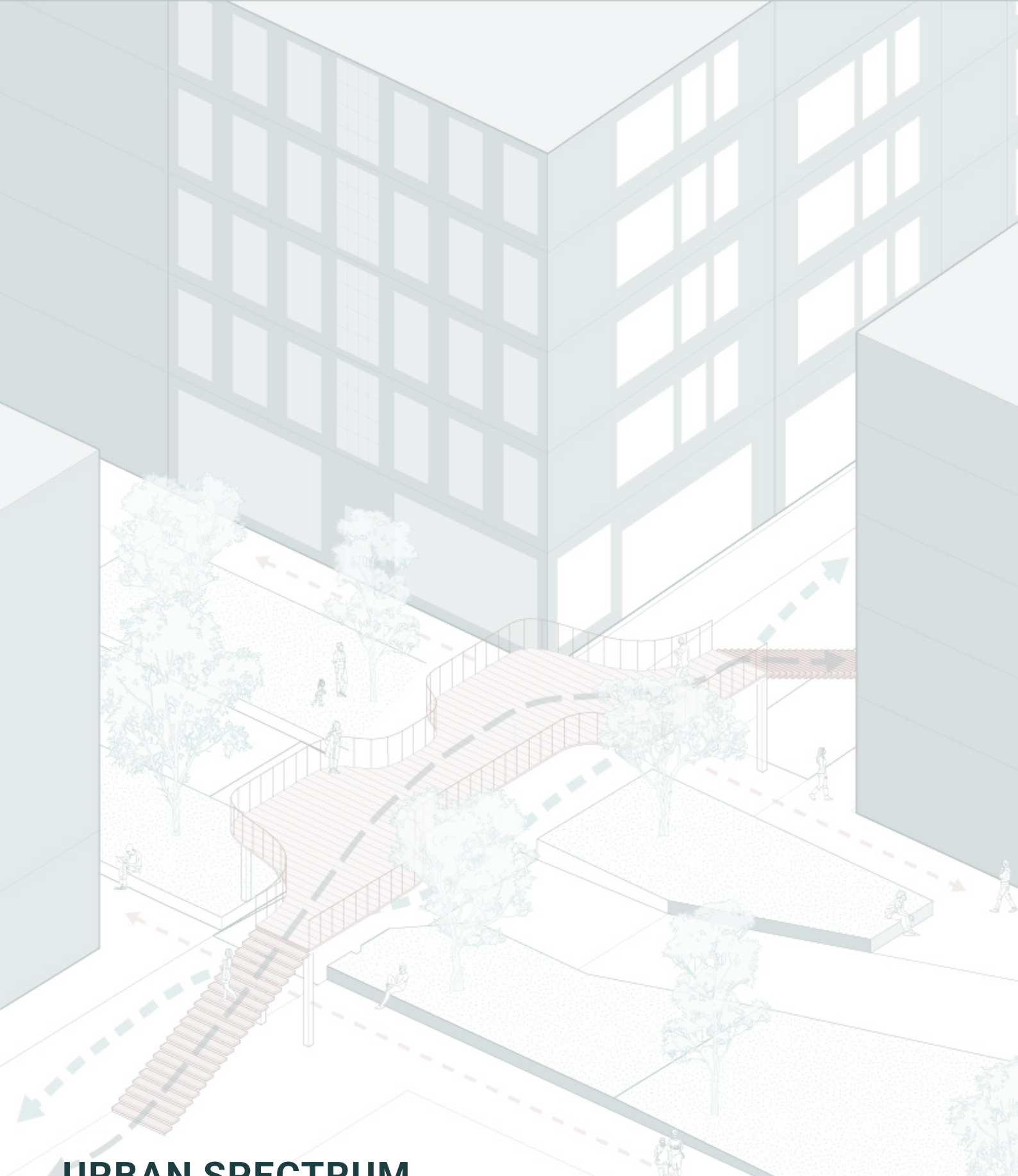

URBAN SPECTRUM

NEURODIVERSITY AS A LENS FOR INCLUSIVE PUBLIC SPACE DESIGN

ROSA KUIJT

URBAN SPECTRUM

Neurodiversity as a lens for inclusive public space design

Master Thesis
Urbanism Graduation Studio 25/26
Msc Architecture, Urbanism and Building Sciences
Department of Urbanism
Faculty of Architecture and the Built Environment, TU Delft

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And finally, as was promised in the plaster room, I want to thank the cast technician that spent extra time to give me a removable cast. Without this, I would not have been able to use my hand in the final week at all.

Thank you all

PERSONAL MOTIVATION

During my education at the faculty of architecture of TU Delft, and especially the Master of Urbanism, I have learned about inclusive design. Not only is it possible to create a more inclusive world through design, I view it as an important part of the role that urban designers have. Among the many ways to define space, it is a resource to be managed, and the factors of efficiency and costs often take priority in the 'real world' after graduation. The master's thesis is the opportunity to express what can be done with space if you let those factors make way for other perspectives.

Although there are many branches and topics within the realm of inclusive design, it is a privilege to be able to work on something that affects those you care about. Having neurodivergent family members and friends, I have seen them avoid going outside and become isolated because of it. I have also seen them becoming exhausted before ever getting to their destination. Being taken into consideration makes the biggest difference for whom the world is usually not designed.



Figure 1: Personal motivation neurodivergent struggles
Made by author

GLOSSARY

Neurodiversity	the natural variations in the ways people think, process information and experience the world (this includes neurotypical and neurodivergent individuals)
Neurotypical	individual whose brain development, cognitive processing and behaviour align with the societal norms
Neurodivergent	Individual whose brain development, cognitive processing and/or behaviour deviates from the societal norms

ABSTRACT

This thesis explores neuro-inclusivity as a driver for an inclusive design approach. This not only addresses a disproportionate adverse effect of urban stress on neurodivergent individuals but also provides an interdisciplinary perspective on improving well-being for the broader population through insights into varied human experiences.

Several key theoretical insights guided the direction of this thesis. Legibility, human scale, and urban stressors of built environments impact cognitive demand on the users. The Pressure Performance Curve and Seyle's stress models are used in the context of environmental psychology show how interaction with the environment can be used as a coping mechanism to reduce or increase stress where needed.

The methodology includes literature review, walk-along interviews, spatial analysis, and research by design. The research found that neuro-inclusive public space design should create less cognitively demanding environments in general and provide variability in affordances: options for users to interact with the environment to regulate stress in various ways.

The proposed strategy can be described as flexibility through multiplicity. The theoretical insights and research findings are applied to make space more easily understood and to protect users from urban stressors. This is complemented by creating a calm and lively route that users can choose to go on and switch between based on their needs at that time. Future recommendations include researching the transferability to other degrees of urbanicity, different scales, and other themes within the social dimension of urbanism.

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THE IMPORTANCE OF INCLUSIVE DESIGN APPROACHES

Hyperdiversity in polarized society and the role of public space

More and more people moving to the city creates the condition of hyperdiversity. This means the co-existence of many different groups of people with diversifying characteristics (Vertovec, 2007; Tasan-Kok et al., 2014). Based on these characteristics, examples of which are shown in figure 2, people have different experiences and opportunities. Public spaces are often designed around implicit norms and the 'typical citizen' (Hajer & Reijndorp, 2001). They struggle to accommodate the multiplicity of the city's population, leading to unequal and sometimes exclusionary experiences (Lefebvre, 1996; Aelbrecht et al., 2019; Haselbach et al., 2024).

This condition of hyperdiversity conflicts with societal polarization. Social, cultural, and political divides surface in the news and daily life. Political narratives can simplify these complex issues into the binary of us versus them, reducing tolerance for differences between groups. In a 2019 survey, 75% of respondents perceived growing differences in opinions on societal issues, as shown in figure 3. The results also showed increasing disparities between groups (SCP, 2019). The 2025 version identifies polarization as a key driver of exclusionary behavior (SCP, 2025). As a result, minority groups are more easily positioned as outsiders, reinforcing the idea that there is a legitimate or typical citizen.

In this context, public space can play a crucial societal role as a common ground. Here, individuals are exposed to people who are different from themselves. Seeing 'others' engaged in recognizable everyday activities helps an individual relate to them, fostering empathy (Hajer & Reijndorp, 2001). In this role, the quality of public space lies in its capacity to support small informal interactions and sharing space with others in a way that makes differences visible (Whyte, 1980; Gehl, 2010). For public space to fulfill that role, it needs to be intentionally designed to stimulate the visibility of different groups. To that end, inclusive design with different minority groups in mind is important.

This societal role conflicts with the economic pressures on public space in commercial areas. Space is a valuable resource, often subject to the pressures of financial return. As a result, public space is often designed as a tool to stimulate consumption and spending, diminishing its function as a public domain or common ground (Hajer & Reijndorp, 2001; Madanipour, 2010).

The tension between the conditions of hyperdiversity and polarization highlights the importance of inclusive design that prioritizes the role of public space as a common ground that makes differences visible.

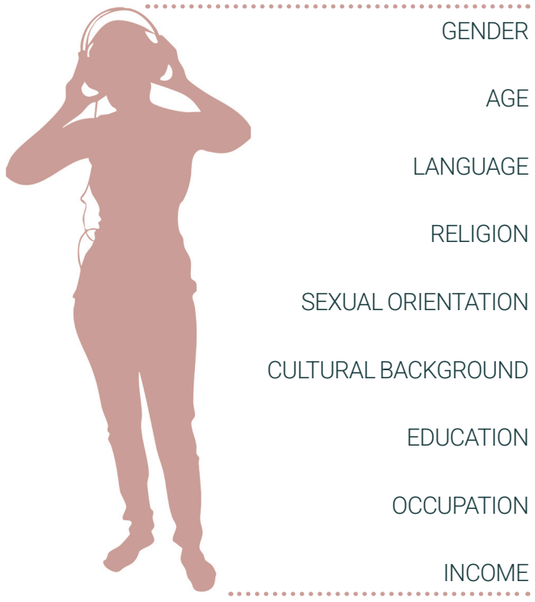

Figure 2: Examples of diversifying characteristics
Made by author

Statement:

"In our country, differences of opinion about societal issues are becoming more intense."

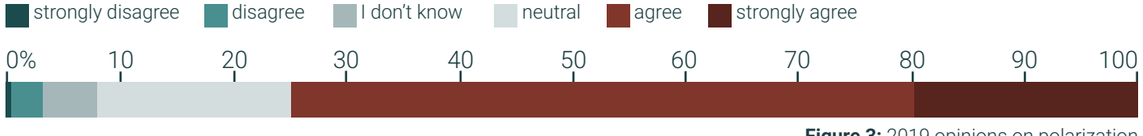

Figure 3: 2019 opinions on polarization
adapted from Dekker and den Ridder (2019), Burgerperspectieven 2019-1

NEURO-INCLUSIVE DESIGN

why neurodiversity is staying behind in inclusive design

Inclusive design approaches aim to enable a broader range of users to use space on their own terms. They emphasize flexibility and the capacity of environments to support different ways of interacting with space (CABE, 2006). In the context of hyperdiversity, researchers and designers can pick a diversifying characteristic to put in the spotlight for an inclusive design approach.

For example, there have been significant improvements in inclusive design for physical disability. Low-floor buses have been introduced (OECD, 2020). GIS and AI systems have been created to create measurable improvements (Watanabe et al., 2021). The European Commission issues a yearly award for city accessibility to reward improvements (European Commission, n.d.).

Cognitive disabilities, mental health conditions, and neurodevelopmental disorders are often less visible but equally impactful (WHO, 2011). Neurodiversity is a diversifying characteristic that describes the variations in the ways people think, process information, and experience the world. This is a spectrum that includes neurotypical and neurodivergent people whose respective cognitive functioning do or do not fall within societal norms. The latter is a group of 15% to 20% of the population (Doyle, 2020). Although no neurodivergent person is exactly the same, almost all struggle with sensory sensitivities (Finnigan 2024; Doyle, 2020). It is still rarely a driver within inclusive design.

One cause for that may be that cognitive differences are more difficult to standardize than physical impairments. Physical accessibility can often be translated into clear guidelines, but neuro-inclusive design requires dealing with subjective and highly variable experiences. Research also notes that cognitive accessibility is often overlooked because it is less visible and harder to quantify (Santiago Pineda, 2024; Finnigan, 2024). Designers do not yet know how to design inclusively with neurodivergence in mind (Black et al., 2022)

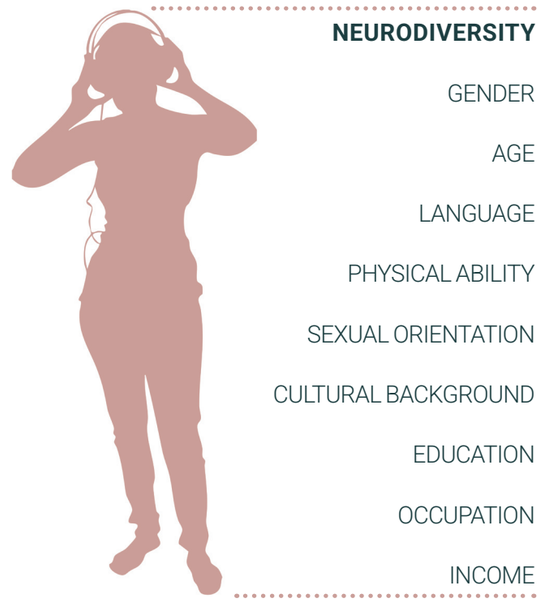

Figure 5: Neurodiversty as a diversifying characteristic
Made by author



Figure 6: 1 in 5 people are neurodivergent
Made by author

NEURO-INCLUSIVE DESIGN

the importance of neuro-inclusive spatial design

Despite the barriers that have limited the progress in neuro-inclusive design, it is an important topic to explore in spatial design. Exploring how cognitive variations affect spatial experience may offer a new perspective on varied human spatial experience overall. These experiences are shaped by the ways human minds perceive and process (Finnigan, 2024; Rathod & Wagner, 2021). As variations in these cognitive processes influence the resulting experience, neurodiversity becomes relevant. Neurodivergent conditions are diagnosed once enough symptoms have been observed, but cognitive variation exists on a spectrum across the population, as shown in figure 8 (Koolschijn et al., 2015; Ekblad 2013). This means that while neurodivergent individuals are the ones who struggle most with these issues, they can affect many more in smaller ways.

It is also a topic that is currently relevant. Opinions about neurodivergence are appearing everywhere. Rising diagnosis rates, as seen in figure 7, have led to greater public awareness and debate. Some research suggests over-diagnosis, claiming the bar for diagnosis has become too low and “overmedicalization” of normal human variation is taking place (Kazda et al., 2021; Dyck, 2019). Others attribute the rise to improved recognition and understanding of previously underdiagnosed conditions (Abdelnour et al., 2022). Psychologists nuance that either way, people are clearly struggling with these issues, showing the need to explore accommodation (Thapar, 2026).

Together, these perspectives show that neuro-inclusivity is not a niche concern but an important expansion of inclusive design.

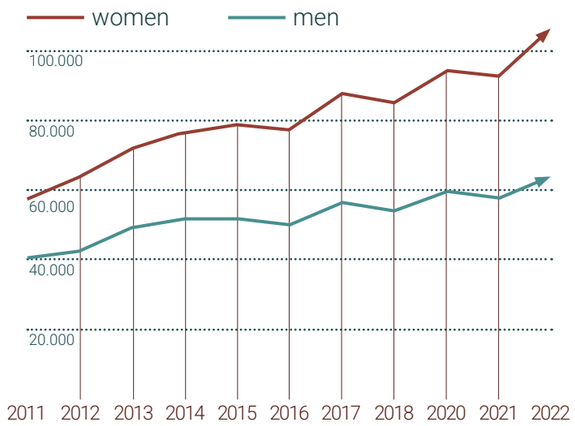

Figure 7: New ADHD diagnoses Netherlands 2011-2021
Adapted from Batstra (2024) in De Correspondent, based on Nivel Zorgregistraties Eerste Lijn data

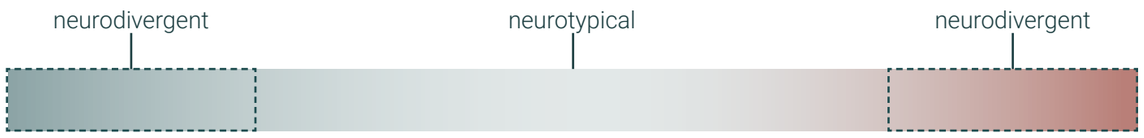

Figure 8: Simplified representation of the neurodiversity spectrum
Made by author

COGNITIVELY DEMANDING PUBLIC SPACES

The impact of urban stress and its disproportionate effect on neurodivergent people

Neuro-inclusive design can be particularly relevant in cases where it might reveal something about varied human spatial experience overall. This is the case with the issue of urban stress.

Urban stress is the strain resulting from exposure to the chaotic and fast-paced environment of high-density urban environments. Factors like traffic intensity, noise, pollution, and wide boulevards with a high flow of people contribute to stress and attentional fatigue (Steg et al., 2013; Pallasmaa, 2012; Mallgrave, 2013). Continuous exposure to urban stressors has long been linked to reduced mental health, increasing the risk of depression, and other medical repercussions (Xu et al., 2023; Pelgrims et al., 2021). High-density urban environments have more intense urban stressors, causing even more stress and fatigue (Baumann & Brooks-Cederqvist, 2023).

On top of the broad impact of urban stress, this issue also disproportionately affects neurodivergent people. They often experience external stimuli more intensely than neurotypical individuals, causing more intense stress responses (Doyle, 2020; Finnigan, 2024). They commonly experience panic and exhaustion to the point that it becomes exclusionary (Kenna, 2023; Gaines et al., 2025; Aminpour et al., 2026).

The negative impact of urban stress on all users of the public space combined with the disproportionate effect on one group highlights the need to explore mitigation strategies. Neuro-inclusive design may work towards this goal by taking neurominorities into account while also linking psychological and sociological knowledge about the cognitive needs of the broader population to spatial design.



Figure 9: Urban stress
Made by author

CASE STUDY

Rotterdam

The chosen case study is the public space surrounding the Binnenrotte, located in the city center of Rotterdam in the neighborhood Stadsdriehoek. There are several reasons why Rotterdam is a relevant choice of city.



Figure 10: Location Binnenrotte
Made by author with QGIS

Rotterdam has one of the densest large city centers in the Netherlands, as seen in figure 11. This is relevant because urban stressors are amplified in areas with higher density (Baumann & Brooks-Cederqvist, 2023).

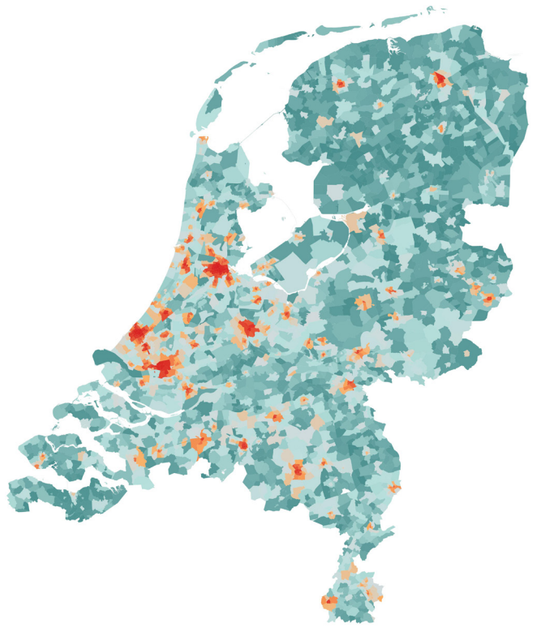

Figure 11: Densities in the Netherlands
Made by author with QGIS

Rotterdam is also very diverse, being highlighted as the first superdiverse city in the Netherlands (Vertovec, 2007). Inclusive approaches in general are most relevant in places where unequal experiences are more likely to occur due to higher diversity. Embracing diversity is a main theme in the municipality's environmental plan 'De Veranderstad' (The Change City). The municipality stresses its commitment to creating an empowering environment that encourages people to use the outside spaces (Gemeente Rotterdam, 2021b). In the city center specifically, one of the mentioned goals is to create a duality between lively activity and room for tranquility (Gemeente Rotterdam, 2021a)

Finally, the city planning contributes to urban stress. Because of the bombings during the Second World War, much of the city center was rebuilt from scratch. This resulted in a modernist, car-oriented layout with wide streets, large-scale infrastructure, and relatively limited historical layering. Comparisons to other large cities like Amsterdam or Utrecht, where the historical layering is more intact, can be seen in figure 12 through 14. This is relevant because environments in modernist cities often have more intense sensory experiences like wind and noise, less spatial enclosure to take refuge in, and more complex crossings and mobility flows.

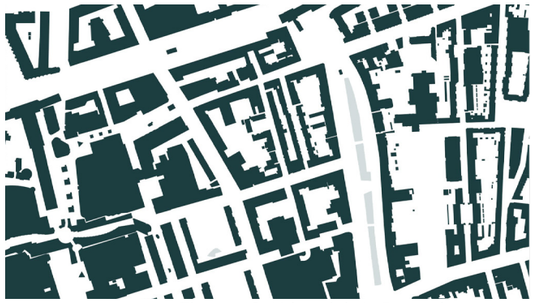

Figure 12: Urban fabric Rotterdam centre
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)



Figure 13: Urban fabric Utrecht centre
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)



Figure 14: Urban fabric Amsterdam centre
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)

CASE STUDY

The Binnenrotte area

The Binnenrotte is one of the busiest commercial areas in the center of Rotterdam. Busy shopping streets, touristic landmarks, mobility streams, and residential functions all come together here, which are shown in figure 21. This comes with many urban stressors.

Station Blaak is a stop for both trains and the subway below the ground. Above the ground is the pedestrian area of Binnenrotte. Right next to it is a busy car road, bicycle lanes alongside it, and many crossings. This creates unpredictable movement in a crowded environment.

It is also an area that goes through changes throughout the week. Every Tuesday and Saturday, a market takes place where residents as well as tourists can spend the day shopping. These changes in activities and filling of the space may cause stress, especially to those who do not do well with unpredictability and crowded places (Gadion et al., 2023).

The opportunity to overcome these challenges makes this a relevant site.



Figure 15: Non-market days on the Binnenrotte
Photograph by the author



Figure 16: Bi-weekly market
Photograph by the author



Figure 17: Commercial character of the area
Photograph by the author



Figure 18: Lingering in the area
Photograph by the author



Figure 19: Markthal attracts many types of users
Photograph by the author



Figure 20: Many terraces in the area
Photograph by the author



Figure 21: General exploration location Binnenrotte
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)

PROBLEM STATEMENT

In hyperdiverse cities such as Rotterdam, public space is expected to serve a wide range of users with different ways of perceiving and engaging with the environment. However, public space fails to accommodate the cognitive needs of a neurodiverse population.

Urban stressors in modern cities produce cognitively demanding public spaces. This is especially the case in commercial areas like the Binnenrotte, where economic drivers shape public space more than human well-being.

Urban design often assumes a “typical” user, resulting in public spaces that privilege normative patterns of perception and behavior while invisibly excluding others. While inclusive design responds to exclusionary environments, cognitive variation is underrepresented. Because of the low visibility of neurodivergent conditions and the hard-to-measure nature of subjective experience, knowledge on possible accommodations falls short.

As a result, neurodivergent individuals are disproportionately excluded from everyday urban life, while the broader population also experiences stress. In a polarized society, this exclusion extends beyond individual well-being: public space loses its capacity to function as a common ground, where people with differences encounter one another through everyday activities. Those encounters are essential in stimulating mutual recognition and empathy.

This undermines social inclusivity, highlighting a potential to extend inclusive design to include neuro-inclusivity.

THESIS AIM

This thesis works towards the goal of not only diminishing the disproportionate effect of urban stress on neuro-minorities, but also improving the spatial quality of public space for all users. This refers specifically to enhancing comfort, legibility, and the ability of users to regulate stress through engagement with the environment.

This research works towards that goal by gaining an understanding of how a neurodiverse population psychologically and socially experiences urban public space, and translating these insights into neuro-inclusive design.

Using the Binnenrotte in Rotterdam as a case study, the thesis applies this knowledge to a highly demanding urban environment, addressing the amplified urban stressors in such environments.

Inclusivity and equity are guiding values. Ultimately, the project aims to contribute to socio-spatial justice by showing how to reduce exclusion caused by cognitively demanding environments and positioning the role of public space as an accessible and shared domain for all.

MAIN RESEARCH QUESTION

How can urban design include insights on neurodiverse spatial needs to create a more inclusive public space surrounding the Binnenrotte?

CHAPTER 2
APPROACH

THESIS ORIENTATION

Objectives

The objective of this thesis is to analyze how cognitive variations impact spatial experience and what this implies for the definition of neuro-inclusive design. The second objective is to spatialize this in a design for the public space surrounding the Binnenrotte in Rotterdam, where urban stressors are exacerbated by commercial functions and modernist planning.

Scope and limitations

The term "neurodivergent" has no agreed-upon boundary of what is or is not part of it. To keep the project feasible, this research deals only with individuals with ADHD and autism who are able to live independently and work or study full-time. This selection was based on the following reasons.

- These are both neurological conditions that affect sensory processing and seem to affect experiences in the public space more than other types under the neurodivergent umbrella.
- Autism and ADHD are more prevalent in the population than other forms of neurodivergence (Doyle, 2020), which makes finding enough participants more feasible.
- Due to time constraints and saturation, 10 participants are interviewed. Having more participants with the same condition and patterns makes the conclusion from that pattern stronger.
- Participants who are unable to live independently and work or study full-time are potentially vulnerable. Doing research with them may put them at risk.

Working with this scope means that this research can form a base but would be more complete and valid if further research included more types.

Ethical perspective

The values of equity and inclusion form the ethical foundation of this project. Designing public space for an assumed neurotypical norm excludes certain groups by putting certain ways of sensing, moving, and behaving over others. This research views cognitive and sensory differences as equal variations of human experience that deserve recognition in urban design, not as deficits.

The project also reflects on the ethical responsibility of designers to engage with target groups through participatory processes. One ethical consideration within the human participation study was which participants to include. From the ethical perspective of equity, it could be said that researching those at the far ends of the spectrum is the most inclusive. Theory like “Designing from the Margins” states that designing for the most marginalized is still generalizable for a wide range of users, making it the most inclusive (Rigot, 2022). Due to the practical and ethical reasons stated in the scope of the project, this was not possible. People who are not able to live independently or work or study full-time were excluded because of their potential vulnerability.

Looking at public space as a public domain, designing for one minority can quickly become exclusive to other. Therefore, the definition of neuro-inclusive design must follow from the needs of a neurodiverse population, not solely from the needs of neurominorities. That is why the research approaches this from multiple perspectives: theory of urbanism, neurodivergent psychology, and general environmental psychology. This approach is shown in figure 22.

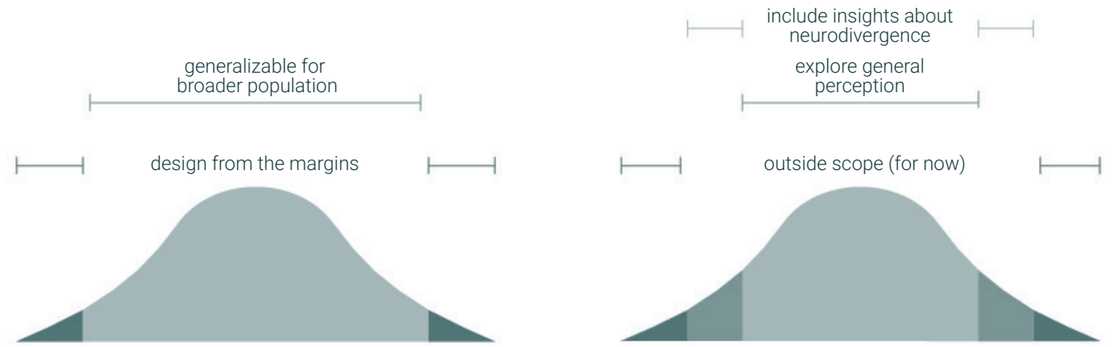

Figure 22: Design from the margins bell curve vs thesis approach
Created by author, based on Rigot’s (2022) Design from the margins

THESIS ORIENTIATION

Societal relevance

The tension of hyperdiversity in polarized society highlights the need for inclusive design approaches that not only accommodate the different needs of a diverse population but also reflect values like inclusivity and equity.

The impact of urban stressors, which unequally affects neurodivergent people, reveals a spatial inequality. There is a need for an extension of inclusive design that accounts for the natural variations in cognition, not through prioritizing neurominorities, but by using an all-encompassing lens. This thesis aims to contribute to this by showing what neuro-inclusive public space design might look like in the highly urban environment of the Binnenrotte.

Scientific and professional relevance

Research regarding neuro-inclusive design or cognitive spatial experiences tends to fall within one or two categories, as shown in figure 23. Research that synthesizes all three categories, culminating in design, is currently absent. This thesis contributes by bridging the gap between theory, empirical studies, and site-specific urban design, showing how neuro-inclusive design can react to existing conditions.

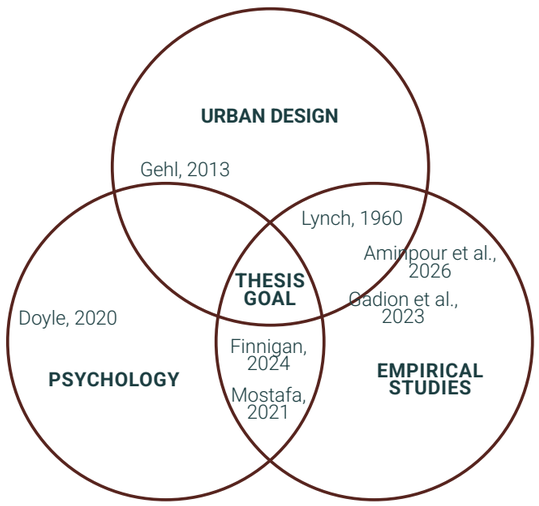

Figure 23: Diagram of knowledge gap in discourse
Created by author

LITERATURE REVIEW

Source selection

Approach

In order to decide the lens in which this thesis attempts to approach neuro-inclusive public space design, sources from urbanism, psychology, and environmental psychology were explored.

Source selection process

Sources were initially selected by searching on Google Scholar and Scopus with combinations of the following keywords: neuro-inclusive, neurodivergence, ADHD, autism, cognitive demand, design, public space, urban design, and urbanism. Websites that hosted these academic sources also suggested related sources after reading these. Finally, AI chatbots were used to further explore any other related sources. Although prompts asked only for academic sources, this can never be trusted outright and critical review was done before accepting any source.

Critical review of sources

All sources were critically looked at and only accepted after consideration of the used citations, scope, and methods of the research. Preference was given to sources posted on academic repositories (ScienceDirect, ResearchGate), due to their review policies. Supplementing with books and project reports was also necessary to get a more complete picture. When selecting sources that used interviews as a way of collecting evidence, attention was paid to the amount of participants and if the location of the research was comparable to the location of this thesis in terms of urbanicity.

AI disclosure

This research made use of Artificial Intelligence (AI) tools to support the finding of relevant academic sources, language improvement, and brainstorming in the initial phases. It never replaced critical analysis, original ideas, or ethical reflections. All AI outputs were carefully reviewed and verified. AI tools were always cross-checked for accuracy against reliable academic and professional sources.

THEORIES AND CONCEPTS

The cognitive demand of the urban built environment

Imageability

The theory of imageability says that an environment that is more easily understood (or more legible) is a less demanding environment (Lynch, 1960). Highly imageable environments are less cognitively demanding because they offer clear spatial structure and recognizable features. High legibility should cause users to feel an emotional sense of security or confidence in their use of the space (p. 8). Differentiation in an otherwise rigid structure increases the memorability (p. 94). This focuses mostly on the visual sense.

Key concept:
Legibility: clarity of spatial structure that allows users to navigate effectively and makes an environment less demanding

Urban stress

Chaotic and fast-paced conditions in dense urban environments can cause stress in individuals; this is called "environmental stress". Chronic exposure leads to mental and physical health issues.

Key concept:
Urban stressors: This includes environmental factors (noise pollution, air pollution, etc.) and social factors (overcrowding, lack of personal space, etc.)
Built environment: The physical surroundings made by humans. In the context of urban stress this is defined by factors like density, lack of green spaces, and overwhelming visual stimuli.

Varied human perception

Embodied experience

Embodied experience expands on imageability to include the multisensory nature of spatial experience (Pallasmaa, 1996). This extends beyond vision to include touch, sound, smell, and bodily movement. People experience space through the body.

Key concepts:
Embodiment: perceiving and understanding the world through the physical body, sensory input, and emotions.
Multisensory perception: integration of all senses in spatial experience

The neurodiversity paradigm

The neurodiversity paradigm is a framework viewing neurological differences, like autism and ADHD, as natural variations in human cognition rather than diseases or deficits (Dwyer, 2022). These natural variations alter the perceptions of people because stimuli are processed differently.

Key concept:
Natural cognitive variation: Neurodiversity is a natural, normal form of human diversity, much like variations in ethnicity or personality.

Stress recovery through affordance interaction

Affordance theory

Affordance theory adds that individuals perceive and act within their environment based on the possibilities for action it offers. Gibson (1979) argues that perception is directly linked to action: people do not just see objects but what they can do with them. These affordances are relational, meaning they depend on both the properties of the environment and the abilities of the individual.

Key concepts:
Affordances: Action possibilities that are provided by the environment.
Perception-action coupling: Perception is directly linked to potential actions.
Variability of affordances: Different users perceive different possibilities in the same environment and different opportunities can be provided through design.

Human design

Human design provides specific examples of these affordances, adding the importance of protection, and explains how human scale makes an environment less demanding (Gehl, 2013).

Key concepts:
Human scale: environments that match human proportions and perception
Protection: protecting users from physical harm and environmental discomfort

Seyle's biological model of stress

Seyle's biological model of stress, the general adaptation syndrome, includes three stages: alarm, resistance, and exhaustion. It shows the two sides of dealing with stress: reducing stimulation can delay the moment where stress occurs, while coping mechanisms can make sure it does not reach the point of exhaustion.

Alarm reaction: the response of an individual that is exposed to stress
Coping: regulation methods

THEORIES AND CONCEPTS

Conceptual framework

Combining these theories forms a definition of spatial experience. Spatial experience is determined by initial perception of the environment and the interactions a person has within that environment, as shown in figure 24. Adding the concepts that factor into these steps leads to the conceptual framework shown in figure 25.

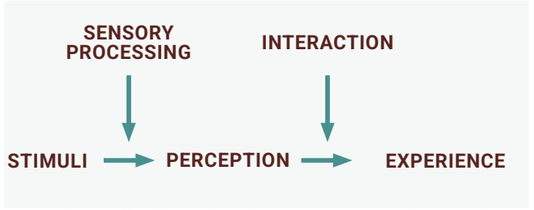

Figure 24: Simplified visualization of spatial experience
Created by author

Subquestions and relation to conceptual framework

Subquestion 1: How cognitively demanding is the public space?

The 4 concepts from urban design theory and environmental psychology that influence cognitive demand in urban public spaces are further explained and mapped on the site.

Subquestion 2: How does a neurodiverse population perceive urban environments?

Varied human perception is the filter through which stimuli from the built environment reach a person. This subquestion expands and challenges theories about spatial perception through psychological and sociological knowledge. Both general perception and insights about neurodiversity are included.

Subquestion 3: How can an environment provide opportunities for interactions that regulate stress responses through affordances?

This subquestion combines conclusions from the previous subquestions with biological and psychological stress models to determine affordances that may be used in urban design to create an interaction-inviting environment.

Subquestion 4:
What would a neuro-inclusive design for the public space surrounding the Binnenrotte look like?

This final subquestion synthesizes the conclusions from previous subquestions into design.

SQ3

SQ2

SQ1

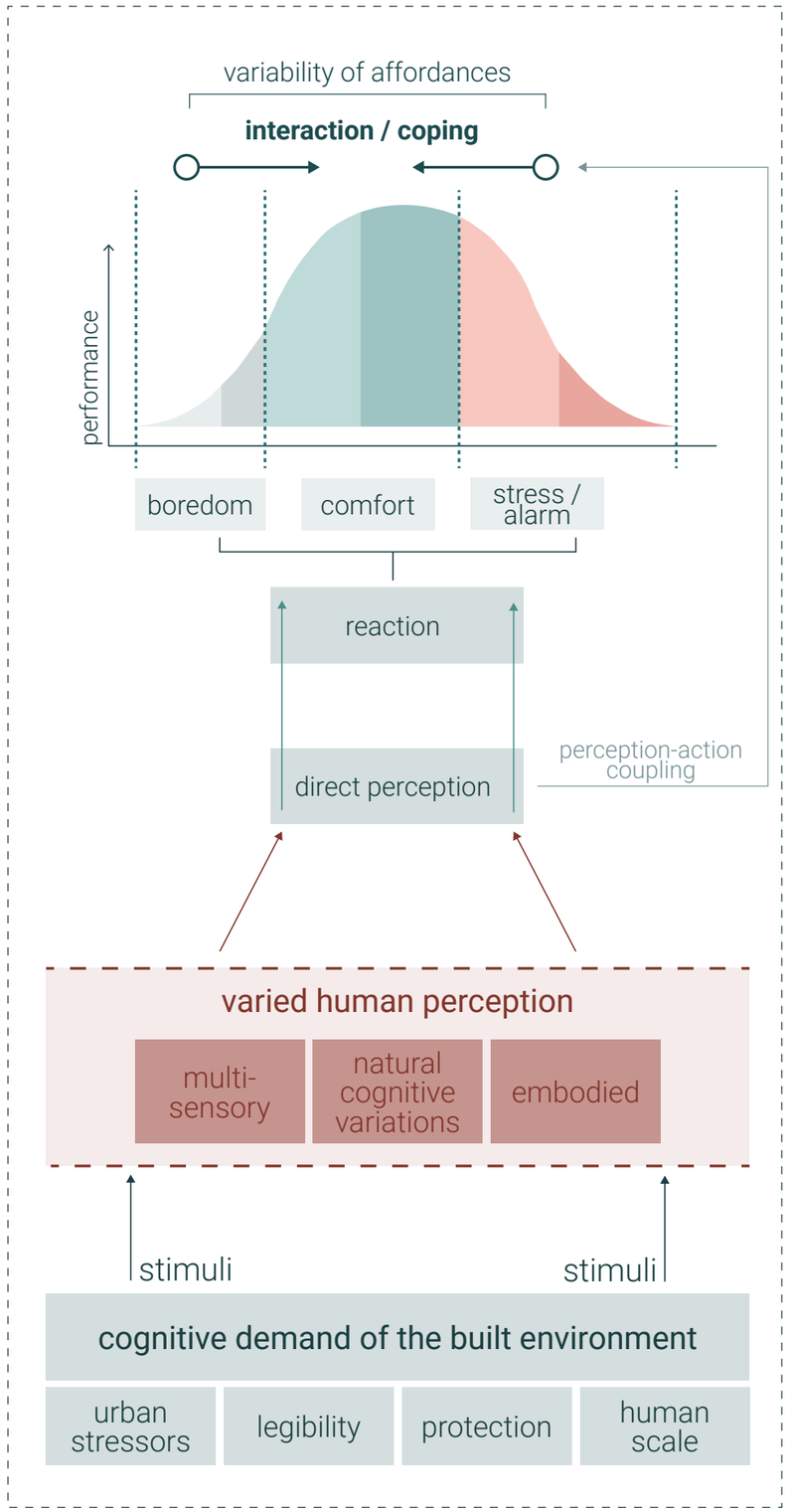

Figure 25: Conceptual framework
Created by author

METHODOLOGY

how methods feed into eachother

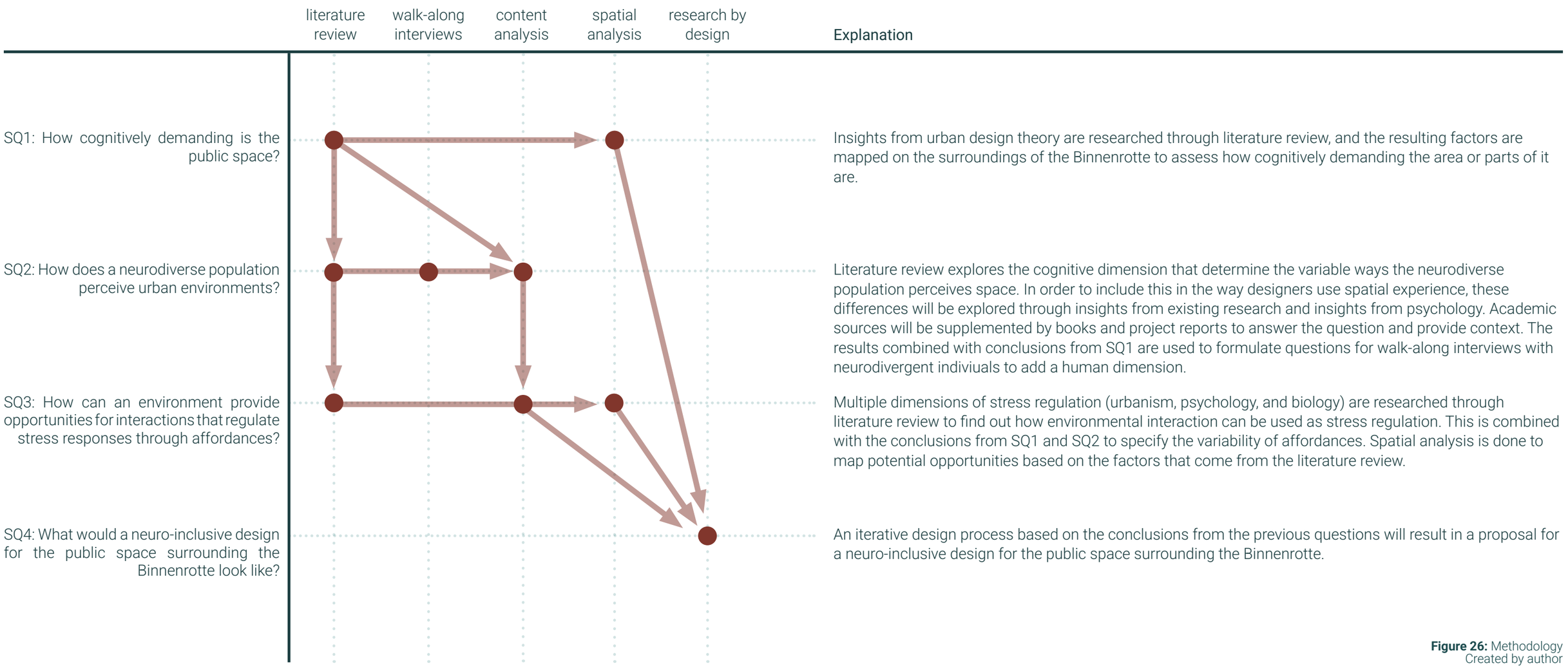

Figure 26: Methodology
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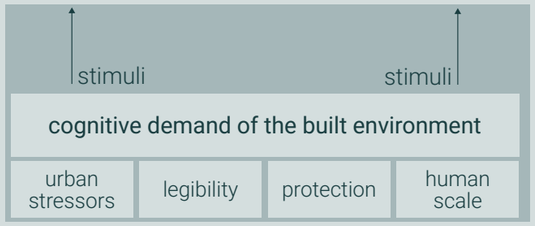
CHAPTER 3
COGNITIVE DEMAND OF THE PUBLIC SPACE

CHAPTER OVERVIEW



SQ1: How cognitively demanding is the public space?

In this chapter, the factors that determine the cognitive demand of the public space are explained and mapped. The factors fall under the 4 categories from the theoretic framework:

1 Protection
- traffic
- crime
- unpleasant sensory experiences

2 Human scale

3 Legibility
- hierarchy of dominance
- movement clarity
- materiality

2 Urban stressors
- sounds
- smells
- crowding

LEGIBILITY

Landmarks

Imageability is the physical quality that evokes strong mental images in users of the public space (Lynch, 1960). This is relevant to cognitive demand because highly imageable environments are often very legible. This means they are easier to organize mentally, remember, and navigate, as well as feel more emotionally secure.

A highly imageable area has elements that have a strong identity, clear structure, and meaning. Identity means that an element is identified as a separate entity, structure refers to the relation the element has to other elements, and meaning can be a practical use or an emotional response.

These elements can be paths (channels of movement), nodes (crossings of paths), edges (boundaries), districts (subsections of the area), or landmarks. Starting with this last one, figure X shows the landmarks in the area surrounding the Binnenrotte. As this is the city center, there are many strong landmarks here, as shown in figure 27. Many of them are located at one end of the Binnenrotte. There is a lot of liveliness here, with the commercial functions of the Markthal, the mobility hub of station Blaak, and tourists visiting the landmarks.

The striking visual effects caused by the size, intensity, and interest of the landmarks is what is called "dominance" in the theory of imageability. But this only improves imageability when contrasted, which requires a hierarchy of dominance within the elements. This is achieved by ranges or gradients (p. 106). As the many landmarks are clustered at one end of the Binnenrotte, this instead creates an dominant node at this end of the path.

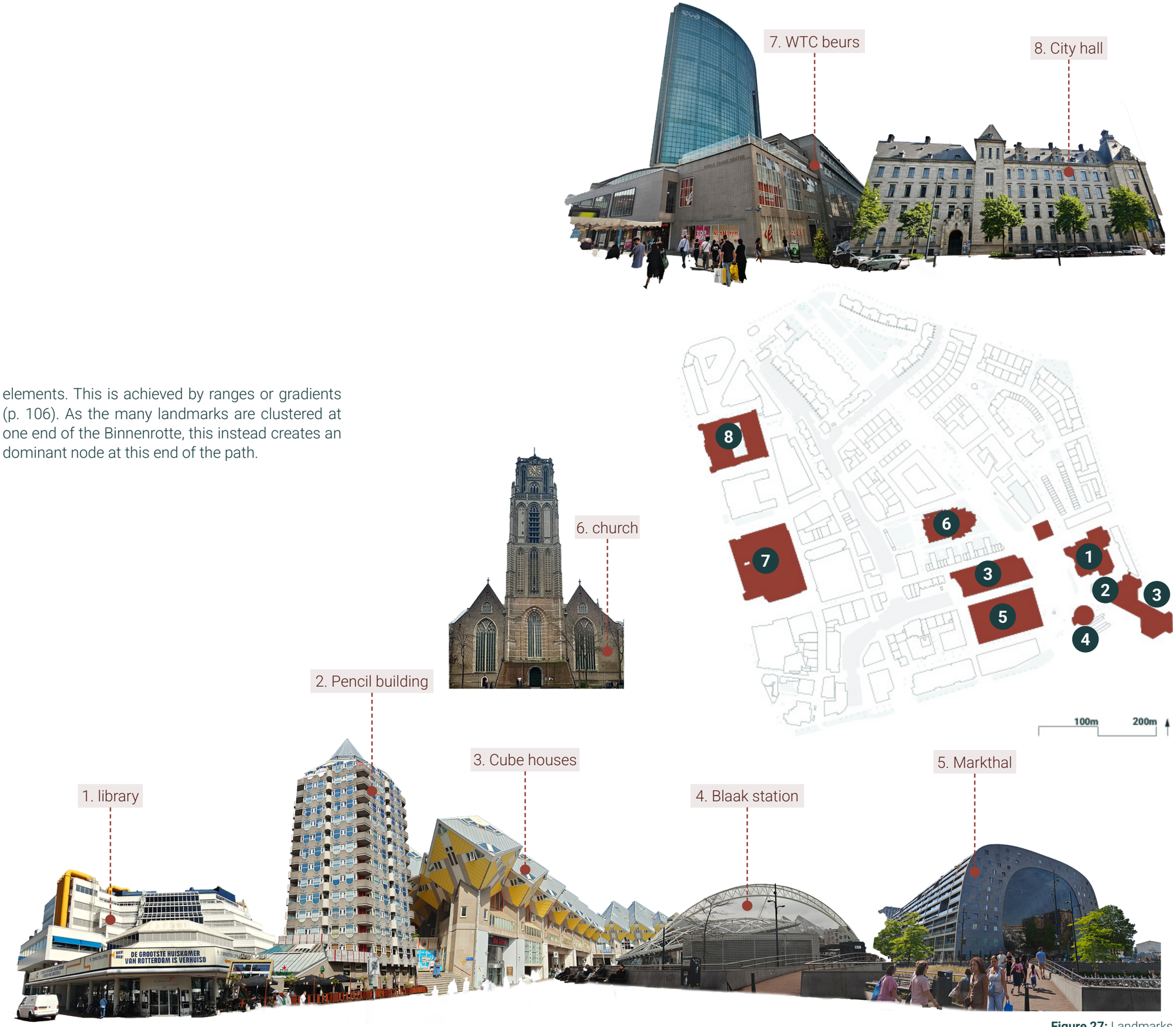


Figure 27: Landmarks
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)

LEGIBILITY

Motion awareness

Besides dominance and hierarchy, motion awareness is also a factor that can improve legibility. This refers to spatial elements that make it easy for a person to understand the direction, speed, and destination of their own movement. This makes navigation and orientation easier and less cognitively demanding. Physically, this may look like rythmic elements along a path, split lanes, ramps, or gradients through edges or materiality. A good sense of motion awareness is achieved if walking distance or time corresponds with spatial elements in a logical way.

Figure 29 shows the time needed to walk along the Binnenrotte. It costs about 9 minutes to walk from Blaak until the other end at Pompenburg. There are nodes along the way because of crossings with the Meent, Grotekerkplein, and Hoogstraat. But these nodes are not pronounced through spatial elements.

The buildings and materiality on the Binnenrotte show a lot of continuity and linear direction, which follows the principles of legibility. But the path lacks any significant form of subdivision, rythm, and hierarchy of dominance. This results in a very long corridor where the end is not easily seen, which is shown in the photo in figure 28, which was taken halfway down the Binnenrotte. This results in a lack of any real motion awareness on this path.



Figure 28: Name
Photograph made by author

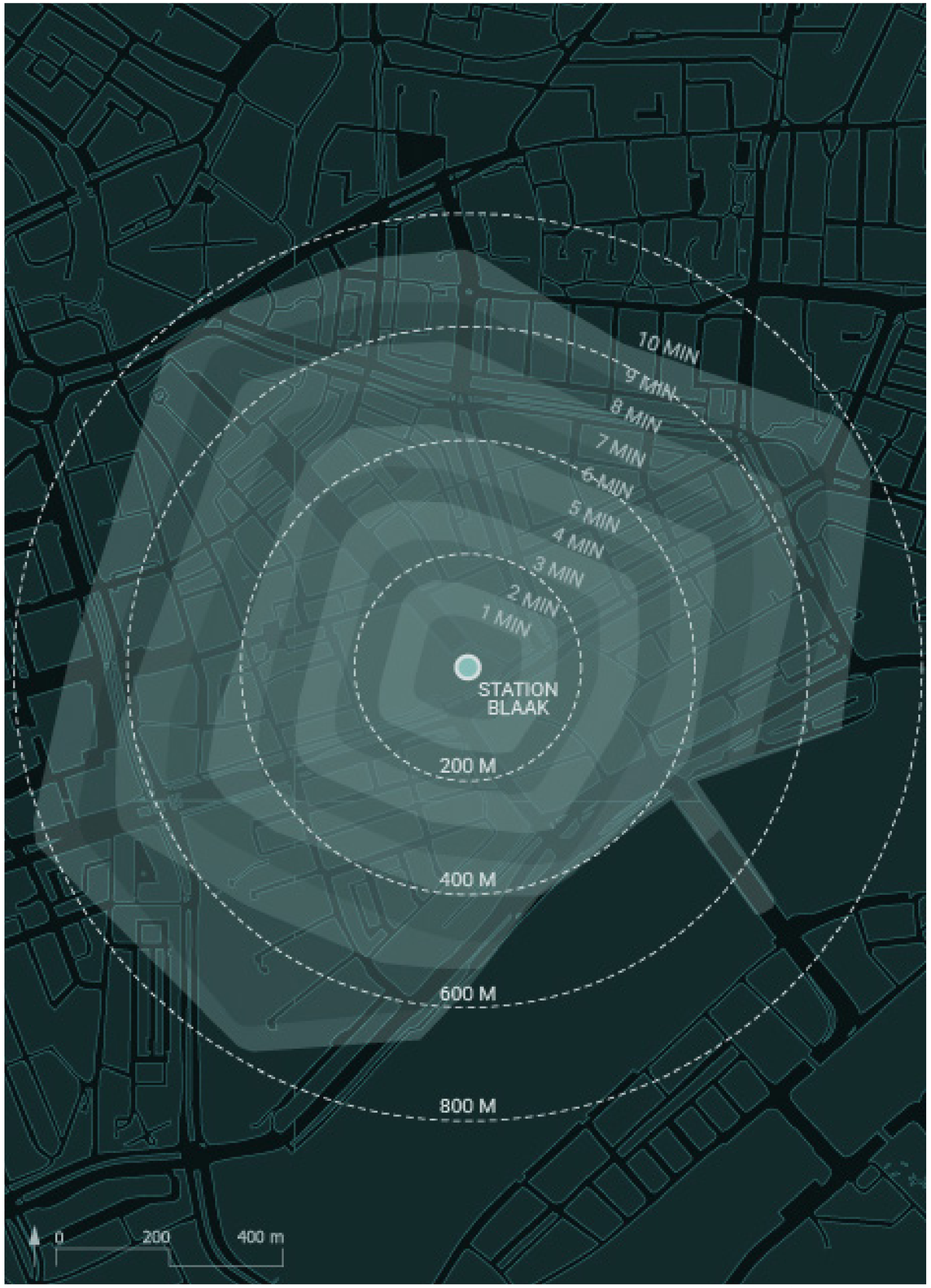


Figure 29: Pedestrian isochromes
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)

LEGIBILITY

Materiality

Materials can communicate changes of direction, division of large open spaces, and more. This communication can make it easier to understand the space, making it more legible and less cognitively demanding. In the area surrounding the Binnenrotte, different types of stones are used. Four main types can be distinguished, which are also photographed and located in the map:

1. red dual-toned (herringbone)
This is the most prevalent, being used on the Binnenrotte as well as Grotekerkplein.
2. concrete (stacked bond)
3. grey-brown (herringbone)
This is prevalent in the older areas that have not been redeveloped recently.
4. marbled pavers (running bond)

The square has its own typology, using mostly the red dual-toned herringbone with stripes of the darker tone in a stretcher bond. This structure is perpendicular to the rows of the market stalls.

A communicative material pattern used to be at the crossing between Hoogstraat and the Binnenrotte. Two perpendicular bands highlighted the crossing of the Binnenrotte and the busy shopping street, as seen in figure 32. At some point concrete was introduced, disrupting the structure and leaving behind a less organized transition, as shown in figure 33.



Figure 30: Hierarchy
Photograph made by author



Figure 31: Map of pavement photos
Screenshot from Google Earth (Google, 2023)



Figure 32: Crossing between Hoogstraat and Binnenrotte
Screenshot from Google Earth (Google, 2022)



Figure 33: Crossing between Hoogstraat and Binnenrotte
Screenshot from Google Earth (Google, 2025)



Figure 34: Hierarchy
Photograph made by author



Figure 35: Hierarchy
Photograph made by author



Figure 36: Hierarchy
Photograph made by author

PROTECTION

In the human design toolbox, perceived protection is the first category of environmental comfort (Gehl, 2013). This matters because feeling protected through physical aspects of the environment lowers the need to constantly be on the lookout, which is mentally taxing. Protection refers to the design of urban areas that influences unpleasant experiences and maximizes security for pedestrians. This is further specified into three categories:

Protection against traffic and accidents: In spaces where vehicles and pedestrians are near each other, street design affects how safe a pedestrian may feel. There are many examples in the area, like raised and wide zebra crossings and trees between different types of mobility lanes, which are shown in figures 37 through 39.

Protection against crime and violence: In spaces that are secluded or where there are no “eyes on the street” because of the surrounding functions, a user may feel less safe. There are many cafes and restaurants open late in this commercial area, increasing visibility. Even in one of the calmest areas, Grotekerkplein, there is a restaurant on one of the corners. This is shown in figure 41.

Protection against unpleasant sensory experiences: This refers to protection from environmental factors such as wind, rain, cold, snow, and excessive noise. There are few publicly accessible covered areas where people can take shelter in case of rain; the most notable example is the roof over the entrance of Blaak station, shown in figure 40. This almost forces people to go into cafes or stores, where they are usually expected to spend money.



Figure 37: Example of protection from traffic
Photograph made by author

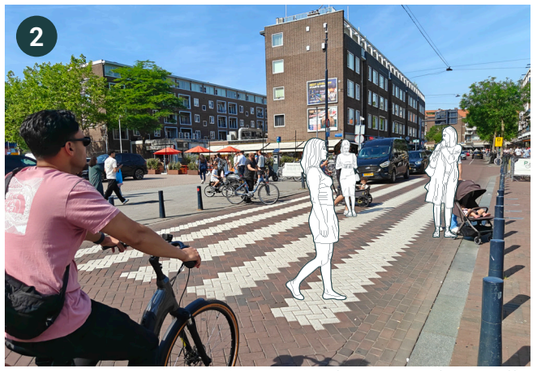


Figure 38: Example of protection from traffic
Photograph made by author



Figure 39: Example of protection from traffic
Photograph made by author



Figure 40: Example of protection from sensory experiences
Photograph made by author



Figure 41: Examples of protection from crime
Photograph made by author



Figure 42: Mobility map with locations photos
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)

HUMAN SCALE

Another aspect of Gehl's toolbox is human scale, referring to the size of the human body and distances that are not so large that individuals cannot estimate their sizes compared to their own bodies (Gehl, 2013). He argues that well-being in cities is increased by designing at the human scale through enclosure, material variation, and gradual transitions.

In contrast, large, exposed public spaces with limited differentiation like those found in post-war reconstruction areas, can increase perceptual load and reduce comfort. According to Gehl, this overdimensioning leads to the loss of a vibrant street life compared to the intricate and concentrated streets in older cities (Gehl, 2011).

This analysis shows the scale of different streets within the area, showing a variety in scales depending on the streets in the sections in figure 41 through 44. Their locations are shown in figure 45. The Binnenrotte is unsurprisingly the largest space, where human scale is lost almost completely. This is for a good reason, as the large space is needed for the bi-weekly market, and it is also more proportionate to the taller buildings on the Binnenrotte.

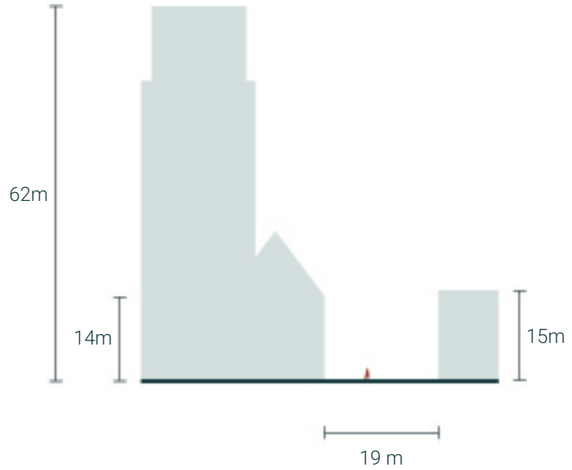


Figure 41: Section 2
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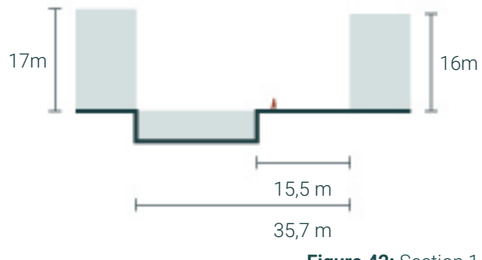

Figure 42: Section 1
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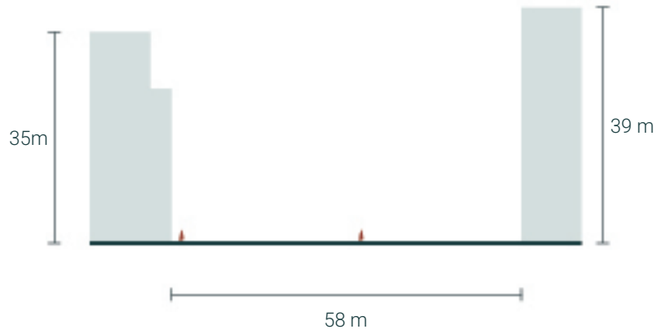

Figure 43: Section 3
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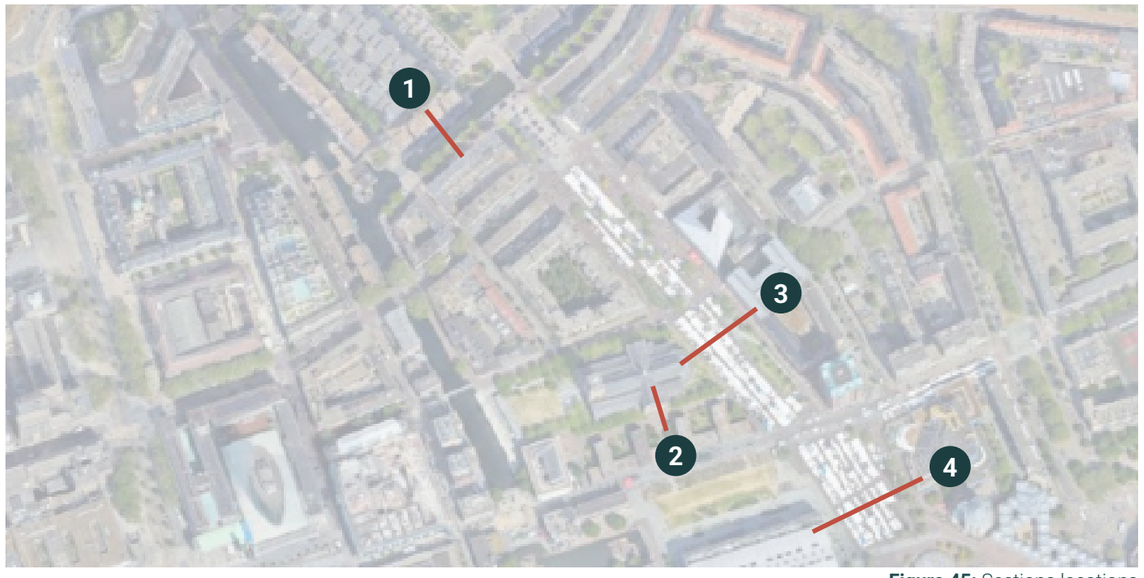


Figure 45: Sections locations
Screenshot from Google Earth (Google, 2023)

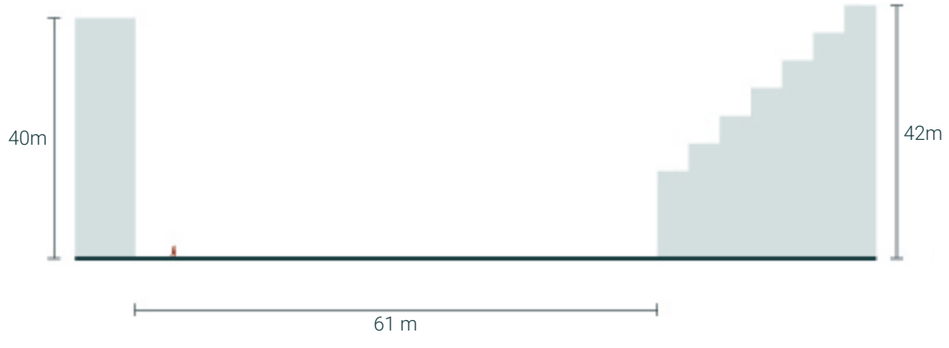


Figure 44: Section 4
Created by author



Figure 46: Photo Hoogstraat
Photograph made by author



Figure 47: Photo Haagseveer
Photograph made by author



Figure 48: Photo Meent
Photograph made by author

URBAN STRESSORS

crowding: space syntax

In order to predict crowding, it is important to have an idea of why people take certain paths over others. This starts with functions as destinations. In this area, commercial functions are dominant. But people also tend to take the simplest path to their destinations. This is where space syntax comes in.

Angular choice (figure 50) in space syntax identifies the straightest paths between all possible origin-destination pairs in a network. High angular choice indicates a street segment with a high potential for “through movement”.

Angular integration (figure 51) measures how easily a specific street segment can be reached from all other segments in the network by minimizing the number of turns required to get there. High angular integration means a street segment is highly accessible from all street segments in the system, requiring the fewest total changes of direction to reach it.

High-choice and high-integration streets typically serve as the “foreground network” of a city, characterized by high traffic, shops, and cafes. This makes them indications of potential crowding.

Within the area, three streets have both high angular choice and integration. These are the Meent, Haagseveer, and Hoogstraat. These are the busiest shopping streets, as seen in the functions map in figure 49.



Figure 49: Commercial functions on ground floor
Created by author using OpenStreetMap data (OpenStreetMap contributors, 2026)



Figure 50: Angular choice
Created by author using OpenStreetMap road data (OpenStreetMap contributors, 2026) and Space Syntax analysis in QGIS.

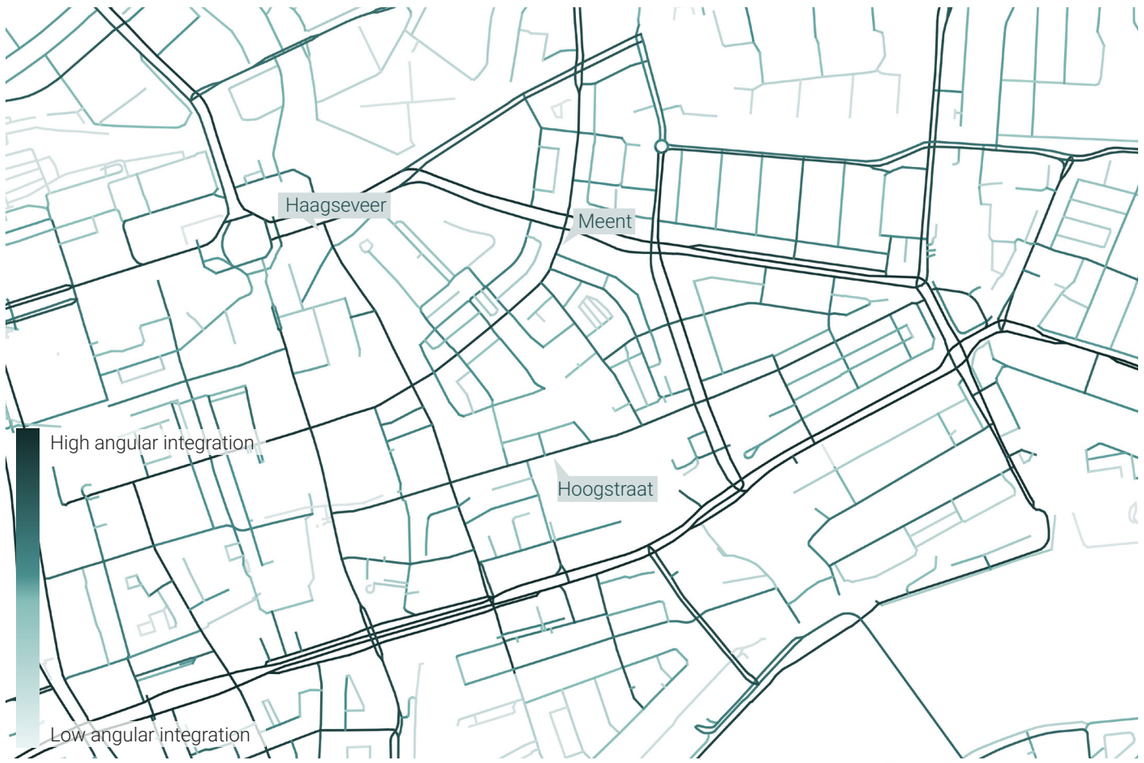


Figure 51: Angular integration
Created by author using OpenStreetMap road data (OpenStreetMap contributors, 2026) and Space Syntax analysis in QGIS.

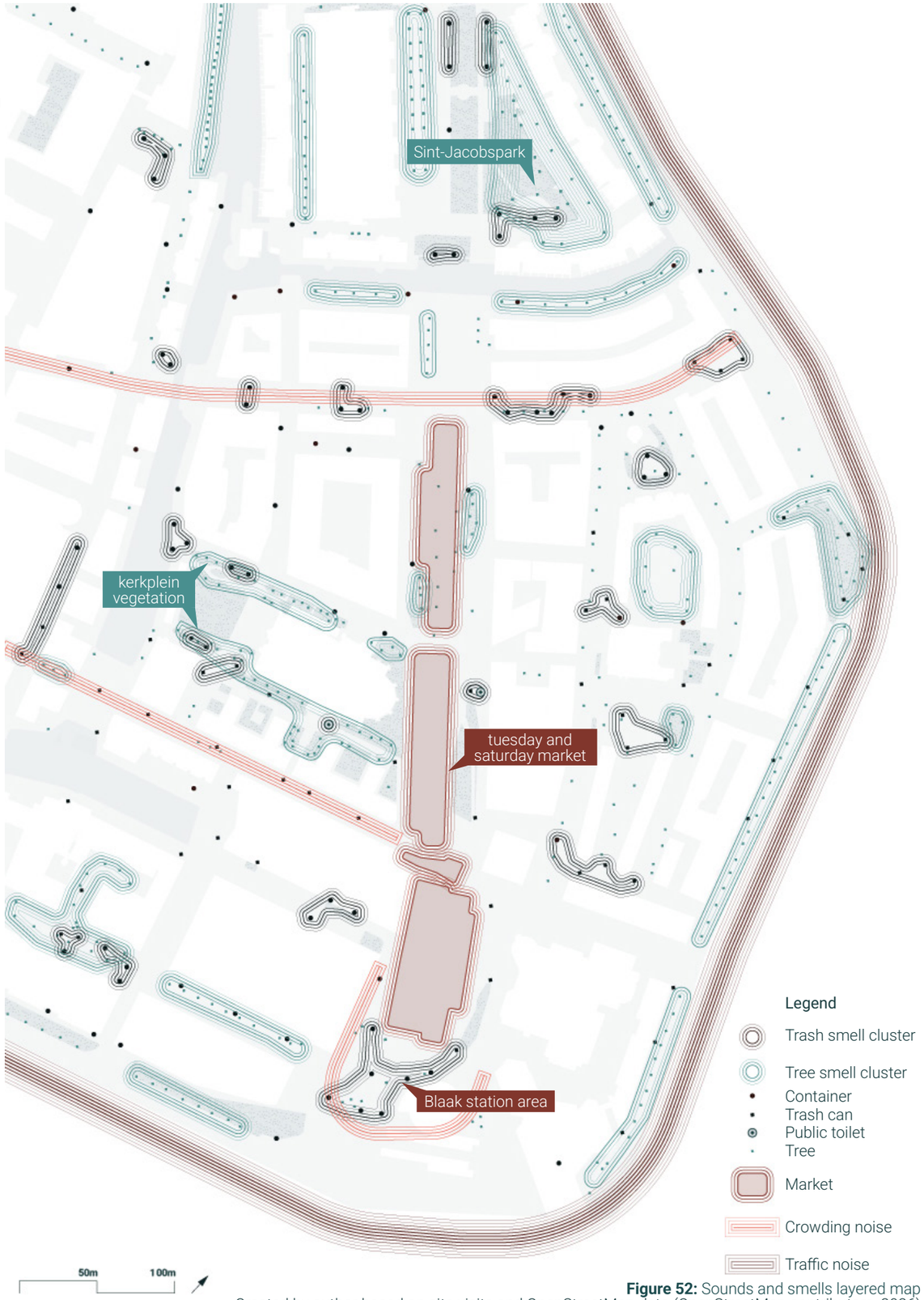


Figure 52: Sounds and smells layered map
Created by author based on site visits and OpenStreetMap data (OpenStreetMap contributors, 2026)

URBAN STRESSORS

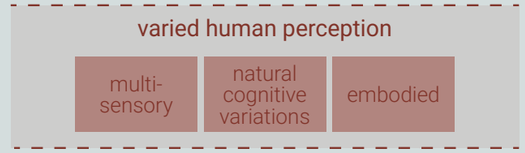
Sounds and smells

Cities are experienced not only visually, but through multiple sensory stimuli. That is why it is also important to show other kinds of sensory input. The analysis in figure 52 explores the spatial distribution of sounds and smells within the area. Smells from trash, vegetation, or markets, and sounds from commercial and social activities, and traffic create cognitive stimulation. Urban stress is produced through the accumulation of sensory stimuli rather than through isolated elements. That is why the analysis shows them layered together. By identifying areas of high sensory intensity and locations where multiple stressors overlap, the research seeks to understand how different urban conditions may affect users differently. By mapping these factors, it becomes possible to identify areas where sensory conditions are highly stimulating, as well as spaces that provide relief and restoration.

It is important to note that not all types of sounds and smells are equally impactful. Some sensory input can be stressful, while others can be relaxing. The environmental stressors that are the most impactful are noise, poor neighborhood quality, and traffic congestion (Steg et al., 2013). On the other hand, smelling trees and other vegetation is often not viewed as an urban stressor but as a pleasant sensory experience. Others are more ambiguous, like the food smells of the market. This can depend on the moment and on the personal situation of the person. In order to understand these personal aspects, varied human perception needs to be explored further.

CHAPTER 4
VARIED HUMAN PERCEPTION

CHAPTER OVERVIEW



SQ2: How does a neurodiverse population perceive urban environments?

In the previous chapter, spatial and environmental factors in the public space that influence cognitive demand were explored. But how people perceive also depends on their personal perception. In this chapter, spatial perception is explained through theory from urbanism and then expanded with psychological knowledge about natural cognitive variety (neurodiversity).

HOW DOES A NEURODIVERSE POPULATION PERCEIVE URBAN ENVIRONMENTS?

insights from urbanism

Spatial experience is not universal or only defined by physical aspects of the environment. They vary based on the person who is experiencing it as well. Key insights from urban design theory include that perception is embodied and multi-sensory.

EMBODIED PERCEPTION

Theory like imageability is focused mostly on the sense of sight, only mentioning smell and sound in minor ways (Lynch, 1960). Pallasmaa rejects architecture's focus on vision as the dominant sense, as it results in architecture that prioritizes striking visuals over completely embodied experiences that allow the users to feel more rooted in a space. He also critiques contemporary architecture's lack of things going on in the peripheral vision. Cognition is not separate from the body or environment; there is an iterative process between these three that informs spatial experiences.

MULTISENSORY PERCEPTION

Rathod & Wagner (2021) explain the process of experiencing as perceiving stimuli from the built environment through the sensory systems. This includes the traditional five: visual, auditory, tactile, olfactory (smell), and gustatory (taste). There are also three lesser-known ones: vestibular (balance, orientation, and motion), proprioception (position and movement of one body part compared to another), and interoception (sensing internal bodily signals). They form a cognitive filter through which physical aspects are perceived.

NEURODIVERSITY

This is where neurodiversity comes into play. Natural human variations in cognitive functioning create different sensory perceptions. As a crucial part of neurodivergence is a difference in one or more ways of processing sensory stimuli, this suggests it affects perception. In order for design to include these variations when designing for improved experiences, they need to be specified.

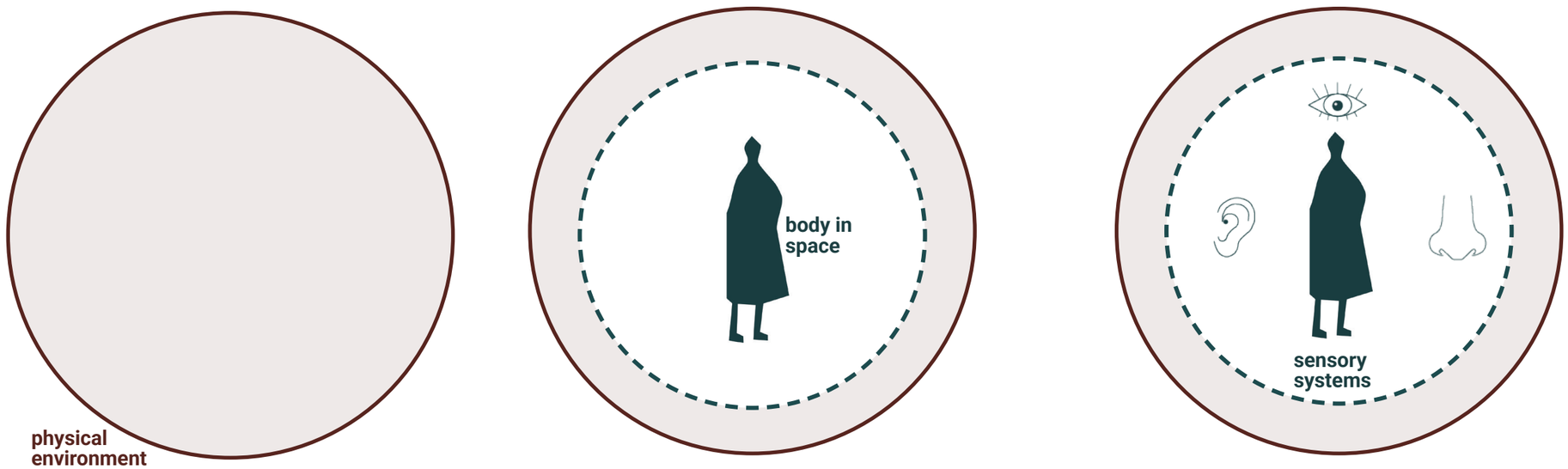


Figure 53: Layers of perception
Created by author

HOW DOES A NEURODIVERSE POPULATION PERCEIVE URBAN ENVIRONMENTS?

existing reports on neurodivergent accomodation in design

Existing reports on design that accommodates neurodivergence show what has already been discovered regarding differences in sensory perception. An important limitation to mention is that many of these reports focus on one type of neurominority, primarily autism. Comparison of the existing research shows that most are focused on schools and children, and none culminate in spatial design of public space (Tola et al., 2021).

A notable example is the ASSPECTS design index, which was the result of 10 years of empirical research (Mostafa, 2021). The index is a design toolbox for architecture that facilitates the needs of individuals on the autism spectrum. The principles are based on common characteristics among autistic people, such as noise sensitivity, affinity for routine and predictability, overstimulation, preference for low ambiguity, a need for recalibration, and proneness to accidents. The principles depicted in figure X follow from this. Although this research was focused on indoor spaces, the principles seem general enough to use in broader applications as well.

There are also recent rapports that deal with outside experiences. The “Streets for Diversity” report (Gadion et al., 2023) identifies design opportunities based on interviews with 31 neurodivergent individuals and 14 experts. The report came to 14 insights about neurodivergent public space experiences, which are listed in figure X. The report also concludes that while half of neuro-inclusive design is about managing stress, the other half comes from providing choices to accommodate personal differences (p. 94).

Sensory struggles are the most common issue mentioned in both these reports, as well as most current literature (Doyle, 2020). These can be based on sight, hearing, smell, taste, feeling, vestibular (balance, orientation, and motion), proprioception (position and movement of one body part compared to another), and interoception (sensing internal bodily signals) (Finnigan, 2024).

Recently, more attention is being paid to the idea of neuro-inclusive urban design. A March 2026 report came to the 9 design recommendations shown in figure X based on walking interviews and an online questionnaire (Aminpour et al., 2026).

The recommendations from these reports range from morphological interventions to personal tools. The recommendations that seem to be included multiple times are dedicated rest zones, diversity in (street) furniture to accommodate multiple ways of pausing, and nature-based calming measures. By taking one step back to the psychology that informed these reports as well, this picture can become more complete to inform further research and the design process.

ASSPECTS: RECOMMENDATIONS
1 Spatial sequencing
2 Transition
3 Escape
4 Sensory zoning
5 Acoustics
6 Compartmentalisation
7 Perceived safety

Figure 54: ASSPECTS principles
Adapted from Mostafa (2021)

STREETS FOR DIVERSITY: RECOMENDATIONS
1 Quiet spaces where individuals might take a break from visual and auditory stimuli
2 Sensory stations where people van benefit from positive stimuli
3 Seating and comfortable furniture
4 Restrooms
5 More nature on streets to make walking routes feel calmer
6 Create streets that are perceived safer, especially regarding traffic
7 Tools to address the unpredictable
8 Tools to help Navigate
9 Individual sensory supports
10 Community street initiatives
11 Opportunities to connect
12 Raising awareness and understanding

Figure 55: Design recommendations
Adapted from Gadion et al. (2023)

TOWARDS NEUROINCLUSIVE PUBLIC OPEN SPACES: RECOMMENDATIONS
1 Make amenity locations easy to find in advance
2 Prioritise cleanliness and quick maintenance
3 Prioritise high-quality public space around transport interchanges and along key walking routes
4 Co-locate key amenities to support longer, more comfortable visits to public spaces
5 Invest in local pocket parks, recognising that convenience can outweigh size
6 Provide a diverse range of seating
7 Design seating to support different postures
8 Include tables
9 Use warmer-touch materials

Figure 56: Design recommendations
Adapted from Aminpour et al. (2026)

HOW DOES A NEURODIVERSE POPULATION PERCEIVE URBAN ENVIRONMENTS?

understanding neurodivergence

Figure 57 lists characteristics associated with neurodivergence that can also be linked to spatial experience. Symptoms that can be logically linked to spatial experience provide insights regarding the needs of neurodivergent people.

AUTISM AND ADHD (ATTENTION DEFICIT HYPERACTIVITY DISORDER)
Characteristics an individual with autism may experience fall within the themes of socio-emotional skills, communication, rigidity, imagination, cognition, motor skills, and sensory sensitivities (Federatie Medisch Specialisten, 2014). ADHD characteristics are divided into three categories: inattention, hyperactivity, and impulsivity (Federatie Medisch Specialisten, n.d.). In figure X, they are not grouped by condition but by thematic links: struggles with combining sensory systems, regulation through movement, non-normative behaviours, temporal struggles, and sensory hyper- or hyposensitivity.

NUANCES
In the case of over- and understimulation, one of the most universal aspects of neurodivergent conditions, an important nuance should be made. It is not the case that certain individuals experience overstimulation and others experience understimulation. These can happen in the same individual in different situation; for example, when a person has no control over the sensory stimulation, hypersensitivity is more likely to occur (Finnigan, 2024).

CONCLUSIONS
Where theory from urbanism argues for multisensory engagement (Pallasmaa, 2012), the group of characteristics that show struggles with combining sensory systems may suggest neurodivergent people could benefit from refuge spaces where only one sense is stimulated.

Secondly, some characteristics oppose each other, some examples of which are shown in figure 58. This highlights the need for multiplicity in the characters of spaces to support this variety.

Finally, the categories of regulation through movement and non-normative behavior show the need for spaces built for interaction. For example, having objects to climb over or looping paths makes it easier to self-regulate through movement. This overlaps with theory from urban design stating spatial experience is not only based on perception but also interaction

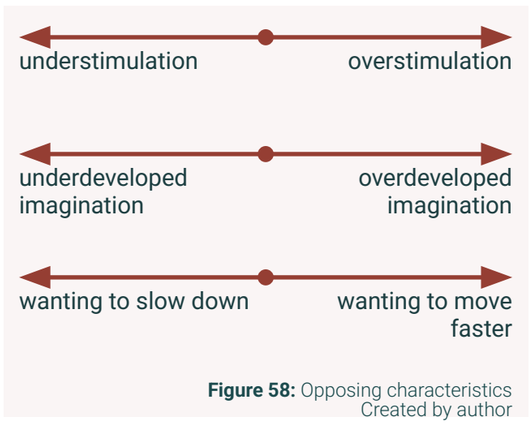


Figure 58: Opposing characteristics
Created by author

Struggles with combining sensory systems

- Context blindness, focussing on details but being unable to have overview (autism characteristic)
- Distracted by movement, changes in light and other stimuli (autism characteristic)
- Sometimes only being able to use one sense at a time (autism characteristic)
- Missing details (ADHD characteristic)
- Losing focus during activities (ADHD characteristic)
- Forgetfulness (ADHD characteristic)
- Easily distracted by external sensory stimulation (ADHD characteristic)

Non-normative behaviours

- Lack of awareness regarding personal space (autism characteristic)
- Inability to follow social rules (autism characteristic)
- Sudden overwhelm or panic without clear cause (autism characteristic)
- Lack of insight into what is expected of them (autism characteristic)
- Moving around in ways/ situations that are inappropriate (ADHD characteristic)

Regulation through movement

- Needing to selfregulate through movement or tics (specific repeated movements) (autism characteristic)
- Restless movement (ADHD characteristic)
- Struggling to stay seated (ADHD characteristic)

Temporal struggles

- Inability to change pace in changing cirumstances (autism characteristic)
- Inability to idealize the future, focus on ‘right now’ (autism characteristic)
- Slow processing of information and inability to multitask (autism characteristic)
- Slow pattern of action (autism characteristic)
- Inability to wait (ADHD characteristic)

Sensory hyper- or hyposensitivity

- Hyper- or hyposensitivity to sounds, light, smell, tactile sensations and temperature (autism characteristic)
- Sensory over- or understimulation (ADHD characteristic)

Other

- Great preference for rigid structural patterns, inflexibility (autism characteristic)
- Under- or overdeveloped imagination (autism characteristic)

Figure 57: Thematic symptom categories
Created by author based on FMD, 2014; FMD, n.d.

HOW DOES A NEURODIVERSE POPULATION PERCEIVE URBAN ENVIRONMENTS?

lived experiences of neurodivergent individuals

Interviews can add a human dimension to understand the impact and variation of these characteristics. The on-site interview questions were structured to find out the feelings and opinions the interviewees had about public spaces. This includes the experiences they have had in the past as well as their impression of the site of this project.

Many of the opinions they shared did not seem unique to neurodivergent individuals. What did seem different, and was common between all interviewees, was how much these impressions got to them.

Neurodivergent needs do not seem different thematically, but they do feel more urgent.

Many expressed opinions about needings to focus on one thing at a time. An example that came back a few times was the use of music in headphones to drown out the multiple different types of noises of the public space.

Combining multiple sensory systems is sometimes impossible. This leads to confusion, overwhelm, and exhaustion.

> “I think things tend to get to me more than to others. I sometimes get the feeling that people are able to do their own thing and shut things out. I can’t do that.”

> “Busy situations make me overwhelmed. When there are a lot of people walking at different speeds, it’s very frustrating because there is not one rhythm.

> "Listening to music drowns out the many different noises that are always there, which makes the going outside less draining for me."

> “I’m very sensitive, especially sounds and busy rooms. And i find it hard when there is something unexpected.”

> “Sometimes, things are a lot more intense for me than for other people. The ‘normal’ steps to get there feel more like giant barriers.”

> “Being in a cramped space with many people made me really want to get away quickly and it drained my energy so much.”

> "Car noises can feel very overwhelming, as well as any intense smells."

> “To a certain point, I am always stressed when I’m in public.”

HOW DOES A NEURODIVERSE POPULATION PERCEIVE URBAN ENVIRONMENTS?

lived experiences of neurodivergent individuals

The interviews ended in a walk where questions aimed to find out their experience of the site. Many of the participants mentioned aspects that are also present in the literature, like the importance of protection and losing overview in large spaces, reinforcing their validity through these lived experiences.

Looking at the previous projects on neurodivergent accomodation, neurodivergent characteristics, and the lived experiences, it seems that stimulation affecting all people is processed differently in neurodivergent individuals. This causes different reactions. This can go in the direction of overstimulation or understimulation after initial perception.This leads to the question: what happens after initial perception?

> "Feeling safe is the most important part of what makes a space comfortable. I think neurodivergent people struggle with feeling safe more than others, so this is very important."

> "A lot of Rotterdam is so big that I don't have an overview anymore. I mean the streets and buildings for example."

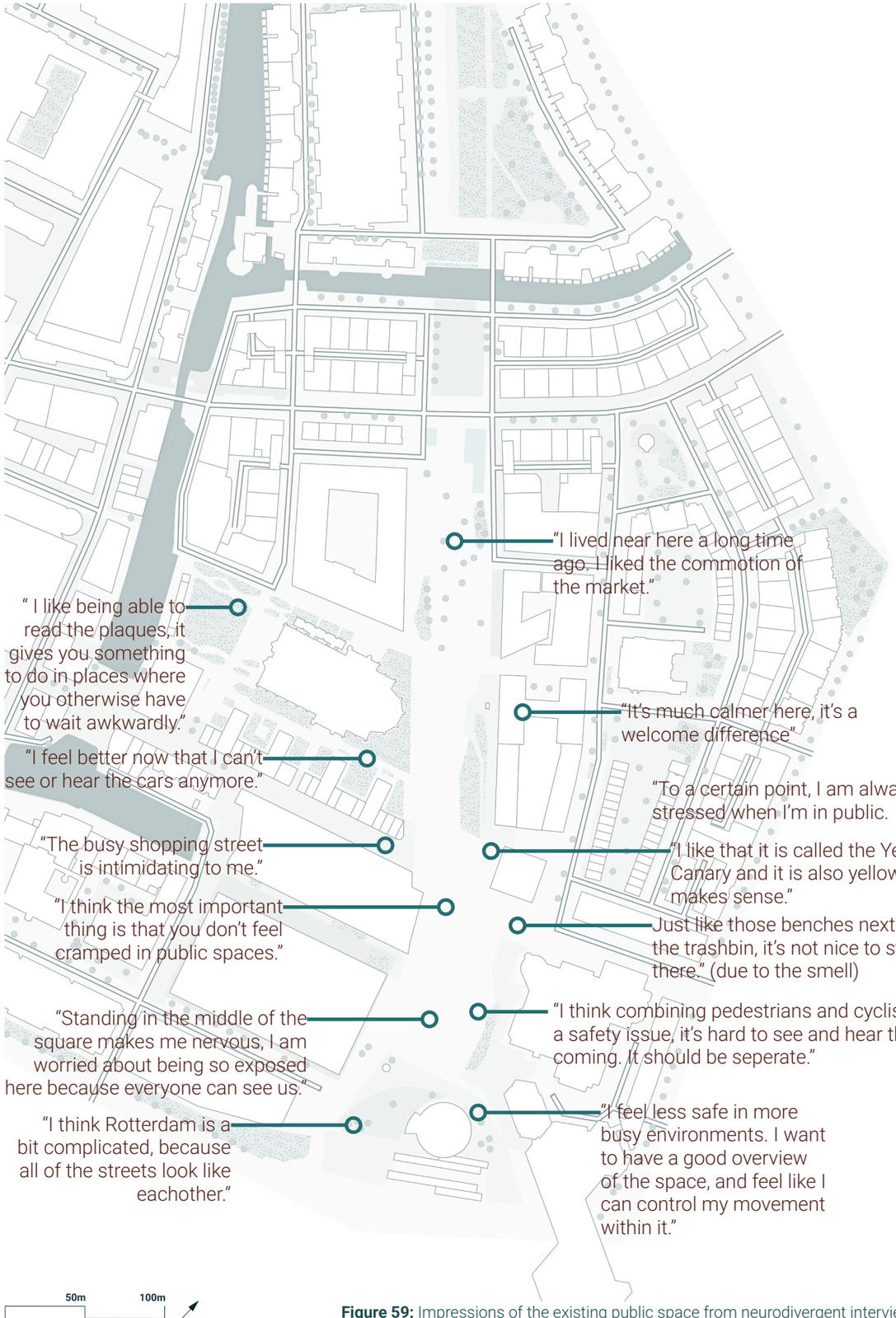
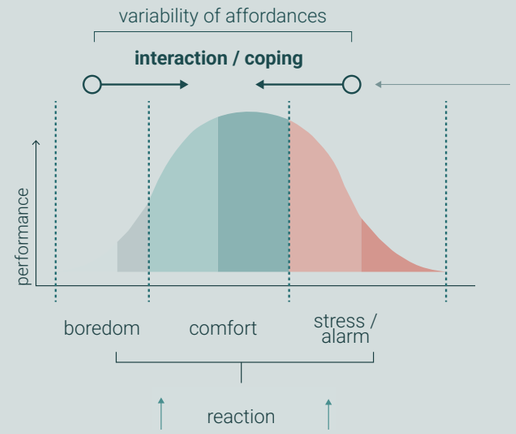


Figure 59: Impressions of the existing public space from neurodivergent interviewees
Created by author using interview quotes and OpenStreetMap data (OpenStreetMap contributors, 2026)

CHAPTER 5
REGULATION THROUGH INTERACTION

CHAPTER OVERVIEW



SQ3: How can an environment provide opportunities for interactions that regulate stress responses through affordances?

The first chapter approached cognitive demand of the public space in terms of physical characteristics and environmental factors. The second chapter explored the variable cognitive filter based on personal perception and how spatial perception may lead to stress.

This chapter explores stress from a psychological and biological perspective, after which a link will be made to urban design in terms of how design is able to help people with regulation / coping.

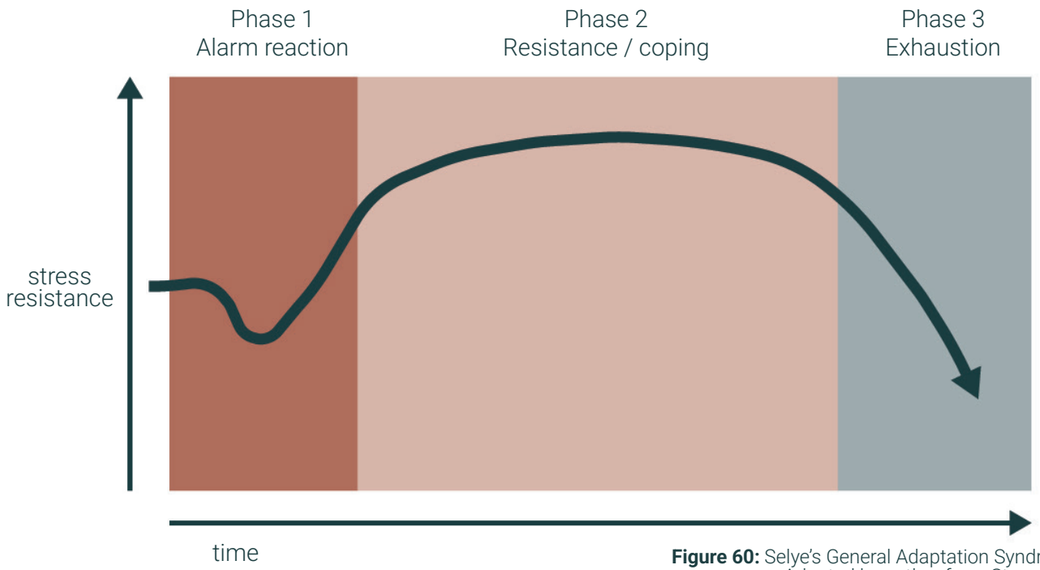


Figure 60: Selye's General Adaptation Syndrome (GAS)
Adapted by author from Steg et al. (2013)

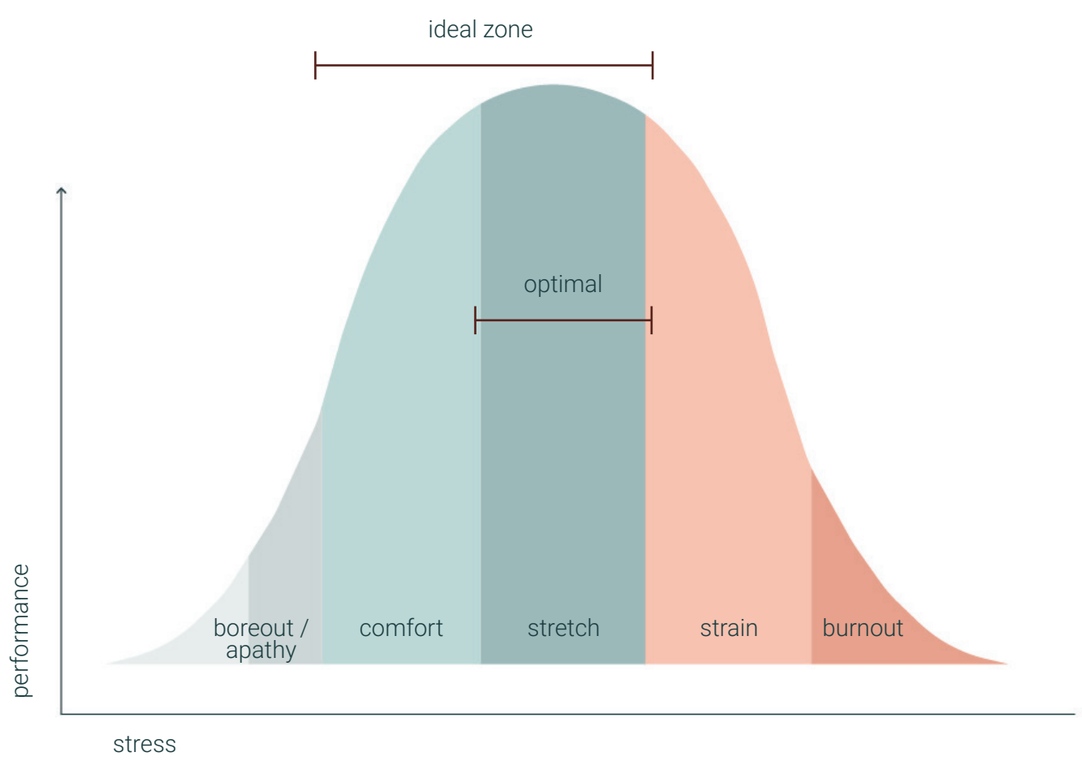


Figure 61: Pressure performance curve
Adapted by author from Thomas and Medellin (2025)

REGULATION THROUGH INTERACTION

insights from environmental psychology about stress regulation

To understand stress and regulation, several models have been developed. While there are many forms of stress or arousal, the one that is relevant for urban design is caused by environmental stimulation. This can activate the sympathetic-adrenal medullary (SAM) system which is associated with the fight-or-flight response (Steg et al., 2013). Although this has historically been an evolutionary life-saving system, it can activate unnecessarily in modern environments like urban public spaces.

Seyle's biological model of stress, the general adaptation syndrome shown in figure 60, includes three stages: alarm, resistance/coping, and exhaustion (Steg et al., 2013). When stress occurs, the body tries to resist by expending energy. When the stimulation does not end before too much energy is used up, exhaustion happens.This is important because it shows the two sides of dealing with stress: reducing stimulation can delay the moment where stress occurs, while coping mechanisms can make sure it does not reach the point of exhaustion.

Psychology has different models for stress. The pressure performance curve based on the Yerkes-Dodson law explains the relation between stress and performance (Nickerson, 2025), and is shown in figure 61. Up to a certain point, stress or mental arousal is beneficial. Reviews of this curve have created a nuance: more simple routine tasks benefit from higher arousal, while complex cognitive tasks benefit from lower arousal (Nickerson, 2025).

This highlights the importance of the ability to regulate stimulation through coping mechanisms, which is also supported by research on use of the public space by neurodivergent people (Aminpour, 2026; Gadion et al., 2023). Design can make allowances in space to enable people to interact with their environment in different ways that may serve as coping mechanisms.

REGULATION THROUGH INTERACTION

Variability of affordances

Based on the variety of users and their varying stress levels and needs, the public space can provide different kinds of invitations for interaction through spatial characteristics. These can be called affordances. Based on the conclusions from the previous subquestions, several affordance categories are defined. They are shown in figure 62, and follow from combining ideas from literature.

Starting with the Human Design Toolbox, Gehl (2013) mentions 'providing opportunities', which are affordances that invite various forms of interaction.

Movement: There should be room for walking without obstacles. The space should be accessible for everyone and have good surface materials.

Resting: This includes creating attractive zones to linger in, supports for standing, good places for sitting, and using environmental advantages like interesting views, the sun, and places where people already gather.

Orientation: Gehl mentions reasonable viewing distances and unhindered sightlines. This overlaps with various principles from imageability like visual corridors, movement clarity, and more aspects increasing the ease of orientation. That is why they are grouped together in one category of the affordance framework.

Social: Street furniture and general design should stimulate talking and other activities for people to do together.

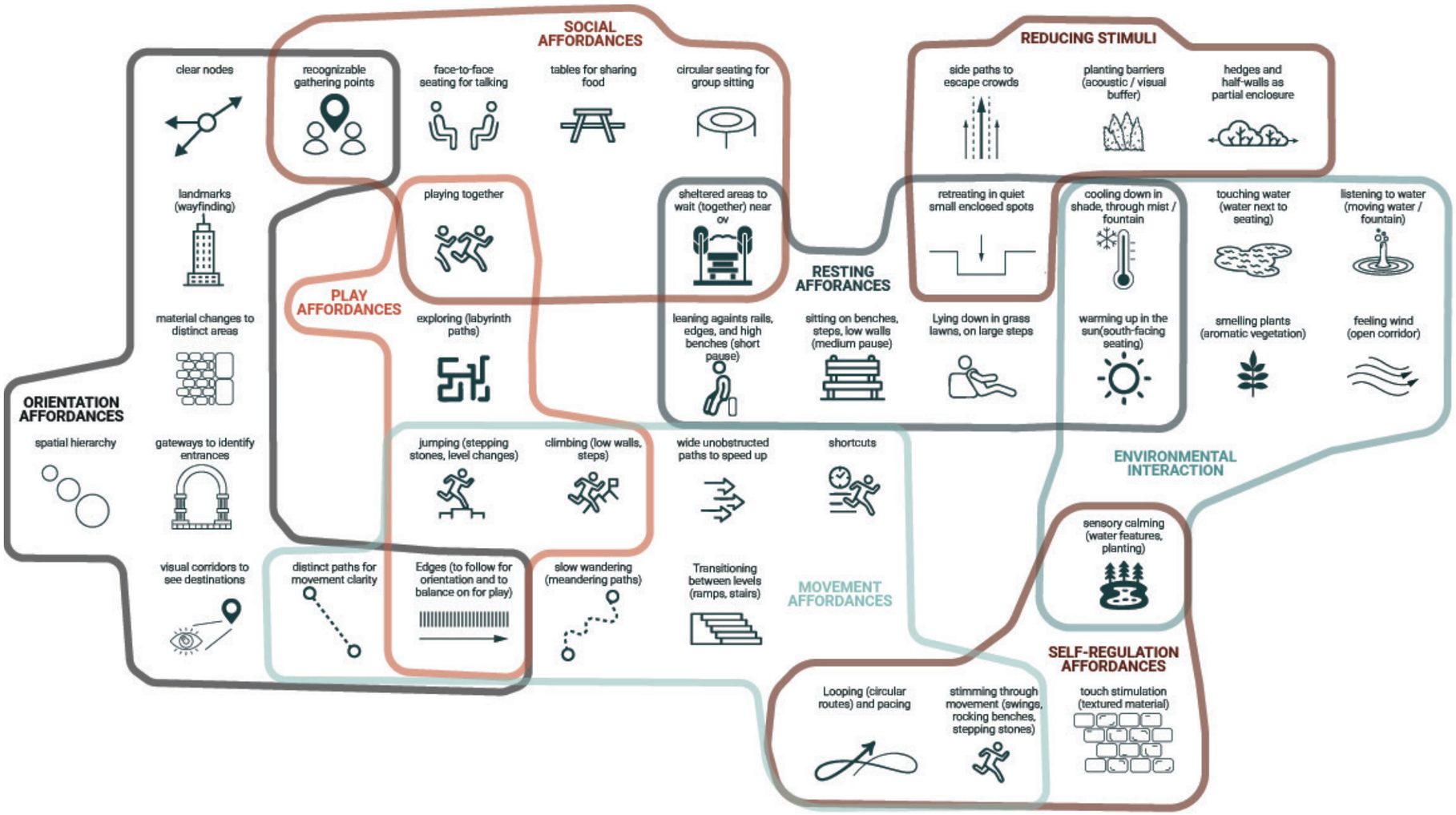


Figure 62: Affordance categories
Created by author

Play: Public space should invite creativity, physical activity, exercise, and play.

Environmental affordances: Trees, plants, water, sun and shade, heat and coolness, and breeze form environmental interactions. This is backed up by many studies that have found evidence that interacting with natural environments can have a stress-reducing effect (Steg et al., 2013; Mitchell & Popham, 2008; De Vries et al., 2003). Studies also seem to suggest that the accessibility and usability of green spaces are more important in this regard than quantity (Zhang et al., 2015; Van Dillen et al., 2011).

Adding the conclusions from the exploration of neurodivergence back in, some of the characteristics that neurodivergent people experience can already be accommodated through these affordances (e.g., regulation through movement and distraction making orientation difficult). One addition is the need for reduced stimuli, based on the characteristic of struggling to combine sensory systems and overstimulation.

The next step is to spatialize this by determining locations that show potential for specific affordances. For environmental interaction, these can be parks and planting, shade and sun, and wind amplification and reduction. As the other categories rely on less measurable factors, street characters are analyzed visually.

POTENTIAL: ENVIRONMENTAL INTERACTION

parks and planting

The map in figure 63 shows the water, grass lawns, and trees, in order to get an idea of the larger areas of the urban green-blue infrastructure surrounding the Binnenrotte. These may offer opportunities to create environmental affordances.



Figure 63: Trees, water, and grass lawns
Created by author OpenStreetMap data (OpenStreetMap contributors, 2026)

Sint-Jacobspark

Sint-Jacobspark is the main park in the area. It is located on a slight slope, creating a view over the Binnenrotte. There are grass lawns, benches spread along paths, play areas for children, and a dedicated dog area.



Figure 64: Sint-Jacobspark
Photograph made by author



Figure 65: Sint-Jacobspark
Photograph made by author



Figure 66: Sint-Jacobspark
Photograph made by author

Kerkplein

Kerkplein is a small square wedged between the church, the Delftsevaart canal, and several buildings that host public and commercial functions. There is a grass lawn, a statue of Erasmus, many benches, and a lowered concrete stepped seating area on the canal. In between these steps and the rest of Kerkplein, there is a stage where events often take place and where people can also sit.



Figure 67: Kerkplein
Photograph made by author



Figure 68: Kerkplein
Photograph made by author

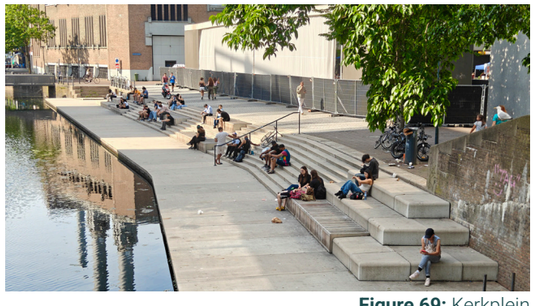


Figure 69: Kerkplein
Photograph made by author

POTENTIAL: ENVIRONMENTAL INTERACTION

shade & sun

Knowing where shade and sun are at different times and in different seasons can inform design decisions regarding interaction with the environment.

The maps on the right show sunny and shady spots in the summer and winter during different times. Sunny spots in the winter, shady spots in the summer, and the last sunny spots in summer are labeled, as these are often where people like to stay.

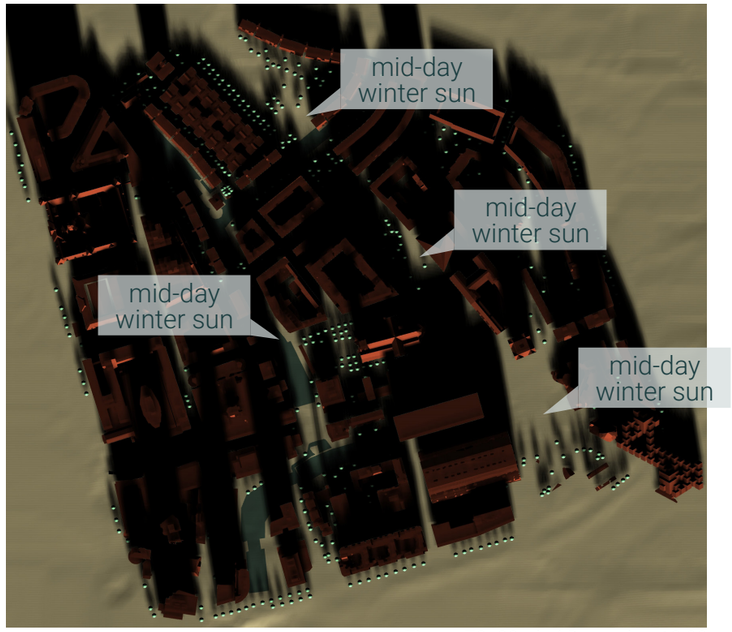


Figure 70: 22nd of December 12.00
Created by author in Rhino; geometry derived from TopoExport

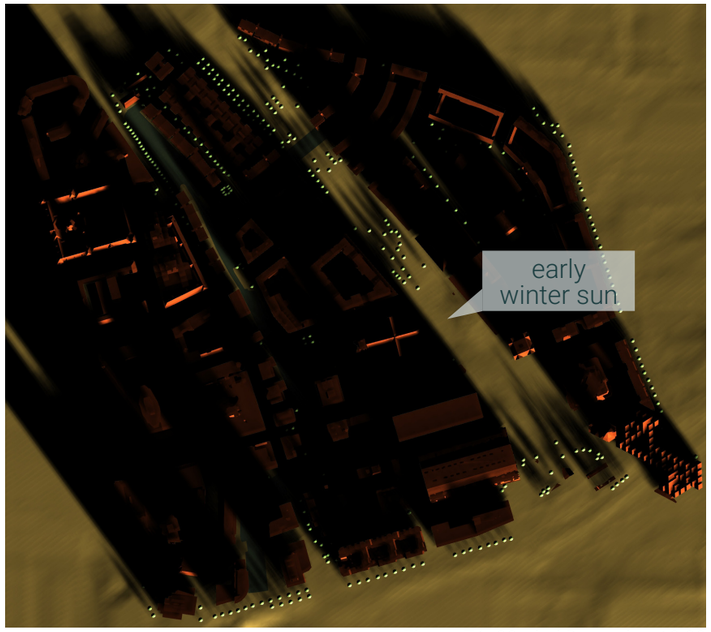


Figure 71: 22nd of December 10.00
Created by author in Rhino; geometry derived from TopoExport



Figure 72: 22nd of June 20.00
Created by author in Rhino; geometry derived from TopoExport

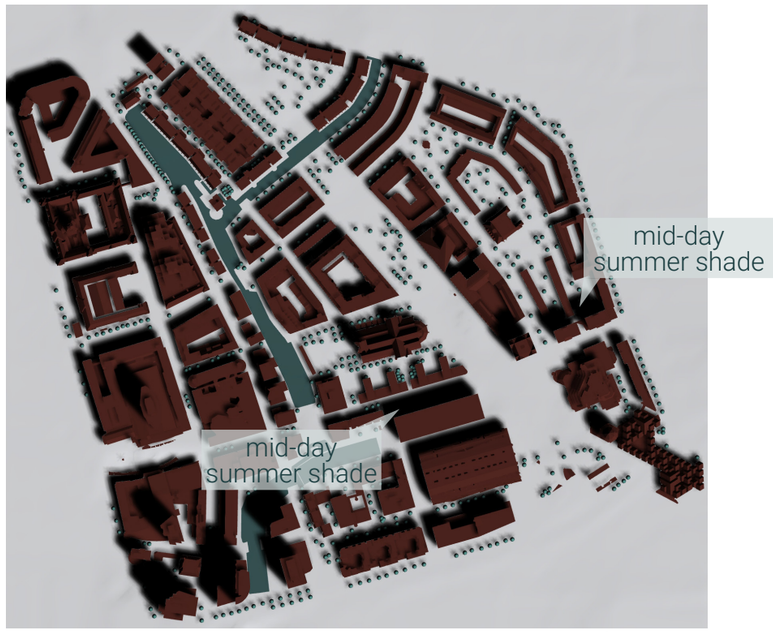


Figure 73: 22nd of June 12.00
Created by author in Rhino; geometry derived from TopoExport

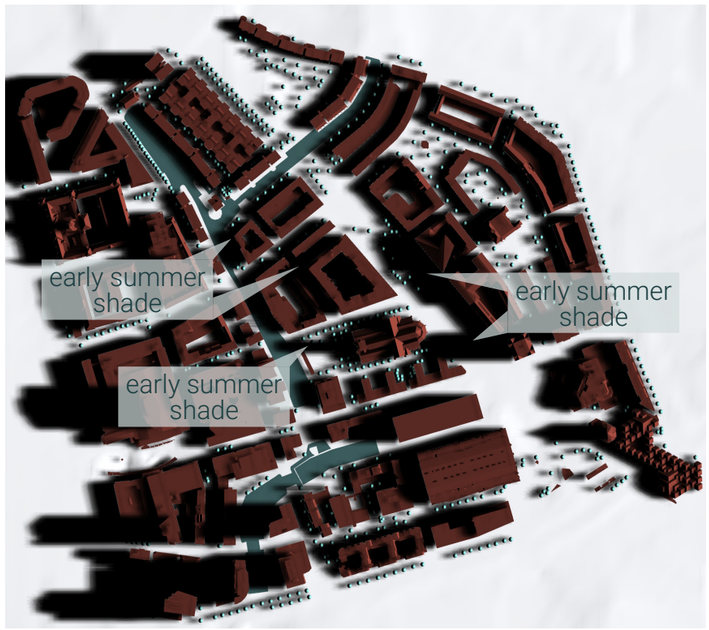


Figure 74: 22nd of June 09.00
Created by author in Rhino; geometry derived from TopoExport

POTENTIAL: ENVIRONMENTAL INTERACTION

wind amplification and reduction

Objects in the environment can amplify or reduce wind speeds, creating places where you can feel the wind more or less. Areas where wind is reduced across multiple wind directions can be great spaces to retreat and take longer pauses, especially in colder weather. On hot summer days, an area where wind is amplified may be a good place to cool down, especially if there is also shade. Wind amplification and reduction zones in different wind directions are shown in figure 75.

After identifying amplified and reduced areas in each wind direction, the layering of these points to clusters where amplification or reduction is relatively consistent across different wind directions (figure 76).

In this area, the most significant reduction clusters are the north end of the Binnenrotte, the Grote Kerkplein, and some along the Mariniersweg. Amplification areas are on the crossing of the Binnenrotte and Hoogstraat, the Korte Hoogstraat, and Blaak.

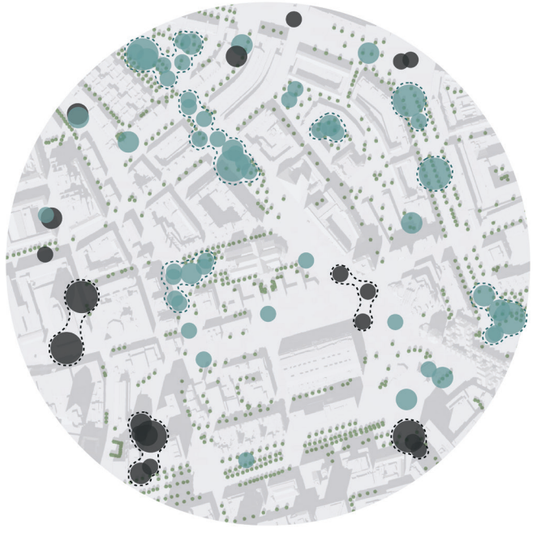


Figure 76: Amplification clusters
Analysis by author using ArchiWind simulation software

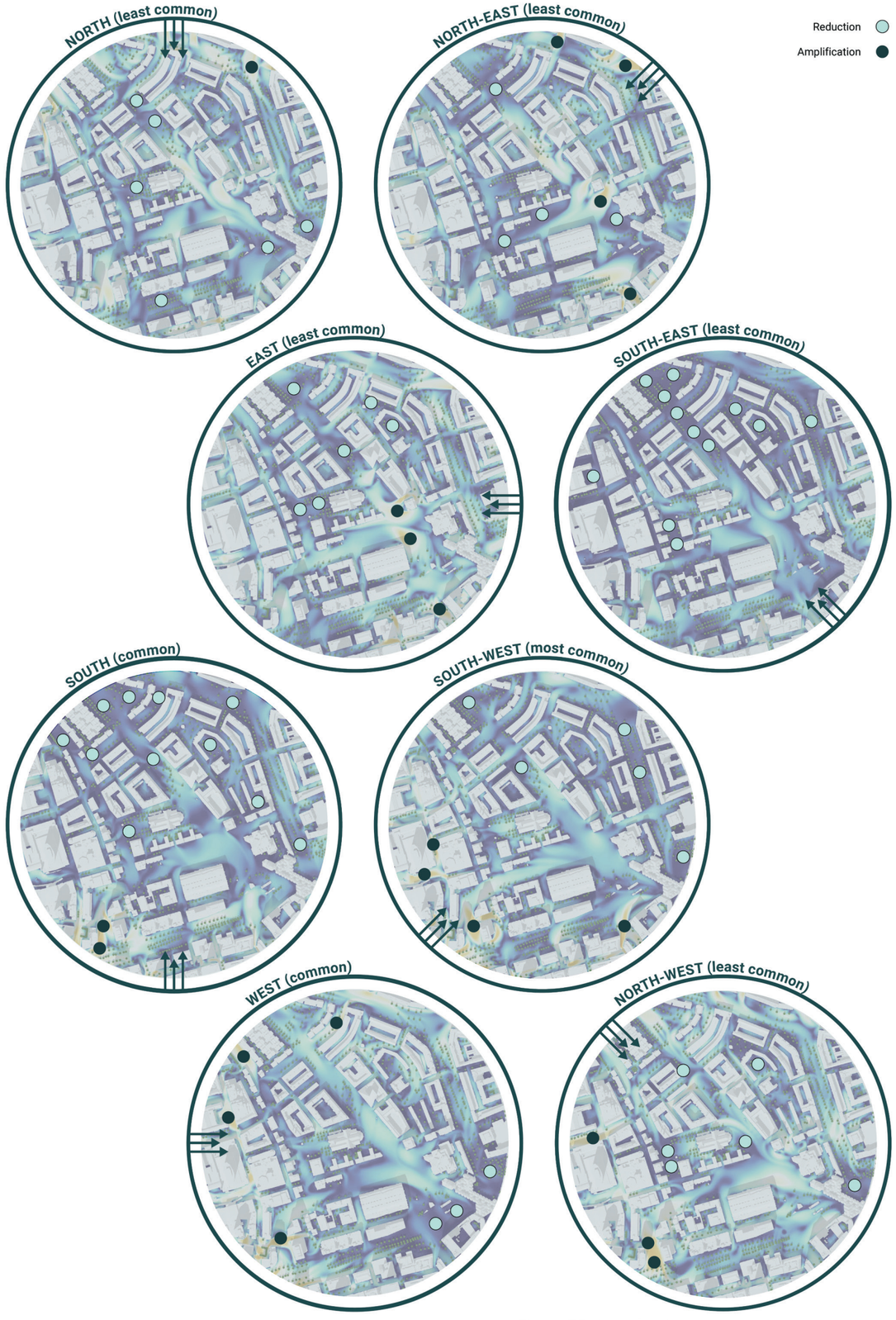


Figure 75: Amplification and reduction per wind direction
Analysis by the author using ArchiWind simulation software

POTENTIAL: STREET CHARACTERS

street character and potential

Not all streets have a similar character. Figure 77 shows the elements in different streets that determine their character, which may show potential for certain affordance types over others.

1. Binnenrotte: On non-market days, the full width of the space is open. The first ground is mostly occupied by commercial functions.

2. Botersloot: A relatively closed-off facade and large advertisements reduce intimacy. This also seems a main parking space for bicycles.

3. Kerkplein south: This is a smaller scale, especially coming off the Binnenrotte. Planting gives a sense of calm. The historic church is the main viewpoint.

4. Kerkplein north: The corner restaurant and its outside tables draw the most attention, there are multiple trees, there is a relatively small scale compared to the adjacent Binnenrotte.

5. Kerkplein west: People often sit on the stone steps next to the water, the podium serves as event space, there is a strong visual connection to the other side of the water.

6. Oppert: One side has residential functions, the other a few shops. A lot of the facade is dedicated to the parking garage, so there is not a lot going on here and only a few people. The church forms a viewpoint.

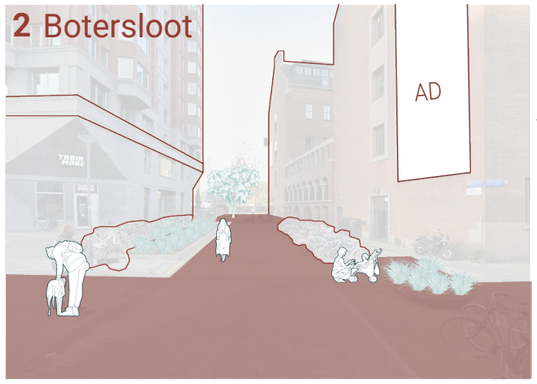
7. Meent: A busy shopping street, the main one in this area. Pavement space is often interrupted by parking spaces or sidewalk cafes, so there is not a lot of space to walk.

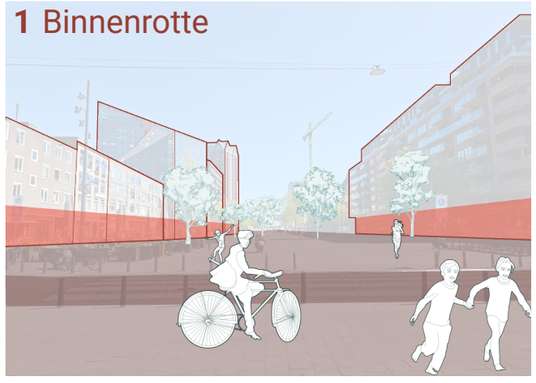
8. Lombardkade: A car-centric road on the waterfront with lots of parking. Functions are mostly residential, with some shops in the plinth.

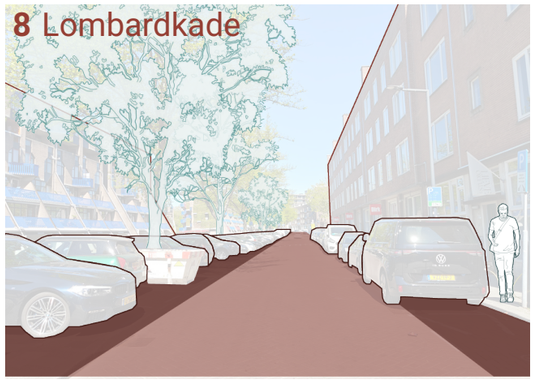


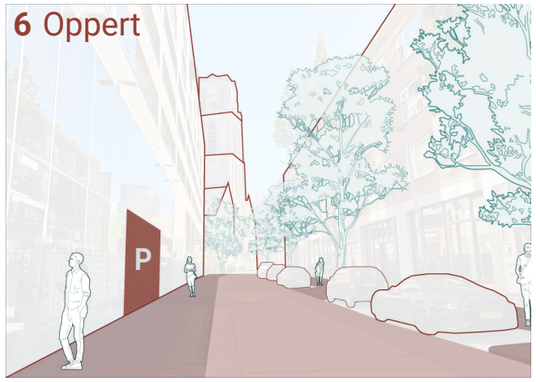
Figure 78: Locations street characters
Created by author with OpenStreetMap basemap (OpenStreetMap contributors, 2026)

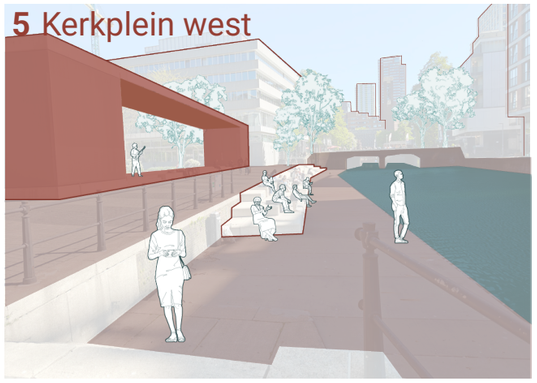














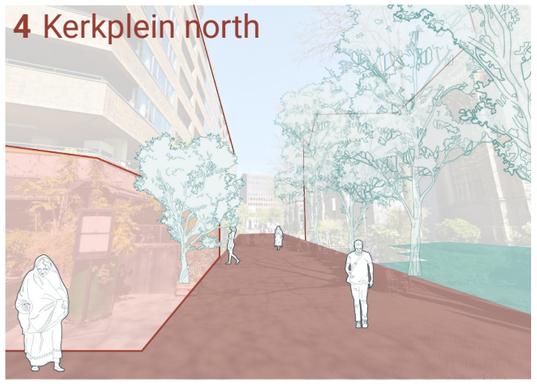


Figure 77: Street characters
Made by author

POTENTIAL: CAR PRESENCE

car presence now and planned

The characters of many streets are defined by heavy car presences. The municipality plans to reduce car presence in the center through their Traffic Circulation Plan (VCP) (Gemeente Rotterdam, 2024), relying more on other modes of traffic and parking garages for vehicle parking. Their plans, as well as current parking facilities and one-way streets, are shown in figure 79. On Pompenburg/Goudsesingel, a redesign of the street will reduce the number of lanes for car-use. This recovered space will be used for cyclists and calmer crossings. On the Mariniersweg, lanes will also be reduced from four to two, making space for added planting and possibly a small city park. The Meent and Hoogstraat have been designated as city streets with amenities, where people are encouraged to linger. A traffic filter on the Meent should keep out vehicles to strengthen this character.

There are currently 10 road segments in the area that allow only one-way vehicle access. The VCP plan includes several additions to this in order to lower road widths and free up space. These additions are currently not within the site area.

These interventions and the VCP in general are in line with the intentions set out in Rotterdam's first spatial vision: de Veranderstad (translation: the Change City) (Gemeente Rotterdam, 2021). The vision document stresses the municipality's aim to be healthy, inclusive, compact, circular, and productive. Among other principles, it states that public space should be designed in a way that encourages meeting for diverse residents, balancing the busy character of the city with calmness, and that less space will be allocated to cars.

This provides an opportunity for that space to be used in plans that increase wellbeing in different ways, in line with the direction of the municipality's vision.



Figure 80: Parking Meent
Photograph made by author

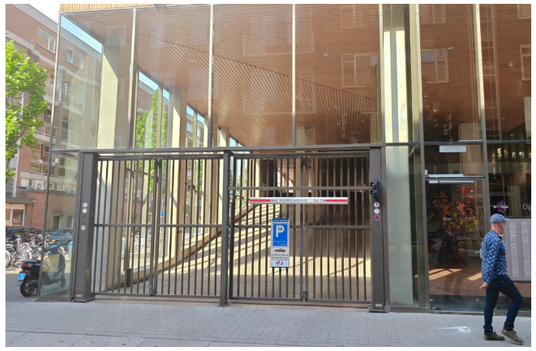


Figure 81: Parking garage Oppert
Photograph made by author



Figure 82: Parking garage Meent
Photograph made by author

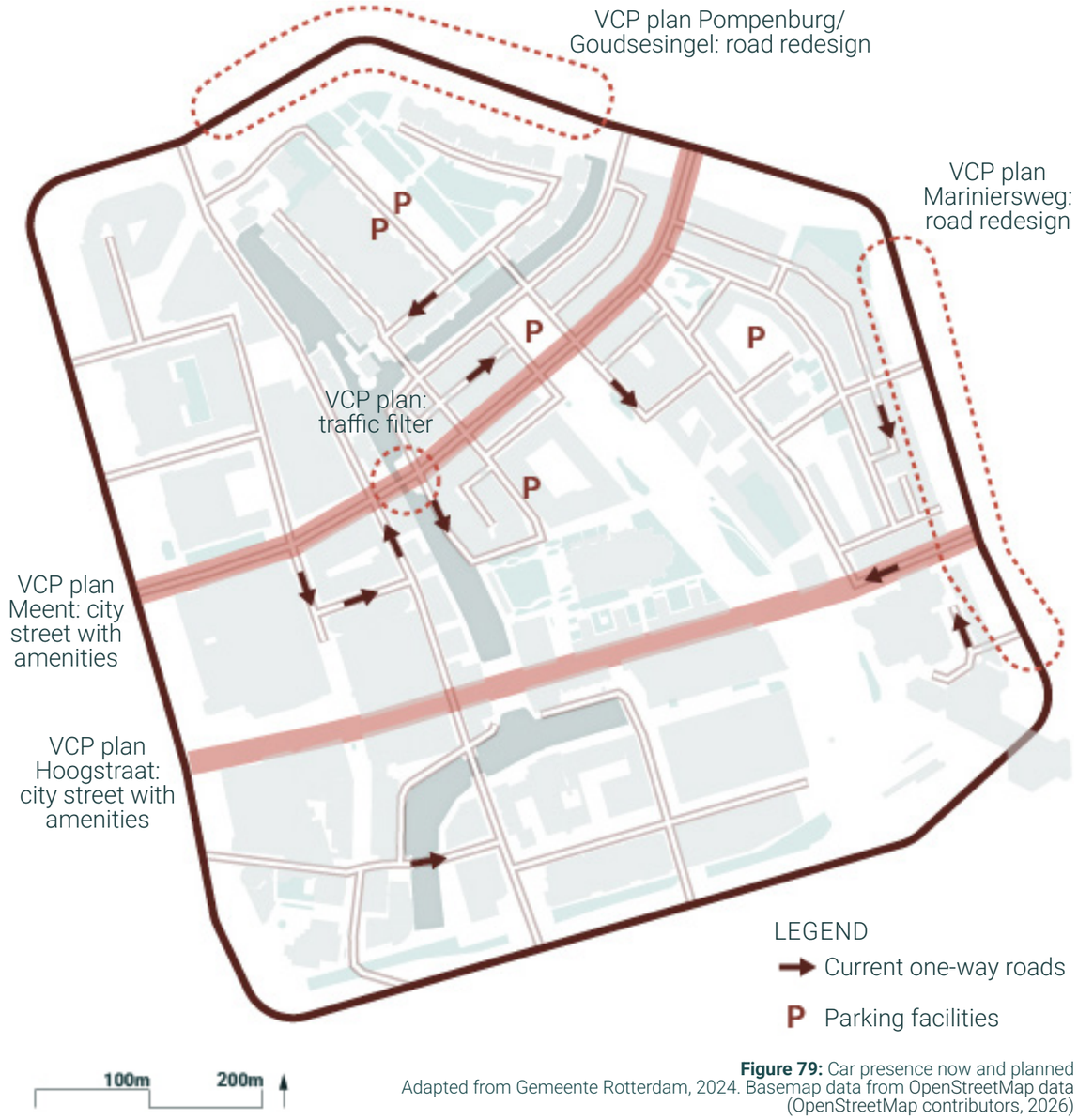


Figure 79: Car presence now and planned
Adapted from Gemeente Rotterdam, 2024. Basemap data from OpenStreetMap data (OpenStreetMap contributors, 2026)

CHAPTER 6
NEURO-INCLUSIVE DESIGN

CHAPTER GUIDE

SQ4: What would a neuro-inclusive design for the public space surrounding the Binnenrotte look like?

This chapter uses the conclusions from each previous ubchapter to create a definition of neuro-inclusive design and apply it to the site towards the goals of improving wellbeing in use of the public space.

VISION

flexibility through multiplicity: routes with different characters

Based on the conclusions from the previous subquestions, there are two ways to tackle a cognitively demanding environment: make the environment less demanding and provide varying opportunities for people to regulate their stimulation level. Regulation can be helpful in the case of overstimulation as well as understimulation. A neuro-inclusive public space should do both.

Routes

Different categories of affordances may clash with one another, while others may form synergies. At the same time, the bi-weekly market creates changing conditions throughout the week that mean the large space of the Binnenrotte is needed, reducing the potential for interventions. Instead, the focus shifts to the surrounding area.

The vision consists of a network with multiple routes. The main route still needs to be easy to orientate on and move through in order to lower the cognitive demand. Beyond that, most space is left for the market instead of affordances.

This is complimented by two alternative routes, where individuals can switch between depending on their needs and moods. This covers the second goal of providing varying opportunities for people to regulate their stimulation level. One is a calmer route for those who may benefit from reduced stimulation, and the other is a lively route where affordances are social and more stimulating. These routes, with examples of affordances fitting their character, are visualized in figure 85. This essentially creates a varied system within the existing street network, aiming to create value in the domains of well-being and social life.

In order to spatialize this abstract vision, conclusions from the analyses should be layered together.

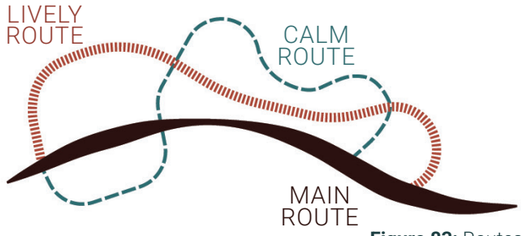


Figure 83: Routes
Created by author

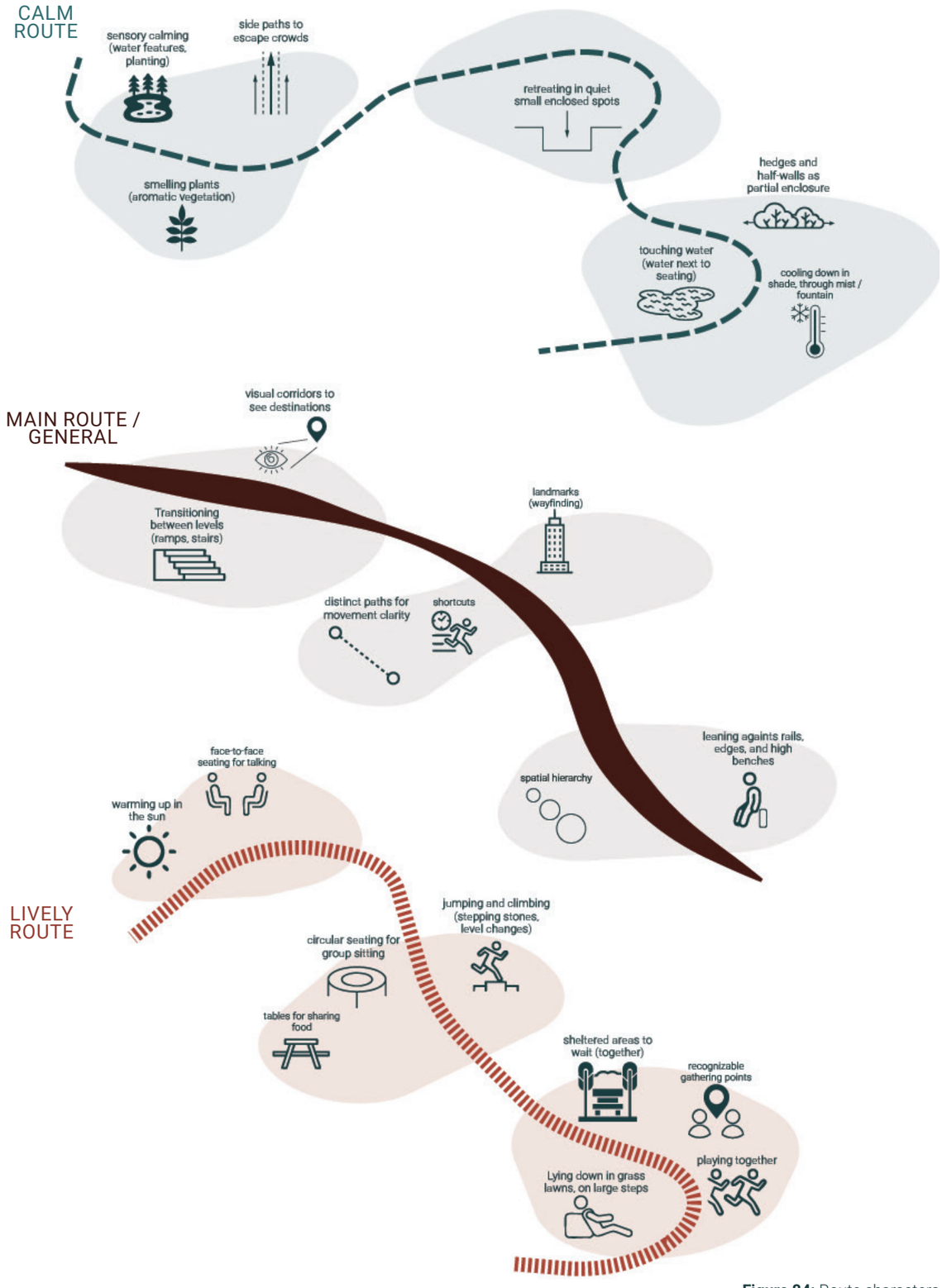


Figure 84: Route characters
Created by author

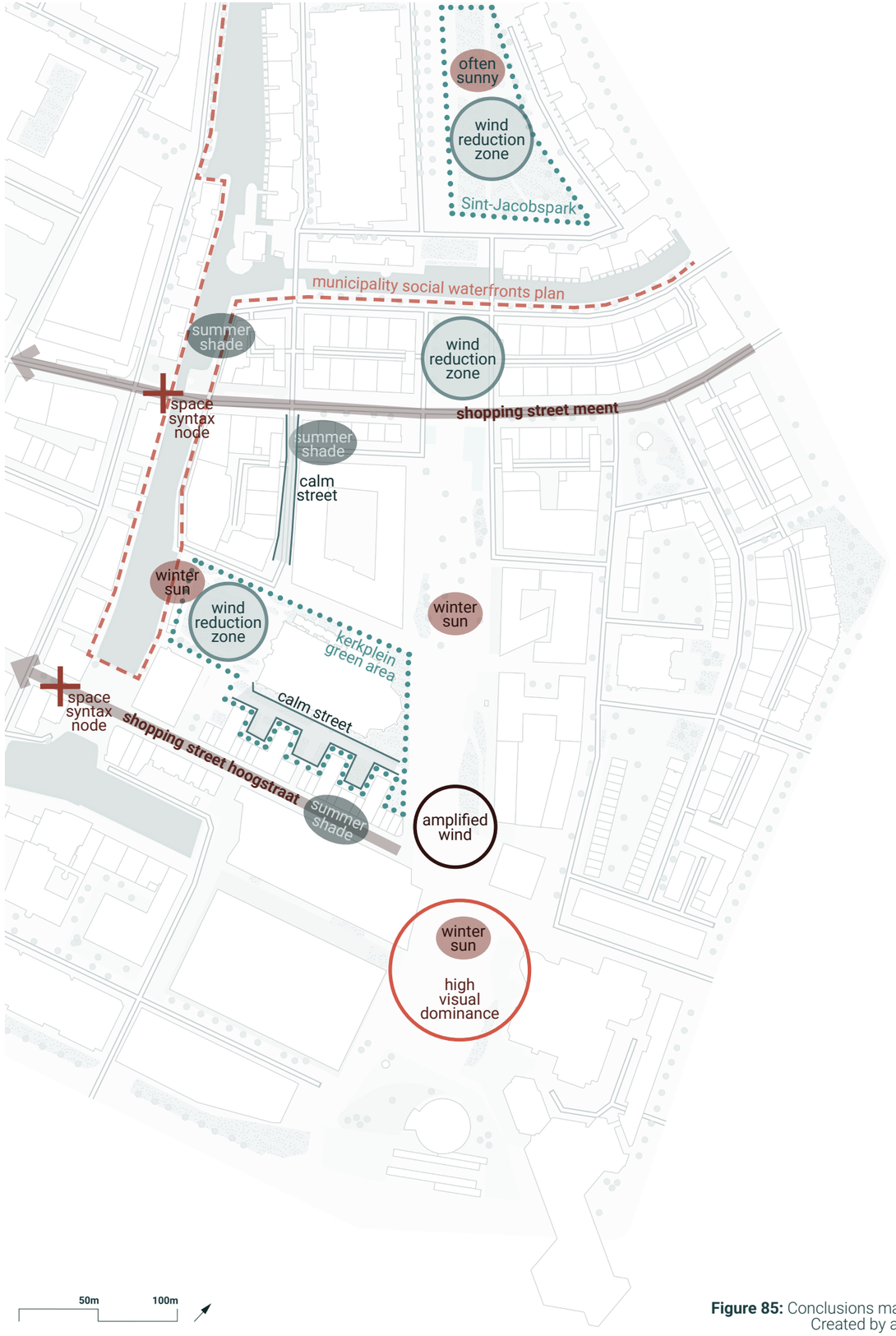


Figure 85: Conclusions mapped
Created by author

CONCLUSIONS MAPPED

Figure 85 shows the combined conclusions from the mapped factors based on subquestions one and three.

Some factors might be beneficial for either route. Summer shade and winter sun can form good sensory experiences whether an individual is seeking refuge on the calm route or social gathering on the lively route. The same can be said for wind reduction zones.

Other factors, like streets that have either a more calm or lively character, may form clues to guide the routing of the specific characters. These have been separated to show the reasoning behind the locations of the two alternative routes shown in figure 86 and 87.

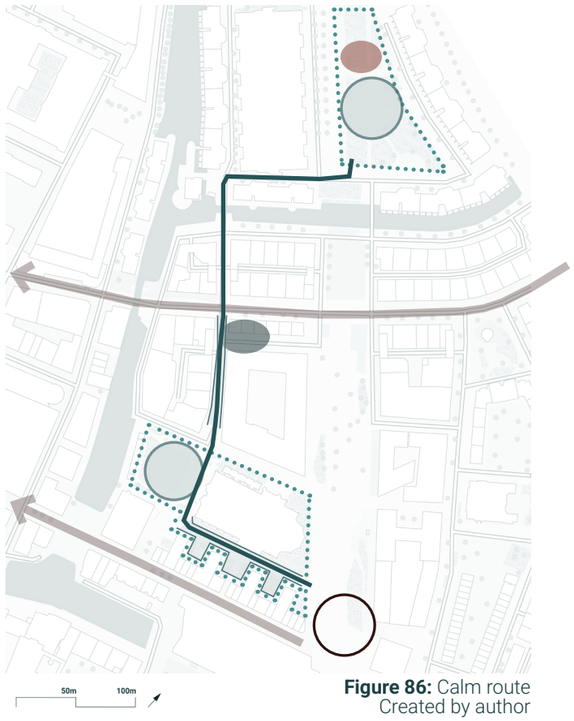


Figure 86: Calm route
Created by author

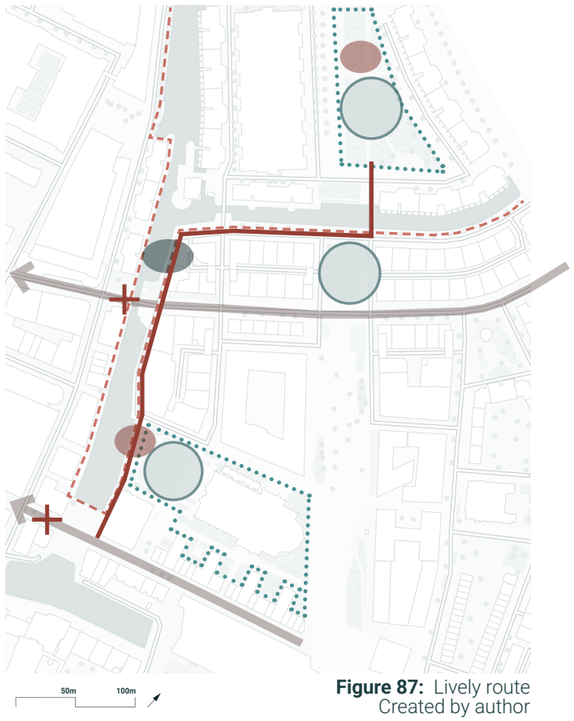


Figure 87: Lively route
Created by author

PLAN

Spatial interventions that will help actualize the vision focus on making the existence of the routes more visible or on strengthening the character of the routes. Before designing, it is important to know where space can be found for them.

The municipality's VCP already reduces car presence through street interventions in order to make space for pedestrians, cyclists, and planting. These interventions are expanded in the plan to make space for the design in line with the project's stance of choosing human well-being as the main driver in public space design instead of commercial efficiency.



Figure 88: Routes
Created by author with OpenStreetMap basemap data (OpenStreetMap contributors, 2026)

The large parking space would be removed, making place for a small public square where people are able to linger without paying (opposed to the nearby cafe terraces). Verticality is needed to make this form as a visual anchor to mark this end of the Binnenrotte before the canal, and the form should also visually connect to Sint-Jacobspark. Situated on the lively route, affordances would focus on social gathering, play, and orientation.

Taking away the two lanes of parking on the Lombardkade would create 8 meters of space in the street section.

The location of the car road shifts after a crossing to create difference to improve imageability.

At intersections between the Binnerotte and branching streets, smaller orientation points improve movement clarity on the Binnenrotte by creating rhythm and through smaller vertical elements (e.g., a statue) that can be seen from far.

The Delftsevaart has a width of 7 meters. This one-way road does not have a lot of room, but it is on the waterfront. The road and pavement are already leveled to allow more space for pedestrians as cars do not often use this route. Small interventions could include smaller street furniture overlooking the water and material changes to encourage play and movement, like hopskotch markings and chalk mazes.

The southernmost street between the Binnenrotte and Grotekerkplein is the earliest branche-off when walking from Blaak towards Meent. Material gradients can signal the beginning of the calm route.

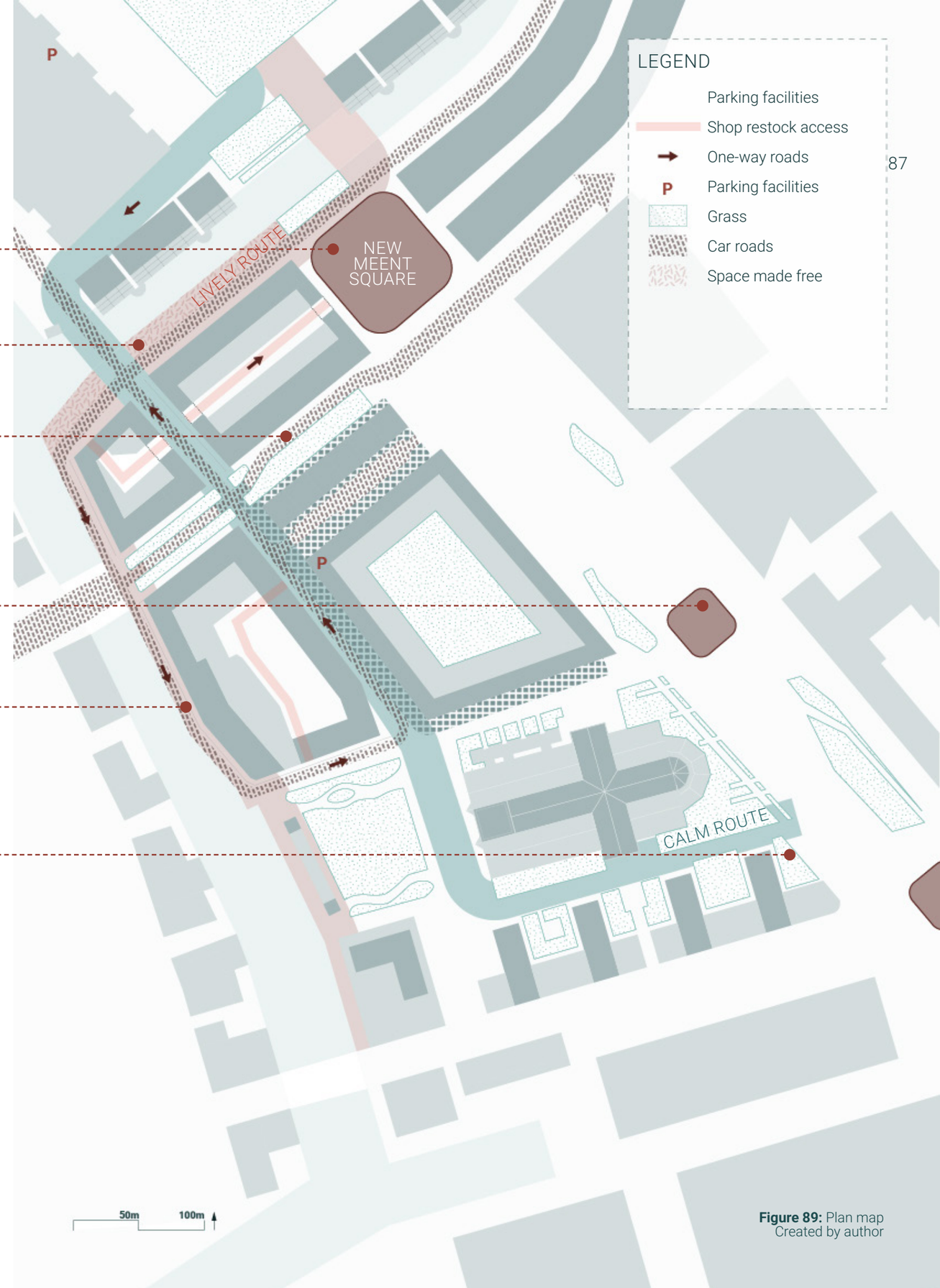


Figure 89: Plan map
Created by author

INTERVENTIONS

Areas to be further developed

Interventions that work towards the actualizion of the routes include the creation of regulation zones and street reorganisations, depending on existing conditions and available space. On the alternative routes, the intention is to invite lingering in different ways, and to cross streets with different characters without compromising the function of either route.

INTERVENTION AREA PRIORITIES
Three locations were chosen for further development because the routes and existing conditions of the space create a potential conflict, and because opportunities were seen in the character of the spaces as well as amount of space available. While solutions in smaller spaces are just as valuable, the chosen spaces allowed for more compexity to show the potential of interventions.

Kerkplein
The context of the location includes the square function, which doubles as an event space, and the church as a viewing object. The design task forms around the proximity of the calm and lively route.

Oppert crossing
The context of this location is mostly the crowded Meent shopping street. The design task is having the calm route cross the shopping street in a way that functions well for both streets.

Stokvis bridge:
The waterfront is the most important aspect of the context here. The design task is the crossing of the calm and lively route.



Figure 90: Routes
Created by author with OpenStreetMap basemap data (OpenStreetMap contributors, 2026)

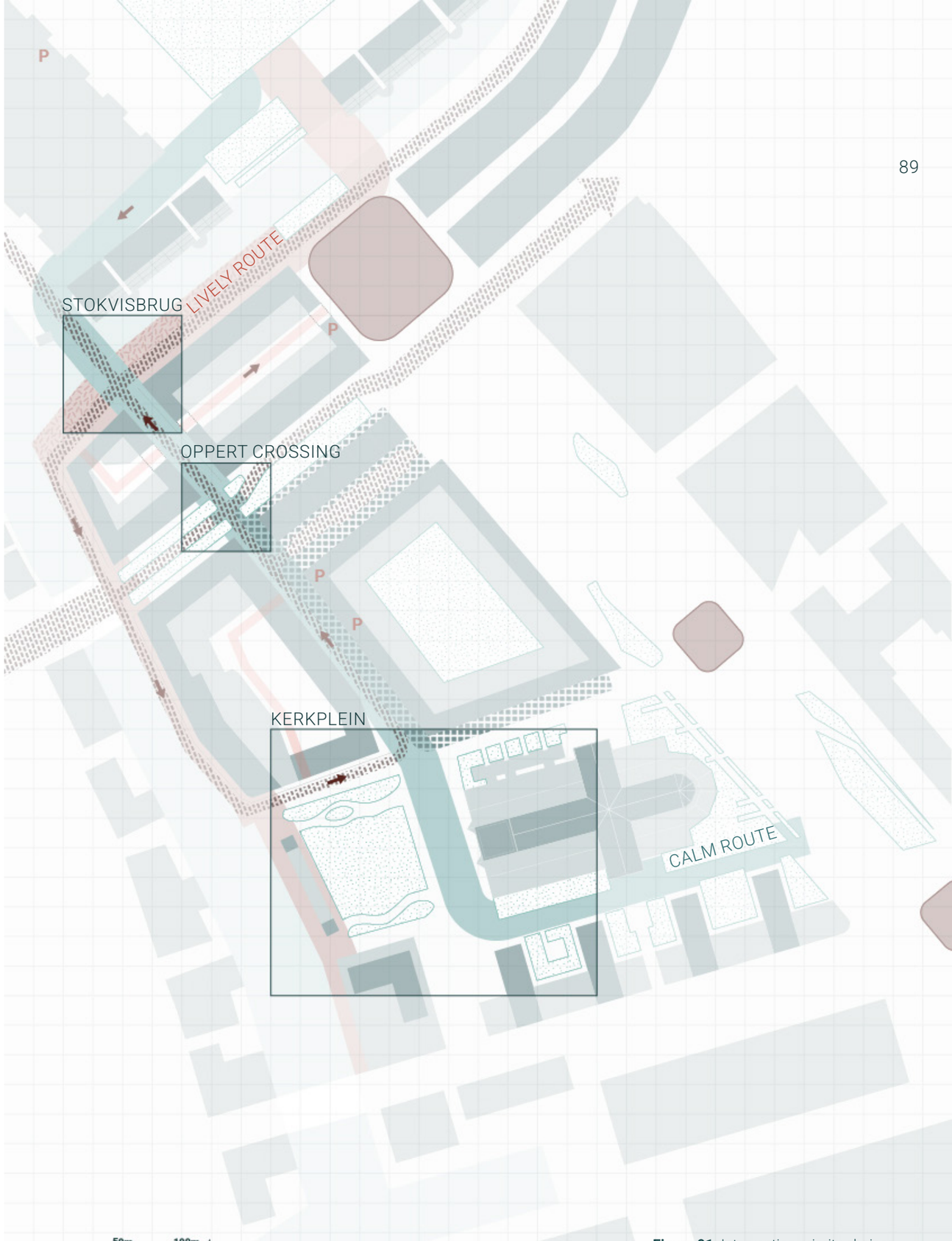


Figure 91: Intervention priority choices
Created by author

GROTEKERKPLEIN: PROXIMITY OF THE LIVELY AND CALM ROUTE

orientation, sheltered refuge, and social gathering

Situated right beside the large scale corridor of the Binnenrotte, Kerkplein is a smaller open space facing the church on one side and the Delftsevaart canal on the other. Grotekerkplein plays an important role in the area for lingering already, with the large planted areas, the church and public functions surrounding the square, the podium, and the events that take place here. Since the space is wedged between the proposed lively and calm route, as shown in figure 92, a transition is needed.

This is where the proposed sheltered refuge spaces come into play, dividing the space by creating small spaces protected from the noise as well as weather on the calm side. Seating faces the podium and the lively route on the other. The roof is walkable, creating space for observing and orienting.

The three existing recessed spaces form a big reason for the calm character of the street between Grotekerkplein and the Binnenrotte. The design continues this gesture with the form of the sheltered seating areas, as shown in the diagram in figure 93.

The existing recessed spaces are used to create single sense zones, combining reduced stimulation with environmental interaction affordances, which is shown conceptually in figure 94. The space closest to the Binnenrotte experiences the most noise. This is chosen as the sound zone, as a vegetative barrier can reduce incoming noise, and a fountain with flowing water adds sound. This is not only a more pleasant sound source than urban noises, their low frequencies are able to mask. The middle space connects to the busy Hoogstraat, allowing individuals to people-watch without needing to go into the street. The third space can be used as a smelling garden, with educational signs.

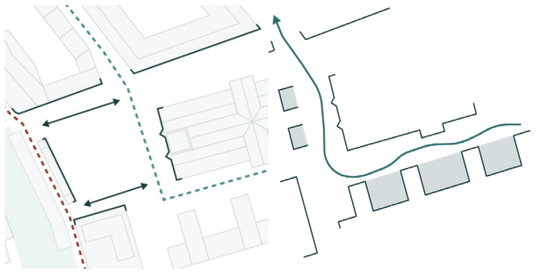


Figure 92: Proximity calm and lively route
Created by author

Figure 93: Recessed spaces along calm route
Created by author

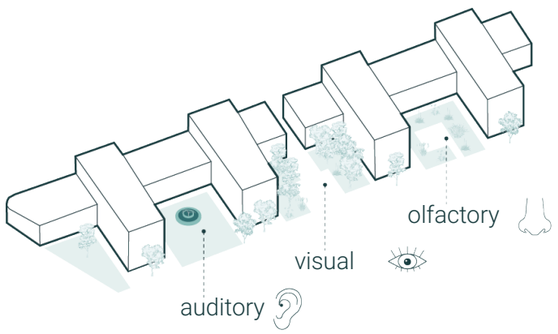


Figure 94: Single sense zones
Created by author

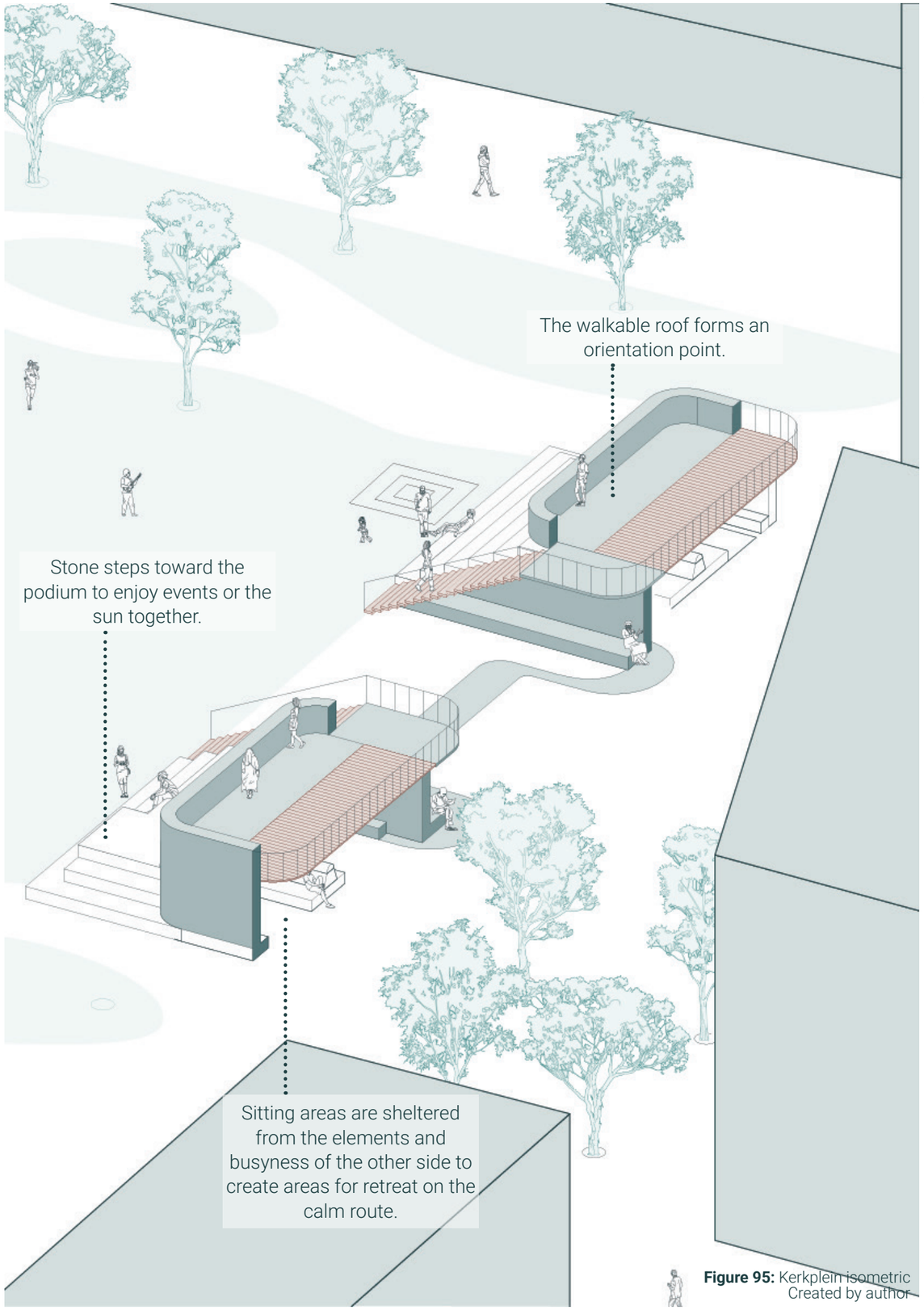


Figure 95: Kerkplein isometric
Created by author

CORNER
RESTAURANT

DAY / NIGHT
Sheltered areas can sometimes becomes unsafe spaces at night due to lower visibility and social control. The corner restaurant is open daily until 23.00 and the church regularly has evening programs. This provides the' eyes on the street' principle previously discussed with protection from crime.

CHURCH
FRONT
ENTRANCE

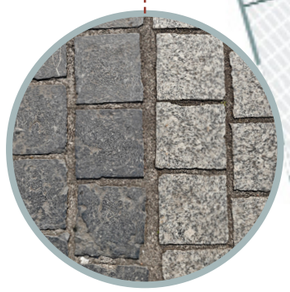
+3m

+0.4m

+3m

+0.75m





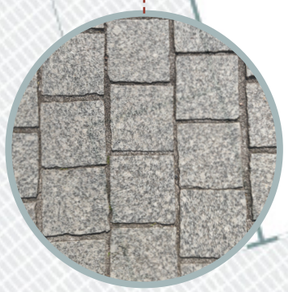


Figure 97: Material changes as subtle hints at changing characters
Photos made by author

SEASONAL CHANGE
The smelling garden should contain various types of vegetation that give off scents in different seasons. Viburnum bodnantense and Sweet box bloom in winter, Winter honeysuckle from december onwards, and Witch hazel from january untill March. Evergreens like Osmanthus and Skimmia maintain smells throughout the year.

Figure 96: Kerkplein map 1:500
Created by author

KERKPLEIN

orientation, sheltered refuge, and social gathering

The church impacts the community dynamics as well as the general social context of the square. Between it being one of the few remaining buildings from before the bombings in the Second World war, the religious function, and the community events held by the church, its value is undeniable. The design reacts to this by leaving enough space in front of the church and by having the design of the refuge space at a distance from eachother which frames the church rather than obscuring the view.

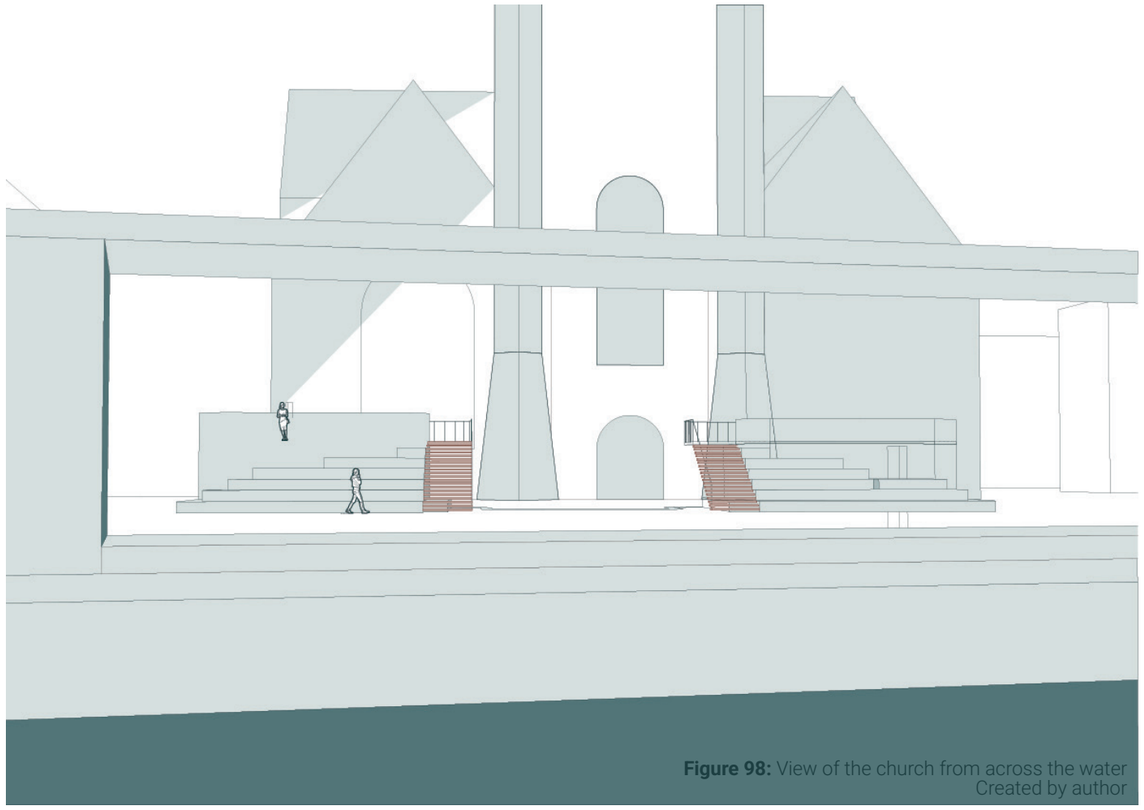


Figure 98: View of the church from across the water
Created by author

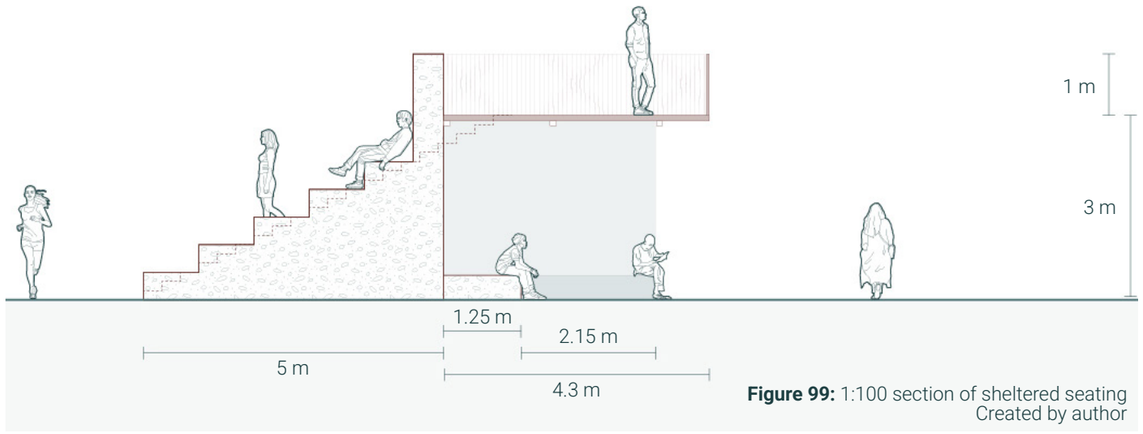


Figure 99: 1:100 section of sheltered seating
Created by author

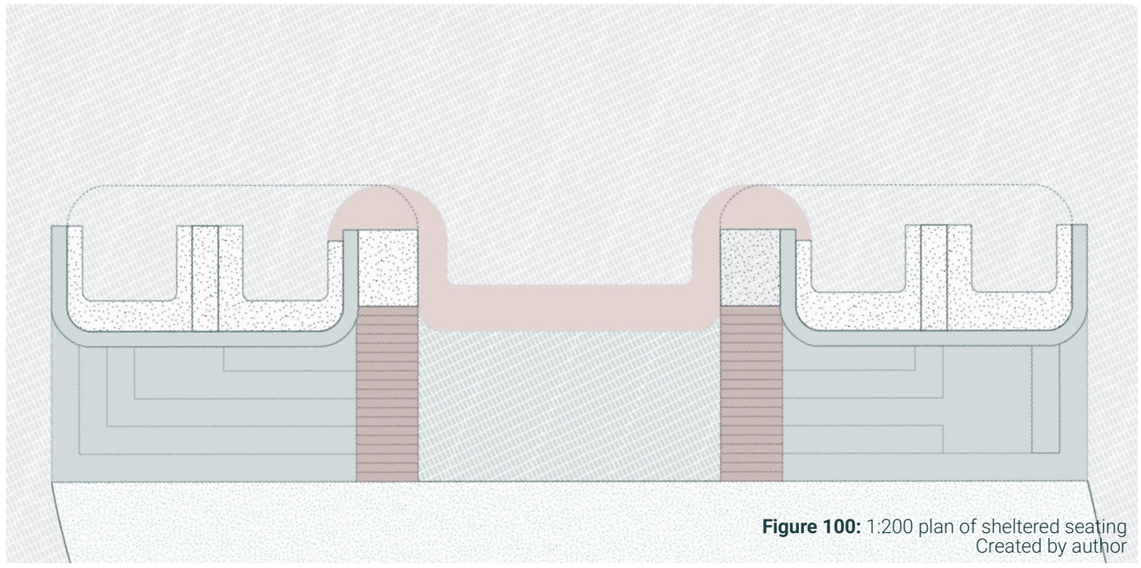


Figure 100: 1:200 plan of sheltered seating
Created by author

OPPERT

different ways of crossing

The Meent is a busy shopping street that crosses the northern part of the area. Space is currently mostly allocated to the entrances of the commercial functions and to cars. The municipality is already planning to make parts of the Meent car-free, with the exception of emergency vehicles and sweeper trucks. The design takes this into account on this location.

In the envisioned routes, a crossing would take place with the calm route on Oppert street. As these characters clash, the design task is formed around creating different ways of crossing. The intervention is an overpass allowing those walking over the Oppert to go over the Meent, being able to look over it, but not go into the busy commercial street itself. Another option is going underneath on the lowered path, which also has enough height to allow the vehicles that do need access here.

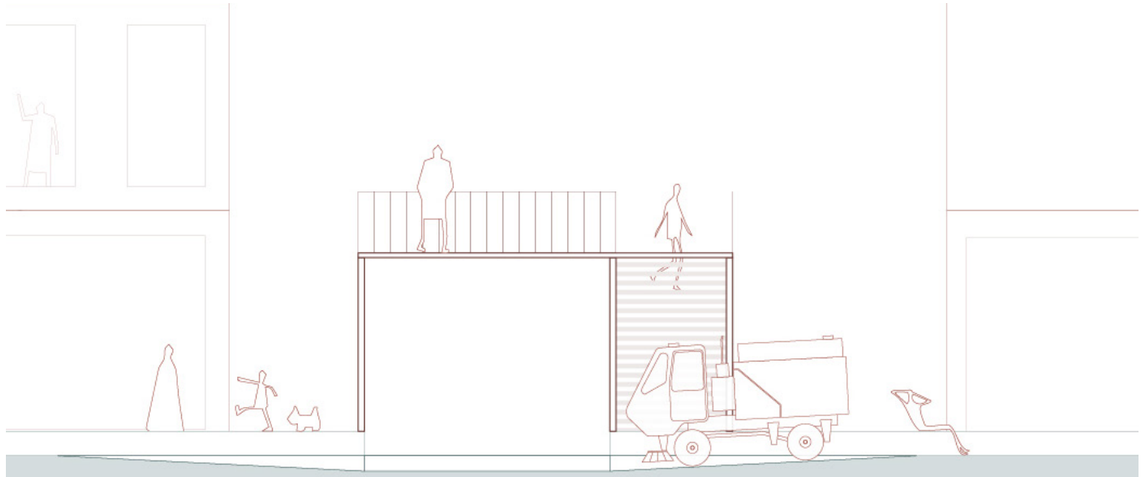


Figure 101: 1:100 section of Oppert overpass
Created by author

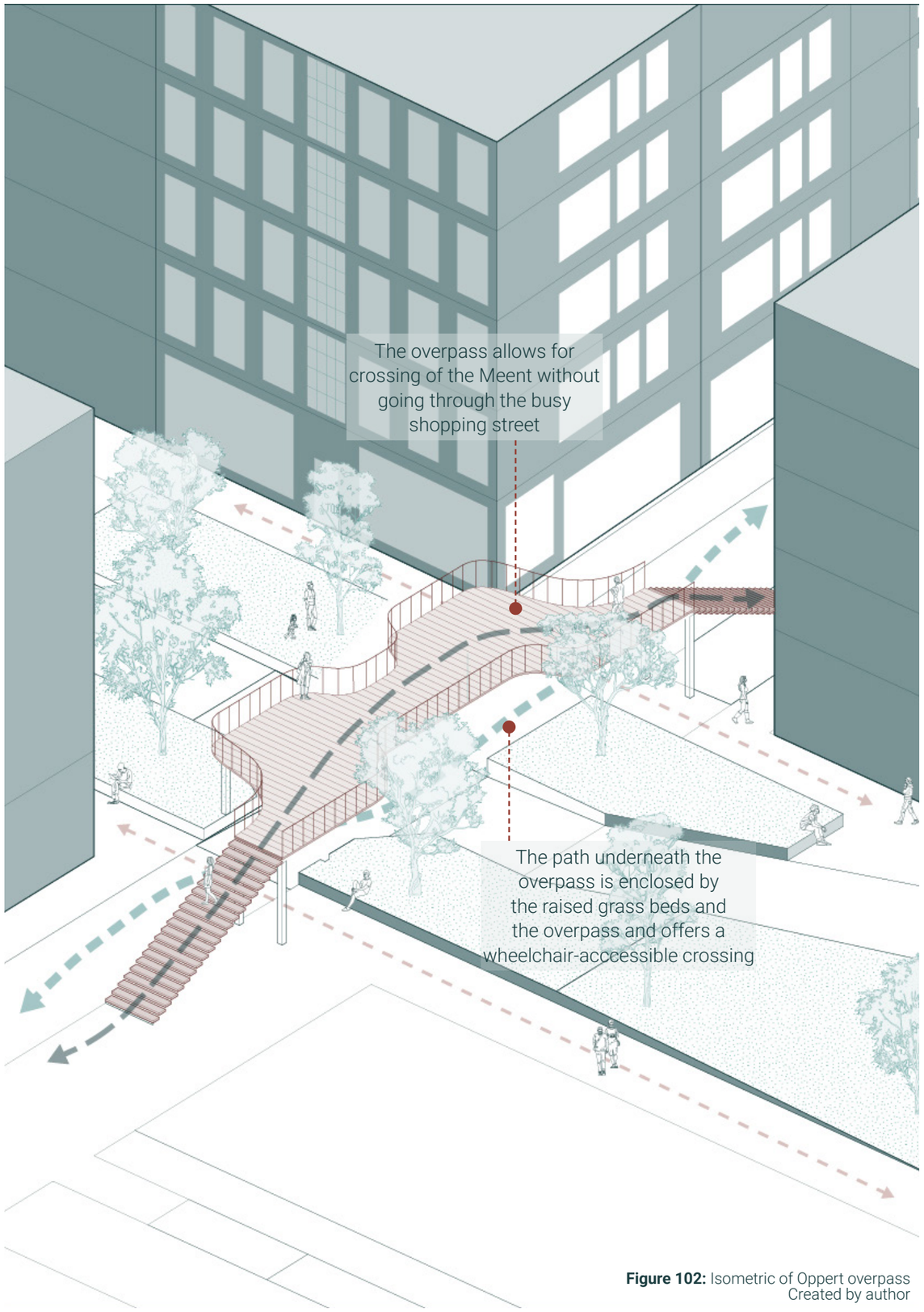


Figure 102: Isometric of Oppert overpass
Created by author

OPPERT

crossing between the calm route and shopping street Meent

As car use will be very limited here, the street can be on one level. Material changes can still communicate the path vehicles will take, preventing confusion when do they do need to be here. There is no need to completely redo the materials here, as there are already different pavers on the current car road and pavement which can remain as large parts of the pavement can remain as they are now. The material used on the calm route on Grotekerkplein are continued here.

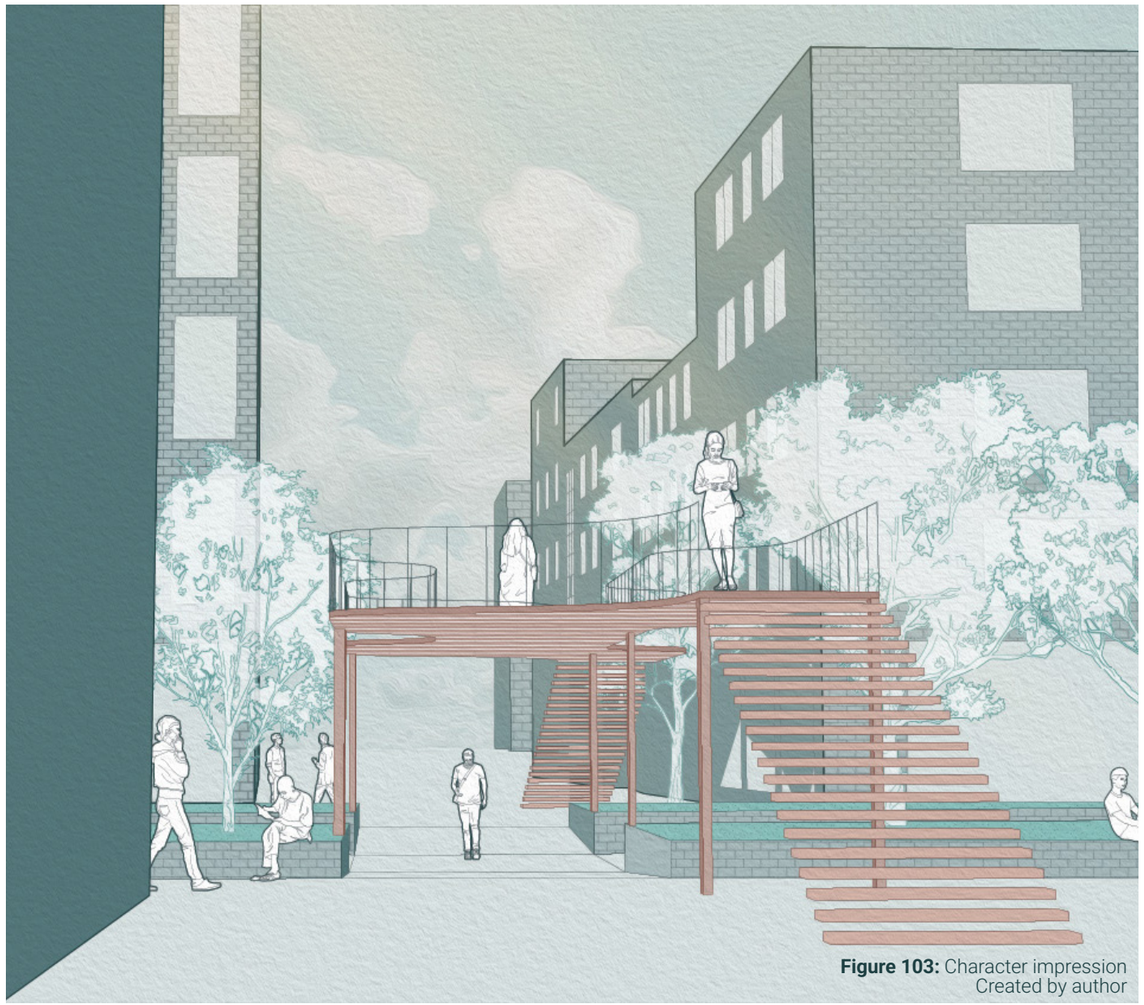


Figure 103: Character impression
Created by author

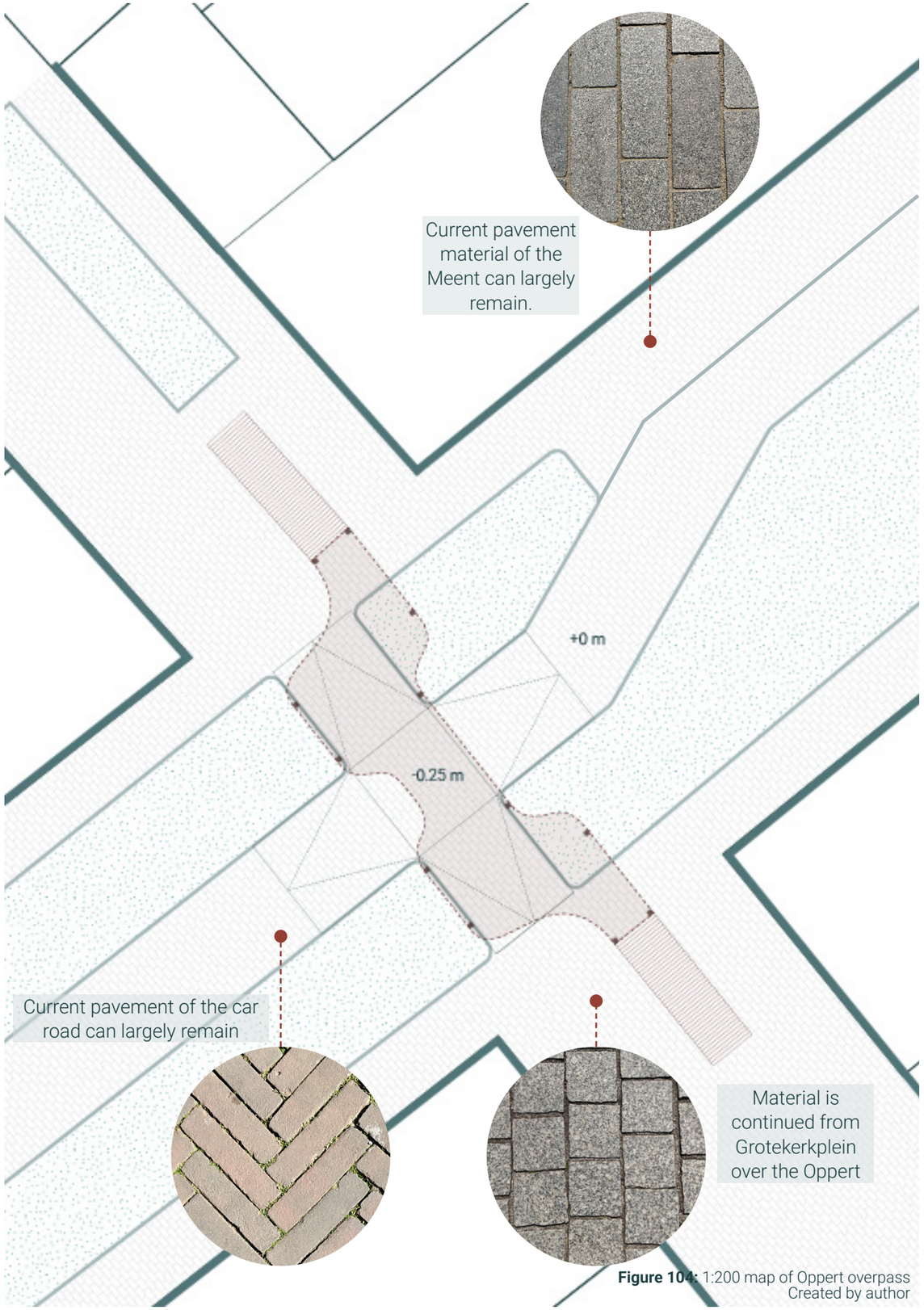


Figure 104: 1:200 map of Oppert overpass
Created by author

STOKVISBRUG

crossing between the lively and calm route

The Lombardkade is currently mostly occupied by car parking. According to municipalities plan, the waterfronts are going to be transformed to become social spaces. At Stokvisbrug, Lombardkade and Oppert intersect, creating a crossing between the envisioned lively and calm route. As this road remains necessary for car mobility, this is a third factor of the context.

The design task stems from the crossing of the calm and lively route. The design segments the Lombardkade into strips of different levels with different functions. The highest level allows unimpeded movement, while the lower level has seating to allow sitting together near the water. Surrounding the crossing, the elevation changes create some distance between the ongoing calm route and locations meant for lingering together to prevent disruption of the calm route.

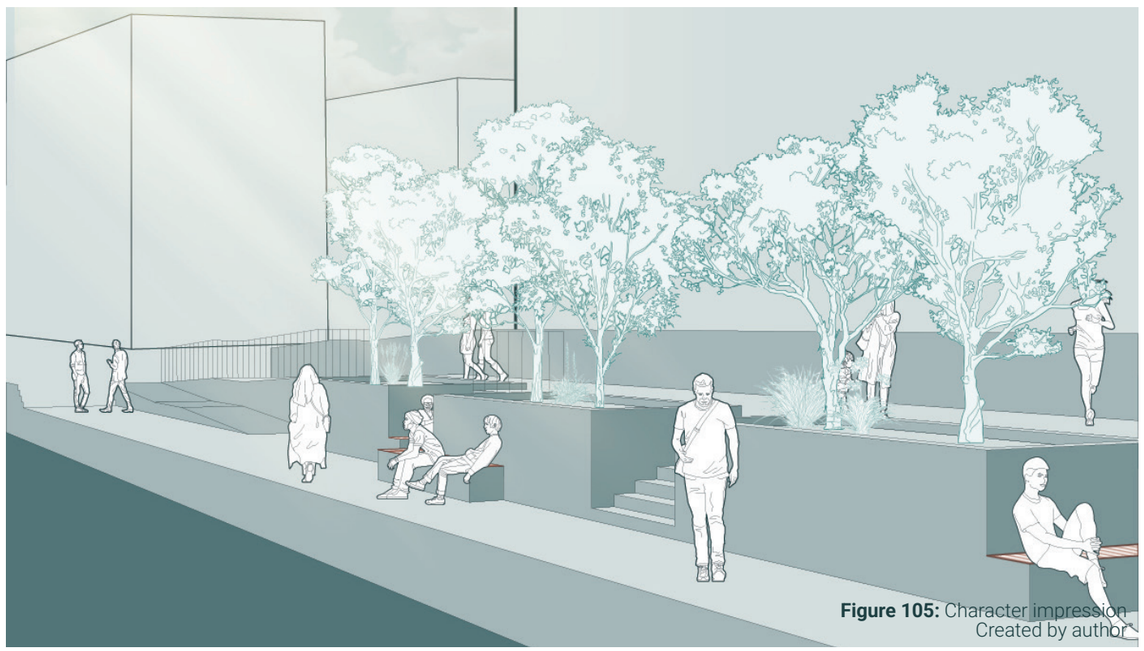


Figure 105: Character impression
Created by author

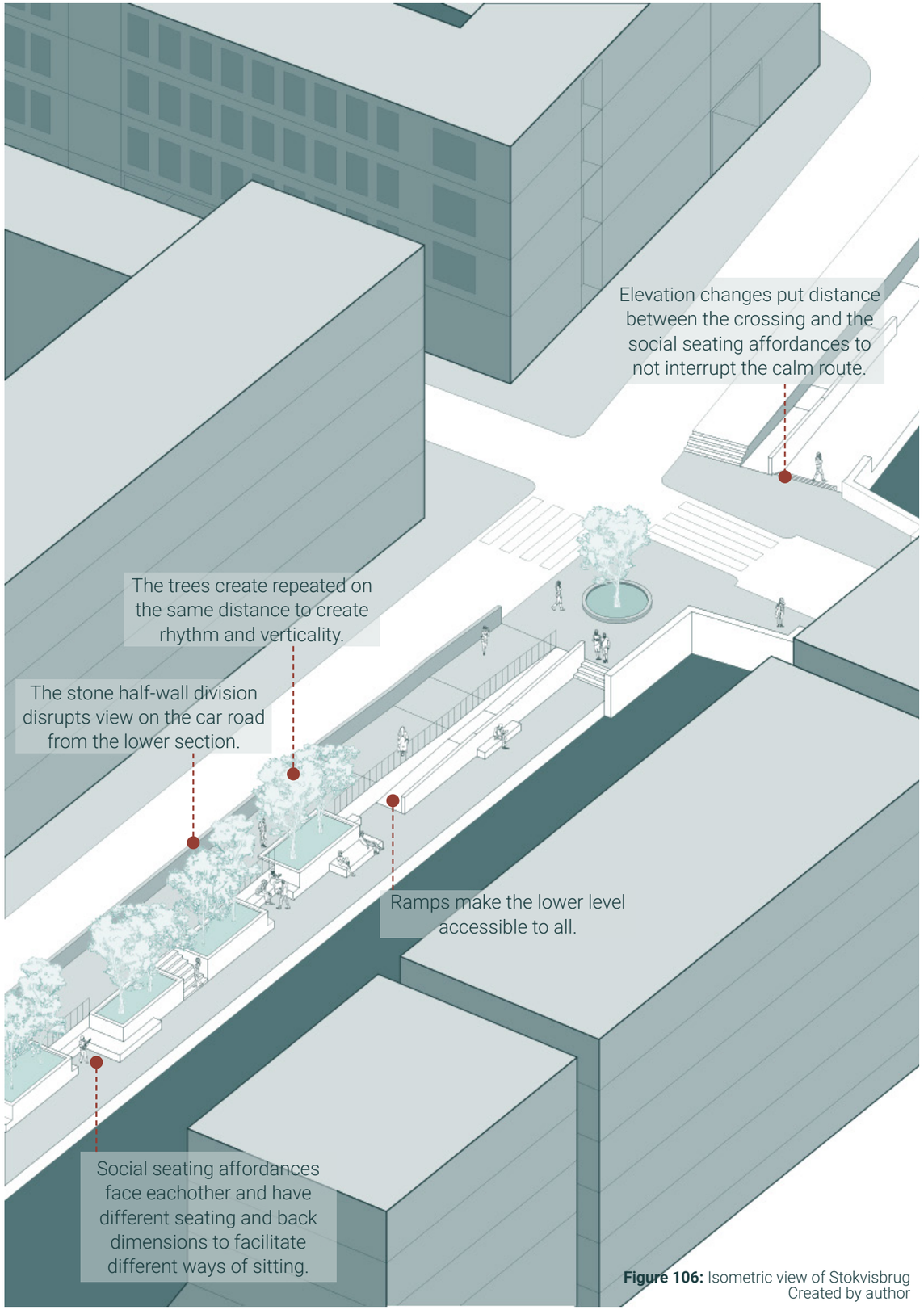
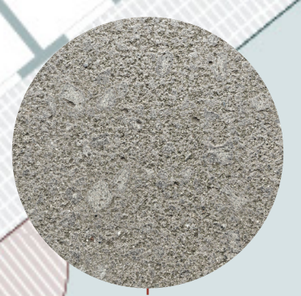


Figure 106: Isometric view of Stokvisbrug
Created by author





-0.6 m

+0.6 m

-0.3 m

+0.3 m

-0.6 m

-0.3 m

+0.6 m

Figure 107: 1:200 map of Stokvisbrug
Created by author

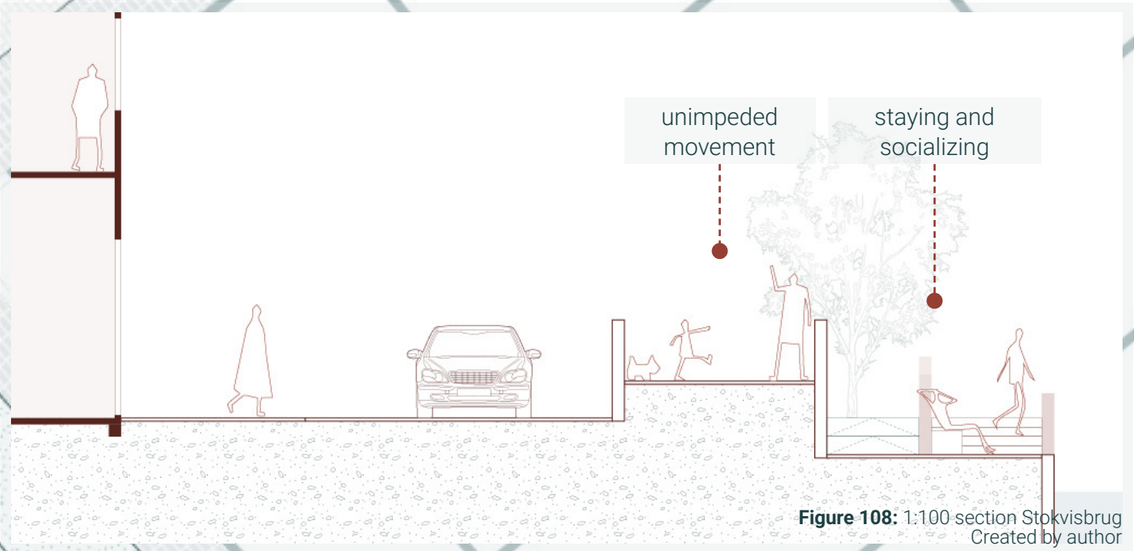


Figure 108: 1:100 section Stokvisbrug
Created by author

CHAPTER 7
CONCLUSION

CHAPTER OVERVIEW

This chapter answers the subquestions and main research question, describes possible implications, and reflects on the process and project.

CONCLUSION

answers to the research questions

Subquestion 1: How cognitively demanding is the public space?
Key insights from theory say that factors like movement clarity, hierarchy, and dominant visuals determine how easily understood a space is. In On the Binnenrotte itself, these factors are most present in at one end of the Binnenrotte, with the corridor having no clearly stated end or rythm inbetween. This makes orientation harder. Scales that are too large to be understood in terms of the human body are also mentally taxing because of the lack of the environmental cues that our minds use to intuitively measure distance and navigate. This happens at the Binnenrotte because of the large open space needed for the bi-weekly market. Smaller scales can be found in the area, in streets next to the Binnenrotte. A sense of protection from traffic, crime, and unpleasant sensory experiences through physical aspects of the environment lowers the need to constantly be on the lookout. The focus on pedestrians in this commercial area comes with good examples of measures taking to protect pedestrians from traffic. With many cafes and restaurants at the ground level, this area also has many 'eyes on the street', increasing protection from crime. Protection from unpleasant sensory experiences, like covered public seating, is harder to find here. Urban stressors like noise, smells, and crowding also take mental energy to process. Hotspots in the area include the shopping streets and heavy traffic roads, but the bi-weekly market is the most significant source of loud noises and smells. An important nuance is that there are no universally bad or good stimuli. This depends on context and the perceiver, leading to the need to explore this dimension further.

Subquestion 1: How does a neurodiverse population perceive environments?
Spatial experience is not only based on physical aspects of the environment, but also by the person perceiving it. People perceive based on their entire body and with their sensory systems. These systems are the visual, auditory, tactile, olfactory, gustatory, vestibular, propriocepion, and interoception. Cognitive processes can vary because of natural variations, which are collectively called neurodiversity, and include both neurotypical and neurodivergent individuals. There is a growing amount of projects that aim to accomodate neurominorities in spatial design. The recommendations that seem to be included multiple times are dedicated rest zones, diversity in street furniture to accomodate multiple ways of pausing, and nature-based calming measures. Taking a step back to look at the actual characteristics of neurodivergent conditions shows that these individuals may benefit from refuge spaces where only one sense is stimulated, opposed to urban design theory that argues in favor of multi-sensory engagement. Opposing characteristics highlight the need for multiplicity in the characters of spaces, and individuals needing to self-regulate may benefit from design built for interaction with the environment. Interviews to explore the lived experiences of neurodivergent individuals showed that their perceptions are not thematically different from what may bew expected from neurotypical individuals, but their reactions to environmental stress seem to be more intense and urgent. In order to address this, more needs to be known on stress reactions.

Subquestion 3: How can an environment provide opportunities for interactions that regulate stress responses through affordances?
Stress theory from psychology says that overstimulation can cause stress and understimulation stimulation can cause boredom. Either of these thing are more likely to occur to neurodivergent people due to sensory hyper- or hyposensitivity. Changing the environment to be more or less stimulating can help prevent stress and boredom. Stress theory from biology says that at the moment of stress, people try to use coping mechanisms to prevent mental fatigue. Providing opportunities to cope may help people prevent the consequences of over- or understimulation. These opportunities are called affordances. Combining insights from neurodivergent psychology, environmental psychology, and urban design theory leads to a framework of affordances with 8 typologies: orientation, play, social, movement, resting, reducing stimuli, environmental interaction, and self-regulation. Not all of these affordance categories work well together, and others may be able to form synergies. Most notably, reducing stimuli clashes with social and and play affordances, while orientation and environmental affordances may work well with most other types.

Subquestion 4: What would a neuro-inclusive design for the public space surrounding the Binnenrotte look like?
Based on the conclusions from the previous subquestions, neuro-inclusive design is defined here as lowering the cognitive demand of the public space through form and providing variability in potential interactions that may help regulate stimulation levels. Based on the clashing and synergetic affordance categories, the vision includes two alternative routes with distinct identities: a lively route and a calm one. The lively routes offers mostly social and play affordances, with the intention of being a stimulating environment. The calm route offers reduced stimuli and self-regulation affordances, with the intention of being a soothing environment. These provide options for all users of the public space to move along and linger in different environments based on their varying needs, and to switch between these when their feelings change. Other affordance typologies, namely orientation, movement, and environmental interaction are not route-specific. These are implemented on the main route of the Binnenrotte and wherever possible and where the specific locations have the most potential due to the context provided by existing conditions.

Interventions are focussed on the strengthening of the characters of these envisioned routes as well as making these routes visible so that users are made aware of these options through their form.Three locations are further developed show how context influences the spatialization of these interventions. These contexts are the proximity of two routes, the crossing of two routes, and the crossing of the calm route with a busy commercial street. These all subdivide space and provide choice in different ways.

MAIN RESEARCH QUESTION

How can urban design include insights on neurodiverse spatial needs to create a more inclusive public space surrounding the Binnenrotte?

The results of this thesis show how urban design can include insights on neurodiverse spatial needs to create more inclusive design by expanding interdisciplinary knowledge on spatial experience with relevant psychological and biological insights regarding cognitive processes and natural human variation.

These combined insights informed a definition of neuro-inclusive public space design to operationalize the knowledge in the design. This definition consists of two main principles: lowering the general cognitive demand based on physical aspects of the environment, and providing choice and variability in affordances. The vision that follows from this embodies flexibility through multiplicity.

Lowering cognitive demand can be done through incorporating protection, rythm, hierarchy, and varying scales in the design of public space to make spaces easier to understand and navigate. In the context of the Binnenrotte, the large scale and distances meant that the most impactful changes would be accentuating nodes along the path and the currently unpronounced end point at the Meent. This improves initial spatial perception for many types of users, but does not account for personal differences in cognitive processes.

Providing choice and variability is embodied in the design through two envisioned alternative routes with a calm and a lively character. This vision is actualized through interventions that strengthen the characters of the routes and make them more visible. Research through design led to three different site-specific ways of segmenting space and providing affordances based on the characters of the routes. In the case of the calm route, affordances are focused on reducing stimuli. In the case of the lively route, social affordances are the first priority.

Ultimately, the main answer to the question is designing flexibility into space through multiplicity, allowing users to continuously choose instead of being forced into one way of existing in public spaces.

IMPLICATIONS AND/OR RECOMMENDATIONS

The most transferable result is the concept of the routing which is applied in this project to accomodate the varying needs of users. This is initially an abstract concept that is then applied to the context surrounding the Binnenrotte. Transferability may be found for other thematical contexts, different scales, and varying degrees of urbanicity.

In terms of scalability, it may be interesting to look into the transferability accross scales. In this project, the concept is applied to a neighbourhood scale, placing interventions based on potential that was assessed through spatial analysis. In my opinion, the city scale would seem a logical expansion of the concept. I believe that cohesive parts of the city, often neighbourhoods, should still be a starting point for this. A second layer based on the larger scale environmental, sociological, and infrastructural systems of the city could connect this to create a city-wide network. From there, the regional scale could be explored as a possibility, but I cannot anticipate anything specific on that scale without looking at the city scale first.

In the case of urbanicity, it may be interesting to see how a different set of contextual aspects (eg. densities, functions, infrastructure, and cultural factors) may influence results. In the context of the Binnenrotte, it is easier to create stimulating environments than calming ones because of the existing functions and activities. In a peri-urban environment, this may just be reversed. A practical example is that the creation of sheltered refuge spaces may become more complex. In the context of the city centre this was relatively simple as nearby functions provide 'eyes on the street', but in less urban settings more attention may need to be paid to temporal aspects and safety concerns to keep these spaces safe. Looking at the bigger picture, as urbanicity has played a big role in the results, it may even be the case that the definition of neuro-inclusive design this research came to might change in vastly different contexts .

Thematically, it may be interesting how transferable the routing concept is to other themes within the social domain of urbanism, specifically other types of diversities or even hyperdiversity in general. As explained in the introduction, this is merely one diversifying characteristic of urban dwellers that affects spatial experience. Although I do believe that this is a broad project, exploring intersectionality seems a logical expansion.

CONCLUSION

reflection

What is the relation between your graduation project topic, your master track (A, U, BT, LA, MBE), and your master programme (MSc AUBS)?

The master programme (MSc AUBS) teaches students to integrate interdisciplinary knowledge in design on different scales and to balance analytical and critical thinking with creativity. I implemented what I learned in this thesis by grounding design desicions in evidence and theory from different perspectives and combining them logically to come to new ideas.

The master track Urbanism concerns the integration of social sciences, physical sciences, and design between the scales of public spaces, neighborhoods, cities, and regions. This thesis is mostly oriented between the social dimension and design, only touching on the physical sciences by incorporating environmental analyses like wind analysis and a sun/shade study. The project transitions between neighborhood and public space scales.

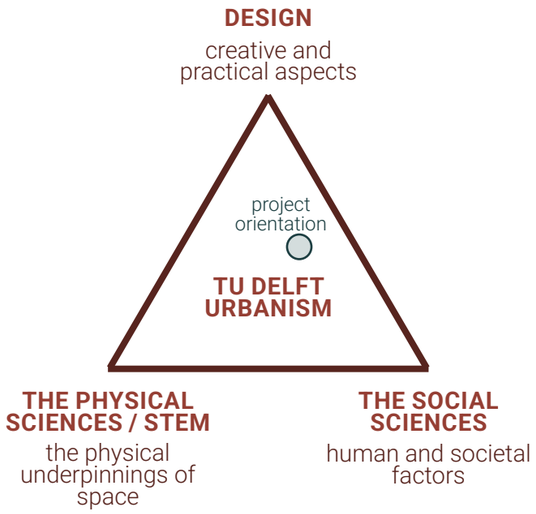


Figure 109: Thesis orientation in the dimensions of urbanism
Adapted from Rocco & Gonçalves (2025)

Methodology: how are the research and design related in your project? How do research and design influence eachother?

There was a lot of explorative research to find the right fit for the approach of the thesis, which included reading papers in related fields and books from urban designers and theorists. In this case, the right fit meant spatial factors and theory that could be connected with psychological and biological knowledge in order to root the approach, vision, and design in combined knowledge from different disciplines.

The approach included parallel literature review, participatory research, spatial analysis, and research by design (in the later phases), which informed eachother continuously. This means that spatial analysis was done alongside theoretical literature review instead of drawing conclusions from literature before moving on to the site. This informed the design by grounding the project in the context of the location early on informed later versions of the conceptual framework. This also lead the vision to start to be developed parallel to research, continuing this parallel process well into the design portion of the thesis.

How do you assess the value of your way of working (your approach, your used methods, used methodology)?

Looking back now, the parallel approach may have lead to a very site-specific vision as well. The alternative routes concept is derived not only from the human variability researched in subquestion 2, but also from the Binnenrotte's temporal functioning which made me look for potential design locations elsewhere. This is not inherently positive or negative, but it does raise the questions about transferability discussed in the recommendations.

Reflecting on the human participation portion of the research, I struggled with this method's place in the narrative. As a result of this struggle, the interviews are slightly seperated from the flow of the rest of the thesis. The main goals of the interviews were adding a human layer and site-specific experiences to the otherwise mostly theoretical research. Although I do believe that the results of the interviews work towards those goals, I now believe that including participation in the design would have been better. This would have added more value in terms of procedural justice and in terms of the narrative.

CONCLUSION

reflection

How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?

The main academic value lies in the interdisciplinary approach that grounds variable and personal aspects in more specific scientific layers of evidence. Many of the insights from the literature review and interviews were things people will often intuitively say when asked about their spatial experience. Then, when looking into the psychological and biological dimensions, there were scientific explanations for these seemingly vague and personal feelings. In this thesis, psychology and some biology explains the scientific basis for otherwise hard to grasp aspects like “feelings” and “ambiance”. People often say that the social side of urbanism is not an exact science. Rooting practice in interdisciplinary knowledge not only makes for better urban design, but also forms an evidence layer to communicate to those who do not see the value of social improvements because of hard-to-measure terms and factors.

Any significant design development for the actual Binnenrotte did not fit into into project due to scope and time limitations. I do believe this may have added further value, due to the temporal context caused by the bi-weekly market and different uses of the space.

In terms of societal value, I see value in positioning yourself as a designer. In this case, this positioning is prioritizing well-being as a driver in spatial design over economic advantage and protecting public space's function as a truly public domain.

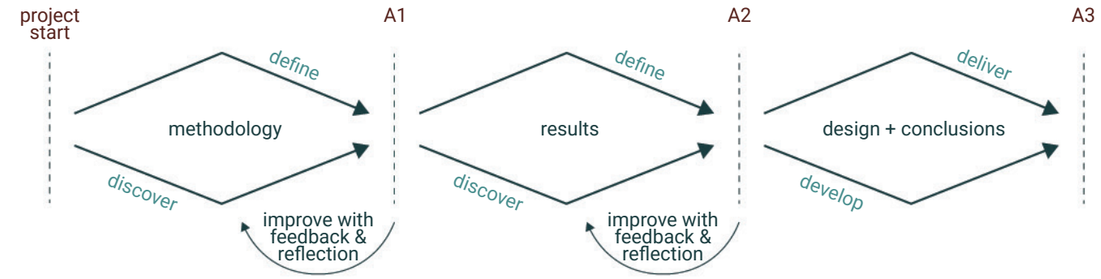


Figure 110: Intended process diagram
Created by author

On the graduation process: how did the research and design process work out according to the original plan?

The process was initially planned as a diamond process, with each period starting with exploration before evaluating different directions of thought to decide the best option to develop further. This is visualized in figure 110. In reality, the process was much less linear. With every step, and especially every progress presentation, I went back to rethink the previous steps after learning more. This was most evident in the conceptual framework, which was remade 4 times. This actual process is shown in figure 111.

Looking back, I branched off in different directions a lot in the early and middle part of the thesis. This lead me to only narrow down to the right theme's and design location relatively late in the process. In the end, this did not leave me with enough time to deepen the project and add layering in the design to increase complexity. Doing this in that amount did not add value to the thesis, but it did add to my education.

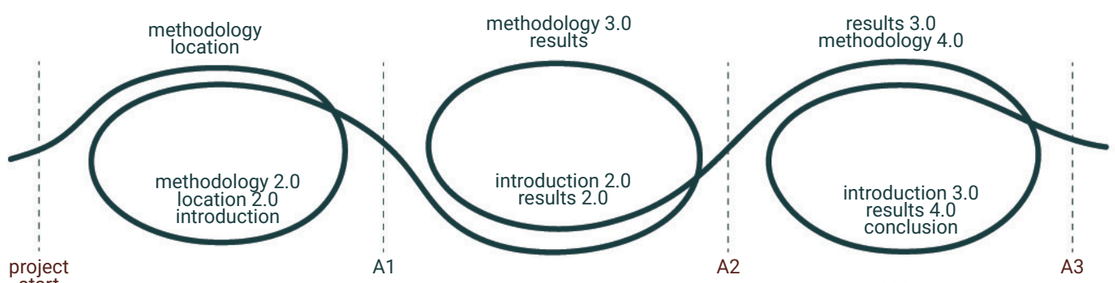


Figure 111: Actual process diagram
Created by author

CHAPTER 8
BIBLIOGRAPHY & APPENDIX

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Ethics Approval Application: Brainspace: developing a neuro-inclusive design method by learning from neurodiverse space experiences
Applicant: Kuijt, Rosa

Dear Rosa Kuijt,

It is a pleasure to inform you that your application mentioned above has been approved.

Thanks very much for your submission to the HREC which has been approved.

In addition to any specific conditions or notes, the HREC provides the following standard advice to all applicants:

• In light of recent tax changes, we advise that you confirm any proposed remuneration of research subjects with your faculty contract manager before going ahead.

• Please make sure when you carry out your research that you confirm contemporary covid protocols with your faculty HSE advisor, and that ongoing covid risks and precautions are flagged in the informed consent - with particular attention to this where there are physically vulnerable (eg: elderly or with underlying conditions) participants involved.

• Our default advice is not to publish transcripts or transcript summaries, but to retain these privately for specific purposes/checking; and if they are to be made public then only if fully anonymised and the transcript/summary itself approved by participants for specific purpose.

• Where there are collaborating (including funding) partners, appropriate formal agreements including clarity on responsibilities, including data ownership, responsibilities and access, should be in place and that relevant aspects of such agreements (such as access to raw or other data) are clear in the Informed Consent.

Good luck with your research!

Sincerely,

Dr. C. Shelley-Egan
Chair HREC
Faculty of Technology, Policy and Management

APPENDIX II: INTERVIEW QUESTIONS

Introduction
With this research, I am trying to understand how neurodivergent people experience public space, and the public space of the Binnenrotte. There are no wrong or right answers, I just want to know your experiences. Also, feel free to tell me things that you think are relevant that I am not asking you about.

Questions about neurodivergence
- What does your neurodivergence mean for you in daily life?
- Are their ways in which you feel your perception stands out or differs from other around you? (last week, etc..)
- What are positive sensory stimuli for you?
- What are negative sensory stimuli for you?

Opening questions, at the location but sitting down
- What does public space mean for you?
- How well can you usually navigate? What makes you think that?
- What do you usually enjoy in public spaces and how do you feel your neurodivergence is related to this?
- What factors affect your feelings of safety in a public space?
- What factors makes you want to linger in a public space?
- What would make you want to avoid a certain public spaces, parts of it, or routes?
- Do you ever feel overwhelmed in a public space?
- If so, what factors make you feel overwhelmed in public spaces?
- Do you have a recent example?
- What do you want to do when you are overwhelmed?
- What did you want to do? VS What did you do? How did you feel about that?
- Do you sometimes feel judged in public spaces? How often?
- Do you use tools that make being in public space easier?
- What about those tools helps you?
- What other struggles with public spaces have you experienced in the past? How do you feel your neurodivergence is related to this?
- How do these preferences and struggles affect your feelings about public spaces?
- How have your opinions, struggles, and preferences on public space changed through time?

Site- specific questions
Please alert me if you particularly notice a certain sight, sound, smell, feeling. Any stimuli, whether it is external or internal. I will ask you what you are thinking about that stimulus.

- How well do you know Rotterdam in general?
- What is your opinion of the public spaces in Rotterdam, and how does it compare to other cities you know?
- How familiar are you with this specific public space at the Binnenrotte?
- What is your general impression of this space?
- Both pedestrians and cyclists are allowed here, how do you feel about that?
- Standing in the middle of Binnenrotte plein:
What do you notice about this square first?
What are your opinions and feelings about this square?

Standing in the Hoogstraat shopping street:
- What do you notice about this street first?
- What are your opinions and feelings about this street?

Standing on the Grotekerkplein:
- What do you notice about this space first?
- What are your opinions and feelings about this space?

Market questions
- Have you been to the market here at the Binnenrotte?
If so, what are your opinions and feelings about it?
- Do you go to other markets in the Netherlands?
- If yes: what are your opinions and feelings about it?
- If no: why do you not go to them?
- How do you feel about crowded events in general?

Directly after the interview:
- Is this space easier or harder than other public spaces?
- What makes the difference?
- Do you feel this space was designed for you?
- Are there specific things that would help you if they were changed?
- When looking back at what we discussed and what you experienced, what aspects were most important to you?
- Were there questions that I asked, that you feel are not important or relevant?
- Did anything surprise you?
- Did you feel anything different from usual?
- Is there anything else, about your experiences today or in the past, that you would like to add?