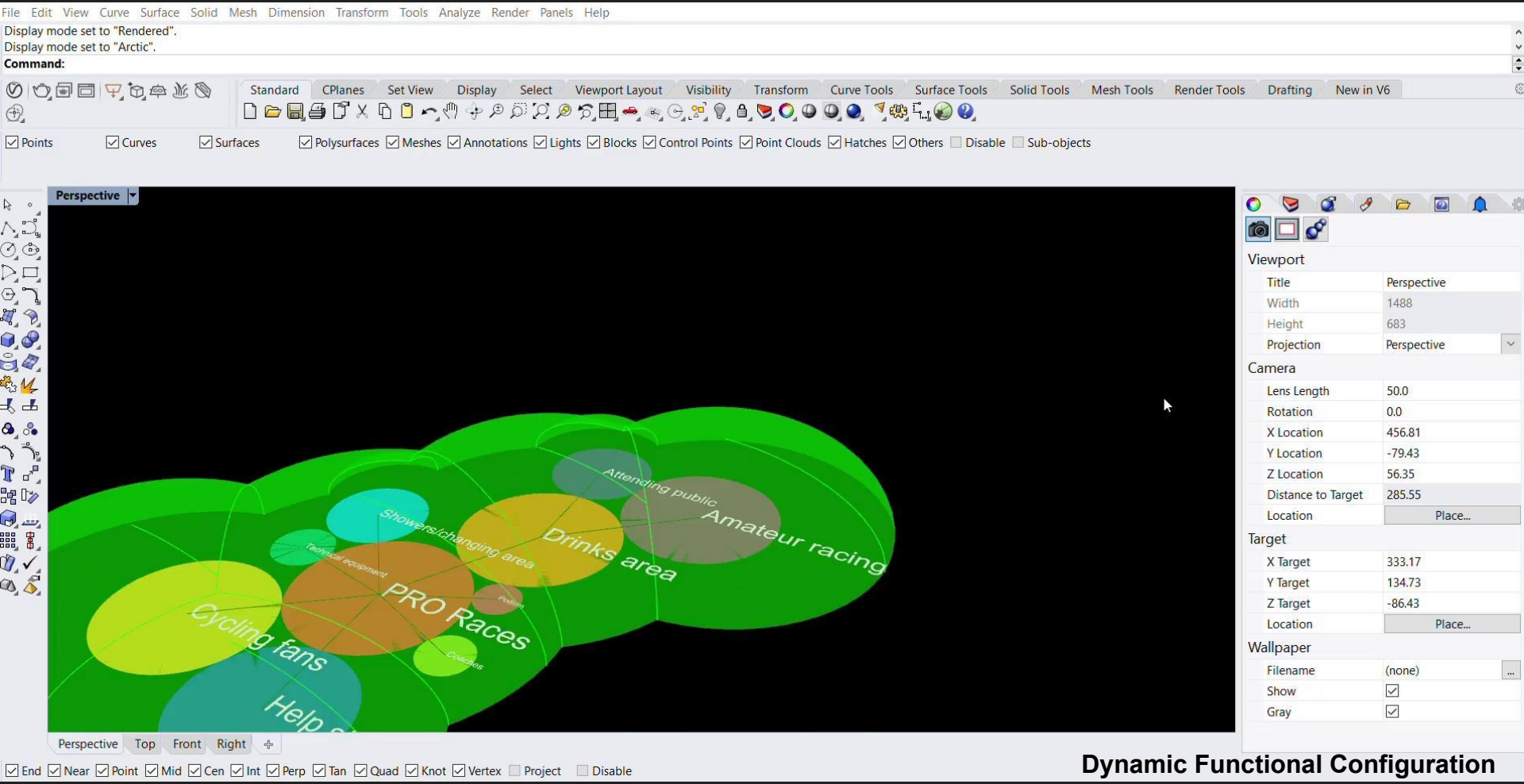

TIME
8 10 12 14 16 18 20 22 24
SURFACE AREA IN m2
I.ROAD RACING
pro races
podium
road racing
attending public
help staff
press
cycling fans
592.27
25.55
523.84
242.09
292.42
27.43
538.78
II.BMX CYCLING
BMX track
sitting area
3979.52
1612.11
III.TECHNICAL SPACES
showers+changing rooms
technical equipment
207.90
77.56
IV.AMATEUR CYCLISTS
racing area
showers+changing rooms
workshop space1
workshop space2
workshop space3
298.14
107.64
27.89
42.25
27.89
V.PUBLIC
coaches/colleagues
drinks area
57.51
538.78
min max
Programmatic Spatial Requirements

flexible

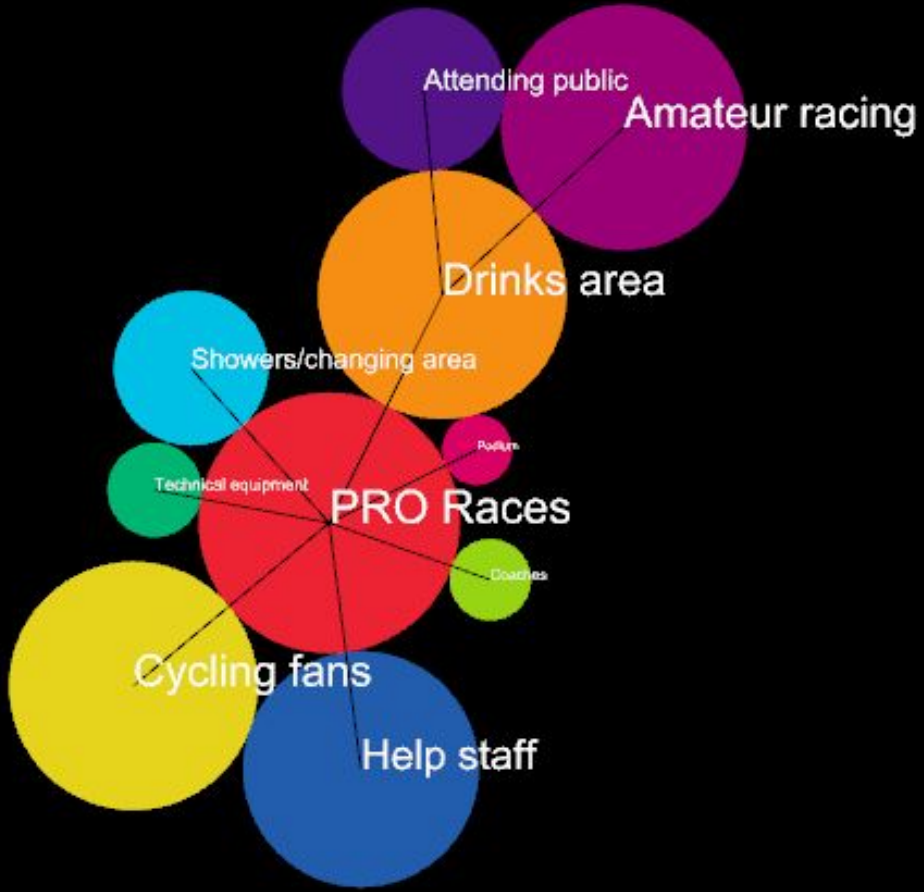
Yokohoma Terminail, FOA

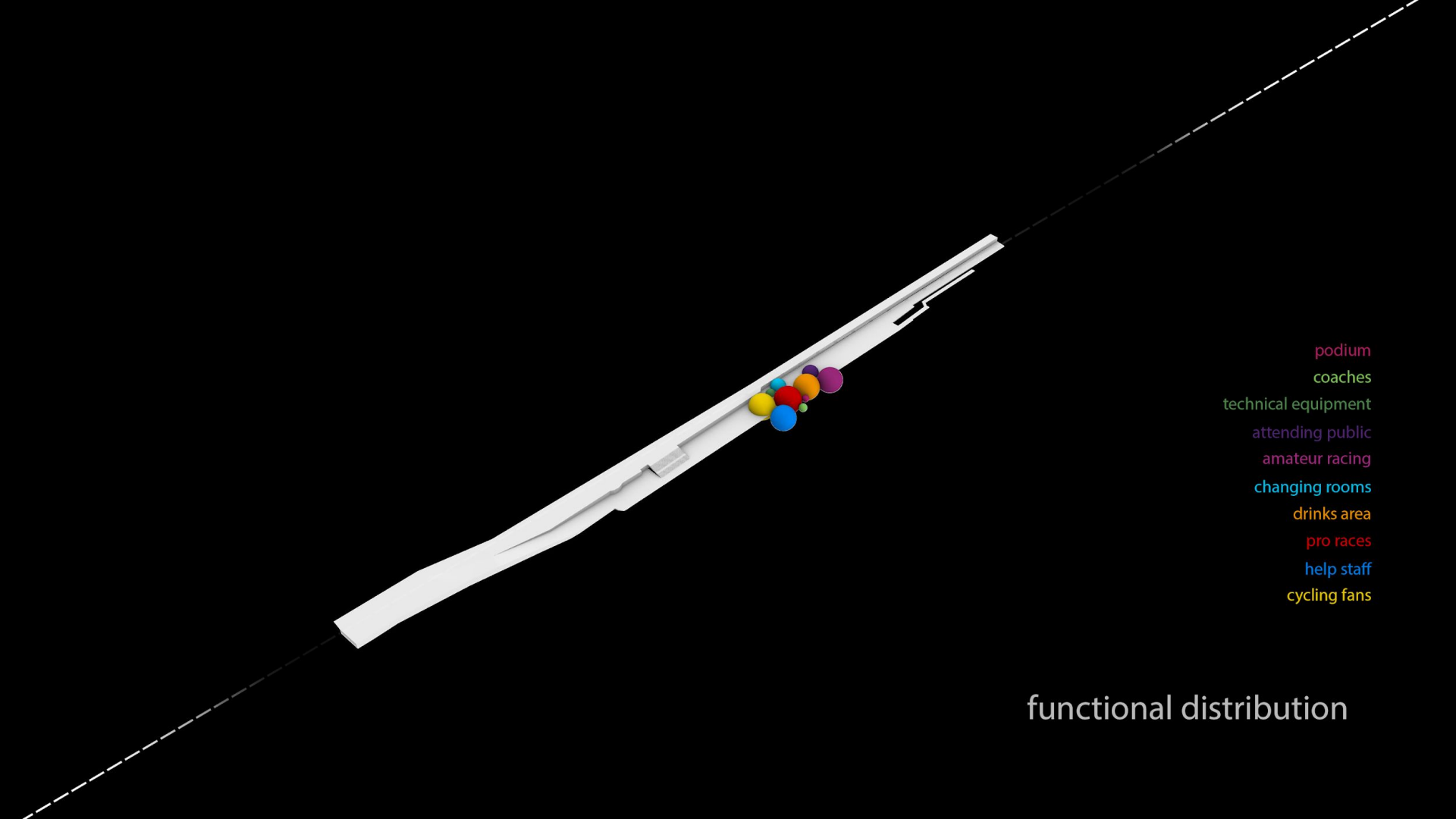


Rules of Proximity



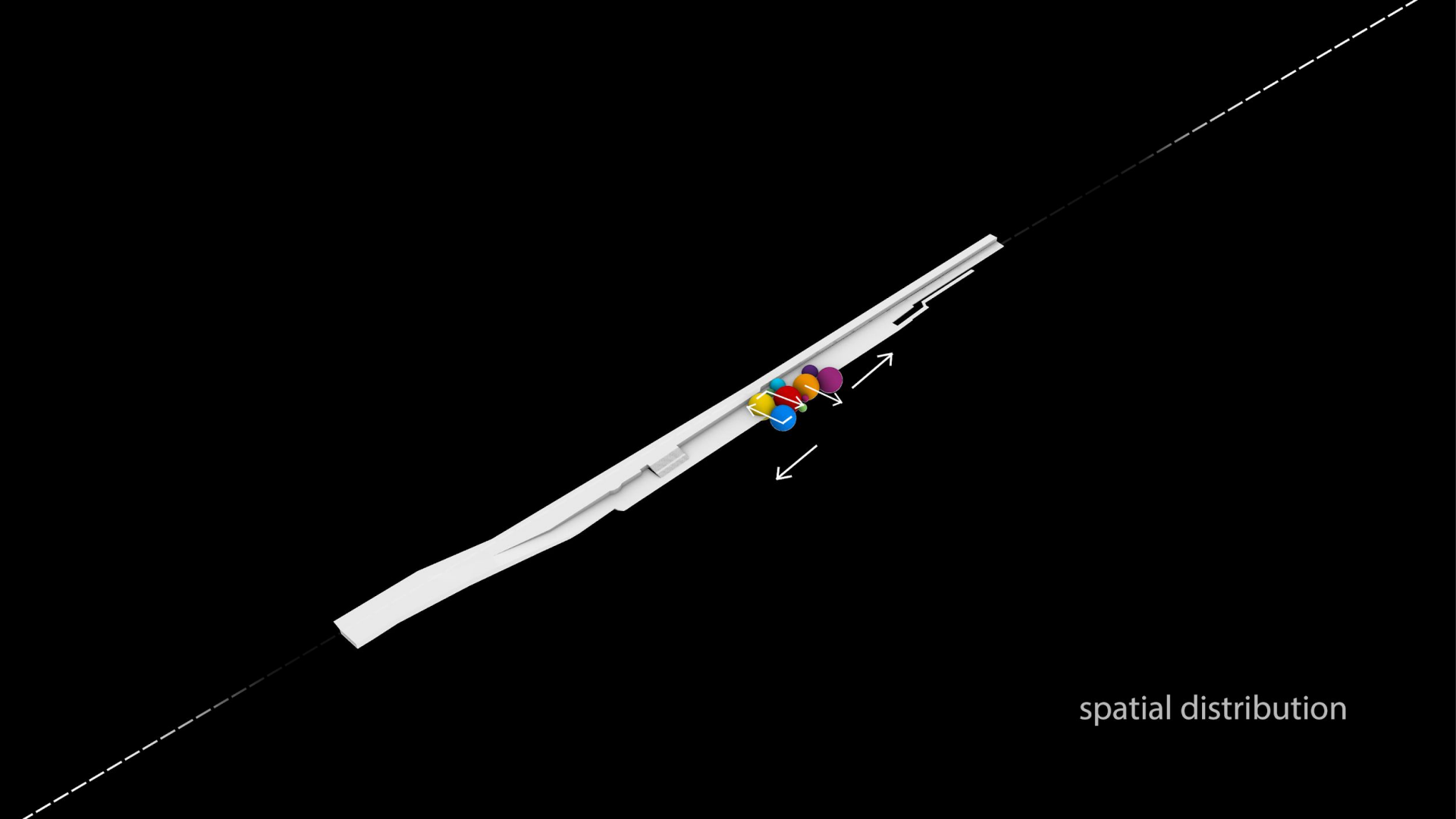
Dynamic Functional Configuration


Attending public
Amateur racing
Drinks area
Showers/changing area
Podium
Technical equipment
PRO Races
Clothes
Cycling fans
Help staff



functional distribution

Voronoi rationalization of the Functional Diagram


spatial distribution


1500sm

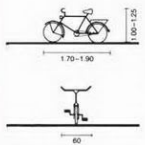
BICYCLE PARKING

Dimensions of bicycles → ①–②. Note allowances for baskets and children's seats. Include space for special types: recumbent bikes up to 2.35 m long; tandems up to 2.60 m; bicycle trailers (with shaft) approx. 1.60 m long, 1.00 m wide; bikes adapted for disabled people and for delivering goods.

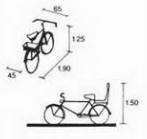
Offer comfortable parking → ③ wherever possible: narrow parking can cause injury, soiling and damage during locking/loading. Double rows with overlapping front wheels can save space.

Cycle stands must give steady support, even when loading the bike. Locking should be possible using only one 'U' lock, securing the front wheel and the frame to the stand at the same time. Tubular stands are therefore suitable → ⑨. Provide an intermediate bar for children's bikes. Stands should be 1.20 m apart with access lanes 1.50–1.80 m wide → ⑦–⑨. Cycle stands which do not provide sensible locking opportunities only suitable for internal use in areas of restricted access.

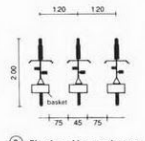
General installation design should be clear and user-friendly: close to the destination, easy to find and approach. For long-term parking, consider roofing and lighting → p. 219. Supervision is advisable at railway stations, sports grounds, shopping centres etc.



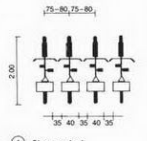
① Basic bicycle dimensions



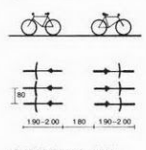
② Bicycle with basket/child's seat



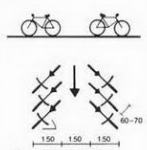
③ Bicycle parking: ample space



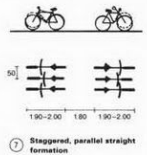
④ Close packed



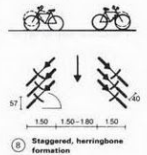
⑤ Basic layout parallel in straight lines



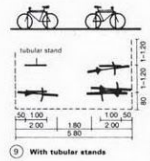
⑥ Parallel, herringbone formation



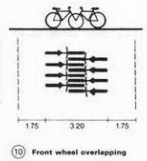
⑦ Staggered, parallel straight formation



⑧ Staggered, herringbone formation



⑨ With tubular stands

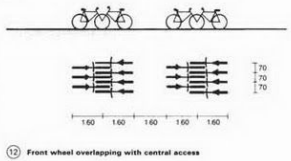


⑩ Front wheel overlapping

apartments	1 per 30 m² total living area
visitors to apartments	1 per 200 m² total living area
student residential halls	1 per bed
secondary schools	0.7 per pupil place
colleges of further educ.	0.5 per student place
lecture theatres	0.7 per seat
libraries	1 per 40 m
college canteens	0.3 per seat
places of work	0.3 per employee
shops for daily supplies	1 per 25 m² sales area
shopping centres	1 per 80 m² sales area
retail units for	1 per 35 m² sales area
professional offices, doctors' practices	0.2 per client on premises
sports arenas, halls, indoor swimming pools	0.5 per clothes locker
regional gathering places	1 per 20 visitor places
other gathering places	1 per 7 visitor places
local restaurants	1 per 7 seats
beer gardens	1 per 2 seats

If several uses happen at the same time in a building, then the totals for the different uses should be added up.

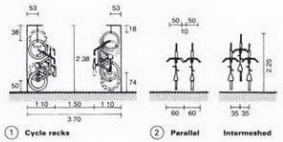
⑪ Guide values for capacity of cycle parking



⑫ Front wheel overlapping with central access

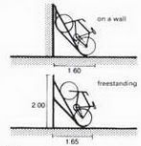
BICYCLE PARKING AND CYCLE PATHS

Basic space requirements for cyclists are made up of the bicycle width (0.60 m) and the height allowed for the rider → ⑤ plus the necessary room for manoeuvre under various conditions. Although the minimum width of a single-lane cycle path is 1.00 m, it is preferable to increase this to 1.40–1.60 m, particularly where riders could be travelling at higher speeds. Where traffic is two way, an ideal width of 1.60–2.00 m allows oncoming cyclists to pass each other safely as well as making it easy to overtake slower riders.

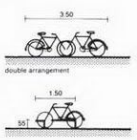


① Cycle racks

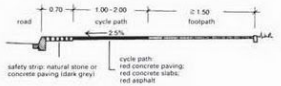
② Parallel Intermeshed

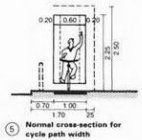


③ Tilted racks

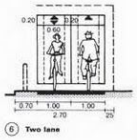


④ With frame holder

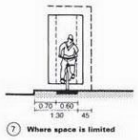




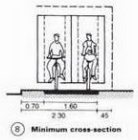
⑤ Normal cross-section for cycle path width



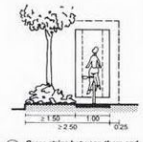
⑥ Two lane



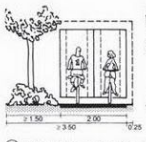
⑦ Where space is limited



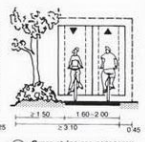
⑧ Minimum cross-section



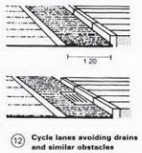
⑨ Grass strips between them and the road are a good solution



⑩ Most suitable arrangement

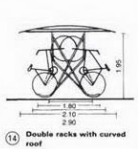


⑪ Grass strips are necessary with two-way traffic

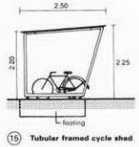


⑫ Cycle lanes avoiding drains and similar obstacles

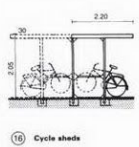
⑬ Weather protection roof – curved roof



⑭ Double racks with curved roof



⑮ Tubular framed cycle shed

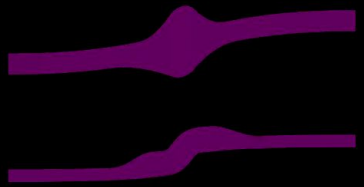


⑯ Cycle sheds

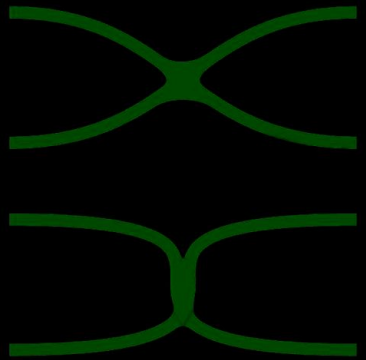
Quickly returning to the ground by the waterfront

Quickly returning to the ground , urban side

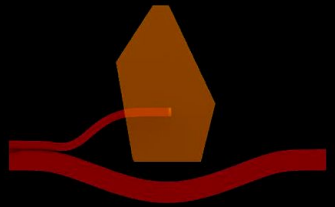
Cross connection with elevation change



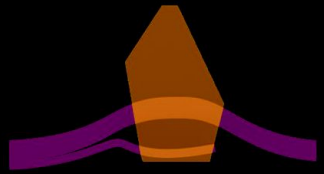
Sudden change of flow



Cross from a side to the other of the site, from space to space



Around a space but directed to another one

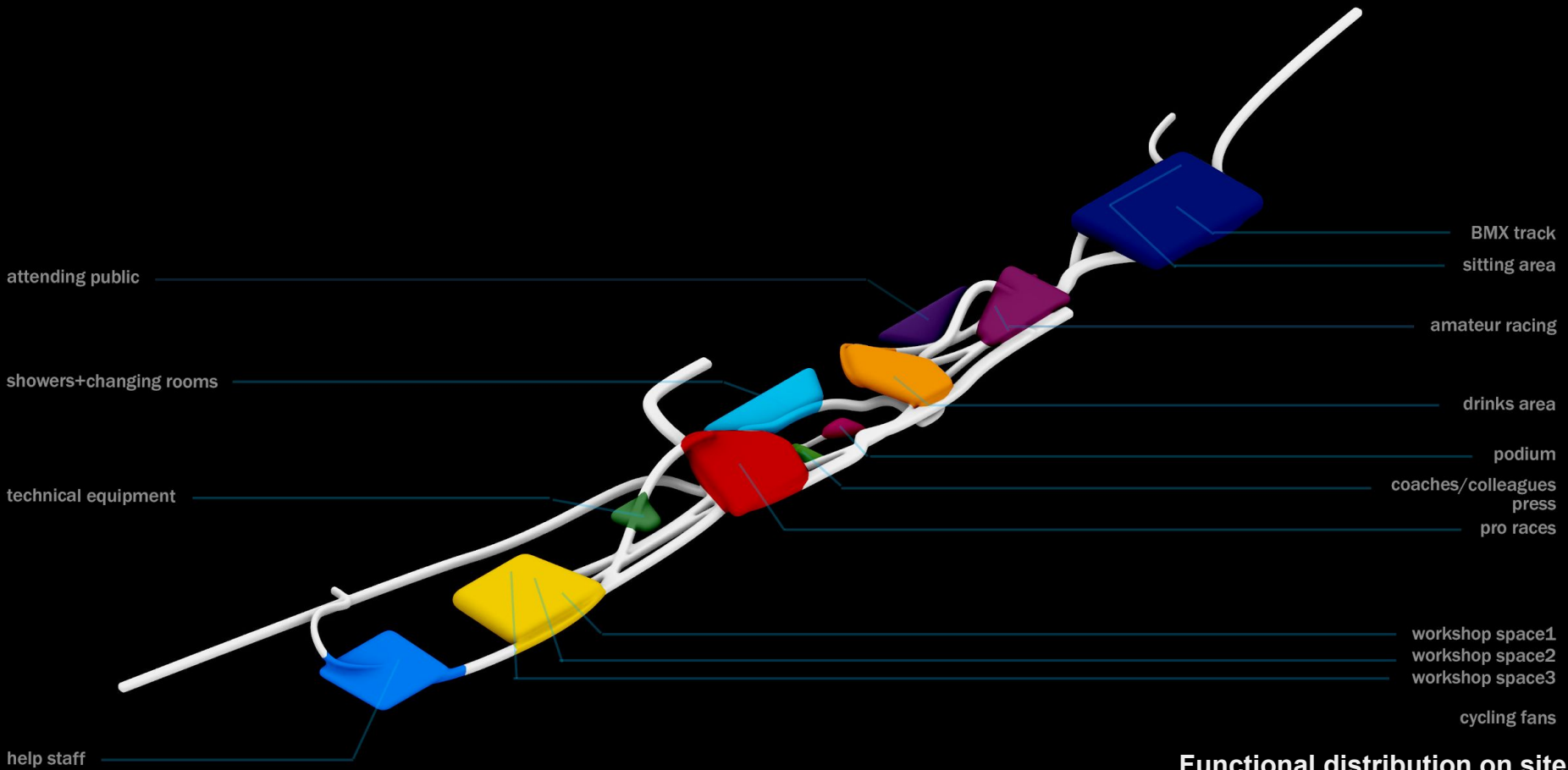


Path under a space with possible access inside

Connecting separate levels and not parallel entrances

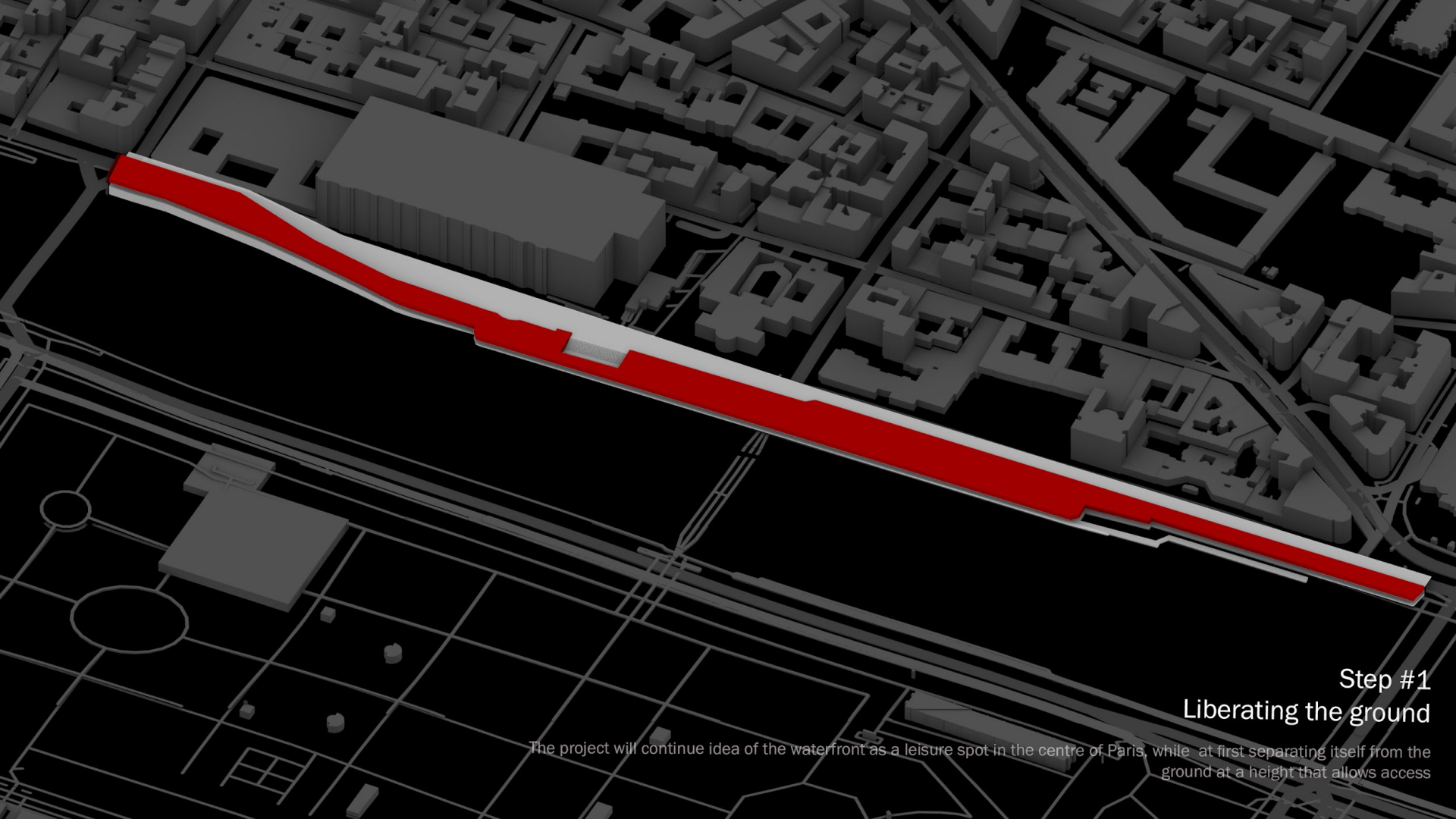
Stream division

Program-specific flows



Functional distribution on site

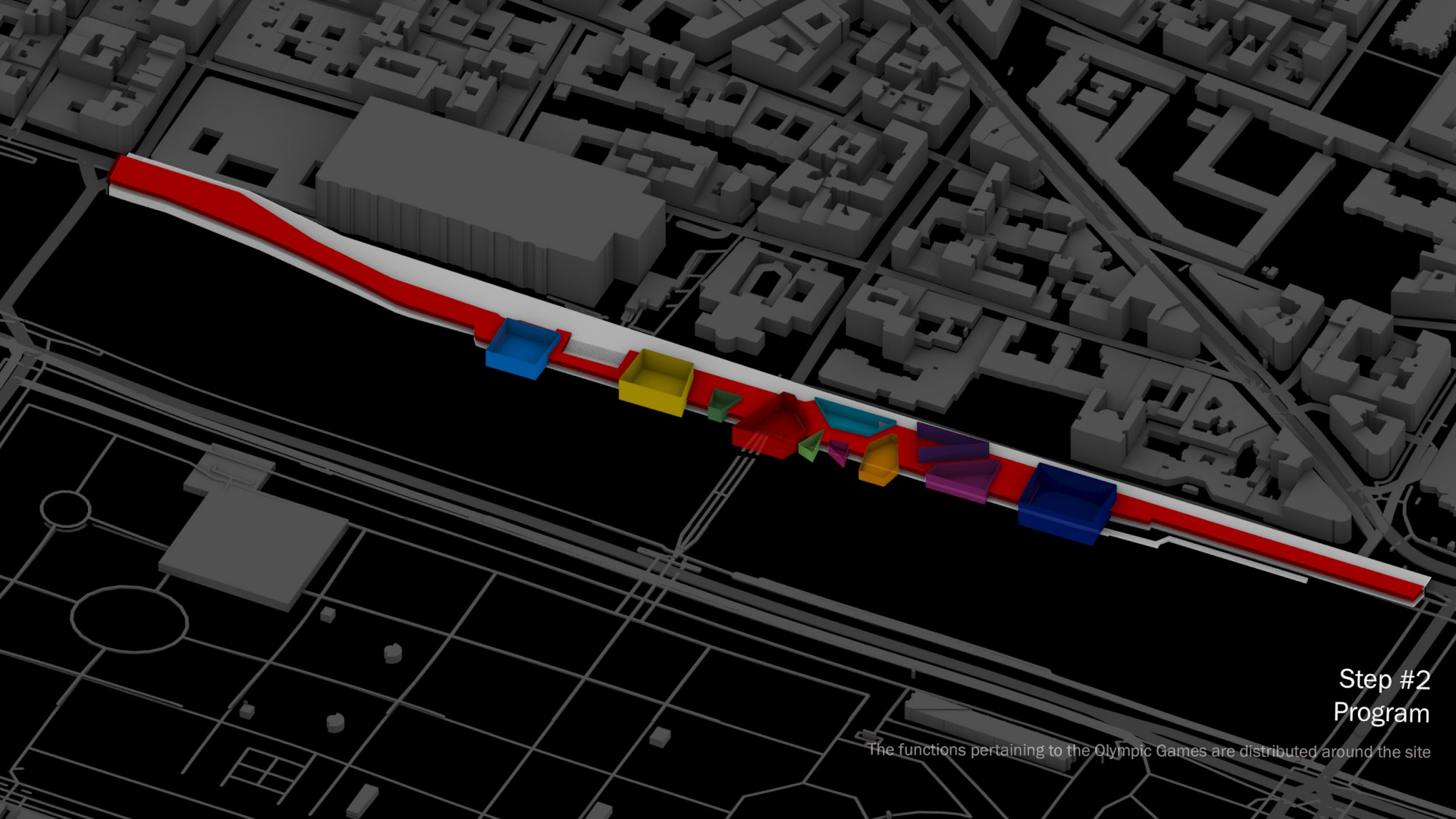
“The ground is no more. There are too many needs to be realized on only one plane. The idea of a datum level, the absolute of the horizontal, has been abandoned.” (Koolhaas 2000)



Step #1
Liberating the ground

The project will continue idea of the waterfront as a leisure spot in the centre of Paris, while at first separating itself from the ground at a height that allows access

Jussieu Libraries, OMA

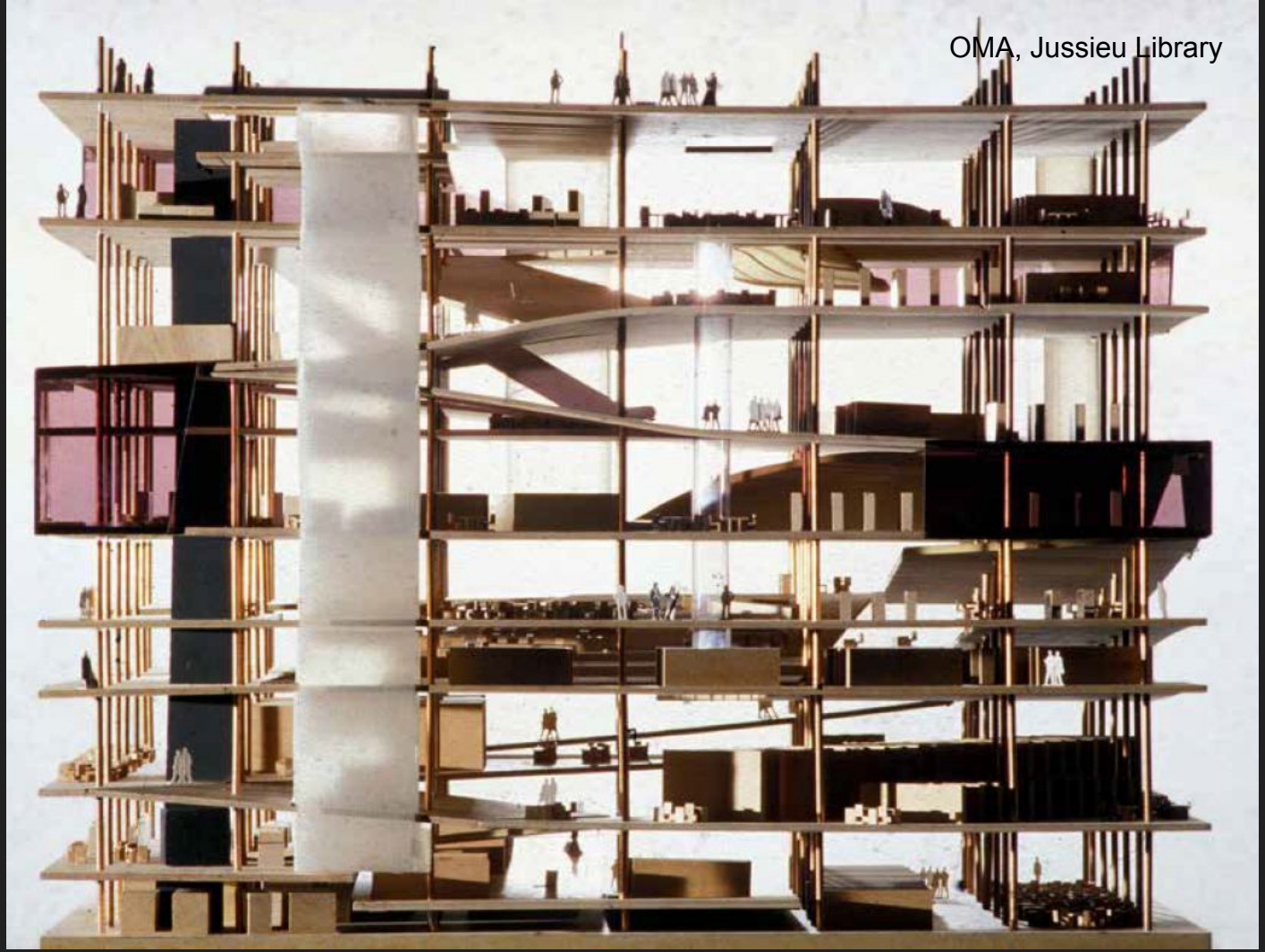


Step #2
Program

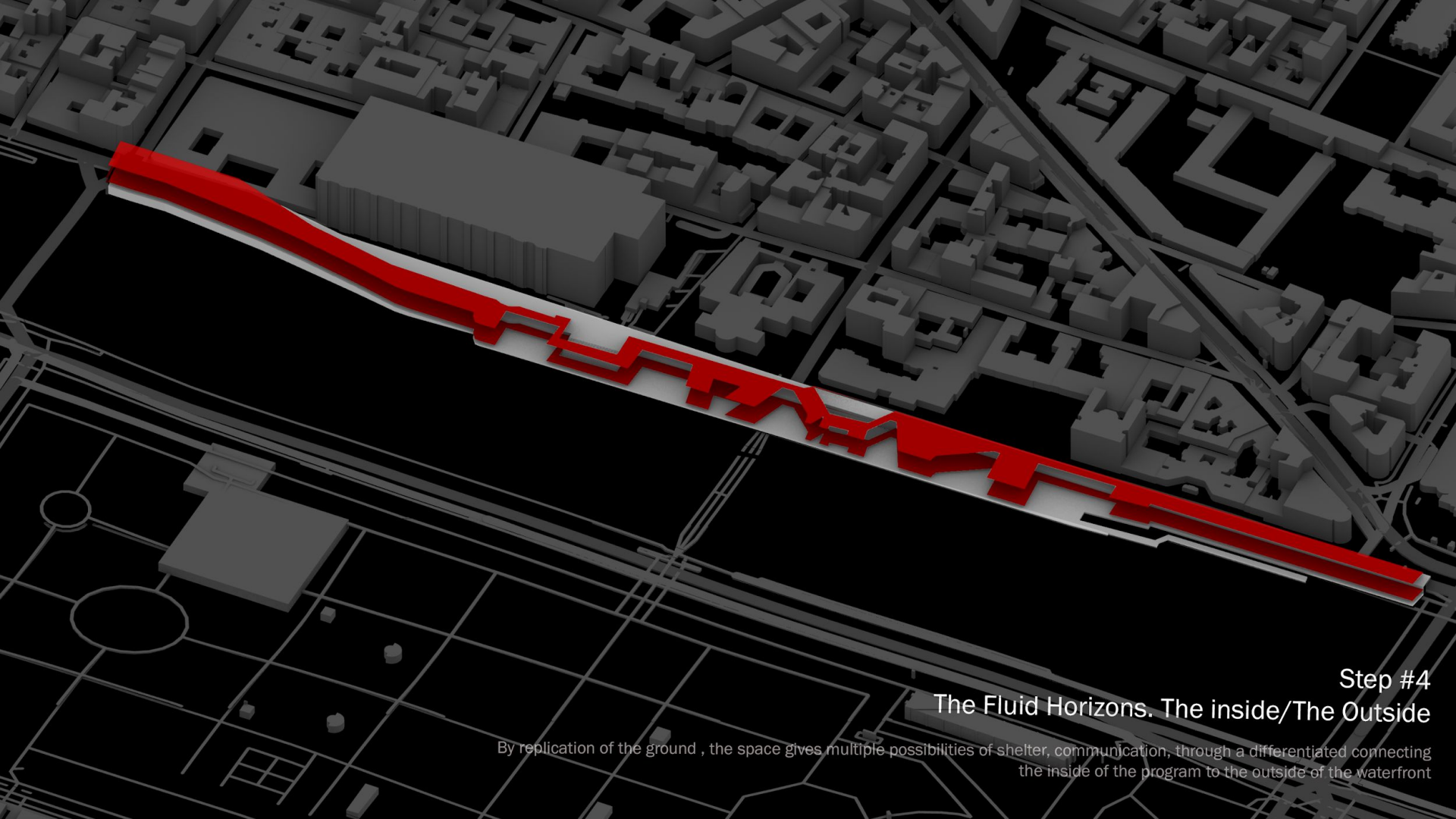
The functions pertaining to the Olympic Games are distributed around the site

Step #3
The negative space as social connector

Using a simple Boolean process, the program is visualized at the intersection of positive and negative space

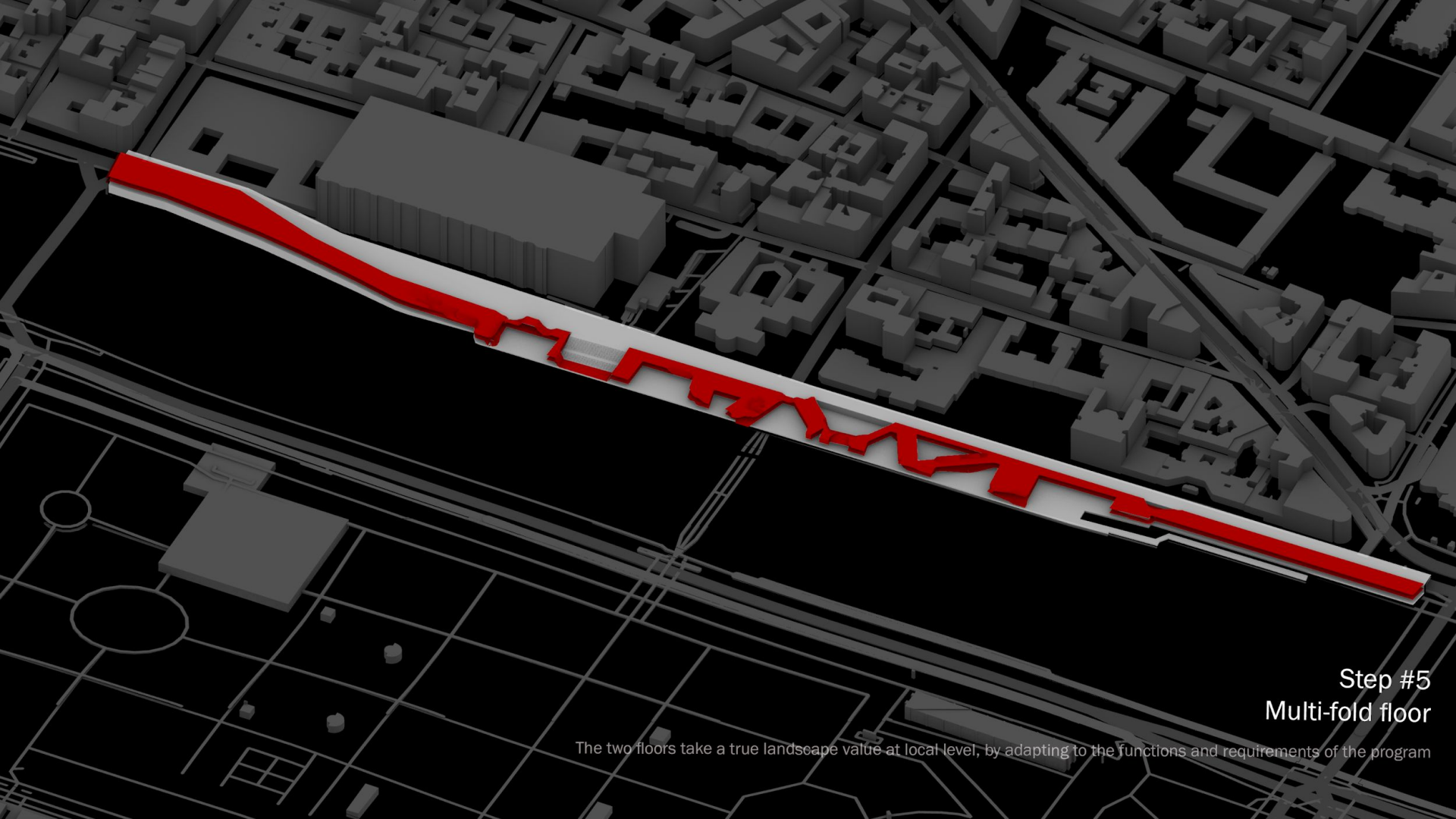


OMA, Jussieu Library



Step #4
The Fluid Horizons. The inside/The Outside

By replication of the ground , the space gives multiple possibilities of shelter, communication, through a differentiated connecting the inside of the program to the outside of the waterfront

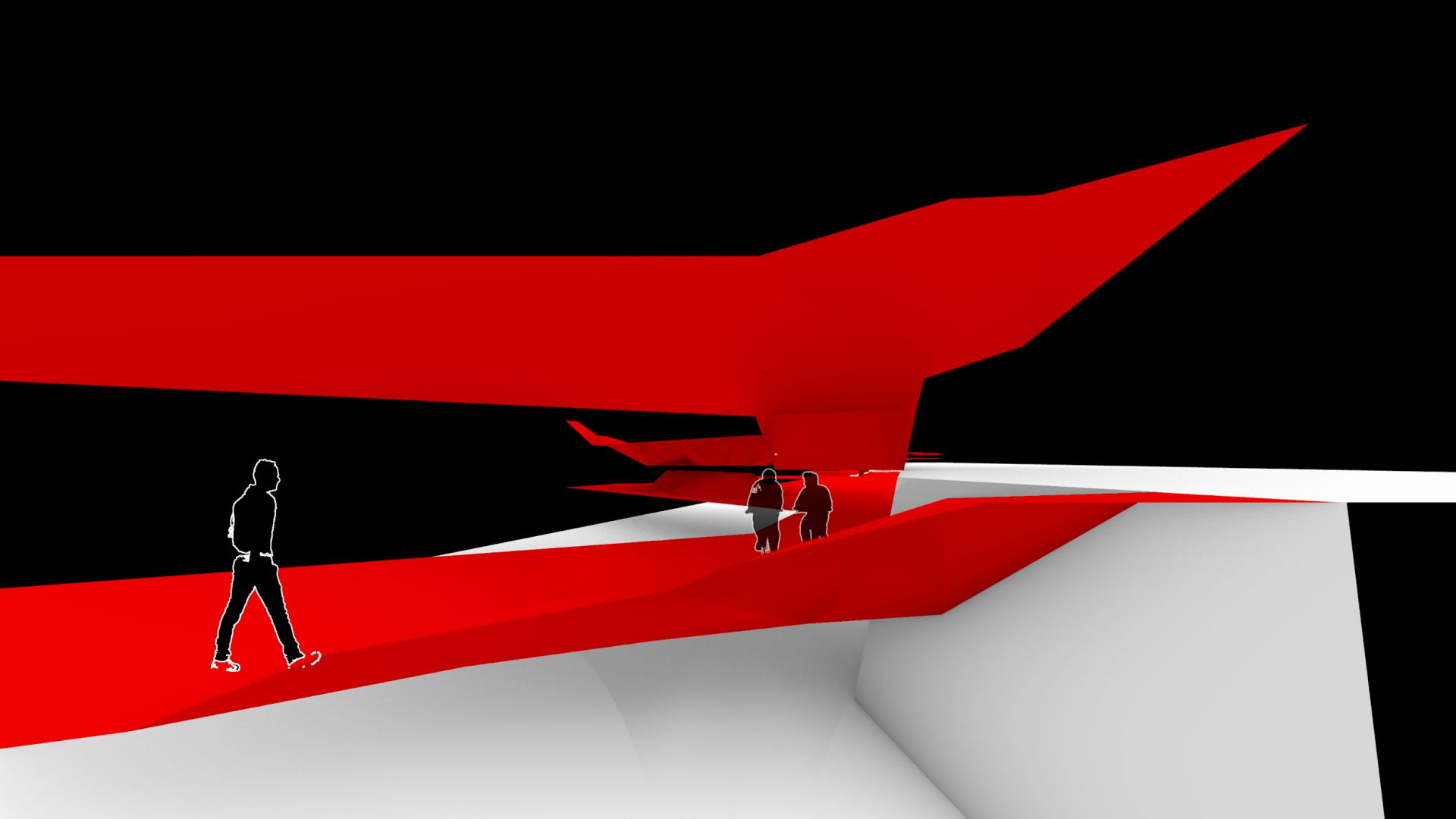


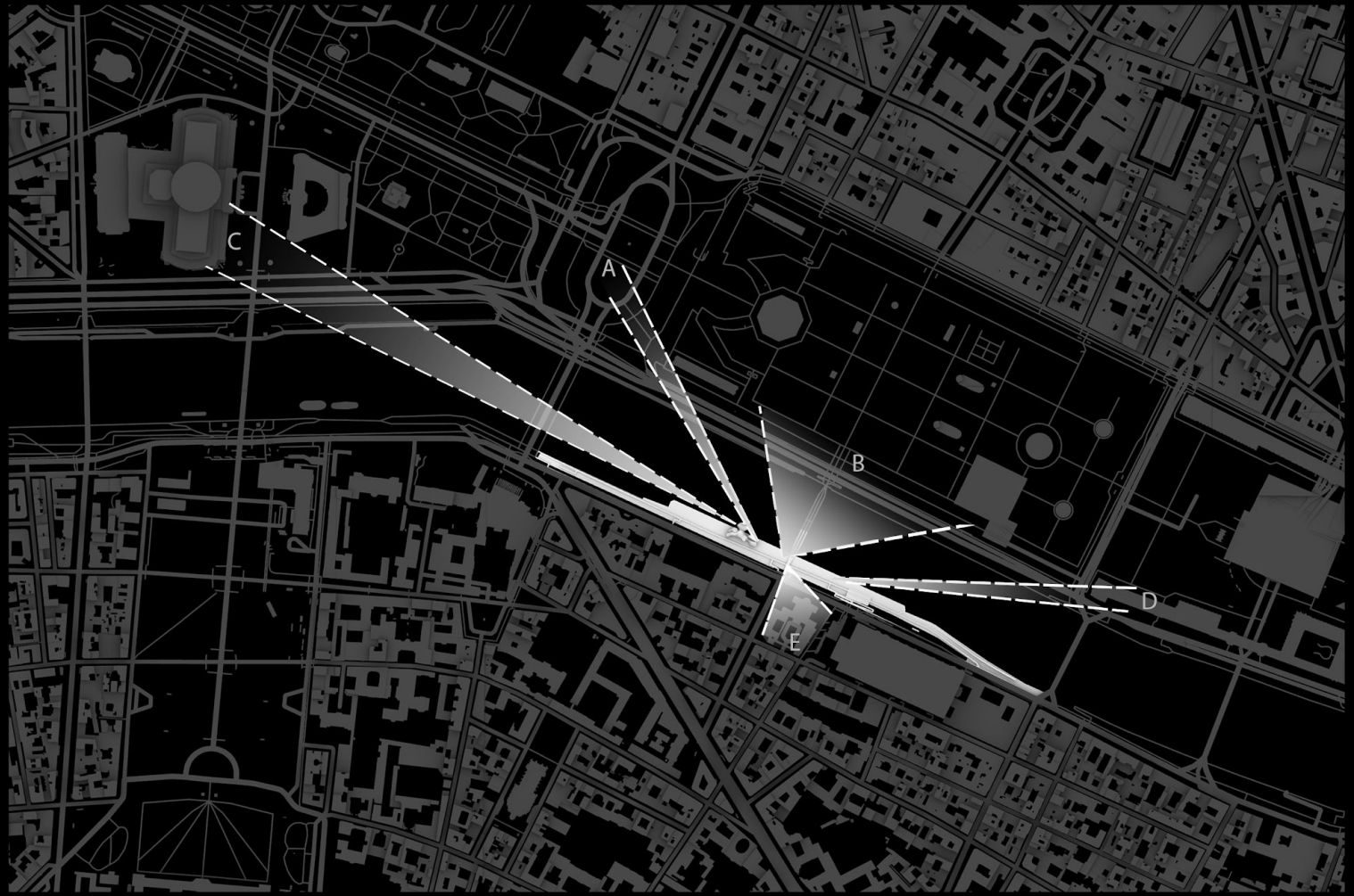
Step #5
Multi-fold floor

The two floors take a true landscape value at local level, by adapting to the functions and requirements of the program

“...the primary perception of structure has always been that it should be vertical. A **reconceptualization of ground** and verticality in light of complex vectors and movements might not change the expediency and need for level floors, but it would open up possibilities for structure and support that take into account orientations other than the simply vertical”

Greg Lynn, Animate form





A Fontaine des Mers

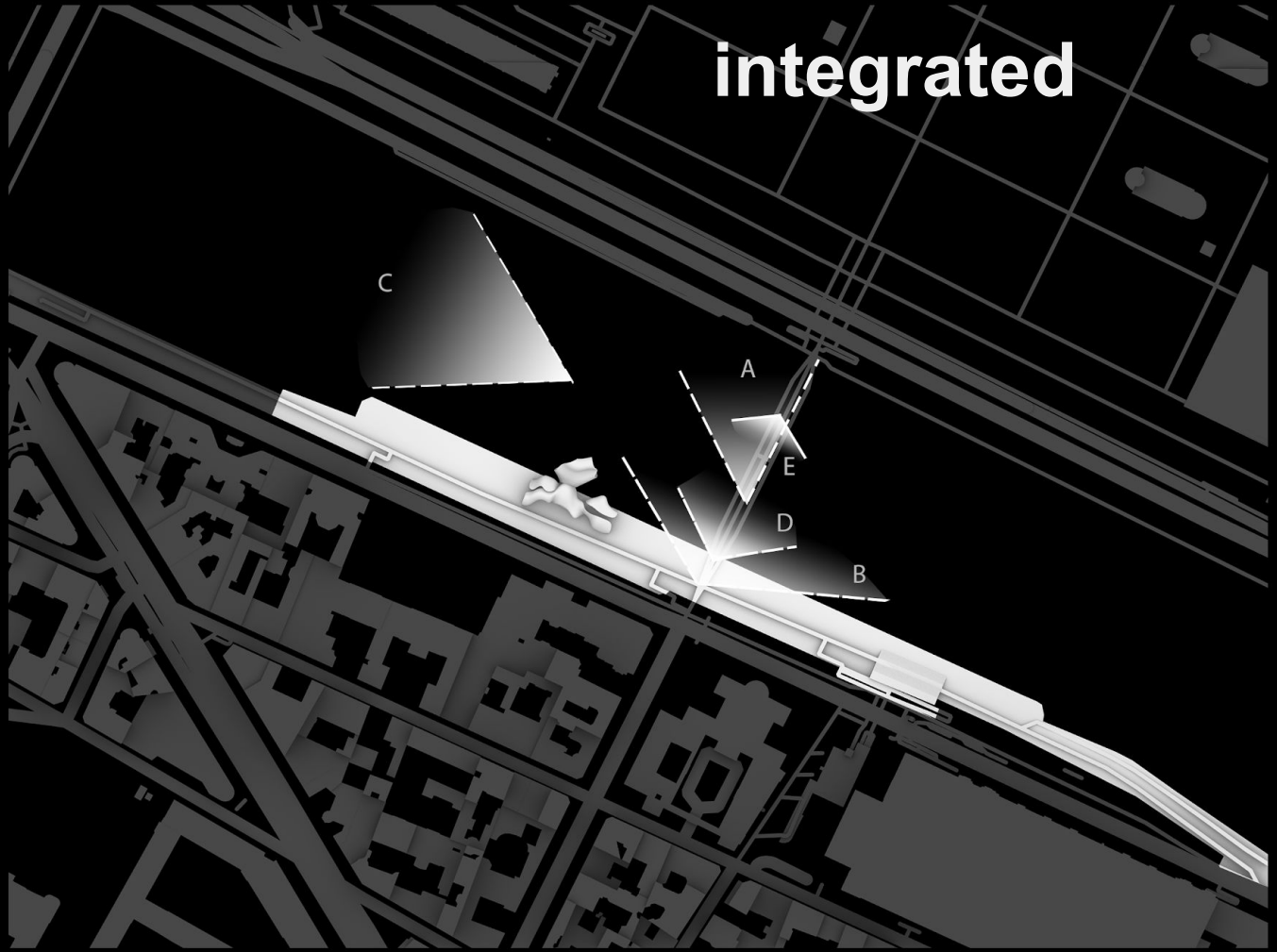
B Versaille Gardens

C Grand Palais

D Ecole du Louvre

E Musee d'Orsay

integrated



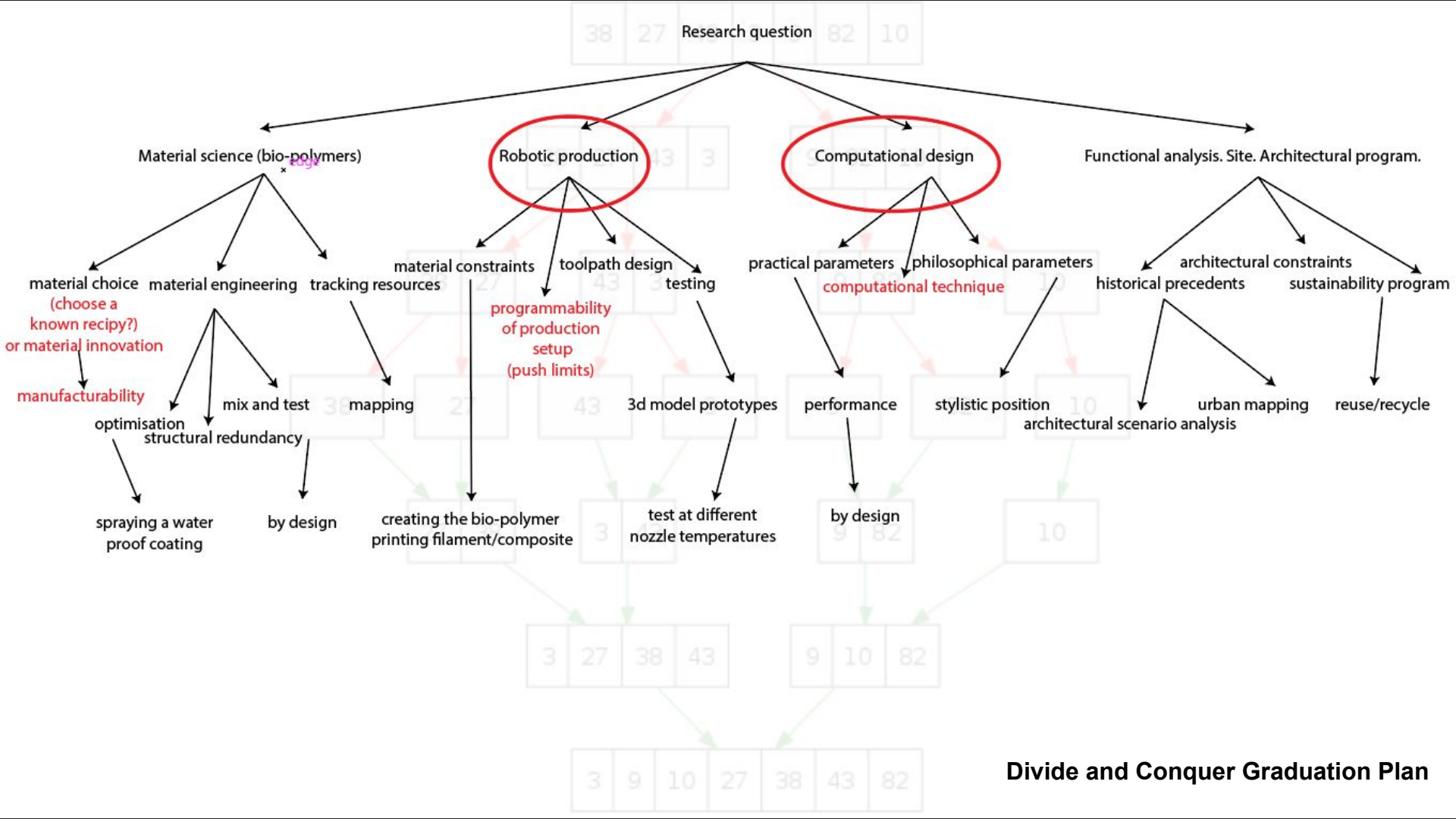
A

B

C

D

E

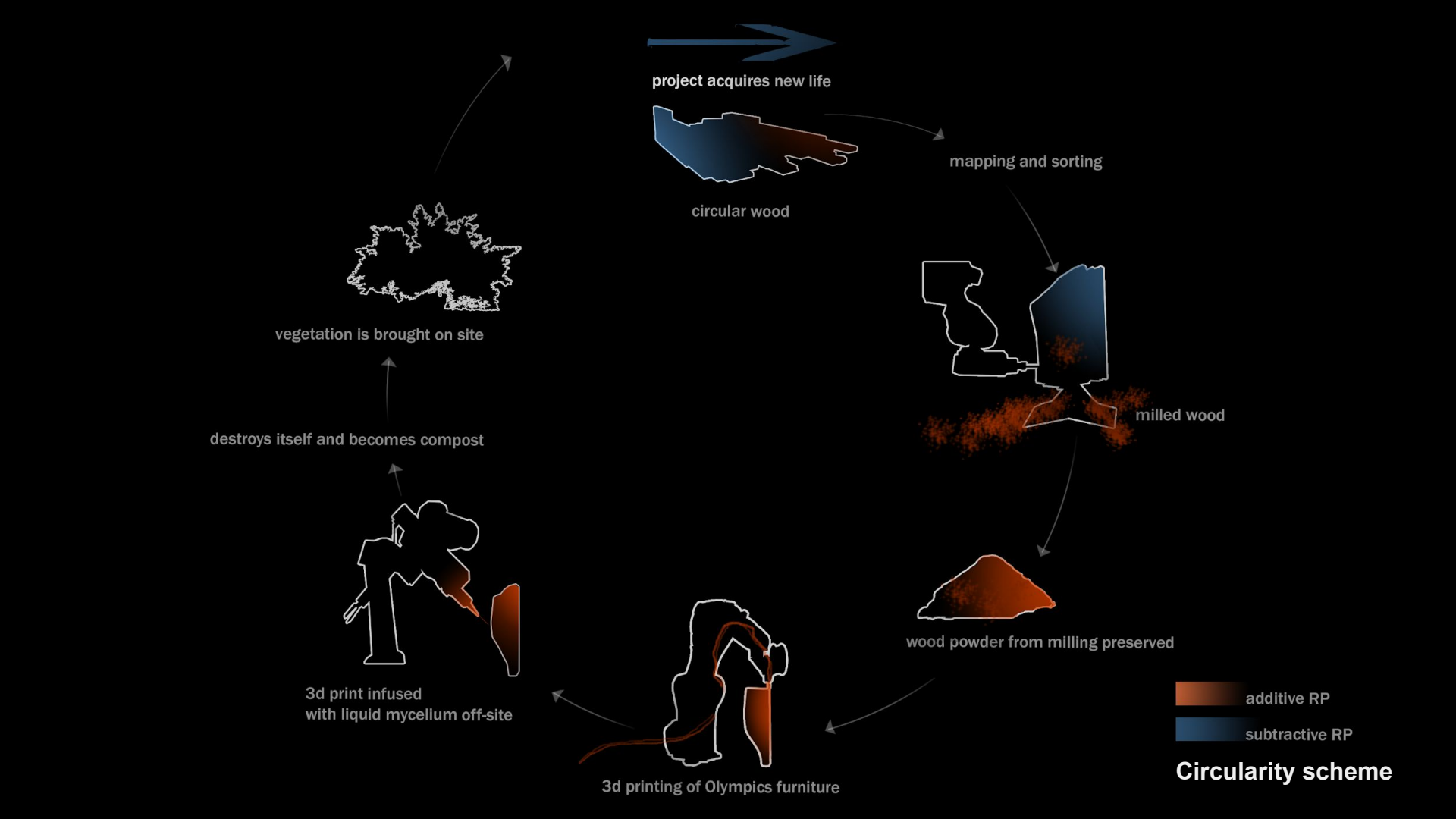


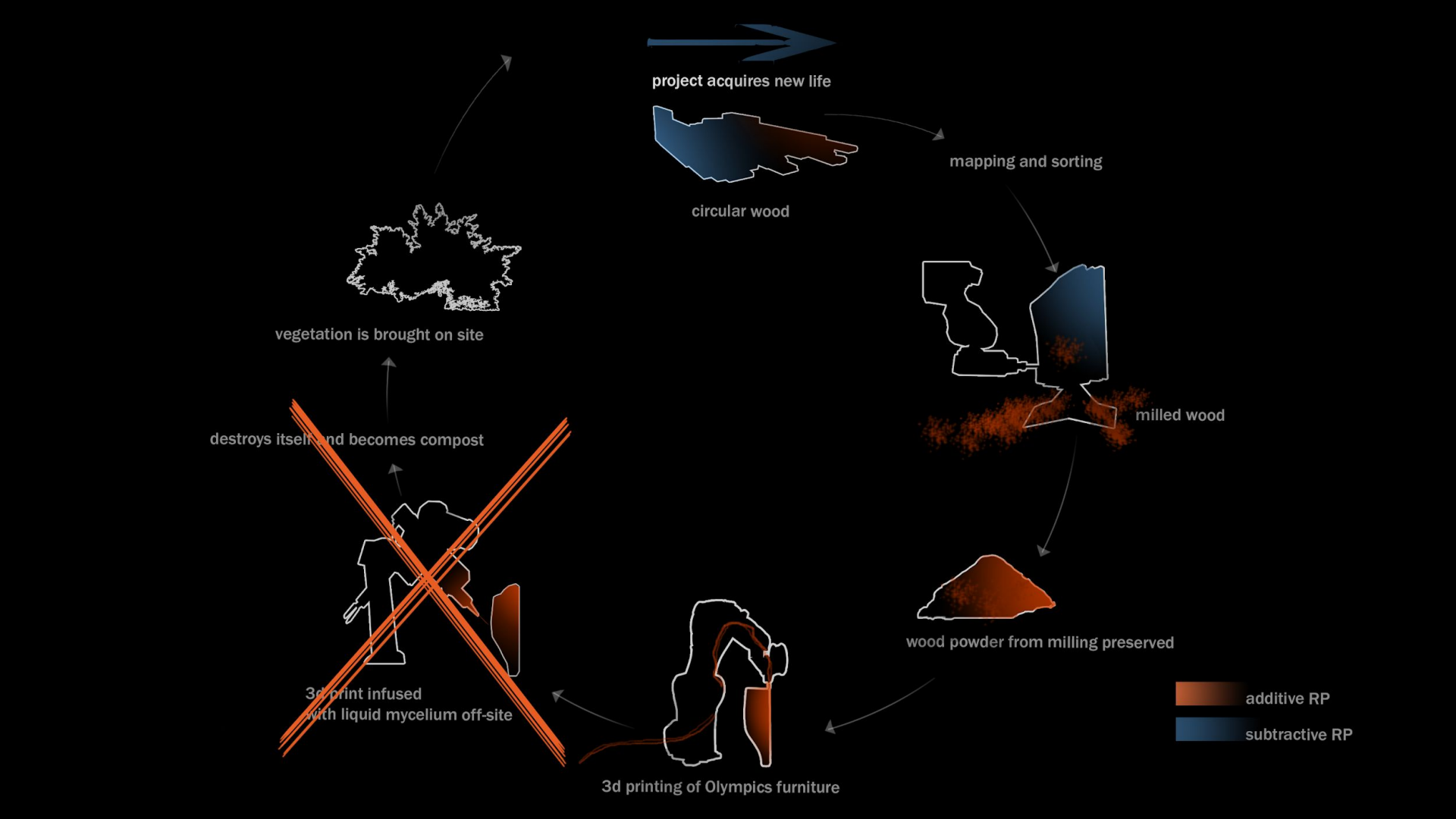
Divide and Conquer Graduation Plan

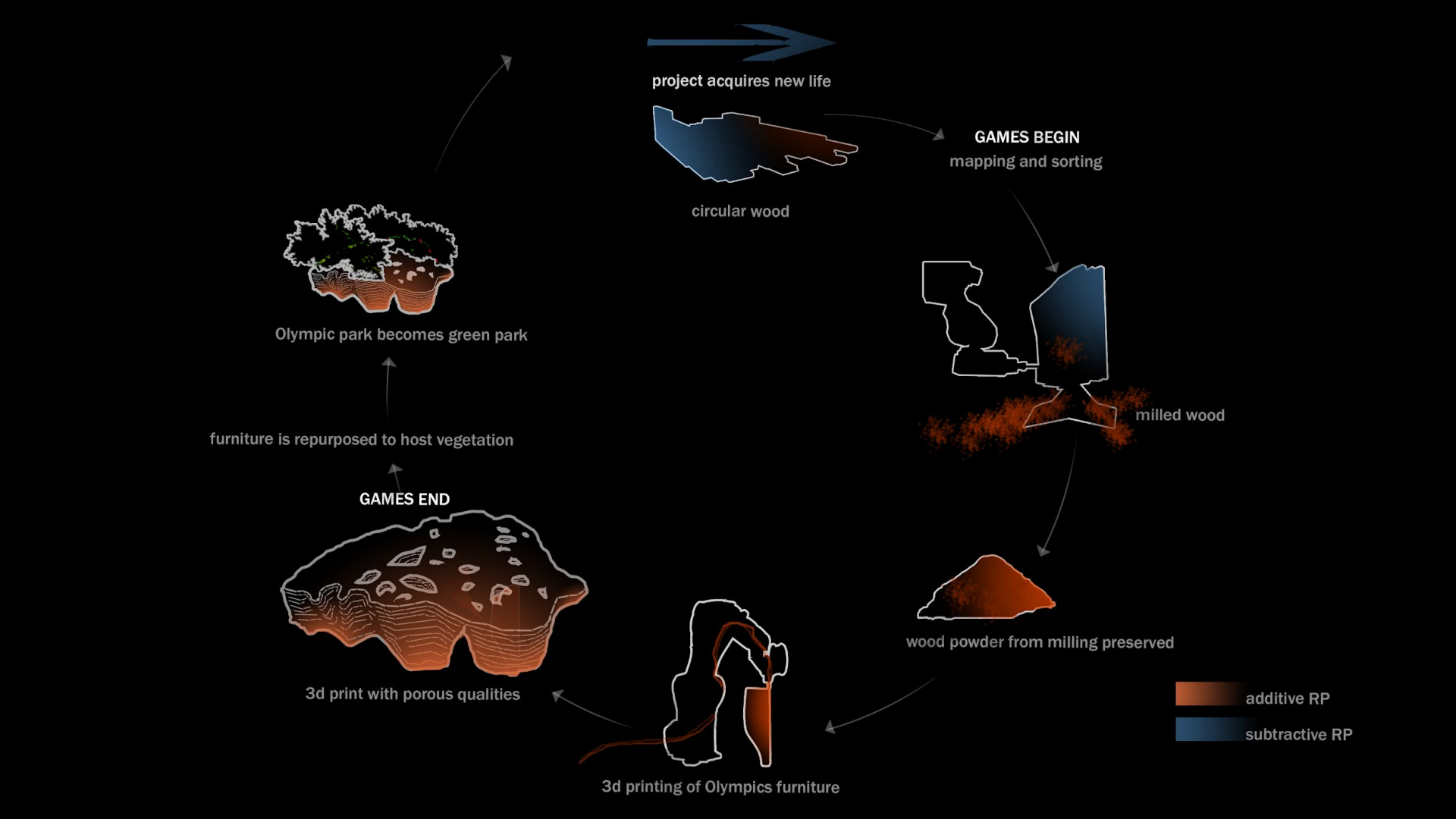

temporary

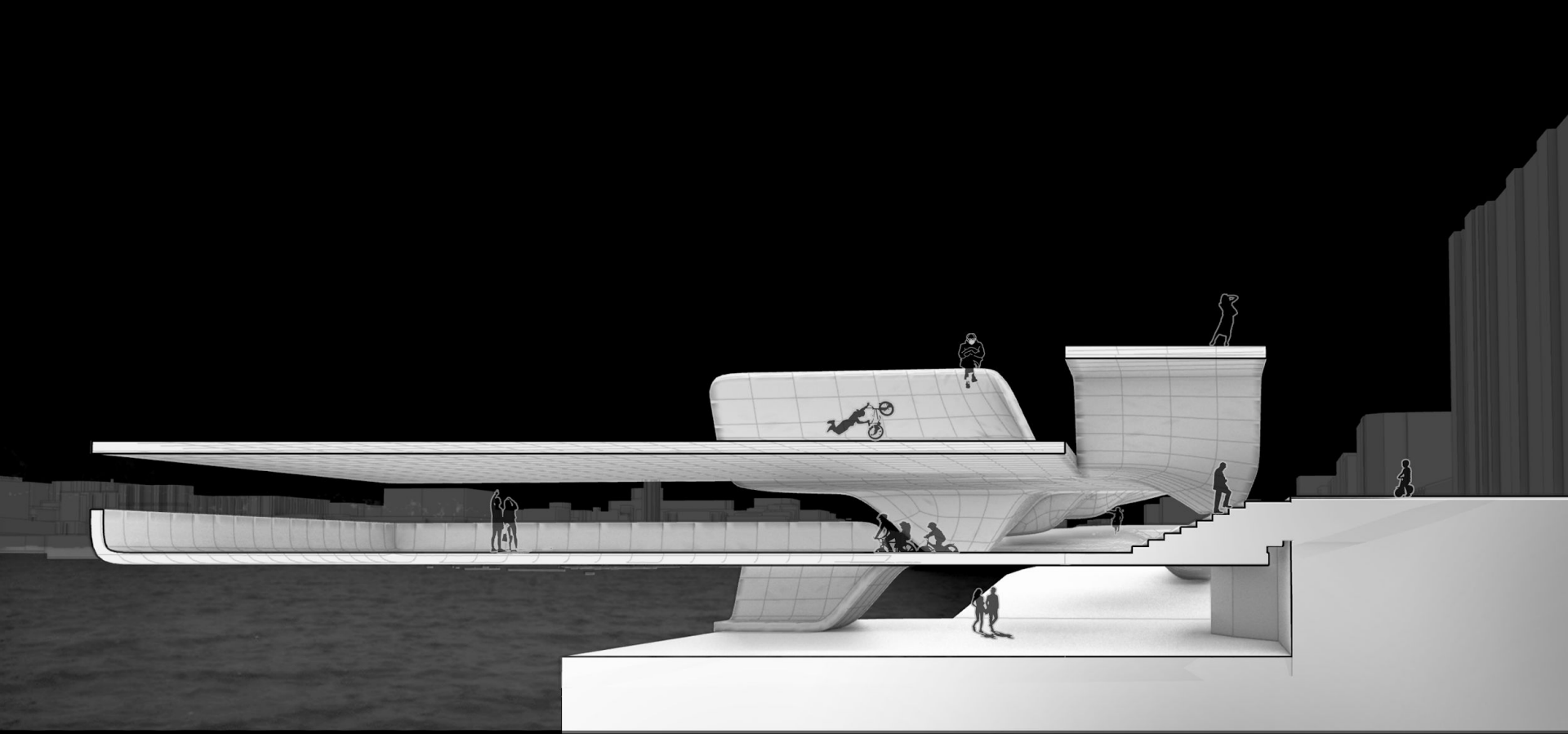
re-purposed

Bethlehem Steel Stacks Park, Pensylvania

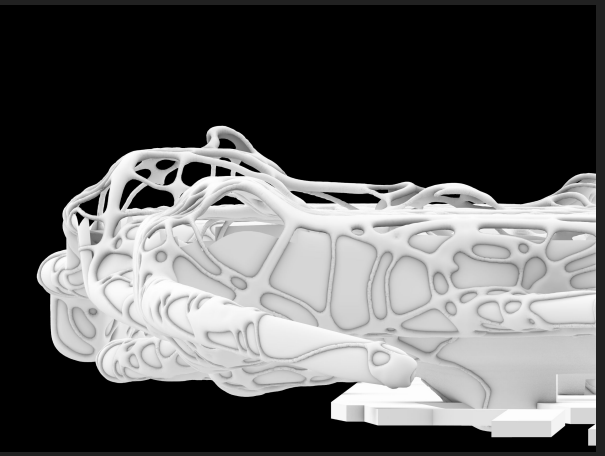

project acquires new life
circular wood
mapping and sorting
milled wood
wood powder from milling preserved
3d printing of Olympics furniture
3d print infused
with liquid mycelium off-site
destroys itself and becomes compost
vegetation is brought on site
additive RP
subtractive RP
Circularity scheme


project acquires new life
circular wood
mapping and sorting
milled wood
wood powder from milling preserved
3d printing of Olympics furniture
3d print infused
with liquid mycelium off-site
destroys itself and becomes compost
vegetation is brought on site
additive RP
subtractive RP

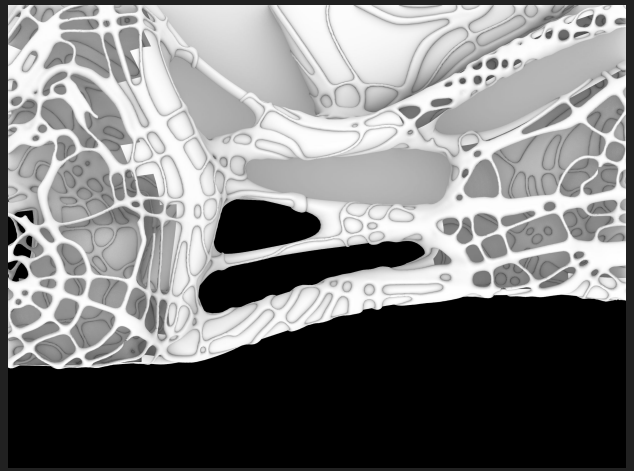

project acquires new life
GAMES BEGIN
mapping and sorting
circular wood
milled wood
wood powder from milling preserved
3d printing of Olympics furniture
3d print with porous qualities
GAMES END
furniture is repurposed to host vegetation
Olympic park becomes green park
additive RP
subtractive RP



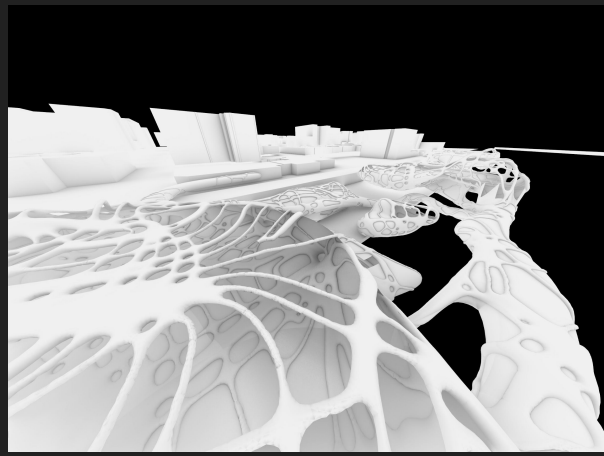
Preliminary Design Section



Expressive of Urban Multisensorial Experiences

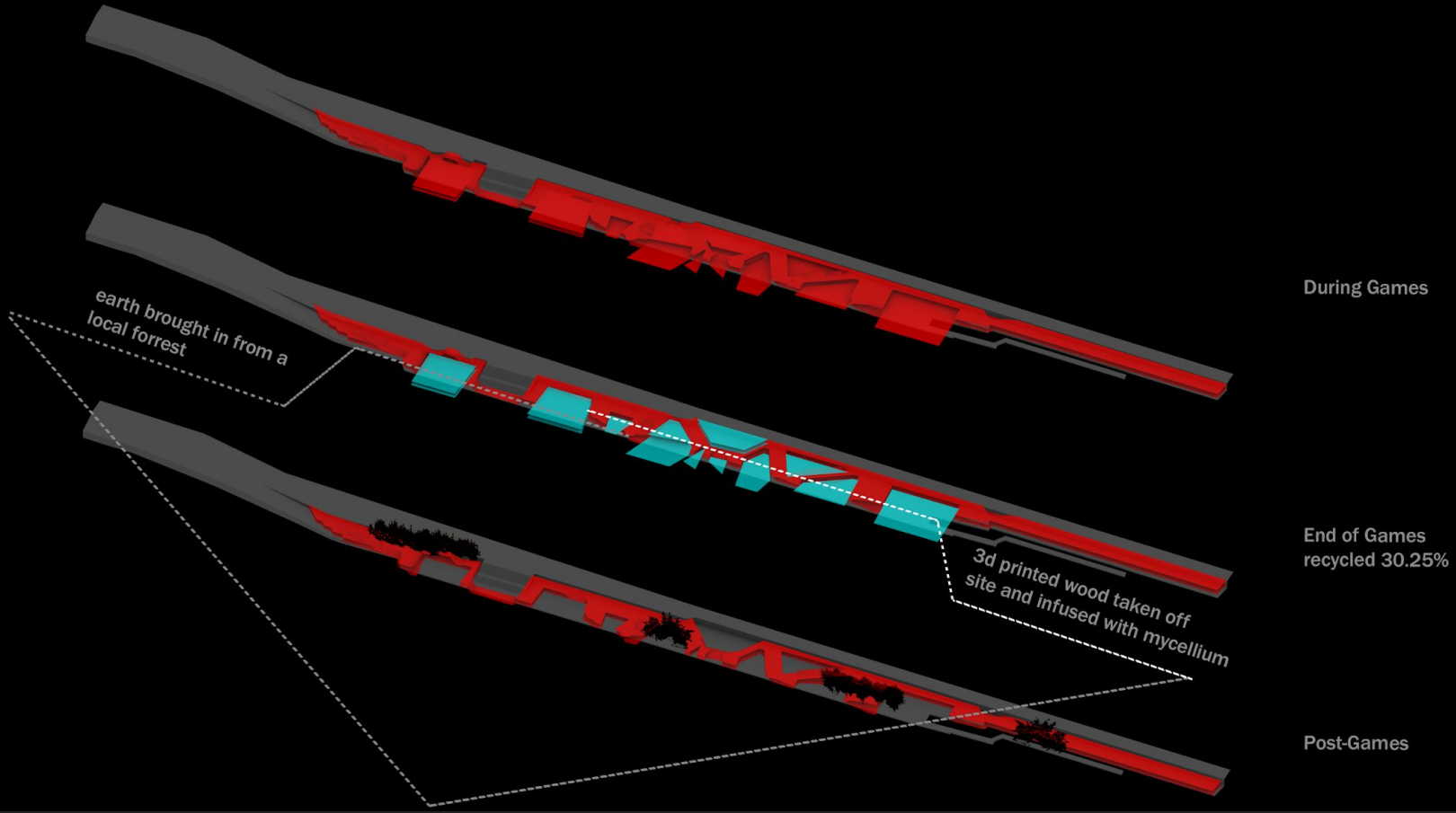


Localized/optimal transition gradient



Materially Efficient

Patterns of Materiality and Formal Language


earth brought in from a
local forrest
3d printed wood taken off
site and infused with mycellium
During Games
End of Games
recycled 30.25%
Post-Games

Bike is ready for Paris!

Thank you!