Landscape, a healer for the elderly

Explore a salutogenetic and activating living environment for the elderly

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MSc Thesis Landscape Architecture
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Preface

This thesis is fascinated by personal interest in the relationship between health and landscape. Besides, aging population increases rapidly, which draws my attention onto the issues. Looking around our daily environment, unfriendliness to the elderly can be seen with a consequence of low engagement of the group of outdoor space.

Thus, this thesis is aimed to explore the relationship between health, landscape and the elderly. Besides, it tries to find out a way to stimulate the engagement of the age group at the same time.

I would like to thank my supervisor, Rudi van Etteger, for his patient guiding and support during the whole thesis process. I would like to thank Agnes Patuano and Kevin Raaphorst for their input in green light presentation and proposal presentation. I would like to thank Siqi Li and Lisheng Jiang for their encouragements and critique comments. Finally, I would like to thank my family and friends for their help and support.

Abstract

Aging population increases rapidly all over the world, so as in Netherlands. With the shift of population, transformations are required on the health care system, elderly housings, city infrastructures and so on. Meanwhile, disease risks increase with aging, which causes a large burden to the society. To promote the health of the elderly, municipalities pay most attention on the health care system, but ignore the salutogenetic effects of the landscape. Since the discovery of the relationship between human health and nature, healing landscape is regarded as a preventive medicine to diseases. Abundant researches and studies have shown the benefits of healing landscape to the heath from the physical, mental and spiritual aspects. However, the application of the healing landscape still needs to explore, for example, the living environment. Living environment is the daily environment of the elderly in which they spend most of time. Nevertheless, the usage of the outdoor environment is unsatisfactory. Seniors have shown a lower visitation to green areas.

Thus, this thesis aims to expand the knowledge on healing landscape and to explore a way to both provide salutogenetic effects and stimulate the engagement of the elderly.

The purpose of the thesis is achieved through research and design process. The first part of research is to form the theoretical framework on the basis of the theory of healing landscape, the theory of age-friendly design and the theory of engagement. By understanding the qualitative elements from the theories, tool boxes are explored for the further testing. The second part of the research is intended to summarize the facilitating factors and constraints of seniors' usage. Zwanenveld is selected as a case to conduct the study. Finally, two testing models are generated and evaluated to get the results.

This thesis gives an example to explore a healthy and activating living environment for the elderly and motivates a future integration of health promotion in landscape.

Key words: the elderly, health, salutogenetic, living environment, green space, blue space.

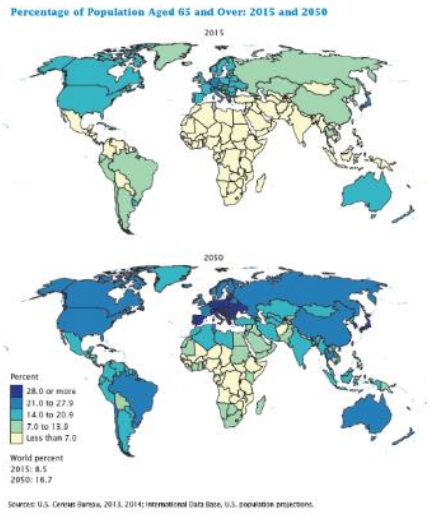
CONTENT

01 Introduction

1.1 The trend of aging society and aging community

Aging population in Netherlands

The aging population increases rapidly in many countries all over the world. According to report from US census bureau (2016), the elderly population, aged 65 or older, is projected to more than double in the world by 2050, with the proportion from 8.5 percentage (617.1 million) in 2015 to 16.7 percentage (1.6 billion) in 2050(figure 1.11). In addition, the proportion of the aging population exceeds 14 percent already in 2015 in most European countries and will be increasing above a quarter by 2050. Netherlands, was one of the 25 oldest countries in the world in 2015(He, Goodkind and Kowal, 2016). The aging population will be increasing from 2.4 to 4.6 million between 2012 and 2040 in Netherlands, which means around 26 percentage of Dutch population is 65 years or older and 40 percentage of elderly is 80 years or older. (Statistics Netherlands [CBS], 2010)(Elderly care physicians in the Netherlands, 2015)(figure 1.12).



Population pyramid. Age composition in the Netherlands 2013. Source: Statistics Netherlands.

Figure 1.11: Percentage of seniors' population, in 2015 and 2050(Bureau, 2014). Figure 1.12: The age composition (Netherlands ,2013).

Increase housing caring for the elderly

The increasing aging group makes a great shift of the population and requires a transformation of society as well to adapt aging trend. Municipalities of Netherlands have emphasized the importance of enabling elderly people living independently and living longer at home. Extra 44,000 homes catering for elderly will be demanded every year between now and 2021, including both new built homes and adapted homes, which indicates the increase of the aging communities in cities in future (Government.nl, n.d.).

As a landscape architects, we also need to be aware of the trend of aging society and aging community. Age group, as a vulnerable group, will be the main targeted group we design for in future. Preferable landscape for the elderly is needed to provide them a better quality of life.

1.2 The increase of disease risk when getting old

Normal aging

Aging is an inevitable process. With aging, the status of body gradually changes. Jaul and Barron (2017) concludes the sensory changes and physical function of normal aging, associated with age group of 85, which includes hearing loss, visual acuity, lower walking speed and mobility disability.

High disease risk in old age

Besides, old age is easily accompanied by physical, mental and cognitive diseases (Bhatt, 2015). Research shows that there are one half of dutch elderly people who live independently have one or more chronic diseases (Zantinge et al., 2011). Besides, the rate of Dementia grows with age and the death rate from Alzheimer's disease continues to rise these year (Jaul and Barron,2017). Dementia is also a number 1 disease in the Netherlands that about 1 in 5 people get dementia in Netherlands (Rijksoverheid.nl, n.d.). Mental disorders, especially depression and loneliness, are the common psychological problems in aging group, due to the ageing-related processes and absence of a confidant (Alexopoulos, 2005)(Jaul and Barron,2017)(Madianos, Gournas and Stefanis, 1992) （figure1.21） .

To mitigate the trend of high rates diseases risk with aging, it is quite essential to promote a healthy environment for the elderly, having both salutogenetic effects and preventative impacts on their health. Therefore, green and blue spaces in the living environment are unignorable for the elderly, as a healer, due to the discovery of the relationship between the nature and health (Finlay et al, 2015) (Kaplan and Kaplan, 1989).

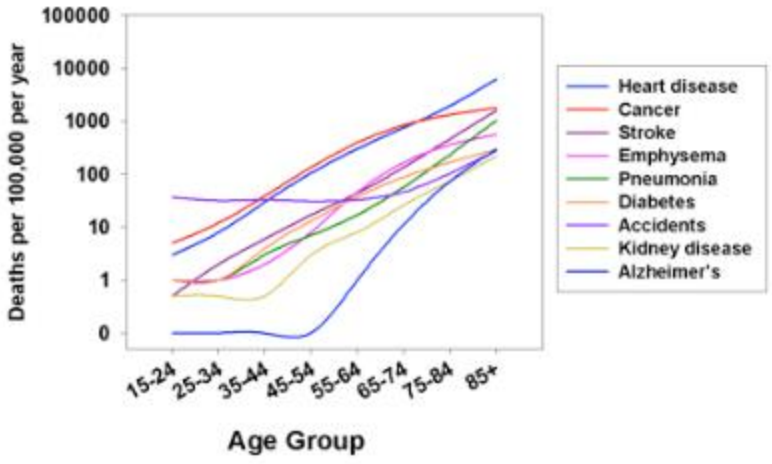


Figure 1.21: The diseases' rate in different age groups (Miller, 2002).

1.3 Salutogenetic effect of landscape.

Health care is no doubt a main issue of elderly population. However, the increase of life expectancy makes elderly people live longer but not ensure them live healthier and well-being.

In fact, when getting old, there is an increased risk of getting both physical and mental diseases, such as falls, arthritis, Alzheimer's, heart disease, and depression (Serby and Yu, 2003) (Madeline, 2016). In Netherlands, there is a clearly increased risk of morbidity and disability among who aged 75 years and older, causing a deceased quality of later life (Zantinge et al., 2011).
To promote the health of the elderly, further studies has shown a shift of the focus on health care, from hospital-based care to community-based care, and from curative medicine to preventive 'medicine' (Davidson and et al., 1996) (Stebbins, 1986) (Zantinge et al., 2011).
Healing landscape can be regarded as one of great preventive and mitigating medicine since the discovering of the salutogenetic effects of nature (Overholt, 2012). A Dutch report also indicates the importance of considering the environment as a preventative factor to promote health and autonomy of elderly people (Zantinge et al., 2011). There are abundant literatures and researches showing the benefit to human health by exposure to nature. (Maller et al.,2005) (Pretty,2004). Further evidences have been discovered that therapeutic gardens have great impact on elderly people's health by relieving the pain, promoting attention, releasing the stress, lowering anxiety, reducing the amounts of medications and antipsychotics. (Detweiler et al., 2012). Moreover, by designing a salutogenetic space, it also can encourage the physical exercise, stimulate social interaction and promote the cognitions of elderly people (Marques, McIntosha and Kershaw, 2019). Thus, creating a salutogenetic landscape for elderly becomes a significant mean to provide a better quality of later life.

1.4 The outdoor environment for the elderly people.

Less usage of outdoor environment
Although, a bundle of studies has shown the great impact of nature on the health of people from physical, mental and spiritual aspects (Finlay et al, 2015), the usage of green and blue space in urban context is unsatisfactory among elderly people. As a vulnerable group, elderly people show a lower level of visitation to green space, compared with other age groups (Payne, Mowen and Orsega-Smith, 2002). According to the studies, participation in outdoor activities and physical activities decrease with aging (Payne, Mowen and Orsega-Smith, 2002).

Possible limitations of the elderly use
Inaccessibility
Accessibility is an important factor for the elderly people who are unwilling to use the green and blue space due to their lower walking speed and the mobility disability. Boeijen (2016) indicates that every 30 minutes, there are someone falls on the street with emergency care need and 58 percentage of incidents are resulted from environmental factors, such as barriers and obstacles in public space (Boeijen, 2016)(Stahl et al., 2008) (Maaren, 2018).

Lack of age-friendly infrastructure & space
Lack of age-friendly infrastructure and space is another factor of the less visitation of green space. Researches show a demand for equipping green spaces to adapt age-appropriate physical activity and social interactions (Marques, McIntosha and Kershaw, 2019). The layout of elements

in the space is also an aspect to facilitate the participation of elderly with mobility problems (Hoeymans et al., 2010).

Anxiety, unsafety
Moreover, as a vulnerable group, elderly people are more likely to feel anxiety, unsafety and fear to be a victim when being outside, which decrease the usage and the staying time for them in a green space (Greve, 1998)(De Donder, 2015).

Since the therapeutic effects on health has been found from green and blue space (Finlay et al, 2015), it is quite significant to stimulate the engagement of elderly people in a preferable and healthy environment, making them self-reinforcing.

1.5 Relevance

Social relevance
With the aging trend, the number of the elderly people are increasing largely and rapidly. Correspondently, the issues of the elderly become increasing serious and the society requires a transformation to adapt the aging trend. Health issue is one of most concerned problems among the elderly. With aging, the elderly easily get diseases, which brings a great burden on society. Municipalities stress the importance of seniors' autonomy and encourage a healthy aging in citizens'' later life. Besides the support to health care system, promoting a healthy living environment for the elderly is another good solution to decrease the risks of aging-related diseases.

Scientific relevance
The studies on healing landscape for elderly people mostly concentrate on special medical environments. Other types of environments, like living environment still need explorations. This thesis studies the daily living environment for the elderly, adding practical implications simultaneously.

Medical relevance
There is a profound number of researches and literatures regarding the relation between landscape and health. Landscape therapies are also can be found in hospitals as a type of approach to recover the body functions. Thus, the study on a healthy and activating living environment contributes to an exploration of a broader use of health approach.

Landscape Architecture lens
With the increasing number of the elderly, this group deserves more attention as a vulnerable group. Although, age-friendly cities, age-friendly communities are promoting and advancing a lot nowadays, when looking around, outdoor environment still shows a lot unfriendliness to seniors. Practical implications require a plenty of work. The concept of age-friendly cities was

firstly proposed by Word Health Organization (2007), that refers to promote the health, participation and security of elderly people. However, studies on age-friendly outdoor environment are mostly concentrated on the safety, security, accessibility and cleanness. The healing features of the outdoor landscape, which related health with landscape together, are not clearly integrated. As the disease risks raise with aging, the preventative approaches to promote seniors' health is increasing vital. Healing landscape is one of solution. Improving the health of elderly people is not only limited in the dense and grey health care centers. The daily outdoor environment can benefit a healthy and activate age as well by an enjoyable and salutogenetic experience. Thus, I think the salutogenetic effects of landscape would be of significance to provide for the elderly for their better quality of later life.

02 Research design

2.1 Problem statement

As a rapidly increasing group, health problems are more and more serious. Despite the medical treatments, green and blue spaces are also discovered to have salutogenetic effect on the physical, mental health of the elderly. However, the application of the restorative gardens is more used in medical environment for special groups. The other outdoor environments, such as the living environment proposed in this study, are lack of healing qualities, especially for the healing qualities for the seniors' group. Awareness should be stressed in landscape design.
Besides, lower level of visitations of the elderly to the green area show the problem of the engagement of landscape of the elderly. How to make the environment affording for the elderly people is also should be considered when design a healing environment.
In this thesis, it explores the healing and activating landscape in the living environment for the elderly people.

2.2 Knowledge gap

In fact, the idea of 'healing' emerged from ancient time. However, on twentieth century, there is a diminution in the consideration of medical environment. Due to a revolution in the provision of healthcare, there is a growing understanding of the importance of physical environment to people's health (Marcus and Sachs, 2013). Nowadays, a bundle of studies and theories can be found to create a healing and therapeutic garden, such as Geographer Jay Appleton's 'prospect-refuge theory' (1975), Kaplans 's(1989) 'attention restoration theory', and Roger Ulrich's 'Theory of Supportive Gardens' (1999). However, most of these theories are applied only on a garden scale, not in a bigger scale, like community scale. Most of them are utilized in the medical environment, not in a more public and common places. Besides, most of literatures only focus on the healing effect of the green space and ignores the therapeutic impact of blue space in the environment.
Also, although there are several literatures about the age-friendly design for community (Lui et al., 2009) (Smith, Lehning and Dunkle, 2013) (Plouffe and Kalache, 2010), salutogenetic effects of living environment need to be emphasized more to promote the healthy aging for the elderly.
Moreover, exploring the method for the elderly to activate the participation with interactive outdoor healing landscape is also a limited knowledge (Marques, McIntosha and Kershaw, 2019).
Therefore, this thesis is going to narrow the knowledge gap for a healthy and activating environment. It explores the healing landscape on a bigger scale, in a wider place application, considering the effects of both green and blue space and combing engagement principles for elderly people.

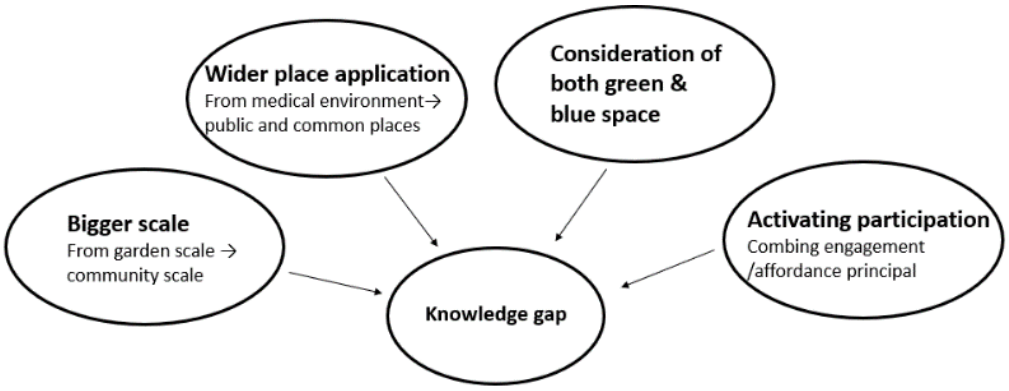


Figure 2.21, Knowledge gap.

2.3 Research objective and questions

2.31 Objective

Health issues among elderly people are increasingly significant in Netherlands, due to the increased aging population and high health care cost. In response to a call for 'healthy aging' from municipalities, creating a healthy environment for elderly people is essential to optimize the functions of the elderly (Zantinge et al., 2011). Thus, the objective is proposed below:

Explore the qualities of green and blue space in living environment, which both give salutogenetic effect on the health of elderly people and stimulate the engagement of landscape of seniors.

2.32 Design question and research question

According to the objective, the design question is:

How could we create a salutogenetic and activating space for elderly people in their living environment to promote their health and stimulate the participation?

To answer the design question, research is needed to collect the data.

Main research question:

What characteristics of green space and blue space can both provide a salutogenetic effect and stimulate the engagement of elderly people?

Sub-questions:

1)What qualitive elements of green space and blue space provide a salutogenetic effect and encourage the engagement of elderly people theoretically?

2)What characteristics of green space and blue space facilitate or complicate the usage of elderly people?

3)What are the response to the alternative designs in the aspects of salutogenetic influences and engagement?

2.4Concept framework

2.41 Definition

There are several concepts in the thesis need to be defined.

Elderly people

Elderly people in this thesis are defined by the people that are aged 65 years or older and have sort of independent ability to live in community (Zantinge et al., 2011) (Molster, 2015). And also, they are proposed to have the demand for promoting physical, mental or spiritual health.

The health of elderly people

Primarily, the WHO (1948) defined health as "a state, of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Generally, the health of elderly people including physical, mental and social aspects (Marques, McIntosha and Kershaw, 2019). In this thesis, I will more focus on the mental health of elderly, but also consider the physical and cognitive health. The health effects are mainly through the experience and perception of the elderly people.

Healing landscape & salutogenetic effect

Healing landscape was firstly defined by Gesler(1993, p.171), as a place with 'an enduring reputation for achieving physical, mental, and spiritual healing.' The healing effects can be sorted in three aspects by Cooper and Barnes (1999, p3), 'a relief from physical symptoms or awareness of those symptoms'; 'stress reduction'; 'an improvement in the overall sense of well-being and hopefulness that an individual is experiencing and thereby assisting physical improvement.' Besides the concept of 'healing effects', 'salutogenetic effect' was also proposed with a little difference. Antonovsky(1998) defined salutogenic concept as the basis of promoting health, with the attention to prevent health risks and potential diseases. In a word, healing means more making the ill people better, while salutogenic means more promoting good health for everyone. To be more precise, I will use the word 'salutogenetic effect' which includes both ill seniors and well-functioning seniors to describe my purpose of this thesis.

For landscape, it includes both green space and blue space. In this thesis, green space indicates the place with prominent amount of natural content in urban area. And blue space indicates the space with water element.

Engagement & Affordance

The engagement refers to the participation of the elderly. Related to the engagement concept, affordance was proposed by Gibson (1977), referring to the relationship between people's actions and environmental features. This gave an inspiration of how to design the engagement of people. From the landscape perspective, affordance can be defined in three qualities: function, meaning and attraction (Heft, 2010).

2.42 Conceptual framework

Studies show the benefit of healing landscape to the health of elderly people's health. However, the lack usage of green space decreases the potential possibilities for the elderly to promote their health, which makes it essential to facilitate the engagement of the elderly people in landscape. Moreover, the formation of environments can influence people's behaviors, action and interaction and the engagement of the elderly can be influenced by the types and phenomena of the space. Therefore, the conceptual framework is shown as follow (Figure 2.42).

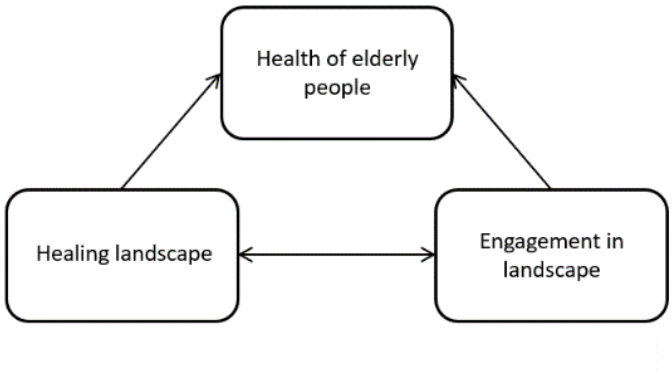


Figure 2.42: Conceptual framework.

2.5 Methodology

2.51 Methods and methodology

There are two main parts of the research: research for design and research through design (Figure 2.51). Based on the sub-research question 1, literature study is used to looking for the theory for healing landscape, the theory for age-friendly design and the theory for the affordance of landscape.

Then a case is selected for research. Field trip, mapping, site observation and scoring are applied to analyze the current spatial situation, seniors'' behaviors and the healing qualities of site. Summarizing the results, sub question 2 is answered and spatial models are generated due to the spatial problems. After evaluating, one developed spatial model is created, and a small site is selected for the model testing.

Based on the theories and site analysis, two alternative models are created and tested to answer the sub-question 3. Models are evaluated by colleagues and supervisor in the aspects of salutogenetic effects and the willing of participation. Outcomes are analyzed and design recommendations are generated for the later design process.

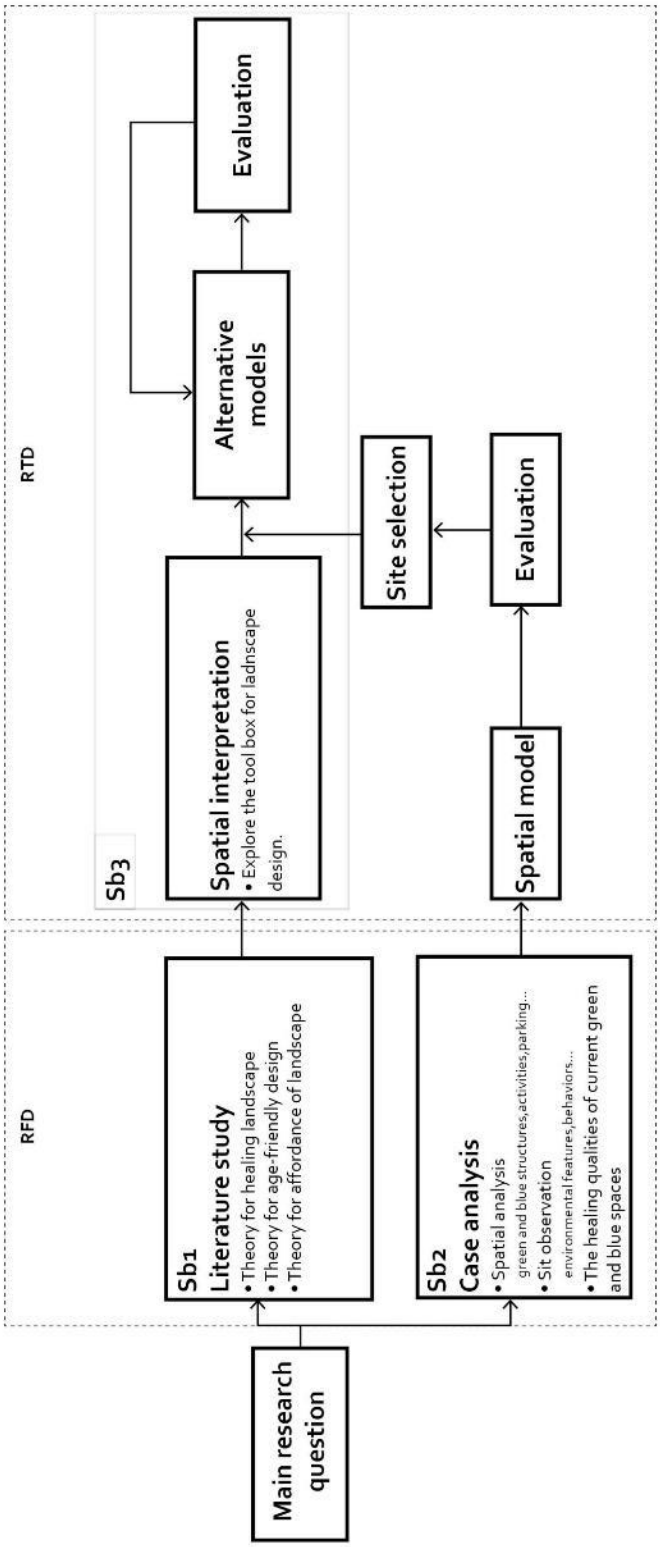


Figure 2.51: Methodology.

03 Theoretical framework

In this chapter, literature study method is applied. It concludes the theory of healing landscape, theory of age-friendly design and theory of engagement. By combining, this chapter answered the sub-question1 of the thesis:

1) What qualitive elements of green space and blue space provide a salutogenetic effect and encourage the engagement of elderly people theoretically?

3.1 Healing landscape

Since the discovery of the healing effect of landscape, there are abundant experiments and literatures to proof and illustrate the theories behind that why and how landscape can heal human-beings.
Based on the theories on healing effects of gardens from different research area, Stigsdotter and Grahn (2002) included the theories into three different schools: the healing garden school, the horticultural therapy school and the cognitive school. In their classification, what need to be noticed is that, the horticultural therapy school is the combination of the healing garden school and the horticultural therapy school. Therefore, since my research is focus on the qualities of the green and blue spaces, I think the combination of other two schools will not generate new knowledge. Then, my study will concentrate on the healing garden school and horticultural therapy school.

3.11 The healing garden school

According to the categories made by Stigsdotter and Grahn (2002), in the healing garden school are the theories which illustrate the relationship of nature and human health. Health effects are stemmed from the passive experience of visitors in the gardens and more from a mental aspect. Theories are illustrated from the perspective of environment psychology and landscape architecture. There are three main theories in this school which are Less demanding environment theory, Stress reduction theory and Attention restoration theory.

Stress reduction
Human beings are biological individuals with the essence close to the nature. The first theory claims that nature-like surroundings and wild nature can cause the change of our emotional center in the limbic system of brain, which stimuli prompt reflexes that make us relax and stress reduction. (Stigsdotter and Grahn, 2002). This also has been proved by Ulrich (1999) in laboratories. According to Ulrich's research, he made the healing effect of nature measurable and claimed that it was the properties of **a sense of control, social support, physical movement and exercise, and positive natural distractions** of gardens that help people release their stress.

The four properties are illustrated as follow:
A sense of control: A garden provides multiple choices allowed induvial to make.
Individuals, with illness, always lack control of their own body and of their physical environment. This means they fail to have the perceived ability to do the things they want and determine what others can treat to them (Gatchel et al., 1997), causing greater stress and anxiety to them. A garden which allows individuals to make choices by themselves, provides a recovery to their emotional and physical control, giving them a temporary escape from the stressful environment.

Social support: A garden provides gathering space and stimulate social interactions.
Social support indicates the emotional and physical support from one or more other people

(Ulrich,1999). According to Ulrich (1999, P42), *'People who receive higher levels of social support are usually less stressed and have better health status than persons who are more socially isolated.* 'Appropriate social support gives people an opportunity to share their emotions and to keep away some pessimistic feelings, especially the loneliness.

Physical movement and exercise: A garden provides low-impact physical activities, such as walking, wheeled mobility and physical rehabilitation (Winterbottom, and Wagenfeld, 2015, P43). Abundant of data has shown the benefits of physical movement and exercise, which not only benefits individuals' physical health, but also reduces their stress and depressions.

Positive natural distractions: A garden provides visual exposure to nature.
Nature, as a positive environmental distraction, is proofed by mounting evidence that it can elevated individuals' emotional situation in the perceiver. By viewing the natural settings in the garden, individuals can release their stress and block the anxiety, promoting a beneficial influence on their physiological systems (Ulrich 1999).

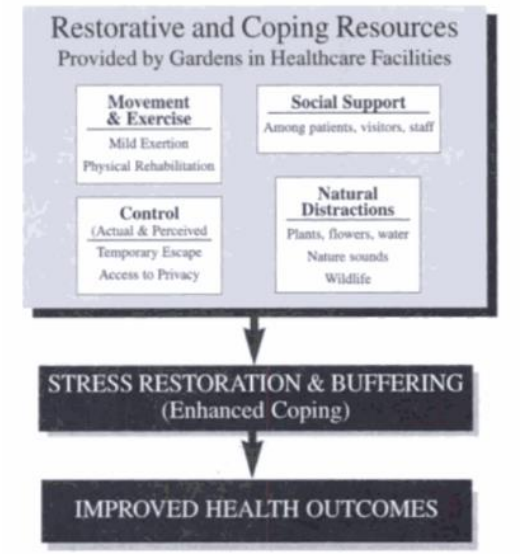


Figure 3.112: conceptual model: Effects of gardens on health outcomes (Ulrich 1999, P37).

Attention restoration
The second theory of healing garden school is about restoration of cognitive functions. There are two different types of attention of man: spontaneous attention and directed attention (James,1983). **Directed attention** is governed by the higher consciousness center of our mind, which makes us highly concentrate on our work in short time, blocking irrelevant distractions simultaneously. It is used to deal with complex work and used out quickly. **Spontaneous attention**, also called soft fascination, is governed by the older parts of the mind, which does not require high concentrations to block irrelevant surroundings. It can be used for long time without feeling tired. Evidence has showed that utilizing directed attention for long time, beyond one's capacity, causes exhaustion and fatigue syndromes of individual (Aldwin,2007). Recovery of prolonged directed attention is significant. Kaplans (1995) claims that nature, gives individuals a restorative experience and recovers prolonged directed attention, partly by the spontaneous

attention from nature. He concludes four characteristics of the restorative nature settings: being away, extent, fascination, compatibility. Correspondingly, following four restoratively qualitative features are developed in outdoor design (Kaplan, Kaplan, and Ryan 1998) (Marcus and Sachs, 2013).

Coherence: A garden organizes the elements and spaces logically and consistently, giving people a sense of wholeness. Coherence makes people easily understand and concentrate on the natural space, separating them with unpleasant environment.

Complexity: A garden provides rich landscape features, different sensory experiences and various spaces for different demanding.

Legibility: A garden provides a clear layout and markable features for wayfinding. The legibility of the place guarantees venerable groups exploring the garden by themselves, with less direct attention.

Mystery: A garden provides an exploration and discovery for individuals.

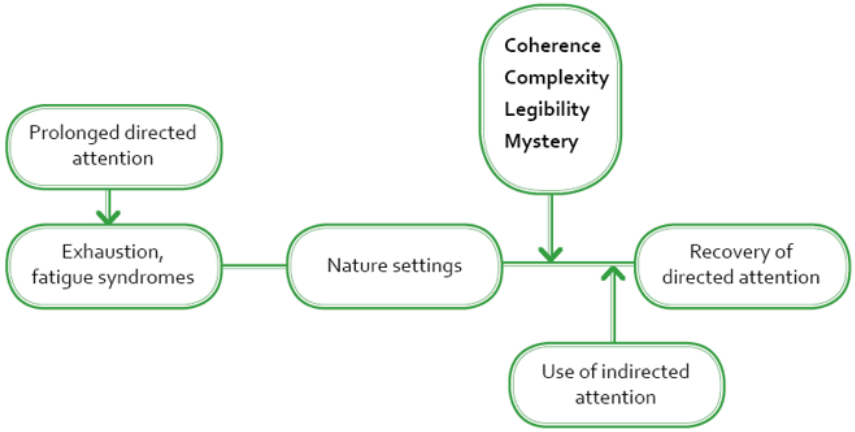


Figure 3.113: conceptual model of effects on health outcomes.

Less demanding environment

The last theory of this school is the less demanding environment theory. Stigsdotter and Grahn (2002) claim that this theory is due to the fact that *''Garden and nature make demands that can softly balance individual's own ability and control.''(p62)*

This theory claims that besides the obstacles in physical environment, there exists mental functional obstacles as well, especially to the people who suffer from the trauma like grief and mental problems. For the people who have the trend of psychological problems, it is essential for them to have a less demanding relations, both with people and environment. Searles (1960) and Ottosson (2001) make a sequence of the different elements according to the demanding to people. They find out that human demand more than animals since the complex relationship and emotions between human beings such as lying and guilty. Animals demands more than plants since they can run away and you may pay your empathy to them. Plants demands more than rock and water since rock and water are still and stay there all the time.

Figure 3.114: conceptual model of effects on health outcomes.

3.12 Horticultural therapy school.

Horticulture, actually is a kind of therapy which developed extensively for a long time. Based on the classification of Stigsdotter and Grahn (2002), the horticulture therapy school includes horticulture therapy but is not least of all.

'According to the theory belonging to this school the health effects are primarily derived from the activities in the garden room. A theory often put forth among medical and horticultural therapeutic scientists is that the health effects are due to the fact that work in a garden is particularly obvious, meaningful, and enjoyable. (p63)

In this school, activities are the main recovery machine for the people with illness. Summarized from the literature of Stigsdotter and Grahn (2002), the restoration of horticulture therapy school is from three aspects. The first one is that individuals get self-rewarded and self-esteem from rewarding activities. For instance, working in garden can not only harvest food as rewards, but also bring them a feeling of meaningfulness and pleasure in their psychological state (Relf,1992). Secondly, functional actives help people do more exercise and practice their body, which benefits their physical health. The last one is that, through educational activities, people promote their cognition skills by doing and learning things. However, what needs to be noticed is to balance people's challenge and capacity when doing activities. It is always good to give different choices for people depends on their different capacities.

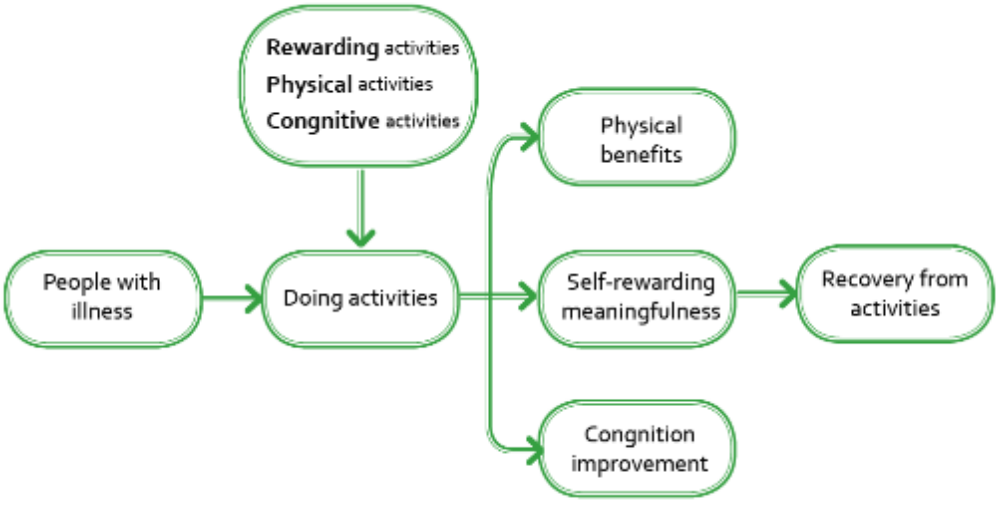


Figure 3.12: conceptual model of effects on health outcomes.

3.13 Defining typology based on the schools.

Based on the different characteristics of different schools, two different typologies are defined for the testing. One is the nature-based typology, which is derived from the healing garden school. In this typology, it is focused on salutogenetic experience of the people from a psychological perspective. The other is the activities-based typology, which is derived from the horticultural therapy school. Activities are the main methods in this typology to provide salutogenetic effects.

3.2 Age-friendly design for the elderly

According to literature study, I find that the outdoor environments caring for the elderly people typically focus on four parts: the nursing home, gardens for the frail elderly, outdoor environments for the elderly with dementia and outdoor environments for the elderly with disability. After sorting out the main qualitive elements in design considerations, these four types of spaces show great commonalities on the characteristics.

3.21 Nursing home.

Nursing home, is the place where most elderly people gather. It is designed for the elderly in particular. It is significant to take a look into the characteristics of nursing home which plays an essential role in age-friendly design for the elderly.
Marcus and Barnes (1999) identified the features of nursing home comprehensively. They claimed that nursing homes should meet the requirements of *''a homelike environment, privacy, sensory stimulation, socializing, places to be with family, outdoor activities, comfortability, a sense of security and accessibility. ''(P425)*

3.22 Garden for the frail elderly.

Elderly people, as a venerable group, is increasing frail with aging. Gardens for the frail elderly are aimed to meet the demands of seniors, promote the physical and psychological health of the elderly, and recover their anatomy and independence. This type of gardens also deserves considerations.
Marcus and Sachs (2013) lined out the general requirements of this kind of garden for the elderly, which should *''have a look of a domestic garden, provide a simple and clear garden layout, provide appropriate destination points, provide plenty of choice, provide garden spaces both at the back and in the front of the building, work closely with staff, and consider the culture and attitudes of the elderly.'' (p132)*

3.23 Outdoor environment for the elderly with dementia.

As mentioned before, dementia is a number 1 disease in Netherlands, which means that about 1 in 5 people get dementia in the country (Rijksoverheid.nl, n.d.). Compared with different age groups, the rate of dementia among the elderly is even the highest one (Jaul and Barron,2017). This makes the consideration of gardens for elderly with dementia reasonable and necessary.
Mitchell (2003), asserted that *"familiarity, legibility, distinctiveness, accessibility, comfortability, and safety"(P605)* are the main characteristics of outdoor environment for the elderly with dementia.

3.24 Outdoor environment for the elderly with disability.

With normal aging, the physical function of body changes. Movement-oriented disease is very common among the elderly, such as arthritis, stroke, and multiple sclerosis. For this kind of disease, the movement limitation is the main challenge to deal with. Winterbottom and Wagenfeld (2015) talked about the gardens for adults with physical challenges, which also included elderly group. From the book, *safety, physical activities, a sense of control, accessibility, sensory interaction, comfortability and rest spots along road* are the main requirements for the gardens.

3.25 Conclusion of age-friendly design

Based on these four parts, it can be easily seen that some of these characteristics are overlapped. For example, it is both important to consider safety in outdoor environment for the elderly with dementia and the elderly with disability Also, since a sense of control is achieved by plenty of choices, they have the same meaning. Thus, these two requirements in gardens for the frail elderly and for the elderly with disability can be concluded together, as a sense of control.
By analogy, I sum up the qualitative elements for age-friendly design as followed (Figure 3.251).

Qualitative Characteristics of age-friendly design	Nursing home (Marcus and Barnes,1999)	Garden for the frail ederly (Marcus and et al,2013))	Outdoor environment for the elderly with dementia ((Jaul and Barron,2017)	Outdoor environment for the elderly with disability (Winterbottom and Wagenfeld,2015)
• A sense of belonging	• Homelike environment	• A domestic garden / Culture consideration	• Familiarity	
• Legibility		• A simple and clear garden layout	• Legibility/ Distinctiveness	
• A sense of control		• Plenty of choice		• A sense of control
• Accessibility		• Spaces both at the back and in the frontof the building	• Accessibility	• Accessibility / Rest spots along road
• Sensory Stimulation	• Sensory Stimulation			• Sensory interaction
• Safety	• A sense of security	• Work closely with staff	• Safety	• Safety
• Outdoor activities	• Outdoor activities			• Physical activities
• Comfortability	• Comfortability		• Comfortability	• Comfortablility
• Privacy	• Privacy			
• Socializing space	• Socializing space/ Places to be with family			

Figure 3.251: conclusion of the characteristics of age-friendly design for the elderly.

3.3 The engagement of the elderly people.

3.31 Affordances of landscape

Data has shown that elderly people are the most inactive age group in urban green areas (Payne, Mowen and Orsega-Smith, 2002). Lower visitation of green area reduces the opportunities for seniors to be restored by healing landscape. Thus, how to reactivate the engagement of elderly people in outdoor landscape seems to be a significant issue.

Affordances, is the concept related to people's behaviors and actions. From the aspects of environmental psychologists, affordances reveals how individuals experience the environments in course of action. It makes us pay more attention on people's behaviors and activities in daily environments to promote the engagement. The significance of the individuals' experience is in the background of an individual's action and history (Lewin, 1951). *Affordances,* is defined by three qualities: function, meaning and attraction (Heft, 2010).

Function

Function is of great significance to the properties of affordances. To identify the function of an

environment is to consider the possibilities of actions and behaviors in the environment. However, this does not mean to cause a specific action, but to anticipate the possibilities as well as constraints in course of action. It is about the possible relation **between people and their behavior** in the environments (Heft, 2010).

Meaning

Users, are the main objects who use the environments. However, one specific space will have different meanings to different users due to their individual's history. This makes us pay attention to the possible relationship between environment and people. Besides the physical and material characteristics of the environment, meaning, as a **sociocultural consideration**, also plays an essential role in the affordance of landscape (Heft, 2010).

Attraction

Attraction is an additional property of affordance, which makes the environment **more desirable and unique to users**. It affects the relationship between people and environmental features as well (Heft, 2010). Making the environments more **attractive** gives a more unique and valuable experience for people and ties them with environments more closely.

3.4 Theory combination

After reviewing the theories of healing landscape, of age-friendly design and of the engagement of people, I combine the theories together to form the qualitative characteristics lists of the healing garden for the elderly and of the horticulture therapy for the elderly.

Healing garden for the elderly & the horticulture for the elderly.

Lots of commonalities can be found between the theories of healing garden school and of age-friendly design. Some of the qualities are the same in the two theories such as the legibility, the social support and the socializing space, physical movement and exercise and outdoor activities. Some of the qualities include other qualities. For example, the complexity includes the sensory stimulation and a sense of control. When the place is complexity enough, with various elements, rich sensory experiences and different types of spaces, it already offers people lots of choices, that is a sense of control. After the combination, the result shows in the figure (Figure3.41).

By analogy, I also conclude the characteristics of the horticulture for the elderly. The commonalities between the theories of the horticulture therapy school and of the age-friendly design are not as much as that between the theories of healing garden school and of age-friendly design. However, it stressed the power of the activities more. The result shows in the figure(Figure 3.42).

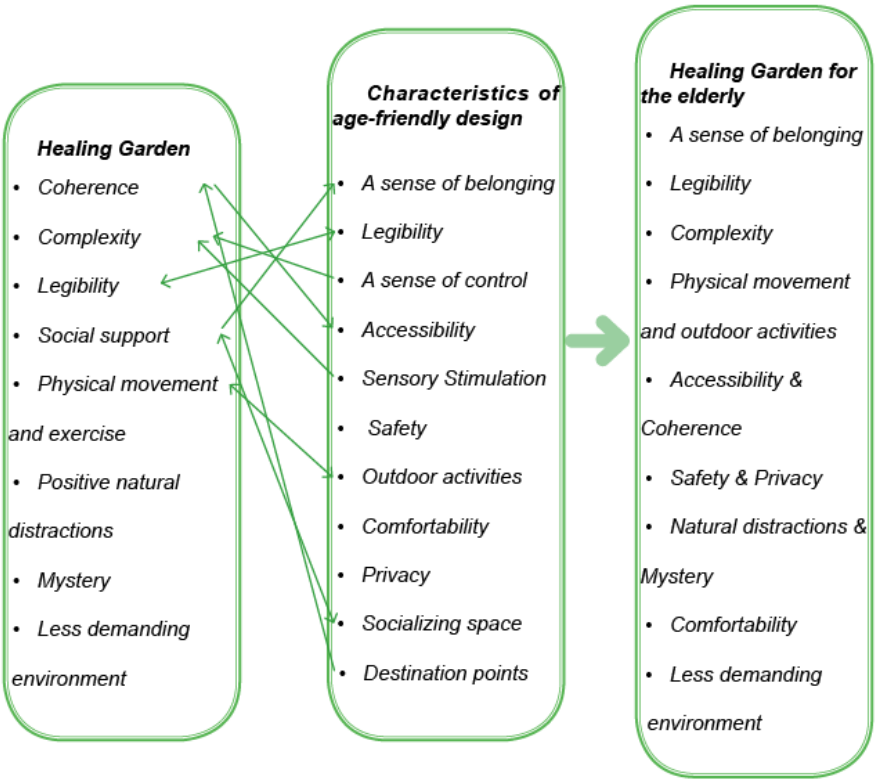


Figure 3.41: combination of the healing garden school and age-friendly design.

Figure 3.42: combination of the horticulture therapy school and age-friendly design.

The commonalities and differences of theories between the healing garden for seniors and the horticulture for seniors.

After reviewing and combining theories, I have a more comprehensive understanding of the qualities required to benefit the health of elderly people. When comparing these two theories, it can be found out that in both theories, it is significant to provide a sense of belonging, legibility, complexity, accessibility, safety and comfortability to the elderly.

However, the theory of horticulture areas for the elderly accentuates to provide activities, gardening for seniors, while the theory of healing garden for the elderly focuses on the natural environment for seniors. The quality of physical movement and exercise is not the highlight in this theory. Instead, to provide an environment which is less demanding and have natural distractions for the elderly are the focuses in this theory.

In the later testing models, the commonalities of theories will be considered in both models, but the differences will be magnified and emphasized.

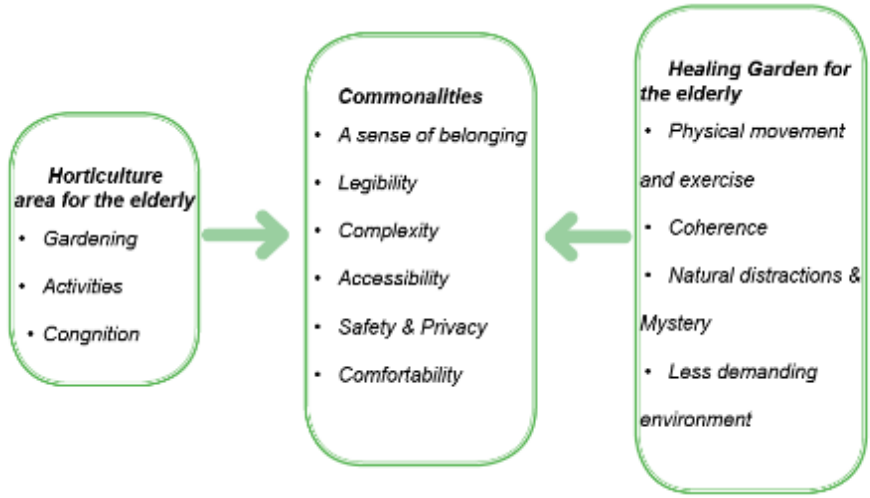


Figure 3.42: the commonalities and differences of theories between the healing garden for seniors and the horticulture for seniors.

The perspective of affordances.

Looking at the theory of affordance in landscape, I find that the qualities are actually refelcted in some of the qualities of the healing garden for seniors and of horticulture therapy for seniors.

Functions is related to the quality of activity. Meaning, as a sociocultural aspect, is included in a sense of belongings from a mental and social aspects. As for attraction, it is an additional property, referring to the desirable and the unique of the area and depending on the specific site and situation. I think it is more appropriate as a criterion than a quality to design with.

I think the qualities in affordance theory are the important criteria for the later evaluation of a salutogenetic and activating environment.

04 Exploration on design tool box

This chapter is aimed to explain the qualitative elements from theories in spatial language. It connects the healing qualities with corresponding spatial formation and forms a tool box for the later development in specific site situations.

4.1Exploring design tool boxes

Exploration on design tool boxes makes a better spatial understanding on the healing and activating qualities for the elderly. It translates the qualities in a conceptual way, laying the foundation for the following model design concerning specific situation.

Legibility

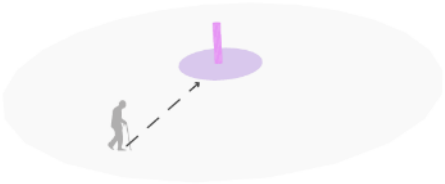
Legibility is important to seniors due to their degeneration of cognition skills with aging.

Different characters of space.

Enduing space with different characters makes the distinctiveness of the space, making elderly people recognize places easily.

Landmark & signage.

Landmark and signage help direct the elderly in the whole space.

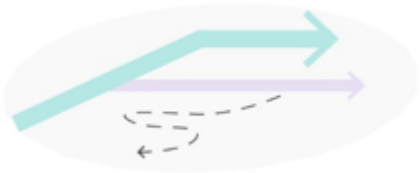


A sequence of environment cues.

A sequence of environment cues in site gives ‘green guidance’ to the elderly for way finding, which also contributes to the coherence of the whole place.

A clear & simple layout.

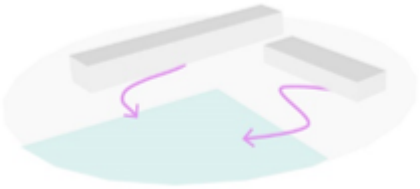
A clear and simple layout helps elderly people read and understand the place, preventing them getting lost.



Accessibility & coherence

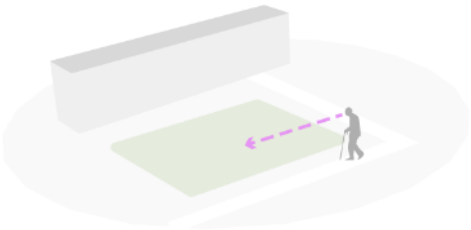
Physical connections to the green/blue spaces.

Physical connections are necessary in order to access the place.



Viewing accessibility.

Besides physical accessibility, viewing accessibility is important as well, especially for the anxious and afraid elderly.

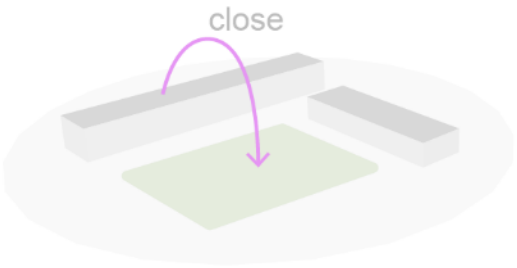


Consistent green and blue spaces.

The consistent green and blue spaces make a sense of whole world for the elderly, giving them a sense of being away from their homes.

Short distance.

The distance from seniors' homes to green and blue spaces is of significance to the elderly with mobility inconvenience.



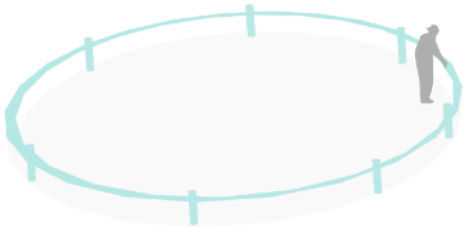
Safety & privacy

Enclosure space.

Enclosure space gives the elderly a sense of safety. Simultaneously, it blocks people peeking from outside and improves privacy for them.

Safe infrastructure and facilities.

The physical function of elderly degenerates, causing falls and mobility disabilities. Safe infrastructures and facilities make a physical safe environment, helping the elderly keep balances.



Rest spots at shorter distance.

Due to the mobility impairments, the capacity of seniors' walking is weaker compared to the generals. The rest spots at shorter intervals are preferred for them to have a rest.

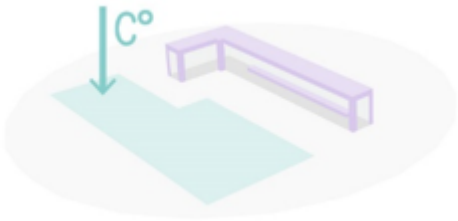
Separation of private, semi-public and public spaces.

A clear separation of private, semi-public and public spaces makes different groups to use their own spaces, allowing the privacy in the site.

Comfortability

Shade and water body

Seniors, as a vulnerable group, are more sensitive to physical environment. Therefore, it is significant to provide a shade and water body to make the elderly feel comfortable.



A sense of belongings

Reserve historical structures

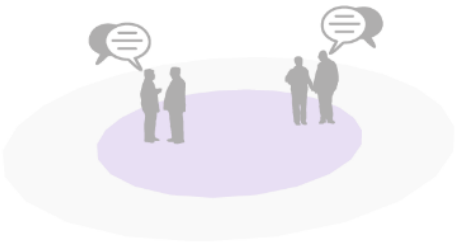
Historical structures in the site give a mental belonging to the elderly, which promotes their cultural pride and identity.

Restoration of old green & blue areas

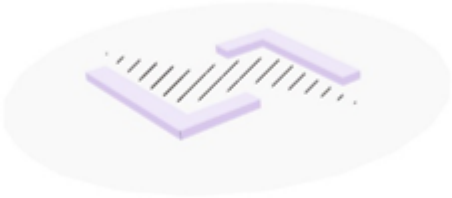
The old green and blue areas in the site are related to the elderly neighbors' memories of the places. Restoring these old structures creates a physical familiar environment for the elderly.

Social space.

Apart from a physical sense of belongings, a mental sense of belongings is also of significance for the elderly. Providing socializing spaces for the elderly to have the interactions with their family members, their old friends, or even with strangers, makes them feel less isolated and lonely. They will be mentally attached with the place.



Stimulation of social interaction.
Researchers shows right-angle or U-shape sitting benches can stimulate conversation between strangers. Promoting social interactions makes the elderly mentally belong to the place.

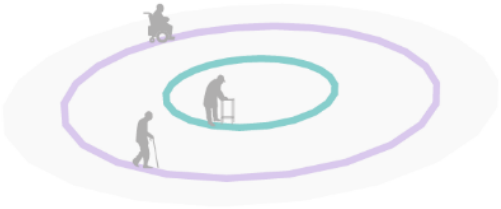


Complexity
Different sensory stimulation.
Taste, sight, touch, smell, and hearing are five basic senses of human. Stimulation of different senses allows rich perceptions of landscape to seniors and makes the environment more complex and interesting.

Variety features in a smaller area.
Elderly people have limited capacities of movement. Enriching the variety in a smaller space enables the elderly with mobility limitations experience different scene.

Multiple choices.
Multiple choices offered in the site allow the elderly to choose what they want depends on their demanding and capacities.

Movement & exercise
Walking path in different length and with different difficulty.
In account of capacities and challenges for the elderly, building walking path in different length and with different difficulties gives them choices to choose the most suitable way for themselves.



Low-impact physical exercise for elderly.
Facilities and spaces are provided for elderly to do low-impact physical exercise, such as walking, wheeled mobility and physical rehabilitation (Winterbottom, and Wagenfeld, 2015, P43).

Mystery
In account of the anxiety and unsafety for the elderly in the outdoor environment, mystery is less important compared to other qualities.

View blocking

The view blocking forbids people from knowing the place at the first glance, stimulating an interest of exploration.

Less demanding environment

A less demanding environment benefits the mental health of the elderly.

Figure: conceptual model: Effects of gardens on health outcomes.

Cognitions

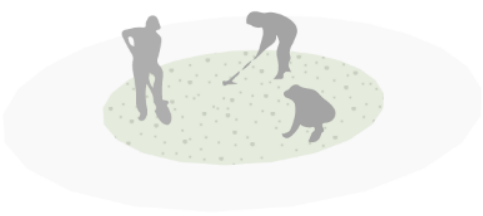
Educational activities.

Educational activities in the place help the elderly acquire knowledge and improve their cognitional functions.

Gardening

Gardening activity

Gardening is a meaningful activity for seniors and promotes their physical, mental and cognitional health.



Activities

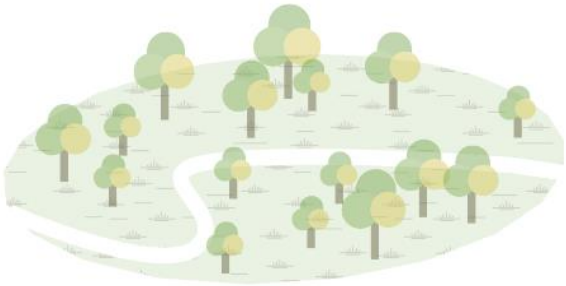
Providing spaces for different activities use.

Providing different types of spaces for different activities, such as rewarding activities, physical activities and social activities. Rewarding activities make seniors feel rewarded and appropriate physical activities are beneficial for seniors' physical health. Social activities stimulate a closer relationship between neighbors and promote their psychological health.

Natural distraction

Natural planting

Natural planting provides a natural-like setting for the elderly to release negative emotions.

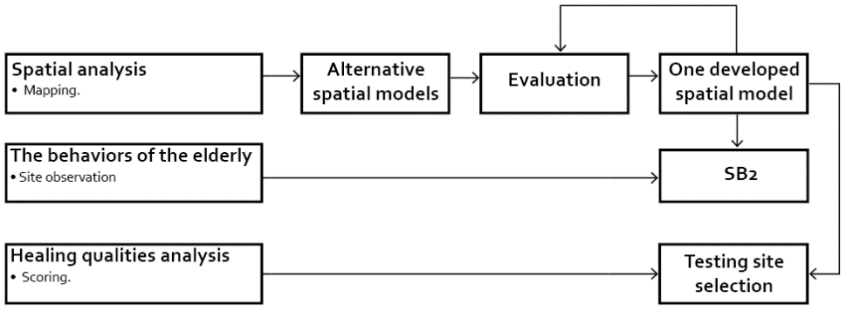


05 Case study: Zwanenveld, Nijmegen

In this chapter, the methods of mapping, site observation and scoring are applied. By analyzing the spatial problems, seniors' behaviors and healing qualities, this chapter is intended to answer the sub-quation2 of the thesis:

2) What characteristic of green space and blue space facilitate or complicate the usage of elderly people?

Simultaneously, the testing site will be selected according to the analysis.
Procedure:



5.1 Introduction

Attitudes from municipality of Nijmegen.

Recently, city conversions on the environment vison of Nijmegen are held for the project Environment and Planning Act in 2021. In 2021, the action on the living environment of Nijmegen will be applied to promote the quality of the whole physical environment (Nijmegen.nl, 2018). Because of this, city discussions around the future of Nijmegen are held in December,2018 to collect the voices of residents, companies, entrepreneurs and institutions (Nijmegen.nl, 2018).

In the meetings, health and aging wave is pointed out as a concern for the future. The figure below shows the results of the votes of two issues (Figure 5.11). One the one hand, none of the presence claims that the city of Nijmegen is already prepared for the aging wave. However, the data indicates a huge increase of the population number of elderly people and the elderly living alone, by respectively 55% and 88% in the year from 2015 to 2040 (Figure 5.12) (Nijmegen.nl, 2018). With aging, lots of problem is expected to be caused in the future and an environment for the elderly is what the municipality should be improved a lot. On the other hand, the votes for the healthy city give a negative result as well. More than half of people answered ‘’no’ when asking if Nijmegen is a healthy city. The health properties of the city should be stressed and promoted furtherly.

To prepare a future environment vision, municipality also did research for living quality of residential areas. Result shows that Zwanenveld is one of the neighborhoods that is below the average environmental quality (Figure 5.13).

Thus, the issue about elderly group and health are studied in this thesis, aimed to contribute to the city’s future and the residents’ welfares, in a landscape design way.

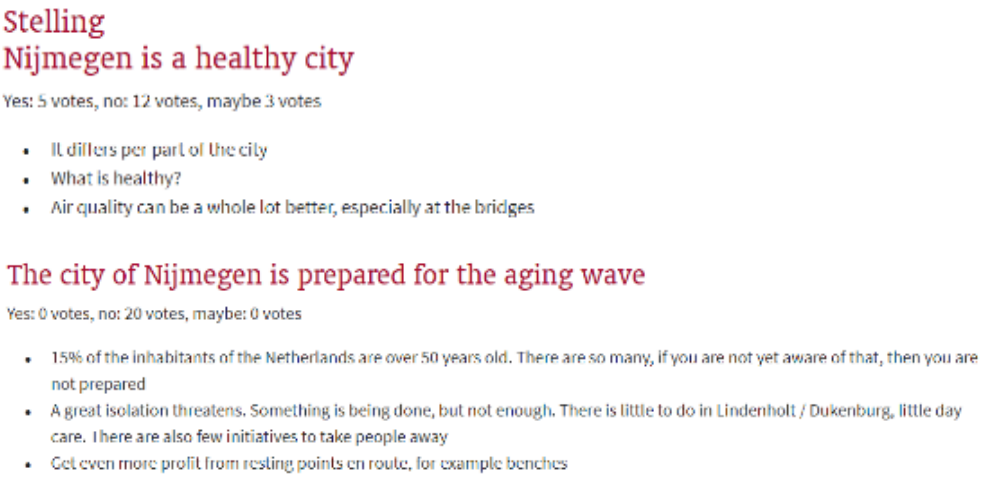


Figure 5.11: the results of votes (Nijmegen.nl, 2018).

Figure 5.12: the number of the elderly from 2015 to 2040 (Nijmegen.nl, 2018).

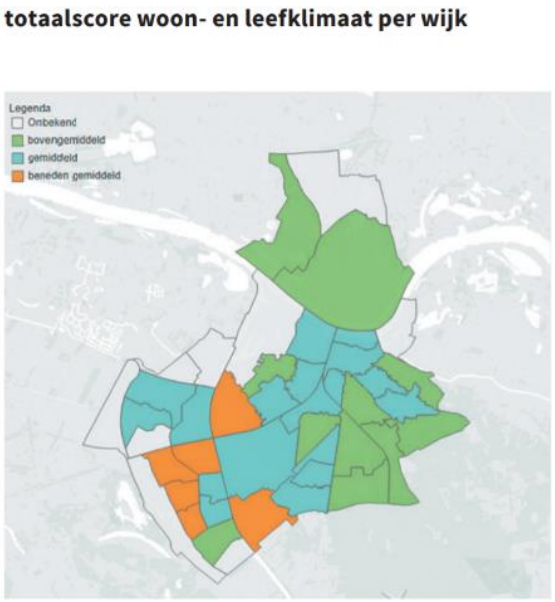


Figure 5.13: the environmental quality analysis of the neighborhoods in Nijmegen (Nijmegen.nl, 2018).

The Location of Zwanenveld

Zwanenveld is a dutch neighborhood, located in the south-west parts of Nijmegen. It belongs to the Dukenburg district which includes nine neighborhoods: Zwanenveld, Tolhuis, Lankforst, Meijhorst, Aldenhof, Malvert, Weezenhof, Vogelzang and Staddijk.

Around the neighborhood, on the northern side lie the Tilburg-Nijmegen railway line and Wijchenseweg- N326, which provide a good traffic connection with the central of Nijmegen. On the eastern side of site is located the Maas-Waal canal, the border between the Dukenburg and a campus. On the southern and western side of the site are the main roads, the Nieuwe Dukenburgseweg and the Van Schuylenburgweg respectively, separated the neighborhood from

other two neighborhoods Tolhuis, Lankforst. More specific and detailed information will be introduced in later spatial analysis part.

Figure 5.14: the location of Zwanenveld.

The development of the site.

Zwanenveld was built during the year from 1970 to 1980. From then on, the neighborhood has small changes continuously. The biggest change in the neighborhood is during 2000-2010 with the redesign of the Geologenstrook park.

Figure 5.15: the development of the site (AlleCijfers.nl, n.d.).

From the history map (Figure 5.16), we can see the development of the site from 1970 until now. In 1976, an important shopping centre was opened, called Denkenburg shopping center. It is located in the north-western corner of Zwanenveld. After the renovation in 1990, it comprises 100 stores with a total surface area of 23,470 m2 and becomes a service center for the whole of Dukenburg and Lindenholt districts. It attracts large numbers of citizens from Nijmegen (Nl.wikipedia,n.d.).In 1986, a train station called 'Station Dukenburg', next to the shopping center, was eatablished. It lies between the railway connection of Tilburg and Nijmegen, allowing the neighbors get to the city center conveniently. In 1994, a big bus hub also called 'Station

Dukenburg' was built besides the train station, where both city and regional buses depart from (Nl.wikipedia,n.d.).

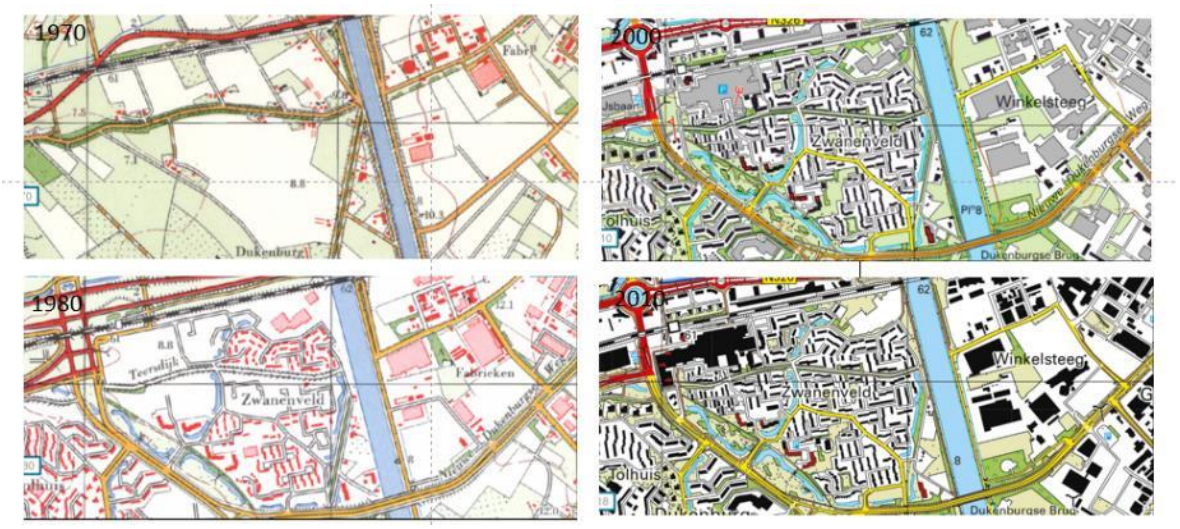


Figure 5.16: history map in 1970, 1980, 2000 and 2010 (Topotijdreis, n.d.).

The housing in the neighborhood

Zwanelved occupies 87 hectares, of which 59 hectares of paved surface (68%), 23 hectares of the green (26%) and 5 hectares of water (6%). In the neighborhood, there are 2427 houses, which consists of 55% of low-rise buildings and 45% of multi-stories buildings (Archive, 2007).

From the figure 5.17, the functions of the houses can be clearly seen, which includes the use of shopping, housing, office, meeting, industry, sport, education, health care and other usage.

Figure 5.17: the different housing in Zwanenveld (AlleCijfers.nl, n.d.).

The population of Zwanenveld.

Based on the data of CBS in 2017, there are 4,640 residents in total and the composition of age group in Zwaenveld shows in the figure 5.18 (CBS, 2017). The largest age group in Zwanenveld is the people aged 45 to 65 years old with the proportion of 29 percentage. The number of elderly neighbors, who aged over 65 years, takes up approximately 19 percentage of the whole population, which is the third largest group among all age groups. From the figure, a trend of

the increasing of the elderly neighbors can be easily and clearly seen. What I can deduce is that about 20 years later, seniors will be the most potential age group which has the largest population.

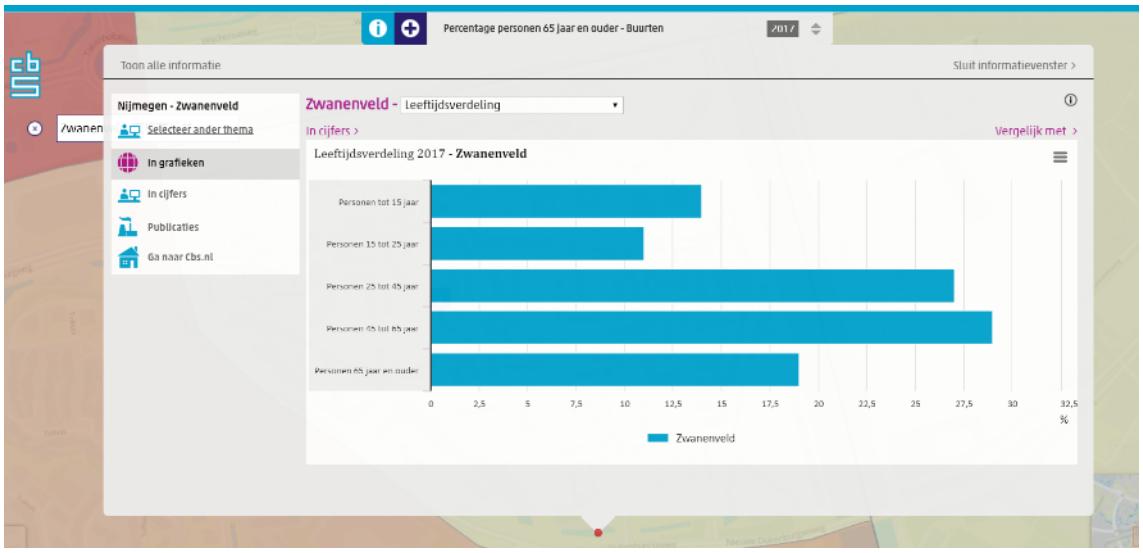


Figure 5.18: the age group composition in Zwanenveld (CBS, 2017).

The health status of the population

According to the health data of Zwanenveld (AlleCijfers.nl, n.d.), it can be seen that the health status of the residents is good in general. However, when zooming into the special age group, the elderly people, the number of the elderly with illness is even bigger than the number of the elderly with good health, with the proportion of 57% and 54% respectively. Therefore, the health problem of the elderly is a big issue in the neighborhood which requires a demand of healing landscape for them.

However, since the healthy elderly still occupies a large proportion of population, the target elderly group should be not only the elderly with illness, but also the elderly who is in good health status.

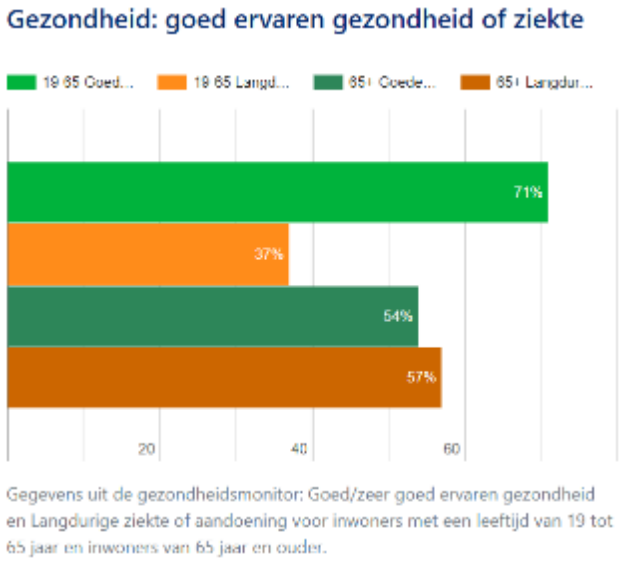


Figure 5.19: the health status in Zwanenveld (AlleCijfers.nl, n.d.).

5.2 Spatial analysis

5.21 Mapping

5.211Current green and blue space.

Dispersion unevenness

When looking into the neighborhood, it can be found that there seems to have no lack of greenery and water features (Figure5.21). However, looking more cautiously, the locations of the greenery are dispersed unevenly. Most of greenery stays in the southern parts of the neighborhood. In the northwest, where the shopping center is located, are of much paved surface. The blue space in the area are consisted of Canal maas-waalkanaal in the eastern side, the linear water bodies in the Geologenstrook park, and the linear water bodies along road. There are adequate water resources in the neighborhood, benefiting the micro-climate of the site.

Figure 5.211: current green and blue space

Current green and blue structure

Based on the current green space, a clear green structure can be seen (Figure 5.212). The old green corridors, the liner community park and the consistent liner green areas are consisted of the whole current green structure of Zwanenveld. The blue space in the area are all linear formation, composing the blue structure in neighborhood (figure 5.213).

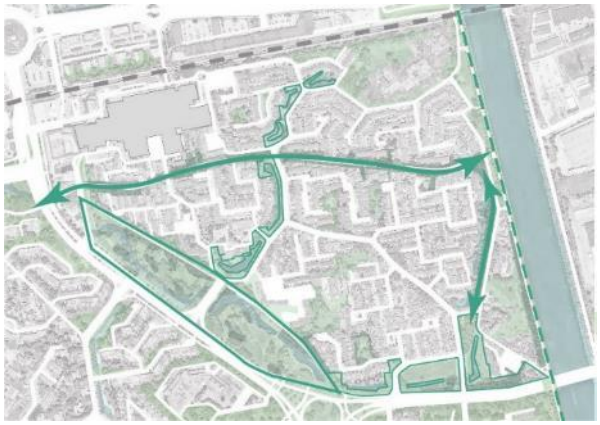


Figure 5.212: current green structure.

Figure 5.213: current blue structure.

Accessible green and blue space.

For the relationship of the health and green space, it should be noticed that it is through the experience in the space that people receive restorations. That makes it significant to investigate the green and blue areas whether they provide experience for the residents or not. Accessibility is what related to the investigation.

Although there seems to have enough greenery and clear green structure in the site, half of them is inaccessible. That is residents are not allowed to go through or close to them. In another word, they provide less experience for neighbors of the whole space. Specifically, most accessible green spaces concentrate in the southwest while there lack accessible green areas in the north which provide a favorable experience for residents.

Simultaneously, a green corridor which is accessible means it is a walkable green path for the elderly in the neighborhood. From the map (figure 5.214), a clear and brilliant accessible green corridor lies in the west-east direction of the space. However, in the south-north direction, there is only a short and inconsistent walkable corridor in one side of the space. In the south-north direction, a walkable green corridor is expected for the moving of the elderly to get out from their houses safely and enjoyably.

As for the blue spaces, as showed in the map (Figure 5.215), the chances of experiencing water features are gathered in the Geologenstrook park where the elderly can easily get close to the water bodies and potential receive the salutogenetic effects of the water. Instead, along maas-waalkanaal, there is no pedestrian path but a bike path. In the south-west direction, there has enough water resources potentially offering a healing experience for seniors but without utilization.

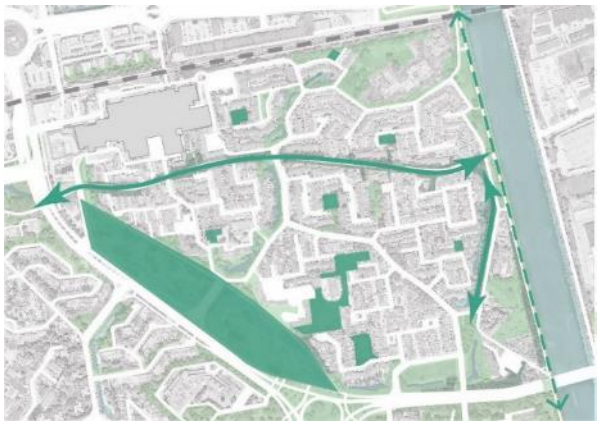


Figure 5.214: current accessible green space

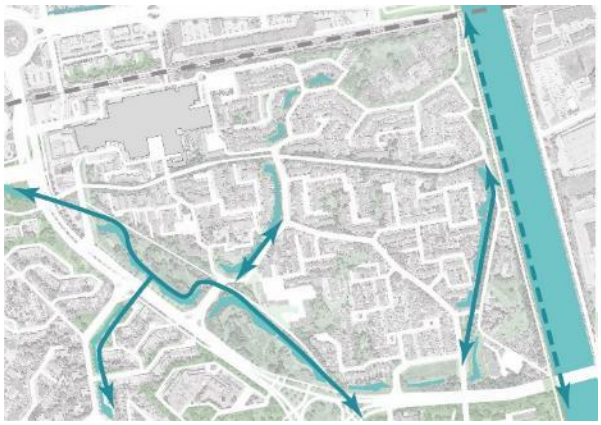


Figure 5.215 current accessible blue space

5.212 Activity space

Activity space is the space where residents can gather to carry out activities with their families, friends and neighbors. After mapping (Figure5.216), community park and kids' playgrounds are the only two types of spaces for the activities in neighborhood.

The inclusive Geologenstrook park

On the western edge of Zwanenveld is the Geologenstrook park, a linear community park for all age groups. It is a remnant from the penultimate ice age, the same as Staddijk in Nijmegen

(Waterbewust, 2009). In the park, big trees, wild bushes, old braiding water system, green lawns create a different world from surrounding outside. Old tree lane lies in between with park and neighborhood. Wandering trails are through the park with benches along sides. Sculptures are located to indicate the freedom and democracy. However, the usage of the park is not satisfying. The areas are too closed and shady. And the vegetation is too dense and wild to make people feel safe in the park. The old tree lane, as a separation wall, decreases the accessibility from the neighborhood.

Playgrounds for kids

The playgrounds are distributed evenly in the site. Nearly each block has its own small playgrounds and nearly all of them are surrounded by groups of old trees and lush bushes. They are also natural and wild enough.

However, the playgrounds are mainly for the kids and the usage of them is not optimistic. In the playgrounds, what exist are all children-play equipment such as slides and swings, and rough materials for the exploration such as sands and soils. Moreover, they are unfriendly for the accessing and staying of the elderly who are willing to accompany with their grandchildren. Each playground has obstructed borders, either the low fences or hedges, hindering the accessing of the elderly with wheelchairs. The paths in the playgrounds are all not paved which are too rough for the elderly with crutches and wheelchairs to go into. Additionally, some of the playgrounds have no apparently paths which provide exploration and freedom for kids but cause inaccessibility and unfriendliness to the elderly. For the staying, just one or two spaces have benches for resting and the number of benches in these spaces are far away to meet the demands for the elderly who are expected to sit down and watch children' playing. **More specifically shows in the photo study.**

Figure 5.216 activity space in Zwanenveld.

Serve radius

Based on the analysis of the activity space in Zwanenveld, the Geologenstrook park is the only area which is inclusive to seniors' activities. Researches refer that 500 meters is the appropriate waking distance for the elderly. As showed in the map (Figure 5.217), there are above one third of the area are out of service radius, clustering in the eastern side of the area.

Figure 5.217 Serve radius of Geologenstrook park in Zwanenveld.

Potential accessible green and blue space

Considering the analysis above, potential accessible green and blue space plans are generated. The potential green spaces are consisted of abandoned space, potential for space afforded with activities and the linear consistent green space along the road, appropriate for green walking corridor. Since the existing blue spaces are most along road where there no spacious space for activities, the function of the potential blue space is the walkable blue corridors in the site.

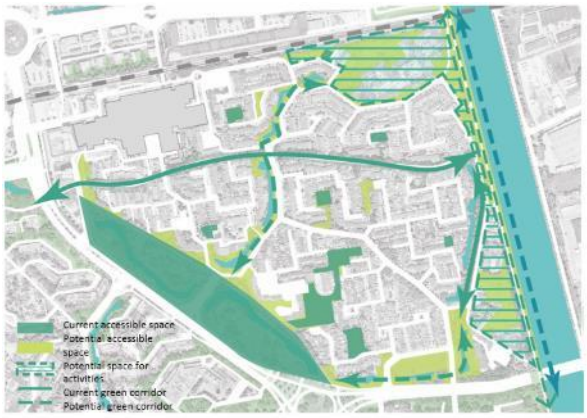


Figure 5.218 Potential accessible green plan.

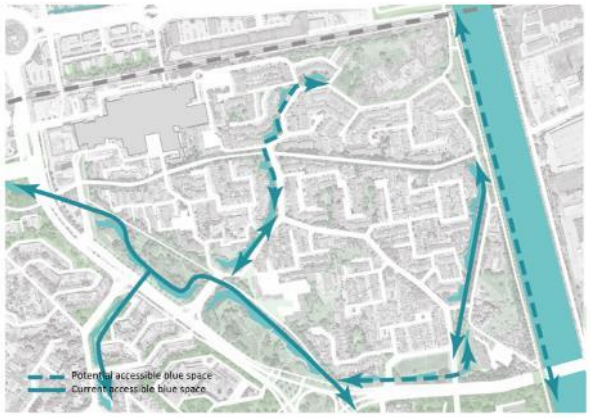


Figure 5.219 Potential accessible blue plan.

Parking area-the grey space.

Paved surface occupies the largest area with a proportion of 68% in the site. Besides the residential buildings, parking areas are the main cause of the large amounts of the unused hard surface, as what shows in the map.

There are two different types of parking areas in the neighborhood. One is the parking square, the other is the linear parking space along the road. According to the photo study showed later, we can find that parking lots are not full used and lack of management. Cars are always parked in the informal areas, while the surrounding official parking lots are not full used. Some of the cars even influence the pedestrian road in the neighborhood. The parking squares occupy too much space potential for public space.

Figure 5.220 Parking areas in Zwanenveld.

5.22 Photo study

Environment obstacles along pedestrian road.
Unevenly pavement, cars, tree roots.

Environment obstacles in public space.
Fences, hedges.

Lack management of cars

Lack of walkable roads.

Too wild space, unsafety.

Park, Abandoned space.

Old green corridor.

Water features

Shade.

water bodies in the park.

5.23 Site observation

To understand the elderly group furtherly, I did a site observation of seniors' residents in the neighborhood. By observation, I find out the favorable places of the elderly, analysis the characteristics of spaces and summarize the behaviors of the group.

The characteristic of the most gathering space.

In the neighborhood, the most preferable areas are **the old green corridor, the De vleching, and the bike path along the Canal maas-waalkanaal.** Based on the site observation, I conclude the features of these areas to explore the factors that facilitate the usage of the elderly.

Shade

Analyzing the commonalities of three spaces, shade is the most significant characteristic among all spaces. Old lush trees with big canopy create physical shade for the elderly in the corridor and the bike path along cannel. Moreover, the trees and shrubs in the sites formed an encloser space which provide a psychological safe shade or harbor for them. The De vlechting is an elderly caring center in the neighborhood, as a shade offering helps for the elderly.

Old structure.

From history maps, old green corridor and the cannel exist already as the start of the neighborhood. The two old structures with nice experience stay in the memories of the seniors from their childhoods, which gives a sense of belonging for them physically and mentally.

Linear corridor as strong guidance

The corridor and the road along cannel have strong guidance with one direction and the rows of tress on both sides. With the functional depredating, elderly people easily get lost. With the strong guidance, the elderly can easily find their ways and understand the space. The strong guidance of these two spaces are the potential reason why the elderly gather in these two spaces more rather than in the community park.

Short distance from all blocks.

The old green corridor is the most highly used spaces in neighborhood. I think distance is an important factor for the phenomenon. As located in the middle and spanned the whole neighborhood in eastern-western direction, it has short and appropriate distance from every

block of Zwanenveld.

Caring Destination for seniors

De vlechting serves as a destination caring for the elderly in ZwanenIveld. It is the elderly care center where provide service for the elderly. Seniors regard this place as a harbor of themselves where they the environment are special for them. Because of this, this place is one of most gathering places of the elderly.

The behaviors of the elderly in the site.

By site observation, walking is the most common behaviors of the elderly, and the action is mostly happened under the shade and along the water. **Low walking speed** is the features of the elderly walking. Besides, walking dog, biking, chatting, jogging, fishing and sunbathing were also observed in the neighborhood. These **activities** are mostly **mild and gentle**. What to be noticed is that chatting between the elderly are mostly happened on the pedestrian road or in their yards. And sunbathing takes place in their yards as well. The locations of the actions also partly indicate the unfriendliness of existing space to seniors.

5.24 Spatial problem conclusion

Based on the mapping, photo study and site observation, the spatial problems are concluded as below.

1.Current green spaces are not unfriendly enough for the elderly people. Environmental obstacles are seen in the neighborhood for the elderly, like rough roads, steps and fences.

2.There lack spaces for elderly gathering and doing activities. In the neighborhood, the spaces for carrying out activities are consisted of kid's playgrounds and a community park. The environmental obstacles in kid's playgrounds hinder the usage of the elderly while the location of inclusive community park makes it hardly service the seniors lived in the eastern side of neighborhood.

3. Some parts of pedestrian roads are not safe and walkable enough for the elderly. In the north-south direction, there lacks a safe and walkable corridor to connect the houses and public areas.

4. Parking area are not full used but make a large area of pavement, which is potential for the other use. Besides, cars park randomly and lack management.

5.3 Spatial models in large scale

5.31 Strategy

1.Rearrange the parking area.

1.1Change grey space to green space

1.2Add green space into grey space

1.3Adding parking lots.

To adapt existing situation, the first step is to replace the grey area of low utilization with green areas for resting or activities. Secondly, for the lots highly used, add green into grey space to build green parking lots and hide view from pedestrian road. Movere, as a compensation, add new layers of parking surface aboveground or underground, which allows the same land occupation but more parking surfaces.

2.Optimizing the structure of current accessible green and blue space
2.1Create walkable path through.
2.2Connect the isolated green spaces.

Simultaneously, current green and blue areas provide insufficient experience for the people. And the green and blue connections between residential blocks and public spaces are not good and systematical enough. Thus, optimizing the current green and blue spaces is required to meet the demanding of residents. Basically, strategy is to create walkable path for seniors to access the favorable green and blue spaces and to connect the isolated green and blue spaces, aimed to provide an enjoyable walking system for seniors to approach green and blue spaces out of their houses.

3.Creating new center spaces.
Furtherly, to create new center spaces to provide public spaces for the residents to have social interaction such neighborhood events, chatting or exercising.

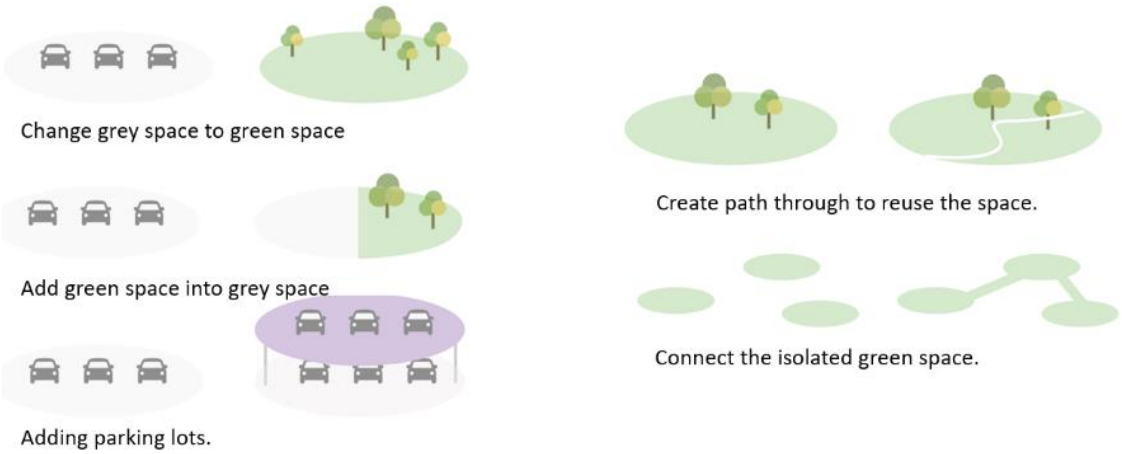


Figure 5.31 strategies of spatial models.

5.32 Sketched models

Model 1 center spot
Due to the lack of public space for activities, a center spot is created in this model to meet the demands of the residents. Considering the distance from all the blocks, the spot is placed in the center of the neighborhood. In the center spot, green, blue and hard surface are interlaced. Some of existing buildings are expected to be moved to the north-eastern corner of the neighborhood, where there is an abandoned area now. A walkable green corridor, connecting the park, center spot and the new building area, is generated to provide a pleasing walking road in the north-south direction.

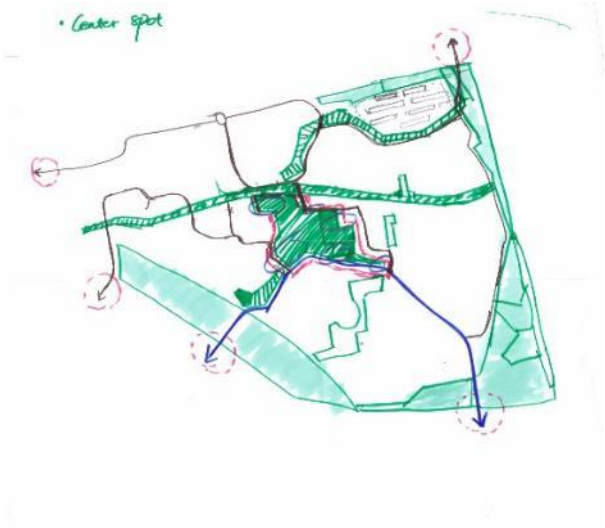


Figure 5.321 center spots model.

Model 2 optimizing current situation

This model is to optimize current green and blue spaces. Abandoned spaces in the eastern side of neighborhood are redesigned and reused. To make the movements of the elderly more safe, convenient and pleasing, pedestrian road system is intended to have a clear separation from auto roads. A blue walking path is created through the current linear blue areas. Besides, new small green areas are added to extend a current linear lawn to generate a new green walking corridor and connects the park and abandoned space.

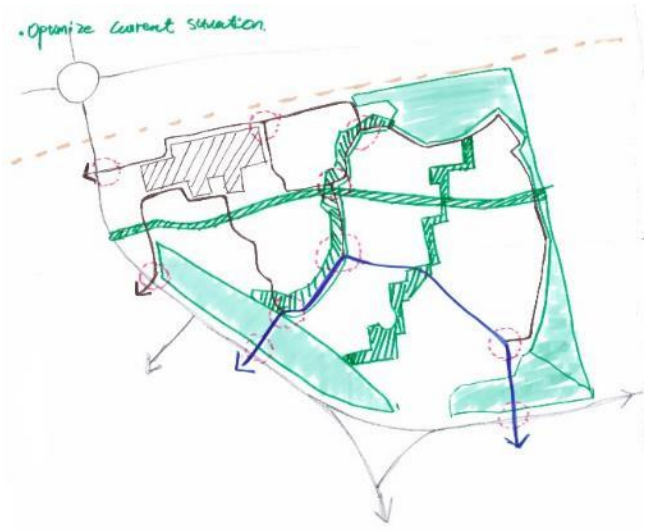


Figure 5.322 optimizing current situation model.

Model 3: Small center blocks

In order to provide space friendly to seniors, this model is to create small center spaces for residential block to stimulate the social interactions in the neighborhood. In this model, parts of existing playgrounds are reserved for the use of the kids, the rest are adapted to meet the demanding both for kids and elderly. Moreover, several parking lots are transformed to green areas and as compensation, new parking lots are placed in the abandoned places. A walkable blue corridor is created for the seniors through the site.

Figure 5.323 small center blocks model.

5.33 Evaluation of the models.

In three models, due to the feasibility, the model to create central space is given up. Removing the existing houses and rebuilding new houses mean high expense and complex communication issues between owners. Besides, the location of the spot is too close to the current park.

The model 2 and 3 have its different strengths. Model 2 optimizes the current green and blue spaces, providing two destinations with good connection for the elderly in the neighborhood. Model 3 provides small gathering spaces in the residential blocks, making the areas closer to seniors with mobility inconvenience and promoting residents' interactions in the blocks.

Thus, I make a developed model based on the combination of model 2 and model 3.

5.34 Developed model

The developed model is a combination of model 2 and model 3 above. In the model, two parks as destinations lie in the different edge side of the Zwanenveld for the different use demanding of seniors. The blue and green corridors connect the destinations to provide a good movements experience through the sites. In the residential blocks, small green centers are created to offer a gathering space for social interactions. Along the cannel, walking trails and platforms are located to attract people to enjoy the view.

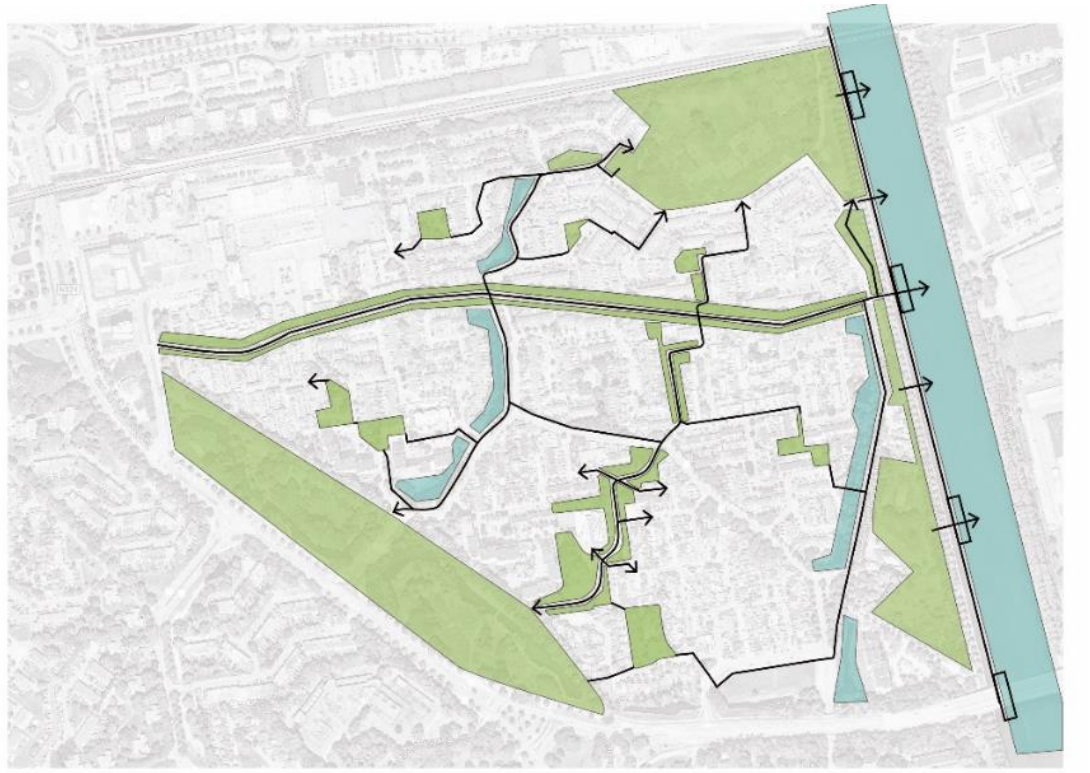


Figure 5.341 developed spatial model.

5.4 Healing qualities analysis

5.41 Scoring

Based on the site field trip, I analysis the healing qualities of existing green areas in Zwanenveld to understand the site from healing aspects. The healing qualities to investigate are from the chapter 2 theoretical framework. And for each healing quality, I made criteria based on the definition and environmental factors of the quality and each quality has 5 points. I numbered the green areas as well to make it clear for the scoring analysis (Figure 5.41).

Accessibility

The criteria of accessibility:

- Short walking distance (Walking distance in 500m).
- Walking paths through.
- Entrances.
- Visual accessibility.
- No environment barriers (Steps, fences, slopes).

Results:

Old green corridors and area 9 have high accessibility in the area. There are roads from residential blocks to the old green corridors and area 9, which causes the formation of entrances. The

locations of the corridors make a short distance from all residential blocks. As for area 9, it is a lawn with several trees on which gives a nice visual accessibility. In the area, paved paths are through with less environmental obstacles.

Complexity

The criteria of complexity:

- Difference sensory experience.
- Landscape variety in the space.
- Multiply choices (roads, space and so on).

Results:

In Zwanenveld, the Geologenstrook park is the most complex place. Walking in the park, you can not only see a natural scenery but also hear the sounds of birds and ducks. Water, trees lanes, lawn and intense vegetation rich the landscape variety in the area. There are crossing roads and different types of spaces, providing choices for residents. As for least complex areas, they are abandoned spaces and simple green areas by roads.

Coherence:

The criteria of coherence:

- Consistence of landscape elements (water, vegetation and road).
- Visual consistence.
- Organized spaces along the walking road.

Results:

In the site, the old green corridor in the western side has good coherence of both green areas and water features. Instead, there are several isolated small green areas, disconnected with other green space, showing the low coherence in the neighborhood.

A sense of belongings

The criteria of a sense of belongings:

- Old structure
- Social activities

Results:

In the neighborhood, Maas-Waal canal and the green corridors has the longest history which exist before 1970. Besides, the tree groups in the northwest corner become smaller than they in the past. For the mental aspects of a sense of belongings, there are lack of social activities in the neighborhood, and social interactions between the elderly mostly take place in the community park and in the green corridor.

Legibility

The criteria of legibility:

- Clear layouts
- Easy wayfinding
- Landmark
- Character of the space

Results:

In the site, old green corridors and the bike path along the canal have simple and clear layouts with strong guidance, showing a high legibility in the areas. Instead, the two abandoned areas in the neighborhoods indicates the lowest legibility.

Comfortability

The criteria of a sense of comfortability:

- Shade
- Temperature.

Results:

Based on the site experience, the comfortable spaces are where there are big trees with shades and water bodies with pleasant temperature. They are one of old corridors, the bike path along the canal and the community park.

Safety

Mental safety

The criteria of mental safety:

- Management of the environment
- The enclosure of space
- The quality of pavement and furniture.

Results:

Overall, since the neighborhood was built early, the pavement is not under good condition. This makes the elderly feel unsafety for the lack of balance. Besides, old green corridors provide a mental safety to the elderly due to the enclosure of the spaces and the managed environments. Instead, two abandoned spaces give the lowest mental safety, where there are wild grasses with less management, making a feeling of unsafety.

Physical safety

The criteria of physical safety:

- Shelters for sunshade and wide block.
- The separation from car roads and bike paths.
- Environmental obstacles in the area.
- Safe infrastructure in the area. (furniture special for the elderly)
- Visual safety.

Results:

In the neighborhood, many areas have environmental obstacles, such as unevenness pavements, fences and steps. Besides, in public spaces, there are lack of suitable and safe facilities for seniors to use. Old green corridor in the middle of the site is the most physically safe environment for residents, however, environment obstacles such as steps, hedges still exist, decreasing the use of the elderly.

Privacy

The criteria of privacy:

- The enclosure of the space.
- Small size of space.

Results:
The places with high score of privacy are the playgrounds, which are small and partly enclosed by shrubs and trees, avoiding the visual accessibility from the streets. Inprivate spaces in Zwanenveld are open lawns along the street with high visual accessibility.

Physical movement
The criteria of physical movements:
- The consistence of the roads
- Obstacles on the movements

Results:
In Zwanenveld, the old green corridors in the middle of the site and the bike path along the canal provide good physical movement with less environmental obstacles and continuous paths. There are some inaccessible green areas without path through, showing no movements.

Less demanding environment
The criteria of less demanding environment:
- The sequence of demanding environment.

Results:
Based on the theory, the spaces with water demand less than the green areas and the canal is the least demanding space in the neighborhood.

Natural distraction
The criteria of natural distraction:
- Experience in the site.

Results:
Based on the site experience, the community park is the place with natural attractions. However, the area with excessively wild nature may result in the mental unsafety to the elderly. The abandoned spaces give unpleasant experience; thus, they are regarded as no attraction.

Activities
- Number of activities
- Number of populations doing activities.

Results:
This quality is assessed by the current facilities or spaces for activity use and the number of the residents doing activities. Based on site observation, old green corridor and the bike path along the road are the places with larger population number and the playgrounds are the space with different facilities. In the site, there are also green areas with no activity function.

As for qualities of **cognition and gardening**, the neighborhood has no gardening areas and has no educational function areas.

5.42 Conclusion

Healing qualities/ Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
A sense of belonging	**3.5**	**2.5**	**1.5**	**2**	**1**	**3**	**2**	**3**	**2.5**	**1.5**	**2.5**	**2**	**2**	**1.5**	**0.5**	**4**	**35**
Legibility	2.5	1.5	0	3.5	0	3.5	1.5	3	2	1	2	2.5	3	1	1	3.5	31.5
Accessibility	2.5	2	0.5	1	0.5	3	1.5	2	3.5	2	2.5	2	2	1.5	1.5	3	31
Complexity	5	1.5	1	3	1	3	1.5	2	3	1	2	2	2	1	1	2	32
Safety (physical)	**2.5**	**1.5**	**1.5**	**1.5**	**1**	**2.5**	**1.5**	**2.5**	**2.5**	**2.5**	**1**	**1.5**	**1.5**	**2**	**1**	**3**	**29.5**
Safety (mental)	2.5	2	1	2	1	3	1	2.5	2	2	2	2	2	2	1	3	31
Privacy	**2.5**	**1**	**1**	**1.5**	**1**	**2.5**	**0**	**3**	**1**	**3**	**2.5**	**3**	**2.5**	**1**	**0**	**2.5**	**28**
Comfortability	**4**	**2.5**	**1**	**4**	**1**	**4**	**2**	**2.5**	**1.5**	**1.5**	**1**	**2**	**2**	**1**	**0.5**	**3**	**33.5**
Coherence	**4.5**	**3.5**	**1**	**3**	**3**	**5**	**4**	**3**	**3**	**0**	**0**	**0**	**1**	**0**	**0**	**4**	**35**
Activities	**3**	**0**	**0**	**2**	**0**	**2**	**0**	**3**	**2**	**0**	**3**	**3**	**3**	**0**	**0**	**3**	**24**
Natural attraction	4	3	0	4	0	3	2	2	2	1	2	2	1	1	1	3	31
Less demanding environment	3	3	1	4	2	3	3	1	2	2	1	1	1	1.5	1.5	2.5	32.5
Physical movement	4	1	0	5	0	4	0	2.5	3	0	0	2	2.5	1	0	5	30
Total	**43.5**	**25**	**9.5**	**36.5**	**11.5**	**41.5**	**20**	**32**	**30**	**17.5**	**21.5**	**25**	**25.5**	**14.5**	**9**	**41.5**	

Figure 5.42 conclusion of scoring.

From the evaluation table (Figure 5.42), we can have a clear look into the healing qualities of each spaces. Overall, 'a sense of belonging', 'comfortability' and 'coherence' are the three highest healing qualities of green areas in neighborhood. The old structures, the greenery and water features, and the liner pattern contribute to the three qualities. Nevertheless, the whole area lacks 'physical safety',' privacy' and 'activities'. The lack of management of vegetation, the environmental obstacles and the unfriendliness of public areas decrease the scores of these qualities largely.

In Zwanenveld, according to the table, site 1, 16, 6 are the most healing spaces for the elderly, which are the Geologenstrook park and two old green corridors. Site 3, 5, 15 are the areas in shortage of healing qualities, which are two abandoned places and a simple green area along roads.

Figure 5.41 numbers of sites.

5.5 Conclusion and site selection

5.51Conclusion

In this chapter, studies on the case, Zwanenveld are carried on. Spatial environments, healing qualities of green areas and the behaviors of the elderly are analyzed and observed in the site. The characteristics of the areas where the elderly gather most partly give the answers of what facilitate the usage of outdoor environment for the elderly. Instead, when mapping the area, the spatial problems show the constraints to the usage of the seniors. The figure 5.51 shows the summary of the analysis.
Besides, a healing qualities analysis is conducted in the whole neighborhoods. My conclusion is that the qualities of 'a sense of belonging', 'comfortability' and 'coherence' contribute to the salutogenetic effects on the elderly while the qualities of 'physical safety', 'privacy' and 'activities' are lacking and should be promoted.

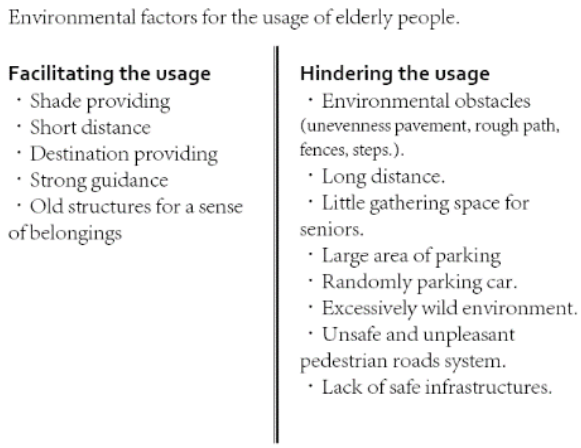


Figure 5.51 factors that facilitate or hinder the usage of the elderly.

5.52 Site selection

Based on the spatial analysis and healing analysis, a testing site are selected, showed in the map (Figure 5.52). The site is out of the service radius of community park and is one of the most unhealing space in the area.

Figure 5.52 factors that facilitate or hinder the usage of the elderly.

06 Design

In this chapter, two alternative models are made on the basis of theoretical framework and site analysis. According to the typologies defined before, two models are
Natural-based design model→ healing garden school for the elderly.
Activities-based design → horticulture school for the elderly.

After the delivery of design models, evaluations are conducted on three parts: the healing qualities evaluation, the engagement evaluation and the comparison of other aspects. By collecting the comments from colleagues, this chapter is intended to answer the sub-quation3 of the thesis:

3)What are the response to the alternative designs in the aspects of salutogenetic influences and engagement of the elderly?

6.1 The context of the site

The site selected is in the northeast corner of Zwanenveld. It is approximately 5.5 hectares and lies between the Canal maas-waalkanaal and residential buildings. Maas-waalkanaal is in the east of the site and a dijke with approximately 1.5 meters high is regarded as the eastern edge of the site. Besides, a railway is in the northern side of the site, generating a slope with big height difference of 9 meters (Figure 6.11).
Inner the site, green areas and the foundations of previous buildings remain. At the edges of site, there are partly surrounded by groups of trees and shrubs.

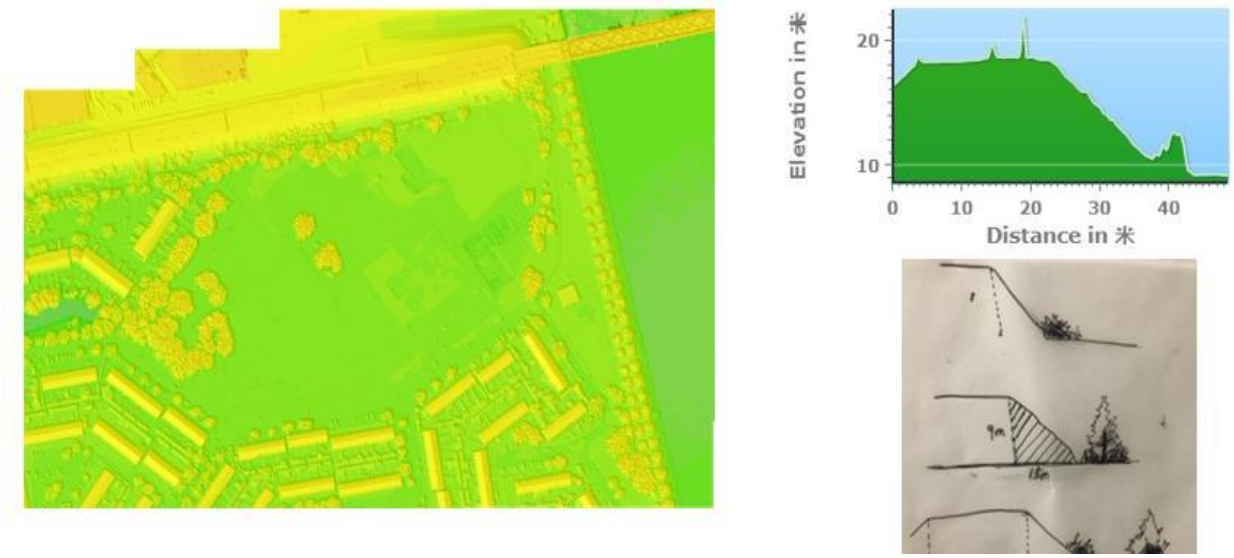


Figure 6.11 the height map of the site (arcgisonline, n.d.).

Figure 6.12 the current situation of the site.

Population movement

Surrounding the site, current road system is consisted of car roads, bike paths and pedestrian roads. Based on site observation, generally, the population movement in the main roads is larger than that in secondary roads. Furtherly, since the shopping mall is in the western side of the site, movements of population are larger from that side. Besides, there is also movement from outside of the neighborhood by the reginal biking path along the canal. Thus, based on the population movement, main entrance and secondary entrance are generated (figure 6.13) (figure 6.14) (figure 6.15).

Figure 6.13 Current road system

Figure 6.14 Population movement

Figure 6.15 Entrance

Less demanding environment.

Analyzing current green and blue areas, the residential blocks are the areas with high demanding according to the theory. Complex relationships between neighbors, families and friends make a high demanding environment for the elderly. Instead, canal is the least demanding areas with still water and pleasing scenery. Thus, the trends of movements based on the sequences are from the entrances to green areas and from green areas to the canal.

Figure 6.16 Current situation of the site.

Figure 6.17 Demanding sequence

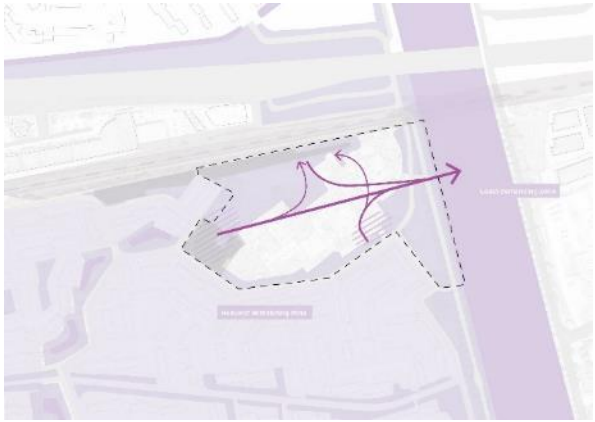


Figure 6.18 Trends of movement depends on less demanding environment theory.

Coherence.

Current surrounding green and blue areas show good coherences. Nevertheless, the site is an abandoned space without water features and consistent green, resulting in the incoherence of green and blue areas.

Figure 6.19 Current green and blue space

Figure 6.20 Current green coherence

Figure 6.21 Current blue coherence

Accessibility

Looking at the current roads system around the site, the main road bordered the site can partly hinder the accessibility of the elderly to the site due to the unsafety of traffic. Besides, the regional bike path along the canal and the bike path inside the site interfere the movements from the site to the canal.

Figure 6.22 Current road system

Figure 6.23 Current parking area

Figure 6.24 Obstacles for the accessibility

A sense of belonging

A physical sense of belongs refers to the familiarity of surrounding environment. Based on that, I compare the current situation with history map to see the differences between past and present situation. The tree groups in the north and the lawn in south of the site become smaller than before, which can be restored in the later design.

Privacy

Surrounding the site, residential blocks are the private areas while the roads around are the public zones. In the site, there are some potential private spaces surrounded by tree groups, providing good bases for creating small and enclosed spaces.

Figure 6.25 Historical and current vegetation.

Figure 6.26 Privacy analysis map.

6.2 Design models for the small site

Procedure of the design:

Initial design → evaluated →developed design models → evaluated.

6,21 Initial design models

Before the developed models, initial design models were created based on the theories and site studies. However, after the evaluation by my colleagues and supervisor, models were changed and adapted a lot to form later developed ones.

Depending on the schools of healing landscape, two models are generated. One is the salutogenic garden which is a natural-based model, and the other is community garden which is an activities-based model.

In the salutogenic garden, there are two different models for the elderly with different health status. For the elderly with well function, a long walking path are generated in the site for a long-distance movement. Along the roads, rest spots are arranged in difference space with different landscape features and elements, from trees to water and then to rocks and canal. The sequence of the elements is aimed to provide a less and less demanding environment for the elderly. For the venerable elderly, short walking roads are provided with rest spots in small spaces, which

located in the north of the site. A bird feeding zone in the northwest of the site is to stimulate the sensory experience of the elderly. Along the rivers, shelter boxes are provided for the bike path crossing of the elderly to the canal.
In the community garden model, traditional gardening zone and bed-raised gardening zone are created for different seniors with different capacities. In these two zones, small green blocks with trees are designed to provide rest spots with shade for seniors. Water detention pools are created to harvest water for the reuse. Besides the gardening zone, a center square for the community market are in the center of the site to provide a food trades and social interaction for the residents. And a picking garden with different height of trees and shrubs are provided a rewarding activity for the elderly with wheelchairs and the elderly with good autonomy.

Figure 6.211 initial design plane of salutogenic garden.

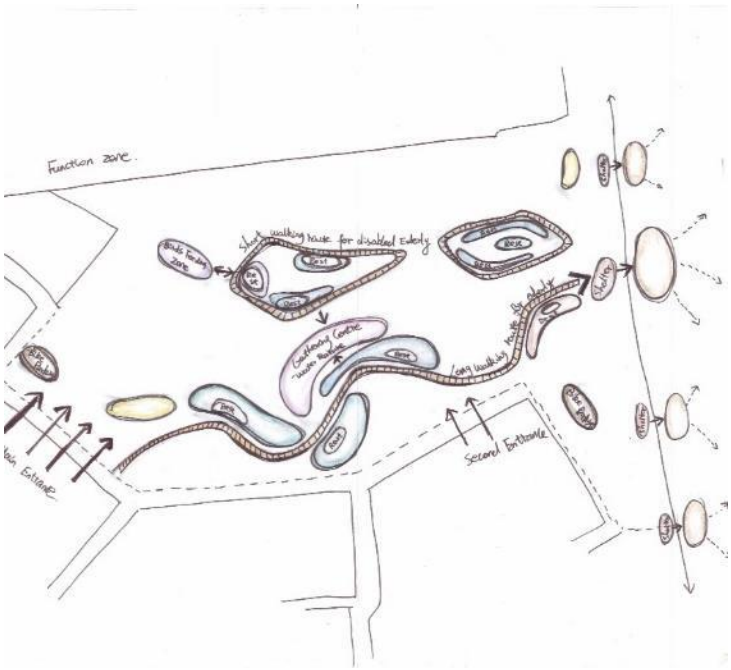


Figure 6.212 function map of initial design of salutogenic garden.

Figure 6.212 initial design plane of community garden.

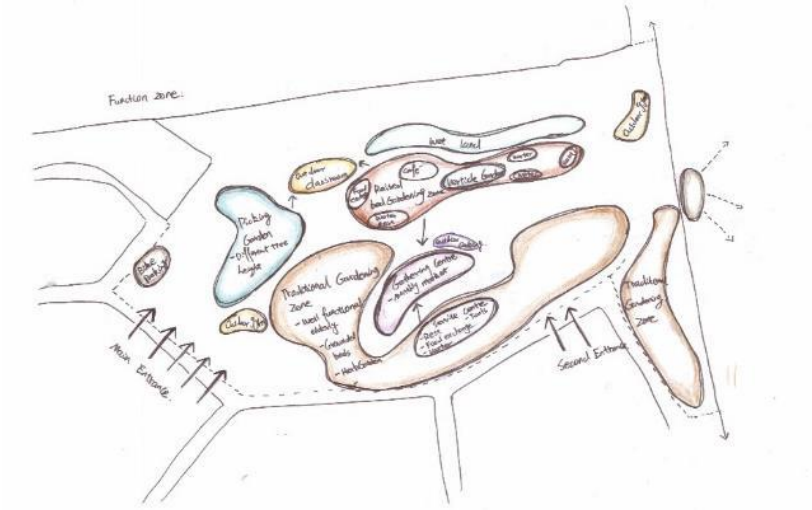


Figure 6.214 function map of initial design of community garden.

6.22 Reflection on initial design.

Reflected on the comments of my colleagues and supervisor, it is good that both of models create spaces for different elderly groups with different capacities. However, both models are kind of lacking clear structures. The rest spaces and function zones are too separated to some extent, hardly giving environmental impressions on the elderly.

Specifically, in salutogenic garden, besides designed for two different groups, the rest spots along the roads makes elderly can have a rest in a short distance. The shelter boxes along the bike path by the canal, provide safe waiting spaces for crossing. However, the landscape features may be not recognizable and felt by the elderly due to the sensory degradation. The distinctiveness of environmental phenomenon should be strengthened and enlarged, creating a whole of space different from their daily living environment. Additionally, the location of the spaces for seniors with disability is inappropriate. Due to the mobility impairments, it will be more convenient for

them if the caring area is close to the entrances. It is similar to the feeding zone, where there might attract pest and should be put away from residential buildings to reduce the influences. Moreover, the issues of current surrounding traffic and parking areas are not considered.
As for the community garden, the food trade is a good point for the residents to deal with surplus foods and stimulate social interactions. The monthly market might be a community event, strengthening the relationship bonds in neighborhood. Besides, water detention ponds add the quality of sustainability in the site. Nevertheless, it lacks a clear structure. The raided-beds zones for seniors with disability are not close to the entrances, causing the inconvenience for them. Furthermore, paths for bikes or cars should be considered for the transportation needs for gardening tools or harvested foods. Surrounding traffic zone and parking areas are better to be taken into accounts as well.

6.23 Developed design models

Natural-based design model→ healing garden school for the elderly.
Concept: Salutogenetic circles
Nature and the garden have the capacity to balance the demands from outside, which includes social relationship but also physical environment. A salutogenetic green space should offer demands for people to attract them, but since the vulnerable group need a less heavy demanding environment as well as relationship, the environment model should provide a main environment that is less demanding, with a small portion which is more demanding for well-functional people. Zoom into the site, on one side is the private blocks where lots of people gather with complex relation and on the other side is the still less demanding canal.
The concept of the salutogenetic garden is to bring the elderly from the heaving demanding environment to least demanding cannel, experiencing the demanding less circles in a basic order, reliving their negative mood step by step, and getting completely released and restored. The composition of the demanding less circles are forest circle, the water circle, the rock circle and animal circle, derived from the less demanding environment theory.
Besides, as reported data of the health status of the seniors, the number of well-functioned elderly and the elderly with disabled are almost the same. Space for both two different group is required. Considering mobility impaired elderly, the caring circles are created which includes all the landscape elements from less demanding environment theory, aimed to provide varieties in a space to attract seniors.

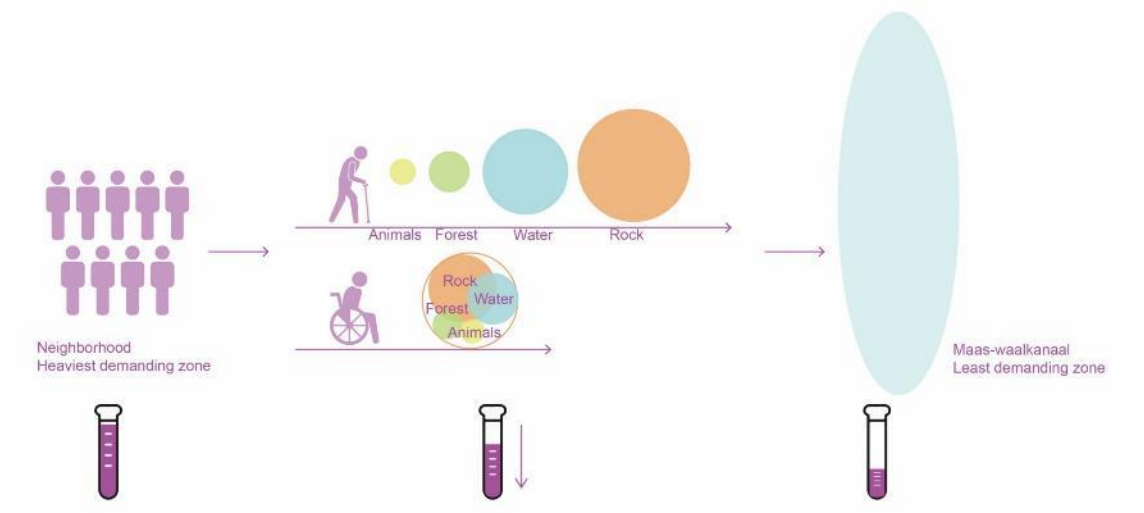


Figure 6.231 concept of Salutogenetic circles

Principles

The design of salutogenetic circle is mainly based on less demanding environment but also combining other healing qualities.

The design of salutogenetic garden.

As was mentioned before, the design is for two different elderly groups depends on their capacities. A long-distance main walking road is created for the well-functioned elderly, guiding them through different circles, and two small caring circles are created for the elderly with disability. Along the main road, sculptures are situated on each entrance of the circles, as landmarks for the wayfinding. The big distinctness of each circle also helps elderly people distinguish the spaces easily and quickly. To guarantee the safety of the space, the bike path crossing the area is separated from the main walking road. The street profile of the boundary of the site are also redesigned, separating the pedestrian path and auto path and turning the parking areas along roads into green areas.


Forest circle
Plateform along rail-way
Water circle
Rock circle
Caring circle
Caring circle
Plateform
Animals circle
Shleter along bike path
0
10
20
30
40
50m

Figure 6.232 function map of Salutogenetic circles

Figure 6.233 traffic map of Salutogenetic circles

Figure 6.234 environmental cues.

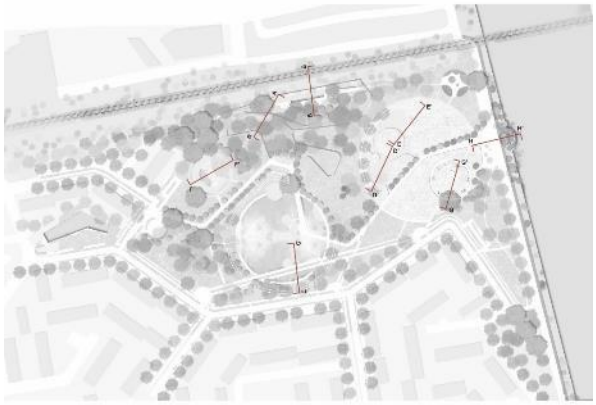


Figure 6.235 section line.

Forest circle

The forest circle is located where the remaining old tree groups stand and is enlarged to provide a sense of belonging for the elderly. To provide different scenes for the elderly, the heights of parts of wooden trails are different but in the requirements of design for disabled people, which means the elderly with wheelchairs and crutches can also use, having different height views.

On the north side of the site, lies a slope due to the railway station. Making use of the height, falling water features, a vertical green wall and soft natural slope are created to stimulate the senses of the elderly.

Figure 6.236: sectionAA'.

Figure 6.237: sectionBB'.

Water circle

The water circle aims to create different relationship between water space and the elderly, stimulating different sensory of the elderly. There are resting areas not only along the water circle and in the middle of the water, but also the areas to watch the water fountain, touch the water and sit by the water due to small height difference. The walking path surround the circle goes down 1 meter on one side to create different experience and the bike path is elevated 1 meter above the ground to make sure the passing of seniors. Rails are created as safe infrastructure on the area in the middle of the water.

Figure 6.238: sectionCC'.

Rock circle

The rock circle is the largest circle in the area. Rock, combined with greenery and flowering, gives a less demanding but vibrant environment for seniors. In the rock circle, small topographies are created to give a feeling of surrounding and embracing to the elderly. There are different sizes of space for the demanding of different groups, providing privacy for them. Trees are planted to offer shade for the elderly, simultaneously. Besides, on current situation, there are rocks along the canal which can be reused into the rock circle.

Figure 6.239: sectionDD'.

Figure 6.240: sectionEE'.

Care circle

The care circles are special for the elderly with disability. The two care circles lie close to the main entrance and secondary entrance, due to the mobility impairments of the special group. Inside care circles are the combination of the less demanding elements from the theory. The main attention is to have rich variety in small space to attract the attention of seniors. The road is 3 meters wide which can be passed by two elderly with wheelchairs. Besides, handrails are designed surround all the circle of the space to contribute to the walk exercise to them, guaranteeing the safety of them as well.

Figure 6.241: sectionFF'.

Figure 6.242: sectionGG'.

Animal circle

The animal circle is located close to the river to decrease the negative influence to neighborhood such as insect pest and Mosquitoes. In the animal circle, there grow flowering plants to attract butterflies and bees. Feeding boxes are built for the elderly to feed birds. The boxes are 1.5 meters high to avoid the action of bending for seniors

Interface with cannel

For the relationship with canal, a gentle slope with 8% degree are created with the grade elimination of current slop. Along the cannel, a wooden wandering path and several platforms are created. Facing the main walking path is the main hydrophilic platform which concentrates the all the elements of less demanding environment as well. Trees and shrubs are planted, rock sculptures are created, and water are close enough to experience. Besides, seniors can buy drinks and snacks from the café built on the platform.

Since a regional bike path break the connection from site to cannel, on the other side of cannel, considering the mobility impairments, several shelters are created for seniors waiting to cross. In the shelter, seniors can sit down to rest and get healthy drinks from the vending machine.

Figure 6.243: sectionHH'.

Perspective.

Caring circle.

Water circle.

Activities-based design → horticulture school for the elderly.

Concept: Community gardening forest.

Reflecting on the initial design, the new gardening design pays more attention on the structure and legibility of the site. Based on the theories of horticulture school for the elderly, the restorative feelings are derived from the self-rewarding, cognition improvement and physical benefits. The main concept of the gardening model is to provide rewarding activities, educational activities, physical activities and social activities for the elderly.

Gardening is the main activity in the area. Depending on the capacities of different groups, there is a traditional gardening zone for well-function seniors and a caring gardening zone for the seniors with disability. Besides, a green belt is created from the main entrance to the canal, which afford the requirements of cognition, food trads & exchange, outdoor activities and water harvest functions of the space.

Figure 6.244: concept of community forest.

The principles

Overall, the activities-based model is mainly based on the different qualities from nature-based model, but also combines the common healing qualities from chapter 3.

The design of activities-based model.

In the gardening-based model, caring gardening zone and traditional gardening zone are the main activities in the site. Besides, a green belt is created in the middle of the site from the main entrance to the cannel, which provides outdoor classroom, monthly market square, exercise square, outdoor gym area, fishing spot and wandering trials. When people are tired of gardening

work, it is a good option to go into the green and have a rest. In the site, due to the need of transport tools and the harvest, bike path is allowed in the area but has a clear separation of the pedestrian path. Rows of trees on both side of main road function as guidance for the elderly crossing the area by bike while linear water detention ponds in the green belt are another environmental cues for the elderly on foot.

Traditional gardening zone
Caring gardening zone
Picking garden
Plateform
Monthly market square
Water detention ponds
Exercise Square
Tool house
Outdoor classroom
0
10
20
30
40
50m

Figure 6.245: function map of community gardening forest.

Figure 6.246: traffic map of community gardening forest.

Figure 6.247: environmental cues.

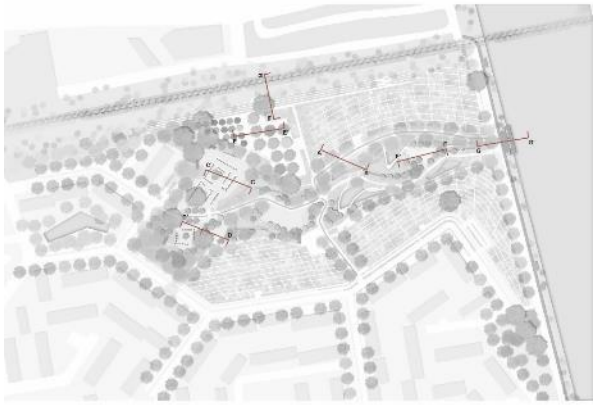


Figure 6.248: section line

Traditional gardening zone

Traditional gardening zones occupy the biggest area in the site, where vegetables and fruits grow in the grounded beds. By the study of Bouman (2012), five types of urban agriculture are introduced: Do - it - Yourself farm, experience and public farm, city park, the farm and care farm. Based on characteristic of five different urban agriculture, Do - it – Yourself gardening is selected for the traditional gardening zones on account of a sense of control and the engagement stimulation it brings. Besides the traditional zones are the service centers where there provide gardening tools, water resources and exchanged foods & seeds. As for the slope on the northern side, terraced gardening fields are created for the well-functioned elderly.

Figure 6.249: section AA'

Figure 6.250: section BB'

Caring gardening zone

The caring gardening zone is located close to the main entrance of the site, offering convenience to the elderly with mobility problem. In the caring gardening zone, it gathers the tool house, watering pool, goods exchange boxes in one space, to meet the demands of the elderly. Simultaneously, the gardening beds and water pools are all designed raised with the height of 90 centimeters for the accessibility of wheelchairs. For the aspects of sustainability, the sources of the water are parts from the rain water of detention ponds. Moreover, the small green blocks in the caring zone provide shade and resting spaces for seniors.

Figure 6.251: section CC'

Figure 6.252: section DD'

Activities in the area

In the site, besides gardening, seniors can pick fruits in picking garden, doing group exercise on exercise square, doing outdoor gym on the equipment zone, learning knowledge in the outdoor classroom, selling or exchanging food on the market square, doing cooking under the tree and doing fishing along the cannel. Most activities are included in the green belt, except the gardening zone and the picking garden. In picking garden, two different height of trees are planted depends on the capacity of different group. The under-tree spaces are also a good space for the social interactions. The exercise square is located in the greenery with water pool surrounded, which makes seniors doing exercise in natural environment.

Similar with the salutogenetic circle model, for the relationship with canal, a gentle slope with 8% grade, a wooden wandering path and platforms along the river, and shelters along bike path are created. However, there are benches providing for fishing.

Picking garden

Figure 6.253: section EE'

Exercise square

Figure 6.254: section FF'

Fishing

Figure 6.255: section GG'

Perspective

Caring gardening zone.

Exercise square.

6.3 Evaluation of design models

According to the theoretical framework in chapter 3, the evaluation of the design models is consisted of three parts, the healing qualities evaluation, the engagement evaluation and comparation of other aspects. Therefore, the criteria of healing qualities evaluation and engagement evaluation are derived from the theories of the healing landscape for the elderly and the theories of engagement of landscape.

Healing qualities evaluation

Looking back to the principles of the models, they both take the common healing qualities into account. Thus, in the result of evaluation, there is a large overlapping part of the qualities. The differences exist in the different healing qualities and in the quality of the healing features.

Overall, healing garden model includes less quantities of healing qualities but provides a better experience of the landscape. Healing gardens benefit the elderly's health through the passive experience of the elderly, thus why the model pays more attention to the perception of the people of landscape. A physical sense of belonging, accessibility, complexity, mental safety and comfortability are present better compared with activities-based model because of the restoration of the old structures, the different experience of sensory, the abundant greenery and water, the separation of road system and the shade by mature trees.

Instead, the gardening model includes more special qualities such as cognition and gardening activities, which at the same time increases the social interaction, contributing to a sense of belonging in a mental aspect. Moreover, if you create the activities, at the same time the physical movement and exercise will be included. The green belt structure in the site provide the coherence and natural distraction as well. My conclusion is that the gardening model meets more quantities of healing qualities, which meets more demands of the elderly in the aspects of healing.

Healing qualities	model 1	model 2
Commonalities		
A physical sense of belonging	😁 ✓	😐 –
A mental sense of belonging	😐 –	😁 ✓
Legibility	😁 ✓	😁 ✓
Accessibility	😁 ✓	😐 –
Complexity	😁 ✓	😐 –
Physical safety	😁 ✓	😁 ✓
Mental safety	😁 ✓	😐 –
Privacy	😐 –	😁 ✓
Comfortability	😁 ✓	😐 –
Differences		
Coherence	😟 –	😁 ✓
Physical movement & exercise	😁 ✓	😟 –
Less demanding environment	😁 ✓	😟 –
Natural distraction	😁 ✓	😟 –
Activities	😟 –	😁 ✓
Cognition	🙃 ×	😁 ✓
Gardening	🙃 ×	😁 ✓

Notes: 😁 ✔, the quality is good; 😐 —, the quality exists but not good comparatively;🙃×, the quality is missing.

Figure 6.31, summaries of the evaluation by colleagues.

Engagement comparison

In the theory of engagement of landscape, function, meaning and attraction are pointed out as the factors.

Function refers to the possibilities of the actions in the environment. In the two design models, it can be clear seen that the community gardening forest provides more functions than the salutogenetic circle. By the place making, it forms an environment in which equipment provides opportunities to stimulate the physical, social, cognitive and rewarding activities such as outdoor gym, community market, outdoor classroom and gardening. Instead, the salutogenetic garden functions as a natural area where rest and wandering are the main actions of the elderly.

Moreover, the community gardening forest model gives more meaning to the elderly through the social bond it promotes. The activities in the community gardening forest model stimulate the social interactions such as the group exercises and conversations around gardening. Simultaneously, gardening is indeed a meaningful and enjoyable work for the elderly (Relf, 1992;

Simson & Straus, 1998). By managing the small plots by themselves, elderly people will be attached closer to the space.

As an additional property of the affordance of landscape, attraction refers to the uniqueness of the desirableness for seniors. In the spatial analysis, a community park which has abundant greenery and water features are already existing. The report of the neighborhood from Nijmegen municipality also shows a lack of social interactions between population groups in Zwanenveld. Based on the current situation, activities-based model is more desirable than nature-based model to the elderly in the neighborhood.

As the different intentions in the design, one is to provide a natural and less demanding environment and the other is to offer different activities opportunities for the elderly. The salutogenetic garden model are more desirable for the elderly group who have complex relationship with his family and friends, or the elderly who suffer from trauma like grief and psychological problems. As the activities-based model are more suitable for the lonely seniors and seniors with disability, making them get involved in community events and feel rewarded and functioned again.

Other aspects comparison

Moreover, there are some issues from other aspects that cannot be ignored. In the activities-based model, the management of gardening zones are much harder than the salutogenic garden. Although it is Do-It-Yourself gardening, basic management and organization of the whole site still need, which will cost money and cause new management issues. Besides, the seasonal views should be considered as well. After the harvest of seasonal foods, what will show in the gardening zones? Small green blocks with evergreen plants can be added in gardening zones, contributing to a more vibrant view. For the salutogenetic garden, the iconic shape of the circles might become a new identity of the site, promoting residents' attachment of the site.

6.4 Conclusion of design

According to the theoretical framework in chapter 3, two design modes are generated, the salutogenetic circles and the community gardening forest.

To evaluate models more comprehensively, I distributed the evaluation forms to my colleagues and asked for the comments. Although there are only 7 colleagues responding, the results show a lot of commonalities. When they imagined themselves as seniors, nearly all of them are more in favor of the community gardening forest model, except two. According to their response, the main reasons are the special and interesting activities and the natural green belt in the model, making them feel more encouraged to go outside and feel relaxing. Instead, the natural-based model, especially the forest circles, would make them feel partly unsafe when visit in the night, in particular. However, the other two people who prefer the salutogenetic circles, claimed that the wholeness of the spaces might stimulate their different experiences and the iconic shapes of site might become a new identity of the spaces. More detailed results are showed in the chapter 6.3.

07 EVALUATION

7.1 Discussion

Reflection on theory

The theoretical framework of the thesis is mainly consisted of three parts: the theory of healing landscape, theory of age-friendly design and theory of engagement. The theories of healing landscape are divided into two categories: the healing garden school and horticultural therapy school while the theories of age-friendly design are derived from the nursing home, gardens for the frail elderly, outdoor environments for the elderly with dementia and outdoor environments for the elderly with disability. I think my theoretical framework has a good comprehensive review of the related theories. The theories of healing landscape are from the perspective of both environmental psychology and landscape architecture. They cover two main different schools of the healing landscape, which are the foundation of the definition of typologies in the later design. The theory of age-friendly design summarizes the features of places where seniors gather most and the places dealing with common diseases among the elderly. As for the engagement of the elderly, I use the theory of the affordance of landscape which illustrates the relationship between peoples' action and environmental features.

I combined the three parts of theories together and summarized the differences and commonalties between the theory of healing garden for the elderly and the theory of horticulture for the elderly.

I think in the theory part, the characteristic of the elderly people can be discussed more. What are the important qualities or and what are dispensable qualities for the elderly due to the features of them? After filtering and shortening qualities, this might make the later design have more focuses.

Reflection on case

Zwanenveld is a dutch neighborhood in Nijmegen. It was built during the year from 1970 to 1980, which is old and need a transformation. The elderly population in neighborhood now is the third largest group and is potential to become the largest group in 20 years later. Based on the spatial analysis and photo study, we can see there are lots of environmental obstacles and a serious need of space for the gathering of seniors. The connections through the neighborhood also require improvement, especially on the walking path for seniors. Based on the spatial problems, spatial models are made, evaluated and developed. Additionally, the qualities of a sense of belonging, comfortability and coherence are the three highest healing qualities of green areas in neighborhood because of the old structures, the greenery and water features, and the liner patterns of green spaces. Nevertheless, physical safety, privacy and activities should be promoted due to the lack of management of vegetation, the environmental obstacles and the unfriendliness of public areas.

I did lots of analysis to the neighborhood from the spatial and healing aspects. However, only the site observation acquires direct data from the elderly. The analysis part is mainly based on experience by myself. To understand the group more deeply, it would be better to add methods like questionnaire and interviews. Besides, reflected on the results of scoring of the healing

qualities, scores are generally low. The reason might be the low healing qualities of the green areas but also might be affected by the subjective critiques, since it is a self-scoring process. Standards are made to try to decrease the influence of subjectivity and increase the scientificalness.

Reflection on evaluation process

The evaluation of the testing models is consisted of three parts: the healing qualities comparison, the engagement comparison and the other aspects of comparation. It is based on the theoretical framework above. The evaluation results show the community gardening forest model is better than the salutogenetic circles model. Thus, the characteristics of the activities-based model is of significant to provide a both salutogenetic and activating environment for the elderly.

Reflected on the evaluation process, the evaluation groups and the numbers of responders make the limitation of the results. The evaluation groups are the colleagues who are asked to imagine as seniors. However, the different backgrounds and age gaps between my colleagues and the elderly residents in site would make the differences of the results. Besides, the number of the responders is another factor of the limitations, although the results shows the similarities on comments.

7.2 Recommendations

The relationship with other age groups.

Humans are social creatures, which means the interactions and cooperation between different groups. Elderly people are one of the age group on the social family. Thus, further studies on the relationship between different age groups are essential to influence their behaviors and actions. For example, by designing a space both afford the functions for the elderly and kids, vitality will be added in the space, increasing the attraction to seniors.

The possibilities of combination.

This thesis studies two different model. One is the natural-based model and another one is the activities-based model. Based on the evaluation, we can find that each model has its different benefits. The natural based model provides a good experience for the elderly while the activities-based model encourages the participation of the elderly. In the following research, it is meaningful to explore the ways that combine the strengths of both models.

7.3 Conclusions

This thesis is aimed to expand the knowledge on healing landscape, by exploring a salutogenetic and activating living environment for the elderly people. It stresses the salutogenetic effects of the living environment and integrates the perspective of affordance into design. With the global aging trend and the concerns on health issues, this thesis also shows a way to deal with in a landscape approach. Besides, it increases the awareness of designers to integrate the salutogenetic aspect in future design.

To achieve this, a theoretical framework is created by literature reviews and Zwanenveld, as a research case, is used to analyze and test the findings. The results of research are given below.

SRQ1: What qualitive elements of green space and blue space provide a salutogenetic effect and encourage the engagement of elderly people theoretically?

By combining the theories of healing landscape, of age-friendly design and of the engagement of people, the qualitative elements are a sense of belonging, legibility, accessibility, complexity, safety&privacy, comfortability, coherence, physical movement & exercise, less demanding environment, natural distraction, activities, cognition and gardening. Based on the different healing schools of healing landscape, these qualitative elements can be concluded into two groups, the healing garden school for the elderly and the horticultural therapy for the elderly. The commonalities and differences of these two groups are shown below (Figure 3.42).

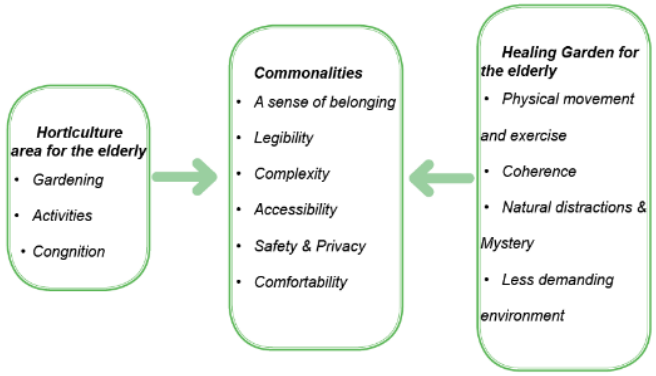


Figure 3.42: the commonalities and differences of theories between the healing garden for seniors and the horticulture for seniors.

SRQ2: What characteristics of green space and blue space facilitate or complicate the usage of elderly people?

Based on this question, Zwanenveld as a case are studied and researched by mapping, photo study, site observation and scoring. By observing the preferable spaces of the elderly in neighborhood, the characteristics of spaces give the answer to the factors facilitating the usage of the elderly. The spatial analysis by mapping and photo study shows the constraints of the outdoor environment for the elderly. The figure 5.51 shows the summary of the analysis. Besides the testing of theories, to solve the basic spatial problems of the site, spatial models are generated, evaluated and combined to form a developed one.

Besides, the scoring results of the healing qualities analysis indicate that a sense of belonging, comfortability and coherence contribute to the salutogenetic effects on the elderly while physical safety, privacy and activities are lacking in the site.

Environmental factors for the usage of elderly people.

Facilitating the usage	Hindering the usage
· Shade providing · Short distance · Destination providing · Strong guidance · Old structures for a sense of belongings	· Environmental obstacles (unevenness pavement, rough path, fences, steps.). · Long distance. · Little gathering space for seniors. · Large area of parking · Randomly parking car. · Excessively wild environment. · Unsafe and unpleasant pedestrian roads system. · Lack of safe infrastructures.

Figure 5.51 factors that facilitate or hinder the usage of the elderly.

SRQ3: What are the response to the alternative designs in the aspects of salutogenetic influences and engagement?

Based on the spatial model and healing qualities analysis, a site in a smaller scale is selected to do the testing of the research. Following the different schools of healing landscape for the elderly, two design models are generated: salutogenetic circles (nature-based model) and community gardening forest (activities-based model).

According to the response from colleagues (chapter 6.3 and 6.4), the community gardening forest model is more in favor of due to the various interesting activities and the natural green belt it offered. It meets more demands of the elderly in the healing aspect and encourages the engagement and participation of the elderly. Instead, the salutogenetic circles model has fewer healing qualities but provide a better experience of landscape. The iconic shape of this model might help to create the identity of the space, strengthening the attachment and sense of belongings of the site. Safety and privacy might be two concerns in the site because of the dense vegetation and lack of small spaces. Additionally, management and season views are two other issues that should be taken into accounts.

MRQ: What characteristics of green space and blue space can both provide a salutogenetic effect and stimulate the engagement of elderly people?

To sum up, with evaluation and comparison, the community gardening forest (actives-based model) are a better example to both provide a salutogenetic effect and stimulate the engagement of elderly people. That is, the characteristics of a sense of belonging, legibility, accessibility, complexity, safety&privacy, comfortability, activities, cognition and gardening are of significant for a salutogenetic and activating environment for the elderly.

DQ: How could we create a salutogenetic and activating space for elderly people in their living environment to promote their health and stimulate the participation?

Firstly, it is important to identify the target group of users in the space. What is the health status of the elderly residents? Is the space mainly for the well functioned elderly or the elderly with disability? To be clear of the target group is important to identify the potential users of the space.

In this case, the well-functioned elderly and the elderly with illness is nearly the same. Thus, in the design of the site, we should consider the space for the use of both groups equally important. Some special caring facilities like handrails should be considered to be built in the site to meet the demands of the seniors who are ill.

Secondly, figure out the problems of current green and blue areas in both healing and spatial aspects. Salutogenetic effects on people not only concentrate on the isolated green islands, the green connections from homes to the spot or from one spot to another are essential as well. Thus, it is important to do the spatial analysis of the site to analyze the main movement of the elderly residents and provide a safe and pleasant walking path for them.

Thirdly, design from the large scale into the small scale. As landscape architects, we should have a systematic way of thinking, linked small scale with large scale.

Finally, design a model imbued with common qualities from the theories of healing landscape for the elderly, but stressing and enlarging the quality of activities, as a facilitating factor of usage. A sense of belonging, legibility, accessibility, complexity, safety&privacy and comfortability are the basic requirement of a salutogenetic environment. To promote the health of elderly and stimulate their participation, activities, cognition and gardening are of significant to be emphasized in the design.

Moreover, other issues such as the management and seasonal view are also should be taken into consideration.

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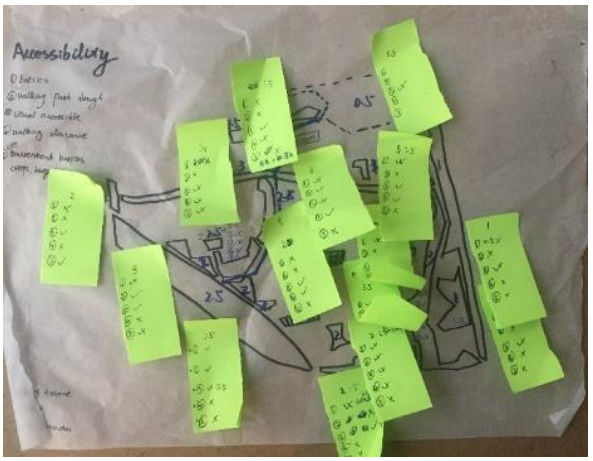
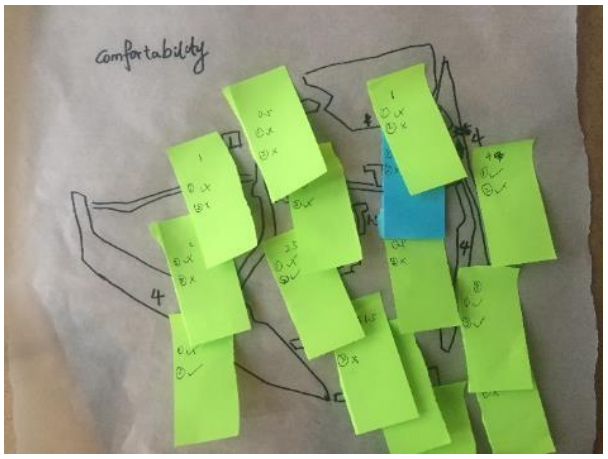
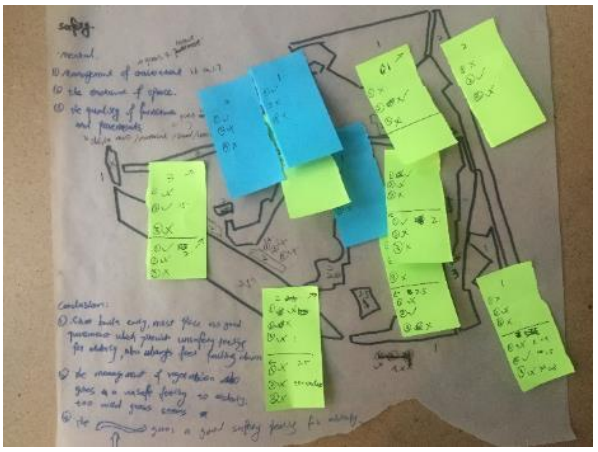
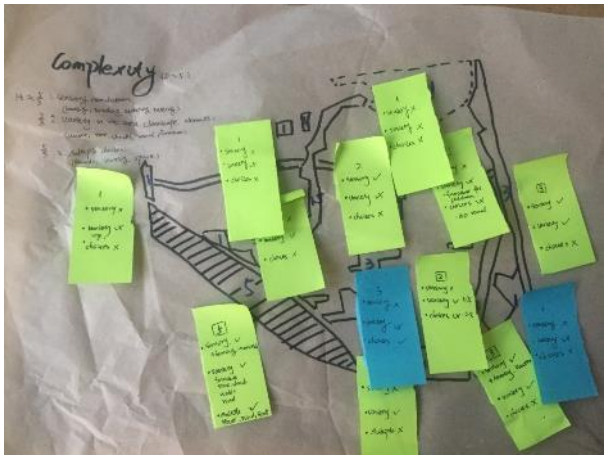
Appendix

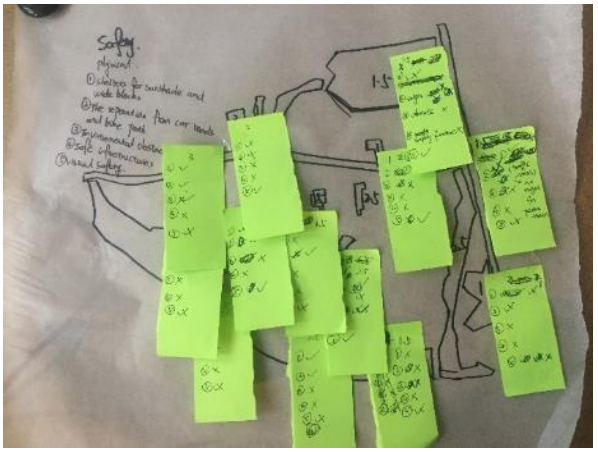
The results of scoring

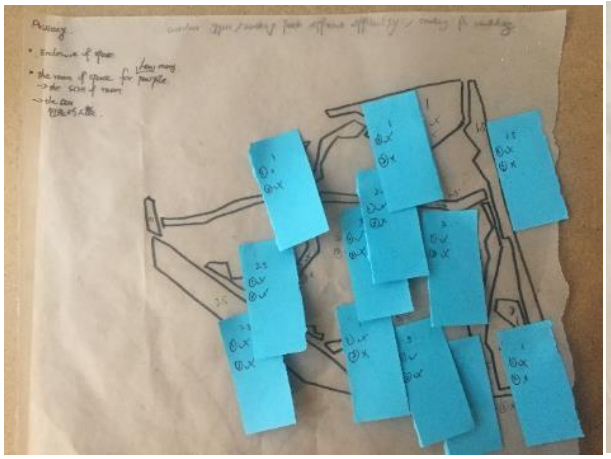


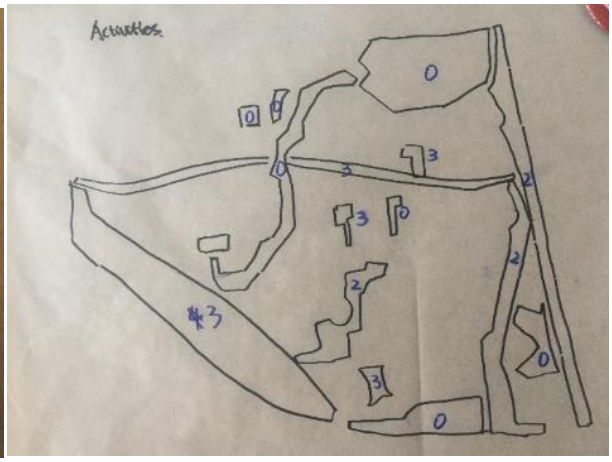


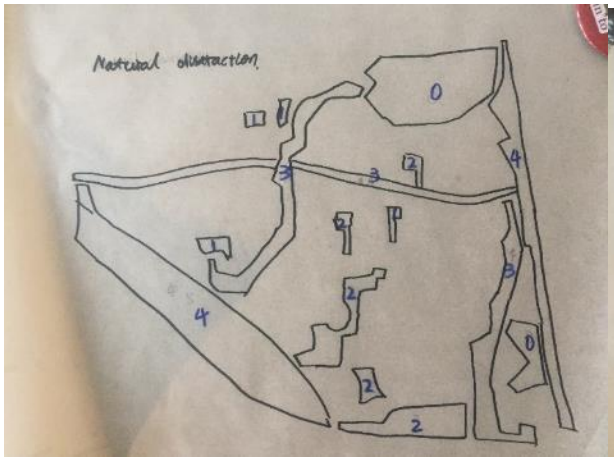


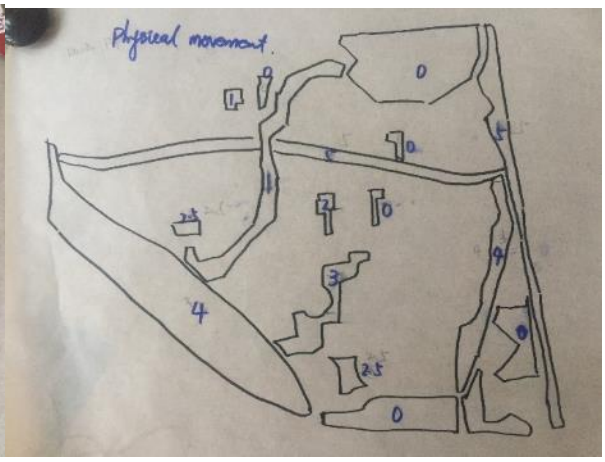




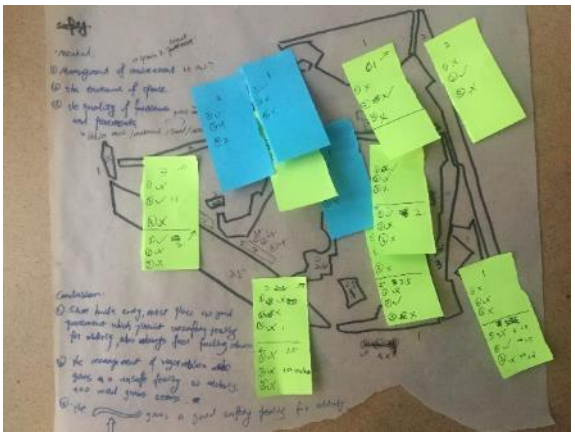


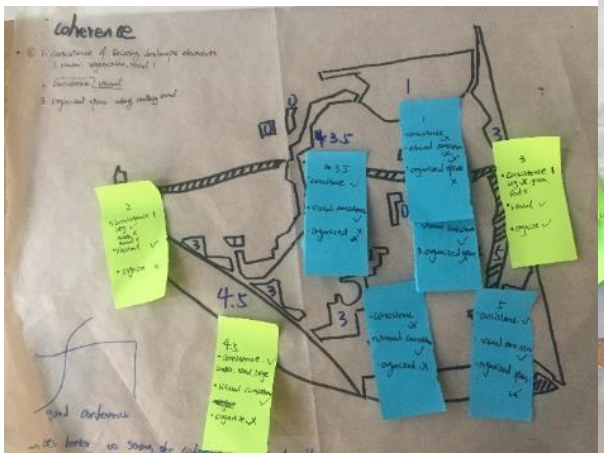

Activities

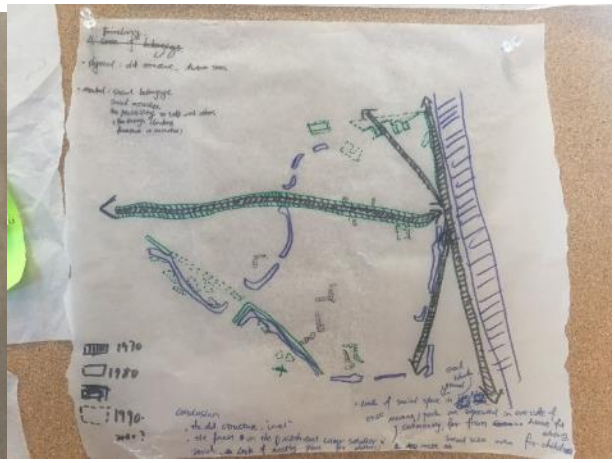

Material distraction

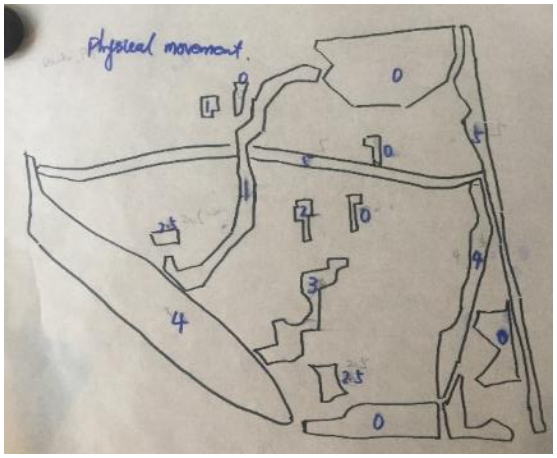

Physical movement


Less Demanding Environment




coherence




Physical movement.
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