

DESIGNING HEALTHY ENVIRONMENTS

AN INTEGRAL APPROACH FOR
THE DESIGN OF HUMAN HEALTH
SUPPORTING ENVIRONMENTS
IN THE HAGUE

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Designing healthy environments: an intergral approach for the design of human health supporting environments in The Hague.

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Figure 1 Morgenstond, Leggelostraat

PREFACE

"As a pupil at secondary school, I got support in the process for choosing a study. I looked for something creative and technical; for me, this study was architecture. One of the questions I had to answer was: What is your dream job? At that time, that job was being a city planner. A new hospital, designed by me, should be the crowning glory. This hospital was a challenge because this is an important building for the city with complex logistics. I imagined a hospital where the interior of the rooms would improve the health of the patient."

It is thus remarkable that the focus for this graduation project is on human health, and the impact of the surroundings on people. When I chose this topic, I also remembered that I learned a lot over the last years. Besides learning a lot about the field of urban design and planning, I now know also what my personal strengths are. In spatial assignments I prefer a practical approach and I have a large societal awareness. I like to work on different scales, because their relationship is challenging.

The results on this research project are presented in this report. During this long period, I often experienced valleys in my process. But after all, this report is a high peak. The realization of this report was not possible without the support of my mentors, Alexander Wandl and Maurice Harteveld. Alex, thank you for all the time you took to discuss with me, for your inspiring insights and your optimistic way of thinking. And thank you for your trust in my abilities, even at the moments when I lost it. Also Maurice, thank you for all the valuable discussions and different perspectives human behaviour in space.

My sincere thanks also goes to the municipality of The Hague, especially to my internship coordinator Niels Al. I am grateful that I got the opportunity to gain deeper insights into the planning and political processes in The Hague. I also like to thank the smart study group colleagues, for all the conversations about graduation struggles, their honesty and optimism. Last but not least, I would like to thank my friends, family (mam, pap and Merlin) and Roger for all the mental support and confidence throughout this process. This accomplishment would not have been possible without them.

All the best,

Linda Klaassen

ABSTRACT

The origins of urban planning were developed in the late nineteenth century mainly due to health concerns. Nowadays, human health and urban design are separate academic fields and their relationship is often disregarded. The main challenge for urban planning is dealing with the pressure on the available space affected by urbanization and climate change. The role of health is changed in our society due to two major reasons. The first reason is the evolvement in health, diseases and the impact of them which are changing over time, for example due to improved health care. The second reason is the changed common perspective towards health; the current emphasis is on participation in daily life instead of the absence of illnesses. Large health differences are identified between different kind of neighbourhoods.

This research focusses on the relation of human health and the design of urban environments. The goal of this research is to design urban environments which contribute to the health of the residents. For this reason, the emphasis is on the promotion of a healthy lifestyle. For this research three determinants of health related to space are identified: the physical environmental, the social environmental and the behavioural determinants of health. Six design principles, derived from these determinants of health, are composed to guide the design process. A set eighteen of design elements are chosen as instruments which have a relation with health. These design elements can be used to transform urban environments towards more human and sustainable living environments.

The design approach is tested on two test cases in The Hague: Rustenburg Oost and Morgenstond Zuid. Both these neighbourhoods have health related problems, however they have a totally different urban form. After analysing these areas, two kinds of design locations are identified for both. On one hand, the space around infrastructural bodies are mentioned. For these test cases, waterlines are the large scaled elements. On the other hand, public spaces which are typical for the neighbourhood are indicated. The elaboration of the test cases show the effectiveness of the healthy design approach. The various designs demonstrate that the application of the healthy design approach is applicable to different urban fabrics.

DEFINITIONS

Communicable, or infectious diseases, are caused by microorganisms such as bacteria, viruses and parasites that can be spread, directly or indirectly, from one person to another. This transmission is possible by contact with blood and bodily fluids; breathing in an airborne virus; or by being bitten by an insect. Examples of communicable diseases are tuberculosis (TB), influenza (flu) and HIV.

All the factors, risk and protective, which influence human health are the **determinants of health**. Many factors combine together to affect the health of individuals and communities. Whether people are healthy or not, is determined by their circumstances and environment.

The benefits that humans derive from nature are known as **ecosystem services (ES)**. They can be divided into four categories: provisioning services, regulating services, habitat or supporting services, and cultural services (Millennium Ecosystem Assessment, 2005). Functioning ecosystems are the foundation of human well-being and most economic activity, because almost every resource that mankind utilizes on daily basis relies directly or indirectly on nature.

Health is the quality of the functioning of a living organism. For this research the definition by Huber will be used: 'Health as the ability to adapt and to self-manage, in the face of social, physical and emotional challenges. (Machteld Huber, 2010)'

Noncommunicable, or chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviours factors. For example cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma), diabetes, obesity and mental disorders.

Social-ecological systems are linked systems of people and nature, emphasising that humans must be seen as a part of, not apart from, nature (Berkes & Folke, 1998). Social-ecological systems are complex adaptive systems in which social and biophysical components are interacting at multiple temporal and spatial scales (Liu et al., 2007)

Socioeconomic status (SES) is a significant dimension for the social standing or class of an individual or group. It is often measured as a combination of education, income and occupation.



Figure 2 Rustenburg, Doldersestraat

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MOTIVATION

Research

One of the founders of urban design and planning in The Netherlands is Cornelis van Eesteren. He is well-known of the General Expansion Plan (1926) for Amsterdam, particularly because of his functionalistic approach. He was often working with lab coat on, like he was a doctor and could heal the ill city. However, the challenges he faced are totally different than the challenges of today. This research tries to 'heal' the city as well, but in a contemporary perspective.

First of all, the perspective towards health is different. In 1948 the WHO defined health as follow: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." At that time, goals were to exclude communicable diseases from people. This was possible by large advancements made in health care, but also because of the construction of the sewage systems. Today, we know how to prevent and how to treat most communicable diseases. The health challenges of today have a broader perspective. A new concept of health was introduced in 2011 by Huber (2014): 'Health as the ability to adapt and to self-manage, in the face of social, physical and emotional challenges.' In this concept like having a job or

having regular social contacts matter.

The second point is the changing environmental context. Our climate is changing faster than many expected; temperature rising, sea level rising, heavier rainfalls and extreme droughts are happening in cities. These extreme weathers can cause floods, urban heat stress and disrupt the ecosystem. Our cities have to be resilience and adaptive to protect the inhabitants living there.

The last main difference is the way of urbanizing. Van Eesteren had the assignment to build new parts of the city from scratch for facilitating the population growth. He acted like a pioneer and tried new concepts. His urban compositions were spatially and functionally related towards the modern movement with an increasing focus on nature, sun and water. Nowadays, large and medium sized cities in the Netherlands expect also population growth for the next decades. In contrast to city expansion, the current focus lies on transformation of the existing urban areas. These kind of transformations are only possible by a good understanding of the existing situation and improvement of the qualities in a specific location.

ETYMOLOGY HEALTH

The English word 'health' is derived from the ancient Germanic word 'hailiz'. This word is in Old English transformed to 'hæle' and in Old High German to 'heil', which means about the same: wholeness, being whole, complete. The ancient Greek word for health was 'euexia', which means being in good condition (Huber, 2014).

Urban design is not a medicine, but it can facilitate conditions for a healthy lifestyle and environment. This environment exist out of structural elements. Elements which form shapes and divides functions. Space is a composition of (recognizable) elements which can give a (un)pleasant feeling, shapes daily life and gives possibilities social interaction. This has been a personal motivation for this research; the trust that good urban designs can improve life standards. The goal of this research is to improve the health of inhabitants of The Hague by integrating the user perspective with the ecosystem services approach. I believe that it is only possible by integral approaching of spatial developments.

Internship Municipality of The Hague

This graduation project is combined with an internship at The Municipality of The Hague. From June to December 2016 I will be a part-time intern at the department of urban design and planning (Stedenbouw en Planologie). This internship has advantages for me, such as the large amount of available knowledge about spatial planning and The Hague itself. Because I work three days a week at the town hall, I am close to the current activities in The Hague. It also gave me the possibility to easily make contact with other departments which have a role in the planning process, health promotion or the social domain. My role is to inspire my colleges at my department with the renewed role of health in planning and spatial design. One of my personal goals is that the result of this research is usable for the spatial policy makers in The Hague.



Figure 3 Van Eesteren in lab coat
(www.vaneesterenmuseum.nl)

THE HAGUE

The Hague is the third largest city of the Netherlands with 525.745 inhabitants (1 January 2017, Municipality The Hague). The city is the political headquarter of the Netherlands, it is the seat of the Dutch government and parliament, the Supreme Court, the Council of State and of many international organizations. There is a coastline of 11 kilometres with a regional harbour. Since 1843, is The Hague accessible by train, Holland Spoor being the only station. The rail connection to Utrecht is constructed in 1870. In this period is a new station build, today well-known as Central Station.

The main structure of the city is based on geomorphology. This city fabric is gradually formed in during many centuries. The geomorphic surface is based on elongated beach ridges (sand) interspersed with lower peatlands. The sandy grounds have higher surface and solid foundations, and because of these advantages, it were the first constructed areas. The main streets are based (parallel or perpendicular) on this elongated strokes. This structure is noticeable as the DNA of The Hague. The differences in soil type are also related to the welfare of people. Richer people could afford a better dwelling, they built their (often larger) houses on sand. The workers lived in a smaller house on the peatlands. Nowadays, these differences are still visible. The Hague has old neighbourhoods with a richer population, and post-war neighbourhoods with apartment buildings were a more poorer population lives. This differentiation gives The Hague a fragmented appearance .

Another spatial striking point is that almost every domain within the boundaries of the

municipality has urban characteristics. Because of this, spatial facts are sometimes misleading. The number of amount of green per inhabitant of The Hague is low, but the inhabitants are using also parks and open areas of the adjacent municipalities. This example shows that it is necessary to have a wider perspective.

The municipality of The Hague is expecting that the amount inhabitants will grow, this number is estimated between 50.000 and 80.000 inhabitants towards 2040. This will means that The Hague has to densify. The progress of densification will go along with restructuring, which gives possibilities for sustainable, climate proof and healthy interventions.

LEGENDA

- Sand
- Water
- Buildings
- Urban area
- Green zones
- Forrest
- Municipality border

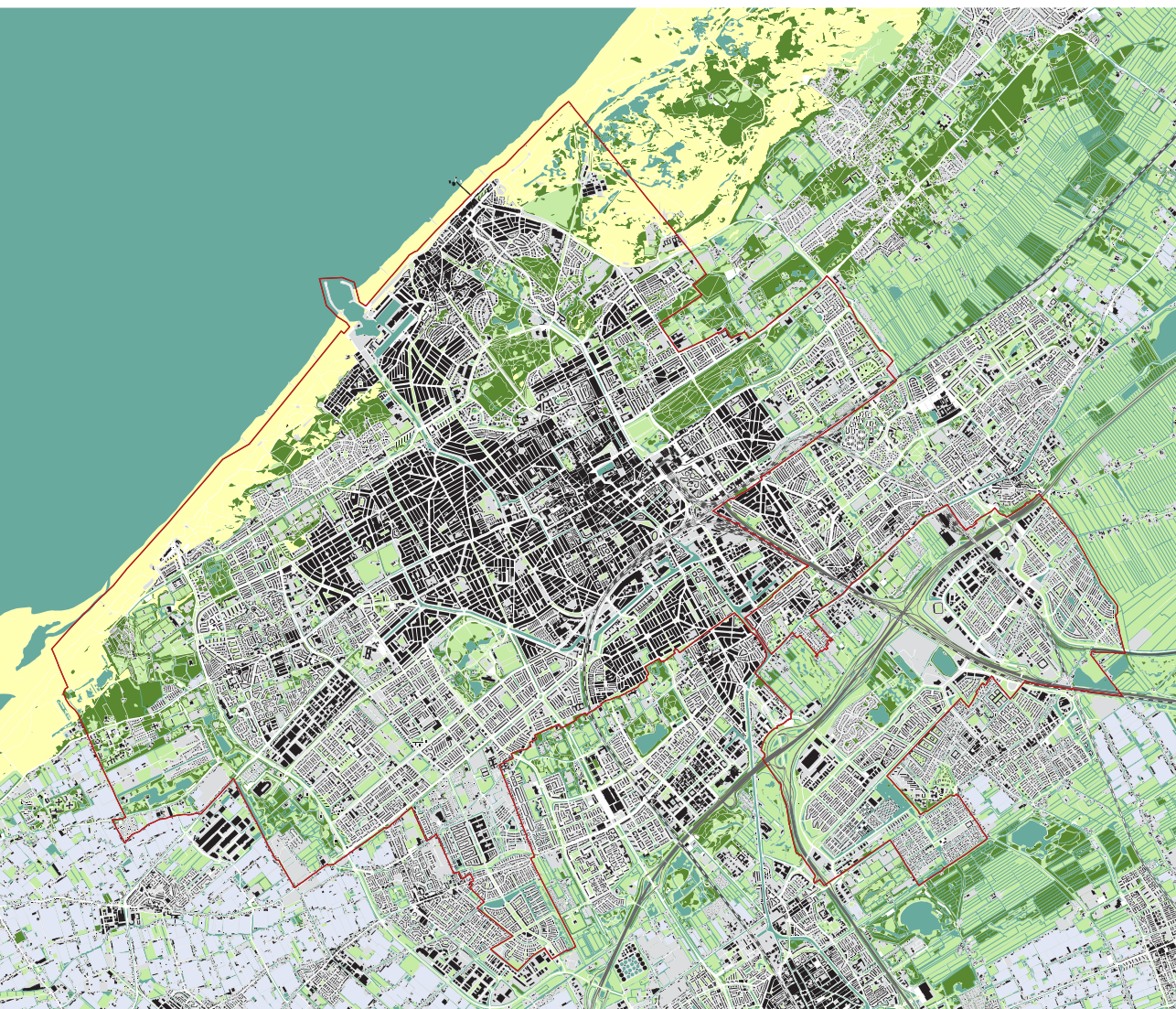


Figure 4 The Hague
(Municipality of The Hague)

SCALE - 1:100.000

RELEVANCE

Academic relevance

Two major trends in urban design are challenging the spatial academic field. On one hand, the challenges which come up from climate change; the cities have to be prepared for extreme weather circumstances. On the other hand, the social shifts which are happening in the Netherlands; urbanization from villages to cities is a key issue. In addition, social shifts in cities, such as more segregation, forces urban planners to new spatial solutions. Both these trends put pressure on the available space and are strongly related to human health. The relation between health and urban planning is neglected the last period, but Figure 5 shows that health many ways is connected. Also, the field of health is in transformation. Today, health is seen in a broader perspective and the focus is about managing your own life. This research tries to translate the new health perspectives to spatial interventions and tries to come up with integral solutions for neighbourhood restructuring.

Societal relevance

One of the aspects of the welfare system in The Netherlands is the basic health care which is accessible for everyone. Having an health insurance is an obligation for Dutch inhabitants, what literally means that 'healthy people' pay for the healthcare of 'ill people'. When there are more 'ill people', the total cost will grow. Other disadvantages of 'ill people' are less working (less taxes) and the seclusion of the society. Having a healthier population is thus desirable for Dutch inhabitants.

There are strong relations between health, education and income. People with a higher

level of education often have a better income and less troubles and uncertainties in their life. These people are on average more healthy than people with a lower level of education. This relation is called the socioeconomic status (SES). As explained in the former chapter, The Hague is a fragmented city with many different neighbourhoods and inhabitants. These different neighbourhoods ask different ways of support from the government.

Six neighbourhoods in The Hague got the title: deprived urban area. The average SES of the inhabitants in these neighbourhoods is lower than the average of The Hague or The Netherlands. This title means that the municipality supports this neighbourhood with extra monitoring and financing. The people in these neighbourhoods need support by improving their quality of life, but this is complex and consist of many aspects. This support sounds like a good development, but by making this statement gave these neighbourhoods a negative connotation. The municipality noticed the advantages of preventive measures, because on long-term they can save money on health care and social insurances. This approach has of course benefits for the inhabitants, because their lives will improve. More healthy people also means more participation from people, which forms a more vibrating society.

Ethical paragraph

To enable this research are many sources and data used. Papers and reports are written from the perspective of a writer, even as data is selected with a prospect. Having this knowledge, means that I have to be critical by using these sources. It is important to

understand which paradigm the writer has and what the goal of his story is. By using different perspectives towards a theme, my research will be more convincing.

The municipality of The Hague and GGD Haaglanden granted me much accurate data, such as demographic data, neighbourhood figures and health facts. This data is originating from inhabitants in The Hague. I am aware of this, and may only use this data when these are not reducible to a person. If data is reducible to a person, the privacy of inhabitants at risk. This research is done with respect to the sources.

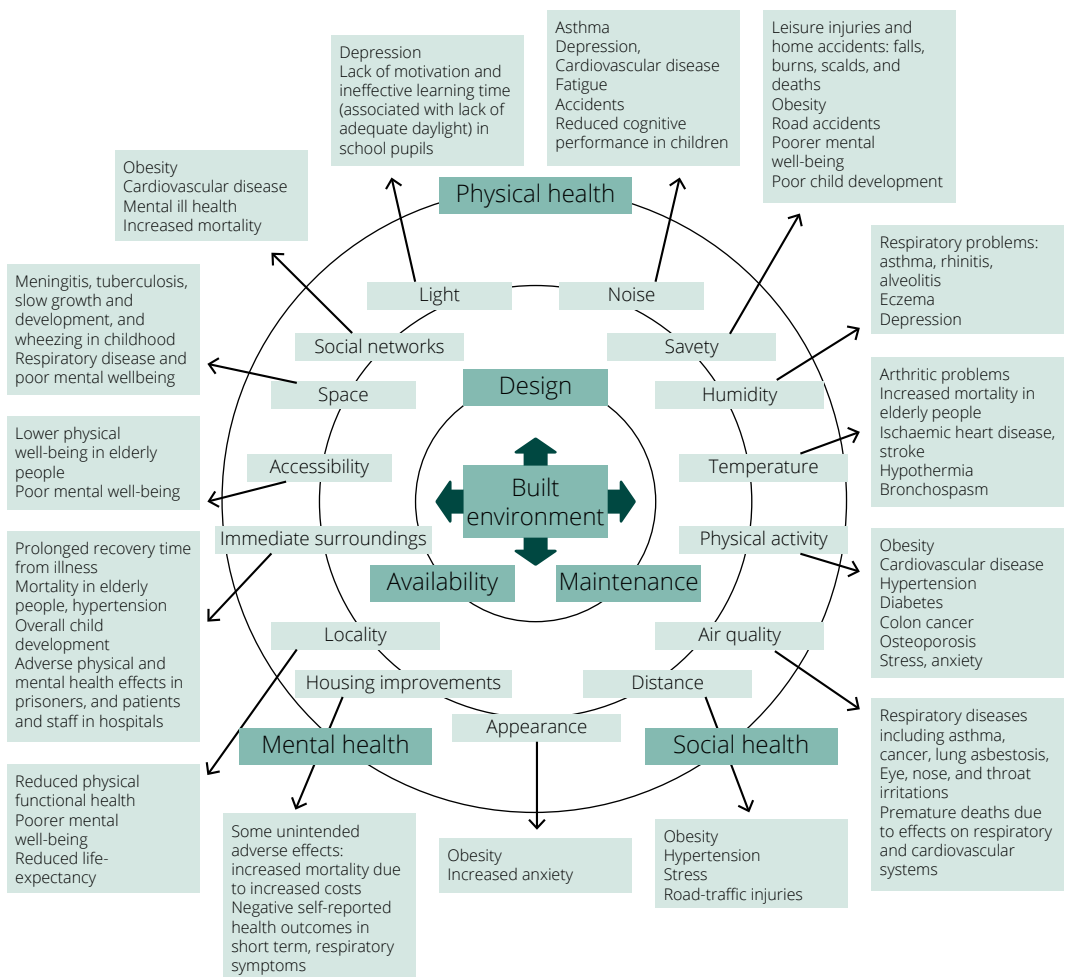


Figure 5 The built environment and health
(Lavin T, Higgins C, Metcalfe O, Jordan A, Health impacts of the built environment, 2006)



Figure 6 Rustenburg. woman with rollator

PROJECT FRAMEWORK

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PROBLEM FIELD

This section explains the challenges and problems which The Hague faces. The context for this research is funded on two bigger trends and developments in health, each with its own spatial implications. The problem field shows the urgency for transformation in The Hague and is the foundation for design approach of this research project.

Climate change

Our climate is changing, this is resulting in changing environmental conditions and more extreme weather events (KNMI, 2015). Despite the global efforts in mitigation strategies, we experience already the negative effects. The main impacts on the environment are temperature rising, heavy rainfalls, sea level rising and drought periods. The effects of temperature rising are most present in urban areas, heated surfaces and materials cannot cool down and causing urban heat islands. The intense and short rainfalls in combination with shortage of water storage leads to overcapacity of the sewage systems, which will overflow. The sea level rising and drought periods are imposing the dikes, which can collapse and causing floods. The built environment is not everywhere prepared for these environmental changes, what could lead to dangerous situations to the Dutch inhabitants.

Because of climate change are Dutch urban environments vulnerable (PBL, 2012). Cities have to invest, on different spatial scales, in adaptation and resilience strategies. The municipality of The Hague is aware of these effects and composed the Implementation Plan Climate Proof The Hague (Gemeente Den Haag, 2012). This is a pragmatic approach which is based on city developments in

combination with climate proof interventions. The Hague has identified three areas with specific vulnerabilities (Figure 8). The coastal area is vulnerable because of sea level rising and groundwater pollution, the urban area has water nuisance through a high percentage of paved surfaces. Expected climate change problems in the polder areas are water nuisance because of a shortage of water storage. The city centre of The Hague is also vulnerable for heat stress. The transformation towards climate adaptation asks often for intensive use of space.

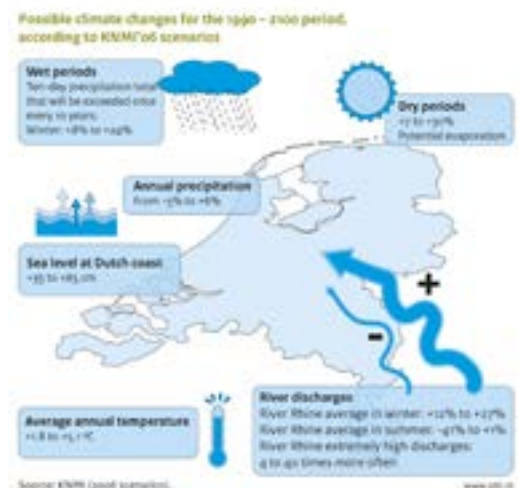


Figure 7 Expected Climate Change The Netherlands (KNMI)



Figure 8 Indicative map of climate effects, The Hague
(Gemeente Den Haag, Uitvoeringsplan klimaatbestendig Den Haag, 2012)

Urbanization trends

The Netherlands is facing a period of migration from villages to the larger cities. Large cities function as magnets for young high-educated people, because of the availability of jobs, education institutes and (cultural) facilities. The key effect of this internal migration is that the most urbanized areas in The Netherlands have to densify more and more. Because of international instability, the Netherlands has to expect also external migrants.

On the short-term, The Hague is suspecting a population growth of 5% towards 2020 (Gemeente Den Haag, 2015). By an increasing population and barely changing households belong also an increasing housing stock. In 2020 are 7000 extra houses necessary, what a growth of 2,8% in housing stock means (Gemeente Den Haag, 2015). Towards 2040 are more deviations in the prognosis, but the region is still expecting population growth. These extra houses need a location, what will mean that there will be pressure on existing (non-functioning) buildings and empty plots.

Both, urbanization and climate adaptation, putting pressure on the available space in densely urban areas. These trends result in complex situations, which can increase each other by using an integral spatial approach towards the limited space.

LEGENDA

- Coastal zone: sea level rise and ground water nuisance
- Urban area: water nuisance because paved surfaces
- Polders: water nuisance because a lack of storage
- ⊙ Vulnerable for heat stress

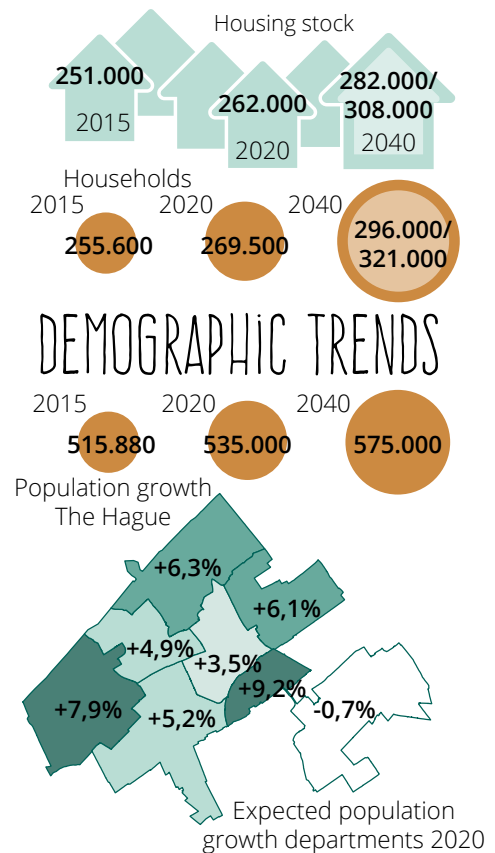


Figure 9 Demographic trends The Hague
(facts: Gemeente Den Haag, Bevolkingsprognose Den Haag 2015, 2015)

Health perspective

The former two trends have strong intrinsic spatial implications. The relation between human health and space is more difficult to describe, because this can have direct and indirect influences. The indirect role of health in urban development is neglected the last centuries. New perspectives towards health lead to a renewed view to the impact of spatial form for human health. Positioning and deepening of this renewed view is one of the incentives for this research. This changed perspective brought new insights for health professionals as well as the spatial planning profession.

In history, the main challenge in health improvement was based on absence of diseases. Today, health is seen a state of body and mind and is influenced by many factors. Many people have chronical diseases, but they feel healthy and are not physical limited. Huber (2014), one of the pioneers in the health profession, defined health as the ability to adapt and to self-manage, in the face of social, physical and emotional challenge. Health in this sense is related to every aspect of life – the social, the economic and the environmental. Knowing that human health is influenced of many components which may interact with each other, gives the opportunity to approach the determinants of health as an complex system (Glouberman et al., 2006). To develop effective health interventions within this complex web, what is needed is an approach that recognizes both the particular vulnerabilities and also addresses the effects

that the urban environment has on all city residents. Therefore, improving health in cities is a matter of making numerous small-scale interventions, selecting those that prove to be effective, encouraging self-organization among city dwellers, and constantly modifying approaches as the system continually changes and adapts (Glouberman et al., 2006). Human health is no longer seen as problem of the health care profession, but it is key element in many disciplines. This research will focus on the relations between human health and urban space.

OLD HEALTH PERSPECTIVES

The Greek Hippocrates (approx. 460-370 BC), was the first who believed that diseases were caused naturally, not because of superstition and gods. In that time, there was a difference between illnesses and well-being. Almost five hundred years later, the Greek-Roman physician Galenus improved the ideas of Hippocrates by dissecting animals and performing audacious surgeries. Till the early modern period, the thoughts of Galenus where unaffected. This changed from the 16th century on because of developments in cellular pathology, microbiology and neurology. Diseases were no longer understood as external an/or holy agents, but as parts which can be searched in the physical body; in organs, cells and microbes. In this time, the main focus for health is on the absence of diseases (technocratic view).

Inequalities

Because of the impact of many determinants of health, health is not equal divided over populations. The life expectancy of lower educated people is less than six years on average than for highly educated. For life expectancy in perceived good health this difference is 19 years. These health differences are strongly associated with work and income. Health differences also exist between immigrants and immigrants. And these social determinants relate again to the physical and social living conditions, lifestyle, access to care, and therefore with health (RIVM, 2014).

The Hague is a fragmented city with many different neighbourhoods and inhabitants. There are major differences in culture, socioeconomic status (SES) and education between people. The form of the buildings, streets and public spaces are also rather different. This results in neighbourhoods with high health numbers, but there are also neighbourhoods which grading under average. The neighbourhoods with lower health rates have often a lower SES, what also mean that the people here live in cheaper housing. In The Hague are six neighbourhoods which got the label: deprived urban area (GGD Haaglanden, 2014). These neighbourhoods are Stationsbuurt/ Rivierenbuurt, Schildersbuurt, Transvaalkwartier, Bouwlust-Vrederust, Morgenstond and Moerwijk. The quality

of the environment, health and well-being due to an accumulation of complex social problems remains significantly behind in comparison to other neighbourhoods. The municipality supports this neighbourhoods with extra monitoring and financing. In the infographic below are some health differences visualized between deprived and non-deprived neighbourhoods in The Hague.

HEALTH DIFFERENCES THE HAGUE

● Deprived neighbourhoods The Hague

● Non-deprived neighbourhoods The Hague

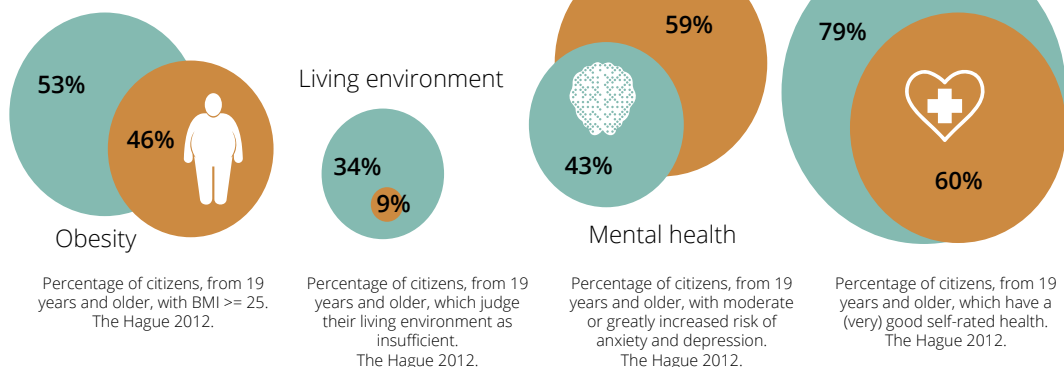


Figure 10 Health differences The Hague

(facts: Gemeente Den Haag, Gezondheidsmonitor Den Haag 2014, 2014)

PROBLEM STATEMENT & GOAL

Problem statement

The Hague is facing major health differences under its inhabitants. These health differences are not scattered over the city, but mainly clustered in neighbourhoods. Human health has many determinants which influence the quality of life. A major influence on health is the environment where people live in, not only the environment itself, but also the people where we share this with.

Human health is always seen as a matter of health care, but they are not involved in the development of the environment. The role of the environment to human health is under applied to promote the health of actors. Also in the profession of spatial planning, this was for many years an under exposed theme. The current state of the spatial form of several parts of The Hague does not contribute to the health conditions of the inhabitants.

Research goal

The main goal of this research is to make a design approach for spatial transformation which will promote human health. The Hague, a city with large health inequalities, is the test case for this research. Improving human health will be done by reducing the harmful environmental effects and promoting a healthier lifestyle. The advantages of urban ecosystem services will be used for this spatial transformation. By increasing the social- ecological resilience, the differences in human health will be smaller. An integral approach is a condition for the design of healthy environments. A practical approach will be given to make implementation of healthy interventions possible. It is not a goal to design a medicine to make ill people healthy, but this design approach facilitates public health promotion in the urban environment.

RESEARCH FRAMEWORK

Research questions

The main question tries to achieve the stated research goal. The key issues of this graduation project are included in this question. The four sub-questions are supporting this main question. The main question is formulated as following:

How can the design of urban space promote human health in The Hague?

To be able to answer the main research question and to guide the process, the following sub questions are formulated:

- 1. What is the relationship between the urban environment and human health?***
- 2. How does the urban form of The Hague relate to human health?***
- 3. Which spatial principles facilitate healthy environments?***
- 4. How to transform Rustenburg Oost and Morgenstond Zuid towards healthy environments?***



1. What is the relationship between the urban environment and human health?

The goal of this research question is to get a better understanding of the impact of the urban environment on human health. The urban environment will be explored on physical appearance, ecology and use. The answer will give the research a theoretic foundation and reveals the strong linkage between the urban environment and human health.



2. How does the urban form relate to human health in The Hague?

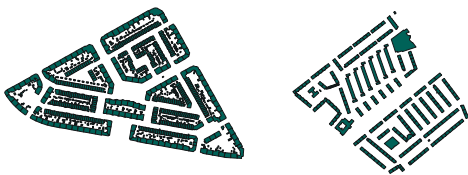
As stated in the project statement, the differences in human health are not scattered over the city, but mainly clustered in specific neighbourhoods. The aim of this question is to get a understanding of the urban structure of The Hague. On one hand, the areas where the people live with health issues will be investigated. On the other hand, the aspects which can benefit or are disadvantage for human health will be

researched. The answer on this question will reveal in which neighbourhoods interventions are most urgent and where the opportunities for transformation. The expectation is that similarities between the neighbourhoods with urgency for change will be found.



3. Which spatial principles facilitate healthy environments?

The goal of this question is to get an overview of possible interventions for healthy design on different scales. How the spatial solutions will benefit health will be described even as the considerations between divers solutions. The possible spatial solutions asks for different ways of implementation, this will be enlightened by advantages and disadvantages of each separate intervention. Ownership, maintenance and implementation processes will be described, to show the spatial and health impacts.



4. How to transform Rustenburg Oost and Morgenstond Zuid towards healthy environments?

The answer on this question involves an integral research and design process for two test cases: Rustenburg Oost and Morgenstond Zuid. Both neighbourhoods does have health issues, but the form, inhabitants and way of former transformation is rather different. First, a detailed analysis will be done for both neighbourhoods. The outcomes of the third sub-research question will be used to redesign these neighbourhoods. At last, the role of actors and insight for implementation will be articulated.

These sub-research questions will be explained in more detail and their linkage will be visible in the diagram (Figure 11). The diagram shows that the search to spatial principles and the analysis is an reciprocal process. The used methods to answer these questions is reported in the next paragraph.

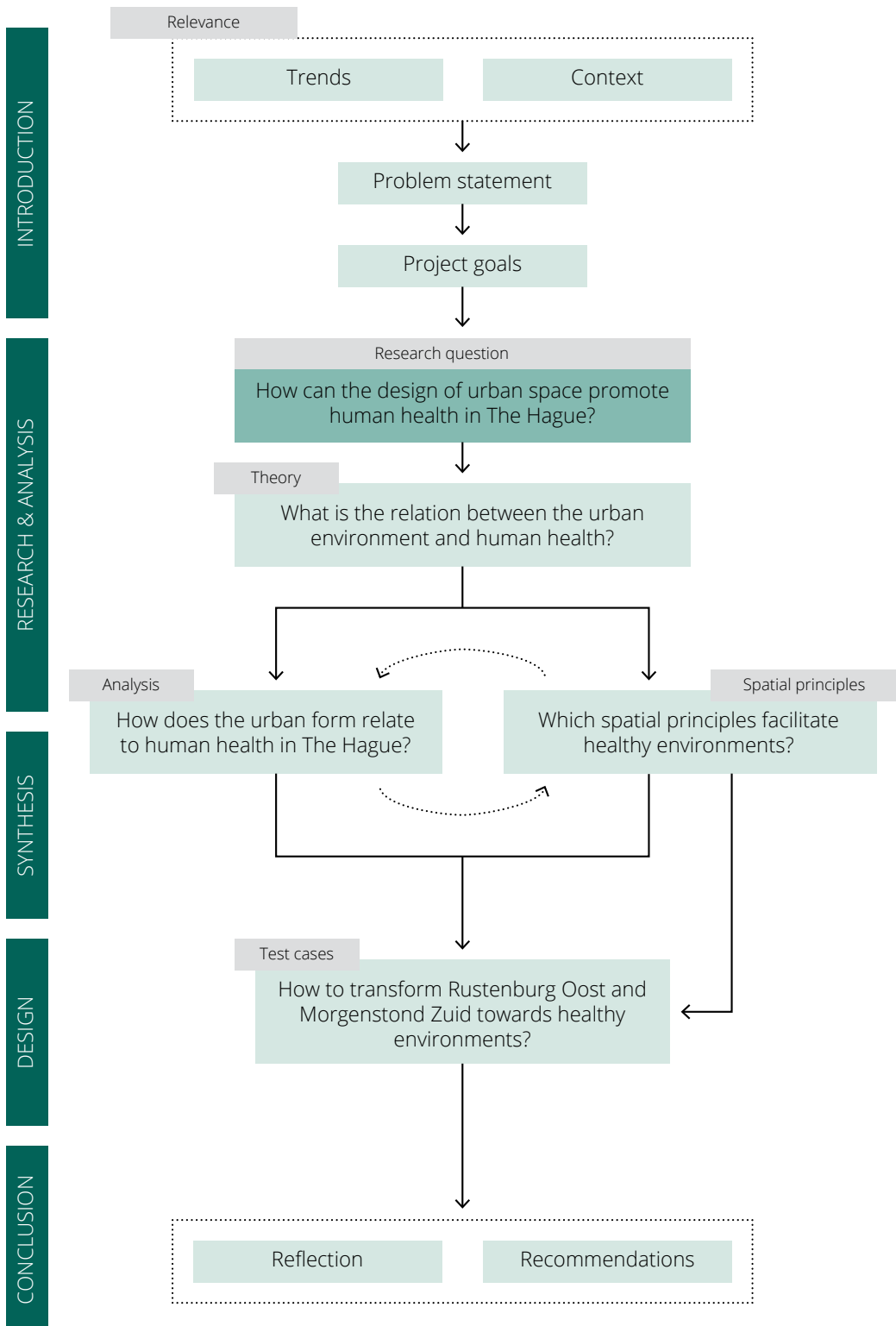


Figure 11 Hierarchy research questions

Methodology

Many different resources and tools are used to answer the research questions. The diagram Figure 12) on the other page shows which methods are used to answer specific sub-research questions.

Literature review

This graduation research characterizes itself by a broad interdisciplinary exploration between different science fields, such as health science, sociology, behavioural sciences and environmental design and planning. This broad exploration will be the theoretical foundation for this graduation project. Different written sources were used in different phases of the research: books, scientific papers and governmental reports.

Governmental reports of The Public Health Service (GGD), Dutch National Institute for Public Health and the Environment (RIVM) and the World Health Organization (WHO) could provide basic knowledge about human health. A renewed, dynamic perspective to human health is given by Machteld Huber (2010). Key journals were *Health & Place*, *Ecosystem Services* and *Landscape and Urban Planning*, because they published many articles with correlation between more fields. A clear understanding of the linkage of urbanization, biodiversity and ecosystem services is given in the book of Elmquist et al. (2013).

Next to the literature which focuses on single aspects, there is also literature about the integral phenomena of healthy spatial planning. Professor and spatial planner Hugh Barton advocates in his many books the significance of the impact of the environment to human health. His last book, *'City of Well-being'* (Barton, 2017) was a leading source for this research. Design principles in public space are explained by Jan Gehl.

Data analysis

Health has many determinants which can influence the quality of the health level. Therefore, many methods are developed to measure health. The RIVM and GGD are the main providers of these health data. Geographic and population information is provided by the municipality of the Hague. This data will be often visualized in infographics to make it tangible.

Spatial analysis

Analysis of spatial quality and quantity of a geographical area is the key to understand the use and vitality of physical structure. Mapping is used to get a better understanding of an existing area, this technique reveals structural patterns and physical features, namely the present and past historical patterns of urban structure, form, land use and behaviour patterns. Mapping urban morphology provides an understanding of the existing physical form and structure of the urban environment at different scales, from individual buildings, lots, street patterns and blocks. For example, sections on building blocks scale will give an understanding of the openness.

Case study

Case studies are a valuable way of sharing project information and research methods on complex urban design issues. Two neighbourhoods in The Hague are selected as exemplar projects. These two neighbourhoods have spatial and health characteristics, which make comparison with similar neighbourhoods possible. The same analysis and design methods will be used for both neighbourhoods.

Research by design

Through research by design new pathways are explored, people come up with innovative ideas and concepts that they would not encounter in a regular research or design process (Roggema, 2016). In research by design, the design process forms a pathway through which new insights, knowledge, practices and products come into being. The strong interrelationship between investigation and creation is the advantage of this research approach. Drawing possible solutions in a manner to get more sensitive on form and use of space. The results of this method are often not final spatial solutions, but merely conceptual innovations that could help to understand and deal with wicked problems. This research and design process will give grips for which spatial solutions will fit to different morphological typologies. This explorative method is characterized by a continuously interactive process between research and designing skills. This method is applied on the case studies. The expected products are design plans that detail development, improvements or regeneration proposals for a single streets or open spaces in the neighbourhoods.

Site visits

By visiting the research location, the understanding how the physicality of the built environment affects activities and social behaviour will be exposed, through recording the use of urban spaces by people. These observations and understandings can help direct design development and changes to urban spaces and places. By observations on location, the use and the quality of the space will be visible. The many pictures made on the visits are used to explain the urban features of an area.

Visiting events

The interdisciplinary topic of health and urban planning was the last years in renewed perspective by academic and practise professionals. Because of that renewed perspective, often were events organized to discuss about the relevance and unite the different science fields. Inspiration about this topics was found on the congress 'Building the Future of Health' (1-4 june 2016, Groningen).

Other events which I visited were the reading 'Gezonde Stad Utrecht, IABR' (25 January 2016, Utrecht), the discussion afternoon 'Stadscafé Gezonde Stad' by the RIVM (28 October 2016, Utrecht) and the events and workshops related to the three transition agendas of the municipality of The Hague, such as the 'Stadsatelier' (14 September 2016 and 3 October 2017, The Hague).

Practice experience

While the internship at the municipality of The Hague, I had contact with health as well as planning and design professionals. I had the opportunity to follow their process and discuss with them about the considerations in a project. My experiences will be guideline for the last research question, expert interviews with policy workers from different departments of the municipality and inhabitants of The Hague will be ingredients to answer this question. The understanding of spatial policy gives indications for the implementation or maintenance of projects.

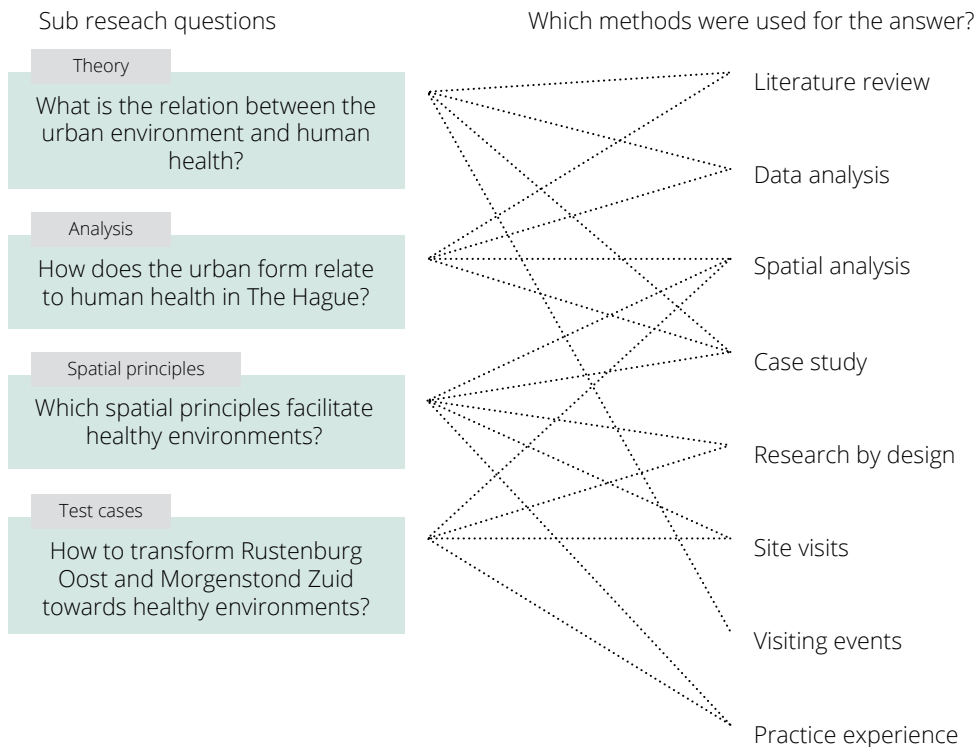


Figure 12 Methodology



Figure 13 Rustenburg, sidewalk Soestdijksekade

HUMAN HEALTH & ENVIRONMENT

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HUMAN HEALTH

History

"If you want to learn about the health of a population, look at the air they breathe, the water they drink, and the places where they live." – Hippocrates, the Father of Medicine, in the Fifth Century BC.

Health and spatial planning have historically a strong relationship. The quote of Hippocrates demonstrates that this relationship was acknowledged even 2500 years ago. The meaning and influence on human health and techniques to transform the environments changed in time and by that their relationship. This paragraph will deepen this relationship by showing some interesting periods.

Halfway the nineteenth century was living in a city a challenge. Many people were poor and lived in small and bad quality housing. These relative high densely populated areas had to face epidemics of infectious disease, such as cholera, smallpox and measles. For a long time, the origin of the illnesses were not clear. The miasma theory, that cholera was caused by disease causing particles in the air, was the dominant theory. John Snow (1813-1858), one of the fathers of modern epidemiology, proved by mapping that this theory was wrong. In 1854, he mapped the cases of a cholera outbreak around Broad Street in London and found out that all outbreaks were centred on a public water pump. Because of the geographic research approach, Snow investigated that cholera was transmitted via water. Removal of that pump led to a rapid decline in the incidence of cholera. His geographic approach can be seen as the precursor of GIS.

The disastrous living conditions in cities in the

nineteenth century were upgraded because of spatial interventions, such as sewage systems, waste management, water purification and improved housing. An example of these interventions are the 'Waterproject' of W.N. Rose in Rotterdam. His idea was to build new waterlines (singels) around the city for the provision of clean water, drainage of waste water and waste management. This system was still a mix of clean and waste water and did not improve the health conditions of the inhabitants. The construction of an underground sewage system, an idea of G.J. de Jongh, which separate the water flows would have these desired improvement.

The developments in health care made big steps in the first half of the twentieth century, forced by the occurs of the two World Wars. This was also the starting point for the frequently use of antibiotics. After the two wars, vaccinating of children became self-evident and DNA was discovered. From an health perspective, infectious diseases were not a large enemy anymore and the role of mental well-being grew. In that period, many cities in the Netherlands had large housing shortage. This was the point that many modern neighbourhoods were built in in the periphery of cities. These new neighbourhoods were constructed with tall apartment blocks in a strict orthogonal structure with large open spaces in-between. This open structure could provide the inhabitants much green space around their houses and a clean living environment far away from the industries. This approach seems to be too idealistic, however the social structures of daily urban life are lost in this large scaled urban fabric. And because of the larger distances, these neighbourhoods

are facilitating car use instead of promoting walking and cycling.

The last decades, many new urban parts are built with the approach of the compact city. The term compact city embodies the opposite of urban sprawl. The main focus for this urban development is sustainability. The compact city is meant to be more energy efficient and less polluting, because compact city dwellers can live closer to shops and work and can walk, bike, or take transit. One of the aspects of sustainability is healthiness; to sustain an ecosystem or city over the long run assumes that it will be healthy. In this case, healthiness is defined as ecological health, with the environmental impact assessment (EIA) as main tool. In that period, there was much focus on data instead of subjective quality of the living environment. If we take a look into the neighbourhoods which are built in the last centuries of the twentieth century, such as VINEX-neighbourhoods Ypenburg (The Hague), Leidsche Rijn (Utrecht) and Meerhoven (Eindhoven), we can conclude that they are not as visionary as planned. These neighbourhoods are still too car-dependant and often far away from the city centre. In addition, the realisation of greenery is lacking behind and facilities are often separated. Verbeek and Boelens (2016) state that, at present, the input of environmental health in planning is highly institutionalized, while overall, spatial and urban planners remain disconnected from health issues.

A century and a half since John Snow's map pinpointed the source of a cholera outbreak in London's Soho district, the technology and knowledge-base is now coming into place for a new wave of urban health science and associated interventions focused on the current urban plagues of sedentary-related and age-related noncommunicable diseases (Chinmoy Sarkar & Webster, 2017).

Definition

In the history is the meaning of human health often changed. This meaning shifted because the priority of healthy problems. After World War II the WHO defined the following definition: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is

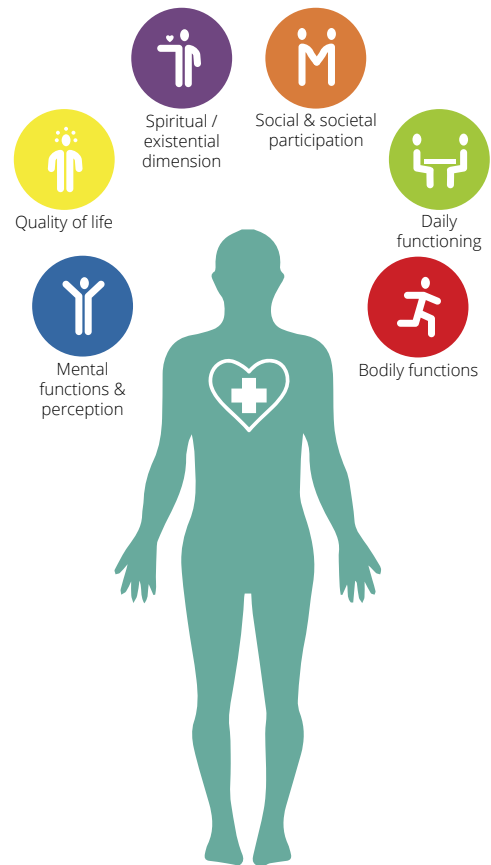


Figure 14 Health aspects
(by author, based on M. Huber)

one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition." (WHO, 1946)

Strong parts of this definition are the broad approach and the focus on equality. But since the beginning of this century, criticism on the WHO's state is intensifying. One of the limitations of this definition is in the word 'complete'. This term is seen as utopian and is difficult with operationalization, as 'complete' is not measurable. Also the present demography of diseases which shows a transition from infectious to mainly chronic diseases that people may live with for decades. In this context, the definition declares the large majority of people as being definitively ill, without considering their ability to cope and deal with their situation (Huber, 2014). Barton and Tsourou (2000) appointed that

this definition challenges the conventional assumption that health policy is a matter only for health care professionals. They argue that health should be a central goal of many policies and agencies, specifically for the urban planning profession.

‘Health as the ability to adapt and to self-manage, in the face of social, physical and emotional challenges’ (Huber, 2014). A new concept of health is introduced by Machteld Huber (2014). She emphasized that health is no longer considered as a static condition but rather as the dynamic ability to adapt and to manage one’s own well-being. In this concept, also known as positive health, are six main dimensions of health described – bodily functions, mental functions & perception, spiritual/existential dimension, quality of life, social & societal participation, and daily functioning; together containing 32 underlying aspects (see Figure 14).

These main dimensions can be visualized in a web diagram (Figure 15) on a subjective scale for practical use, indicating a fictional estimation of a person’s state of ‘positive health.’ This visualization can function as a communication tool with professionals of different fields, especially when ‘shared decision

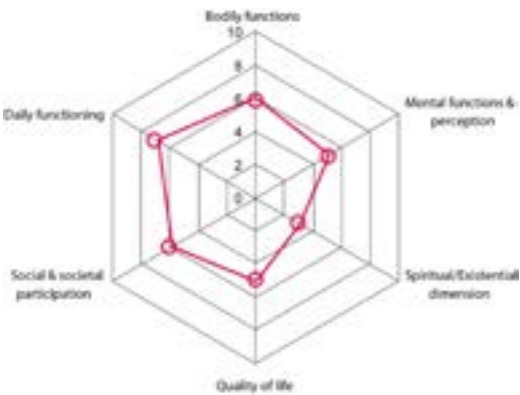
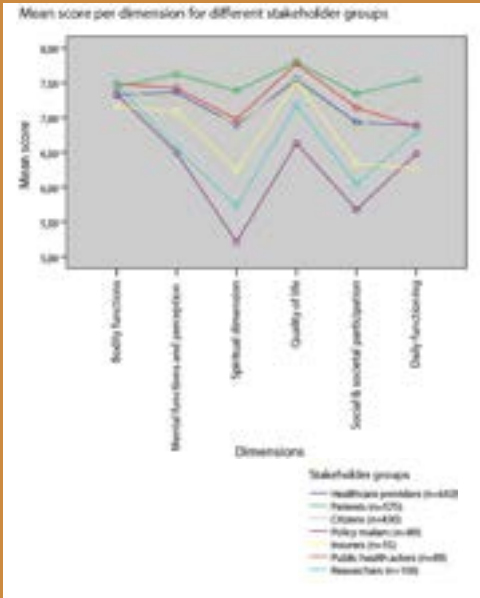


Figure 15 Positive health web diagram
(Huber, M., van Vliet, M., Giezenberg, M., Winkens, B., Heerkens, Y., Dagnelie, P. C., & Knottnerus, J. A. (2016))

making’ is also practised and the question is posed on which aspect of the web diagram the patient has the wish to improve his/her situation (Huber et al., 2016). In this research is tried to optimise the positive health approach of Huber.

STAKEHOLDERS & HEALTH

In her explorative research towards a new concept of health, Huber (2014) involved seven main stakeholder domains of healthcare: healthcare providers (physicians, nurses, physiotherapists), patients with a chronic condition, policymakers, insurers, public health actors, citizens and researchers. All the stakeholders were asked to rate the importance per dimension as being part of ‘health’ on an 9-point scale. In the figure in this frame are the mean composite scores per stakeholder group visible. Striking is that policymakers rank the dimensions of health the lowest of all the domains. In contrast with patients, they have the highest scores.



CALCULATE HEALTH

Human health is dependant of many aspects, and because of that difficult to measure. Health care professionals has determined some indicators to make effects of illness visible.

- Life expectancy at birth, the average number of years that a new-born could expect to live if he or she were to pass through life exposed to the sex- and age-specific death rates prevailing at the time of his or her birth, for a specific year, in a given country, territory or geographical area.
- DALY (Disability-Adjusted Life Years), one DALY can be thought of as one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability (Murray & Lopez, 1996).



- Self-rated health, hardly any other measure of health is more widely used and more poorly understood than self-rated health. It is based on asking individuals to evaluate their health status on a four- or five-point scale, or to compare their health status with that of age peers. This subjective data shows a significant, independent effect on mortality and other health outcomes including chronic disease incidence, diabetes complications, physical and cognitive functional limitations, health services use, and clinical biomarkers have also been investigated (Benyamini, 2011; Bombak, 2013; Jylhä, 2009).

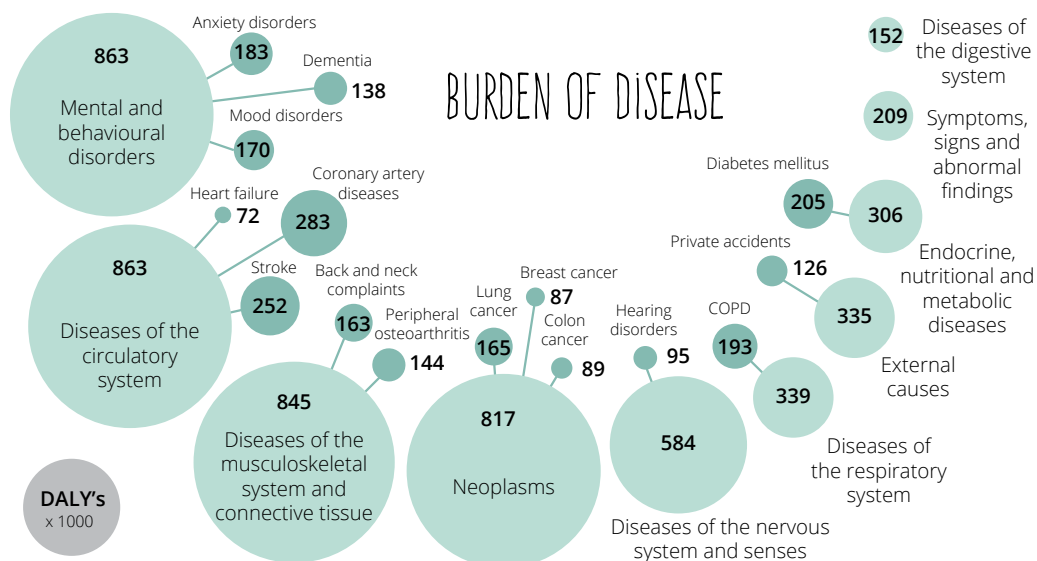


Figure 16 Burden of disease of groups of diseases and individual diseases, 2015

(facts: RIVM: <https://www.volksgezondheidenzorg.info/ziektelast-nederland>)

Health trends in The Netherlands

The impact of health is evolving in time, some trends for the following decades will be explained in this paragraph. These trends are driven by demographic, economic, social-cultural, political, ecologic and technologic developments. The Netherlands National Institute for Public Health and the Environment (RIVM) outlines the trends in health developments in the Netherlands every four year in a 'Volksgezondheid Toekomst Verkenning,' (VTV, English: Public Health Future Exploration). The last edition 'Een gezonder Nederland' (A healthier Netherlands) was from 2014. Now, they are working on the 7th 'Volksgezondheid Toekomst Verkenning,' the first outcomes of this publication gives a clear overview of the health issues for the near future (RIVM, 2018).

Although, the Dutch life expectancy will grow, there will be more ill people in the Netherlands. The fact that there will be more ill people is based on the rise of chronic illnesses. The RIVM expect that the amount of chronic ill people will rise from 8,5 million in 2015 (50% of the population) to 9,8 million by 2040 (54%). The dispersion of the impact of diseases is visualized in Figure 16. Nowadays, mental disorders are claiming the most DALY's, this group of illnesses will even grow towards 1.110.400 DALY's in 2040. The Dutch life expectancy is still growing because of consistent improvement in prevention and treatment opportunities (care).

One of the challenges is to facilitate the needs of the large group of elderly. In 2040,

there will be more elderly and they will be older. An ageing population tends to have a higher prevalence of chronic diseases, physical disabilities, mental illnesses and small accidents. This is also visible in the Figure 16, diseases related to old age, such as dementia and osteoarthritis, have many DALY's. Consequently, they ask for relatively more support and health care. The challenge is to optimise opportunities for older people to take active part in society. Healthy aging is only possible in an living environment with adjustments with fits their life, for example neighbourhoods which are rollator and wheelchair accessible.

Unhealthy lifestyles have major impact on health, smoking is by far the leading cause of death and disease (by 13% of the burden of disease), followed by overweight (BMI > 25) and too little physical activity. These risk factors are visible in Figure 17. The researchers expect that the percentage of overweight people will grow towards 62% (9,1 million people) of the Dutch population in 2040. One in three Dutch people moves too little and this will be the same in 2030. In addition to the influence of lifestyle, the social and physical environment are important for the occurrence of disease. Thus, unfavourable working conditions and environmental factors contribute to the disease burden for approximately 5% to 6%. This research mentions next to all the risks also the possibility of positive influences towards health of the environment, such attractive public spaces which invites to more cycling and walking.

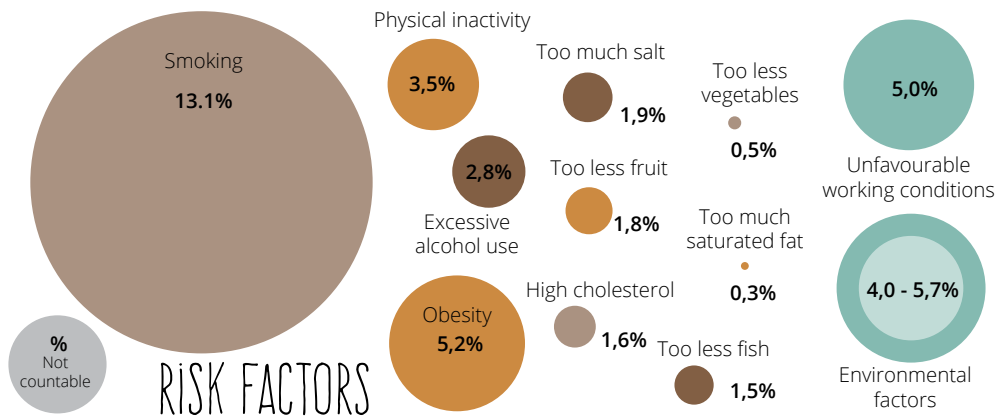


Figure 17 Contribution of risk factors to the burden of disease
(facts: RIVM: <https://www.volksgezondheidenzorg.info/ziektelast-nederland>)

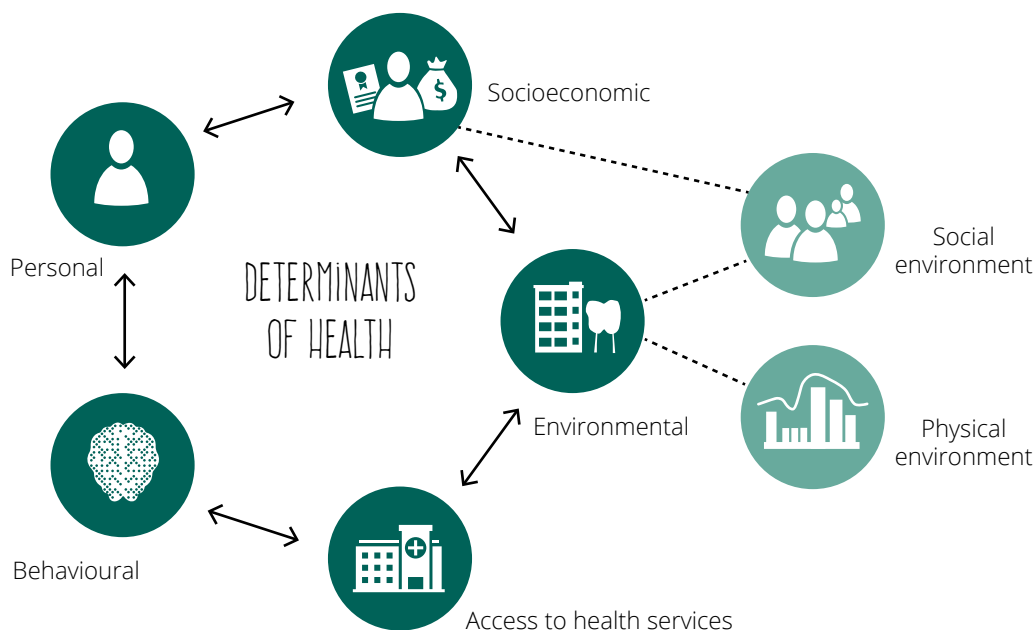


Figure 18 Determinants of health

Determinants of health

All the factors, risk and protective, which influence human health are the determinants of health. Based on the settlement health map of Barton and Grant (2006), the healthy city research of Glouberman et al. (2006) and health future studies of the Dutch National Institute for Public Health and the Environment (RIVM, 2010, 2014), I have chosen in this study for five main groups determinants of health; personal, socioeconomic, environmental, behavioural and access to health services. These determinants of health have strong links with each other and are in also in a group interrelated. For example, for someone with genetic cardiovascular disease (personal) it is important to be keep the body in good condition. This can be done by sufficient physical activity (behavioural) and quitting smoking (behavioural). If this person quit smoking, his lungs will have better capacity and physical activity will be easier (interrelated behavioural).

Personal determinants of health

The personal determinants are characteristics of individuals. This can be congenital, such as genetic information, or acquired during life, for example weight, blood pressure and personality. Resilience and dealing with stress are personal characteristics with impact

on health, even as the bodily structure and functioning.

Socioeconomic determinants of health

Social and economic influences on health, broadly configured to include social, cultural, and gendered roles, among other social determinants of health described as 'the conditions in which people are born, grow, live, work and age, including the health system. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels, which are themselves influenced by policy choices. The social determinants of health are mostly responsible for health inequities – the unfair and avoidable differences in health status seen within and between countries' (NSW Department of Health, 2010).

Behavioural determinants of health

Behaviours (activities, actions, or patterns of actions) undertaken by individuals that have the potential to influence health, including behaviours undertaken to promote, protect or maintain health, whether or not such behaviours are objectively effective towards that end (NSW Department of Health, 2010). The behavioural determinants include all activities of a person, this can be daily exercise, smoking, eating habits and sexual activity.

Environmental determinants of health

Environmental determinants are all contextual and community-related mechanisms and processes which affecting human health. The environmental determinants of health are dividable in two sub-groups: the physical and social. The physical environmental factors are the external factors and conditions that affect people’s lives. These factors are location based and affect everyone in that area. The impact on every person is different, adverse conditions may affect vulnerable population groups more than others. The factors in the physical environment that are important to health include harmful substances, such as air pollution or proximity to toxic sites (the focus of classic environmental epidemiology); access to various health related resources

(e.g., healthy or unhealthy foods, recreational and medicinal resources); and community design and the built environment (e.g., land use mix, street connectivity, transportation systems) (Medicine & Council, 2013). The social environmental determinants consist of the amount and quality of contacts people have. These factors are strong related with the socioeconomic factors, because the people you meet are in same cultural groups. Factors in the social environment that are important to health include those related to safety, violence, and social disorder in general, and more specific factors related to the type, quality, and stability of social connections, including social participation, social cohesion, social capital, and the collective efficacy of the neighbourhood (or work) environment (Ahern & Galea, 2011).

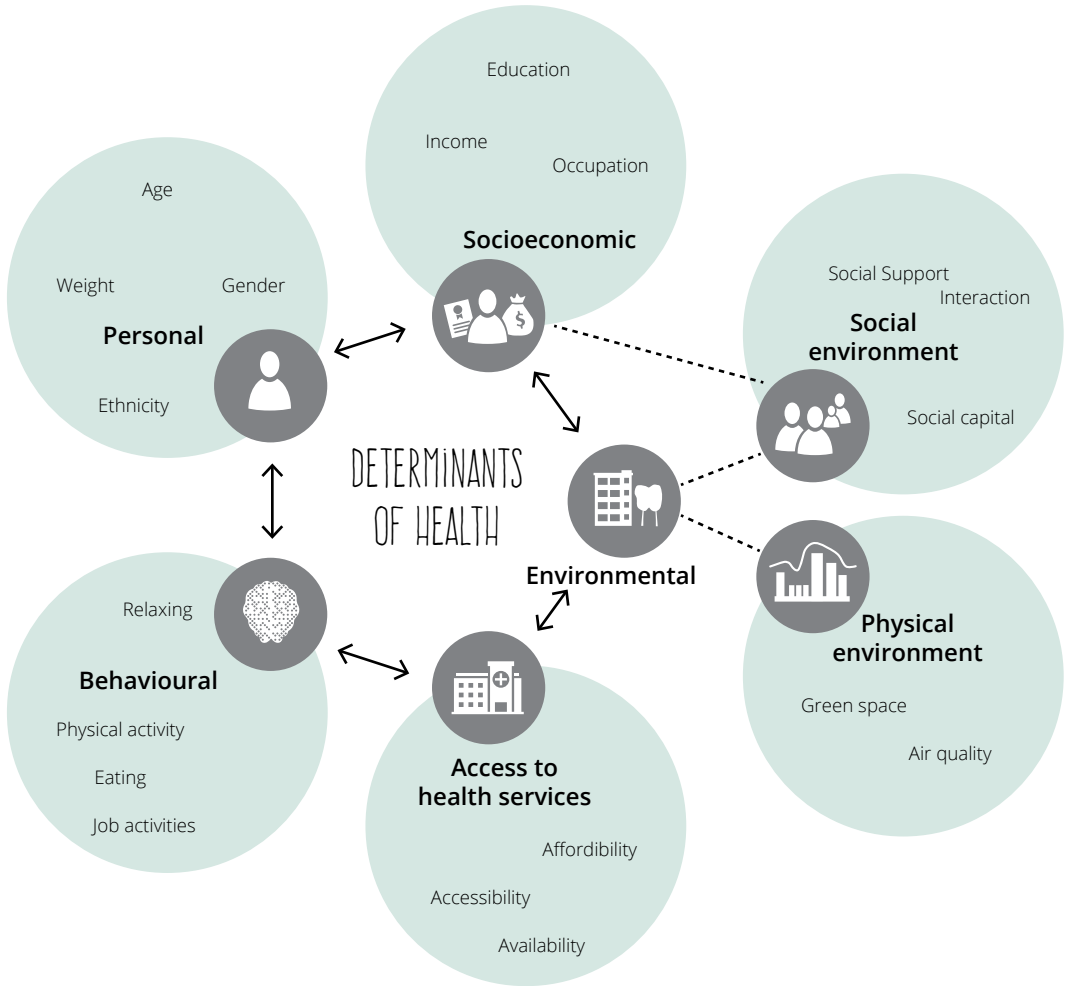


Figure 19 Determinants of health with variables

Access to health services

Facilitating access to health services is concerned with helping people to command appropriate health care resources in order to preserve or improve their health. This concept exist out of four main aspects; geographic accessibility, availability, affordability and acceptability (Peters et al., 2008). The first one, geographic accessibility, focusses on the physical distance or travel time from service delivery point to the user. Availability can be measured in terms of the opportunity to access the health care as and when needed, such as hours of operation and waiting times that meet demands of those who would use care, as well as having the appropriate type of service providers and materials. The affordability, also financial accessibility, is the relationship between the price of services (in part affected by their costs) and the willingness and ability of users to pay for those services, as well as be protected from the economic consequences of health costs. Every person who lives or works in the Netherlands is legally obliged to take out standard health insurance to cover the cost of, for example, consulting a general practitioner, hospital treatment and prescription medication. It is possible to take out additional insurance to cover costs which are not included in the standard package. Financial access is now considered one of the most important determinants of access and is most directly associated with dimensions of poverty (Peters et al., 2008). The last aspect is the acceptability, this mentioned the match between how responsive health service providers are to the social and cultural expectations of individual users and communities.

Environmental scope

The intervention scope of this research is public space and (collective and private) gardens in cities, such as parks, cemeteries, schoolyards, sport fields, streets, squares and vacant lots. This research is limited to the circle of influence of urban planning professionals. The several determinants of health have different relationships with the form and function of open space. Some, such as the environmental factors, have strong linkage with the appearance of space. Others factors, to be specific personal and socioeconomic factors and access to health services, have only indirect connection to the urban environment. The social environmental, physical environmental and behavioural determinants of health are in

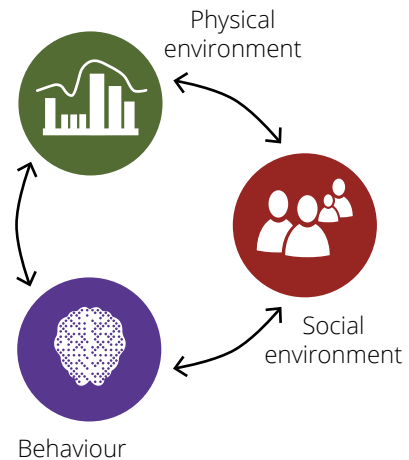


Figure 20 Determinants of health related to space

the direct circle of influence the environment. In this research is chosen to make more profound in this three motives for human health protection and improvement. The three groups have a indissoluble relationship with each other. When someone feels lonely (social environmental), a walk in the nearest park (physical environmental) with a neighbour could disappear this desponded feeling.

SOCIAL-ECOLOGICAL SYSTEM

Social-ecological systems are linked systems of people and nature, emphasising that humans must be seen as a part of, not apart from, nature (Berkas & Folke, 1998). Social-ecological systems are complex adaptive systems in which social and biophysical components are interacting at multiple temporal and spatial scales (Liu et al., 2007). Cities are complicated social-ecological systems with both tightly and loosely connected components interacting dynamically over space and time making resilient, equitable, sustainable cities difficult to achieve (McPhearson, Hamstead, & Kremer, 2014). In an epoch of Anthropocene, global demographic shifts in the form of increasing urbanization, rural to urban migration and ageing population have imposed severe strains upon city systems, much beyond the carrying capacity of existing natural resources and man-made infrastructures (Chinmoy Sarkar & Webster, 2017).

There is an increasing consensus on the benefits of a systems-based multi-disciplinary approach towards upstream non-clinical environmental interventions in the form of 'healthy place' interventions, minimizing/offsetting damage to natural and green urban environments, and promotion of positive behaviour changes (Rydin et al., 2012). The state of human health at individual-level and their production and socio-spatial distribution across populations as well as contextual urban scales (such as neighbourhoods and cities) originate as a result of complex interplay between multiple multi-level causative factors (Chinmoy Sarkar & Webster, 2017).

The majority of humans are exposed to urban environmental conditions that often challenge

human health and well-being and also threaten natural resources (Elmqvist et al., 2013). To improve the health conditions in urban areas a system approach can be helpful. Green infrastructure (GI) and ecosystem services (ES) are promoted as concepts that have potential to improve environmental planning in urban areas based on a more holistic understanding of the complex interrelations and dynamics of social-ecological systems (Hansen & Pauleit, 2014). GI is a resilient approach to managing wet weather impacts that provides environmental, social, and economic benefits. ES provided by a GI can provide healthy environments and physical and psychological health benefits to the people residing within them (Tzoulas et al., 2007). Sandifer and Sutton-Grier (2014) stated that human health and well-being can be considered the ultimate or cumulative ES. Within this complex system approach, several health concepts are developed to link the environment with people. In the following paragraphs, three health approaches are explained: Millennium Ecosystem Assessment: Health synthesis, the Settlement health map and the Health niche model.

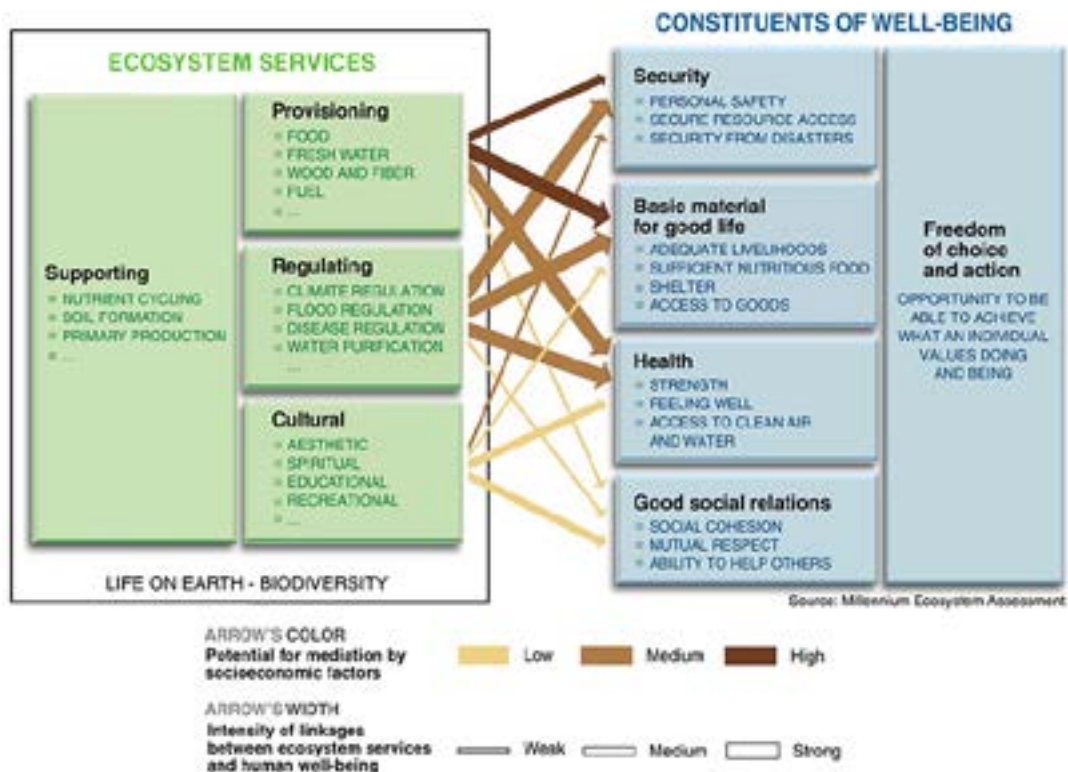


Figure 21 Categories of ecosystem services relating to health
(Millennium Ecosystem Assessment (2005))

Millennium Ecosystem Assessment: Health synthesis

The ES concept conceptualizes human-environmental interactions through a series of linked components that relate ecological processes to human well-being (Luederitz et al., 2015). Since the publication of the Millennium Ecosystem Assessment (2005), there is a growing interest for the relation between ES and human health. The causal links between environmental change and human health are complex because often they are indirect, displaced in space and time and dependent on a number of modifying forces (Millennium Ecosystem Assessment, 2005). Urban ES are defined as the services and benefits which people obtain from the ecosystem, in those areas where the built infrastructure covers a large proportion of the land surface, or as those in which people live at high densities (Pickett et al., 2011). Based on the type of services, the ES are categorized in four groups. The first category are the supporting (or habitat) services, these services are necessary for maintenance and production of (other) ecosystems. Often, these services goes

together with the following three categories. The provisioning services are the products we gain from the ecosystem, such as food, fresh water, raw materials and medicinal resources. Regulation services characterize themselves on provision by acting as regulators, for example regulating the quality of air and soil or by providing flood and disease control. The last category, the cultural services, are recognized by non-material benefits people obtain of the ecosystem. Recreation, tourism, spiritual experience and aesthetic appreciation are values of an ecosystem which belong in this category. The links between the categories of ecosystems and well-being are visible in Figure 21. Ecosystem disservices are functions of ecosystems that are perceived as negative for human well-being (Lyytimäki & Sipilä, 2009).

Barton's settlement health map

The settlement health map (Figure 22), developed by Barton and Grant (2006), combines an ecosystem analysis which expresses the relationship between people and their environment with a public health approach which identifies the relevant social/environmental determinants of well-being. According to the health concept of Huber (2014), Barton uses also a broader perspective of health and appoint this the best opportunity for people now and in the future to enjoy good quality of life. In his opinion is health policy not only a matter for health care professionals, but it has to be central to many aspects of national and local policies. The settlement health map is developed to bridge the gaps between professions, and demonstrates how they relate to health and to decisions in the built environment. The physical environment, our focus in this review, is covered by the two spheres natural and built environment. The seven spheres shown on the map represent a specific area. Barton, Thompson, Burgess, and Grant (2015) explains on the diagram (working outwards), the built environment sphere (and the human activities within it) profoundly affect the natural environment, and vice versa: settlements are dependent on the ecological processes of nature, at both local and global scales. The outer parts of the map and the inner are directly related. For example, when people walk rather than rely on the car they reduce greenhouse emissions, and in this way they help to moderate the threat of climate change. The microcosm of personal behaviour and health and the macrocosm of global ecology are linked. This interrelationship enables the simultaneous achievement of diverse goals. Such as economic benefits not only stem from a healthier population and reduced ecological risks, but also the social business opportunities opened up by energy crops, food hubs, woodcrafts and tourist attractions. The diagram encourages recognition of symbiosis: healthy people; healthy places; healthy planet (Barton et al., 2015).

Health niche model

Health status and risk evolve over life-course as a result of complex interactions between an individual's inherent biological (cellular, physiological, and genetic) and environmental (socio-economic, built and natural environmental) factors (C. Sarkar

& A. Webster, 2017b). Each individual can be thought of as being encapsulated by a hypothetical 3-D hypervolume, which we called the health niche (Figure 23) (Sarkar, Webster, & Gallagher, 2014). In this example is the emphasis on cardiovascular diseases. Given the complexity of the notion of a healthy city, we employ the concept of urban health niche to conceptualize a bottom-up model that incorporates and integrates the multiple, multi-level health determinants existing at the different spatial hierarchies in a city system (Sarkar et al., 2014). The three scales which are distinguished are the micro-scale, meso-scale and macro-scale. As individuals come together to form a population, individual health niches self-organize, reconfiguring one another and intertwining together to constitute the coalesced niche for the population cluster (say a family, an ethnic community, etc) (C. Sarkar & A. Webster, 2017a). C. Sarkar and C. Webster (2017) assess the health state of an individual as a function of the spatio-temporal variations in the corresponding urban health niche.

Conclusion comparisons

All of the three social-ecological system approaches indicate that there is no doubt between the reciprocal relationship between space and human health. Studies of the relationships between built environment and health are becoming stronger, meaning that they are able to conclude with greater statistical power, at finer levels of detail in terms of both health and built environment measures as well as gain deeper insights about causality in the reported associations (C. Sarkar & A. Webster, 2017a). Another agreement between the three approaches is the search for a balance between dispersion and concentration of population. On one hand, a dispersed population is advantaged because they are more exposed towards the ecological system. The concentrated population is facing health benefits from near facilities, jobs and many social contacts. On the contrary, this population is associated with higher consumptions which increases the pressures on ecosystems (Millennium Ecosystem Assessment, 2005). Different are the economies they focus on. The Millennium Ecosystem Assessment (2005) has an emphasis on developing countries, the other two approaches have an accent to wealthier cities.



Figure 22 Settlement health map
(Barton and Grand (2006))

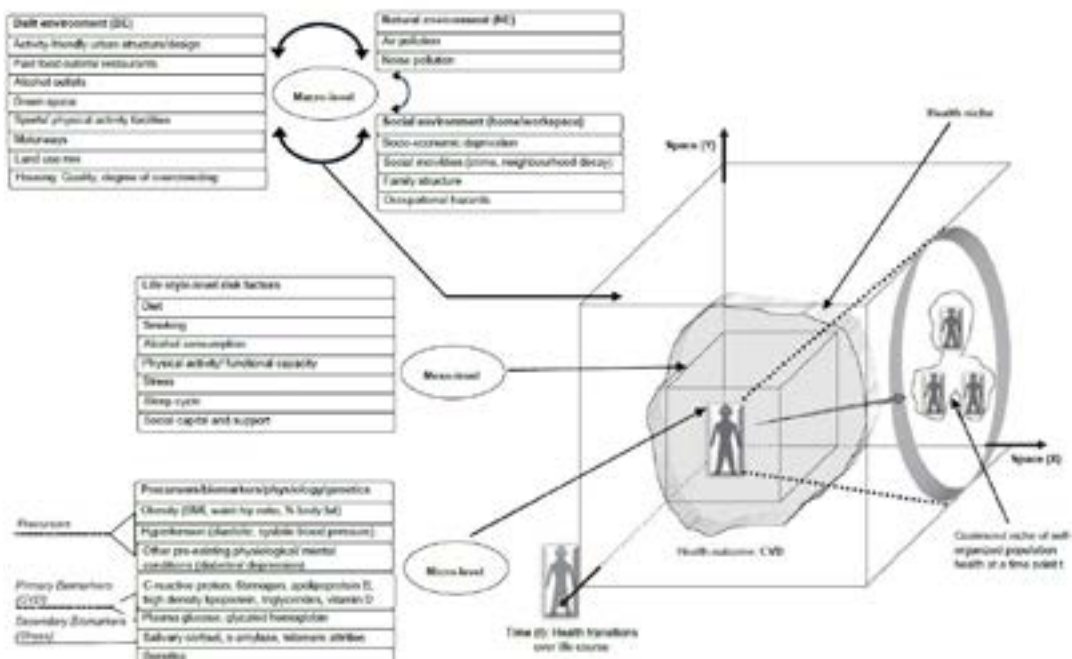


Figure 23 Health niche model for cardiovascular diseases
(Sarkar, Webster and Gallacher (2014))

PHYSICAL ENVIRONMENTAL FACTORS

Ecological resilience

Cities are man-made structures in a natural environment. Often, the relation with the natural system is totally lost and urban activities dominate in the ecosystem. One the consequences is the poor air quality in cities, mainly caused by (i) air pollution from industrial processes, energy generation and the heating of buildings, (ii) the carbon emission of combustion engines and (iii) temperature rising. The first reason can only be tackled by changing the source; cleaner industrial processes, sustainable powers sources and energy neutral buildings. Traffic increases heat stress and air pollution in streetscapes, and cumulative effects of both stressors are a major health risk for urban dwellers (Burkart et al., 2013). Temperature rising in urban settings can lead to urban heat stress. Urban citizens are particularly at risk of suffering from heat stress, especially during extreme heat events as locally generated heat exacerbates the effects of regional scale heatwaves. This exacerbating happens because the heat is absorbed in impervious surfaces with high heat capacity and restrain urban areas to cool down. Knowing this, we may state that the use of materials for buildings and infrastructure is related to temperature in urban settings. Also the addition of green to urban structure can decrease air pollution and lower the outdoor temperature. Trees have the ability to provide shade, block solar radiation from reaching people and limit solar heating of impervious surfaces with high heat capacity and thermal conductivity, reducing heat storage. Street trees have the potential to regulate air quality by absorbing pollutants and increasing pollutant deposition. Vegetation can increase urban albedo (compared to dark asphalt surfaces),

vegetated surfaces have lower radiative temperatures than impervious surfaces with the same albedo and reduce elevated temperatures by evapotranspiration. Water is one of the most valuable resources on earth with an important role for any kind of life. The urban water system is the total sum of the natural and constructed parts of the water cycle in urban areas. It includes both the existing natural, freshwater ecosystems, and the water infrastructure that we have built to supply us with drinking water and to collect, storage, move and treat our wastewater. The storage of water in reservoirs, the management of rivers and storm water, and changes in land use cover, all have direct health and resilience implications. Indirect implications with water can affect food production, micro-climate conditions and biodiversity. Water sensitive planning within urban settings needs to address all stages of the water cycle. Solutions to improve the water system are smarter use of water, we can think about a system which minimize the drinking water or adequate use of rain water for flushing toilets. Open and surface water has often spatial qualities, this can combined with detention and holding basins and natural drainage.

Biodiversity of and within urban ecosystems is integral to ecosystem functioning and the provision of ecosystem services to urban residents (Gómez-Baggethun & Barton, 2013). Urbanization destroys or modifies native habitats and creates new ones with its infrastructure. Because of these transformations, urban landscapes invite non-native and native species that are generalists. Nevertheless, urban settings reveal a great variety of habitats and species. Especially

in temperate cities, the diversity of vascular plants and birds can be higher than in the surrounding landscapes (Elmqvist et al., 2013). Connectivity between reserves and refuges is vital in order to allow wildlife movement and colonization – and provide continuity between town and country (Barton, 2017).

Re-localization or regionalization of food production is argued to be an important part of the effort to make urban regions more sustainable and resilient by diversifying regional agriculture and providing urbanites access to fresh, healthy food. In neighbourhoods, on small scale, food can be produced in private (allotment) gardens, community gardens, rooftop gardens, and urban farms. In addition, these sites provide ecosystem services such as runoff retention, habitat to support biodiversity, recreation and education opportunities, support sense of place, and are sites for social-ecological memory (McPhearson, Hamstead, & Kremer, 2014).

However, alongside these benefits, ecosystems also produce nuisances, biological hazards and geophysical hazards. Ecosystem disservices negatively affects human health, for example

by allergies caused by wind-pollinated plants, fear from dark green areas that are perceived as unsafe and diseases transmitted by animals. The assessment of disservices is complicated because the same ecosystem function can be valued as a service or disservice depending on the person making the valuation and the context. Awareness of the multifaced way of the physical environment is key element for urban professionals.

For transformation of the physical environment is understanding of the climate an requirement.

- Climate adaptation (Water sensitivity, robust, adaptivity)
- Less heat stress/ heat alleviation
- More biodiversity (Pollination, trees+plants)
- (local) food production
- Better air quality
- Sustainable energy production
- Quality of life

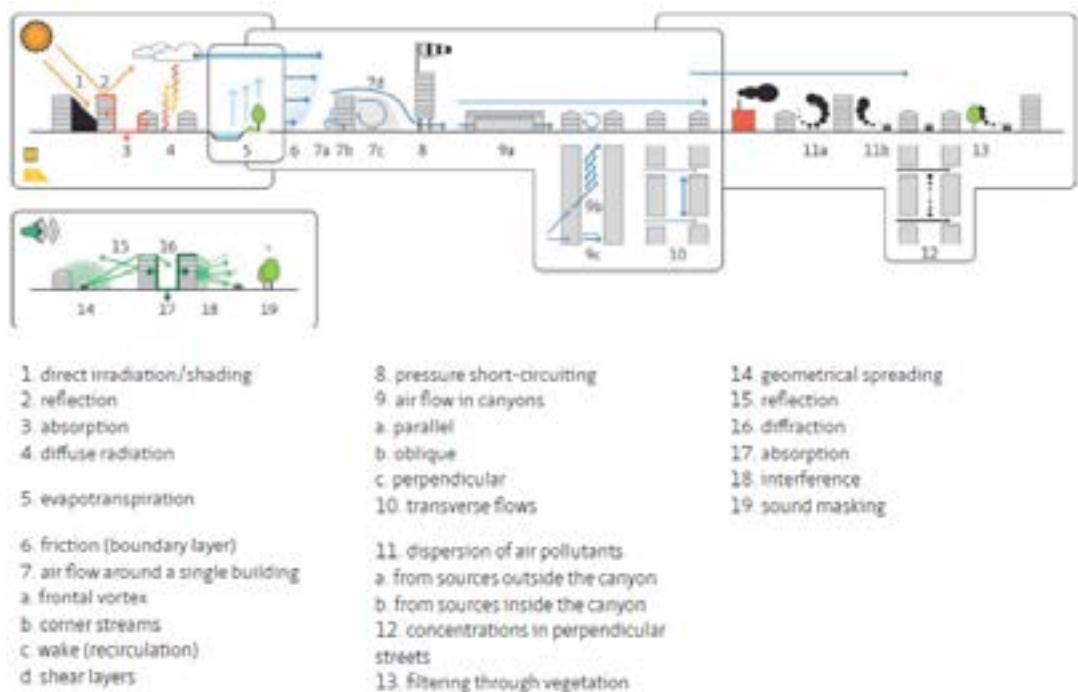


Figure 24 Overview of the physical principles of the urban microclimate
(Pijpers - Van Esch (2015))

High quality structures

In the former section, there was a focus on quantitative improvements, now the qualitative aspects for human health of the physical environment will be explained. The former section had an emphasis on communicable diseases, the impact of the physical environment on mental health will be described here. Cultural ecosystem services, like recreation, aesthetic appreciation, spiritual experiences, sense of place and social cohesion, enrich human life with meanings and emotions as well as contribute to enhance the physical and mental health of city inhabitants (Gómez-Baggethun & Barton, 2013; TEEB, 2011). Green space is often positively related to mental health. Benefits of nature and greenspace for well-being come at three levels, each with implications for planning and design: (i) viewing nature – through windows, from the car, even indirectly on television; (ii) experiencing nature – feeling a part of the natural world by sitting in gardens or pocket parks, smelling the perfume of flowers, listening to the birds, hearing the trickle, swirl of tumble of water and, (iii) being active in nature – playing, walking, running, climbing, trekking, gardening, sporting activity. (Barton, 2017). Health is linked to daylight and sunlight access, which helps to ameliorate Seasonal Affective Disorder (SAD) and improve the cognitive functions of dementia sufferers (Barton, 2017). Direct sunlight in homes helps to reduce fuel bills and thus combat both fuel poverty and carbon emissions. Our sense of hearing brings both joy and pain, in particular for environmental sounds. Exposure to noise, such as aircraft noise, industrial processes, construction sites or noisy neighbours can lead to reduced attention span and great anxiety. On the contrary, natural sounds of birds, water, leaves rustling tend to relax tensions and raise the spirit (Barton, 2017). Smart orientation of buildings and effective hierarchy of places can have many advantages for mental health.

Spatial principles for local urban settings, which are given, have often impact on several health aspects. For example, more neighbourhood tree cover in urbanized areas, independent from green space access, is related to better overall health, primarily through lower overweight/obesity and better social cohesion, and to a lesser extent through less type 2 diabetes, high blood pressure, and asthma (Ulmer et al.,

2016).

Benefits of nature and greenspace for well-being come at three levels, each with implications for planning and design:

- Viewing nature – through windows, from the car, even indirectly on television. This has value and emphasizes the need for trees and natural features to permeate the urban environment; for example through street planning
- Experiencing nature – feeling a part of the natural world by sitting in gardens or pocket parks, smelling the perfume of flowers, listening to the birds, hearing the trickle, swirl of tumble of water. (Sun & Shadow)
- Being active in nature – playing, walking, running, climbing, trekking, gardening, sporting activity. (Barton, 2017)

SOCIAL ENVIRONMENTAL FACTORS

The social environmental determinants consist of the amount and quality of contacts people have. These factors are strongly related with the socioeconomic factors, because the people you meet are in the same cultural groups. Factors in the social environment that are important to health include those related to safety, violence, and social disorder in general, and more specific factors related to the type, quality, and stability of social connections, including social participation, social cohesion, social capital, and the collective efficacy of the neighbourhood (or work) environment (Ahern & Galea, 2011).

local identity and sense of belonging, the norms of mutual trust and support, community-level networks and pressure groups, and the level of civic engagement.

Social capital

Neighbourhoods are spatial entities with a local social and spatial patterns. A community is a network of people who know each other; often they are related to each other because people live in the same area, share the same activities or belong to the same cultural group. For many people, place-based social networks remain critical to their sense of identity, social support and mental well-being. Creating a policy for the physical environment can sharpen social pressures or create social opportunities. These communities ask for opportunities for social interaction, for example toddlers playing on a playground or people meeting casually at the market. Creating opportunities for social interaction, thus for social support, is the main aspect for the design of neighbourhoods. According to (C. Sarkar & C. Webster, 2017), the built environment, by configuring spaces, promotes social interactions and thereby can influence the sense of community and help sustain specific levels of social capital. Five different aspects can be related to the social capital. These aspects are; the informal networks created by friends and neighbours, a

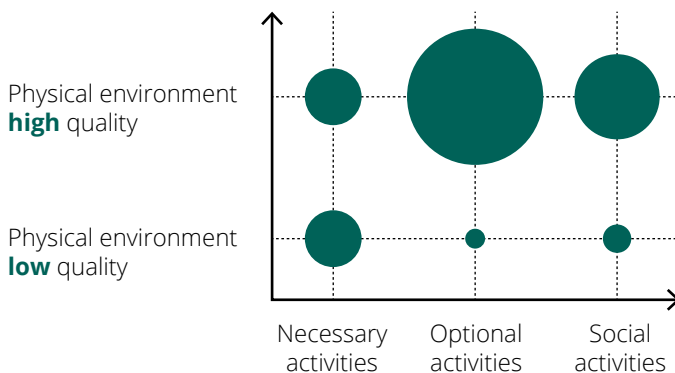
Social activities

Social activities include all types of communication between people in city space and require the presence of other people (Gehl, 2010). Social activities include a wide spectrum of activities. There are many passive see and hear contacts: watching people and what is happening. This modest, unpretentious form of contact is the most widespread social city activity anywhere (Gehl, 2010). A more active form of social contacts are the unpredictable and spontaneous meetings. People exchange greetings and talk to acquaintances they meet. Or people talk about common pursuits when waiting. Finally, there is a large group of more or less planned common activities: markets, street parties, meetings, parades and demonstrations (Gehl, 2010).

Gehl (2010) explains the relation between activities in urban space and the quality of the environment. He puts great diversity of activities in city space on a scale according to their degree of necessity. At one end of the scale are the meaningful necessary activities, which are activities that people generally have to undertake, for example going to school and waiting for the bus. At the other end of the scale are the largely recreational, optional activities that people might like, such as sitting down to enjoy the view or the good weather. A large majority of the most attractive and popular city activities belong to this group of optional activities, for which is a great city quality a prerequisite (Gehl, 2010). Social activities include all types of communication between people in city space and require

the presence of other people (Gehl, 2010). Social activities can be passive and active. Unpredictability and unplanned, spontaneous actions are very much part of what makes moving and staying in city space such a special attraction (Gehl, 2010).

Humans use the physical environment for daily activities, traveling, recreation and to meet others. The physical environment shapes the way they behave and is because of that indirect related to their health. The growing fields of environmental psychology and eco-therapy also demonstrate that direct or indirect exposure to natural settings can have a restorative effect on mental health and social interactions (Frumkin & Jackson, 2014). While people make their own choices, the context of those choices is set by the environment people live in as well as economic circumstances, cultural norms of behaviour and their personal characteristics and experiences. Currently, almost half of the Dutch citizens is overweight (BMI<25), what also means that these people have increased risk of heart attack, stroke, osteo-arthritis, diabetes and some forms of cancers. Obesity is largely preventable by sufficient physical activity and consuming healthier food. Supportive environments, which make regular physical activity the easiest choice, give opportunities for active recreation and offer healthy food. This creates spatial options for a healthier lifestyle.



Graphic representation of the connection between the outdoor quality and outdoor activities. An increase in outdoor quality gives a boost to optional activities in particular. The increase in activity level then invites a substantial increase in social activities.

Figure 25 Physical environment and outdoor activities
(Gehl, J., Cities for people, 2010)

Deprived neighbourhoods

Studies from various countries have reported that social neighbourhood features, such as social networks, social capital, cohesion, informal social control, disorder, and unsafety feelings affect people's health. Living in cohesive neighbourhoods and in neighbourhoods with much social capital has been found beneficial for both physical and mental health. We observed that deteriorating social cohesion and unsafety feelings in the area can be negatively associated with the health of residents, independent of the other area aspects, while improvement in social cohesion was associated with better general health of the population (Ruijsbroek, Droomers, Hardyns, Groenewegen, & Stronks, 2016).

Data across 308.849 individuals, followed for an average of 7,5 years, indicate that individuals with adequate social relationships have a 50% greater likelihood of survival when compared to those with poor or insufficient social relationships. The magnitude of this effect could be compared to quitting smoking and it exceeds many well-known risk factors for mortality (e.g. obesity, physical inactivity) (Holt-Lunstad, Smith, & Layton, 2010). This comparison shows the importance of social relationships for health. The research of Holt-Lundstad (2010) states that based on their findings, the most important challenge is how to effectively utilize social relationships to reduce mortality risks. The design of the living environment can be seen as one of the ingredients to utilize stronger social relationships. Health professionals and social workers in The Hague emphasize the importance of social relationships to recognize and solve health issues. Especially for people with smaller social networks and less knowledge of the Dutch healthcare and governmental systems, is it of great importance to increase and widen their social environment. Often, these networks are based on cultural backgrounds and not well-known with the Dutch structures.



DEPRIVED NEIGHBOURHOODS THE HAGUE

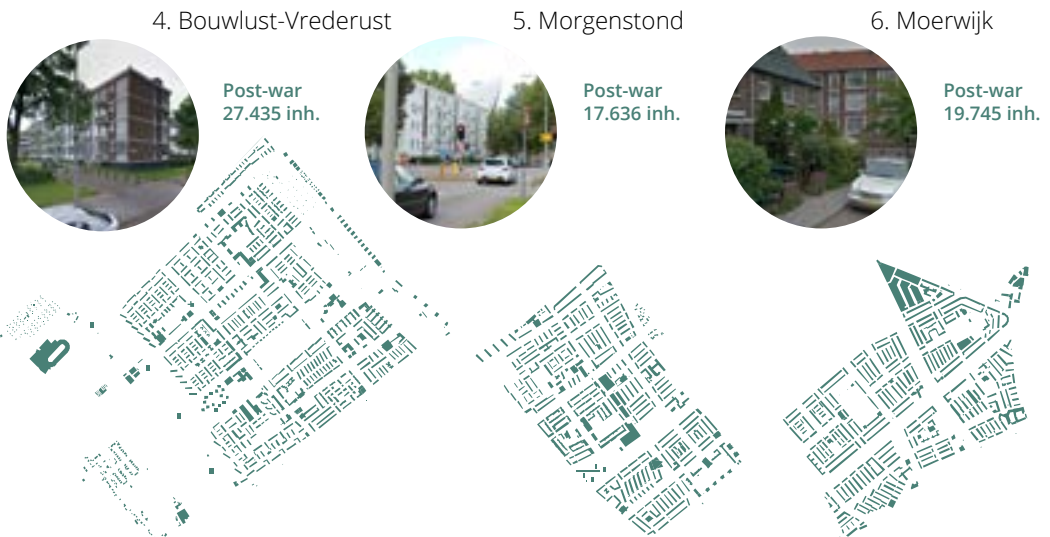
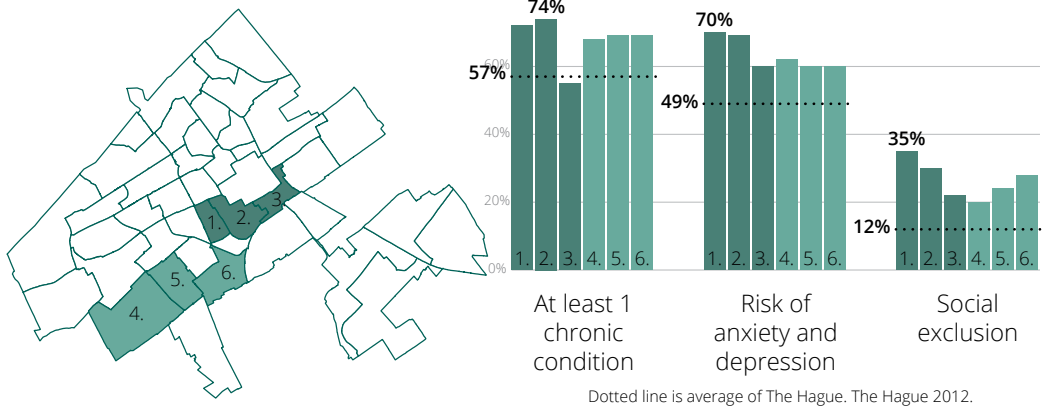


Figure 26 Deprived neighbourhoods The Hague

(facts: GGD Haaglanden, Gezondheid van volwassen en ouderen; een gebiedsgerichte analyse, 2014)

BEHAVIOURAL FACTORS

The focus of this graduation project is on the role of the built environment in affecting human health. However, as important as the built environment is, it is far from being the only determinant of health. Even well-lit, cheerful staircases; broad, attractive sidewalks; and safe, well-constructed bicycle paths may not seduce people into forgoing the elevator, walking to work, and cycling on errands (Dannenberg, Frumkin, & Jackson, 2011).

Changes to the environment may facilitate healthy lifestyle choices among some individuals and have little or no impact on others (Dannenberg et al., 2011). In one study, for example, expanded access to outdoor individual sports facilities increased physical activity only among adults who had low self-efficacy for exercising (Cerin, Vandelandotte, Leslie, & Merom, 2008).

Active travel

Healthy lifestyle

Active travel= walking, cycling to work/school/ daily facilities/shops/PT hubs

- Logical + attractive routes
- Optional: challenging routes with obstacles, for more fun, more freedom of choice, awareness

Children active play= running, gambolling, playing

- Attractive playgrounds for different target groups (age)
- Connection between playground
- Accessibility & safety of playground

Adults recreational activity

- On spot; facilities (sports, gardening, fitness)
- On route; attractive walking/ cycling/ wheeling routes (zie ook optional route Active travel)

Rest & spirituality

- Options to reflect, possible role for religion
- Contact with nature

Goal: Make people more aware of their healthiness and facilitate more and easier options for an healthier lifestyle.



Figure 27 Spatial aspects related to design principles



Figure 28 Rustenburg, Tienhovenselaan

DESIGN APPROACH

REFERENCE PROJECTS 56

Superkilen, Copenhagen (Denmark) 57

Bo01-'City of tomorrow', Malmö (Sweden) 58

'Leefstraten', diverse cities in Flanders (Belgium) and the Netherlands 59

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Fictive neighbourhood residents 65

REFERENCE PROJECTS

This research is not the first attempt to design healthier urban places. In this section, three reference projects are analysed to learn from the interventions and manner of implementation. Every reference project has different highlights and therefore different specific influences towards human health.

The first reference project is a park in Copenhagen (Denmark), the second project is the sustainable neighbourhood Bo01 in Malmö (Sweden) and the last project is called the 'leefstraten' and covers several cities in Flanders (Belgium) and the Netherlands. Similar in all the projects is the oceanic climate, differences are the involvement of the actors and scale of impact. Each project is rated on its influence on the three variables of determinants of health.

Superkilen, Copenhagen (Denmark)

Copenhagen is well-known by the green areas between the urban fingers. This structure made it possible to create a strong, save and attractive cycle network through the city. Copenhagen is one of the most cycle friendly cities in the world. Superkilen, a contemporary park designed by BIG, Topotek and Superflex, hooked on to this vision. They designed a 700m long urban space wedging through one of the most ethnically diverse and socially challenged neighbourhoods in Denmark. The existing cycle paths are reorganized and new connections linking to the surrounding neighbourhoods are created. The park supports diversity, this is visible in spatial elements from all over the world. These elements include furniture, play elements, lampposts and trees. The public space is divided in three zones with their own characteristics. The red zone is the playful area with kinder garden elements, sport objects and a market square. The black zone is the urban living room with many sitting objects and the green zone focus on sporting. Because of the patchwork of meeting points and exercise possibilities, this park is a good example for healthy urban design.

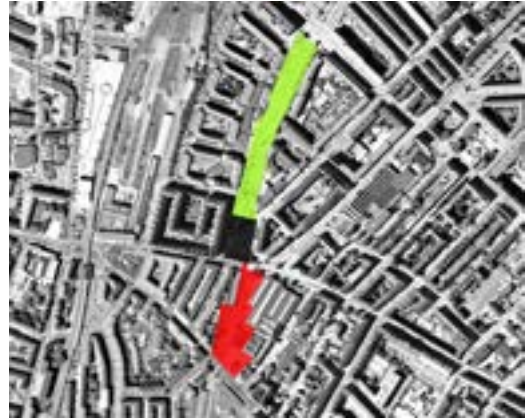


Figure 29 Zoning map Superkilen
(Bjark Ingels Group)

Brilliant intervention

The many different playful and interactive elements which represent and connect the inhabitants in the surrounding area.



Figure 30 Black zone, Superkilen
(Iwan Baan)

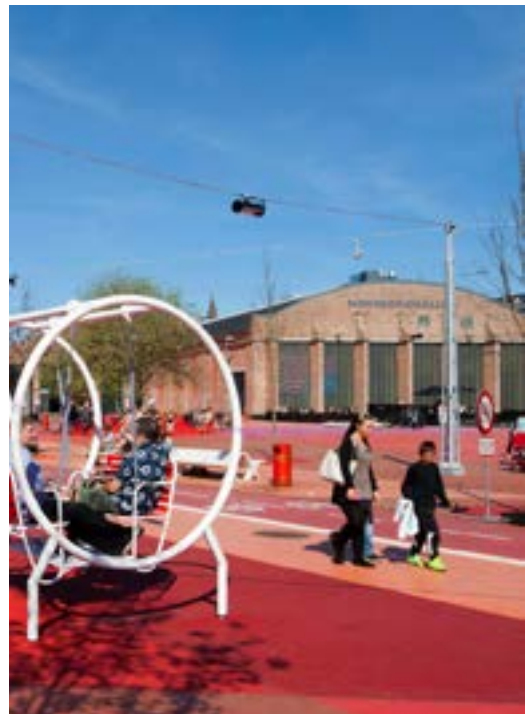


Figure 31 Red zone, Superkilen
(Torben Eskerod)

Bo01-'City of tomorrow', Malmö (Sweden)

This neighbourhood in Malmö is realized in a former industrial port, where the ground used to be polluted. Bo01 represents the first step in the process of transforming this former port, which will offer housing for 30.000 people. Despite the high density and the urban character, a great deal of attention has been given to highly diverse green spaces and biodiversity. Large numbers of trees, creeper plants, ponds and green roofs mean that every garden is home to at least 50 varieties of plants and offers food for birds. The public spaces, most of which are closed to cars, provide a range of possibilities for cycling or walking along its pleasant routes. The area is characterised by its use of recycled water, raw materials and waste, and its use of natural resources such as sun and wind energy. By stimulating a great deal of diversity in the architecture without the usual restrictions, the district's planners have created an unusual laboratory, resulting in an attractive district. This neighbourhood is a good example because of the integral sustainable approach. This is a newly constructed neighbourhood, but some spatial interventions are also usable in existing neighbourhoods.



Figure 32 Detail watermanagement
(Jonathan Perrin)

Brilliant intervention

The high quality of the implementation of the sustainability concept. Also small scaled interventions, such as the detail on Figure 32, shows that concept in detail is elaborated.



Figure 33 Masterplan western harbour
(Jonathan Perrin)



Figure 34 Inner area Bo01
(City of Malmö)

'Leefstraten', divers cities in Flanders (Belgium) and the Netherlands

This concept started in 2013 in Gent (Belgium) under the name: leefstraten. Since then, the same concept has been applied in several cities under terms as: 'toekomststraten', 'tuinstraten', 'droomstraten' en 'samenleefstraten.' This concept is a temporary transformation of urban streets which were unsafe, full of parked cars and had an unattractive public space. The new design is often done with sitting elements made of cheap materials, fake green grass and the addition of plants and flowers.

This concept is chosen as example of excellent healthy urban planning because of the easy application and the main role for the inhabitants. Inhabitants have the opportunity to experience the advantages and disadvantages of using their street as a living area. The process of transforming gives the inhabitants more ownership which makes them feel more concerned about their living environment. Although, this concept is still temporary, it shows the municipalities that the transformations performed well.



Figure 35 Droomstraat Berkelseweg, Utrecht
(Mick Otten)

Brilliant intervention

The empowerment of the residents is the most valuable good of this approach. The process is maybe even more important than the spatial configuration.



Figure 36 Leefstraat, Ghent
(Lori Zimmer)

DESIGN PRINCIPLES

The six main healthy topics from the theory can be translated to design principles. These themes have each in their own impact on human health. The application of these principles is only possibly by use of common design conditions, such as safety, scale, accessibility, context and climate. Understanding of these conditions is prerequisite for basic urban planning. Every design principle represents a part of the healthy design approach. Ecological resilience has an emphasis on the quantitative physical environment. This design principle has as goal to optimize the effects of the ecosystem. The high quality structures is focussing on the experience of the physical environment. The quality of the built and natural environment benefits the well-being of human beings. The two design principles derived from the social environmental determinants of health are

social capital and social activities. The first principle focusses on the health benefits of a community. The last principle has the goal to optimize the opportunities for social interaction in any possible way. From the behavioural determinants of health are active travel and healthy lifestyle derived. Both principles are related to conscious choices of individuals. In the first principle, the emphasis is on the way people travel in daily life. The last principle focusses on how they use their spare time.

Investors and policy-makers have a responsibility to understand the importance of local community networks – including formal and informal social groups – and to work with local organizations to ensure that their decisions facilitate those networks. This social responsibility applies across the board – to the private sector as well as the public and

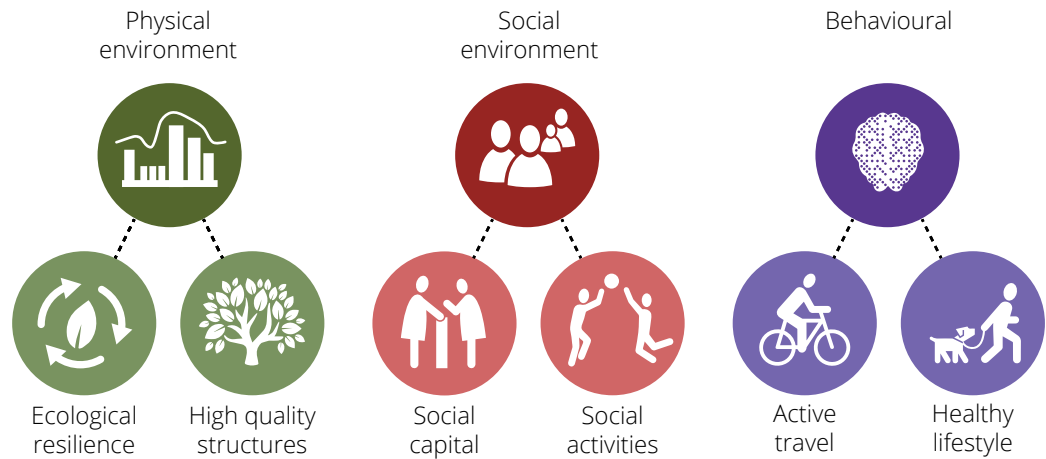


Figure 37 Relation theory and design principles

DESIGN CONDITIONS



HEALTHY DESIGN PRINCIPLES



DESIGN ELEMENTS



Figure 38 Relation theory and design principles

voluntary sectors. Planners have a particular responsibility to structure the public realm in such a way that social networks are supported and fostered, not undermined (Barton et al., 2010).

In to book A Pattern Language of Christopher Alexander are many patterns explained for urban planning and architecture (Alexander et al., 1977). He also wrote about the importance of human health in urban planning.

47 health center

Statement: More than 90 per cent of the people walking about in an ordinary neighbourhood are unhealthy, judged by simple biological criteria. This ill health cannot be cured by hospitals or medicine. Solution: Gradually develop a network of small health centers, perhaps one per community of 7000, across the city; each equipped to treat everyday disease- both mental and physical, in children and adults – but organized essentially around a functional emphasis on those recreational and educational activities which help keep people in good health, like swimming and dancing.

“A system of health care which is actually capable of keeping people healthy, in both mind and body, must put its emphasis on health, not sickness. It must therefore be physically decentralized so that it is as close as possible to people's everyday activities. And it must be able to encourage people in daily practice that lead to health. The core of the solution, as far as we can see, must be a system of small, widely distributed, health centers, which encourage physical activities -swimming, dancing, sports, and fresh air- and provide medical treatment only as an incidental side of these activities.

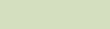
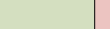
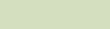
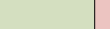
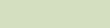
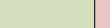
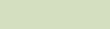
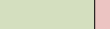
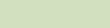
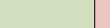
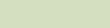
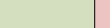
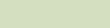
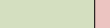
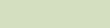
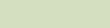
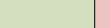
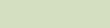
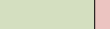
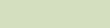
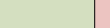
	Ecological resilience	High quality structures	Social capital	Social activities	Active travel	Healthy lifestyle
Furniture						
Sport and interactive objects						
Aesthetic and cultural objects						
Green infrastructure						
Food production						
Water management						
Waste management						
Environmental protection						
Traffic calming						
Nodes of public transport						
Bicycle facilities						
Routes						
Ownership of public space						
Local shops and facilities						
Flexibility and temporality						
Information provision						
Surface						
Lightning						

Figure 39 Direct influence of design element for design principles

NARRATIVE HEALTHY ENVIRONMENTS

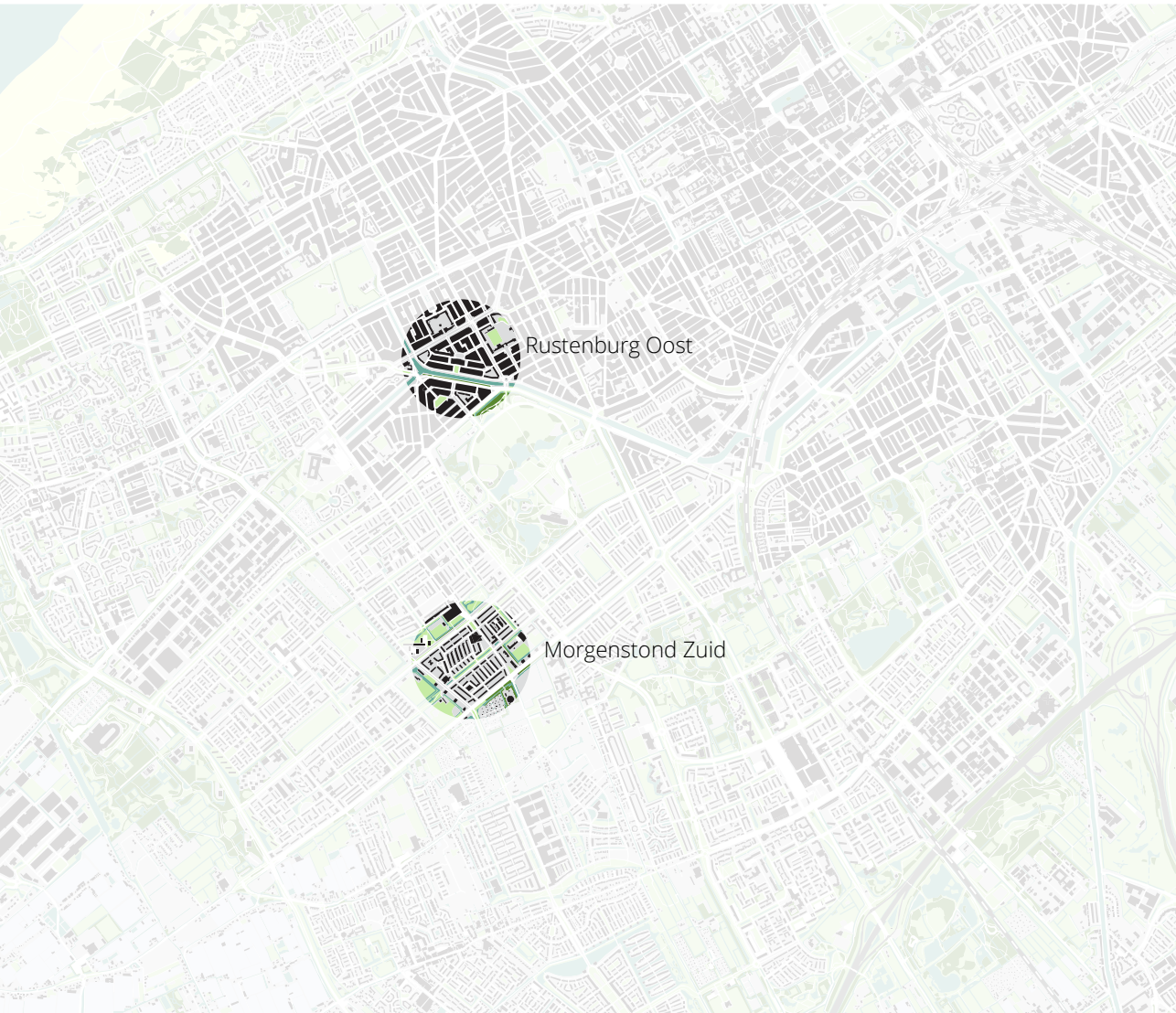


Figure 40 Test case neighbourhoods The Hague

SCALE - 1:50.000 

Rustenburg



- John (44)** Software engineer
Obesity, BMI > 30
- Nadia (39)** Saleswoman at bakery
Diabetes mellitus
- Adam (9)** Primary school pupil
- Sofia (6)** Primary school pupil
Asthma & hay fever



- Bea (67)** Since a year retired
Genetic coronary artery disease
- Lives together with dog

Morgenstond



- Harry (79)** Back and neck complaints
Recovering from a TIA
- Sara (75)** Volunteer at neighbourhood centre
Osteoarthritis



- Jamal (25)** Cipier in a prison
- Talisa (22)** Law student
Experience much stress

Figure 41 Fictive residents test cases

Explanation test cases

RUSTENBURG
-shows phenomina of deprivation

MORGENSTOND
- deprived neighbourhood

both:
- plans of municipality
- contrasting structure

Fictive neighbourhood residents



Figure 42 Morgenstond, cyclepath Steenwijklaan

TEST CASE: RUSTENBURG OOST

SPATIAL ANALYSIS	68
Spatial characteristics	70
DESIGN LOCATIONS	77
SOESTDIJKSEKADE & LAAKKANAAL	78
WOONERF	82

SPATIAL ANALYSIS



Figure 43 Spatial concept
Rustenburg

SCALE - 1:4.000



Figure 44 Physical
environmental structures
Rustenburg

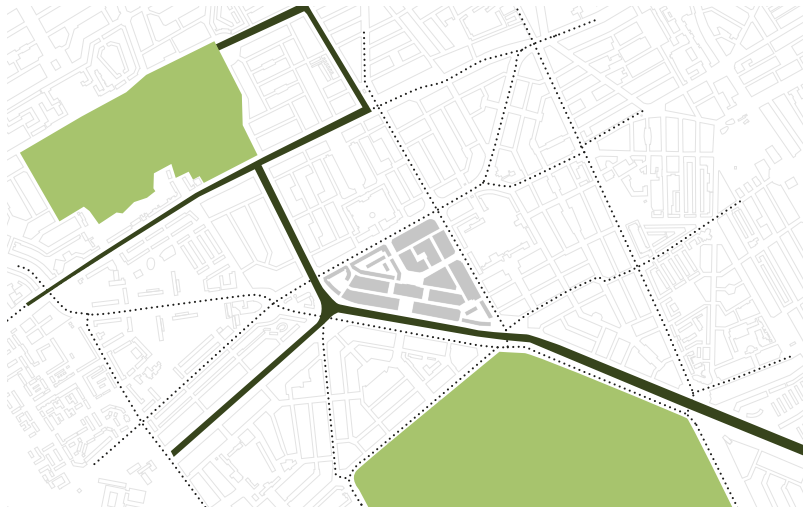


Figure 45 Social
environmental structures
Rustenburg



Figure 46 Physical and
social environmental
structures Rustenburg

LEGENDA

- Large green-blue zones
- Important green-blue zones structures
- Social functions



SCALE - 1:4.000



Spatial characteristics

History

The neighbourhood Rustenburg-Oostbroek was built between 1923 and 1937. The neighbourhoods Transvaalkwartier and Valkenboskwartier form the edges on the north and east part of Rustenburg-Oostbroek. The south-west edge is the Laakkanaal. This canal was dug after annexation of Loosduinen in 1923. This canal improved the transport of the agriculture in Het Westland. The structure of Rustenburg-Oostbroek is based on a revision of the extension plan for The Hague by H.P. Berlage. The intended inhabitants for this neighbourhood were wealthier workers.

Urban form

This structure is characterized by an orthogonal and symmetric morphology, clear hierarchic infrastructure and important public functions on strong locations. The hierarchy in the infrastructure is visible in the 40m width of the main roads in comparison to the 'frugal' design of residential streets. The main roads are designed as monumental roads, with higher buildings and spatial highlights (school, churches). Tram connections were built on these main roads.

Green infrastructure

Little green is present in this neighbourhood. Except for some small lots with bushes and

trees, there is no space left for greenery. This was not necessary in the eyes of the municipality, because the Zuiderpark, close to the neighbourhood, could be used for recreation. Laakkanaal is situated along the neighbourhood. In the past, this was an important infrastructure for cargo ships. Today, it functions as water storage and border between polders.

Architecture

The building blocks are closed elongated blocks, generally with three layers. The housing typology varies between row housing and small apartment buildings. The roofs reveal often the type housing; the row houses have often saddle roofs and the apartment buildings have flat roofs. The architecture of the buildings is inspired on F.L. Wright and is recognizable by the red brick walls, the horizontal accents in the façade and vertical rhythm in porches and bay windows (Freijser & Teunissen, 2008). This architecture is well-known as the 'Nieuwe Haagse School' (New school of The Hague). Shared stairs as entrances to the apartments are typical elements of this tendency. The neighbourhood is not a masterpiece of the Nieuwe Haagse School, but the architecture is today still much appreciated (Freijser & Teunissen, 2008).



Figure 47 History: Loenensestraat with tram
(Neighbourhood organization 'Oog voor de buurt')

Functions

The public functions, such as schools and churches, are land marks along the main roads (Escamplaan, Dierensestraat, Apeldoornsestraat and Zuiderparklaan). The corners of the housing blocks were meant for commercial functions (see Figure 47). The idea of these commercial corners was based on local economy, the inhabitants of the neighbourhood could buy almost all their daily groceries within 200m from their house (Centrale Directie van de Volkshuisvesting en de Bouwnijverheid, 1971). The neighbourhood had also a concentration of shops on the Dierensestraat.

Transformation

The housing shortage, the development of technology and the upcoming of the car changed The Hague vigorous after the Second World War. In the south-west part of The Hague new neighbourhoods were built, this time under direction of W.M. Dudok and with a modern appearance. Rustenburg-Oostbroek was not anymore the edge of The Hague, but part of the urban fabric. In 1948 tramline 15 (Zuiderparklaan-Staatsspoor) is constructed on the Zuiderparklaan (see Figure 48). Already in 1958, the line is dissolved in order to make room for the car.

A questionnaire from 1971 proved that

Rustenburg-Oostbroek was in good social condition. Nine out of ten respondents were satisfied with the amount of contact with their neighbours and more than 80% often made a chat in the shops or on the streets (Centrale Directie van de Volkshuisvesting en de Bouwnijverheid, 1971). This questionnaire also asked to compare Rustenbroek-Oostbroek with the new neighbourhoods (Moerwijk and Morgenstond). The results indicated that 74% did not want to life in the a new neighbourhood. They understood the advantages of the modern urban approach, such as the space and the green, but this doesn't compensate the alternating, cosy and intimate ambiance of their own neighbourhood (Centrale Directie van de Volkshuisvesting en de Bouwnijverheid, 1971). This vibrancy can be seen as one of the qualities of Rustenbroek-Oostbroek.



Figure 48 History: Corner shops on Blaricumseplein
(Neighbourhood organization 'Oog voor de buurt')

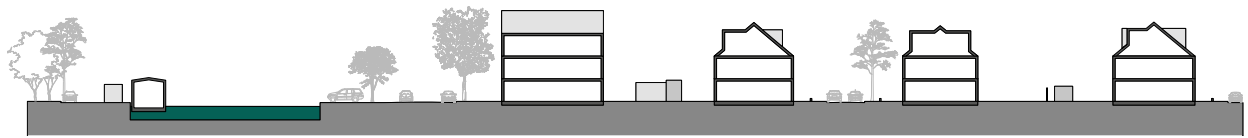


Figure 49 Section Rustenburg Oost

SCALE - 1:1.000

LEGENDA

- ▲ ▲ Front of building
- ▤ Public space
- ▬ Streets
- ▬ Buildings

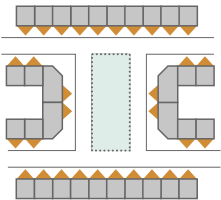
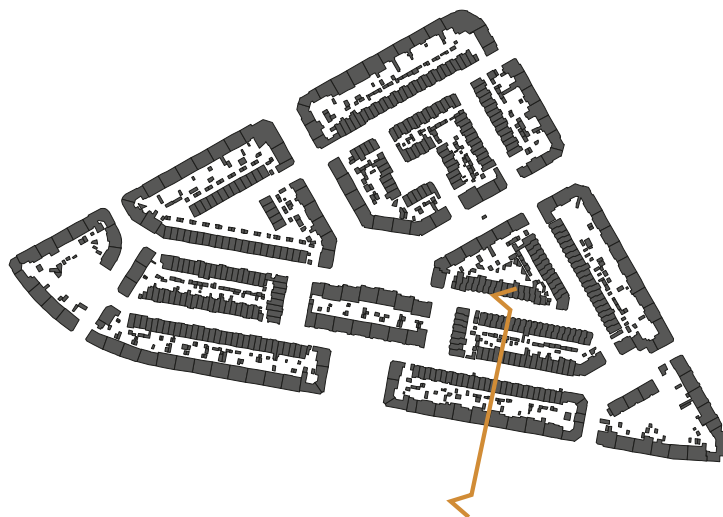


Figure 50 Typology public space Rustenburg Oost

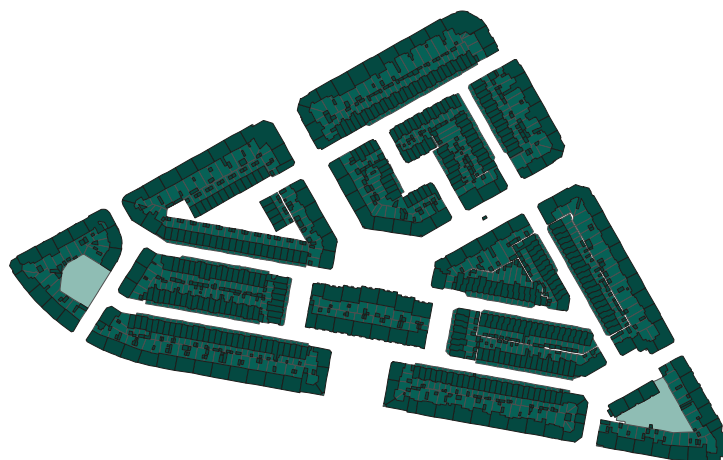
LEGENDA

Buildings



LEGENDA

Private space
 ↑
 Collective space
 ↓
 Public space



LEGENDA

Front of building
 Back of building
 Typological public space
 Atypical public space
 Buildings
 Buildings in construction

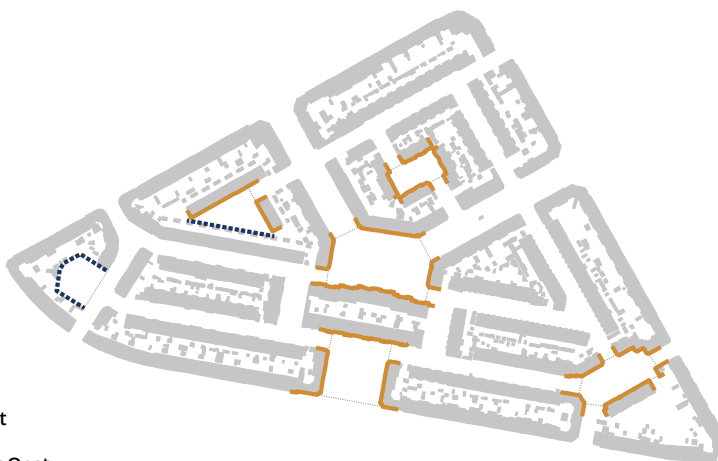


Figure 51 Buildings Rustenburg Oost

Figure 52 Private/Public Rustenburg Oost

Figure 53 Classification public space Rustenburg Oost

SCALE - 1:4.000



LEGENDA

- Social facilities with substantial impact
-
-
- Social facilities with rather impact

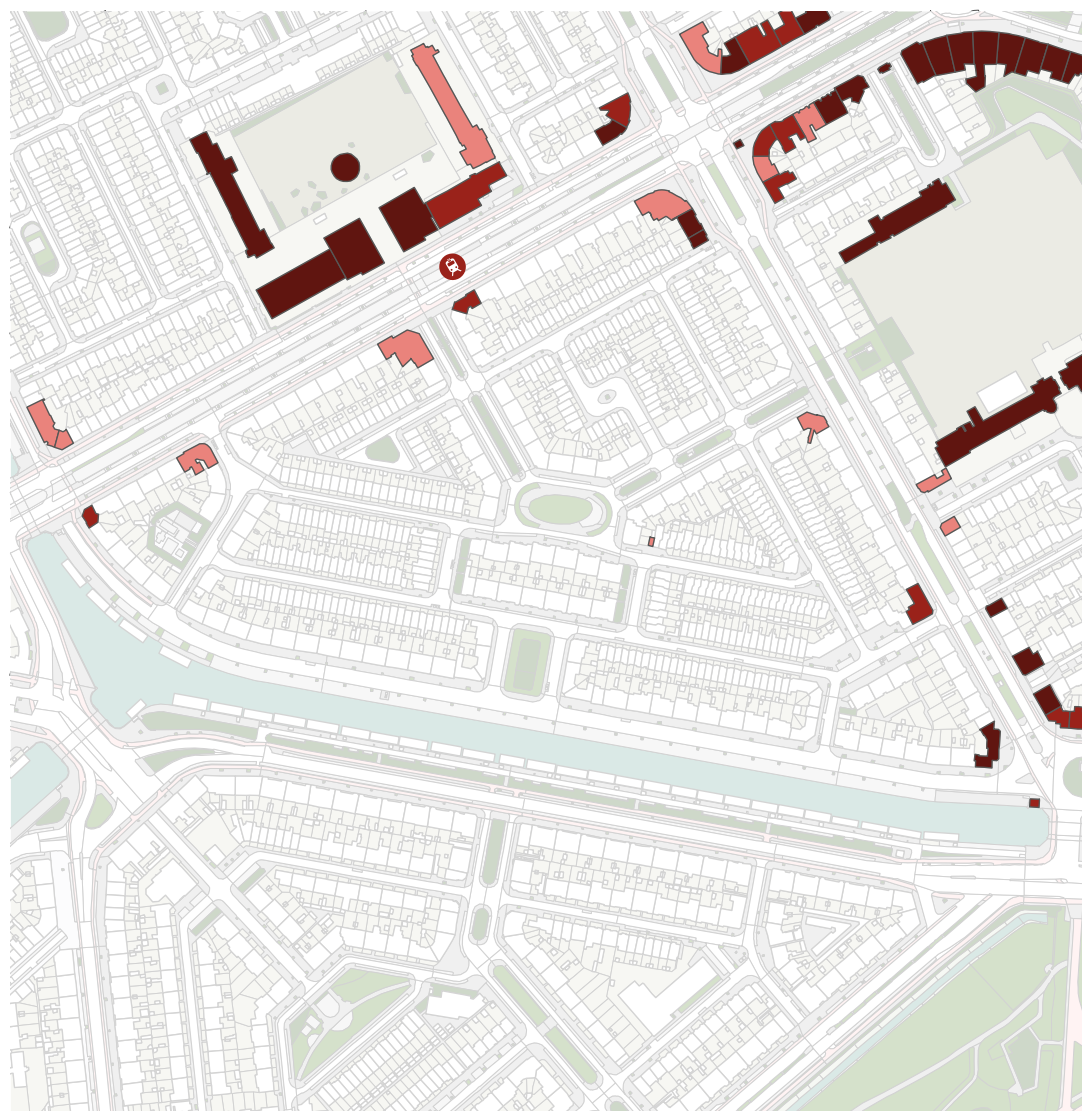


Figure 54 Social facilities Rustenburg Oost

SCALE - 1:5.000



LEGENDA

- Water
- Grass
- Bushes
- Trees



Figure 55 Physical environmental structures Rustenburg Oost

SCALE - 1:5.000





DESIGN LOCATIONS

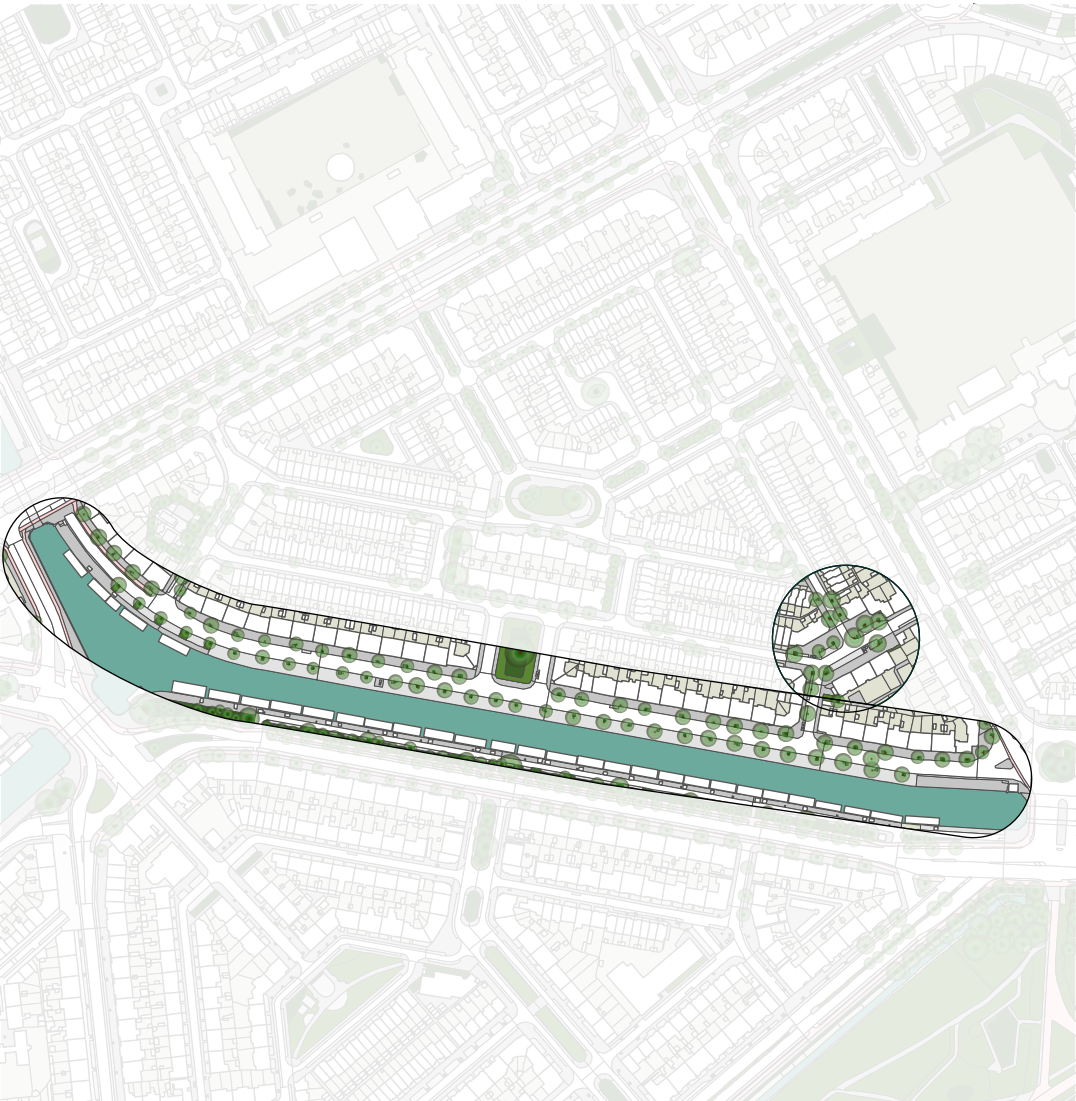


Figure 56 Design locations Rustenburg Oost

SCALE - 1:5.000 

SOESTDIJKSEKADE & LAAKKANAAL



Figure 57 Soestdijksekade & Laakkanaal



SCALE - 1:2.500



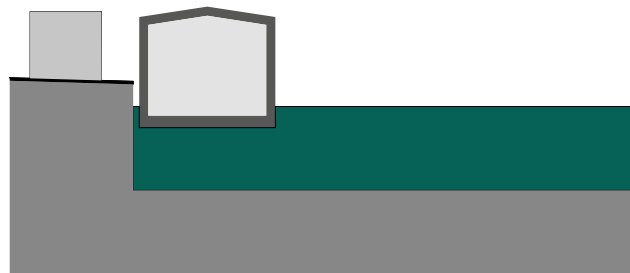


Figure 58 Section Soestdijksekade & Laakkanaal



SCALE - 1:250

WOONERF



Figure 59 Woonerf, montage tram



Figure 60 Woonerf

SCALE - 1:1.000





Figure 61 Morgenstond, inner open garden

TEST CASE: MORGENSTOND ZUID

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COLLECTIVE OPEN GARDEN	100

SPATIAL ANALYSIS



Figure 62 Spatial concept
Morgenstond

SCALE - 1:4.000



Figure 63 Physical
environmental structures
Morgenstond



Figure 64 Social
environmental structures
Morgenstond

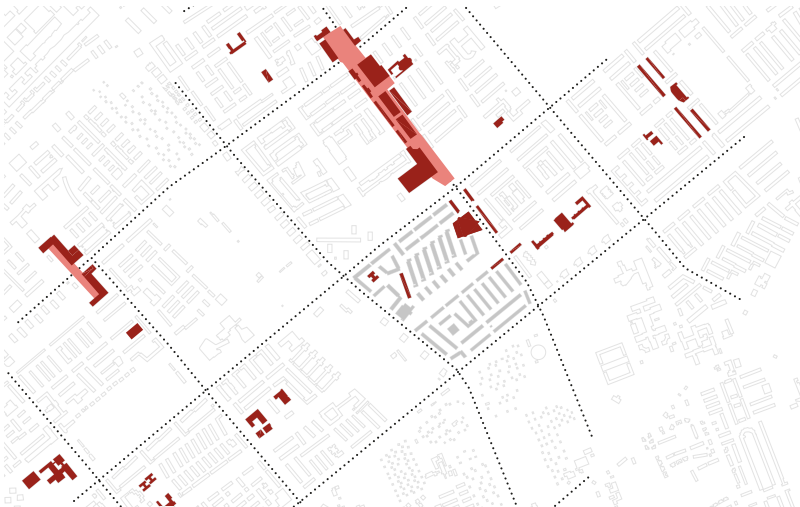


Figure 65 Physical and
social environmental
structures Morgenstond

LEGENDA

- Large green-blue zones
- Important green-blue zones structures
- Social functions

SCALE - 1:4.000



Spatial characteristics

History

This neighbourhood, built between 1950 and 1960, is based on the extension plan for The Hague by W.H. Dudok. The extension was already planned before World War II. After the war, this large extension had to solve the shortage of affordable working-class houses. In ten years, 9200 dwellings were built in Morgenstond. Dudok strived for a gentle transition between the city and the surrounding landscape. Most of the housing is owned by housing associations and are in use for social housing. Morgenstond is called after farms which were located in the former polder area.

Urban form

This new neighbourhood had to meet the new insights of urban design and public housing, influenced by the modern movement. The main infrastructure is related to the parallel lines of the coast and perpendicular lines are strong connected to the existing city structure (see Figure 66). The neighbourhood should be more spacious, opener and greener than the pre-war neighbourhoods. To achieve this goal, Dudok designed open housing blocks with collective gardens. The infrastructure in the neighbourhood is also rectangular and the building blocks in this fabric are ordered elements (Valentijn, 2002).

Green infrastructure

With the design of Morgenstond, also green areas were planned. Next to the Melis Stokelaan, a green belt from the Zuiderpark towards Ockenburgh was planned. Perpendicular on this axis a green buffer zone was planned. In the first case, this was meant for a ring railway, but sport facilities and allotment gardens were built. This big cross should connect different green areas with each other. Many long waterlines, the small canals, are designed to emphasise the rectilinear lines in the neighbourhood. Next to the aesthetic role, these waterlines are meaningful for the drainage or precipitation. Because of their openness the collective gardens have the appearance of public green space (see Figure 67). This modern way of building did not include individual gardens, sheds and fences.

Architecture

This neighbourhood is built in the 'maakbaarheid' ideology. The form of the neighbourhood is inspired by the modern principles of CIAM, with rhyme between the buildings and a clear hierarchy. The construction of the portico flats is financed with low budgets, which explains the lesser variation between building blocks. This was possible because of new building technologies such as prefabricated building methods. Most of the long building strips have half-deepened plinths,

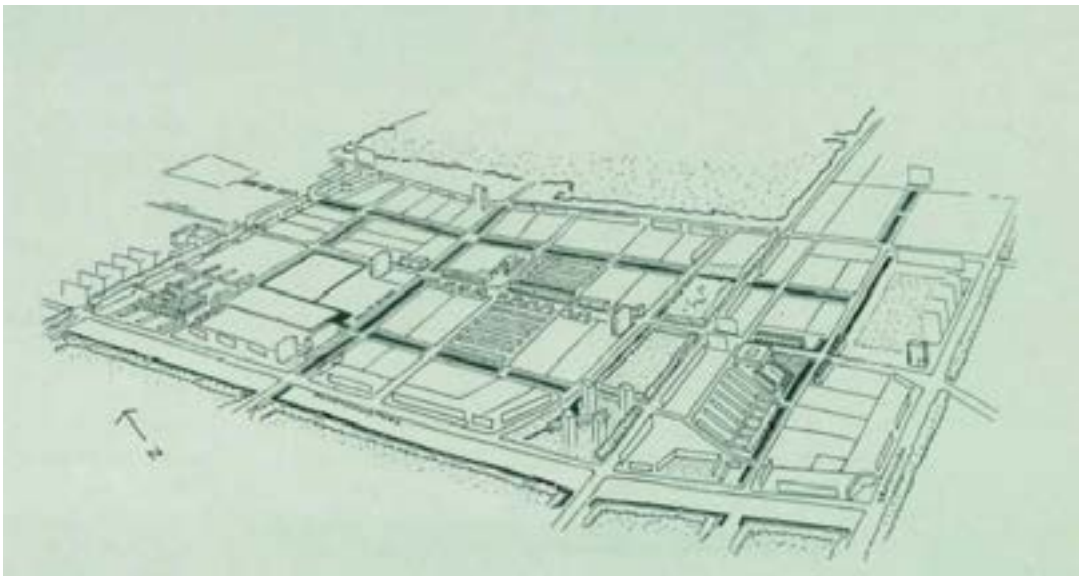


Figure 66 Drawing structure Morgenstond
(Valentijn, 2002)

three or four layers and a flat roofs.

Functions

A large shopping area with public functions was planned around the Leyweg. Dudoks idea was only to build some shops, a school and a church, but Bakker Schut (head of public works of the Municipality of The Hague) expected the need for a vibrant public area (Valentijn, 2002). Because of his view, a cinema, neighbourhood centre and a library were added. This elongated area reserved for these public functions has been experienced as unattractive and uncomfortable since the opening. Despite the negative appearance of the area, it is still the main shopping area for the South-Western part of The Hague.

Transformation

Dudoks philosophy, that the public realm is not necessary in the neighbourhoods, was probably the downfall voor Morgenstond. He believed that new mobilities gave enough opportunities to travel to like-minded people. The first phase of restructuring was in the beginning of this century. Portico flats had been removed for the typical low-rise, high-density rental and owner-occupied houses, resulting in streets that look exactly the same as those found in most of the VINEX-neighbourhoods. The new housing often has private gardens, which changed the public space drastically. These transformations were

done without any respect for existing building typology or existing qualities of the spatial form. The replacement of social housing with private housing attracted more wealthy people to this area. Because of this replacement, the socioeconomic-data were upgraded in the renewed areas. Parts of neighbourhood still have multiple socioeconomic problems and a low building quality, which are the main reasons for the expected urban renewal.



Figure 67 History: Collective gardens Morgenstond, 1957
(The Hague, 'Dienst van Stadsontwikkeling')

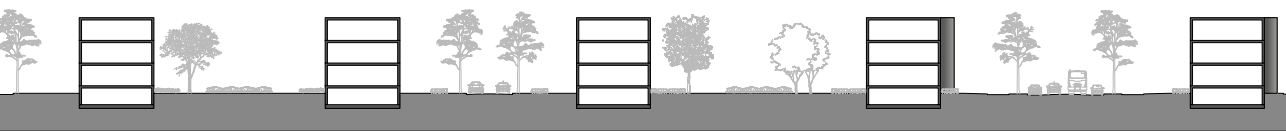


Figure 68 Section Morgenstond Zuid

SCALE - 1:1.000

LEGENDA

-  Front of building
-  Public space
-  Streets
-  Buildings

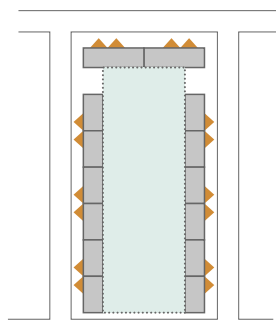
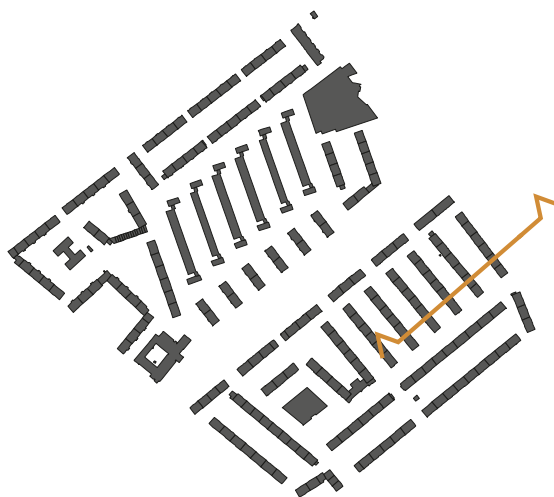


Figure 69 Typology public space Morgenstond Zuid

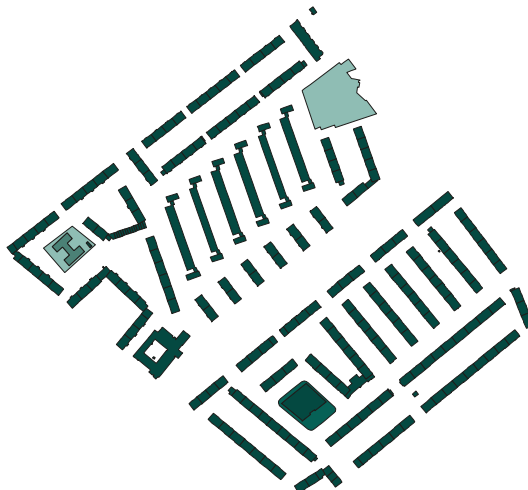
LEGENDA

Buildings



LEGENDA

Private space
 ↑
 Collective space
 ↓
 Public space



LEGENDA

Front of building
 Back of building
 Typological public space
 Atypical public space
 Buildings
 Buildings in construction

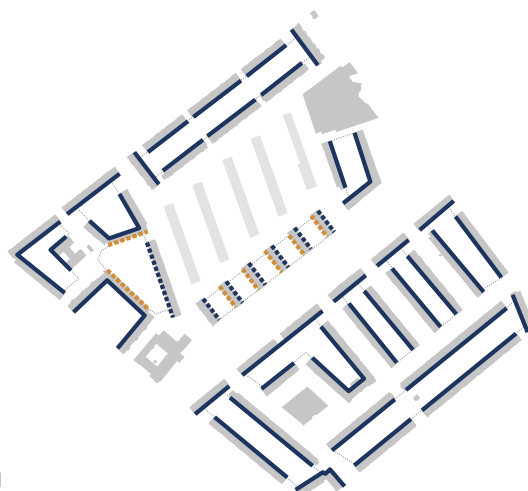


Figure 70 Buildings Morgenstond Zuid

Figure 71 Private/Public Morgenstond Zuid

Figure 72 Classification public space Morgenstond Zuid

SCALE - 1:4.000



LEGENDA

- Water
- Grass
- Bushes
- Trees

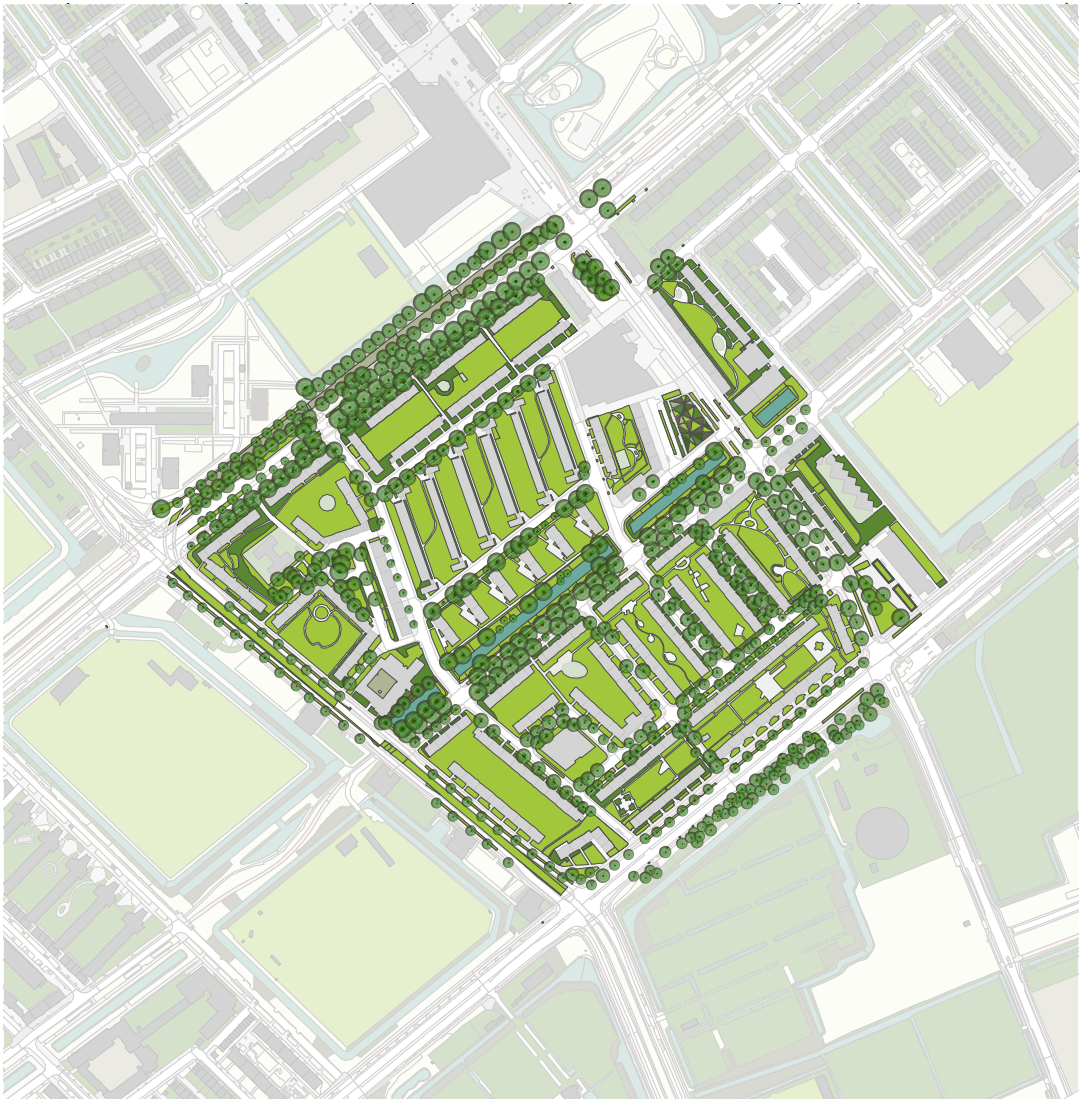


Figure 73 Physical environmental structures Morgenstond Zuid

SCALE - 1:5.000



LEGENDA

- Social facilities with substantial impact
-
- Social facilities with rather impact

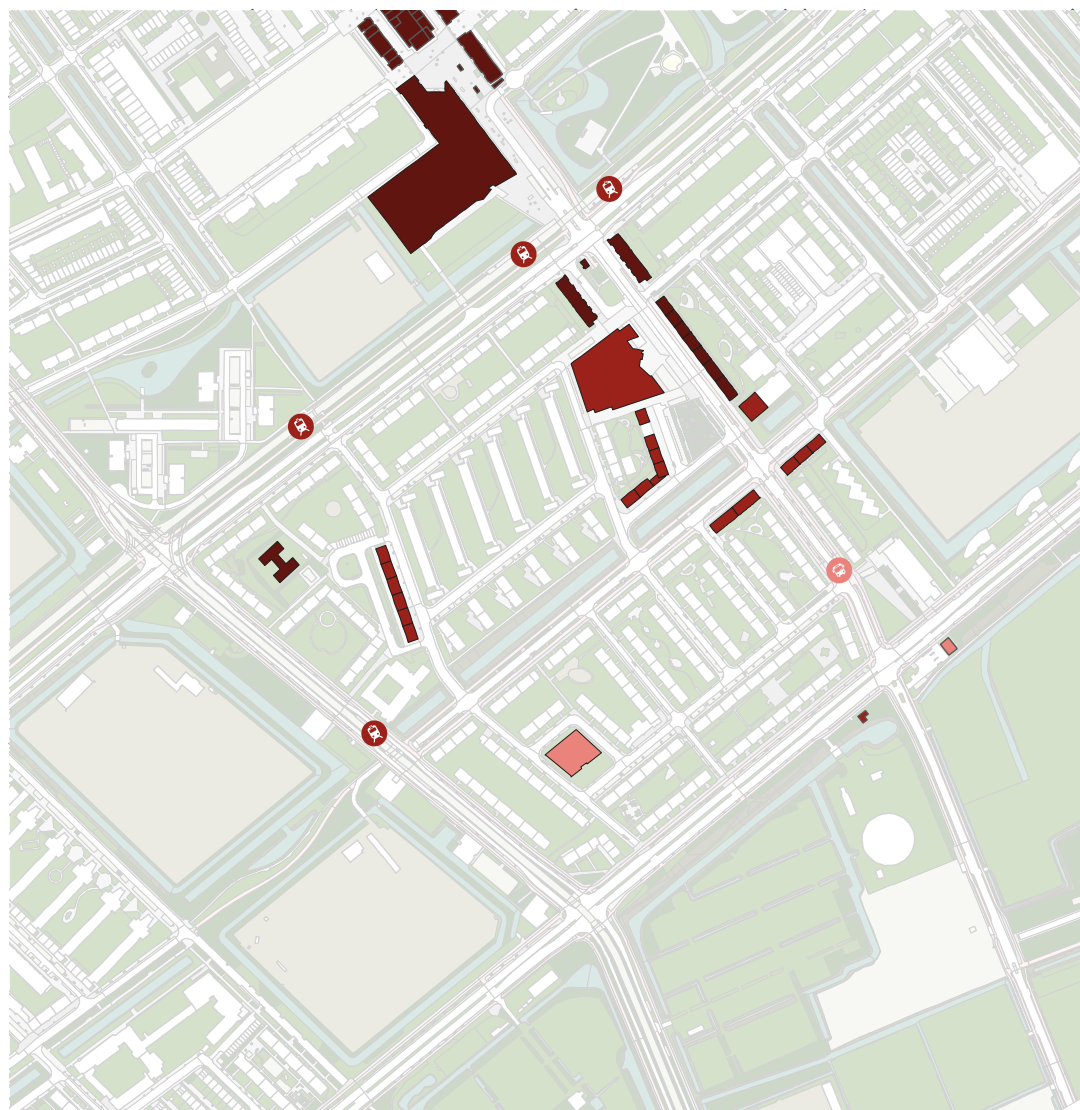
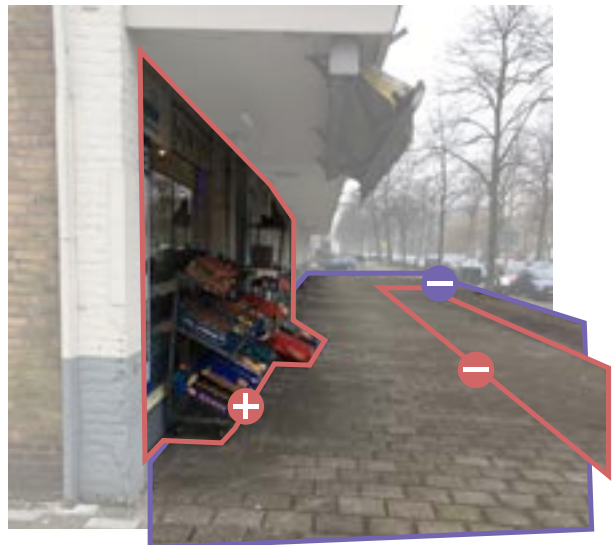
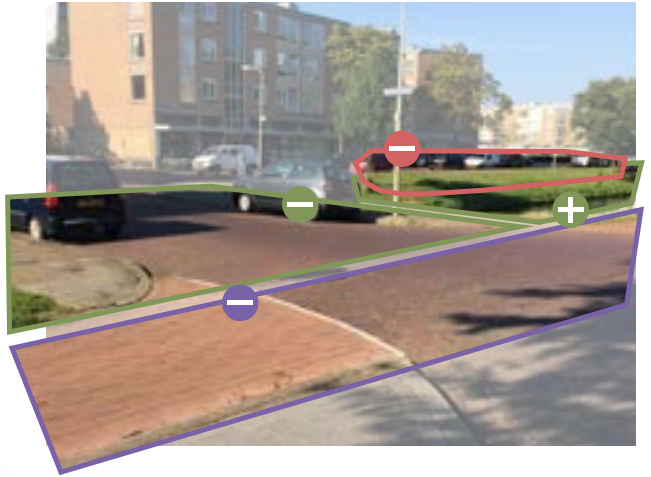


Figure 74 Social facilities Morgenstond Zuid

SCALE - 1:5.000





DESIGN LOCATIONS



Figure 75 Social facilities Morgenstond Zuid

SCALE - 1:5.000



STEENWIJKLAAN & STREAM





Figure 76 Steenwijklaan & stream

SCALE - 1:2.500



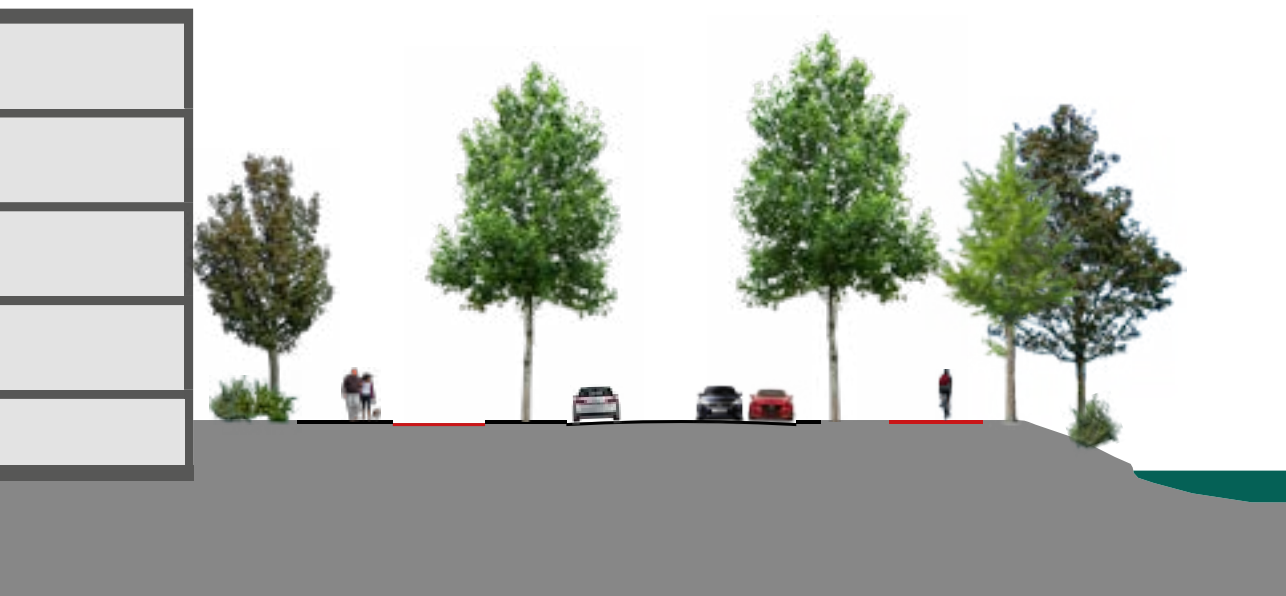


Figure 77 Section Steenwijklaan & stream



SCALE - 1:250

COLLECTIVE OPEN GARDEN



Figure 78 Collective garden, photomontage



Figure 79 Collective garden

SCALE - 1:1.000





Figure 80 Rustenburg, bufferzone Zuiderparklaan

CONCLUSION & REFLECTION

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CONCLUSION

The main goal of this research is to develop a design approach for spatial transformation which will promote human health. The Hague, a city with large health inequalities, is the design location for this research. An integral approach was set as a condition for the design of healthy environments. A practical method will be given to make implementation of healthy interventions possible. It is not a goal to design a medicine making ill people healthy, but this design approach facilitates human health promotion in the urban environment. From this statement the main research question is derived; how can the design of urban space promote human health in The Hague?

Before answering the main research question, first the four sub research questions are answered:

1. What is the relationship between the urban environment and human health?

Describing the relationship between the urban environment and human health depends on the view on human health. Our view towards human health evolved over time, for example in the 1850's communicable diseases as cholera and measles were serious threatening human health. Nowadays, noncommunicable diseases are the main challenge for people. In this is research, human health is regarded as: "Health as the ability to adapt and to self-manage, in the face of social, physical and emotional challenges". This comprehensive approach has the focus on human functioning, and not on the presence of diseases.

The relationship between the urban environment and human health can be described using three factors; the physical

environmental, social environmental and behavioural factors. The physical environmental factors are a combination of the natural and built environment. This can be used to create a clean living environment which should be robust to damages and adaptive to change. The social environmental factors create a link between the social interactions in a neighbourhood and the urban form of that neighbourhood. These factors are used to improve social activities of inhabitants by creating common goods, which will promote social interactions. The behavioural factors describe the human behaviour that can be directed with the urban form of the neighbourhood. This can be used to promote a healthier living style among the inhabitants.

2. How does the urban form of The Hague relate to human health?

The Hague has a many natural green zones, providing ecosystem services and opportunities for leisure. The ecosystem services have a strong impact on the physical environmental factors of the human health. The accessibility of these green zones by bike, or walking, can be improved to stimulate a healthier lifestyle. The extensive public transportation system of The Hague can also be exploited; it avoids pollution by car and increases physical activities to get to/from the stops. The socioeconomic status of inhabitants influences the health of those inhabitants; a lower status is associated with a lower health. The social housing is clustered in several neighbourhoods with homogenous spatial characteristics, and these neighbourhoods are mostly occupied by inhabitants with a lower socioeconomic status. This results in an unequally divided health profile over the city The Hague.



Figure 81 From theory towards design

3. Which spatial principles facilitate healthy environments?

Using the three factors describing the relation between urban environment and human health, six design principles were created. From the physical environmental factors the principles of ecological resilience and high quality structures are derived. Ecological resilience covers the measurable hygiene environment which is reflected in the physical health while the high quality structures are related to the mental experience. The social

environmental factors are divided into social capital and social activities. The first aims at improving the locality and community while the latter aims to increase the social interaction between inhabitants. Active travel and healthy lifestyle are derived from the behavioural factors. Both design principles are focussed on the choice awareness. Active travel looks at the type of transportation, such as walking and cycling. Choices for a healthier lifestyle can be improved by designing the urban form adequately. Eighteen design elements are

described, each with their own influence on human health. Compositions of these design elements facilitate healthy environments.

4. How to transform Rustenburg Oost and Morgenstond Zuid towards healthy environments?

This research focusses on two test cases in The Hague; the neighbourhoods Rustenburg Oost and Morgenstond Zuid. These neighbourhoods were chosen because of the large health issues and the differences in spatial structure. Morgenstond is official labelled as a deprived neighbourhood and Rustenburg shows several health backlog symptoms. Looking to the spatial structure, Rustenburg Oost is mainly private ownership and consists of closed building blocks made up by row housing. Morgenstond Zuid however, is mainly social housing with an open block structure built out of portico flats. This discrepancy means different use of public space, and for Morgenstond a lack of public realm.

The public space in Rustenburg Oost is scarce due to the dominance of car parking, and can thus best be characterised by the lack of greenery. To improve this situation, a design is made focussing partly on a large water structure and partly on the neighbourhood typology. The water structure, the Laakkanaal, is on a larger scale and thus having a larger impact on the area. All six design principles can be used to transform and strengthen the presence of the canal in the area. On a smaller scale, the neighbourhood typology consists of framed spaces between the blocks. The design principles of ecological resilience, social capital and active travel can be used to improve these areas such that they contribute to the human health.

In Morgenstond Zuid a design is made for a large water structure and for the neighbourhood typology, which is similar to Rustenburg. However, the underlying problem is completely different. The water structure is a stream, and its presence for the neighbourhood will be improved using all six design principles. The neighbourhood's typology can best be described as a collective garden in between the open blocks. Plenty of public space is available in the blocks, but the space is filled up with low quality greenery and does not meet the needs of the inhabitants. The principles of high quality structures, social

capital and healthy lifestyle are applied here.

All sub-questions are used to answer the main research question:

How can the design of urban space promote human health in The Hague?

The form of the environment is strongly related to human health. This relation can be direct, explained by the physical environmental determinant of health. The indirect relation can be explained by the social environmental and behavioural determinants of health. There exists no unique formula to promote human health by using the urban space. However, by analysing the neighbourhood and identifying the dominant spatial structures and typologies, specific solutions can be developed. These solutions are built on the six design principles, which should be present in a desirable solution. A balance among the design principles should be found because some design interventions impact design principles differently. The design principles present an integral approach for the design of urban space which is can be applied to existing neighbourhoods.

RECOMMENDATIONS

... for further research

The amount of research covering the relation of health and space has been increasing over the last decade. However, evidence-based research is still scarce. There is an increasing need for objective, detailed and precise measurements of attributes of built environment that may influence our lifestyle and behaviour, hence the physical and mental health. Connections between the built environment and health are complicated by the long causal pathway between the component of the built environment and the health outcome. The multi-dependency of health outcomes makes it difficult to prove spatial configurations. First steps towards a more detailed research are being made in the UK. This project, UKBUMP, will be the first unsurpassed national level data infrastructure and evidence-base for predictive modelling of the relationship between most conceivable urban planning and design configurations and specific health outcomes (C. Sarkar & A. Webster, 2017a). If the high expectations of this research will be achieved, similar research is desirable for the Netherlands. The outcome of this research can give specific information for healthy designs interventions, which can give new insight for the suggested design approach.

... for the urban planning and health practise

Earlier in this report the lacking connection between the disciplines of urban planning and health is mentioned. Today, health is entering the planning process only through generic environmental norms and regulations. The process has to change such that considerations regarding the implications of the expected use are taken into account. For urban planners it should be a requirement to learn the basics

of human health and, vice versa the field of health should be educated with the procedures belonging to spatial development. The next steps towards integrated training include the development of a shared language across disciplines, expansion of funding support for multidisciplinary research, training, practice, formalization of interdisciplinary training competencies, curricula, and program structures. Spatial planning and health agencies should become interrelated driving forces towards a new, dynamic and resilient healthy future.

... for implementation of healthy environments

This design approach facilitates possibilities for healthier behaviour and social interactions. Nevertheless, this does not mean that residents use the space as proposed. The involvement of residents in transition processes of neighbourhoods can contribute to the adaption of healthy interventions. On one hand, they get information about the effects of the environment which will increase the awareness. On the other hand, they can suggest their needs for transformation. Using their opinion will increase the chance of a functioning design. This empowerment of inhabitants is possible for temporarily and permanent transformations.

This design approach focusses only on the impact of the outdoor space on humans. However, people spent most of the time inside buildings. The indoor and outdoor space are connected, therefore healthy environments will have positive impact on the climate in buildings. However, the indoor space is dependent on installations and use. To be complete, indoor spaces should as well be designed with health promotion in mind.

REFLECTION

This paragraph reflects on the content and the process of my graduation project. First, a retrospective view of the project towards the academic field and the social context will be given. Subsequent a personal reflection of the process and a consideration about the aspects I learned from this project will be given.

Retrospective view

Health is often seen as the most valuable good. If we have a look into the budget of our national government, we can literally state that health is precious. The RIVM expected that the yearly health costs will almost double from €5100 in 2015 to €9600 in 2040 (RIVM, 2018). These cost will mostly be spend on health care, only a very small part is focussed on promotion of health. The fact that health care is that expensive is sort of a paradox, because if we would invest more in health promotion, there will be more healthy people. On the long-term this will mean that there will be less health care costs. This design project focusses on promotion of human health and making people resilient for our fast changing society. This promotion will be done by creating facilities which make healthy habits easier and form a strong community. These habits and community can have more benefits, such as a more participative society.

Research can be seen as the foundation for designing. A strong foundation and a specific solution can be obtained by an iterative process between research and design. This project has a broad range of research fields, such as human health, environmental, behavioural, social and urban design knowledge. Many positive health related aspects are applied in this research to a cumulative positive

health solution. There are contradictions in the designs, for example the organization of neighbourhood events. These events are positive for the strengthening of social capital, but is also support unhealthy drinking and eating habits. This research does not take away unhealthy lifestyles, it facilitates more possibilities for healthy activities. This dissension makes the designs at some points fragile. This approach could be used to minimize the health inequalities in The Hague. It is naïve to think that by the implementation of the designs, the health problems of individuals will be immediately reduced. The effects of this approach can be visible on a longer timescale, while they are influenced by other determinants of health. This project gives insights on how human health can be used as the main objective for neighbourhood transformation. The test cases show that health interventions have an impact on different spatial scales.

The environmental technology and design chair has as mission to take a leading role for creating a sustainably realized, comfortable and healthy climate in the living and built environments. The focus of this project is creating healthy environments by using three main variables; the physical environmental, social environmental and behavioural factors. Understanding of the ecological system is an important aspect of this research, just like for the chair. The challenge in this project is the urban environment. I tried to find a balance between urban facilities and comfort, and restoring ecological drivers. In many cases the ecological foundation of my solutions is missing. I tend to choose for 'green' solutions instead of specific interventions.

Personal reflection

At the start of this graduation project I had high goals for the result in mind; this graduation project was the final project at last. I felt that adding an internship to my research would yield a strong combination, because I could consider the academic and practical perspective. I arranged a part-time internship at the department of urbanism and planning of the Municipality of The Hague. At the beginning, I established personal learning goals. For example, I would learn more about the application of GIS in design projects and using the opinion of inhabitants for my project. In retrospect, I can conclude that all these points did not work out the way I had in mind.

I see this graduation project as a journey with many obstacles. Starting this journey with a duration of twelve months in mind, finishing it with that duration doubled. My personal experience of the progress if visualized in Figure 82, the explanation of my progress will follow below. The most difficult part for me was the plan for the journey. My direction often changed and I spread my reach, instead of following one direction. Looking back, I can say that on many occasions I was the obstacle. My uncertainties for choices and my difficulties in writing did not improve my research. Other obstacles were bad luck, with emphasis on the theft which happened to me. The period before my P2, I remember as the biggest obstacle I had to overcome. I felt lost in the project and was disappointed in my abilities. Perfectionism

is one of the characteristics of my personality. Often, this functions as a quality, but in this project it was an obstacle which I could not let go. Despite this all, I finished the report. Still, every time I read it aspects which I could have added or changed are popping up in my mind. To end positively, because of the support of my mentors, the knowledge I gained at the course 'In je kracht bij afstuderen' and my perseverance, I was able to cross the finish line of this long journey. I might not reach the bar I set in the beginning, but I am proud that I overcame many obstacles and have finished this graduation project.

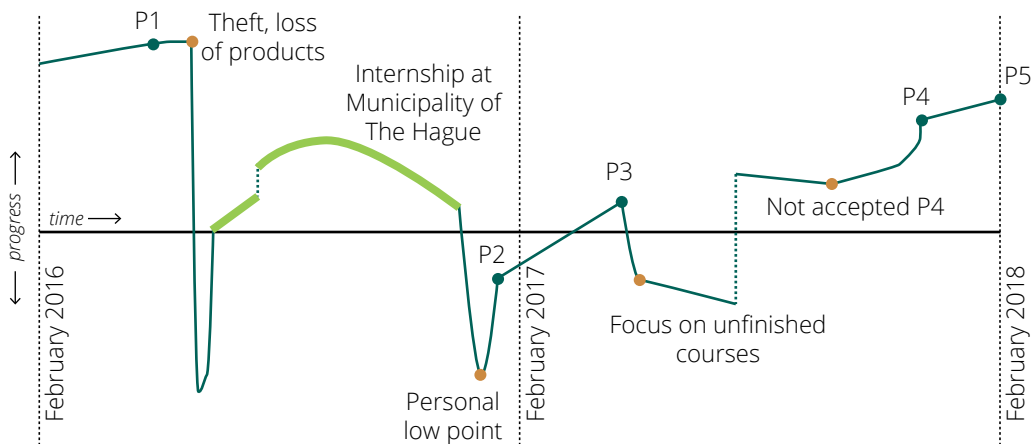


Figure 82 Timeframe of graduation process



Figure 83 Morgenstond, open inner courtyard

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Figure 84 Rustenburg, Blaricumseplein

APPENDIX

RELEVANT STRUCTURES THE HAGUE 118

RELEVANT STRUCTURES THE HAGUE

LEGENDA

- Dune
- Recreational green
- Non-accessible green
- Cemetary
- Sport fields
- Allotment garden
- Row of trees
- Water

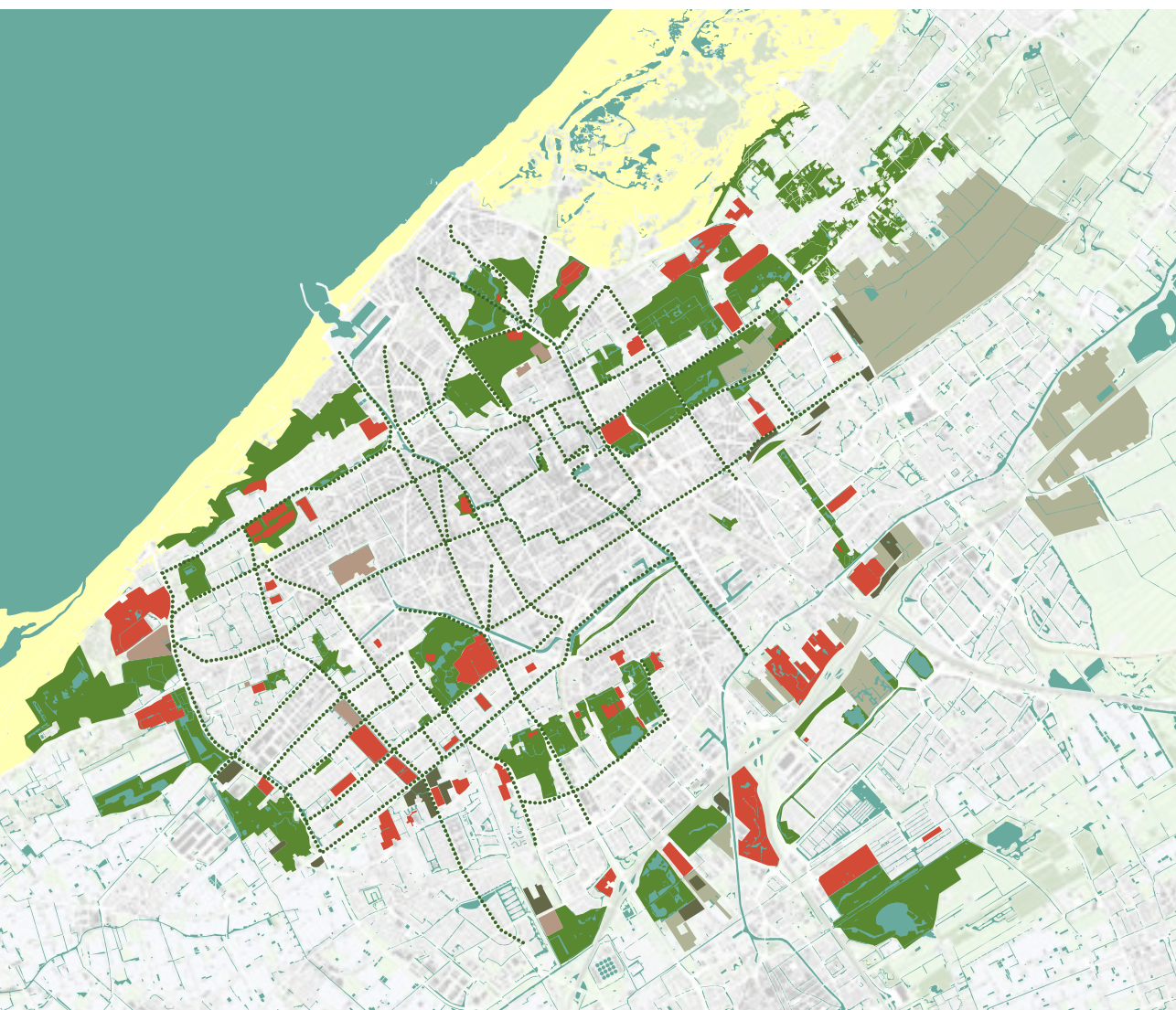


Figure 85 Green city structure The Hague

SCALE - 1:100.000

LEGENDA

- Bosom
- Polders
- Open water

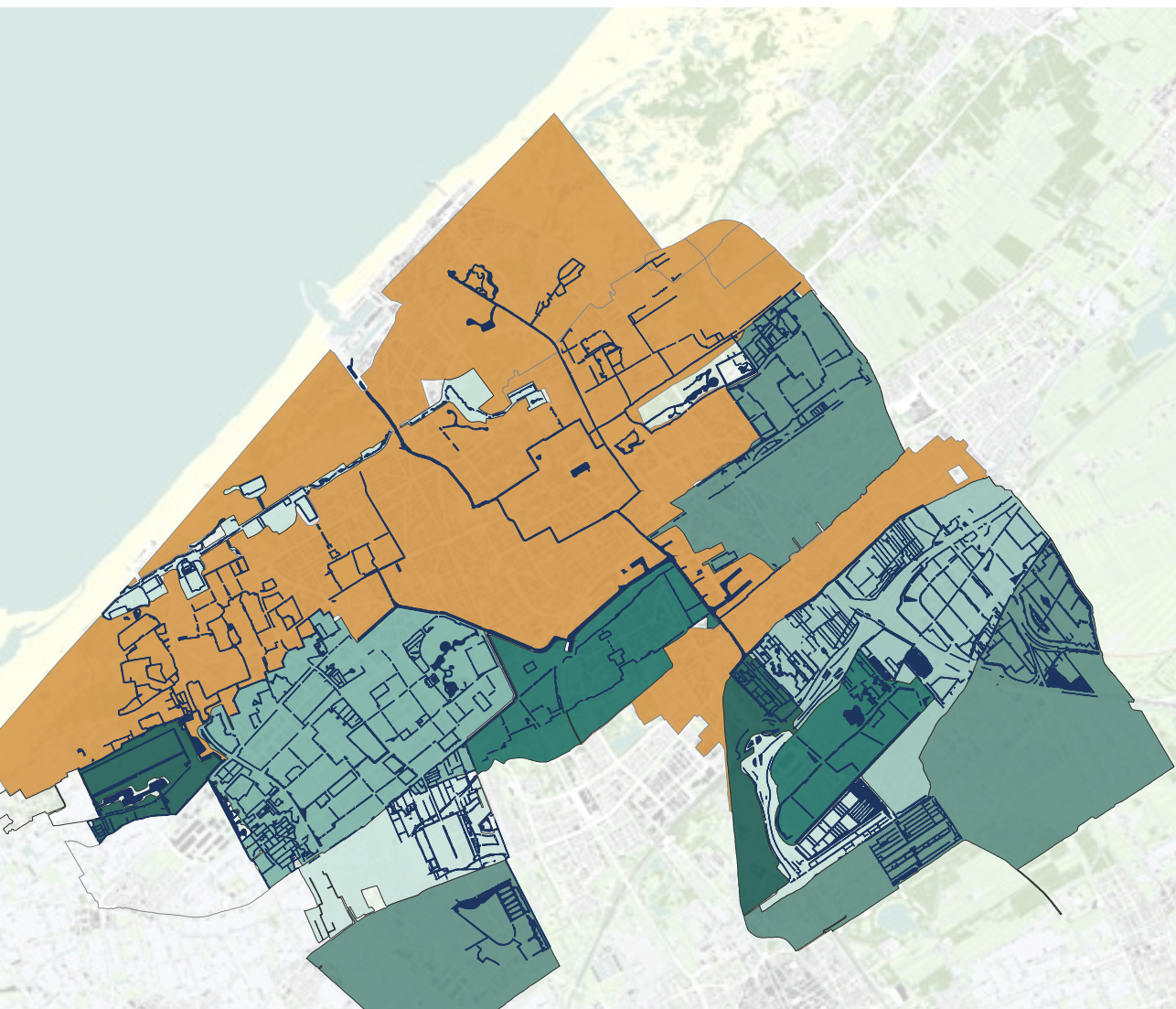


Figure 86 Watersystem The Hague

SCALE - 1:100.000



LEGENDA

 Shopping area

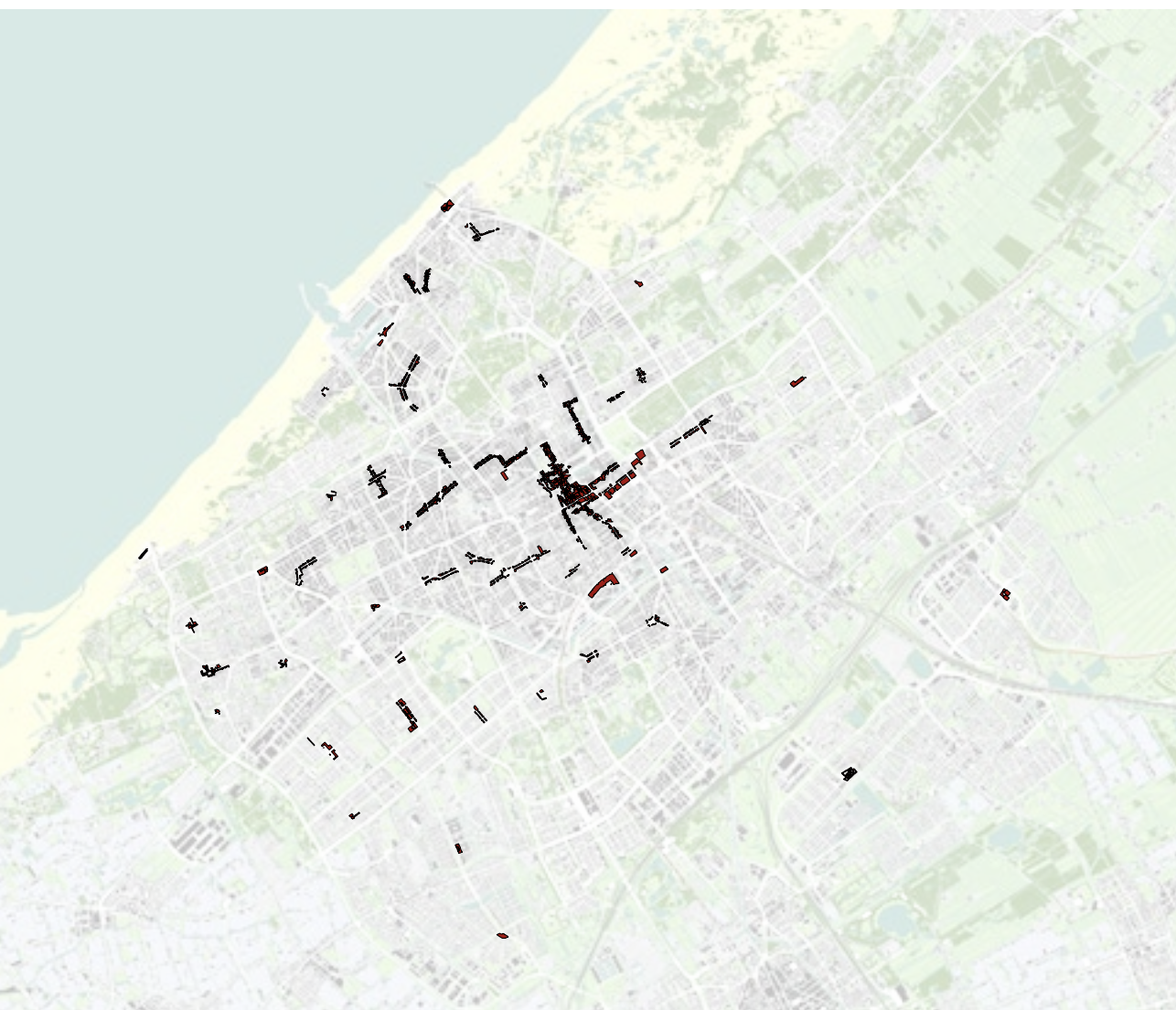


Figure 87 Shopping areas The Hague

SCALE - 1:100.000 

LEGENDA

 Main cycle route

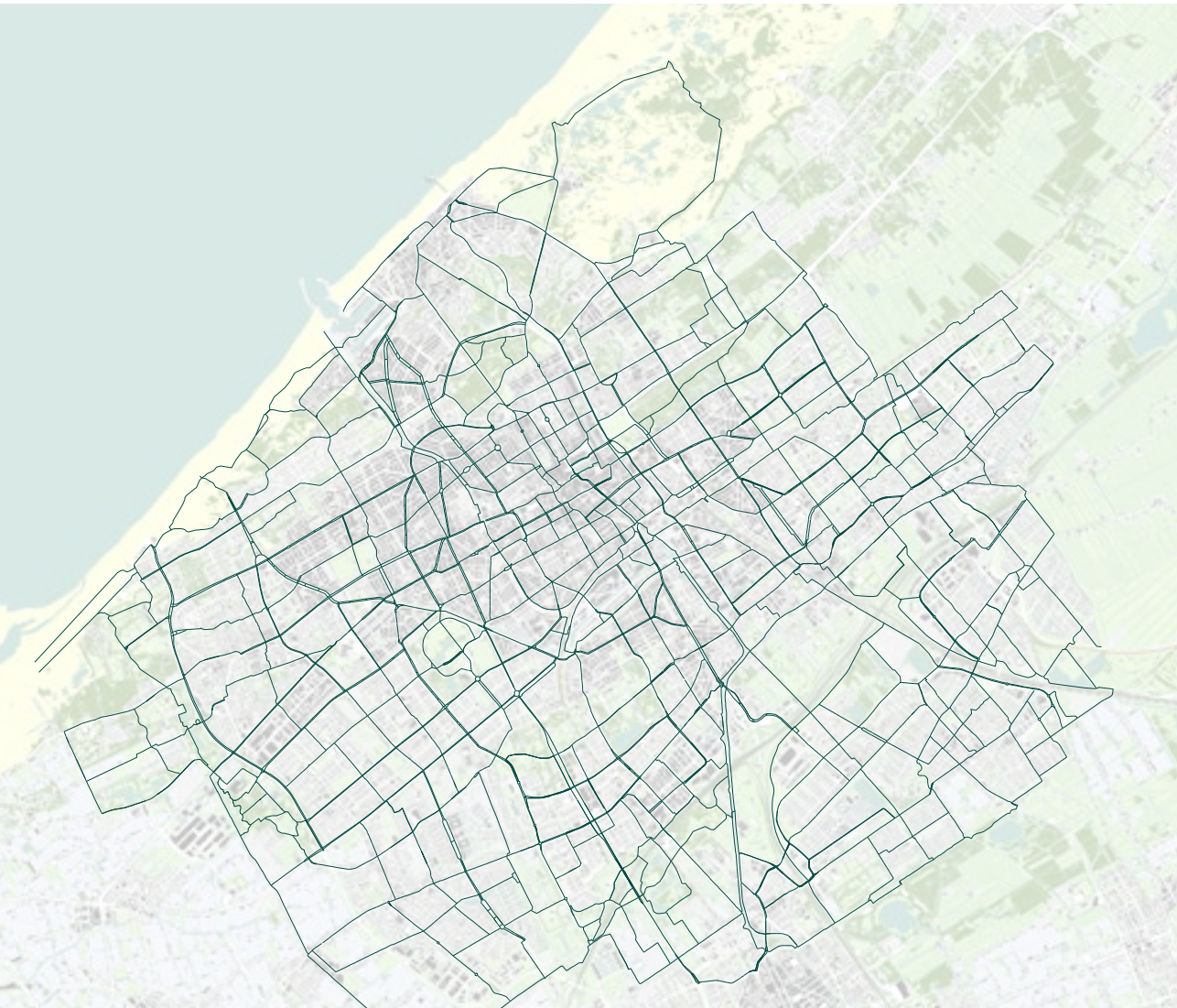


Figure 88 Main cycle structure The Hague

SCALE - 1:100.000 

LEGENDA

-  Train
-  Lightrail
-  Tram
-  Bus
-  Regional bus
-  Train station
-  Lightrail stop
-  Tram stop
-  Bus stop
-  Regional bus stop

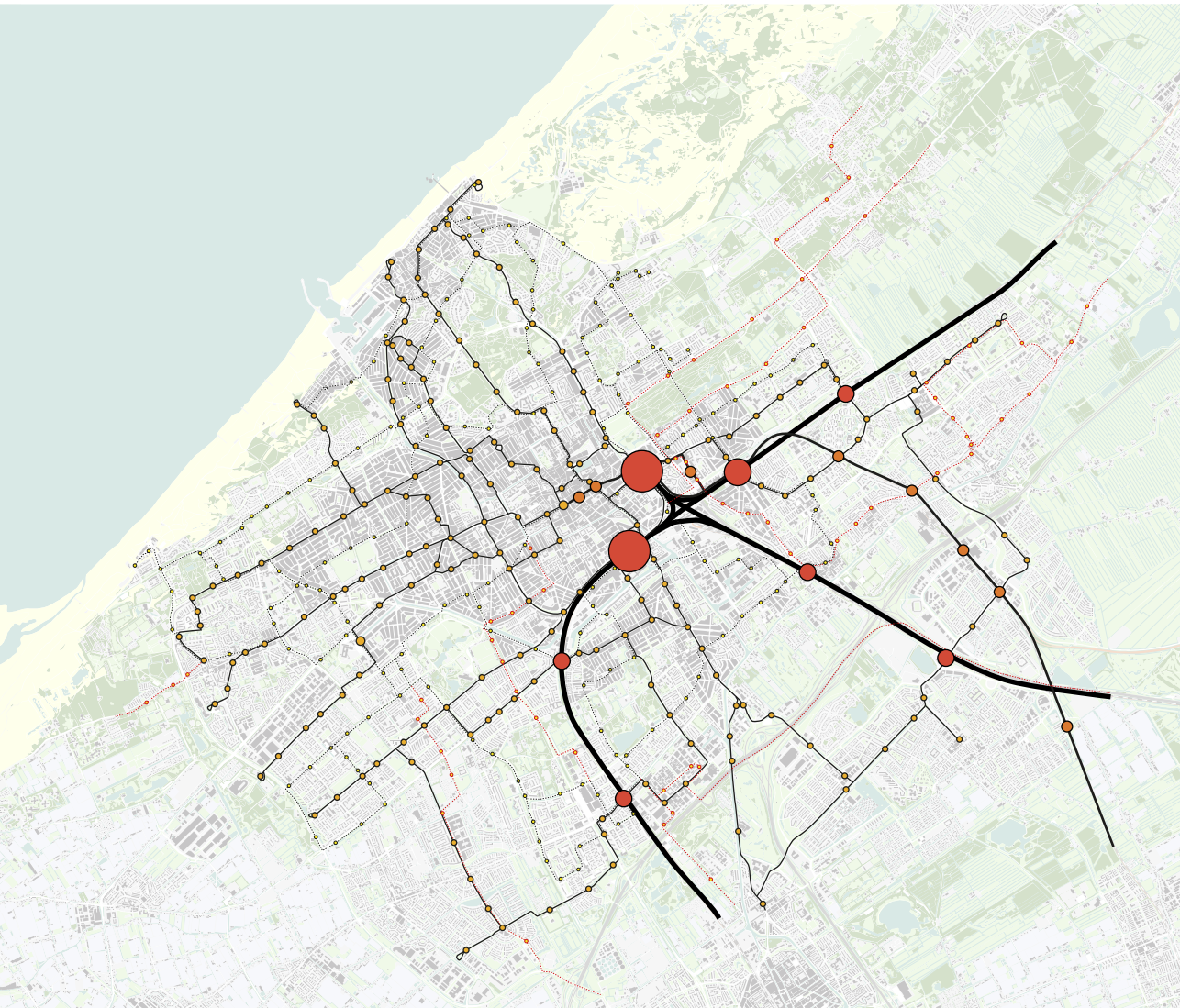


Figure 89 Public transport system The Hague

SCALE - 1:100.000 

