THE EXPIERIENCE OF WATER
RESEARCH PLAN

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Studio
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ARGUMENTATION STUDIO

The primary reason for my AE choice is that the technical solution is strongly integrated into this Studio. I think an Architect must be able to propose technical solutions later on. Secondly, I am very interested in the flexibility and freedom offered by the Studio. This allows me to concentrate on my own architectural interests while still having the liberty to pursue my ideas. Thirdly, I strongly support the Studio's focus on sustainable, ecological, societal, and technical challenges. These are highly relevant issues that need to be addressed.

Keywords
Rising sea levels, flood-resistant, sustainability, resilience, water architecture, sense of place, modularity, sense of place, emotional engagement

1. Sea level rise

The diagram (Figure 1) illustrates how current decisions will shape the future climate. Between 2011 and 2020, global temperatures rose by approximately 1.1 degrees Celsius compared to the period between 1850 and 1900 (Ministerie van Infrastructuur en Waterstaat, 2023). Future warming hinges on our actions to combat climate change, with higher emissions scenarios leading to more significant warming.

Due to this increase in these global temperatures, the sea level rises. Figure 2 illustrates the historical and projected rise in sea levels along the Dutch coast, influenced by factors such as the overall global temperature increase, as outlined in the National Delta Programme for 2024.

Approximately 26% of the Netherlands lies below sea level (as shown in figure 3), with 59% of the country facing the risk of flooding from either the sea or rivers, according to the Planbureau voor de Leefomgeving in 2007. This presents a significant challenge for hydraulic engineers and urban planners, especially in recent decades, as they strive to adapt coastal cities to counter sea level rise and more intense storms (Davoudi, Crawford & Mehmood, 2009). Due to shifts in hydrological cycle, exceptional river discharge, heavy rainfall, erosion, sedimentation and land subsidence, grey infrastructures (dykes, seawalls, dams, etc.) are constantly being built. As a result, 55% of the Netherlands' land is safeguarded by dykes (Planbureau voor de Leefomgeving, 2007).

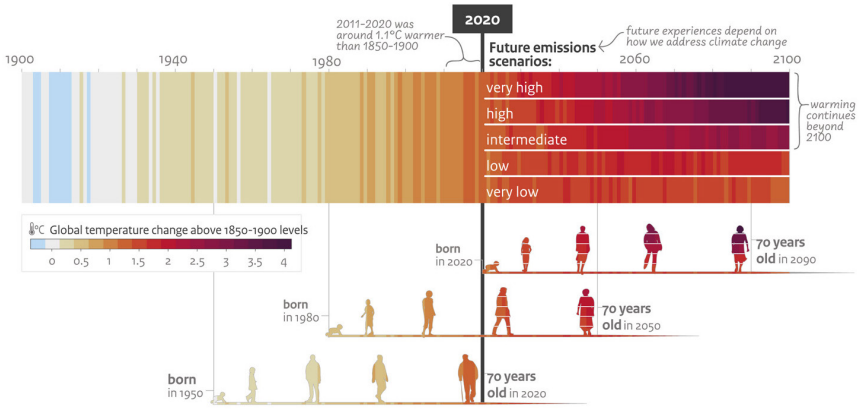

Figure 1, Global temperature change (IPCC, AR6 Synthesis Report, Figure 'SPM.1').

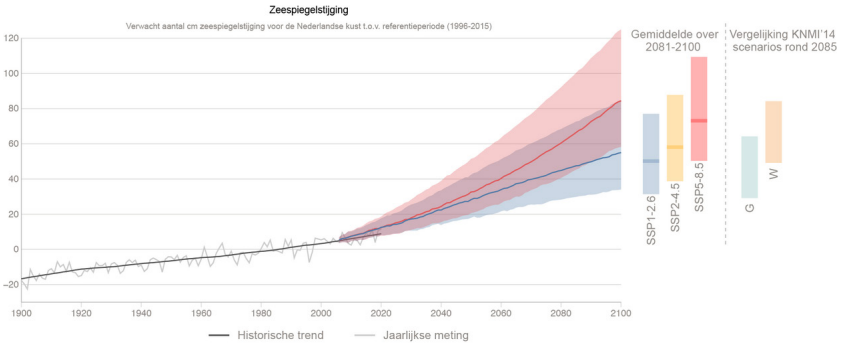

Figure 2, Sea level rise Dutch coast (Ministerie van Infrastructuur en Waterstaat, 2023).

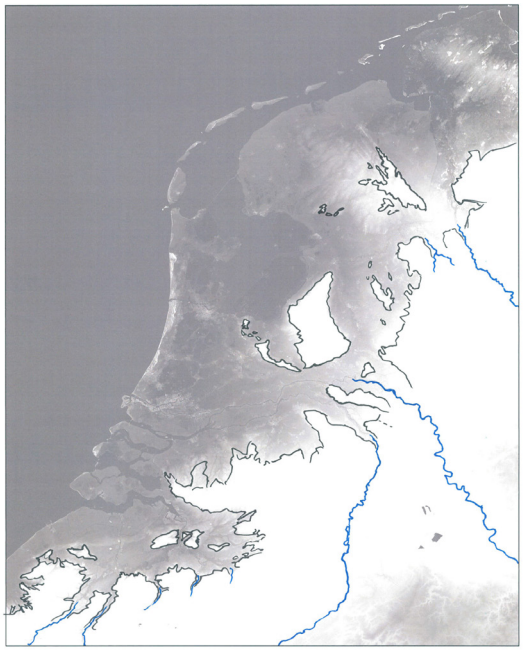

Figure 3: Flood prone area Netherlands. (Universiteit Utrecht, 2019)

2. Disconnection water Rotterdam

Coastal settlements are among the most vulnerable areas due to the impacts of climate extreme events because are predominantly located in vulnerable areas such as coastlines, mouths of major rivers or low-lying areas of estuaries and deltas (Magnan et al., 2022). Rotterdam is one of those settlements in the Netherlands, which belongs to vulnerable areas.

Rotterdam was founded around 1260, near a dam in the river Rotte (from which the name Rotterdam originated) (Doolaar, 2022). A small port started at the dam, where goods were transhipped. The port provided trade, causing the city to grow. In the sixteenth century, the port was also given an important function in fishing. The city and harbor evolved together, resulting in a harmonious urban environment (see Figure 4). In the second half of the nineteenth century, the Nieuwe Waterweg provided better accessibility from the sea, expanding the port considerably (Meyer et al., 2012).

During the Second World War, The bombardment on 14 May 1940 caused large parts of the city to fall into ruins (Doolaar, 2022). It soon became clear that the city had to be rebuilt, but not like pre-war Rotterdam. Rotterdam would rise according to a new vision: The clean healthy city. Planned according to the latest in modernism, in architecture and urban planning. High quays with sharp lines came back (Figure 5). The modern movement caused the city to lose its curtain connection with people and the environment (Norberg-Schulz, 1980).

Over the years, the port has been more associated with industrial activity and shifted more and more to the west, away from the city. But where is that connection with the city? The urban waterfronts were mostly occupied by the port and its functions. As cities turned them to their ports, they frequently turned their backs on their waterfronts as well (Alaily-Mattar, 2020). When waterfronts were abandoned in the process of containerization, opportunities opened for port cities to reconnect to the water.

Figure 4, Rotterdam 1860 (Stadsarchief Rotterdam, 1860)

Figure 5, Schoenenmagazijn Huf (Wederopbouw Rotterdam, 1953)

3. Human experience/perception not reflected in design

Many houses and residential areas currently lack resistance to rising sea levels. Looking ahead, designers will need to integrate the relation with water more extensively into their designs to ensure resilience against future water-related challenges. While there are numerous water-inclusive designs, practical solutions often lead to a disconnection with the water, resulting in a lack of legibility in designs. Legibility, in turn, depends on people's perception, which is influenced by their adaptability to living standards and comfort levels (Figure 6).

In cities like Rotterdam, the presence of water is less prominent than it used to be, making it less legible in the urban landscape. Water feels inaccessible, it feels like a non-place with a lack of character (Van Der Hoek, 2023). Unfortunately, the human perception experience is frequently overlooked or neglected, receiving insufficient attention in water-related spaces.

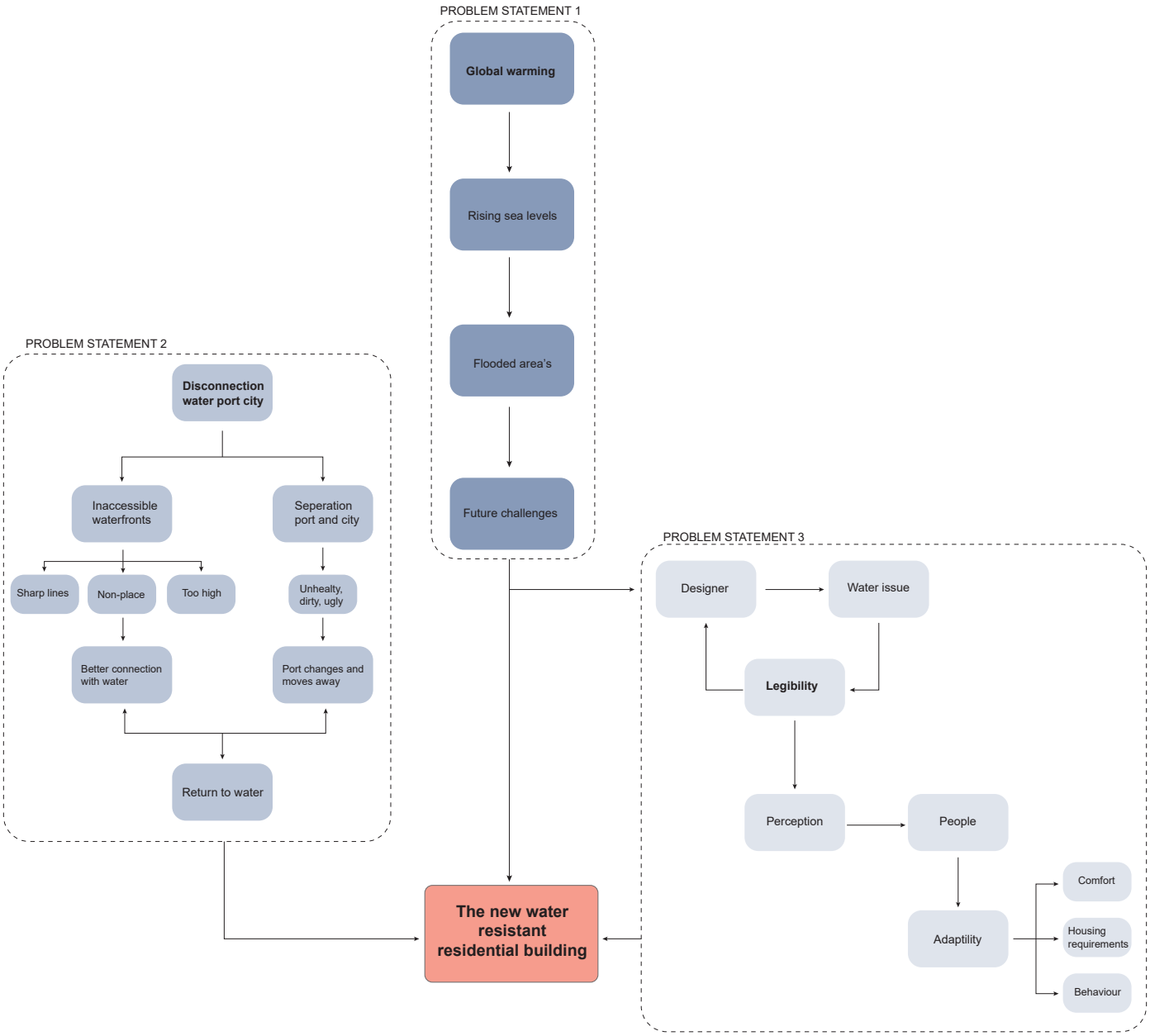

Figure 6, Scheme Problem Statement (author).

DESIGN OBJECTIVE

The aim is to develop innovative architectural solutions that address the dual challenge of future flood risks and enhance new living standards (new comfort with living standards), thereby creating a resilient and inclusive built environment.

When waterfronts were abandoned in the process of containerization, opportunities opened for port cities to reconnect to the water. Architecture can be used to signpost the return to the water. Rotterdam's city ports will be the ultimate location for this, to reshape the experience of the water and the port in the city. The connection between Rotterdam city and the harbour will be made stronger. There will be an extra challenge because this area will fall outside the protected dike area

Because of the lost connection in the past during the modern movement between humans and the environment, it is important that we design for today's society. Who is going to live there, how do people spend their time?

Aligned with the vision outlined by the municipality of Rotterdam (Omgevingsvisie Rotterdam, 2021), The program will fulfil the need for housing, working space and recreation space in Rotterdam. Especially for this program, people need to have a certain connection with the place, to make it a meaningful project.

DESIGN QUESTION

"How can architecture accommodate rising sea levels, ensuring human experience, sustainability and resilience in the context of the harbour of Rotterdam?"

1. History context*: How has the historical development and urban planning of Rotterdam influenced its current disconnect from the water?*

2. Program: *How can the human experience be integrated into flood-resilient architecture in de program of housing, working and recreation?*

3. Sustainability: *How can principles of sustainability design be integrated into architectural interventions in flood-prone regions?*

4. Modularity: *How can modular design strategies contribute to creating a resilient building program with mixed-use, in the harbour area that is resistant to rising sea levels?*

Hypothesis

Through the integration of flood-resilient design, human expierience of environment, sustainability principles, modularity, and reconnection with Rotterdam's maritime heritage, architecture will be a prototype for future living. This approach not only promotes reinforcing resilience against environmental challenges and sustainability but also enhances societal experience.

REFLECTION ON THE RELEVANCE

My goal is to create a prototype with my design that showcases how we should design for future living: flood resilient, sustainable, and with a human connection to the built environment. I think it is important to explore diverse ways of living to ensure future-proofing. While focusing on the context of Rotterdam Harbour, this project should also be adaptable to various port cities worldwide.

THEMATIC RESEARCH OBJECTIVE

Although significant research exists on how to build on/with the water, there is a gap in understanding the human perception of water. This includes aspects such as the sense of place, genius loci, emotional relationship to water and the cultural and historical human-water relationship. Different definitions arise around this therminlogy. This paper uses those definitions:

Sense of place is a generally accepted concept of space within which man can relate himself, his environment, and the cosmos as a whole (Wellborn, 1966).

Genius Loci refers to the pervading spirit of a place. It covers the unique atmosphere or character of a specific location, independent of individual experiences (Norberg-Schulz, 1980).

Emotional engagement relates to how our emotions respond to the built environment. It considers the impact of sensory cues (such as lighting, sound, and smell) on our well-being and experience of a space. This can be caused by materials, forms, transitions etc. (Spence, 2020)

The goal of the research paper is to create design guidelines offering a framework for designers (architects, urban planners) to conceive and implement flood-resilient buildings that contribute positively to the waterfront environment and enhance the overall urban experience, particularly from a social perspective. This will be done by comparing case studies, which will showcase successful adaptation strategies, looking from certain social aspects and how it is practically addressed. These case studies could provide valuable insights. The design guidelines will cover aspects such as closeness to the water, building materials, construction techniques, urban structures, forms.

RESEARCH QUESTION

"How can from a human perspective, where emotions and experiences play a role, architecture influence and enhance the perceived experience of buildings in port cities that interact with water?"

When referring to the harbour area of Rotterdam, I am specifically addressing the City harbours (stadshavens) that are closely situated to the city and will now still have their function but are anticipated to lose their function in the future.

Human perception lens

1. Sense of Place: *What factors contribute to individuals' sense of connection and attachment to specific locations, particularly in waterfront areas?*
2. Emotional Engagement: *What emotional responses do architectural spaces evoke in individuals?*
3. Human-Water Relationship: *What cultural, historical, and socio-economic dynamics shape the relationship between people and water?*

Architectural engineering lens

4. Water typologies: *What are the different typologies of water-dwelling structures utilized in flood-prone regions, and what is the infuence on human expierience?*
5. Construction techniques: *What innovative construction techniques and foundation designs are suitable for building in flood-prone areas and what does this contribute to the human experience of water?*
6. Materials and water Interaction: *What materials and building technologies are best suited for withstanding the corrosive effects of water and thereby improving human interaction and experience?*
7. Case studies: *What lessons can be drawn from historical and contemporary case studies in terms of their connection to water and adaptation to rising sea levels, including human interaction?*

Hypothesis

From a human perspective, where emotions and experiences play a role, I hypothesise that architecture can have a significant impact on the perceived experience of buildings in port cities that interact with water. This hypothesis is based on the concept of visual perception in architecture, where people experience and perceive the built environment through their visual senses. The choice of shapes, patterns and the way architecture relates to water can have profound effects on how people experience these buildings and the emotions they evoke.

REFLECTION ON THE RELEVANCE

The thematic research will be divided into two different lenses, to fill the research gap by combining these perspectives. This approach promises to be highly generative and applicable across various contexts involving human interaction and the development of water-resilient built environments. This research will become increasingly important in the future for both new construction and existing environments struggling with water-related challenges.

The research of these two lenses will be applied within the specific context of the Rotterdam Harbour but will have wider relevance for other port cities facing similar conditions.

RESEARCH METHODOLOGY

Literature research

The human perception lens will be created through literature research about the Sense of Place, Genius Loci, and emotional engagement. The book written by Norberg-Schulz: Genius Loci: Towards a Phenomenology of Architecture will form a good base. will form a good base for this.

The architectural engineering lens will be investigating books and research about the practical way of building with water. The book of Float! Building on the water to combat urban congestion and climate change, and Amphibious housing in the Netherlands: architecture and urbanism on the water. Books will help formulate and understand these principles.

Case studies

To address the main question and test the literature, different case studies will be examined through both the lens of human perception and architectural engineering. These case studies will involve comparing different elements including the utilization and integration of waterfront spaces, architectural materials, and design approaches To structure these case studies will be organized within a table format. This table will categorize different elements such as architecture elements, relationship to water, accessibility etc. (Figure 7).

Interview

The case studies in the Netherlands will be visited. Residents and users can be interviewed and their experiences taken into account.

Case study	Architecture elements	Relation to water (in, on, next to)	Accessibility water	Construction technique	Materialization	Relationship private/ public space	Sustainability	Social perspective
A								
B								
C								
D								

Figure 7, Matrix case studies.

The initial focus will be on analysing Dutch case studies, followed by an examination of historical classic case studies that dive into the theme of water experience. Subsequently, case studies in port cities, such as Hamburg and Oslo, where waterfront development has already occurred, will be explored (Figure 8).

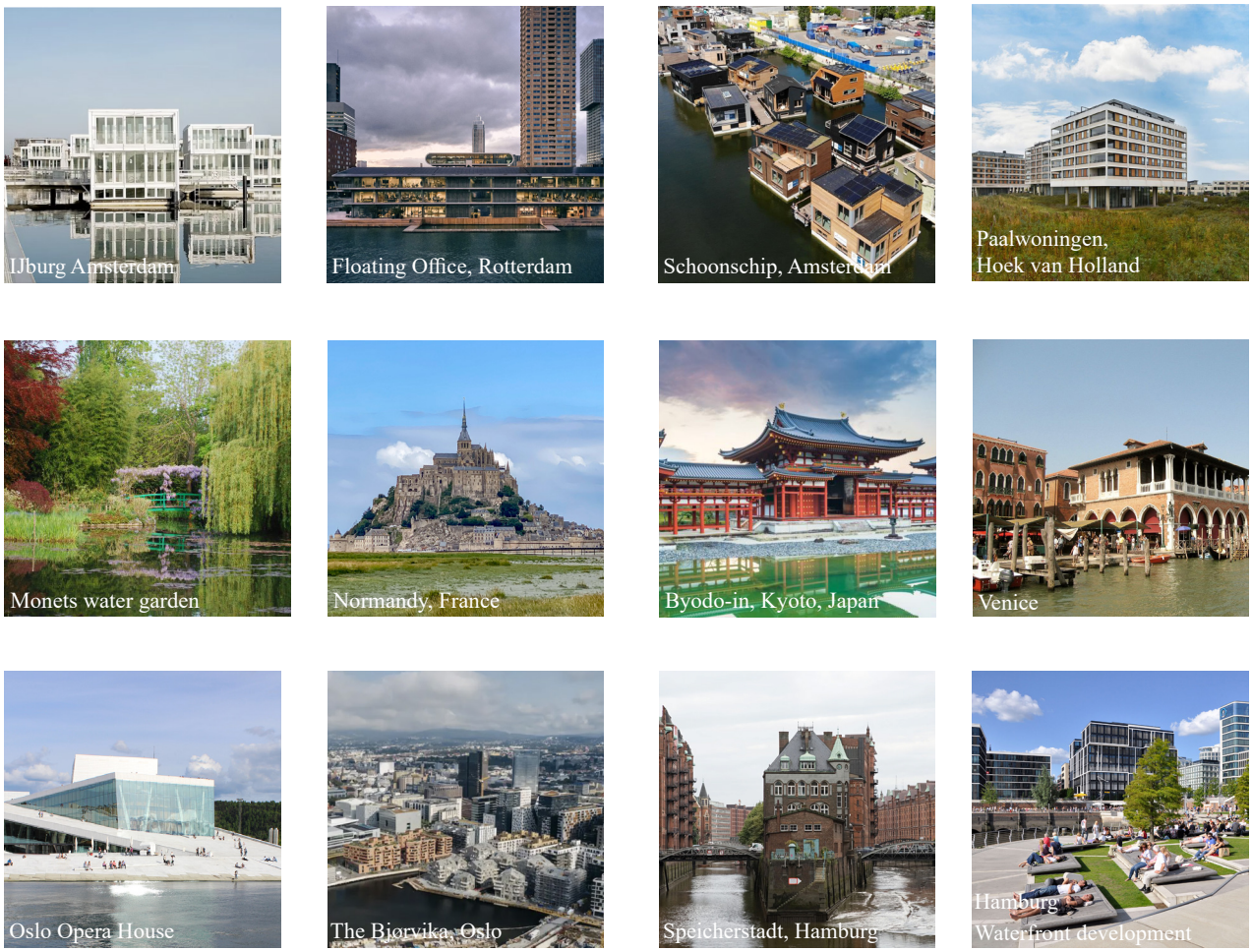

Figure 8, Different case studies.

EXPECTED RESULTS OF RESEARCH AND DESIGN IMPLEMENTATION

The output of the thematic research is a framework of design guidelines, which formulate the basis for the design. How to build with the water, looked from a social perspective. Design guidelines will give insight into the typology, use of materials, use of construction methods, use of the waterfront and interaction with the water, and distances to water (see Figure 9).
These guidelines will be formed by looking into case studies, from the lenses of human perception and architectural engineering. Limitations?

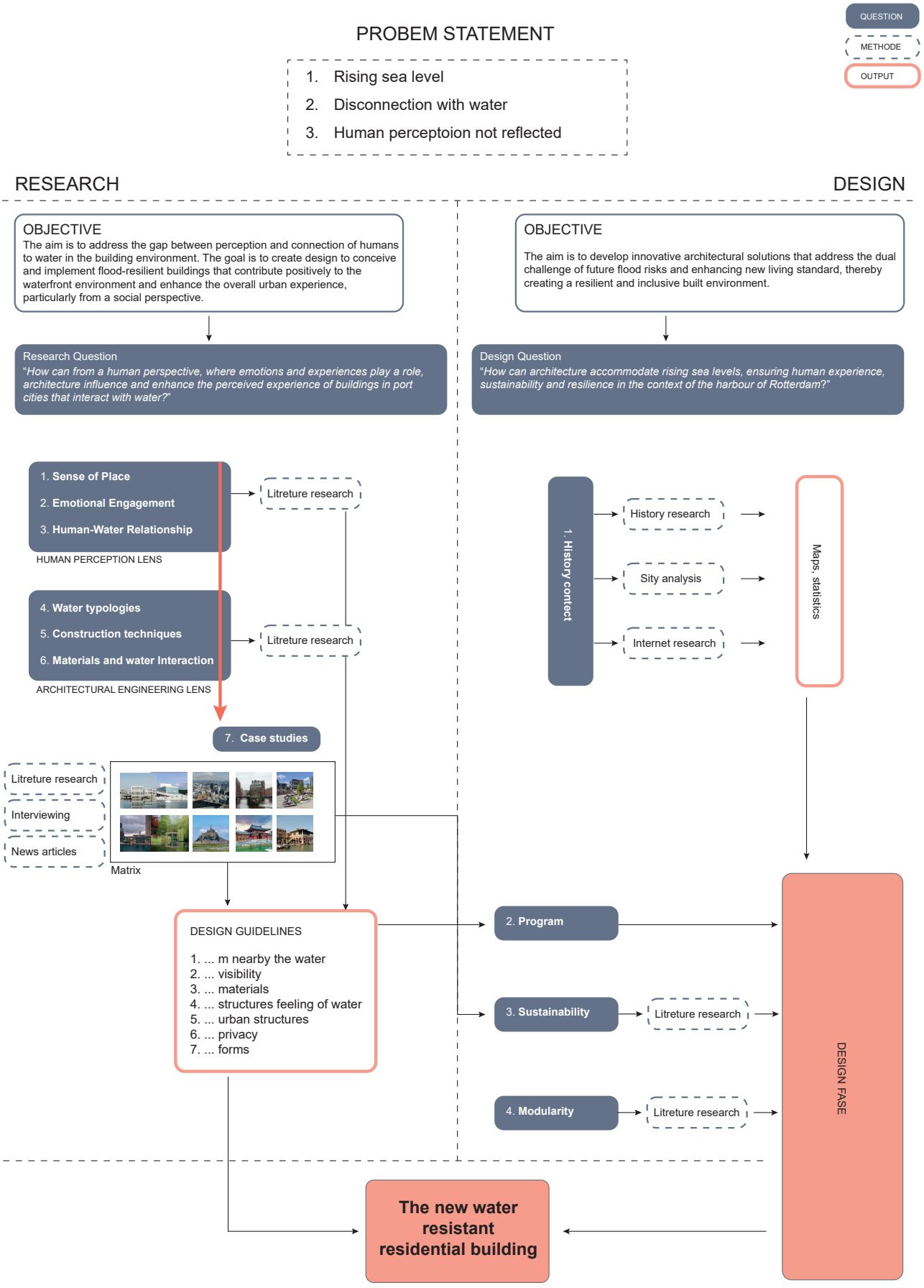

Figure 9, Scheme relation between research and design (author).

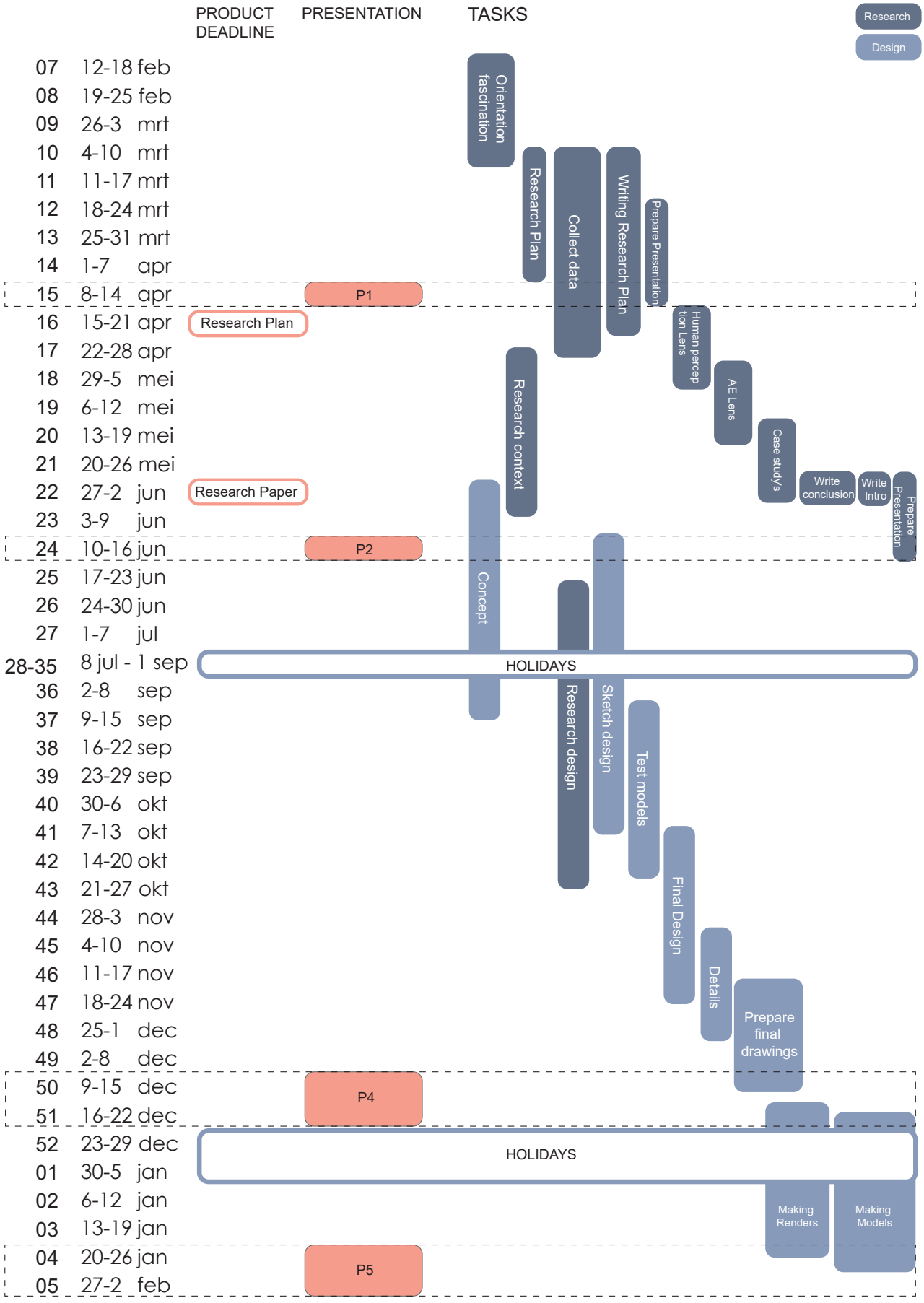

Figure 10, Planning research and design fase.

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