The cognitive dissonance
of
the value of nature
in
urban planning

A mixed methods study exploring the usage, functionality and planning of urban green spaces in the city of Breda, the Netherlands.

Colophon

The value of green spaces for healthy cities

With rapid urbanisation, the urgency to treat unhealthy cities is growing. This primarily quantitative study sheds a light on how the characteristics of urban parks influences the visiting behaviour of individuals. Starting from the general assumption that contact with nature provides health benefits, this study promotes a more adequate valuation of urban nature in planning practise. The results of this study can contribute to more efficient planning of urban parks, and thereby contribute to increasing the amount of contact urban dwellers have with nature.

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Cities are among the brightest stars in the constellation of human achievement. At the same time, ecological footprint analysis shows that they act as entropic black holes, sweeping up the output of whole regions of the ecosphere vastly larger than themselves.

Rees and Wackernagel (1996, p. 245)

Preface

Dear reader,

In front of you lies a Spatial Planning master thesis focused on green spaces in urban context and their functionality for human habitats. Although exploring the health of natural ecosystems might be the empirical motivation for this study, with this study I want to make a broader contribution in exploring the relationship between cities and nature.

On the one hand, my choice for this subject can be explained by my affinity with engineering and my relatively 'biophilic' childhood. As a child of two biologists, my childhood was filled with being around and taking care of pets, visits to natural areas, kayaking and traveling to natural reserves and cities across the world. This context may explain why the visualisations of Richard Register eco-cities and the book on Biophilic Cities by Timothy Beatley inspired me to write my thesis on a topic related to nature in cities.

On the other hand, the choice of this subject is not solely due to my personal background. Part of my interest in this subject relates to the health of our planet. I don't think I need to emphasize the urgency in treating the critical situation of our planet's ecosystems, acting upon this should be of major importance for those governing and planning cities. Although (solving) this problem as a whole might exceed the urban scale, rapid urbanisation puts a focus on creating human habitats that are among others healthy and sustainable. I am not stating that cities are inherently unhealthy, but that with the increased salience of cities, we should focus on making these places as optimal as possible for human life. More importantly, we as society should take immediate steps in creating cities (including its flows of resources) that are in balance with the natural ecosystem.

In this thesis, I argue for the importance of nature and natural processes for the existence of humans. With the knowledge of the importance of nature for humans, you will find that justifying the place of nature in cities creates a cognitive dissonance, the act itself becoming inherently contradictory. The question of nature within cities should not be focused on 'why' but 'how'.

Last but not least, I would like to thank Marieke Maas, Gwen Bun and Ricardo Snijder for helping me with distributing the survey. With the large sample size, I had put myself up for a challenge, thanks to your help I was able to actually finish the survey gathering in time. Special thanks to Sara Macdonald and Wim van den Berg for supervising me in writing this thesis, the long meetings we had were of importance in guiding and structuring my thesis.

Ruben van Huijgevoort
June 18, 2019

Summary

The urban population is rapidly increasing all over the world, which puts more stress upon the current built up environment. The health of the urban population is becoming an increasingly important subject, especially in preparing cities for the future. The subject of biophilia explains the affiliation humans have with other living organisms, in other words the inherent relation between humanity and nature. A large body of research has shown that spending time in nature and urban parks increases the health of individuals. This study focuses on functionality of urban green spaces in providing contact with nature, specifically by looking into the usage of parks and their functionality according to municipal officials and policy documents.

This study utilises a mixed methods approach. To start out with, a broad literature review was conducted. This begins at the broader debate on nature and the city, followed by a look into the concepts of green infrastructure and ecosystem services and finally discusses the relation between nature and human health. The theory of this study shows the intrinsic value of nature for human health and the functionality of green infrastructure in providing ecosystem services to cities. In order to operationalise data gathering, the neighbourhood of Boeimeer in Breda and the Sonsbeeckpark and Zaartpark were opted as case for this study. Boeimeer inherits a large amount of green spaces, but also is located in close proximity to the city centre. To gather empirical data, a relatively large (online) survey was conducted in the neighbourhood. Respondents answered questions about their usage (i.e. duration & frequency of use and activity & intent) of both parks and were asked how they perceived the accessibility and safety of the parks. As final variable, the walking distance of each respondent to the park was measured. To further enrichen the survey data, semi-structured (expert) interviews were conducted with the community board, a citizen's initiative maintaining the park and two municipal officials. These interviews were specifically focused on green space planning, policy and maintenance. Policy documents were analysed to supplement the qualitative data gathered from the interviews and the survey.

The empirical data of this study has shown that the parks in Boeimeer are of intrinsic value to the neighbourhood and the city as a whole. This study found a clear significant relation between the perceived accessibility of respondents and their frequency of visits. Perceived accessibility was found to be of lower influence on visitation of parks than that of the actual walking distance between park and respondent. This shows that the abundance of green spaces is of importance for citizens to gain health benefits from them. Furthermore, this study has shown that reasons for visiting and the activities undertaken in the parks are of influence on the duration of visits, whereas the perceived accessibility and distance are of more importance for explaining the frequency of visits. Additional to the quantitative data, the interviews and policy document analysis showed that the municipality of Breda wants to become the 'first city in a park', but that to some extent there is a lack in practical steps regarding achieving this goal. On a positive note, policy documents suggested that first steps towards adequate green space valuation are taken and the interviews suggested that the new *Environmental Planning Act* induces more strategic green space planning for health.

In essence, this thesis shows that urban green spaces are of intrinsic value for the liveability of cities. When taking into account their functionality in providing ecosystems services it becomes clear why green spaces deserve more adequate valuation and an overall more prominent place within planning practise. The main question of planning research and practise should therefore not be focused around 'why' but 'how'. How do we balance cities with nature? Profound analysis of the functionality of green spaces and the services they provide can offer a strong foundation for strategic green space planning. Utilising the full potential of the characteristics of green infrastructure can offer a valuable approach for preparing our cities for challenges in climate change, sustainability, mobility, urbanisation, liveability and health.

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Introduction

“For more than 99 percent of human history people have lived in hunter-gatherer bands totally and intimately involved with other organisms ... the brain evolved in a biocentric world, not a machine-regulated world.” (Kellert & Wilson, 1995, p. 32). This quote shows that humans have an inherent relation with nature. However, ongoing urbanisation induces a perspective of humans as a dominantly urban creature, when in reality, humanity heavily depends upon nature for its survival.

According to the United Nations (UN) (2018), 68 percent of the world’s population will be living in cities by the year 2050. In other words, the urban population will double by 2050 (World Health Organization [WHO], 2019). This rapid urbanisation puts stress on society and the current built-up environment. Furthermore, health within cities continues to play an important role within our society. Brundtland (2003) states the following about this:

> There can be no real growth without healthy populations. No sustainable development without tackling disease and malnutrition. No international security without assisting crisis-ridden countries. And no hope for the spread of freedom, democracy and human dignity unless we treat health as a basic human right.

The WHO (2019) states that not only air pollution but also lack of safe spaces for walking, cycling and physical activity contribute to death rates from cardiovascular diseases, cancer, respiratory illness and injuries. Rapid urbanisation increases the urgency to improve the overall health of residents within cities.

Although the majority of humans are living in cities, nature should not be neglected, as Beatley (2010) states “it [nature] is not optional but essential.” (p. 3). There seems to be a shared consensus among scholars about how the relationship between nature and humans can be explained, being through an evolutionary mechanism that makes humans appreciate natural scenes more, because (simply put) they seem better for survival (Carrus, Dadvand & Sanesi, 2017). Kellert and Wilson (1995) introduced this vision as the ‘biophilia hypothesis’. Biophilia is “the innately emotional affiliation of human beings to other living organisms.” (as cited by Beatley, 2010, p. 3).

Green infrastructure (GI) provides benefits to humans and can be defined as all natural, semi-natural and artificial networks of multifunctional ecological systems found within, around and between urban areas, at all spatial scales (Tzoulas et al., 2007). In other words, nature provides ecosystem services to humans. Although there seems to be a consensus among scholars about the physical and mental health benefits associated with nature exposure (Frumkin et al., 2017), the exact mechanisms (i.e. physical activity, stress reduction and social contacts) underlying these benefits have yet to be clearly explained (Gascon et al., 2015; Carrus, Dadvand & Sanesi, 2017; Nieuwenhuijsen et al., 2017). In other words, increased contact with nature is seen as a valuable tool for increasing overall health, but the exact manner in which this contributes to health is not clear. In this sense, characteristics such as safety, proximity and accessibility influencing residents’ visitation to urban green spaces (UGS) are important for effective planning of healthy environments. Therefore, the understanding of these relationships is of importance for urban planners (Gascon et al., 2015; Lee, Jordan & Horsley, 2015).

As there is no clear understanding of the relationship between characteristics of parks and their specific effect on functionality within the literature, this thesis aims to fill a gap in the literature in two ways. The first objective of this study is to give an insight into how ecosystem services provide benefits to humans in urban areas via green infrastructure. This objective is achieved through a literature review, which serves as the theoretical chapter for this study. The second objective is to explore how the characteristics of UGS influence the duration and frequency that people visit these areas. The duration and frequency of participants' visits and the amount of contact with nature (i.e. an environment primarily consistent of organisms) a certain park induces provides an insight into their basic functionality. In order to reach these objectives, the following main research question is asked:

'To what extent do characteristics of urban green spaces influence their functionality in providing ecosystem services in the city of Breda, particularly those concerning human health?'

In this sense, functionality relates to the basic assumption that more contact with nature, and the diverse set of accompanied activities people undertake in and around nature, improves the health of individuals. The functionality of urban green spaces can also be related to other types of ecosystem services, such as climate resilience and mobility. To understand these differences, the understanding of ecosystem services is of importance in this thesis. The following sub-questions are used to guide the main subjects of this thesis:

1. To what extent do ecosystem services contribute to human health within cities via green infrastructure?
2. How are green spaces mentioned in policy of Breda and what is its functionality in relation to health according to municipal officials?
3. How do the characteristics of urban parks and the activity/intent with which individuals visit the park influence the park visitation of inhabitants of the Boeimeer neighbourhood in Breda?

The first sub-question is largely answered through reviewing the academic literature on this subject. This is also where the characteristics of urban parks, from the third sub-question, are discussed in depth. To further enrich the research data of this thesis, additional semi-structured (expert) interviews were conducted and empirical policy documents were reviewed, which is used to answer sub question two. The third research question relates to the survey of this study, the data from this is statistically tested.

The *societal relevance* of this study derives from the global trend of a growing urban population and the increasing importance of health within cities. The results from this study can help urban planners with choosing the kind of UGS that best fit the needs of specific areas and thus plan more effectively. The insights of this study could influence policy regarding GI in cities. Furthermore, smaller green spaces in most Dutch cities seems to be neglected, as in most countries the design of public space primarily is influenced by mobility concerns (Seto et al., 2014). This study can provide a solid foundation to promote more nature-driven design of public space. The *scientific relevance* can be found in that it gives more insight into how the characteristics of UGS influence the amount of exposure to nature. Finally, this study also adds to the existing knowledge about UGS usage and planning in Dutch context.

In the first chapter of this thesis, the theoretical background of this study is discussed with a focus on ecosystem services, green infrastructure, nature and the city and nature and spatial planning. The theoretical background provides the knowledge to construct a conceptual model, which serves as the foundation for the quantitative part of this study. The second chapter describes the methodology of this study. This is where the case of the Boeimeer neighbourhood in Breda, the Netherlands, is introduced and data gathering methods, operationalisation and analytical testing is discussed. In the third chapter the results from this study are presented and interpreted. To finalise, the fourth chapter offers the conclusion of this thesis and the fifth chapter a reflection on the overall execution and methodology of the project.

Chapter 1: *Nature and the city*

The theoretical background of this study starts with an insight into the wider debate of nature and the city, planning priorities and sustainability. These subjects can be seen as foundational for this study. In the second paragraph, the concept of green infrastructure and urban green spaces is discussed. The following paragraph focuses on the services that nature provides to humans in an urban context, which arguably justifies the place of nature within cities. Thereafter, the relations between human health and urban green spaces are discussed in depth. These insights provide a profound theoretical background to construct a conceptual model and accompanied hypothesis in the fifth and final paragraph of this chapter.

§ 1.1 Nature, the city and planning - *balancing the non-existing dichotomy*

The place of the natural environment in cities and the place of environmental protection within spatial planning is discussed within this paragraph. The first section shows that arguing about a dichotomy between nature and the city is to some extent inefficient, as the impetus of the biophilia hypothesis shows that this debate should be focused around the deficiency of organisms. The second section shows that balancing cities and organic environments should be the main subject for discussion, as a majority of planning issues are divided into a tripartite of subjects and conflicts.

1.1.1 A non-existing dichotomy

To introduce this subject, it could be useful to start at the genesis of it. Arguably, this started when the first relatively larger settlement or city, came into existence. This dates back to around 11.000 years ago when, according to Curry (2008), the first temple in the world was constructed. Other structures or places could be considered as 'the first' city, but this temple is the first structure (that we know of) of relatively large scale. In the genesis of this large construction, an easily accepted, arguably non-existent, dichotomy was created, namely that of nature versus the city. This dichotomy argues how and in which manner these two concepts differ.

In current times, continued growing urban populations induces the feeling of a division between urban and rural areas, which is in line with the dualism of nature and the city. According to Beatley (2010), the dichotomy between nature and the city is outdated, as he explains that nature in cities is all around us. It can indeed be argued that all built environments are natural because everything is built from natural resources, through socially mediated natural processes (Heynen et al., 2006). Harvey (1993) states that it is hard to see where 'society' begins and 'nature' ends. This is where the Hegelian and Marxist term of *first and second nature* can offer a different point of view. First nature being the original, pre-human nature and second nature being the artificial one, created on the existing first nature (Cronon, 1991). The built environment in this sense is part of second nature, but this notion does not justify one form of nature over the other. Furthermore, it should be stated that only about 23 percent of the world's land mass can be considered wilderness, or pre-human nature (Watson et al., 2016). In highly urbanised countries, like the Netherlands, almost no land area (especially in and near cities) can be considered as wilderness. Thus, it arguably does not make sense to use the division between first and second nature or nature and the city within highly urbanised countries.

Moreover, Heynen et al. (2006) note that urbanisation is primarily being discussed as "a process whereby one kind of environment, namely the 'natural' environment, is traded in for, or rather taken over by, a much more crude and unsavoury ‘built’ environment.” (p. 4). It would then make sense to view nature and the city as intertwined (eco)systems, that of the built environment and an environment largely existing of other organisms, in other words, organic environments. Urban green spaces would then, although built by humans, be the places where the organic environment is more prominent than the built-grey environment. Swanwick et al. (2003) suggest something similar, the spaces between the built environment (in this sense primarily buildings, but not pavement and such), coined the external environment, is composed of two spaces, namely ‘grey’ and ‘green’ space. The first being dominantly impermeable ‘hard’ surfaces (e.g. concrete or street pavement). The second being dominantly permeable ‘soft’ surfaces (i.e. soil, grass, shrubs, trees and water) including private and public owned spaces (Swanwick et al., 2003).

Although these insights offer a promising point of view of how nature does and does not differ from the city, it should be stated that how the city, peri-urban and rural areas are to be defined and what characterises their difference is far from clear (Zimmer, 2010). In this thesis, the difference between these areas is recognised. However, the distinct difference should be made between organic environments, which primarily exist of organisms and built environments, which primarily exist of ‘grey’ surfaces and arguably have an organism’s deficiency.

Short and Benton-Short (2013, p. 4-5) state that, simply put, “cities provide an inevitable contrast to the ‘natural’”. Altogether, why does nature need justification in an urban context if there are clear (physical and mental health) benefits from natural environments for humans? Urban nature is often appreciated for its positive effect on property values (as cited by Andersson et al., 2014). This justifies the allocation of urban nature within an urban context, but purely in a property valuation and economic sense. In a way, the process of justifying the place of nature within cities creates a cognitive dissonance for those planning and governing cities, as there are clear benefits from the natural environment, even when reviewed in a superficial manner.

This brings us back to the idea that humans are becoming a dominantly urban species, or at least the understanding that humanity is able to drastically influence the environment, supposedly also to fit its needs. It can be argued that the current urban environment cannot be described as ideally ‘fitting’, as it still includes among others unhealthy and unjust components. However, these components and conflicts can be considered inherent to urban environments. To an extend urban planners can influence how the urban landscape and in which manner it takes shape. In general, the normative goal of this process would be to create an environment that fits the needs of its inhabitants. To understand how nature relates to the content that planners are dealing with, the following section gives an insight into how nature generally is embedded in spatial planning, and its priorities and conflicts.

1.1.2 A careful balancing act

The place of nature and sustainability is located in a challenging position in the playing field of spatial planning. The art in this game can be seen as trying to be ‘just green enough’, a careful balancing act between a diverse set of priorities and stakeholders (Wolch et al., 2014).

When reviewing the place of the natural environment within spatial planning, Campbell’s (1996) Planners Triangle (figure 1.1) opposes some interesting insights. According to Campbell (1996), planners broadly have to consider three fundamental priorities: Social Justice, Economic Development and Environmental Protection. These priorities form three conflicts between them. Between Social Justice and Economic Development, the *property conflict* arises, which defines the dualism between private interest and public good. The priorities of Economic Development and Environmental Protection induce the *resource conflict*, which is the conflict between economic growth and maintaining natural capital. To finalise, between Social Justice and Environmental Protection the *development conflict* takes shape. This conflict can be characterised by the question of "How could those at the bottom of society find greater economic opportunity if environmental protection mandates diminished economic growth?" (Campbell, 1996, p. 299). In the centre of the triangle, as Campbell (Ibid) suggests, the ideal of 'green, profitable and fair', in other words, sustainable development can be found. Campbell (2016) adds to this that, rather than seeing the centre of the triangle as an equilibrium, he sees it as the elusive apex of the three conflicts.

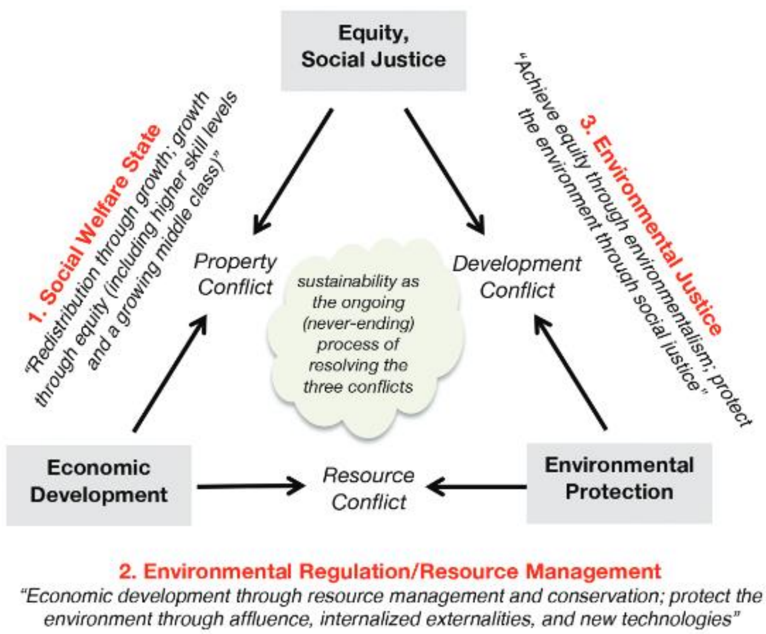

Figure 1.1. Campbell's Planners Triangle (2016).

Furthermore, when discussing nature in spatial planning, sustainability and specifically environmental sustainability cannot be excluded. It is not unusual to refer to the Brundtland definition when looking into sustainable development, as the contributions from Brundtland and her United Nations committee provided an (almost) global consensus on the urgency for sustainability (Goodland, 1995). Sustainable development in this definition is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." (WCED, 1987). To further specify this definition a common division between, social (people), environmental (planet) and economic (prosperity) sustainability is made, also known as 'triple P' (Hammond, 2006). This tripartite can also be seen in Campbell's Planners Triangle.

Environmental sustainability, in essence, is about maintaining natural capital (Goodland & Daly, 1996). Morelli (2011) defines environmental sustainability as "meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them [emphasis added]" (p. 6). In this sense, urban nature can play an important role in the revitalisation of ecosystems that have been damaged by extensive consumption of resources in cities, and with it making the cities more sustainable. Furthermore, according to Ahern (2011), the assessment of ecosystem services (discussed further on) has gained more acceptance as an explicit approach for measuring sustainability. This concept has proven useful to associate urban form with multiple social and biophysical functions (Ibid), which shows that urban nature, and its services are an important part of making cities sustainable. The manner in which ecosystem services are transported to and within urban environments is discussed in the following paragraphs.

§ 1.2 Nature as infrastructure - *planning a medium*

Planning principles and concepts can be seen as useful tools for planners, not only for analysis or appliance, but also to guide goals and policy. This paragraph gives insight into several planning principles used for planning green spaces and the constraints these principles have. In short, this section shows that green infrastructure is a promising planning principle but has to be used with care.

1.2.1 Urban green spaces and green infrastructure

Within spatial planning literature, green spaces in cities are generally referred to by two terms: Urban Green Spaces (UGS) and Green Infrastructure (GI). Variations on the terms are common as for example, Small Public Urban Green Spaces (SPUGS) are also mentioned in this research field (Peschardt et al., 2012; Peschardt & Stigsdotter, 2013). UGS traditionally has been used in reference to parks and other natural areas in urban context. The most important role of this space was considered its recreational characteristics (Sandström, 2002) and its positive effect on the quality of life of citizens (Burgess, Harrison & Limb, 1988).

Although both terms are used in academic literature, there has been some discussion about the spatial scale and coherence of the term UGS. To upgrade the term UGS to a more coherent planning entity, the concept 'green infrastructure' was introduced by Sandström (2002). Benedict and Mcmahon (2002) define GI as an "interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations." (p.12). For additional clarification, it would be useful to also take the definition as stated by Tzoulas et al. (2007) into account. According to Tzoulas et al. (2007), the concept of GI comprises "all natural, semi-natural and artificial networks of multifunctional ecological systems within, around and between urban areas, at all spatial scales" (p. 6). However, it does not include wilderness, as GI is strategically planned and managed to provide ecological, social, and economic benefits (Matthews, Lo & Byrne, 2015). These benefits are in line with sustainable development as discussed before. In this sense, UGS can be seen as the individual green spaces in cities, whereas GI can be seen as the network that encompasses all these spaces and more. GI thereby focuses on the importance of interconnected habitats (as cited by Tzoulas, 2007) and its multifunctional role (Sandström, 2002). Thus, natural corridors, patches and regional connectors can also be considered as GI.

Furthermore, what also should be noted is that Sandström (2002) introduces urban green spaces into the realm of infrastructure, which provides an interesting point of view. In order to understand what the combination of these concepts mean the definition of infrastructure by Neuman (2006, p. 6) should be taken into account:

> Infrastructure is the physical network that channels a flux (water, fluid, electricity, energy, material, people, digital signal, analog signal, etc.) through conduits (tubes, pipes, canals, channels, roads, rails, wires, cables, fibers, lines, etc.) or a medium (air, water) with the purpose of supporting a human population, usually located in a settlement, for the general or common good.

Following this definition, it can be stated that urban green spaces are the medium through which the ecological system (and ecological processes) provides services to humans. These services are coined as ecosystem services, profoundly discussed further on. This introduction to infrastructure, however, also opposes some critical points. To begin with, the notion that this approach confines GI to an engineering discourse, which makes it easier to see GI as a mechanical design endeavour and with that foreclosing issues beyond the 'technological fix' from politics (Lennon, 2015).

Furthermore, it should be stated that urban nature not only provides benefits but also disadvantages. One of the critiques on more nature within cities, or the effectiveness of green infrastructure, is that it also brings ecosystem detriments (Gómez-Baggethun and Barton, 2013; Lõhmus, and Balbus, 2015). GI is seen as an alternative to greenbelts and is a competing notion of preserving greenspace. According to Thomas and Littlewood (2010), a promising aspect of GI is that it makes way for valuing environmental features as economic assets. This characteristic of GI strongly relates to the economic valuation of ecosystem services as a whole (discussed in the next paragraph). Therefore, GI can be considered a useful concept when relating ecosystem services to spatial planning. However, this perspective of the concept puts an emphasis on the economic, physical and social development above that of environmental conservation (Lennon, 2015).

1.2.2 Planning principles

According to Hansen and Pauleit (2014), GI is a cumulation for innovative planning approaches, as it incorporates several principles that overlap with other concepts. Hansen and Pauleit (2014), define two categories of approaches regarding GI planning principles, namely those addressing green structure and those addressing governance process (Ibid).

To start with the approach and characteristics associated with green structure. Hansen and Pauleit (2014) define the *integration approach,* which includes combining GI with other forms of urban infrastructure. For example, active travel networks can easily be combined with GI, while it can at the same time function as space for water storage. In general, GI has been widely discussed in regard to resilience and climate adaptation of urban areas (Gill et al., 2007; Foster, Lowe & Winkelman, 2011; Meerow & Newell, 2017). It can mitigate the urban heat island effects while also providing a place for social cohesion within a neighbourhood. In this sense, GI seeks to combine ecological, social and economic, biotic and cultural functions, which is considered to be its *multifunctional* characteristic (Hansen & Pauleit, 2014). UGS can also be used as spatial bridging ties - a tie that connects two spatially distinct areas within a community - while at the same time include other functions (Cabrera & Najarian, 2015). In addition to spatial bridging, GI can tie multiple green spaces at different scales in other functions, which is seen as its *connectivity* characteristics (Hansen & Pauleit, 2014). Following this, GI can be used to address initiatives at different geographical scales, from parcels to community, regional and state assets. Thus, GI can be seen as a *multi-scale* concept. To finalise the approaches regarding green structure, GI is considered to be a *multi-object* concept, as it encompasses a diverse range of blue (i.e. waterways and other surface water) and green spaces (Ibid).

In addition to the approaches addressing green structure, the following approaches regarding the governance process of GI are mentioned by Hansen and Pauleit (2014). The *strategic approach,* GI planning aims that are flexible and focused on long term benefits. For example, GI planning can be related to future scenario’s some city planners use for creating long term visions and policies. Furthermore, the concept of GI can be used to enhance *social inclusion* in urban planning, as it incorporates multiple scales and objects. The last governance process regarding GI planning focuses on its *transdisciplinary* characteristic. GI uses knowledge from several different principles, like landscape ecology, architecture and urban and regional planning. This also induces the partnership between multiple stakeholders.

In short, green infrastructure as a planning principle offers a diverse set of approaches that utilises the characteristics of the concept, which shows that green infrastructure is a promising concept. Especially its multi-scale, object and functional characteristic seems to be of importance for its impetus. It can be argued that connecting this concept to ecosystem services and their valuation can be of value for planning practice. The following paragraph elaborates further on the subject of ecosystem services.

§ 1.3 Nature and its services - *a cognitive dissonance*

The actual importance of nature for humans can be found in the services it provides, which is discussed in this paragraph. This paragraph shows how nature is essential for humans and why justifying the place of nature in urban planning creates a cognitive dissonance. Furthermore, the planning principles related to ecosystem services bring forward a set of indicators that form a first step in identifying services in specific urban green spaces, showing the possibility of strategically planning ecosystem services in practice.

1.3.1 From suggestion to definition

The ideas about the valuation of ecosystems were first envisioned by Westman (1977). He suggested that, in order for society to make more grounded policy and management decisions, the (social) value of the benefits that humans gain from ecosystems could be enumerated. It was Ehrlich and Ehrlich (1981) who coined Westman's conception as 'ecosystem services'. After the United Nations published its Millennium Ecological Assessment [MEA] (2005), the concept gained broader attention (Costanza et al., 2014). The number of scientific papers related to this topic has risen exponentially in the past decades (Fisher, Turner & Morling, 2009; Liquete et al., 2013). Before the publishing of the MEA the definitions from Daily (1997) and Costanza et al. (1997) were commonly used. However, in this thesis, the definition that Fisher et al. (2008, p. 645) constructed is used "*ecosystem services are the aspect of ecosystems utilized (actively or passively) to produce human well-being* [emphasis added]". This definition differs from previously used versions in that it includes ecosystem structures (i.e. stock, infrastructure, pattern or capital) as well as processes and/or functions if they are, directly or indirectly consumed and utilised by humanity (Fisher et al., 2009). For further clarification, figure 1.2 shows the interaction between the different kinds of 'capital' that together add to human well-being. Natural capital encompasses the society in which built and human capital are embedded (Costanza et al., 2014). The contributions of natural capital to human well-being are the ecosystem services. It should be stated that ecosystem services cannot be derived from natural capital without the existence of the human, social and built capital (Ibid), shown in the model (figure 1.2) with the 'interaction' point.

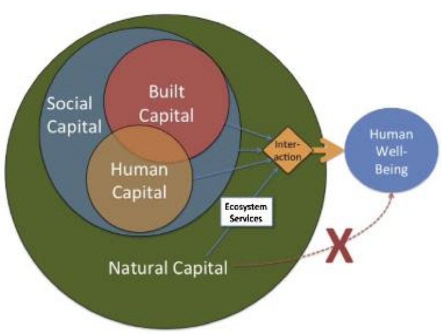

Figure 1.2. Interaction between built, human, social and natural capital (Costanza et al., 2014, p. 153).

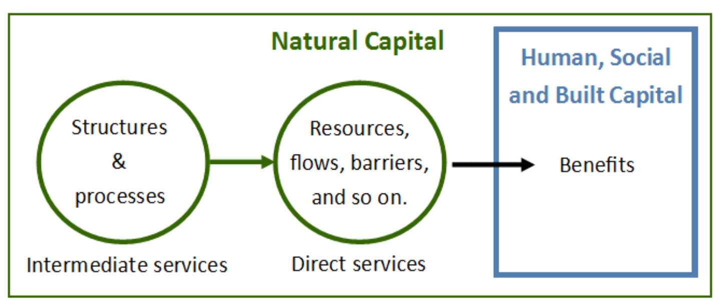

Figure 1.3. Ecosystem intermediate, final services and benefits (Author).

Thus, human benefits (from ecosystems) indirectly and directly derive from structure and processes within the natural capital. These structures and processes, however, would both exist without the necessity to interact with society. The benefits to humans occur when societal capital is used to gain access to the resources (visualised in figure 1.3). For example, nutrient cycling is a natural process (that would exist without the existence of humanity) where one outcome is fresh water. This resource becomes beneficial to humans when it is extracted. In this sense, the nutrient cycle provides an intermediate service and clean water a final service (Fisher et al., 2009). The process, visualised in figure 1.3, is a combination of the conceptual relationship as proposed by Fisher et al. (2009, p. 646) and the interaction of different forms of capital in figure 1.2.

There is a strong connection between GI and ecosystem services. Both concepts have an inherent focus on providing benefits to humans. The critique of Lennon (2015) on the focus of GI on economic, physical and social development above that of environmental conservation, is also applicable to ecosystem services. Although other forms of ecosystem service valuation do exist (discussed further on in this paragraph), economic valuation seems to be the most prominently used valuation. Some scholars suggest that this concept, and its manner of valuation, might in fact be the last great hope for making conservation mainstream (Portman, 2013). Furthermore, the notion of intermediate services provided by natural capital advocates for the health of ecosystems itself. Nevertheless, Portman (2013) states that the ecosystem service language needs to be expanded beyond the academic literature of ecologists. The concept can provide many basic advantages, despite its complexity, to professionals active in place-based fields, such as applied geography (Ibid). Which brings this subject to a focus on the spatial allocation of these services.

1.3.2 Production and benefit area

As the definition and current understanding of ecosystem services is clarified, this raises the following question: 'how does this concept relate to urban nature?'. Arguably, nature in cities is almost always in a way shaped by humans. It would be useful to put this into a spatial perspective. GI cannot be seen as wilderness and the specific infrastructure would not exist (in this manner) without humanity, but the natural processes and structure within GI would. GI is not wilderness, but it is the planned and managed natural spaces that support ecosystems and provide benefits to humans. Fisher et al. (2009) discuss some possible spatial relations between service production (P) and service benefit (B) area, visualised in figure 1.4. They mention (1) in situ areas, where the production and benefit area are the same, (2) omnidirectional areas, where production area benefits the surrounding area without directional bias and (3, 4) directional areas, where the production area benefits a directionally biased benefit area.

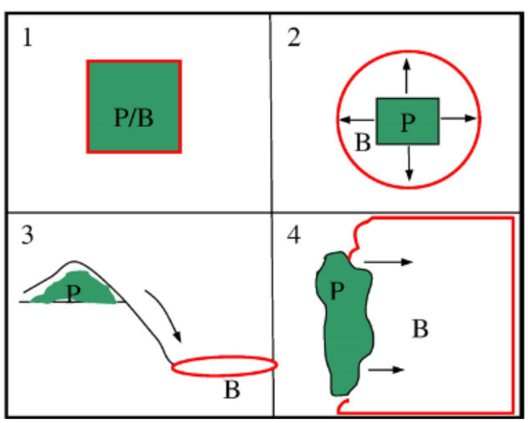

Figure 1.4. Proposed relations between production (P) and service benefit area (B) (Fisher et al., 2009).

GI can be considered as a production area, but some forms of green space would provide more or different benefits than others, considering their individual (spatial) characteristics. For example, an urban park consisting of bushes and grass would provide less cooling than a similar size park that also has several trees. Urban green spaces that can be entered (i.e. relatively lower vegetated parks with paths) could then be considered in situ as well as omnidirectional production areas. Urban green spaces that cannot (easily) be entered (i.e. highly vegetated spaces without paths) can then be considered solely omnidirectional. Can all urban green spaces be considered a production area? Arguably, they should at least provide a final service. Consider the benefit being recreation, the urban green space should be large enough to provide basic recreation like walking. If the benefit would be water retention, almost all urban green can be considered a benefit production area. In order to get a better insight into the relation of health with urban ecosystem services, it would be useful to construct a relatively complete overview of urban ecosystem services.

Other spatial dynamics of ecosystem services can be defined. When taking into account that GI is a multiple object concept, another function can be added next to those of a production and a benefit area. Coutts and Hahn (2015) show that elements of GI can be considered to be patches, corridors and regional connectors. When following Beatley's (2010) narrative on the biophilic city this generalisation might not be useful in cities. Nevertheless, this generalisation suggests that natural areas can be seen as a medium between patches of production and benefit areas. These insights suggest that concretely defining the functionality of all green spaces in cities would be of great value for practitioners. As specific regulation could protect the valuable services that nature provides via these spaces.

1.3.3 Urban ecosystem services and their valuation

Combining the ecological functions (process and/or component providing the service), as explained by De Groot et al. (2010) with the urban ecosystem services, provides an insight into what types of UGS deliver specific services (Table 1.2). Gómez-Baggethun and Barton (2013) discuss a range of important urban ecosystem services and their associated natural structures and processes (as discussed previously). They mention the services and detriments as listed in table 1.1. These services and detriments offer an insight into the benefits and detriments related to ecosystems in urban areas.

Table 1.1. Urban ecosystem services and detriments (Gómez-Baggethun and Barton, 2013).

Urban Ecosystem Benefits	Urban Ecosystem Detriments
food supply (i.e. urban agriculture)	air quality problems (i.e. volatile organic compound [VOC] emission)
water flow regulation and runoff mitigation	view blockage
urban temperature regulation	Allergies
noise reduction	accidents (i.e. branches falling on roads)
air purification	fear and stress (i.e. unsafe feeling from densely vegetated areas)
moderation of environmental extremes (i.e. storms, floods and wave buffering)	damages on infrastructure (i.e. breaking of pavement or pipelines by roots)
waste treatment	habitat competition with humans (i.e. animals perceived as unpleasant, unhygienic and scary)
climate regulation	
pollination and seed dispersal	
recreation and cognitive development	
animal sighting	

In order to connect services and detriments to specific indicators and spaces table 1.2 has been constructed, this table can be seen as first step in determining the specific functionality of urban green spaces. The table shows that some urban ecosystem services, for example, water flow regulation, can be found in almost all urban green spaces and others, for example, waste treatment, only in very specific areas.

Table 1.2. Ecosystem services and detriments, their accompanied functions, indicators and types of UGS. Functions and indicators largely adopted from De Groot et al. (2010), urban ecosystem services from Gómez-Baggethun and Barton (2013).

Services	Ecological functions	Indicator	Types of UGS
Food supply	Presence of edible plants and animals	The total or average stock in kg/ha	Urban agriculture plots, community gardens etc.
Water flow regulation and runoff mitigation	Role of natural area in water infiltration and gradual release	Water retention capacity in soils or at surface level	All green spaces on all surfaces at all scales
Urban temperature regulation	Amount of vegetation (area and number of) and water surface area	Temperature in Celsius (Urban Heat Maps) relative to green coverage	All green spaces on all surfaces at all scales
Noise reduction	Amount of vegetation (area and number of), number and kind of trees	Amount of noise from specific urban activities in relation to green coverage	Green spaces with a fair amount of vegetation
Air purification	Capacity of ecosystems to extract aerosols & chemicals from the atmosphere	Leaf area index NOx-fixation, etc.	All green spaces on all surfaces at all scales
Moderation of environmental extremes	Role of nature in dampening extreme events	(e.g. flood mitigation) water-storage (buffer) capacity in m3	All green spaces on all surfaces at all scales
Waste treatment	Role of biota and abiotic processes in removal or breakdown of organic matter xenic nutrients and compounds	Denitrification (kg N/ha/y) Immobilisation in plants and soil	Composting areas, generally not public
Climate regulation	Influence of ecosystems on local and global climate through land-cover and biologically-mediated processes	Greenhouse gas-balance (esp. C-sequestration); Land cover characteristics	All green spaces on all surfaces at all scales
Pollination and seed dispersal	Abundance and effectiveness of pollinators	Number & impact of pollinating species	Specific habitats for pollinating species
Recreation and cognitive development	Landscape-features Attractive wildlife	Number/area of landscape & wildlife features with stated recreational value	Green spaces with recreational features
Detriments	**Ecological functions**	**Indicators**	**Types of UGS**
Air quality problems	The capacity of ecosystems to output VOC into the atmosphere	Number of VOC emitting species and accompanied emission	Green spaces encompassing VOC emitting species
View blockage	Presence of (relatively large) vegetation	The amount of interference between urban sight lines and relatively large vegetation	Relatively larger trees and bushes.
Allergies	Presence of species that induce allergic reactions	Number of species and percentage of population allergic to these	Specific habitats and vegetation inducing allergies
Accidents	Presence of trees that have a high probability of losing branches More extreme weather events	Amount of trees and extreme weather events accompanied by insufficient maintenance	Primarily trees
Fear and stress	Density of vegetation	Amount of densely vegetated areas; unsafe complaints	UGS regarded as unsafe by inhabitants living nearby
Damages on infrastructure	Presence of vegetation that easily damages infrastructure	Interference between vegetation and infrastructure	Mostly trees and deep-rooted plants
Habitat competition with humans	Presence of multiple habitats	Interference between habitats; citizen complaints	UGS providing habitats

Arguably, almost all services directly or indirectly contribute to the health and well-being of urban dwellers. Coutts and Hahn (2015) state that some services derive from the presence of GI (i.e. water, air, heat reduction), others from literal access (e.g. physical activity), and some simply from exposure to it (e.g.

stress reduction). Literal park visitation, as in accessing or travelling along the border of it, contributes to the benefits derived in the latter two manners.

The valuation of these services can be done in several manners. To some extent these can be related to the planning priorities from Campbell (1996; 2016), for example, De Groot, Wilson and Boumans (2002) describe ecological, social-cultural and economic valuation.

Ecological value is related to the health of the system (structure and processes) itself, which is measured with ecological indicators (i.e. diversity and integrity) (De Groot et al., 2010). *Social valuation* of ecosystem services is heavily related upon the importance people give to it, for example, for physical and mental health, education, cultural diversity and identity (heritage value), freedom and spiritual values. The *economic value* is broadly divided into *use values and non-use values* (Ibid). The first includes the value of directly consumable goods such as fish and timber, and that of non-consumable user value, like aesthetic and recreational value. Indirect economic value, for example, is the air and water purification (Ibid). Furthermore, *non-use value* is considered to be "the importance attributed to an aspect of the environment in addition to, or irrespective of its use value." (De Groot et al., 2010, p. 262). The third type value is in between use and non-use, it is related to the option of utilising the ecosystem services in the future, either within our own lifetime or in those of future generations. The sum of these economic values is known as Total Economic Value (TEV) (Ibid). It is important to note that physical and mental health benefits are considered as a social value of ecosystem services. However, they can also be translated to economic valuation when, for example, speaking of productive working hours.

In order to further specify urban ecosystem services relating to health, the specific health benefits from visitation of UGS are needed to be formulated. These specific relations contribute to the construction of a conceptual model for the quantitative part of this study.

§ 1.4 Nature and human health - *essential benefits*

To further specify the relation between nature and human health, his paragraph focuses on the health benefits humans gain from nature, specifically those gained by contact with urban parks. To start off, the current understanding of the relation between (urban) nature and health is established. Secondly, several characteristics that influence the visitation of parks are identified. In short, this paragraph narrows down to a specific number of variables that can be tested to give insights into the visitation of urban parks.

1.4.1 From early findings to current understanding

Beliefs about the restorative functions of gardens for people with an illness dates back centuries and has widely appeared in different cultures (as cited by Ulrich, 1967). The first (widely cited) study that supported these assumptions was that of Ulrich (1984), as he demonstrated that visual contact with nature speeded up post-surgical recovery. At first, the focus of these studies was largely on the healing benefits of patients (Carrus, Dadvand & Senesi, 2017). However, in the last three decades, a large amount of research in this field has proven that contact with natural environments can be a relatively effective tool for restoration from stress and mental fatigue (as cited by Van den Berg et al., 2007). Initial findings on the restorative function of nature have been confirmed by several studies as described by Carrus, Dadvand and Sanesi (2017). These studies show that contact with nature reduces stress (Ulrich et al., 1991), restores cognitive functions (Hartig et al., 1991; Berman, Jonides & Kaplan, 2008) and positively affects perceived general health (e.g. Korpela and Ylén, 2007), subjective well-being (e.g. Lafortezza et al., 2009; Carrus et al., 2015) and the quality of life (e.g., Mensah et al., 2016).

To visualise the current understanding, it is useful to divide some factors into a conceptual model. To start with, there seems to be general agreement among scholars of the positive effects of UGS on human's physical health and well-being (e.g. Maas et al., 2006; Lee & Maheswaran, 2011; Carus et al., 2017; Nieuwenhuijsen et al., 2017). Following this, there seems to be a general consensus about a division in characteristics (personal and green space related), functionality, mechanisms (i.e. physical activity [PA], stress reduction, social contacts) and outcomes from UGS (Bedimo-Rung, Mowen & Cohen, 2005; Wolch et al., 2014; Lee et al, 2015; Nieuwenhuijsen et al., 2017). However, the mechanisms that influence the benefits have yet to be sufficiently established (Nieuwenhuijsen et al., 2017).

Furthermore, these mechanisms can be related to the urban ecosystem services as discussed in the previous section. Mechanisms can be seen as the manner with which health benefits are derived from ecosystems, which highly relates to the activity and intent with which individuals visit parks. The model, as shown in figure 1.5, visualises the main relations between characteristics of UGS (specifically parks) and their users and the functionality, mechanisms and outcomes derived from UGS. This model relates to ecosystem services in that it is located at the nexus between the final service (as discussed in the previous paragraph) and the benefits gained from these services. The value of these services can be divided into economic, social and environmental.

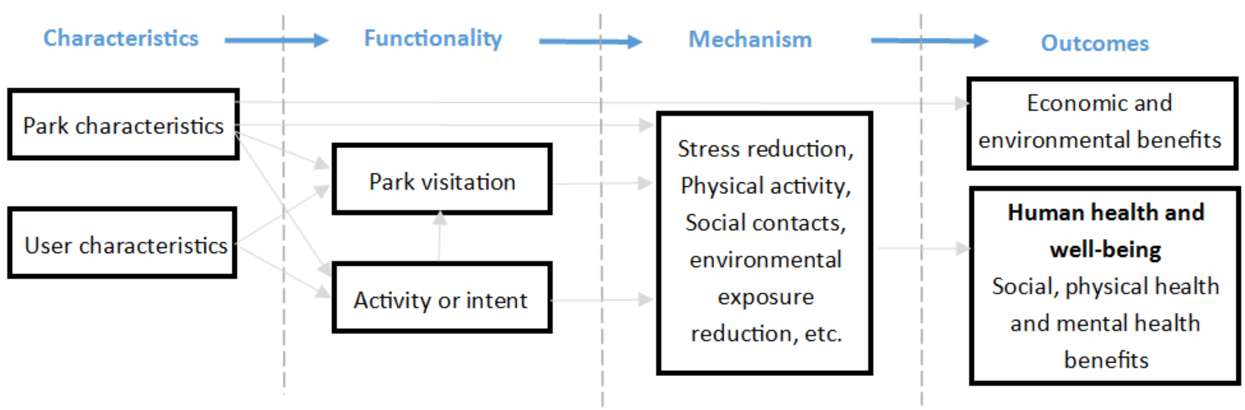

Figure 1.5. Influence of park (and user) characteristics on human health and well-being (and economic and environmental benefits), largely based upon frameworks from Bedimo-Rung et al. (2005), Wolch et al. (2014), Lee et al. (2015) and Nieuwenhuijsen et al. (2017).

In order to contribute to the current understanding of the relations shown in figure 1.5, this thesis focuses on a small section of the model. This study specifically focuses on the relationship between park (and to an extend user) characteristics that influence the functionality of the park itself. The activity or intent is also included, as this possibly provides interesting insights. Arguably, within a spectrum of multiple types of UGS, parks are the most tangible objects to study. Parks of relatively large size and as a single spatial entity can provide relatively more, or a greater amount of, ecosystem services than smaller UGS. The size of UGS will also positively influence the ability to show possible significant relations between characteristics and functionality. To further substantiate the conceptual model of this study, the following section focuses on specific characteristics of parks that could influence functionality.

1.4.2 Urban park functionality and characteristics

In this study functionality is minimised to the park visitation of the respondent and the activity and intent with which the park is visited. Functionality, in general, can be defined as "the quality of being suited to serve a purpose well; practicality" (Oxford English Dictionary [OED], 2019), however, some scholars suggest that functionality as a dichotomous measurement concept is not sufficient (Carter & Ross, 2016). Carter and Ross (2016) conclude that it should be measured in more informative indicators. The functionality of a park heavily relates to the intent with which the park is planned. However, in this study, the focus lies within the functionality in deriving health benefits from the park. Lee et al. (2015) state that the specific health outcomes derived from UGS are not directly related to the presence of the park, but rather to the activities that are undertaken in the park. In this sense, the activity in the park highly relates to the functionality of the park. However, it can be argued that visiting a park provides some basic functionality. For example, the most basic activity while visiting a park, walking, will already add to the cumulation of health benefits. Furthermore, when following the biophilia hypothesis, simply the change from being in a prominently built environment to a prominently natural environment will add to overall well-being.

Perceived Accessibility and Safety

An important characteristic of park usage is accessibility, specifically how this is perceived by respondents. In general, accessibility is seen as an important factor in the use of public open space (Giles-Corti et al., 2005). In a study by Wang et al. (2015) perceived accessibility had the greatest effect on the user intention of respondents. This means that higher perceived accessibility of the park will increase the intention of respondents to visit it. The study (Ibid) also shows that perceived accessibility is a better indicator of user intention than the geographic distance between park and respondent. This indicates that perceived accessibility could also be an important factor in determining actual visitation of urban parks by respondents.

Furthermore, a study by Wang, Brown and Liu (2015) has focused on empirically testing perceived accessibility as a multidimensional construct, which indicates that the internal complexity of the construct might give interesting insights. For example, the actual and subjective distance from the respondent to the park has shown to be of low influence on the perceived accessibility. However, another study (McCormack et al., 2010) concludes that in general, proximity to the park is seen as major indicator to the perceived accessibility of it. Furthermore, subjectively identified safety is seen as an important factor for indicating perceived accessibility (Ibid). This could imply that perceived safety is of influence on the actual visitation of parks. Cohen et al. (2010) conclude that on the one hand low perceived safety has been considered to negatively affect park usage, on the other hand, high perceived safety does not appear to positively affect park usage, which makes it an interesting variable to study.

Proximity to park

The distance between public space and its users has been of growing interest in studies regarding physical activity and public space usage (Kaczynski et al., 2014). There seems to be an inconsistency in research results about this variable. This study can contribute to making this relation more grounded. Giles-Corti et al. (2005) state that distance from home influences the type of usage and the frequency that respondents use public open space. Specifically, users of smaller parks in Australian cities (as cited in Giles-Corti, 2005), has shown that (provided there are no major physical barriers affecting access) distance is a major factor for determining the park usage. Most users of the survey were found to be drawn from a radius of

500 meters from the park (Ibid). However, a study by Mowen et al. (2007) did not find a significant relation between proximity to park and frequency and duration of usage.

Activity and intent

Brown et al. (2014) have put forward a useful set of physical activities with diverse intensity and benefits and types of benefits that can be obtained from green space (table 1.3). These activities make way for speculation about the final two section of the model from figure 1.5, namely the mechanisms and outcomes from park visitation.

Table 1.3. Physical activity with accompanied intensity and benefits with accompanied type (Brown et al., 2014).

Physical activity	Intensity	Benefit	Type
Very slow walking/strolling	Low	Enjoy nature	Environmental
Moderate-paced walking	Moderate	Get exercise/fitness	Physical
Fast-paced walking	Moderate	Escape stress	Psychological
Jogging or running	High	Enjoy tranquillity	Psychological
Cycling slowly	Moderate	Spend time with friends	Social
Cycling briskly	High	Observe nature	Environmental
Moderate intensity sport	Moderate	Be around good people	Social
High intensity sport	High	Do something creative	Psychological
Resting/sitting	Low	Connect with family	Social
Standing activity	Low	Place to think/reflect	Psychological
Using playground/fitness equipment	Moderate	Rest/relax	Psychological
Yoga/stretching	Low	Spending time outside	Environmental
Boot-camp or fitness program	High		

Note: activities and benefits are not linked in the manner as visualised above

§ 1.5 Conceptual framework and hypotheses

In order to provide insights into the characteristics and functionality of UGS in the Netherlands, the conceptual framework as shown in figure 1.6 is utilised.

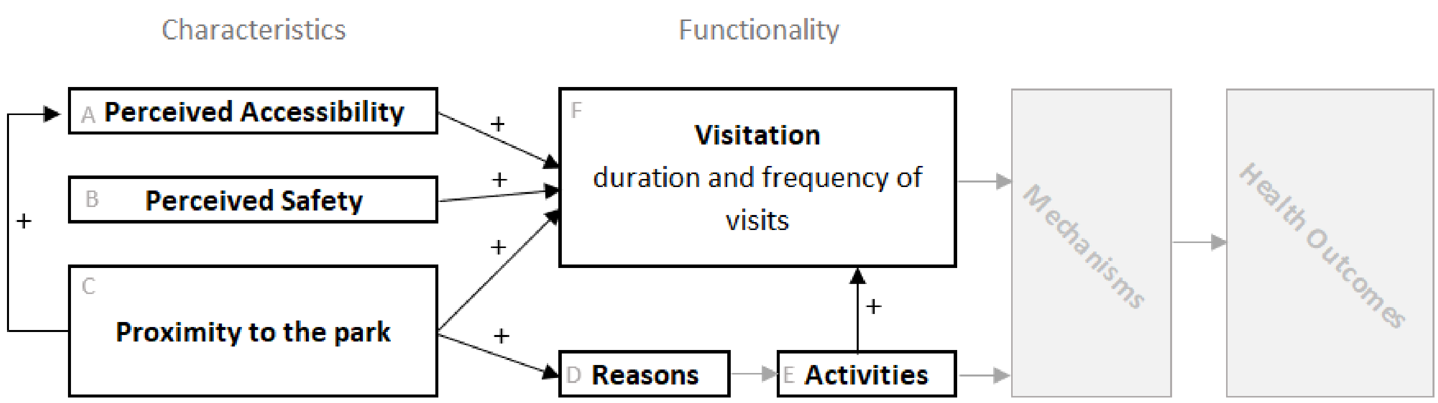

Figure 1.6. Conceptual model for park visitation (non-holistic).

In general, the model in figure 1.6 is based upon the four larger columns as seen in figure 1.5 (p. 21), namely characteristics, functionality, mechanisms and health outcomes. The focus of this model lies within specific variables in the columns of characteristics and functionality. The areas and relations shown in a lighter grey colour are not tested in this study. This model does not give a holistic overview of all variables of influence on visitation, rather it focused on several characteristics found to be of importance. Other characteristics were left out because of the size and complexity of the model and the accompanied time frame of this study.

The park characteristics that are used in this model are found to be of importance when defining overall park visitation. Several characteristics, as discussed in the previous paragraph are added. To start with that of perceived accessibility, which is ought to have a positive influence on visitation. Furthermore, because the internal consistency of this variable is considered to be relatively complex it is tested if distance between park and individual influence the perceived accessibility. The second characteristic used in this study is perceived safety, which is only found to have a negative effect on visitation when the overall safety is perceived as negative. In this model, however, it is also tested for having a positive effect on visitation when the safety is perceived as positive. As final characteristic the distance between park and respondent is tested for a positive relation on overall visitation, meaning the closer respondents live to a park the more they will visit. Functionality in this model is split between visitation, the reasons individuals have for visiting and the activities they undertake within the park. The link between reasons and activities is made between park characteristics because a closer proximity to the park could induce other reasons for visiting, for example, spending time with family (in the case of letting smaller children play within a park) would be a reason for visiting a park more close by rather than one located further away. Another deducted relation is added between the reasons for visiting and the actual activities undertaken, however, this relation (shown in lighter grey), is not tested within this study. The effect of the number of activities on visitation is considered to be positive. In general, the relations surrounding reasons and activities are added for experimental purposes. In other words, these variables are added to try and map where the actual relations might be located and to make speculation about health outcomes a possibility.

The relations as described and visualised in the previous section lead to the following research hypotheses:

1. *The higher the individuals perceived accessibility of the park, the higher the visitation.*
2. *The higher the individuals perceived safety of the park, the higher the visitation.*
3a. *The less distance between the park and respondent, the higher the perceived accessibility.*
3b. *The less distance between the park and respondent, the higher the visitation.*
3c. *The less distance between the park and respondent, the more reasons individuals can think of to visit.*
4. *The more activities an individual participates in within the park, the higher the visitation.*

Visitation in these hypotheses is divided into (1) average duration of visits in minutes, (2) frequency of visits per month and (3) overall visitation in minutes per month. In the following chapter the methodology to test these hypotheses is discussed in depth.

Chapter 2: *Methodology*

Within this chapter the methodological design of this study is discussed. To start off, the case of the Boeimeer neighbourhood in Breda is described in the first paragraph. After this, the type of research within which this study is categorised is discussed in the second paragraph. The empirical data gathering methods are also introduced in this paragraph. In the third paragraph the operationalisation of the different variables derived from theory are discussed. The fourth paragraph explains the analytical testing of the quantitative data. To finalise, the sample characteristics and representativity are discussed in the last paragraph.

§ 2.1 Case description Boeimeer neighbourhood

The Boeimeer neighbourhood in the city of Breda, the Netherlands is the case study location of this thesis (figure 2.1). Several parks of relatively similar size (in comparison to other parks in Breda) are located in the Boeimeer neighbourhood. For this study, the Burgemeester van Sonsbeeckpark (A) and the Zaartpark (B) were used as subject for the survey. The survey was not conducted with people in the parks but rather in the neighbourhood surrounding these green spaces, because this allowed for inclusion of data from inhabitants who do not visit one of the parks frequently. The process could surface findings that possibly would not have been found when only questioning park visitors.

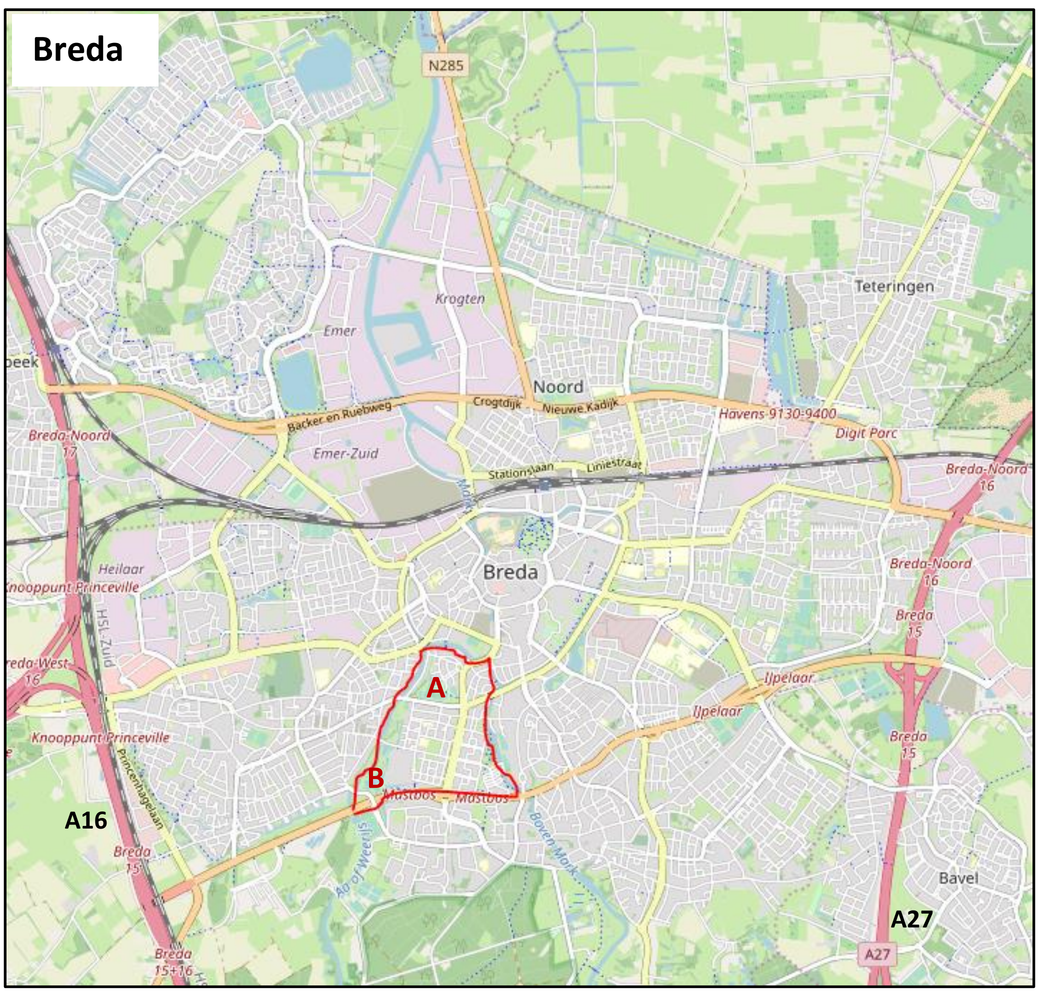

Figure 2.1. Location of Boeimeer neighbourhood (red contour) and the Burgemeester van Sonsbeeckpark (A) and Zaartpark (B) in Breda. Maps adjusted, obtained from www.openstreetmap.org.

2.1.1 Boeimeer, history, features and demographics

Breda is the 9th largest city in the Netherlands with approximately 180.000 inhabitants. The city is situated in one of the southern provinces of the Netherlands, named North-Brabant. The Boeimeer neighbourhood is situated in the southern district of Breda (Figure 2.1). The neighbourhood got its name from the polder it was built upon, the Boeimeer polder. This name is derived from the oldest known name 'Boymere' which is related to the meaning of wet grounds, as the area is located between two rivers, the Mark and the Aa river (Community Board Boeimeer, 2019). The area was largely uninhabited until the mid-15th century. Around the 1900, this area was part of three smaller, former municipalities. The larger part of the polder was situated in the former municipality of Prinsenhage, which was considered a larger village at that time (Huijgens, 2016). Due to rapid urbanisation in the second half of the 20th century, Breda and its surrounding municipalities grew together. The urbanisation of the Boeimeer area and this part of Breda is visualised in figure 2.2. Boeimeer can thus be considered a neighbourhood that has somewhat village like characteristics but is located in close proximity to the city centre.

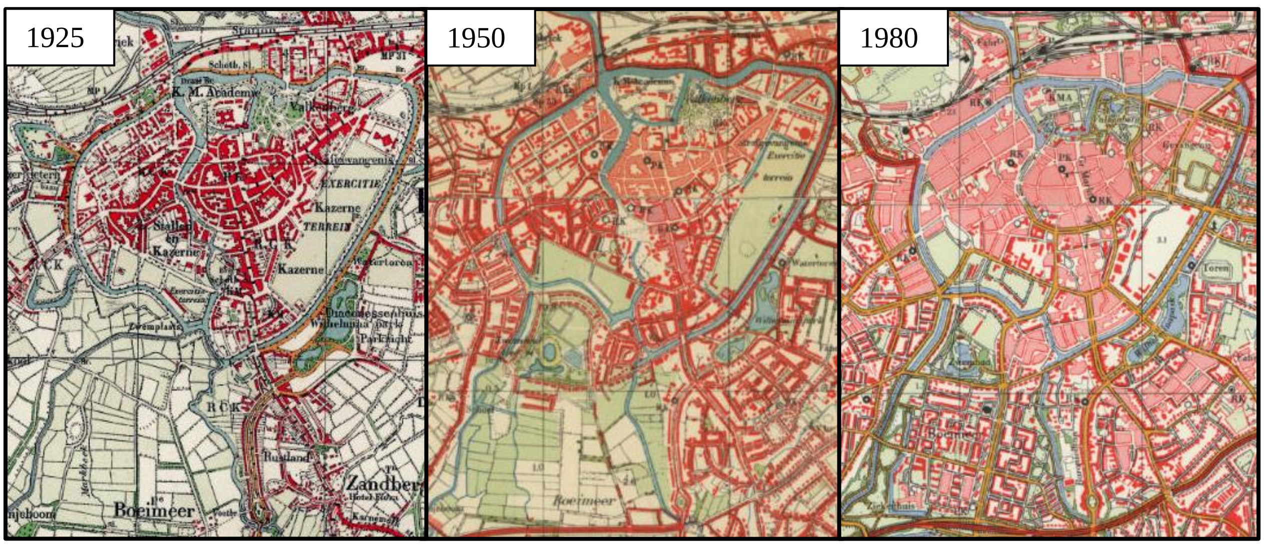

Figure 2.2. Growth of Breda and the Boeimeer neighbourhood (built up area in red). Maps reprinted from Kadaster (2019).

To give more insight into the current situation of the neighbourhood, several features of and services in Boeimeer are discussed (figure 2.3). To start with, the road layout within and around the neighbourhood can highly influence accessibility of services in the neighbourhood. Breda is located in between two highways (A16 and A27) which are connected via the northern and southern ring road of Breda. The southern ring road, the Graaf Engelbertlaan, is located on the south side of the neighbourhood. There are two major road axis in the neighbourhood, namely the Julianalaan (crossing the map in figure 2.3 horizontally) and Graaf Hendrik III laan/Irenestraat (crossing the map in figure 2.3 vertically). These two axis form access roads for the city centre and surrounding neighbourhoods to the ring road (figure 2.3). Although these roads can be considered major spatial obstacles, almost all have prioritised pedestrian crossings, which improves walkability in the neighbourhood. However, these roads could still create divisions between neighbourhood parts and influence overall park visitation of the specific parks.

Secondly, there is a relatively large number of services located within the neighbourhood. Among others, the following types of facilities are located in Boeimeer: medical, educational, sporting and commercial/shopping facilities. The hospital and assisted living facilities are relatively unique features as they are not commonly seen in neighbourhoods of Breda. Due to the large number of services located in the neighbourhood the percentage of residential properties is fairly low. There are approximately 3000 properties located in the Boeimeer neighbourhood and approximately 50% of these have a residential function (Vastgoeddata, 2019). To give a more detailed insight into Boeimeer, the services that are located in the neighbourhood are shown in figure 2.3. What can be noticed is that the facilities located right next to the Zaartpark have a relatively large spatial footprint within the neighbourhood, which leads to the question if these also form an obstacle for visiting the Zaartpark.

Figure 2.3. Map of the Boeimeer neighbourhood with services and facilities. Map adjusted, obtained from openstreetmap.org.

The following demographic data gives a first insight into the characteristic of the population living in Boeimeer. To start with, Boeimeer has 5780 inhabitants according to a 2018 database from the Central Bureau for Statistics [CBS] of the Netherlands. The neighbourhood therefore accounts for 3.2% of the population of the city of Breda. The average household size of Boeimeer is 2.1 inhabitant per household, which is also the case for the whole city (Ibid). The gender distribution of Breda and Boeimeer are almost similar, but the percentage of woman inhabited in Boeimeer (52%) is slightly larger than that of Breda (51%) (Ibid).

Furthermore, the data on household structures as reported by CBS (2018a) show that the number of households with children is slightly higher in Boeimeer (32%) than it is in Breda (30%) (Ibid). This can possibly be explained by the large variety of educational facilities in the neighbourhood.

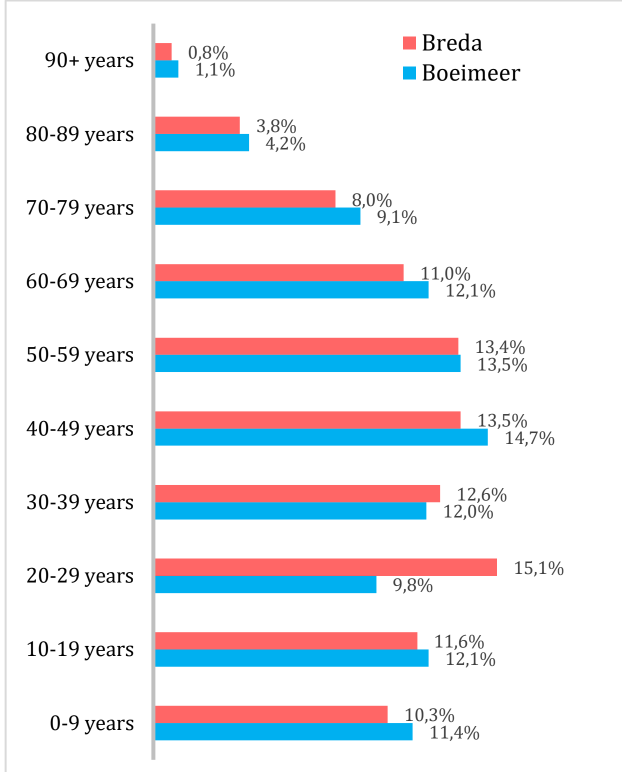

Figure 2.4. Age distribution Breda and Boeimeer. Data obtained from Municipality of Breda (2018).

The last demographic aspect that should be discussed is that of the age distribution of Boeimeer (in comparison to that of Breda), as shown in figure 2.4. The age group in which the most difference can be seen is that of the ages between 20 and 29 years, this group is less present in the Boeimeer neighbourhood (9,8%) than in Breda (15,1%). This could indicate that the number of students and young professionals living in the neighbourhood is relatively low. Furthermore, the percentage of 30 to 39 year is slightly lower and the percentage of 40 to 49-year-old residents is slightly higher than that of Breda (figure 2.4). When excluding lower age groups from the survey the average age of the sample might increase drastically.

2.1.2 The Burgemeester van Sonsbeeckpark and the Zaartpark

The parks that are included in the survey are the Burgemeester van Sonsbeeckpark (from now on Sonsbeeckpark) and the Zaartpark. The parks are located relatively close to each other and are connected with a path that runs alongside the Aa river. Both parks are of relatively large size in comparison to other parks in Breda.

The Sonsbeeckpark (figure 2.5) is located in the area where in the 15th century the river of de Aa debouches into the Mark river (Sonsbeeckpark, 2019a). Current surface water in the park, however, is not connected to these rivers anymore. The park was officially opened in 1936 by the mayor, van Sonsbeeck, on the day he left to become governor in the southern province of Limburg (Ibid). The Sonsbeeckpark during this time was an important feature in the neighbourhood, especially in combination with the sporting facilities[1] (Ibid). However, at the current time only the swimming pool and tennis court remain a physical feature in the neighbourhood. The global financial crisis in 2008, had a negative effect on the city of Breda's

[1] Sporting facilities including a swimming pool, former football stadium of the city's football club, cinder track and a tennis court.

budget and thus impacted the funding available for park maintenance. The lack of maintenance negatively influenced the appearance of the park. In 2012, the residents around the park started helping with the maintenance of it. Thanks to a deal (mentioned as park deal) between the municipality and the organisations 'IamSonsbeeck' (a local citizens' initiative) and 'Showkorps Concento' (a musical corps), they are now responsible for the maintenance of the park (Municipality of Breda, 2019a). This shows that the park is of value to the neighbourhood, as residents are proactively involved in its maintenance. Assuming that the municipality has recovered from the global financial crisis, this shows that the park deal is of value for both parties as the park deal is still active in current time.

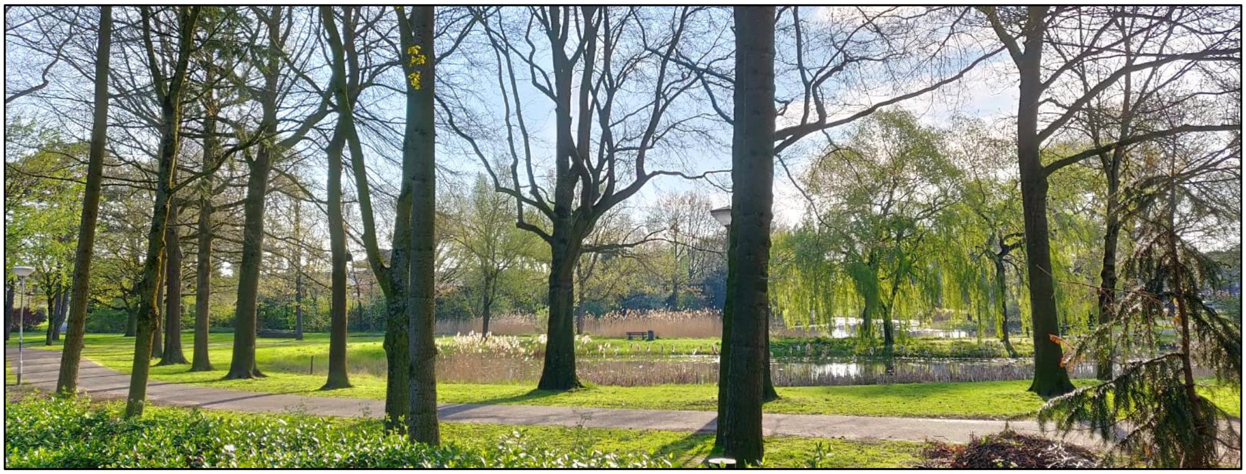

Figure 2.5. Burgemeester van Sonsbeeckpark in Breda (Author).

The Zaartpark (figure 2.6) is located along the Aa river and is in comparison to the Sonsbeeck park less centrally located in the neighbourhood. It also has less access points in the neighbourhood than the Sonsbeeckpark, which could influence the overall visitation of residents. However, as it is situated alongside the Aa river, it can more easily be used for longer walks along the river and its accompanied green spaces. The Zaartpark was restructured in 1996 to include more transitional areas between lower wet and higher dry areas (Zaartpark Breda, 2019). In 2005, the river meanders were restored and replaced the several weirs that were in place. These changes add to the more natural and ecological character of the park. The Zaartpark is considered to have a more ecological (maintained) appearance than other parks in Breda (Ibid). Implying that the appearance of the park is more similar to a small nature reserve than an urban park.

Figure 2.6. Zaartpark Breda (HSN Landscape Architects, 2019).

§ 2.2 Research type and data gathering methods

2.2.1 Research type

This study is of empirical-analytical nature and has utilised a mixed-methods approach (embedded design), which was primarily focused on quantitative research methods. Specifically, the quantitative insights are embedded into a more complete picture formed by the qualitative results. The quantitative part of this study has focused on the analysis of survey data, conducted in the Boeimeer neighbourhood. In the survey, the respondents answered questions about their usage of the parks, the activities they undertake in them and how they perceived the park's safety and accessibility. In addition to a survey, participant observations are a common method used in this kind of research. However, this study also tried to define why people might not visit parks as often as others and the influence of specific characteristics on this. Furthermore, observations are limited by specific times individuals visit and make it difficult to define separate users as some might visit daily and others only monthly. Defining park usage and the characteristics of influence on this was therefore opted as best done by a large home-to-home survey. Survey data statistically confirmed or contradicted specific relations between the variables, which made quantitative research a sufficient method for defining the park usage.

The qualitative part of this study enriches the overall empirical data, creating a more complete picture of green space policy and planning in Breda. This part of the study was primarily focused on several semi-structured expert interviews, which provided an insight into how the functionality and valuation of green spaces is translated into policy in Breda. Another qualitative aspect of this study was the analysis of empirical documents, particularly policy documents of the municipality of Breda.

2.2.2 Quantitative data gathering

The outline of the survey (Appendix A.2 & A.3) roughly followed the constructs and variables as discussed in the following paragraph. The content of the survey was kept to a minimum as the size of the survey was expected to negatively influence the number of responses. In order to minimize the non-response rate to the survey, the community board of Boeimeer and IamSonsbeeck were contacted to help with notifying a part of the inhabitants in advance. This rather 'official' notification was expected to stimulate residents to fill in the survey. The notification created a snowballing effect through the neighbourhoods, as some respondents immediately mentioned receiving a message via Whatsapp or Facebook. Furthermore, in order to mitigate the number of respondents lost between receiving the invitation and actually filling in the survey, the option to leave an e-mail address for having a chance of winning a 30-euro gift card was added.

Privacy of respondents was an important aspect of the empirical data gathering. The privacy of the respondents was at no point in this study violated. Personal information was processed separately from the survey data. Furthermore, leaving personal information (i.e. e-mail addresses for receiving the results and having a chance of winning the price) was kept to a minimum. The personal information of respondents remained private, was not distributed and deleted after finalising the study. Respondents had no obligations in leaving personal information and most questions of the survey could be skipped.

The theoretical sample was considered to be the whole population of Boeimeer, which had 5780 residents at the time. However, to sufficiently collect survey data the sample was operationalised. The operational sample was designed to consist out of residents that have been and/or will be living in the neighbourhood for a longer period of time, because their experience with the parks was expected to be based more on substantial experience. In order to increase valuable response, the operational sample was limited to residents older than 19 (76,5 percent of the population) as these residents were considered to be homeowners, long term renters or students living on their own or living with their parents. The age limit also helped with conducting a home-to-home survey, as almost every home inhabited a resident whom was older than 19 years. The operational sample size thereby consisted of 4422 residents (5780/100*76,5). The manner in which the respondents were contacted did put another frame on the sample. In this case, a home-to-home survey was the most sufficient and privacy friendly method to conduct the survey. The number of households located in the Boeimeer is 2394 (Vastgoeddata, 2019). In order for the survey response to be less biased, only one person per household was allowed to fill in the survey. This had put the sample size with accompanied frame on 2394 households. A large sample size made way for dividing the sample into several groups when needed for analysis. The response needed for this analysis was estimated around 200 to 240 respondents. With a sample fraction of 10% (k=240/2394) and an estimated response of 20%, the number of invitations needed to be delivered was 1200 (=240/20*100).

The survey was conducted randomly. In order to create a random sample of addresses, the database of Vastgoeddata (2019) (a large real estate database) was used to create a list of all addresses in Boeimeer that were categorised as residential. This list was thoroughly checked for flaws. Although the list was checked numerous times, errors did still occur. Due to these errors, a total of 1130 addresses were reached and provided with an invitation for filling in the survey. Additional explanation on the errors can be found in chapter 5. In total 357 residents responded to the survey (table 2.1).

Table 2.1. Survey response rate.

	Number of addresses	Proportional
Response	357	31,6 %
Declined	351	31,1 %
Non-response	422	37,3 %
Addresses contacted	1130	100,0 %

The strategy that was used for gathering survey respondents had a focus on increasing the response by having face to face conversations with the residents. A large number of respondents appreciated this personal manner of contacting. In general, residents were contacted on a weekday (primarily Wednesdays and Fridays), the remaining addresses were visited on a weekend day (primarily Saturdays) or a public holiday (one of the surveying days was on Good Friday). The last wave of surveys was conducted on afternoons and evenings. After this final round of going door to door, if no one was home, an invitation letter was left in the residents' mailbox providing instructions about filling out the survey online. Additional explanation of the survey gathering period can be found in Appendix A.1.

Table 2.2. Survey acceptation rate.

	Number of addresses	Proportional
Accepted verbal invitation	555	49,1 %
Declined verbal invitation	351	31,1 %
Received hard-copy invitation	224	19,8 %
Addresses reached	1130	100,0 %

If the respondent was home, a short verbal explanation of the study and the survey was given. When respondents agreed to participate, they were given a short note (Appendix A.1) with an explanation and the weblink to the online survey. If the resident did not react positively on the online survey, they were offered to fill in a hard-copy survey instead, which was gathered on a specific day and time discussed with the resident. The combination of an online and a hard-copy survey was shown to be useful. A large number of residents would in first instance respond negatively on filling in a survey, after hearing that the survey could be filled in online whenever they had time in the next few days, most would accept the invitation. However, as expected beforehand, there was a difference between residents accepting the invitation and those filling in the survey as can be seen when comparing table 2.1 with table 2.2.

Almost half (49,1%) of the 1130 addresses contacted accepted the invitation for filling in the survey (including hard-copy surveys). In total, 351 residents (31,1%) were not interested in participating in the survey. Only 19,8% (n= 224) of the addresses were not home after the third time and therefore received the hard-copy invitation for the online survey. With a response rate of 31,6% a total of 357 residents filled in the survey. Six of these surveys were deemed as not useful due to missing values and where excluded from the dataset.

2.2.3 Qualitative data gathering and analysis

The qualitative part of this study was largely based on (expert) interviews and a policy document analysis. The interviews were conducted in a semi-structured manner, as this allowed the interviewer to steer the topics discussed in the interview whereas the interviewee remains able to provide additional subjects. The structure that was given to the interviews was materialised in the form of a by theme structured list of questions, which guided the overall subjects of the interview (Appendix B). The key participants (table 2.3) for this study were considered to be municipal planning officials, a member of the voluntary organisation maintaining the Sonsbeeckpark and a community board member. The interview data was processed anonymously, interviewees were only mentioned by their occupation or relation to the topic of this study. The interview parts relating to the topic of research were transcribed, other parts were summarized (Appendix B).

Table 2.3. Interview respondents

	Respondent	**Date**
Interview A	Founder I am Sonsbeeck	April 18, 2019
Interview B	Two members of the community board of Boeimeer	May 2, 2019
Interview C	Municipal official of the department of urban space	May 2, 2019
Interview D	Municipal official of the department of mobility and environment	May 13, 2019

Note: GGD = Municipal Health Services Organisation

The document analysis of this study was largely based upon policy documents, such as the municipal coalition agreement, municipal area development visions, municipal spatial adaptation ambitions and the municipal climate implementation. The document analysis is limited to the policy documents deemed relevant for the research subjects.

§ 2.3 Operationalisation

2.3.1 Constructs and other variables

Construct Perceived Accessibility

The perceived accessibility of respondents was tested via a construct. Nicholls (2001) explains that the meaning of accessibility is referred to as, the ease with which a resident can reach a service (such as a park). According to Wang et al. (2015), perceived accessibility is the subjective dimension of accessibility and thereby measures the extent to which individuals consider the service accessible. Therefore, the items of this construct were primarily focused on the accessibility experienced by the respondents. Wang et al (2015) consider the perceived accessibility as the outcome of individual evaluation of a diverse set of attributes of park access, for example, foot path connection, proximity and transport. Which indicated that different means of transport should be included in the construct. The items used by Wang et al. (2015) (figure 2.7) offer an overall good internal consistency (Cronbach's alpha = 0.801). These items therefore were taken into account when forming the items used in this study.

1. How would you rate your overall ease of access to this park?
2. How easy is it for you to physically get to this park?
3. Are there any socio-personal issues (e.g. perceived safety issues or antisocial behaviour) that make you avoid visiting this park?

Figure 2.7. Perceived Accessibility items (Wang et al., 2015, p. 88).

The three questions from figure 2.7 show the division between perceived accessibility, perceived physical accessibility and perceived socio-personal accessibility. Furthermore, Wang et al. (2015) mention questions such as "I can easily walk to this park" and "The walk to this park is a pleasant experience" (p. 57) to define walkability. These questions also indicate the accessibility by various means of transport, as discussed before. Supporting the usage of several means of transport in the same construct.

Construct Perceived Safety

McCormack et al. (2010) state that, among others, (perceived) safety is of importance in encouraging park usage. They state that most personal safety concerns mentioned in studies are associated with the presence of undesirable users of parks (e.g. drug users, homeless persons, loiterers). Furthermore, specific physical attributes such as lighting and increased security and surveillance, are considered to influence the perceived safety of parks (Ibid). Wang, Brown & Lui (2015, p. 57), utilised questions such as "There are people participating in illegal activities around this park" and "This park is regularly patrolled by police" to further define this construct. However, the perceived safety of parks does not only encompass the safety of individuals but also the safety of children or pets that a person brings to the park (Ibid). For example, residents with dogs might feel less safe visiting a park with a busy road next to it, because of the possibility of the dog getting injured by traffic. This same fear also would apply to individuals bringing their younger children to parks. Therefore, traffic safety, undesirable users and physical attributes were all taken into account in defining the construct of perceived safety.

Proximity to park

The proximity from the respondent to the park was ideally measured in the actual distance from home to the park. A commonly used range from which most park users could be drawn is that of a radius of 500 meters from the park (Giles-Corti, 2005). A simple manner of measuring this would be to ask the respondent to write down their actual walking distance from home to the park. However, this would require another action to be done by the respondents, which was expected to have a negative influence on responses. Another manner of doing this was adding a survey number to the invitation and linking them to the list of addresses. However, this manner will include a privacy sensitive component, as respondents home addresses are linked to their survey information. Several options therefore were added into the survey. To start with, the respondents were asked to either fill in their exact walking distance measured via google maps or fill in the survey number. As safety question a question was added that measured in an ordinal manner with increments of 250 meters. Data gathering had shown that most respondents did not mind leaving their survey number.

Park visitation

The actual park visitation of the respondent was measured with two questions about the average frequency of visits per week and the average time spent in the park per visit. Frequency was considered to be a more sufficient question when an ordinal division was used, for example, daily, weekly monthly and so on. When analysing data, visitation was divided into average frequency and duration of visits and an average overall amount of time spent in the park per month.

Activity and intent

The activity and intent of the individuals visit to the park highly relate to each other. Both variables are expected to highly influence the mechanisms and actual health benefits gained from the visit. For example, walking is an activity that can be done in the park, but the respondent's intent of walking can differ. An individual can walk through the park to get from one point to another, as a means of traveling, or simply to get some rest and physical activity. Thus, a difference was made between traveling through the park as a means to an end and visiting the park as an end itself. Simple activities such as, walking (as means and as end), running (for physical activity), biking (as means and as end), sitting (for rest and restitution or stress reduction) and nature observation (idem) were also taken into account. The activities proposed by Brown et al. (2014), shown in table 1.3 (p. 23), were used for operationalisation of this variable.

2.3.2 Controlling variables

The survey included basic questions regarding personal information, however, the majority of questions in the survey were optional and all questions regarding personal information could be skipped. To specify, questions about the respondent's gender, age, education level and household structure were asked. Age and gender were expected to be important personal variables when discussing park visitation. These questions gave more insight into what kind of respondents filled in the survey. The overall demographic data of the neighbourhood allowed to check if the response was representative for the whole neighbourhood, which is done in paragraph 2.5.

2.3.3 Reliability and validity

Overall reliability can be increased when the number of respondents is maximised, therefore, this study aimed to have as many respondents as possible given the specific time constraints. The internal reliability of the construct used in this study were primarily tested for their internal consistency with the measurement of the Cronbach's alpha. Items that had shown to decrease the internal consistency were removed (if not logically essential to the construct) to improve consistency of the constructs. The internal consistency of a construct was considered sufficient if Cronbach's alpha was between 0.7 and 0.8. A Cronbach's alpha between 0.8 and 0.9 means a construct had good internal consistency and above 0.9 the internal consistency was considered to be excellent (De Vocht, 2017). Furthermore, the items within the constructs were analysed by several people to maximise the validity of the construct. The external reliability of this study is assumed to be sufficient, as it is largely based on a wide variety of studies. The act of comparing the survey data to the demographic data and accompanied weighting factors improves the reliability and ecological validity of the study.

§ 2.4 Analytical testing

The hypotheses from the theoretical background are linked to fitting statistical testing procedures. The data from the survey were tested by the statistical tests mentioned in this section. All hypotheses consist of an independent variable influencing a dependent variable and the variables have an interval or ratio scale of measurement. This translates to linear regressions as parametrical tests used for analysing the relations.

Table 2.4. Analysis scheme.

Nr.	**Hypothes**is	**Independent variable -** ***scale of measurement***	**Dependent variable -** ***scale of measurement***	**Statistical testing procedure**
1.	The higher the individuals perceived accessibility of the park, the higher the visitation.	Perceived accessibility - *Interval*	Visitation - *Ratio*	Linear regression
2.	The higher the individuals perceived safety of the park, the higher the visitation.	Perceived safety - *Interval*	Visitation - *Ratio*	Linear regression
3a.	The higher the proximity to the park, the lower the perceived accessibility.	Proximity to the park - *Ratio*	Perceived accessibility - *Interval*	Linear regression
3b.	The less distance between the park and respondent, the higher the visitation.	Proximity to the park - *Ratio*	Visitation - *Ratio*	Linear regression
3c.	The less distance between the park and respondent, the more reasons individuals can think of to visit.	Proximity to the park - *Ratio*	Number of reasons - Ratio	Linear regression
4.	The more activities an individual participates in within the park, the higher the visitation.	Number of activities - *Ratio*	Visitation - *Ratio*	Linear regression

As the majority of the hypotheses were focused on searching for explaining visitation, multiple linear regressions based upon all variables were conducted in order to surface the model that explains the largest variance. Separate reasons and activities were taken into account in these models as well.

The statistical test includes several assumptions that needed to be checked before conducting the analysis. In the process of data gathering and analysing the following assumptions were needed to be met for a regression analysis (De Vocht, 2017):

1. Independent observations
2. Both variables have an interval or ratio scale of measurement
3. The relation is theoretically causal: independent X influences independent Y; not vice versa.
4. The relation is linear. Check with scatter plot.
5. The residuals are normally distributed.
6. The residuals have a consistent variance.

All assumptions were deemed as sufficient, Appendix C.1 includes the plots for checking assumptions four five and six. For testing a multiple linear regression another assumption that had to be met, namely that of no multicollinearity. This assumption means that the independent variables in the multiple linear regression model cannot have strong correlations between them ($r > 0{,}7$). As the multiple linear regressions were not the main focus of this research, this assumption was not profoundly checked. However, a paired correlation matrix of each multiple regression was added in Appendix C.2. Further tests regarding multicollinearity were not executed.

Next to meeting the assumptions of the parametrical tests the sample also needed to be representative to the whole neighbourhood, in order to be able to construct statements about this population. The following paragraph therefore discusses the sample characteristics and representativity.

§ 2.5 Survey sample characteristics and representativity

In this paragraph the representativity of the survey sample is discussed. The descriptive statistics of the survey sample are discussed on the basis of six demographic variables, namely gender, age, household structure (and size), type of residency and education level. These variables give an insight into the characteristics of the survey response group upon which the results are based. Furthermore, some variables were compared with existing demographic data to check if the sample was representative for the whole neighbourhood. The results of the goodness-of-fit tests indicate if the survey is representative, these results are discussed below. In order to provide valid statements about the population the data of the survey needs to be tested on representativity.

Gender & Age

The gender distribution of the sample shows that 57% (n= 185) of the sample is female and 43% (n=142) male. In total 327 respondents answered this question (24 missing values). The average age of the respondents in the sample is 53 years. In comparison to the existing demographic data (p. 28), this seems relatively high. However, it should be noted that no respondents under 20 were taken into account, which justifies the relatively high average age[2]. The youngest respondent is 21 and the oldest 91 years old. In total, 324 respondents have given their age (28 missing values).

The chi-squared goodness-of-fit test shows that the age distribution of the samples does not match that of the population. Especially the age group of 20 to 29-year-old respondents is underrepresented and the age group of 50 to 59-year-old respondents is overrepresented. These differences are shown to be significant, $X^2(6) = 40$; $p = 3{,}72e\text{-}07$. The goodness-of-fit test of the gender distribution of the sample has shown to be fairly similar to the population data, $X^2(1) = 2{,}7$; $p = 0{,}098$.

Household structure and size

The household structure of the sample is divided into three categories based on existing datasets from the CBS (2018a), the categories being one person households, multiple person households without children and multiple person households with children. The percentage of one person households is 18% (n = 60), multiple person household with children accounts for 48% (n = 156) of the sample and multiple person

[2] Using the demographic data from paragraph 2.1 to calculate the average age with exclusion of residents under 20 years old shows an average age of 51.8 years old.

households without children 34% (n =111). The total respondents on this question is 327 (24 missing values). The average household size is 2,7 persons per household (n = 322). The majority of the households of the sample are two-person households (35%, n = 115) and four-person households (26%, n = 83).

The average household size of the sample indicates that larger households are overrepresented. The chi-squared goodness-of-fit test of household structure shows that there is a significant difference between the distribution of the population and the sample, $X^2(2) = 74$; $p < 2{,}2e\text{-}16$.

Type of residency

The data of this variable shows that the majority of the sample lives in row houses, namely 71% of the sample (n = 232). The least frequent type of residency is that of the fully detached houses, this type accounts for only 1,5% (n = 5) of the survey sample. The number of residents living in apartments and semi-detached homes is fairly equal in the sample, namely 13% (n = 44) semi-detached and 14% (n = 46) apartments. This variable has a total of 327 responses (24 missing values).

Education level

This variable is separated into three categories, namely lower[3], middle[4] and higher[5] level of education. The majority of the survey respondents belongs to the latter category, 74% (n = 240). Only 7% (n = 24) can be considered of the lower education level and 18% (n = 59) of the middle education level. Only one respondent has no education. In total 324 respondents filled in this question (27 missing values). The goodness-of-fit test has not been conducted on this variable as no comparable population data was found. However, the percentage of high educated respondents suggest that this distribution does not fit general population data. The distribution of education of Breda shows that 33% of its inhabitants has a lower level education, 39% a middle level and 28% a higher level of education (CBS, 2018b). Witch further substantiates that the sample does is not representative on this variable.

Table 2.5. Weighting factors age groups.

Age categories	Sample	Weighting factor	Weighted sample	
years	**n**	**G**	**n*G**	**%**
20-29	12	3,448	41	12,8
30-39	52	0,974	51	15,7
40-49	67	0,926	62	19,2
50-59	85	0,671	57	17,7
60-69	60	0,851	51	15,8
70-79	33	1,164	38	11,9
80+	14	1,598	22	6,9
Total:	**323**		**323**	**100%**

Weighting cases

[3] Primary school, lower vocational education [LBO], lower technical education [LTS], lower economic and administrative education [LEAO], lower household and industrial education [LHNO], normal general secondary education [MAVO], more extensive primary education [MULO] and preparatory secondary vocational education [VMBO]

[4] Secondary vocational education [MBO], higher general secondary education [HAVO] and preparatory scientific education [VWO]

[5] Higher professional education [HBO], higher technical education [HTS], higher economic education [HES] and scientific education [WO]

The goodness-of-fit test has shown at multiple variables that the survey sample is not representative for the research population. The survey data is weighted[6] on the basis of one variable, namely age. The weighting factors are presented in table 2.5. Although this does skew the survey data to fit the age distribution, there are still some variables that have significant differences in distribution between the sample and population. Therefore, the weighted sample cannot be deemed as representative.

Thus, the hypothesis discussed in the next chapter were tested with weighting factors. In other words, the outcomes of statistical tests as discussed in the following chapter solely provide insights on the sample.

[6] Weighting of cases is conducted with the survey package for RStudio.

Chapter 3: *Research results*

In this chapter the research results are presented and discussed. The first paragraph starts at a smaller spatial scale and discusses park usage in the neighbourhood of Boeimeer, which is primarily based upon the survey results. Following this subject, urban green spaces of the neighbourhood are discussed based upon several forms of data. The second paragraph discusses the broader subjects of healthy urban living and green spaces in the city of Breda. These results are primarily based upon the interviews and a review of policy documents (i.e. environmental planning policy, coalition agreement).

§ 3.1 Park usage Sonsbeeckpark and Zaartpark

3.1.1. Descriptive statistics

Park visitation is measured in two variables, namely the average duration in minutes per visit and frequency of the visits of individuals. The combination of both variables gives an insight into the overall time a person spends visiting each park per month, which is also used as dependent variable within several hypothesises. Analysing these three variables separately is done because some independent variables have more effect on the duration of the visit than on the frequency of visits or vice versa. With this approach, these differences become more easily noticeable.

Table 3.1. Average duration, frequency and overall visitation.

	Zaartpark			**Sonsbeeckpark**		
	Duration	Frequency	Visitation	Duration	Frequency	Visitation
Mean	18,92	3,88	92,21	20,07	5,73	128
Standard Error	1,45	0,39	12,14	1,40	0,56	16,07

The descriptive statistics of the survey show that in general the Sonsbeeckpark is visited more often and for a longer amount of time, which add to a higher overall visitation (Table 3.1). This might be due to the fact that the Sonsbeeckpark is more centrally located within the neighbourhood.

Table 3.2. Average traveling time with most used type of transport.

	Zaartpark	**Sonsbeeckpark**
Mean	7,00	4,28
Standard Error	0,34	0,38

Additional data on the average traveling time (table 3.2), according to respondents, shows that a majority of the sample is based upon inhabitants living closer by the Sonsbeeckpark. Respondents on average need to travel approximately two minutes and 45 seconds longer to the Zaartpark than to the Sonsbeeckpark (standard error is ± 22 seconds). Thus, confirming the central location of the Sonsbeeckpark.

Table 3.3. Number of respondents most used type of transport (frequency and proportion).

	on foot	**biking**	**moped or scooter**	**car**	**Total**
Zaartpark Freq.	222	77	3	1	303
Prop.	73,3 %	25,4 %	1,0 %	0,3 %	100 %
Sonsbeeckpark Freq.	247	67	2	0	316
Prop.	78,2 %	21,2 %	0,6 %	0 %	100 %

Although there seems to be a difference in average traveling distance, as shown in table 3.3, the majority of respondents visited the park on foot (Z 73%; S 78%) or by bike (Z 25%; S 21%). Whereas the other forms of transportation are almost not used within the sample population. These basic descriptive statistics give a first insight into the usage of the parks. The following sections focuses on the actual results of the hypotheses.

3.1.2. Hypotheses results

Hypothesis 1: *The higher the individual(s)' perceived accessibility of the park, the higher the overall visitation.* Accessibility in general is seen as an important factor in the usage of public spaces (Giles-Corti et al., 2005). A study by Wang et al. (2015) showed that perceived accessibility is a better indicator for user intention than the geographic distance. This hypothesis investigates the relation of perceived accessibility to the visitation of parks.

Perceived accessibility was measured in a construct which has been transformed to a standardised likert score for analytical testing. The internal consistency of the construct of perceived accessibility has shown to be sufficient for both the Sonsbeeckpark (Cronbach's alpha = 0,72) and the Zaartpark (Cronbach's alpha = 0,78). The mean standardised likert score of perceived accessibility in the Zaartpark is 0,46, which indicates an overall positive accessibility (SE = 0,015). The mean for the Sonsbeeckpark is a small portion higher than that of the Zaartpark, namely 0,52 (SE = 0,015). In general, this relatively small difference in perceived accessibility can be accounted to the fact that the Sonsbeeckpark is more centrally located within the neighbourhood.

Linear regression models were formed between perceived accessibility per park and its effect on the three variables of visitation (outcomes shown in table 3.4). All relations can be considered to be positive but weak ($0,1 < r < 0,3$) or even very weak and non-existing (according to Cohen's rule of thumb). However, the outcomes show that there is a stronger correlation between the frequency of visits than that of the duration and the individual's perceived accessibility of the parks. Furthermore, the outcomes show that there are significant effects between all visitation variables related to the Zaartpark, but only to frequency of visits when looking at the Sonsbeeckpark.

Table 3.4. Outcomes linear regression perceived accessibility and visitation (hypothesis 1).

	Zaartpark (df = 299)			**Sonsbeeckpark** (df = 308)		
	Duration	Frequency	Visitation	Duration	Frequency	Visitation
Correlation (r)	0,15	0,29	0,24	*0,00*	0,16	*0,10*
Level of significance (p)	< 0,05	< 0,001	< 0,001	*0,96*	< 0,01	*0,097*
Regression coefficient (b)	10,99	8,72	215,66	*ns*	7,06	*ns*
t statistic	2,46	4,66	3,72	*ns*	2,90	*ns*
Effect size (Adjusted R^2)	0,02	0,08	0,05	*ns*	0,02	*ns*

Note: df = degrees of freedom; ns = no significant effect

The formulas constructed based upon the outcomes of the separate linear regression models can be found in figure 3.1. These show that for the Zaartpark one unit of perceived accessibility adds to approximately 11 more minutes per visit, 9 more visits per month and in total 3 hours and 36 minutes more spend in the park per month. For the Sonsbeeckpark one unit of perceived accessibility adds to 7 more visits per month.

Average duration of a visit to the Zaartpark	= 13,89 + 10,99 * PA
Monthly visits to the Zaartpark	= - 0,11 + 8,72 * PA
Monthly minutes spend in the Zaartpark	= - 6,54 + 215,66 * PA
Monthly visits to the Sonsbeeckpark	= 2,05 + 7,06 * PA

Figure 3.1. Formulas explaining visitation per unit of perceived accessibility (PA) (hypothesis 1).

This hypothesis shows that the perceived accessibility of individuals influences overall visitation. However, in case of the Sonsbeeckpark there is only a significant relation when looking at the frequency of visits. In the Zaartpark the correlation shows that there is a stronger relation between frequency of visits than the other variables. Based upon this data, it can be stated that the perceived accessibility of parks primarily influences the frequency of visits. In case of the Zaartpark (which is less centrally located) perceived accessibility seems to be of more importance in explaining variance in the three forms of visitation. The highest explained variance can be found in the relation between perceived accessibility and frequency of visits at the Zaartpark, where it explains 8% of the variance in frequency of visits.

Thus, as proposed by Wang et al. (2015), perceived accessibility, not only is an indicator for user intention but also for actual usage and in specific frequency of visits. However, as tested in hypothesis 3b, the walking distance between respondents and the park seems to be an overall more important factor in explaining actual visitation.

Hypothesis 2: *The higher the individuals perceived safety of the park, the higher the overall visitation.* According to Cohen et al. (2010), the perceived safety of parks negatively influences the usage when the overall safety is perceived as low. However, when the overall safety is perceived as high, then it does not influence visitation. Furthermore, McCormack et al. (2010) suggest that perceived safety is an indicator for perceived accessibility, which further substantiates the value of finding a direct relation between perceived safety and visitation.

Perceived safety was measured in a construct which has been transformed to a standardised likert score for analytical testing. The internal consistency of the construct of perceived safety are considered sufficient for both the Sonsbeeckpark (Cronbach's alpha = 0,74) and the Zaartpark (Cronbach's alpha = 0,69). The mean standardised likert score for perceived safety in the Zaartpark is - 0,013, which indicates a slightly negative perceived safety (SE = 0,015). The mean for the Sonsbeeckpark is a small amount higher than that of the Zaartpark, namely 0,09 (SE = 0,017), which indicates an overall positive perceived safety.

Table 3.5. Outcomes linear regression perceived safety and visitation (hypothesis 2).

	Zaartpark			**Sonsbeeckpark** (df = 307)		
	Duration	Frequency	Visitation	Duration	Frequency	Visitation
Correlation (r)	*-0,07*	*-0,02*	*0,00*	*0,06*	0,13	0,13
Level of significance (p)	*0,37*	*0,72*	*0,94*	*0,21*	*0,08*	0,01
Regression coefficient (b)	*ns*	*ns*	*ns*	*ns*	*ns*	131,00
t statistic	*ns*	*ns*	*ns*	*ns*	*ns*	2,59
Effect size (Adjusted R^2)	*ns*	*ns*	*ns*	*ns*	*ns*	0,01

Note: df = degrees of freedom; ns = no significant effect

The formula constructed (figure 3.2) based upon the outcomes shows that per unit of perceived safety the overall visitation of the Sonsbeeckpark increases with about 2 hours and 11 minutes per month.

Monthly minutes spend in the Sonsbeeckpark = 117 + 131 * PS

Figure 3.2. Formula explaining visitation per unit of perceived safety (PS) (hypothesis 2).

The single linear regressions on this hypothesis (outcomes in table 3.5) show that only one type of visitation is significantly affected by perceived safety. The data on the Sonsbeeckpark shows that perceived safety has a weak positive effect on overall visitation. A significant effect has been found which explains 1% (R^2 = 0,01) of the variance in visitation of the Sonsbeeckpark.

There are no significant results that are similar to the relation between perceived safety and visitation as suggested by Cohen et al. (2010). However, the data on the Zaartpark (generally negative perceived safety) shows a negative correlation between perceived safety and visitation, whereas the Sonsbeeckpark (generally positive perceived safety) shows a positive one. The results only show a significant effect on the overall visitation of the Sonsbeeckpark, which might have to do with the fact that the mean perceived safety was relatively higher than that of the Zaartpark. More difference between mean perceived safety, especially between negative and positive correlations, could surface interesting findings.

Hypothesis 3a: *The less distance between the park and respondent, the higher the perceived accessibility.*
An inconsistency within the literature makes this an interesting relation to explore. A study by Wang, Brown and Liu (2015) has shown that the actual distance between park and respondent is of low influence on the perceived accessibility of the park. Whereas a study by McCormack et al. (2010) concluded that proximity to the park is seen as a major indicator for perceived accessibility.

Table 3.6. Number of respondents per walking distance (in meters) category and park.

Distance categories	Zaartpark		Sonsbeeckpark	
	Freq.	Prop.	Freq.	Prop.
0 - 250	18	5,5 %	124	37,7 %
250 - 500	58	17,6 %	119	36,2 %
500 - 750	72	21,9 %	59	17,9 %
750 - 1000	91	27,7 %	24	7,3 %
1000 +	90	27,4 %	3	0,9 %
Total	**329**	**100 %**	**329**	**100 %**

The walking distance between parks and respondents is measured with the measurement tool of google maps, which can be considered as a fairly accurate indicator for actual walking distance. As discussed in the previous chapter the two parks differ in their geographical location within the neighbourhood and the survey data confirms this point. The Sonsbeeckpark, which is more centrally located, has a mean distance (from park to respondent) of approximately 360 meters (SE = 14,04), whereas the Zaartpark has a mean distance of 780 meters (SE = 18,09). This difference can also be seen when looking at the number of respondents in relation to the distance to the parks in table 3.6. The number of respondents increases when the distance to the Zaartpark increases, whereas it decreases at the Sonsbeeckpark. When combining the data with the maps as used in the online survey (Appendix A.3), it becomes clear that a larger number of residents live closer to the Sonsbeeckpark than the Zaartpark.

Table 3.7. Outcomes linear regression walking distance and perceived accessibility (hypothesis 3a).

	Zaartpark (df = 284)	**Sonsbeeckpark** (df = 276)
Correlation (r)	-0,35	-0,19
Level of significance (p)	< 0,001	< 0,01
Regression coefficient (b)	-0,0003	-0,0002
t statistic	-6,17	-2,76
Effect size (Adjusted R^2)	0,113	0,028

Note: df = degrees of freedom

The formulas (figure 3.3) based upon the data from this test show that every 100 meters the standardised likert score of perceived accessibility of the Zaartpark decreases with 0,03, in case of the Sonsbeeckpark this number is 0,02.

Perceived accessibility of the Zaartpark	= 0,66 - 0,03 * Di
Perceived accessibility of the Sonsbeeckpark	= 0,59 - 0,02 * Di

Figure 3.3. Formulas explaining (standardised likert score) perceived accessibility per unit of distance (Di) (hypothesis 3a).

The regression analysis (table 3.7) of this hypothesis shows a fairly strong negative correlation between distance and perceived accessibility when it comes to the Zaartpark. This relation is less prominent in the data from the Sonsbeeckpark, as this relation can be considered to be weak. However, in both cases there seems to be a significant effect of distance on perceived accessibility. The linear regression on the Zaartpark shows the highest explained variance, namely 11,3%. Which means that 11,3% of the variance in perceived accessibility can be accounted to distance from the respondent to the park. In the case of the Sonsbeeckpark this is only 2,8%.

The results on this hypothesis on the one hand show that perceived accessibility is relatively strongly affected by walking distance to the park in the case of the Zaartpark. On the other hand, in a more centrally located park, the Sonsbeeckpark, this is less the case. In general, it seems that these findings are in line with the study of McCormack et al. (2010) instead of that of Liu (2015).

<u>**Hypothesis 3b:** *The less distance between the park and respondent, the higher the overall visitation of the park.*</u> There was some inconsistency within literature regarding this subject. As discussed in the theoretical chapter, a widely cited study by Giles-Corti et al. (2005) has shown that distance influences park usage. Another study (Mowen et al., 2007) did not find a significant relation between distance and the frequency and duration of visits. Therefore, this hypothesis focuses on a specific relation between walking distance and visitation.

Table 3.8. Number of respondents divided into distance and visitation categories.

		Frequency of visits per month									Average minutes per visit							
		1 to 5	5 to 10	10 to 15	15 to 20	21 to 25	26 to 30	31 to 35	35+	**Total**	1 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	60+	**Total**
Distance (m) to Sonsbeeckpark	0 - 250	48	29	12	3	9	6	3	4	114	51	21	23	2	8	6	3	114
	250 - 500	64	16	3	3		1			87	48	24	11	2	7	9		101
	500 - 750	28	2	2						32	22	8	10	1		2		43
	750 - 1000	14	1		1					16	9	3	4		3	1		20
	1000 +	2	1							3	2							2
	Total	156	49	17	7	9	7	3	4	**252**	132	56	48	5	18	18	3	**280**
Distance (m) to Zaartpark	0 - 250	7	5	2				1	1	16		7	8	2	1			18
	250 - 500	25	6	6		2	1	3	3	46	17	16	16	2	4	1		56
	500 - 750	41	6	2		1	2			52	18	22	18	1	2	1	1	63
	750 - 1000	44	9	3	1		1			58	29	23	11	3	1	1		68
	1000 +	33	6	1						40	20	19	9		4	3	1	56
	Total	150	32	14	1	3	4	4	4	**212**	84	87	62	8	12	6	2	**261**

Note: shading added as emphasis on increasing numbers of respondents per category.

As discussed in the previous hypothesis, the geographical location of the parks is a prominent factor influencing the usage of the parks by inhabitants of the neighbourhood. When crossing the data from frequency and duration of visits with the distance from park to respondent, this relation also becomes visible. Table 3.8 shows the number of respondents divided by distance and visitation categories. When looking at the data on the Sonsbeeckpark (the upper half of the table) most respondents are concentrated in the upper left corner. Most respondents visiting the park are located within 500 meters (walking distance) of the park, visit the park one to ten times a month and most likely remain in the park up to 30 minutes. The data on the Zaartpark shows that the majority of respondents visiting the park live between 250 and 1000 meters of the park, are most likely to visit the park one to ten times a month and remain on average between one and 30 minutes in the park. The difference between the parks is seen in the distribution within these margins and there seems to be more equal distributed respondents in the first three duration categories in the Zaartpark. In general, the respondents are visiting the Zaartpark less frequent but tend to stay longer in the park.

Table 3.9. Outcomes linear regression walking distance and visitation (hypothesis 3b).

	Zaartpark (df = 295)			**Sonsbeeckpark** (df = 297)		
	Duration	Frequency	Visitation	Duration	Frequency	Visitation
Correlation (r)	-0,21	-0,34	-0,28	-0,21	-0,33	-0,29
Level of significance (p)	< 0,001	< 0,001	< 0,001	< 0,01	< 0,001	< 0,001
Regression coefficient (b)	-0,012	-0,008	-0,201	-0,018	-0,014	-0,354
t statistic	-3,71	-5,31	-4,25	-3,08	-5,11	-4,65
Effect size (Adjusted R^2)	0,04	0,11	0,08	0,04	0,10	0,08

Note: df = degrees of freedom

The formulas (figure 3.4) based upon the outcomes show that in case of the Zaartpark per 100 meters walking distance between park and respondent the average duration of visits decreases with 1,2 minutes, the monthly frequency of visits with 0,8 times and the overall minutes per month with approximately 20 minutes. In case of the Sonsbeeckpark 100 meters accounts for a decrease in 1,8 minutes per visit, 1,4 times less visits per month and an overall decrease in visitation of about 35 minutes and 30 seconds per month.

Average duration of a visit to the Zaartpark	= 27,6 - 1,2	* Di
Monthly visits to the Zaartpark	= 9,8 - 0,8	* Di
Monthly minutes spend in the Zaartpark	= 245 - 20,1	* Di
Average duration of a visit to the Sonsbeeckpark	= 26,1 - 1,8	* Di
Monthly visits to the Sonsbeeckpark	= 10,3 - 1,4	* Di
Monthly minutes spend in the Sonsbeeckpark	= 251 - 35,4	* Di

Figure 3.4. Formulas explaining visitation per unit of distance (1 unit is 100 meters) (hypothesis 3b).

The linear regression on this hypothesis (table 3.9) shows that there are significant relations between distance and visitation. The correlation on the frequency of visits can be considered a negative relatively strong relation. Correlation on duration and overall visitation shows a weak negative relation. The distance seems to explain 8% of the variance in overall visitation of respondents and 10 to 11% of the variance in frequency of visits.

The data on this hypothesis shows that walking distance significantly effects visitation of parks, which makes distance an important factor for general visitation of parks. The largest explained variance was found at the influence of walking distance on the frequency of visits.

Hypothesis 3c: *The less distance between the park and respondent, the more reasons individuals can think of to visit.* Reasons that individuals have for visiting a park are expected to influence the activities and amount of visitation of the park. Furthermore, specific activities can be linked to a set of benefits obtained from green spaces as proposed by Brown et al. (2014). This hypothesis focuses specifically on the effect of distance on the number of reasons that individuals have to visit the park. A larger number of reasons is expected to increase the chance of visiting the park.

Table 3.10. Frequency table of reasons chosen for visiting the parks.

	Re 1	Re 2	Re 3	Re 4	Re 5	Re 6	Re 7	Re 8	Re 9	Other	Total
Zaart Freq.	142	213	65	35	30	1	16	80	25	34	641
Prop.	22,2%	33,2%	10,1%	5,5%	4,7%	0,2%	2,5%	12,5%	3,9%	5,3%	100%
Sons Freq.	142	182	44	30	63	8	10	125	20	34	660
Prop.	21,5%	27,6%	6,7%	4,5%	9,5%	1,2%	1,5%	18,9%	3,0%	5,2%	100%

Reasons 1: being in a natural environment; 2: exercise; 3: decreasing stress; 4: relaxing; 5: spending time with family and friends; 6: to be among people; 7: to be able to think clearly; 8: traveling through the park; 9: walking with the dog.

On average the respondents checked two reasons for visiting the parks (Zaartpark, mean = 1.95, SE = 0.1; Sonsbeeckpark, mean = 1.92, SE = 0.07). The main reason to visit both parks was to exercise (Z 33,2%; S 27,6%). The second most selected reasons were to be in a natural environment (Z 22,2%; S 21,5%). Other reasons that stand out is to travel through the parks to another destination (Z:12,5%; S:18,9%). The Sonsbeeckpark is more used for this latter reason in comparison with the Zaartpark, most likely also due to the geographical location of the Sonsbeeckpark.

Table 3.11. Outcomes linear regression walking distance and number of reasons (hypothesis 3c).

	Zaartpark (df = 301)	**Sonsbeeckpark** (df =301)
Correlation (r)	-0,35	-0,21
Level of significance (p)	< 0,001	< 0,001
Regression coefficient (b)	-0,002	-0,001
t statistic	-5,58	-2,76
Effect size (Adjusted R^2)	0,123	0,042

Note: df = degrees of freedom

The formulas (figure 3.5) based upon the outcomes of this linear regression show that for every 500 meters walking distance a respondent lives from the Zaartpark the respondent has 1 less reason for visiting it. In case of the Sonsbeeckpark this border is set at 1000 meters.

Number of reasons to visit the Zaartpark	= 3,16 - 0,2 * Di
Number of reasons to visit the Sonsbeeckpark	= 2,3 - 0,1 * Di

Figure 3.5. Formulas explaining number of reasons per unit of distance (1 unit = 100 meters) (Di) (hypothesis

The linear regressions on this hypothesis (table 3.1) show a relatively strong negative correlation between distance and number of reasons to visit the park in the data on the Zaartpark and a weak negative correlation at the Sonsbeeckpark. In both cases, distance has a significant effect on the number of reasons that individuals have for visiting the parks. The results from this hypothesis suggest that the further a park is away from inhabitants; the more effort is needed to give those a reason for visiting.

Hypothesis 4: *The more activities an individual participates in within the park, the higher the overall visitation.* This hypothesis focuses on the effect of the number of activities undertaken in parks on the overall visitation. The results help with further specifying the influences that activities that individuals undertake within the park individuals have on the visitation of parks.

Table 3.12. Frequency table of activities undertaken in the parks.

	Ac 1	Ac 2	Ac 3	Ac 4	Ac 5	Ac 6	Ac 7	Ac 8	Ac 9	Other	Total
Zaart Freq.	12	180	48	83	96	30	2	5	3	26	485
Prop.	2,5%	37,1%	9,9%	17,1%	19,8%	6,2%	0,4%	1,0%	0,6%	5,4%	100%
Sons Freq.	17	218	48	57	128	44	0	46	33	47	638
Prop.	2,7%	34,2%	7,5%	8,9%	20,1%	6,9%	0,0%	7,2%	5,2%	7,4%	100%

Activities 1: strolling; 2: walking; 3: walking with the dog; 4: jogging; 5: biking; 6: resting/sitting; 7: yoga/stretching; 8: active recreation (e.g. playing soccer); 9: other group activities (e.g. barbecuing and picnics).

On average the respondents carry out more activities within the Sonsbeeckpark (mean = 1,93; SE = 0,07) than in the Zaartpark (mean = 1,49; SE = 0,07). The most popular activity in both parks is walking in general (Z 37,1%; S 34,2%). Next to walking, the Zaartpark is mostly used for biking (19,8%) and jogging (17,1%). The Sonsbeeckpark is also used for biking (20,1%) but far less for jogging (8,9%). In general, walking and biking makes up for over half of the activities carried out in the parks. The data on the Sonsbeeckpark shows that it is more used for group activities (5,2%) and active recreation (7,2%) than in the Zaartpark (0,6%; 1,0%).

Table 3.13. Outcomes linear regression number of activities and visitation (hypothesis 4).

	Zaartpark (df = 315)			**Sonsbeeckpark** (df = 317)		
	Duration	Frequency	Visitation	Duration	Frequency	Visitation
Correlation (r)	0,50	0,21	0,26	0,33	0,31	0,31
Level of significance (p)	< 0,001	< 0,001	< 0,001	< 0,001	< 0,001	< 0,001
Regression coefficient (b)	9,32	1,61	59,81	5,87	2,81	74,59
t statistic	3,96	3,76	4,36	5,26	2,87	4,05
Effect size (Adjusted R^2)	0,25	0,04	0,07	0,11	0,09	0,09

Note: df = degrees of freedom

The formulas (figure 3.6) based upon the linear regression model are constructed as follows. In case of the Zaartpark with every additional activity the average duration of visit increases with about 9 minutes and 20 seconds, the frequency of visits increases with 1,6 times per month and the overall visitation of the park per month increases with approximately 1 hour. The data on the Sonsbeeckpark shows that with every additional activity the average duration of visits increase with 6 minutes, the average number of visits per month increases with almost 3 visits and the overall visitation with about 1 hour and 15 minutes per month.

Average duration of a visit to the Zaartpark	= 4,4 + 9,32	* Number of activities
Monthly visits to the Zaartpark	= 1,3 + 1,61	* Number of activities
Monthly minutes spend in the Zaartpark	= - 0,9 + 59,81	* Number of activities
Average duration of a visit to the Sonsbeeckpark	= 8,7 + 5,87	* Number of activities
Monthly visits to the Sonsbeeckpark	= 0,21 + 2,81	* Number of activities
Monthly minutes spend in the Sonsbeeckpark	= -18,3 + 74,59	* Number of activities

Figure 3.6. Formulas explaining visitation by number of activities (hypothesis 4).

The linear regression model on this hypothesis (table 3.13) shows that in the case of the Zaartpark there is a strong positive correlation between the amount of activities and the duration of visits, but a weak positive correlation with the frequency of visits. The data on the Sonsbeeckpark shows a relatively strong positive relation between number of activities and the overall visitation. All regressions show a significant effect from the number of activities on the visitation. The highest explained variance was found in the relation between number of activities and the duration of visits in the Zaartpark. In this case, number of activities explains 25% of the variance in average duration of visits of respondents.

Thus, the results of this hypothesis suggest that the more activities individuals undertake in a park, the more frequent and longer they will visit the park. This indicates that encouraging a diverse set of activities is an important factor for park usage.

3.1.3. Multiple linear regression models

In addition to the hypothesis discussed before, several multiple linear regression models have been put together. These models are constructed of the variables from the survey that were significant and produced a model with the highest explained variance. As weighting cases can influence the data to an extent that it can hide relations that the clean data would have shown, the models in this section are based on clean unweighted data. Open cells are variables that were found to have no significant effect within the model.

Table 3.14. Multiple linear regressions Zaartpark

Zaartpark	**Duration** (Adj. $R^2 = 0,252$)		**Frequency** (Adj. $R^2 = 0,223$)		**Visitation** (Adj. $R^2 = 0,108$)	
Variables	**b**	**p**	**b**	**p**	**b**	**p**
Intercept *(b0)*	*8,50*	*< 0,001*	*5,21*	*< 0,01*	*179,76*	*< 0,01*
Activity 2 (Act2)	10,12	< 0,001				
Activity 3 (Act3)	13,61	< 0,001	6,06	< 0,001		
Activity 6 (Act6)	12,05	< 0,001				
Activity 8 (Act8)	18,91	< 0,01			- 68,07	< 0,05
Perc. Access. (PA)			6,46	< 0,001	178,71	< 0,01
Distance (Di)			-0,006	< 0,001	- 0,05	< 0,001

Note: b = regression coefficient; p = level of significance.

Table 3.14 shows the models of visitation based upon data of the Zaartpark. The model on duration of visits explains 25% ($R^2 = 0,252$) of the variance by its variables. What these models show is that, when looking at the Zaartpark, a quarter of the variance in duration of visit is explained by four activities. These activities being, walking (act2), walking with the dog (act3), resting and sitting (act6) and active recreation (act8). The model on frequency of visits to the Zaartpark explains 22% of the variance and solely constructed upon the activity of walking with a dog, the perceived accessibility of the respondent and the distance between park and respondent. Whereas the model of overall visitation of the Zaartpark shows significant effects with active recreation, perceived accessibility and distance between park and respondent. However, the latter model only explains 11% of the variance in minutes of visitation per month.

Duration (minutes/visit)	= 8,5 + 10,12 * Act2 + 13,61 * Act3 + 12,05 * Act6 + 18,91 * Act8
Frequency (visits/month)	= 5,2 + 6,06 * Act3 + 6,46 * PA - 0,006 * Di
Visitation (minutes/month)	= 180 - 68,1 * Act8 + 179 * PA - 0,05 * Di

Figure 3.7. Multiple linear regression formulas explaining visitation of the Zaartpark.

With the data from table 3.14 the formulas in figure 3.7 can be constructed. These show how the duration, frequency and overall visitation can be calculated based upon the model's variables.

Table 3.15. Multiple linear regressions Sonsbeeckpark

Sonsbeeckpark	**Duration** (Adj. R^2 = 0,331)		**Frequency** (Adj. R^2 = 0,241)		**Visitation** (Adj. R^2 = 0,197)	
	b	**p**	**b**	**p**	**b**	**p**
***Intercept** (b0)*	*9,82*	*< 0,001*	*2,53*	*0,219*	*122,89*	*< 0,01*
Number of Re. (Nr)	11,09	< 0,001			40,68	< 0,01
Number of Act. (Na)	4,71	< 0,001	1,68	< 0,001		
Reason 1 (Re1)	- 8,48	< 0,01				
Reason 2 (Re2)	- 12,98	< 0,001				
Reason 3 (Re3)	- 17,52	< 0,001				
Reason 7 (Re7)	- 15,79	< 0,01			-207,57	< 0,05
Reason 8 (Re8)	- 19,94	< 0,001			- 97,04	< 0,01
Reason 9 (Re9)	- 8,34	< 0,05				
Activity 1 (Ac1)	- 13,68	< 0,01				
Activity 3 (Ac3)			7,49	< 0,001	131,77	< 0,01
Activity 9 (Ac9)					231,74	< 0,001
Perc. Safety (PS)			6,55	< 0,001	136,79	< 0,01
Perc. Access. (PA)			5,24	< 0,05		
Distance (Di)			- 0,01	< 0,001	- 0,24	< 0,001

Note: b = regression coefficient; p = level of significance.

As previous analysis has shown, the parks do differ in among others geographical location and characteristics. The outcomes based upon the Sonsbeeckpark (table 3.15, formulas in figure 3.8), seems to be relatively different. The model of duration for the Sonsbeeckpark explains about 33% (R^2 = 0,331) of the variance in duration of visits by respondents. A clear difference between the two parks and the models of duration is that the model of the Sonsbeeckpark incorporates the negative effect of six reasons for which people would visit the park. Whereas the number of reasons a respondent has to visit the park seems to have a positive effect on duration of visits. The model on frequency of visits to the Sonsbeeckpark explains approximately 24% of variance, based upon the number of activities respondents undertake in the park, the activity of walking the dog, the perceived safety and accessibility of the respondent and the walking distance between park and respondent. Another difference between the models of the Sonsbeeckpark and the Zaartpark is that the models on the Sonsbeeckpark incorporate more reasons, shows higher explained variance and in general include more variables. In general, the frequency of visits and the overall visitations for both parks seem to be primarily influenced by activities, perceived accessibility and/or proximity.

Duration (minutes/visit)	= 9,8 + 10,1*Nr + 5*Na - 8,5*Re1 - 13*Re2 - 17,5*Re3 - 15,8*Re7 - 19,9*Re8 - 8,5*Re9 - 13,7*Ac1
Frequency (visits/month)	= 2,5 + 1,7*Na + 7,5*Ac3 + 6,6*PS + 5,2*PA - 0,01*Di
Visitation (minutes/month)	= 123 + 40,7*Nr - 207,6*Re7 - 97*Re8 + 132*Ac3 + 232*Ac9 + 136,8*PS - 0,24*Di

Figure 3.8. Multiple linear regression formulas explaining visitation of the Sonsbeeckpark.

The multiple linear regressions show that the variance in duration of visits in the Zaartpark can be accounted to four specific activities, being jogging, walking with the dog, resting/sitting and active recreation, explaining 25% of the variance in duration of visits. Whereas the duration of the Sonsbeeckpark is primarily positively influenced by the number of reasons and activities and negatively influenced by specific reasons. The model explaining 33% of the variance in duration of visits.

The models on frequency show that, in case of the Zaartpark, frequency of visits is primarily influenced by if the respondents use the park for walking with the dog, the perceived accessibility and walking distance. These three variables explaining 22% of the variance in frequency of visits. In case of the Sonsbeeckpark, the m odel explains 24% of the variance in frequency by the number of activities that respondents undertake in the park, specifically if respondents use the park for walking with the dog, the perceived safety and accessibility of the park and the walking distance.

The results on overall visitation show the lowest explained variance, namely 11% in case of the Zaartpark and 20% in case of the Sonsbeeckpark. The overall visitation of the Zaartpark in this model is influenced by if the respondent uses the park for group activities, the perceived accessibility of the park and the walking distance between park and respondent. The model of the Sonsbeeckpark uses more variables to explain variance in visitation, specifically this is positively influenced by the number of reasons. If the respondent uses the park for walking with the dog and doing group activities, the perceived safety of the park and the walking distance between park and respondent. The model shows negative influence when the respondent visits the park for clear thinking and traveling through the park.

3.1.4 Concluding remarks

The quantitative results show that approximately 210 of the 350 (60%) respondents from Boeimeer visit the Zaartpark and approximately 250 of the 350 (71%) visit the Sonsbeeckpark (table 3.8, p. 40). These numbers show that the percentage of respondents visiting green spaces is relatively high, especially when taking into account that this only covers the visitation of two specific parks within the neighbourhood. The actual functionality becomes more clear when showing that the reasons for visiting the park are primarily to exercise and to be in a natural environment, accumulating to 50% of the reasons respondents had to visit the parks (table 3.10, p. 45). The majority of activities undertaken are walking and biking (table 3.12, p. 46). The differences in activities undertaken in the parks and reasons respondents have for visiting the park also suggest that both parks inherit a different identity.

The insights from this paragraph, thus, shed a light on the actual usage of the parks and the manner in which the characteristics and the identity of the park influences visitation and with that possible health outcomes. The data generally suggests that the Zaartpark is more used for activities related to nature reserves, like releasing stress, jogging and relaxing. In contrast, the Sonsbeeckpark is more used for spending time with family, being among people, active recreation and group activities, in other words, a more social urban park. As the actual usage and to some extend the functionality (in activities and intent of visits) of the parks are more clearly explained, comparing these results with the planning of parks by the municipality could provide some interesting insights. The following paragraph looks into the qualitative data of the parks and the planning and maintenance of them. These give insights into if and how the municipality strategically plans green spaces for the health of citizens.

§ 3.2 From the neighbourhood to city scale

Additional qualitative data was gathered to further enrichen the quantitative data discussed in the previous paragraph. The qualitative data discussed in this section is divided by geographical scale. In the first section, the findings about the parks in Boeimeer and the neighbourhood are discussed. The second section focuses more on the findings relating to the city scale planning of green spaces and the implementation of healthy urban living as a whole.

3.2.1 Urban green spaces and Boeimeer

Looking at the maps and photos provided in chapter two, it becomes clear that Boeimeer is a neighbourhood that has a large amount of green spaces in different shapes and forms. The streams, which almost completely surround the neighbourhood, create a neighbourhood scale greenbelt. The utility of the stream valleys is mentioned in a municipal policy document as used for "natural interweaving of the rural area with the urban area." (Municipality of Breda, 2013a, p. 16), which highly relates to nature and the city as highly intertwined ecosystems, based upon definitions by Swanwick et al. (2003) and Heynen et al. (2006). Several survey respondents recognise that these 'natural' features accompanied with the close connection to the city centre makes Boeimeer a one of a kind neighbourhood in Breda. One respondent states the following about the neighbourhood:

> *"The very special thing about Boeimeer is that there are so much green spaces and parks, whilst you properly live in the city."*
>
> Survey respondent (May 6)

Not only do the stream valleys contribute to the identity of 'nature in the city', the urban parks located in Boeimeer also seem to play an important role. The Zaartpark and the Sonsbeeckpark are important distinct features in Boeimeer and according to some respondents these parks have different functionalities.

> *"The parks in Breda are really enriching and I regularly visit all four* [mentioned in the first survey question] *all with the same amount of joy but with a different purpose."*
>
> Survey respondent (April 10)

The data from the survey suggests that in general the Zaartpark is less visited by Boeimeer inhabitants than the Sonsbeeckpark. However, the neighbourhood located on the west side of the Zaartpark seems to be more actively involved in the layout and maintenance of the park (Interview B). The data on hypothesis 3b (p. 43) suggests that the majority of visitors would live within 500 meters - a distance mentioned by Giles-

Corti (2005) - of the park, at least in case of the Sonsbeeckpark. In case of the Zaartpark the inhabitants living within 500 meters are primarily located on the west side of the Zaartpark. However, there seems to be a prominent future development that will change the current situation of the Zaartpark. The Amphia terrain (hospital), located on the east side of the Zaartpark, is going to be redeveloped into a residential area. Amphia has several locations in Breda and is aiming to relocate all facilities to a single location (Interview C). The municipality sees this as an important development in their vision of the city for 2030, most likely because it is a redevelopment project of relatively large size (Municipality of Breda, 2013a, p. 17). Urban nature and healthy urban living are the two main pillars for this future development (Interview C), which can be accounted to the fact that the Zaartpark is adjacent to the redevelopment project. Furthermore, it seems that the focus on healthy urban living primarily comes from the demand of citizens and the willingness of the project developer (Interview C).

As discussed in chapter two, the parks do differ in geographical location and layout. The data discussed in the previous paragraph does imply that the Zaartpark is more seen as a park to reduce stress than Sonsbeeckpark. A possible explanation for this is that the Zaartpark has a more natural identity (i.e. more in line with natural reserves outside of the city) than the Sonsbeeckpark, which has been designed as an English garden as explained by the founder of IamSonsbeeck (Interview A). On the other hand, the data on the Sonsbeeckpark shows that it is more used for activities for example with family and friends, creating the possibility of more social cohesion between park visitors within the park. These findings can be related to the urban ecosystems services and detriments as shown in table 1.2 (p. 19), based upon studies by De Groot et al. (2010) and Gómez-Baggethun and Barton (2013). Although most services and detriments are to an extent provided by both parks, it can be stated that the Zaartpark with the abundance of vegetation is more likely to be of more value for urban temperature regulation and noise reduction. However, the location of the Sonsbeeckpark (adjacent to heavily used roads) is of more value in providing these services. The Zaartpark can also be considered to be of value in case of cognitive development in a more organic/natural environment, whereas the Sonsbeeckpark most likely has more value in providing a place for recreation. Although the ecosystem detriments might be more difficult to concretely link to the parks, the data from hypothesis 2 (p. 41) suggests that fear and stress might not be existent in both parks. However, not only the inherent characteristics of the park seem to influence the usage of them. One of the survey respondents discusses the facilities located near the Sonsbeeckpark, which might explain the overall more group activity-based identity.

> "*The swimming pool and tennis court are a part of the Sonsbeeckpark.… The Mastbos* [a forest area located near the neighbourhood] *plays a much bigger role for visiting nature."*
>
> Survey respondent (April 18)

In addition, the founder of the IamSonsbeeck organisation (Interview A) explains that the park is used for multiple events. For example, IamSonsbeeck organizes park days for the maintenance of the park and once a year the park is used for the event "Boeimeer Bloeit" (translation: Boeimeer Flourishes), an event organised by the community board of the neighbourhood. According to the founder of IamSonsbeeck (Interview A) this has changed the feeling of ownership over the park.

> *"At first this park wasn't really of the neighbourhood; it was more an anonymous urban park. In current time this is different, there is more social control over the park and less litter. … It's their park, it's our park! If someone is messing around in the park, others will speak up about it."*

In this sense both parks have their own identity. When asked what respondents would change about the two parks, most answers were focused on adding more street furniture, more lighting and improving surveillance (Appendix A.4). These subjects seem like general public space issues regarding safety, especially safety in the evening and at night, slightly contradicting findings on hypothesis 2 (p. 41).

On a more critical note, the geographical location of Boeimeer in relation to the city centre poses some findings related to issues regarding urbanised city cores. The most prominently mentioned subject by respondents was that of the amount of traffic on the two main road axes in Boeimeer. However, other nuisances, for example by leisure boats, also can be related to the close proximity of Boeimeer to the city centre. These leisure boats use the stream running adjacent to Boeimeer (in the East) to get from the city centre to a stream valley (named Markdal) located near the South of the city. A survey respondent states the following about this:

> *"The nuisance by the recreation boats, whom travel through here from the city centre to the Markdal* [a stream valley located close to Boeimeer]*, has increased drastically in past years."*
>
> Survey respondent (April 17)

The route that the recreation boats use is recognised as 'blue leisure' by the municipality (Municipality of Breda, 2013a, p. 42). This highly relates to the multifunctional characteristics of green infrastructure as explained by Hansen and Pauleit (2014). It could be speculated that with the redevelopment of the New Mark[7] area, the blue leisure in these streams could increase. The act of the leisure boats traveling to the stream valley can be related to the production and benefit areas of ecosystem services as discussed by Fisher et al. (2009). For example, the streams create a somewhat directional bias for reaching the benefit area of the valley by boat, the service in this case being blue leisure.

As mentioned in chapter two, the two major road axes in Boeimeer feed traffic from the southern ring road of Breda to the city centre and surrounding neighbourhoods (Municipality of Breda, 2013a, p. 56). Some of these roads are considered to be dangerous and to have a negative influence on the liveability of Boeimeer. Several survey respondents mention the roads in relation to accessibility, safety and fine dust dispersion.

> *"The busy roads do indeed form obstacles, which I personally don't find obstructing, however this is the case for others with for example strollers or wheelchairs."*
>
> Survey respondent (April 12)

> *"The Juliana lane* [the road running adjacent to the Sonsbeeckpark] *with all the (speeding) cut-through traffic is not only unsafe for the children but also a major source of fine dust. Reducing this traffic would benefit the livability."*
>
> Survey respondent (April 22)

These responses show that the roads and large amount of traffic on them is seen as a negative side of Boeimeer. However, according to Interview C, this situation seems to be known by municipal staff. According to the community board (Interview B) and a municipal official (Interview C) steps are being taken to improve the situation of the Graaf Hendrik III lane. In general, the ambitions of the municipality

[7] A redevelopment project that resurfaces the Mark river where it was located before rapid urban growth, the project includes the transformation of an old military terrain into a new city park. (Municipality of Breda, 2019b)

to include more urban green in Boeimeer is relatively high. The vision from the municipality seems to be largely focused on adding more trees within the whole neighbourhood and creating a kind of forest atmosphere in the neighbourhood (Interview D). Nevertheless, this notion of greening deserves a critical point, namely that the governing coalition in Breda is liberal and that Breda can still be characterised as a 'car city' (Interview D), generally focusing more on car traffic than other forms of transport. This perspective can also be found in the coalition agreement of the governing parties (Aartsen, Hof & Drunen, n.d.), which specifically states that *"the northern ring road is the priority in increasing traffic flow of the city"* (p. 30). According to a municipal official (Interview D), this is also due to the fact that Breda cannot be compared to other major cities in the Netherlands, especially in the case of density as Breda is relatively spread out, except for the city centre. In essence, it seems that the characteristics of GI (Hansen & Pauleit, 2014) are not fully utilised, as the combination of GI with active travel networks might positively influence the mobility challenges in Boeimeer and offer more spatial bridging ties within and between neighbourhoods. However, these implementations do need more practical research.

Furthermore, there is a difference in stating ambitions and actually realising those. Without a concrete set of practical implications, the ambitions as mentioned before, seem relatively far from realisation, which could be due to the political field that tends to rather focus on other subjects. For example, an important ambition for the municipality seems to be that of 'city in a park', meaning that Breda will be the first European city that is located within a park (Aartsen et al., n.d., p. 7). This is in line with what Interviewee C mentioned, *"If you say, 'city in park' you do have to show how you are going to do that",* which shows that confidence in achievement of this goal is doubtful. According to another municipal official (Interview D), this ambition is not focused on concrete practical implementation (such as extensive greening plans or the ambition of a specific number of tress and bushed planted by 2030), but rather a general idea that will be taken into account in (re)development projects. These insights show that there might be some distrust among municipal officials in the implementation of the ambition.

3.2.2 Urban green space planning in Breda

Specific knowledge on biophilia was observed in one of the municipal official interview's (Interview D), who explicitly mentioned the evolvement of the human brain in a dominantly natural context, which highly relates to the biophilia hypothesis. When asked if current cities are fitting for humans, the interviewee gave the following answer (Interview D):

> *"Well, what can be noticed is that the usage of antidepressants in urban environments, for example, is higher than that of rural areas. I think that there is a lack of green, a green deficiency, for a large number of people."*

Another municipal official (Interview C) also shows knowledge regarding this subject, suggesting a specific relation between urban green spaces and the happiness of individuals. This shows that knowledge gained from scientific research is present in planning practise. Awareness of the positive effects of urban green spaces on health can be considered the first step in advocating for a more adequate valuation of green spaces in spatial planning. The municipal official (Interview D) continues explaining that the 'green deficiency' is seen as support for the 'first city within a park' ambition. As a result, they hope to see that urban green will manifest itself within urban planning as a more dominant entity. However, this will remain place specific as every project and location differs in the possibility for green space planning (Interview D). The general focus of this is that of 'eco-touch and eco-tech', meaning that in higher density urban areas the focus lies on implementing technical innovations (e.g. vertical greening), whereas lower density urban areas can implement more conservative 'ground-bound' green spaces (Interview D). According to a municipal official (Interview D), there are some clear changes happening in the city centre in the next 10 years. The change in function (implied relating to land-use) offers the municipality a rather rare chance to implement more urban green spaces in the city centre (Interview D). Proposedly these changes are happening because of several trends within the city, especially changes connected to vacancy (Municipality of Breda, 2017). The changes in the city centre indicate future implementation of eco-tech solutions, as the city centre is considered to be relatively dense. Another municipal official (Interview C) states that Dutch cities can increase the number of green buildings or vertical green, a form of eco-tech solution, as other countries are ahead in developing these types of initiatives.

There are two specifications of the amount of urban green in neighbourhoods that the municipality aims to meet by 2030 (Municipality of Breda, 2016, p. 24). The first is called the '*pantoffelafstand'* (translation: slipper distance), which means that everyone should live at least within approximately 200 meters of a (small) urban green space. The second is called the '*fietskwartierke*' (translation: biking 15 minutes), which is used for the distance (specified as 3 kilometers) that people need to bike to get into rural 'outer' areas (Municipality of Breda, 2016, p. 24). However, a municipal official involved with the green structures of the city explains that only one neighbourhood is considered to not meet this demand and cannot compensate in other factors (for example in larger gardens per parcel) (Interview D). On the one hand, the current situation of Breda can be considered fairly sufficient in regards of distance to green spaces for all its citizens. On the other hand, this poses the question if the criteria of the number and allocation green spaces are up to date, questioning if strategic green space planning takes place. Furthermore, when asked if these two aims derive from strategic health planning the following answer was given by the municipal official (Interview D):

> *"It's human focused design, health is an important factor of that. … This is more as a factor in creating a good living environment, health is a part of this."*.

This insight to some extent relates to the social valuation of ecosystem services as mentioned by De Groot et al. (2010). Although Interviewee D stated an almost direct connection between the aims and urban health, it seems that these aims are more used to meet the demands of the citizen in regards of liveability, which in essence is not a bad method for a public governmental body. The municipal official (Interview D) continued explaining that this is also how the 'city in park' ambition was formed, because a survey showed that a large number of inhabitants found this an important subject. The liberal coalition in charge of governing Breda does not seem to negatively influence this ambition that much (Interview D). Furthermore, the municipal official (Interview D) states that the municipality is trying to make the one neighbourhood that does not meet the '*pantoffelafstand'* and the '*fietskwartierke'* more green, specifically through a plaza redevelopment project. This does indicate some practical implementation of the ambition and with that eco-touch focused urban design, as these areas offer solutions on ground level. However, this still remains project-to-project based implementation rather than a concrete set of steps of how the municipality is aiming to achieve the 'first city in park' ambition within 11 years.

In addition to these insights, a municipal official (Interview C) states that in general, small green spaces - as the respondent calls it 'shredded green spaces' - get lost within urban (re)development. Stating that urban green spaces are only seriously taken into account when they are permitted, which clearly juxtaposes the previous mentioned aim to manifest urban green spaces into urban planning. Interviewee C also stated that in legal terms, if a certain space is defined (e.g. in zoning plans) specifically as 'nature' strict rules apply, which is not the case with spaces that are defined as urban green. Interviewee C also stated that in this sense *"nature is a restrictive factor for cities"*. These insights to some extent relate to the broader debate of nature and the city and the balancing act between economic development, social justice and environmental protection. In this case, nature is defined as wilderness and opposes a positive restriction to the city, showing that environmental protection as mentioned in Campbell's Planners Triangle (2016) is rooted within laws and regulations. The municipal official (Interview C) states the following about the current situation of green space planning and the hierarchy of planning interests: "*It seems that we still view parking norms as more important.".* However, it also seems that these terms of defining spaces in zoning plans are changing. The municipal official (Interview C) further on continues explaining the following:

> *"We don't enforce green spaces, at least not in legal terms. However, we are trying this in the Breda South-West plan, where I am now working on more green, where we simply say that we have the important main roads to access the city but other roads are subordinated and this is where green has to be more important than the pavement. … You have nature, which you simply cannot touch, after that you have green space that belongs to the green network of the city, which you at least want to protect and actually want to expand … and then you have the green spaces in public space which are more shredded but actually also matter. We have given these spaces a 'public space' function instead of a traffic function. … Previously, these shredded green spaces were mainly defined as other function … in that case you can just simply remove them."*

This insight shows that the municipality is trying to find a better place for urban green spaces in urban planning as a whole. Furthermore, the functionality of green spaces is mentioned within policy documents regarding the city centre (Municipality of Breda, 2013b, p. 48). The valuation of green spaces seems to be done primarily in an economic sense, which relates to economic valuation of ecosystem services as described by De Groot et al. (2010). Nevertheless, these findings show that steps are taken in valuing nature within the city.

To conclude, in general it seems that the municipality is actively planning for a certain amount of green spaces in neighbourhoods and that the valuation of these green spaces is becoming more profound. Specific neighbourhoods that are known for having fewer green spaces get extra attention in meeting the standards the municipality has set for itself. Currently, the ambition of *'city in park'* seem to derive from a simple demand from citizens but is adding momentum to the green space planning in Breda. What should be stated is that although Breda has a fairly liberal governing coalition, this ambitious goal is taken seriously when looking into upcoming (re)development projects. It seems that, although municipal officials are familiar with the health outcomes derived from urban green spaces, strategic green space planning explicitly for health has not yet gained momentum within this municipality. Strategic health focused urban planning is discussed within the next section.

3.2.3 Healthy urban living in Breda

As this study highly relates to the health of citizens and to an extent how the urban environment influences this, this section shortly discusses the implications around healthy urban living. These findings can show to what extent the municipality utilises green spaces to achieve a more healthy urban environment.

Active lobbying by the Municipal Health Services (GGDs) have shown to be of major importance for incorporating health within the new environmental planning act (EPA) of the Netherlands (Interview

C). Incorporating health within urban planning can be considered a fairly new practice, especially in relatively smaller cities in the Netherland. Innovative planning subjects seem to surface more easily in the biggest five cities of the Netherlands. In general, urban planning of cities in the Netherlands seems to be focused on the upcoming new EPA. Several interview respondents mentioned activities involved in working towards the new environmental plans (Interview B, C & D). A municipal official working for GGDs (Interview C) in North-Brabant (province which Breda is located in) explains that these public organisations wanted to *"have a seat at the table of spatial planning"* for several years now, which was a specific goal for them in 2019. The original focus of these organisations is generally framed around public health issues, especially on topics such as vaccinations, medical support in case of disasters, research on health (and infections) of large population groups and informing on health risks as consequence of bad nutrition and unprotected sexual intercourse (GGD Hart voor Brabant, 2019). However, according to the municipal official (Interview C), the organisations are aware of not only the positive but also the negative effects of the environment on health. Therefore, they opted for the subject of health to be a part of the new EPA in the Netherlands. Thanks to this lobbying, health now has a prominent factor within the new EPA (Interview C). With this, the GGD's seem to have gained a seat at the table of spatial planning. The municipal official explains that GGD's are contacted by municipalities to give advice on this subject in upcoming environmental plans, especially because the subject as it is stated within the new EPA is relatively new and hard to define (Interview C).

On the one hand, the municipal official (Interview C) states that the collaborations between spatial planning stakeholders and the GGD's can be considered very fruitful, as the GGD's have lots of knowledge on the subject of health. On the other hand, the municipal official (Interview C) gives a critical note on the engineering discourse in which spatial planning can take place in the Netherlands, stating that *"Preventing the lists ... which state that doing this and that is sufficient enough* [implied as important]*".* The municipal official (Interview C) continues explaining that this can be a pitfall because *"Human health is related to so much more and every area needs something else."*. These insights show that when spatial planning issues are confronted with an engineering discourse, especially when talking about topics such as urban green and healthy urban living, a specific working method or set of requirements might not be desirable. It also shows that municipal planning official is trying to prevent this subject from becoming a mechanical design endeavour as discussed by Lennon (2015). This envy for lists of requirements has to do with the fact that urban health does not only include space specific factors but also highly depends upon demographical factors, in other words, it is the relation between the urban and the human that defines specific health needs and outcomes. Specific lists of requirements could standardise the dynamic situation into a static one and provide mismatching outcomes.

Thus, it seems that health focused urban planning is getting more attention with the upcoming new EPA. However, the vagueness of the concept seems to be a delaying factor for practical implementation.

3.2.4 Concluding remarks

What can be concluded from the findings is that green space planning is primarily guided by the visions and ambitions as stated within policy documents and by terms used in zoning plans. Among other ambitions of Breda, the 'first city in park' ambition stands out. It seems that these ambitions form guidelines for all urban (re)development projects. To be specific, the '*pantoffelafstand'* and '*fietskwartierke'* are requirements for neighbourhoods to meet, and those neighbourhoods who do not yet meet these requirements gain an increased focus on urban green in (re)development projects. However, the critical note here seems to lie within the fact that Breda is a fairly spread out city spatially and has a liberal governing coalition. These two factors might contribute to the overall idea that Breda is and remains a city dominated by cars instead of other forms of transportation that can be more easily combined with urban green. Furthermore, urban green spaces do not yet have a well-established position in urban planning in Breda, as mostly other topics such as mobility and residential development are deemed as more important. Urban green spaces are only taken into account within urban (re)development projects in Breda when specific permits are in place. Nevertheless, incremental steps are taken to provide a more adequate valuation of green spaces within spatial planning in Breda. Although there seems to be no strategic green space planning for health, the basic knowledge about biophilia and the positive health outcomes from nature is known among some municipal officials. Furthermore, the demand for more green spaces makes the ambition of 'city in park' one that is inherently driven by the inhabitants of Breda. With the upcoming EPA and the knowledge about urban health from GGD's, more profound health focused green space planning seems a logical consequence.

Chapter 4: *Conclusion*

This thesis shows the importance of organic environments to humans and supports a more adequate valuation of the functionality of urban green spaces in planning practice. In general, this study has contributed to knowledge on how characteristics of urban parks influence the duration and frequency of visits by residents living nearby, specifically in the medium sized Dutch city named Breda. The qualitative data of this study embeds the findings in a more complete picture of municipal green space policy and planning, especially in relation to the health of citizens.

The introduction of this thesis has shown the origin of the research subject and described in which research area it is located. The first chapter has funnelled the theory from the broader debate on nature and the city towards the more defined concepts of green infrastructure and ecosystem services, ending at a concrete framework explaining the relation between urban parks and human health. The second chapter discussed the methods used in answering the research questions and hypothesis. Following this, in chapter three, the empirical results were discussed and related back to theory. To finalise, this conclusion wraps up the thesis. Firstly, the implications of the sub questions are separately discussed in order to sufficiently work towards answering the main question of this thesis, which is done afterwards. Secondly, based upon these results the recommendations for practise are constructed. Thereafter, in the third section, the implications of this study and the recommendations for future research are discussed. Finally, the conclusion is brought to an end by shortly discussing the main points to take from this study.

Sub question one: *To what extent do ecosystem services contribute to human health within cities via green infrastructure?*

The majority of the answer of this research question was gained by the literature review of this thesis. There are two steps within this question, namely (1) to what extent do ecosystem services contribute to human health and (2) how these services are utilised through urban green spaces. These two steps are reviewed in-depth within the first chapter of this thesis. To start with, literature on green infrastructures (Gill et al., 2007; Foster et al., 2011; Meerow & Newell, 2017) shows that it is a promising planning concept, especially due to its multi-scale, -object and -functional characteristics, appointed by Hansen and Pauleit (2014). However, green infrastructure, as discussed by Lennon (2015), tends to be characterised to an engineering discourse. I conclude from this that the concept must be used with awareness for that it does not only become a technical design endeavour. The valuation of green infrastructure is related to the benefits derived from environmental features (Thomas & Littlewood, 2010). In broader terms, literature on ecosystem services (Fisher et al., 2009) shows that benefits from nature are not only derived from direct, but also from indirect services. Thus, I find that natural ecosystems are of major importance for basic human health. Valuation of ecosystem services can be divided into ecological, social and economic valuation, as explained by De Groot et al. (2002). Furthermore, I consider the knowledge on ecosystem services accompanied with their production and benefit areas, as opted by Fisher et al. (2009), as an important tool for defining functionality of urban green spaces. Specifically, I find that analysing urban ecosystem services and detriments on several scales can offer useful insights in their value for cities. In essence, green infrastructure is one medium, in Sandström's (2002) definition of infrastructure, through which ecosystems are delivered to cities. The utilisation of these services through urban parks is done both directly via usage and indirectly through the presence of parks and processes such as temperature regulation and air purification, mentioned by Gómez-Baggethun and Barton (2013). Different activities are assumed to have different influence on social, physical and mental health of humans. I found that several authors (Bedimo-Rung et al., 2005; Wolch et al., 2014; Lee et al., 2015 and Nieuwenhuijsen et al., 2017) were using a similar framework for defining the relation between urban parks and human health. Based upon these I constructed a framework that can serve as a foundation for future research in this field.

In general, I conclude that green infrastructures in cities are of importance for human health in that it provides additional possibilities for individuals to increase benefits derived from nature. Furthermore, I found that the indirect services of ecosystems are of greater importance for cities than direct services, as these serve as foundation. It seems that basic health derives from core processes within ecosystems. In order to mitigate issues accompanied with rapid urbanisation, the presence of green spaces is of major value to the health of cities. Strategically planning green infrastructure for the health of citizens should therefore be a key focus for growing cities.

Sub question two: *How are green spaces mentioned in policy of Breda and what is its functionality in relation to health according to municipal officials?*
The interviews and empirical policy document analysis support the answer of this research question. Four indicators were found which show the valuation of green spaces within the municipality is transitioning from a rather superficial valuation to a more profound one. To start with, there is a foundational motive for more green space centred urban planning, namely the fact that the green space ambitions of city (Municipality of Breda, 2013a) derive from a large demand of citizens (Interview D). On the one hand, I conclude that this demand driven ambition induces a somewhat superficial impetus for green space planning, only relating to health via liveability according to Interview D. On the other hand, the second indicator, a policy document (Municipality of Breda, 2013b, p. 48), showed that steps are taken to adequately value green spaces in a more profound manner by specifically relating green spaces to health. The third indicator for more profound valuation of urban green spaces is the knowledge of municipal officials. Based upon the Interview C and D I found that the understanding of biophilia and the positive relation between nature and human health were present. The final positive indicator is that the environmental planning act is inducing changes, as noticed by the community board (Interview B) and discussed in Interview C and D. Specifically, based upon Interview C, I conclude that terms used for green spaces in zoning plans and the growing awareness among municipalities on health as subject in spatial planning are results of the environmental planning act.

Although these indicators offer an overall positive view upon the transition, two indicators were found proving this transition has some challenges to overcome. To start with the fact that the ambition of Breda to become the first city of Europe located within a park simply lacks practical implications. No specific plan for achieving this ambition within 11 years was found. The ambition is mainly used to guide incremental, project-based, green space development. Secondly, I found that rather than utilising the full potential of green infrastructure, more conservative practical solutions remain the main focus of the governing coalition. In general, I conclude that although more profound valuation of green spaces is gaining moment, strategic green space planning for health of citizens seems to be lacking in the city of Breda.

Sub question three: *How do characteristics of urban parks and the activity/intent with which individuals visit the park influence the park visitation of inhabitants of the Boeimeer neighbourhood in Breda?*
This study has shown that there is a clear significant relation between the perceived accessibility of respondents and their frequency of visits to the Zaartpark, b = 8,72, t(299) = 4,66, p < 0,001, Adjusted R^2 = 0,08. This relation showed a lower explained variance in case of the Sonsbeeckpark, b = 7,06, t(308) = 2,90, p < 0,01, Adjusted R^2 = 0,02. There were no notable significant relations found between perceived safety and the duration or frequency of visits. The walking distance between the Zaartpark and respondents was found to be of significant influence on perceived accessibility, b = -0,0003, t(284) = -6,17, p < 0,001,

Adjusted R^2 = 0,113. In case of the Sonsbeeckpark this relation was also found to be significant but again had a lower explained variance, b = -0,00023, t(276) = -2,76, p < 0,01, Adjusted R^2 = 0,028. These relations could explain why a notable significant relation was found between walking distance and the frequency of visits to the park, Zaartpark b = -0,008, t(295) = -5,31, p < 0,001, Adjusted R^2 = 0,11; Sonsbeeckpark, b = -0,014, t(297) = -5,11, p < 0,001, Adjusted R^2 = 0,10. Perceived accessibility was found to be of lower influence on visitation of parks than that of the actual walking distance between park and respondent. The final notable relation that was found is that the number of activities undertaken within that park were of high influence on the duration of visits, explaining from 11% to 25% of duration of visits depending on the park, Zaartpark b = 9,32, t(315) = 3,96, p < 0,001, Adjusted R^2 = 0,25; Sonsbeeckpark, b = 5,87, t(317) = -5,26, p < 0,001, Adjusted R^2 = 0,11. The multiple linear regressions show that the reasons for visiting and the activities undertaken in the parks are of influence on the duration of visits, whereas the perceived accessibility and distance are of more importance for explaining the frequency of visits. In general, the variables taken into account show that the experience of park visitation is relatively complex. This explains the contradicting findings within literature, such as the relation between proximity to the park and visitation as proposed by Giles-Corti et al. (2005) and Mowen et al. (2007). In general, this study has shed a light on the influence of these specific variables on the usage of the Zaartpark and Sonsbeeckpark in the neighbourhood of Boeimeer. Specifically, the different identity of both parks induces different activities undertaken in them and with that different overall visitation.

Main research question: *To what extent do characteristics of urban green spaces influence their functionality in providing ecosystem services in the city of Breda, particularly those concerning human health?*

The diverse set of characteristics influencing the usage of green spaces make for a highly complex reality. These variables do not only relate to the characteristics of parks themselves but also to characteristics of individuals. However, based upon the data from the Zaartpark and Sonsbeeckpark in Breda, it can be stated that simple characteristics, such as proximity to the park provide a high explained variance and thereby provide a more concrete set of variables for planners to work with. Although the functionality of urban green spaces depends upon a number of characteristics, it can be stated that these spaces are the medium through which ecosystem services are provided to urban areas. The benefits derived from these range from air purification and noise reduction to waste treatment and cognitive development. When defining the functionality of these spaces not only the services but also the detriments should be taken into account. The framework for defining the relation between urban green spaces and health is clearly defined, however, the mechanisms and their specific outcomes are yet to be established. Nevertheless, literature on ecosystem services provides a profound foundation for the importance of direct and indirect ecosystem services for human health.

Recommendations: *Utilising green infrastructure and ecosystem service analysis with decisiveness.*

Several recommendations are formed based upon the results of this study. These recommendations can be divided into those for improvements of the parks and the neighbourhood of Boeimeer in specific and those for improvements on the municipal and even regional scale. Starting with the recommendations on a smaller spatial scale, specifically for the neighbourhood of Boeimeer and the Zaartpark and Sonsbeeckpark. Both parks seem to be of major importance for the neighbourhood. The Sonsbeeckpark specifically seems to be important because it is a social urban park and therefore acts as bridging tie between communities. The characteristics providing these benefits should be maintained as much as possible. Moreover, the IamSonsbeeck organisation seems to be increasing the feeling of community within the neighbourhood, improving social sustainability. It is of importance that in some form this organisation continues existing. Moving on to the Zaartpark, this park is acting more as a smaller natural area located within the city. The differences in visitation suggests this park might have a greater pull on residents than the Sonsbeeckpark. With the upcoming redevelopment project of the Amphia terrain a recommendation would be to take into account how this influences the characteristics of the park, as this is of major importance to its usage. Furthermore, improvement of the neighbourhood as a whole seems to be centred around mobility issues. A recommendation for the municipality would be to take other forms of mobility than car-based ones into consideration, or at least more heavily prioritising active travel measures. Moving towards a larger spatial scale, it seems that the municipality of Breda to some extent is lacking decisiveness, specifically in elaborating on the major goal of becoming the first European city located within a park. For such an ambition practical steps need to be set out. For example, a first step could be to provide better valuation of green spaces in zoning plans.

Following this, more general recommendations can be given. As adequate valuation of green spaces is gaining moment, more profound analysis should be started. At several spatial scales green infrastructure networks should be analysed in their functionality, specifically on the services these places provide and the value they have. Valuation should then not only be done in economic sense but also in social and ecological manner. On a regional scale such analysis can act as concrete foundation for more environmental protection while on a city scale they can help in guiding more profound green space policy. Furthermore, the characteristics of green infrastructure can be fully utilised by analysing the functionality of places. For example, its multi-object, -scale and -functional characteristics becomes more clear when combining the concept with active travel networks and climate adaptation measures within urban areas.

Future research: *Specifying and valuating*

Although this study gives an insight into green spaces in the city of Breda, there are still areas to study that remain untouched. This study has provided a framework for future research surrounding the relation between urban parks and human health. Firstly, more academic research is needed into specifying the relation between specific activities in parks and their health outcomes. In other words, clearly defining the benefits gained from mechanisms. Outcomes in these areas could further support strategic health planning and justify adequate valuation of green spaces even further. Secondly, in order to give a more holistic overview of variables influencing visitation of parks, a larger quantitative study is needed. Finally, there is a need for defining to what extend specific urban ecosystems (services) add to general human health. For example, tracking the number and types of green spaces in certain areas and comparing differences with the health of citizens would provide valuable insights into the actual strategic planning of green spaces for health. This kind of research should be conducted on several spatial scales. For example, a study similar to that of Costanza et al. (2014) could be conducted on several spatial scales to provide more specific results.

To finalise, urban places can be considered inherently complex. Nevertheless, parks seem to be of intrinsic value to them. The variables used in this study shed a light on to what extent characteristics of green spaces influence their functionality in providing ecosystem services, specifically which are used to derive health outcomes. The understanding of biophilia and the value of nature to humans seems to become more embedded among those involved in governing and planning cities. Furthermore, there seems to be a foundational demand for more green space centred urban planning. Equipped with knowledge on adequate analysation methods and promising planning concepts, finding a balance between organic environments and built environments seems to be a matter of time.

Chapter 5: *Reflection*

This chapter offers a reflection upon the methodological approach and overall execution of the study. To start with, the general methodological approach and focus of this study is discussed. Secondly, the data gathering, and analysis methods are reviewed and to finalise, the overall execution of the study is discussed.

Overall methodological approach and research focus

There is no arguing in that the research approach selected is just one manner of adding to the knowledge on the health effects of urban green spaces on humans. There are two factors that primarily influenced the choices made in finding a sufficient research approach and focus for this study, (1) the relatively small-time frame accompanied with the study and (2) the broad scope of the research area that this study belongs to. One of the choices made is to focus this study on the relation between urban park characteristics and visitation of individuals, simplifying the relation between contact with nature and health benefits to a positive linear one. In other words, meaning more contact with nature cumulates to more health benefits. It can be argued that for urban planners this can be the most interesting research area, because insights in how the planning of urban parks influence its functionality can help to plan green spaces more strategically, improving our urban habitat. However, this is a human centred form of functionality, whereas urban parks also function as support for ecosystems. Furthermore, as explained in this thesis a research gap was found in defining specific mechanisms and their health outcomes. In order to avoid unnecessary complexity and to keep this thesis relatively close to spatial planning and human geography an approach was constructed that did not further elaborate on this research gap. With it, taking away the focus from health and excluding a large number of health questions from the survey.

The broadness of the research area of interest can be found in the theoretical background, discussing a relatively large number of subjects and theories relating to the research topic. This broad focus has resulted in a theoretical background that in some places jumps from one subject to the other. However, adequate steps have been taken to narrow down from a larger discussion on nature and the city to the specific research area on which this study will provide insights. Insights which are primarily interesting because of their specific geographical location, namely a neighbourhood in the city of Breda, the Netherlands. Furthermore, it should be stated that the conceptual model used in this study was not a holistic model and only served as model for testing some variables whom were found being of interest in the literature review. The construction of a more holistic model would have contributed more to the current understanding of usage of parks but would have not fitted within the limited time frame of this study. Although the additional qualitative data in this study has enriched the findings, they did heavily influence the amount of focus on specific sections. Moreover, one interview was more focused on healthy urban living, which did not really match the research questions as suggested beforehand. One of the sub questions was adjusted to match this topic. As these interviews were seen as additional to the survey data, the methodology and execution has been regarded as adequate. To conclude, it can be stated that an even more confined conceptual model and an exclusion of qualitative data gathering could have resulted into less time related issues and would therefore have improved overall quality and validity.

Empirical data gathering and results

The gathering of empirical data in this study was also constricted by the time frame. However, necessary steps were taken to guide the process and, when deemed necessary, extra time was taken to properly consider data gathering methods. For example, the survey questions were extensively discussed with three individuals (thesis supervisor, internship host and an additional faculty member) and at one point the start of data gathering was pushed back by four days to ensure the quality of the survey in relation to coherence with the research aim and sub questions.

Furthermore, errors were found in the list generated for setting out the survey invitations. Most flaws were found at the apartment buildings located in the neighbourhood, as some of these were listed as one address. The specific data from these objects would then show a more extensive list of addresses, which was used to complete the list of addresses used for this study. The final list was randomised via Excel. The top 1200 addresses were taken as the (contacting) sample. Due to flaws in this method some addresses were not actually of a residential function, most of these were found to be detached garage boxes. The sampling errors were not corrected with additional addresses because of the relatively small number in relation to the whole sample. Only 17 addresses were found to be of no residential function. The remaining addresses were found to have no mailbox or doorbell.

Although the survey data gathering method was designed to increase the possibility of obtaining response that was representative for the neighbourhood, the response was not regarded as representative as the survey demographics did not fit the neighbourhood demographics. Following this, only one weight factor was included to match the age categories more realistically. The weighted results and non-weighted results were compared to make sure the weighting did not hide any relations that the 'clean' data could have shown. Other weights were not added due to a lack of demographic data and the possibility to influence the data too much. Thus, the data was analysed in a relatively clean manner, which means that relation were not influenced that much by weighting. When looking into the results, however, it must be taken into account that these purely reflect the sample and do not match the population. The survey characteristics are profoundly discussed to show on what kind of demographic group the results are based.

As stated before, the content of the survey was extensively discussed with several people. Nevertheless, in some cases it was difficult to adequately operationalise variables in a manner that would also be pleasant for participants to respond to, some questions were formulated relatively unpleasant. Especially the formulation of the questions on perceived safety could have triggered faulty response, because these were sometimes stated in double negative manner.

Thus, additional time spend on the survey would have improved the overall reliability of the results. In general, the survey had some flaws, but the overall execution went better than expected as the response was relatively high. However, a smaller sample would have also been sufficient, which would have eased up the process. A pleasant unexpected occurrence was that of the amount of qualitative data gathered via the comment box of the survey. These comments have given more qualitative insights into the study and made way for more general discussions about the green spaces in Boeimeer.

General execution of the study

In general, the scope of this study could have been even more restricting. This could have added to overall ease of pressure and a higher quality, validity and reliability of the study. Nevertheless, general execution went well thanks to a structured approach and a professional working environment provided by the internship company. The guidance provided by the internship host among others was important for making decisions that guided the research process. The critical note in this reflection would be that the broadness of the subject and the methods have contributed to time constraints that in some cases had put a lot of pressure on processes within the study.

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Appendices

Appendix A: Survey

- **A.1:** Survey gathering method, Facebook post and invitation letters (Dutch)
- **A.2:** Hard-copy survey (Dutch)
- **A.3:** Online survey and website (English/Dutch)
- **A.4:** Qualitative data survey (Dutch)

Appendix B: Interview transcripts and topic lists

- **B.1:** Interview A - founder I am Sonsbeeck
- **B.2:** Interview B **-** two members of the community board of Boeimeer
- **B.3:** Interview C - municipal official of the department of urban space
- **B.4:** Interview D - municipal official of the department of mobility and environment

Appendix C: Outputs RStudio

- **C.1:** Parametrical tests hypothesis
- **C.2:** Multiple linear regression analysis