Influence of Urban Design in the Choice of Transportation Mode – Cycling for a People-Centred Urban Form

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A small child takes a stroll in a theme park. S/he starts idealising this space, everything is orderly, yet spontaneously chaotic, and there are fun alluring elements behind every corner. The streets are small enough for the child to get a grasp of what is going on. There are no loud cars, people fill up the footpaths. Some brave to the most insane rides, while others prefer sitting on a bench, enjoying cotton candy and looking around. There is laughter and smiles all around, every child feels vibrant and happy. The space feels safe. The child begins to idealise the theme park. “Mom, why can’t we go there every day? Why can’t every place be like the theme park?”.

The child has a point. What if as adults, we would experience the same joy in a city that a child does in a theme park? What if we would soundly feel safe, content and inspired by our urban surroundings? Would this kind of an ideal city, be a healthy city?

I am a student passionate about public spaces, healthy urban lifestyles, human-scale cities, and storytelling. This master thesis stems from an attempt to bridge these topics together. At the core of the study is bicycle transportation networks, for I am a firm believer that cycling has the power to transforms urban lives and societies into a healthier form. At a theoretical level, the discussion builds around the connection of urban design and people’s choice for transportation mode. These discussions are tight to a context of my birth country’s capital, city of Helsinki.

This thesis finalises my studies in Spatial Planning at Utrecht University. First and foremost, I want to indicate my biggest thanks to my supervisor Patrick Witte, who has been supporting and encouraging throughout the whole process, yet seriously challenged my way of reasoning. Second, I want to thank my former professor Stan Geertman for connecting me with great people in the field in Helsinki, who further helped me in the process of finding interviewees for the qualitative section. This been said, I also want to thank each interviewee for dedicating their time and having discussions with me.

In June 2017, I participated in the Velo-City 2017 Conference in Arnhem-Nijmegen as a volunteer. During this conference that specialises in cycling advocacy and network planning, I gained much inspiration, and beyond all, met many great people. My dearest thanks for insightful conversations also to all people I connected with in the conference.

This process was a challenge for me, not only for its scope, but also because the topic of transportation planning was completely new to me, as was quantitative data analysis. I have learned a great deal, and was I to repeat the project, I would do many things differently. However, I can genuinely say that with my knowledge and time limits I have done the best work I could. Lastly, none of this would have been possible without the support of the Positive Energy peer group from the MSc class of 2016-2017 in Spatial Planning, and my other dear friends, who have been very patient in listening and giving feedback. Here’s to many more laughs, dinners, and trips to come with Laura Tenniglo, Anouk Paris, Kasia Iwińska, Jidde Koekoek, Nathan Pfeyffer, Melissa Warmenhoven, Lewis McAndrew, Kaludia Murzyn, Piia Lempiäinen, Niamh Ni Mohan, Elena Barcaru, Thea A. Hambleton, and finally, Hanna R. Nyqvist.

ABSTRACT

Amidst proponents of human-scale cities, the bicycle has (re)gained a reputation of being a facilitative problem-solving tool for many current urban issues, such as the combat against climate change, decreasing socio-economic differences between population groups, decreasing traffic congestion, creating liveable cities by establishing better-functioning public spaces, and, like highlighted in this thesis, in attempts for better urban health. In the 21st Century, the bicycle has (re)opened a window for sustainable urban futures. This study discusses to what extent people's decision-making in the choice of transportation mode is influenced by urban design factors, particularly in the case of cycling in Helsinki, Finland. Through a mixed-method approach, statistical analysis is conducted and combined with expert interviews. The results show that residential location and daily travel distance influenced the inhabitants' purpose and reason to cycle, but were not significant when cycling was not chosen as a transportation alternative. Moreover, in all tested cases, end-journey activity influenced the Helsinki inhabitants' satisfaction toward the cycling network. The qualitative results suggest, accessibility and convenience of cycling, city form in terms of its infrastructure, and people-centred infrastructure, are furthermore demand side determinants that influence the inhabitant's decision-making while choosing cycling for a transportation alternative. However, other factors, such as people's mind-sets also pay a role in choosing a transportation mode, and therefore urban design is not alone responsible for guiding people toward a certain transportation mode.

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LIST OF ABBREVIATIONS

ENG	English language
FCF	Finnish Cycling Federation
FIN	Finnish language
HePo	(FIN) Helsingin Polkupyöräilijät; (ENG) Helsinki Cyclists
HCPD	Helsinki City Planning Department
HCT	Helsinki City Transport (FIN HKL)
HKL	(FIN) Helsingin Seudun Liikenne (ENG HCT)
KSV	(FIN) Kaupunginsuunnitteluvirasto; (ENG) Helsinki City Planning Department (HCPD)
OSF	Official Statistics of Finland
Rep	Representative

THESIS GLOSSARY

Around-the-year Cyclist	Person who cycles around the year
Cycling Culture	Consist of political will, land use planning and policies, cycling advocacy
Cycling Incentives	Design of bicycle networks, crossings and junctions, easy access, and safety
Human-Scale (City)	City forms, designs and plans that are people-centred
Infrastructure	Refers to (cycling) transportation infrastructure and in the analysis represents urban design
Land Use	Here refers to land use in transportation planning
Normalisation of Cycling	Occurs when cyclists' are not a stereotypical group of people, but when people of all ages and background cycle (part of cycling culture)
Seasonal Cyclist	Person who cycles between May-Sep
Situational Cyclist	Person who cycles when no ice or snow on the ground
Transportation Network	A city's transportation system, which tends to be dominated certain transportation modes (such as car-traffic, or in contrast cycling)
Urban Design	Subfield of urban planning (Sternberg 2000); concentrating on physical forms of cities (Cuthbert 2011); seeking to create urban spaces for people
Urban Form	Here refers to the geographical form and the overall form of city's constructions (e.g. shape of geographical area; compactness of the city)
Urban Health	Refers to public, social, and environmental health, and the quality of urban lives

1: Introduction

Amidst proponents of human-scale cities, the bicycle has (re)gained a reputation of being a facilitative problem-solving tool for many current urban issues, such as the combat against climate change, decreasing socio-economic differences between population groups, decreasing traffic congestion, creating liveable cities by establishing better-functioning public spaces, and, like highlighted in this thesis, in attempts for better urban health. In the 21st Century, the bicycle has (re)opened a window for sustainable urban futures.

Traffic planning joints all actions and movements taking place in cities together, similarly like the bicycle unites a variety of urbanism discussions. Perhaps for this reason, bicycle transportation planning has during the recent years increased in popularity, and been lifted to the agenda of urban regions internationally. However, as cities continue to strive for more cycling-friendly environments, much of these sustainability and health-seeking cities face constrains in their physical environments. Many cities and planners are currently working on strategies that would provide better facilities for cycling, and encourage the inhabitants to cycle more.

The field of urban planning and design have been researched widely, and many have focused on how city design influence lives within cities (e.g. Lynch 1960; Gehl 2011). Certain kind of structures are understood to have a certain kind of impact on the inhabitants, and this understanding can be utilised by planners and designers. For instance, heavy car traffic is known to restrict peace and human-scale dimension of urban areas, and therefore is regulated in cities that strive for more people-friendly environments. Nevertheless, it remains undiscovered, how urban design ties together with transportation planning: the influence of infrastructural designs on people's decision to choose a transportation mode, is not strictly ascertained.

Research in transportation planning typically takes either a supply or demand –driven approach. During the literature review, it was discovered that many academic studies in the field divorce themselves from people-centred research, in that it is more of an exception than a norm to place the inhabitants and their demands at the core of the study. Based on this observation, the thesis takes an inhabitants-based approach.

This research is an attempt to bridge the aforementioned topics together. It aims at understanding the connection between urban transportation and urban design, specifically in how the latter influences individuals' choices to choose the former. The challenge is approached through a case of cycling in Helsinki, by studying how (if at all) the city form and infrastructure influences people's decision to choose the bicycle as a transportation alternative.

This chapter lays out the context for the study. First, the relevance of transportation is highlighted, after that an introduction to the circumstances of the Helsinki case are given. Before moving on to Chapter 2, the research aims and questions are stated. The introduction chapter is kept short and precise, for the analytical framework is more focused on the societal and academic relevance, as well as theory. The methodology for the research is presented in Chapter 3, which is followed by Empirical Findings, Chapter 4. Finally, Chapter 5 engages a discussion relating to the research questions.

1.1 Why Transportation Planning?

Transportation can be characterised as "*movement of people and goods*" (Vuchic, 1999, p.24). The city inhabitants typically reside in one district, work in another, and visit shops, friends and family again in different city parts. In order to connect these functions and activities, commuting and shipping of supply and people is required, and for this reason transportation serves as the fundamental links between diverse urban activities (ibid). Therefore, both historically and today, transportation can be considered as the lifeblood of cities.

Historically, cities grew to places where conditions for trading were suitable, particularly by riversides and other coastal areas. The geographical position of cities thus often has a strategic location, in terms of transportation, or having access to a specific resource such as mining. For this reason, transportation is traditionally linked together with population demography. Where trade was possible, populations grew more quickly, and growth of cities accelerated (Pacione, 2009, pp.37-40).

Considering that urbanisation continues to increase to this date, urban mobility remains a vital aspect of city lives. Every individual is bound to commute in one way or another, and they will evidently choose transportation modes supported and encouraged by the city planning bodies. For this reason, it is essential to deliberate what kind of urban transportation means are invested in ad encouraged by the city. In this thesis, transportation planning is specifically connected to urban design and the urban form. Nevertheless, the traditional approach of focusing on the supply of urban form is reversed, in that the quantitative part looks for infrastructural demands the Helsinki cyclists have. Moreover, the qualitative part focuses on what experts see is demanded by the people, and these results are used to further interpret the statistical section.

1.2 A Bicycle Tour Through the Context of the Study

The Finnish capital Helsinki is known for its urban rhythm in combination to proximity to nature. The city centre covers a peninsula and several bays, and the rest of the capital spreads on nearby islands along the coastline. A certain poetic politician once called Helsinki a "pocket-sized metropolis", which reasonably captures the essence of the city. The city centre is a vibrant and compact environment (at least on a Finnish scale) with walkable distances. While the journey to the suburbia also only takes some tens of minutes, instead of hours, like in many other metropolitan regions (Berglund & Kohtala 2015 p.30). Helsinki is home to approximately 600 000 people. The Greater Helsinki Region, which includes the surrounding cities of Espoo and Vantaa, inhabits about 1.46 million people all together (Helsinki Region 2017). The total population of the country reaches up 5.5 million people, which is little considering the vast size of the country (OSF 2017). The population density translates into about eighteen persons per square meter, which is one of the most sparsely populated countries in the EU. Though Finland shares much of its political and architectural history with the fellow Nordic countries, its remote location at the edge of Europe sometimes pushes the city to fight a bit harder than other European regions in order to be seen and heard. Currently Helsinki unfolds large urban redevelopment projects in terms of housing, urban tourism, renovation, and infrastructure enhancements (Berglund & Kohtala 2015). Some view that the city has an urgent need to become more vibrant, compact, and environment and people friendly. Because the transformations the city undertakes influences all inhabitants' and visitors' lives, careful consideration of what kind of a city Helsinki wants to be in the future, is vital. The country is generally quite strict about building regulations, largely for environmental protectionism reasons. Creating some academic context for this debate, the governance system of Helsinki is considered next.

Helsinki & Urban Governance

In June 2017, the Helsinki City governance went through a structural reformation. The key changes that emerge along the reformation, are a new mayoral system, and that the existing "departments and municipal enterprises will be organised into administrative sectors according to their functions" (City of Helsinki 2017b, paragraph 2). In terms of urban governance, the reformation ought to increase efficiency. Prior to the reformation, different departments were separated from each other in hierarchy but also in the departments physical location. Along the structural change, the former departments are grouped into committees, and eventually also physically relocated in the same building (see Attachments 1.1 and 1.2 for visualisation). Thus, the collaboration between the formerly separated departments should in time, ease. Prior to the reformation, the City Council has the highest decision-making power. While the Mayor and Deputy Mayors created the executive body, monitoring operations, administration, and structure, they also each managed, supervised, and developed their respective areas of responsibility (City of Helsinki, 2017c). A new committee, named the City Environment Committee, consists of Environment and Permits Sub-Committee, Buildings and Public Works Sub-Committee, Rescue Committee, and the Board of HCT (Helsinki City Transport, FIN Helsinging Kaupungin Liikenne; City of Helsinki, 2017b). The Head of the Sector is responsible for land use and city structure, building and public areas, and services and permits (see Attachment 1.2).

Helsinki as a Cyclist City

The recent years Helsinki, like many other cities internationally, has increased its focus on the development of bike transportation infrastructure. Helsinki is officially committed to the Charter of Brussels, which means that by 2020, the aim is to have biking covering 15% of all commuting trips within the city. The commitment to the Charter of Brussels is means to support the city's ambitious over-arching goal: "to become the world's best metropolis in sustainable transport" (City of Helsinki, 2014a, p.10). Aligned with these targets, the City of Helsinki has created a specific development plan (FIN Pyöräilyn edistämisohjelma) for cyclist traffic. The report acknowledges that enhancing cycling infrastructure has "major financial benefits for the society" (ibid, p.11). Today, the City of Helsinki invests approximately 100 million euros in traffic infrastructure annually. From this amount about 8-12 million euros, or 10% of the total invested capital, are dedicated for cyclist infrastructure (phone interview, Putkonen, 22-01-2017). The report on biking development suggests that the investments on biking infrastructure should rather reach up to 20 million euros (ibid, p.11). That being said, capital investments for cycling infrastructure have increased in the past few years, but are still far away from the ideal targets.

Nevertheless, the past few years the amount of biking commute in the city has only reached approximately 10-11%, altering a little bit by year. Therefore, it is relevant to consider what is keeping Helsinki from reaching the Charter of Brussels targets. In this light, the central aim for bike transportation development in Helsinki is to create an encompassing network that is accessible and safe with straight, direct, and easy to follow routes (City of Helsinki, 2014a, pp.10-11). In the plans for enhancing the cycling network, accessibility is addressed by creating cohesive biking routes for the entire city; while safety reflects to separation of bike and pedestrian lanes. Straight and direct biking routes ought to encourage people to cycle more, and make the possibility of combining cycling with other methods of transportation, such as trains, preferable (ibid). The geographical focus areas of the bike network projects are divided into three regions, the city centre, the so-called 'baana' bike-lanes, and the residential areas. In addition, a project for shared bicycle system was established last summer, and is gaining attention increasingly. In the summer of 2017, the City Bike system got extended by 1000 bikes and 150 stations around the city (phone interview, Putkonen, 22-01-2017).

This been presented, Helsinki seems like an ideal case to study people's transportation choice through the case of cycling. The city has a fairly well functioning bicycle network, and is used by many of the inhabitants – yet there is still space for improvements in the network, and space to spread the quantity of urban cyclists. Moreover, the city is already working on improving the current bicycle network, which makes the topic up-to-date, instead of being merely utopian.

1.3 Research Aims & Questions

Based on the above, this research investigates the connection between urban transportation and urban design. Bringing the topics together through a case of cycling transportation, it tries to understand which urban design factors have been important when the Helsinki inhabitants have chosen cycling as a transportation alternative. Therefore, the research questions are:

1. To what extent is people's decision-making in the choice of transportation mode influenced by urban design factors, particularly in the case of cycling in Helsinki?

    a. Who cycles in Helsinki?

    b. Is there a difference between the end-journey activity, reason why cycling chosen as a transportation alternative, and why cycling was at times not chosen as a transportation alternative, between the Helsinki cyclists based on their residential location and daily distance travelled?

    c. Is there a difference between how the Helsinki cyclists' rate their satisfaction toward the cycling network and their residential location, daily distance travelled, and end-journey activity?

    d. According to the experts, what are the demand side determinants of choosing the bicycle as an alternative transportation mode in Helsinki?

2: Analytical Framework

The analytical framework builds on the Golden Circle[1]. At the core of the model are two concepts, urban health and transportation planning. The first part of this chapter defines the concepts of urban health and transportation planning, and thereafter, highlights the connection between the two fields. In so doing, subchapter 2.1 examines *why* the development of cycle networks is important. Meanwhile, urban design is approached as the *how* of the model, aiming to theoretically understand which designs are more preferable than others. Part 2.2 focuses on understanding what is urban design, and how it influences city structure, and further transportation planning. Finally, the *what* of the model illustrates the 'product' part of the study, aspiring to understand what constitutes best practice bicycle networks. Subchapter 2.3 deliberates on the specific design aspects that could address public health more profoundly. The analytical framework is thus broken down to elaborate the concepts of urban design and urban transportation, by drawing together health, design, and cyclist network planning.

[1] For more detailed description of the Golden Circle, see Attachment 2.1.

2.1 Urban Health and Transportation Planning – Marriage or Divorce?

It is not a new idea to think of city planning in connection to public health. Today, health may not be the typical key driver behind urban design and planning processes, but in fact it was "the original impetus in the 19th Century for the profession of city planning" (Jackson 2003, p.198). The Victorian and industrial cities substantiate this claim, when the unsanitary conditions became drivers for urban planning practice (Hall 2014). In European cities like Barcelona, Madrid and Paris, the unsatisfying hygienic and social conditions were tackled with functionalist design and zone plans[2] (WHO 1999). In the United Kingdom, the dirt, noise, and pollution accelerated by industrial cities was experienced more intensively than ever before; and the urban conditions escalated an immediate demand for rethinking city structures into a healthier form (Hall 2014, p.7). In the quest for healthier urban lives, Ebenezer Howards' idea of *Garden Cities of Tomorrow* (1898) triggered a snowballing movement which would influence city structures across Europe and North America for decades to come (Hall, 2014, p.7; WHO, 1999, pp.3-4).

The following storyline takes a historical outlook on city development from the perspective of health and transportation planning, dating from the industrial era. It is considered that historical processes significantly influence the shape of cities up until the 21st Century, and furthermore, that historical knowledge facilitates contextual understanding. Based on these discussions, both concepts of urban health and transportation planning are specifically defined at the end of this subchapter (2.1.4).

2.1.1 From the Garden City Ideal to Car Dependent Urban Form

The accelerating urbanisation of the industrial period created an increasing demand for more efficient transit, both within the city centre and between the different industries located outside of the urban core. The steam engine transformed the efficiency of long-distance (manufacture) shipping to a completely new dimension. Yet, commuting modes for individuals developed more slowly. European cities like London, Paris, and Berlin (and in the United States, New York), were amongst the first cities where the developments of the industrial period visibly influenced the urban form (Vuchic, 1999, pp.5-10), and not necessarily in the idealised way. Below it is examined why.

The Garden City Legacy for Transportation & Urban Health

Howard's garden city thesis was a response to the industrial city, and became to be one of the most influential responses, as well. Howard presented that a great escape from industrial city slums and other unhealthy urban conditions was possible; by creating a new, structured space outside of the city. The garden city was built on two central ideas. Firstly, decentralisation, because Howard foresaw that "the twentieth century would be the age of the 'great exodus' from the 'closely-compacted, over-crowded, city' (Howard, 1904)". As such, garden cities were built outside of old cities, in a sense forming early versions of the modern suburbia. Secondly, garden cities reflected on community, since decentralisation would steer peoples to migrate into self-contained areas that combined the proximity of residence, leisure, and working opportunities (Fishman, 1978, p.232). The garden city zoning consisted of residential blocks, green central park or a green belt and some services. In order to differentiate and connect these areas, and to connect the garden city to the old city centre, transportation routes were also a central part of the blueprint (Fig. 4.2 in Hall, 2014 p.97).

[2] The functionalist urban design and zone plans were also used to enhance the efficiency of the economic and transportation systems.

Today, it is understood that Howard's utopia later turned into an antithesis of his original idea. Rather than creating utopian urban spaces, the garden city ended up reoccupying the countryside, and in fact spatially separating social groups from each other, leaving the poorest inhabitants to the compact and dilapidated city slums (Appleyard & Jacobs 1982, p.3; Hall, 2014, p.8). In more economic terminology, these zoning ideals also separated the primary, secondary and tertiary[3] industries' location, which reflected the transportation arrangement of urban regions (Vuchic, 1999, pp.5-10). In this way, the garden city ideal functioned as a pedal for the birth of the modern suburbia (Hall, 2014, p.8).

Inner City Mobility: Emerging Public & Wheel Transportations

The industrial revolution also altered commuting *within* the city, not only between different economic sectors and the sub-urban areas. It seems that inside cities, the wheel has been the primary tool which altered the mobility patterns of majority of populations. Wheel carriages, horses, and bicycles slowly began to transform the traditional inner-city commuting from walking into a more efficient form, saving time and energy. Along these late 19th Century inventions and developments, also city structures started to change, as transportation demanded more space from the streets. The early versions of public transportation began to emerge during the same period. Nevertheless, the publicity of these transportation modes was quite different from how public transportation is understood today. Sooner, these 'public transportations' were only for the wealthy people who could afford the traveling tickets (Vuchic, 1999, pp.5-10). Parallel to expensive 'public transportation' forms, the bicycle developed a reputation of being used by the less-wealthier people. In some ways, this analogy of the bicycle still exists in some people's minds.

By the beginning of the 20th century streetcars (early version of trams) started to become a part of cityscape around the European and Northern American big cities (like London, Paris, New York; Vuchic 1999, pp.1-13). The streetcars influenced city infrastructure and the urban form significantly, much like horse-wagons earlier on, as they demanded more space for moving and turning. In this sense, the streetcars functioned as accelerator for automobile as local transportation mode. By the 1920s, the extensive streetcar systems started to disappear from European (and Northern American) city centres. Yet, it was only after the Second World War the automobile began to shape cities, and indeed dominate the form of newly built urban areas (Newman & Kenworthy, 2015, p.1).

Planning Cities for Automobiles

Urban planning and design trends emerging the first half of the twentieth Century, such as the New Town and Le Corbusier's Radiant City model, were highly influenced by Howard's ideas (Hall 2014). Because these new ideals for living were built on the premise that car would be the future for transportation, city designs facilitated urban sprawl and space, components which were not available in the industrial city centres. Typical problems for car-dependent cities are still today urban sprawl, and due to that, high costs of transportation. These problems are both, a result and a process of infrastructure and land-use policies which have been formulated to align with the dominant economic innovations, namely, the automobile (Newman & Kenworthy, 2015, p.2). Urban scholars such as Jacobs (1961), Mumford (1961) and Schneider (1979) have each illustrated the problematics of planning policies that prioritise car-traffic. Essentially, from the 1960s onwards car-

[3] Primary industry refers to agriculture, secondary to manufacturing industry, and tertiary to government, administration, banking, trade, education, and cultural industries, or in other words, to the service economy (Vuchic, 2007, p.5).

dependent suburbs became common in European (and North-American) landscapes, and this rapid expansion of motorway infrastructure dominates urban landscapes and city developments in many parts of the world still today. Finland is (unfortunately) a great example of this trend: due to the country's relatively late urbanisation, most of its cities were built during the era when the automobile was viewed as an ideal transportation mode (Berglund & Kohtala 2015).

Heritage of Transportation Models in the Current Urban Form

Understanding the historical development of transportation planning is relevant in order to be able to analyse its current state. Recapitulating the above, the heritage of the garden city remains appropriate because it triggered a transformation process of the urban form. On the positive side, garden cities improved the efficiency of transportation, both in long and short distance. Yet, on the negative side, the legacy also increased the demand for car-transportation, which eventually engendered urban sprawl and high costs of transportation. Some thinkers believe, that in the 21st Century, the era of car dependency is finally decreasing (Newman, Kosonen & Kenworthy, 2015; Kosonen, 2007; Rainer et al., 2012). The rationale stems from developed economy examples, for instance in that urban planners and designers are searching and coming up with alternatives for car-transportation, using green and/or sustainable energy sources instead (Newman & Kenworthy, 2015, p.30). Moreover, it seems that the publicity begins to be more concerned on the state of the natural environment, higher efficiency for transport[4], and on higher quality of the city environment and public spaces. From this viewpoint, it is relevant to consider how can a city's transportation system be analysed in more depth. The next part will delve more into this discussion.

2.1.2 Urban Transportation Systems: Reflection of the Society

The historical examples illustrate how urban transportation can be viewed as a metaphorical reflection of today's societal development, and current problems. Conflicts between social and individual interests, or between public services and market conditions, may be visible for instance in the user profiles of diverse transportation modes, and in the coverage of alternative transportation modes reaching around the urban area (Vuchic 1999). In the 2000s, variety of transportation modes differ in their cost, speed, environmental influence, and adding these aspects together, in their impact on individuals as well as the society at large. In medium and large sized cities, people tend to choose their transportation mode based on which is the most beneficial for them at the given moment, often striving for efficiency. In smaller cities, choice of transportation typically relates to social factors, such as income (Vuchic 1999, p.31). Sometimes, a person may prioritise quick transit for long distance, such as car or train, and at others, modes that are more flexible in smaller scales seem preferable, like walking or cycling. In these terms, transportation is connected to time and space.

Private and Public Transportations

It could be considered, that private transportation modes provide the most freedom for the individual, because the user is independent from schedules. In such a case, private transportation modes refer to cars, motorcycles, walking, or driving a bicycle (Vuchic 1999, p.30). However, private transportation mode does not necessarily guarantee quicker speed or higher quality travel than public transportation. It is believed, that a city's regulatory and policy systems significantly impact individual's urban mobility. For example, if a person is in demand of driving a car through a city

[4] For instance, trains carry up to twenty times as much people as individual cars; and bikes fit a densely built and populated city form better than cars.

centre, but the city regulates car usage in the city centre, the route may be more efficient through cycling lanes. Many studies suggest that in high density areas walking and cycling is generally the most efficient way to move (Gehl 2011). In contrast, in suburban areas the car often remains as the most efficient transit model, because of how the infrastructure is typically laid out (Vuchic, 1999, p.88). To create an efficient network of variety of transportation modes, the city needs to support both private and public modes. In the case of cycling networks, an example of balanced public-private system would be combing the commute with train or other public transportation modes, or to use a shared-bicycle system. Moreover, whether the city's transportation system is more private or public oriented, it has an influence on how accessible certain places and city areas are. The cost of traveling may influence different individuals or social groups differently, which is why it is essential that urban transportation opportunities need to be designed by keeping equity in mind. Having equal access to different transportation modes can be central for the general quality of life within the city; and thus, transportation has an influence on the liveability of cities, not only in terms of urban politics and the quality of the infrastructure, but also regarding the coverage of transportation services (Vuchic, 1999, pp.87-88).

Analysing the Society through its Transportation System

Developing and transforming a transportation system is evidently a complex issue, as it can be approached from multiple different perspectives. Returning to the public-private composition, the local and global political situations may influence the dominant transportation format, such as has been the case in the Netherlands during the 1970s oil crisis[5] (Martens 2004). Political decisions influence the city form through steering construction, which evidently influences the city infrastructure for instance in prioritising cycle paths over car traffic. Moreover, as the transformations begin to take place, new services emerge around the idealised transportation mode. Nowadays shared-bicycle system has become a common supplement for urban transportation networks, to give an example (Jäppinen 2013). Together, such planning and execution decisions imply a message to the individual, which can be either dis- or encouraging to a certain direction. For instance, if the city is designed for car infrastructure, the communicated message suggests that car is the socially ideal mode for commuting, whereas parallel biking may be considered as a transportation choice of a people with certain social status. Yet, an "inadequate understanding of these complex problems in urban transportation, compounded by the strong pressures exerted by special-interest groups, are serious obstacles to solutions that would serve the public good" (Vuchic 1999, p.30).

Bridging all these ideas together, it can be claimed that the transportation system of a city tells much about the city's current health. If a city favours sustainable policies in transportation planning, it also supports the health of the urban environment. If a city regulates automobile usage in inner city areas, it also aligns with mental and physical health of its inhabitants. However, urban health is also a broad concept, and demands some further elaboration. Next under consideration is, what urban health implies.

2.1.3 Urban Health: The Key for a Great City

As it has been suggested above, urban health encompasses much more than just hygienic conditions. In the 21st Century Europe, public urban health perhaps more commonly refers to

[5] The Dutch experience in regulating car-traffic culminated during the 1970s' global oil crisis, when the key decision-makers foresaw that oil consumption could not continue in the same phase in the future (Martens 2004, p.283).

disease and obesity related issues (instead of basic hygienic concerns, as public health has been understood in the past). Moreover, urban health refers to social health; environmental health; economic health; and generally, the quality of urban lives. Each of these understandings are examined below.

Public Health

"Our genetic systems work best when they are physically active", states Maria Hopman, a researcher at the Radboud University Medical Hospital, in her speech *Cycling for Health*[6]. "Humans are made to move", she continues, while pursuing the listener on that cycling is not only a smart way for urban mobility, but also natural for our physiology. The inactivity of human body is associated with more than thirty chronic diseases, which cost approximately 86 billion USD annually for the world economy. Evidently, healthier people take less sick leave from work places, and are more productive in their tasks. Even in the Netherlands, so-called 'sit-deaths' kill about eight thousand persons a year. It is well known that the suggestions for adults is to move minimum thirty minutes a day, which can easily be reached if biking is used for daily commute (Hopman 2017).

Social Health

However, when talking about the health benefits of cycling, it should be kept in mind that health does not only refer to physical health. Health can also be considered in terms of psychological health, such as happiness as sense of community. Cycling may function as bridge for bonding and making new friends, and thus increase the social satisfaction of individuals lives (Hopman 2017). Appleyard's piece Livable Streets (in Tumlin 2012, p.31) concluded that people who reside in lightly trafficked streets, had more friends and communal ties to their neighbours than those living in medium or highly trafficked streets. Adults used the streets for chatting, and the teenagers and children for games. In contrast, the residents of streets with high motor vehicle traffic rather kept to themselves, and used streets solely for passing by (ibid).

Environmental Health & the Quality of Urban Lives

Environmental health can refer to the conditions of the natural environment in the city, nature's presence, and sustainability in general. The city's dominant transportation systems evidently have an influence to the environment, both in terms of sustainability, but also from a city form perspective. It is argued that the scale of constructions influence how individuals experience their environment (Gehl 2011) and furthermore, influence individuals' mobility choices. Adding these aspects together, a healthy city refers to a city with high quality of life. Yet, Chapter 3.2 part delves more deeply into the discussion of a human-scaled city, arguing how urban design can facilitate cities to reach healthier environments to live in, and therefore, elaborate on the connection between urban design and urban health.

2.1.4 Defining Urban Health & Transportation Planning

Looking at the history of transportation system developments and urban health, a theoretical connection between the two concepts can be observed. Multiple studies support the proposition that cities with less motorised vehicle consumption are healthier in terms of their environment, public, and social health (Tumlin 2012; Vuchic 1999; Gehl 20111; Hopman 2017; Newman & Kenworthy 2015; Hall 2014, to name a few). The transportation dependency between sub-urban

[6] *Cycling for Health* was a speech at the Velo-City 2017 conference (Arnhem-Nijmegen), in the category of people, happiness and health.

areas and the old city centres has been one of the key criticisms of twentieth Century urban form legacies. Relocating the residential ideal away from the city, while still leaving the employment sector in the old town, by-produced a demand for well-functioning transportation system. Between the city and the suburb, there could ideally exist an efficient and healthy commuting system. However, realistically the long commute rather yields a dependency for a four-wheeled vehicle. In sum, it seems that public health –focused planning practices nearly disappeared from European and North American planning culture in the post-war period. In many ways it seems, that the late 20th Century city developments were not concentrated on creating cities for people, but rather, on creating cities for wealth accumulation and for the promising modern transportation mode, car traffic.

Today, many planners and scholars aspire to react against automobile-dominant transportation structures, having the understanding how it may threaten individuals' and societies' health, if not combined with other transportation modes. There exists a group of thinkers who particularly support car-free urban developments (such as Gehl, 1971 & 2011; Jacobs, 1992; Lynch, 1960; Vuchic, 1999; and White, 1999). Across North America and Europe there have been endeavours for bringing the city back to human scale, like Jan Gehl famously phrases it. At the centre of this human-scaled-city movement often lies pedestranisation of inner city streets, and the development of comprehensive bike networks around the city. It seems that urban governments and planners are returning to thinking "the influence of [urban] design … on aspects of physical health, and social and cultural vibrancy" (Jackson, 2003, p.191). Perhaps therefore, cyclist transportation is in the minds of many 21st Century urban thinkers often considered as a tool a tool to increase the health of the city inhabitants and environments, and increase vibrant street life. Next, the ideas the human-scale school are examined, aiming to create a framework that will guide the later data analysis.

2.2. Urban Design Reshaping Cities – Towards a Healthier City Form

It is difficult to assemble a precise definition for urban design, largely because the field itself is interdisciplinary, but also because the experience of urban design is subjective. In a sense, urban design is the art of making cities for people. It focuses on the spaces between buildings (Gehl 1987 and 2011), their proportions, directive features (Lynch 1960, White 1999), ownership (Banerjee 2001), and vibrant qualities (Jacobs 1992). Urban design is a problem-solving tool, aiming to balance land-use conflicts stemming from different parties' perceptions and priorities (Carmen, 2013). Urban design is also connected to time and space: some solutions prevail city spaces for centuries, while others some decades, or only some years. Thus, the design of a city includes historical layers from the industrial city, the garden city, former zoning plans, the car-dominant suburbia, and recently, from attempts to create a sustainable city. Urban design "may be unintentional, but not accidental" (Carmen, 2013, pp.15-16). Essentially, urban design is about the interplay between the physical environment and human actions.

This part encapsulates literature on urban design, first considering its definition, second its function, and third current ideological ideals for urban design. While the literature on urban design is extensive and increasing (Carmona and Tiedsell, 2007, p.6), here the purpose is to draw an understanding of how urban design influences urban health, and thus urban lives in general, and further, how can urban design be observed from a transportation planning perspective.

2.2.1 Defining Urban Design

There have been many attempts to create guidelines on what constitutes urban design, and what does not. Like Madanipour (1997) acknowledges, because urban design engages in multiple activities[7], it is difficult to draw a clear definition of the field. Yet, perhaps the character of the discipline to some extent allows the lack of specific definition, because its multidiscipline nature demands flexibility in terminology. Otherwise urban design is at a risk of limiting itself either to "the visual qualities of small urban places, or, on the other side of the spectrum, in the transformation of an abstract urban space" (ibid, p.22).

Nevertheless, if the definition of urban design is too loose at the other end of the spectrum, it also may threaten "the intellectual heritage that gives the field its distinctive perspective and enriches its practitioners' design capabilities" (Sternberg 2000, in Carmona and Tiedsell 2007, pp.33-34). For instance, urban design should be clearly distinguished from other fields that also "seek to shape the built environment", such as architecture, land use planning, or environmental planning (ibid, p.41). Sternberg highlights this distinction in a clever way, explaining that the field of urban design is far more dependent on societal aspects; such as market forces, power relations, and conflicts between different interests, like private and public. Moreover, for example land use planning and environmental planning aspire to influence the urban form, but they are not (at least directly) concerned about the human experience in urban spaces (Sternberg 2000). Along the same lines, Cuthbert (2011, p.20) refers to urban design as "social practice". Where architectural pieces can exist independently from the social reality, urban design will influence, and be influenced by social patterns and ideologies. Also, because it is typically practiced from multiple disciplines, a viewpoint from Cuthbert could be borrowed, urban design is about "what urban designers do" (Cuthbert 2011, p.28). These ideas can be named as integrative theory of urban design, which Sternberg builds on

[7] See Attachment 2.2 for clarification of Madanipour's conceptualisation.

Karl Polanyi's work. At the core of the theory thus lies an observation that urban design is closely connected to "human experience of the urban realm" (Sternberg 2000, p.41).

Based on the above, it can be gathered that urban design can be observed from multiple perspectives, like mentioned from the visual tradition or social dimension. Classical theorists such as Sitte (1965) and Bacon (1974) spoke more about the artistic legacy of urban design, believing that a good urban form follows artistic principles. However, some classical thinkers, such as Lang (1962), also highlighted human needs in urban design, more so connected to the Sternberg's and Cuthbert's ideas. Because the human dimension is at the centre of this thesis, here also the definition of urban design relates more closely to the social viewpoint.

It seems that a red thread in defining urban design is that it is an interdisciplinary field, and closely related to humans inhabiting the city. With these explanations, urban design is viewed as a subfield of urban planning (Sternberg 2000), which seeks to create urban spaces for its inhabitants. Where urban planning is more focused on policies that shape urban development, urban design concentrates on the more physical forms of cities (Cuthbert 2011). Nevertheless, even though there exist distinct differences between urban planning and design, policies steer design solutions, which is why these fields cannot be fully separated from each other, but rather work hand in hand. As briefly mentioned above, urban design can also be viewed as means to shape cities. The next part delves into this discussion more specifically.

2.2.2 Urban Design & the Human-Scale City

Like it is not a new idea to think spatial planning in terms of urban health, it is also not a new idea to think urban design in terms of human-scale. The term human-scale refers to characteristics that relate to the human body, its sensors, motors, mental capabilities, and social relations and institutions (Tumlin 2012). Therefore, human-scale designs are those constructed for the scope of humans, such as cycle lanes or pedestrian streets, and in contrast, not for large-scale elements, like cars. The most famous human-scale design advocates (Lynch 1960; Gehl 1971; Jacobs 1992; White 1999; to name a few) appeared in the field of urbanism during the second half of the twentieth century and onwards, responding to functionalism and modernism in architecture, spatial planning and transportation planning. These writers are known for studying city design in connection to people's behaviour and quality of life, centrally speaking about how urban spaces and design can influence people's actions and perceptions either positively or negatively. In order to observe urban inhabitants' transportation choices from an urban design perspective, it is considered vital to be aware of traditional works which talk about the connection between urban design and human behaviour. Therefore, this section underlines some essential concepts in the discussion, and simultaneously argues for the central role of physical designs.

One of the most referenced pieces in urban design literature is Kevin Lynch's *The Image of the City* (1960), which provides a conceptualisation for urban design features. Though Lynch's original framework is formulated more than half a century ago, it remains relevant due to its helpful analogy to analyse public city spaces by observing the identities, structures, and meanings behind different designs (Lynch, 1960, p.8). Although it is nowadays a bit blurry what can be defined as public space and what not (Banerjee, 2001), here public space centrally denotes streets and city squares, because of the transportation and cycling network context. The blurriness of public space definition stems from the ownership and user rights of some spaces. Say, if a public space is privately owned, but the owner allows for anybody's free access, can the space still be named as public (ibid). On the other hand, Banerjee (2001) discussed the future of public spaces, recommending it should rather be referred as public life, for this conceptualisation also encompasses socio-cultural public realm, whereas public space is only concentrating on the physicality of buildings. In any regard, this is a discussion for a different thesis. Yet the design of streets and city squares should not be forgotten, for it is not only Lynch who has paid attention to their importance.

With a similar idea than Lynch's, White (1999) describes the urban surroundings through paths, portals, and places. "Paths in urban setting are devoted to circulation" (in Carmona and Tiesdell, 2007, p.185), whereas portals refer to "urban environments [that] are about transition and transformation" (p.188), such as gateways and crossing between plazas and paths. Places, then, mean all spaces that have a certain identity, such as courtyards, gardens, parks, or public squares. Based on these characteristics, White defined as good and successful place as one that "is well defined, providing a sense of arrival, of culminating experience… [and] has distinguishing qualities that establish a unique identity" (1999, pp.192, 198 in Carmona and Tiesdell). White also talks about a success of s place in terms of sensuality, so that the surrounding stimulate human senses, feelings and emotions through views, textures, movements, sounds and scents.

Jan Gehl, a major human-scale city advocate, argues that high quality public spaces enhance the liveability, vibrancy and attractiveness of a city (Gehl, 2011). In the previous subchapter (2.1) urban health was constructed to contain a liveability aspect, precisely in terms of social health and quality of lives. Connecting the human-scale ideal to well-being of city inhabitants, it is important also to consider 'good' urban design in terms of urban health. Following Gehl's proposition (Life Between Buildings: Using Public Space, original in 1971), it is argued that physical design, scale, and distance between different constructions largely influence on people's interactions in public spaces. For instance, urban design influences "*how many* people use public spaces, *how long* individual activities last, and *which* activity types can develop" (Gehl in Carmona and Tiesdell, 2007, p.141 italics in original). Interestingly, also Lynch stresses the psychological influence of city spaces on urban dwellers, arguing that certain structures may steer not only people's perceptions, but sometimes also choices.

2.2.3 Bridging Urban Design together with Transportation Networks

While historically transportation planning was strongly linked with strategic land use planning, it is still a rather recent approach to consider transportation planning from an urban design perspective. Urban design links to transportation networks in that the dominant mode of transportation influences which is the most effortless and efficient way to move around the city (Tumlin 2012; Saelens 2003). Therefore, the design of the transportation network may also infleunce which mode of transportation seems the most preferable for an individual. In this sense, urban mobility and design are evidently interconnected, and in a planning process should not be separated from one another, but rather be considered and developed parallel.

Yet, a problem that often occurs, is that one mode of transportation is prioritised over another. A classical misunderstanding in the attempts of trying to decrease traffic congestion is to increase the number of lanes on motorways and other large streets. In fact, Romero et al. (2017, p.135) argued that even improvements in existing infrastructure directed to motor vehicles may increase traffic congestion, ad hoc what the developments seek to avoid. This has been the case particularly with private driving from the second half of the twentieth Century onwards. Ideally, urban transportation ought to consist multiple opportunities for the user, from railway and subway systems to cars, busses, walking, and biking, for collaboration and merging varying perspectives on one field may generate more human- and environment-friendly results in planning (Tumlin 2012).

Urban Design, Transportation Networks & Land Use

That being said, "Determining factors that influence the type of transportation used by individuals helps policymakers determine built environment characteristics that promote increased use of one mode of travel over another, such as access to transit or land use mix" (Mueller 2016). Existing research suggest that cycling (and walking) is more common in neighbourhoods with higher population density, greater connectivity, and mix in land use, than those which are less densely populated, weakly connected, and only account for single land use models (Saelens 2003, p.80). Mixed land uses typically appear in older cities, where many homes situate above street-level shops. Such mix-use of land increases the convenience of running errands by foot or bicycle. In contrast, modern land use models typically supported separation of functionalities, illustrated well by later twentieth century born suburbs. In these areas, residents are more likely to choose car as a transportation mode (Saelens 2003).

The influence of land use in people's mobility choices, precisely when choosing a non-motorised or motorized transportation mode, has been found two have two major factors: the distance of travel (proximity), and directness of travel (connectivity) (Frank, 2000). Other reasons that are likely to influence this choice, are the convenience or access, for example whether parking is available, travel costs, and environmental quality (Saelens 2003, p.80). For instance, walking is usually the quickest mode for transit when the distance is less than 400m, and therefore preferred in public squares, transportation terminals, large building complexes, malls, university campuses, and shopping streets. Although, it must be mentioned that if the space and routes are attractive for pedestrians, people gladly walk longer distances, too (Vuchic 1999, p.31).

Urban Design & Choice of Transportation Mode

The impact of the built environment, mobility choice and even automobile use have been widely researched. Badoe and Miller (2000) categorised that much research tends to be focusing on residential, employment density, accessibility, and neighbourhood design. Also, it seems that most model attempts tend to focus on travel demand, and the 'three Ds': density, diversity, and design. The '3Ds' framework was introduced by Cervero's and Kockelman's (1997), and many have extended it later by adding to 'Ds', destination accessibility and distance to transit into their models (Mueller 2016, p.3). Ewing & Cervero studied the connection between built environment and walking behaviour by computing "elasticities for individual studies and pooled them to produce weighted averages" (2010, p.265). In their results, it was found that the physical environment indeed affects transportation, yet explains only part of the decision to walk as a transport (Ewing & Cervero 2010, p.274). However, Ewing and Cervero, as well as Boarnet (2011) and Mueller (2016) highlight that there seems to be a lack of consistence in studies that aim to model travel behaviour with the built environment. This juxtaposition creates some difficulty in gathering precise literature from the field. Until now, many studies are limited in that they merge much data together, and sometimes its meaning can disappear in the process, because decision making of transportation choice is often a complex process (Mueller 2016). For example, the choice of transportation may depend on the commute end activity, and therefore not even be consistent amongst individuals. For example, Badoe and Miller considered transportation-land-use interaction from the perspective of automobile ownership, and critically concluded that many studies in the field tend to have "weaknesses either in data used or in methodology", contributing "to the lack of clarity with respect to the direction and magnitude of policy impacts" (Badoe & Miller 2000, p.261). Moreover, Hull & O'Holleran (2014, p.370) confirmed that research in the area does not clearly show which is the direction of the decision-making process (are individual's choices directed by the built environment). For instance, "Statistical analysis of opinion surveys has focused on individual norms, attitudes and values towards cycling and shown how these vary by socio-demographic group" (Hull & O'Holleran 2014, p.370).

2.3 High Quality Bicycle Networks: Best Practices

The Netherlands and Denmark are often considered as best practice examples for cycling infrastructure and policy (e.g. Hull & O'Holleran 2014; Bertolini & le Clerq, 2003; Martins, 2004; Pucher & Buehler, 2008), and commonly used as reference cases by cities that are learning how to manage change in their respective cycling networks. For example, Transport for London led an International Cycling Infrastructure Best Practice Study, which observed that nearly every interviewed authority was referring either to Denmark or the Netherlands as optimal cycling infrastructure experts (Urban Movement & Phil Jones Associates, 2014). Yet, the report for London Transport also highlights the importance of "Listen and learn, but then find your own way" (p.16), referring to the importance of context-specific solutions.

Below, a deduction from best practice cycling infrastructure literature are considered, aiming to gather a read thread in what constitutes good, functional, efficient and pleasant cycling network. The literature and government policy documents are divided into categories of: *cycling culture* and *incentives for cycling.* Cycling culture refers to social patterns and norms relating to cycling, such as political will, land use plans, and cycling promotion and advocacy. Whereas incentives for cycling relate to more specific infrastructures, such as bicycle network design, easy accessibility, cycling safety, and crossings and junctions.

2.3.1 Cycling Culture

Inevitably, aspects such as a city's topography, climate, weather, and social demographics influence the popularity of cycling as a transportation mode. In a sense, it is easy to advocate cycling as a sustainable mobility choice in cities with a flat topography, young population structure, and to blame rough weather conditions from optimising the bicycle as a transportation mode. However, it is not like the best practice examples, Netherlands or Denmark would be completely ideal climates for cyclists. In the Netherlands, the average temperature in January is about 2 degrees Celsius and 17.2 Celsius in July, while in Denmark the average January temperature is 0 Celsius, and 16.6 in July (World Bank 2017). The annual rainfall in the Netherlands is 765mm, and more than 900mm in Denmark. In comparison, in Helsinki the annual rainfall is only 650mm, and temperature in July 16.6 Celsius, which does not significantly differ from the Netherlands and Denmark. Nevertheless, the average temperature in January is around -8 Celsius, which is already a difference that can be felt (World Weather and Climate Information 2016). Moreover, Colville-Andersen, a famous Danish cyclist advocate, strongly believes that good cycling conditions do not depend on the geographical qualities or climate conditions of the city. Sooner, the determinant is how the business around cycling is functioning: large investments in good infrastructure and innovation contribute back to economy in annual health savings (Colville-Andersen, 2017, paragraph 4). This information illustrates the point that looking at physical geographic factors alone cannot explain people's mobility choices. Instead, the deliberation of mobility choices must extend to examine social and cultural factors as well, which are given attention next.

Cycling Culture & Local Political Will

Building on the above, the literature suggests that for the development of successful cycling network, it is important to have an optimal cultural environment (Vaismaa 2014; Hull & O'Holleran 2014). Cycling culture points at political will, both in terms of the state and its people, and therefore strategical scene of transportation planning as well. Firstly, the practice of spatial planning is inevitably connected to the local political scene, because the overarching regulations and policies are formulated by the government (Gupta et al. 2015). Therefore, it is beneficial if the local political system supports sustainable mobility means, for in such a case the general values and goals of the city are likely to favour cycling. To give an example, previous studies show that that regulating car traffic is at the core of cycling policy (Pucher & Buehler 2008). Car traffic, in turn, is largely steered through land use rules and regulations, like determining where driving an automobile is allowed, and which are the speed limits. Due to this, land use planning in transportation network development also plays a vital role.

Cycling Culture & Land Use Planning (in Transportation Network Development)

Land use plans are known as one of the most influential policies that shape urban transformation and the urban form; due to their long-lasting influence and large-scale coverage. Therefore, land-use policies should also be carefully aligned with longstanding developmental goals. However, it needs to be noted that land use planning as a general term refers to all kind of guidelines that has to do with land use; whereas here land use planning is considered precisely from the perspective of transportation planning and infrastructure.

That being clarified, it seems that land use plans in best practice cycling cities are tight together with policy that at large scale supports mixed-land use, compact building, and at more detailed scale, regulates the speed and use of automobiles, and furthermore prioritises cycling in their infrastructure plans and guidelines. It is well known that it in the best practice cases, it was precisely fundamental policy changes from the 1960s and onwards, which stimulated their success in creating high quality cycling networks (Pucher & Buehler 2008, p.496). In in Denmark and the Netherlands, mixed land use policies are aligned with cycling infrastructure (Hull & O'Holleran 2014, p.370). To illustrate, the general guidelines focus on compact building, and cycling is included in the land use plans comprehensively already on the wider planning scales, which arguably is one factor that guarantees efficient cycling policy in these countries. On the street level, cities that limit the use of the automobile, especially in city centres and suburbs, tend to have significantly more efficient cycling networks than cities without such a policy (Vaismaa, 2014, pp.274-279). Furthermore, Vaismaa interestingly argued that the existence of car-regulating policies is a consequence of long history of positive attitude towards biking (2014, pp.274-275), which is also a vivid example of strong political will.

It seems that the political will to enhance cyclists' conditions in Helsinki is continuously increasing. The Finnish Manual for Cycling Traffic states that a functioning cycling network begins from defining what are the ideal conditions for the network in the local context. As such, the manual describes the purpose of network planning is not to build cycling roads, but rather to increase the general conditions and safety, and to enhance the connection between cycling and other traffic (Pyöräliikenteen suunniteluohje, verkkoatson suunnittelu, p.1).

Cycling Promotion & Advocacy

The recent years, cycling advocacy has gained much attention: internationally through conferences such as Velo-City and Winter Cycling Capital; locally through cycling promotion in public spaces via shared-bicycle systems, and cities own promotion-programmes. Cyclist advocacy refers to promotion and marketing of biking, with the aim of increasing awareness and through that increase the number of urban cyclists. Moreover, in the twenty first century where competition amongst cities is increasing globally, ranking such as the Bicycle Friendly Cities Index by Copenhagenize Co. are lists that in a sense measure the success of different cycling cities, and what cycling advocates annually keep their eye on as well. However, it is understood that cyclist advocacy alone does not encourage people to use cycling as a transportation mode. Like Vaismaa phrases it, "A familiar idea from the entrepreneurial world is that the product needs to be in a great condition. The same ideology applies to cycling promotion" (2014, p.285).

To recapitulate, while many would agree that cycling advocacy and promotion alone is not sufficient to implement change in people's behaviour, it is still a notable influencer for the larger picture. If not for anything else, at least because governmental regulations and policies still set the general guidelines and directions for cycling infrastructure, its development, and therefore, its favour. Next, the thesis more specifically considers incentives that influence cycling from a design and infrastructure related perspective.

2.3.2 Incentives for Cycling

The literature suggests that the easier, quicker, and safer biking is the more likely those roads are to be used. Essentially, it seems to be the *quality* and not the quantity of cycling paths which encourages people to get active on their bicycles (Vaismaa, 2014, pp.278-279). Yet, what specifically constitutes quicker, safer, and easier cycling? Below, cycling infrastructure is considered from a more detailed perspective, considering bicycle network design as a whole; and in specific what prioritising cycle infrastructure denotes in terms of road crossings and junctions, and end-trip facilities.

Bicycle Network Design & Policy

Cycling networks which are well connected and thereby work efficiently, are those that the users tend to prefer the most. Connectivity of a city district is well carried out for instance in the classical grid-pattern, and hindered when barriers such as motorways break the pattern of streets with foot and cycle paths (Randall 2001). The Urban Movement Best Practice report showed that general clarity about the network designs are essential for the user experience. As such, connectedness, continuity and directness are key aspects of high quality cycling infrastructure design (Urban Movement 2014, p.6).

In order to guarantee high quality and connectivity for the entire road network, it can be profitable to think of cycle paths in terms of hierarchy. For instance, the Helsinki Cyclist Manual suggests that in neighbourhoods and less densely populated areas, it is most important to have the essential activities connected. The City of Helsinki sees two types of cycling roads, main and others. The main roads constitute the body of the network, guarantee accessibility, comfortableness, and safety from other traffic; and are defined by the number of users per road, how much space the path takes in the urban form, and what is its main function. For instance, the so-called Baana cycling paths are considered as main roads, since they connect essential parts of the city together, do not allow car-traffic in them, and for its central location, is used by many inhabitants (Helsinki Cycling Manual 2014). Other studies, such as the Urban Movement Best Practice report, have specifically stated that at the bottom of the road hierarchy are paths, tracks and lanes; which situate in busy streets amongst other traffic. For these type of cycle roads, proper separation from motor traffic is a demand (Urban Movement 2014).

However, even though "Quantitative cross-sectional research has shown a relationship between characteristics of the built environment, such as the availability of routes for cycling and patterns of cycling (Krizek & Johnson, 2006; Ogilvie et al., 2011; Parkin, Ryley, & Jones, 2007; Rietveld & Daniel, 2004 in Hull & O'Holleran 2014, p.370), the direction of the relationship seems yet to be unclear.

Moreover, there is a demand for certain traffic laws at the network level. It is evident, that in the urban transportation network cyclist safety is maximised, which can be guaranteed through legal setting. For instance, there needs to be "special legal protection for children and elderly cyclists", and the law needs to be on the side of the cyclist, rather than motor vehicles (Urban Movement 2014[8], p.523). In this sense, in best practice cities cycling policy has been formulated to be 'irresistible', so that motor traffic is calmed down by speed regulations and car-free zones; cyclist traffic is separated from high speed motor traffic, and particularly paid attention to in crossroads and intersections (ibid). Therefore, the safety aspect of bicycle transportation networks are examined next.

Cycling Safety

Numerous studies have concluded road safety to be one of the key hinders for a decision not to cycle (Cleland & Walton 2004; Dill 2009; Hull & O'Holleran 2014). Therefore, in order to encourage people for cycling, it is essential that the infrastructure supports safety on roads. In the Netherlands, for example, cycling has successfully been 'mainstreamed', based on the premise that the profile of cyclist does not depend on one's gender, age, cycling gear, or income group (Pucher & Buehler 2008, p.496). In other words, cycling has largely become a transportation mode for everybody.

Bicycle safety have been studied by looking at traffic accidents which involved a bicycle, comparing the injury and fatality rates through time and across countries. The use of a bicycle helmet might be a good indicator on the general cycling safety of the given (European or North-American) city. Pucher & Buehler's interviews with Dutch planners and cycling experts revealed that the professionals resist bike helmets, for the reason of them making cycling "less convenient, less comfortable and less fashionable" (2008, p.509). At an extreme case, the helmet may increase the risk for more accidents; due to the cyclist gaining a false feeling of safety which may make their cycling behaviour riskier than without a helmet; and from the perspective or motor vehicle drivers, making the driver less concerned about cyclists as they seem less vulnerable with the helmet (Walker, 2007).

Cyclist safety can and should be guaranteed through multiple approaches. Firstly, land use policies in traffic planning direct cyclist safety at a large scale, for instance in separating cyclist from motor vehicle traffic and pedestrians, or in regulating automobile speed and presence in certain areas, like city centres and suburbs all together. In more specific, safety can also be assured through smaller scale designs, like cycle paths and lanes (Pucher & Buehler 2008, p.551). A classic example of this is to separate bike lanes from other traffic with curb or other objects, such as plants, row of lamp poles, or like in the Danish model, parked cars. The bicycle is in a way a medium-quick transportation mode, it is significantly slower than cars, but quicker than pedestrians. Therefore, it is essential that the cyclist are separated from other traffics, for mixing different mobility speeds together in one lane is confusing and unsafe.

Crossings & Junctions

Especially in a city centre areas where the mix-use of transportation alternatives is high, traffic lane design in crossing and junctions are essential for the fluency and safety of the traffic flow. Ideally, crossings prioritise cyclist over the automobile, which in practice means that the cyclist do not need

[8] These results are from the Urban Movement 2014 report, which gained the data from interviews with bicycling coordinators in the Netherlands, Denmark and Germany.

to stop behind cars to wait for the traffic lights, but have the priority to stop in front of them (Pucher & Buehler 2008). Prioritising cyclist so that their frequency of stopping is minimised may increase the willingness of people to choose the bicycle as transportation alternative, as it guarantees a comfortable journey with a decent speed (Urban Movement 2014, p.6.).

In terms of design, aspects such as coloured paths, no curbs, advanced cyclist waiting positions in front of cars, and well-maintained roads are key policies to prioritise cyclists in traffic (Pucher & Buehler 2008). In the past, a popular method to decrease traffic congestion has been to build more motorways and add car lanes in city streets. However, it has recently been proven that such solutions rather function as an accelerator for car use (Hall, 2014, p.8), which does not only add environmental and noise pollution to cities, but also, decreases walkable and human-scale lives on streets, which in a long term, may even have a harmful influence to the local economy.

Easy Access & Traffic Guiding

Easy access denotes the abovementioned connectivity, and furthermore connectivity with other transports. For instance, it is important not to leave bike transportation as secondary to public transportation (Vaismaa 2014, p.285); but instead provide solutions to combine cycling with other public transports. The opportunity for bicycle parking around the city is vital for the ease of the transportation modes use. Even in the Dutch bicycle history, there was a time when the bicycle was viewed as a competitor to other transportation modes, such as buses, trams and trains (Martens 2008, p.283). This pitfall should be avoided, and instead acknowledge cycling as connected to other transportations, like walking or train-traffic. That being said, bicycle parking at big public transportation stations is vital for the efficiency and functionality of bicycle networks as a whole. Moreover, methods such as “Improved lighting and security of bike parking facilities often featuring guards, video-surveillance and priority parking for women” are considered as plausible policies (Pucher & Buehler 2008). For easy access to a transportation mode, it is thus important to consider *end-of-journey* activities and facilities. Essentially, these terms relate to parking opportunities around the city and in different activity locations, such as train stops, malls, bureaucracies and work places, and moreover, showering opportunities in working places (Urban Movement 2014). Also Hull & O’Holleran noted that the success of best practice cycling nations and cities “appears embedded in an integrated policy approach to promoting cycle accessibility for commuting, shopping and leisure purposes using car restrictive measures where necessary (Hull, 2010)” (in Hull & O’Holleran 2014, p.370).

2.4 Recapitulation

This chapter has extensively discussed urban health and its connection to transportation planning, what is meant by the concept or urban design, and what best practice cities for bicycle transportation networks tend to include in their infrastructure, policy and design. First, a brief look into transportation planning and its history was given; as well as providing a definition for urban health. Moreover, it was observed that there is a theoretical connection between urban health and transportation planning; in terms that a given city's transportation system demonstrates the state of the society, for instance whether it supports sustainable and healthy urban lifestyles. Second, it was concluded that urban design may facilitate a city to become healthier, considering all as aspects of the urban health definition: public, social, and environmental health, and in general quality of urban lives. It was argued that a healthier city is one in which human-scale designs and planning policies flourish, such as prioritising cycling as a transportation mode over automobile transit. Lastly, this theoretical argument was illustrated by looking at cycling infrastructure. Particularly cycling culture, namely political will, land use planning, and general cycling advocacy were considered as important factors; as well as more specific incentives that facilitate cycling, such as design on a network level, and specific infrastructures in terms of safety, crossing and junctions, and easy access[9]. Particularly this last part of the chapter is used as a conceptual reference in the analysis and discussion sections that follow.

[9] For brief reminders of the conceptualisation, see the Thesis Glossary.

3: Methodology

The overarching framework for data collection and analysis follows a mixed-method design. A mixed-method design is chosen to triangulate the data, and to gain a more comprehensive analysis. The epistemological viewpoint for the study is a critical realist's perspective. This chapter briefly examines the nature and philosophy of the study method (3.1), and corroborates why combining quantitative and qualitative approaches is relevant for the case (3.2). Moreover, the way of collecting data is described in detail (3.3), parallel to introducing the reader for the used datasets (3.4). Lastly, the study risks and limitations are acknowledged (3.5).

3.1 Epistemology

The thesis views reality in two ways, as 'real mechanisms and structures' and 'actual events and things'. The critical realist's perspective denotes that objects exist independently, whereas the understanding of objects is subjective for the individual (Price, 2014). Therefore, for a critical realist the social world (reality) is constantly in the process of renewal and change, which is also why understanding change and emergence patterns of a given phenomenon align with the research design (Bhaskar 1989, p.4, in Bryman 2012, p.616)[10].

Building on the above, an alternative for the traditional research logics is abductive reasoning, which combines both inductive and deductive tendencies (Sayer, 2003). Research logic typically follows either an inductive or deductive reasoning. In inductive research a theory stems out from empirical observations; while in deductive research, the empirical world is approached through a theoretical lens, aiming to elaborate the data in terms of the given theory (Bryman 2012, pp.36). However, here abductive reasoning is considered as appropriate, because the phenomenon is observed as "a dialogue between empirical data and theory" (Vaismaa, 2014, p.17). Moreover, Pelzer suggested that combining insights from the traditional two paradigms is particularly suitable for studying bicycle culture, for the approach is sensitive for interpreting social phenomenon (Pelzer, 2010, pp.9-10). For instance, the built environment, like cycling infrastructure, represents the 'real' objects of urban social lives, while the 'actual' is more related to cycling-friendly culture, observed subjectively.

Lastly, since the research method combines quantitative and qualitative data, it is suitable that the approach shifts between inductive and deductive reasoning throughout the study. In the data analysis, the quantitative part is deductive, as the chosen units of analysis are based on a theoretical background (see 2.3). The interviews, on the other hand, follow an inductive logic, due to the nature of thematic interviews. Like Philipp (1998, p.273) concluded, the two traditional types of methods are not necessarily mutually exclusive, but instead can strengthen one another. The mixed-method research is elaborated next with more detail.

[10] Critical realism is not dealt with much depth here, for the theoretical framework and empirical analysis are more at the focus of this study. However, for more on critical realism and its philosophy, see for instance Andres Sayer's *Realism and Social Science* (2000) and *Method in Social Science, A realist approach* (2003).

3.2 Mixed-method Research

The study deliberates what factors of the urban form influence the decision-making of Helsinki inhabitants while choosing cycling as transportation mode. Often social phenomena are studied through a case study methodology, as it enables intensive understanding and in-depth evaluation of a specific case. As such, this study has some case study tendencies, for it indeed uses a case (cycling in Helsinki) as an example to illustrate a theoretical point. However, the biggest concern for a case study is the inability to generalise the results (De Vaus 2001, pp.219-221). For this research aims at understanding larger scale patterns, and thereby search for some general tendencies, a case study design alone is not applicable for the study. Thus, the mixed-method approach is considered appropriate.

The research does not only couple quantitative and qualitative methods, but it also consists of both, secondary and primary data. A survey with more than two thousand respondents is used as the quantitative basis for the study. The survey (elaborated below) was executed by the Planning Department of Helsinki City (2016), and includes Helsinki inhabitant's opinions on current cycle-lane conditions and the development of the bike transportation system in general. The aim of the quantitative analysis is to identify patterns that may reveal what hinders and motives there exists for the inhabitants to choose bicycle as a transportation mode in connection to their urban environments.

Moreover, expert interviews are conducted, with the aim of providing more depth to the quantitative results. The interview respondents vary from Helsinki-based planning practitioners to academics, cycling activists, and other persons in the field of societal development. This type of mixed method design is also known as explanatory sequential design (Creswell 2012), which refers to two phases, first collecting numerical data, and second using the qualitative data to explain the quantitative part. The idea behind this mix-method research strategy is to triangulate angles to tackle the research questions, in that numerical data explains patterns, whereas qualitative data the more in-depth values.

Data Triangulation

Data triangulation can be divided into four different categories: triangulation of data, theory, method and researchers (Tuomi & Sarajarvi 2009, pp.144-145; Eskola & Suoranta 2001, pp.68-69). Here triangulation is used in theoretical perspectives (see Chapter 2), as well as in data collection and methodology. The data is triangulated by combining a quantitative survey and qualitative interviews. Therefore, also the analysis includes varying approaches. Mixed-method approach is chosen to diminish the weaknesses both quantitative and qualitative methods alone may face (Bryman, 2012, p.616), that is to understand the scope of the research more profoundly. With the help of quantitative data, this thesis looks at the more inhabitant-focused aspect of bike transportation networks. The qualitative data, on the other hand, aims at recognising a more depth to the statistical data.

3.3 Data Collection

The data collection can be divided into three phases. First, the literature review and background information research were conducted desk-based, focusing on theory, and taking place throughout the study. The numerical data is gathered from secondary source, and the original data is collected by the Helsinki City Transportation Planning Department. Considering that at the core of this thesis are in fact, people, the perception of the Helsinki inhabitants' is attempted to gain by using secondary data collected by the City Planning Department. The so-called Biking Barometer has been conducted twice, first in 2014 (review published 2015) and second in 2016 (review published 2017). The purpose for the original data collection was to follow the development of biking as a transportation mode in Helsinki in the eyes of the inhabitants, and with the help of these data, plan future projects for enhancing biking conditions in the city. Both samples consisted of 2004 respondents between the ages of 18-74, and the participants were randomised. The data was collected through phone-call based questionnaires (City of Helsinki 2014a, p.4; City of Helsinki 2016a, p.5; for questionnaire questions see Attachment 3.1). In addition to the 2004 survey respondents, approximately 3800 people were reached, but did not want to participate in the interview (City of Helsinki 2016a, p.6). These data have thus been used before in the publication of the Helsinki City Planning Department (available in Finnish). However, in this research these data are analysed in a way that has not been presented before, and, to the knowledge of the author, these data have not yet been used for academic studies.

The qualitative data is collected through expert-interviews. The interviews were conducted between April – June 2017, some of them taking place over Skype, and some face to face with the interviewees both in Helsinki and in Utrecht. The interviews were conducted to gain a better understanding of the quantitative data and the case context. More specific information about the interviews are listed below (3.4.2).

3.4 Data Analysis

3.4.1 Quantitative Part: User Experience Through Secondary Data

The Cycling Barometer 2016 is used to respond to the sub-research questions a-c. The data is used descriptively. The specific variables are defined with the support of the theoretical framework. However, before elaborating the chosen variables, the quality and content of the data is considered.

Data Representatives

Before looking at the data structure more specifically, it is first examined whether the Bicycle Barometer data is representative of the Finnish population. This is done with the help of the Chi-Square Goodness of Fit -test, to examine what is the likelihood between the observation and the null hypothesis. The test is done with two different population characteristics, gender and age group, to guarantee the liability of the results. A general problem with the Chi-Square tests is that the results are approximate. However, because the sample sizes are large, the approximation is not something that should cause a concern (Field 2000, p.2067).

In 2016, 50.72% (=2791/5503) of the Finnish population were female, whilst the male part of the population was 49.28% (=2712/5503). These data are taken from the government statistics website (Statistics Finland 2016a). The hypothesis is that there is no significant difference in the gender distribution between the Cycling Barometer dataset and the country's age distribution. Table 3.1 shows that the Chi-Square is .062, number of Degrees of Freedom (Df) equals the number of classes minus 1. The Asymp. Sig is .803, that is >0.05, which reads as the results being representative of the population, since the hypothesis was matched.

The same test is run to the age groups of the respondents. The beginning of the year 2016, the number of working-aged people in the capital region (Uusimaa) was 1 088 277, whereas the population from 15 to 74 was 1 252 250 people (Statistics Finland 2016b). The percentage of working population was 86.90% (=1 088 277/1 252 250). The number of people aged 65+ was in total 163 973, which translates into 13.10% (=163 973/1 252 250). However, it needs to be mentioned that the data from Statistics Finland (2016b) is not categorized exactly like the data in the Bicycle Barometer. In the Bicycle Barometer working age is 18-64, whereas in the Statistics Finland dataset working age is 15-64. In the outcome, the expected number of employed people is slightly higher than the observed number of employed inhabitants (see Category 1 in Attachment 3.1). Yet, because Statistics Finland has a wider range for 'working-age' than the Cycling Barometer, the difference between the expected and observed number is not considered as significant. Moreover, for the unemployed inhabitants the observed value was in fact higher than the expected number (see Category 2 in Attachment 3.1). Therefore, regardless of the minor difference in the age group sample, these data are regardless considered as suitable for the Chi-Square test. The hypothesis is again that there is no significant difference in the age distribution between the 2016 Cycling Barometer dataset and national statistics. Table 3.1 presents the Chi-Square of the age distribution, which is 1.875. The Degrees of Freedom is 1, and the Asymp. Significance .171, also >0.05. Thus, also these results align with the hypothesis. Based on the two Chi-Square tests, the data can be considered as representative of the local population.

Table 3.2 Outcomes of the Chi-Square Tests			
	Chi-Square	Df	Asymp. Sig
Gender	.062	1	.803
Age	1.875	1	.171

Data Structure

The structure of the 2016 database is presented in Table 3.2 (N=frequency of responses; % = percentage of all responses). Looking at the data structure, it can be observed the characteristics of the respondents are versatile, and various connections between different attributes could be studied. However, specific attributes are subtracted for the analysis so that the chosen variables align with the theoretical assumptions.

In addition to the demographic characteristics, the data includes a questionnaire. The specific questions are listed in Attachment 3.1. From these questions, only the most relevant ones, that is the questions which relate to decision making based on the commute purpose, to distance travelled, duration to the destination, and to the time of the year.

In the empirical findings, the descriptive statistics are analysed in order to gain an overarching understanding of the context, both in terms of the research case as well as the content of the data. The descriptive statistics focus on the characteristics of the population, and follow the structure provided in the framework.

Table 3.3 Quantitative Data Structure				
	All Respondents		Cyclists	
	N	**%**	**N**	**%**
All Respondents	2004		1406	
Gender				
Female	1022	51%	694	49%
Male	982	49%	712	51%
Age Group				
18-24	193	10%	139	10%
25-34	478	24%	358	26%
35-49	554	28%	430	31%
50-64	496	25%	329	23%
65-74	283	14%	150	11%
Area				
Inner City	702	35%	494	35%
Suburbia	1302	65%	912	65%
Education				
Primary School	114	6%	72	5.1
Secondary School	773	39%	507	36.1
Undergraduate Degree	471	24%	335	24%
Graduate Degree	646	32%	492	35%
Work Situation				

Employed	1227	61%	923	66%
Unemployed	105	5%	71	5%
Student	228	11%	166	12%
Pensioner	381	19%	201	14%
Other	63	3%	45	3%
Income per House Hold (gross of previous year)				
Less than 20 000€	276	15%	180	13%
20 000€ - 39 999€	419	21%	285	20%
40 000€ - 69 999€	459	22%	330	24%
70 000€ - 99 999 €	262	13%	203	14%
More than 100 000 €	190	9%	141	10%
N/A	398	20%	267	19%
Cycling				
All year round	223	11%	223	16%
When no snow on the ground	619	31%	619	44%
May-September	564	28%	564	40%
Not at all	598	30%	-	-
Size of Household				
1	574	29%	356	25%
2	819	41%	576	41%
3	260	13%	194	14%
4 or more	351	18%	280	20%
Children of School Age				
Yes	369	18%	246	22%
	1635	82%	890	78%
Access to Car (per House Hold)				
Yes	1262	63%	903	64%
No	742	37 %	503	36%
Uses Public Transportation				
Daily or almost daily	783	39%	476	34%
2-3 times a week	411	21%	334	24%
Once a week	321	16%	249	18%
Less than once a week or never	489	24%	347	24%
Uses Car				
Daily or almost daily	622	31%	417	30%
2-3 times a week	439	22%	321	23%
Once a week	312	16%	237	17%
Less than once a week	589	29%	415	30%
Never	42	2%	16	1%

Choosing Units of Analysis

The choice of variables for the analysis is based on the literature review and analytical framework (Chapter 2). It was discovered, that to study people's mobility choices is a complex topic, for there are various reasons influencing individual's decision-making. Developing on the idea of de Dios Ortuzar & Willumsen (2011), Romero et al. classified a set of influencing factors into three groups: "(i) intrinsic characteristics of the individuals, (ii) characteristics of the travel and (iii) characteristics of the transportation mean" (2017, p.136). This analogy is useful, because it enriches the analysis context by enabling aspects such as household size, location of housing, income, purpose of the commute, distance travelled, duration to the destination, time of the year (especially in the Finnish weather context), and travel smoothness, costs, and personal preference of the commute to be taken into an account. Therefore, the analysis should be conducted in a context which enables multiple aspects to be taken into an account.

Consequently, the variables analysed in the first part of the quantitative section (4.1.1), which describes the profiles of Helsinki cyclist, are educational background, employment rates, annual household income, and used transportation mode (cycling, car, and public transportation). Nevertheless, in the later parts of the analysis variables that relate to the city form and infrastructure more closely are chosen, because the theoretical background does not directly build on inhabitant's educational background, current employment status, or for that matter income group. Instead, variables relating to inhabitants' geographical location and typical daily habits are chosen. The second part of the quantitative section (4.1.2) considers the reasons why Helsinki cyclists decided to bike, and for this purpose three factors are chosen: purpose for cycling (end-journey activity), reason for cycling (ideology), and reasons why bike not chosen as a transportation alternative. Lastly, the Helsinki cyclist satisfaction toward the city in terms of cycling conditions is observed, in terms of it safety, smoothness and convenience of cycling, and network in general (4.1.3). These factors are moreover compared in terms of residential location, daily distance travelled, and end-journey activity. It is considered that in this way, the analysis will sufficiently consider the factors that Romero et al. (2011) suggest are essential for the topic.

3.4.2 Qualitative Section: Expert Interviews

The specific interviewees were chosen based on a snowballing networking process. First, a professor from Utrecht University at the Faculty of Geosciences kindly shared some valuable contacts at Helsinki's end, for he had done some cooperation with Helsinki-based urban planning and development researchers in the past. His contact in Helsinki shared information and contact lists for Helsinki-situated professionals in the field of transportation and cyclist network planning, after which the network again enlarged. Lastly, I participated in the Velo-City 2017 cycling advocacy conference in Arnhem-Nijmegen in June 2017, and met a lot of people working with cycling advocacy and transportation planning both within in Finland and elsewhere. A few of these contacts agreed to have an interview regarding this thesis. Due to this reason, the interviews were conducted in two sloths, prior and after the conference. The original language for five of the interviews was Finnish, for which reason the key points have been translated by the author. The interview taking place in the Netherlands was conducted in English.

Name Referred in Analysis	Field	Expertise	Date of Interview
Rep from HSL	Cycling Promotion and Communications	Working with cycling promotion and communications	April 26, 2017
Rep from HCPD	Traffic Planner	Specialised in car- and cycle transportation & traffic planning	May 23, 2017
Helsinki Cyclist	Helsinki-based Cyclist Advocacy Organisation	Cyclist throughout his lifetime, volunteer-work at a cyclist advocacy organisation	May 23, 2017
Think Tank Rep	Researcher for a Helsinki-based Think Tank	Generalist researcher in urban studies and planning, Helsinki cyclist	May 29, 2017
Rep from FCF	Representative from the Finnish Cycling Federation	Part of the movement who started cycling advocacy in Helsinki	June 20, 2017
Rep from Utrecht Province	Cycling policy advisor, Utrecht Province	Expertise in cycling policy, based in Utrecht, the NL	June 30, 2017

Table 3.4 Interviewees

Table 3.4 summarises the expertise of the interviewees, however so that the identity of the interviewee has been anonymised. All together six interviews were conducted. The first interviewee is a representative from HSL (Helsinging Seudun Liikenne), which is the largest governmental organisation in Helsinki working with cycling promotion and communication. She has been working with cycling advocacy related topics for most of her career. This interview was conducted via Skype. The second interviewee is a traffic planner from the Helsinki City Planning Department (HCPD), who has a strong history in the cycling network planning scene in Helsinki. Moreover, he has experience from the consultancy work, and is familiar with the Danish and Dutch cycling contexts. The third interviewee is a cyclist advocate based in Helsinki, having biked and lived in the city for most of his lifetime. The fourth interviewee is another Helsinki-based cyclist, having a specialisation in urban planning and urban studies. She is currently employed as an urban researcher by a Helsinki-based think tank. The second, third, and fourth interview were conducted face-to face during a field study in Helsinki. The fifth interviewee has been working with cycling advocacy for about a decade, and represents the Finnish Cycling Federation. This interview was done through Skype. The last interviewee is a senior cycling policy advisor, currently employed by the Province of Utrecht. This interview was conducted face-to-face in Utrecht, and is the only interview which original language was English. Thus, all other interviews were translated into English from Finnish by the author. The final transcriptions have been seen and accepted by each interviewee.

Regardless the fact that some interviews were conducted face-to-face, and some via Skype, the interviews followed a same logic. Each interview was semi-structured, and had six pre-defined discussion topics; namely (1) change in the system; (2) change in the city form; (3) promotion & enhancements; (4) planning and maintenance; (5) bicycle parking; and (6) safety. These themes stemmed from the literature review, in that the three first themes relate to *cycling culture*, whereas the last three more to *incentives for cycling.* Due to the varying expertise of the interviewees, each interviewee had a bit differing focus point amidst the themes. After the data collection, the interviews were analysed in three phases. Firstly, all transcriptions were carefully read through and re-categorised under the abovementioned themes. Due to the semi-structured nature of the interviews, some intersecting occurred. Therefore, the second phase was to write a storyline out of the interviews, as of to minimalize conceptual overlapping. Lastly, the interview themes were translated in terminology that aligns with the theoretical framework.

3.5 Limitations & Risks

As the quantitative data is collected from a secondary public source, they are accessible for anybody with access to internet. However, the original questionnaire and data are available in Finnish only, which creates some limits for the access. Yet, in the Attachment 3.1 translations for the questionnaire are provided, which may facilitate a non-Finnish speaker to use the data, too. Therefore, the quantitative part of the study is replicable, as the data is public, and as the steps conducted are elaborated in the thesis and attachments (Bryman 2012).

The measurement validity concerns if the variables used indicate the connection between the individual's decision-making and urban design. For the questionnaire questions particularly ask for factors that influenced the cyclists' choice of transportation mode, and their satisfaction toward certain aspects of the cycling network, it can be considered that the variables are connected. However, the results do not pinpoint the direction of causality with a solid certainty, and therefore, the discussion deliberates whether the independent variables truly are "responsible for the variation that has been identifies in the dependent variable" (Bryman 2012, p.47). As the sample for the quantitative data is randomised, the data can be considered as externally valid. Lastly, because the study context situates in a real-life example, its ecological validity is considered as applicable for a natural social situation.

In qualitative research, general limitations are its lack of ability to generalise data, that the research may not be replicable due to changing social contexts, and sometimes, lack of transparency (ibid). These concerns exist even within the qualitative section of this thesis: only six expert interviews were conducted, which is not large enough sample size to draw general conclusions. Moreover, for the interviews were conducted in a certain time-period which is relevant to the interview discussions, the exact same interviews cannot be conducted in the future by another person. Lastly, the interviews were conducted by one person only, and the interviewees were gathered by network snowballing, which may influence the objectivity of the results gathered.

However, the quality of the qualitative research part is aimed to guarantee by paying attention to its validity, replication, and reliability (Bryman 2012). First, the external validity bias is tried to overcome by not claiming that the qualitative results are generalizable in the first place. The purpose of the qualitative data is to deepen understanding of the quantitative data, rather than making a generalisation based on the interviews. Second, the trustworthiness of the results is attempted to guarantee by conducting expert interviews, so that the chosen representatives in fact are familiar with certain terminology, as well as study context and topic. In this way, misunderstandings regarding context and culture are at best avoided. In terms of replication, description about the content of the qualitative interviews (code-tree/themes) and the characteristics about the interviewees are given above, which could be used to conduct the interviews again.

A fundamental limitation for this study is that the topic of people's decision-making is generally complex to study. The influence of urban design is difficult to measure, due to the open-ended definition or urban design/urban form, but also because individuals' experience in an urban environment can be subjective. These limits are aimed to overcome by considering urban design in terms of cycling infrastructure, and by being aware that the results rather show general tendencies than absolute truth. Moreover, peoples' decisions may be influenced by very small factors and alter often, and, as there seems to be a lack of consistency in the previous methodologies (see for instance Ewing & Cervero 2010; Mueller 2016; Badoe & Miller 2000). The mixed-methodology is an effort to overcome these biases, but in a sense also a creative attempt, and therefore could be criticised for exploratory tendency. Moreover, in terms of mixed-methodology, there is a risk of subjectivity in that the qualitative data can be read as complimentary to quantitative results, whatever they be. However, being aware of these biases, the researcher can at her best to try to look at the data objectively, and understand the limitations of the methodology.

4: Empirical Findings

This chapter presents the empirical data. The first part (4.1) focuses on the secondary source quantitative data, while the second part (4.2) on the qualitative data gathered from the expert interviews. For each figure, table, and graph, the background data can be accessed in the Attachments under the respective number of the figure.

4.1 Quantitative Section

The quantitative section is divided into three themes. First, 4.1.1 presents who cycles in Helsinki, and second, 4.1.2 considers which factors have been influential when Helsinki cyclists have chosen their mode of transportation. Third, 4.1.3 examines the inhabitants and cyclists' satisfaction toward the bicycle network system in connection to their physical surroundings (infrastructure). The influence of the physical surroundings toward people's transportation choice is looked by combining questions relating to satisfaction together with three variables: residential area, daily distance travelled, and end-journey activity.

4.1.1 Who cycles in Helsinki?

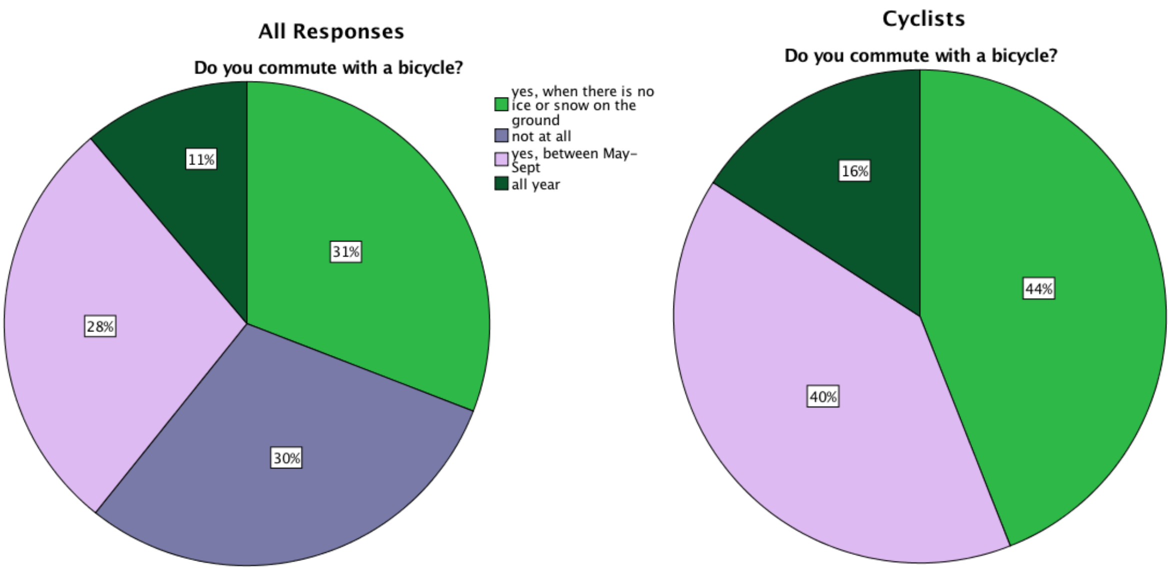


Fig. 4.1 Frequency of Cycling

(All responses n = 2004; cyclists n = 1406[11])

First, the number of cyclist in Helsinki is considered. The survey reveals that 70% of the respondents do cycle at least occasionally. However, much of the cycling takes place seasonally: 28% of cyclist only use bikes during the late spring, summer, and early autumn; and 31% cycle when there is no snow or ice on the ground. Amongst the cyclist, the majority (44%) seems to use the bicycle whenever there is no snow or ice on the ground, whereas 40% of the respondents report their cycling period to take place between the months of May and September (See Fig. 4.1). 16% of the cyclist use the transportation mode around the year, regardless of weather conditions. From now on, those who cycle between May and September are referred as *seasonal cyclist*, because in Helsinki (and Finland in general) these months are considered the cycling time of the year. Those who cycle when there is no ice or snow on the ground, are referred as *situational cyclist*. The rest of the group are considered as *non-cyclists* or *around-the-year cyclists*. In order to gain more contextual understanding, it is interesting to look at who cycles in Helsinki. Therefore, the first part of this analysis chapter looks at cycling in Helsinki in relation to one's educational background, income group, and residential location.

[11] The number of respondents is mentioned for each graph, because there are differences between the sample sizes, for two primary reasons. One, in some graphs only certain groups of the respondents are looked at; such as cyclists, or people having access to cars. Two, not every survey respondent replied to every question of the survey.

Educational Background & Cycling

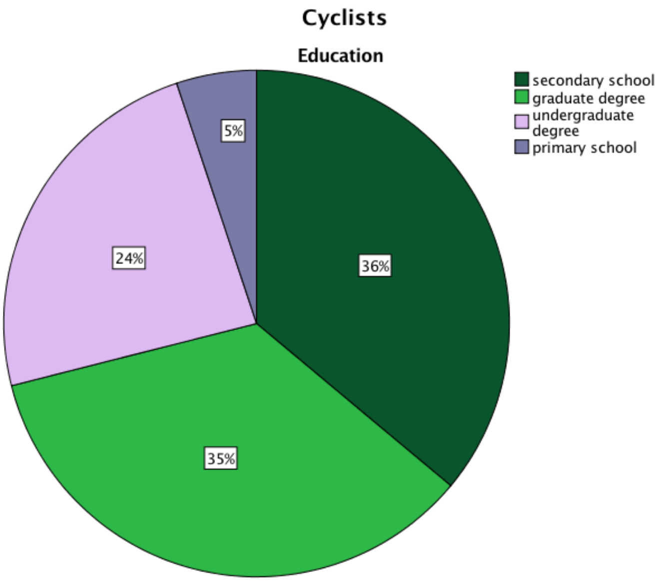


Fig. 4.2 Educational Background & Cycling
(Cyclists n = 1406)

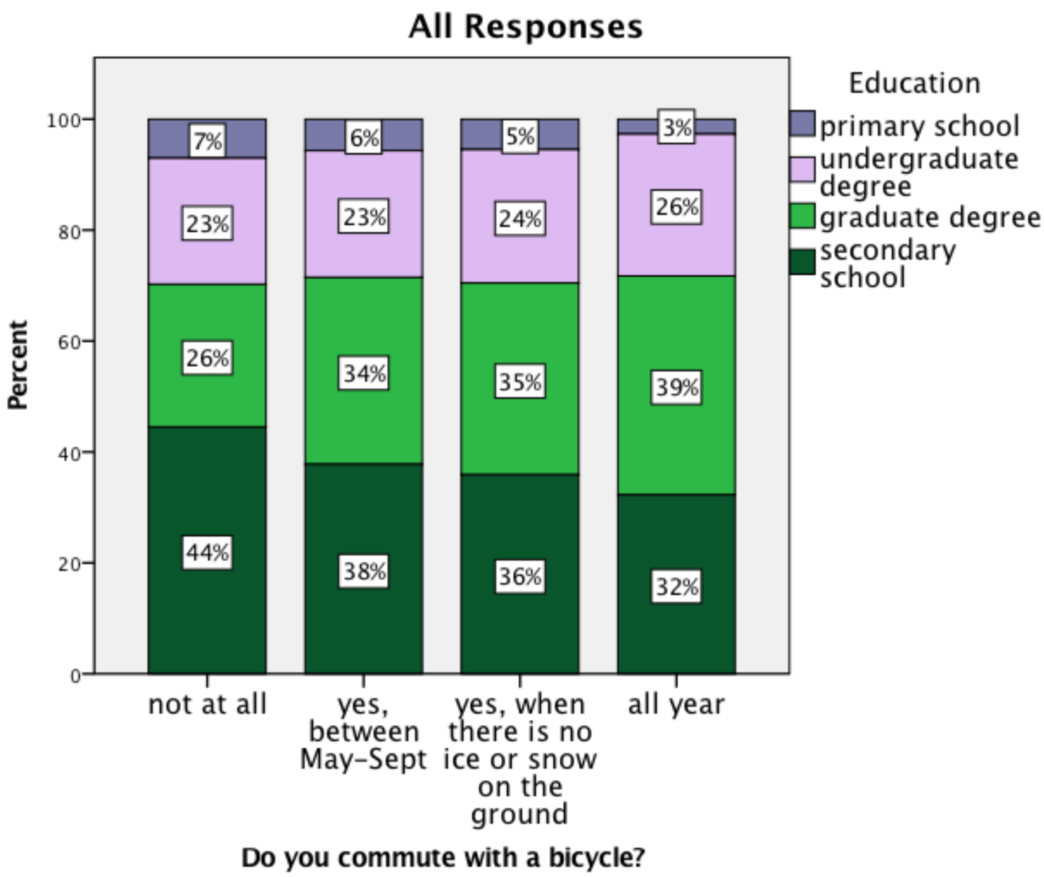


Fig. 4.3 Educational Background & Cycling Frequency
(All responses n = 2004)

Figure 4.2 illustrates the educational background of cyclist in Helsinki. It shows that most Helsinki cyclist possess either a primary education (36% of cyclist) or graduate degree (35% of cyclists). Those with only a primary education cycle the least (5% of cyclists).

Figure 4.3 is a result of a crosstab in which cycling frequency (period of the year when cycled) and education are considered in relation to each other (see Attachment 4.3 for Crosstab Output). It shows that most of the *all-year cyclists* have a graduate degree, with 39% of the total who report their cycling behaviour to last around the year. Inhabitants with primary level education are less likely to cycle all year, they constitute only of 3% of all-year cyclists in Helsinki, whereas those with a secondary school education form 32% of the all-year cyclist, and undergraduates 26%. From the *situational cyclists*, inhabitants with a secondary school education are the most active ones, with 36% out of all situational cyclists. Yet, inhabitants with a graduate degree background constitute 35% of cyclist during times without snow or ice, which is only a minor difference to those with secondary school education. The biggest divergence from the active cyclist groups is again with people with primary school background, who account for 5% of this cyclist group. A similar pattern applies to *seasonal cyclists*. Secondary school graduates comprise 38% of all seasonal cyclists, graduate degree respondents 34%, undergraduates 23%, and primary school graduates 6%. Interestingly, for *non-cyclists*, also the largest educational background group is secondary school graduates with 44%. Those with a graduate degree consists of 26% of the non-cyclist, and 7% of the non-cyclists have an undergraduate.

In sum, in Helsinki the most active cyclist by educational group are those with a secondary or graduate degree backgrounds, however, this educational group is also the background for those who cycle the least.

Employment & Cycling

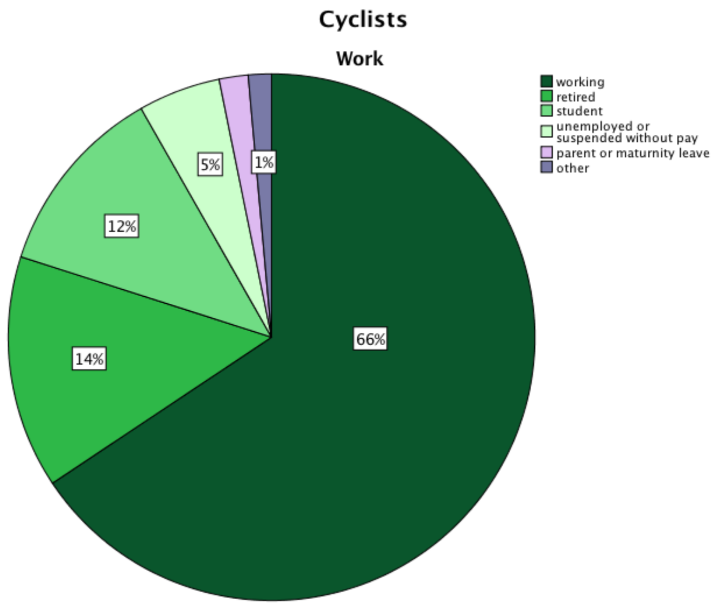


Fig. 4.4 Employment Situation & Cycling
(n=1406)

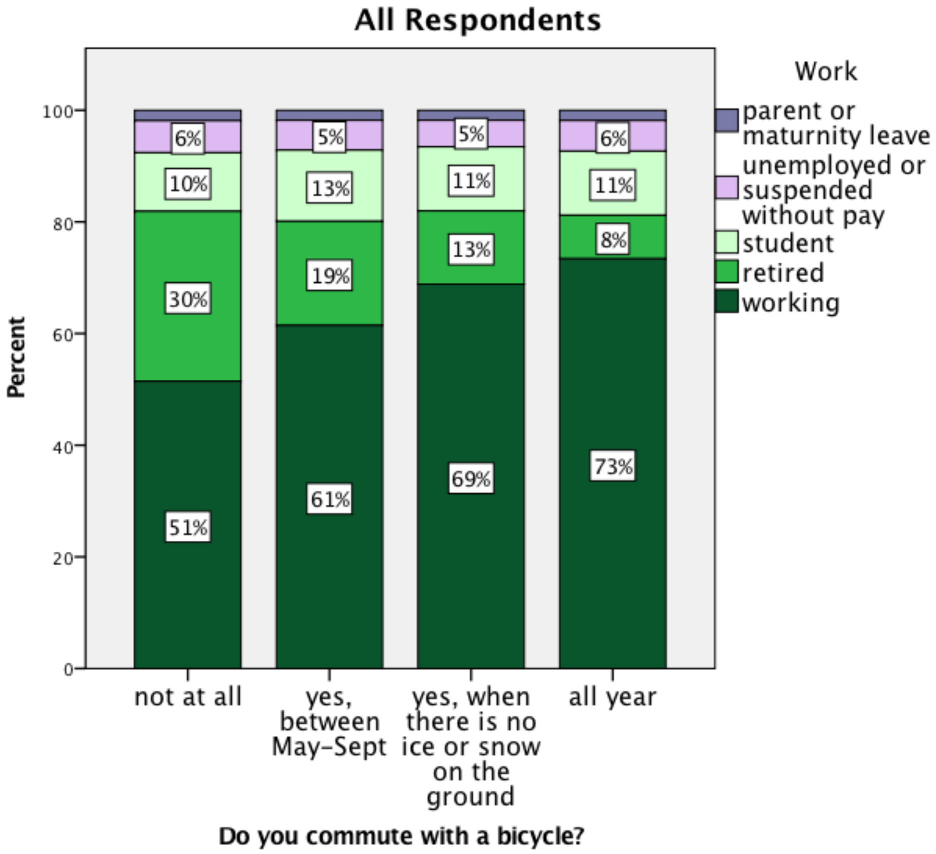


Fig. 4.5 Employment & Frequency of Cycling
(n=2004)

Figure 4.4 shows the work-life situation of Helsinki cyclist. 66% of cyclist are working full-time, and the second largest cyclist group, the retired, cover 14% of Helsinki cyclists. 12% of the city's bikers are students, and 5% unemployed. The minority of the city's cyclist identify as something else, for instance having a paternity or maternity leave (see Attachment 4.4 for frequency table).

Figure 4.5 moreover presents the working situation of Helsinki inhabitants per their cycling frequency (period of the year when cycled). The connection is statistically significant, for As. Sig. = .000. From the *around-the-year cyclists*, 73% are employed, 11% are students, and 8% pensioners. 6% or the around-the-year cyclists are unemployed. Moreover, 69% from the *situational cyclists* are currently employed, and 13% retired. From this cyclist group 11% are students, and 5% unemployed. From the *seasonal cyclists.* 61% have employment, but the quantity of retired seasonal cyclists is larger than situational or around-the-year cyclist, that is 19%. Also, 13% out of the seasonal cyclists are students, which is the largest percentage for students in any other cyclist group. The unemployed again account for 5% of this cyclist group. Lastly, 51% or the *non-cyclists* are employed, while the second largest group of non-cyclists are the retired, by 30%. 10% of the non-cyclists are students, and 6% unemployed.

In brief, those who cycle the least in Helsinki by current employment situation are those on a maternity or paternity leave, second the unemployed, and third the students. The most active cyclist groups are the employed inhabitants, and the retired (see Attachment 4.4 for Cross-tab).

Annual Household Income & Cycling

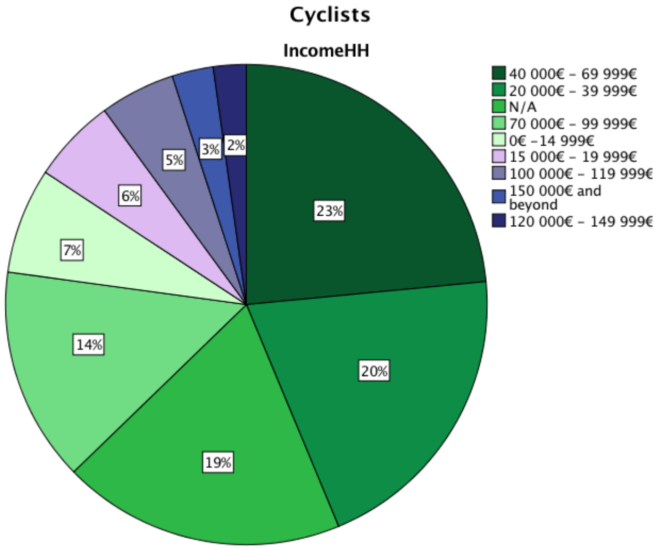


Fig. 4.6 Annual Household Income & Cycling
(n=1406)

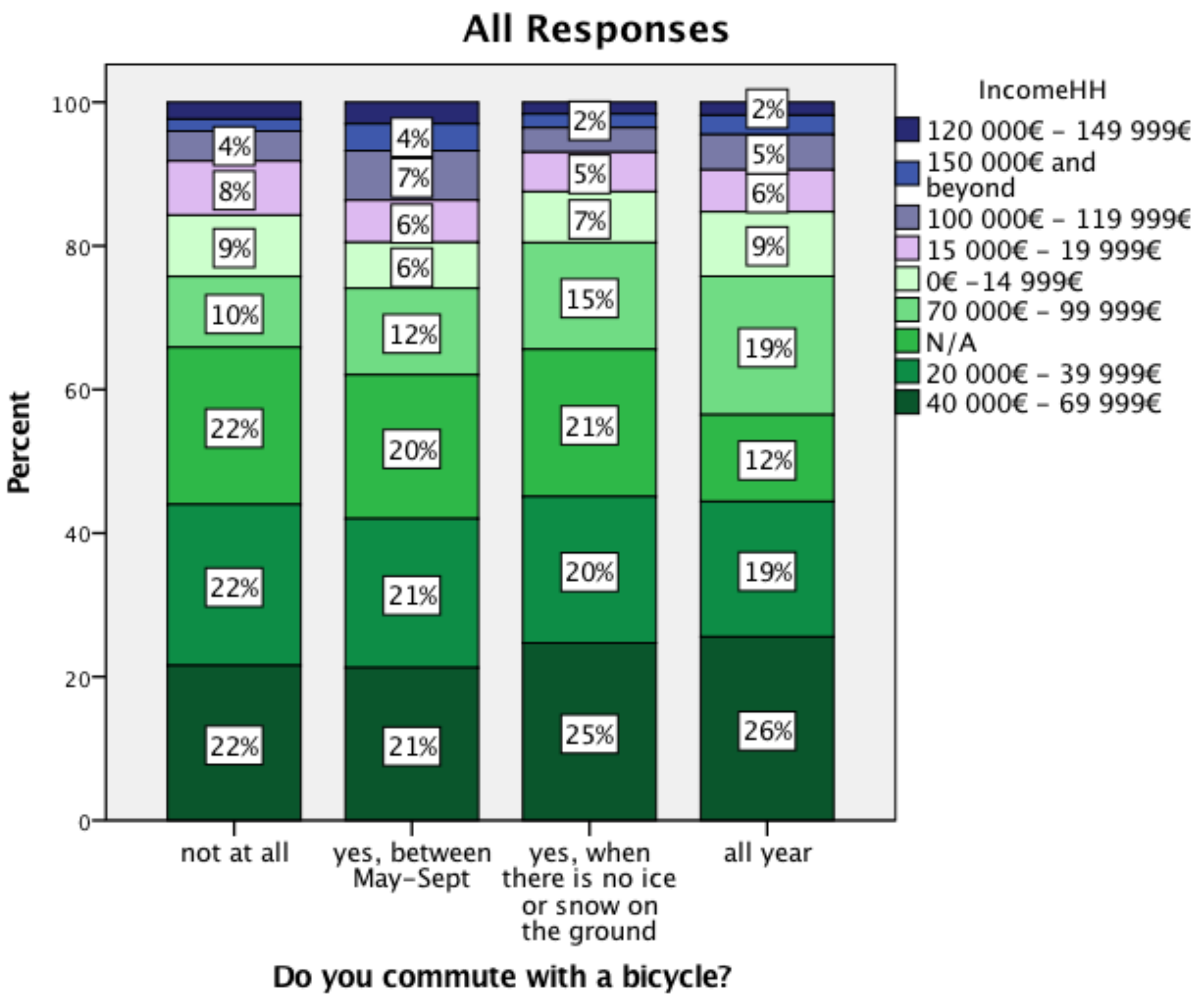


Fig. 4.7 Annual Household Income & Cycling Frequency
(n=2004)

Figure 4.6 simply presents the income frequency of Helsinki cyclists. The average income in Helsinki is around 3300€ monthly, or 39 600€ annually (Yle 2016). Furthermore, Figure 4.7 visualises the relation between cycling frequency (period of the year when cycled) and household annual income. The figure is a visualisation of a computed crosstab, which statistical significance is As. Sig. = .003 (see Attachment 4.5). It can be observed that the largest income groups *amongst all-year, situational, and seasonal cyclists* are those around the middle-income average of the country (20 000€ - 39 999€ and 40 000€ - 69 999€) and a little bit beyond (70 000€ - 99 999€). However, it is also these income groups who account for the largest percentage for the *non-cyclists*. Moreover, it needs to mentioned that in this graph the quantity of 'no-answers' was high, for household average income is rather sensitive information.

Next, the analysis looks at the data in terms of residential location. Residential location is considered for it may reveal patterns that are typical for individual's choices, such as regarding daily distance travelled, or the access to other forms of transportation modes than cycling.

Location of Residence & Used Transportation Mode – Cyclists

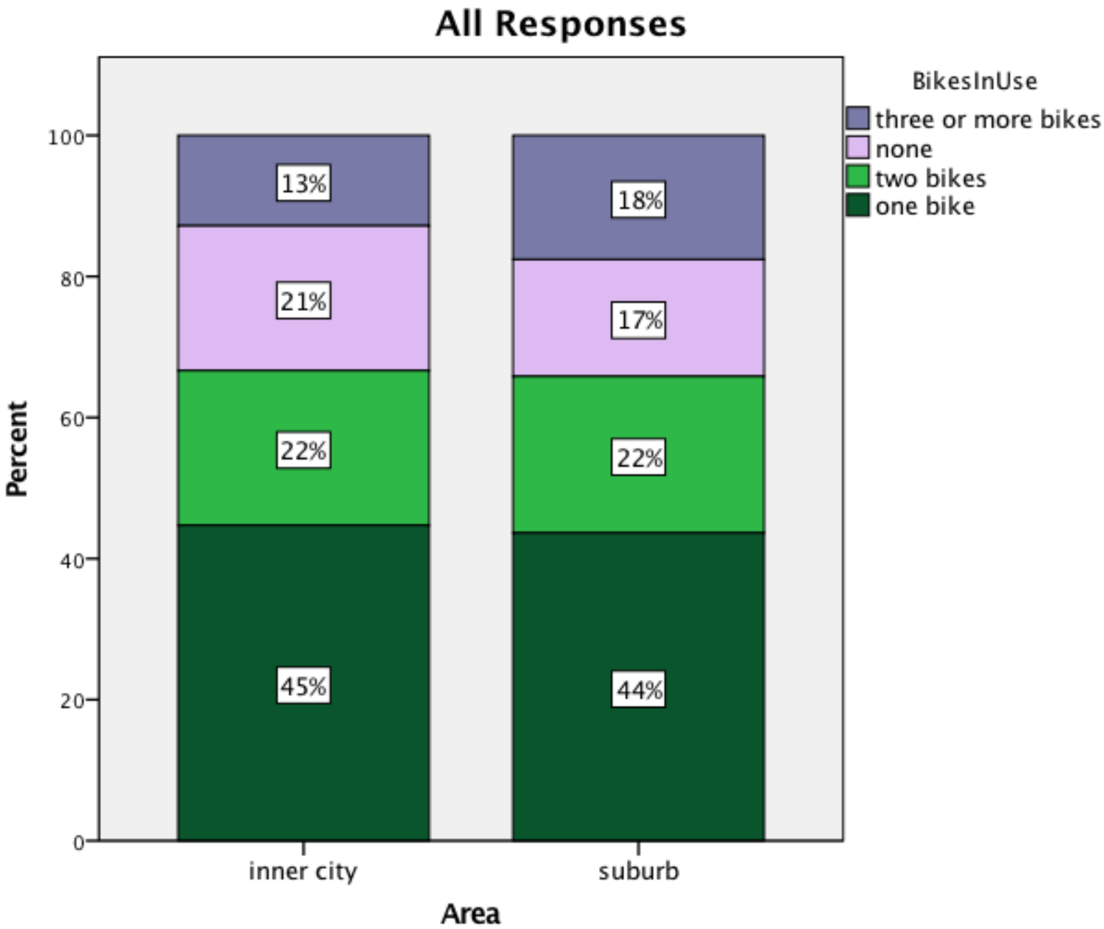


Fig. 4.8 Residential Locations & Access to Bikes
(n=2004)

Figure 4.8 visualises the accessibility to bikes per residential location. The cross tabulation is statistically significant (As. Sig. = .014). The difference in access to bikes between residential locations does not radically deviate. For both inner-city and suburb residents, it is most common to have access to one or two bikes. However, it is more common to have access to zero bikes than three or more bicycles. There are more inner-city residents with no access to a bicycle at all (21%) than suburb residents (17%). Likewise, it is more common to have access to three or more bikes if the individual resides in the suburbs (18%) than in the city-centre (13%). All together 84% of suburb residents have access to bicycles, whilst in the inner city 80% or people have access to bicycles (see Attachment 4.6 for crosstab).

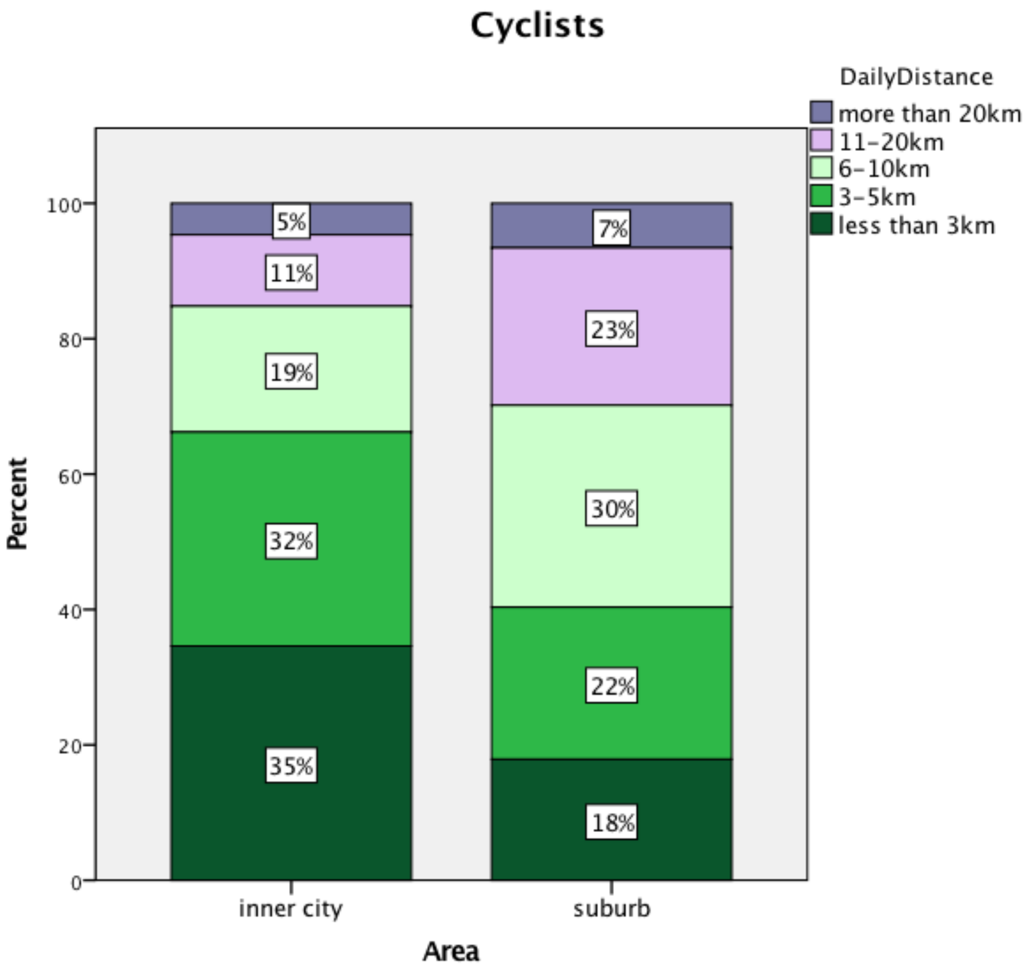


Fig. 4.9 Location of Residence & Daily Distance Travelled
(n=1406)

Fig. 4.9 visualises the connection between Helsinki cyclists' daily travel distance (to work, school, or other daily destination) and residential location. The As. Sig. = .000, and therefore these results are viewed as noteworthy. A clear trend is that the inner-city residents cycle shorter distances, 67% of inner-city cyclists' commute distances shorter than 5km. In the suburbs, only 30% of the inhabitants cycle distances below 5km. The most common distances for cyclists in the suburbs are 6-10km by 30% of the people, and 11-20km by 23%. In inner-city the respective percentages are 19% for 6-10km, and 11% for 11-20km. Thus, the largest difference of the daily cycled distance between the inner-city and suburb inhabitants are, quite logically, that inner-city residents bike shorter distances than those in the suburbs (see Attachment 4.6 for crosstab).

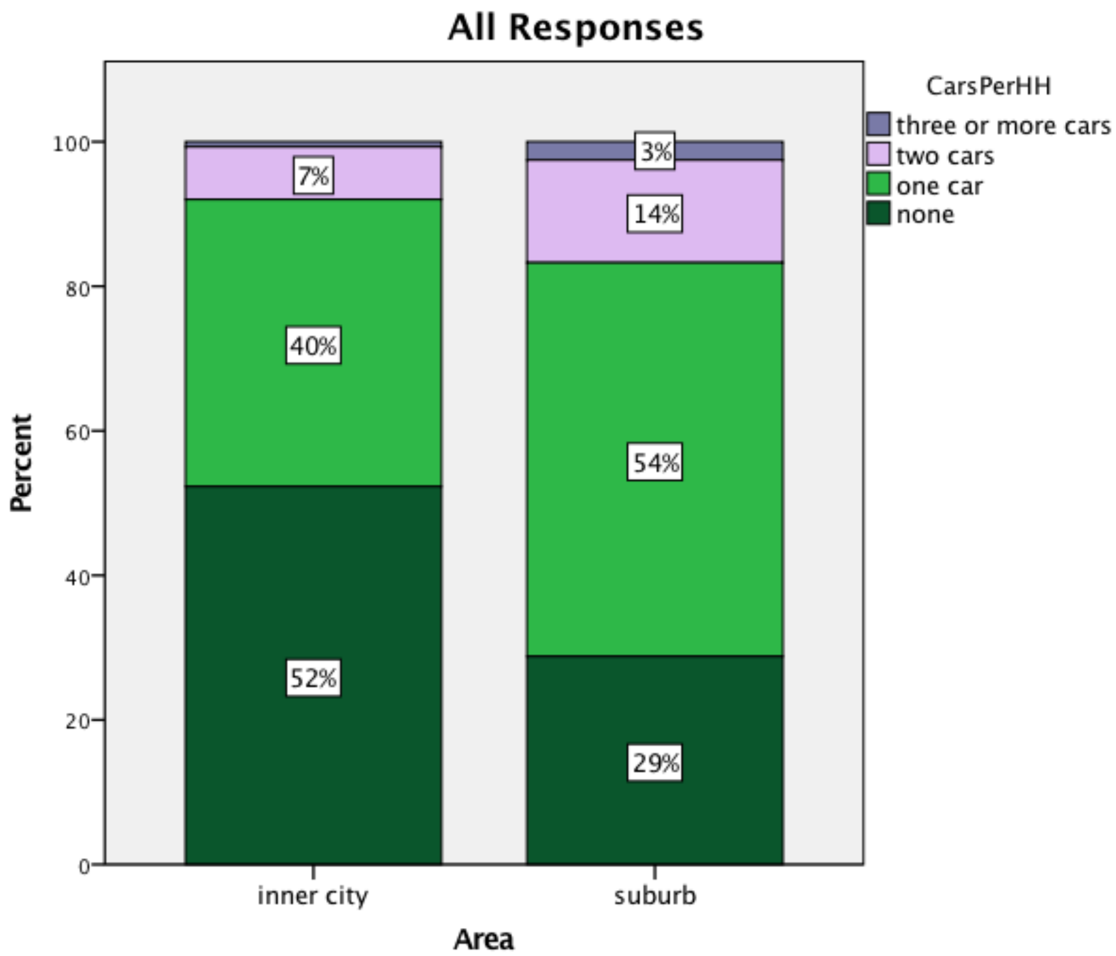


Fig. 4.10 Residential Location & Access to Cars
(n=2004)

Figure 4.10 reveals the access to cars per residential location (As. Sig. = .000). It is evident that most (52%) of the inner-city residents do not have access to a car, whereas amidst the suburb residents the non-car ownership only accounts for 29% of the people. Most suburb residents have access to one car (54%). However, also a great deal of inner-city residents have access to one car, according to the data 40% of the inhabitants. In the suburbs, 17% of respondents have access to two or more cars, but in the inner city only 8% possess the same accessibility (see Attachment 4.8 for cross table). As such, people residing in the inner city are less like to possess multiple cars.

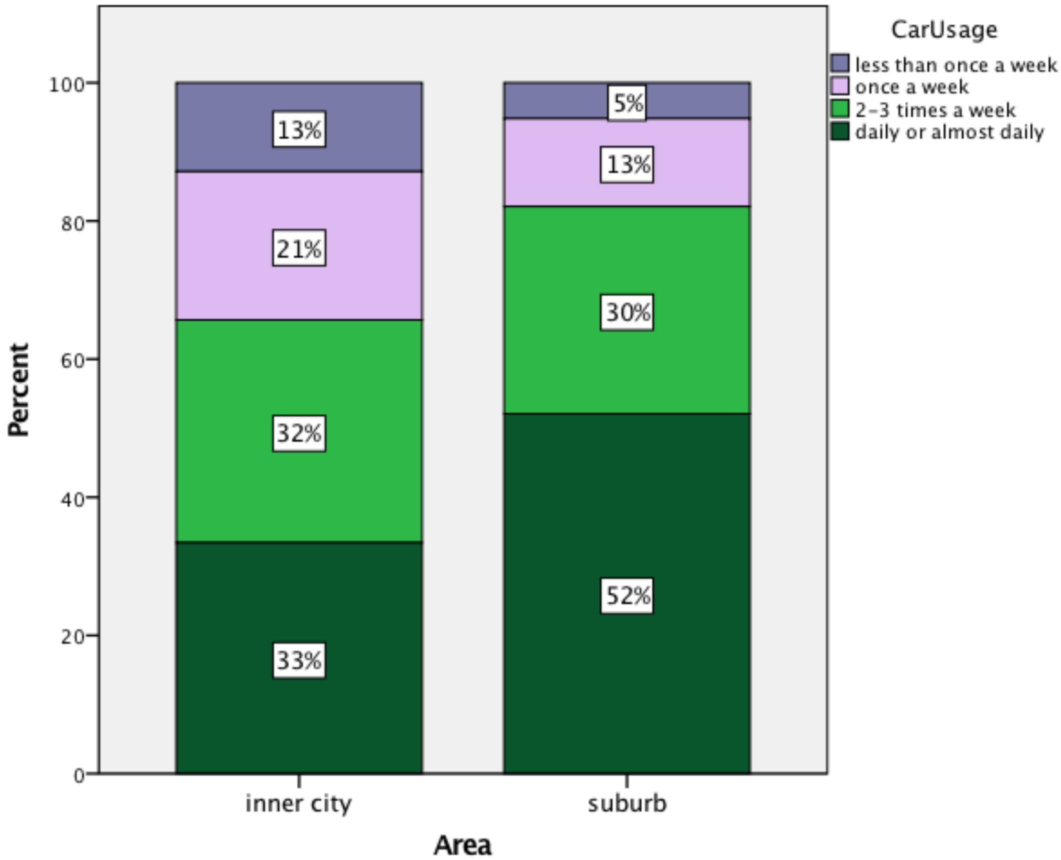


Fig. 4.11 Residential Location & Usage of Cars

However, the data which reveals access to cars per residential location does not alone explain how much the residents in fact use their cars. Therefore, Figure 4.11 shows how often residents who have access to one or more cars, drive. In the inner city, 33% of people with access to car drive daily or almost daily, while in the suburbs the corresponding percentage is 52%. The difference between those who drive 2-3 times a week is less. In the inner city, 32% use car 2-3 times a week, and in the suburbs 30%. Yet, quite interestingly, 21% of inner-city inhabitants use car once a week, while in the suburbs it only concerns 13% of the people. In the end, these data show that those residing in the suburbs are likely to use cars more often than those living in the inner-city area.

Location of Residence & Used Transportation Mode – Public Transportation

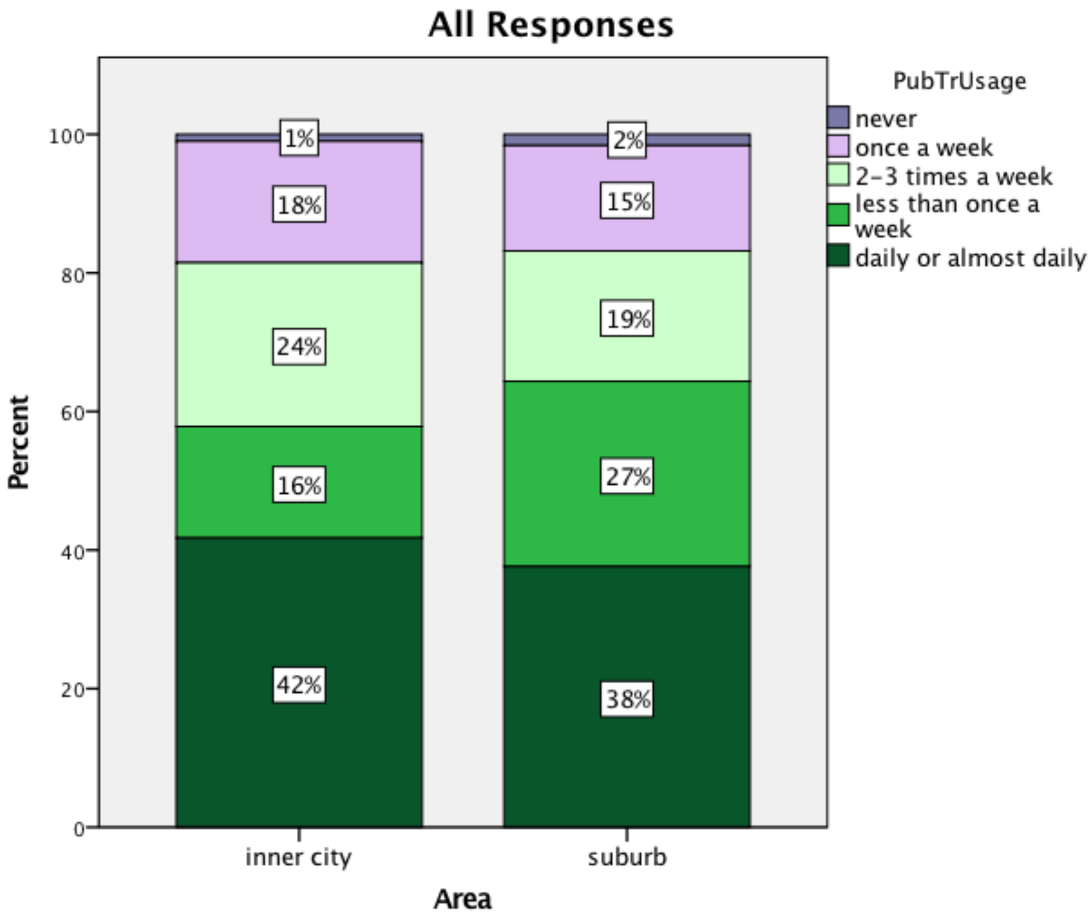


Fig. 4.12 Residential Location & Usage of Public Transportation
(n=2004)

Finally, Figure 4.12 demonstrates the connection between public transportation use and residential location. The calculation is statistically significant, for As. Sig. = .000 (i.e. <.05). From all the inner-city residents, 42% use public transportation daily or nearly daily, and in the suburbs, the respective percentage is 38%. Thus, in daily usage the difference between public transportation use does not seem to depend on the residential location of the individual. The largest divergence in the public transportation use between inner-city and suburb residents is those who use public transit less than once a week. Near the city centre this constitutes 16% of the population, while in the suburbs 27%. This could be a result of higher car usage in the suburb areas. In the inner-city, those who use public transportation 2-3 times a week accounts for 24% of the inhabitants, and in the suburbs 19%. Those who use public transportation once a week or never do not greatly differ from each other in percentage by residential location.

Recapitulation

Together the data presented in sub-chapter 4.1.1 provides an idea of who the cyclists in Helsinki are. Figures 4.2 – 4.7 looked for the percentage of cyclists per educational, employment, and household annual income background. Figures 4.8 – 4.12, for their part, considered the areal distribution of residents and their preferences for transportation mode.

By education, the most active cyclists in Helsinki possess either a secondary degree or a graduate degree. By employment situation, those who cycle the most frequently are currently employed or retired. Lastly, by average household income, those who cycle the most often earn between 20 000€ - 69 999€ annually, which falls on both sides of the average annual income, however more leaning towards above the average annual income. According to these data, the non-cyclists of Helsinki by education also possess either a secondary degree or a graduate degree. Moreover, by employment situation, most of the non-cyclist are employed or retired. Finally, most of the non-cyclist also fall in to the annual income group of 20 000 € - 69 999€. For the results are fairly similar for each variable group, these data may not reveal much more than which educational, employment and annual income background the majority of Helsinki inhabitants hold. However, from all the cases together, it can be gathered in the case of Helsinki, cycling is not connected to the affordability of the transportation mode, since the unemployed, students, and lower income groups (below 19 999€ annual household income), are statistically not those who cycle the most.

By residential location, the inner-city cyclists tend to bike shorter distances than the suburb residents (Fig. 4.8 – 4.9). Moreover, the suburb residents are more likely to have access to a car, and tend to use cars more frequently than inner-city residents (Fig. 4.10 – 4.11). Similarly, the inner-city inhabitants use public transportation more frequently than those in the suburbs (Fig. 4.12). Regardless that the data mildly suggests these patterns, the differences between transportation choices by residential location are not radical. Therefore, considering only the inner-city suburb residential differences does not give a sufficient explanation for people’s transportation choices. Due to this, the next sub-chapter focuses on opening up the possible factors that may influence the Helsinki inhabitants’ choice to choose the bicycle for transportation alternative.

4.1.2 Are There Factors Relating to City Infrastructure, which Outline the Choice to Cycle in Helsinki?

This part seeks to assess some reasons for the Helsinki cyclists' decision-making. It is divided in three parts, first looking at the purpose of one's commute (end-journey activity), then reasons why cycling chosen as a transportation alternative (ideology), and lastly what have been the reasons when cycling was not chosen (hinders). Each of these themes are examined in attention to residential location and daily distance travelled. These variables are chosen from the database to represent urban infrastructure, since there may be difference in people's preferences based on residential location as well daily traveling distance.

Purpose for Cycling (End-Journey Activity)

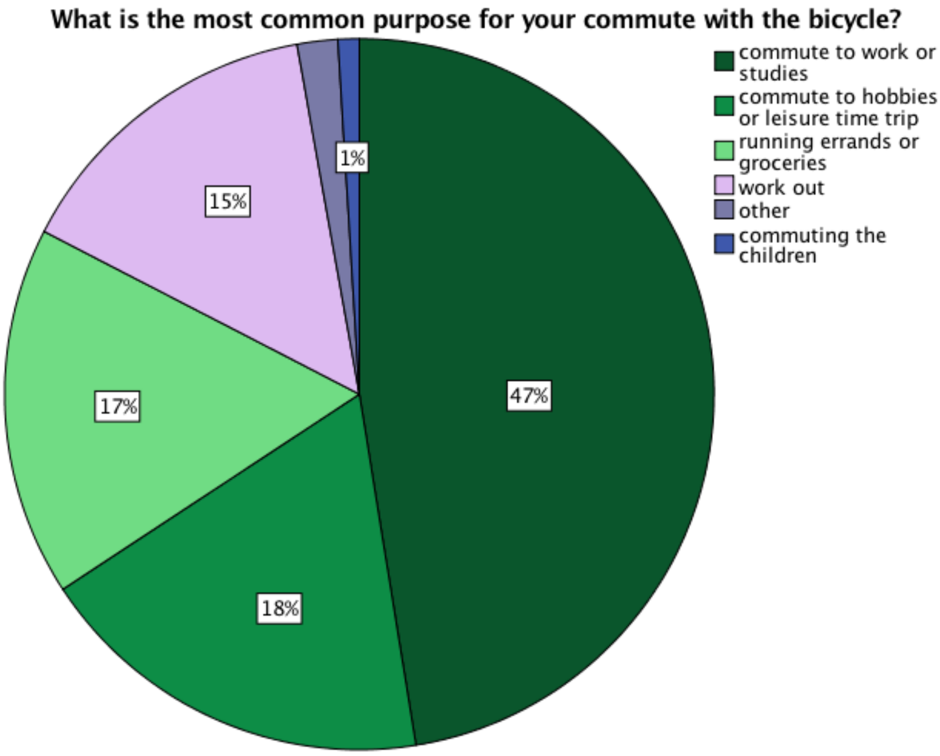


Fig. 4.13 Purpose for Cycling (End-Journey Activity)
(cyclists, n=1136)

Figure 4.13 bestows the most common purpose for cycling amidst the Helsinki inhabitants. 47% cycle to their daily activity, that is to work or studies. The second most popular cycling purpose with 18% are those who bike to their leisure time activities. Moreover, 17% or inhabitants cycle for running errands, such as groceries. A rather large part of the people, 15%, still primarily cycle for work-out purposes.

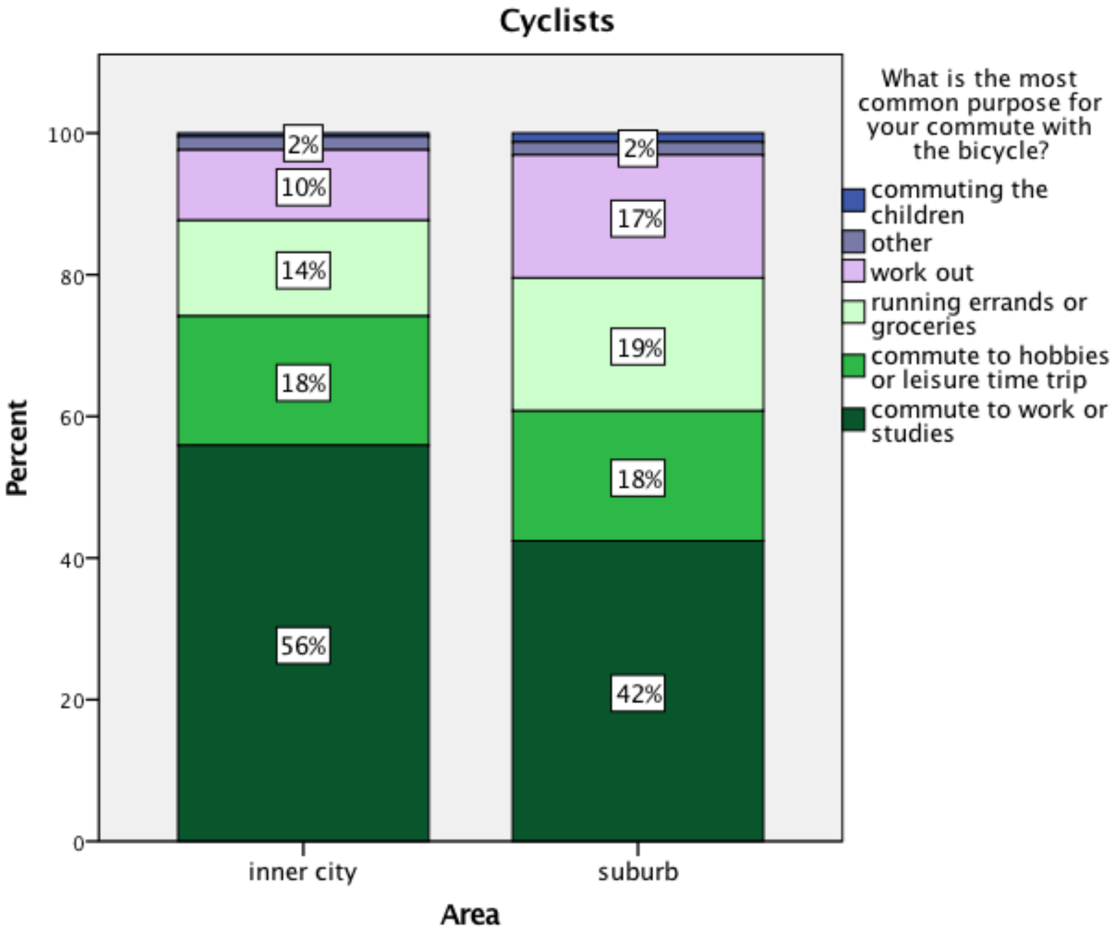


Fig. 4.14 Purpose for Cycling per Residential Location

(n=1136)

Independent Sample Test			
		Levene's Test for Equality of Variances	t-test for Equality of Means
		Sig.	Sig. (2-tailed)
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.019	.000
	Equal variances not assumed		.000

Table. 4.14 Independent Sample Test

Figure 4.14 presents the most common reasons for cycling by residential location. Cycling to daily activity (work, studies) is a little bit more common amongst inner-city cyclists (56%) than the cyclists from the suburbs (42%). Yet, residential location does not seem to influence those who cycle for fun or for leisure time activity (18% for both inner-city and suburb residents). However, in the suburbs people tend to choose cycling as a transportation alternative for running errands (19%) and for work-out (17%) more than the inner-city inhabitants do (14% for running errands; and 10% for work-out).

However, this graph does not alone tell the significance of these results. Therefore, an independent sample test is run to measure the significance of the means between the inner-city and suburbs residents (Table 4.14). The zero hypothesis is that these classes are equal. Table 4.14 is a summary of the independent sample test, and the *Equal variances assumed* and the *Equal variances not assumed* relate if the assumption has been broken or not. It shows that the Levene's test is significant, since p = .019 which is smaller than .05. This denotes that the "assumption of homogeneity of variances has been violated", or in other words that the classes significantly differ from one another (Field 2013, p.374). Therefore, the row of *Equal variances not assumed* needs to be looked at, where the Sig. is 0,000, also being smaller than 0.05. The conclusion of this independent sample test is that the difference between the means of the sample is significant, which in practice denotes that the inner-city and suburb residents differing end-journey activities are essential information.

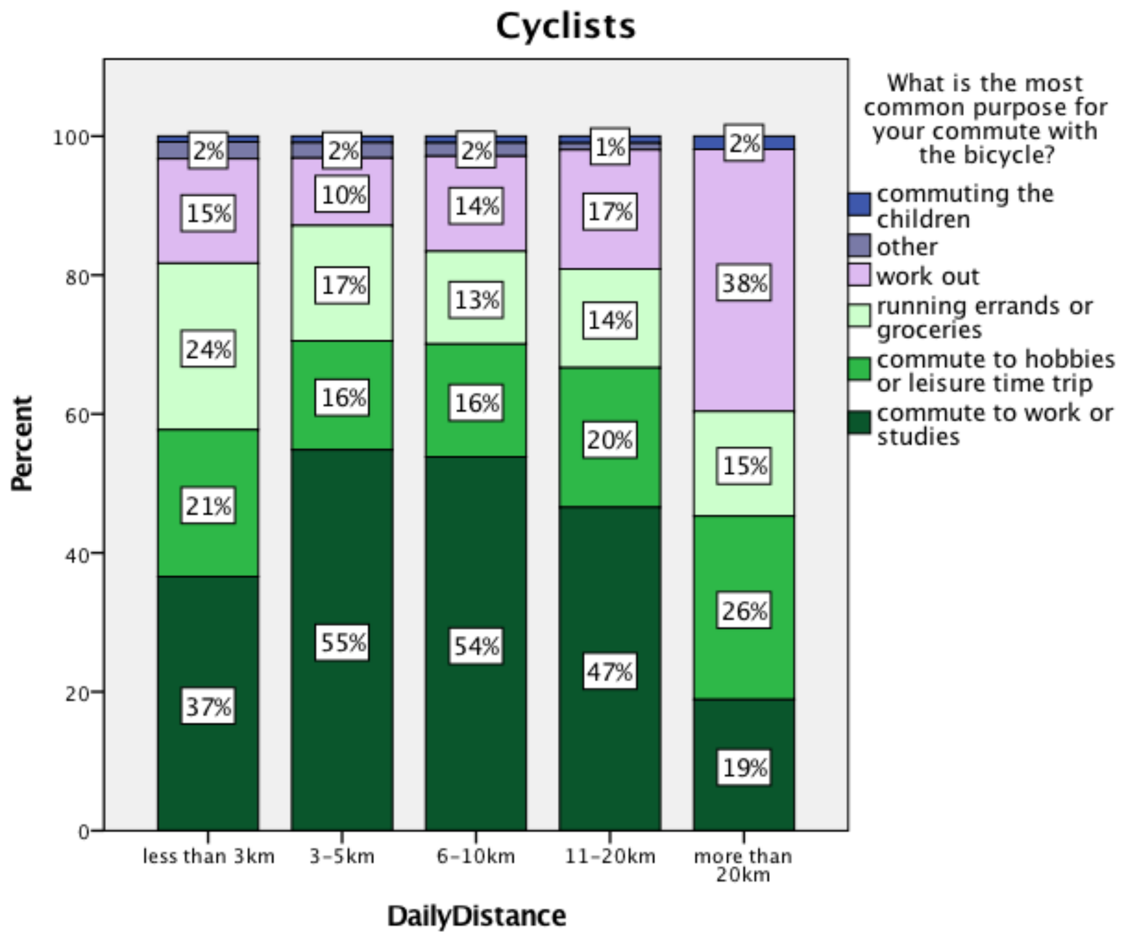


Fig. 4.15 Purpose for Cycling per Daily Distance Travelled

(n=1136)

Independent Sample Test			
		Levene's Test for Equality of Variances	t-test for Equality of Means
		Sig.	Sig. (2-tailed)
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.003	.017
	Equal variances not assumed		.027

Table. 4.15 Independent Sample Test

Figure 4.15 visualises the purpose of one's cycling commute in relation to the distance travelled, and Table 4.15 the results of the independency sample test. It shows the assumption of homogeneity has again been violated, since the Levene's test p = .003. Thus, the significance of the test is found under the row equal variances not assumed, which displays that the significance is = .027, that is smaller than .05, and therefore the independent sample test concludes the means between the samples are significantly different (see full Table output in Attachment 4.15).

For distances up to 20km, commute to work or studies is the most common reason for the end-journey activity. Amongst those who cycle distances between 3-10km, more than half of the cyclist bike to work or studies (55% for 3-5km and 54% for 6-10), and also nearly half of the 11-20km distance cyclists bike to work or studies (47%). Out of cyclist who bike less than 3km, 37% has work or study as the most common end-journey activity. However, the most common purpose for cyclists of 20km and beyond is work-out purposes (38%). The second most common purpose for cycling is commute to hobbies or other leisure time activities, which is the most common amongst people who cycle more than 20km distances (by 26%), and least common amongst those who cycle 3-10km distances. For short distance cyclists (<3km), running errands or doing groceries is the second most common end-journey activity (24%). For other cycled distances the same end-journey activity is a bit less popular (17% for 3-5km; 13% for 5-10km; 14% for 11-20km; and 15% for >20km). The work-out purpose is the second most popular purpose amongst 11-20km cyclists, and <3km cyclists (after the >20km cyclists).

In summary, the most common end-journey activity seems to be work or study commute, particularly within mediocre cycling distances (3-20km). The second most common end-journey activity varies according to the distance cycled, so that for mediocre distances it is commuting to leisure time activities, for 20km or more work-out activity, and for 3km or less running errands.

Reason for Choosing the Bicycle as a Transportation Alternative (Ideology)

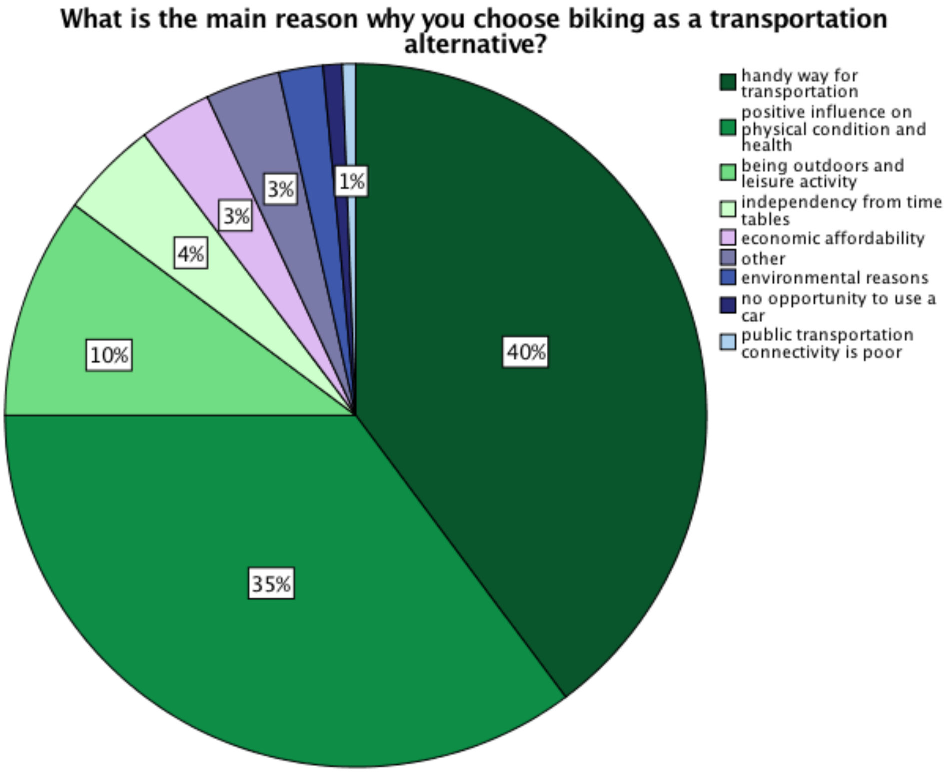


Fig. 4.16 Reason to Choose the Bicycle
(n=1136)

On the contrary, Figure 4.16 illustrates the rationale behind people's choice to cycle in the first place. 40% of the inhabitants seem to think it is a handy way for transportation, and 35% choose cycling for its positive influence on physical condition and health. 10% of people view cycling as an outdoors and leisure time activity. Interestingly, 4% of the population rationalise cycling due to its independency from time tables, and 3% choose cycling for its economic efficiency. Only 2% hold environmental friendliness as a primary reason for cycling.

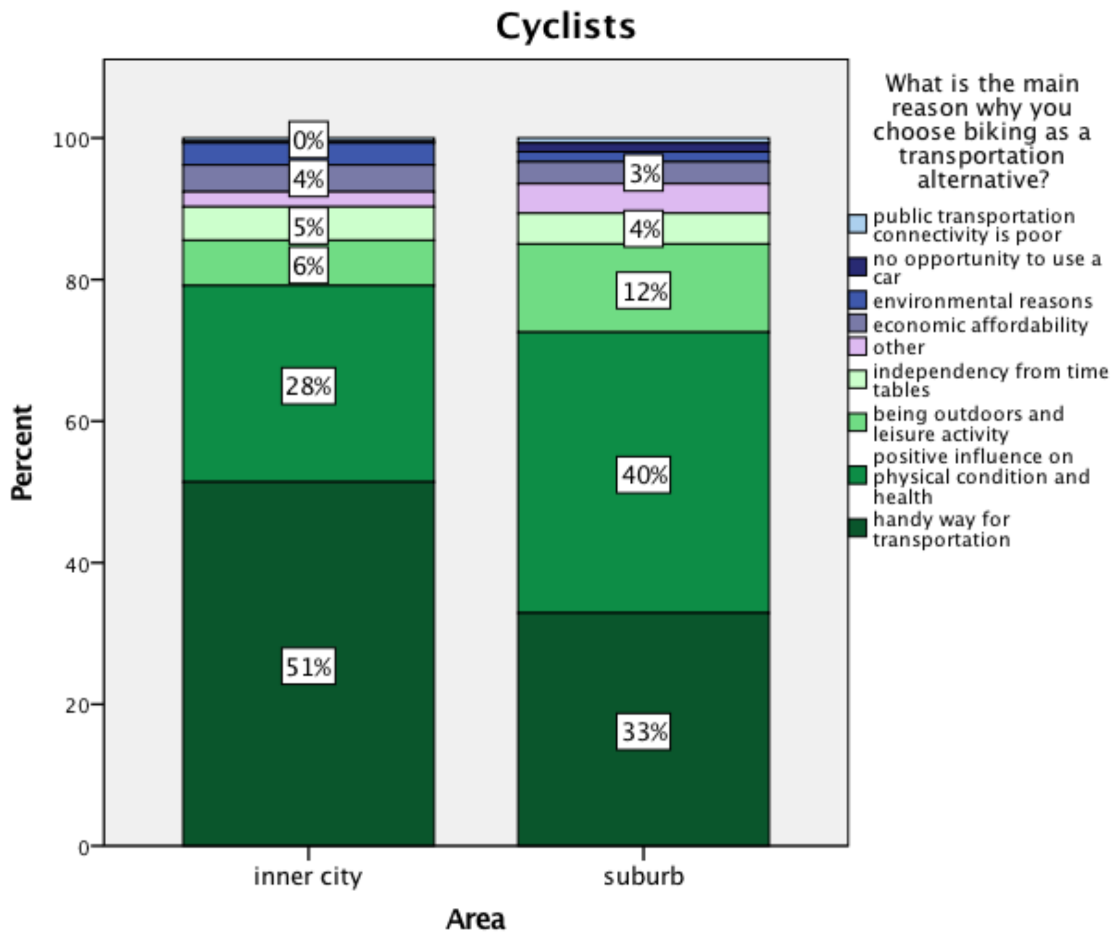


Fig. 4.17 Reason for Cycling per Residential Location

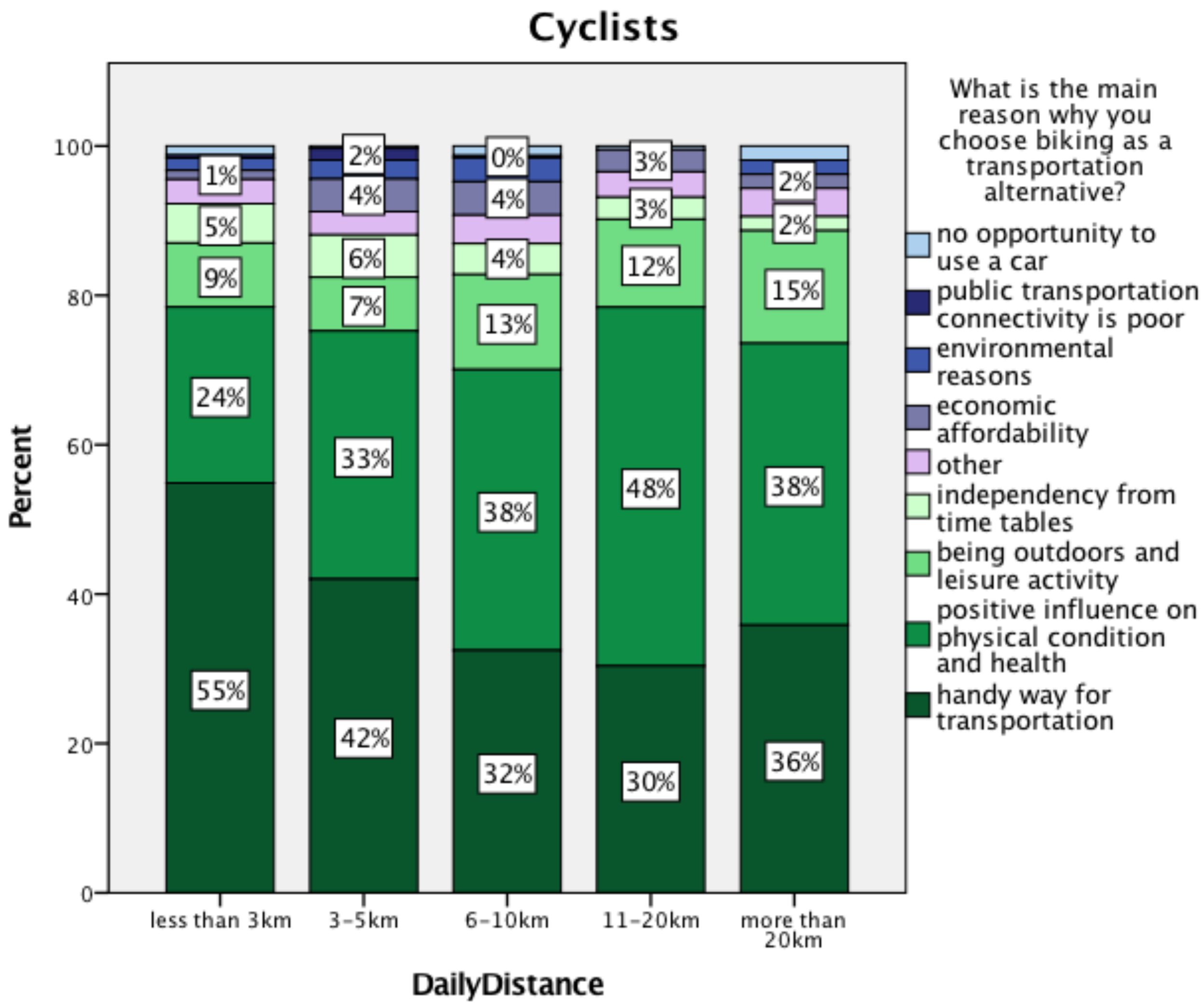
(n=1136)

Independent Sample Test			
		Levene's Test for Equality of Variances	t-test for Equality of Means
		Sig.	Sig. (2-tailed)
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.000	.000
	Equal variances not assumed		.000

Table 4.17 Independent Sample Test

Figure 4.17 shows the rationale Helsinki cyclists have for their choice of transportation in connection to residential location (see Attachment 4.17 for outputs), and Table 4.17 the summarised output of the independency sample test. The tables shows that the assumption of homogeneity is not met, since the Levene's test p = .000 (i.e. <.05). Thus, the test results are observed from the row of *Equal variances not assumed.* The Sig. is .000 which tells that there is a significant difference between the means of the samples. Therefore, the differences in responses between cyclist that reside in different city areas, are significant.

For 51% of the inner-city inhabitants, the key motivation behind cycling is that they perceived it as a handy way of moving around. Interestingly, for the residents outside of the inner-city this motivation is primary only for 33%. In contrast, for most suburb residents the positive influences on physical health and condition are the primary rationale for choosing bike as a transportation alternative (40%). From the inner-city residents, 28% chose health as a primary reason for transportation. Moreover, 12% of the suburb inhabitants choose cycling for leisure time activity, whereas in the inner-city the same motive accounts for 6%.



4.18 Reason for Cycling per Daily Distance Travelled

(n=1136)

Independent Sample Test			
		Levene's Test for Equality of Variances	t-test for Equality of Means
		Sig.	Sig. (2-tailed)
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.238	.000
	Equal variances not assumed		.000

Table 4.18 Independent Sample Test

Figure 4.18 shows the connection between the daily travelled distance and rationale of choosing the bicycle. 55% of people who cycle distance below 3km, chose the bicycle for its ease. Also the majority of cyclists for distances between 3-5km used the same motivation (42%). However, for distances beyond 6km, the most popular choice of cycling was based on its beneficial influences on physical condition and health (38% for distance between 6-10km; 48% for 11-20km; and 38% for more than 20km). Furthermore, more people rationalised their choice to use bicycle by outdoor and leisure time activity, if their daily cycled distance was more than 6km.

When the independent test was run to these variables, it was found out that the variances are equal (Levene's test Sig. = .238), or in other words that there is no difference in the variances of the population. The p-value of equal variances assumed is p = .000, which means that statistically these results are significant.

Reason for Not Choosing the Bicycle

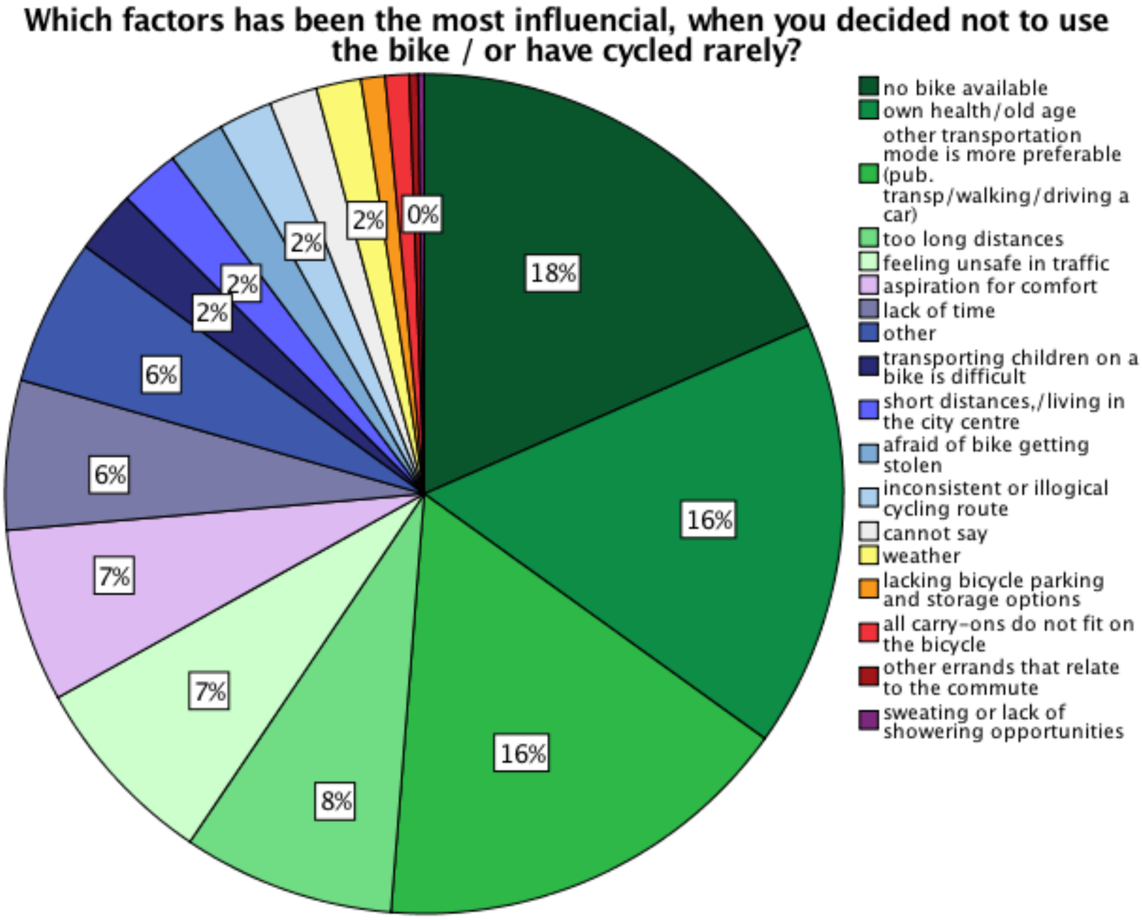


Fig. 4.19 Factors Influencing the Lack of Cycling

(n=868)

Figure 4.19 visualises people's rationalisation at those times, when they decided not to commute with a bicycle. The most common reason is that people had no bike available (18%), or that they considered themselves to not be in shape for cycling (16%). Moreover, 16% consider that at the given moment, another mode of transportation was simply more convenient (16%). Also, too long distances seem to hinder people's willingness to choose the bicycle as a transportation method (8%). 7% decided for another transportation form due to feeling unsafe in traffic as a cyclist. Another 7% found cycling more uncomfortable than other means. Moreover, many rationalise their choice based on lack of time (6%).

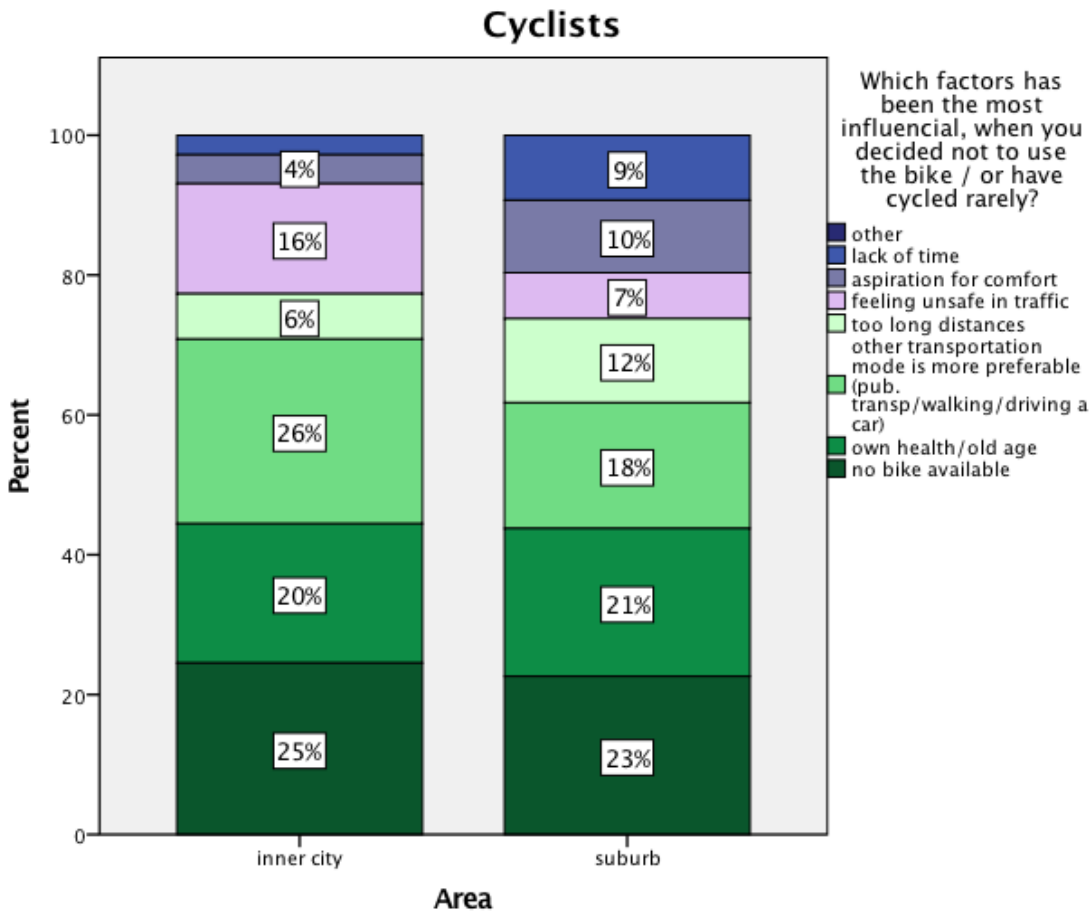


Fig. 4.20 Factors Influencing Lack of Cycling per Residential Area
(n=707)

Independent Sample Test			
		Levene's Test for Equality of Variances	t-test for Equality of Means
		Sig.	Sig. (2-tailed)
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.642	.851
	Equal variances not assumed		.850

Table 4.20 Independent Sample Test

In Figure 4.20 the seven most significant factors of Figure 4.19 have been looked at in relation to residential area. The major reasons for people's decision to not to use bicycle as a transportation mode does not differ greatly between inner-city and the suburbs. Amidst the inner-city residents, 25% do not bike due to a lack of access to bicycle, in the suburbs the same reason is given by 23%. Similarly, closer to the city centre 20% name health to be a key hinder, and in the suburbs 21%. However, within the inner-city 26% of people prefer other modes of transportation at times when they decided not to bike, while in the suburbs the same reason was given by 18%. Quite logically, more suburb residents consider distances to be too long for cycling (12%) than inner-city residents do (6%). What is interesting about these data is that 16% of inner city inhabitants consider cycling to be too unsafe, while in the suburbs this only accounts for 7%.

Table 4.20 shows the results of the independent sample test. The Levene's test shows the p-value to be more than .05 ($p = .642$), which means that the variances are equal. Therefore, the significance of the test is found under equal variances met, and $p = .851$. This denotes there is no significant statistical difference between inner-city and suburb residents when it comes to not choosing the bicycle as a transportation method.

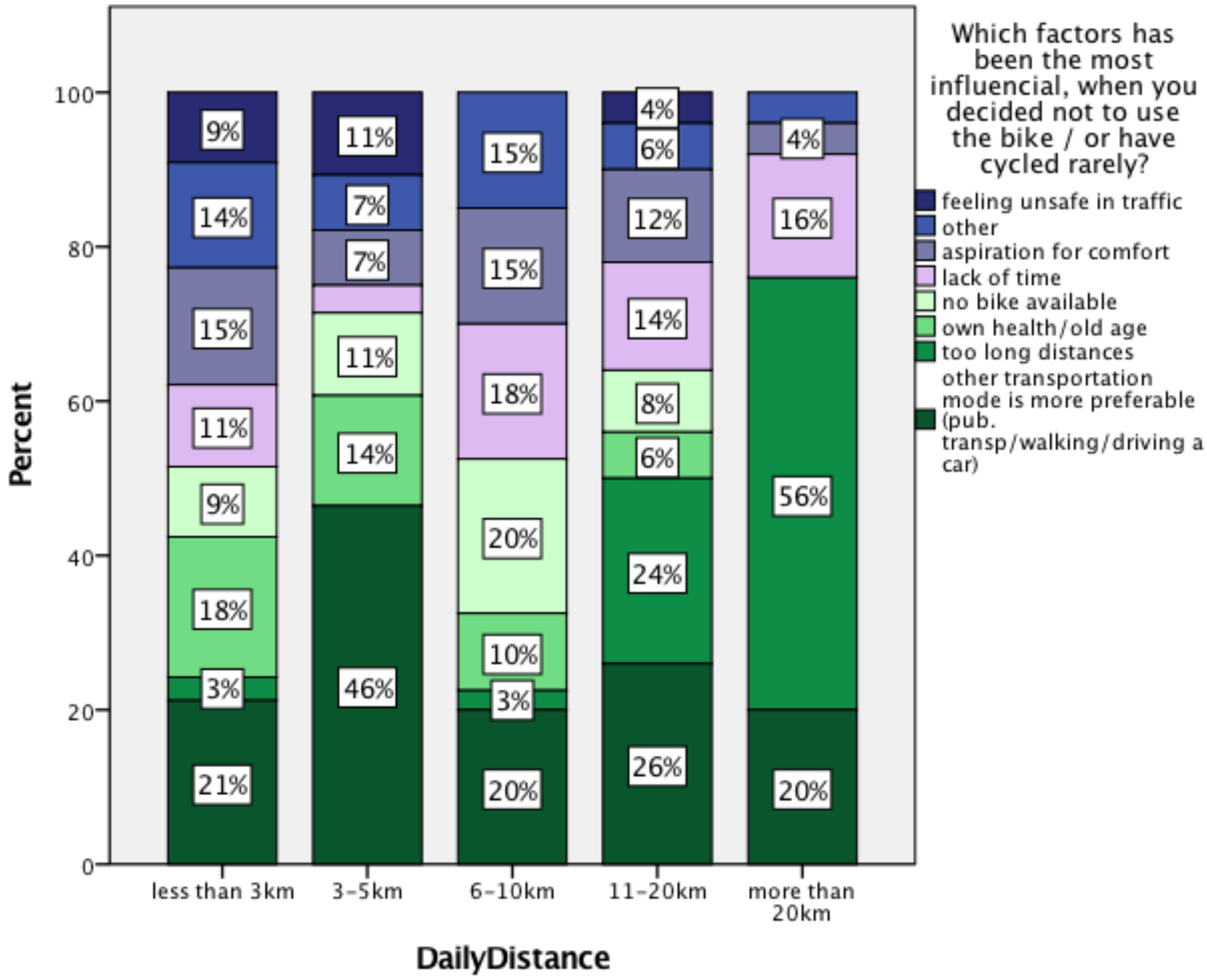


Fig. 4.21 Factors Influencing Lack of Cycling per Daily Distance Travelled

Independent Sample Test			
		Levene's Test for Equality of Variances	t-test for Equality of Means
		Sig.	Sig. (2-tailed)
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.869	.104
	Equal variances not assumed		.104

Table 4.21 Independent Sample Test

Moreover, the decision of not to cycle was tested together with the variable of daily distance. Figure 4.21 visualises these results, which show that for those cycling distances below 20km, the most common reason for not cycling is simply that another transportation alternative is preferred. For people commuting longer distances than 20km the most common reason for not cycling is that the distances are too long.

The independent sample test (Table 4.21) shows that the assumption of homogeneity is not met, since the Levene's test p = .869. Moreover, the significance of equal variances not assumed shows p = .104 which tells that there is no statistically significant differences between the two groups.

Recapitulation

Subchapter 4.1.2 considered the purpose and rationale of Helsinki cyclists' transportation choices, and what hindered the inhabitants at times when they chose another alternative for transportation. It was discovered, that the first two have statistical significance together with the residential area and daily distance travelled, whereas residential area and daily distance travelled are insignificant factors when the bicycle was not chosen as an alternative (see Table 4.22 for summary of significant results).

Table 4.22 Summary of Significant Results (Figures 4.14-4.21)

	Independent Variable			
	Residential Location		Daily Distance Travelled	
	Sig.	Insig.	Sig.	Insig.
Purpose (End-journey Activity)	x		x	
Reason (Ideology)	x		x	
Reason for Little Use		x		x

First, the results show that the purpose for the majority of Helsinki's cyclists is to commute to work, studies, or other daily activities on their bikes. Moreover, much of the cyclists commute to leisure time activities on the bicycle, run errands, or view cycling as a work-out (Fig. 4.13). In the inner city, it is more common to cycle to daily activities than in the suburbs, and likewise in the suburbs residents are more likely to cycle for work-out or for running errands than in the inner-city (Fig.4.14). Regardless of where the individual lives, most of Helsinki cyclists who bike distance shorter than 20km, nevertheless cycle to daily activities. Those who cycle more than 20km daily, consider cycling as a work-out rather than commute (Fig. 4.16).

The main reason (ideology) for choosing the bicycle as transportation alternative is that it is viewed as a handy way of transportation. The second most common rationale for cycling was positive influence on health, and third that it was viewed as a recreational outdoors activity (Fig. 4.17). Seeing cycling as a convenient transportation mode is the most common motive for cycling in the city centre, whereas in the suburbs most inhabitants choose cycling for its positive influence on physical condition (Fig. 4.18). Furthermore, those who tend to cycle less than 5km a day, chose cycling for its transportation convenience, yet those who cycled more than 6km a day, chose it for health reasons (Fig. 4.20).

The factors which hinders the Helsinki inhabitants from choosing the bicycle as transportation alternative, are many. The most common reasons were not having access to a bike, considering on health/age too weak, and simply preferring another transportation mode. The next most common reasons for lack of cycling were too long distances, feeling unsafe in traffic as a cyclist, seeking for comfortable commute modes, and lack of time (Fig. 4.21). However, the results show that not choosing the bicycle is not statistically connected to either of the independent variables, residential area or daily distance travelled.

To this point, the empirical results have delivered some clarity considering what personal factors influenced people's mobility choices in Helsinki. However, the physical infrastructures have yet hardly been discussed, and therefore, are delved into next.

4.1.3 Helsinki Inhabitants Transportation Choice & Infrastructure

The influence of physical infrastructure and/or urban design to people's transportation mode can be difficult to measure, as was established in the analytical framework and methodology chapters (see for instance Romero et al. 2017; Mueller 2016; Ewing & Cervero 2010; Badoe & Miller 2000; Hull & O'Holleran 2014). However, here the Helsinki cyclists' satisfaction toward the cycling network is considered together with the variables of residential location, daily distance travelled, and end-journey activity. The general hypothesis is that these results will reveal information about the people's satisfaction toward certain (large-scale) infrastructural aspects, and thereby open a discussion on whether the measurements are appropriate to study the connection between decision-making of transportation mode and urban design. Without a further do, the general satisfaction is observed first (Fig. 4.22).

Helsinki Cyclists General Satisfaction to Cycling Network & Facilities

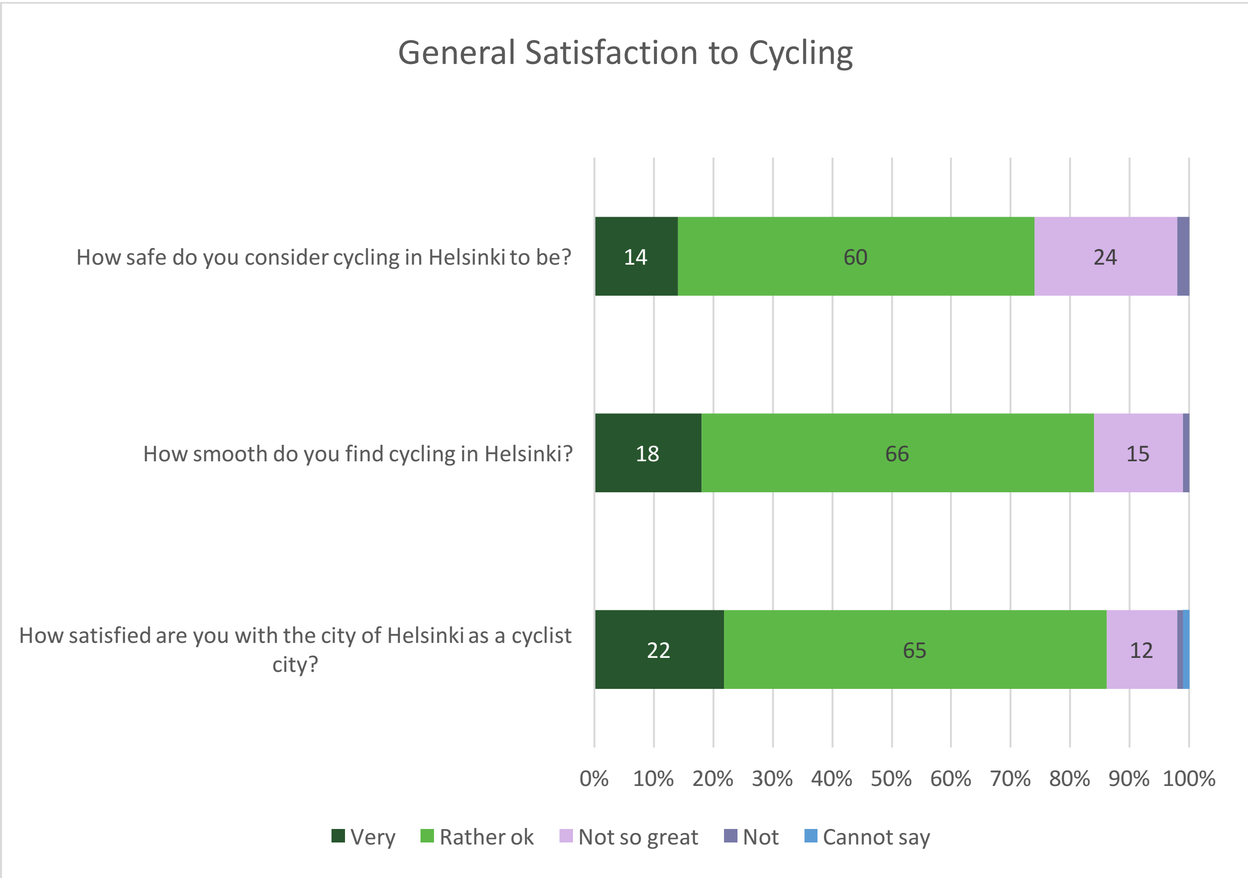


Fig. 4.22 General Satisfaction to Cycling
(cyclists, n=1136)

Figure 4.22 summarises the responses for the survey questions that have to do with general satisfaction of inhabitants toward the bicycle system. The first row visualises the satisfaction to cycling safety in Helsinki by cyclists. 14% are very satisfied with cycling safety, and a clear majority, 60%, are rather satisfied. However, 24% of the inhabitants also consider the network rather unsafe for cycling. The second row shows the satisfaction toward smoothness of cycling. 18% consider the network very smooth and 66% rather smooth. 15% of the people still consider the network as rather inconvenient, yet the satisfaction toward the convenience of the network is greater than the satisfaction to safety. Lastly, the general satisfaction of people toward Helsinki as a cyclist city is presented. 22% are very satisfied with Helsinki as cyclist city, and 65%, are rather satisfied with the cycling network in general. 12% of the people are rather unsatisfied with the conditions, yet the percentage of the unsatisfied is smaller in the general satisfaction category than the more specific questions (see Attachment 4.22 for frequency table).

In sum, from Figure 4.22 it can be gathered that in general the inhabitants seem to be rather satisfied with the cycling situation in Helsinki, yet, as more specific questions are asked (about safety and smoothness), people are not as satisfied with the network in general. Next, these questions relating to satisfaction are considered in connection to the cyclists' residential location, daily distance travelled, and end-journey activity. To save the number of pages, the outputs and figures are only found in the attachments (Attachment 4.22a-4.22i). The statistical significances of the results are tested with the independent samples test for each variable, as has been the case above.

Satisfaction to Safety & Residential Location

First, the satisfaction to safety amongst the Helsinki cyclist in relation to residential location is tested. The results tell that 11% of inner-city cyclists consider the network safe, whereas in the suburbs 16% consider it as safe. The percentage of those who are rather satisfied with cycling safety does not differ greatly between the residential regions; in the inner-city this accounts for 59% of cyclists and in the suburbs 61%. In the inner-city 28% consider cycling as unsafe, and in the suburbs 16% (Attachment 4.22a).

In the independent sample test, the null hypothesis is that the there is no significant difference between the two groups (inner-city and suburb residents). The research hypothesis however is, that the difference is significant. The Levene's test is significant since p = .000 (i.e. <.05), so the two classes significantly differ from each other. The significance under the row equal variances not assumed tells that p = .057, which reads that there is no significant difference between the sample means. Thus, it can be concluded that there is no statistical difference between the residential locations, meaning that the research hypothesis is repealed (see Attachment 4.22a for outputs).

Satisfaction to Safety & Daily Distance Travelled

Second, the satisfaction of safety and daily distance are considered in relation to each other (Attachment 4.22b). For all distances, most people considered Helsinki to be rather safe as a cyclist city (60% for distances up to 5km; 61% for distances between 6-20km; and 57% for distance beyond 20km). For all distances except for distances beyond 20km, the second most people considered cycling in Helsinki as rather unsafe (26% out of <3km distances; 25% of 3-5km distances; 22% of 6-20km distances; and 19% out of >20km distances). Likewise, for all distances expect for >20km cyclists, the third most people are satisfied with the safety of cycling (13% of <3km; 12% of 3-5km; 15% of 6-10km; 16% of 11-20km; and 21% of >20km).

The statistical significance of these variables also tested with the independent sample test. The Levene's test shows that the Sig. = .295, meaning that the results vary. The significance of the equal variances assumed is p = .184, telling that there is no statistical relevance between these variables. However, it is interesting to find out that the daily distance travelled does not significantly influence the Helsinki cyclists' perspective of traffic safety.

Satisfaction to Safety & End-Journey Activity

Lastly, the satisfaction of safety was considered in terms of the end-journey activity, namely the variable purpose of commute (Attachment 22c). Most people consider cycling as rather safe, regardless of which end-activity they had. From work and study commuters this accounted for 63%; from people running errands 56%; leisure time commuters 60%; work-out cyclists 55%; from those transporting the children 64%; and other, 67%. Yet, there was more variety in responses between those who consider cycling as rather unsafe, and end-journey activity. 24% from work and study commuters, those running errands, and work-out cyclist consider cycling as rather unsafe. For leisure time activity commuters this account for 24%, but amidst those commuting the children only 9%. Interestingly, those who consider cycling the most safe in Helsinki, are the ones transporting their children, with 27% of cyclists thinking that cycling is safe. The second most satisfied cyclists are those biking for work-out or for running errands (19% of both end-journey activity groups view cycling as safe). From the work and study commuters 11% are satisfied with the safety aspect of cycling (see Attachment 22c).

In this case, the Levene's test of the Independent Sample Test shows Sig. = .943. The equal variances are assumed, and the statistical significance is p = .021. This shows that the differences between the classes are statistically significant.

Satisfaction to Smoothness and Convenience of Cycling Roads & Residential Location

The graphs and outputs for satisfaction toward smoothness and convenience of cycling roads in relation to residential location are found in Attachment 4.22d. The Levene's test within the independent sample test for the variable 'area' showed that there is no significance difference between the cases, since the significance is p = .000 and thus heterogeneous (<.05). Therefore, the significance of the results is read under the row equal variances not assumed, which tells that p = .000. Therefore, it can be concluded that the in terms of satisfaction to smoothness of roads, it is essential whether the individual resides in inner-city or in the suburbs.

Yet, looking at the percentages of the cross-tabulation (see Attachment 4.22d), it can be observed that there is not a large difference measured in percentage between inner-city and suburb residents amidst those who are rather satisfied with the smoothness of cycling (inner-city residents 68% find cycling rather smooth; and 64% of suburban residents). However, amidst suburb cyclists, 23% consider the smoothness of cycling very satisfying, whereas amongst the inner-city inhabitants this only accounts of 10% of the cyclists. Likewise, 20% of the inner-city residents rate the smoothness of the network as rather unsatisfying, and in the suburbs only 12% do the same (see Attachment 4.22d).

Satisfaction to Smoothness and Convenience of Cycling Roads & Daily Distance Travelled

Attachment 4.22e reflects the connection between smoothness of the network and daily distance travelled. The Levene's test Sig. = .288 (in the independent sample test), which means that the assumption of homogeneity is met. The statistical significance of equal variances assumed row is p = .138, which means that there is no statistical significance between these variables.

Satisfaction to Smoothness and Convenience of Cycling Roads & End-Journey Activity

Attachment 4.22f shows the connection between the end-journey and satisfaction to smoothness of cycling road. The independent sample test reveals that the Levene's test Sig. = .661, which denotes that the null hypothesis (there is no significant difference between the cases) is met, since the assumption of homogeneity has not been violated. Therefore, the p-value is observed by looking at the equal variances assumed- row, which reveals p = .000. Thus, these results can be viewed as statistically significant.

The highest number of those cyclist who consider the network smooth, mainly commute for work-out (26% consider cycling smooth), for running errands or doing groceries (25%), or commute to hobbies and leisure time activities (61%). 12% of cyclists who commute to work or studies are satisfied with the cycling smoothness. The number of those who are rather satisfied with the fluency of roads in Helsinki, is the largest percentage for each end-journey activity. Out of work and study commuter 71% consider the roads rather smooth, 73% of those who commute the children with the bicycle, 61% or work-out cyclists and those who bike to leisure time activities, and 58% of the cyclists who bike for running errands (see Attachment 4.24f). Lastly, 17% of those who bike to leisure time activities, consider the roads to be not so smooth. Amid errand-running cyclist the number of rather unsatisfied cyclists account for 15%, 16% amongst work- and study commuters, 11% of work-out cyclists, and 9% of those who bike to commute the children. These statistics are also presented in Figure 24.f below.

General Satisfaction & Residential Location

The Levene's test shows Sig. = .000, due to which the assumption of homogeneity is not met, and therefore the significance is found out by looking at the row equal variances not met. The Sig. = .001, telling the interpreter that the results are significant, or in other words that the residential location matters in terms of satisfaction toward the city's cycling system.

The results of the cross-tabulation reveal, that those who are rather satisfied with Helsinki as a cyclist city, are spread to both inner city (68%) and the suburbs (63%). However, in the suburbs 25% of inhabitants are satisfied to the cycling system, whereas only 16% of cyclist who reside in the inner city re satisfied to the network. Similarly, 15% of inner-city located cyclist are rather unsatisfied with the conditions, while in the suburbs 10% are rather unsatisfied (see Attachment 4.22g).

General Satisfaction & Daily Distance Travelled

The general satisfaction of Helsinki cyclist in relation to the daily distance travelled is considered next. The independency test shows that the Levene's Sig. = .757, which denotes the assumption of homogeneity is met. The statistical significance for the equal variances assumed is .040, which can be considered as statistically significant (for it is <.05). However, the results show that there is very little difference between the distance groups and how satisfied the cyclist are (67% rather satisfied for <3km distance; 63% fro 3-5km; 64% to 6-10km; 65% to 11-20km; and 60% for >20km). Also, the alterations amongst those who are satisfied with the network is not changing radically between the different distances travelled, particularly if distance is below than 20km (17% for <3km; 21% for 3-5km; 23% for 6-10km; 25% for 11-20km; and finally, 30% for >20km). Therefore, it can be stated that the general satisfaction of the Helsinki cyclists is not fundamentally fluctuating on the distance travelled daily.

General Satisfaction & End-Journey Activity

Lastly, the general satisfaction of Helsinki cyclists was considered together with the purpose for cycling, which represents the end-journey activity (Figure 4.22i). The independent sample test showed that the results are significant (Levene'st test Sig. = .103, p-value for equal variances assumed = .000). 31% of work-out cyclist were satisfied with Helsinki as a cyclist city, which was the largest percentage of satisfied cyclist out of all commute purposes. The second most satisfied cyclists are those running errands or doing groceries (27%), and those commuting to leisure time activities (26%). 18% of those who commute their children on the bicycle, were well satisfied with the cycling network in general, and 16% of those who commute to work of studies. Again, the majority of the cyclists seems to be rather satisfied with the network. Nevertheless, 18% of those who commute the children were rather unsatisfied with the network, and 14% of work- and study commuters, 13% of bikers to leisure time activities, and 8% out of work-out cyclists as well as those who bike for running errands (Attachment 4.22i for figure and output).

Recapitulation

In summary, a few conclusions can be drawn from these statistics (Figure 4.23 for summary of significant results). First, out of the three aspects of satisfaction, the Helsinki inhabitants are the least satisfied with cycling safety (Fig. 4.22). In terms of residential area, the satisfaction to safety was found to be insignificant, meaning that the difference between areal satisfaction to safety is not statistically relevant (Attachment 4.22a). Moreover, the satisfaction to safety in connection to daily distance travelled was found as statistically insignificant (Attachment 4.22b). However, the results show that the end-journey activity has an influence on how the inhabitants tend to perceive safety. Nonetheless, the distribution of responses does not radically differ from each other, most people from each end-journey activity group are rather satisfied with cycling safety. However, it is notable that those who commute their children with the bicycle rate cycling in Helsinki safer than any other end-journey group. Those who cycle for work or study commute, run errands, or cycle for work-out, share the percentage of people who rank cycling as rather unsafe (24%).

Second, the satisfaction to smoothness of cycling is greater in suburbs than in the inner city, and this difference is statistically significant (Attachment 4.24d). The percentage of cyclists who are rather satisfied with the cycling smoothness does not however, differ greatly between the two regions. Yet, in the inner-city there are less cyclists who are very satisfied with the network smoothness, and more cyclists who are rather unsatisfied with the convenience. The satisfaction to smoothness of cycling does not significantly differ by the daily distance travelled (Attachment 4.24e). However, there is a connection between the end-journey activity and smoothness satisfaction. Shortly put, those who cycle for work-out, running errands, or commute to leisure time activities, are the most satisfied with the cycling smoothness. Yet, the leisure time activity cyclists are also the least satisfied with the cycling convenience; followed by those who run errands with the bicycle, and work- and study commuters (Attachment 4.24f).

Third, the general satisfaction toward the cycling network is not radically spread between the inner-city and suburbs, yet this is statistically noteworthy information. However, there are less people who are very satisfied with the cycling network in the inner-city, and more cyclists who are rather unsatisfied in the inner-city than in the burbs (Attachment 4.24g). The daily distance travelled is also a significant factor when it comes to cycling satisfaction, yet the differences between responses are rather minor (Attachment 4.24h). Mostly the inhabitants seem to be rather satisfied with cycling regardless of their daily distance travelled. The exception is that if cycled more than 20km, the percentage of people reporting they are very satisfied with the conditions is the highest (30%), and if cycled less than 3km, smallest (17%). Lastly, the purpose of cycling also has statistical significance about general cycling satisfaction. Those who cycle for work-out, leisure activity commute, or for running errands, tend to be the most satisfied with the city's biking conditions in general, as was the case regarding travel smoothness and end-journey activity also.

Table 4.23 Summary of Significant Results (Figures 4.22a-4.22i)

	Independent Variable					
	Residential Location		Daily Distance Travelled		End-journey Activity	
	Sig.	Insig.	Sig.	Insig.	Sig.	Insig.
Satisfaction to Safety		x		x	x	
Satisfaction to Smoothness	x			x	x	
Satisfaction General	x		x		x	

4.2 Qualitative Section

Where the quantitative data offers an idea of the current profiles of Helsinki cyclists, factors that influence the choice of the people's transportation mode, and satisfaction of the inhabitants to the cycling network; these data alone do not provide an understanding of where the results stem from. The expert interviews, on the other hand, deliver some contextual understanding for the situation. In this section, the qualitative data are described. They are structured fitting to the themes of the interviews: that is (1) change in the system; (2) planning & policy; (3) change in the city form; (4) network design & accessibility; and (5) safety.

4.2.1 Change in the System

The first theme for the expert interviews was change in the system, which denotes the non-physical changes that have emerged in Helsinki in the field of transportation planning, regarding cycling in specific.

Change in Mind-Sets

Firstly, the representative from HSL introduced that "currently, we are again going through an organisational change that took place at the beginning of this year" (Rep from HSL). HSL (Helsingin Seudun Liikkenne) is one of the key organisations in Helsinki who are working with bike promotion and advocacy. In these terms, the representative from the organisation explains their organisational goal to be, that the Helsinki inhabitants would *"talk about bike traffic and transportation so that it would not be a special thing, not sports, or not some hipster or green-hippie action, but so that cycling would just be a mode of transportation amongst others"*.

Other interviewees also commented cycling as a transportation alternative in terms of normalisation. A traffic planner from the Helsinki City Planning Department (HCPD) explains that *"most Finns do own a bicycle, and most Finnish people do cycle occasionally. […] As such, cycling is quite normal to us, but cycling has not yet been normalised as a daily commuting mode".* This comment brings further insights to the quantitative data, which showed that more than 80% of Helsinki inhabitants have access to a bike (Fig. 4.8), and that 70% of people cycle occasionally (Fig. 4.1). Although cycling may not yet be perceived as a serious alternative for urban transportation, it has nevertheless increased, and like the representative from HCPD reminds, almost doubled during the past fifteen years or so.

The representative from HSL explains this phenomenon in terms of mind-sets; she views that people tend to associate cycling to the summer months. *"If there is a bit snow and ice on the ground, it is experienced that biking is somehow particularly difficult. While actually, it is not"*, she demonstrates. *"Surely one needs winter wheels for the bike for safety, but it actually doesn't demand a terrible amount of effort".* This is also a comment that can further explain the quantitative results, namely that 84% of the Helsinki cyclists use the bicycle either during the summer months, or when there is no ice or snow on the ground. During the interview, the representative continued the discussion by comparing winter cycling in Helsinki to Copenhagen, for they also have snow in the winter. She was flabbergasted by the number of Copenhagen winter cyclists, *"If I remember correctly, it's about 70%]"*, and they also have snow there, at least occasionally. "*I guess it's mainly about not being used to it [here in Helsinki]"*.

The transportation planner from HCPD also considers that there might have been a switch in people's world view the recent years, for instance through people being more able to travel, and see and compare cities internationally to Helsinki. For instance, people might have seen how cycling works in Denmark and the Netherlands, and from there transmit and adopt messages beyond the country borders, bringing new ideas back to Helsinki as well. Yet, the representative also notes that often in Helsinki people cycle with the awareness of their physical health in mind, whereas in the Netherlands and Denmark work-out is often not the primary reason for cycling, but rather the fact that it is often the most convenient way to move around. This point, however, does not completely align with the quantitative data, for the results show that most of Helsinki cyclist seem to cycle precisely for the convenience of the transportation mode (44%), and only 15% for work-out purposes (Fig. 4.13).

Moreover, an interviewed Helsinki Cyclist notes, that at the latest, the change of mind-sets will emerge as there is a switch in generations. As such, he believes the next generation is already more aware of environmental conflicts, and are more responsible consumers. *"I hope a certain kind of mindfulness in traffic is self-evident for this new generation"*. Aligned with this thought, the theme for the 2017 HSL cyclist promotion campaign is that 'it's never too late to start'. The slogan for the campaign states, 'the wheels have been set for rolling' (FIN pyörät on pistetty pyörimään), which according to the HSL interviewee aims to encourage ideology that even if the citizen did not cycle before, nothing stands against of them for starting cycling today. *"Even the city biking project promotes themselves by saying, 'today is a good day to start', or like that it is actually not that big of a change if every now and then you would jump on the saddle from behind the steering wheel of a car"* (Representative from HSL).

Lastly, the representative from FCF commented change in the system with an interesting approach. *"I think that change is most efficiently implemented in a society through an ideological change. […] I do think that in order to implement change, there has to be some meaning behind it which people can identify with"* (Rep from FCF). This observation is interesting to look at in combination with the quantitative data, that shows the reason of Helsinki cyclists decision to choose the transportation form. As noted above, most cyclist chose the bike for its convenience (40%), yet a large part, 35%, also rationalised cycling for its positive effects on physical condition and health, and for engaging in an outdoors activity (10%). One way to interpret these data together is that perhaps cycling advocacy and promotion could try to tackle the ideological part of cycling, in order to spread the mind-set change toward normalisation of cycling actively.

Based on these comments, it can be gathered that a strong theme that kept occurring across the interviews was individuals' attitudes towards cycling. These discussion topics relating to the code 'change in the system' facilitate to understand how the experts in the field of traffic planning and cycling advocacy view future developments regarding cycling culture in Helsinki. In sum, it seems that these experts believe inhabitant's mind-set toward the transportation mode play a key role in changing the system toward a more bicycle-friendly form.

Promotion & Advocacy

The theoretical considerations relating to cycling promotion and advocacy concluded that public attention directed for cycling is important for spreading mindfulness about cyclist traffic, yet, only complimentary for the infrastructural enhancements (Vaismaa 2014). Also, many of the interviewees seemed to agree upon this point. The representative from HSL precisely stated, that *"if the infrastructure is not there, in practice biking won't be very pleasant either, and therefore cannot expand as a transportation method"*. However, the same interviewee also notes that awareness and knowledge about health and environmental situation are also significant, and there should be a positive atmosphere around cycling.

Moreover, the interviewed Helsinki Cyclist talks about the normalisation of cycling, and 'mixed-use of bicycles'. He refers to HSL and their promotion strategy in his speech, for the term mixed-use cyclists is also a term endorsed by them. The Helsinki Cyclists is particularly concerned about the accessibility of cycling. For instance, if a person thinks the minimum gear needed for cycling are *"a helmet, […] a safety vest, […] and protection for shoes, […]"*, the threshold for starting cycling may be quite high. "*During the summer, it is always lovely to see that people are biking in shorts, t-shirts, and dressed, without shoes or even with flip-flops, without a helmet, carrying flowers in the bike basket and such".* By telling this story, the Helsinki cyclist implies that cycling is meant for much wider population than just for the stereotypical geared-up cyclists.

It seems that the governmental organisation approaches promotion by setting goals and spreading awareness. The HSL representative tells that two years ago a new cycling promotion strategy was designed, and that *"prior to this new policy, the region didn't really have anybody who would have been responsible for promotion*. *Surely municipalities had done some kind of small campaigns, I mean we had as well, but there was no cohesive strategic plan for bike promotion".* Nowadays, HSL has taken on a more active role in advocacy and encouragement of cycling. (Rep from HSL). This strategy renewal is the same one which the Helsinki Cyclist was referring to in his comment above.

Furthermore, the representative from FCF makes an interesting point about cycling advocacy and increasing technologies, primarily social media. *"Suddenly social media has started to play such a key role in our society",* he ponders. The representative explains, that the social media boom makes it easier to access international discussions about cycling transportation planning and advocacy, and perhaps that is one reason, why the field is so much on the surface now, for it is very easily accessible (Rep from FCF).

Lastly, the Helsinki Cyclists presents a positive wish regarding cycling promotion. *"It would be great if we got for instance the Automobile Union [FIN Autoliitto] promoting for cycling. If nor nothing else, at least because there would be lesser cars in traffic if more people cycled"* (Helsinki Cyclists).

However, as a criticism toward promotion and advocacy, the representative from HCDP comments, *"I am not a big fan of premature, or very strong bicycle branding and promotion, if the situation is that promotion is actually ahead of infrastructural development"*. As such, he views that the Dutch mentality of *"not giving empty promises"* could be a good principle in promotion and branding (Rep from HCPD). This been said, it can be concluded that many of the interviewee's have a wishful attitude toward cycling promotion and advocacy, and sincerely believe it is an important part of spreading awareness, and implementing the ideological change discussed above. Yet, most seem to agree, that promotional advancements are only complimentary to the infrastructural environment, which is a conclusion also supported by the theoretical framework.

4.2.2 Planning & Policy: Complexity of Planning Cycling Networks

The analytical framework deliberated on sufficient policies for cycling networks, concluding that successful cycling cities tend to favour mixed land-use policy, compact building, and on a street-level scale, limit car traffic and prioritise cycling lanes in infrastructure designs (Bucher & Buehler 2008; Hull & O'Holleran 2014; Vaismaa 2014; Saelens 2003; Tumlin 2003; Gehl 2011, amongst others). From the interview discussions that related to planning and policy, an evident theme kept emerging across the interviews: complexity of planning. Hearing the representative from Utrecht Province to talk about general cycling infrastructure and network policy, it comes clear that *"There is no silver bullet. It really depends on what are the necessities for municipality or a city, and in what stage of development they are. It's really different [for each case]",* he explains. This note aligns with the theoretical findings, that context-specific planning is essential for high-quality cycling networks (Urban Movement 2014).

Moreover, the Utrecht interviewee reminds that what is perceived as cyclist, influences the network development, because the future plans are considered accordingly to the definition of a cyclist. For instance, the stereotypical 'middle-aged man' – cyclist does not necessarily even demand a separate lane for cycling, for they can fearlessly and quickly zigzag amongst car traffic, without paying attention to the traffic rules. Yet, *"for most people cycling is a more social activity, and they [tend] to feel much more vulnerable [in traffic]. So you have to design different options for them"* (Rep from Utrecht Province). With a similar theme, the representative from HCPD reflects on practical examples of the potential harm of boxing cycling as a form of exercise, rather than as a form of transportation. This causes some trouble in the planning process, *"firstly because there are no large enough efforts for improvements"*. For instance, the debate on winter cycling reflect to this issue well, the representative from HCPD notes. *"If there are only few winter cyclist, should the roads be cleared off from snow just for those people?".* Evidently, these comments also relate to road safety for the cyclists, but also other participants in the traffic. Nonetheless, the safety is discussed more precisely later.

Another illustration given by the Helsinki-based transportation planner in terms of complexity of planning is the difference between inner-city and the outskirts: the condition and quality of the lanes are somewhat neglected outside of the city street network, where biking lanes are sometimes paved with sieving, instead of asphalt (Rep from HCPD). This is a fascinating viewpoint, for it pertains to the quantitative analysis precisely, in that the differences between inner-city and suburb residents' satisfaction to the cycling system are compared.

Furthermore, another aspect which further complicates creating comprehensive policies, is that their outcomes can be subjective. *"For instance, if you are an architect and working with city planning, they see changes from a little bit different perspective, like they are more sensitive to those. A lay(wo)man, say if you asked from my mom, does not necessarily even see the given change or paid any attention to it"* (Rep from HCPD). The same story applies to cyclists with different user profiles. Like the representative from Utrecht Province was naming above, the demands of fast and slow cyclists can vary greatly.

At a more network level, interesting discussions in terms of city size and density were raised during the interviews. The representative from Utrecht Province thinks that low density building makes cycling easier to plan and access. The interviewee is familiar with the context of Finland through projects he has been engaged in, and thereby makes a comparison between the Finnish and Dutch situations. In Amsterdam, he gives an example, the city density is indeed high. Yet, the size of the streets also play a role in this equation, due to which parking for cars has become increasingly expensive in Amsterdam. Therefore, *"cycling is a good option to go around"*, he explains. *"But density really matters. And the good connection that we are having, that is for co-creation, for leisure, to go around, to go to green areas"* (Rep from Utrecht Province). The interviewee illustrates this example by talking about the situation in Amsterdam. He tells that already 15 years ago, the municipality of Amsterdam started to restrict parking spaces from the city streets. In the past new buildings used to have minimum parking requirements. "*When you build something, you must provide parking space. […But nowadays] there are[critical] voices who say, well, we shouldn't do that, because it will increase the number of cars in the city".* As a response to these critiques, parking spaces are sold to the free market which can develop the spaces more freely (Rep from Utrecht Province).

This is an example of policy renewal that work toward a more car-free city. With a similar idea, the transportation planner from HCPD notes that the *"traffic environment creates frames for behaviour".* He thinks that because in the Netherlands and Denmark the infrastructure is laid out so that the car driver simply must acknowledge cyclists, the interplay between the traffic modes work. Evidently, this is also what the theoretical framework suggests, that regulating car-traffic is vital for an extensive high-quality cycling network (Saelens 2003; Tumlin 2003; Bucher & Buehler 2008; Gehl 2011; Hull & O'Holleran 2014). However, the HCPD representative also notes that of course the high amounts of cyclist increase this demand of being alert as an automobile driver *"In Helsinki, the biggest demand for development are infrastructure and traffic guidelines… As these conditions are fixed, the amount of cyclist will increase"*, he firmly believes (Rep from HCPD).

Moreover, the expert from Utrecht reflects to the differences between the Netherlands and Finland in land use policy, for he has knowledge about the situation in Finland as well. *"In the Netherlands we have a law that we have to renew our streets every 20 years"*, he tells. However, in Finland the natural conditions are very different due to the thick and solid bed rock. Thus, the use of dynamite is demanded for new constructions, whereas the Netherlands is basically a swamp – "*everything falls through the drain. That means that we have to rebuilt our streets, well, every twenty-forty years […], and that's what we used to do in the maintenance scheme: we can fit in the new demands for road designs [every few decades]*. Of course, the Utrecht Province Rep notes, that in the residential areas the design of the roads do not really change anymore, for most often the residential streets are already turned into cycling-prioritised streets some fifty or seventy years ago (Rep from Utrecht Province). This last statement draws back to the context-specific aspect of cycle network planning, and also reminds that the maintenance of the cyclist road network can vary and have different hinders in different contexts.

Linking to the note of renewing the city form every few decades, the Rep from HCPD expresses his concerns about the current challenges of Helsinki's transportation planning. The city is protective to balance its form by saving historical aspect and building new constructions, such as new transportation models. This is of course a good thing, yet sometimes new plans get hindered due to reasons such as 'it has always been this way'. *"Cycling has existed in Helsinki for a long time, yet there was never a particularly designed infrastructure for it"* (HCDP). It is funny how sometimes we get attached to the city history, even though the it is not nearly as long as anywhere in the Netherlands, for example, where the urban form is constantly altered, he explains.

4.2.3 Change in the City From

Moreover, discussions regarding the city form was engaged with each interviewee. The literature review revealed that land-use plans have a major influence in urban cycling networks, their efficiency and attractiveness for users (Saelens 2003; Frank 2000; Mueller 2016). Aligned with this discovery, many of the interviewees were referring to the influence of land-use policies in discussion of cycling network developments, for example in terms of mixed land-use policy, compact building, and generally prioritizing cyclists in the city infrastructure and guidelines. This is an important topic because the cycling experience may influence people's decision to choose their transportation modes (ibid).

The interviewed Traffic Planner from HCPD told an interesting story, through which he demonstrated fluency of cycling networks. He tells that a couple of years ago, he was visiting Amsterdam with a few colleges, and made a small silent test with them. They were cycling through a rather busy street that yet was familiar to the interviewee from previous visits, so he knew the organisation and structure of the cycling paths would vary during the route. The cycling lanes were mainly one-way tracks, yet at times the cycling paths were physically separated from other traffic, while sometimes the cycling lane landed on the roadway, at times there were narrow streets without any cycling path at all, and then after a couple of blocks the cycling lanes and paths were present again. After two kilometres, the interviewee stopped his crew, and asked them to look back at the route they just cycled through, and if they could recall what kind of cycling structures they have been driving on during this journey. Both of his companionship replied that they've only biked on cycle-paths. This was an interesting experiment, the interviewee tells, because neither of them noticed that at times they were on a cycling lane amidst other traffic. The representative from HCPD explains that it's due to the smooth transitions between the different cycling path arrangements, the companionship did not notice a difference in altering infrastructure. *"In a sense, the cyclist infrastructure is so well-fit with automobile traffic, that regardless if space is scarce, you can just continue your journey at the same spot. [In those transitions], it's only the separation [of cycling path and roadway] that disappears. In a sense, one doesn't even notice this separation"*, he continues, and states that there was no alteration in the feeling of comfort of safety while cycling, regardless of the altering infrastructure forms (Rep from HCPD).

This example illustrates how land-use in traffic planning can influence the comfortableness and fluency of the commute experience, even if mixed-design paths are used. The HCPD traffic planner also thinks, that infrastructure is the key for encouraging people for a certain transportation mode, and further, that infrastructure itself is highly influenced by land-use policies. *"Land use is one of the central components when in discussion of traffic planning; as an example, where offices are located and how they generate traffic, to which streets the traffic is guided. So there is a need to direct traffic; for instance limiting certain kinds of traffics to certain streets, and as such from other streets demolish certain kinds of traffic modes. This is urban planning"*, the HCPD representative analyses.

Moreover, the representative from FCF considers that the zoning plan is a good indicator of seeing to which direction developments are moving. *"The current zoning plan is addressing cycling perhaps better than ever before, which also illustrates this point"*, the representative from FCF comments, denoting that cycling is increasing its popularity in Finland. However, despite the zoning plan recognising cycling as a traffic mode, the representative from HCPD has a critical view regarding the normalisation of cycling in Helsinki. *"Relatively, in Finland we cycle much longer distances than in* *other cycling countries on average. […] At the point when people start to cycle in regular clothing, and when we no longer drive distances of 15km, and instead the [cycled] distances are shorter like in the Netherlands and Denmark they typically are, [that's when cycling is normalised]".* Yet, continuing on his previous point about the nature of urban planning, the HCPD representative concerns, *"for us, this is a big problem. In our organisation, the architects who […] work with land-use planning, they don't consider themselves as traffic planners; and the same applies for us, we traffic planners don't consider ourselves as architects. There is a mismatch there".* Worried about the efficiency and cohesiveness of planning, the HCPD representative hopes for better communication amidst parties in the field.

What comes to compact city building, the representative from Utrecht Province had some fascinating insights, which were already briefly mentioned above. Nevertheless, the viewpoint of the Utrecht based interviewee differ from the experts' based in Helsinki. He notes that the city form is something that influences cycling for sure, yet he explains that the city size, type of facilities, and type of housing are also essential in this consideration. For instance, in the Netherlands the housing type in most cities are row houses with gardens, for "*we always want to be attached to the ground".* While in Helsinki most people live in apartments, the living is much denser than in the Dutch cities. *"Our cities are much more spread out",* he explains, *"and in those spread out cities, cycling works very well. Because you cannot have good public transport. So we cannot operate a tram system, a metro system, buses are not very frequent, so then cycling is a good way to go around"* (Representative from Utrecht Province).

Interestingly, a few of the Helsinki-based inhabitants seem to think quite the opposite about the compactness of Helsinki. For instance, the representative from Think Tank precisely notes that *"clearly, we have not built the city as densely as we could have"*. She talks about the change of the city form in relation to people and their path-dependencies, describing that the Helsinki inhabitants are used to living in *"half-a-city, in a sense Helsinki is not a full city because [the inner-city] is situated by the sea".* She explains that the city does not have an opportunity to expand its core from every direction like many other cities in Europe do. *"This can cause sort of geographical and structural barriers which people are used to live with, so to say that even if the infrastructure would change, people and their habits are not altered that quickly"* (Rep from Think Tank). However, speaking about future developments of the city, the Helsinki cyclist ponders what will happen as one of the city's regional plans is executed, namely to increase the population by 300,000 people by 2030. *"Logistically it makes much more sense to increase bicycle parking than car parking, and therefore encourage cycling […]. The cape of Helsinki simply doesn't fit everybody to drive cars around here"*, he advocates.

These examples show that there are many ways of looking at the urban form, such as above in terms of urban density, and the form of the local infrastructure design. Lastly, the Helsinki Cyclist gave an example, how cycling traffic can influence the urban form even beyond the physical city. The Helsinki cyclist referred cycling to be *"a multi-purpose solution [for cities], in that it influences to noise levels, particulate emissions, general satisfaction and safety in traffic, people are in better condition, employers thank for healthier employees with lesser sick leaves, and people being more alert at working places…"* (Helsinki Cyclist). Therefore, cycling traffic can also have a positive influence in the city form. The notion of a healthy city was elaborated in terms of the thesis' societal relevance. Bridging the healthy city discussion with the aforesaid, perhaps urban form could also refer to non-design factors; such as urban health. In any case, from these discussions it could be gathered, that even the concept of urban form can be subjective.

4.2.4 Network Designs & Accessibility

The Helsinki Cyclist speaks about specific design that to his opinion could enhance the Helsinki cyclist network. Firstly, *"it's great that the network is expanding and being enhanced, say in adding South-West quality corridors for cycling […] that ease moving… They should be as direct as possible, have as little altitude changes as possible so that the knees don't get busted in up-hills, and so that they are as continuous as possible, so that one didn't need to change the side of the road for a one kilometre way, more so that you can drive where you're ought to".* Moreover, he reminds that the roles of being a cyclist, a pedestrian and a car driver may change even within a day, so we should remember not to only talk about cyclist traffic, but all traffic in general. *"We've already seen the car-versus-bike debate, it doesn't provide us with anything fruitful, [rather we should aim for] a common collaborative goal"* (Helsinki Cyclist). This been said, it would be great to see even the union for cars to promote cycling, he continues.

In terms of significant developments in cycling transportation mode in Helsinki, the interviewed representative from the Finnish Cyclist Federation (FCF) interestingly noted, that the recent years the most significant developments in the field have not necessarily been physical constructions and infrastructure, but instead, setting and committing to political goals. These targets are significant, *"because at the time as we set goals, we can also define a starting point, and so begin to work towards achieving these goals"* (Representative from FCF). However, he also continues that *"other policies, such as the design manual for cycling traffic are important, because they for instance signpost there should be one-direction lanes instead of mixed lanes. Earlier, this certain kind of will and also definitions from the city's /municipality's side have been lacking, and in a sense, before 2009/2010, the design of cycling traffic was more so talking than tacking action"* (Rep Finnish Cycling Federation). While generally speaking about cycling enhancements and aiming to spread cycling, the representative from FCF notes, that in order to encourage people to choose cycling as a transportation mode, *"Infrastructure is number one [incentive] for sure, but also soft ways, such as promotion, are important".*

End-Journey Facilities

As has been theoretically established in the framework, easy access to cycling roads seems to be one of the key incentives for people to choose bike as a transportation alternative. The interviewee from the Think Tank notes, *"from my own perspective, when I decide not to commute with a bicycle, it often depends on little things. Along the lines that, if I'm heading there later, and then perhaps… or actually near by it's difficult to get with a bike; I need to hurry later on during the day, and somehow, when many small grievances merge, I decided that it's just easier to take a bus"* (Representative from Think Tank). This note aligns with the theory, that functioning end-of-journey facilities may have a high influence on the person's individual choices. Moreover, it is interesting to use this note to interpret the quantitative data, since the results showed that in most cases, it was indeed end-journey activity that had most influence on people satisfaction toward the cycling system.

One way to think of end-journey facilities, is in terms of efficient bicycle parking. The representative from HSL tells that at the moment municipalities have *"big plans to build and enhance routes, and parking facilities".* She explains, that there are about 12,000 bike parking sports around the city, and within the coming years about 8000 more will be built. "*For instance, locking bikes from the trunk/body is now increasing, actually all future parking systems will have this option. Also parking spots with roof, and parking spots behind locked doors are being planned"* (Rep from HSL). This kind of actions should influence the expansion of cycling, she tells. It seems, that the new parking conditions are planned with the Helsinki context in mind.

Furthermore, the Helsinki Cyclist has an interesting thought regarding end-journey facilities. He thinks that cycling should be made as encouraging as possible by both public and private parties, *“for instance if employers would be in support of cycling, through policies such as economically supporting cycling by providing good facilities, meaning parking, showering and so on”,* he suggests. *“Perhaps even participation in the purchase of the first bicycle, through a some kind of bonus system. Some organise these kind of mobile bicycle-fix-stations during the work day, so basically that you can leave your bike stalled, and as you go home from work, it has been fixed and taken care of”.* The Helsinki Cyclists explains that these small deeds can work as encouragements to realise that cycling is a nice way to move around, especially for the desired 5-7km distance. It is interesting, that he acknowledges the this distance in combination to non-infrastructural incentives. Perhaps indeed such commitments by working places would make more people realise cycling as a handy way of transportation. Nevertheless, according to the quantitative results, lacking parking opportunities at work and school places were not amongst the most common reasons why people choose not to cycle, only 1% reported this as a major hinder for not cycling (Fig. 4.19). In other words, these data suggest different results.

Designs Dis- and Encouraging for Cycling

These examples relate to the idea that with city design and clever policies, people can either be dis- or encouraged for a certain transportation mode. The representative from Utrecht Province gives an illustration. *“Generally spoken, barriers in city centres are very helpful to encourage cycling”.* By this the interviewee refers to car-regulations, aligning with the theory that regulating car traffic is essential for cycling policy (Saelens 2003; Gehl 2011). He explains that in his home village, Driebergen, it is difficult to pass the village by a car due to regulations, and therefore within the city cycling rates are higher. However, the interviewee reminds that from this village, people still often take the car to use facilities that cannot be found from the small town (Rep Utrecht Province).

Along the same lines, the transportation planner from HCPD critiques the land-use of traffic planning in Helsinki. He illustrates how the street hierarchy relates to land-use, through presenting the logics of road hierarchy. Basically, in Helsinki the car-driver is almost always on top of the hierarchy, which can be observed by street designs. For instance, if a pedestrian or a cyclist enters a crossroad, even if they were heading to the main direction of the road, they need to cross zebra lines, and thus make space and priority for the car driver. *“It is logically silly”,* the HCPD Rep ponders, “*while in Holland and Denmark […] the foot path continues without breaks, there are no zebra crossings […], and the car driver must cross the pedestrian road, not the other way around”.* The traffic planner tells that in a couple of cases, like in a few crossings at Helsinginkatu, modernisation to the traditional car-dominant system have been constructed. Yet, “*on the other hand there were many crossings where the permission was not allowed, due to concerns relating to city form*” (Rep from HCPD).

Within this discussion, the HCPD Rep tells a story of a few years back from an excursion to Copenhagen. Apparently, there had been some sort of resistance toward modernisation of traffic plans, some of his co-worker being worried of *“how would cars know how to turn to these streets if there is no zebra crossing to signpost that”.* During the excursion, the interviewee raised this debate on the surface with the Danish experts, telling that *“in Finland, we have come to a conclusion that cars do not know how to turn on crossing if there are no zebra lines, and for that reason would like* *to know how you in Denmark have solved this problem”,* and asking if in Denmark they had had a similar problem in planning. “*Of course […], I got exactly the reply I was looking for. The experts started laughing, and told that we can go back to Finland and let the department know that in Denmark, we recognise a crossing from where there is space between the facades of the buildings”.*

Though this is a bit mischievous illustration, the point behind it highlights a theoretical assumption (e.g. Lynch 1960; Ewing & Cervero 2010): that urban designs can direct people’s traffic behaviour, in that the design shows users which mode of transportation has the ‘highest power’ in the network system. The HCPD interviewee explains that in the Netherlands, *there are five principles for transportation planning and design […], and all of the enhancements needs to somehow relate to the higher hierarchy principle. One of these principles is that the design of the infrastructure must communicate what you are ought to do*”. In practice this means that the purpose of traffic signs is not to tell the user what they are ought to do, but instead support the designed infrastructure by showing for whom the arrangements are for. Say, the pavement colour, material and design of the streets signpost who is ought to use the street: asphalt belongs to cyclist; and the material (such as tiles) also telling the driver they are arriving into a residential neighbourhood. *“For instance, on residential streets there are no separate cycling paths, the traffic is mixed. Only on a proper traffic street are there separate cycling paths made of asphalt”*. These principles are very strong, and the whole philosophy of infrastructure is based on them, the representative from HCPD explains.

Moreover, the HCPD reminds about the importance of intersections precisely. *“If the interface are not working, then the whole new system is not working”.* This also refers to the significance of the entity of the cycling network, and how simple adjustments in the existing network context can add up to a more cohesive network. For instance, *“getting one-way lanes to the city centre is a very important matter”*, he finishes off.

On a similar point, also the representative from Think Tank refers to the roles people take in traffic. She thinks back to her own cycling behaviour in Helsinki, and notices, that sometimes it can be confusing to know where the cyclist is ought to go. For instance, if a cyclist should consider themselves a cyclist, car driver, a pedestrian, or a car-cyclist. *“I think sometimes even in newly renovated areas it can be seen that these [roles] have not been properly thought through”.* This draws back to the general cycling guidelines in Helsinki, in that at occasions the separation of pedestrians, cyclists, and even car-drivers is not so clearly communicated. The HCPD interviewee makes a strong point in the categorisation of different transportation modes. *“Cyclists and pedestrians have a different level of behaviour, and it is absurd that we categorise cyclists and pedestrians in the same place, yet as a zebra line appears, [these groups are merged together…]. Like, how can different rules apply to people who are using the same lane”*, he continues. *“This is one of the most concrete conflicts in traffic and transportation planning in Finland, say in Denmark or Holland such would be completely unacceptable”.*

The interviewee from the Think Tank also had some thoughts regarding crossing and intersections. She related back to the construction site in front of the Opera House in Helsinki, and was convinced that the temporary arrangements were not working safely. *“When the construction site was still there, people started to use the bicycle lanes wrong, but now as it’s all gone, folk are still [a bit confused]. Like it’s not very well guided. Bit by bit I am kind of getting a realisation, that maybe I was suppose to go there when I’m cycling toward the car traffic. [But also], in the spot where I need to stop to wait for the traffic lights, there is no button I can push, so I’m also not sure if I’m suppose* *to continue there, or switch my route to the pedestrian lane, and walk the bike across the zebra lines".* As such, the Think Tank representative expresses her dissatisfaction toward the temporary solutions that are designed for cyclist during construction work, which interestingly is also a concern expressed by the survey responses.

These expert interviews revealed some idealised structural designs desired by the interviewees. In short it seems, that in the experts' viewpoint, end-journey activity is something that largely determines the choice of transportation mode on that given moment. Yet, many seem to believe, that encouragement for more cycling could be done by showing example through infrastructural design changes. Primarily these referred into prioritising cyclists' more in the full traffic network hierarchy, but also that specific design aspects, such as one-lane roads and clearer guidelines for cycling traffic could take place. To recap, this part has provided interviewee's perspectives on end-journey activities, encouragement through design, the order of proper network hierarchy, and the expert's viewpoint on crossing and junctions. These topics are brought together in the last subchapter by considering cycling safety.

4.2.5 Safety

As was established in the framework, cycling safety is theoretically believed to be one of the key barriers for people to hop on their bikes (Cleland & Walton 2004; Dill 2009; Hull & O'Holleran 2014). This theoretical assumption was examined to be true in terms of the quantitative data (Fig. 4.22), and it seems that many of the interviewees agree with these theoretical findings, too. For instance, the Helsinki Cyclist talks about the importance of network fluency and safety, and particularly whether cycling is perceived as safe. Moreover, he notes *that "if changes are done in the cycling traffic rules and systems, it is essential how well these reformations are informed to the publicity and expressed that these changed are in fact a better solution, and guarantees more safety"* (Helsinki Cyclist).

This idea is furthermore connected to the land use aspects discussed in the framework; that the decision of how to 'spend' urban space has an impact on how safe people feel on the streets. Such was the case for instance by an example presented by Pucher & Buehler (2008), in saying that small designs like the separation of cycling lanes from other traffic, may increase the safety feeling of the transportation form users. Moreover, the Helsinki Cyclist highlights that a cyclist advocacy organisation named HePo (Helsingin Polkupyörilijät; ENG the Helsinki Cyclists) tries to drive forward a legal suggestion, which namely states that people are suggested to wear helmets while cycling. The reason for the organisation to work against this suggestion, is *that "if there is a suggestion in the law without a sanction, why is it there in the first place"*, the Helsinki Cyclist explains. *"Law is about restrictions and rules, and breaking these restrictions and rules are followed by a legal punishment".* Moreover, the Helsinki Cyclists expands the helmet discussion by prompting that the helmet as such does not increase safety. *"It is a good thing to have if you get into an accident and fall down, but the fact that you have a helmet on will not change the traffic around you to any safer format".* To his opinion, the topics of helmet use and traffic safety are *"happily blended",* although what in fact increases cycling safety on roads, *"is clearer infrastructural arrangements, and higher quality execution"* (Helsinki Cyclist). As the representative point is clear, he still adds, *"[Sometimes] it feels like there are a lot of ammo used in spreading enlightenment to a topic which will regardless not guarantee a long-term solution for behaviour".*

The representative from HCPD thinks the risk of accidents is higher in Finland than Denmark or Holland, for the same reason the Helsinki Cyclists was naming: infrastructure. He views that in these best-practice cycling countries the general entity of traffic is less controlled. This can, according to his example, observed for instance if a cyclist bikes on a road that is not meant for cycling. Cycling on the car lane even for a moment, cars begin to honk at the bikers and suddenly as a cyclist, you and are very aware of your presence in the roadway, not the cycle path. In Finland, the role of the cyclist is a little bit less clear, and therefore the traffic also less safe (Rep from HCPD).

Lastly, the Utrecht Province representative paints a picture of a safe cycling environment, in the light of mixed-user cyclist profiles. "*When you have cargo-bike moms in the streets, then you have happy cities".* When the moms feel safe enough to commute their children around with a bicycle, and even to stop in a street corner here or there to chat with their friends, that when you have a true cycling culture, he explains. And seemingly, the on-going cycle of cycling traffic improvements starts with infrastructure. *"If you build facilities, then the people will come, and then you build better facilities"* the representative from Utrecht Province states.

Recapitulation

To summarise the findings of the qualitative section, first change of people's mind-sets was discussed. This change referred to individual's worldview, political and planning system, and promotion in that through advocacy certain ideas can be spread. Second, planning and cycling policy were tackled, ending in thoughts that compared the system between Finland and the Netherlands. Third, changes in the city form were considered, resulting into an interesting discussion about the form and density of the city. Fourth, the sub-chapter on network design and accessibility lifted themes such as importance of infrastructure and end-journey activities. Conclusion was that the expert believe infrastructure is number one for encouraging cycling, but people's cycling-friendly mind-sets vital, too. Lastly, cycling safety was discussed, ending in a thought that cycling should be so safe that it is possible for everybody.

5. Discussion

This chapter draws a discussion based on the empirical findings, since they pertain to the research questions. The structure is based on the research questions. The sub-questions are answered first, followed by a discussion that provides an interpretation of the data for the main research questions. As a reminder, the research questions are restated:

1. To what extent is people's decision-making in the choice of transportation mode influenced by urban design factors, particularly in the case of cycling in Helsinki?

    a. Who cycles in Helsinki?

    b. Is there a difference between the end-journey activity, reason why cycling chosen as a transportation alternative, and why cycling was at times not chosen as a transportation alternative, between the Helsinki cyclists based on their residential location and daily distance travelled?

    c. Is there a difference between how the Helsinki cyclists' rate their satisfaction toward the cycling network and their residential location, daily distance travelled, and end-journey activity?

    d. According to the experts, what are the demand side determinants of choosing the bicycle as an alternative transportation mode in Helsinki?

5.1 Who cycles in Helsinki?

The first part of the quantitative section (4.1.1) focused on creating an image of the Helsinki cyclists' profiles. By looking at the descriptive data, it was discovered that most inhabitants have access to bikes (Fig. 4.7); and that the typical Helsinki cyclists is well educated with a secondary or graduate degree; and belongs to the middle- or upper-middle income groups (Fig. 4.7-4.12). In the analytical framework, the term 'local political will' was discussed in relation to cycling culture, stating that for further enhancements and optimal cycling environment, political will is demanded by the government's as well as the inhabitant's side (Vaismaa 2014; Pucher & Buehler 2008; Hull & O'Holleran 2014). Following this conceptualisation, these characteristics could be read as the Helsinki cyclists as well as inhabitants in general, to possess political will toward cycling.

The two later parts of the quantitative section focused more on the incentives for cycling than cycling culture. However, these data can also interpret to imply political will, for instance in reflecting the cycling ideology of the inhabitants. For instance, Fig. 4.16 visualised the inhabitants' rationale for cycling, and the most common reasons were handy way of transportation, positive influence on personal health, and biking as a leisure time or outdoors activity.

Most of the interviewees seemed to believe that Helsinki is slowly but steadily becoming a more cycling-friendly environment, in that the Helsinki-based interviewee's recognised that the popularity of cycling in Helsinki is increasing, and they seem to hope the cycling culture to spread (Rep from HSL; Helsinki Cyclists; Think Tank Rep; HCPD Rep; Rep from FCF). For example, the HCPD Rep highlighted that Helsinki needs to aim for normalising biking, so that it is not only an incentive for exercise, but so that people would choose cycling because it is the most handy and efficient way to move around (Representative from HCPD). Another example is the Helsinki Cyclists positive expectations toward future generations, as he states that probably the younger generations already are more aware consumers, and might take cycling as a transportation alternative more easily due to its environmental and societal benefits. However, many of the interviewees also were concerned that yet, cycling has not become normalised as a transportation form (Rep from HCPD; Rep from HSL; Rep from Think Tank; Helsinki Cyclist). Thus, even though the quantitative data implies that the typical Helsinki cyclist is in an average person in terms of education, annual household income, residential location, and customs relating to car and public transportation use; the qualitative data indicates that a cyclist in Helsinki is rather a person with a concern to environmental issues or personal health. Such has been the case for instance in the examples above. In the analytical framework (2.1.4), it was outlined that there is a theoretical connection between urban health and transportation planning. Therefore, these results are interesting observations, since they also portray the notion of urban health as presented in the literature review, that is in terms of public, social, and environmental health, and generally regarding to healthy urban lives.

5.2 Is there a difference between the end-journey purpose, reason why cycling chosen as a transportation alternative, and why cycling was at times not chosen as a transportation alternative, and between the Helsinki cyclists based on their residential location and daily distance travelled?

The second part of the quantitative section (4.1.2) focused on looking at the purpose and rationale of the Helsinki cyclists for their transportation choice, as well as why they chose not to cycle at times. Directly answering to this sub-research question, in terms of the end-journey purpose, the difference between both independent variables was tested to be significant. The residential location shows that those living in the inner-city are more likely to commute to work or studies than the suburb residents, whereas in the suburbs more people cycle for running errands or for work-out purpose, than in the inner-city (Fig. 4.14).

This pattern could be a sign of a certain kind of city-form, as discussed in the interviews. For instance, the Rep from Utrecht Province noted, that the city infrastructure and other facilities pay a key role to their transportation modes, for instance in that in villages people tend to cycle, but if needing facilities outside of the village, they may choose a car instead. Seemingly, the case could be that the inner-city residents have a shorter or otherwise more convenient distance to their daily activity, which may make cycling more appealing for this purpose. Similarly, in the suburbs the travel to running errands (e.g. groceries) could be easy to access in terms of infrastructure, as well as the proximity of cycling paths that are suitable for work-outs may be more convenient than in the city centre. Thus, perhaps the fact that more inner-city people see cycling as a convenient transportation mode, tells something about the differences of infrastructure between the inner-city and the suburbs.

The residential location and daily distance travelled were also significant factors in terms of why cycling was chosen as a transportation alternative (Fig. 4.15). Interestingly, this data compliments the above deliberation, in that in the inner-city more people tend to choose the bicycle for its convenience as a transportation mode, and in the suburbs more people rationalise biking due to its benefits for health (Fig. 4.17). The daily distance variable reveals that particularly those cycling distances below 5km view cycling as a handy transportation mode, and beyond 6km as a physical activity (Fig. 4.18).

Fig. 4.19 shows that the most common reasons for people not choosing the bicycle in Helsinki are the lack of access to a bicycle, the health condition of the individual, or that other transportation mode is simply preferred. However, the variables residential area and daily distance travelled were not found to have significant connection with the decision to not cycle, and therefore no difference is found (Fig. 4.20-4.21).

Moreover, if the variables residential location and daily distance are taken as to represent city infrastructure, the discussion can be further linked to normalisation of cycling. ‘Normal’ cycling in Helsinki is through the quantitative data read as being commuting to work or study, commuting to leisure time activities, or running errands, since these three are the most popular reason for cycling (Fig. 4.13). This conclusion can be made since for these end-journey activity purposes, cycling is chosen as a transportation mode, which tells the individual has read cycling as a serious alternative for transportation (unlike in the case of cycling for work-out solely). However, this interpretation of the quantitative data may be slightly misleading, since the qualitative data rather suggests that normalisation of cycling in Helsinki is still on its way (Rep from HSL; HCPD; Helsinki Cyclists; Rep from FCF). Thus, in terms of normalising cycling, there seems to be a contradiction between the quantitative and qualitative data. One way to read this conflict is to consider, that perhaps in Helsinki, cycling is promisingly becoming a serious transportation alternative (based on people's end journey purpose; and rationalisation of the transportation choice); yet, the normalisation of cycling has not yet taken place (since the experts seem to view on a street-level, cycling is increasing, but not yet a transportation mode for everybody).

However, if the variables residential location and daily distance travelled are considered critically, they do not reveal absolute facts about the influence of the city infrastructure on people's decision-making in choosing transportation mode per se. Rather, they provide an idea of the spatial distribution of Helsinki cyclists biking purpose, ideological rationale, and why the mode is sometimes not chosen. However, when looking at the data regarding the Helsinki cyclists' satisfaction toward the network, more insights are gained, which broadens the discussion. Therefore, the results of part 4.1.3 are discoursed next.

5.3 Is there a difference between how the Helsinki cyclists' rate their satisfaction toward the cycling network and their residential location, daily distance travelled, and end-journey activity?

The results show that the variables which are statistically significant are satisfaction to safety and end-journey activity, satisfaction to smoothness and residential location, satisfaction to smoothness and end-journey activity, general satisfaction and residential location, daily distance travelled, and, end-journey activity.

Consequently, the only tested variable that showed statistical difference between the classes in terms of satisfaction to safety, was end-journey activity (Attachment 4.22c). In the logic of Pucher & Buehler (2008), small designs like separation of cycling lanes from other traffic may incentivise people to cycle more. Since no difference between the Helsinki cyclists' safety experience was found in terms of residential location or daily distance travelled; one way to connect these data with the theory would be to inquire, whether significant differences between the two areas exists in terms of bicycle lane safety and infrastructure. Had these spatial variables shown a significant connection with the satisfaction to safety, a discussion whether infrastructural differences between the different city parts exist could have been opened. However, now this data could be interpreted as suggesting, that the cycling safety experience is not dependent on the individual locations or travel length, and thus, that cycling safety does not geographically differ in different city parts. Though Hull & O'Holleran (2014) highlight that cycling safety is a factor that often might hinder people from cycling, the data shows such is not the case in Helsinki, at least not in relation to residential location or daily distance travelled.

Nevertheless, a significant difference was found between the inner-city and suburb inhabitants and satisfaction toward the smoothness of cycling. In this question, smoothness of cycling refers to designs such as curbs and lane condition in general. Though difference between inner-city and suburbs is not radical, the inner-city residents are statistically less satisfied with the network smoothness/convenience than the suburb inhabitants. These results could give insights for the aspect that was lacking above, namely the form of infrastructure. It could be interpreted that in the city centre, the convenience of cycling is a little bit lower than outside the city centre. A theoretical explanation for this could be that some infrastructural designs in the city centre are not as well functioning as in the suburbs. Pucher & Buehler (2008) highlight the importance of prioritising cyclists for instance in crossings and junctions, as do Vaismaa (2014) and Martens (2008, amongst others). Moreover, the Think Tank Rep made a notion of the inner-city infrastructure in crossroads during construction work, when the design for cycling lanes if often confusing and somewhat neglected. That being said, a better connectivity in the suburbs does not necessarily need to be a sign of a more serious problem than an incomplete temporary cycling transportation design solution, or likewise traffic in the city-centre during rush hour. Between satisfaction to cycling convenience and daily distance travelled, no significance was found. Yet again, the end-journey activity is an essential factor for the satisfaction toward smoothness of cycling. In terms of general satisfaction, the differences between the inner-city inhabitants and suburb residents did not alter radically, although this was statistically relevant information. Therefore, it could also be stated that in a large-scale, the satisfaction between the two groups does not alter fundamentally, but there is a trend that more people are very satisfied in the general cycling system in the suburbs than in the inner-city.

Lastly, like in all cases above, the end-journey activity was found statistically significant also in terms of general satisfaction toward the cycling system. Out of all the end-journey activity categories, the work-out cyclists are the most satisfied, whereas the work- and study commuters have the lowest percentage of very satisfied cyclists (Attachment 4.22i). The highest percentage of cyclists that are 'rather unsatisfied' with the general system, is rated by the parents who commute with their children. This is interesting considering the earlier results in terms of safety and end-journey activity, in which the parents were those who were most satisfied with safety. Thus, these results could be suggesting that the parents' relatively high dissatisfaction to the cycling network is not due to safety while cycling, but has to do with other factors instead.

5.4 According to the experts, what are the demand side determinants of choosing the bicycle as an alternative transportation mode in Helsinki?

Four overarching factors that relate to the demand side determinants of choosing bicycle as a transportation alternative were induced from the expert interviews. These are: people's mind-sets, accessibility and convenience of cycling, city form and people-centred infrastructure. As a reminder, the Rep from FCF made a noteworthy comment, that the most significant developments in bicycle transportation planning in Helsinki have in fact been commitments to targets and policies, instead of changing infrastructures. This sign of governmental political will can be interpreted as a step toward the optimal cultural environment of cycling, like was conceptualised in the analytical framework (Vaismaa 2014; Hull & O'Holleran 2014). In the framework as well as in subchapter 4.2, the discussion on changing mind-sets was related to individual's world-views, local politics and planning policies. Based on the interviews, it was observed that these factors seem to be under a transformation process, for instance in that people are becoming more aware consumers (Helsinki Cyclist) or gaining new world-view from their travels (HCPD Rep), and therefore choosing cycling as a transportation mode. If this deliberation on societal change is drawn back to the idea that the city's transportation network reflects societal development (Vuchic 1999), it could be contemplated that the changing mind-sets are early reflections of future infrastructural developments. Theorists such as Kosonen (2007), Rainer et al. (2012, and Newman et al. (2015) moreover have presented that increasing green and sustainable transportation modes, like cycling, are marks of societies' slow developments away from the car-dependent model. The societal transformation furthermore opens an interesting discussion relating to transportation as a service model. Authors like Martens (2004) and Jäppinen (2013) contemplated that alongside societal developments the provided services increase, which are something that can be sensed in the cycling realm as well. For instance, while traditionally cycling may be connected to private transportation forms, new services such as shared bicycle systems are complimenting the supply-side of the transportation mode, arguably resulting from a societal demand.

Speaking of the demand determinants that would encourage cycling more, in all interview cases the interviewee believed that infrastructure is the most essential factor that may dis- or encourage cycling, followed by other cultural aspects, such as open environment in which cycling is not boxed into a stereotype (HSL Rep; HCPD Rep; Helsinki Cyclist). Aligning with the theory, the interviews showed that land-use planning is essential in terms of cycling infrastructure planning. For instance, the Rep from HCPD compared the Dutch and Danish systems with the Finnish one, deliberating that particularly in intersections, the car is often prioritised in Helsinki. Linking to this, the Rep from Utrecht Province (like scholars such as Newman & Kenworthy, 2015) has ensured that car-regulation is vital for cycling policy.

Interestingly, the discussions on city form were nevertheless not one-way. Stemming from discussion with the Utrecht Rep, Think Tank Rep, and HCPD Rep, the form and compactness of the city can be questioned. It seems that in Helsinki, the interviewees' considered city density in terms of infrastructure, whereas in Utrecht the representative spoke of population density. This observation is moreover linked to human-scale aspect of cities (Gehl 2011), in that in the Netherlands population density in many towns may be lower than in Helsinki, yet the infrastructure is more dense in terms of road wideness (narrower streets) and spaces between buildings. Furthermore, an interesting discussion could be departed from the architectural history of cities. Though in the Netherlands the history of cities is much longer than in Helsinki, the qualitative data implies that policies support change and development in cityscapes more easily than in Helsinki (Rep from Utrecht Province; Rep from HCPD). Nevertheless, like the Utrecht Province Rep noted, this is partially due to geographical conditions, in that in the Netherlands roads must be reconstructed every few decades due to the swamp character of the soil, while in Finland the strong bedrock slows construction processes down considerably. These discussions are evidently linked to context-dependency of planning, that has been highlighted in the theoretical framework also (e.g. Urban Movement 2014).

Lastly, linking the discussion together, an evident theme arising from the interviews, is people-centred planning. Essentially, the whole contemplation on prioritising cyclists in traffic, dates back to the concept of human-scale city, as well as healthy city. From a transportation planning viewpoint, it might not be desired that people choose the bicycle due to benefits for individual health, because one purpose of the transportation planner is to design infrastructures that are inviting for users as such. However, looking the concept of healthy city from a human-scale city perspective, it is indeed desired, that people would choose the bicycle due to its health benefits. However, in this conceptualisation, health does not only refer to individual health, but for the health of the society as a whole: in terms of less motorised traffic congestion, less noise in the city, better air quality, and generally more people-centred atmosphere and environment. Moreover, topics such as cycling safety evidently links together with the idea that cycling is for everybody, for the young, the old, the parents, for the daily commuters, and for the work-out cyclists. This been said, the process of improving cyclist conditions in Helsinki, or in fact in any other city, is actually a question of social justice, centring around questions like in which kind of social city we want to live in.

5.5 Final Comments & Future Research Suggestions

Lastly, the answer to the main research question[12] can be corroborated from the above discussion. First, since the study was conducted in the context of cycling transportation, 'urban design factors' refer to infrastructure that are relevant for cycling. The variables that represented infrastructure in the quantitative part of the study, have been residential location and daily distance travelled, and later, end-journey activity. These variables were used to compare the satisfaction of the Helsinki cyclists toward the cycling network as a whole, cycling safety, and satisfaction to smoothness and convenience of the cycling experience. While these results have not specified the direction of the relationship between city design and individual's decision-making process in the choice of transportation mode, they have given an indication of the spatial distribution of the Helsinki cyclists satisfaction to their cycling environments, their purpose for cycling, and the reason why cycling is chosen in the first place. This spatial indication is considered city infrastructure and urban design, complimented by the qualitative data.

First, the results show that residential location and daily travel distance influenced the inhabitants' purpose and reason to cycle, but were not significant when cycling was not chosen as a transportation alternative. The findings suggest that those residing in the inner-city cycle for work- or study commute more than those living in the suburbs. Likewise, the suburb residents tend to cycle more for work-out purposes than the inner-city residents (Fig. 4.14). In terms of infrastructure, this could be a sign of better road connectedness in the inner-city. Second, the results suggest that those residing in the inner-city or cycle distances shorter than 5km, choose cycling for its transportation convenience more often than those residing in the suburbs and commuting distances beyond 5km, who instead consider and choose cycling for its individual health benefits (Fig. 4.17-4.18). These results could further support the earlier thought, in that in the inner-city transportation convenience is a more common rationale for cycling. Third, in all tested cases, end-journey activity influenced the Helsinki inhabitants' satisfaction toward the cycling network. The inner-city residents are more unsatisfied with the network in general and regarding its smoothness than the residents in the suburbs. These outcomes are somewhat conflicting with the previous point, suggesting that in the inner-city the inhabitants are less satisfied with the cycling network than in the suburbs, but also that in the inner-city many choose cycling for its convenience. However, a higher satisfaction toward the system in the suburbs does not necessarily indicate a more serious case than if the suburb residents use cycling more for leisure time activity or sports, they might not be so sensitive for small inconveniences in the road network as the work- or study commuters are. Nevertheless, it could be considered that these factors also influence individual's decision-making while choosing a transportation alternative.

One way to reason these results would be to contemplate, that perhaps in the inner-city the distance of one's residential location and daily commute is somehow experienced as convenient for cycling. Yet, also that there could be some infrastructures and design solutions that influence the cycling experience in a negative way. Complimenting this view with the qualitative data, for instance the intersections in the inner-city could be such a hinder (Rep from Think Tank; Rep from HCPD). However, to draw a precise conclusion like this, more detailed information regarding the end-journey destination would be needed. The quantitative results interestingly show, that the only

[12] To what extent is people's decision-making in the choice of transportation mode influenced by urban design factors, particularly in the case of cycling in Helsinki?

tested factor that was significant in all cases, was end-journey activity. The finding moreover signposts the theoretical belief that end-journey activity is tight together with decision-making in choosing transportation mode (e.g. Romero et al. 2017; Mueller 2016; Badoe & Miller 2000). However, these data do not specifically reveal what is it about the end-journey activity that encourages or discourages people from cycling. Therefore, an interesting further research would be to model out the specific end-journey activity locations, and consider if there are specific designs at the end-journey activities that influence this decision-making. The qualitative data of this study implies that parking opportunities have a major impact on the convenience and accessibility of cycling as a transportation mode (Rep from HSL). Using this as a standing point, for instance looking into the parking facilities of the end-journey activities, such as grocery shops and working places, could thus uncover further information about the end-journey activities.

The qualitative data suggest, that accessibility and convenience of cycling, city form in terms of its infrastructure, and people-centred infrastructure, are furthermore demand side determinants that influence the inhabitant's decision-making while choosing a transportation alternatives. However, also other than urban design factors induced out of the interviews and were considered essential determinants, such as people's mind-sets. Therefore, urban design factors alone cannot be responsible for guiding people toward a certain transportation mode.

From an academic perspective, this study has been an endeavour to place people at the centre of spatial planning research. This is essential because in the field of planning, discussions on people-centred processes are gaining more attention both in academia and practice. In the future, similar databases could be used for research, and the creativity of the scope of the study expanded. Moreover, upcoming studies that utilise government-collected data could generate results that can be adopted by practitioners, developing urban spaces that are mindful of the inhabitants demands. From this thesis both positive and negative lessons can be learned and taken advantage for in future research considering urban design and transportation decision-making. Even if the results of this research were not applicable to practice, the study stands on the side of people-centred research, and as such can be considered as a contribution to the academic society.

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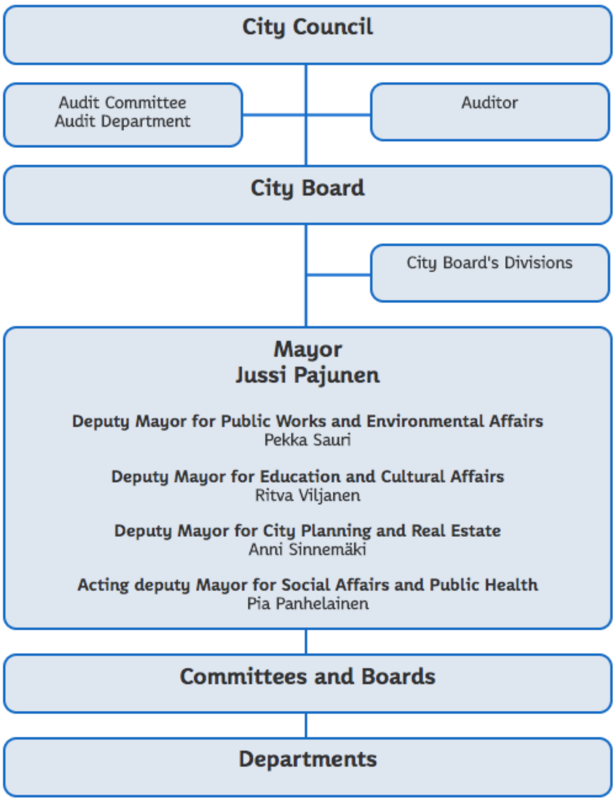
Attachments

Table of Contents

Chapter 1

1.1 Organisation of Helsinki City Governance, before the Reformation

This figure visualises the old organisational structure of the city governance of Helsinki (prior to June 2017).



1.2 Organisation of Helsinki City Governance, after the Reformation

This figure visualises the new organisational structure of the city governance of Helsinki (from June 2017 onwards).

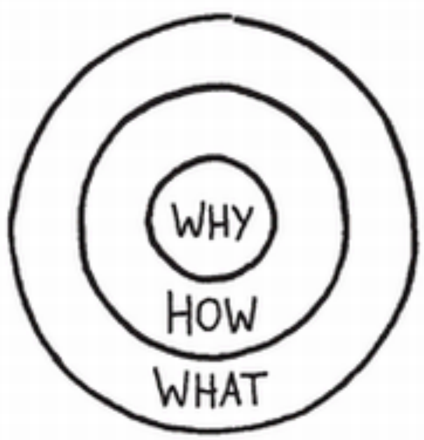
Chapter 2

2.1 The Golden Circle

“People don’t buy *what* you do, they buy *why* you do it”, is the famous phrase from Simon Sinek’s TED-talk (2009), *How great leaders inspire action*. Sinek’s key thesis, the Golden Circle, or perhaps better known as the what-how-why –model, argues that many businesses fail to appear as inspiring for their customers, because they do not fully understand *why* of their product or idea is important.

Although this example is of a business branding strategy, its core idea remains relevant: in order to distribute a product or an idea the rationale for *why* the product is important, needs to be communicated in clear and engaging manner. Thus, the analytical framework builds on the Golden Circle, using the why-how-what model (see Figure below) to elaborate the importance of cycling network design. The chapter illustrates the Golden Circle model in that part 2.1 focuses on the *why*, part 2.2 on the *how,* and finally, part 2.3 on the *what*, giving the framework for the study which the analysis later follows.

Fig. 3.1 The Golden Circle



2.2 Madanipour’s Seven Confusions of the term Urban Design

Madanipour presents, that there are seven confusions in the ambiguity of the term urban design. They are: (1) the scale of urban fabric which urban design addresses; (2) the visual or the spatial emphases of urban design; (3) the spatial or the social emphases of urban design; (4) the relationship between process and product in the city design; (5) the relationship between different professionals and their activities; (6) the public or the private sector affiliation of urban design; and (7), the design as an objective-rational or an expressive subjective process (Madanipour, 1997, p.13).

Chapter 3

3.1 Cycling Barometer Questionnaire Questions

Before starting the analysis, the questionnaire questions of both years of the survey were looked at. The reason for this was first to compare how the questions have been changed from the first survey year (2014) to the second one (2016), and second to decide which questions to focus on in the analysis. Eventually, questions that related to the physical environment, satisfaction, residential location, and distance travelled were chosen, because these attributes aligned with the theoretical framework.

2014

1. The City of Helsinki aims to increase cycling and enhance cycling conditions. How do you relate to bicycle transportation development in Helsinki? Are you...
2. How often do you cycle during seasons when the snow is not on the ground?
3. How satisfied you are with the city of Helsinki as a cyclist city?
4. How fluent/smooth do you find cycling in Helsinki?
5. How safe do you consider cycling in Helsinki to be?
6. How satisfied you are with... how the separation of cyclist and pedestrians lanes takes place in Helsinki?
7. How satisfied you are with... the roads that are suitable for biking in the city centre?
8. How satisfied you are with... bike parking opportunities at (public transportation) stations?
9. How satisfied you are with... bike parking opportunities in other public spaces?
10. How satisfied you are with... opportunities to combine cycling with public transportation during the same journey/commute trip?
11. How satisfied you are with... cycling guidance in Helsinki?
12. How satisfied you are with... the cycling comfortability in Helsinki?
13. How satisfied you are with... the management of cycling paths in Helsinki during winter?
14. How satisfied you are with... the condition of cycling paths during other seasons in Helsinki?
15. How satisfied you are with... informing and communications relating to cycling?
16. Below developments that relate to biking are listed. Please reply to each, whether the development would make you cycle more than currently or would make you start biking (yes or no response).
    a. If the cycling network would be more comprehensive and joint
    b. If cycling was more safe.
    c. If cycling roads were maintained in better condition.
    d. If parking spots and areas for bikes would have better quality.
    e. If guidance about cycling routes was organised better.
    f. If working or study-places would have better facilities for showers and opportunities to storage clothes.
17. Which of the following alternatives is the most common reason for you to use bike as a method of transport? A) commute to work or school B) work out C) commute to hobbies or leisure time activities D) runnin errands and shopping/groceries E) transporting
18. Which of the following is the key reason for you to choose biking as a transportation alternative? A) it is handy B) postivie influence on physical condition and health C) outdoor activity and refreshment D) economic benefits E) environmental friendly F)

19. Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?
20. If you use the car, do you think the amount of car traffic is a problem?

2016

1. The City of Helsinki aims to increase cycling and enhance cycling conditions. How do you relate to bicycle transportation development in Helsinki? Are you...
2. Do you commute with a bicycle?
3. How often do you cycle during seasons when the snow is not on the ground?
4. How often do you cycle during the winter, when there is snow and ice on the ground?
5. How satisfied you are with the city of Helsinki as a cyclist city?
6. How fluent/smooth do you find cycling in Helsinki?
7. How safe do you consider cycling in Helsinki to be?
8. How satisfied you are with... how the separation of cyclist and pedestrians lanes takes place in Helsinki?
9. How satisfied you are with roads that are suitable for biking in the city centre?
10. How satisfied you are with bike parking opportunities at (public transportation) stations? Bike parking opportunities refers to both, qualitative and quantitative factors.
11. How satisfied you are with the bike parking opportunities in other public spaces? Bike parking opportunities refer to both, qualitative and quantitative factors.
12. How satisfied you are with opportunities to combine cycling with public transportation during the same journey/commute trip?
13. How satisfied you are with cycling guidance in Helsinki?
14. How satisfied you are with cycling comfortability in Helsinki? Please consider the road conditions, road edges and other factors that may influence the comfortablness of cycling.
15. How satisfied you are with the management of cycling paths in Helsinki during winter?
16. How satisfied you are with the condition of cycling paths during other seasons in Helsinki?
17. How satisfied you are with temporary arrangements in Helsinki for cyclist when construction work spread over cycling lanes?
18. How satisfied you are with biking informing and communications?
19. What is the most common purpose for your commute with the bicycle?
20. What is the main reason why you choose biking as a transportation alternative?
21. Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?
22. Would the following development make you cycle more or start cycling? Y/N
23. Do you use/have you tested the Helsinki City Bikes? If yes, how often have you used them?
24. To which kind of commutes (or parts thereof) have you used the City Bikes?
    a. Commute to work/studies
    b. Rleating to work errands; for instance a meeting etc.
    c. Commute to leisure time activities
    d. Work out our cycling for fun
    e. Something else?
    f. Other purposes for city bike usage
25. How satisfied you are with the Helsinki City Bike system?

3.2 Data Representatives & Data Structure

Table 3.2 Outcomes of the Chi-Square tests

In the thesis document, Table 3.2 presents the outcomes of the Chi-Square tests, which were used to estimate the reliability of the data. The Chi-Square test were done with the variables of gender and age group.

Gender

	Observed N	Expected N	Residual
male	982	987.6	-5.6
female	1022	1016.4	5.6
Total	2004		

Test Statistics

	Gender
Chi-Square	.062[a]
df	1
Asymp. Sig.	.803

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 987.6.

AgeGroup

	Observed N	Expected N	Residual
1.00	1721	1741.7	-20.7
2.00	283	262.3	20.7
Total	2004		

Test Statistics

	NewAge2
Chi-Square	1.875[a]
df	1
Asymp. Sig.	.171

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 262.3.

Table 3.3 Data Structure

Table 3.3 is a visualization of the data structure. The data is divided into two categories: all respondents and cyclists. The cyclist group is a deduction from whole sample group, in which cases were selected based on who reported that they cycle at least occasionally (Aq2). Here the output for all respondents is presented first, and second the output for the cyclists.

All Respondents

Gender

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	male	982	49.0	49.0	49.0
	female	1022	51.0	51.0	100.0
	Total	2004	100.0	100.0	

AgeGroup

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	18-24	193	9.6	9.6	9.6
	25-34	478	23.9	23.9	33.5
	35-49	554	27.6	27.6	61.1
	50-64	496	24.8	24.8	85.9
	65-74	283	14.1	14.1	100.0

	Total	2004	100.0	100.0	

Area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	inner city	702	35.0	35.0	35.0
	suburb	1302	65.0	65.0	100.0
	Total	2004	100.0	100.0	

AreaSpecific

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	headland	232	11.6	11.6	11.6
	other city centre	470	23.5	23.5	35.0
	suburb W, incl. Lauttasaari	394	19.7	19.7	54.7
	suburb N and NE	428	21.4	21.4	76.0
	suburb SE, Kulosaari and Östersundom	480	24.0	24.0	100.0
	Total	2004	100.0	100.0	

DailyDistance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 3km	551	27.5	27.5	27.5
	3-5km	469	23.4	23.4	50.9
	6-10km	490	24.5	24.5	75.3
	6-10km	359	17.9	17.9	93.3
	11-20km	135	6.7	6.7	100.0
	Total	2004	100.0	100.0	

PersPerHH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	574	28.6	28.6	28.6
	2	819	40.9	40.9	69.5
	3	260	13.0	13.0	82.5
	4	262	13.1	13.1	95.6
	5	72	3.6	3.6	99.2
	6	11	.5	.5	99.7
	7	4	.2	.2	99.9
	9	1	.0	.0	100.0
	20	1	.0	.0	100.0
	Total	2004	100.0	100.0	

ChildPerHH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1635	81.6	81.6	81.6
	1	201	10.0	10.0	91.6
	2	138	6.9	6.9	98.5
	3	27	1.3	1.3	99.9
	4	1	.0	.0	99.9
	5	2	.1	.1	100.0
	Total	2004	100.0	100.0	

ChildCycling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily or almost daily	85	4.2	23.0	23.0
	2-3 times a week	35	1.7	9.5	32.5
	once a week	9	.4	2.4	35.0
	less than once a week	46	2.3	12.5	47.4
	never	194	9.7	52.6	100.0
	Total	369	18.4	100.0	
Missing	System	1635	81.6		
Total		2004	100.0		

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	primary school	114	5.7	5.7	5.7
	secondary school	773	38.6	38.6	44.3
	undergraduate degree	471	23.5	23.5	67.8
	graduate degree	646	32.2	32.2	100.0
	Total	2004	100.0	100.0	

IncomeHH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0€ -14 999€	151	7.5	7.5	7.5
	15 000€ - 19 999€	125	6.2	6.2	13.8
	20 000€ - 39 999€	419	20.9	20.9	34.7
	40 000€ - 69 999€	459	22.9	22.9	57.6
	70 000€ - 99 999€	262	13.1	13.1	70.7

	100 000€ - 119 999€	96	4.8	4.8	75.4
	120 000€ - 149 999€	45	2.2	2.2	77.7
	150 000€ and beyond	49	2.4	2.4	80.1
	N/A	398	19.9	19.9	100.0
	Total	2004	100.0	100.0	

Work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	working	1227	61.2	61.2	61.2
	unemployed or suspended without pay	105	5.2	5.2	66.5
	student	228	11.4	11.4	77.8
	pensionary	381	19.0	19.0	96.9
	parent or maturnity leave	36	1.8	1.8	98.7
	other	27	1.3	1.3	100.0
	Total	2004	100.0	100.0	

BikesInUse

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	360	18.0	18.0	18.0
	one bike	882	44.0	44.0	62.0
	two bikes	443	22.1	22.1	84.1
	three or more bikes	319	15.9	15.9	100.0
	Total	2004	100.0	100.0	

ElectricBikes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	1416	70.7	86.1	86.1
	no, but I am consider on getting one	191	9.5	11.6	97.7
	yes	37	1.8	2.3	100.0
	Total	1644	82.0	100.0	
Missing	System	360	18.0		
Total	2004	100.0			

PubTrUsage

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	daily or almost daily	783	39.1	39.1	39.1
	2-3 times a week	411	20.5	20.5	59.6
	once a week	321	16.0	16.0	75.6
	less than once a week	461	23.0	23.0	98.6
	never	28	1.4	1.4	100.0
	Total	2004	100.0	100.0	

CarsPerHH

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	none	742	37.0	37.0	37.0
	one car	988	49.3	49.3	86.3
	two cars	236	11.8	11.8	98.1
	three or more cars	38	1.9	1.9	100.0
	Total	2004	100.0	100.0	

CarUsage

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	daily or almost daily	622	31.0	31.0	31.0
	2-3 times a week	439	21.9	21.9	52.9
	once a week	312	15.6	15.6	68.5
	less than once a week	589	29.4	29.4	97.9
	never	42	2.1	2.1	100.0
	Total	2004	100.0	100.0	

Do you commute with a bicycle?

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	not at all	598	29.8	29.8	29.8
	yes, between May-Sept	564	28.1	28.1	58.0
	yes, when there is no ice or snow	619	30.9	30.9	88.9

	on the ground				
	all year	223	11.1	11.1	100.0
	Total	2004	100.0	100.0	

Cyclists

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Do you commute with a bicycle?	1406	2	4	2.76	.708
Valid N (listwise)	1406				

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	712	50.6	50.6	50.6
	female	694	49.4	49.4	100.0
	Total	1406	100.0	100.0	

AgeGroup

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	139	9.9	9.9	9.9
	25-34	358	25.5	25.5	35.3
	35-49	430	30.6	30.6	65.9
	50-64	329	23.4	23.4	89.3
	65-74	150	10.7	10.7	100.0
	Total	1406	100.0	100.0	

Area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	inner city	494	35.1	35.1	35.1
	suburb	912	64.9	64.9	100.0
	Total	1406	100.0	100.0	

AreaSpecific

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	headland	158	11.2	11.2	11.2
	other city centre	336	23.9	23.9	35.1
	suburb W, incl. Lauttasaari	287	20.4	20.4	55.5
	suburb N and NE	307	21.8	21.8	77.4
	suburb SE, Kulosaari and Östersundom	318	22.6	22.6	100.0

	Total	1406	100.0	100.0	

DailyDistance

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	less than 3km	334	23.8	23.8	23.8
	3-5km	361	25.7	25.7	49.4
	6-10km	364	25.9	25.9	75.3
	6-10km	264	18.8	18.8	94.1
	11-20km	83	5.9	5.9	100.0
	Total	1406	100.0	100.0	

PersPerHH

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	1	356	25.3	25.3	25.3
	2	576	41.0	41.0	66.3
	3	194	13.8	13.8	80.1
	4	203	14.4	14.4	94.5
	5	65	4.6	4.6	99.1
	6	8	.6	.6	99.7
	7	2	.1	.1	99.9
	9	1	.1	.1	99.9
	20	1	.1	.1	100.0
	Total	1406	100.0	100.0	

ChildPerHH

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	0	1105	78.6	78.6	78.6
	1	164	11.7	11.7	90.3
	2	111	7.9	7.9	98.2
	3	24	1.7	1.7	99.9
	5	2	.1	.1	100.0
	Total	1406	100.0	100.0	

ChildCycling

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	daily or almost daily	68	4.8	22.6	22.6
	2-3 times a week	29	2.1	9.6	32.2
	once a week	8	.6	2.7	34.9
	less than once a week	41	2.9	13.6	48.5
	never	155	11.0	51.5	100.0
	Total	301	21.4	100.0	
Missing	System	1105	78.6		
Total	1406	100.0			

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	primary school	72	5.1	5.1	5.1
	secondary school	507	36.1	36.1	41.2
	undergraduate degree	335	23.8	23.8	65.0
	graduate degree	492	35.0	35.0	100.0
	Total	1406	100.0	100.0	

IncomeHH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0€ -14 999€	100	7.1	7.1	7.1
	15 000€ - 19 999€	80	5.7	5.7	12.8
	20 000€ - 39 999€	285	20.3	20.3	33.1
	40 000€ - 69 999€	330	23.5	23.5	56.5
	70 000€ - 99 999€	203	14.4	14.4	71.0
	100 000€ - 119 999€	71	5.0	5.0	76.0
	120 000€ - 149 999€	31	2.2	2.2	78.2
	150 000€ and beyond	39	2.8	2.8	81.0
	N/A	267	19.0	19.0	100.0
	Total	1406	100.0	100.0	

Work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	working	923	65.6	65.6	65.6
	unemployed or suspended without pay	71	5.0	5.0	70.7
	student	166	11.8	11.8	82.5
	pensionary	201	14.3	14.3	96.8
	parent or maturnity leave	25	1.8	1.8	98.6
	other	20	1.4	1.4	100.0
	Total	1406	100.0	100.0	

BikesInUse

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	33	2.3	2.3	2.3
	one bike	710	50.5	50.5	52.8
	two bikes	381	27.1	27.1	79.9
	three or more bikes	282	20.1	20.1	100.0
	Total	1406	100.0	100.0	

ElectricBikes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	1181	84.0	86.0	86.0
	no, but I am consider on getting one	160	11.4	11.7	97.7
	yes	32	2.3	2.3	100.0
	Total	1373	97.7	100.0	
Missing	System	33	2.3		
Total		1406	100.0		

PubTrUsage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily or almost daily	476	33.9	33.9	33.9
	2-3 times a week	334	23.8	23.8	57.6
	once a week	249	17.7	17.7	75.3
	less than once a week	334	23.8	23.8	99.1
	never	13	.9	.9	100.0
	Total	1406	100.0	100.0	

CarsPerHH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	503	35.8	35.8	35.8
	one car	703	50.0	50.0	85.8
	two cars	172	12.2	12.2	98.0
	three or more cars	28	2.0	2.0	100.0
	Total	1406	100.0	100.0	

CarUsage

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	daily or almost daily	417	29.7	29.7	29.7
	2-3 times a week	321	22.8	22.8	52.5
	once a week	237	16.9	16.9	69.3
	less than once a week	415	29.5	29.5	98.9
	never	16	1.1	1.1	100.0
	Total	1406	100.0	100.0	

Do you commute with a bicycle?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes, between May-Sept	564	40.1	40.1	40.1
	yes, when there is no ice or snow on the ground	619	44.0	44.0	84.1
	all year	223	15.9	15.9	100.0
	Total	1406	100.0	100.0	

Chapter 4

4.1 Quantitative Section

4.1 Frequency of Cycling

Figure 4.1 is a visualisation of the following frequencies.

Statistics

Do you commute with a bicycle?

N	Valid	2004
	Missing	0

Do you commute with a bicycle?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	598	29.8	29.8	29.8
	yes, between May-Sept	564	28.1	28.1	58.0
	yes, when there is no ice or snow on the ground	619	30.9	30.9	88.9
	all year	223	11.1	11.1	100.0
	Total	2004	100.0	100.0	

Statistics

Do you commute with a bicycle?

N	Valid	1406
	Missing	0

Do you commute with a bicycle?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes, between May-Sept	564	40.1	40.1	40.1
	yes, when there is no ice or snow on the ground	619	44.0	44.0	84.1
	all year	223	15.9	15.9	100.0
	Total	1406	100.0	100.0	

4.2 Educational Background & Cycling

Figure 4.2 visualises the educational background of the cyclist in a sample. Selected cases (cyclists) were deducted based on the respondents answer to Aq2 (Do you commute with a bicycle?).

Statistics

Education

N	Valid	1406
	Missing	0

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	primary school	72	5.1	5.1	5.1
	secondary school	507	36.1	36.1	41.2
	undergraduate degree	335	23.8	23.8	65.0
	graduate degree	492	35.0	35.0	100.0
	Total	1406	100.0	100.0	

4.3 Educational Background & Cycling Frequency

The educational background and cycling frequency was analysed by making a cross-tabulation in descriptive statistics. In the thesis document, these data are presented in a graph (Fig.4.3) that was made with a graph builder (in SPSS) for the sake of clearer presentation.

Do you commute with a bicycle? * Education Crosstabulation

Count

		Education			
		primary school	secondary school	undergraduate degree	graduate degree
Do you commute with a bicycle?	not at all	42	266	136	154
	yes, between May-Sept	32	213	129	190
	yes, when there is no ice or snow on the ground	34	222	149	214
	all year	6	72	57	88
Total		114	773	471	646

Do you commute with a bicycle? * Education Crosstabulation

Count

		Total
Do you commute with a bicycle?	not at all	598
	yes, between May-Sept	564
	yes, when there is no ice or snow on the ground	619
	all year	223
Total		2004

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	27.964[a]	9	.001
Likelihood Ratio	28.904	9	.001
Linear-by-Linear Association	24.540	1	.000
N of Valid Cases	2004		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.69.

4.4 Employment Situation & Cycling

Figure 4.4 visualises the output of the following frequency table.

Statistics

Work

N	Valid	1406
	Missing	0

Work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	working	923	65.6	65.6	65.6
	unemployed or suspended without pay	71	5.0	5.0	70.7
	student	166	11.8	11.8	82.5
	pensionary	201	14.3	14.3	96.8
	parent or maturnity leave	25	1.8	1.8	98.6
	other	20	1.4	1.4	100.0
	Total	1406	100.0	100.0	

4.5 Employment & Frequency of Cycling

The employment situation in relation to cycling rates was calculated in the same manner as 4.3, that is by conducting a cross-tabulation under descriptive statistics. Figure 4.4 is the visualized graph of the following outcomes.

Do you commute with a bicycle? * Work Crosstabulation

Count

		Work				
		working	unemployed or suspended without pay	student	pensionary	parent or maturnity leave
Do you commute with a bicycle?	not at all	304	34	62	180	11
	yes, between May-Sept	343	30	71	104	10
	yes, when there is no ice or snow on the ground	420	29	70	80	11
	all year	160	12	25	17	4
Total		1227	105	228	381	36

Do you commute with a bicycle? * Work Crosstabulation

Count

		Work	
		other	Total
Do you commute with a bicycle?	not at all	7	598
	yes, between May-Sept	6	564
	yes, when there is no ice or snow on the ground	9	619
	all year	5	223
Total		27	2004

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	88.819[a]	15	.000
Likelihood Ratio	89.088	15	.000
Linear-by-Linear Association	50.296	1	.000
N of Valid Cases	2004		

a. 2 cells (8.3%) have expected count less than 5. The minimum expected count is 3.00.

4.6 Annual Household Income & Cycling

The below frequency table is the output of Figure 4.6 in the thesis.

Statistics

IncomeHH

N	Valid	1406
	Missing	0

IncomeHH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0€ -14 999€	100	7.1	7.1	7.1
	15 000€ - 19 999€	80	5.7	5.7	12.8
	20 000€ - 39 999€	285	20.3	20.3	33.1
	40 000€ - 69 999€	330	23.5	23.5	56.5
	70 000€ - 99 999€	203	14.4	14.4	71.0
	100 000€ - 119 999€	71	5.0	5.0	76.0
	120 000€ - 149 999€	31	2.2	2.2	78.2
	150 000€ and beyond	39	2.8	2.8	81.0
	N/A	267	19.0	19.0	100.0
	Total	1406	100.0	100.0	

4.7 Annual Household Income & Cycling Frequency

Figure 4.7 in the thesis is a visualised graph from the cross-tabulation of cycling frequency (Aq2) and income per household.

Crosstab

			IncomeHH	
			0€ -14 999€	15 000€ - 19 999€
Do you commute with a bicycle?	not at all	Count	51	45
		% within Do you commute with a bicycle?	8.5%	7.5%
		% within IncomeHH	33.8%	36.0%
		% of Total	2.5%	2.2%
	yes, between May-Sept	Count	36	33
		% within Do you commute with a bicycle?	6.4%	5.9%
		% within IncomeHH	23.8%	26.4%
		% of Total	1.8%	1.6%
	yes, when there is no ice or snow on the ground	Count	44	34
		% within Do you commute with a bicycle?	7.1%	5.5%
		% within IncomeHH	29.1%	27.2%
		% of Total	2.2%	1.7%
	all year	Count	20	13
		% within Do you commute with a bicycle?	9.0%	5.8%
		% within IncomeHH	13.2%	10.4%
		% of Total	1.0%	0.6%
Total		Count	151	125
		% within Do you commute with a bicycle?	7.5%	6.2%
		% within IncomeHH	100.0%	100.0%
		% of Total	7.5%	6.2%

Crosstab

			IncomeHH	
			20 000€ - 39 999€	40 000€ - 69 999€
Do you commute with a bicycle?	not at all	Count	134	129
		% within Do you commute with a bicycle?	22.4%	21.6%
		% within IncomeHH	32.0%	28.1%
		% of Total	6.7%	6.4%
	yes, between May-Sept	Count	117	120
		% within Do you commute with a bicycle?	20.7%	21.3%
		% within IncomeHH	27.9%	26.1%
		% of Total	5.8%	6.0%
	yes, when there is no ice or snow on the ground	Count	126	153
		% within Do you commute with a bicycle?	20.4%	24.7%
		% within IncomeHH	30.1%	33.3%
		% of Total	6.3%	7.6%
	all year	Count	42	57
		% within Do you commute with a bicycle?	18.8%	25.6%
		% within IncomeHH	10.0%	12.4%
		% of Total	2.1%	2.8%
Total		Count	419	459
		% within Do you commute with a bicycle?	20.9%	22.9%
		% within IncomeHH	100.0%	100.0%
		% of Total	20.9%	22.9%

			IncomeHH	
			70 000€ - 99 999€	100 000€ - 119 999€
Do you commute with a bicycle?	not at all	Count	59	25
		% within Do you commute with a bicycle?	9.9%	4.2%
		% within IncomeHH	22.5%	26.0%
		% of Total	2.9%	1.2%
	yes, between May-Sept	Count	68	39
		% within Do you commute with a bicycle?	12.1%	6.9%
		% within IncomeHH	26.0%	40.6%
		% of Total	3.4%	1.9%
	yes, when there is no ice or snow on the ground	Count	92	21
		% within Do you commute with a bicycle?	14.9%	3.4%
		% within IncomeHH	35.1%	21.9%
		% of Total	4.6%	1.0%
	all year	Count	43	11
		% within Do you commute with a bicycle?	19.3%	4.9%
		% within IncomeHH	16.4%	11.5%
		% of Total	2.1%	0.5%
Total		Count	262	96
		% within Do you commute with a bicycle?	13.1%	4.8%
		% within IncomeHH	100.0%	100.0%
		% of Total	13.1%	4.8%

Crosstab

			IncomeHH		
			120 000€ - 149 999€	150 000€ and beyond	I
Do you commute with a bicycle?	not at all	Count	14	10	
		% within Do you commute with a bicycle?	2.3%	1.7%	2

		% within IncomeHH	31.1%	20.4%
		% of Total	0.7%	0.5%
	yes, between May-Sept	Count	17	21
		% within Do you commute with a bicycle?	3.0%	3.7%
		% within IncomeHH	37.8%	42.9%
		% of Total	0.8%	1.0%
	yes, when there is no ice or snow on the ground	Count	10	12
		% within Do you commute with a bicycle?	1.6%	1.9%
		% within IncomeHH	22.2%	24.5%
		% of Total	0.5%	0.6%
	all year	Count	4	6
		% within Do you commute with a bicycle?	1.8%	2.7%
		% within IncomeHH	8.9%	12.2%
		% of Total	0.2%	0.3%
Total		Count	45	49
		% within Do you commute with a bicycle?	2.2%	2.4%
		% within IncomeHH	100.0%	100.0%
		% of Total	2.2%	2.4%

Crosstab

			Total
Do you commute with a bicycle?	not at all	Count	598
		% within Do you commute with a bicycle?	100.0%
		% within IncomeHH	29.8%
		% of Total	29.8%
	yes, between May-Sept	Count	564
		% within Do you commute with a bicycle?	100.0%
		% within IncomeHH	28.1%
		% of Total	28.1%
	yes, when there is no ice or snow on the ground	Count	619
		% within Do you commute with a bicycle?	100.0%
		% within IncomeHH	30.9%
		% of Total	30.9%
	all year	Count	223
		% within Do you commute with a bicycle?	100.0%
		% within IncomeHH	11.1%
		% of Total	11.1%
Total		Count	2004
		% within Do you commute with a bicycle?	100.0%
		% within IncomeHH	100.0%
		% of Total	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	47.207[a]	24	.003
Likelihood Ratio	47.066	24	.003
Linear-by-Linear Association	1.083	1	.298
N of Valid Cases	2004		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.01.

4.8 Location of Residence & Access to Bikes

The following frequency table is the output of Figure 4.8 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS.

Area * BikesInUse

Crosstab

Count

		BikesInUse				
		none	one bike	two bikes	three or more bikes	Total
Area	inner city	144	314	154	90	702
	suburb	216	568	289	229	1302
Total		360	882	443	319	2004

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.561[a]	3	.014
Likelihood Ratio	10.713	3	.013
Linear-by-Linear Association	9.448	1	.002
N of Valid Cases	2004		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 111.75.

4.9 Location of Residence & Daily Distance Travelled (Cyclists)

The following frequency table is the output of Figure 4.9 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS.

Area * DailyDistance Crosstabulation

Count

		DailyDistance					
		less than 3km	3-5km	6-10km	11-20km	more than 20km	Total
Area	inner city	171	156	92	52	23	49
	suburb	163	205	272	212	60	91
Total		334	361	364	264	83	140

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	93.293[a]	4	.000
Likelihood Ratio	94.834	4	.000
Linear-by-Linear Association	77.300	1	.000
N of Valid Cases	1406		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 29.16.

4.10 Location of Residence & Access to Cars

The following frequency table is the output of Figure 4.10 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS.

Crosstab

Count

		CarsPerHH				
		none	one car	two cars	three or more cars	Total
Area	inner city	367	279	51	5	702
	suburb	375	709	185	33	1302
Total		742	988	236	38	2004

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	114.579[a]	3	.000
Likelihood Ratio	115.115	3	.000
Linear-by-Linear Association	102.161	1	.000
N of Valid Cases	2004		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.31.

4.11 Residential Location & Usage of Cars

The following frequency table is the output of Figure 4.11 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS.

Crosstab

Count

		CarUsage					
		daily or almost daily	2-3 times a week	once a week	less than once a week	never	Total
Area	inner city	122	130	132	298	20	702
	suburb	500	309	180	291	22	1302
Total		622	439	312	589	42	2004

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	143.488[a]	4	.000
Likelihood Ratio	146.810	4	.000
Linear-by-Linear Association	139.703	1	.000
N of Valid Cases	2004		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.71.

4.12 Residential Location & Usage of Public Transportation

The following frequency table is the output of Figure 4.12 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS.

Crosstab

Count

		PubTrUsage					
		daily or almost daily	2-3 times a week	once a week	less than once a week	never	Total
Area	inner city	293	166	123	113	7	702
	suburb	490	245	198	348	21	1302
Total		783	411	321	461	28	2004

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	32.323[a]	4	.000
Likelihood Ratio	33.578	4	.000
Linear-by-Linear Association	18.555	1	.000
N of Valid Cases	2004		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.81.

4.13 Purpose for Cycling (End-Journey Activity)

The following frequency table is the output of Figure 4.13 in the thesis.

Statistics

What is the most common purpose for your commute with the bicycle?	What is the main reason why you choose biking as a transportation alternative?	Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?
1136	1136	868
868	868	1136

Frequency Table

What is the most common purpose for your commute with the bicycle?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	commute to work or studies	539	26.9	47.4	47.4
	running errands or groceries	191	9.5	16.8	64.3
	commute to hobbies or leisure time trip	208	10.4	18.3	82.6
	work out	166	8.3	14.6	97.2
	commuting the children	11	.5	1.0	98.2
	other	21	1.0	1.8	100.0
	Total	1136	56.7	100.0	
Missing	System	868	43.3		
Total		2004	100.0		

4.14 Purpose for Cycling per Residential Location

The following frequency table is the output of Figure 4.14 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS. Moreover, and Independent sample test was run for this output (Table 4.14 in the thesis document).

Crosstab

Count

		Area		
		inner city	suburb	Total
What is the most common purpose for your commute with the bicycle?	commute to work or studies	236	303	539
	running errands or groceries	57	134	191
	commute to hobbies or leisure time trip	77	131	208
	work out	42	124	166
	commuting the children	2	9	11
	other	8	13	21
Total		422	714	1136

Independent Sample Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	5.510	.019	-3.930	1134	.000	-.305	.078	-.457	-.153
	Equal variances not assumed			-3.988	924.485	.000	-.305	.076	-.455	-.155

4.15 Purpose for Cycling per Daily Distance Travelled

The following frequency table is the output of Figure 4.15 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS. Moreover, and Independent sample test was run for this output (Table 4.15 in the thesis document).

Crosstab

Count

DailyDistance

		less than 3km	3-5km	6-10km	11-20km	more than 20km
What is the most common purpose for your commute with the bicycle?	commute to work or studies	90	175	169	95	10
	running errands or groceries	59	53	42	29	8
	commute to hobbies or leisure time trip	52	50	51	41	14
	work out	37	31	43	35	20
	commuting the children	2	3	3	2	1
	other	6	7	6	2	0
Total		246	319	314	204	53

Crosstab

Count

		Total
What is the most common purpose for your commute with the bicycle?	commute to work or studies	539
	running errands or groceries	191
	commute to hobbies or leisure time trip	208
	work out	166
	commuting the children	11
	other	21
Total		1136

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	66.335[a]	20	.000
Likelihood Ratio	64.137	20	.000
Linear-by-Linear Association	2.027	1	.155
N of Valid Cases	1136		

a. 8 cells (26.7%) have expected count less than 5. The minimum expected count is .51.

Table 4.15 Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
DailyDistance	Equal variances assumed	9.000	.003	2.385	728	.017

	Equal variances not assumed			2.224	296.298	.027

Independent Samples Test

		t-test for Equality of Means			
				95% Confidence Interval of the Difference	
		Mean Difference	Std. Error Difference	Lower	Upper
DailyDistance	Equal variances assumed	.214	.090	.038	.391
	Equal variances not assumed	.214	.096	.025	.404

4.16 Reason to Choose the Bicycle

Figure 4.16 is a pie chart illustration of the data below.

What is the main reason why you choose biking as a transportation alternative?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	handy way for transportation	452	22.6	39.8	39.8
	positive influence on physical condition and health	400	20.0	35.2	75.0
	environmental reasons	23	1.1	2.0	77.0
	economic affordability	38	1.9	3.3	80.4
	being outdoors and leisure activity	116	5.8	10.2	90.6
	independency from time tables	51	2.5	4.5	95.1
	public transportation connectivity is poor	7	.3	.6	95.7
	no opportunity to use a car	10	.5	.9	96.6
	other	39	1.9	3.4	100.0
	Total	1136	56.7	100.0	
Missing	System	868	43.3		
Total		2004	100.0		

Count

What is the r
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Total

4.17 Reasons for Cycling per Residential Location

The following frequency table is the output of Figure 4.17 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS. Moreover, and Independent sample test was run for this output (Table 4.17 in the thesis document).

Area * What is the main reason why you choose biking as a transportation alternative? Crosstabulation

Count

		What is the main reason why you choose biking as a transportation alternative?					
		handy way for transportation	positive influence on physical condition and health	environmental reasons	economic affordability	being outdoors and leisure activity	independency from time tables
Area	inner city	217	117	13	16	27	20
	suburb	235	283	10	22	89	31
Total		452	400	23	38	116	51

Area * What is the main reason why you choose biking as a transportation alternative? Crosstabulation

Count

		What is the main reason why you choose biking as a transportation alternative?			
		public transportation connectivity is poor	no opportunity to use a car	other	
Area	inner city	2	1	9	422
	suburb	5	9	30	714
Total		7	10	39	1136

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	53.958[a]	8	.000
Likelihood Ratio	55.113	8	.000
Linear-by-Linear Association	18.721	1	.000
N of Valid Cases	1136		

a. 3 cells (16.7%) have expected count less than 5. The minimum expected count is 2.60.

Table 4.17 Independent Sample Test

4.18 Reason for Cycling per Daily Distance Travelled

The following frequency table is the output of Figure 4.18 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS. Moreover, and Independent sample test was run for this output (Table 4.18 in the thesis document).

What is the main reason why you choose biking as a transportation alternative? * DailyDistance Crosstab

Count

		DailyDistance				
		less than 3km	3-5km	6-10km	11-20km	more than 20km
What is the main reason why you choose biking as a transportation alternative?	handy way for transportation	135	134	102	62	19
	positive influence on physical condition and health	58	106	118	98	20
	environmental reasons	4	8	10	0	1
	economic affordability	3	14	14	6	1
Count	being outdoors and leisure activity	21	23	40	24	8
	independency from time tables	13	18	13	6	1
What is the main reason wh a transportation alternative'	public transportation connectivity is poor	1	5	1	0	0
	no opportunity to use a car	3	1	4	1	1
	other	8	10	12	7	2
Total						
Total		246	319	314	204	53

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	76.700[a]	32	.000
Likelihood Ratio	81.717	32	.000
Linear-by-Linear Association	2.885	1	.089
N of Valid Cases	1136		

a. 16 cells (35.6%) have expected count less than 5. The minimum expected count is .33.

Table 4.18 Independent Sample Test

Group Statistics

	What is the most common purpose for your commute with the bicycle?	N	Mean	Std. Deviation	Std. Error Mean
DailyDistance	commute to work or studies	539	2.55	1.023	.044
	running errands or groceries	191	2.34	1.185	.086

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
DailyDistance	Equal variances assumed	9.000	.003	2.385	728	.017
	Equal variances not assumed			2.224	296.298	.027

Independent Samples Test

		t-test for Equality of Means			
				95% Confidence Interval of the Difference	
		Mean Difference	Std. Error Difference	Lower	Upper
DailyDistance	Equal variances assumed	.214	.090	.038	.391
	Equal variances not assumed	.214	.096	.025	.404

4.19 Factors Influencing the Lack of Cycling

Figure 4.19 is a pie chart illustration of the data below.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no bike available	160	8.0	18.4	18.4
	own health/old age	143	7.1	16.5	34.9
	aspiration for comfort	58	2.9	6.7	41.6
	feeling unsafe in traffic	65	3.2	7.5	49.1
	other transportation mode is more preferable (pub. transp/walking/driving a car)	142	7.1	16.4	65.4
	too long distances	71	3.5	8.2	73.6
	lack of time	50	2.5	5.8	79.4
	inconsistent or illogical cycling route	18	.9	2.1	81.5
	other errands that relate to the commute	3	.1	.3	81.8
	all carry-ons do not fit on the bicycle	8	.4	.9	82.7
	transporting children on a bike is difficult	21	1.0	2.4	85.1
	sweating or lack of showering opportunities	2	.1	.2	85.4
	weather	15	.7	1.7	87.1
	short distances,/living in the city centre	20	1.0	2.3	89.4
	afraid of bike getting stolen	19	.9	2.2	91.6
	lacking bicycle parking and storage options	8	.4	.9	92.5
	other	49	2.4	5.6	98.2
	cannot say	16	.8	1.8	100.0
	Total	868	43.3	100.0	
Missing	System	1136	56.7		
Total		2004	100.0		

4.20 Factors Influencing Lack of Cycling per Residential Area

The following frequency table is the output of Figure 4.18 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS. Moreover, and Independent sample test was run for this output (Table 4.20 in the thesis document).

Which factors has been the most influential, when you decided not to use the bike / or have cycled rarely? * Area

Crosstab

Count

		Area		
		inner city	suburb	Total
Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?	no bike available	53	107	160
	own health/old age	43	100	143
	aspiration for comfort	9	49	58
	feeling unsafe in traffic	34	31	65
	other transportation mode is more preferable (pub. transp/walking/driving a car)	57	85	142
	too long distances	14	57	71
	lack of time	6	44	50
	inconsistent or illogical cycling route	8	10	18
Total		224	483	707

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	39.795[a]	7	.000
Likelihood Ratio	41.636	7	.000
Linear-by-Linear Association	.497	1	.481
N of Valid Cases	707		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.70.

Table 4.20 Independent Sample Test

4.21 Factors Influencing the Lack of Cycling per Daily Distance Travelled

The following frequency table is the output of Figure 4.21 in the thesis. In the thesis document the results are visualized with the chart builder tool in SPSS. Moreover, and Independent sample test was run for this output (Table 4.21 in the thesis document).

DailyDistance * Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely? Crosstabulation

Count

		Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?				
		no bike available	own health/old age	aspiration for comfort	feeling unsafe in traffic	other transportation mode is more preferable (pub. transp/walking/ driving a car)
DailyDistance	less than 3km	6	12	10	6	14
	3-5km	3	4	2	3	13
	6-10km	8	4	6	0	8
	11-20km	4	3	6	2	13
	more than 20km	0	0	1	0	5
Total		21	23	25	11	53

DailyDistance * Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely? Crosstabulation

Count

		Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?				
		transporting children on a bike is difficult	sweating or lack of showering opportunities	weather	short distances,/living in the city centre	afraid of bike getting stolen
DailyDistance	less than 3km	5	0	2	6	1
	3-5km	4	0	4	2	0
	6-10km	2	0	2	1	0
	11-20km	0	1	1	1	2
	more than 20km	1	0	2	0	0
Total		12	1	11	10	3

DailyDistance * Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely? Crosstabulation

Count

		Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?				
		too long distances	lack of time	inconsistent or illogical cycling route	other errands that relate to the commute	all carry-ons do not fit on the bicycle
DailyDistance	less than 3km	2	7	3	0	1
	3-5km	0	1	1	0	1
	6-10km	1	7	3	0	0
	11-20km	12	7	2	1	1
	more than 20km	14	4	0	1	1
Total		29	26	9	2	4

DailyDistance * Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely? Crosstabulation

Count

		Which factors has been the most influencial, when you decided not to use the bike / or have cycled rarely?			
		lacking bicycle parking and storage options	other	cannot say	
DailyDistance	less than 3km	2	9	2	88
	3-5km	1	2	1	42
	6-10km	1	6	1	50
	11-20km	0	3	1	60
	more than 20km	0	1	0	30
Total		4	21	5	270

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	122.777[a]	68	.000
Likelihood Ratio	127.343	68	.000
Linear-by-Linear Association	.798	1	.372
N of Valid Cases	270		

a. 74 cells (82.2%) have expected count less than 5. The minimum expected count is .11.

Table 4.21 Independent Sample Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
DailyDistance	Equal variances assumed	.028	.869	1.660	42	.104
	Equal variances not assumed			1.660	41.647	.104

Independent Samples Test

		t-test for Equality of Means			
				95% Confidence Interval of the Difference	
		Mean Difference	Std. Error Difference	Lower	Upper
DailyDistance	Equal variances assumed	.563	.339	-.122	1.248
	Equal variances not assumed	.563	.339	-.122	1.248

4.22 General Satisfaction to Cycling

Figure 4.22 presents the general satisfaction to cycling in Helsinki. The graph was made in Excel, by exporting the frequency tables from SPSS and making the stacked bar then in Excel.

Statistics

		How satisfied you are with the city of Helsinki as a cyclist city?	How fluent/smooth do you find cycling in Helsinki?	How safe do you consider cycling in Helsinki to be?
N	Valid	1136	1136	1136
	Missing	868	868	868

Frequency Table

How satisfied you are with the city of Helsinki as a cyclist city?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	satisfied	248	12.4	21.8	21.8
	rather satisfied	734	36.6	64.6	86.4
	rather unsatisfied	132	6.6	11.6	98.1
	unsatisfied	14	.7	1.2	99.3
	cannot say	8	.4	.7	100.0
	Total	1136	56.7	100.0	
Missing	System	868	43.3		
Total		2004	100.0		

How fluent/smooth do you find cycling in Helsinki?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	fluent/smooth	206	10.3	18.1	18.1
	rather fluent/smooth	747	37.3	65.8	83.9
	not so fluent/smooth	167	8.3	14.7	98.6
	not fluent/smooth	14	.7	1.2	99.8
	cannot say	2	.1	.2	100.0
	Total	1136	56.7	100.0	
Missing	System	868	43.3		
Total		2004	100.0		

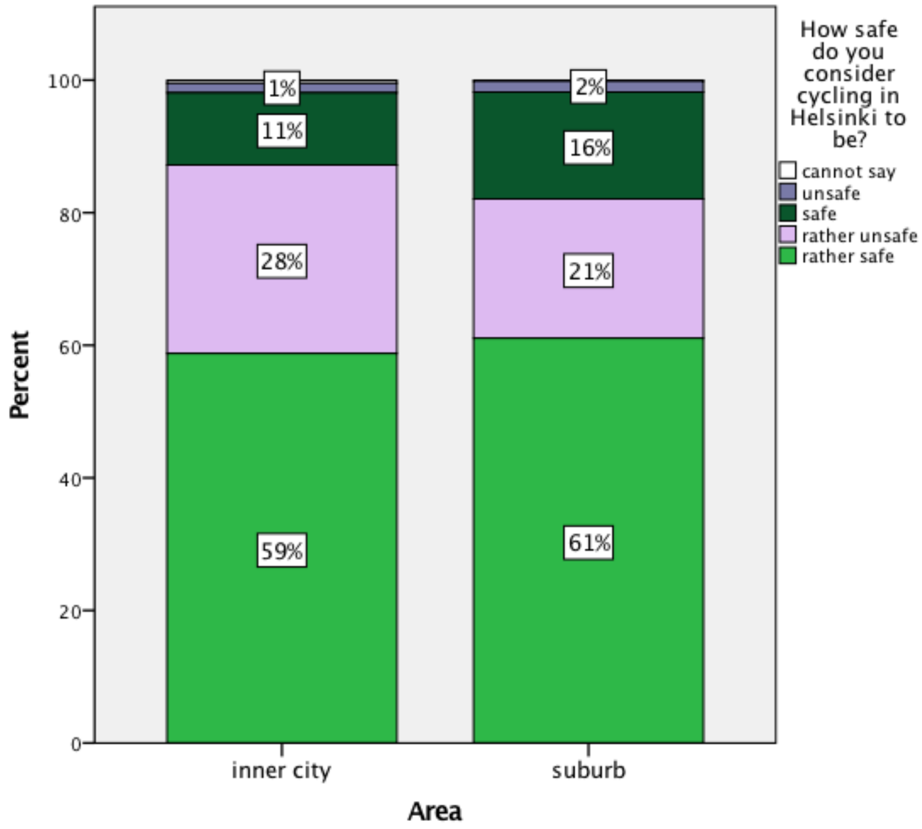
How safe do you consider cycling in Helsinki to be?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	safe	161	8.0	14.2	14.2
	rather safe	684	34.1	60.2	74.4

	rather unsafe	270	13.5	23.8	98.2
	unsafe	18	.9	1.6	99.7
	cannot say	3	.1	.3	100.0
	Total	1136	56.7	100.0	
Missing	System	868	43.3		
Total		2004	100.0		

4.22a Satisfaction of Safety & Residential Location

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How safe do you consider cycling in Helsinki to be? * Area

Crosstab

Count

		Area		Total
		inner city	suburb	
How safe do you consider cycling in Helsinki to be?	safe	46	115	161
	rather safe	248	436	684
	rather unsafe	120	150	270
	unsafe	6	12	18
	cannot say	2	1	3
Total		422	714	1136

Independent Samples Test

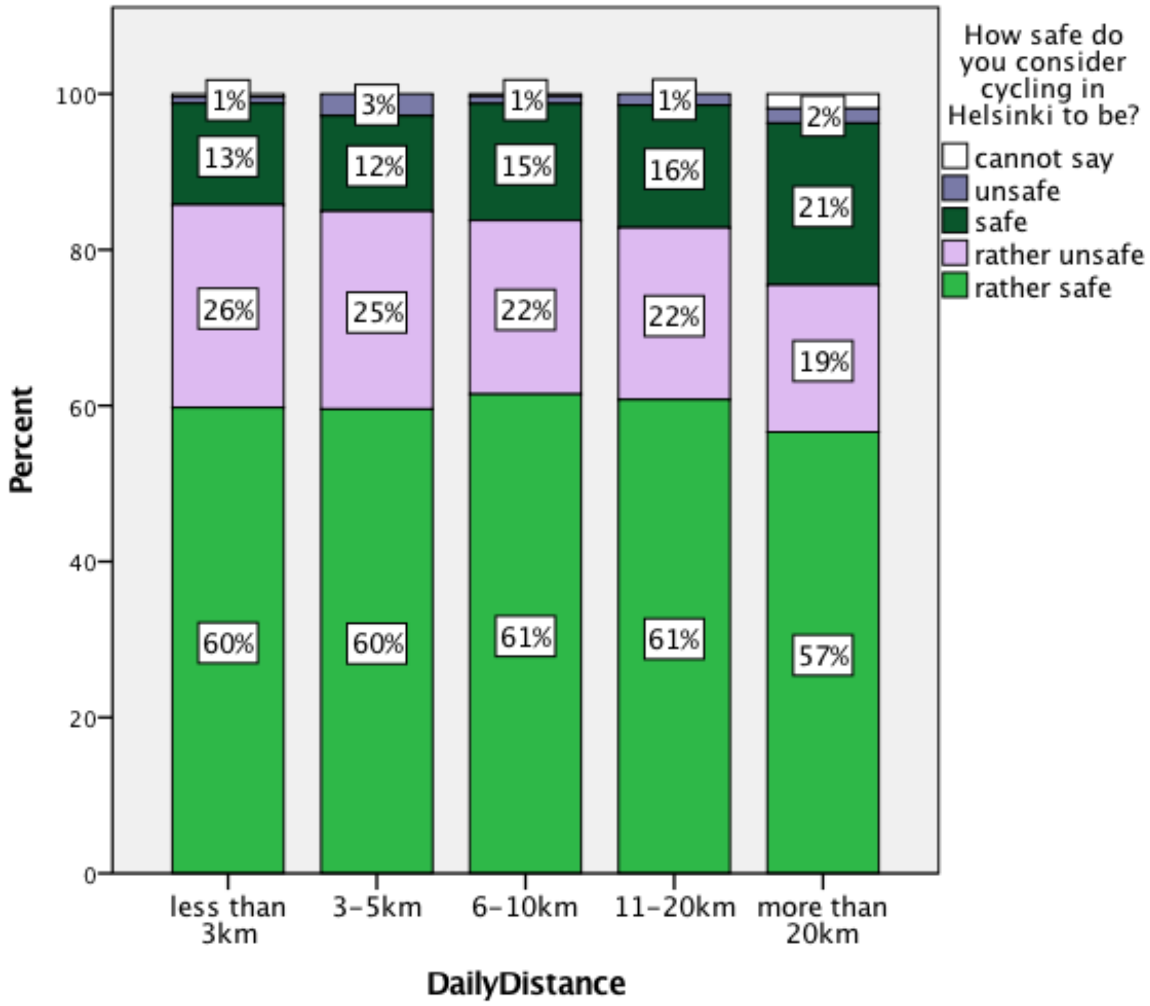
		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Area	Equal variances assumed	17.863	.000	1.844	843	.066	.077
	Equal variances not assumed			1.913	251.999	.057	.077

Independent Samples Test

		t-test for Equality of Means		
			95% Confidence Interval of the Difference	
		Std. Error Difference	Lower	Upper
Area	Equal variances assumed	.042	-.005	.159
	Equal variances not assumed	.040	-.002	.156

4.22b Satisfaction of Safety & Daily Distance

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How safe do you consider cycling in Helsinki to be? * DailyDistance

Crosstab

Count

		DailyDistance					
		less than 3km	3-5km	6-10km	11-20km	more than 20km	Total
How safe do you consider cycling in Helsinki to be?	safe	32	39	47	32	11	161
	rather safe	147	190	193	124	30	684
	rather unsafe	64	81	70	45	10	270
	unsafe	2	9	3	3	1	18
	cannot say	1	0	1	0	1	3
Total		246	319	314	204	53	1136

Independent Samples Test

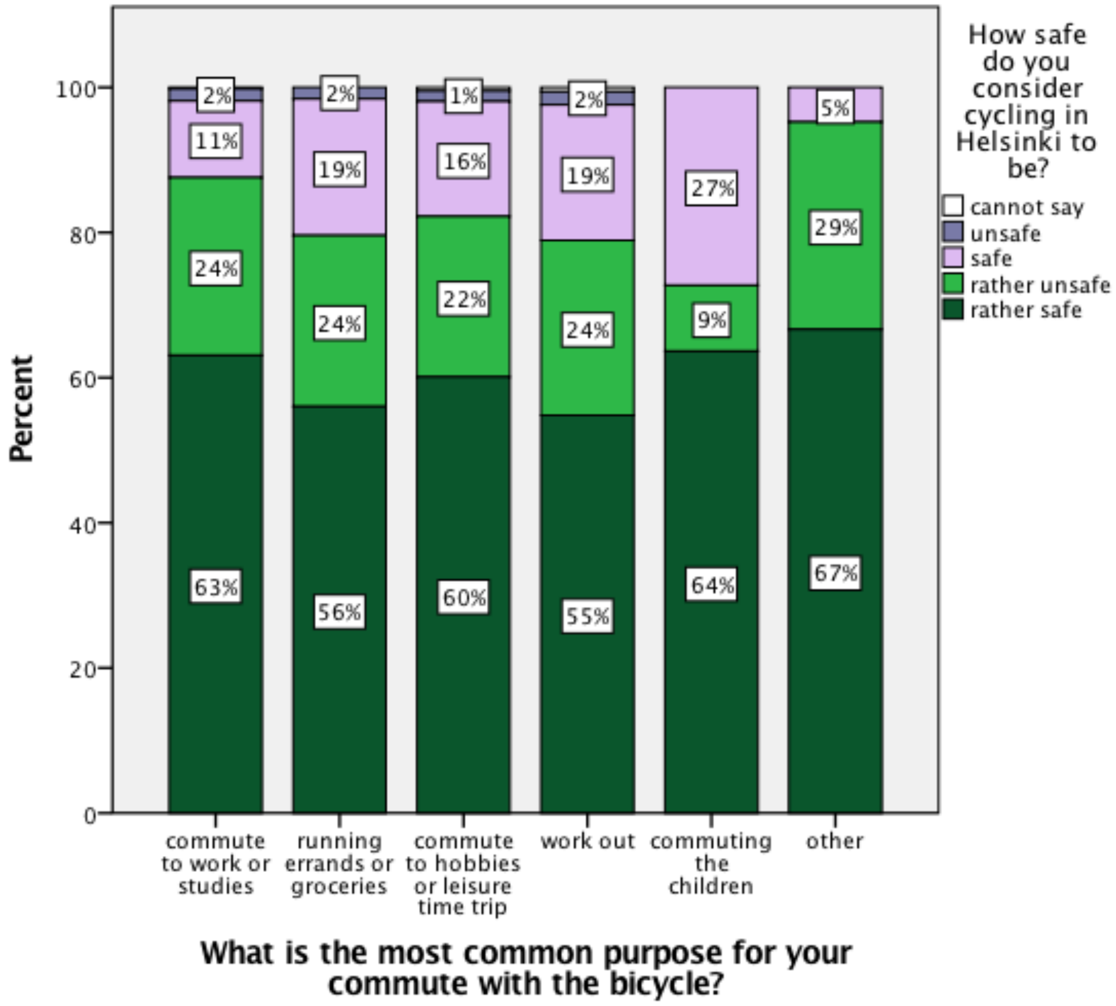
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
DailyDistance	Equal variances assumed	.295	.587	1.331	843	.184
	Equal variances not assumed			1.294	233.760	.197

Independent Samples Test

		t-test for Equality of Means			
				95% Confidence Interval of the Difference	
		Mean Difference	Std. Error Difference	Lower	Upper
DailyDistance	Equal variances assumed	.134	.101	-.064	.332
	Equal variances not assumed	.134	.104	-.070	.339

4.22c Satisfaction of Safety & Purpose of Commute (End-Journey Activity)

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How safe do you consider cycling in Helsinki to be? * What is the most common purpose for your commute with the bicycle?

Crosstab

Count

		What is the most common purpose for your commute with the bicycle?				
		commute to work or studies	running errands or groceries	commute to hobbies or leisure time trip	work out	commuting the children
How safe do you consider cycling in Helsinki to be?	safe	57	36	33	31	3
	rather safe	340	107	125	91	7
	rather unsafe	132	45	46	40	1
	unsafe	9	3	3	3	0
	cannot say	1	0	1	1	0

Total	539	191	208	166	11

Crosstab

Count

		What is the most common purpose for your commute with the bicycle?	Total
		other	
How safe do you consider cycling in Helsinki to be?	safe	1	161
	rather safe	14	684
	rather unsafe	6	270
	unsafe	0	18
	cannot say	0	3
Total		21	1136

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.005	.943	2.274	843
	Equal variances not assumed			2.331	248.170

Independent Samples Test

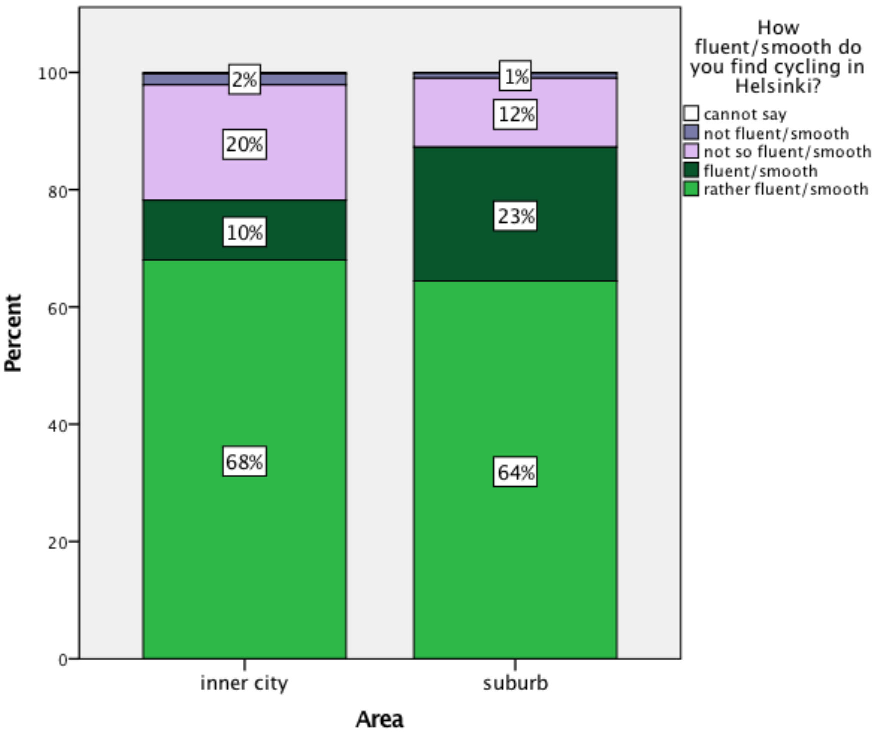
		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.023	.252	.111	.035
	Equal variances not assumed	.021	.252	.108	.039

Independent Samples Test

		t-test for Equality of Means 95% Confidence Interval of the Difference
		Upper
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.470
	Equal variances not assumed	.466

4.22d Satisfaction to Smoothness of Road & Residential Location

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How fluent/smooth do you find cycling in Helsinki? * Area

Crosstab

unt

		Area		
		inner city	suburb	Total
ow fluent/smooth do you find cycling in elsinki?	fluent/smooth	43	163	2
	rather fluent/smooth	287	460	7
	not so fluent/smooth	83	84	1
	not fluent/smooth	8	6	
	cannot say	1	1	
tal		422	714	11

Independent Samples Test

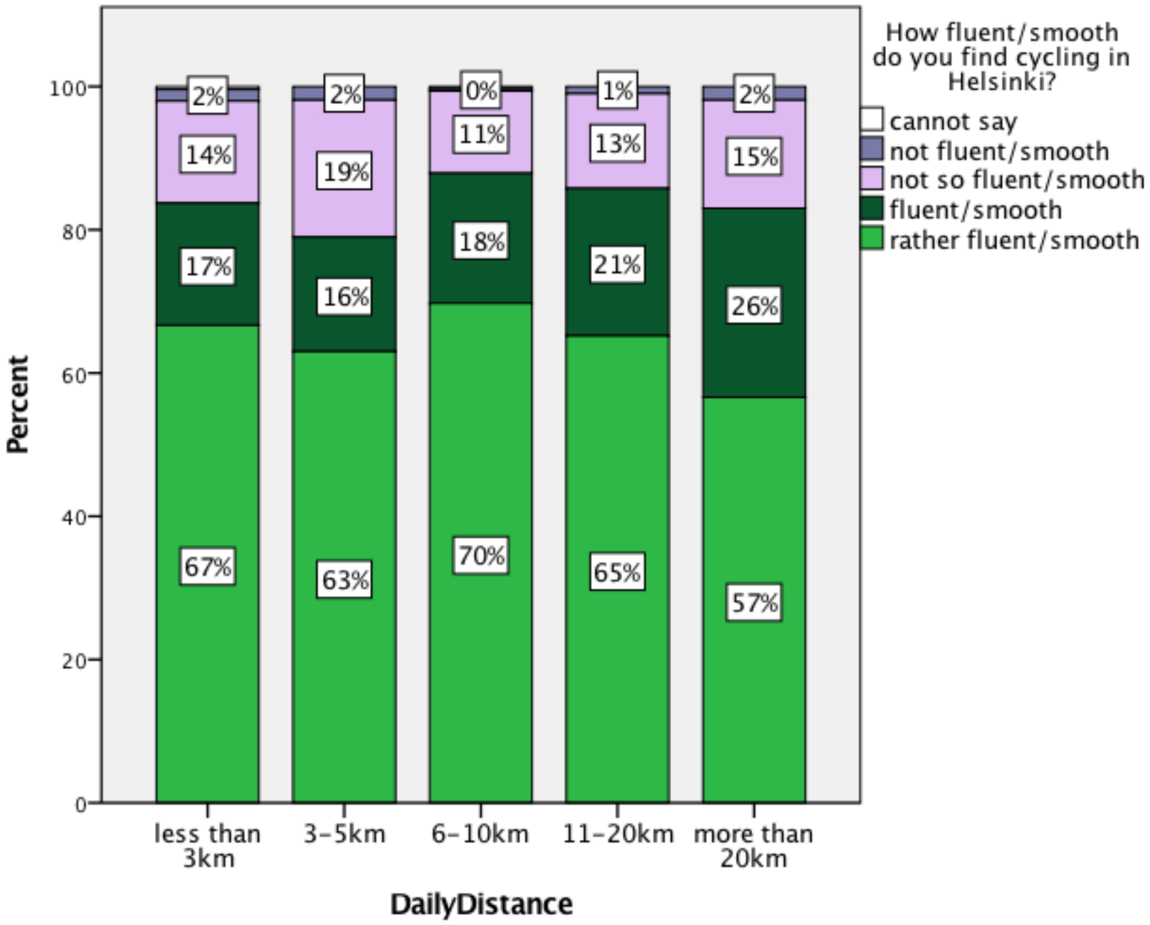
		t-test for Equality of Means		
			95% Confidence Interval of the Difference	
		Std. Error Difference	Lower	Upper
Area	Equal variances assumed	.037	.103	.248
	Equal variances not assumed	.034	.110	.241

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Area	Equal variances assumed	149.040	.000	4.736	951	.000	.175
	Equal variances not assumed			5.236	381.893	.000	.175

4.24e Satisfaction to Smoothness & Daily Distance

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How fluent/smooth do you find cycling in Helsinki? * DailyDistance

Crosstab

Count

		DailyDistance				
		less than 3km	3-5km	6-10km	11-20km	more than 20km
How fluent/smooth do you find cycling in Helsinki?	fluent/smooth	42	51	57	42	14
	rather fluent/smooth	164	201	219	133	30
	not so fluent/smooth	35	61	36	27	8
	not fluent/smooth	4	6	1	2	1
	cannot say	1	0	1	0	0
Total		246	319	314	204	53

Crosstab

Count

		Total

How fluent/smooth do you find cycling in Helsinki?	fluent/smooth	206
	rather fluent/smooth	747
	not so fluent/smooth	167
	not fluent/smooth	14
	cannot say	2
Total		1136

Independent Samples Test

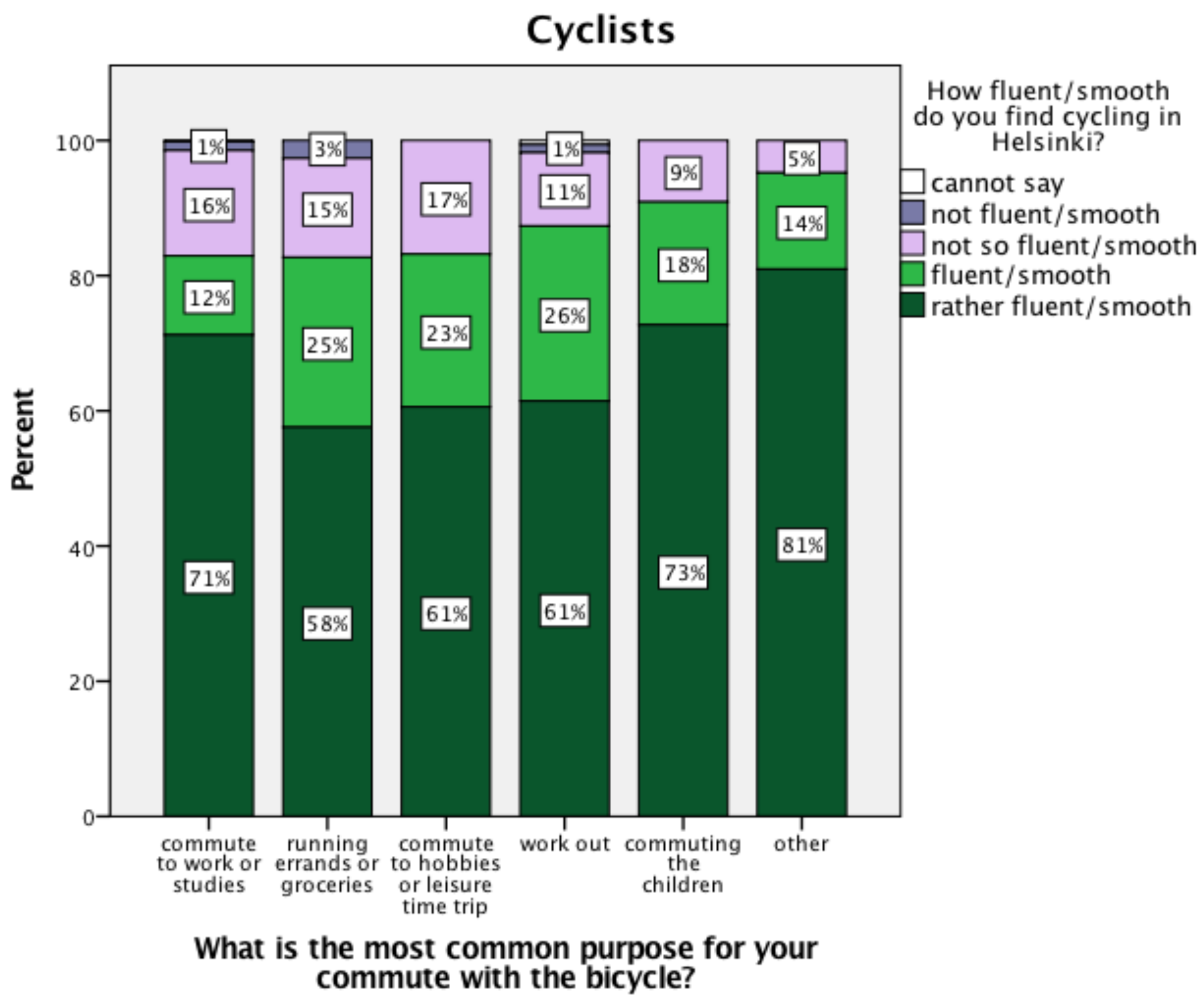
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
DailyDistance	Equal variances assumed	1.132	.288	1.485	951	.138
	Equal variances not assumed			1.436	312.636	.152

Independent Samples Test

		t-test for Equality of Means			
				95% Confidence Interval of the Difference	
		Mean Difference	Std. Error Difference	Lower	Upper
DailyDistance	Equal variances assumed	.134	.090	-.043	.312
	Equal variances not assumed	.134	.093	-.050	.318

4.22f Satisfaction to Smoothness of Cycling & Purpose for Commute

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How fluent/smooth do you find cycling in Helsinki? * What is the most common purpose for your commute with the bicycle?

Crosstab

Count

		What is the most common purpose for your commute with the bicycle?			
		commute to work or studies	running errands or groceries	commute to hobbies or leisure time trip	work out
How fluent/smooth do you find cycling in Helsinki?	fluent/smooth	63	48	47	43
	rather fluent/smooth	384	110	126	102
	not so fluent/smooth	84	28	35	18
	not fluent/smooth	7	5	0	2

	cannot say	1	0	0	1
Total		539	191	208	166

Crosstab

Count

		What is the most common purpose for your commute with the bicycle?		
		commuting the children	other	
How fluent/smooth do you find cycling in Helsinki?	fluent/smooth	2	3	206
	rather fluent/smooth	8	17	747
	not so fluent/smooth	1	1	167
	not fluent/smooth	0	0	14
	cannot say	0	0	2
Total		11	21	1136

Independent Samples Test

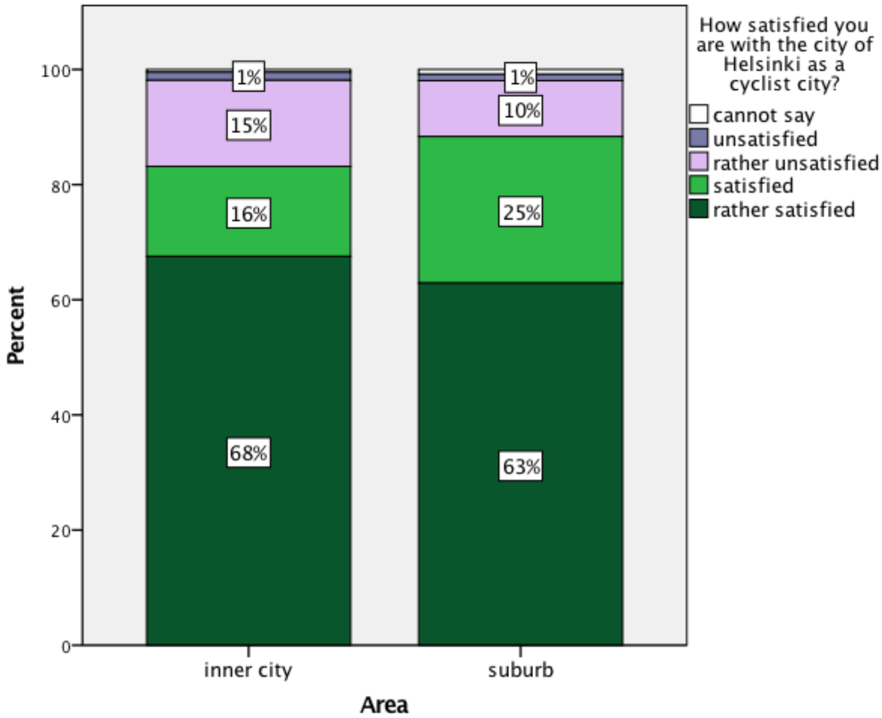
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.192	.661	3.721	951
	Equal variances not assumed			3.838	341.642

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.000	.376	.101	.178
	Equal variances not assumed	.000	.376	.098	.183

4.22g General Satisfaction to Helsinki as a Cyclist City & Location of Residence

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



Area * How satisfied you are with the city of Helsinki as a cyclist city?

Crosstab

Count

		How satisfied you are with the city of Helsinki as a cyclist city?					
		satisfied	rather satisfied	rather unsatisfied	unsatisfied	cannot say	Total
Area	inner city	66	285	63	6	2	422
	suburb	182	449	69	8	6	714
Total		248	734	132	14	8	1136

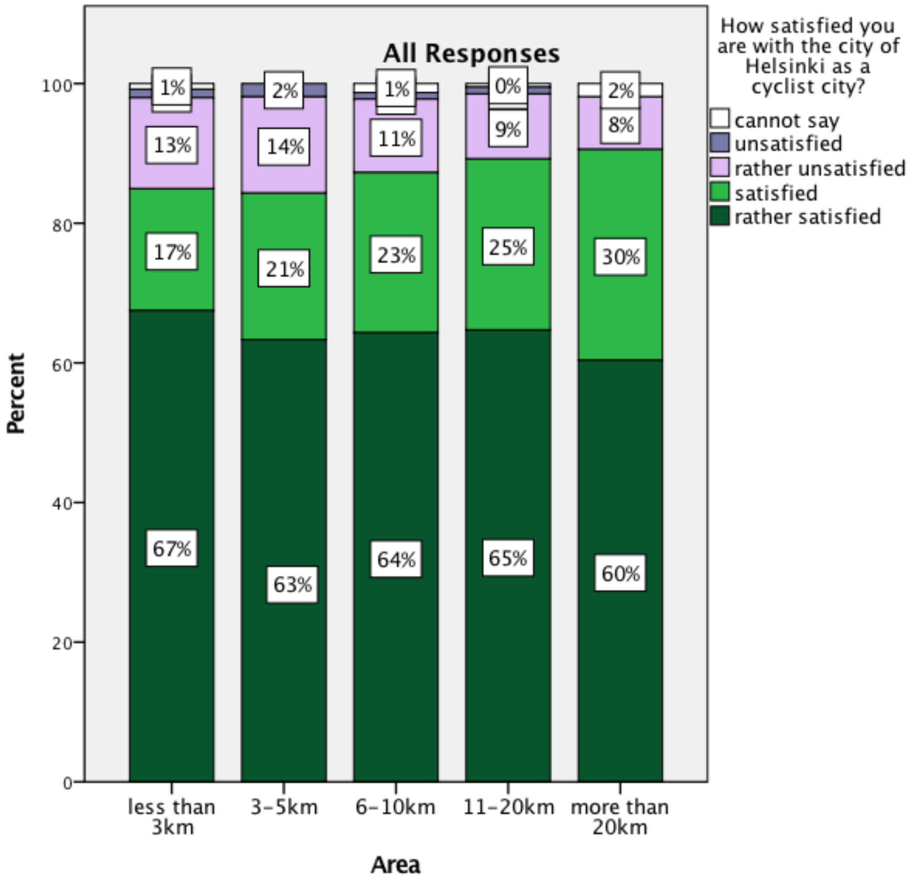
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Area	Equal variances assumed	67.095	.000	3.488	980	.001	.122
	Equal variances not assumed			3.659	464.632	.000	.122

Independent Samples Test

		t-test for Equality of Means		
			95% Confidence Interval of the Difference	
		Std. Error Difference	Lower	Upper
Area	Equal variances assumed	.035	.053	.191
	Equal variances not assumed	.033	.057	.188

4.22h General Satisfaction to Helsinki as a Cyclist City & Daily Distance Travelled
For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How satisfied you are with the city of Helsinki as a cyclist city? * DailyDistance

Crosstab

Count

		DailyDistance				
		less than 3km	3-5km	6-10km	11-20km	more than 20km
How satisfied you are with the city of Helsinki as a cyclist city?	satisfied	43	67	72	50	16
	rather satisfied	166	202	202	132	32
	rather unsatisfied	32	44	33	19	4
	unsatisfied	3	6	3	2	0
	cannot say	2	0	4	1	1
Total		246	319	314	204	53

Crosstab

Count

		Total

How satisfied you are with the city of Helsinki as a cyclist city?	satisfied	248
	rather satisfied	734
	rather unsatisfied	132
	unsatisfied	14
	cannot say	8
Total		1136

Independent Samples Test

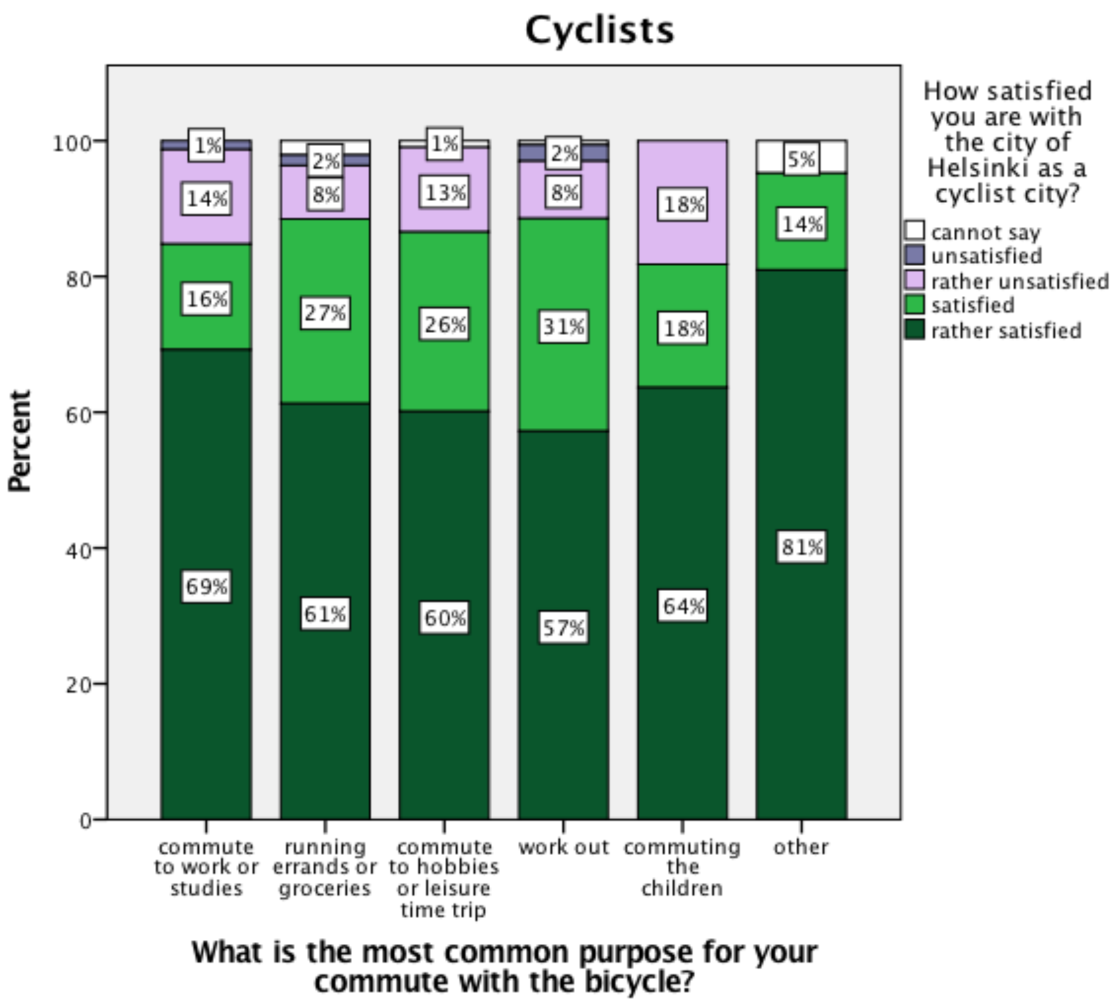
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
DailyDistance	Equal variances assumed	.096	.757	2.057	980	.040
	Equal variances not assumed			2.048	422.590	.041

Independent Samples Test

		t-test for Equality of Means			
				95% Confidence Interval of the Difference	
		Mean Difference	Std. Error Difference	Lower	Upper
DailyDistance	Equal variances assumed	.174	.085	.008	.340
	Equal variances not assumed	.174	.085	.007	.341

4.22i General Satisfaction to Helsinki as a Cyclist City & **Cycling Purpose**

For part 4.1.3 of the thesis, the graphs were added only in the Attachments to space in the document. Below the graph, output, and Independency test are found.



How satisfied you are with the city of Helsinki as a cyclist city? * What is the most common purpose for your commute with the bicycle?

Crosstab

Count

		What is the most common purpose for your commute with the bicycle?				
		commute to work or studies	running errands or groceries	commute to hobbies or leisure time trip	work out	commuting the children
How satisfied you are with the city of Helsinki as a cyclist city?	satisfied	84	52	55	52	2
	rather satisfied	373	117	125	95	7
	rather unsatisfied	75	15	26	14	2

	unsatisfied	7	3	0	4	0
	cannot say	0	4	2	1	0
Total		539	191	208	166	11

Crosstab

Count

		What is the most common purpose for your commute with the bicycle?	
		other	Total
How satisfied you are with the city of Helsinki as a cyclist city?	satisfied	3	248
	rather satisfied	17	734
	rather unsatisfied	0	132
	unsatisfied	0	14
	cannot say	1	8
Total		21	1136

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.103	.749	3.557	980
	Equal variances not assumed			3.625	440.358

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower
What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.000	.333	.094	.149
	Equal variances not assumed	.000	.333	.092	.152

Independent Samples Test

		t-test for Equality of Means
		95% Confidence Interval of the Difference Upper

What is the most common purpose for your commute with the bicycle?	Equal variances assumed	.516
	Equal variances not assumed	.513