Delft University of Technology

Architectural Design Crossovers

Boosting urban soil:

Commons of post-human urbanisation

Architecture, materiality, synergies

Master thesis

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Introduction

The current omnipresence of dividing topics such as ecology, nature, veganism, sobriety, degrowth, etc., that make feelings run high in discussions reveal that we are at a pivotal period in our civilisation's History. It is an "effervescent moment" in the sense of Durkheim, which is part of the societal response to the ecological crisis we face. This crisis is fundamental: it stems from a profoundly anthropocentric conception of the world with harmful effects on the biosphere within which we dwell., threatening the future of humanity. This double realisation forecasts a period of intense transformation for our civilisation, which many dare call an "ecological revolution".

Cities centralise this *problematique*. However, the interconnectedness of our world pushes us to approach the problem globally. Neil Brenner argues that virtually the entire world has been urbanised. Through this global territorialisation, human societies have become one of the most influential forces shaping the planet. The challenge dwells in acknowledging the responsibility coming with such power and mutating the urban condition in depth. Tackling the environmental problem through this scope enables a spacialised analysis of the underlying sociotechnical machinery.

The fields of urban and architectural design are no strangers to the enthusiasm around the ecological question. {numbers on architectural research papers about ecology, nature, etc. at TU]. Indeed, those fields have a load of responsibility in the topic of what material reality they produce and have an essential role as agents of reflection, design and change.

When treating such a complex problem as sustainability, the importance of interdisciplinarity has been clarified.[1] It invites urban designers to venture out of the conventional disciplinary boundaries and tap into ecological sciences, biology, and even geology. This essay calls those fields in to ensure its agenda with solid foundations.

Research questions:

On which values build a new paradigm of urban development?

From the designer's perspective, how is the urban pressure on the ecosystems characterised, both on the site of intervention and the remote locations pertaining to the production of this intervention?

How will it change how an architecture performs locally, perhaps even questioning the definition of a building? How will this architecture be produced?

What can architects do about it? How can we establish and structure this topic as a productive domain of design research?

[1] E.D. Schoolman, J.S. Guest, K.F. Bush, A.R. Bell (2012) How interdisciplinary is sustainability research? Analyzing the structure of an emerging scientific field

Preliminary Definitions

a) Ecology

Ecology as a discipline studies our house, the world, the living and non-living things of which it is formed, as well as their interactions. Ecology comes from the Greek οἶκος (oîkos) 'house', and -λογία (-logía) 'study of'. The power of this discipline lies in its ability to study things in their entanglement with each other, never as isolated from the rest of the system within which they exist. Its realms of application are as vast as the range of scales of the study of our world.

An ecology, as a noun, is a specific study or representation of an ecosystem among many possible others. This denomination has been used predominantly in urban studies to describe a local configuration of ecosystemic dynamics, often with human presence. An example is a study of Los Angeles' historical genesis by Banham[2].

It is a system, an "ecosystem" whose size depends on where we look or where we stop to look. This "gaze" over an ecosystem is an ecology. In this context, designing means intervening in this entanglement and re-arranging / transforming it.

[2] Banham R. (1971) Los Angeles-The Architecture of Four Ecologies

b) Universal commons - soil focus.

Addressing environmental issues soon raises the question of the resources and components of an ecosystem on which living things rely to sustain their existence: water, soil, air, nutrients, energy, etc. In attempts to bring together human and non-human interests and treat them equally, two main research domains cohabit and interact: the Ecosystem services approach and the Common-pool resources approach.[3]

Even though I address ecosystem services in this essay, I preferred the term 'common' as a general approach to emphasise the collectiveness of these resources on which we all depend. To differentiate from the extensive literature using the word from an anthropocentric perspective, I propose the expression 'Universal common' as an extension of the concept to the totality of the species (biocenosis) dependent on this resource. To reduce the scope of research, this essay will particularly emphasise the relationship with the '**soil**' universal common.

The soil is a crucial component of most of the earth's ecosystems, and soil health is vital in resolving the current ecological crisis. It is host to essential material processes on which a significant part of biodiversity relies, namely the biogeochemical cycles of carbon, nitrogen and water.[4] These processes take a long time to settle, balance, and form a fully-functioning system. A diverse community of organisms powers them, constituting 26% of living species identified on earth (from a 2021 estimation).[5]

Its top layer, land, is the primary interface through which we interact with it. Like many other animals, humans traditionally rely on this interface as a main nurturing ground: it provides humanity with 98.8% of its food[6].

c) Ecological agency of Architecture

From an ecological point of view, architectural design is a planned intervention in an ecology as an agent of change, re-arranging and transforming the dynamics of this ecology. Until now, architectural design has been predominantly employed to mediate the interaction between humans and the rest. Its potential is greater. In addition, architecture directly influences the construction industry and, thus, its material ecology. Through material choices, architects influence the nature of this material ecology and, therefore, its environmental consequences. Hence the responsibility of the architect regarding ecology spans multiple scales, both local and remote.

[3] Rodela,R., May Tucker,C., Šmid-Hribar, M., Sigura, M., Bogataj, N., Urbanc, M., Gunya, A. (2019) - Intersections of ecosystem services and common-pool resources literature: An interdisciplinary encounter, Environmental Science & Policy, Volume 94, Pages 72-81, https://doi.org/10.1016/j.envsci.2018.12.021.

[4] Falkowski, P. G.; Fenchel, T.; Delong, E. F. (2008). "The Microbial Engines That Drive Earth's Biogeochemical Cycles". Science. 320 (5879): 1034–1039

[5] Marc-André Selosse (2021) L'origine du monde. Une histoire naturelle du sol à l'intention de ceux qui le piétinent, Actes Sud Nature, p. 137.

[6] Kopittke P.M., Menzies N.W., Wang P., McKenna B.A., Lombi E. (2019) - Soil and the intensification of agriculture for global food security

Its realm of action is not limited to buildings *per se* but can reach the fabric of the landscape itself. Blurring the line is not only promising, but it is also necessary to engage more in-depth with our environment.

d) The Four Natures Theory: re-definition.

John Dixon Hunt is the landscape historian who characterised the three first Natures[7]. The 1st kind is the pristine, untouched Nature (i.e. a tropical jungle), the 2nd one describes the land altered to be useful to man (agriculture, for instance), and the 3rd kind is the one resulting from a "harmonious blend of Art and Nature", like a garden with aesthetic purposes for example. Ingo Kowarik expanded on it in his publication Cities and Wilderness: a New Perspective (2013) and described the 4th kind as the spontaneous wilderness emerging within the urban landscape.

I used the Umwelt theory to translate this starting framework to a non-anthropocentric perspective. Jakob Von Uexküll conceptualised the Umwelt as a living entity's unique and subjective world. Brian Massumi summarises it well: "When I think of my body and ask what it does to earn that name, two things stand out. It moves. It feels".[8] This framework makes no other distinction than degrees of complexity, synthesising the subjective world in two poles: the perceptor and the actor. The subject perceives and acts, and thus territorialises, in the Deleuzian sense, its surroundings.

The consolidation of a territory by a subject can thus be declined into two dimensions:

- Its technological qualities, or how the subject grows and gains power over its environment through the presence of commodities: 2nd Nature.
- Its aesthetic qualities, or how a milieu is perceived, how the subject shifts chaos into meaning: 3rd Nature.

From a subjective point of view, the sum of all the other species' territorialisations, added to weathering, form the environmental reaction: 4th Nature.

When a state of balance is reached, the ecosystem becomes meta-stable. It is described in biological sciences as the ecological climax. It is what 1st Nature refers to, and what 5th Nature theorists intend to re-define.

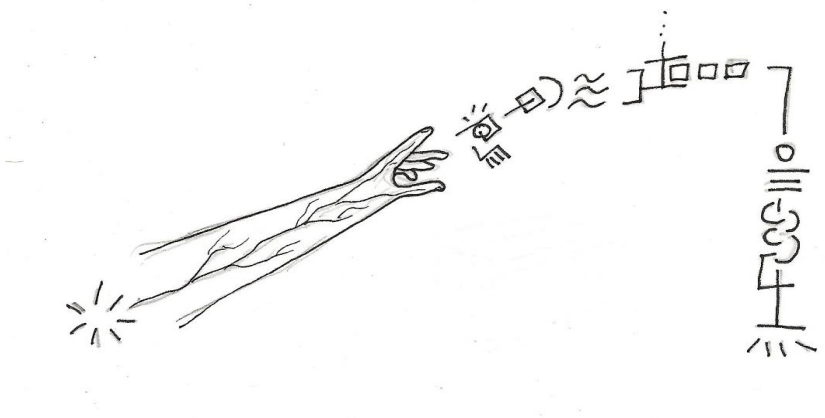


Figure 1. Technological chain

[7] Dixon Hunt, J. (2000) Greater Perfections: The Practice of Garden Theory
[8] Brian Massumi (2002) Parables for the Virtual: Movement, Affect, Sensation (Introduction)

Systemic depiction of a destruction machinery

All species territorialise and impact their environment. Human societies, however, have become predominant. We can safely state that the anthropic influence, or urbanisation, over the world is omnipresent. This over-territorialisation and its consequences have now been extensively characterised[9]. The synchronised disasters that this realisation forecasts put humanity in a paradoxical impasse: If we go on the same path of relentless territorialisation of the world, what lies ahead is more chaos.

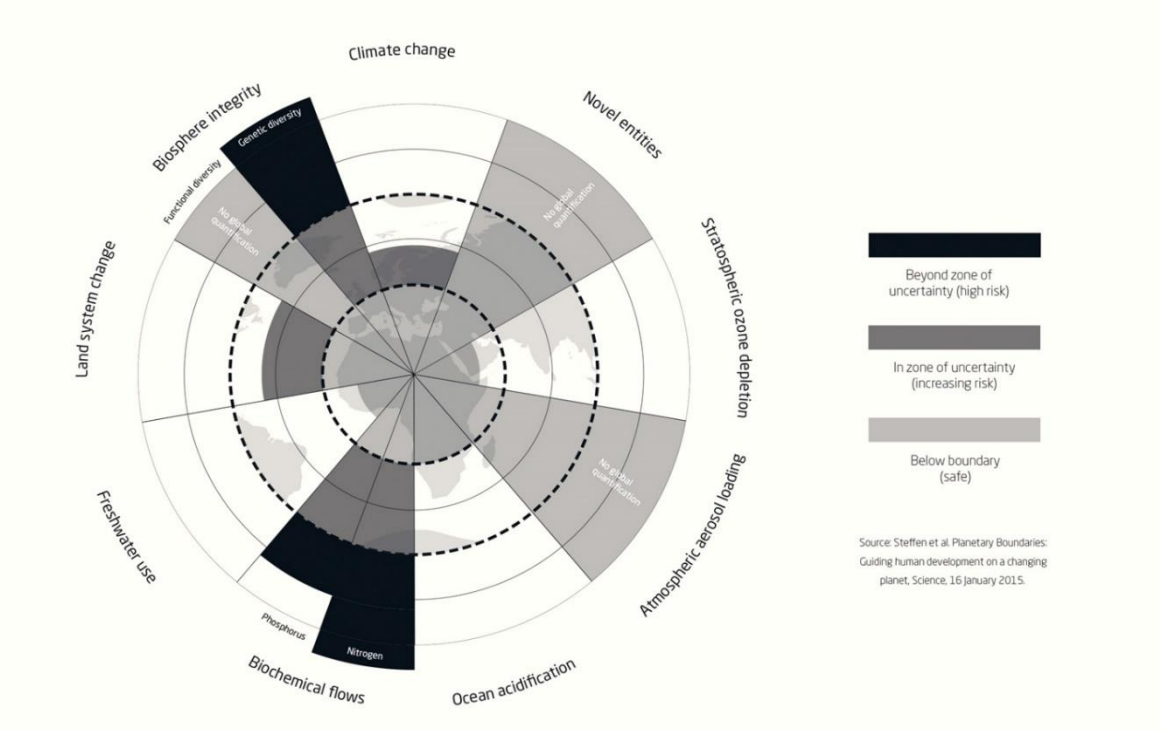


Figure 2. Planetary Boundaries: Guiding human development on a changing planet – Steffen et al., Science (16th January 2015)

What this situation asks of us is to grow out of an anthropocentric, survivalist point of view from which stems a logic of monopolisation of resources and embrace the responsibility that comes with being the dominant species on earth. We need to shift from a paradigm of domination to one of care.

[9] Rockström, Johan & Steffen, Will & Noone, Kevin & Persson, Åsa & Chapin III, F Stuart & Lambin, E.F. & Lenton, T.M. & Scheffer, M. & Folke, Carl & Schellnhuber, Hans. (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity [Internet]. Ecol Soc. 14.

By will or by force, we will have to enlarge what we consider the vital parameters of our contemporary habitat. Thanks to the advancement of observational science, we can now understand and prove that the quality of the air, the cleanness of the oceans, and the number of birds in the forest directly impact our capacity to sustain the current human population on earth. It is no longer solely a loss for whom cherishes a walk in the forest, or a mountain hike. It means that we can no longer consider the human fabricated habitat, which comprises houses, cities and other settlements, as an 'inside' within an 'outside' environment, an infinite nurturing 'Mother Nature'. The 'house' is the entire planet and is shared with many inhabitants of different sizes, shapes, colours, and species. The first problem is thus to tackle representations or the semiologic roots of the problem. What is human, what is our house, what is Nature?

a) Human Nature dichotomy: the importance of language.

An increasingly recurrent theme in architectural and urbanistic debates on ecology is the "relationship between Humans and Nature". It is also how many people, including myself, phrase this problem when they begin researching ecology in this domain. The main canon to sustain this dichotomic depiction of the world is the historical study of how human settlements have colonised and mastered their environment and progressively artificialised the land around them; it then leads to the characterisation of those different types of settlements or Anthromes (anthropogenic biomes), Ellis, E. (2015).[10] This representation of the recent evolution of our world during the so-called "Anthropocene" comes from a deeply-rooted conception, well exposed in the lecture given by G.Kodalak: Nature - Architecture Continuum[11], that the world is hierarchically organised, by right of being the dominant species, to serve and be consumed by homo sapiens. It is essential to understand that the evolution of this conception of the world, as well as the mere definition of 'human' and of 'nature', goes hand in hand with the History of evolution of human societies and cities.

This dichotomy stems from the conception of the world as bodies, or things, which are bounded and exist independently from others.[12] It reflects in the language we use to communicate about the world (both spoken and drawn, etc.) In reality, and this is both brought to light through the philosophical and scientifical look, what we call homo sapiens, buildings, birds, food, bacteria, etc., are not separated entities cohabitating in "space" but should be considered as an entangled whole that co-evolved altogether. They are not only inter-connected but also interdependent. The human body cannot survive without the bacterial community in its stomach nor the nutrients provided by the species on which it feeds. Ignoring this aspect of things can bring malfunctions to it. For instance, for more than thirty years now, consistent research has provided evidence that the over-cleanliness (hence the deprivation of microbes) of our urban environment is most probably responsible for the rise of conditions such as hay fever or asthma.[13] On the other hand, studies also suggest that the lack of access to "Nature" is responsible for mental health discomfort.[14]

Therefore, the human/nature dichotomy is flawed, counter-productive, and potentially fatal at the societal and individual levels. Some argue that the word "nature" should even be removed

[10] Ellis, E. (2015) Ecology in an Anthropogenic Biosphere
[11] Link to Kodalak's lecture
[12] Protevi, J. (2009) Political Affect – Connecting the Social and the Somatic – Posthumanities 7 – University of Minnesota Press
[13] SF Bloomfield, R Stanwell-Smith, RWR Crevel, and J Pickup (2006) Too clean, or not too clean: the Hygiene Hypothesis and home hygiene – doi: 10.1111/j.1365-2222.2006.02463.x
[14] Ref

entirely from the ecological discourse, as its meaning has evolved to become "this thing out there" that is not us and that we can exploit without limits. [15] I am unsure whether such a radical move is required. Still, re-forging the semiological depiction of the system human – built – species – matter – etc. is necessary to truly address the ecological problems we face today as urban designers. If the word "nature" is to be kept, it must include both humans and their makings. Similarly, the places conventionally considered as "human", such as cities, must loosen their boundaries and let life in, as it is in our best interest to do so. Design is a preferred tool to operate and mediate this transformation. Several questions remain: how? What is there to change? And how much effort will it take?

b) Urban regimes of control over soil, and collateral damage

In their will to master the land, humans have constituted a set of physical and regulative tools. The following is a non-exhaustive list of particularly damaging techniques pertaining to urban and architectural design.

Compartmentalisation. Division of the land in cells is an ancestral practice. It underlies the definition of property, identity, use, law and involved actors. Their physical translation comes with the generation of boundaries (like a wall or a motorway). Those will often prevent many species from circulating freely. From garden to garden, for instance, this has been made as a means of social control, preventing humans from entering each others' private properties. What about hedgehogs, foxes, etc.?

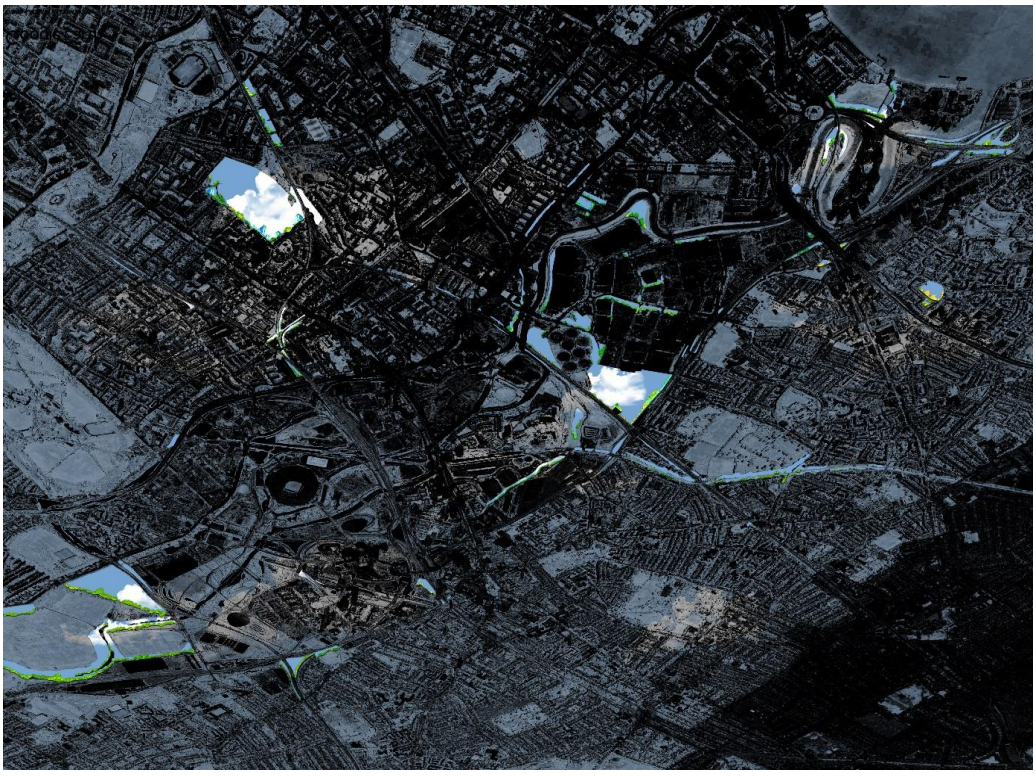


Figure 3. Vertical compartmentalisation: air-ground.

[15] Ecology without Nature, Norton.

Control of the cell and homogenisation. Once the land register has been established, it is possible to define and apply various regimes of control over the cells, depending on their intended function. Different physical characteristics can be expected from a cell and are often desired as immutable. For instance, a road should remain flat. To reach the desired characteristics, various techniques are used again.

- Discarding some organisms employing hunting weaponry or chemical spreading.
- Slowing down the local biochemical metabolism, often making extensive use of mineral components, such as pavement, concrete or asphalt. This often results in sealing the land and breaking the interface soil-air, leading to the death of underground organisms.

Such practices limit natural processes' fuzziness and chaotic flourishment to consolidate human power or culture. Paradoxically we can also say that Nature conservation sometimes has the attributes of those practices. As explained by Bakshi and Gallagher, it is a practice based on a "nostalgia" for idealised natural forms and leads to discarding some "invasive" species which do not fit in the picture. Invasive, according to whom? In reality, there have always been species transfers between biomes, causing disruption but eventually stabilising[16].

Figure 4. Regimes of control, side by side, London, 2021

Discretification of the abiotic conditions. The first Nature, in abiotic terms exists in gradients (weather has no clear boundaries, same as a river, a forest, etc.). However, both as a means to control and as a byproduct of action repetition, we tend to reduce make those gradient discrete (in the mathematical sense). For instance in a city, the surface angles are often reduced to a three-dimentional orthogonal grid. Heterogeneity of those conditions is key for biodiversity to thrive.[17]

Collateral damage. Damage over the soil is sometimes invisible: oil spills, chemical pollution, etc. It touches on the immense unseen effects of human activity (more notorious when talking about air), a growing architectural design topic.

[16] Gilles Clément, brassage planétaire

[17] Griffin, Jenkins, Gamfeld - Spatial Heterogeneity increases the Importance of Species Richness for an Ecosystem Process

c) Designing in a box: remote effects of construction

It is impossible to adequately address the effects that architecture can have on the environment without discussing the displaced effects of its material ecology. Concrete alone, for instance, is thought to be responsible for 8% of worldwide CO2 saturation of the air.[18] In terms of impact on soil, Architecture is notorious for using stone, which had to be taken somewhere. Therefore, construction is both a polluting and an extracting practice.

Figure 5. Vermont Marble Company #5, Abandoned Granite Quarry - Edwards Butynsky (1991)

The problem is that its main actors don't realise its impact. The fragmentation of the building act into different professions breaks the perceptive chain necessary to be conscious of it. This issue also translates from space to time. What happens to a building when its life warranty has ended is rarely addressed at the design stage, although things are changing fast with the development of the circular economy. Construction and demolition together, the industry is responsible for roughly 27 Mt waste going to landfill annually in England and Wales.[19]

To cut short this part, we can summarise the current directions with what the British economist William Forster Lloyd described as "the Tragedy of the Commons" in the early 19th Century. He told the process of a community which relied on the same shared resource to over-deplete it and compromise it because of ignorance and lack of group coordination. It is precisely the stakes of the contemporary ecological problem. Do we have the capacity to coordinate the main economic, industrial, political and cultural actors of our societies, as well as planning a long-term transition, to achieve the civilisational revolution that is necessary to overcome this problem?

[18] Lehne, J, Preston, F. (2018) « Making concrete change: innovation in Low-carbon cement and concrete" – Chatham house report.

[19] Lawson et al. (2001) Recycling construction and demolition wastes - A UK perspective DOI: 10.1108/09566160110389898

Towards a post-human urbanism framework

Introducing the notion of "**care** in our civilisational territorialisation of the biosphere means fostering the development of life both in quantity and diversity. Let it be clear: this is not another simple addition to the agenda of the politician, urban developer or architect. As explained previously, this notion is vital to the balance of the biosphere and our presence. Hence, the idea of care should be positioned on the highest hierarchical level of this agenda. This is a complete shift from the previous paradigm, and this new direction will cause disruptions; we must learn to cohabit again and find balance. In biological terms, the ecological climax is a general translation of this evolution towards equilibrium. Now, what tools can we use to initiate the urban transformation?

a) A third landscape network

The Third Landscape is the sum of all land which doesn't suffer the control of humans. It is a biodiversity sanctuary, forming its most diverse and advanced state.[20]

The third landscape approach is robust in its simplicity. In a given urban area, it allows for rapid identification of the potential spaces which could be classified as such. Interstices, leftovers and wasted landscapes have been discarded from human settlement and use already form pockets of urban biodiversity. Even though their incorporation in metropolitan, architectural and landscape design is still a niche, their potential has been identified and explored.[21]

Figure 6. Third Landscape sites in the Lower Lea Valley, London

These pockets of life, if developed, would provide many species with an alternative to the mineral homogeneity of the urban landscape, which for now mainly empowers a handful of species: humans indeed, but also our infamous urban companions: dogs, cats, rats and pigeons. These pockets would somehow form an analogous function to housing neighbourhoods. It is essential to increase their amount and total surface, but it is as necessary to interconnect them. The importance of an interconnected heterogeneous landscape has been extensively corroborated to increase biodiversity[22] [23] and indicates the development of ecological corridor grids.

[20] Clément, G., Manifeste du Tiers Paysage
[21] Havik, K., Luo, S., Gardens of Interstitial Wildness, Cultivating Indeterminacy in the Metropolitan Landscape, Delft University of Technology, 2020, doi: https://doi.org/10.7480/spool.2020.1.5478
[22] Forman RT (1995). Land Mosaics: The Ecology of Landscapes and Regions. Cambridge, UK: Cambridge University Press.
[23] Leser H, Nagel P (2001). "Landscape diversity - a holistic approach". Biodiversity. Springer: 129–143. doi:10.1007/978-3-662-06071-1_9

To assess the state of those life pockets, systematic monitoring needs to be conducted. This is also a way to somehow give a voice to those who cannot speak, and thus impact the politics. In this regard, some governmental jurisdictions have started experimenting with giving juridic persona status to entities and commons such as rivers, lakes and forests. Although some may argue whether this is actually a good idea (Luque-Lora, 2022)[24], there is without a doubt a shift and attempt to integrate considerations about ecosystems deeper into the systems regulating our societies. The question of monitoring technique is purely scientifical, and some large-scale systems are being developed.[25]

b) Universal commons as infrastructure

To ensure that this bio-community thrives, the essential components on which it relies, universal commons as defined in Chapter 1, must operate as well as possible. This suggests campaigns of de-pollution and un-sealing in dense urban areas, which are explored in more detail later on. This adds to the importance of repairing them on the planetary level (as exposed in Chapter 2) but justifies their implementation within the dense urban fabric as well. Furthermore, the local enhancement of those components (soil, water, air, climate, etc.) would also provide human inhabitants with priceless ecosystem services: healthy air quality, lush vegetation and parks, a balanced and healthy microbiotic community, clean water to swim in, resilience to natural hazards such as heat streaks, floods, etc.

In their quality of fundamental components sustaining a variety of processes in the city of the future, universal commons should be considered as elemental infrastructure and developed as such. As a framework, the Urban Green-Blue Grids has already proven efficient applicability and shares extensive documentation on conducting such transformations on multiple scales. Recent developments in some metropolis, like the New York dryline or the development plan of Bordeaux "55.000 Hectares for Nature", show a similar approach.[26]

Considering ecosystemic functions as critical components of urban systems is explored and advocated by Pierre Bélanger in his publication "Landscape as Infrastructure". The case study of the Leslie spit showcases a system where waste discarding, leisure tourism and a biodiverse community cohabit and positively enhance each other.[27] Such an example hints at new ways to bring human and non-human actors together in urban contexts.

[24] https://www.theguardian.com/environment/2022/oct/14/why-im-sceptical-about-giving-legal-rights-to-animals-trees-and-rivers

[25] Cadenasso, ML., Designing Ecological Heterogeneity – Urban Design ecologies : p272-281

[26] Pötz, H., Green-Blue Grids, Manual for Resilient Cities, Atelier Groenblauw, 2016, ISBN 978-90-9029822-1

[27] Belanger P. (2009) Landscape as Infrastructure

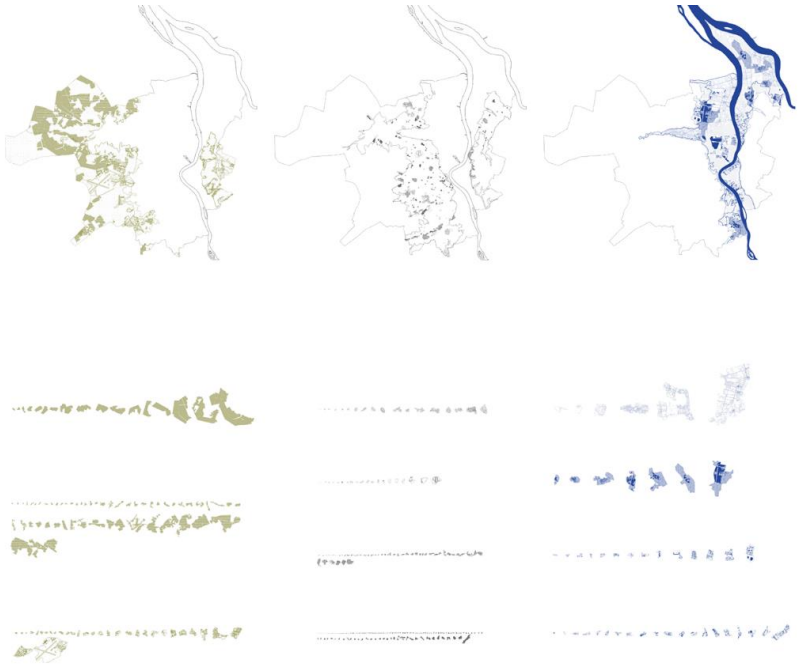


Figure 7. 55,000 hectares for Nature Project Archive– Bas Smets (2012 – 2014)

c) Integrate bio-communities in the making process

Once we see the importance of the processes happening in the soil, as described earlier, there is no need to reinvent the wheel. Developing this infrastructure in the city is a biogeochemical process known as pedogenesis. For this process, we can be assisted by many species. For example, in cleaning the soil from polluting materials, many organisms have proven to be very helpful while being at the same time cheaper and simpler in achieving de-pollution than entirely artificial technology. For instance, a common species of earthworm has shown the capacity to digest the most widespread type of microplastic in the earth's soils.[28] Overall, organisms dwelling in soil (plants, fungi and microbes) offer tremendous interest in waste material recycling and de-pollution.[29] This would come in handy with the forecasted growth of waste production (global waste production is estimated to grow by 70% from 2018 to 2050[30]). We are hinting here at the capacity of such infrastructure to provide ecosystem services to local communities. This mutual enrichment, or synergy, is the promise of the post-human urban condition.

[28] Huerta Lwanga, E., Thapa, B., Yang, X., Gertsen, H., Salánki, T., Geissen, V., et al. 2018. Decay of low-density polyethylene by bacteria extracted from earthworm's guts: a potential for soil restoration. Sci. Total Environ. 624:753–7. doi: 10.1016/j.scitotenv.2017.12.144

[29] Darwish, L., Earth repair, a Grassroots guide to Healing Toxic and Damaged Landscapes, New Society Pulishers, 2013.

[30] Kaza, S., Yao, L., Bhada-Tata, P., Van Woerden, F. - What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, World Bank Publications, 2018.

Tailor the ecology of architecture, here and there

This new direction of urban development asks for a mutation of the architectural intervention. Architecture is a discipline which produces buildings and, at the same time, perpetuates a certain culture of building. It is also self-reflective, and has managed to re-invent itself in the past; it can do it again. This constructive culture shapes cities and alters urbanisation through two main dimensions:

- The **local effects** consist of the range of influences a building has on what is traditionally considered as its site.
- The **displaced effects** are not visible in the direct vicinity of the building. They pertain to its material ecology, how it came to be, and what it will become.

This chapter consists of a proposal on how to tailor those two dimensions to the goals exposed beforehand.

a) Remote effects: give vision

In addition to the extractive and polluting consequences described in chapter 2, the over-stretching of architecture's material ecology has two major issues: logistical expense and vulnerability. The first is hard to establish, but frameworks to show GHG footprints of materials exist.[31] The second is starting to be visible with the consequences of the Ukraine conflict, for instance.

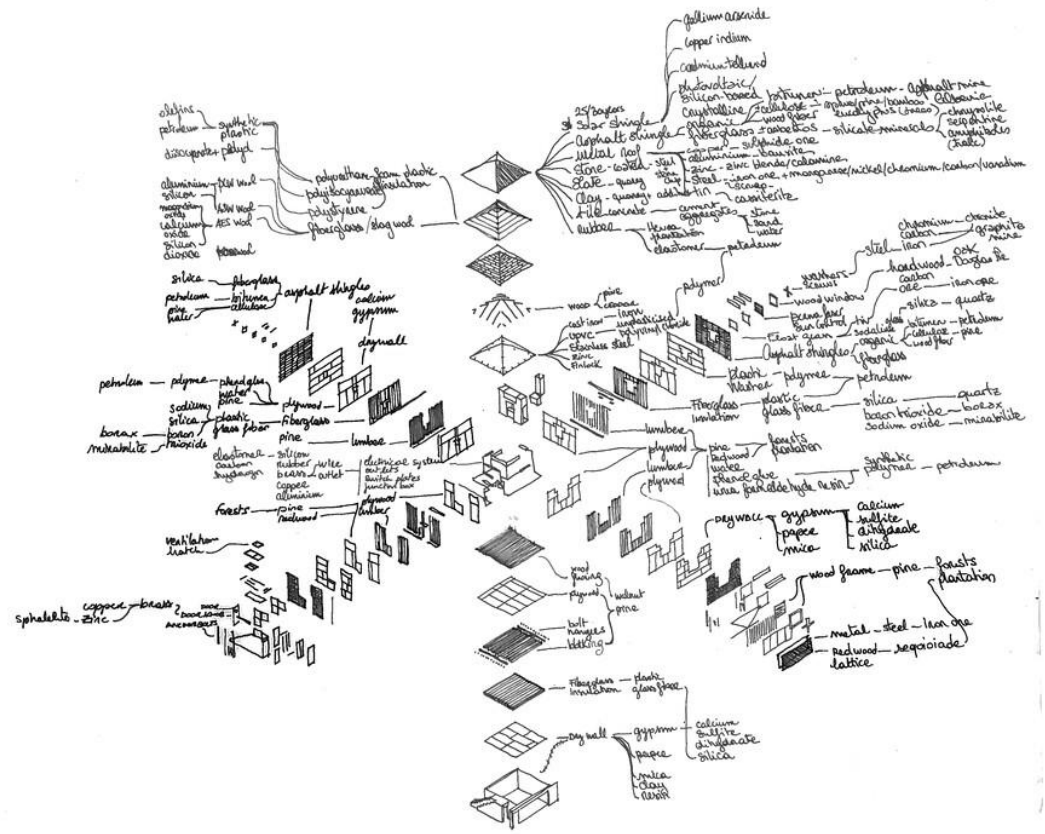


Figure 8. Charlotte Malterre-Barthes, Scales of Extraction, after Morphosis, 2-4-6-8 House Parts drawing. In Space Caviar (eds.), Non-Extractive Architecture, Volume 1: On Designing without Depletion (Berlin and Moscow: Sternberg Press and V-A-C Foundation, 2021)

Overall, there is an urgent need to develop a proper informative system about materials. This applies to architecture particularly, but not only. Cybernetics of materials would have a two-fold interest: bring closer to the decider's perception the obscure ends of a building's range of influence, and anticipate future surges or deficiencies. The primary components of what this system could be are being developed; it is the case of the Material passport, for instance, which allows to trace and document virtually any material in real-time. For deciders or designers, developing adequate recommender systems should also be considered. These ideas are accelerated by the recent development of circularity applied to architecture. However, I remain somehow sceptical towards this system, as it has, in my opinion, two potential flaws:

[31] Environmental Efficiency Aspects of Basalt Fibers Reinforcement in Concrete Mixtures
Jan Fort, Jan Kocí and Robert Cerný

- Construction is expensive, both in terms of energy and financial resources. If generalised, circularity in architecture could foster the shortening of building life cycles, answering to an ever-morphing demand. A transition from one cycle to another would admittedly not require more raw materials but still need workers and logistical means to be executed. Those come with a cost. Alberti stated that architecture should be designed to last as long as possible to make the best use of the great initial expense. [32]
- The second question emerges when pushing the logics of circularity to its extreme. What would happen to materials after, let's say, sixty cycles when the material has aged beyond reusability? Many examples of dismountable new buildings use materials such as CLT. This material is crafted using large quantities of glue, which raises the question of final environmental impact, when the material loses its mechanical properties and must be discarded.

These are minor issues, as circularity probably holds its promise to be a better alternative to the current status quo. However, for future evolutions, an approach which would scale up the circularity of materials beyond the boundaries of industry would be preferable. For instance, bio-degradable materials are circular in the planetary system and don't open long-term problems.

Overall, the fundamental principle to resolving the issues pertaining to the remote effects of an architectural intervention is to enlarge what is considered the **site** of this intervention. The system that is suggested is consequent and should probably be conducted by third parties or even be added to the agenda of local public authorities.

[32] Leon Battista Alberti, On the Art of Building in Ten Books, Introduction.

b) Local effects: architecture and ecosystemic synergies

The effects of an architectural intervention in a given ecology are vast and complex to depict. To address it in a structured way, I used the 4 Natures framework as re-defined in Chapter 1 (definitions) and sliced these effects into two areas of design research: the 2nd nature, pertaining to actions, or technology, and the 3rd nature, treating of the perceptions, or aesthetics. It is important to highlight that they are not independent; their relationality constitutes a whole field of research, the Affect Theory. I emphasised the relation to the universal common '**soil**', as defined in the first chapter.

1) Technological coupling with soil

From a strictly technological point of view, the architectural discipline produces what could be called environmental machines. For instance, a house is a concentration of devices which carry out transformations of the air and water, locally controls the input of light, frames certain points of view, etc., enabling its inhabitants with technological enhancements beyond their body capacities.

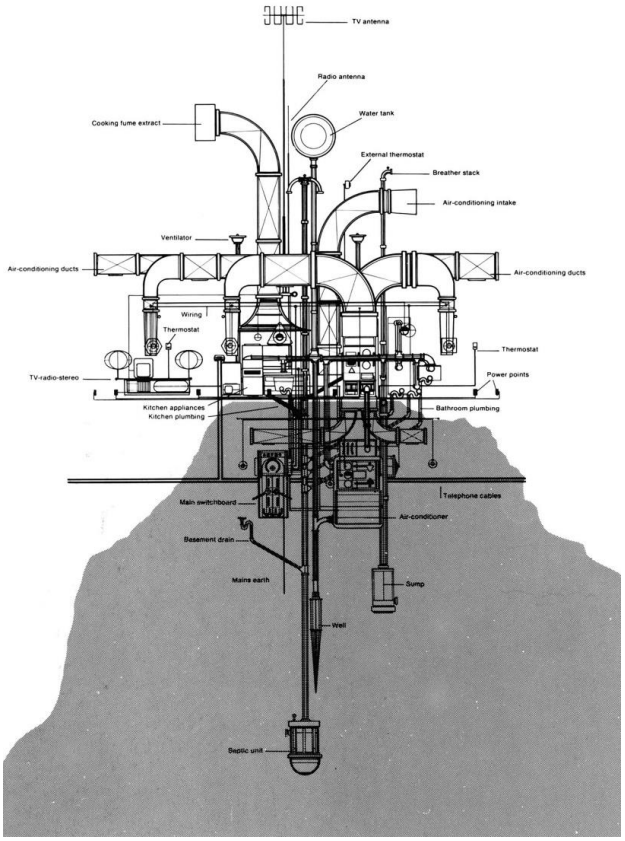


Figure 9. Illustration from "Home is not a House" - R. Banham (1965)

This machine generally has a simple relationship to soil. It drives foundations in it, covers its surface to form a stabilised ground, and sometimes grows food in an allocated space for a vegetable garden. If we look at the necessary conditions for soil to thrive, multiple improvement directions appear.

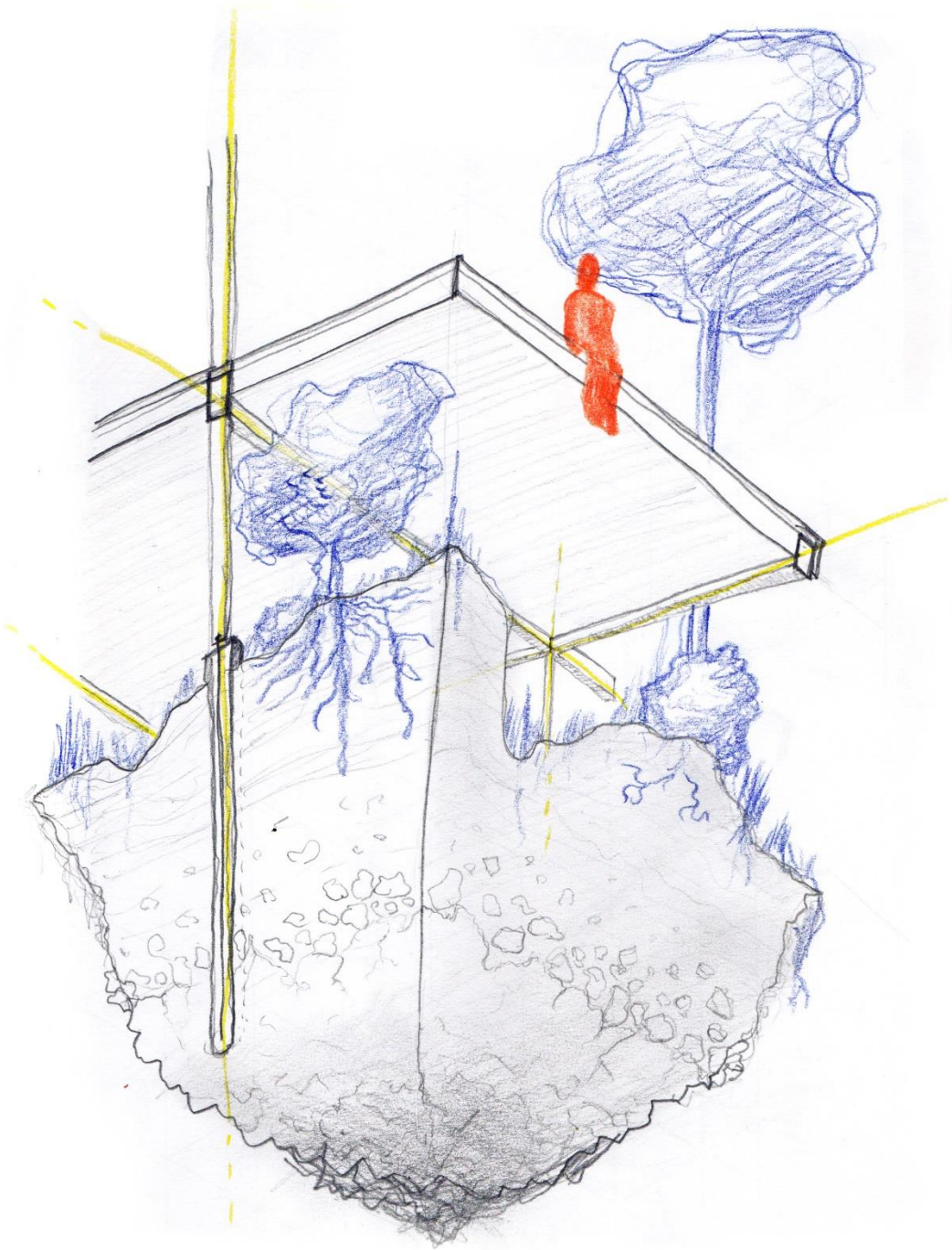
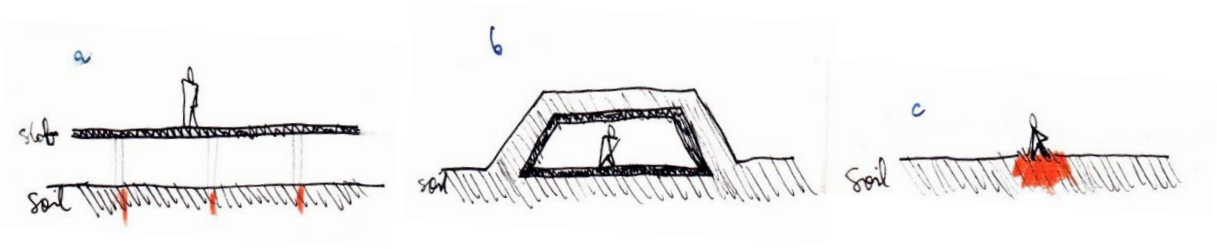


Fig. 10. Architecture and soil

Spatial component. Space needs to be allocated to soil, ideally the most possible. This space spans both horizontally and vertically, as soil needs sufficient thickness. However, space is scarce in a dense urban context. Three spatial locations are possible in relation to the human living machinery.



Elevating above soil (a), by means of stilts. Care must be taken to puncture the created slab with enough holes so that light and air reach the surface. Several urban and architectural theorists, like Le Corbusier[33] or Constant, have notoriously explored this approach[34]. However, it is a structurally demanding device, which means a potentially heavy environmental footprint.

Positioning the living spaces within the soil (b). Different attitudes are possible, from the buried house to a "green" roof or façade. This approach is extensively explored by a wide range of offices, and is subject to the shortcomings of trendiness. It affixes to the skin of the building, and thus becomes part of its image; the visual impact takes over the eco-logical stakes. Some serious attempts to position the architectural element in a balanced relationship with the soil are exposed in the Landform Building publication, but the crucial questions on how to resolve the schism between looks and function remain unanswered.[35] Most of the times, the ground layer is minimised to a thickness where only grass can grow. The most active layers of soil can be a meter thick, while the complete thickness of a healthy soil can reach multi-meter depths.[36] Therefore, weight is a crucial aspect, and soil bulk density depends greatly on its type. On average organic, soils are about 500kg/m^3, but this number can double if its mineral content is high.[37] Again, the structural cost becomes a constraint. To compare approaches a) and b), weight and light diffusion are decisive parameters.

Intersecting soil and living space in the same plane (c). The most widespread approach positions the human settlement in stead of a patch of soil. This approach takes over space from soil, but its relevance resides in its potential to densify human settlement in punctual locations (towers), leaving the rest free. It is an appealing path. However, when pushed to the extreme, besides the comeback of structural expenses, it raises the question both of the vertical detachment between soil and inhabitants, and, if made swiftly accessible, of the demographic pressure wielded on this soil (in terms of stomping, or even food production).

Indeed, there is no definite answer, and the most relevant take on this matter will heavily depend on the specifics of site, program, and materiality. Nevertheless, the invariable is to provide soil with sufficient horizontal space, thickness and atmospheric interface so that the biological magic can happen.

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[33] Le Corbusier et Pierre Jeanneret, « Les Cinq Points d'une Architecture Nouvelle » - Œuvres complètes 1910-1929, Erlenbach - Zurich, Les Éditions d'Architecture, 1937, p. 128

[34] Constant, "New Bablon," Models, piantings and writtings, 1959-74

[35] Kenneth Frampton, Stan Allen, Marc McQuade, Landform Building: Architecture's new terrain. Lars Müller Publishers, 2011, p.47

[36] Richter, Daniel D., and Daniel Markewitz. "How Deep Is Soil?" BioScience 45, no. 9 (1995): 600–609. https://doi.org/10.2307/1312764.

[37] Soane, B.D. (1990). "The role of organic matter in soil compactibility: A review of some practical aspects". Soil and Tillage Research. 16 (1–2): 179–201. doi:10.1016/0167-1987(90)90029-D

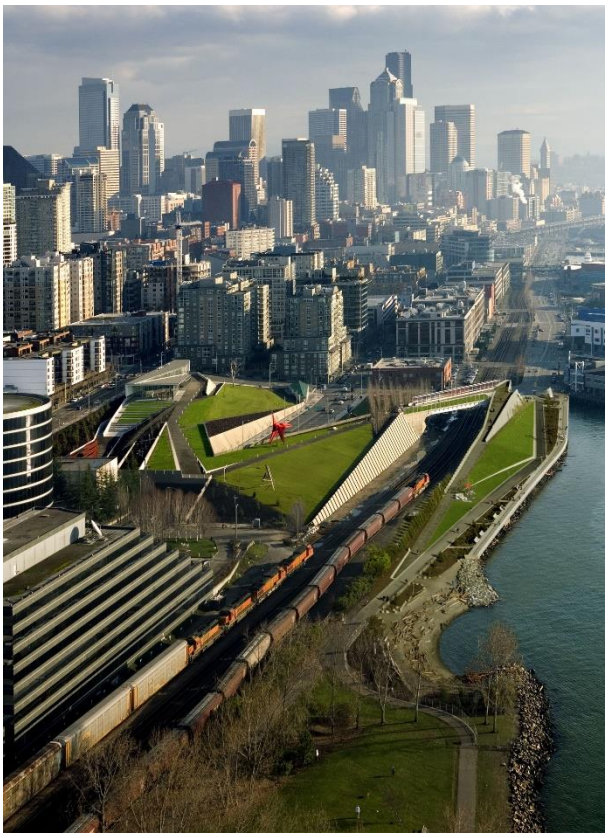
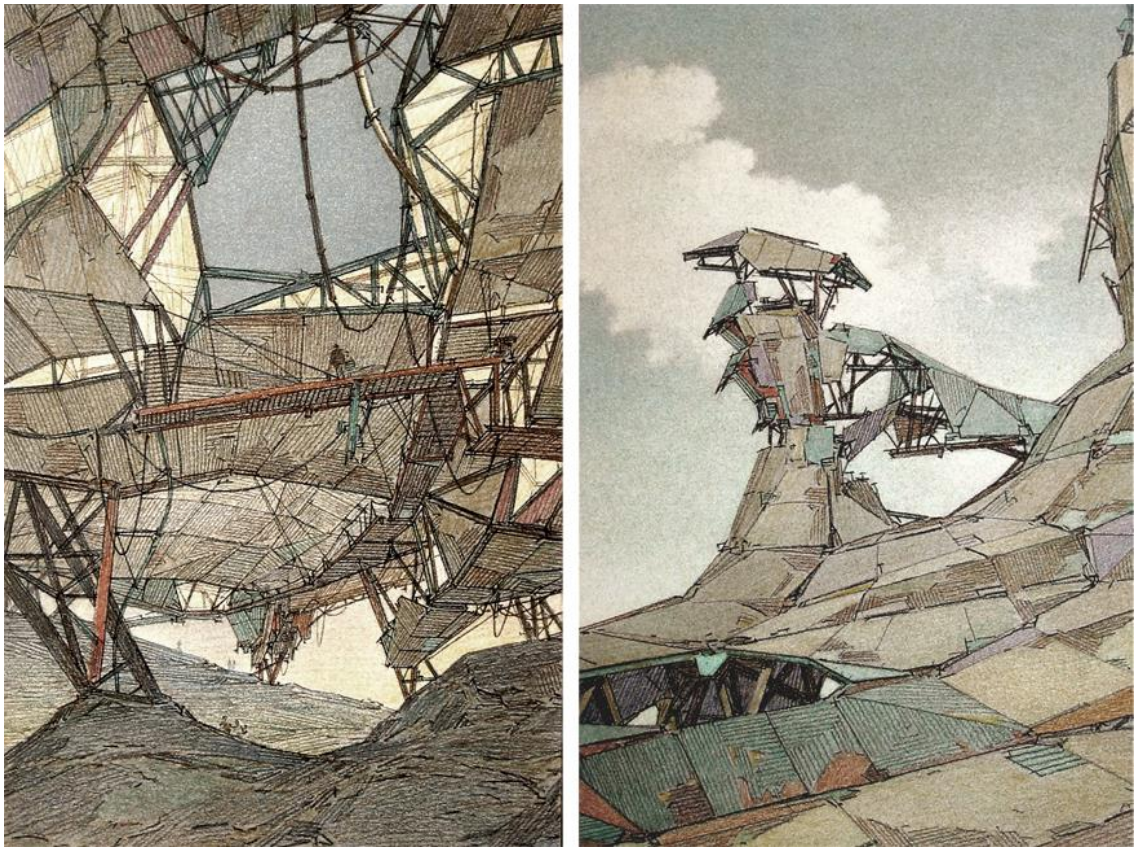


Figure 11. Olympic sculpture park - Weiss / Manfredi (2007)



Figures 12/13. Terra nova - constructed landscape - Drawings by Lebbeus Woods (1988)

Geochemical component. For life to be possible, a certain geochemical balance needs to be achieved. In its physical aspect, architectural design can hardly propose any addition to the soil, due to its slow metabolism and persistence in time. It can, however, facilitate processes like collecting food waste and faeces (as dry as possible) in an ideal way to produce compost, an excellent soil enhancer. I have explored in my design research the possibility of wiring the building so that this process would be entirely local, diffusing the nutrients around the building automatically. This path comes with a load of complications, and I found more promising the solution to treat it at the urban level, centralising the process at a neighbourhood scale facility, for instance.

Taking the problem from a different angle, designing sometimes means removing. In a location with a history of intense human presence, the soil is often saturated with polluting agents, or compacted beyond recovering capacity. In the first case, the implementation of remediating plants (a practice known as phytoremediation) suitable for the extraction of identified chemicals can be planned as part of the project. In the second case, the issue is the lack of porosity of the soil, preventing air, water, and thus micro-organisms and invertebrates from dwelling in it. Some digging mammals proved to be very efficient in soil restoration, as their extensive digging is a first step towards soil de-compaction. They are sometimes called "ecosystem engineers" as their dens and tunnels offer a prime location for other, smaller organisms to settle and take over the process.[38] A biophilic design approach temporarily supporting these "kickstarting" individuals by means of shelter, food and warmth could be productive. In that sense, architecture becomes prosthetic.

To remove can also mean to cease doing what is typically done. Excessive stabilisation of land, for instance, under the form of pavement or laying a carpet of gravel, cancels the crucial soil-air interface. It also inverts the long pedogenesis process by returning to the surface rocky material. Similarly, the planning of gardens which imply an extensive use of pesticides is counter-productive, and other approaches should be preferred.

A tight and productive relationship with the universal commons of our environment provides numerous ecosystem services, which are self-sufficient and require no maintenance. In their development lies the promise of **resilience** for our cities, a quality which will be treasured in the times to come.

Overall, the tracks of improvement of urban soil hint at morphological changes, implementation of new habits, modifications in the texture of the ground under our feet, and the welcoming of newcomers in our neighbourhoods. Biophilic design will raise again the question of mediating between humans and the species with which we will cohabit. Whether this will be part of the future architect's agenda is yet to decide. What remains in the designer's hands is to make sense of this new urban condition for the future urban dweller and to carry on the promise of a home.

[38] Palmer, B.J., Valentine, L.E., Page, M. and Hobbs, R.J. (2020), Translocations of digging mammals and their potential for ecosystem restoration: a review of goals and monitoring programmes. Mam Rev, 50: 382-398. https://doi.org/10.1111/mam.12208

2) Aesthetics: local logics

There can be no change without a vision which people can embrace and make their own.

From the foundations of a shared living environment reconciling humans with their grand family of life, the possibility of a sustainable existence needs to be drawn. Artists, architects, and theorists, have an essential role in this endeavour.

What I believe could be a strong aspect of this vision is the importance that should be given to the local. If architecture complies with the logics of the ecosystem in which it is located, both in what it does (local technologies) and how it is formed (remote effects), local identity will emerge naturally. The materiality will be continuous with the surrounding landscape, and the resulting architecture will closely interact with the ecosystem, becoming an enhancing part of it. Declinations of urban development and architecture will follow the biotopes' characteristics, dynamics and materiality. It shall be somewhere between the regional urbanism of the pre-globalised world, and the contemporary opulence in terms of heavily transformed materials and easy environmental mastering by means of "hi-tech".

Local identity, in that sense, is a collateral benefit of the post-human city. We admire and seek the difference in the world (look at the magnitude of the tourism economy), however, with globalisation, differences regress and the aesthetic of our world is flattening. Architecture has a huge responsibility in this process. Local Urban Plans have proven to be very efficient in preserving some regions from this evolution. An adaptation of this framework to an eco-logical agenda could prove to be efficient.

Besides the local aspect, I think there is potentially significant aesthetic amplitude in relaxing the paradigm of control that we live by and exploring what David Gissen[39] calls "Sub-natures": rust, dirt, dampness, mist; all these textures and sensations feed the senses and the mind. A new generation of design offices has already started to venture into these territories. Some examples are the Paris-based architecture and design office R&Sie(n), the New York-based multi-disciplinary design studio The Living, or the Madrid-based architecture office Ensamble studio. Alongside allowing more diversity of life in the cities and blurring the line between the built and the natural, these openings could bring a new impulse to an otherwise redundant contemporary architecture in quest of meaning.

To close the topic of local effects, we can wonder how to establish those principles as the new norm and generalise them. The urging necessity to do so suggests at least two directions. The normative, or producing a set of regulations, which would imply certain rigidity. The dedicated, or establishing the field as an integral domain of reflection, constitutive or not of the architect's mission, and potentially involving related specialists such as biologists, etc. This second option has the advantage of leaving the execution of the task as an open question, enabling a diversity of proposals and even part-taking in the expression of local culture.

[39] Gissen, D. (2009) Subnature Architectre: other environments.

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Reflection

After four years of studying architecture, venturing into topics proposed by studios and getting to know the field and discovering my aspirations, this final year was the long-awaited time to set my agenda. I originally referred to this topic as the "relationship between humans and nature". It lingered in my mind for quite some time, dropping in and out of my sketchbook.

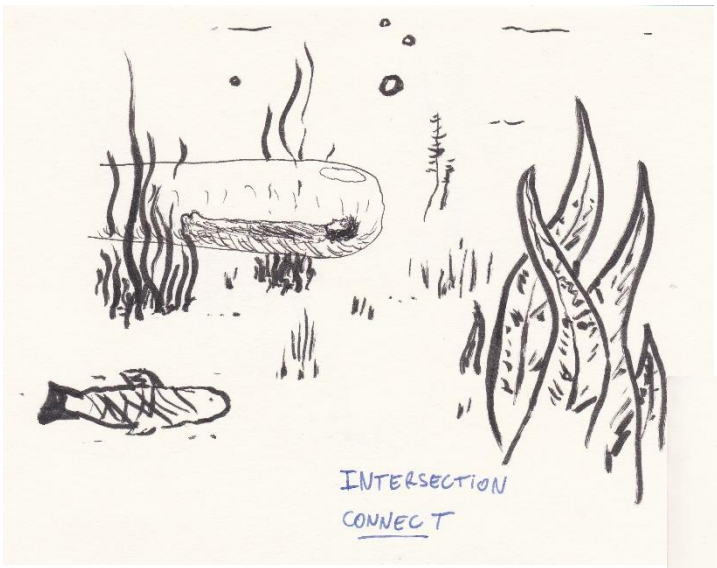
I have an intimate connection to its stakes, and this turned out to be, sometimes, more counter-productive. Indeed, it is also a hot topic, omnipresent in the public debate. Clearing out misconceptions and biases was thus a responsibility if I wanted to have an impact on this societal discussion. As I progressed in my research, I had to tame my romantic take on the topic and face it with more of a rational mind. To simplify, I gained maturity this year by learning to inform my hunch with precise knowledge, overstepping my initial expectations.

My method was relatively intuitive. I was constantly curious about the different foreign fields my topic tapped into. Biology, urbanism, philosophy. I was obsessed with grasping the subject entirely and getting to the bottom. For instance, I found myself diving into the work of Gilles Clément, deeply inspired by his concepts of moving garden and third landscape. I spent countless hours watching lectures of Dr Elaine Ingham, learning as much as possible about the microbiology of the soil; I took long walks thinking about the concept of Umwelt, and unfolding the complexities of subject, bodies, meaning… I wanted to find a stable foundation on which I could build a position I could trust entirely. It turns out that this task is long and will probably take more than graduation to strengthen…

In addition to this extensive research, I carried on with my habit of sketching and used it as a research tool. I stuck to a representational language from beginning to end, involving colour code, line weights, symbols, etc. This research by sketching allowed me to form elementary conceptual bricks that formed my design's fundamental language.

Page 2: research sketches from before the graduation year, 2018 – 2021

Page 3: research sketches from the graduation year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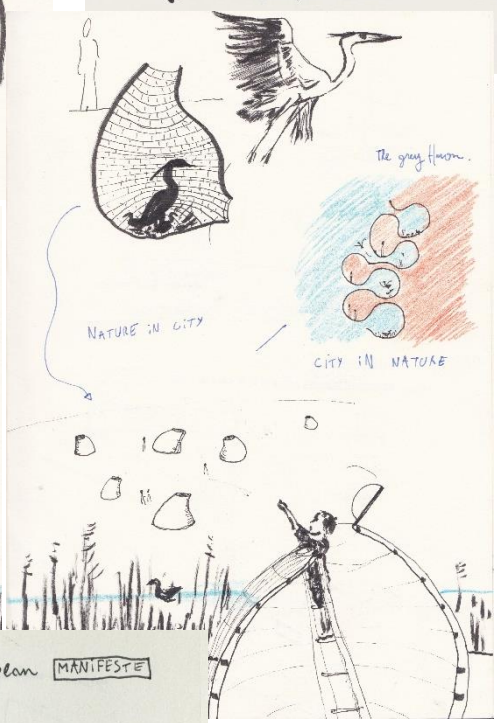
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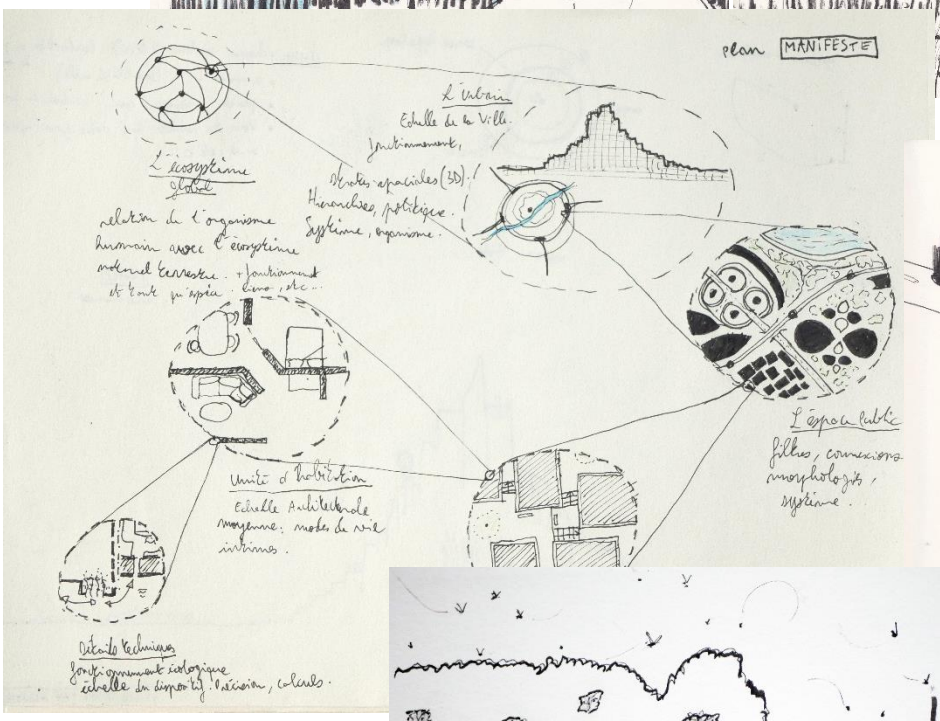
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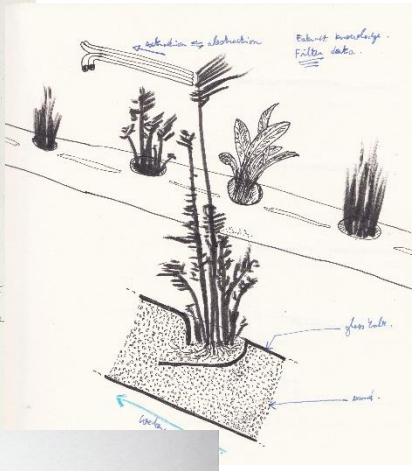

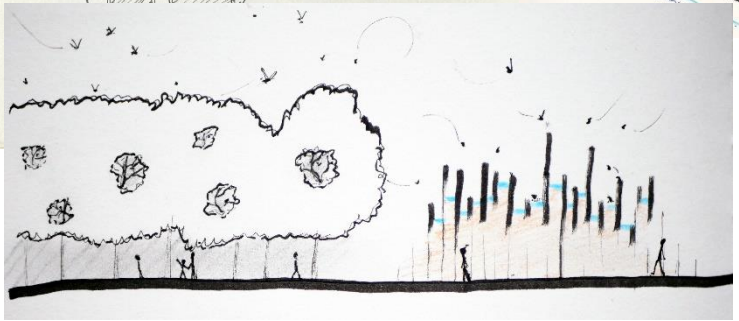

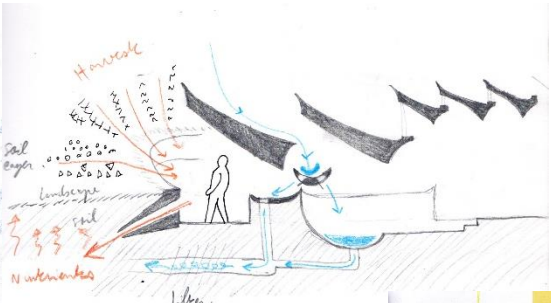
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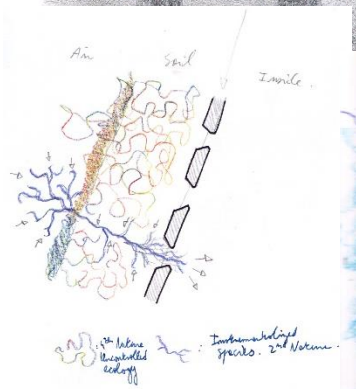
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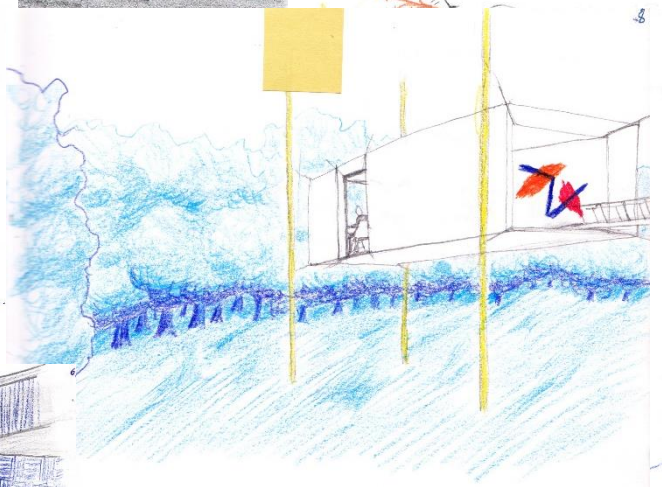
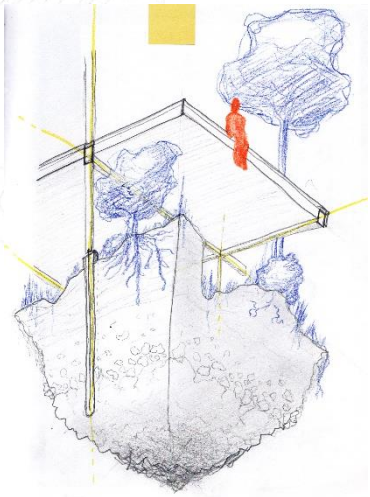
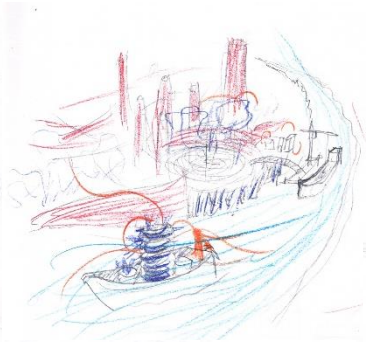
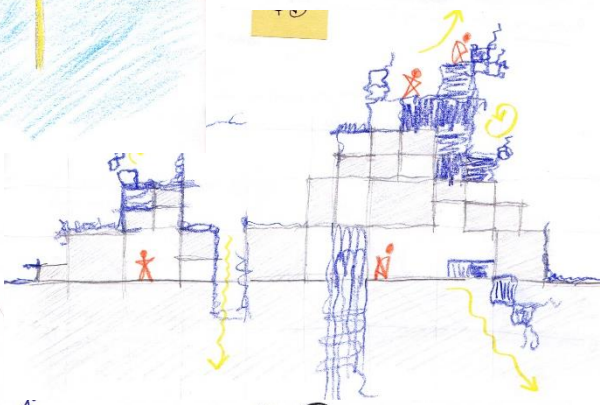
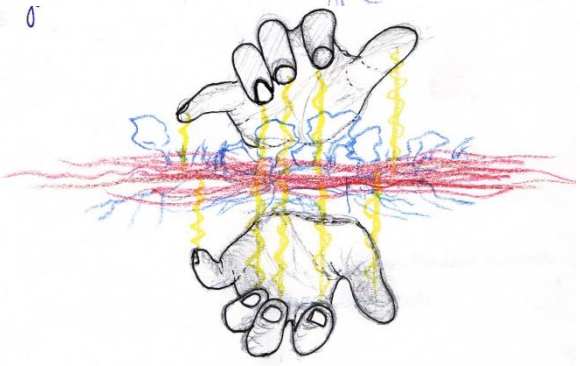
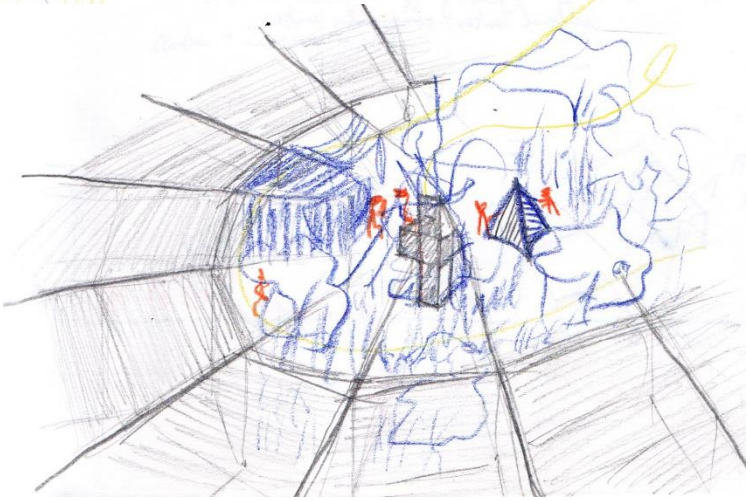


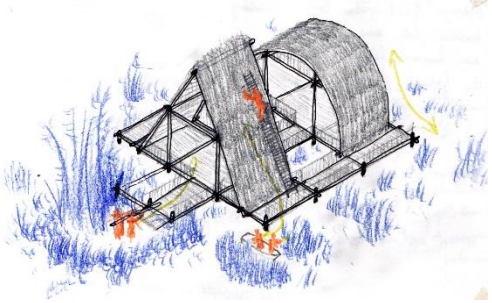










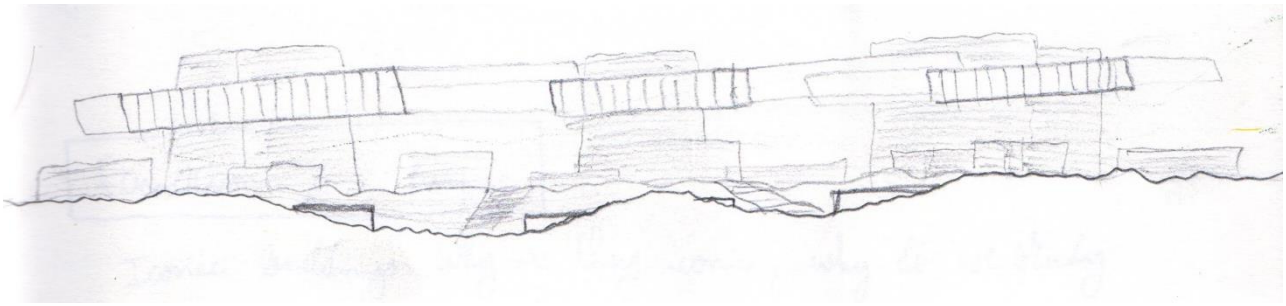


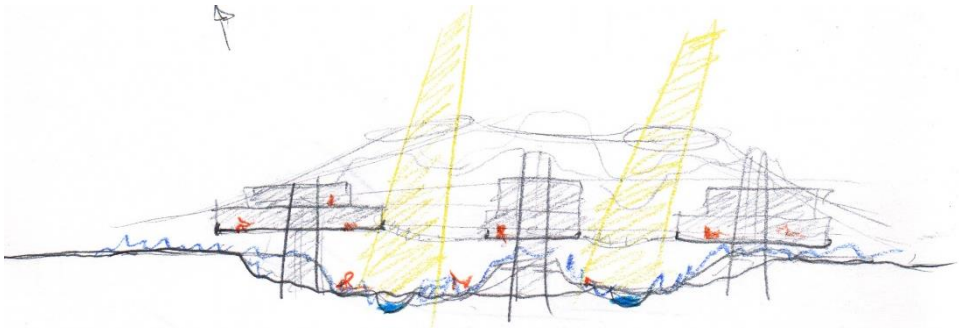
In terms of decision-making and progress, I had to face two main challenges pertaining to the duality of my design proposal. Due to my research, it made sense to have both a design which was innovative in terms of construction and local effects, as well as thinking about the urban function and researching new program assemblages. I believe that architects somehow have taken distance with designing industrial and infrastructural devices. There is a lot of potential in terms of design for such essential elements of our lives. I progressively resorbed my inherited reluctance for this domain and integrated it into a mixed program. A new question arose: where does the task of the architect stop?

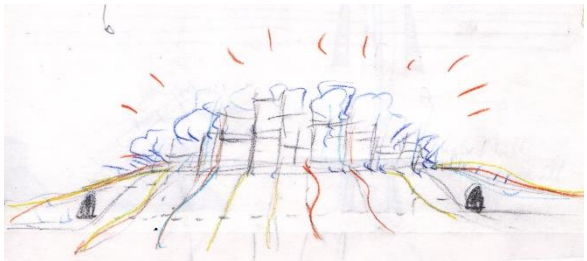
Another quite time-consuming yet enlightening process was choosing a tectonic approach to the materials I had decided to work with: rammed earth, timber, natural fibres and as little concrete and steel as possible. It would have been ideal and faster if I could know from the first sketch if the idea was relevant or feasible. I tested different options and explored some of them quite intensely. This design exploration was both delightful and insightful. I learned more in one year about materiality than in the four previous years and discovered a genuine sympathy for the matter.

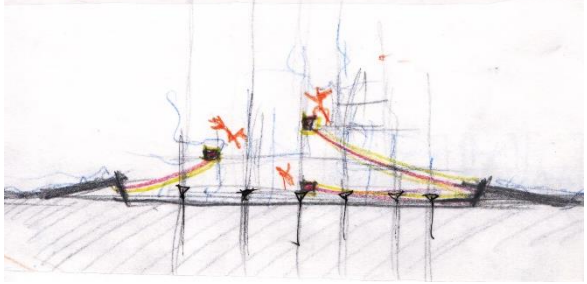
This process was a new way to learn, and although still happening within the university, I feel that it gave me the keys to carry on my learning more independently. I do not regret taking the time necessary to start this transition in the best conditions possible.

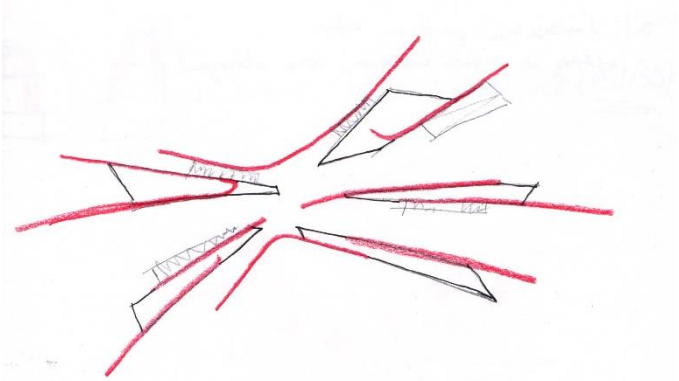
Page 5: orphan project iteration, which never left the sketchbook

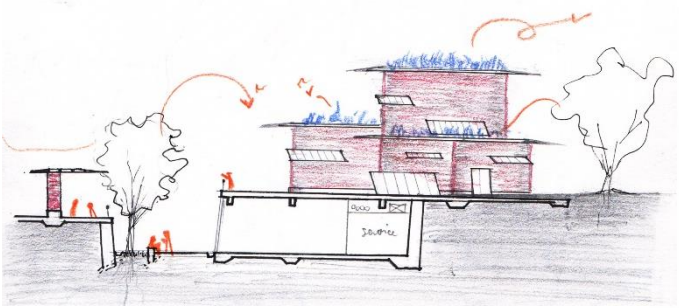


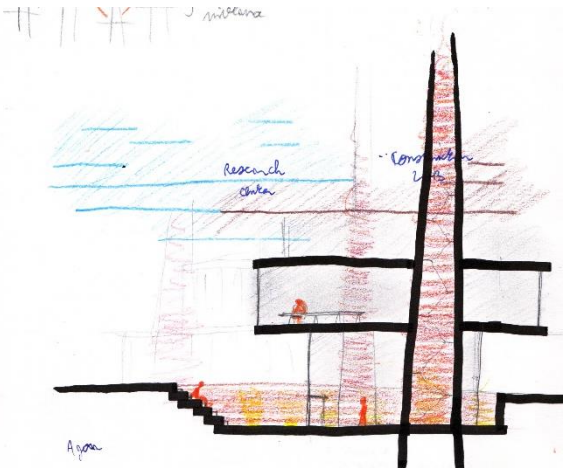








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