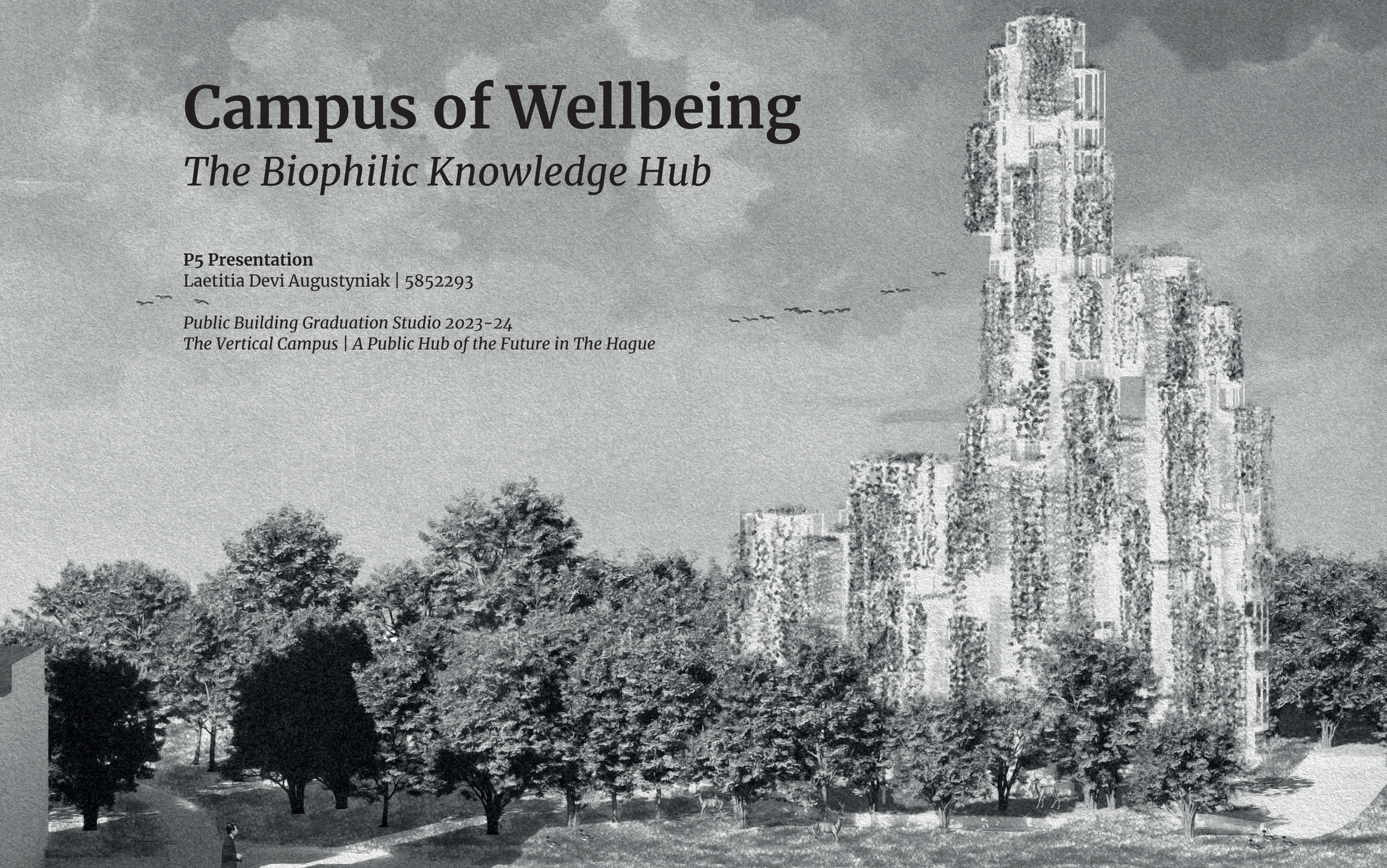
Campus of Wellbeing

The Biophilic Knowledge Hub

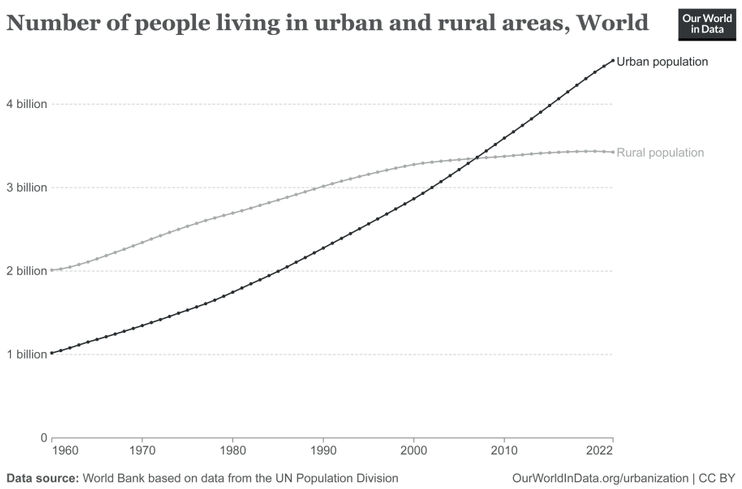
P5 Presentation
Laetitia Devi Augustyniak | 5852293

Public Building Graduation Studio 2023-24
The Vertical Campus | A Public Hub of the Future in The Hague



VERTICAL

Urban Densification

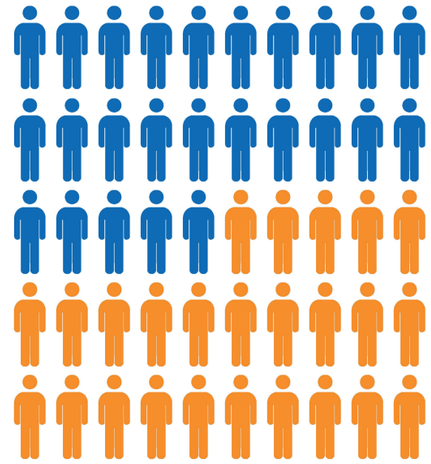


By 2050, the UN predicts that about **68% of the world population will live in cities** - in 2018 it was 55%.

(Source: United Nations 2018)

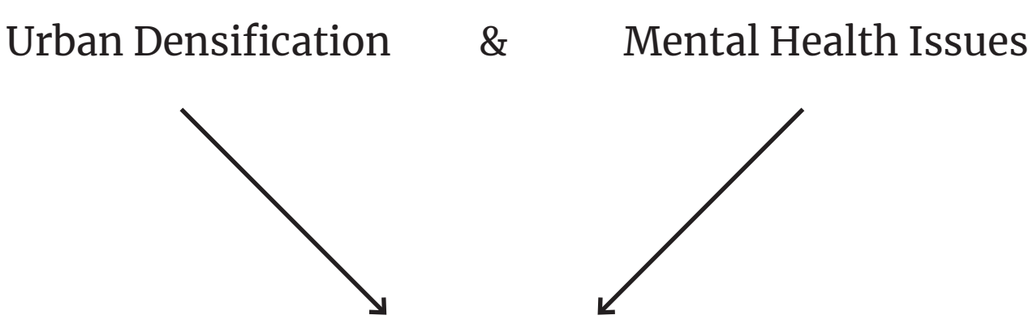
CAMPUS

Mental Health Issues



In 2021, **51% of the students** in higher education reported Mental Health Issues in the Netherlands.

(Source: RIVM 2021)



Biophilic Design

[Biophilia: “love for life“]

Humans

Psychological | Cognitive | Physical

+ **Mental Health** *(Bratman et al., 2012)*
+ **Physical Health** *(Barton & Pretty, 2010)*
+ **Cognitive Performance** *(Berman et al., 2008)*
+ **Attention Restoration** *(Kaplan, 1995)*
+ **Creativity** *(Williams et al., 2018)*
+ **Academic Performance** *(Tennessen and Cimprich, 1995)*
+ **Stress Reduction** *(Yao et al., 2021)*

Environment

City | Animals | Vegetation

+ **Biodiversity** *(Fuller et al., 2007)*
+ **Mitigates the Heat-Island Effect / Cooling** *(Park et al., 2017)*
+ **‘Sponge-City‘ / Water Managment** *(Foster et al., 2011)*
+ **Decrease of Energy Consumption** *(Hoelscher et al., 2016)*

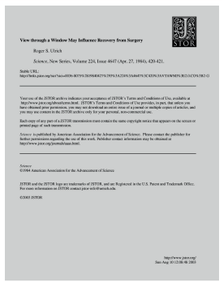
History of Biophilic Design

1964

For the first time the term **'Biophilia'** *(1964) was mentioned by the social psychologist Erich Fromm.*

1980s

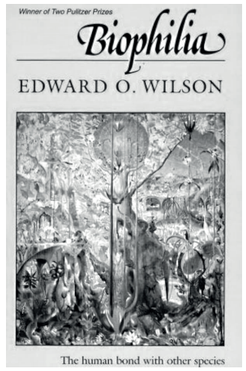
Environmental psychology *is doing more research on how nature influences human wellbeing, beginning in the 1980s and 90s.*


View through a Window May Influence Recovery from Surgery

Roger S. Ulrich

Science, New Series, Volume 224, Issue 4647 (Apr. 27, 1984), 420-421.

1984



The **Biophilia Hypothesis** *was published (Wilson, 1984).*

2001

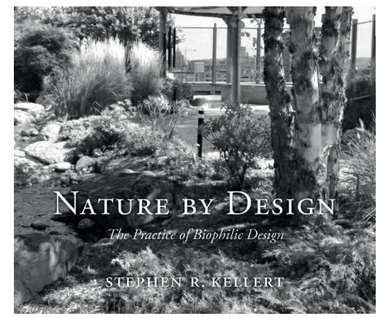
Heerwagen and Hase (2001) published an article describing the idea of **Biophilic Buildings**

2008

Stephen Kellert (2008)as well as Cramer and Browning (2008) publish research papers on various **Biophilic Design Patterns** *for the built environment.*

2018

Book release: "**Nature by Design**: *the practice of biophilic design" (Kellert, 2018).*



Global Developments

1854

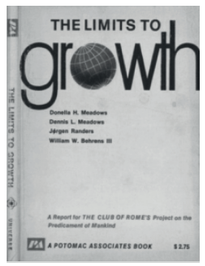
The **Industrial revolution** in the 19th century changed people's life drastically. The American philosopher Henry Thoreau published a book "Walden" (1854) in where he writes about **Holistic Worldview** in harmony with nature (Cunningham, 2022).

1952

Environmental crises such as the Great Smog in London started to create a wider public environmental awareness (Weyler, 2018).


(Source: Daily Mail)

1972



The **Club of Rome**, *a group of scientists, predicts that if the world grows as it does, the latest by 2100, the world won't be able to sustain the global population and its ecosystem (Meadow et al., 1972).*

1972

The first **United Nations world conference** *with 'environment' as its main topic is happening in Stockholm.*

2018

The United Nations publishes a report with predictions that by **2050 about 68%** *of the global population will live in cities.*

2020

Human-made mass exceeds the global **Biomass** *(Elhacham et al., 2020).*

2015

The **Sustainability Development Goals** *(SDG) were adopted by all 193 United Nations Member States.*



Marketing Strategy

Interior Design

Greenery ≠ Biophilic design

Sustainability

Lack of Quantitative Research

Green Washing

Addition or Integration

Artifical Nature

Urban Ecology, 8 (1984) 189–197
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

IMPACT OF URBAN NATURE: A THEORETICAL ANALYSIS

RACHEL KAPLAN
School of Natural Resources, University of Michigan, Ann Arbor, MI 48109 (U.S.A.)

(Accepted 10 October 1983)

ABSTRACT

Kaplan, R., 1984. Impact of urban nature: a theoretical analysis. *Urban Ecol.*, 8: 189–197.

The stresses and strains of the urban environment are widely acknowledged. The means for recovery, for recuperation, are perhaps less evident. In particular, the role of environmental configurations in this process is often neglected in the measurement of quality of life.

The urban natural environment can provide the setting for such restorative experiences, both physically and conceptually. A theoretical analysis is presented that focuses on the importance of fascination and coherence as essential processes in the powerful effects of the nature context. When these are both afforded by the setting, many of the benefits available in more remote natural settings may be available in the nearby urban context as well. The bits and pieces of urban nature are significant not only in terms of active recreational encounters. The view of trees and birds, the thought of spring to come, and the plans for summer's window box can all help in the restorative experience.

INTRODUCTION

Why do cities have parks? Why are thousands of new trees planted each year? Why do people grow flowers and have house plants? Why are landscapes the subject of picture postcards, motel art, and cigarette advertisements? Are fall color tours just a gimmick invented by chambers of commerce?

There is substantial indication that the natural environment matters to people. But the natural settings discussed here are not the distant mountains and beaches, canyons and primeval forests. Rather, the focus in on nature-at-the-doorstep. The urban natural environment can provide a setting for restorative experiences, both physically and conceptually. The purpose of this essay is to explore some of the properties of the natural environment that play this special role. This analysis is then applied to an examination of the kinds of involvements that are necessary to experience these properties.

Urban life is rarely described as peaceful. It can be characterized by such

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PSYCHOLOGICAL SCIENCE

Research Report

The Cognitive Benefits of Interacting With Nature

Marc G. Berman,[1,2] John Jonides,[1] and Stephen Kaplan[1,3]

[1]Department of Psychology, [2]Department of Industrial and Operations Engineering, and [3]Department of Electrical Engineering and Computer Science, University of Michigan

ABSTRACT—*We compare the restorative effects on cognitive functioning of interactions with natural versus urban environments. Attention restoration theory (ART) provides an analysis of the kinds of environments that lead to improvements in directed-attention abilities. Nature, which is filled with intriguing stimuli, modestly grabs attention in a bottom-up fashion, allowing top-down directed-attention abilities a chance to replenish. Unlike natural environments, urban environments are filled with stimulation that captures attention dramatically and additionally requires directed attention (e.g., to avoid being hit by a car), making them less restorative. We present two experiments that show that walking in nature or viewing pictures of nature can improve directed-attention abilities as measured with a backwards digit-span task and the Attention Network Task, thus validating attention restoration theory.*

Imagine a therapy that had no known side effects, was readily available, and could improve your cognitive functioning at zero cost. Such a therapy has been known to philosophers, writers, and laypeople alike: interacting with nature. Many have suspected that nature can promote improved cognitive functioning and overall well-being, and these effects have recently been documented.

Attention restoration theory (ART; Kaplan, 1995, 2001) offers a novel approach to identifying and restoring a cognitive mechanism. ART is based on past research showing the separation of attention into two components: involuntary attention, where attention is captured by inherently intriguing or important stimuli, and voluntary or directed attention, where attention is directed by cognitive-control processes. This separation was proposed by James (1892), and subsequent research has validated James' distinction between voluntary and involuntary attention both behaviorally (Fan, McCandliss, Fossella, Flombaum, & Posner, 2002; Jonides, 1981) and neurally (Buschman & Miller, 2007; Corbetta & Shulman, 2002; Fan, McCandliss, Sommer, Raz, & Posner, 2005). In addition to top-down control, directed attention[1] involves resolving conflict, when one needs to suppress distracting stimulation. ART identifies directed attention as the cognitive mechanism that is restored by interactions with nature.

We are not the first to propose a crucial role for directed attention in effective cognitive functioning. One of the main themes of Posner and Rothbart's recent *Annual Review of Psychology* chapter (2007) is this very topic: how directed attention plays a prominent role in successful cognitive and emotional functioning. Additionally, recent research has implicated an important role for directed attention in short-term memory (see Jonides et al., 2008) and school success (Diamond, Barnett, Thomas, & Munro, 2007).

According to ART, interacting with environments rich with inherently fascinating stimuli (e.g., sunsets) invoke *involuntary* attention *modestly*, allowing *directed-attention* mechanisms a chance to replenish (Kaplan, 1995). That is, the requirement for directed attention in such environments is minimized, and attention is typically captured in a bottom-up fashion by features of the environment itself. So, the logic is that, after an interaction with natural environments, one is able to perform better on tasks that depend on directed-attention abilities. Unlike natural environments, urban environments contain bottom-up stimulation (e.g., car horns) that captures attention *dramatically* and additionally requires directed attention to overcome that stimulation (e.g., avoiding traffic, ignoring advertising, etc.), making urban environments less restorative.

Previous research has provided support for the hypothesis that interactions with nature improve attention and memory (Berto, 2005; Cimprich, 1992, 1993; Cimprich & Ronis, 2003; Faber

Address correspondence to Marc G. Berman, Department of Psychology, University of Michigan, 530 Church St., Ann Arbor, MI 48109-1043, e-mail: bermanm@umich.edu.

[1]Fan et al. (2002, 2005) refer to this type of attention as executive attention.

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journal homepage: www.elsevier.com/locate/jep

Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours

Leanne Martin[a,b,*], Mathew P. White[c], Anne Hunt[a], Miles Richardson[d], Sabine Pahl[b], Jim Burt[a]

[a]Natural England, UK
[b]School of Psychology, University of Plymouth, UK
[c]European Centre for Environment and Human Health, University of Exeter Medical School, UK
[d]Human Sciences Research Centre, University of Derby, UK

ABSTRACT

Contact with, and psychological connectedness to the natural world are both associated with various health and sustainability-related outcomes. To date, though, the evidence base has been fragmented. Using a representative sample of the adult population of England (N = 4,960), we investigated the relationships between three types of nature contact, psychological connectedness, health, subjective wellbeing and pro-environmental behaviours within a single study. We found that specific types of nature contact, as well as individual differences in nature connectedness, were differentially associated with aspects of health, well-being and pro-environmental behaviours. Living in a greener neighbourhood was, unrelated to any wellbeing or sustainability outcomes. By contrast, visiting nature ≥ once a week was positively associated with general health and household pro-environmental behaviours. Moreover, people who watched/listened to nature documentaries reported higher levels of both pro-environmental behaviours. Nature connectedness was positively related to eudaimonic wellbeing and both types of pro-environmental behaviour. Moreover, connectedness moderated key relationships between nature contact, wellbeing and pro-environmental behaviours. The complexity of our findings suggests that interventions increasing both contact with, and connection to nature, are likely to be needed in order to achieve synergistic improvements to human and planetary health.

1. Introduction

Public health and environmental sustainability present two of the most significant global challenges of the 21st century (WHO, 2015). With environmental degradation posing serious consequences to human health (WHO, 2013) and anthropogenic activity further compromising environmental quality (United Nations, 2018), there is increasing recognition that these two challenges are inter-connected (Graham & White, 2016; Nisbet & Gick, 2008). As both public and planetary health are under increasing pressure, researchers have called for better integration of the sustainability and health/wellbeing research agendas (Depledge, White, Mayrock, & Fleming, 2019; Watts et al., 2015). One area of potential overlap concerns people's physical and psychological experiences of the natural world. There is growing evidence that contact with (non-threatening) natural environments is associated with a range of positive health (Lovell, Depledge, & Maxwell, 2018; Twohig-Bennett & Jones, 2018), well-being (Capaldi, Passmore, Nisbet, Zelenski, & Dopko, 2015; McMahan & Estes, 2015) and pro-environmental outcomes (Arendt & Matthes, 2016; Hartig, Kaiser, & Strumse, 2007; Weinstein et al., 2015). However, to date, these outcomes have been largely explored in parallel, rather than simultaneously. Further, there is increasing realisation that nature contact alone may be insufficient and that one also needs to feel psychologically connected to the natural world, i.e. to have positive emotional bonds with nature (Capaldi, Dopko, & Zelenski, 2014), for these potential benefits to accrue (Mackay & Schmitt, 2019; Pritchard, Richardson, Sheffield, & McEwan, 2019; Whitburn, Linklater, & Abrahamse, 2019).

Using data from a representative sample of the English adult population, the current research investigated the links between three different types of nature contact and both self-reported health/well-being outcomes and pro-environmental behaviours within the same study. We also examined the role nature connectedness might play in any such relationships. Previous experimental research found that greater nature contact led to better outcomes via improved psychological connectedness, at least partially (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). As our data were cross-sectional rather than experimental, and our measure of nature connectedness was a trait measure, we focused on moderation rather than mediation. We hypothesised that the level of existing (trait) nature connectedness would affect how nature contact experiences would relate to both health/wellbeing and pro-environmental outcomes.

* Corresponding author. Natural England, UK.
E-mail address: leanne.martin@plymouth.ac.uk (L. Martin).

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HEALTH & PLACE

ELSEVIER

Health & Place 13 (2007) 839–850

www.elsevier.com/locate/healthplace

Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators

Thomas Sick Nielsen*, Karsten Bruun Hansen

[a]Danish Centre for Forest, Landscape and Planning, University of Copenhagen, Rolighedsvej 23, DK-1958 Frederiksberg C, Denmark
[b]City of Copenhagen, Njalsgade 13, DK-2300 København S, Denmark

Received 1 May 2006; received in revised form 4 October 2006; accepted 9 February 2007

Abstract

The article presents the result from a Danish survey on access and use of green areas and the impact on experienced stress and obesity. The statistical results indicate that access to a garden or short distances to green areas from the dwelling are associated with less stress and a lower likelihood of obesity. The number of visits cannot explain the effects of green areas on the health indicators. It is suggested that the significance of distance to green areas is mainly derived from its correlation with the character of the neighbourhood and its conduciveness to outdoor activities and "healthy" modes of travel.
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Keywords: Obesity; Overweight; Mental stress; Green areas; Gardens; Access; Residential environment; Physical activity

Introduction

Lifestyle-related diseases are increasing dramatically in western countries. Recent epidemiological studies in Denmark have revealed that physical inactivity represents a high risk of premature development of chronic diseases such as cardiovascular diseases and type 2 diabetes (Klarlund Pedersen and Saltin, 2003). In addition, there is a marked increase in the prevalence of obesity. At present 30–40% of the adult Dane are overweight (BMI > 25), and almost 10% are obese (BMI > 30). The trend towards low physical activity and increasing BMI is especially alarming when it comes to children (National Board of Health, 2003a). Another lifestyle-related disease on the rise is mental stress. In 2000, 44% of the Danish population experienced stress in everyday life compared to 35% in 1987 (National Institute of Public Health, 2003). Physical diseases together with mental stress, depression and "burn out" syndrome have become a major economic challenge in the contemporary health economy (WHO, 2003; OECD, 2006).

International studies have documented positive health effects of green areas on human health (e.g., Ulrich, 1984; Kaplan and Kaplan, 1989; Marcus and Barnes, 1999). Cardiovascular and mental illnesses as well as low back and neck pain are positively affected (Odani, 2001; de Vries, 2004). It has also been documented that green areas and daylight are beneficial for children, adults and

*Corresponding author. Tel.: +45 35 28 18 30; fax: +45 35 28 15 08.
E-mail addresses: sick@life.ku.dk (T.S. Nielsen), karha@mf.kk.dk (K.B. Hansen).

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sustainability

MDPI

Article

Biophilic Design for Restorative University Learning Environments: A Critical Review of Literature and Design Recommendations

Terri Peters * and Kristen D'Penna

Department of Architectural Science, Ryerson University, Toronto, ON M5B 2K3, Canada; Kristen.Dpenna@Ryerson.ca
* Correspondence: Terri.Peters@Ryerson.ca

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Abstract: The influence of environmental design on people's wellbeing and productivity has been well studied in some settings such as offices, hospitals, and elementary schools, but salutogenic and biophilic design in urban post-secondary educational environments remains understudied and warrants closer investigation. There are unique challenges faced by these students and implementing health promoting and restorative, environmental design strategies could improve the quality of life and learning outcomes of university students. This paper identifies pertinent themes in published multi-disciplinary literature relating to the influence of the built environment on university students: emotional stress, happiness, stimulation, cognitive function, social support, belonging, places to study, lighting, and ventilation. The results of the semi-structured literature review identifies, analyzes, and categorizes relevant studies that examine nature views, nature images, natural colors, natural materials, auditory and olfactory aspects of nature, nature images with water, indoor plants, campus landscapes, study spaces, local materials and style, daylight access, and thermal and environmental comfort. These are organized according to the biophilic patterns identified by Browning, Ryan, and Clancy. Trends and gaps in understanding the influence of biophilic design on university settings are discussed, and the paper identifies evidence-based design recommendations for incorporating biophilic design in university settings.

Keywords: biophilic design; biophilic patterns; architectural design; university campus; learning environments; wellbeing; restorative environmental design; salutogenic design

1. Introduction

Biophilia is defined as people's innate affinity to the natural world, and it has been explored in psychology and sociology since the 1980s [1]. In architecture and design, there has been a growing and recent interest in the impacts of nature on people in buildings [2,3] and in the past decade, there has been a significant increase in published peer-reviewed design research relevant to biophilic design [4–6]. In parallel there has been a growing interest both in architectural practice and in academia relating to better understanding the impacts of buildings and indoor environments on people's health and wellbeing. The World Health Organization cites depression and mental health issues as the leading cause of disability worldwide [7] and since people spend 90% of their time in buildings [4], environmental design presents challenges and opportunities for designers.

In the context of COVID-19, there is increased anxiety around indoor environments and an urgent focus on creating spaces that promote emotional and physical health. Student and instructor behavior and interactions in university learning environments are changing rapidly; for example, many campuses are mandating online learning, social distancing, and for in person instruction, smaller

Annu. Rev. Environ. Resour. 2013. 38:473–502
First published online as a Review in Advance on August 2, 2013
The *Annual Review of Environment and Resources* is online at http://environ.annualreviews.org
This article's doi: 10.1146/annurev-environ-012312-110838
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Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being

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Roly Russell,[1] Anne D. Guerry,[2] Patricia Balvanera,[3] Rachelle K. Gould,[4] Xavier Basurto,[5] Kai M.A. Chan,[6] Sarah Klain,[6] Jordan Levine,[6] and Jordan Tam[6]

[1]The Sandhill Institute for Complexity and Sustainability, Grand Forks, British Columbia V0H 1H9, Canada; email: roly@sandhillinstitute.org
[2]Natural Capital Project, Woods Institute for the Environment, Stanford University, Seaside, Washington 98133; email: anne.guerry@usanford.edu
[3]Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de México, Morelia, Michoacán, 58190 Mexico; email: pbalvanera@oikos.unam.mx
[4]Emmett Interdisciplinary Program in Environment and Resources, Stanford University, Stanford, California 94305; email: rachelle@post.harvard.edu
[5]Duke Marine Lab, Nicholas School of the Environment, Duke University, Beaufort, North Carolina 28516; email: xavier.basurto@duke.edu
[6]Institute for Resources, Environment and Sustainability, University of British Columbia, Vancouver, British Columbia V6T 1Z4, Canada; email: kaichan@mrs.ubc.ca, s.klain.ubc@gmail.com, levine.jordan.s@gmail.com, jordan.tam@gmail.com

Keywords

well-being, ecosystem, cultural ecosystem services, channels of human experience, constituents of well-being, nonmaterial ecosystem benefits, ecosystem goods and services

Abstract

Ecosystems provide many of the material building blocks for human well-being. Although quantification and appreciation of such contributions have rapidly grown, our dependence upon cultural connections to nature deserves more attention. We synthesize multidisciplinary peer-reviewed research on contributions of nature or ecosystems to human well-being mediated through nontangible connections (such as culture). We characterize these connections on the basis of the channels through which such connections arise (i.e., knowing, perceiving, interacting with, and living within) and the components of human well-being they affect (e.g., physical, mental and spiritual health, inspiration, identity). We found enormous variation in the methods used, quantity of research, and generalizability of the literature. The effects of nature on mental and physical health have been rigorously demonstrated, whereas other effects (e.g., on learning) are theorized but seldom demonstrated. The balance of evidence indicates conclusively that knowing and experiencing nature makes us generally happier, healthier people. More fully characterizing our intangible connections with nature will help shape decisions that benefit people and the ecosystems on which we depend.

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Biophilic Design in Architecture and Its Contributions to Health, Well-being, and Sustainability

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BIOPHILIC DESIGN PATTERNS
Emerging Nature-Based Parameters for Health and Well-Being in the Built Environment

Catherine O. Ryan, William D. Browning, Joseph O. Clancy, Scott L. Andrews, and Namita B. Kallianpurkar
Terrapin Bright Green LLC
United States
cate@terrapinbg.com

Abstract

This paper carries forth the conceptual framework for biophilic design that was first laid out by Cramer and Browning in Biophilic Design (2008), which established three categories meant to help define biophilic buildings – Nature in the Space, Natural Analogues and Nature of the Space – and a preliminary list of "biophilic conditions". New research and insights from the neurosciences, endocrinology and other fields have since helped evolve the scientific basis for biophilic design. This paper begins to articulate this growing body of research and emerging design parameters in architectural terms, so that we may draw connections between fields of study, highlight potential avenues for future research, evolve our understanding of biophilic design patterns, and capture the positive psychophysiological and cognitive benefits afforded by biophilia in our design interventions.

Keywords: biophilia; biophilic design; pattern language; prospect-refuge theory; mystery; complexity and order; thermal comfort

INTRODUCTION

Biophilia is the deep-seated need of humans to connect with nature. It helps explain why crackling fires and crashing waves captivate us; why a view to nature can enhance our creativity; why shadows and heights instill fascination and fear; and why gardening and strolling through a park have restorative healing effects. Biophilia, as a hypothesis, may also help explain why some urban parks and buildings are preferred over others. For decades research scientists and design practitioners have been working to define aspects of nature that most impact our satisfaction with the built environment. But how do we move from research to application in a manner that effectively enhances health and well-being, and how should efficacy be measured?

As new evidence emerges, the relationships between nature, science and the built environment are becoming easier to understand old wisdom and new opportunities. The scope of this paper, however, limits its perspective to identifying universal issues, rather than situational or sector-specific issues within health and the built environment. This is due to the huge volume of research appropriate to each industry sector that would be required to validate such a paper and would likely be enough content to formulate a book or even several volumes. This paper therefore presents 3 categories and 14 patterns of biophilic design in a manner reflective of the nature-health relationships most prominent in the built environment. We focus on the patterns for which evidence has shown, at least to some degree, to impact our cognitive capacity to enhance and maintain a healthy, life experience through a connection with nature.

The design patterns have been developed from empirical evidence and interdisciplinary analysis of more than 500 peer-reviewed articles and books. The patterns have a wide range of applications for both interior and exterior environments, and are meant to be flexible and adaptive, allowing for project-appropriate implementation. From a designer's perspective, biophilic design patterns have the potential to re-position the environmental quality conversation

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SCIENTIFIC REPORTS

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Spending at least 120 minutes a week in nature is associated with good health and wellbeing

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ccepted: 8 May 2019
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Mathew P. White[1], Ian Alcock[2], James Grellier[1], Benedict W. Wheeler[1], Terry Hartig[3], Sara L. Warber[4,5], Angie Bone[1], Michael H. Depledge[1] & Lora E. Fleming[1]

Spending time in natural environments can benefit health and well-being, but exposure-response relationships are under-researched. We examined associations between recreational nature contact in the last seven days and self-reported health and well-being. Participants (n = 19,806) were drawn from the Monitor of Engagement with the Natural Environment Survey (2014/15–2015/16); weighted to be nationally representative. Weekly contact was categorised using 60-min blocks. Analyses controlled for residential greenspace and other neighbourhood and individual factors. Compared to no nature contact last week, the likelihood of reporting good health or high well-being became significantly greater with contact ≥ 120 mins (e.g. 120–179 mins: ORs (95%CIs): Health = 1.59 [1.31–1.92]; Well-being = 1.23 [1.08–1.40]). Positive associations peaked between 200–300 mins per week with no further gain. The pattern was consistent across key groups including older adults and those with long-term health issues. It did not matter how 120 mins of contact a week was achieved (e.g. one long vs. several shorter visits/week). Prospective longitudinal and intervention studies are a critical next step in developing possible weekly nature exposure guidelines comparable to those for physical activity.

A growing body of epidemiological evidence indicates that greater exposure to, or 'contact with', natural environments (such as parks, woodlands and beaches) is associated with better health and well-being, at least among populations in high income, largely urbanised, societies[1]. While the quantity and quality of evidence varies across outcomes, living in greener urban areas is associated with lower probabilities of cardiovascular disease[2], obesity[3], diabetes[4], asthma hospitalisation[5], mental distress[6], and ultimately mortality[7], among adults; and lower risks of obesity[8] and myopia[9] in children. Greater quantities of neighbourhood nature are also associated with better self-reported health[10–12], and subjective well-being[13] in adults, and improved birth outcomes[14], and cognitive development[15], in children.

However, the amount of greenspace in one's neighbourhood (e.g. percent of land cover in a 1 km radius from the home), or the distance of one's home to the nearest publically accessible green space or park[16] is only one way of assessing an individual's level of nature exposure. An alternative is to measure the amount of time individuals actually spend outside in natural environments[17,18], sometimes referred to as 'direct' exposure[19]. Both approaches are potentially informative. Residential proximity to nature may be related to health promoting factors such as reduced air and noise pollution (although the relationships are complex[20]), and may also provide 'indirect' exposure via views from the property[21]. Residential proximity is also generally positively related to 'direct' exposure; i.e. people in greener neighbourhoods tend to report visiting greenspace more often[22]. Yet many nature visits take place outside of the local neighbourhood[23]. Moreover, such visits may compensate for a lack of nature in the neighbourhood[24]. In other words, direct exposure, or more specifically in the current context, recreational time spent in natural environments per week, cannot accurately be inferred from neighbourhood greenspace near the home.

Using data from a representative sample of the adult population of England, we aimed to better understand the relationships between time spent in nature per week and self-reported health and subjective well-being. Our research builds directly on a small number of studies that have started to look at similar issues[17,18,24], and answers the call made in several recent reviews for more work in this area[25,26]. Quantification of these 'exposure-response'

[1]European Centre for Environment and Human Health, University of Exeter Medical School, Exeter, UK. [2]Institute for Housing and urban Research, Uppsala University, Box 514, SE-75120, Uppsala, Sweden. [3]Department of Family Medicine, University of Michigan Medical School, Ann Arbor, MI, USA. Correspondence and requests for materials should be addressed to M.P.W. (email: mathew.white@exeter.ac.uk)

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Conceptualising creativity benefits of nature experience: Attention restoration and mind wandering as complementary processes

Kathryn J.H. Williams[a,*], Kate E. Lee[b], Terry Hartig[b], Leisa D. Sargent[c], Nicholas S.G. Williams[a], Katherine A. Johnson[d]

[a]School of Ecosystem and Forest Sciences, University of Melbourne, Australia
[b]Institute for Housing and Urban Research, Uppsala University, Sweden
[c]UNSW Business School, UNSW, Australia
[d]Melbourne School of Psychological Sciences, University of Melbourne, Australia

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ABSTRACT

Accumulating evidence indicates that time spent in natural environments promotes creativity, but few researchers have considered how this occurs. We evaluate two candidate mechanisms, attention restoration and mind wandering. We compare the accounts in terms of attentional focus, brain network activation, cognitive effects, and the temporal progression of these processes across the stages of creativity. Based on this analysis, we propose that (1) gentle shifts between externally oriented soft fascination and internally oriented mind wandering can occur during nature experience; (2) this provides the basis for mutually reinforcing pathways that enhance attention control following nature experience; and (3) mind wandering might support additional benefits for creativity, including flexibility and new associations of ideas. We propose research to test the proposed pathways, including the conditions under which environments influence creativity, the ebb and flow of attention orientation during environmental experience, and the links between attentional focus, brain network activation and creativity.

1. Introduction

How does the experience of nature influence creativity? Anecdotal evidence over millennia and across cultures suggests a particular link between nature and creativity. This is exemplified by the work of writers like William Wordsworth and painters like Georgia O'Keefe who drew on nature as both a source of ideas and as a setting that enabled creativity. Many readers will recognise the related experience of taking a work day lunch break in a park and finding that the solution to a problem suddenly becomes clear, or of returning to work with new energy and ideas. Despite this conjecture, only a relatively small body of research formally tests whether nature experience boosts creativity, and much of this work lacks a theoretical explanation for how such benefits occur. Attention restoration theory (ART; Kaplan & Kaplan, 1989) is commonly referenced to explain the creativity benefits of nature experience in terms of a renewed ability to direct and control attention (e.g. Atchley, Strayer, & Atchley, 2012; McCoy & Evans, 2002). Researchers recognise, however, that ART does not sufficiently explain how nature experience might enable the flexible forms of cognition associated with creativity (van Rompay & Jol, 2016). This has led to speculation that other processes - such as mind wandering - may be involved (Atchley et al., 2012). Mind wandering, sometimes referred to as daydreaming, is internally focused thought that is unrelated to the task at hand (Baird et al., 2012; Smallwood & Schooler, 2015).

On the face of it, these two mechanisms are not readily compatible. For example, when applied to the nature-creativity relationship, ART suggests that creativity benefits occur primarily through restoration of a directed attention capability via an *externally-oriented*, effortless form of attention called soft fascination (Kaplan & Kaplan, 1989; Kaplan, 1995). There is some evidence that these cognitive benefits are due to improved functioning of attention and executive control networks of the brain (e.g., Berman, Jonides, & Kaplan, 2008). In contrast, mind wandering researchers suggest that creativity benefits occur through associative processes - spontaneous formation of associations between previously unconnected ideas - with creativity promoted through *internally oriented* cognition (Schooler et al., 2011). In other contexts, mind wandering has been linked to the functioning of the default network, a complex of brain regions empirically linked to creativity (Beaty, Benedek, Kaufman, & Silvia, 2015).

To resolve this seeming tension, we conduct nature experience in

* Corresponding author. School of Ecosystem and Forest Sciences, Baldwin Spencer Building, University of Melbourne, Parkville, 3010, Australia.
E-mail address: kjhw@unimelb.edu.au (K.J.H. Williams).

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Integration

Layers | Merge | Connect

Biocentric

Plants | Humans | Animals

1. Green Border
2. High-Density City Fabric
3. Fly-Over Infrastructure

Housing area

Malietoren
[Benthem Crouwel Architects, 1996]

New Babylon
[MVSA Architects, 2012]

‘Stichthage’
- previous Central Station -
[Koen van der Gaast and Hans Bak, 1975]

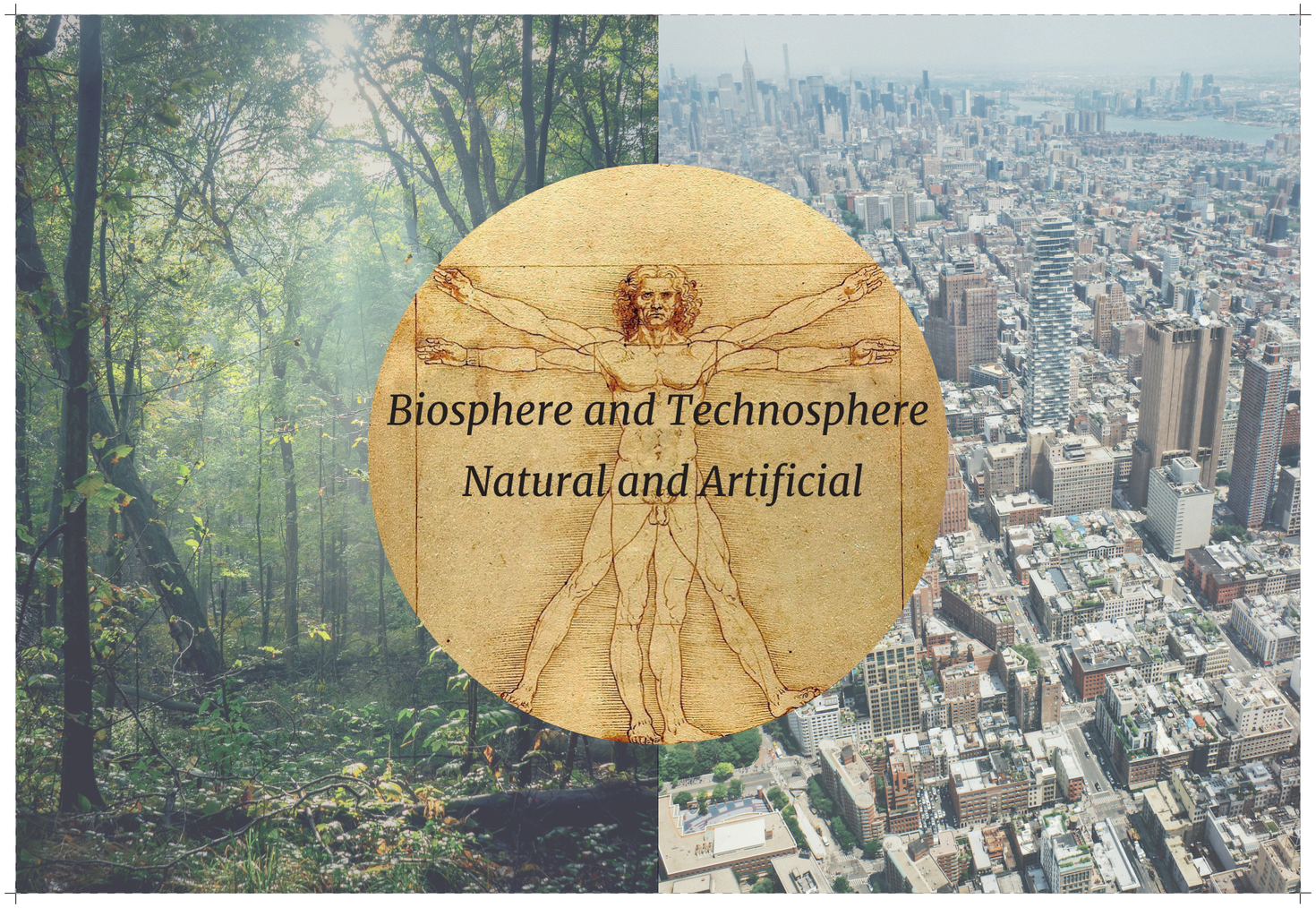
Housing area

Haagse Bos
- one of the oldest forests in the Netherlands -
[1576: “Act of Redemption”]

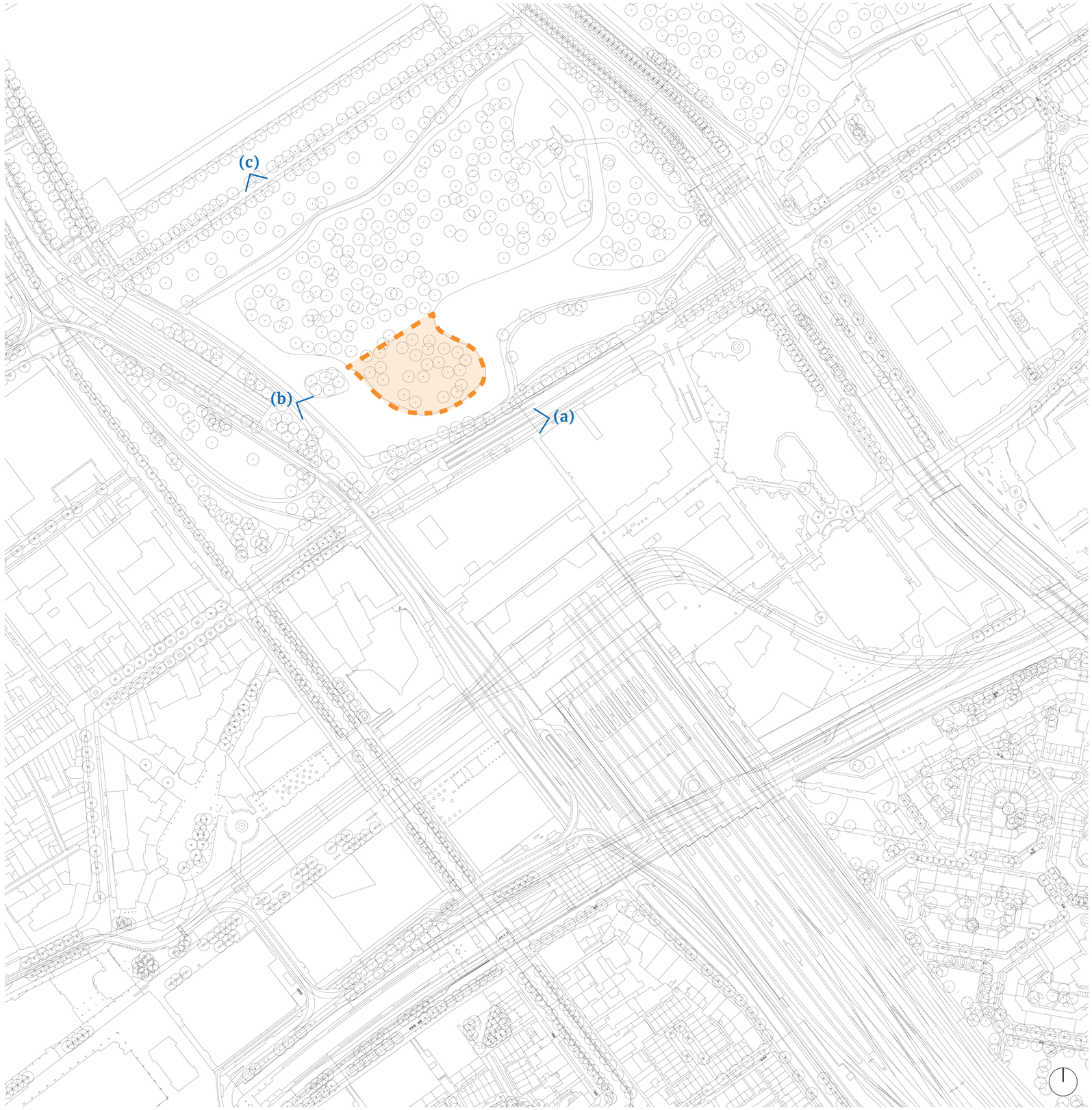
Koekamp
- Deer Park (not public) -
[First deers - around the end of the 16th century]

Governmental Offices

Center of The Hague



Collage from the beginning of ‘Research by Design’




View (a) on Bezuidenhoutseweg to the city center


View (b) looking to ‘New Babylon’ and ‘Stichthage’

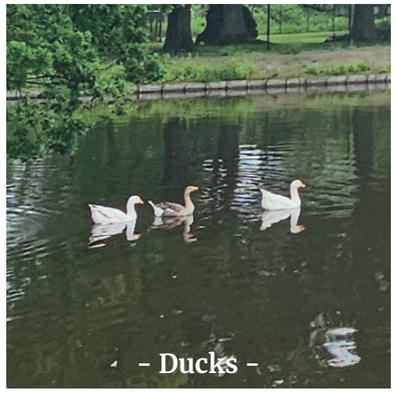

View (c) standing with the back to the Malieveld

- Selection of local species living on ‘Koekamp’ -



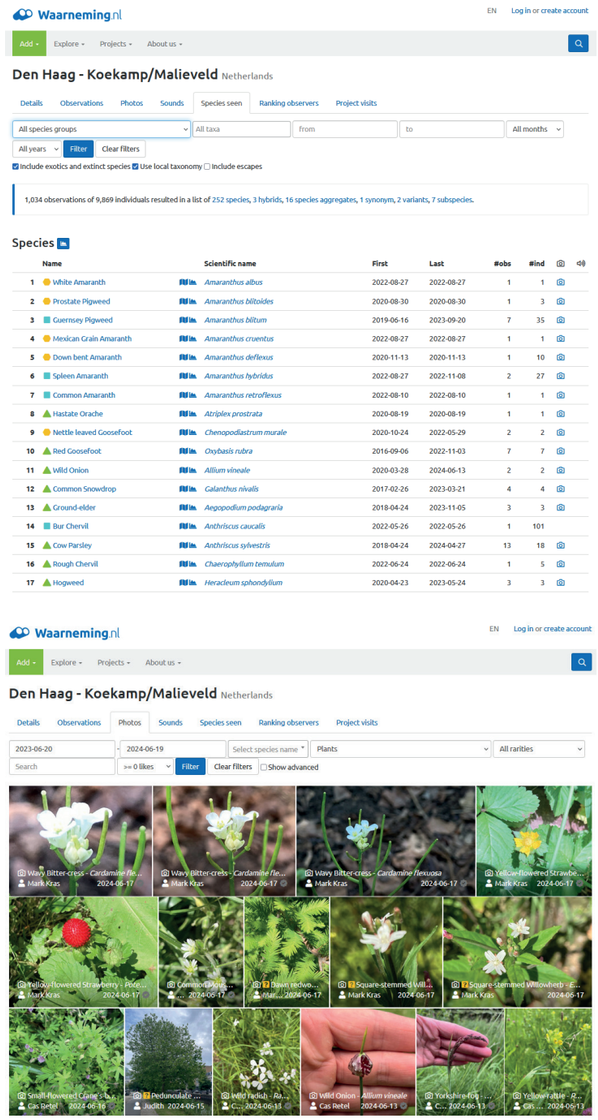












(Screenshots from the website ‘Waarneming.nl’, where everyone can add observed species to a certain area; https://waarneming.nl/locations/192289/species/)



(Source: Wikimedia)

(1) Map by Pieter Floris van der Salm, 1645



(Source: Wikimedia)

(2) Painting by Jacob Coning, 1666



(Source: haagsebeeldbank.nl)

(3) Drawing by G. van Giessen Bron, 1730



(Source: DELVA Landscape Architects / Urbanism)

(3) Future: Opening Koekamp (Design by Powerhouse Company and DELVA)

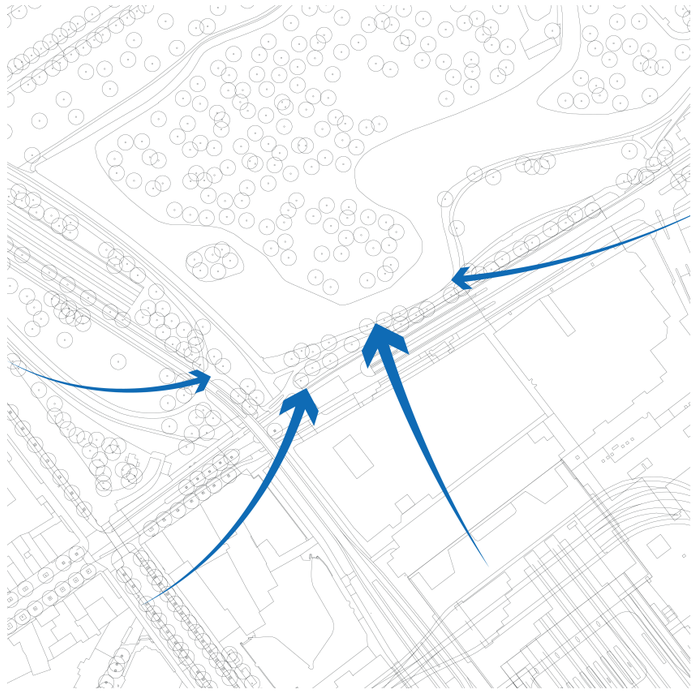


(Source: Collection of the Oakland Museum of California)

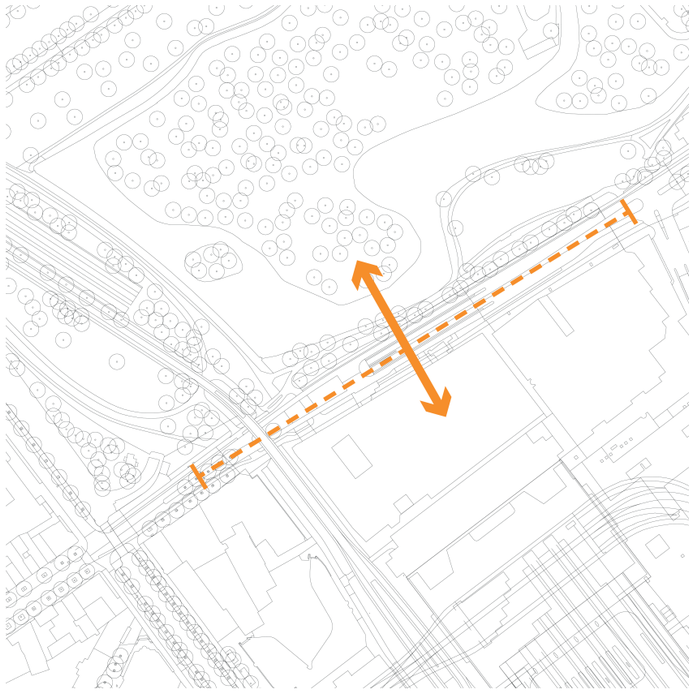
- People‘s Park Protests, Berkeley, 1969 -

Intertwining City and Park:

Entrance to the city of The Hague / Enhancing the existing potential of the area



Central Location / Easy accessible



Merging City and Park / Dissolving Border



Promoting Wellbeing



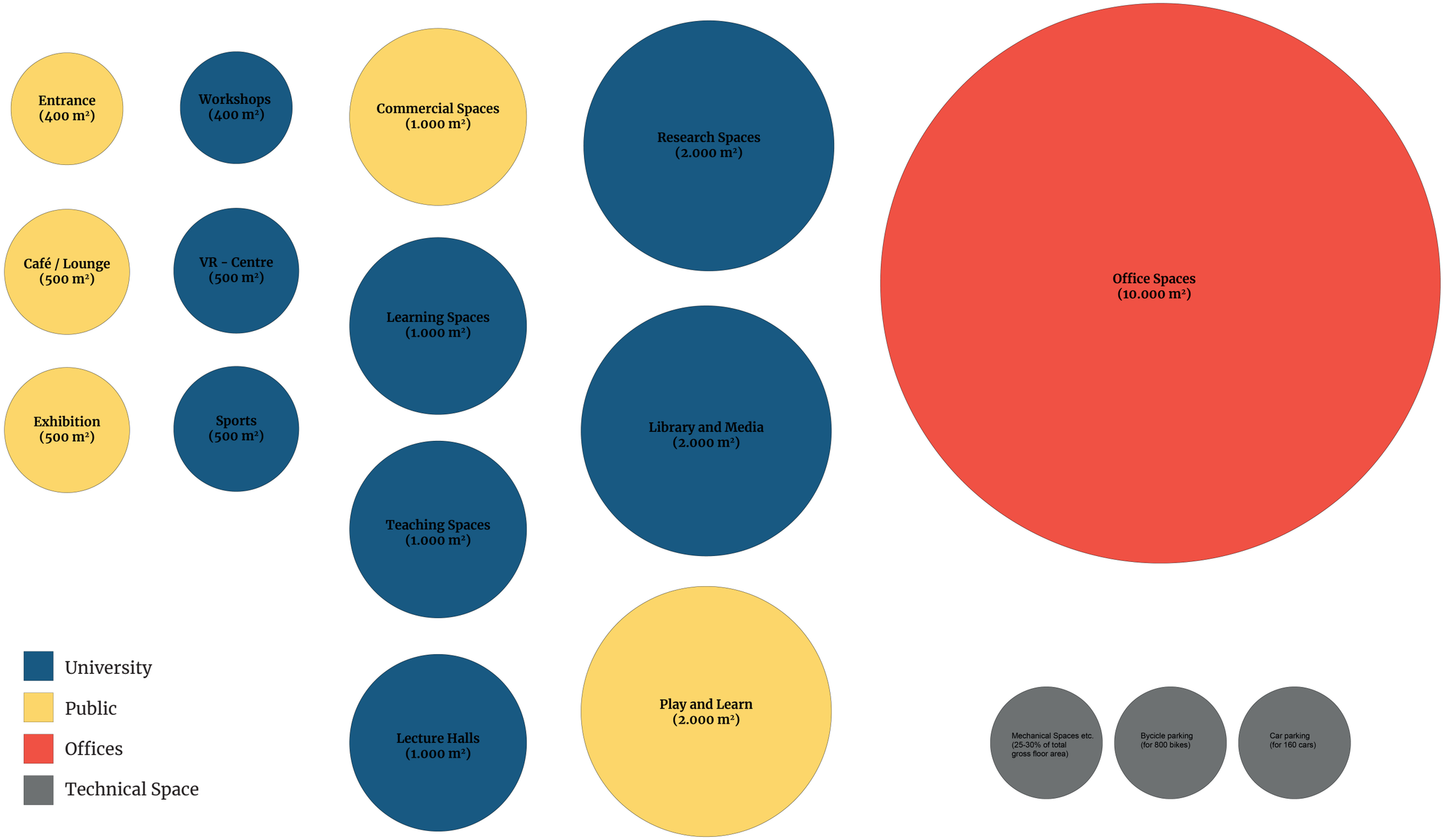
Cognitive Performance

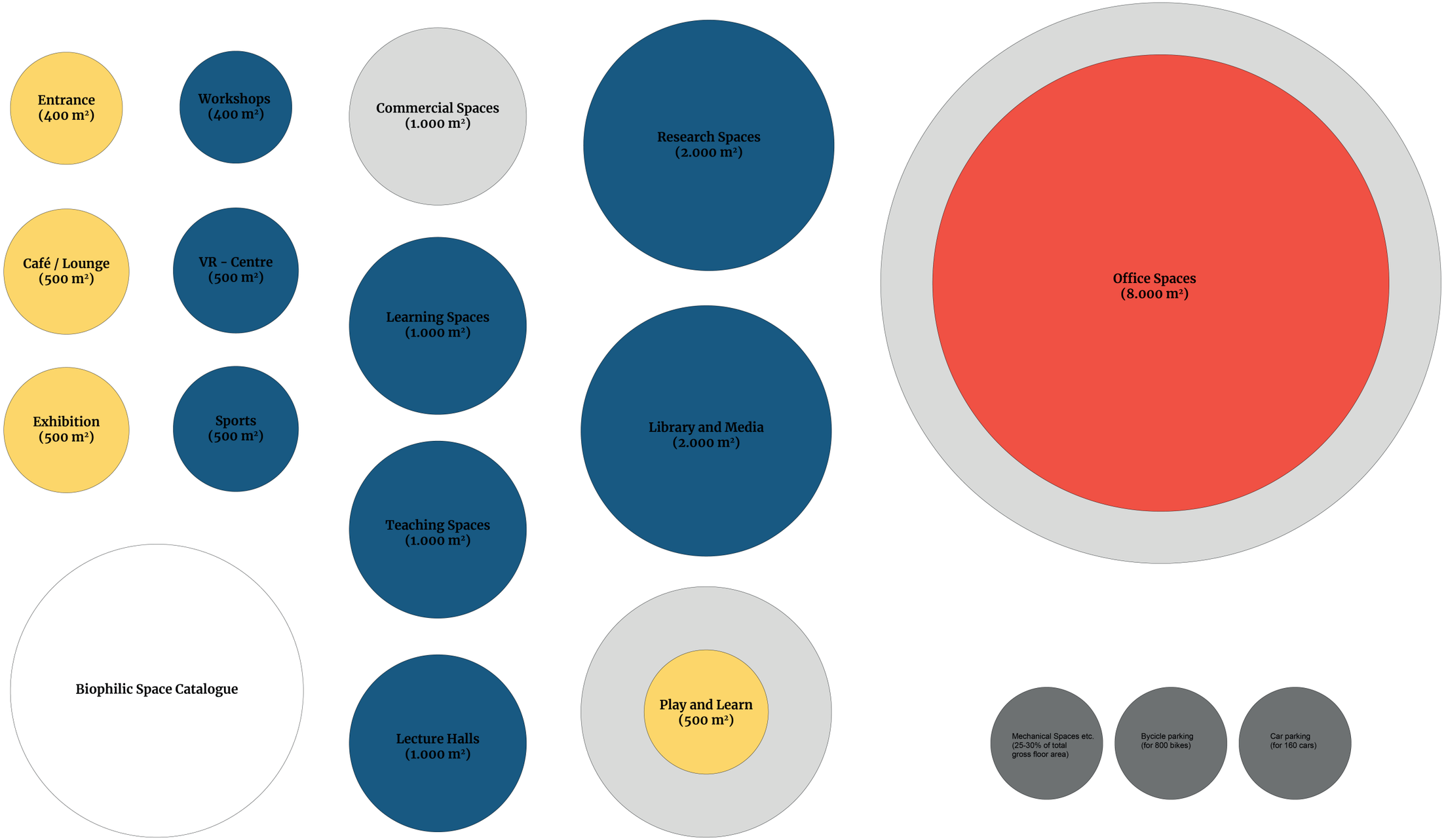


Green Hybrid | Merging City and Nature

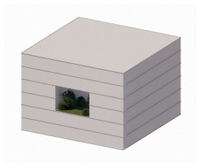


Climate Resilience

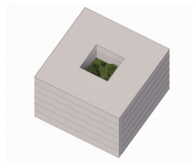

Entrance
(400 m²)
Workshops
(400 m²)
Commercial Spaces
(1.000 m²)
Research Spaces
(2.000 m²)
Office Spaces
(10.000 m²)
Café / Lounge
(500 m²)
VR - Centre
(500 m²)
Learning Spaces
(1.000 m²)
Exhibition
(500 m²)
Sports
(500 m²)
Library and Media
(2.000 m²)
Teaching Spaces
(1.000 m²)
Play and Learn
(2.000 m²)
Lecture Halls
(1.000 m²)
University
Public
Offices
Technical Space
Mechanical Spaces etc.
(25-30% of total
gross floor area)
Bycicle parking
(for 800 bikes)
Car parking
(for 160 cars)


Entrance
(400 m²)
Workshops
(400 m²)
Commercial Spaces
(1.000 m²)
Research Spaces
(2.000 m²)
Office Spaces
(8.000 m²)
Café / Lounge
(500 m²)
VR - Centre
(500 m²)
Learning Spaces
(1.000 m²)
Exhibition
(500 m²)
Sports
(500 m²)
Library and Media
(2.000 m²)
Teaching Spaces
(1.000 m²)
Biophilic Space Catalogue
Lecture Halls
(1.000 m²)
Play and Learn
(500 m²)
Mechanical Spaces etc.
(25-30% of total
gross floor area)
Bycicle parking
(for 800 bikes)
Car parking
(for 160 cars)

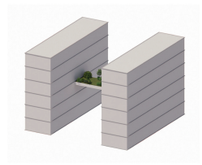
Catalogue - Collection of the 12 Green spaces



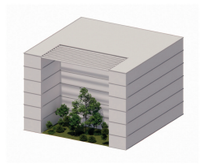
1. Loggia



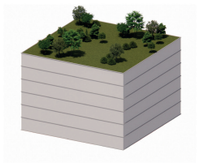
2. Patio



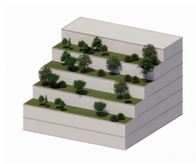
3. Bridge



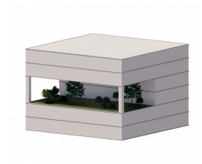
4. Atrium



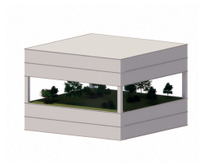
5. Rooftop



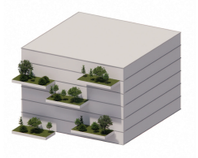
6. Terrace



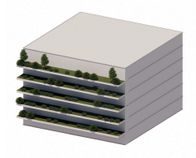
7. Half-Open Level



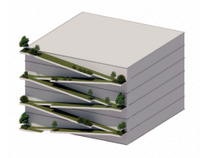
8. Open Level



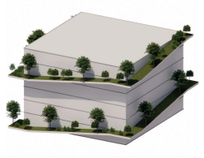
8. Balcony



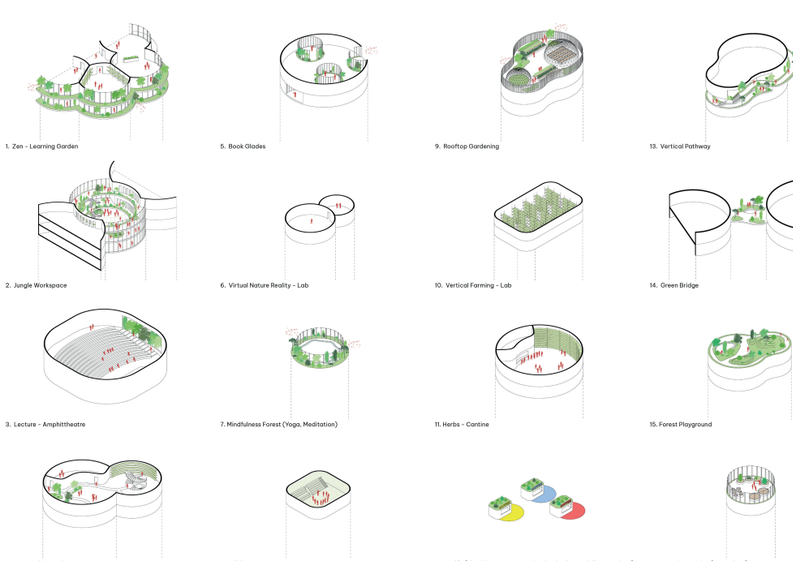
10. Colonnade / Arcade

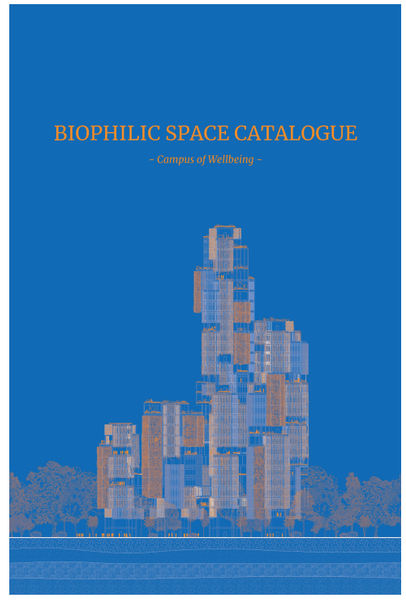


11. Outdoor Circulation (one side)

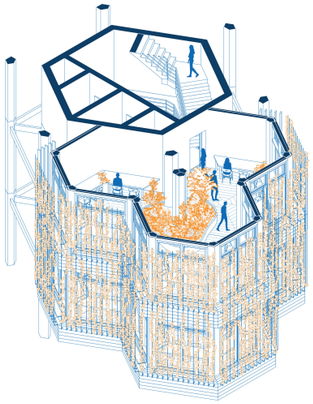


12. Outdoor Circulation (around)

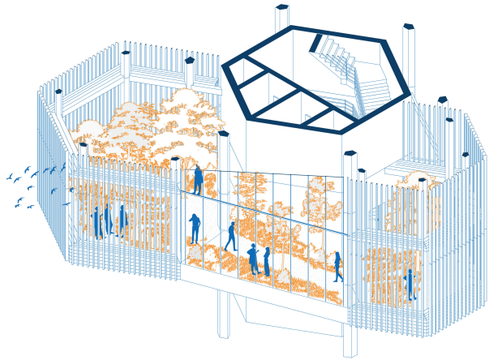




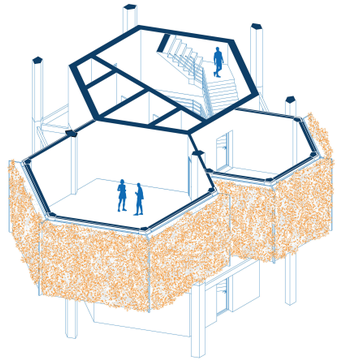
1. Learning Garden



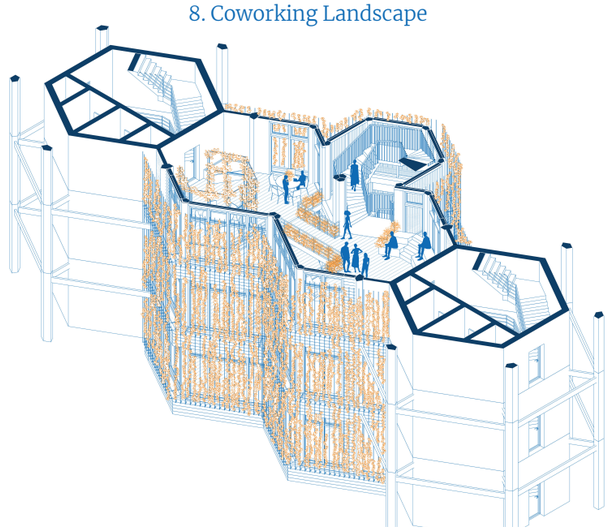
2. Study Forest



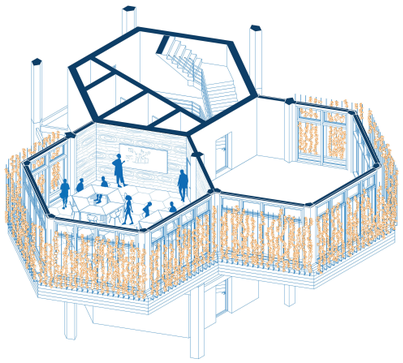
7. Immersive Nature (Virtual Reality)



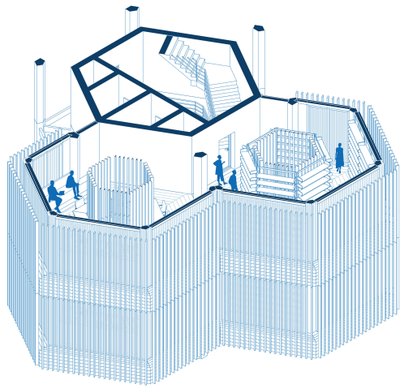
8. Coworking Landscape



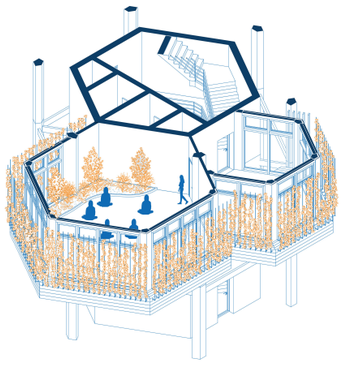
3. Biomimicry Classroom



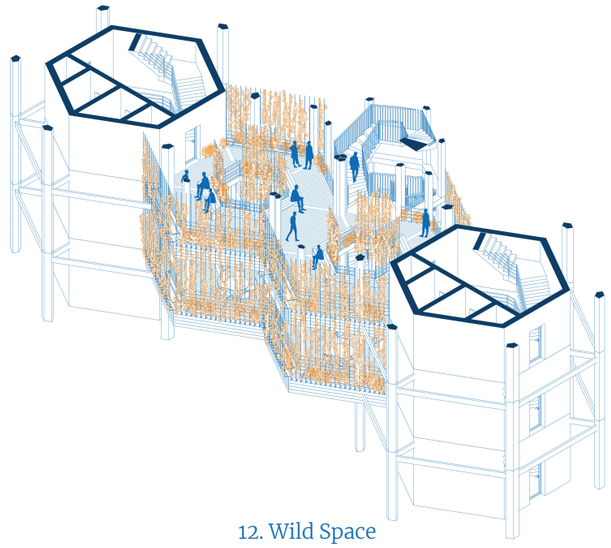
4. Light Library



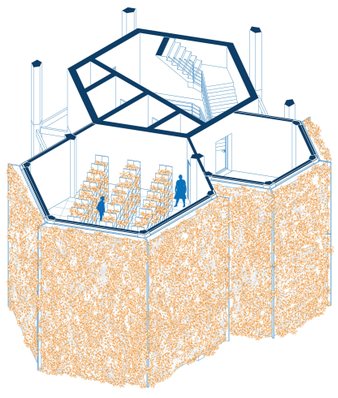
9. Mindfulness Garden -



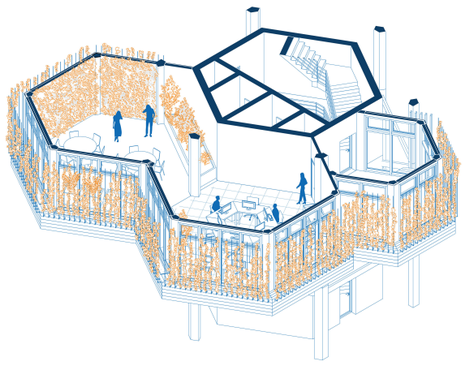
10. Vertical Park



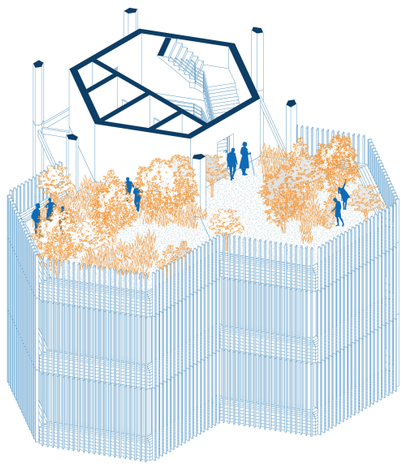
5. Vertical Farming -



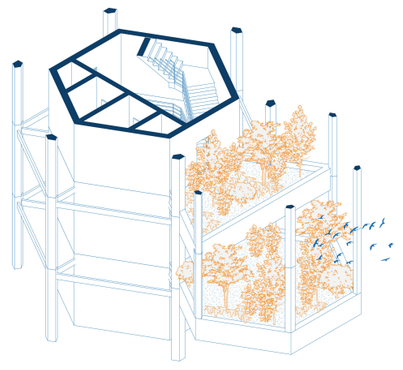
6. Biophilic Test Laboratory



11. Forest Playground



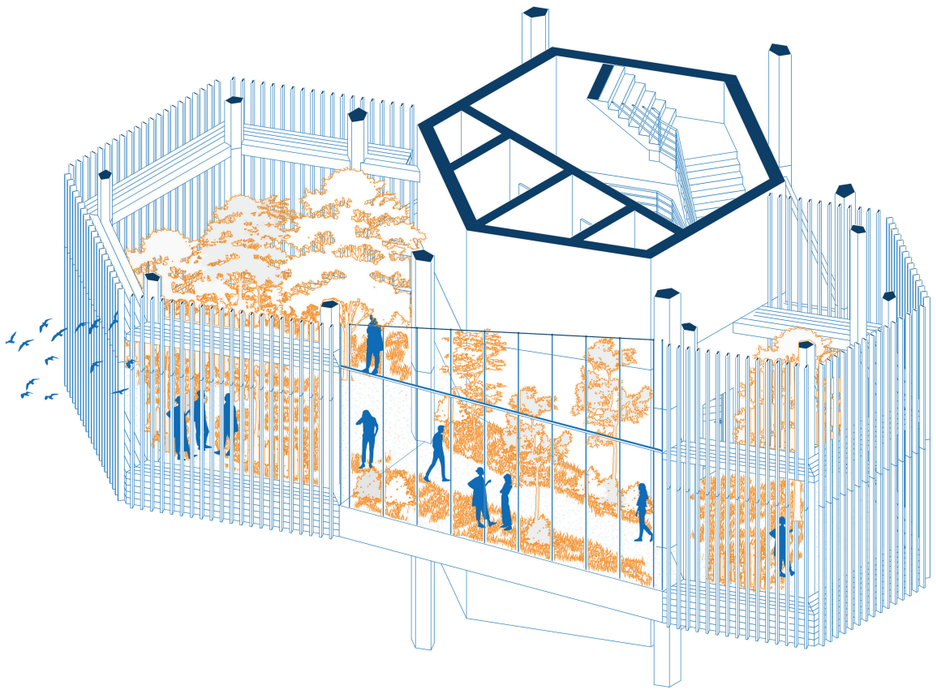
12. Wild Space



1. Biophilic Design Patterns

2. Benefits of Biophilic Design

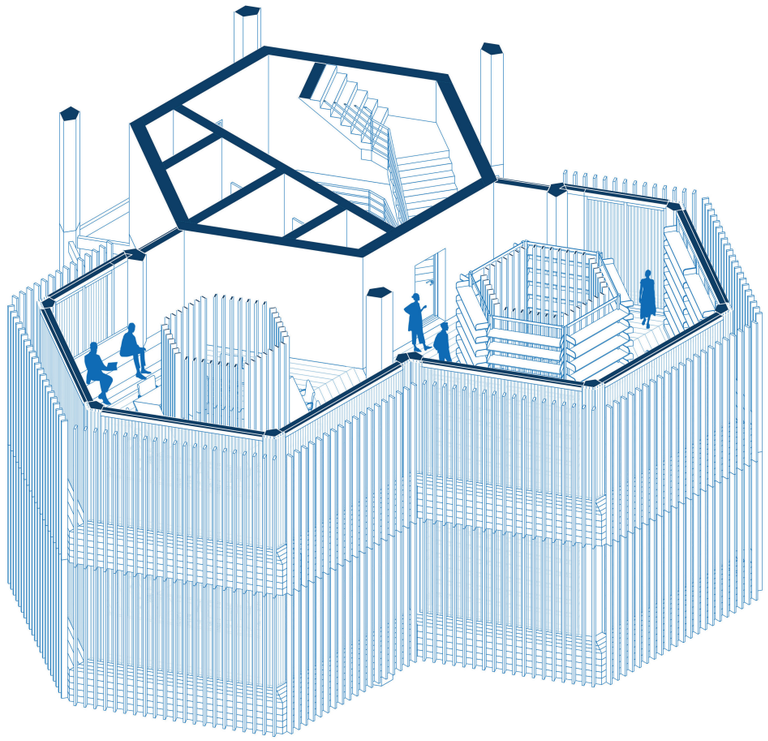
3. Space Characteristics



Name:	Study Forest
User Group:	Students
Function:	Self-study, Taking Breaks
Benefit(s):	Wellbeing, Creativity
Biophilic Design Patterns:	1. Incorporation: *Plants, Weather*

Space Characteristics:

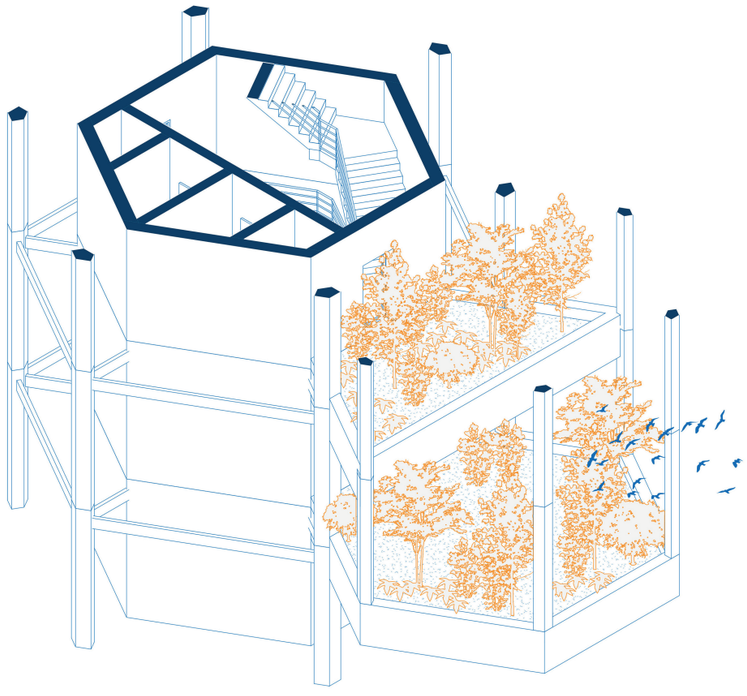
- Atmosphere:	Mixed - calm / busy
- Lighting:	South
- In-/Outdoor:	Outdoor
- Organization:	Mixed - order / wild
- Plant size:	Grasses, flowers, shrubs, small trees
- Materiality:	Soil (incl. grasses) or clay - natural flooring
- Facade:	Open



Name:	Light Library
User Group:	University, Office
Function:	Learning, Self-study
Benefit(s):	Cognitive Performance
Biophilic Design Patterns:	1. Incorporation: *Daylight (various)*

Space Characteristics:

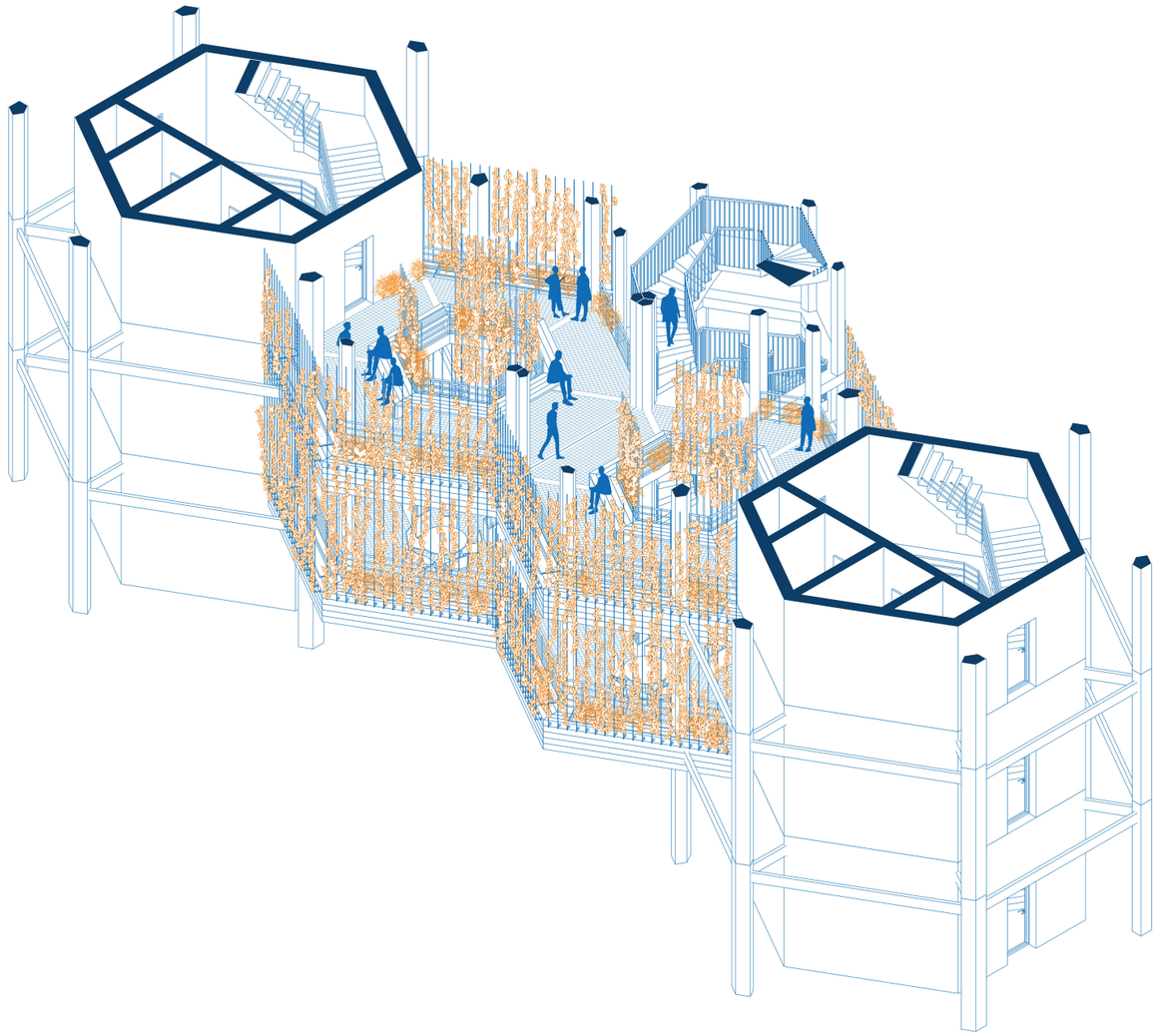
- Atmosphere:	Focused
- Lighting:	West / East
- In-/Outdoor:	Indoor
- Organization:	Order
- Plant size:	-
- Materiality:	Polycarbonat walls, skylights, timber flooring
- Facade:	Translucent



Name:	Wild Space
User Group:	Vegetation / Animals
Function:	Space for non-human organisms
Benefit(s):	Environmental Awareness
Biophilic Design Patterns:	1. Incorporation: *Plants, Animals*

Space Characteristics:

- Atmosphere:	Calm
- Lighting:	South
- In-/Outdoor:	Outdoor
- Organization:	Wild
- Plant size:	Grasses, flowers, shrubs, small trees
- Materiality:	-
- Facade:	Open



Name:	Vertical Park
User Group:	Public
Function:	Meeting, Exchange
Benefit(s):	Wellbeing
Biophilic Design Patterns:	3. Interaction: *Connection to Place*

Space Characteristics:

- Atmosphere:	Busy, Energetic
- Lighting:	South
- In-/Outdoor:	Outdoor
- Organization:	Order
- Plant size:	Climbing plants
- Materiality:	Mesh steel flooring, Permeable
- Facade:	Open

Sun Movement

Urban Movement

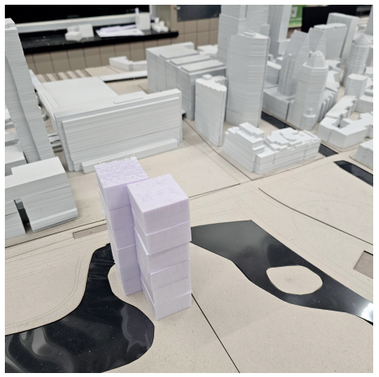
Clash of Form and Typology
(Artifical and Natural Lines)

Sensitive Environment
(Living Organisms, Trees, Plants,)

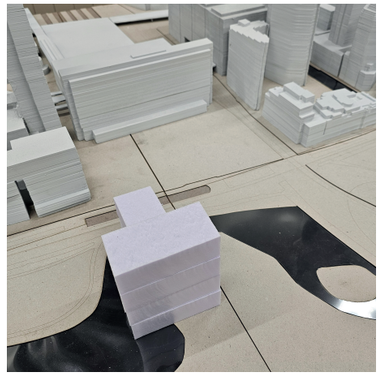
Low Building Footprint

Mixed-Used Building Program
(Clusters that are overlapping)

Merging city and park



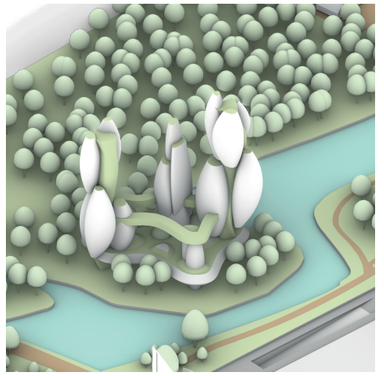
Q2_Week 3 - **Blocks**



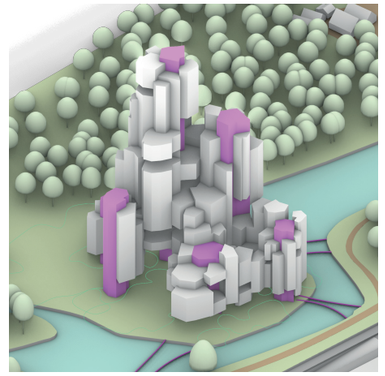
Q2_Week 3



Q2_P2 Massing



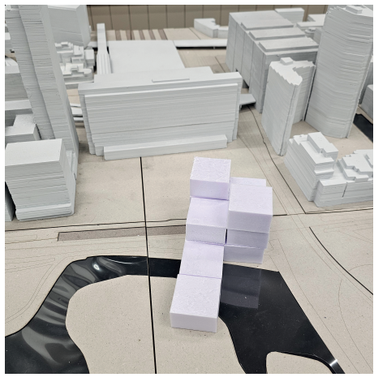
Q3_Week 2



Q3_Week 3 -**Irregularity**



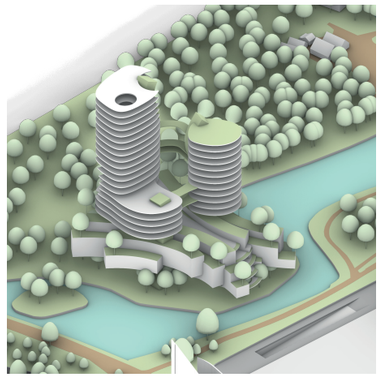
Q3_Week 4



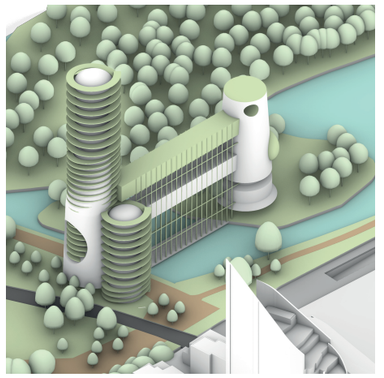
Q2_Week 3



Q2_Week 3 - **Bridge**



Q3_Week 2



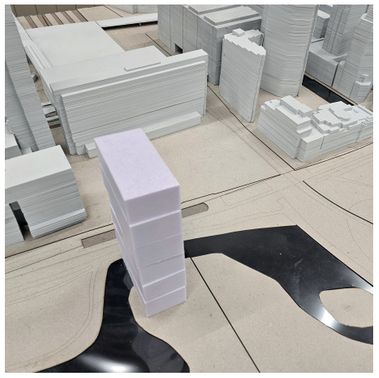
Q3_Week 2



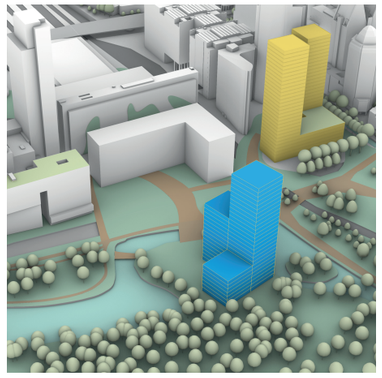
Q3_Week 3



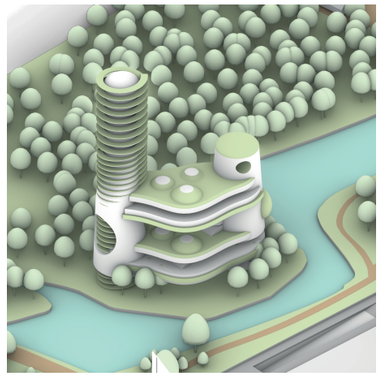
Q3_Week 5 - **Regularity**



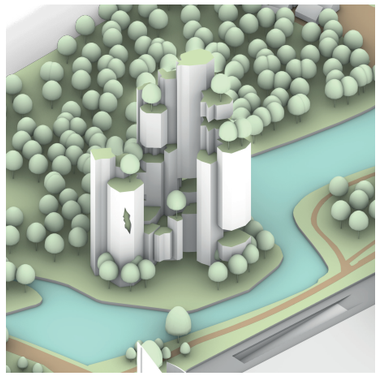
Q2_Week 3 - Tower



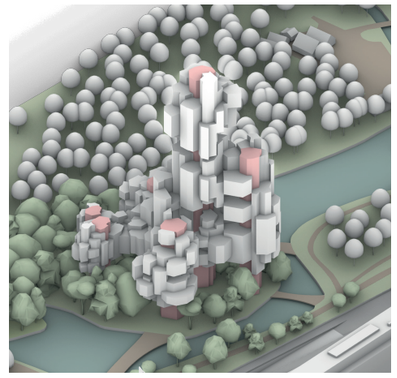
Q2_Week 4 - **Levels**



Q3_Week 2



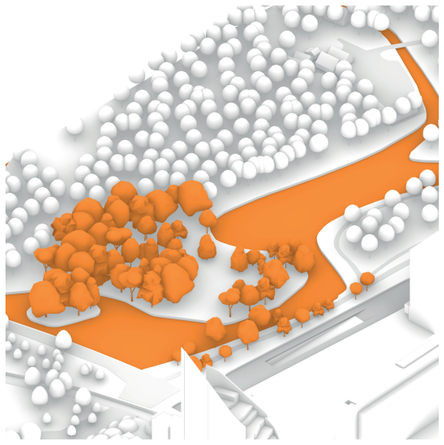
Q3_Week 2 - **Fragmentation**



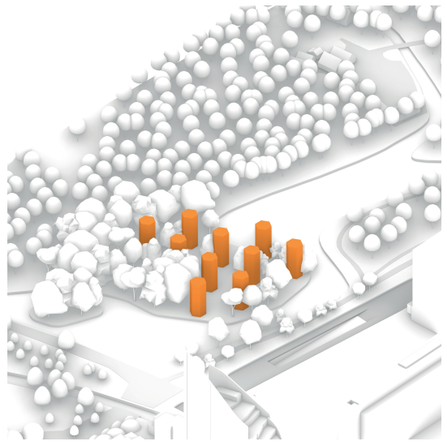
Q3_Week 4



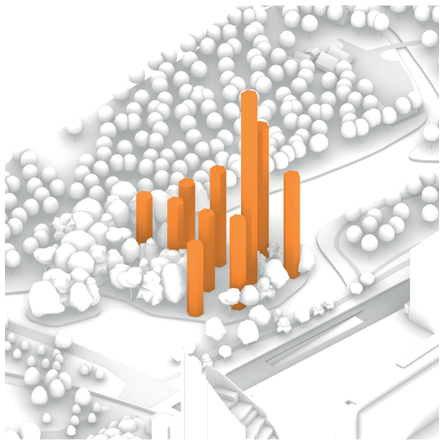
Q3_P3 Final Massing



1. Existing situation / Environmental constraint



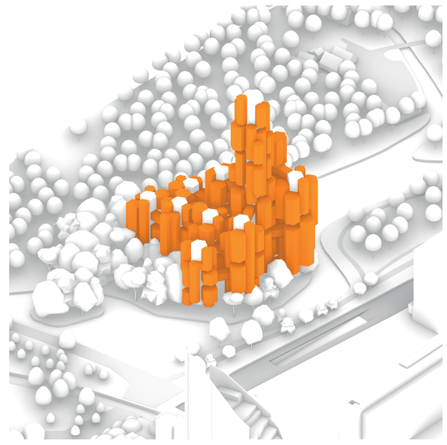
2. Placing cores



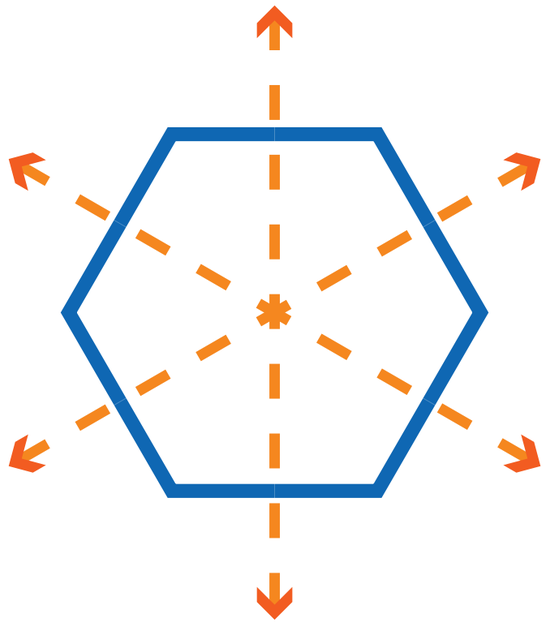
3. Height according urban strategy and sunlight



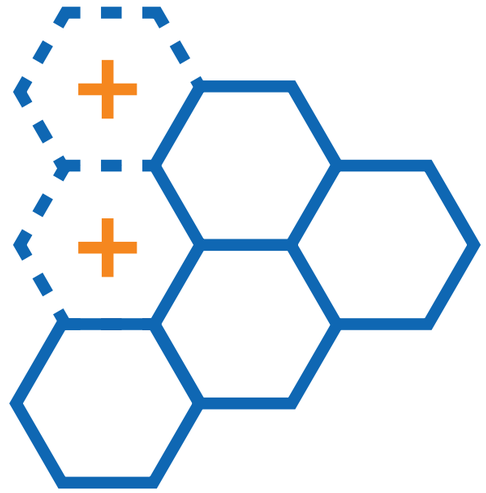
4. Adding Building Program



5. Creating Permeability



Flexibility



Space Efficiency

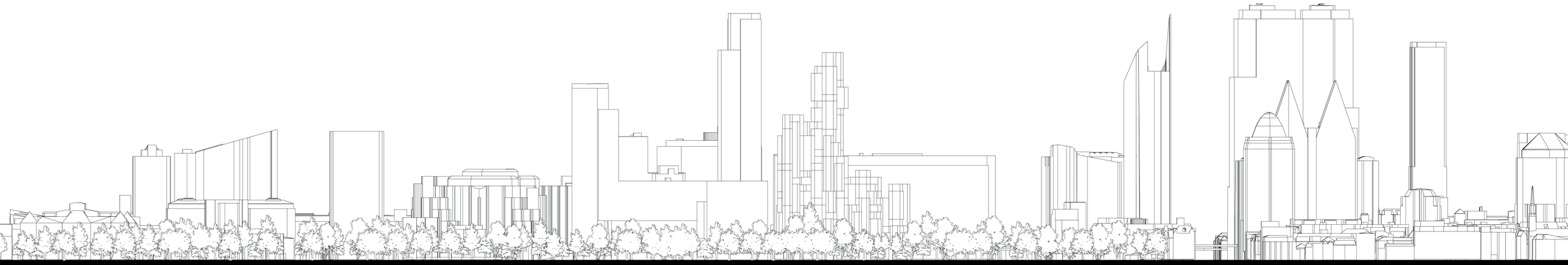
- Site Plan -



- Urban Elevation | View to Koekamp -



- Urban Elevation | View to the Central Station -



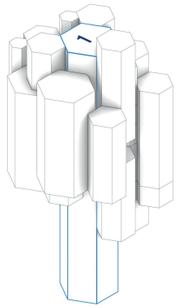


Public

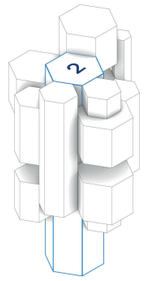
Offices

University

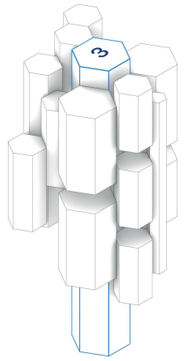
University / Office



1. Public
- Entrance, Cantine, Lounge, Café)



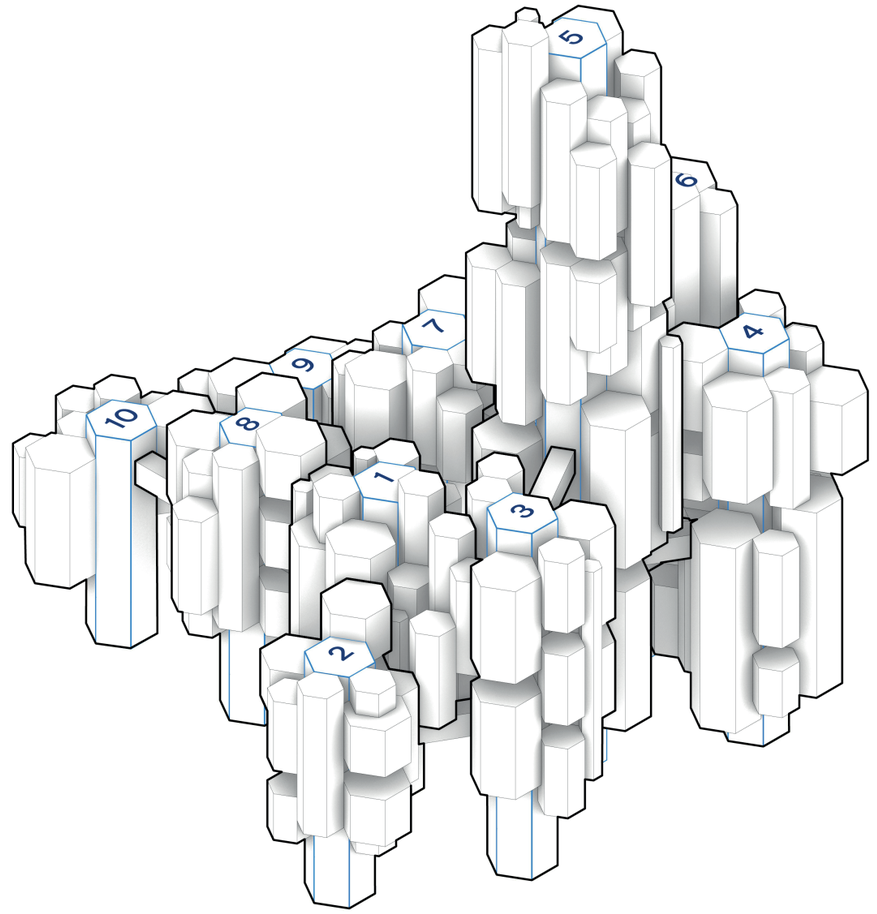
2. Public
- Infopoint, Meeting Spaces

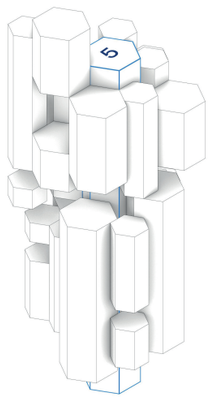


3. Public / University
- Exhibition, Virtual Reality

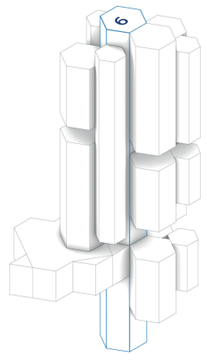


4. University
- Learning Spaces, Classrooms Research, CoWorking, Lecture hall

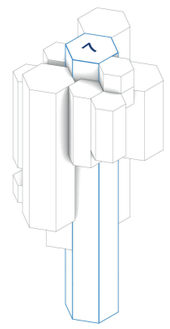




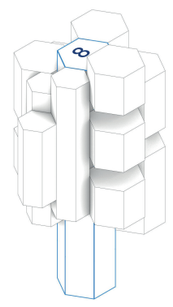
5. Research
- Research spaces, CoWorking, Workshops



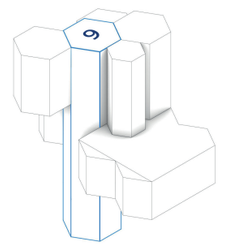
6. Office
- Traditional offices, CoWorking, Lecture hall



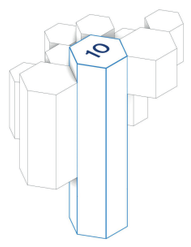
7. Office
- Traditional offices, CoWorking



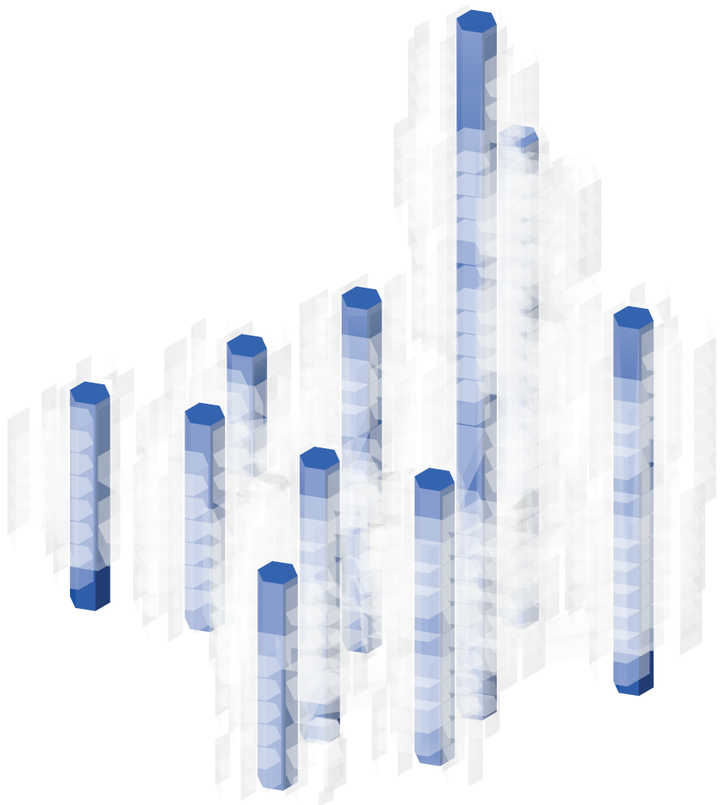
8. Media / Library



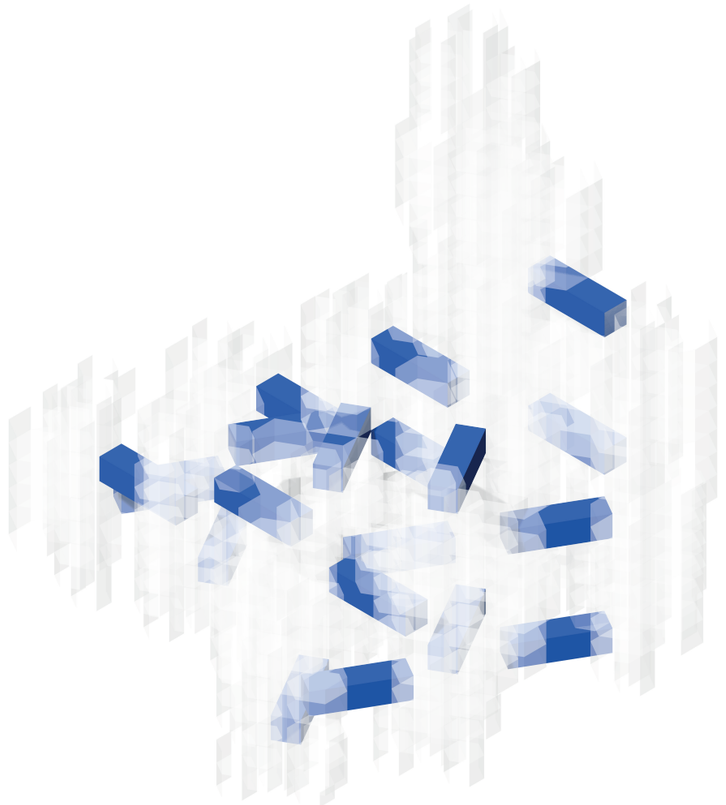
9. Activities
- Sports, Arts



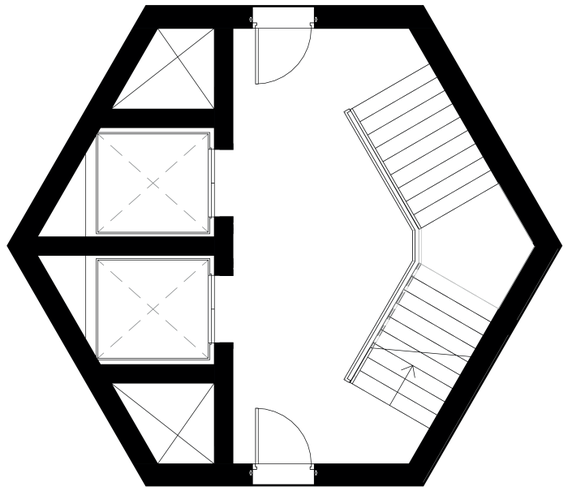
10. Wellbeing
- Consultation, Yoga, Mental Health



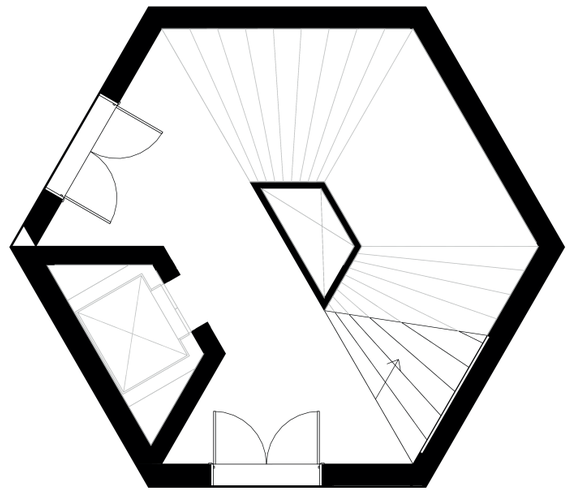
- Vertical Circulation -



- Horizontal Circulation -



- Semi-/ Private Circulation -

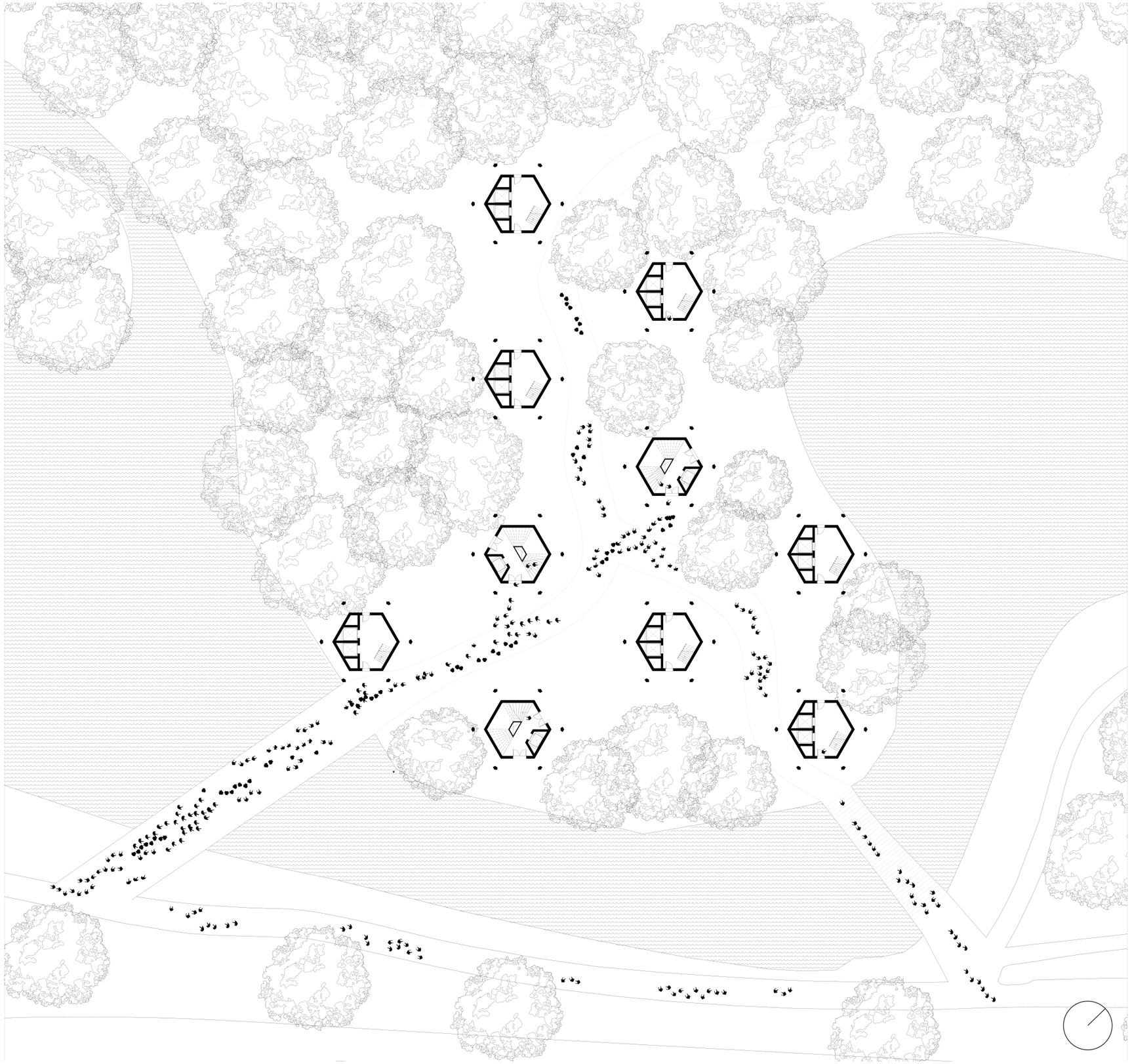


- Public Circulation -

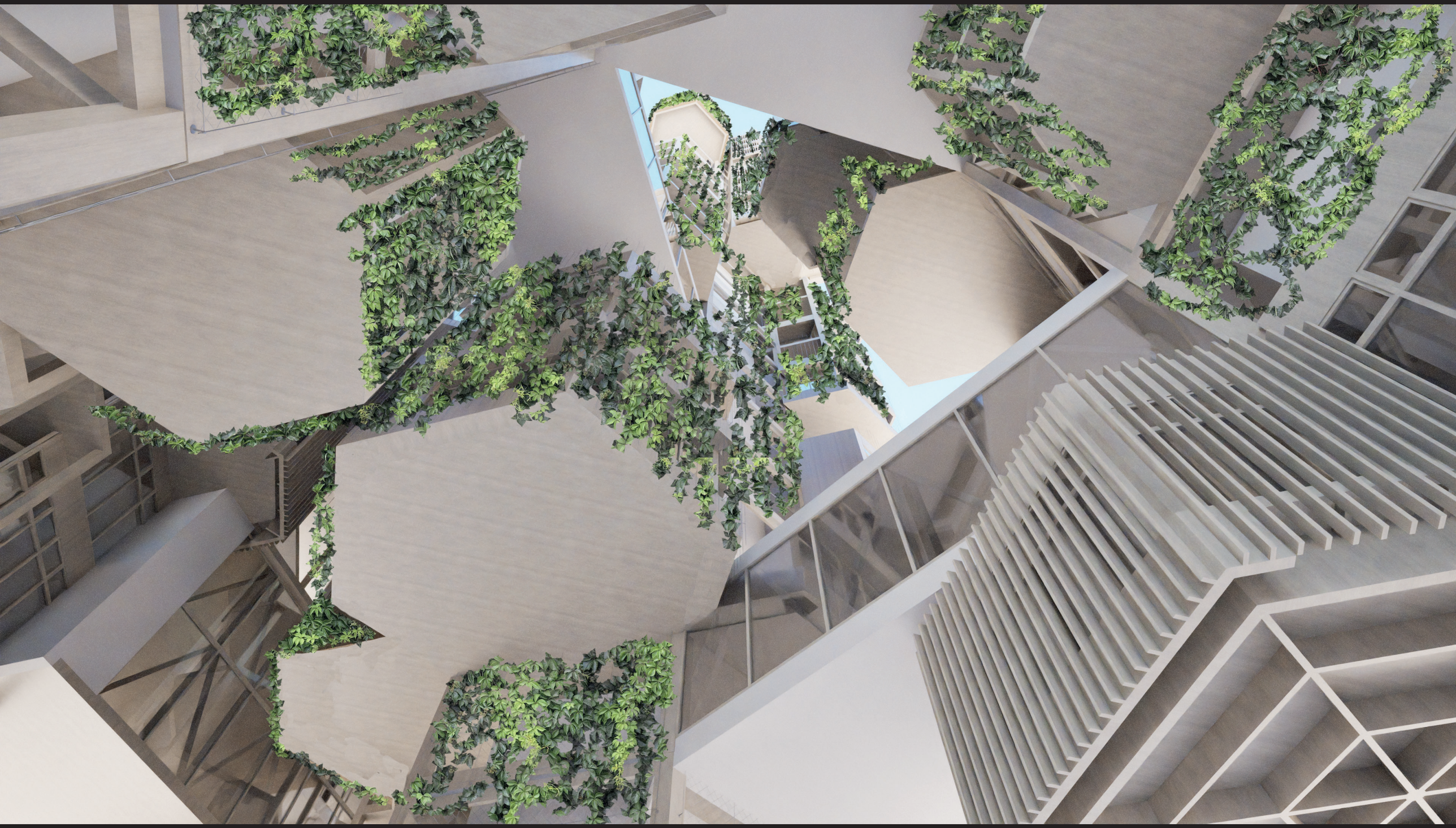
- Exterior View -



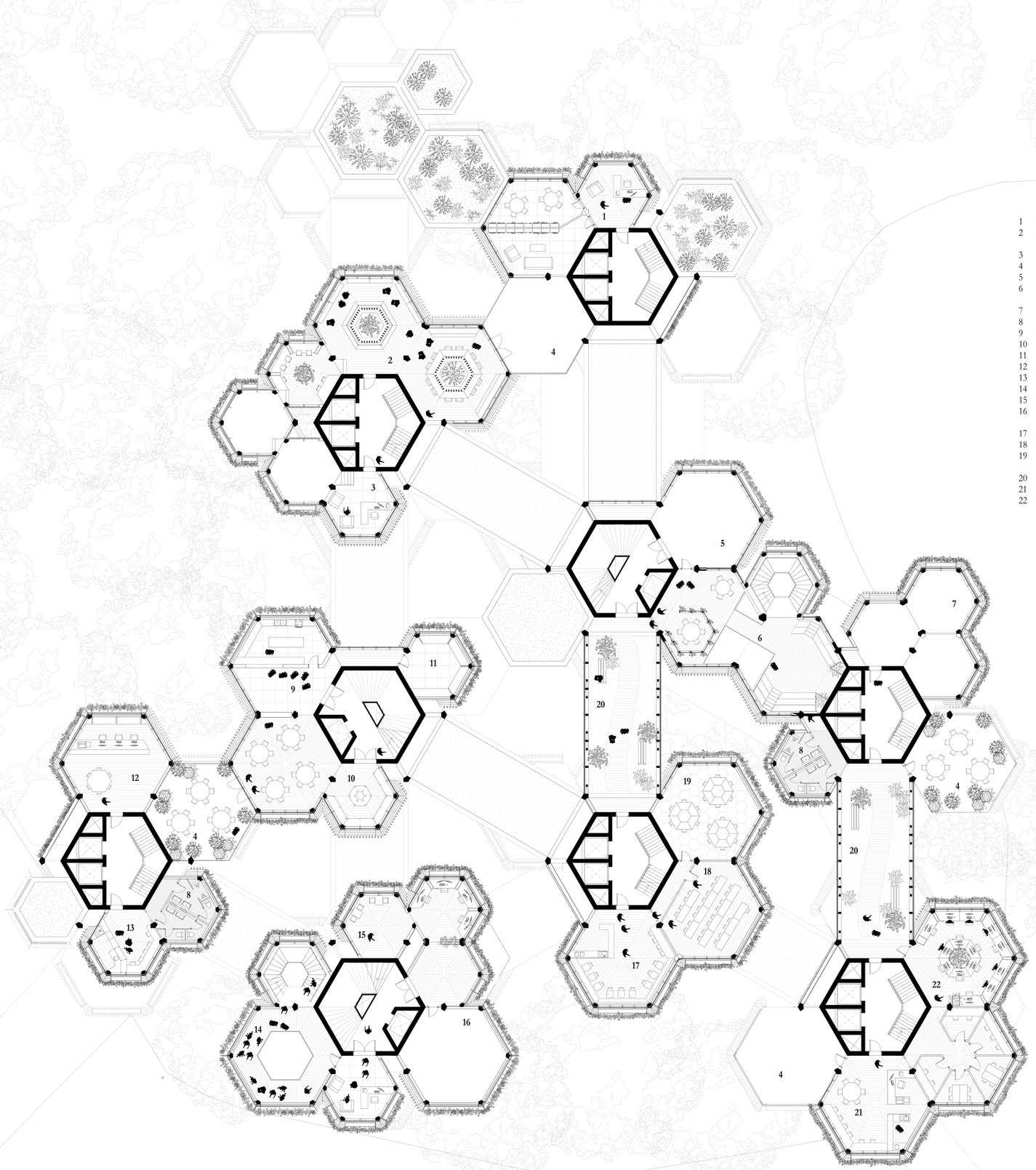
- Ground Floor Plan -



- Impression looking up -



- Typical Floor Plan / 9th Level -

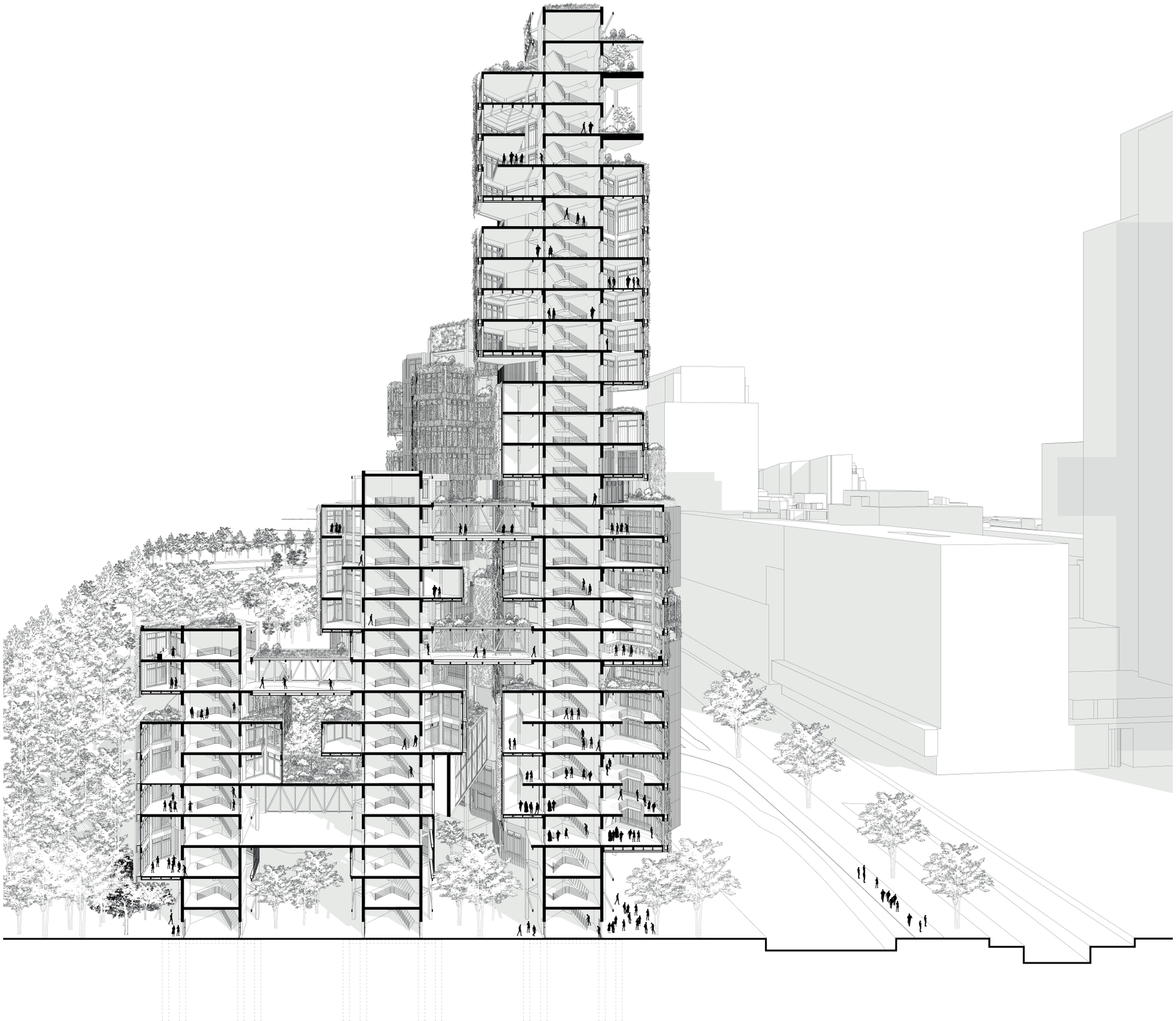


1 Wellbeing Consulation
2 Light Library
(Biophilic Space Catalogue)
3 Small Infopoint/Entrance
4 Accessible Outdoor Rooftops
5 Research Space
6 CoWorking Landscape
(Biophilic Space Catalogue)
7 Rentable Office Space - Small
8 Bathrooms
9 Cantine
10 Cantine-Fresh Herbs
11 Storage
12 General Infopoint
13 Coffee-Bar
14 Exhibition Space
15 Virtual Reality (VR) Lab
16 Immersive Virtual Nature
(Biophilic Space Catalogue)
17 Café
18 Traditional Classroom
19 Biomimicry Classroom
(Biophilic Space Catalogue)
20 Bridges - Cluster Connectors
21 Office Lounge
22 Traditional Office Space

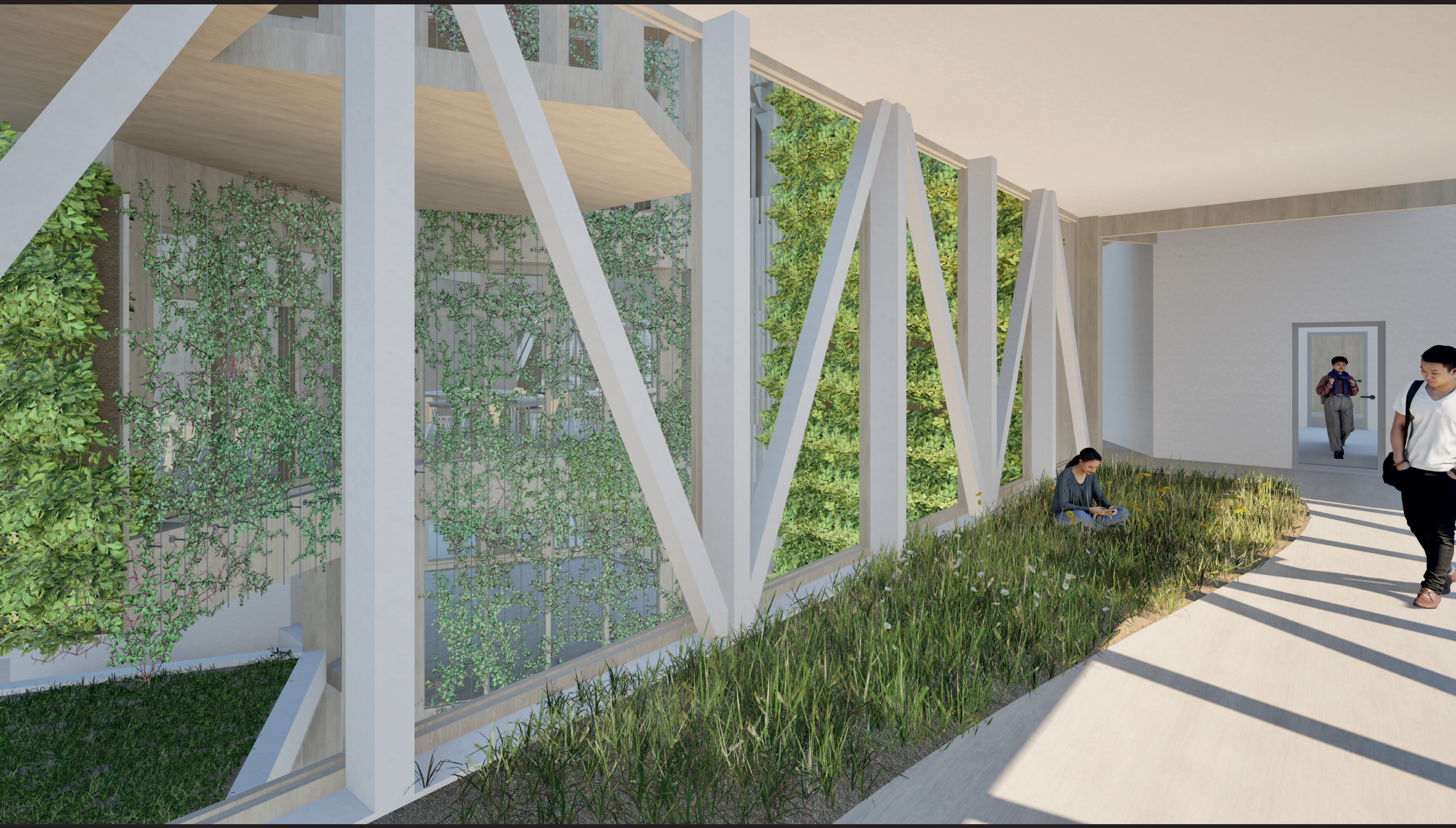
- Café and Meeting Space -



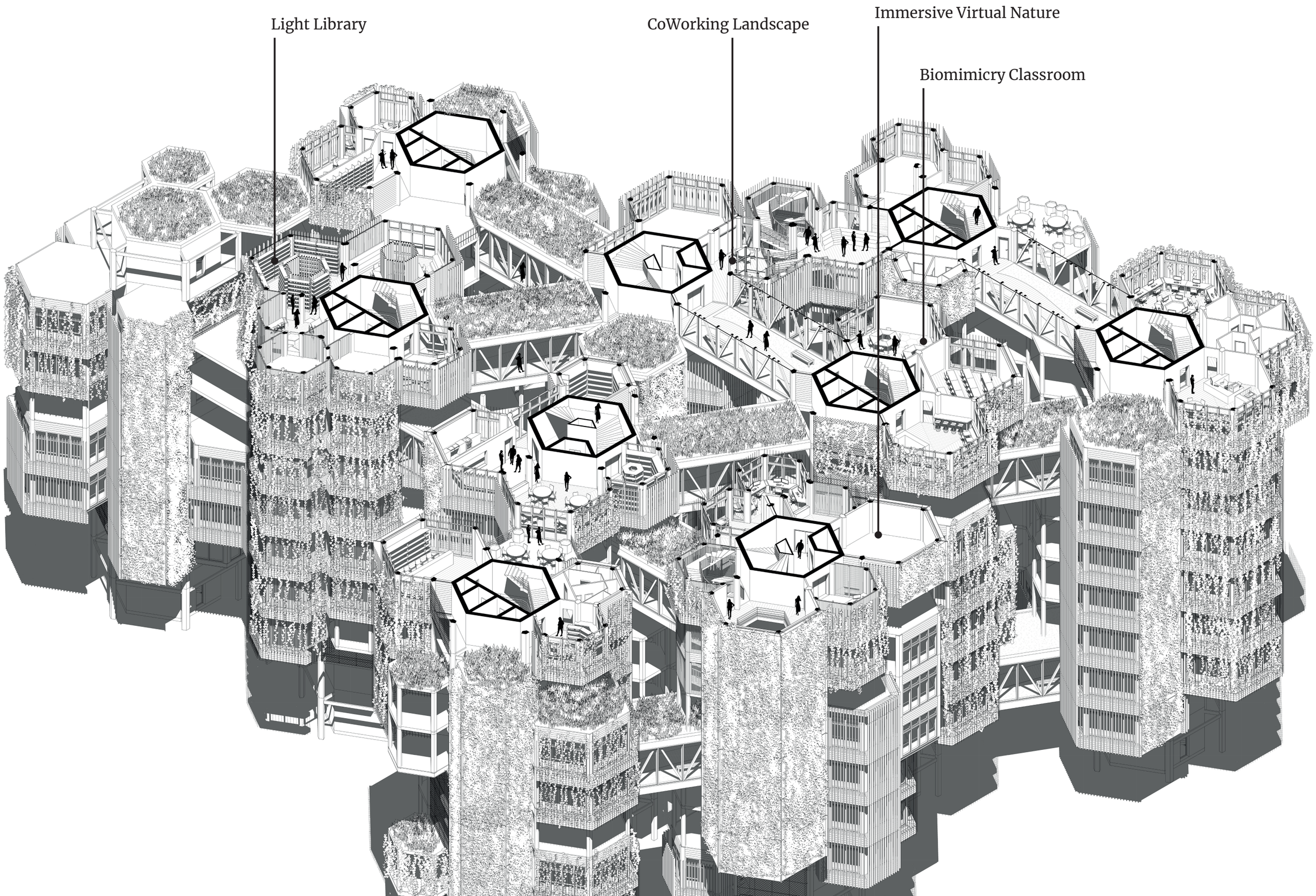
- Perspective Section -



- Interior Bridge -



- Implementation of Green Space Catalogue / 9th Level -



- Light Library -

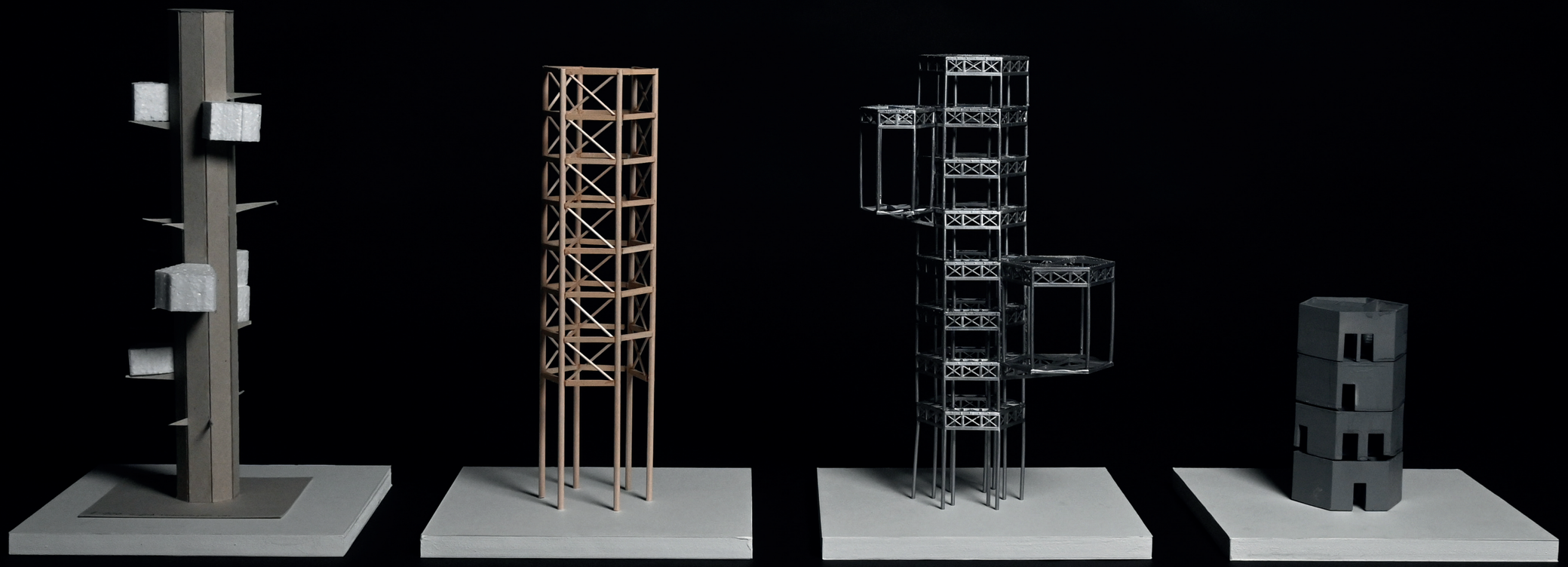


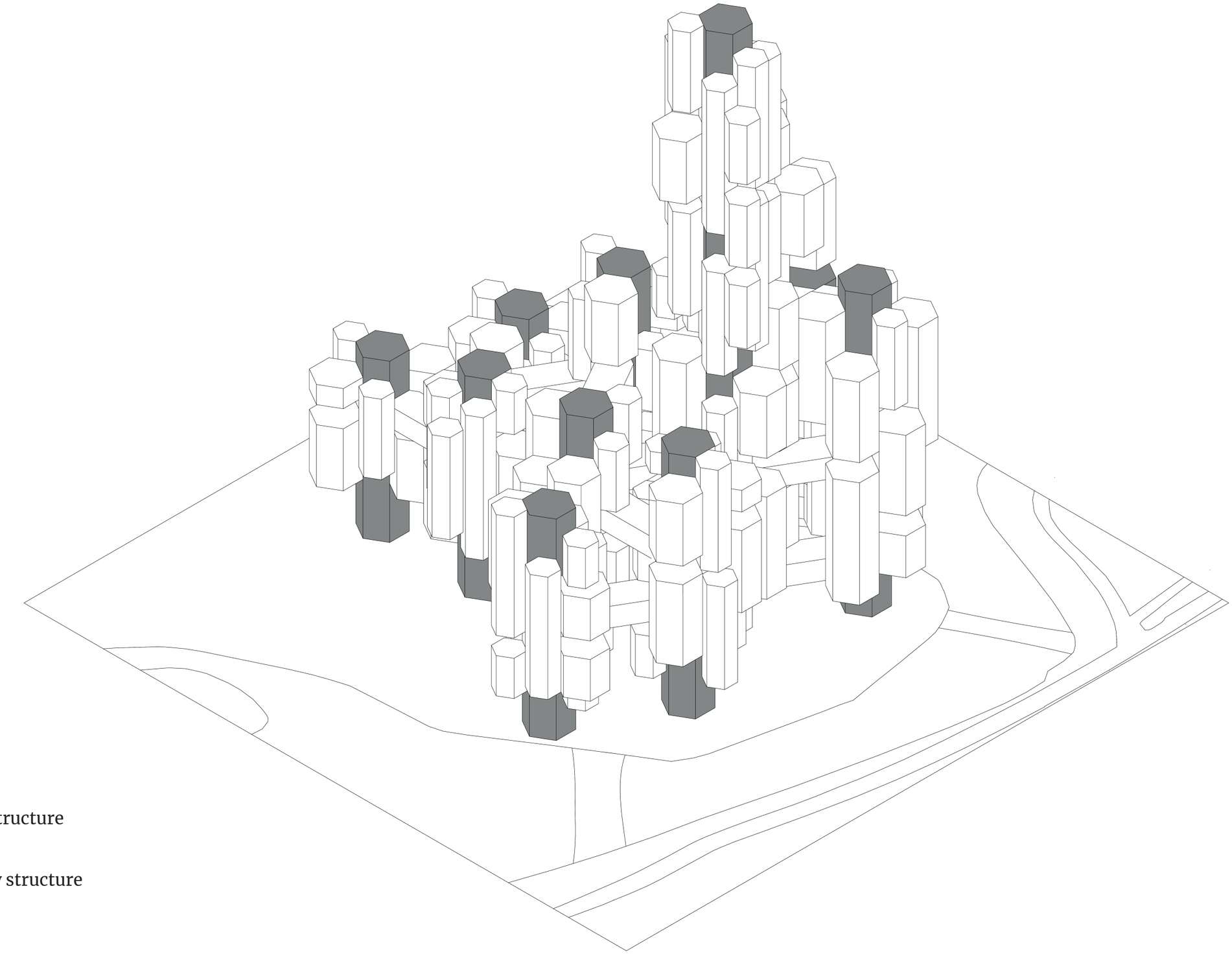
1. Low Footprint - Cantilever

2. Connecting Clusters

3. Adaptability in the Future

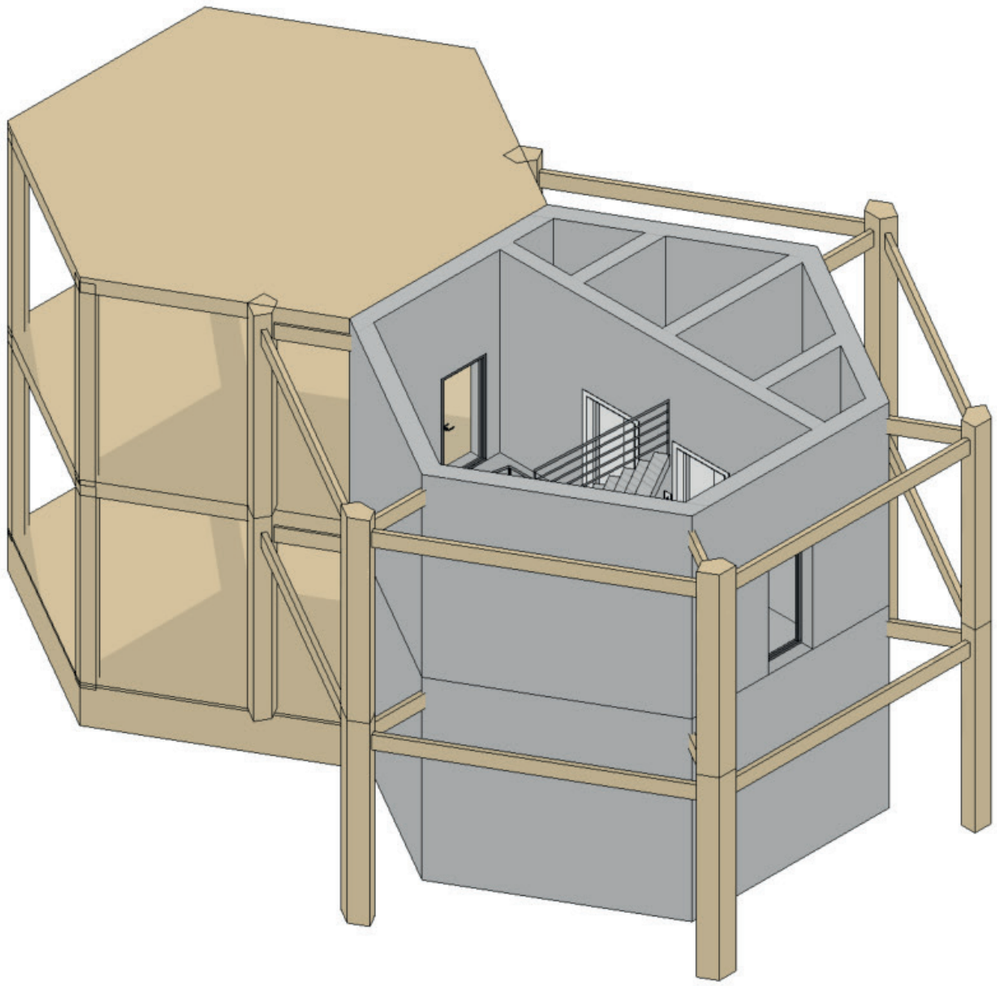
- Structural Development -

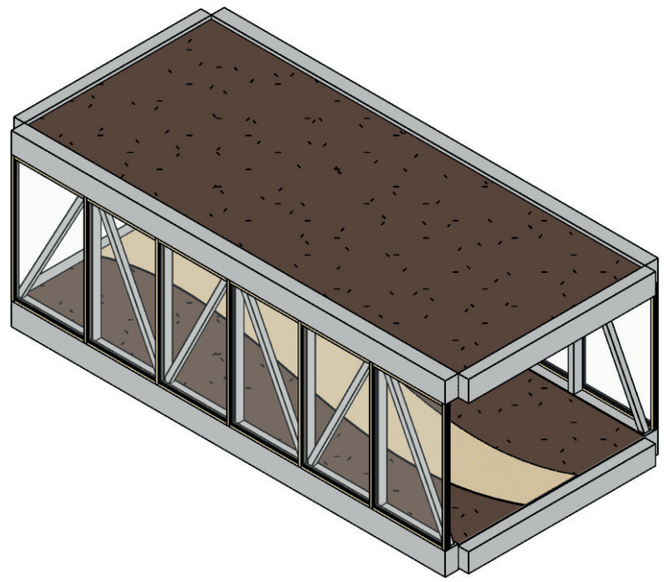


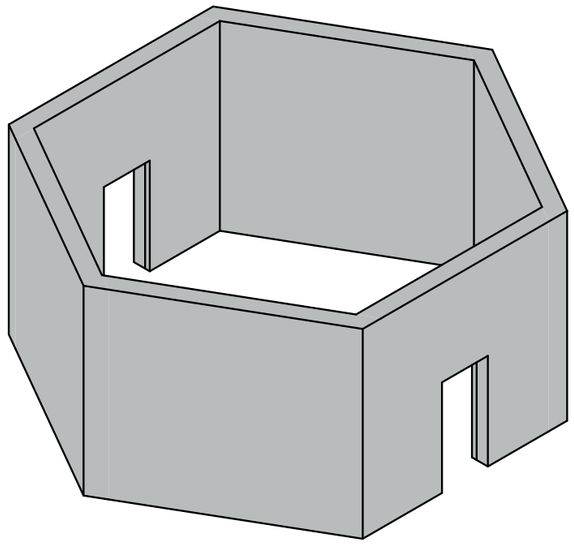


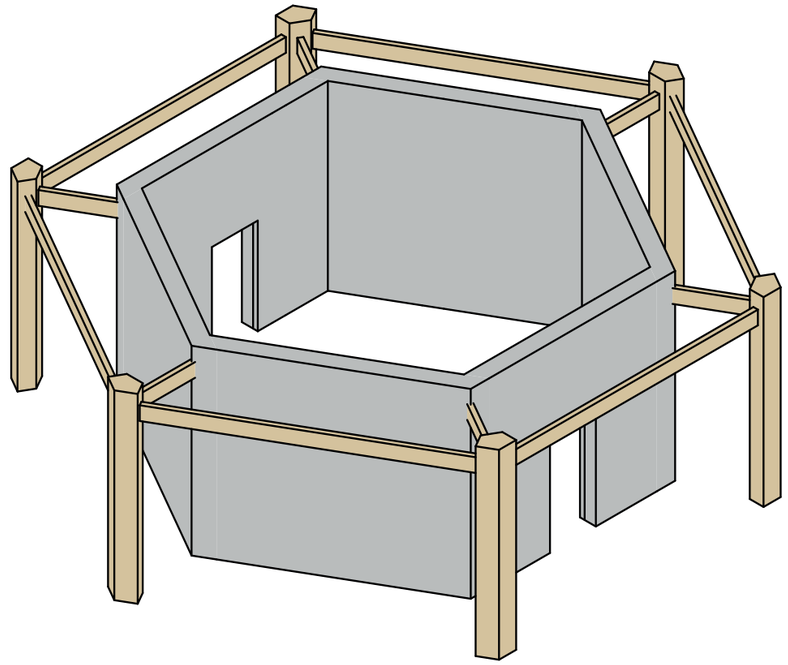
Primary structure

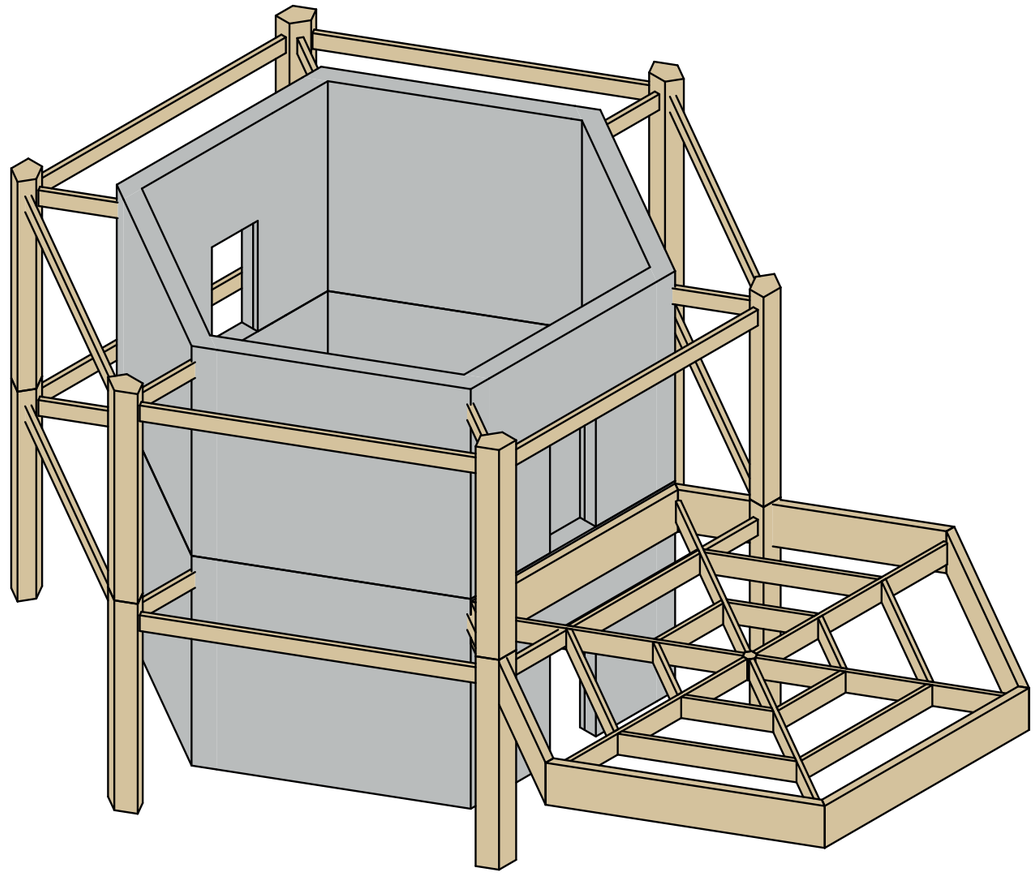
Secondary structure

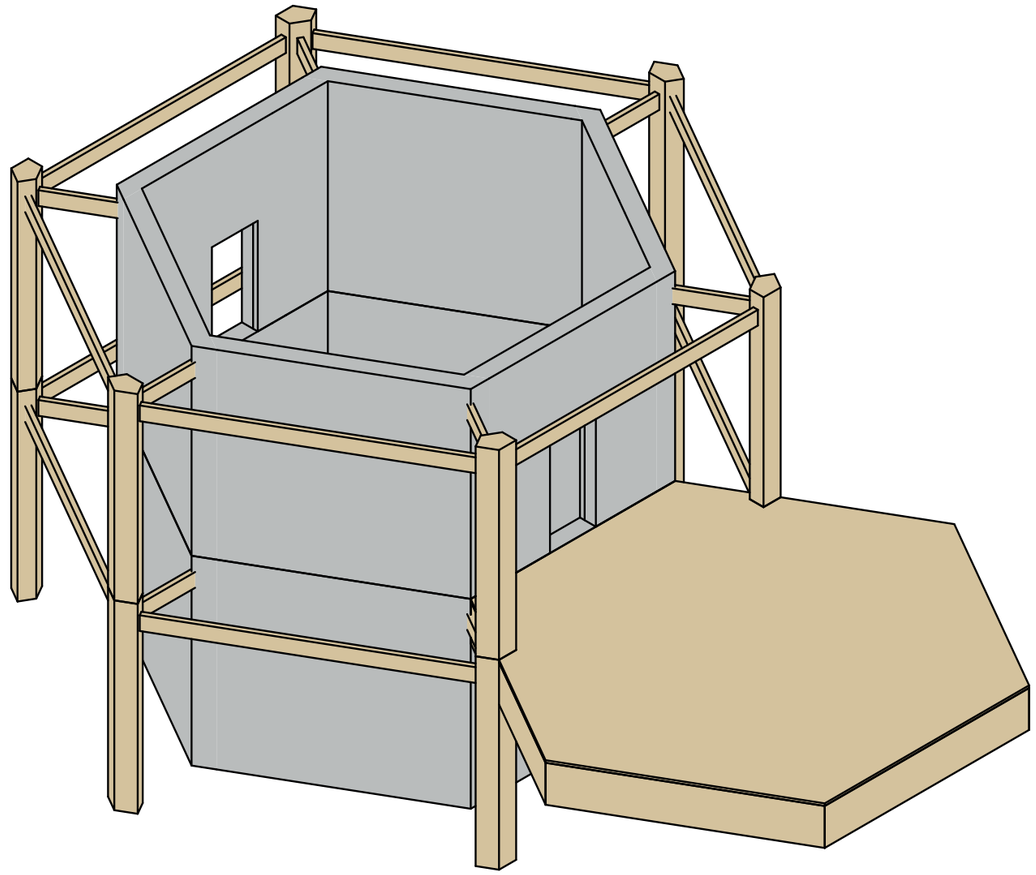


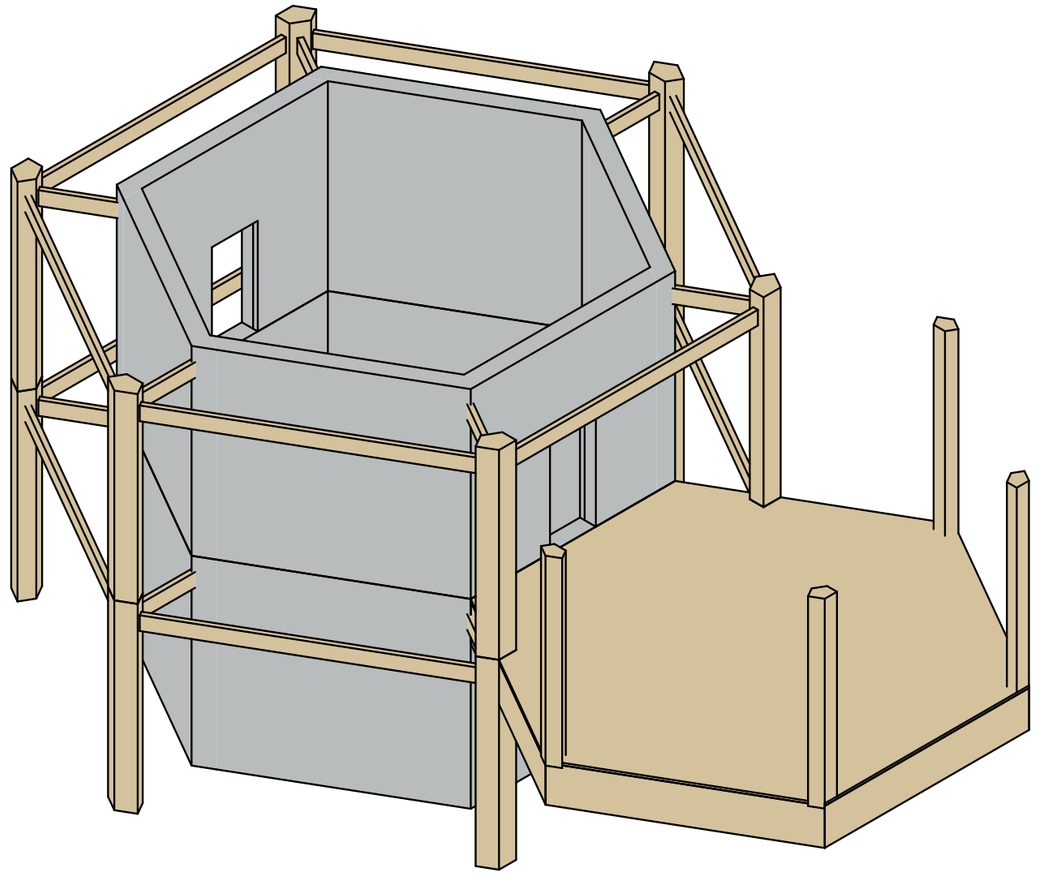


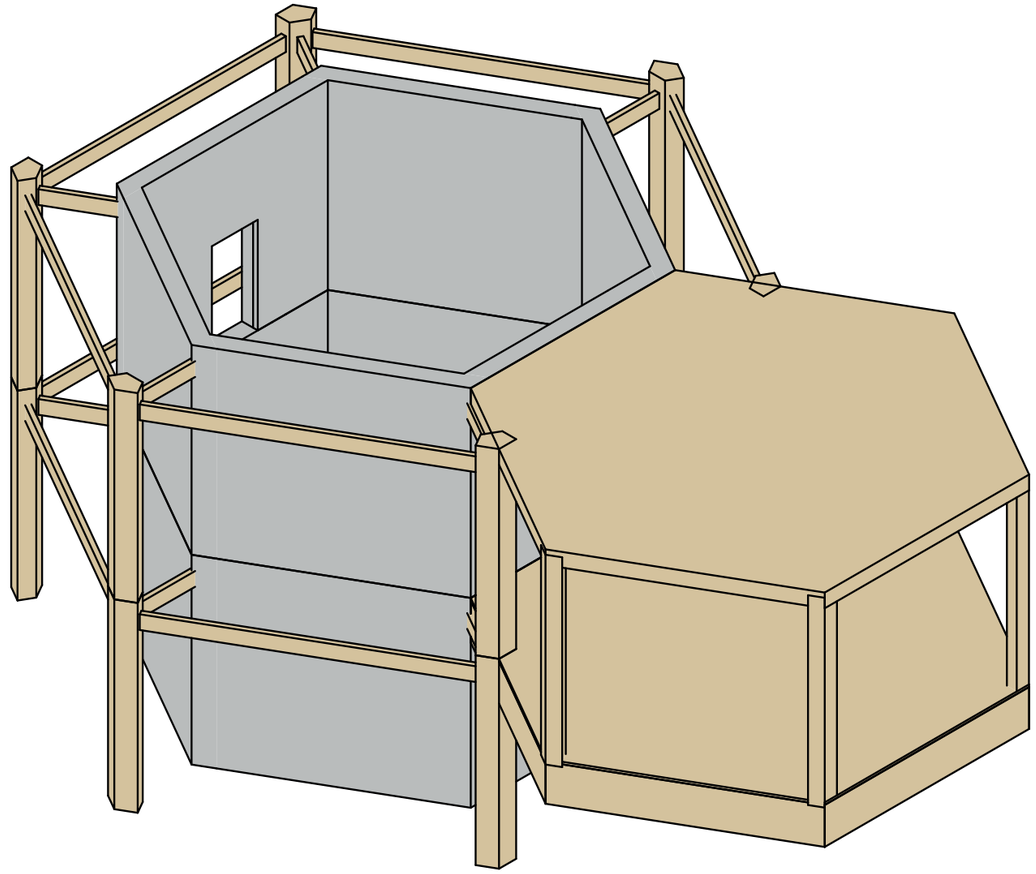


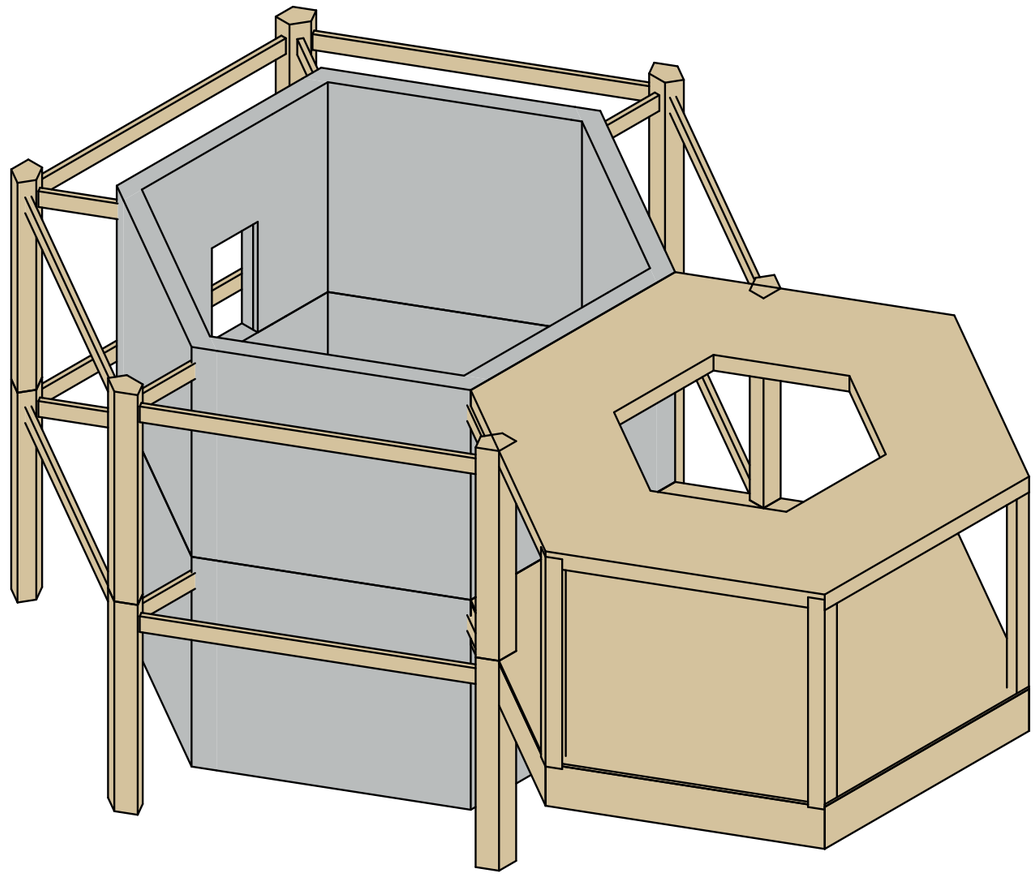


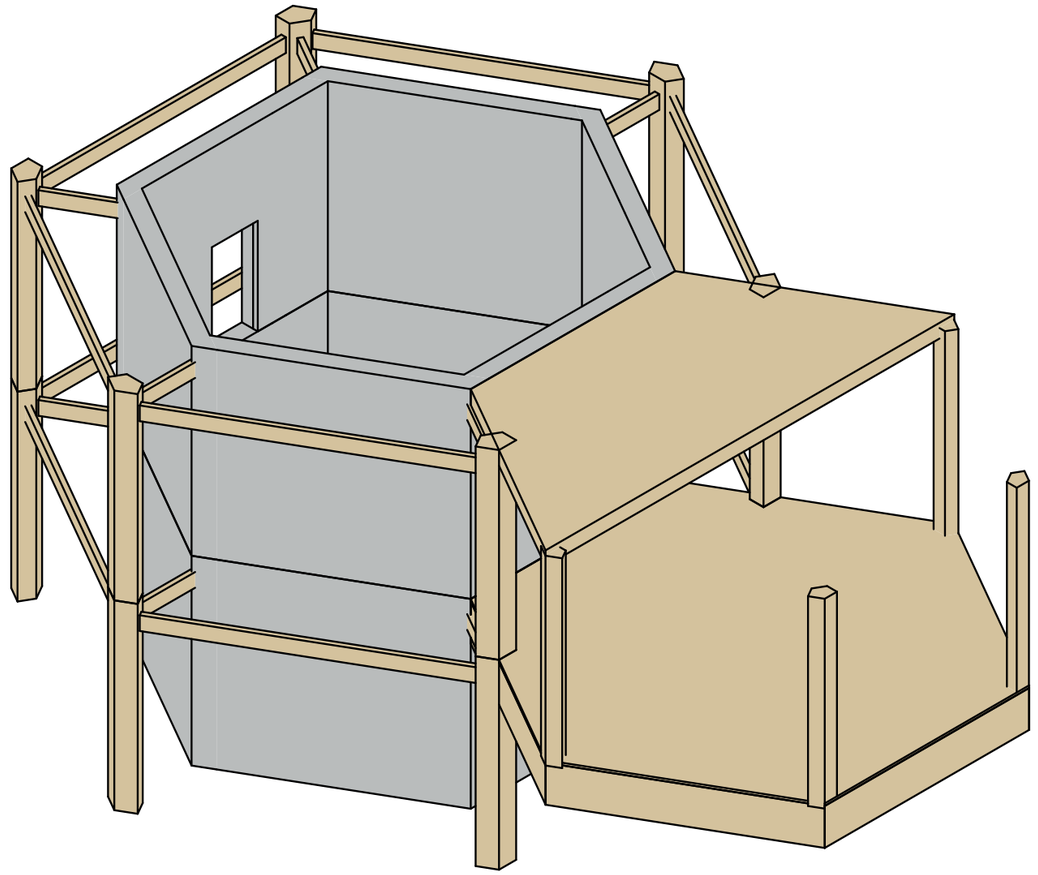














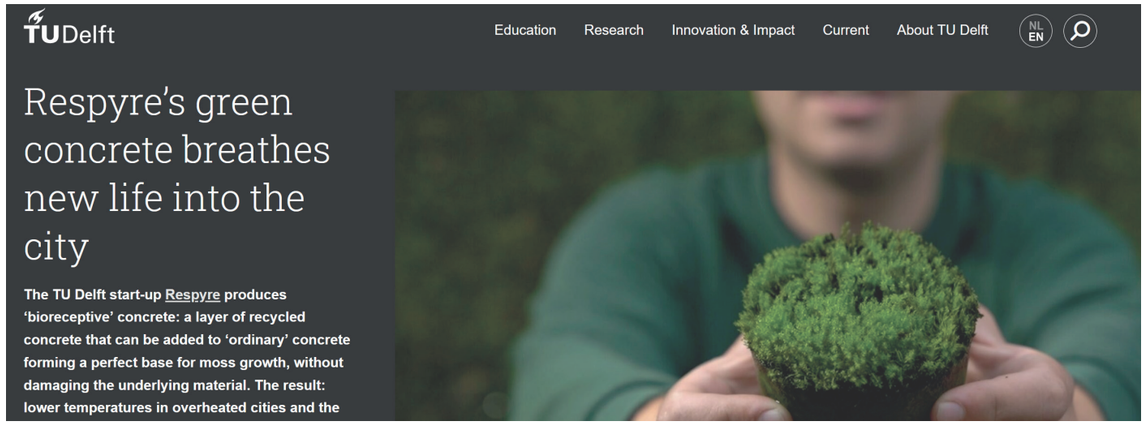


TABLE 1 Bioreceptive concrete mixture as formulated in previous research by the authors (Veeger et al., 2021)

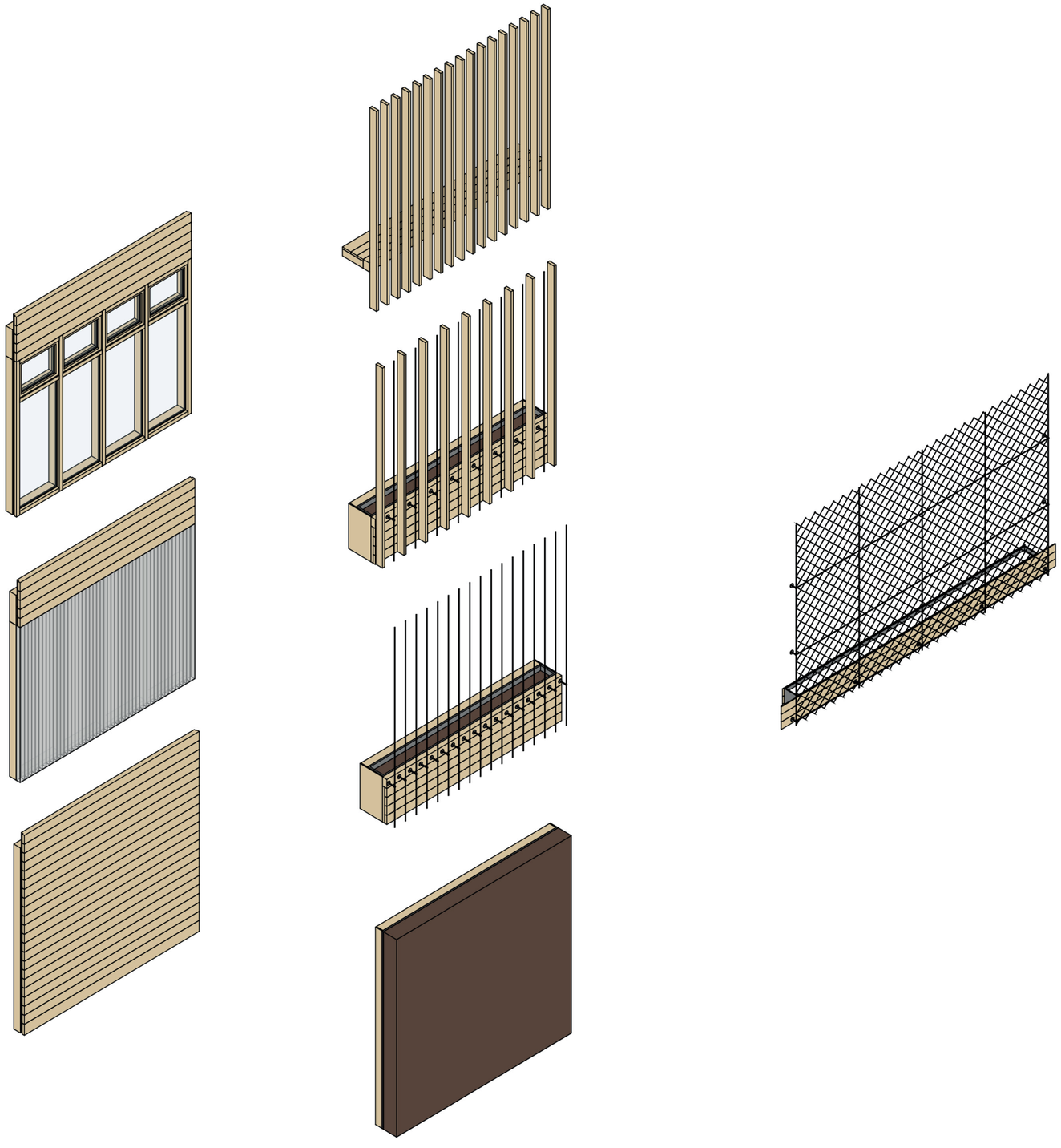
CONSTITUENTS	BIORECEPTIVE CONCRETE
Cement	300kg/m^3 OPC cement (62.5% slag)
Aggregate	578 kg/m^3 Argex AG4/8 (crushed expanded clay) / 762 kg/m^3 sand (0-4mm)
Water	150kg/m^3 (wcf 0.50)
Mineral admixture	30kg/m^3 Bone ash
Plasticiser	None

Bioreceptive Concrete Mix (Source: Veeger et al., 2021)

Biodiversity

Urban Climate

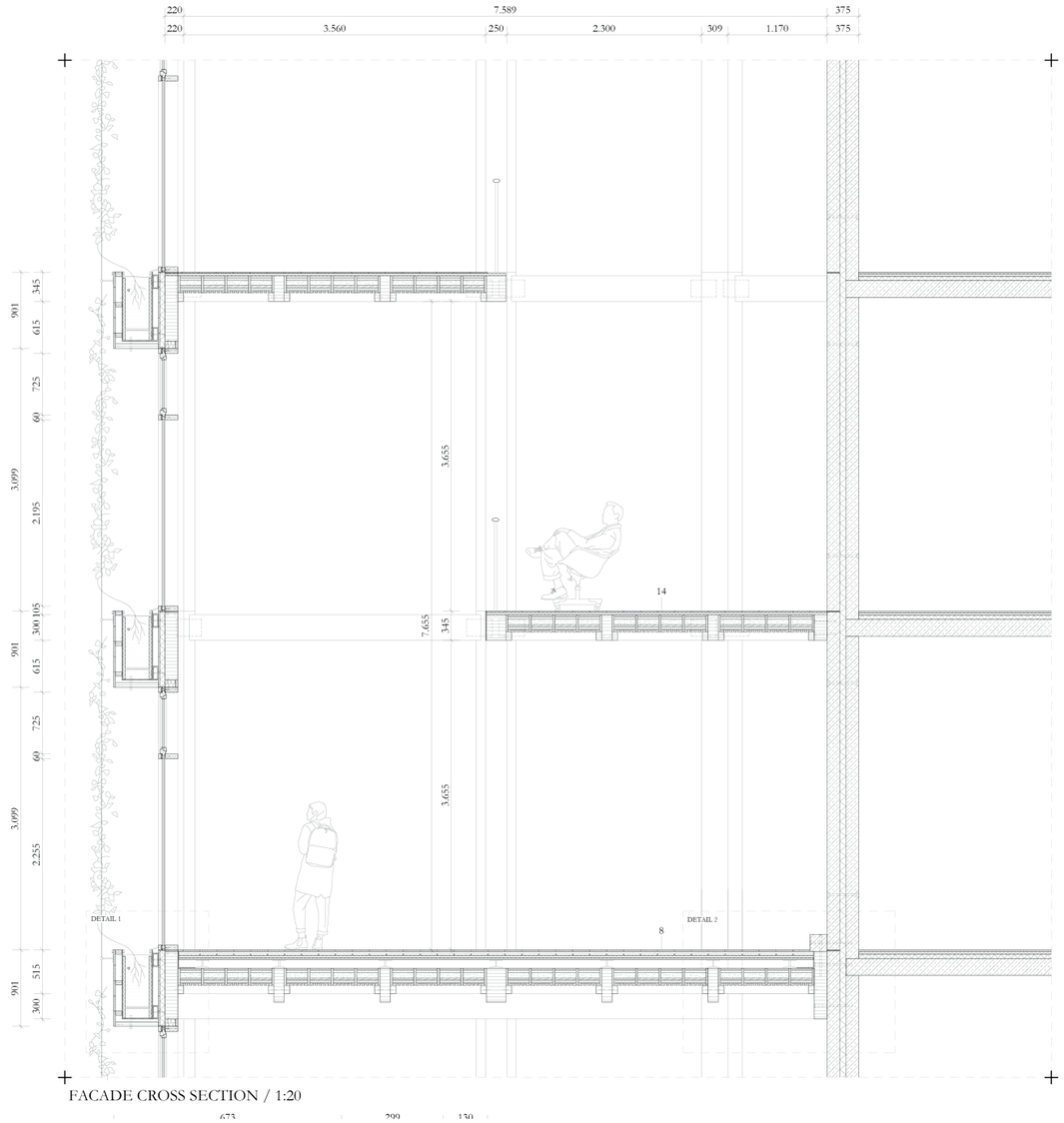
Alternative green facade (Cost)



- Facade Fragment 1:20 -



ELEVATION / 1:20



FACADE CROSS SECTION / 1:20

LEGEND

1 Summergreen Ivy vegetation
- species south side (sun): Ampelopsis aconitifolia
- species north side (shadow): Clematis lanuginosa

2 Green Facade:
- substrate
- 5 mm fleece
- 100 mm gravel
- 10 mm sheet steel trough (planter box)

3 Ø 20/5 mm steel pipe

4 Ø 25 mm irrigation hose

5 Steel rope clamps / 4 mm steel rope

6 60/230 mm Timber facade with triple glazing

7 800/150 mm Glued-laminated timber (GLT) beam

8 Loadbearing floor:
- 15 mm parquet
- 50 mm heating screed
- 30 mm impact soundproofing
- 18 mm formwork element
- 102 mm installation space

9 Lignatur - Geometry surface elements (LFE):
- 65 mm thermal insulation filling
- room acoustics (sound absorption)

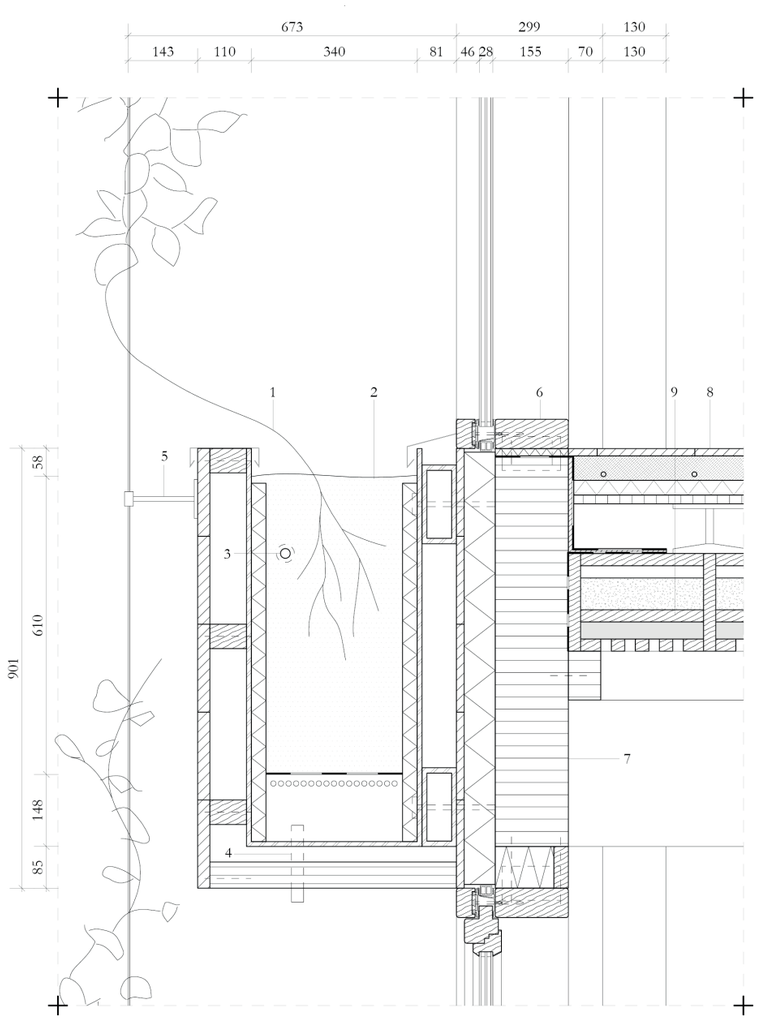
10 375 mm Core wall (sandwich construction):
- 150 mm prefabricated reinforced concrete elements (2x)
- 75 mm thermal insulation (hempwool)
- bolt connection

11 300 mm Core floor:
- 20 mm screed
- Polyethylene (PE) foils
- 30 mm impact soundproofing
- 50 mm thermal insulation
- 200 mm reinforced concrete

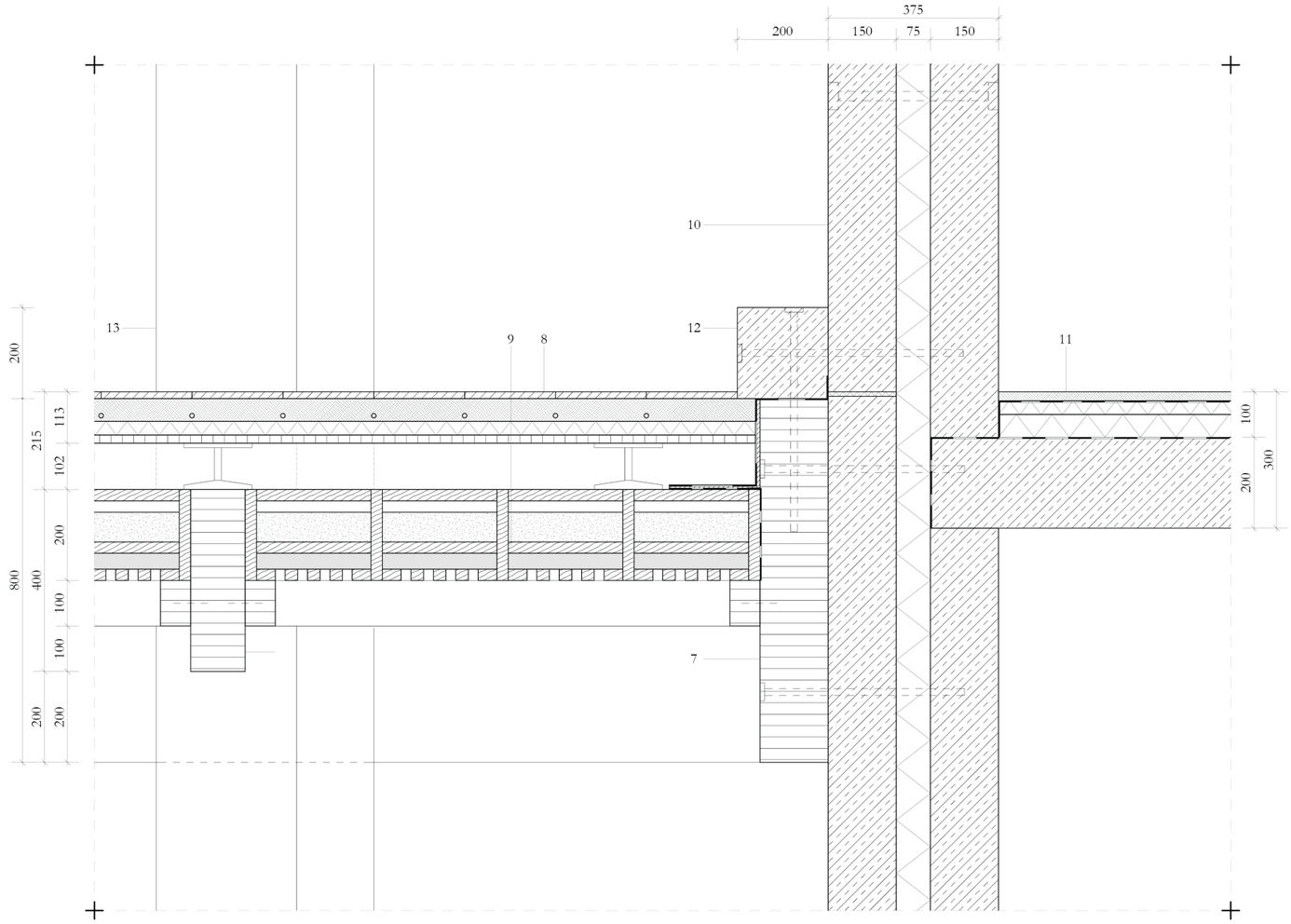
12 200/200 mm reinforced concrete element
(needed for cantilevering)

13 350/350 mm Glued-laminated timber (GLT) column
(supports the cantelevering beams)

14 In-between flexible floors

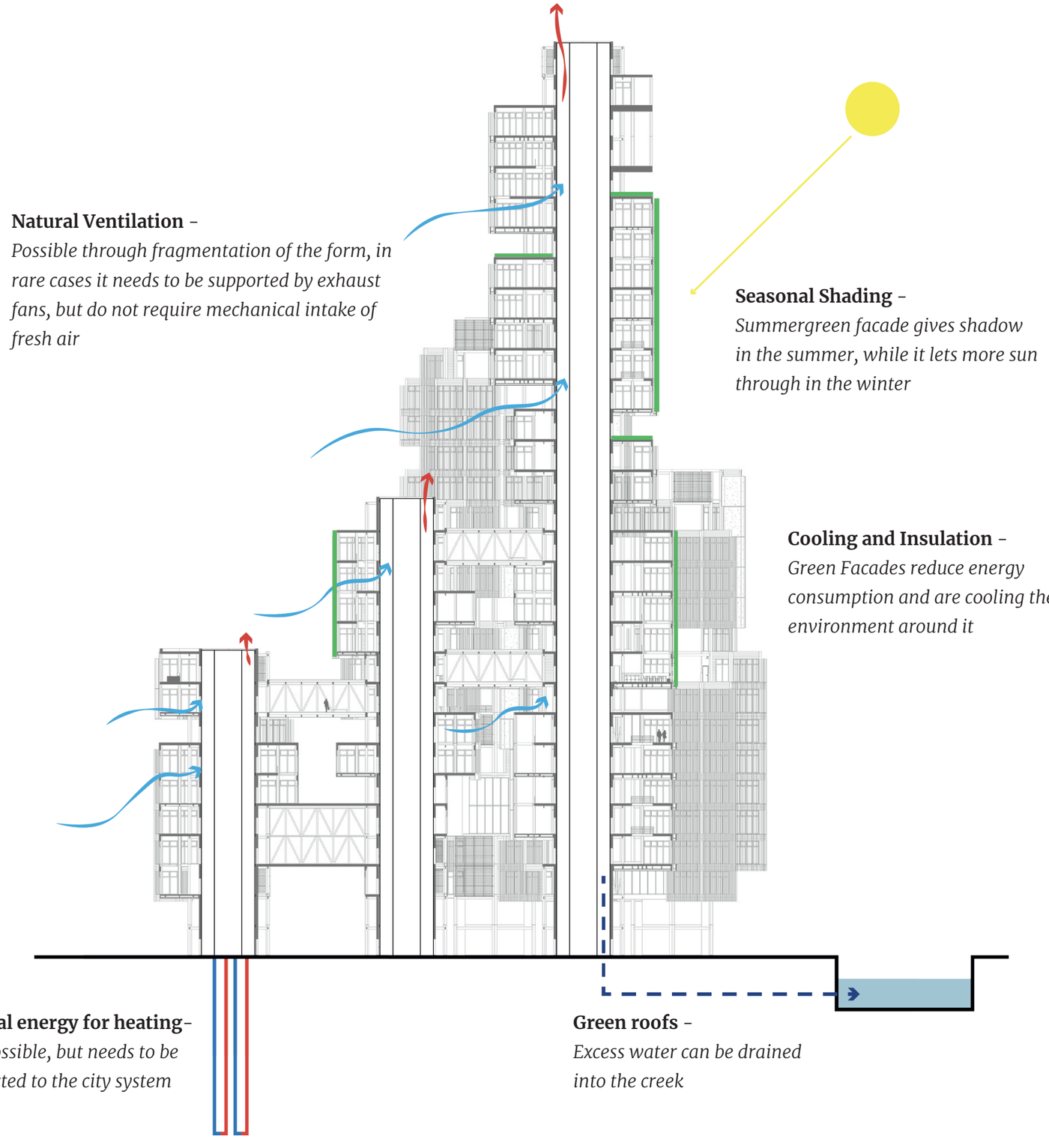


DETAIL 1 - GREEN FACADE / 1:5



DETAIL 2 - CONNECTION OF CORE AND FRAGMENT / 1:5

- Passive Climate Concept -



Natural Ventilation -
Possible through fragmentation of the form, in rare cases it needs to be supported by exhaust fans, but do not require mechanical intake of fresh air

Seasonal Shading -
Summergreen facade gives shadow in the summer, while it lets more sun through in the winter

Cooling and Insulation -
Green Facades reduce energy consumption and are cooling the urban environment around it

Geothermal energy for heating-
Partially possible, but needs to be also connected to the city system

Green roofs -
Excess water can be drained into the creek

- South / East Elevation -



