PORT FOLIO

Zhaoxi Zhang
2014-2022
Evidence-based Design

“Hello. I am Zhaoxi”

As an architect and researcher, I work at the intersection of urban environment, technology and human health. I am always wondering how to bridge the gap between academia and industry, and use practice-oriented research or research-based design to address people’s needs and concerns, and build a better neighbourhood, further a better life for people living in their cities.

“My aim is to explore the integration of research and design and to contribute to the development of a sustainable, smart and healthy future.”

Urban specialist, LEED AP ND

Ph.D. in Environmental Science,
BArch and MSc in Architecture

Contact:
Email: zhangzhaoxi527@gmail.com
TEL: +45 52640558
Copenhagen, Denmark

Gettyimages
@Zhaoxi Zhang/EyeEm
Instagram:
@art.pic.zz
linkedin and Researchgate:
@zhaoxi zhang

Website:
urbanzzhaoxi.com

How can I use my knowledge and background?

In my opinion, research and design are two essential parts of finding a solution. In fact, they are inseparable. It is very important to have strong problem-solving skills and a passion for design. I believe I am the person to bring these qualities to the table.

Firstly, I am able to quickly gain a comprehensive understanding of the context using my research skills from my PhD training, such as using effective research skills, advanced tools and analytical skills to navigate this process and explore the relationship between context and people.

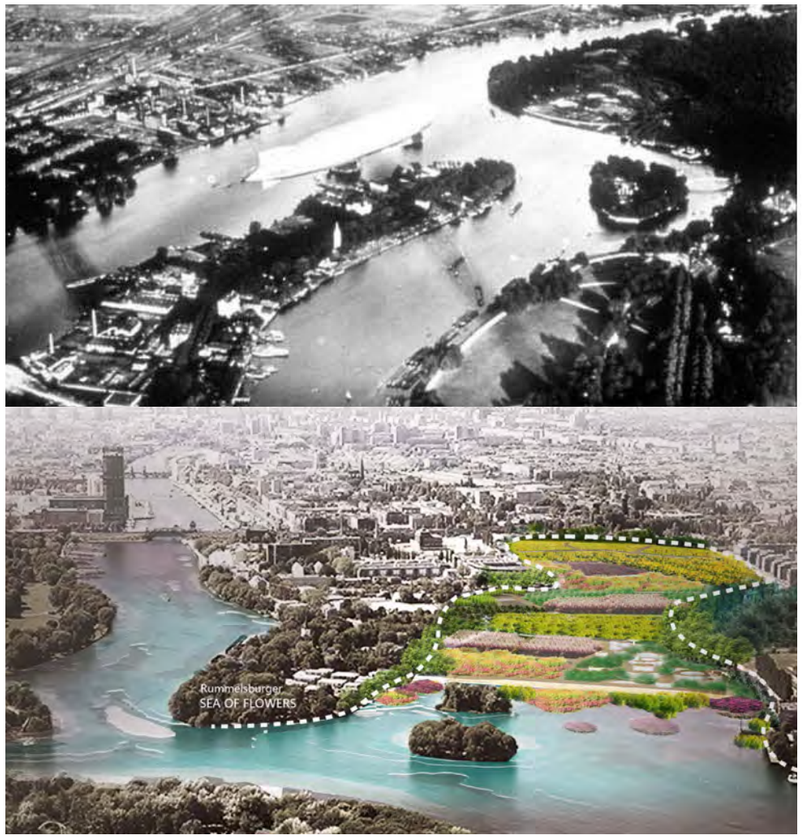
Secondly, as a trained architect, my design skills include not only architectural design, but also a unique aesthetic sensibility, a human-centred design principle, a creative mindset and various innovative approaches. My passion for design and research has allowed me to endlessly explore the possibilities of “better environment, better human life” and has sparked my interest in exploring different solutions through interdisciplinary collaborations.

Content

Sea of flowers: sediment-clean park

Technische Universität Berlin | Spree-Athen: The River as Urban Resource
UD STUDIO 01 - Winter semester 2016-2017

Prof. Dr. Philipp Misselwitz and WM Dipl.-Ing. Aine RyanTan,
Cai Yan | Charalampos Tenis | Jonas Wolf | Zhang Zhaoxi



“What can we do for the river?” instead of “what can the river do for us?”

We asked ourselves: What happens if you put the river first, or at least give it a high priority in planning processes, which has never happened before? The Spree in Berlin has been and still is treated as an object to be neglected, i.e. it has been and still is used for various purposes, such as adding value to waterfront properties or dumping chemical waste in Rummelsburg Bay. Putting the river first means looking at how the river is affected by humans, especially through urban interventions, and then localising these impacts.

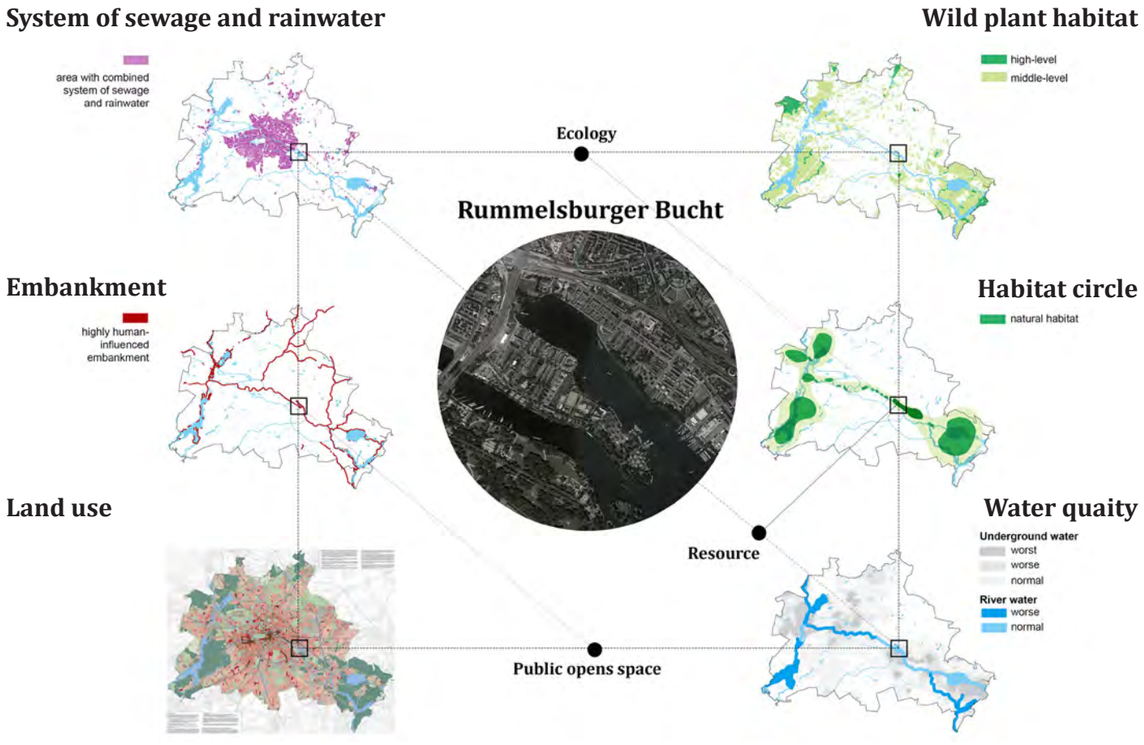
Polluted sediment hypothesis: The water that flows into this bay is constantly polluted by a large amount of highly contaminated sediment containing heavy metals and pollutants. There is so much pollution in this bay that it is often too much for wildlife to survive.

As a result of being so heavily polluted for so long, the environment, people and wildlife have adapted to the situation. One consequence of this adaptation is that people do not get involved in activities on the river and awareness of the river is decreasing.

Rummelsburger Bucht

Looking at the way the city affects the river was our main motivation for the city scale analysis. At the city scale, we found four pressing problems: wildlife-unfriendly embankments; uncontrolled sewage inflow due to mixed sewerage systems in the city centre; endangered groundwater due to polluted soils; and a massively polluted Rummelsburg Bay, which is a lifeline for both humans and the Spree ecosystem.

The labour- and cost-intensive approach of cleaning the bay through process engineering proved to have no effect on the high levels of heavy metals contained in the sludge. In 1999 and 2000, an attempt was made to clean the sediments using a process engineering method: the sludge was pumped out, chemically cleaned and returned to the bay. In the process, 70,000 cubic metres of sludge were treated, but to no avail. Even the most recent measurements of the bay, carried out in 2015, showed no change in toxicity levels, wasting around 70 million euros on a treatment that did not work. There are currently two test areas for a new approach to dealing with the toxic sludge; the water itself is not affected unless the sediment is stirred up. In these test plots, a new concrete mattress is being tested to cover the sediment and trap the heavy metals inside, while new sediment falls on top; so much for the theory.

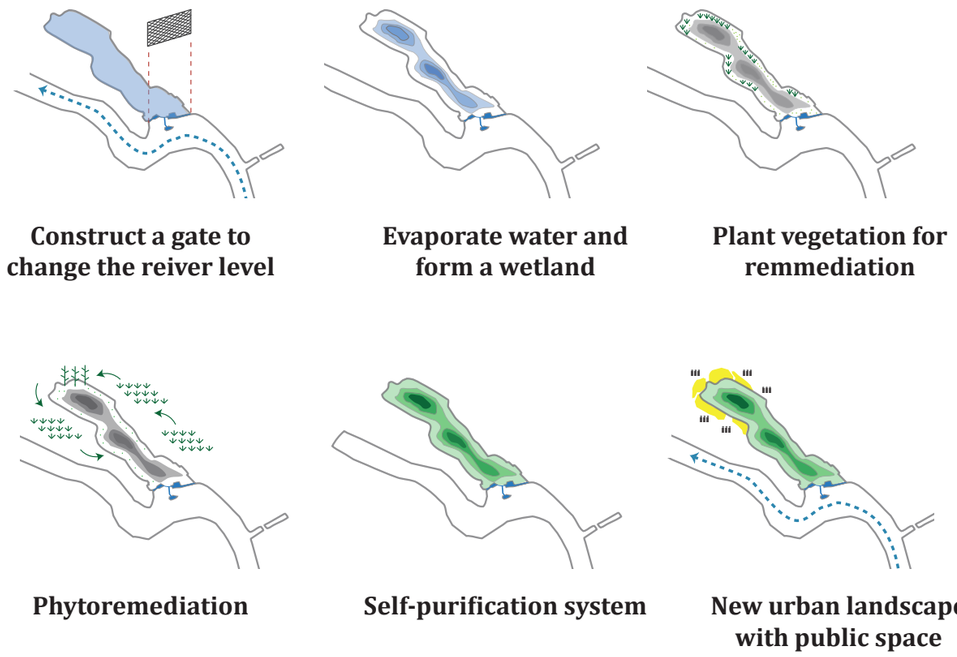


Sediment treatment

In the last two decades, there has been a lot of research into phytoremediation, a process that uses special plants (hyperaccumulators) to extract heavy metals from contaminated soils. At the same time, the harsh mining landscapes are being transformed over time into wild landscapes. Time is the key component and the only drawback of this process. So why not try this method in the Rummelsburg Bay? It's cheap, it's proven to work and it's a new experience. Unfortunately, the bay is filled with water, so we did some research on phytoremediation processes in water and found out that aquatic plants can easily clean the surrounding water, but unfortunately there are no plants that can create deep root networks in the soil in water that is up to 5 metres deep. And then we had this crazy idea of drying out the water and then planting hyperaccumulators there. Such a simple and drastic solution. But this approach would guarantee the process of sediment cleaning, because there are a lot of best practice examples. And an idea was born: What if you replaced one feature with another?

What if you replaced the water with a sea of flowers that you could even interact with? From the idea that the sea of flowers could be interactive, new ideas emerged. Bridges could connect the two sides of the bay, improving access to public transport. Any missing features could be added along the bay to enhance the neighbourhood.

The concept of treatment



The dyke

The key element in drying out the sea is a dyke, a physical infrastructure to keep the water out of the bay. Since we were already proposing an infrastructural building that contrasted with our subtle way of cleaning the bay, we tried to give the dyke different functions. We wanted to use the dyke for another important purpose: to pump the water from the bay into the River Spree and clean it there.

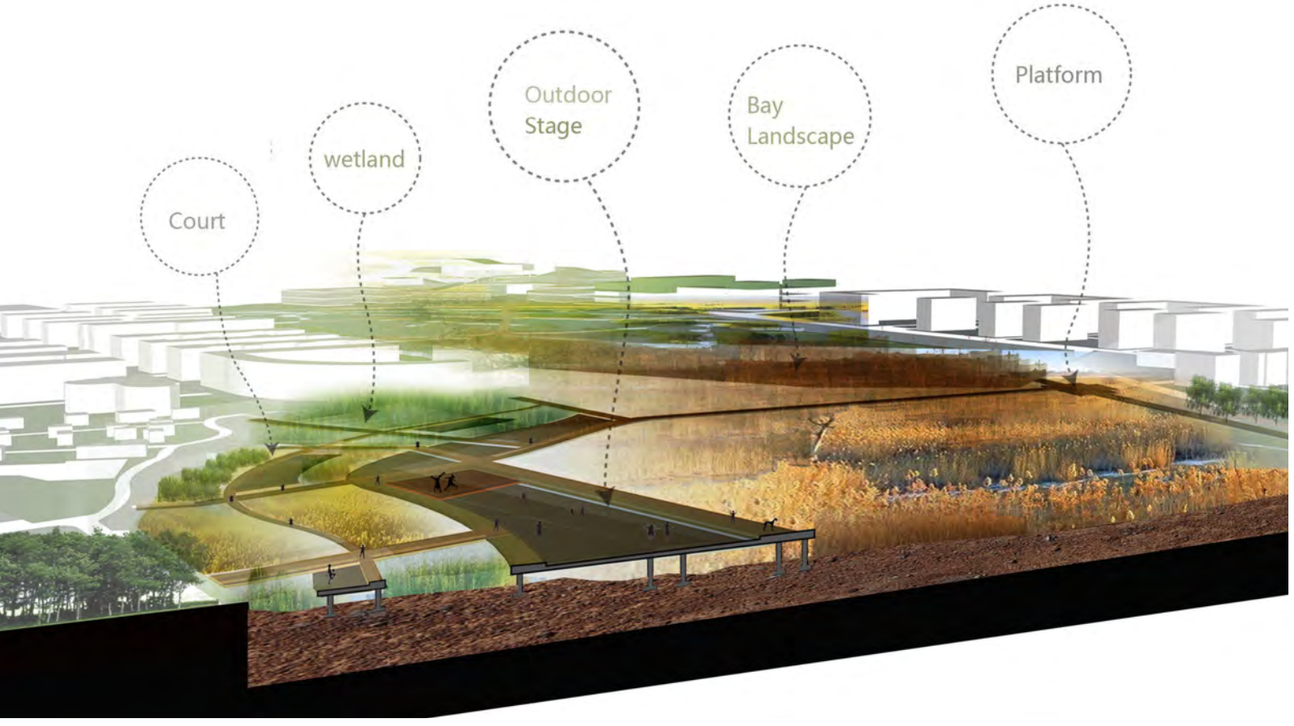
Phytoremediation

The bay is polluted with high levels of heavy metals, up to six times the tolerance level. The pollution is a result of the influx of waste from surrounding factories, which has led to high levels of cadmium, chromium, copper, lead, mercury, nickel, zinc and more. We have put together a collection of plants that respond to the specific toxicity found in the bay: sunflower, oilseed rape, Indian mustard, Bermuda grass and widow's weed.

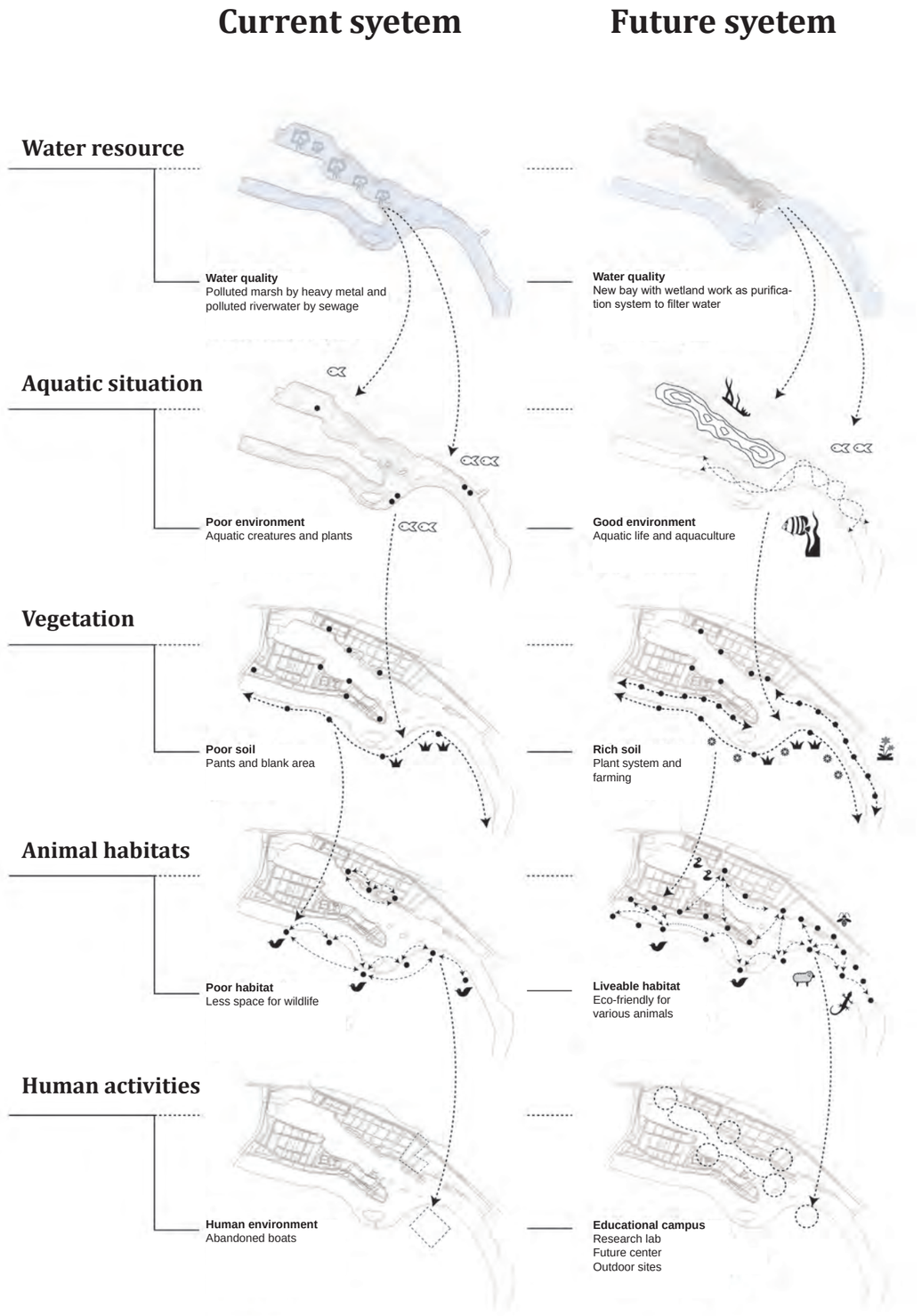
As the plants grow, they take up the toxic particles through their root systems. What makes these plants special is that they can do both: withstand highly toxic soils and take up above-average amounts of toxic particles. Although all plants can extract more than one (toxic) element, there is no one plant that can cure everything. With a cyclical system of plantations we can address this problem.

Education & science

Educating people about the history of the site, and showing them how powerful and fragile nature is at the same time, means moving towards a future where this kind of pollution never happens again. Educating the public about the history and clean-up process is a perfect subject for a museum, which we can imagine on our site, and the campus can provide greenhouses for growing the plants used in the bay, as well as the typical classrooms, laboratories and studios.

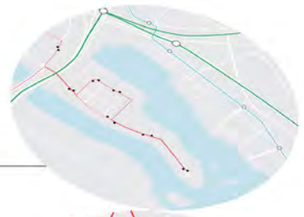


Ecological Perspective



Site analysis

Responding to the spatial situation, the sediment park must provide new opportunities for the neighbourhood. By transforming the bay into an urban space, the park will help to improve the connection between two sides and provide space for better functions and services. The pathways in the park are designed based on existing spatial connections such as the S-Bahn station, bus stations, main roads, public service facilities. Further development with the park includes an eco-tech business, a public education campus and an open-air playground to make the area a more comfortable, active and open neighbourhood.



Public Transport

A S-Bahn station and several bus stops provide easy access to Rummelburger Bucht. The wide bay divides the neighbourhood into two parts.

Road

The area is bounded by railway lines and the river Spree.

Green Space

The Rummelburg bay is surrounded by a residential area and a green area on the embankment.

Land Use

The neighbourhood has two kindergartens and a primary school, but there is a lack of playgrounds for children.

Texture

The lack of restaurants and supermarkets also makes life difficult for some residents.

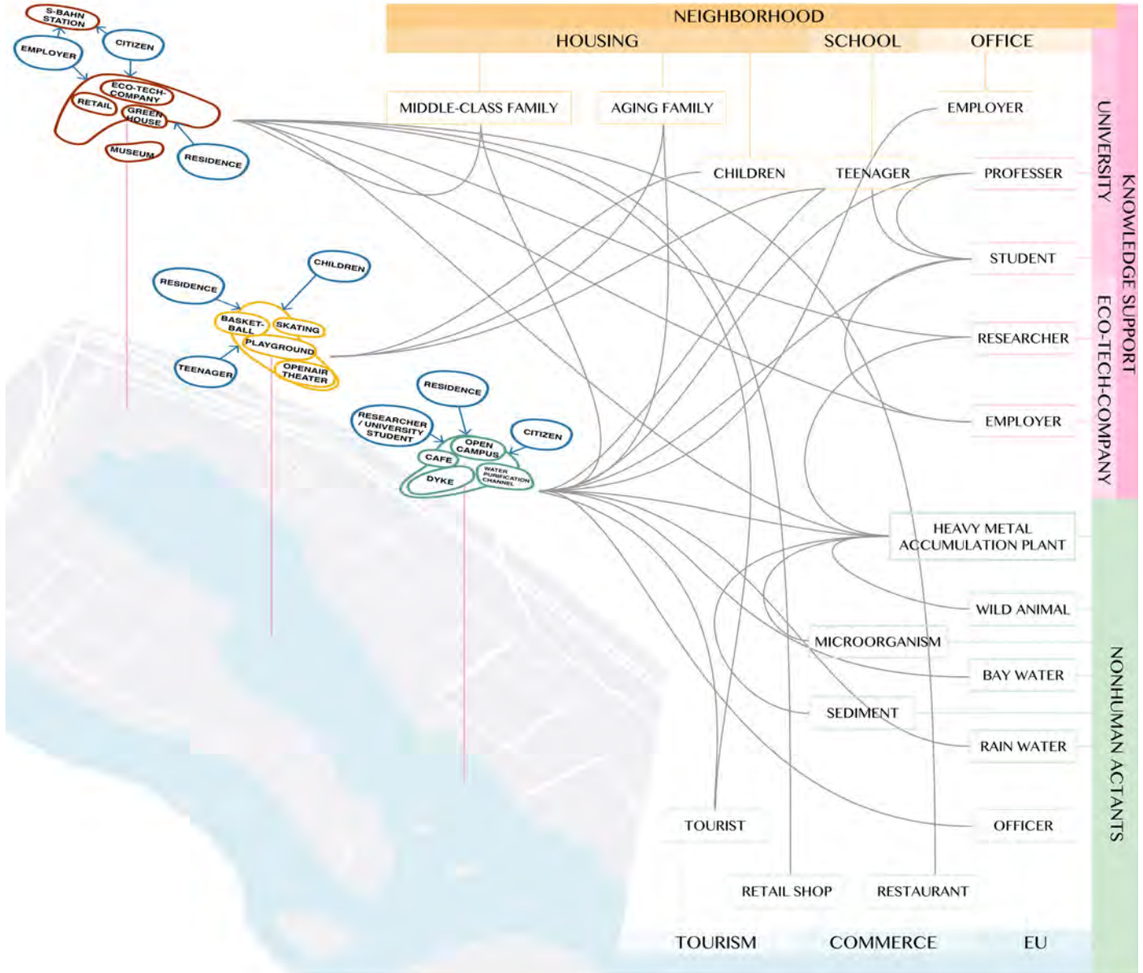
Spatial Situation

Actor analysis

The design also analyses the different actants involved in the process. The definition of the different actants is figured out by a classification into actors from the neighbourhood, actors providing knowledge support, actors providing financial support and non-human actants. The design aims to enable each actant to participate and communicate in the process.into eco-products and promote further innovation.

For people from the neighbourhood, education about ecology and coexistence with nature is provided through an open campus for researchers and the public to play a role in the sediment remediation process. Meanwhile, recreational space, including playgrounds and retail shops, will make life easier.

For those who provide knowledge and financial support, there will be research and work space to comfortably observe the park and plants and record the whole process. An eco-tech business area will enable scientific research to be translated into eco-products and encourage further innovation.



10-year scheme

The whole project will take 30 years to completely remove the heavy metal. The very first step will be the construction of the dike, which will take two years. After that, two pumps will work for two years to remove the water while the plantation begins. From the 3rd year, the construction of footpaths from the dyke into the park area will begin. When it is possible to walk through the park, new areas such as the playground and the campus will be created and new activities will be developed.

Years later, the park will become an attraction for the whole city, renowned for its eco-tech research. Then more companies will be born here and it will slowly become a gathering place for the industries concerned. The 30-year process will leave an amazing park and people will be proud of the area and will make the appropriate decision whether to let the water back in or keep the beautiful landscape.

2017
Rummelsburger Bay

2019
Dyke & Buffer

2021
Pump out water and plant

2023
Public landscape and walkway

2025
Accessibility into the park

2028
Sport area and campus

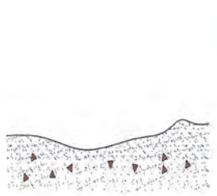
2035
New eco-tech landuse

20147
Cleaned sediment

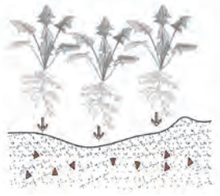
System

The park is equipped with several sediment purification systems. Seven types of plants are used to collect heavy metals, while other facilities for observation and research are located with the walkway on the sediment.

The elevation of each part of the park depends on the original depth of the bay, and the impermeable layer is used in the area with the lowest elevation.



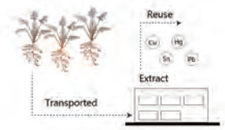
Polluted sediment contains heavy toxic substance



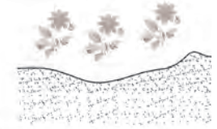
Plant vegetation to absorb the sediment

Extract pollutant through plans' roots

Transfer pollutant from sediment to plant body

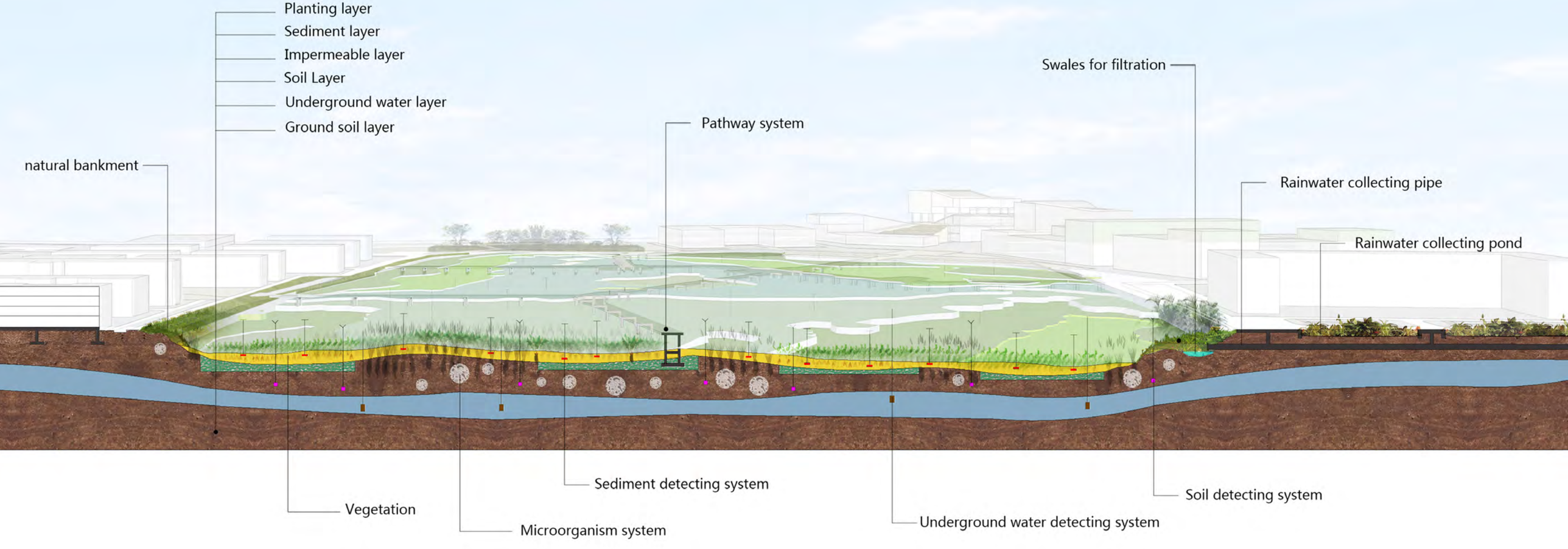


Reclaim used plants and send them to factory



Replant plants and recycle the process

Section of the bay



Interface

The interface between the park and its surroundings is designed to be natural and convenient. Type A shows the existing roads leading into the park for easy walking and future activities such as walking, running, dog walking etc. that will take place in the park. Type B shows the scene where the new playground is easily accessible from the embankment and the school. People, especially teenagers, will be able to play sports, even skate, on a professional pitch close to home and school.

The ‘sediment-clean park’ project aims to revitalise the heavily polluted and neglected River Spree. By giving back to this ancient heart its dynamic soul, urban renewal and quality of life. We imagine a ‘soft infrastructure’ for the river in our site, developing interconnected infrastructures and landscapes that rethink the boundaries between water, land and city. The construction of a dike to dry out the water of the Rummelsburg Bay in order to clean the sediment in the river, which is the main cause of water pollution in the area.

The whole idea is very simple, yet bold. The design includes:

--Cleaning the river sediment by drying out the water with the help of a dike.
--Revitalisation of the heavily polluted river, restoring its former dynamism, leading to urban re-generation and improved quality of life.
--Creation of urban spaces, campus parks, paths for recreation and community development.
--Creation of habitats, rehabilitation of inaccessible embankments
--Rethinking the relationship between infrastructure and ecology in the river city.

Self-healing City

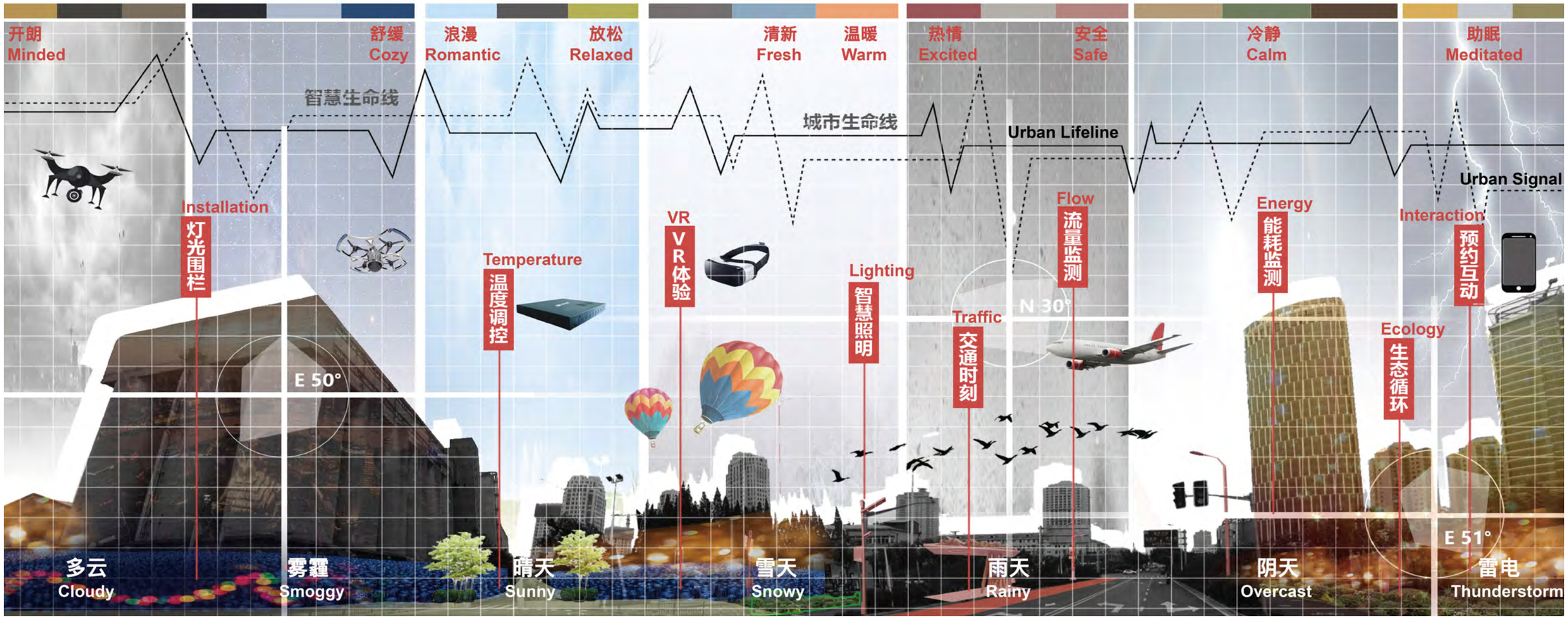
Healthy environment for healthy life

Tsinghua University | Beijing City Lab
Second Shanghai Urban Design Challenge - November 2019
Awards: Second-Pride Design

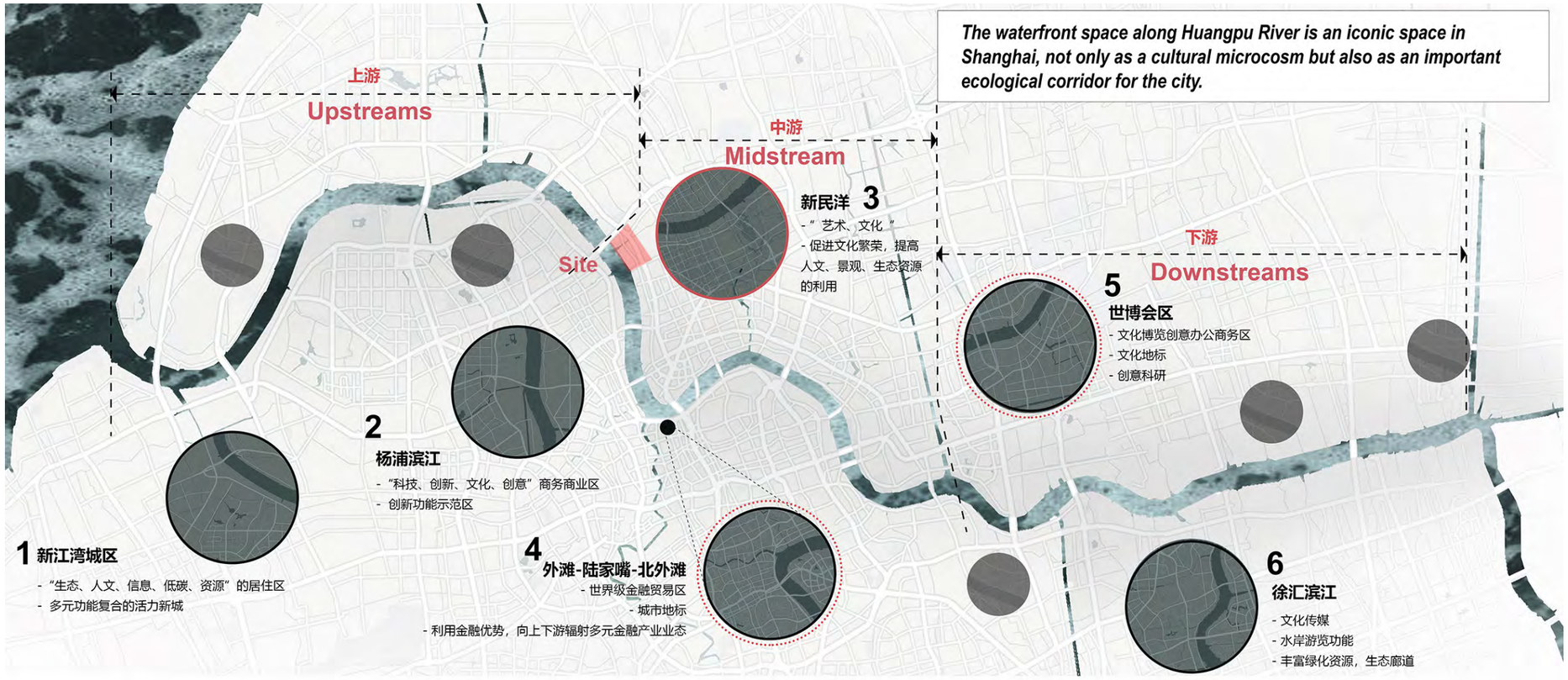
Associate Professor Ying Long
Enjia Zhang | Hanting Xie | Hongyu Zhou | Jianting Zhao | Jingxuan Hou |
Wanting Xu | Yunyi Zhang | Zhidian Jiang | Zhaoxi Zhang (Team leader)

What is a healthy city? In our design, we imagine that a healthy city is not only a good environment with harmony between nature and built elements, but it can also be a self-immune and resilient system, like the human body, which has a self-healing function to cope with environmental risks. The design is based on five dimensions of indicators: built environment, natural elements, history and culture, human behavioural activities and human sensory experience.

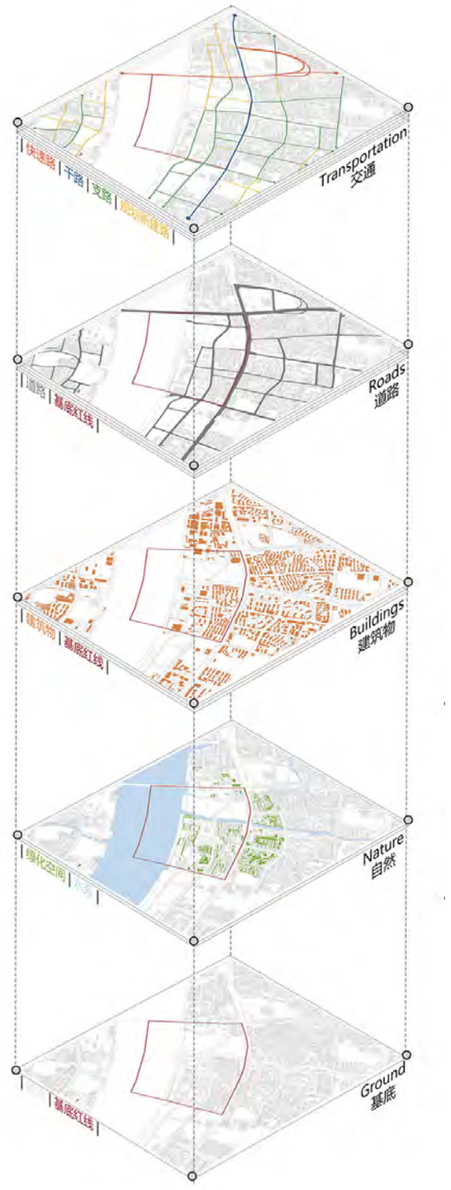
Through the use of various sensors in the built environment, the design forms a 'network of intelligence' for the site to collect intelligent feedback from the urban infrastructure, enabling it to improve the quality of the built environment, adapt the micro-level environment to coordinate people's activities, and enhance people's perception of public life. We aim to automatically adapt to different climatic and event conditions to address the pressing global challenges of climate change, environmental risk and health equity. We hope to achieve a healthy, sustainable and smart urban future.



Context Analysis



Site situation



The design site is located at Minsheng Pier in Shanghai's Pudong district, which is an integral part of the Huangpu River waterfront. This site is significant as it is a critical component of the slow/transport system, ecosystem and social system along the Huangpu River. In the last century, Minsheng Pier played a pivotal role in Shanghai's maritime trade, connecting the city to the rest of the world. Today, Minsheng Pier is an important part of the city's skyline and the overall landscape along the Huangpu River.

In order to gain a comprehensive understanding of the context of the area, we selected six key riverside areas along the Huangpu River for comparative analysis. The design site belonged to area number three. We considered their differences in terms of walkability, landscape and urban vitality. In this way, we can better understand the unique characteristics of each site and how they relate to the design of Minsheng Pier.

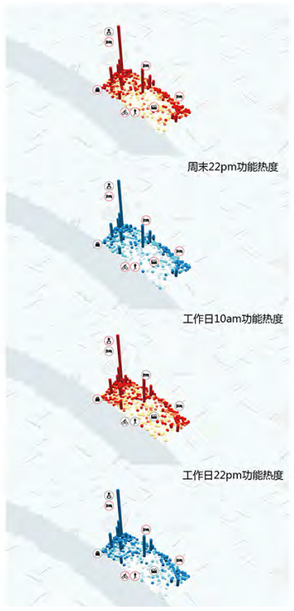
The comparison showed that the quality and vitality of the public open spaces on the design site needed to be improved in order to attract people and provide ongoing enjoyment along the Huangpu River. In particular, more public open space is needed to improve walkability, cycleability and connectivity to the city centre and other riverfront areas.

Site Analysis

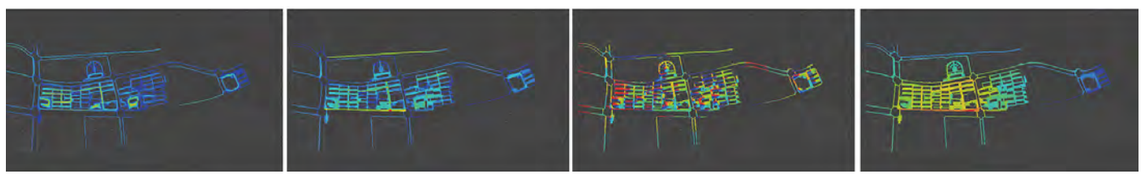
A detailed site visit showed us the existing problems and we believed that the main problems were the deterioration of the facades of the historic buildings, the deterioration of the road surface and the presence of litter. We then carried out a spatial analysis to assess the relationship between attractiveness and accessibility for pedestrians, cyclists and vehicles. The results showed that the overall level of attractiveness was lower than accessibility, indicating low use of the streets.

Our further analysis also showed that people are less willing to visit places near the river because of the lack of transport links near the river. We also looked at the distribution of POIs and human physical activity (i.e. running) on the site and the figures showed that human activity is mostly concentrated and dense during weekends and holidays, suggesting that people come to the site mainly for recreation.

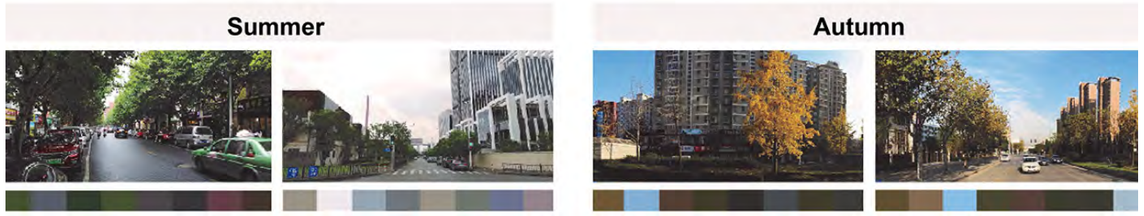
Land use



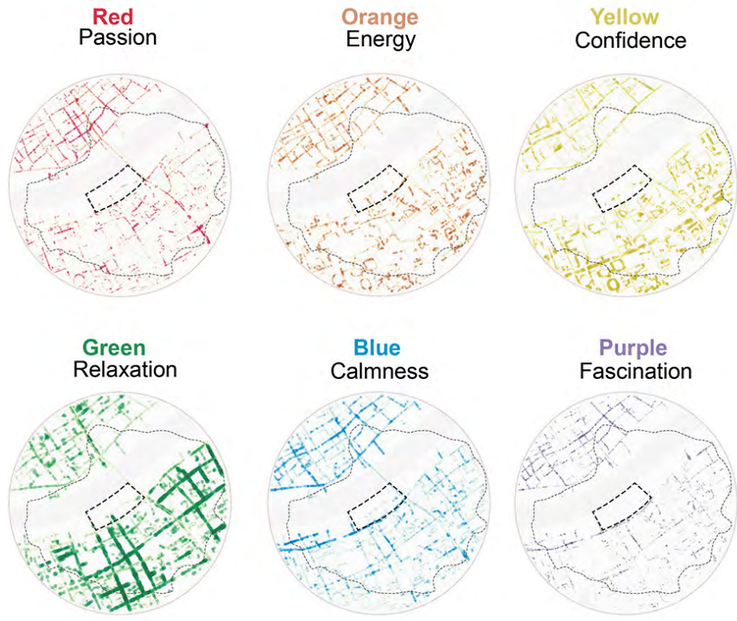
Connectivity

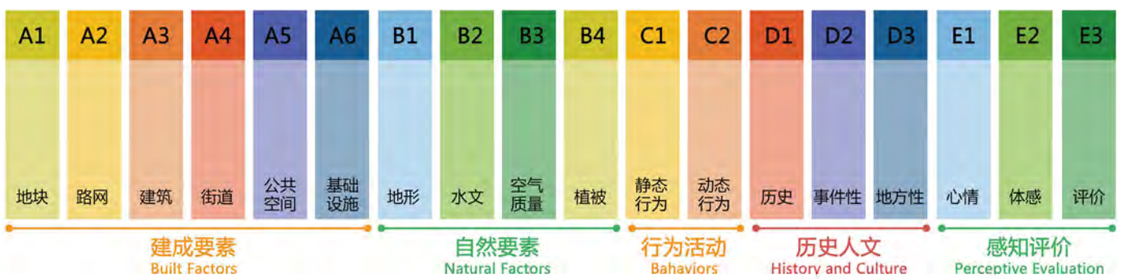


The theory of colour therapy is that the energy of colour is absorbed by cells and affects the whole body, affecting people's health on three levels: physical, emotional and spiritual.



Color analysis

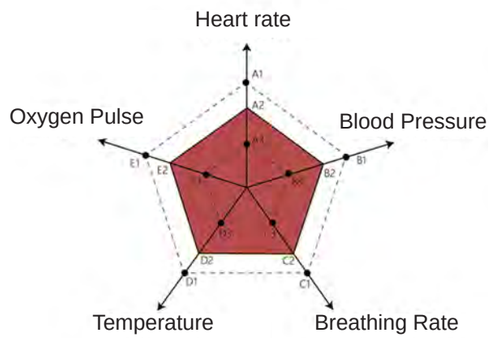




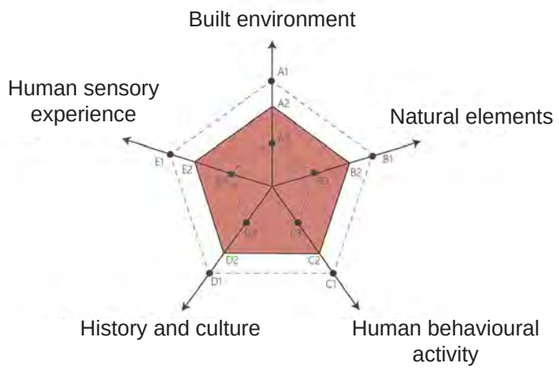
Conceptual Design

We proposed that a healthy city is similar to the human body, which should be self-healing physically and mentally. Like the human body, different urban elements are closely related to each other and form the health of urban systems. Considering the site situation, we developed an urban self-healing system consisting of five dimensions: built environment, natural elements, history and culture, human behavioural activities and human sensory experience.

Human body

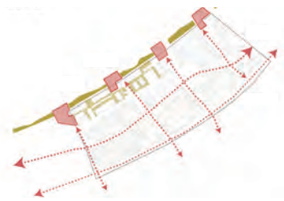


City



Structure

Blue space

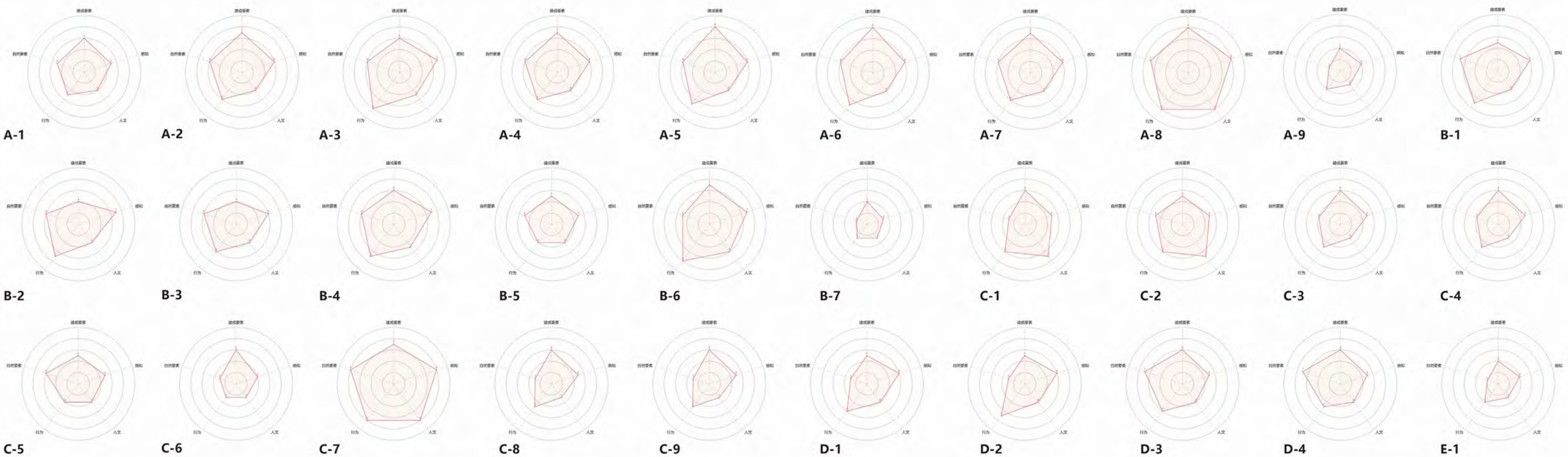


Green space

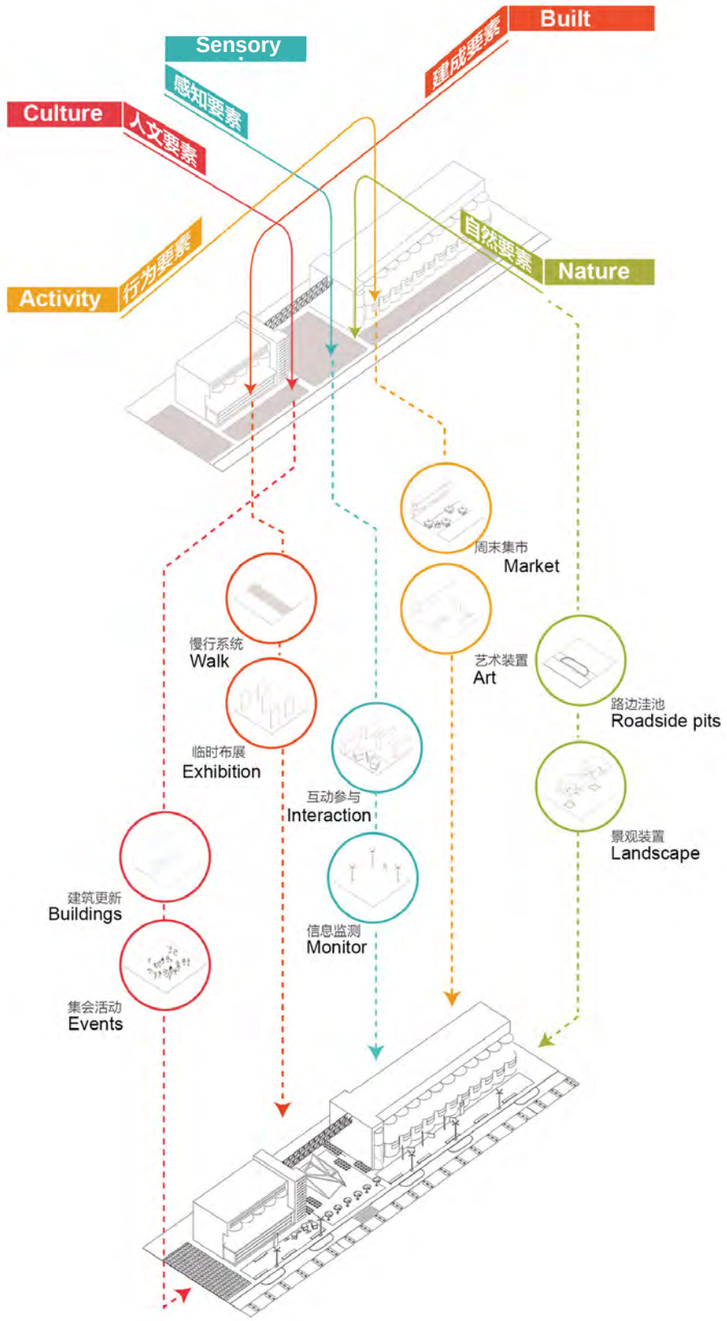
Axis network

Public open space

There are 31 public spaces on the site, we used the urban self-healing system to assess the site situation and applied the colour therapy system to improve the quality of the site, ultimately benefiting human well-being.



Rethinking the direct visual impact of these elements on people, this design focused on the colour characteristics of urban space at the micro scale of public open space, and aimed to extend their healing effect on mental and emotional well-being in daily practice, summarising a colour therapy system with 16 levels.



Transit Oasis

A Multi-functional and Lively Hub for Work and Play

Tongji University | Urban Design Group
Studio II - Summer semester 2015-2016

Professor Yu Zhuang
Junyu Cai | Weiwei Kong | Yao Ding | Zhaoxi Zhang (Team leader)

“Bring the city to life?”
or
“Bring life to the city”

How does transit-oriented development (TOD) benefit urban development? In this design, our site is located near an abandoned railway line from the last centre and along Metro Line 2 in the Jingan district of Shanghai.Meanwhile, newly built metro lines and light rail systems can bring new opportunities to the neighbourhood. Here we look at four strategies to bring people, activities, buildings and public space together: compact development, mixed use, walkable and cycleable networks, and an increasing amount of open, green and recreational public space. We hope to create a multifunctional centre for work and play, a liveable neighbourhood for children and vulnerable people, a healthy environment for all, for long-term sustainability and civilisation in cities.

Site Analysis

In this design proposal, we developed the idea of promoting a comprehensive development of the existing railway land and explored the future urban scenario of the “Transit Oasis”.

By considering the surrounding streets, the distribution of services and infrastructure, the organisation of traffic, commercial areas and the system of green spaces, we discussed the possibility of realising the “15-minute city” in this core area near the old railway station, with the aim of returning public space to public life, bringing the city and people together and creating a place where people can enjoy the “work-life balance”.

Site situation

Road network

Service

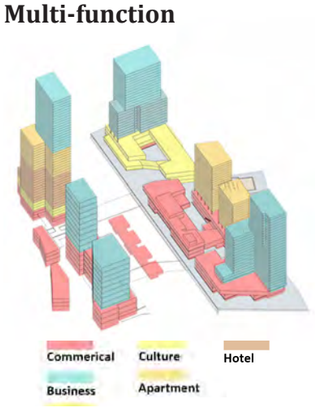
Transport

Connection

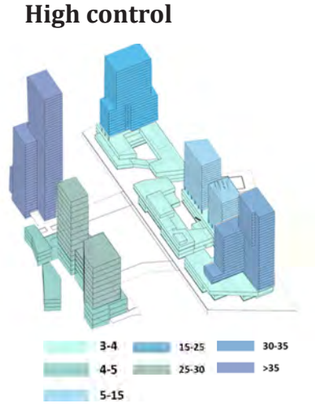
Green space

15-minute city

Multi-function



High control

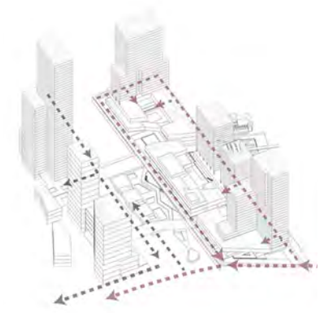


Pedestrain system

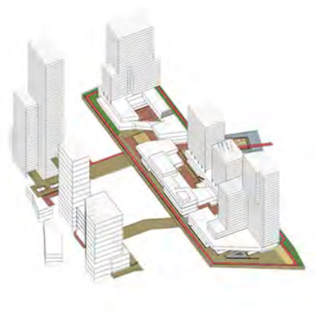
Cycle system

Vehicle System

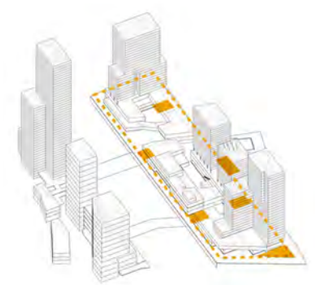
Platform system

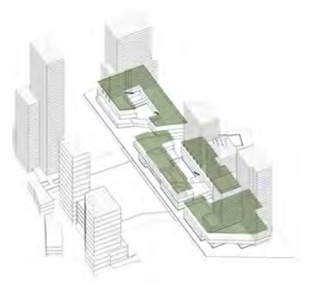


Public Space Syetem



Green Space System





We proposed to encourage the development of the surrounding areas by enhancing their own vitality. By reorganising the layout of multi-functions, creating safe pedestrian spaces and planning attractive cycle routes, we designed multi-level connections to link different types of contexts, including parks, station areas, residential areas, office areas and recreational areas, to form a hub-centred, liveable, convenient and compact 15-minute city.

Masterplan

会文路
永兴路
中兴路
西藏北路
育婴堂路
永兴路
虬江路
会文路
虬江路
交通路
宝山路
虬江路
罗浮路
宝山路
罗浮路
武进路
虬江路
育婴堂路
西藏北路
虬江路
会文路
虬江路
西藏北路
育婴堂路
西藏北路
河南北路
武进路
天目东路
河南北路
江西北路
山西北路
天目东路
康乐路
新马路
河南北路
天目中路
海宁路
江西北路
山西北路
浙江北路
海宁路
天目中路
康乐路
河南北路
浙江北路
塘沽路
河南北路
江西北路
天目中路
海宁路
塘沽路
七浦路
七浦路
七浦路
晋元路
浙江北路
七浦路
海宁路
天目中路
晋元路
海宁路
河南北路
0M
50M
100M
250M
500M

Green Urban Link

Of all the links, the one that holds more of our blessings for the future is the Green Urban Link, which connects the site to the surrounding urban greenery and re-greens the area along the railway. With the pressing global challenges of climate change, environmental risk and health equity, we hope that this Green Urban Link can form a resilient green belt to cope with the challenges of rainfall, air pollution and noise in Shanghai, and benefit people's health.

Walking

Cycling

Green Link

Lifelogging: Urban Greenery and Mental Health

Zhang, Z., Amegbor, P. M., Sigsgaard, T., & Sabel, C. E. (2022). Assessing the association between urban features and human physiological stress response using wearable sensors in different urban contexts. Health & Place, 78, 102924. doi:https://doi.org/10.1016/j.healthplace.2022.102924

Zhang, Z., Amegbor, P. M., & Sabel, C. E. (2022). The feasibility of integrating wearable cameras and health trackers for measuring personal exposure to urban features: a pilot study in Roskilde, Denmark. International Journal of E-Planning Research (IJEPR), 11(1), 1-21. http://doi.org/10.4018/IJEPR.313181

Zhang, Z., Long, Y., Chen, L., & Chen, C. (2021). Assessing personal exposure to urban greenery using wearable cameras and machine learning. Cities, 109. doi:10.1016/j.cities.2020.103006

Zhang, Z. X., & Long, Y. (2019). Application of wearable cameras in studying individual behaviors in built environments. Landscape Architecture Frontiers, 7(2), 22-37. https://doi.org/10.15302/J-LAF-20190203

"Urban design is key to healthy environments for all"

SDG 3 (Good health and well-being) focuses on "ensuring healthy lives and promoting well-being for all at all ages" and prioritises health research for the period 2016-2030, as rapid global urbanisation continues to challenge the health burden of the environments we live in, with the world's urban population set to increase by 70% by 2050.

A 2016 report by the World Bank Group and the World Health Organization found that mental disorders account for 30% of the global burden of non-fatal disease, affecting 10% of the world's population. Mental health problems such as anxiety, depression and stress can be linked not only to unhealthy behaviours such as sleep deprivation and physical inactivity, but also to cancer and other chronic diseases, leading the WHO to advocate for "making mental health a global priority".

Successful implementation of health initiatives requires a comprehensive understanding of urban environments, aspects that are commonly studied in urban health research. The most important task is to gain a comprehensive understanding of the complexity of urban environments from a human perspective.

In my PhD research, I believe that new emerging wearable sensors provide an opportunity to objectively monitor human exposure to urban features at street level, which can help us combat environment-related mental disorders. Therefore, I have proposed a novel approach using a FrontRow wearable lifestyle camera, a GPS tracker and an Empatica 4 wristband as a sensor package to track individuals in urban public open spaces and assess physiological stress response at an aggregate level. I will then link stress response to urban features to measure the health impact of urban design and suggest health-promoting urban design strategies.

What is lifelogging

As early as 1945, Vannevar Bush proposed the concept of 'lifelogging' - the use of intelligent devices to capture the full and continuous characteristics of an individual's life, creating a multitude of individual databases that digitally record their activities.

With the advent of the Fourth Industrial Revolution, people have begun to explore the potential of new technologies and new devices to study the relationship between human behaviour and urban design. Common wearable devices, such as smart wristbands and watches, can record the user's physical condition and activities through human-computer interactions. There are two types of wearable devices that are most commonly used: one is used to monitor bio-signals, the other is used to record behaviour.

Steve Mann developed the first wearable camera in the 1970s. Today, small and lightweight wearable cameras that can take photos periodically, passively and automatically offer excellent features for the visual representation of personal behavioural data. The emergence of wearable cameras offers more possibilities for monitoring individual behaviour in the built environment as a kind of 'lifelogging'.

Measurement

We used three types of device to track people: a medical-grade E4 device worn on the wrist of the non-dominant hand to measure galvanic skin response (GSR) and skin temperature (ST) in real time; a FrontRow (FR) camera, a lightweight and simple device that can take pictures automatically and can be worn by users in everyday life over a long period of time; a GPS device to track people's movements in an urban environment.

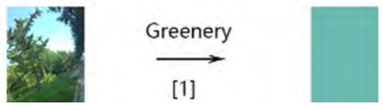
Empatica 4 (E4)

FrontRow (FR)

GPS device

The concept of Greenery lifelogging

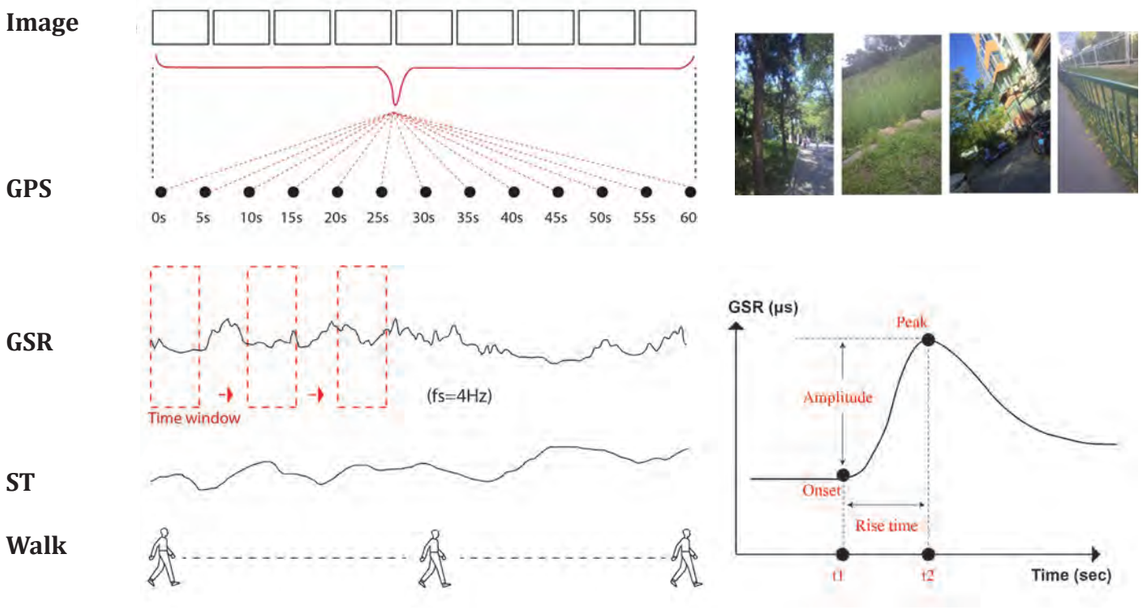
Is there any greenery?
Binary judgement: [1] Existing & [0] No existing



One day sequence of "picture"

One day sequence of "greenery"

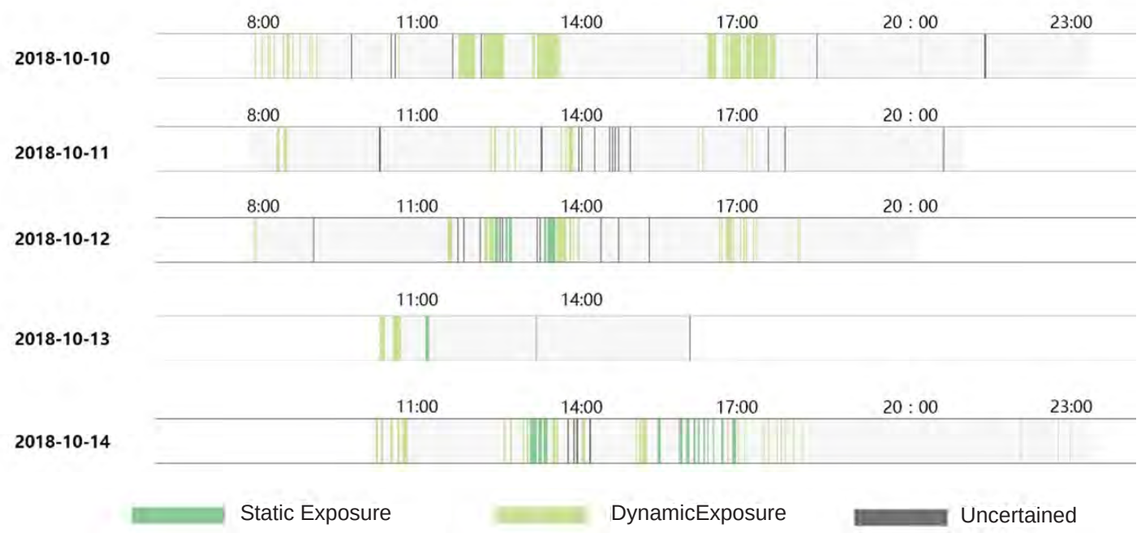
The diagram of linking data from different devices



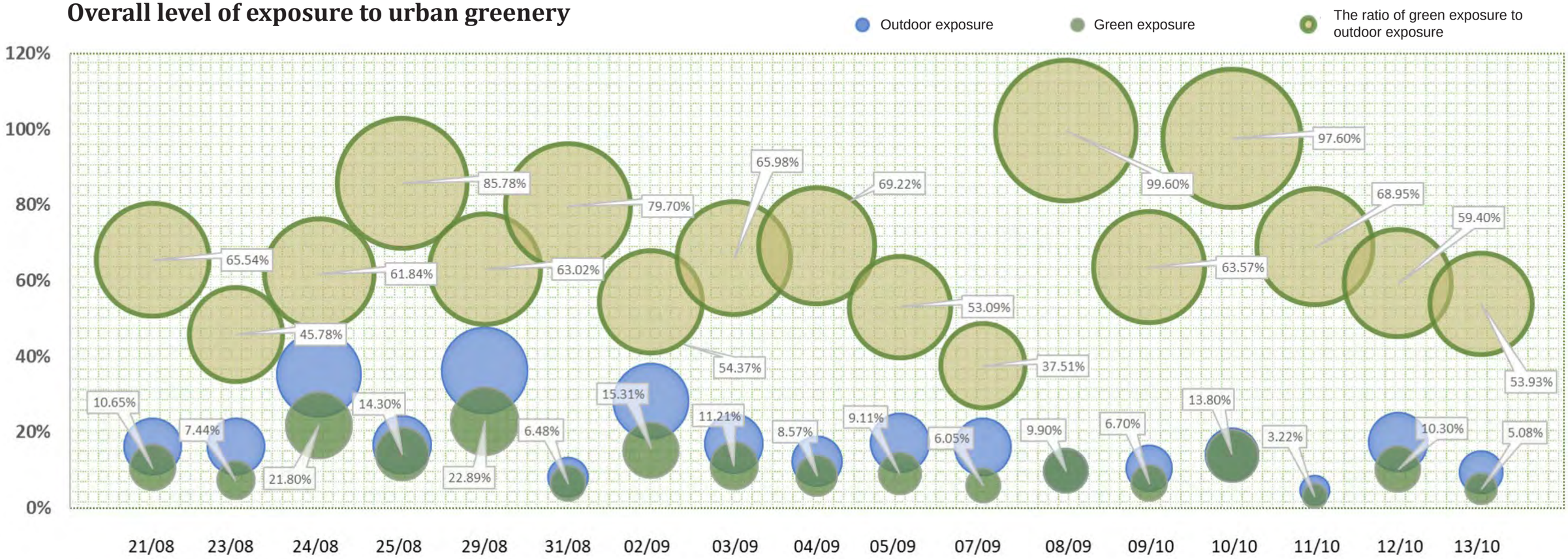
Beijing: Personal exposure to urban greenery

Applying the concept of measuring 'greenery lifelogging' to represent the regularity and characteristics of personal greenery exposure, we propose and validate the effectiveness of using a wearable camera and Microsoft Cognitive Service to assess personal exposure to urban greenery. The Microsoft API is used to identify urban greenery tags, including 'flower', 'forest', 'garden', 'grass', 'green', 'plant', 'scene' and 'tree', in personal images captured by the wearable camera. Personal exposure to urban greenery is assessed by calculating the frequency of urban greenery tags in all images taken. In addition, the overall rating and regularity of personal exposure to urban greenery (including 'static exposure' and 'dynamic exposure') will be explored to identify the characteristics of individual greenery lifelogging.

Static and Dynamic exposure to greenery

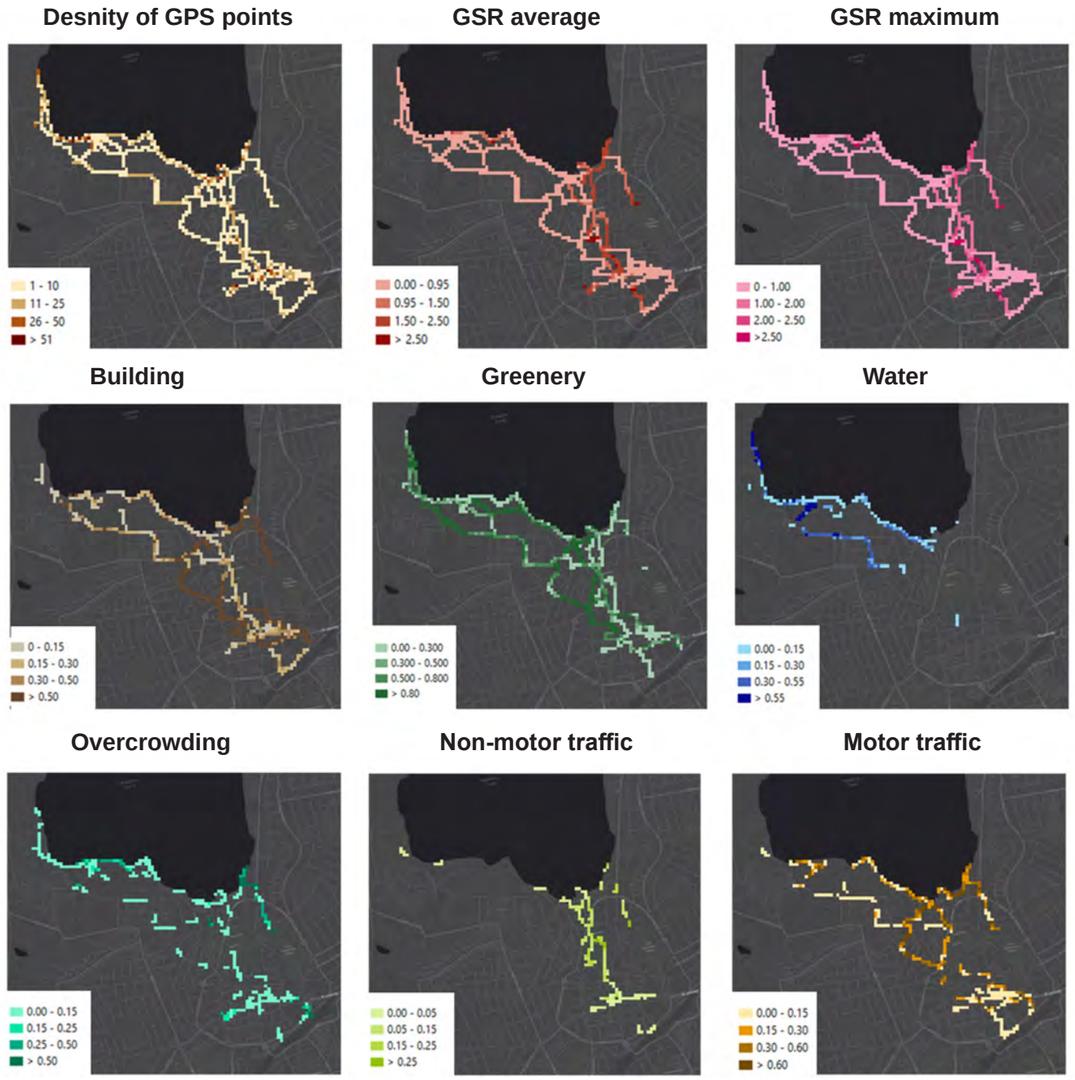


Overall level of exposure to urban greenery



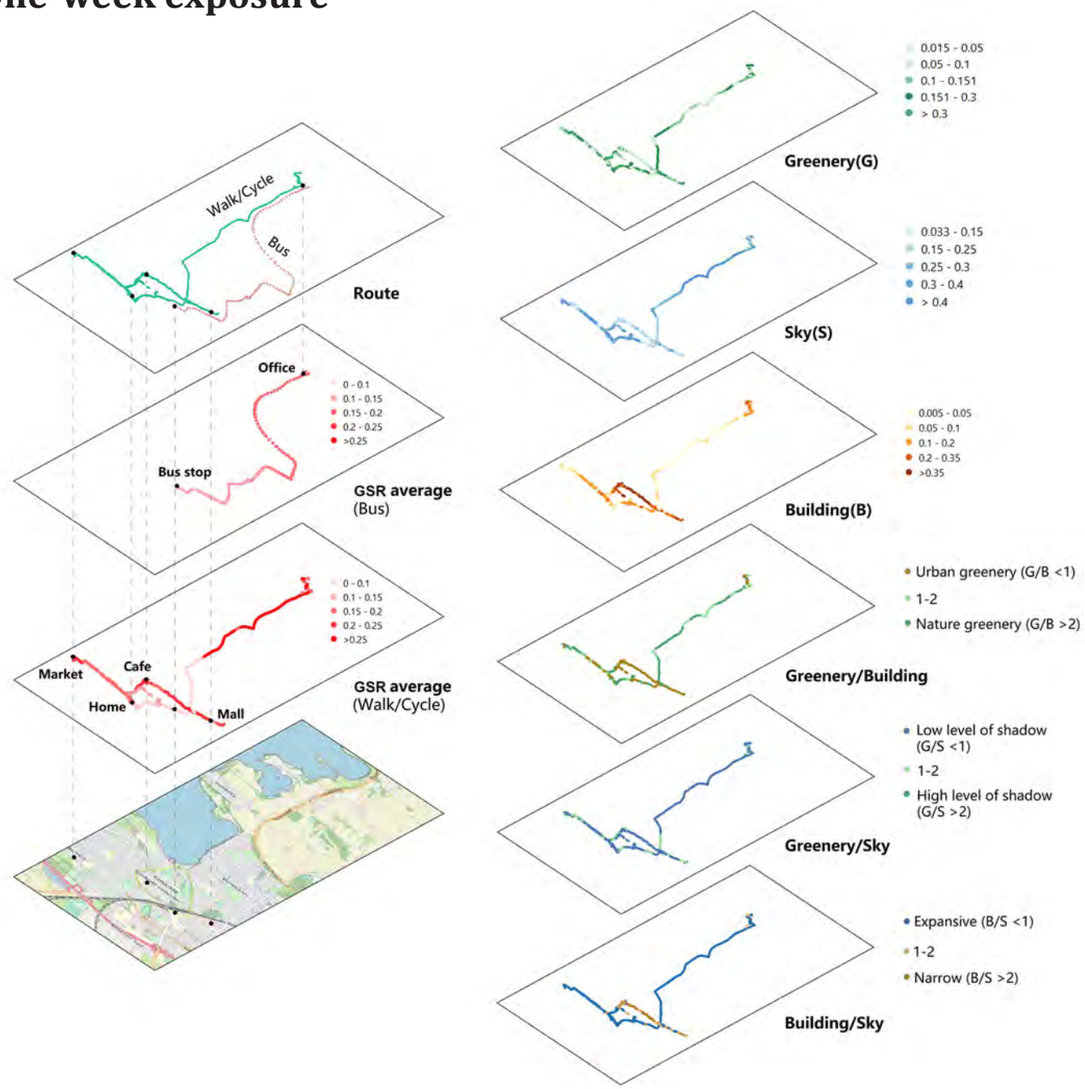
Roskilde: Correpsone
Bio-signal to urban features

12 participants (five female and seven male) were recruited from the university for a one-day participation in November 2020. They undertook a self-guided walk around the centre of Roskilde, wearing an FR camera, an E4 wristband and a GPS. We aggregated the spatial distribution of urban features and health effects within a 30 x 30 metre grid, and overlaid this with the geographical context to visualise the results. Overall, the highest GSR responses were found in the central city, including the railway station and the main road from the centre to the port area, where traffic was heavy. The lowest GSR responses were found near the forest, garden and seaside areas.



Participant number 5 later participated in the one-week study from 16 to 23 November 2020. To assess the 'green' and 'blue' benefits during the long-term tracking, we trained the SegNet model based on the Keras framework (accuracy rate is 0.8122) and detected three categories: sky view, green view and building closure. If the ratio of greenery to buildings (G/B) was <1, it meant that the ratio of greenery in the image was lower than that of buildings, indicating 'urban greenery'; if the ratio was >2, it meant that the ratio of greenery was much higher than that of buildings, indicating 'natural greenery'. We were also able to distinguish between 'narrow space' and 'expansive space' by calculating the ratio of buildings to sky, and we also assessed 'shadow from greenery' by calculating the ratio of greenery to sky.

One-week exposure

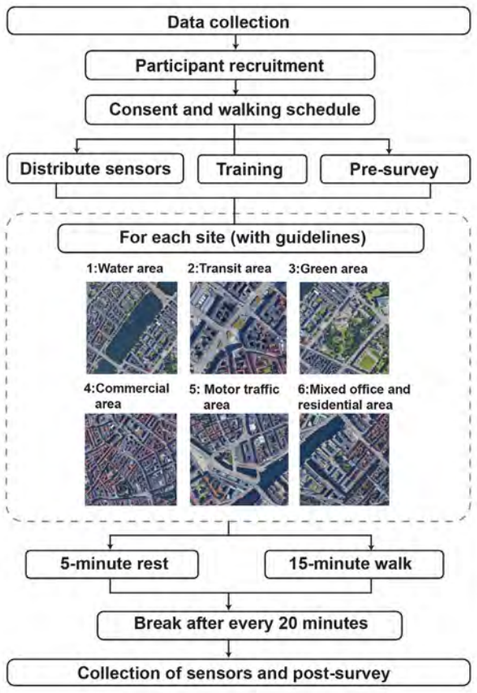


Copenhagen: association between urban features and physiological stress

This experiment will run from June to September 2021, with recruitment taking place between May and September 2021. A total of 86 participants were recruited for this study in Copenhagen. In this study, we used Microsoft Cognitive Services to detect objects from images and applied Categorical Principal Component Analysis (CATPCA) to assess urban features from the detected tags, which we called 'urban indicators', linearly quantifying the consistency and complexity of urban features. We then used Geographically Weighted Regression to estimate the local spatial relationship between the selected indicators and the change score. The GWR results showed the variation of the coefficients between the indicators and the change score by location.

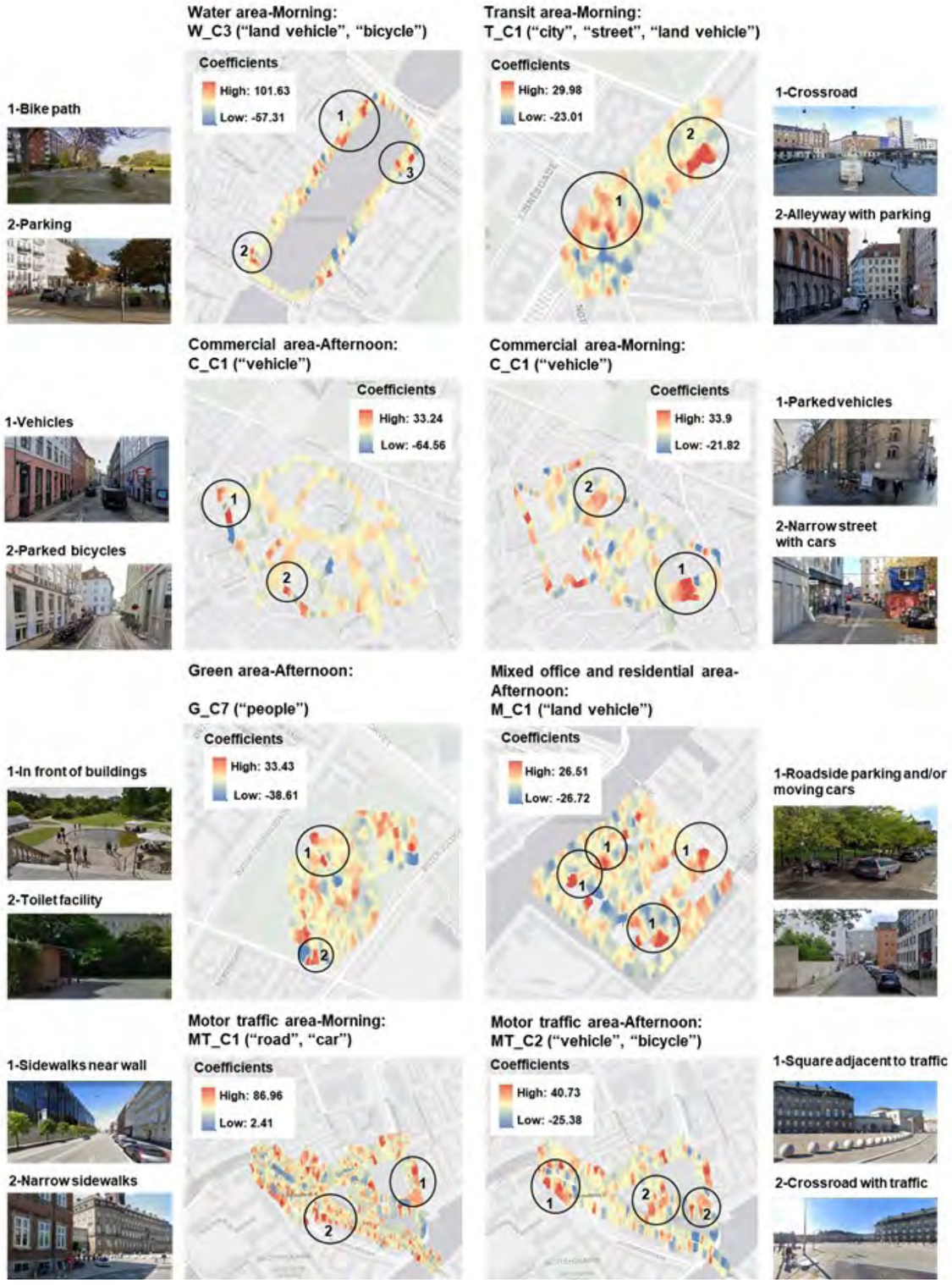
The results show that urban flow (vehicles, bicycles and people), water bodies, greenery and places to sit are associated with changes in human physiological stress response. The results also suggest that the type of urban context may confound the effect of green and blue urban features; i.e. the effect on physiological stress response may be positive or negative depending on the context.

The process of collecting data on site



GWR analysis between the stress and urban indicators

The red spots with the higher coefficient on the map indicate where humans may have higher physiological stress responses influenced by indicators.



Selected projects from 2014 to 2022

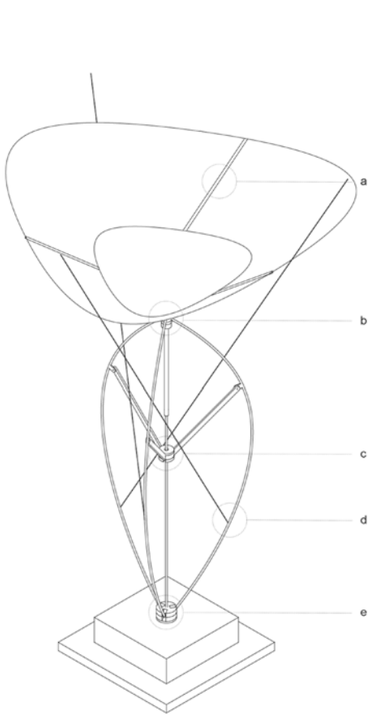
Hydro-flower Meadow

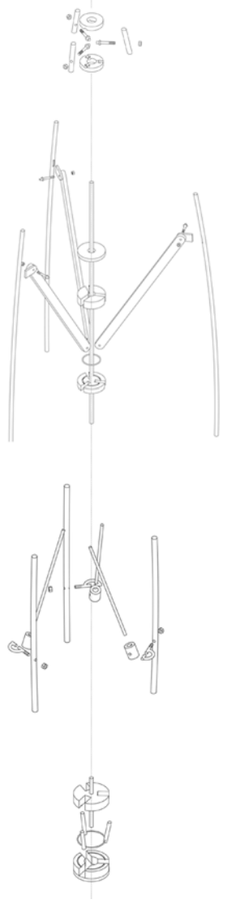
Cyberphysical systems and intelligent building components for urban resilience

Technische Universität Berlin | CHORA Conscious City
Urban Material Intelligence XS-XL - Winter semester 2016-2017
Assistant Professor Liss C. Werner
Jingwei Tan | Yunke Zheng | Zhaoxi Zhang (Team member)

A kinetic structure exploiting the toughness property of materials is proposed for temporary shelter and water collection. This strategy makes it possible to transfer the deformation process of the material to the space forming mechanism and to harvest the internal stress as a restoring force for the kinetic structure. The proposed structure can be placed in groups of different sizes in the urban area.

“Monomer”





Joint a is developed specially for the connection membranes and the core structure, integrating the process of folding, gluing and sewing to ensure the tight binding edge between two membranes to resist the filtration of water.

Joint b is located at the intersection of the three bending tubes. By restricting three axes, each associated with a corresponding tube, the joint guides each tube along a path that avoids the paths of the other tubes, preventing the core structure from colliding during the deformation process.

Joint c is located at the central pole and has three outstretched arms, each of which is connected to a corresponding tube. The centre of the joint is designed so that each of the three outstretched arms can only move in one direction.

Joint d is designed to hold the wires to the side of the structure. When the structure opens, the joint ensures that these wires rotate in a pre-set path leading to the side of the membrane, allowing the wires to increase the stability of the water collection ‘funnel’.

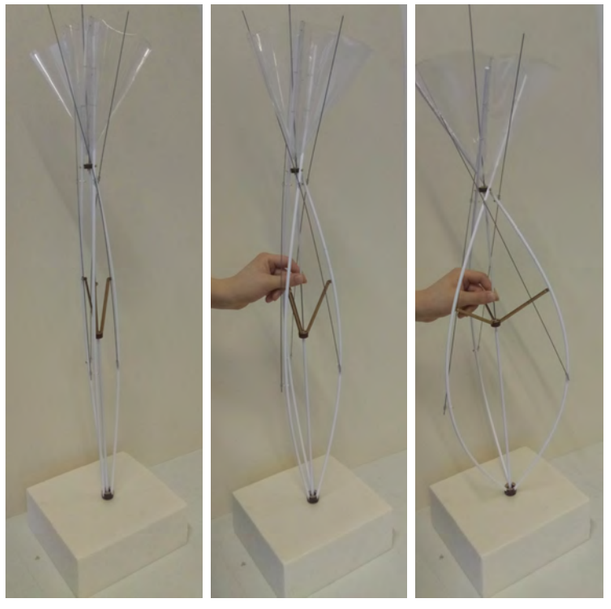
Joint e brings together the lower ends of the bend tubes at the same base point, ensuring that the whole structure can recover from an expanding water collecting ‘flower’ to a minimal space taking installation.

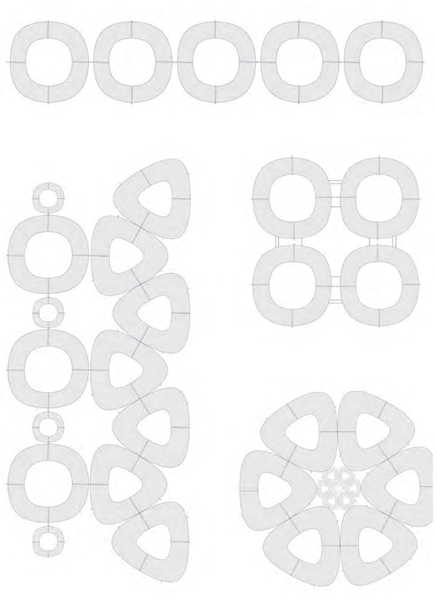
After designing the prototype, we are considering the possibility of adding sensors to the structure to control the deformation process in response to various triggering factors. This will allow the structure to better adapt to different urban scenarios and better serve the city in a wider range of ways.

For example, a gravity sensor can be attached to the structure to monitor the amount of rainwater over a period of time. When the amount of rainwater increases to a certain threshold, the gravity sensor generates a signal that triggers the opening of the structure. Rainfall information is also recorded by the sensor.

In different combinations, for example, the linear arrangement of the structure could be integrated into the design of urban lighting along streets and rivers, while the circular arrangement could enclose and shelter a larger area to create calm spaces in the city. In addition to water harvesting, we imagine that the structure could also be used as a flexible landscape installation arranged along roadsides, grasslands, riverbanks and even on the water, forming a flexible shoreline.

“Polymerization”





Folk Art Village

Transforming a neglected urban village into a cultural landscape

Xi`an University of Architecture and Technology | Department of Architecture
Architecture Studio - Winter semester 2014-2015
Professor Li Xiao
Shuhan Liu | Yao Ding | Zhaoxi Zhang (Design Leader)
Awards: Best Student's Works of Exchange Programs of Architecture Schools in China

To demolish or not to demolish is the question. How can urban villages survive in the face of rapid urban development? The urban village next to the Small Wild Goose Pagoda in Xi'an is an important part of the collective memory for older people, but is likely to be seen as a wasteland by younger people because of its substandard environment, outdated facilities and lack of community vibrancy. There is a need to resolve the conflicts between people's aspirations and physical space, and to emphasise the value of the village to rekindle residents' pride and sense of belonging. In our design we dream that the village will become a container for different lifestyles, a cultural landmark and a symbol for the transformation of the urban village.

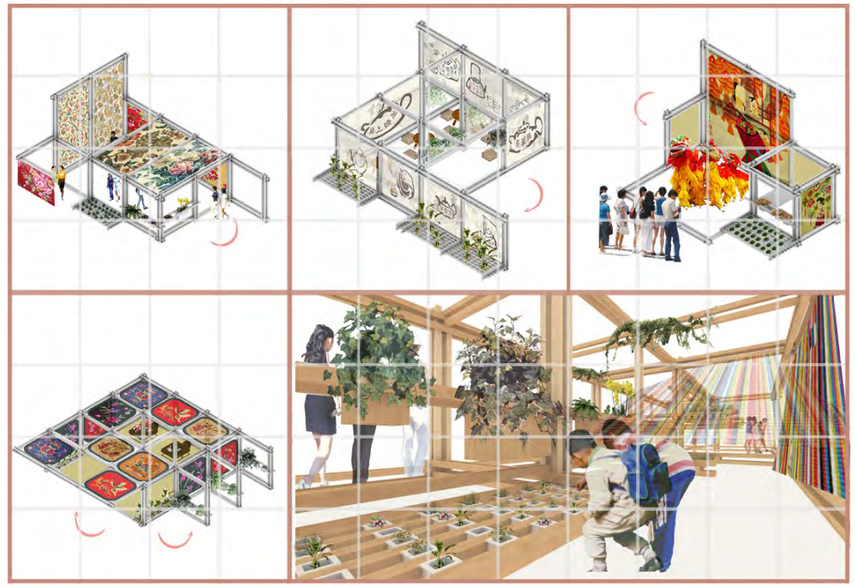
From interviews with local people, we found that traditional festivals, cuisine and folk arts (e.g. paper-cutting, calligraphy and opera) are well preserved by the older people living in the village. However, these "cultural genes" rooted in the villages may disappear after the elderly people pass away because young people are not interested in them. Therefore, in this design we aimed to explore the history, culture and art elements generated by the village and to use the roof space to create spaces for inspiring and attractive exhibitions and workshops. This process not only involves significant physical, social and economic changes to the existing village, but also provides the city with a unique cultural landscape.

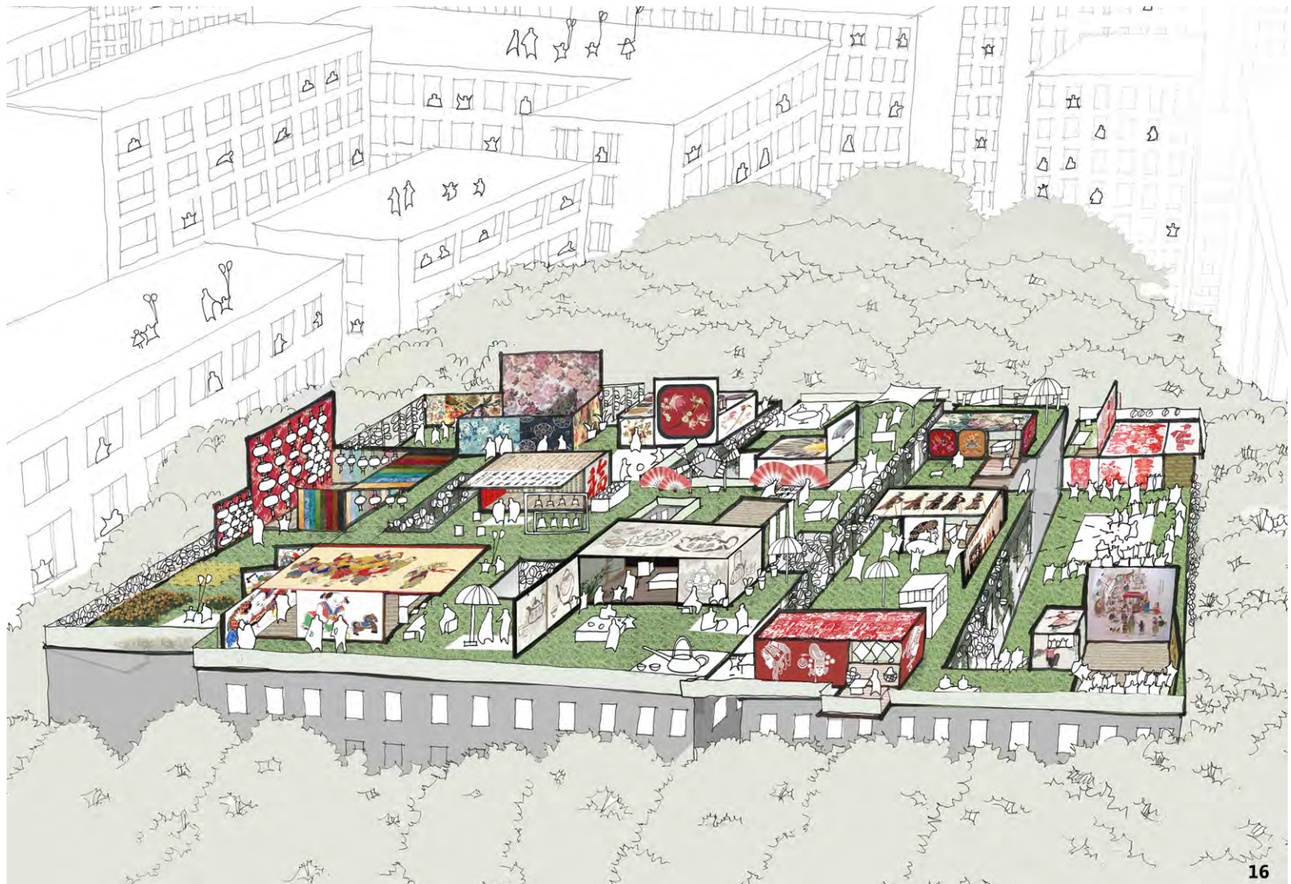
Before

Transformation

After

Roof space for exhibition and workshop



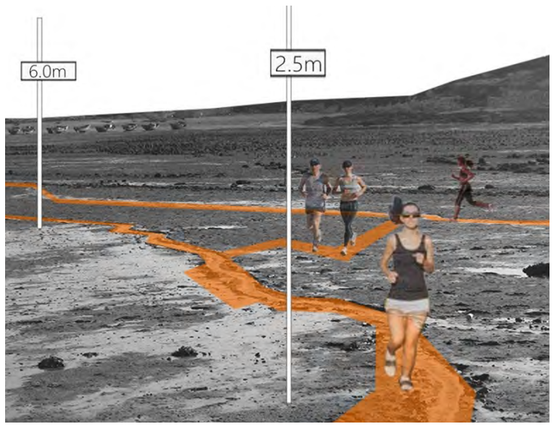


Smart “O”

Future island: integrating technology and nature

Tsinghua University | Beijing City Lab
The Second SPSD Youth Forum Competition Workshop - July 2019
Hanting Xie | Yuwei Su | Zhidian Jiang | Ziyi Tang | Zhaoxi Zhang (Team Leader)
Awards: First-Pride of Design

What is the future for an isolated, neglected and small island? Huangguan Island, in the waters near Fuqing City in south-east China, is about the size of a 500m x 500m playground. With no ferry service connecting it to surrounding islands, even local people rarely visit the island. Instead of adding new buildings to the island, we want to take better care of its unique tidal landscape, natural resources and wild atmosphere, and reduce human intervention. A bold idea is to test the chemical reaction of integrating technology and nature, so we are proposing a lightweight, physical, multi-functional O-ring, known as a smart ‘O’, to connect Huanguan Island and surrounding islands, complementing better communication and resource sharing. Most importantly, the O-Ring will prioritise the protection of the natural environment by providing environmental monitoring, information services and education.



What is O-Ring System?

System 1:Traffic Ring

O-Ring is to serve for water buses and sightseeing train, and provide abundant paved walkways and cycle lanes for pedestrians and riders, becoming the main bridge within the islands.

System 2: Ecological Ring

O-Ring provides rich experience of different natural landscapes, so that people can enjoy the scenery of different landscape zones, such as marine agriculture zone, water landscape park.

System 3: Functional Ring

O-Ring provides more of the functions required in the eastern part of the island, such as meeting rooms, facilities and devices, and leaves space for new functions in the future.

System 4: Monitor Ring

O-Ring combines sensors to monitor the marine environment, collect environmental data and promote human interaction with the environment by phone application and information service.

One wall, one dream

Eco-driven transition to a healthy, cooperative and diverse intergenerational community

Competition: Neighbourhoods for Generations - Dec 2022
Qi Li | Yilin Li | Yi Shi | Wenxuan, Zhang | Zhang, Zhaoxi (Team member)

We are rethinking the problems left over from the post-war housing machines, recognising that a new approach that emphasises the human, social and physical environment is needed to achieve transition within the community. We are opting for Eco-driven Transition, which embraces environmental and social ecology to promote healthy relationships, cooperative living and diverse opportunities in a community.

What is eco-driven transition? It is about creating harmony between environmental ecology and social ecology. Two dimensions: environmental ecology includes not only built elements and constructions, but also the landscape, including urban agriculture, recreational gardening, and living organisms such as animals and insects. Second, social ecology means a holistic system, not limited to individuals, but also between people and society, the built environment and the natural environment.

Which generations are affected by the ecological transition? In demographic terminology, 'generation' describes a cohort of people born during a particular period, but generations should not be narrowly defined by age. We want people who are disadvantaged by factors such as poverty, age, gender, race, ethnicity, disability or immigration status to find mutual help, emotional support, job opportunities, leisure activities, economic products and healthy lifestyles, and to live in a healthy, supportive and diverse environment with the least discrimination, injustice and environmental risks.

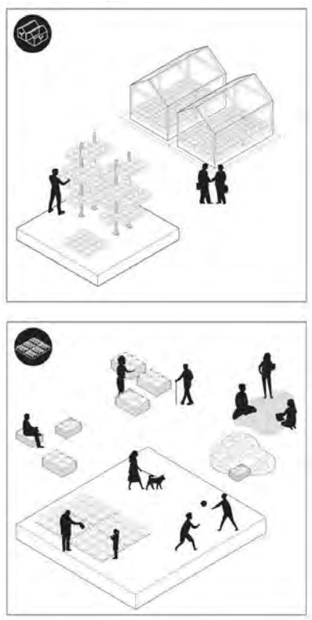
Two challenges:

Passive civil society and limited civic participation: with declining interest in volunteering, civic engagement and civil society can only attract a small and fixed group of people, making it difficult to deal with the conflict of interest and power among the majority of people. It is essential to draw energy and fresh blood from the neighbourhood to rebuild the social ecology. This design seeks to explore the mechanism for meaningful coexistence of different lifestyles, collective effort and a harmonious atmosphere of autonomy. On the one hand, parking-free open spaces with multi-functional 'boxes' as meeting places support residents in self-organising their community life; on the other hand, the integration of recreational gardening and landscape resources enhance the benefits of a holistic ecosystem.

Emotional isolation and the search for true happiness: negative emotions such as loneliness, depression and anxiety affect people of all generations. Rather than seeking support from professionals, it is more practical, economical and sustainable to seek emotional support and spiritual solace from the neighbourhood. We care about people's wellbeing, mental health and happiness, and aim to maintain an ongoing therapeutic landscape to encourage active physical activity and emotional resilience in the neighbourhood. People also gain from active social networking, multi-level collaboration, enthusiasm for knowledge sharing, mutual support and meaningful personal growth from the eco-driven transition.

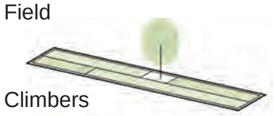
Cooperative model

To promote collobration, we use different scales and styles of plantings, allowing residents have more chance to encounters with others.



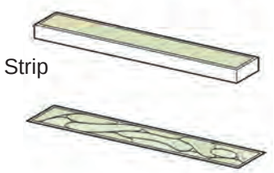
2×10 M²
3-5 HOUSEHOLD

Field



Climbers

Box

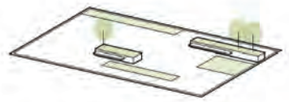


Strip

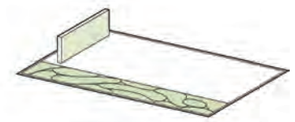
10×10 M²
20-30 HOUSEHOLD

Multi-functional farming

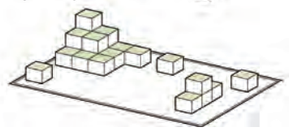
Interactive gardening plaza



Green walls and flower borders

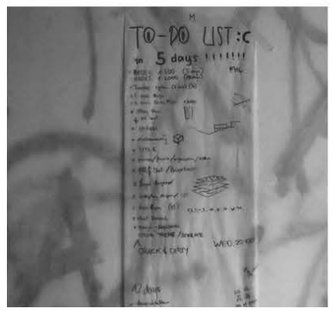


Temporary installations



At the end

I am persistent and diligent,
I am passionate about sharing knowledge,
I am a good communicator.



"Good design is a lot like clear thinking made visual."

- Edward Tufte

In design,
Human-centred design is my principle,
Simplicity and usefulness is my goal.