Experience of cycling

Influences from bicycle culture on place perception and emotions during bicycle journeys in the Rotterdam City Region.

Master thesis
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Master thesis
Utrecht University
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Urban Geography

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Foreword

This document is my master thesis for my master Urban Geography at Utrecht University. This master thesis spells the end of a long time of studying at the Utrecht University. Within this document I present the results of my research about the experience of cycling. Within this research different aspects from the so-called bicycle culture on place perception and experiences during a bicycle journey are investigated.

For me personally has cycling several meanings. The first one is that I use my city bike almost daily for commuting to the university, running errands, going out or visiting friends. The second meaning is that cycling gives freedom to explore the world and that cycling keeps me fit. For this purpose I use my racing bike. During the months I worked on this research I rode my racing bike quite often, especially in spring and summer. It helped considerably for inspiration while doing this research. The experiences on both bikes are different, place perception about places where I am cycling through and the emotions that appear during cycling are different. For me personally it has to do with the purposes of what I use the bike for. A third meaning of cycling is that cycling for me is part of the Dutch culture. These aspects generalized to the population of the Rotterdam City Region come back within this research. This research gives an inside view on how the cycling culture is developed, which factors play a role during cycling and how these factors are experienced during cycling journeys.

I would like to thank Marco Helbich for supervising this project and Lars Böcker for providing the dataset and his help with preparing the data. Furthermore, I want to thank everybody who helped and supported me during the development of this thesis. I wish everyone who is interested, much reading pleasure.

Roel Schaap
December 2014

Summary

This thesis is written in response to the renewed interest from politics and scientists in cycling behavior since the 1970s onwards. After decades of building cycling infrastructure, it is more important to stimulate cycling by promoting campaigns. Within this thesis, cycling is approached from users perspective by analyzing influences on the experience of bicycle journeys in the Rotterdam City Region. Studying cycling behavior seen from users perspective is a missing link in existing scientific research about cycling. Research on experience provides opportunities to gain an insight into the needs of users.

Bicycle culture - which is associated with geography, history, culture and politics of a country - plays an important role to understand cycling behavior and experience of cycling. Important for bicycle experience is the intensity of, and the interaction with, the environment. Intensity of the environment is experienced through valuing of place perception during a bicycle journey. Interaction with the environment is expressed by emotions which are associated with the experience of a bicycle journey. The aim of this research is to show the influencing factors on bicycle experience (place perception and experience of journey) and to determine which factors can be improved to stimulate cycling. By performing a literature study and a statistical analysis, answers are formulated to the following research question:

Which factors related to bicycle culture play the most important role in the valuation of place perception during cycling and the experience of a bicycle journey in the Rotterdam City Region?

The literature study showed four influencing factors associated with bicycle culture, which have a direct influence on bicycle use and experience. Bicycle use and bicycle experience are often interwoven therefore it is difficult to make an absolute distinction. The influencing factors are; the natural environment, the built environment, personal and household characteristics and trip characteristics. Variables within these factors have particular influences on the experience of cycling.

This research showed that the experience of cycling is associated with the perception of different safety aspects. Place perception is valued more negative than experience of journey. Although Within the Rotterdam City Region cycling is experienced as relatively safe.

For experience of cycling especially some built environment variables like address density and building diversity (mix of functions) play a role. A cycling journey through a more monotonous area is experienced less safe than a cycling journey through an area with a higher mix of functions. Also the residential environment of a cyclist contributes to the experience of cycling.

Some variables need some attention for promoting cycling. Age and ethnicity are significant variables within the factor personal and household characteristics and indicate that younger aged cyclist and ethnic minorities experience less safety during cycling. Cycling campaigns can be focused on these groups. Within the built environment some aspects can be improved to provide more safety for cyclist. Traffic safety features need to be improved for a higher valuation for place perception, consequently some additional research is needed.

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1. Intoduction

Within the modal split of the Netherlands the daily bicycle share is on average 27% of all journeys made (Fietsberaad, 2009). This number varied during the last decades. Reason for this are the changing society and different influences during history. Nowadays cycling is seen as an important form of transportation. To improve bicycle usage it is important to understand the developments during history and the developments of today to recognize what cyclist experience during a bicycle trip.

1.1 Problem identification

The history of bicycle usage in the Netherlands has got highs and lows. The introduction of the car for the masses between the 1950s and 1970s has led to a decline in bicycle use. At the same time this decline and the inconvenience of the car for the environment and the spatial impact, ensured that one started thinking differently about cycling. Since the 1970s there is renewed political interest in cycling because of the high fuel prices due to the oil crisis. Governments have built new cycle routes between and in urban areas to make cycling more safe, which has led to increased bicycle use (Pucher & Bueheler, 2008).

In 1992 the "Master plan Bicycling" was presented by the Dutch ministry of traffic. Goals to improve cycling usage and safety for cyclists were formulated. More cycle infrastructure was built to give space for non-motorized vehicles (MvVW, 1999). Since then, cycling usage improved but there was lack of investments in cycling facilities at train- and other public transport stations, such as bicycle parking places. It was important to improve the connection between public transport and especially the train. Since the 1990s more investments have been made and it worked because the amount of commuting trips by train and by bike increased (Martens, 2007). Nowadays there is still a shortage of parking lots for bicycles at stations. There will be lots of money invested in cycling facilities within the coming years but the question is, will this be enough because of the growing bicycle share in cities (Openbare ruimte, 2013). The recent history of the bicycle policies in the Netherlands show that policies matter and that the bicycle share has risen again since the 1970s.

To stimulate cycling, the Ministry of Infrastructure and Environment provides in policies for improving sustainable transportation. Within the ministry the 'Knowledge group cycling deliberation (Kennisgroep Fietsberaad)' provides knowledge about cycling. For example, they found solutions for traffic safety and they promote cycling for commuting purposes as an alternative for car usage. In this way cycling is becoming safer, congestion problems will be partly solved and policies can be improved to stimulate cycling (Rijksoverheid, 2014 I; II; III). Together with groups like the Cyclist Association (Fietsersbond), which represents the interests of 13,5 million cyclists in the Netherlands, research to improve cycling is and will be done (Fietsersbond, 2014 I). Where the national government facilitates in cycling policies, local governments have the responsibility to implement the policies, therefore they usually have a cycle policy plan (Olde Kalter, 2007). This means that in a lot of cities developments are taking place. In the 1990s most new developed neighborhoods (VINEX) were planned based around cycling infrastructure and public transport (Fietsberaad, 2009). Nowadays, new developments in old historical inner cities provide more cycling facilities in combination with public transport. The redevelopment of Utrecht Central Station is an example. Car infrastructure developed in the 1970s and 1980s is replaced by bicycle infrastructure and other bicycle related facilities (CU 2030, 2014). The same kind of developments happen in other Dutch cities as well. Groningen and Zwolle are the cities in the Netherlands with the highest bicycle share due to the fact that the city centers are more or less car-free and bicycle highways and other cycle facilities have been built to provide safe bicycle connections (Fietsberaad, 2009).

Although a lot of money has been invested for cycling infrastructure successfully, there are differences between bicycle share throughout the country. A lot of factors are involved that explain the differences in bicycle use between regions and municipalities. Geographical variations are important, in the countryside the bicycle share is lower than within cities due to longer distances. Also demographical diversity matters. Ethnical minorities cycle less than natives. There are

differences between age groups, gender, education, profession level etcetera (Fietsberaad, 2009; 2014 I; Rietveld & Daniel 2004). Promoting cycling is for the near future probably more important than building new infrastructure (Pucher & Bueheler, 2008). According to Ligtermoet &Partners (2012) research is required to find ways to promote cycling for diverse groups.

Research is done from several perspectives and out of diverse scientific disciplines surrounding these specific issues. Recent research on cycling behavior tries to understand these differences by investigating factors like the history and bicycle policies. Pucher & Bueheler (2008p.496) argue that cycling policies are at least as important as history, culture, topography and climate on the cycling behavior in a country, because cycling policies shape the circumstances for a cycle friendly country and a bicycle culture. Also the research about cycling culture from a geographical perspective like Pelzer (2010) did, is important to understand differences in cycling behavior, use and experience. Cycling culture is a combination of the long history of government intervening and the parallel changes of people's behavior (Pelzer, 2010). Pelzer describes which social and geographical environments influence bicycle use and bicycle experience.

Bicycle experience is described as the emotions and perceptions of people during and about cycling. The Dutch knowledge Institute of Mobility policy (KiM) investigated how people experience mobility (Harms et al, 2007). This research investigates factors from a traffic psychology perspective like the impact of emotions on cycling. It shows that research on experience can help by improving the needs of users.

1.1.1 Rationale

The rationale of this study is the importance of cycling in the Netherlands and the importance to stimulate cycling by promotion campaigns. The renewed interest from politics (Fietsberaad, 2009; Harms et al, 2007; Olde Kalter, 2007) and research done by scientists (Pelzer,2010; Pucher & Bueheler 2008; Rietveld & Daniel 2004) from several perspectives demonstrate this. Mobility is important, the developments of the past decades and the question how to make the transportation system more sustainable, make cycling an interesting and actual topic to study. For an urban geographer it is important to implement this within the context of the city, taking various natural, social and cultural factors into account. With growing cities and growing needs for energy, it is important to make the transportation system more sustainable. The development of the bicycle culture in the Netherlands the past decades, shows that there is a lot of potential. Building just infrastructure is not enough, research is needed to find new ways to stimulate cycling. Therefore the bicycle culture described by Pelzer (2010) is chosen as a starting point for this research, because it gives a complete view and describes diverse environments with several influencing factors that have impact on bicycle use and experience.

1.2 Research scope

This research focuses on people's experience of cycling in the Rotterdam city Area. For this topic cycling behavior of the individual is investigated by researching cycling journeys. To improve the bicycling share, it is important to understand people's bicycle behavior and to define which factors play an influencing role. Therefore it is important to know which factors are the most important and which kind of influence they have for bicycle use and bicycle behavior (Olde Kalter, 2007). Within this research is chosen to investigate how cyclists value places they are cycling through and which emotions appear during a cycling journey influenced by the bicycle culture. In this way the advantages and disadvantages from different influencing factors can be investigated from user perspective. This format is based on ideas out of diverse researches such as for example Pelzer (2010) and Harms et al (2007).

This research consists of two parts. The first part of the research is a literature study which shows the influences from the different environments of the bicycle culture and the most important factors that have an impact on bicycle experience. The research about bicycle culture from Pelzer (2010) shows the influences on bicycle use and cycling experience seen from a Dutch perspective. When studying cycling behavior it is important to keep the context of the country in mind, because

bicycle use and behavior is different from country to country and from place to place (Van Acker et al, 2010). The Dutch cycling culture is an unique phenomenon for the rest of the western world, but at the same time cycling in the Netherlands is seen as a natural habit taken for granted by most citizens and scientists (Pelzer, 2013). Scientists no longer see the effects from cycling when there is only focused at the Dutch context for studies on bicycle behavior. Therefore within this study is chosen for a research from Dutch perspective with some examples from other countries. In this way the most important influencing factors can be placed within Dutch context and provides the literature study a complete view of the different influencing factors. This also results in a more comprehensive view of the essence of the experience during a bicycle trip. Buijs & van Kralingen (2003) show that cyclists experience place perception by valuing the environment. Harms et al (2007) show that emotions are important for experiencing bicycle journeys.

The second part of the study is the empirical research. An existing dataset from a cross-sectional research of individual travel behavior is used to select the most important variables which influence bicycle use and experience. Also, the variables that explain cycling experience are selected. The empirical research is a case study and focuses on cycling behavior in the Rotterdam City Region (RCR). This case study is chosen because the RCR is a dynamic and important region for the Dutch economy. Noteworthy is that the modal split of the Netherlands and the RCR show differences. In the RCR 19% of all journeys is a cycling journey, versus 27% for the Netherlands (Fietsberaad, 2010). The empirical research will show if this cycling share will also have influences within cycling experience.

1.3 Research purpose

This research gives an insight of the complexity of cycling behavior seen from users perspective. The purpose of this research is to make an overview of the most important factors forthcoming of the cycling culture which influence cycling experience. The results of this research will show which factor(s) play the most important role within bicycle experience and will define which variables are significant. According to Harms et al (2007), an advantage of research on experience of bicycle use, is that it provides opportunities to gain an insight into the needs of users. This means that negative experiences can be partly improved by governments or companies to stimulate cycling and improve bicycle use. The underlying purpose of this research is to give some policy recommendations.

1.4 Scientific relevance

There is much research done about cycling use, cycling behavior and choice of transportation mode. This thesis shows new scientific perspectives in comparison with other scientific literature about cycling. This thesis forms an addition to the existing scientific knowledge about cycling.

Where researchers like Pelzer (2010), Heinen et al (2010) and Rietveld & Daniel (2004) look at cycling behavior with influences from different environments or factors that have impact on bicycle use, this thesis focuses on experience of these environments and factors, during cycling. This gives the opportunity to do research from the perspective of users, which is missing in existing research. Learning from experiences from current users is important when performing cycling research with the purpose to get more people on the bike (Ligtermoet &Partners, 2012). In addition to Levelt (2003) who shows a research about from traffic psychological perspective, this research will give insight on the influences of emotions that appear during cycling. This is important because according to Harms et al (2007) emotions play a role within experience.

Another new perspective is the comparison of cycling purporses. Where the majority of literature focuses on one specific purpose of cycling, mostly commuting (Heinen et al, 2010), this thesis is focused on cycling for commuting and leisure purposes to give a complete view of cycling experience and to show if there are different experiences and needs between cycling purposes.

Other studies often show the most influencing factors that are important to choose a particular transport mode. For example, the influence of the weather (Böcker et al , 2013) or cycling as seen from a sport/ health perspective like Oja et al (1998). This thesis shows a multidisciplinary research utilizing literature and perspectives from multiple disciplines to show what influences

cycling behavior and experience. Together with the Dutch specific context, cycling culture and the approach from cyclist perspective, this research has got a new scientific view for an urban geographer and other scientists. The goal is to show several aspects which have influence on bicycle experience and find gaps for which additional research is needed.

1.5 Social relevance

Cycling is an important part of the Dutch transportation system and bike usage can make this system more sustainable particularly within urban areas. Therefore this thesis provides a research from new scientific perspective as described in paragraph 1.4. From a social perspective this thesis will add a research that is focused to improve the bicycle share by learning from the experiences of users.

In the Netherlands almost everyone is a cyclist and most people are happy about cycling (Fietsersbond, 2014 II). Cycling is used for commuting but also for leisure and sport activities. This shows the importance and impact of cycling. A lot of investments have been made in cycling infrastructure and cycling policies. For companies, governments and cycling organizations it is good to know what cyclist think of provided infrastructure, policies and which influences are even more important during the experience of cycling.

In this way governments and companies can provide in facilities and policies based on the meaning of cyclists to make cycling even more attractive. This thesis shows factors which have an influence on individual cyclists, this has an impact for new developments to make the transportation system more sustainable, particularly within the RCR.

The RCR is one of the eight city regions in the Netherlands. It is a mandatory regional cooperation and is legally regulated in the Joint Regulations Act 2005 (Wet gemeenschappelijke regelingen). It is a co-operation of 15 municipalities in the Maas delta and has the purpose to develop regional governance focused on accessibility, living conditions and business opportunities. The region develops for example infrastructure projects and policies for better infrastructural usage. These projects are mostly in collaboration with the province or the national government (Stadsregio Rotterdam, 2014 I; II; III). The city region also provides in cycle policies. In the past ten years policies were focused on building missing links in the cycle network. Living-, working areas, the countryside and important facilities are connected for commuting and leisure purposes. Cycle highways, parking facilities at public transport hubs and public transport cycle facilities are realized.

The current goal is to promote cycling in the region. Where cycling policies in the past are focused on building infrastructural facilities, nowadays this is changed because the majority of cycle infrastructure is practically complete. In 2012 a research finished to investigate the best ways to promote cycling for different target groups and different travel purposes (Gemeente Rotterdam, 2007; 2012; Stadsregio Rotterdam, 2014 I; Ligtermoet &Partners, 2012). This thesis will fill the gap in investigating cycling behavior for different purposes seen from a cycling cultural perspective, the results can be used for further research for promoting cycling in the RCR.

1.6 Research questions

The problem identification, research scope, scientific and social relevance led to the formulation of the following research question:

Which factors related to bicycle culture play the most important role in the valuation of place perception during cycling and the experience of a bicycle journey in the Rotterdam City Region?

Within this question there are four topics that have to be investigated. Therefore sub questions are formulated. Firstly, the meaning of bicycle culture and the most important factors for bicycle use and experience need to be investigated. This first topic is investigated within the theoretical framework.

1. ***What is bicycle culture and which factors play, to which extent, a role in bicycle use and experience?***

The second topic is to investigate bicycle experience; this topic is also investigated within the theoretical framework. Within this thesis, place perception is investigated through valuing the environment cyclists are cycling through. Therefore it is needed to clarify which kind of value judgments appear during cycling, that influence bicycle use and behavior. For the experience of journey it is required to investigate which kind of emotions appear during cycling.

2. ***How do cyclists value the environment they are cycling through and which emotions appear during a bicycle journey?***

The third topic is the first subject of the empirical research and investigates which factors have an influence on the experience of place. The experiences of place are value judgments about the environment people are cycling though during a bicycle journey. The value judgments are influenced by several factors, some variables out of these factors are significant and have effects on place perception.

3. ***To which extend do factors related to bicycle culture influence value judgments about the place during cycling and which variables are significant?***

The fourth topic concerns the experience of journey expressed by emotions that appear during a bicycle journey. These emotions are also influenced by several factors. Also in this case some variables are significant and have an effect on the experience of the journey.

4. ***To which extend do factors related to bicycle culture influence emotions which appear during a cycling journey and which variables are significant?***

1.7 Reading guide

This paragraph shows the main purposes of each chapter.

Chapter 2 is the theoretical part of the research and forms the theoretical framework. Within the theoretical framework an overview of existing scientific literature is given. The goal is to explain the influences of bicycle culture to show how cycling is embedded within the Dutch society and which factors play a role within cycling experience. Further is investigated how cycling is experienced.

Chapter 3 provides the research design for the empirical research. Based on the theoretical framework, the most important influencing factors and independent variables are defined and a conceptual model is created. Also the dependent variables are formulated. Further, some specific aspects about the research area are described and the methods for the statistical tests are selected. The purpose of this chapter is to provide information how the empirical data are collected, variables are operationalized and how and why certain statistical analysis are done.

Chapter 4 provides the data analysis and results. In this chapter the descriptive statistics and the statistical analysis are performed. It shows the results of the statistical analysis argued by literature and shows which are the most important influencing factors for cycling experience.

Chapter 5 is the conclusion and discussion section of the research. Further, some policy recommendations are provided and the strengths and limitations of this research are discussed.

2. Theoretical framework

This chapter shows the literature review from mostly scientific literature and consists of three different subjects. First, before understanding what people experience during cycling, the influencing factors on bicycle use and bicycle experience are investigated to understand where these factors are coming from and to show the wider context of cycling behavior. The interplay of these factors is the bicycle culture: *'A historically shaped constellation comprising a physical-, institutional- and socio-cultural environment which influence bicycle experience and use (Pelzer, 2010P.34).'*

The second part describes the most important factors that have influences on experience of cycling. This factors are the relevant parts of the environments out of the cycling culture that have a direct influence on bicycle use and experience.

The third aspect described in the final paragraph is how, by which emotions and perceptions, this influencing factors will be experienced and perceived by individuals. Experience is the interplay of perceptions, feelings, thoughts, emotions and behavior of a person (Omgevingspsycholoog, 2014). According to Buijs and van Kralingen (2003) experience can be measured in different ways with a variation of different influencing factors. Where one study about experience is focused on measuring perceptions of the environment and the forthcoming experiences, the other study focusses on personal preferences and valuing of the environment. This study is focused on both aspects. The first aspect mentioned by Buijs and van Kralingen (2003) is the experience of journey the second the experience of place (place perception).

2.1 Cycling culture

In the Netherlands 35% of all trips below 7,5 km and 44% of the trips between 1 and 2,5 km are made by bike (Rietveld & Daniel, 2004). The historical context of cycling in the Netherlands shows that cycling is embedded in Dutch history and culture and that it is something socially constructed (Pelzer & Brömmelstroet, 2010). Social construction is the process of subjective opinion formation, measurement and imaging of the users (Low, 1996). This social construction can be found back within the Dutch Cycling Masterplan (1999) which shows the history and the role of the bike within society from the late 1800s onwards. Cycling is an important form of transportation that is provided by cycling policies. The long history and policies are just a part of the explanation why the cycling share within the Netherlands is high compared with other western countries (Oijen, et al, 2011.P2).

This paragraph shows the deeper mechanisms which play a role within bicycle usage and experience. Pelzer (2010) shows that within the cycling culture there are different influencing environments that have influences on bicycle usage, and bicycle experience. According to Pelzer cycling experience is the interaction whit the environment and the intensity of the environment whereby environment is socially constructed. His research about bicycle culture demonstrates a comprehensive conceptual model (Figure 2.1) seen from a critical realistic perspective. It covers the influencing environments (structures) on bike use and cycling experience (events). Cycling experience and use are influenced by the physical environment, the socio cultural environment and the institutional environment. The physical environment is the spatial area where cycling takes place and is influenced by nature (geography and weather) and people (built environment). The socio-cultural environment describes the social place and status of someone within society and the institutional environment are the policies involved which shape the cycling conditions.

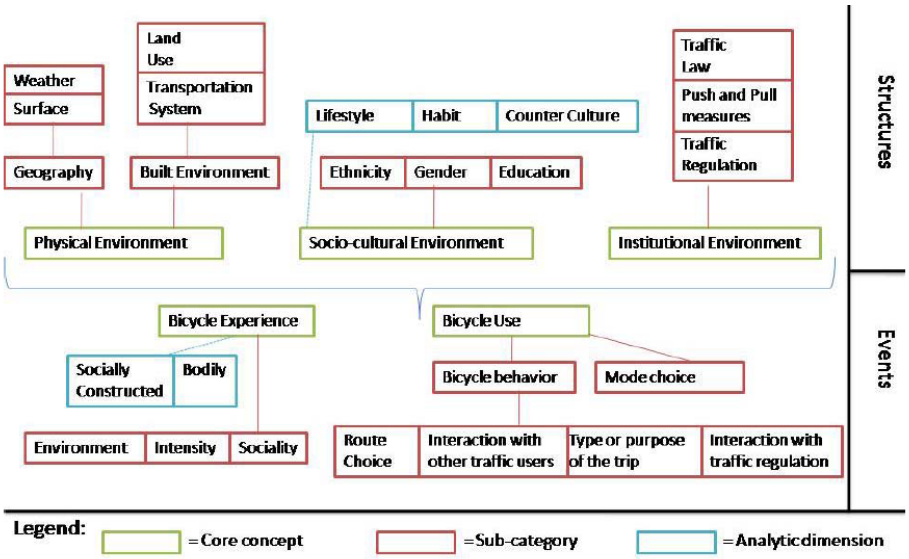


Figure 2.1 Cycling culture according Pelzer (2010.P.86)

The interplay of these environments allows for user interaction, because based on the intensity of the different types of environments they will adjust their cycling behavior and use. The different environments have in one way or another influences on each other. The institutional environment contains policies which have influences on the built environment and the social and cultural environment. The built environment is mostly planned by policies. Guidelines for education are provided by the government such as transportation costs, traffic policies and taxes. Based on this, people make choices to go cycling or not. Also the influences from the social and cultural environment are important because people are influenced by other people regarding their meaning of cycling. This is reflected in their life style, education, ethnicity, gender and habits which influence personal preferences. These environments have a reinforcing effect on each other because change in one environment means a reaction in another environment. The intensity of these environments is reflected in the experience of cycling because it has influences on people's behavior, thoughts and emotions (Pelzer, 2010).

Heinen et all (2010) made an overview of scientific literature about influences on transportation and defined factors that are important for cycling to commute. Their research is a combination of empirical results of travel behavior, transportation planning, psychology and health science. They make a distinction between the influences of the built environment, natural environment, socio-economic factors, psychological factors, and some other factors like cost, travel time, effort and safety. The built environment is seen as the most important factor because it is seen as the spatial context where the transportation between a and b takes place. Within the built environment the urban form, infrastructure and the availability of facilities are the most important aspects.

The natural environment has an influence on cycling behavior in terms of physical effort due to the experience of the weather and experience of the shape of the natural landscape. Socio economic factors are the personal and household characteristics like gender, age, ethnicity and income. Heinen et all (2010. P69) argue that commuting behavior is strongly linked to personal and household characteristics. The psychological factors can be compared with what Pelzer (2010) shares by socio-cultural environment. Heinen et all (2010) argue that psychological factors influence the decision if people take the bike to work. It has to do with the influences of attitudes, social norms, habits on cycling behavior. The aspects costs, travel time, effort and safety are important for commuting by bike. When for commuting cost and travel time can be saved this are the reasons to take the bike instead of another transport mode. A higher travel time results in a lower bicycle share due to the fact that it costs more effort and the bike cannot compete with other forms of transportation. Safety is an important reason to go cycling and is one of the most important experiences during cycling.

These elements also come back within the study of Titze et al (2008, P253.) who determined an association of the built-environment, social-environment, and personal-level factors on the one hand, and bicycling for transportation on the other. The built environment is a particularly important factor within this study because they measured that land use-mix correlates positive with bicycle share. This means that diversity is an important factor for experience of cycling. Titze et al also mention safety as an important factor for cycling as well.

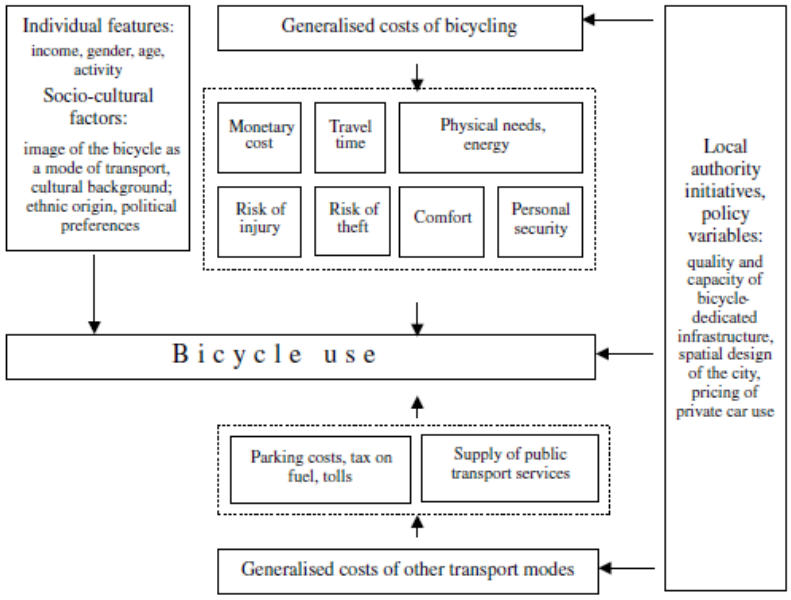


Fig 2.2 : Socio-economic perspective bicycle use (Rietveld & Daniel, 2008.P.533)

Rietveld & Daniel (2004) shows bicycle use from an economical perspective and shows that policies have impact on bicycle use (Fig 2.2). The institutional environment (local authority) influences these choices by introducing policies, to stimulate bicycle use. Through pricing, people will make choices which transport mode they use. Pucher & Buehler (2008) argue that policies like; transport policies, land-use policies, urban development policies, housing policies, environmental policies, taxation policies and parking policies have significant influence on bike use. Olde Kalter (2007) calls this push and pull factors and argues that these factors make cycling within inner cities more interesting than driving by car. The goal of push factors is to improve the competitiveness for the bike compared with the car. Most push factors are based on pricing, like parking pricing, fuel tax and tax on car ownership. Push factors are also interventions within the built environment like building speed bumps or closing roads for cars for example. These interventions are intended to encourage cycling. Pull factors are therefore to make cycling more attractive and improve the built environment by building cycling infrastructure and facilities. In this way pull factors can be experienced physical.

Rietveld & Daniel (2004) show that bicycle use is dependent on the institutional environment and the personal characteristics. As argued by Rietveld & Daniel (2004) policies are important in improving cycling behavior. Policies have influences on the shape of the built environment and indirect on the cycling behavior of people because push and pull factors can shape a cycle friendly environment. Socio-cultural and individual features have the most important input because individuals decide to go cycling or not. Van Twuijver et all (2006) argue that this factors can be more influenced by policies when implementing push and pull factors in this way that people are almost forced to use the bike. This is not seen as the solution, it is the idea of the Dutch government that people make choices by themselves based on what they think is the best and what is socially responsible. This shows that the impact of pricing, push and pull factors from the government are important but that still the choices of people are the most important factor. But these choices are influenced by policies.

This paragraph shows that the bicycle culture can be seen as an interplay of different environments that have influence on bike usage and bicycle experience. The institutional environment tries to stimulate cycling behavior but will not be direct experienced during cycling. Influences of the institutional environment will be experienced while observing the built environment. The most important experienced factors are firstly, the built environment what is according to Heinen et al (2010) the spatial area where cycling takes place and secondly, the natural environment because

weather and the natural landscape influence cycling behavior. Furthermore, the personal and household characteristics play an important role in the experience of cycling because every person has a different background and thus experiences cycling in a different way. Another important factor are the trip characteristics whereby travel purpose and travel time are important for bicycle use. In the next paragraphs these factors are further discussed and show how bicycle use is influenced and how cyclist experience it.

2.2 Natural environment

Cycling is a physical and active form of transportation (Oja et al,1998) because cyclist experience their trip by providing physical effort during cycling. The natural environment are the natural geography, landscape and weather influences and is the only factor which cannot be influenced by people directly, but it has an direct influence on the travel behavior of people.

The type of landscape influences the shape of the built environment. For example, when a city is built in a hilly surrounding the city has slopes. (Heinen et al, 2010) argue that the presence of slopes have negative influences on cycling. At the other hand Titze et al (2008) found that the presence of steep slopes had a positive influence on cycling for leisure purposes. Böcker et al (2013) argue that landscape (slopes) have more impact than weather influences on cycling behavior. Although it is not clear if slopes have a significant influence on cycling experience, it has to do with the experience and the purpose of the cyclist. For recreational purposes hilliness can be the reason to go cycling while commuters probably don't take the bike. Pelzer (2010) argues that the flatter the country the better it is for cyclists in general. Rietveld & Daniel (2004) show that within their dataset. Dutch cities with slopes (Maastricht and Heerlen) have got a lower bicycle share than other cities.

The climate describes the weather over a 30 year period the weather refers to daily weather conditions. A mild climate is the best for cycling because the seasons have influences on cycling (Heinen et al, 2010). This is not just because of the extremes between temperatures and precipitation in winter and summer but also daylight hours have influence. Darkness has negative influences on cycling (Stinson & Bhat, 2004; Gatersleben & Appleton, 2007).

The weather can vary daily and from place to place. Van Twuijver et all (2006) found in there Dutch survey that bad weather conditions are the first reason to not take the bike. The weather has a much more direct influence on bicycle use and experience than the climate and the landscape because the factor is always different. Although Pelzer (2010) argues that the weather is a complex and difficult to measure variable. It is difficult to measure which aspect of the weather has the greatest impact.

Other literature shows that precipitation, wind speed and temperature are the most important aspects. Sabir (2011) argues that the weather has a measurable effect on travel behavior. Temperature has the biggest impact followed by precipitation and wind. Wind speed, precipitation and extreme temperatures have influence on traffic safety. Rietveld & Daniel (2004) argue that wind has the greatest impact because one cannot dress themselves against it, in contrast to temperature and precipitation. Heinen et al (2011) find that wind has a negative impact on commuting by bike even as Thomas et al (2012) who find a negative impact on cycling flows in general. Rietveld & Daniel (2004) and Sabir (2011) argue that the impact of weather has less influence for commuting compared with recreational and sporting purposes. This is due to the fact that for leisure purposes the weather conditions are part of the experience and oft a choice to do active outside activities like cycling.

Sabir (2011) argues that wind speed has a negative impact above 5 Beaufort (heavy winds) because of safety reasons for traffic. This are wind speeds from 8 till 10,7 meters per second and is called a quite powerful wind (Windfinder, 2014). This makes clear that there are different aspects of wind that have probably an impact on cycling experience.

Sabir (2011) found that precipitation in the Netherlands has a negative effect on bicycle use, more people chose public transport or the car instead of the bike, but this is also depending on the amount and kind of precipitation. Also temperature has impact, low temperatures below 0°C or temperatures above 25° C have an impact for some purposes of bicycle use like for leisure and

sporting purposes. According to Böcker et al (2013) temperature and precipitation have influences on the trip distance for active forms of transportation.

The natural environment plays a role within bicycle experience but in first instance it has influences on bicycle use especially with more extreme circumstances. If someone is a daily cyclist, the weather influences are less important than for a leisure cyclist and the same holds true for the form of the landscape. For an individual, personal and household characteristics combined with the purpose of the trip play a role within the experience of the natural environment. This is also based on where someone is accustomed (Böcker et al , 2013).

A steep terrain can be seen as an argument to go cycling for leisure or sporting activities because of the experience. For commuting it can be an argument to choose another transport mode because it can cost too much physical effort for a daily cyclist. The most concrete experienced influencing factor of the natural environment are the weather influences. The most important experience during cycling is the amount of the physical effort that is needed with different weather circumstances. Weather has influences on traffic safety by extreme high, or low temperatures below 0°C, even as extreme precipitation and extreme wind speeds.

2.3 Built environment

The built environment is; *' the human-made or human-altered space in which individuals live out their daily lives' (Rosso et al, 2011, p. 2).* Heinen et al (2010) argue that built environment consists out of three elements. The first two elements are important for this research namely urban form and infrastructure which are the most important because this is the human made layout of the city. The third element is according to Pelzer (2010) cycling facilities. According to Pikora (2003) there are four elements that can be experienced within the built environment namely; functionality, safety, aesthetics and the destination.

2.3.1 Urban form

Urban form is the physical layout of the city what according to Ewing (2005) says something about the density, diversity and design of the built environment. According to Saelens et al. (2003) cycling use is related to proximity of functions between the place of origin and destination. Proximity is determined by two variables density and land use mix (diversity). Density is the amount of people, jobs and houses (addresses) within a particular area. Diversity is the mix of functions and different forms of transportation and infrastructure within an area. Design is how the built environment looks like. This are the aesthetics according to Pikora (2003) and has to do with the valuation of the amount of green, parks/nature, design of buildings and the pollution level of the area. Ewing (2005) shows that an increase of all these factors results in an increase in percentage of active travel (Cycling, walking).

Heinen et al (2010) argue that density of the urban form from the city influences the distances, proximity and thus the travel time between different places and or functions. The network layout of a city plays a role within the connectivity of the network and the mixture and diversity of functions. When people live close together it is better possible to create a higher bicycle share because people can live closer to their work and the amount and diversity of facilities is higher (Kunreuther & Noland, 1995; Martens, 2004; 2007). How more close everything together how shorter distances, this makes an area potentially better for cycling. Density and diversity are identified as significant factors for bicycle use.

A city can have a more people friendly or car friendly design. A people friendly city leads to more bicycle usage because the connectivity of the cycle network is better and the city is not heavily dominated by cars (Pucher & Buehler, 2008). A people friendly city leads to more safety, which is one of the most important factors for bicycle experience. According to Pikora (2003) this safety includes personal safety and traffic safety. Personal safety means that someone experiences a pleasant, livable built environment. Traffic safety has to do with the amount and kind of traffic, the speed(limit) and safety features of the infrastructure.

This spatial planning and design of the city is closely connected with the geography and landscape where the city is built. This results in differences between compact cities or sprawled cities for example. Sprawled cities often have low densities, long distances and a low land use mix and is thus not pleasant for active forms of transportation (Ewing, 2005). Within big city's distances are longer but also the public transportation network is often denser due to high densities of people and functions. In this case public transport can better compete with the bike and results in lower bicycle share (Rietveld & Daniel, 2004). Martens (2004) and Rietveld & Daniel (2004) show that small and medium sized cities in the Netherlands have the highest bicycle share. This shows the effects of the urban form of the built environment and indicates how one experiences the built environment during cycling.

2.3.2 Infrastructure

Infrastructure is an important element as a result of the built environment and the urban form. Pelzer (2010) argues that two major experienced factors in route decision are important namely comfort and speed. Well maintained and well planned cycling infrastructure make traveling with relatively high and comfortable speeds through traffic in urban areas possible, this is an important argument to take the bike for lot of purposes (Van Twuijver et al, 2006). According to Pikora (2003) the infrastructure can be experienced due to the functionality, which for example has to do with the directness of the infrastructure and the type of infrastructure and the type of traffic and the speed.

For cycling infrastructure there are many different forms, for example, bicycle paths, bicycle lanes and 'normal' streets (with or without markings). Separate cycle paths provide in a high traffic safety. Research confirms that the type and quality of bicycle infrastructure matters and that it increases the use of the bike (Heinen et al, 2010). In the Netherlands these kind of facilities and infrastructure are already used for a long time which means that Dutch cycling facilities are generally on a high level. This is due to the fact that Dutch cities have relatively uniform infrastructure facilities through national guidelines. Together with the status of the cyclist in Dutch traffic this makes the Netherlands one of the safest cycle countries in the world (Pucher an Bueheler, 2008).

Dill (2009) did research in Portland USA to the effects of bicycling infrastructure in general. The effect of the availability of sec cycling infrastructure is difficult to measure in the Netherlands due to the great availability of cycling infrastructure almost everywhere. Portland is one of the cities in the USA that provides in some bicycle infrastructure and a relatively high bicycle share. Dill showed that the availably of bicycle infrastructure led to more bicycle share. Continuity of the infrastructure network is an important factor to improve the traffic safety of the cyclist and thus bicycle use and the experience of cycling. The example of Portland shows the importance of the availability of cycling infrastructure. Pucher et al (2010) argue that places with a high bicycle share have good infrastructure, cycling policies and education programs.

2.3.3 Facilities

A distinction can be made between different facilities that are important for cycling behavior. These are facilities along the cycling route and facilities at the destination site. Titze et al (2008) found in their study that facilities at the place of destination are the most important reason to go cycling instead of attractiveness during cycling, land mix use and facilities along the route.

Scientific research shows that for commuters, cycling facilities at work are also the most important reason to go cycling (Heinen et al, 2010). People prefer bicycle parking facilities above showers on work for example. Although the availability of showers and secured bicycle parking are both significant variables (Hunt and Abraham, 2007). Within the Dutch research of Van Twuijver et al (2006) the availability of parking spaces at a destination is important. This is important for commuting, leisure activities and for sport purposes. The experience of the destination is experienced by the availability and diversity of functions (Pikora, 2003).

Parking facilities are important for comfort and safety reasons, good parking protect bikes from weather influences and against theft (Martens, 2007). The needed quality of the parking facility depends on the type of bike, the age of a person and the purpose of the journey. People who cycle to

work have most of the time more expensive bikes than students for example. They have also more money to spend and want to have a secured locker in some cases. It depends on the group which quality is needed, but overall a good parking place within a short distance of the destination is important (Hunt and Abraham, 2007). Also parking facilities at stations and other public transport hubs are important arguments to go cycling. The research of Martens (2007) showed that this increased bicycle use and cycling experience in the Netherlands.

2.4 Personal & household characteristics

Heinen et all (2010) argue that cycling behavior is strongly related to personal and household characteristics. Besides that every person has got their own identity, influences from the society are important as argued by Pelzer (2010). Further the weather influences and the natural landscape are aspects that are experienced different per person because every person has a different background and has different preferences.

Van Acker et al (2010) argue that travel behavior is strongly related to the social place of the individual but for cycling in the Netherlands it is a bit different. In the Netherlands cycling can be seen as a habit, it has always been part of the Dutch culture, it is what someone does without thinking. Research showed that therefore are two major reasons. One is that the Netherlands has a long history of an egalitarian society. The bike has always been a transportation form for everyone and people didn't want to show when they were rich or poor. The other reason can be found in Protestantism. Max Weber (2010[1905]) argues it as the tradition of reliability and thrift. This must always be seen within the Dutch context with a combination of a good cycling policy and historical coincidence (Oijen et all, 2011).

When looking at the society of today, research showed that native Dutch people cycle more than immigrants. It could be argued that immigrants are not used to cycling, sometimes they cannot even ride a bike. They sometimes see it as a poor man's vehicle. For them there is no tradition of Protestantism and an egalitarian society (Oijen et all, 2011).

Heinen et all (2010) argue that cycling is not an objective choice out of different hard 'criteria' but an outcome of attitudes and based on earlier experiences. This comes back within different lifestyles and different socio-economic and household variables. Van Acker et al (2010: 227) argue that a lifestyle is: *'the individual's, opinions and orientations toward general themes such as family orientation, work orientation and leisure orientation'.*

Looking to different socio-economic and household variables Heinen et all (2010) are not able to give any hard conclusions about the influences on commuting by bike because, most of the factors are dependent on the context of the country of research. This shows again that it is important to focus on Dutch studies within this research. In their research Heinen et all made an overview of different scientific literature and found that there are some variables that have to be investigated, this variables are described below and are put in Dutch context.

Yong people cycle more than elderly, but age is not significant. Pucher & Buehler (2008) show that the group 15-25 is the biggest cycling group because most of them are students. According to van Van Twuijver et all (2006) plays education level a small role within the choice to use the bike as transportation mode for short distances. Higher educated people cycle more than lower educated people. The age group between 26 and 45 is the smallest cycling group. People with a high income cycle less than people with a low income. Owning a car has a negative influence on cycling. There is also a difference between men and women but that depends on the country, in the Netherlands due to the high cycle rates, cycling is also popular by woman. Cycling in the Netherlands is almost for everyone, for all trip purposes (Pucher & Buehler, 2008, Garrard et al., 2008).

Boumans and Harms (2004) argue that employment status is an important factor. A part-time worker in the Netherlands cycles more than a full-time worker, probably because they live closer to their work. People with a high status cycle less. This is also dependent on the household structure. On the other hand (Pucher & Buehler, 2008) argue that Dutch cycling rates are distributed almost even on all different income groups.

Existing literature shows that personal and Household characteristics do not have a significant influence on cycling distribution within the Netherlands. The only exceptions are probably ethnic minorities.

2.5 Trip characteristics

The most important characteristics of a bicycle trip are travel time and travel purpose. The travel purpose is already mentioned in relation to other influencing aspects. Leisure trips are in general experienced different than other kind of trips.

People who use the bike measure time instead of distance because time is part of the experience of comfort and speed. According to Pelzer (2010) distance is often not comparable with travel time. In the Netherlands a bike journey from 10 to 20 minutes is experienced as a short trip (Van Twuijver et al, 2006). Travel time is dependent on the spatial structure (urban form) of the place and the availability of infrastructure. In this factor the kind of bicycle infrastructure, waiting times for traffic lights and the directness of the cycling routes are important.

For commuting, the shortest travel time is one of the most important arguments to take the bike, because direct routes and short travel times can compete with motorized forms of transportation (Rietveld and Daniel, 2004). Directness of a cycling route does not per definition mean that it is the shortest in distance. Sometimes less traffic lights, less traffic, a better quality of the infrastructure, shorter waiting times for crossings combined with a longer distance make sense in travel time and in terms of comfort and traffic safety. Comfort and safety is more important for inexperienced cyclist than for experienced cyclist. Experienced cyclists prefer the shortest travel time above a bit more comfort, more traffic safety and a longer distance (Stinson & Bhat, 2005). Travel time is one of the most important aspects especially for commuting purposes. In comparison with other transport modes. Kunreuter & Noland (1995) show that policies who make travel time shorter for bicycling will result in an increased bicycle use because it makes cycling more comfortable.

Gatersleben & Appleton (2007) argue that for commuting direct routes are needed but people may decide to take a more indirect route because of traffic safety. When people can use safe cycle routes to commute or use for other cycling purposes people will use the bike potentially more often. Direct routes seems to be less important for leisure purposes because then cycling is part of the experience and travel time and distance make not that much sense. Still traffic lights and crossings with high volume traffic streets will not promote cycling behavior because of traffic safety. This shows that for leisure purposes travel time is less important than traffic safety and that in general safety is the most important experience during a trip (Stinson & Bhat, 2005).

2.6 Place perception and experience of journey during cycling

There are several factors with different variables indicated that have influence on bicycle behavior and bicycle use, the question is to which extend this variables have influence on bicycle experience.
The previous paragraphs showed that bicycle use is strongly related and interwoven whit experience. Harms et al (2007p.63) argues that people who use the bike more often are more positive about cycling. According to Pelzer (2010,P20) it is important to understand what cyclist feel and think and second that it has to be placed in a wider cultural web. This wider cultural web is already explored in this chapter, in this paragraph is indicated how cyclists experience the influencing factors. In this way, experience; the interplay of perceptions, feelings, thoughts, emotions and behavior of a person can be measured (Omgevingspsycholoog, 2014). According to Pelzer (2012) there are two elements that can be experienced during cycling and these are intensity of and the interaction with the environment. Within this research this is translated into two elements that that will be further investigated. The first is experience of place about place perception during cycling and how people valuing the environment during their cycling journey. The second is the experience of journey about the emotions that appear during a cycling journey.

2.6.1 Experience of place

Experience can be measured in different ways with a variation of different factors. According to (Buijs & van Kralingen, 2003) these factors explain how people think about the places they visit. This is all about experiences from the past, personal preferences, appreciation and social construction.

Experience of place is what people think about the built environment by valuing different aspects. This has to do with the idea of a total experience what means that people have always an opinion of something (Omgevingspsycholoog, 2014). Tilstra (2011.p.17) argues that perceptions and experiences are highly contextual and personal and that the relationship between humans and environment plays an important role.

For experience of place during cycling, the qualities of different spatial elements within the built environment are important because they can have an influence on the perception of cyclists. Important things that can be experienced are cycle infrastructure and the urban form of a city that provides in density, diversity and design. This has to do with the availability of functions and has influences on proximity of functions and cycling facilities within the built environment. For their research to the association of the built environment, social environment and personal factors with cycling, Titze et al (2008) used different factors that have influence on experience of place during cycling. The first factor is about quality and connectivity of the cycling infrastructure, the second about traffic safety, the third about attractiveness of cycling conditions and the land-use mix and diversity of uses. This last one describes the variety of buildings along the bicycle routes. Within their research this variables where the most important influences for experience.

These elements are based on the study of Pikora et al (2003) about valuing of the aesthetics of the built environment. Different aspects like maintenance, cleanness, architecture are included in valuing place perception. In the research was asked if the respondents find this elements important or not. This had led to data in a vive point Likert scale. The conclusion was that the spatial elements which provide in personal safety and traffic safety are seen as the most important to value place perception.

2.6.2 Experience of journey

Within experience of a journey, comfort and speed are important. Comfort and speed are influenced by the qualities of the built environment but also other factors play a role. According to Pelzer (2010P.24) refers comfort to convenience and safety aspects, which includes for example pavement quality, a scenic environment and little car traffic. Speed refers to travel time for the cyclist. The ways in which people experience comfort and speed are expressed in emotions (Levelt, 2003).

Harms et al (2007 P.32) argue that emotions do control behavior. An emotion is a mental state that is clearly distinguishable of other mental conditions like tiredness. Mental conditions can have influence on emotions. It is usually accompanied by physical changes and facial expressions for instance. Emotions occur when a personal interest will be harmed or will be promoted and this can lead to take action and show a sudden behavior. There are 5 basic types of emotions. These emotions are universal for people from different cultures and some mammals like monkeys. The basic emotions are; joy, fear, anger, sadness and disgust. Other emotions are derived from these basic emotions. Differences between positive and negative emotions can easily be distinguished, joy is positive and fear is negative for example. Just 4% of the Dutch population experiences cycling as something negative. From the Dutch population, 67% associated cycling with joy.

Levelt (2003) found the same emotions and same kind of outcomes. Within his traffic psychological research he went a step further and found a relation between emotions and safety. Levelt asked his respondents to rate the influence of their emotions on the way the respondent thought this has an influence on the experience of safety. This was measured on a five point likert-scale. The relation found was that positive emotions have a positive effect on the experience of safety and negative emotions have a negative influence on the experience of safety of the respondent. With this method the subjective safety is measured. Heinen et al (2010) argue that there are two types of safety; objective and subjective safety. '*Objective safety is 'real' safety for cyclists, measured in terms of the number of bicycle-related incidents per million inhabitants. Subjective safety*

refers to how individuals perceive safety, and is mostly measured in terms of the stated safety experience of users or other respondents (Heinen et al, 2010 p.63).' For the experience of journey subjective safety is the most important experience because this is the safety experienced from users perspective during and about a particular bicycle journey.

During cycling one can experience the traffic safety and the safety of the places where one cycles trough. Titze et al (2007) showed an example of this experience and the influence on that for cycling experience. In a study in Austria people perceived high traffic safety, but though the fear for theft at the destination they were less liked to go cycling on regular basis. This example shows different aspects of the subjective safety and the influences and importance of the facilities at the destination of the bike trip. Another example is when the traffic safety is not perceived as safe people will use alternative routes or they take another transport mode this is also dependent on the purpose of cycling.

Stinson & Bhat (2005) argue that traffic safety is less important for experienced cyclist than for inexperienced cyclists. This has to do with their experience of cycling and how they perceive safety. Within the inexperienced group are younger (< 24 years) people and older people (> 54 years) involved, while the experienced cyclist are middle aged. Within the Netherlands the oldest group will also be more experienced due to the influences of the cycling culture, but the youngest group is the most inexperienced group because of the age.

Another aspect according to Pelzer (2010), who argues that the experience of safety has fewer influences in cycle use in the Netherlands compared with other countries due to the high safety standards of the infrastructure. He found a difference in perception of safety for commuting purposes. Safety seems to be more important when the distance is longer than 5 kilometers (20-25 minutes) but the reason why safety is less important for commute trips under 5 kilometers is not clear. This could be because a commuter is very familiar with the route they take. In addition to this, the chance of their safety being jeopardized over a short time is naturally smaller than a trip in excess of 20 minutes. Pucher et al (2010) argue that due to increasing bicycle share the safety level will improve too because other traffic is more used to cyclists.

2.7 Final remarks theoretical framework

This paragraph shows the most important findings of the theoretical framework, which is used for the conceptual model and operationalization in the next chapter. This chapter led to answers on the following research questions.

What is bicycle culture and which factors play, to which extent, a role in bicycle use and experience? How do cyclists value the environment they are cycling through and which emotions appear during a bicycle journey?

Cycling in the Netherlands is often seen as a habit, the long history of bicycle use by almost everyone within society, the availability of cycling infrastructure and related facilities make it for scientist difficult to estimate the influences and meaning of bicycle behavior in the Netherlands. The influences and impact of the Dutch bicycle culture is better to understand in comparison with researches from other countries where cycling is not seen as a habit. This made clear that different variables are important for bicycle use and experience.

Bicycle culture as described by Pelzer (2010), shows that bicycle use and experience are influenced by different environments. The interaction between this environments is dynamic and make cycling possible. Some environments cannot be direct experienced during cycling, like for example the socio-cultural and the institutional environment. Other scientist showed that there are other variables that have influences which are direct experienced during a cycling journey (Heinen et al, 2010; Titze et al, 2008; Rietveld & Daniel, 2004; Olde Kalter 2007; Van Twuijver et al, 2006). The combination of this, led, for this research, to the definition of four different influencing factors which have a direct influence on bicycle experience. The defined factors within this research are the natural

environment, the built environment, the personal & household characteristics and the trip characteristics.

This different influencing factors consists of different variables which influence the experience of cycling. Most literature is focused on bicycle use but this is closely connected with bicycle experience. In fact, the experience of cycling is a result of bicycle use which is intertwined whit experience. For example, natural environment conditions (weather and natural landscape) have an influence on bicycle use and are at the same time part of the experience (Böcker et al 2013; Titze et al, 2008). This makes it difficult to make an absolute distinction between bicycle use and bicycle experience. According to Harms et al (2007) is cycling more positive experienced by cyclists who use the bike more often.

Most influenced and experienced during cycling are different safety aspects which are experienced in different ways. Within this research two different aspects where safety is part of is focused on. Experience of cycling is the interaction of, and the interaction with the environment (Pelzer, 2012). Therefore the first aspect is the experience of place (place perception) where value judgments about the aesthetics of the environment result in the amount experienced personal safety and traffic safety (Pikora et al, 2003). This experience of different spatial elements is based on experiences from the past (Buijs & van Kralingen, 2003).

The other part of the experience is focused on emotions that appear during a bicycle journey. A combination of the five different basic emotions values the experience of subjective safety (Harms et al, 2007; Heinen et al, 2010). This part of the experience (experience of journey) is place and time dependent.

3 Research design

In this chapter the research design is outlined to provide an overview of the used methods, data selection and to delimit the empirical research. First the conceptual model is provided to show the relations between the different influencing factors and the influence on the dependent variables experience of place and experience of journey. Than the research area is further outlined to introduce some specific place-based aspects that can have influence on the experience of cycling as well. Paragraph 3 provides all technical and background information about the collected and the selected data so the research will be delineated. The third and fourth paragraph provide the operationalization of the different dependent and independent variables used within the empirical research. The final paragraph provides an explanation about the used statistical methods and shows which steps are taken to get desired results provided in chapter 4.

3.1 Conceptual model

Within the theoretical framework is discussed that the environments which are part of the bicycle culture according to Pelzer (2010) have influence on bicycle experience and bicycle use. From these environments, different influencing factors are derived that have a direct influence on bicycle experience. These factors are the natural environment, the built environment, personal & household characteristics and trip characteristics. These factors consist out of a collection of different theme related independent variables which are operationalized within paragraph 3.5.

The theoretical research showed that in practice the different influencing factors have influence on each other too, which is related to the bicycle culture which is country and place specific. In this research the influences of these factors on the experience of cycling is investigated. The goal of this conceptual model (Figure 3.1) is to provide a simplified representation of the this study. Within this model is assumed that the four independent factors have influences on the experience of cycling. In the empirical research is investigated which variables out of the different factors are the most important by providing two different analysis for place perception (experience of place) and the experience of journey.

The dependent variables, experience of place and experience of journey, are based on the idea that; people have perceptions and forthcoming experiences of the environment which can be measured, even as personal preferences that valuing the environment (Buijs and van Kralingen, 2003). These are the experience from the intensity of, and the interaction with, the environment (Pelzer, 2012). Experience of place measures value judgments about the intensity of the environment. Experience of journey is associated with the interaction with the environment expressed by emotions that appear during a bicycle trip. These dependent variables are further operationalized within paragraph 3.4.

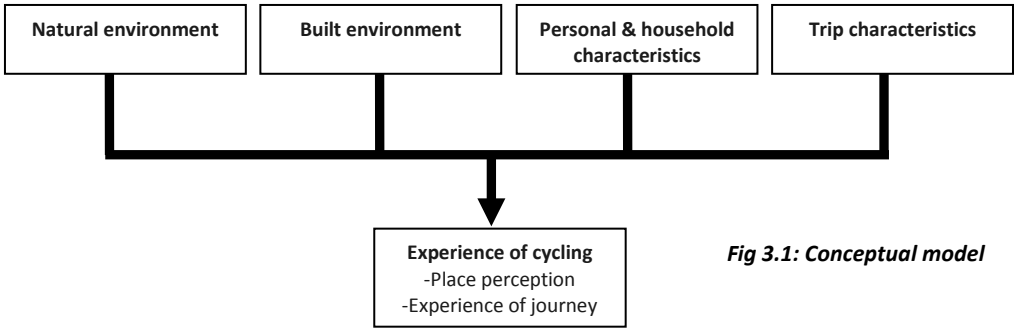


Fig 3.1: Conceptual model

3.2 Research area

The research objects for this thesis are as argued before cycling journeys in the Rotterdam city area. Van Acker et al (2010) argued that bicycle use is country specific and that therefore the context of the place have to be kept in mind when doing research. Within countries place-based differences are also important therefore some specific aspects about the different influencing factors of the Rotterdam city region are described in this paragraph. These place-based aspects make the Rotterdam City region an interesting area for doing this research because it is a diverse area with some specific aspects which might have an influence in the experience of place or the experience of journey.

The Rotterdam City region counts 15 municipalities in the surrounding of Rotterdam. These municipalities are situated in the south-western part of the province Zuid-Holland at the shores of the Nieuwe Waterweg around the Rotterdam seaport (Fig 3.2). Together these 15 municipalities have more than 1,2 million inhabitants (Table 3.1) which means that this is one of the biggest urban regions of the Netherlands. The spatial area is around 540 square kilometers (Stadsregio Rotterdam, 2014 II).

Because the Rotterdam City region is situated along the west coast of the Netherlands, the area has got a mild sea climate. Temperatures in winter on average have a minimum between -3 ˚C and an average maximum of 6 ˚C while the average temperature is 1 ˚C. In summer the minimum average temperature is around 12 ˚C with a maximum average of 21 ˚C. The amount of precipitation is almost even disturbed during the year. Due to the geographical location the city region has got different influences of the wind, mostly out of sea. These different wind influences have also to do with the urban form of the built environment. High-rise towers like within the city center of Rotterdam and the open fields in the country side for example, have influences on wind speeds and the way how it can be experienced. These are the place-based effects of weather on cycling and are related with different urban residential areas (Helbich et al, 2014).

Within the Rotterdam city area there are four different types of living areas; inner-city, outer-center, green/suburban and rural (Fig 3.2) (Böcker & Thorsson, in press). An inner-city area is for example the city center of Rotterdam with high-rise buildings. Rotterdam-Zuid is an outer-center area. Examples of the green/suburban areas are the municipalities of Alblasserwaard, Barendrecht and Ridderkerk, south of Rotterdam. Eventually rural areas are the municipalities of Westvoorne, Brielle and Bernisse, southwest of Rotterdam. These built environment factors might have other place-based influences than shown within the research of Helbich et al (2014).

Fig 3.2: Rotterdam city region (Böcker & Thorsson, in press.)

The final specific aspect within the Rotterdam city region is about the presence of ethnic minorities and the relation with the low bicycle share. Within the Rotterdam City region 19% of all journeys is a bicycle journey which is low compared with the Dutch average of 27% (Fietsberaad, 2010). As argued in chapter two the influence of the social-cultural environment have got influences on personal and household characteristics which have influences on bicycle use and thus experience of place during cycling and the experience of journey. Within the Rotterdam City region live around 434.163 ethnic minorities which is 36% of the total inhabitants. Most of the immigrants live in the municipality of Rotterdam where 297.825 (48%) of the people are immigrants. According to the municipality of Rotterdam (2007) this group makes little or no use of the bicycle. One in five immigrants admitted in a survey that they are not able to use a bike, because they cannot cycle, or they are not used to cycle within the busy traffic. Most of the immigrants use public transport or go walking instead. This is an example of the municipality of Rotterdam, but, because the population of Rotterdam shares for more than 50% (Table 3.1) within the entire region, this is a factor to take care of and plays a role within the whole region. This is not just because of this specific example but also according to Fiets beraad (2010) that ethnic minorities in general cycle less than native people.

Municipality	Inhabitants per 1 Jan 2012	Immigrants Total	Percentage cycling journeys*
Alblaserwaard	25.003	4.432	20%
Barendrecht	47.053	9.689	16%
Bernisse	12.426	1.033	22%
Brielle	16.072	1.949	16%
Capelle aan de Ijssel	66.122	20.774	19%
Hellevoetsluis	39.442	6.951	18%
Krimpen aan de Ijssel	28.692	3.646	17%
Lansingerland	55.265	8.201	22%
Maassluis	31.849	7.830	21%
Ridderkerk	45.208	3.503	19%
Rotterdam	616.260	297.825	14%
Schiedam	76.244	27.573	19%
Spijkenisse	72.171	16.941	18%
Vlaardingen	71.042	18.882	22%
Westvoorne	13.901	1.383	17%
Total	1.216.750	434.163	19%

(CBS,2014; *Fietsberaad 2010)

Table 3.1: Inhabitants, immigrants and bicycle share per municipality

3.3 Data collection

The relevant data for this research is selected from a large and detailed dataset of existing research on travel behavior and the influence of the weather. The study is called; Research on travel behavior and weather in the Rotterdam city region (UU et al, 2013), and has resulted in a diverse and detailed dataset consisting out of five different parts.

Part one is a basic survey in which general questions were asked to see if the respondents were able to meet the participation requirements. This resulted in the second part of the survey, with data about the personal and household characteristics of the respondents in the urban region that participated. The research sample existed out of 1953 citizens of the Rotterdam City Region from 15 years and older. Within the sample there was an oversampling of non-native Dutch people and older people (65+)(UU et al, 2013). This is done because of the generally lower response rate of these groups (Adler et al., 2002). The first two parts of the sample have resulted in data about the personal and household characteristics of the respondents.

The third part of the dataset is the travel diary and is the most important part of the data for this research. A travel diary is used to get more detailed information, compared with other methods, about travel behavior for specific trips people make and is very common in travel behavior research (Kenyon, 2006). There are different forms of travel diaries, for this purpose people had to answer questions for three times two days in the period August 2012 till February 2013 about the kind of trip, the purpose of the trip, the weather during the trip, the used transport mode(s) and how people experienced the trip. The days of the reported trips are randomly selected because every respondent became an email when to submit a travel diary for which days. In the end this resulted in a responds of 950 completed travel diaries about more than 15.000 trips with different forms of transportation. For this research the bike trips are selected, data of 3032 trips are available. Because the travel diary is detailed there could be made a selection of variables that are relevant for the dependent factors experience of journey, and experience of the place.

The fourth part of the selected variables are the natural environment variables. Within the dataset no variables are available of the natural landscape, but different weather variables are available. This is because the original research was focused on weather influences on travel patterns. The weather data was collected by the Dutch Meteorological Institute (KNMI) and are variables about the weather circumstances during every hour of the day in the period August 2012 till February 2013.

Last part of the data are the built environment variables. These data is available for the residential locations of the respondents and for almost all journeys and is collected by the Utrecht University. The variables consisting of data about the land use mix like for example data about the residential environments of the people, the diversity of buildings, density of addresses and green percentage along the routes that people cycled. This data collection resulted in a database of 2815 cases for this research.

3.4 Data operationalization dependent variables

Within this research, is based on Pelzer (2010; 2012), chosen to focus experience of cycling on two dependent variables, experience of place and experience of journey. Experience of place is the place perception of a cyclist based on value judgments of the place which have an influence (Pikora et al, 2003; Titze et al , 2008). Experience of journey is focused on the total experience of a trip whereby according to Harms (2007) and Levelt (2003) emotions appear during cycling which have an influence. Within the original dataset 12 variables are available (Appendix 1) which are associated with place perception and experience of journey. It was needed to merge different variables together to generate two dependent variables. Within this paragraph is discussed how the variables are merged together and how these variables are operationalized.

3.4.1 Factor analysis and reliability analyses

Within the travel diary respondents was asked if they could give an opinion about six place perception items and six items about emotions and moods that appear during a bicycle journey (Appendix 1). These items resulted in 12 variables that are all ratio scale variables with a Likert-scale value between 1 and 5. Before variables could merged together it was needed to rescale some variables in the way that value 1 is the most negative value judgment or emotion and value is 5 is the most positive value judgment or emotion.

After rescaling became clear that it was not possible to count the variables simply together because for some place perception variables it was not clear if they could be interpret as a positive or negative impact so they could not be used. The literature study gave an indication which kind of variables could be included in the variable experience of place. In other, similar researches about experience of cycling the same kind variables are used. Like for example in the research of Titze et al (2008) and Pikora et al (2003). Same counts for variables about emotions, the selected variables are emotions that are, according to Harms et al (2007 P.32), derived from the 5 basic emotions. The variables about moods are not used because moods are mental states and have influence on emotions.

The next step was performing a factor- and reliability analyses (Appendix 2, 2A & 2B). This was needed to find if the different Likert-scale variables that merge together to one variable will not lose too much strength of data (Field, 2013). According to SPSS Wizard (2014), SPSS finds factors on basis of correlations and when the correlations are high they can put together within the same factor. The results of the factor and reliability analysis showed that the new factors in this case, the independent variables experience of place and experience of journey did not miss too much strength of data. Both new constructed variables consisting out of 4 different original variables. Because it is easier to interpret the outcomes of statistical models, within the factor analysis it is chosen to count the variables together and use the average value within the new variables. Therefore, the variables experience of place and experience of journey have an average from 4 different values between 1 and 5.

3.4.1 Experience of place

Table 3.2 shows the used variables out of the travel diary which are used to create the variable experience of place. The table shows which variables are converted in respect to the original data so that no negative value judgments and positive value judgments are counted together within the place perception variable.

Variable	Description	Scale	Values
Greenness	Valuing experience of greenness of the environment.	Ratio	1= Very less green 2= Less green 3= Not less/not much green 4= Much Green 5= Very much green
Exposure	Valuing experience of the exposure of the environment.	Ratio	1= Very sheltered 2= Sheltered 3= Not sheltered/not open 4= Open 5= Very open
Aesthetics	Valuing experience of the aesthetics of the environment.	Ratio	1= Very ugly* 2= Ugly* 3= Not pretty/not ugly* 4= Pretty* 5= Very pretty*
Liveliness	Valuing experience of the liveliness of the environment.	Ratio	1= Very monotonous* 2= Monotonous* 3= Not lively/not monotonous* 4= Lively* 5= Very lively*

(*Converted values)

Table 3.2: Value judgments

The variable experience of place (table 3.3) is a dependent variable on ratio scale that measures an average value of the 4 different variables. How higher the value how more positive the place is experienced during a cycling journey. According to Pikora et al (2003) has place perception associations with the experience of personal safety and traffic safety. Personal safety is about experiences of a pleasant, livable built environment. Traffic safety is about experience of the safety features of the infrastructure, the traffic volume, kind of traffic and the speed. The value judgment is based on the experiences from the past, personal preferences, appreciation and social construction (Buijs & van Kralingen, 2003).

Variable	Description	Scale	Values
Experience of place	Valuing experience of place during cycling.	Ratio	Number between 1 and 5

Table 3.3: Dependent variable; Experience of place

3.4.2 Experience of journey

Experience of journey is a combination of the ratio variables happiness, calmness, satisfied and fearless. These variables are emotions that people experienced during their cycling journeys. Table 3.4 shows which variable names and values are converted in respect to the original data (Appendix 1) so that no negative emotions and positive emotions are counted together within the variable experience of journey.

Variable	Description	Scale	Values
Happiness	Experienced emotions during cycling	Ratio	1= Very sad 2= Sad 3= Not sad/Not happy 4= Happy 5= Very happy
Fearless**	Experienced emotions during cycling	Ratio	1= Much fear 2= Fear 3= No fear/Not fearless 4= Fearless 5= Much fearless
Satisfied**	Experienced emotions during cycling	Ratio	1= Very irritated* 2= Irritated* 3= Not satisfied/Not irritated* 4= Satisfied* 5= Very satisfied*
Calmness	Experienced emotions during cycling	Ratio	1= Very restless* 2= Restless* 3= Not calm/Not restless* 4= Calm* 5= Very calm*

*Converted values **Converted variable name

Table 3.4: Emotions

Levelt (2003) argues that the way how people experience a bicycle journey is a combination of good and bad emotions and this will measure or indicate the experience of peoples comfort and safety. Experience of comfort and safety is one of the most important experiences during a cycling journey and an argument to go cycling. According to Heinen et al (2010) comfort and safety in this case is the subjective safety of a cyclist which is personal, time and place depended. The dependent variable experience of journey is measured on ratio scale (Table 3.5). The value of the variable is an average value between 1 and 5. How higher the experience of journey is valued how more comfort and safety, or in other words subjective safety, is experienced during a bicycle journey.

Variable	Description	Scale	Values
Experience of journey	Experience of comfort and safety during a cycling journey	Ratio	Number between 1 and 5

Table 3.5: Dependent variable; Experience of journey

3.5 Data operationalization independent variables

The four different influencing factors consist out of different independent variables. These variables have according to the literature effects for bicycle experience. Within this paragraph the selected variables are operationalized per influencing factor.

3.5.1 Natural environment

To measure the influences of the natural environment the available variables within the dataset are the weather influences. The most important weather variables according to the literature are the wind speed, temperature and amount of precipitation. The weather variables are measured as an average per hour (Table 3.6). Because cycling trips are most of the time less than one hour and the weather circumstances can be different every minute this is the reason to choose for the most detailed available data about the weather during a cycling journey. Using this method, the weather during every trip can be measured in the most accurate way.

Variable	Description	Scale	Values
Temperature hourly	Average temperature in °C per hour	Interval	Temperature in °C
Wind speed hourly	Average wind speed in meter/sec per hour	Ratio	Wind speed in meter/sec
Precipitation hourly	Average precipitation in mm/sec per hour	Ratio	Precipitation in mm/sec

Table 3.6: Weather variables

3.5.2 Built environment

For the built environment four different variables are available (Table 3.7) to measure diversity, density and design according Ewing (2005). The first variable is the variable residential environment also used in other mobility studies in the Rotterdam City Region (Böcker & Thorsson, in press; Helbich et al, 2014). With this variable, place-based differences can be indicated. It can be measured if cyclists living in different residential environments experience place perception and the experience of journey different. Within the statistical models dichotomous dummy variables are used whereby rural-area is reference category for the residential environments inner-city, outer-center and green-suburban.

To measure the density of how many households live in proximity of each other along a cycling route the address density is used. The urban design is measured by the building diversity and the quality of the public space is measured by the green percentage along the route. Within the research of Titze et al (2008) and Pikora et al (2003) also variables about the land-use mix like the green percentage, building diversity and address density along the route are used. Within these studies these variables where important for bicycle experience.

Variable	Description	Scale	Values
Residential environment	Living area respondent	Nominal	0= Rural (ref) 1= Inner-city 2= Outer-center 3= Green-suburban
Green percentage	% green in a buffer of 200 meters along the route.	Ratio	%
Address density	Amount of addresses in a buffer of 200 meters along the route.	Ratio	Number
Building diversity	Building diversity index (Shannon) in a buffer of 200 meters along the route.	Ratio	Index

Table 3.7: Built environment variables

The data for green percentage, address density and building diversity is measured within a buffer from 200 by 200 meters around the route. An bicycle journey has an average value for this variables. The green percentage is the sum of the average percentage green around the route within the buffer. Address density measures the average amount of addresses within the buffer along the route. Building diversity is measured with the Shannon diversity index and measures an average index value for the entire route within the buffer.

The Shannon diversity index is often used to measure biodiversity of an area. In this research the Shannon diversity index measures the amount of buildings with a different function within an area, in this case within an area of 200 by 200 meters along the route. From the collected data an index value is made by the formula of Shannon (Dier en natuur, 2014; Kuosmanen, 2010). When the index value is 0,0 than it indicates that there is no diversity of buildings along the route.

3.5.3 Personal and household characteristics

The personal and household characteristics (Table 3.8) describe which kind of person someone is. Age, gender, household income, education and ethnicity are associated with the background of a person and the household. Household income and education level are categorical variables. Within the statistical models dichotomous dummy variables are used for every category, therefore reference categories are selected. For household income the category ≤ €2000,- is reference category and for education the lower education level. As shown within the theoretical framework these variables matters in how someone experiences cycling. Within the Rotterdam city area ethnicity can play an important role as well because of the low cycling share within the Rotterdam City Region (Fietsberaad, 2010). The variables are selected from the database of the survey. In almost every transportation research personal and household characteristics are seen as a factor with important influencing variables (Heinen, 2010).

Variable	Description	Scale	Values
Gender	Gender of the respondent	Nominal (Dichotomous)	0= Female (Reference category) 1= Male
Age	Age (years) of the respondent	Ratio	Current age
Ethnicity	Ethnic group of the respondent	Nominal (Dichotomous)	0= Native Dutch (Reference category) 1= Nonwestern
Household Income	Net household income per month in Euro's	Ordinal	99= ≤ €2000,- (Reference category) 2= >€2000 ,- - ≤€3000,- 3= > €3000,- - ≤€4000,- 4= >€4000,- 9= Unknown
Education	Education level of the respondent	Ordinal	99= Lower (Reference category) 0= Middle 1= Higher 9= Unknown

Table 3.8: Personal and household variables

3.5.4 Trip characteristics

The trip characteristics (Table 3.9) are based on how and why one travels, the used variables are selected from the travel diary. Within this factor a couple of variables are important to understand how someone experiences cycling. The first variable is the travel time, travel time is more important than distance, because people measure a journey in time and will make a choice in travel mode based on the travel time. It is impossible to put both variables within a model because travel time and travel distance have too much influence on each other (Pelzer, 2010).

The second variable is travel motive which is important because the experience of cycling can be different per purpose. The variable available within the dataset is trip motive with four different purposes: leisure trips, commuting to work or study, errands and social visits. These categories are also used by the municipality of Rotterdam (2007). Within the statistical models leisure is the reference category for the dichotomous dummy variables work/study, errands and social visits.

Variable	Description	Scale	Values
Travel time	Travel time in minutes	Ratio	Travel time in minutes
Trip purpose	Purpose of the journey	Nominal	1= Work/study (Commuting) 2= Errands (Incl. grocery shopping & picking up persons) 3= Social visits 4= Leisure (Incl. fun shopping) (Reference category)

Table 3.9: Trip characteristic variables

3.6 Methodes

Within this research is made use of descriptive statistics with visual presentations and some advanced statistical methods. The descriptive statistics are used to show how different variables within the different factors are in general valued for place perception and experience of journey. These descriptive statistics are used to support the results of the advanced statistical tests and to get a first impression about the variables. Therefore is chosen to look at every independent variable.

For the advanced statistical methods within this empirical research the influences of different independent variables on the dependent variables experience of place and experience of journey is tested. Because the dependent variables are on ratio scale and the different independent variables are on an interval-, ratio- or nominal dichotomous scale, two multiple linear regression models will be performed for the statistical analysis. In this case the standard method within the computer program SPSS is used which means that all independent variables are put in once within the multiple linear regression model. Therefore, all variables will be taken into account in the outcome of the model and shows which variables are significant and which not.

The reason to choose for the standard method is that according to Field (2013) and Vocht (2009; 2011) different dichotomous dummy variables are together one categorical variable. It is needed that all outcomes from these variables, although they are not significant, are visible within the outcome of the multiple linear regression model. Another reason is that both multiple linear regression models make use of the same independent variables. In this way it is visible for both models which variables are significant and which are not and what are the different influences of the variables between both models.

The first multiple linear regression model (Figure 3.3) measures the relation: Influences of the natural environment, built environment, personal and household characteristics and trip characteristics from cyclists on the place perception during a cycling trip. This multiple regression model has to give answers on the research question;

To which extend do factors related to bicycle culture influence value judgments about the place during cycling and which variables are significant?

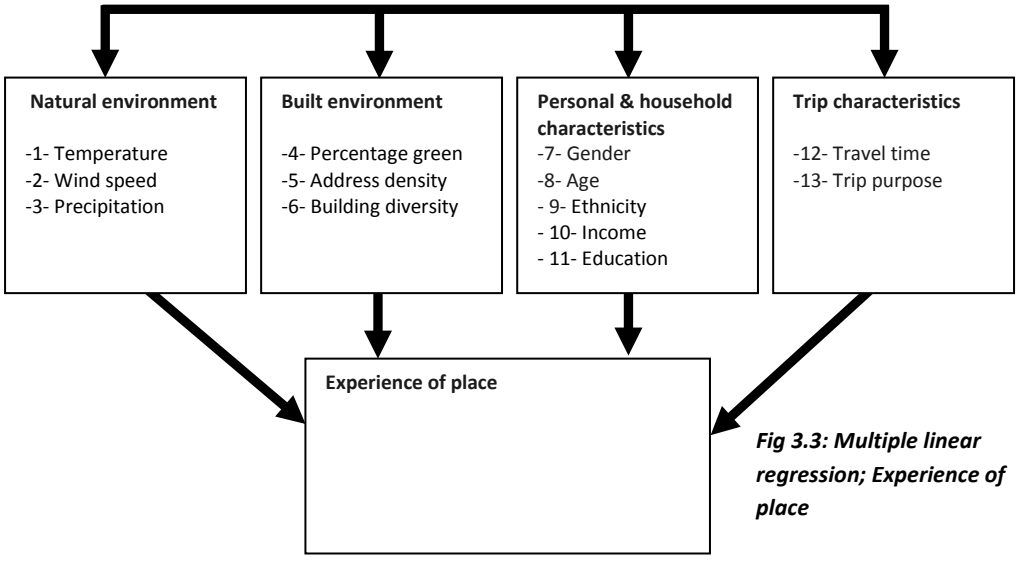


Fig 3.3: Multiple linear regression; Experience of place

The second multiple linear regression (Figure 3.4) measures the relation: Influences of the natural environment, built environment, personal and household characteristics and trip characteristics from cyclists on the experience of comfort and safety during a cycling journey. This multiple linear regression model has to give answers on the research question;

To which extend do factors related to bicycle culture influence emotions which appear during a cycling journey and which variables are significant?

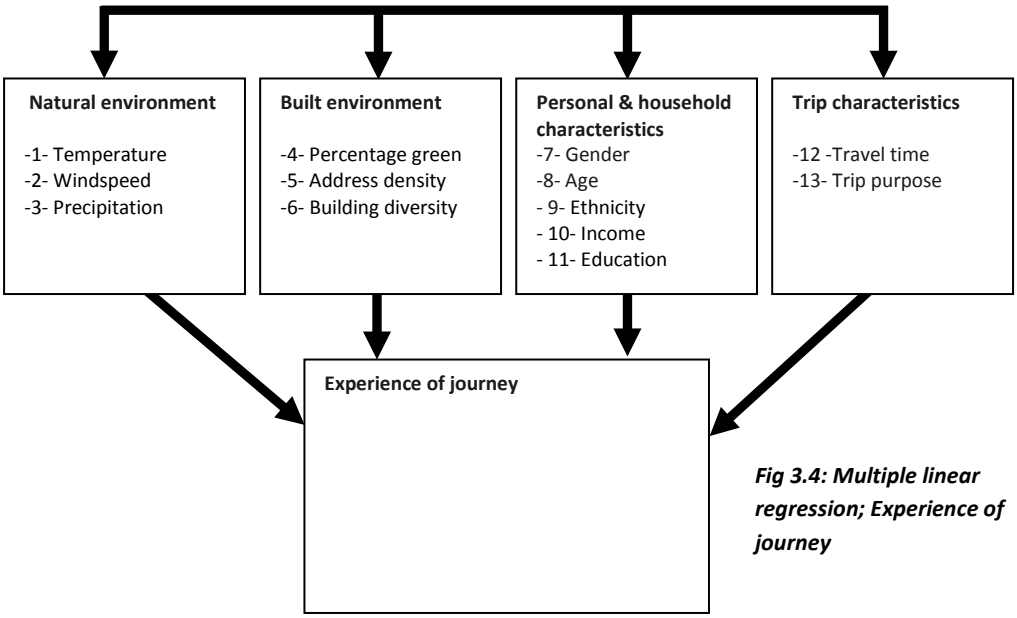


Fig 3.4: Multiple linear regression; Experience of journey

4. Statistical analysis

Within this chapter the results of the statistical analysis are discussed and compared with other scientific studies as found within the theoretical framework. First the sample composition shows the general characteristics of the research. Than the descriptive analysis show a general impression of the different independent variables in relation with the dependent variables experience of place and experience of journey. Finally, the multiple linear regressions show the statistical links and which variables are significant and which factors play the most important role, argued by literature and the descriptive statistics.

4.1 Sample composition

The sample of this research consists of 2815 cycling trips, which is 20% of the total amount of trips from the complete research sample about different transport modes. This is similar to the data of Fietsberaad (2010) for the Rotterdam city region (paragraph 3.2) which shows that 19% of the total trips is a cycling journey. The cycling trips are driven with an average temperature of 13,7°C, an average wind speed of 3,2 meter per second and with an average amount of precipitation of 0,6 mm per second. Within the sample there is an almost even distribution of people who live within an inner-city area, outer-center area, green/suburban or a rural area. The percentage of green along the cycling routes have an average of 14% per 40.000 square meters. The address density shows an average of 42,6 addresses per 40.000 square meters where the average building diversity index is 0,32 per 40.000 square meters. 40% of the cycling journeys is driven by male, 60% by female and with an average age of 47 years. The youngest person who cycled is 18 years the oldest 82. 93,5% of the cycling journeys are driven by native Dutch people. Most of the people have a household income between 0 and 3000 euro's per month and a middle education level. 40% of the trips is done for doing errands and the average travel time is 17,5 minutes.

Variable	Characteristics		Variable	Characteristics	
Air temperature In °C, in sum per hour	Mean St. Dev Lowest Highest	13,7 8,314 -11,1 33,1	**Gender**	Male Female	40% 60%
Wind speed In meter per second, in sum per hour	Mean St. Dev Lowest Highest	3,2 1,556 0,3 11,0	**Age**	Mean St. dev Lowest Highest	47 15,204 18 82
Precipitation In mm per hour, in sum per hour	Mean St. Dev Lowest Highest	0,6 0,254 0,0 3,7	**Ethnicity**	Native Dutch Non western	93,5% 6,5%
Residential location	Inner-City Outer-center Green/suburban Rural	25% 27% 23% 25%	**Household Income** Per month	< €2000,- €2000,- - €3000,- €3000,- - €4000,- > €4000,- Unknown	32% 26% 18% 8% 16%
Green percentage (buffer 200m) Sum of % green within 200 by 200 meters along the route.	Mean St. Dev Lowest Highest	14,0 18,637 0,0 98,1	**Education**	Low Middle High Unknown	24% 41% 34% 1%
Address density (buffer 200m) Amount of addresses within 200 by 200 meters along the route. N=2825	Mean St. Dev Lowest Highest	42,6 29,576 0,0 158,9	**Trip purpose**	Work/Study Errands Social visits Leisure	22% 40% 11% 27%
Building diversity (buffer 200m) Shannon index of buildings within 200 by 200 meters along the route.	Mean St. Dev Lowest Highest	0,32 0,226 0,00 1,26	**Travel time** In minutes	Mean St. Dev Lowest Highest	17,5 24,045 0,0 520,0

Table 4.1: Sample composition N=2815

4.2 Descriptive statistics experience of place

The dependent variable experience of place measures a value judgment about place perception during a bicycle journey. 1,25 is the most negative value judgment and 5,00 the most positive (Table 4.2). The mean value is 3,21 the median is 3,25. Because the values are based on an average of 4 different variables with a Likert-scale value between 1 and 5 is chosen to use the median as divide between two classes within this analysis. The category <3,25 consist out 1374 cases which means that 48,8% of the bicycle journeys are experienced as predominantly negative for place perception. For the other category >3,25, 51,2% (1441 cases) the place perception during cycling journeys is experienced as positive. This paragraph shows for every independent variable per influencing factor how the experienced personal safety and traffic safety (Pikora, 2003) of a bicycle journey is valued. This analysis is done to get an impression about the value judgments for different variables in relation with experience of place.

Experience of place N=2815	
Characteristics	**Values**
Mean	3,21
Median	3,25
St. Dev	,58
Min	1,25
Max	5,00

Table 4.2: Variable characteristics

4.2.1 Natural environment

Higher temperatures lead to a higher valuation of place perception (Fig: 4.1). From the bicycle journeys cycled with temperatures below 0°C, 66,3% is experienced as predominantly negative. When the temperature rises the place perception for less cycling journeys is experienced predominantly negative. Above 25°C, 43,7% of the trips is experienced as predominantly negative for place perception, which is little higher than within the category > 15°C-≤ 25°C (41,7%).

The wind speed (Fig: 4.2) indicates that it has a negative influence for place perception above 5 Beaufort (>8,0 m/s (Windfinder, 2014)). Because just 0,9% of the bicycle journeys is driven with wind speeds above 5 Beaufort and is valued by 60% of the cases as predominantly negative it gives an indication that wind speed has influence on cycling use and to less extend on place perception. Wind speeds till 2 Beaufort (3,3m/s) and till 4 Beaufort (7,9m/s) show almost the same amount of positive and predominantly negative valuations for place perception.

The amount of precipitation indicates (Fig: 4.3) that trips with an amount of precipitation of more than 0,5 millimeter per hour have a much lower place perception than with less precipitation, 67% of the trips is experienced as predominantly negative.

Like with the wind speed, also with an high amount of precipitation cycling use decreases. When the precipitation level is higher than 0,5 mm per hour 3,7% of the people use the bike. This indicates in general that weather influences have influences on bicycle use and to a less extend on place perception, this relation is stronger for precipitation and wind speed than for temperature. This has also to do with the frequency which temperatures below 0°C and 25°C degrees as well as extreme wind speeds and larger amounts of precipitation appear.

Fig: 4.1 Valuation temperature

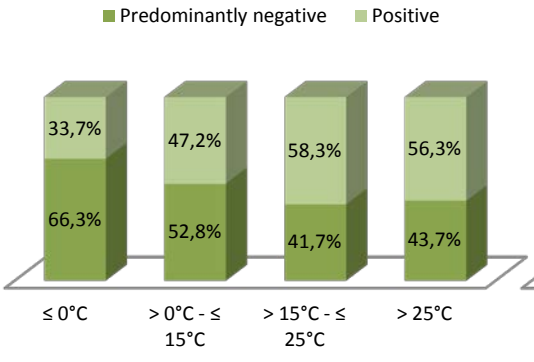


Fig: 4.2 Valuation wind speed

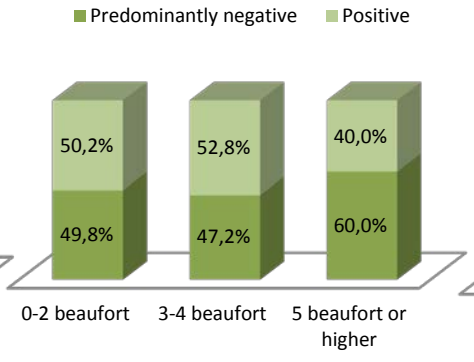
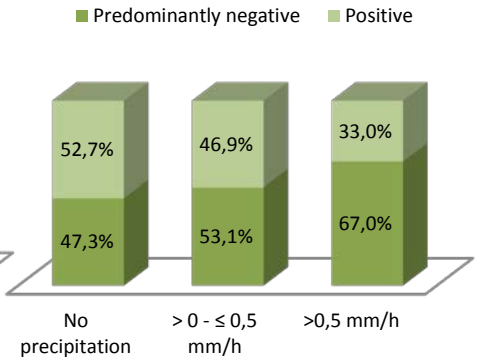


Fig: 4.3 Valuation precipitation



4.2.2 Built environment

Within the built environment there are different places of residence, the residential environment (Fig 4.4) has influence on the valuing judgment for experience of place. 59,3% of the cycling trips started in the inner-city are experienced as predominantly negative. For the other residential environments it becomes clear that cycling journeys started within these environments are experienced much more positively. Trips started within rural environments are for 56,9% experienced as positive which is the most positive valued category.

The green percentage (Fig: 4.5) shows a more positive value judgment for experience of place when the percentage green per 40.000m² is higher. 60,8% of the trips with an average green percentage of more than 20% per 40.000m² show a positive valuation. Where 52,7% of the trips with 10% or less green per 40.000 m² is valued predominantly negative.

Fig: 4.4 Valuation residential environment

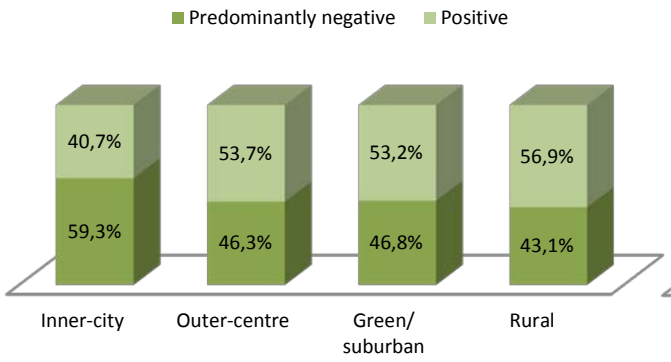
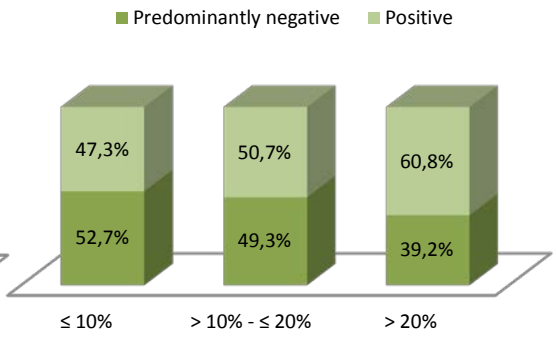


Fig: 4.5 Valuation green percentage



The address density (Fig: 4.6) and the building diversity (Fig 4.7) indicate that how denser and more diverse the built environment how more negative the experience of place is valued. During 60,8% of the trips with a building diversity from below 0,2 per 40.000m² the place perception is valued as positive, while for an diversity index above 0,4 per 40.000m², 43,3% of the trips are experienced as predominantly negative. The same counts for the address density where 57,7% of the trips is valued positive for the category below 30 addresses per 40.000 m² and 39,7% as positive within the category more than 60 addresses per 40.000 m².

Fig: 4.6 Valuation adress density

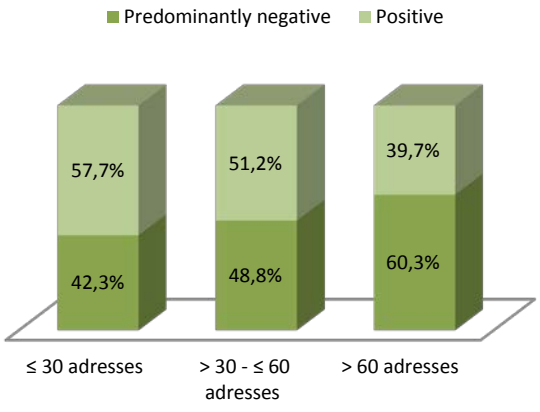
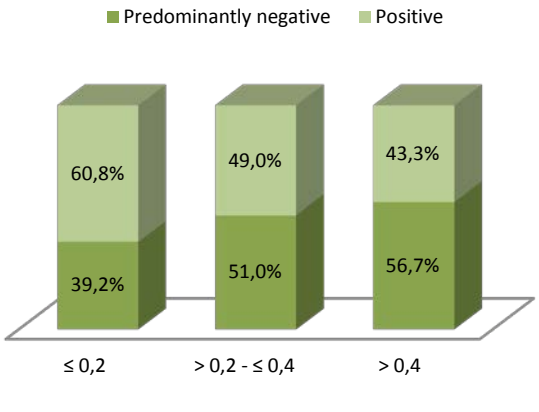


Fig: 4.7 Valuation building diversity



4.2.3 Personal & Household characteristics

The variable age shows that (Fig: 4.8) how younger a cyclist how more negative the place perception is perceived. Whereas in 54,6% of the trips done by people above 65 years place perception is perceived as positive, this percentage is 40,6% for the youngest group (<22 years).

Differences exist between gender, males (54,5%) perceive place perception more positive than females (49%) (Fig: 4.9). Looking to ethnicity (Fig: 4.10) it becomes clear that native Dutch have a slightly more positive place perception (51,4% versus 47,8%) than non-western ethnicities.

Fig: 4.8 Valuation age

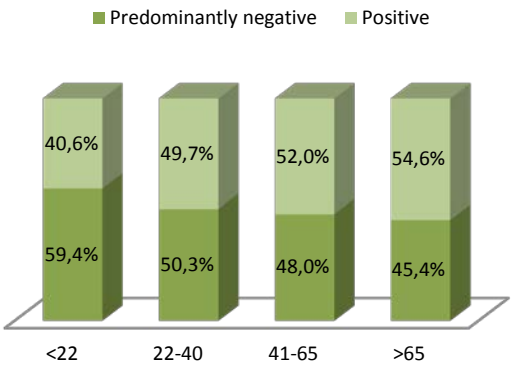


Fig: 4.9 Valuation gender

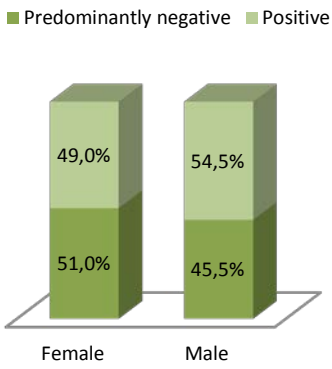
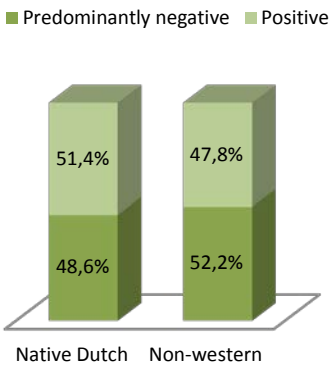


Fig: 4.10 Valuation ethnicity



The education level (Fig: 4.11) shows a relatively even distribution between negative and positive place perception. The unknown category is just about 1% of the trips so this can be disregarded. The differences between household income (Fig: 4.12) are slightly different for every class. How more income how more positive the place perception except for the highest income group. The income group above €4000,- has for 46,9% of the trips a positive place perception while the other income categories experience respectively 49,2%, 52,2% and 56,4% from the trips as a positive place perception.

Fig: 4.11 Valuation education

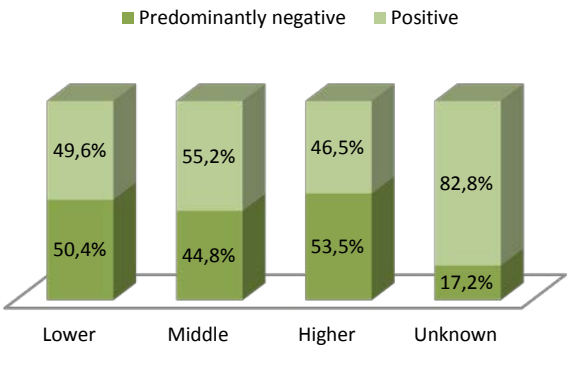
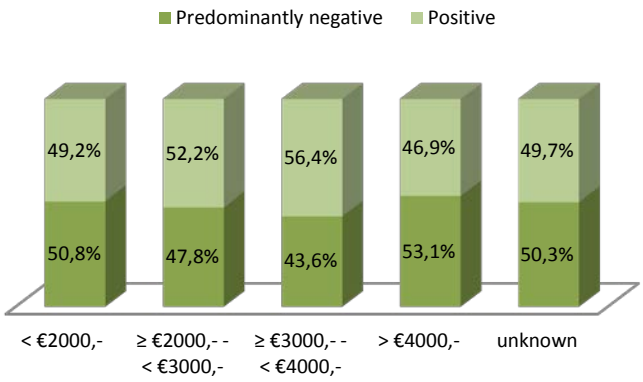


Fig: 4.12 Valuation household income



4.2.4 Trip characteristics

The value judgments for trip motives (Fig: 4.13) on experience of place are that for leisure, place perception is experienced for 59,3% of the trips as positive. Place perception is for commuting to work and study experienced as the most negative compared with the other trip motives. 53,7% of the trips are experienced as predominantly negative. For doing errands and social visits the experience of place is almost the same with respectively 49.1% and 49,2% of the journeys experienced as positive.

For the variable travel time (Fig: 4.14) it means that how longer a trip how more positive place perception during these trips is valued. By short trips below 10 minutes 48,2% of the trips is valued as positive. While for trips longer than 45 minutes 59,5% of the trips are experienced as positive.

Fig: 4.13 Valuation trip motive

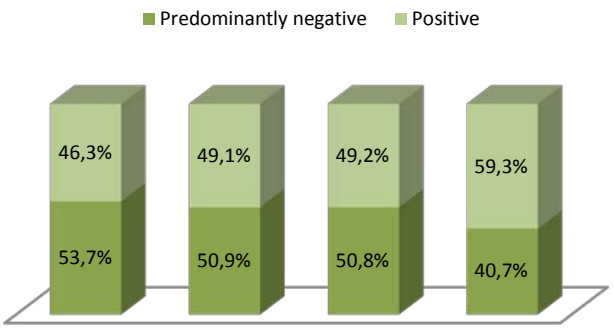
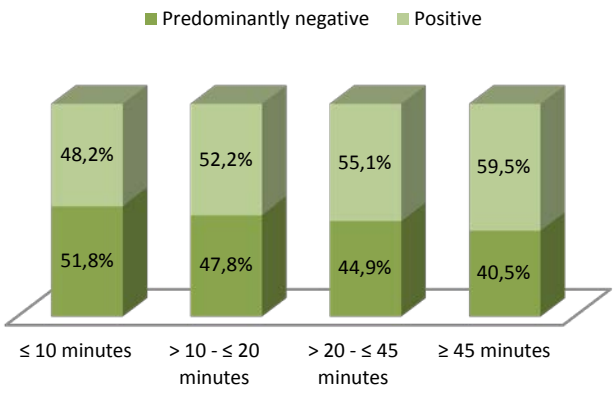


Fig: 4.14 Valuation travel time



4.2.5 Final remarks

This paragraph indicated how variables are valued in respect to experience of place. Within this section some presuppositions for the multiple linear regression are given based on the descriptive statistics and the sample composition.

Within the factor natural environment the weather variables have to less extent a valuation for personal and traffic safety than other factors because weather has more influence on bicycle use. Wind speeds from 5 Beaufort and a precipitation level from 0,5 mm/hour result that bicycle use is low, this ensures that hardly can be judged about place perception during cycling. The valuation for place perception below 0,5mm/hour and below 5 Beaufort is not much different compared with less wind or no precipitation. The presupposition for the weather influences is that temperature is the only variable that can have influence because it assumes more about place perception within a wide temperature range whereby the valuations of place perception are diverse for low and high temperatures.

The built environment variables have probably influences because of the differences between the amount of trips experienced as positive and negative within different variables. The presupposition is that the variable residential environment plays a role because of the differences in valuations between the categories. Also the amount of addresses and diversity of buildings play probably a role because of the differences in valuation of place perception between a less divers/ dens area and a more divers/dens area. The green percentage shows little difference in valuation in a small range of green percentage.

Personal and household characteristics play probably to less extend a role because of the small differences in valuation between different categories within variables like gender, ethnicity, household income and education level. Age can potentially have an influence because a higher age results in a more positive place perception during a bicycle trip.

Within the influencing factor trip characteristics the presupposition is that all variables play a role. Between the trip motives, there are some differences in respect to leisure and a longer trip results in a higher valuation of place perception.

4.3 Descriptive statistics experience of journey

Experience of journey N=2815	
Characteristics	**Values**
Mean	4,01
Median	4,00
St def	0,71
Min	1,00
Max	5,00

Table 4.3: Variable characteristics

Experience of journey is the experience of comfort and safety of the cyclist during a cycling journey expressed by different emotions. The minimum valuation of this variable is 1,00 and the highest is 5,00. For experience of journey the general valuation is more positive than for experience of place, research showed (fietsersbond, 2014, II) that 84% of the Dutch population has a positive experience of cycling. Experience of journey has an average valuation of 4,01 and a median of 4.00. The median is for the same reason chosen as division between categories in paragraph 4.2. But to show also the impact of predominantly negative values, is chosen to select three different categories instead. The category predominantly negative (<3,25) is 15% of the amount of cycling trips. 44% of the cycling trips experienced comfort and safety as predominantly positive during cycling (Category: ≥3,25 -≤4). During 41% (Category: > 4 - ≤ 5) of the cycling trips comfort and safety is experienced as positive. This analysis is done to describe per influencing factor the most important valuations of the experienced subjective safety to support the multiple linear regression model.

4.3.1 Natural environment

The temperature variable (Fig:4.15) shows that how higher the temperature how more positive the experience of comfort and safety is experienced from the category >0°C- ≤15°C till the category above 25°C. The category below 0°C shows an exception because this category is valued more positive than the category >0°C- ≤15°C. Within this category 16,8% of the trips is valued as predominantly negative, 38,4% as predominantly positive and 44,7% is valued as positive.

The wind speed (Fig: 4.16) shows that the experience of the subjective safety is lower valued when the wind speed is higher. By wind speeds between 0 and 2 Beaufort the experience of comfort and safety is pretty high, just 12,7% of the trips is experienced as predominantly negative. Within the category 3 till 4 Beaufort this is 18,1%. Where, by wind speeds from higher than 5 Beaufort this amount is 20%. This category shows a distorted view because this category is just 0,9% of all trips within the sample. At least it indicates that the wind speed has a negative influence on the valuation of experience of journey above 5 Beaufort and it has a negative influence on bicycle use.

The amount precipitation (Fig 4.17) shows in general that a higher amount is negative for the experience of journey. Where by no precipitation, the amount of predominantly negative experienced cycling journeys is 13,2%, tis is 18,7% within the category till 0,5 mm per hour and 42,7% by more precipitation than 0,5 mm per hour.

Fig: 4.15 Valuation temperature

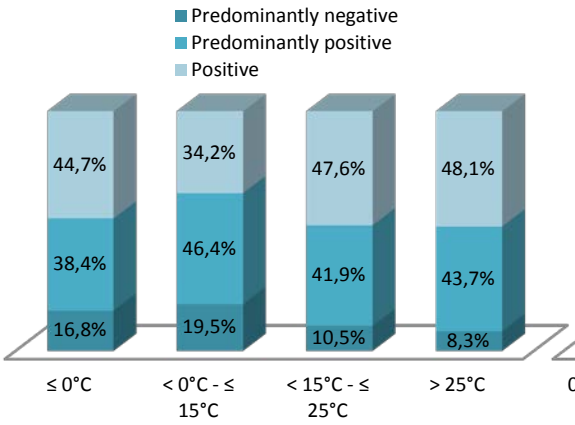


Fig: 4.16 Valuation wind speed

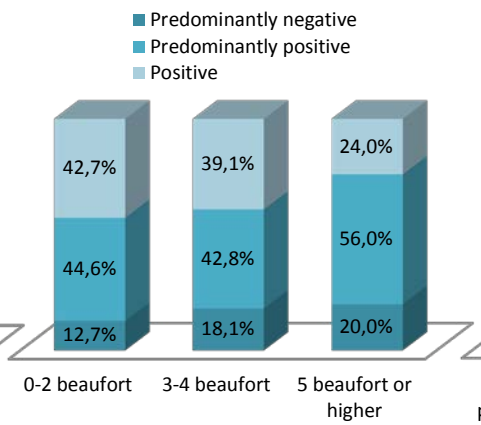
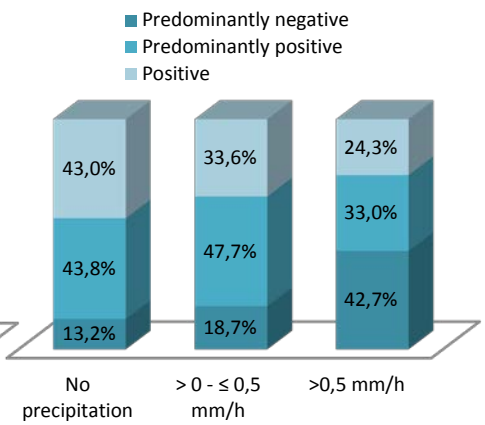


Fig: 4.17 Valuation precipitation



4.3.2 Built environment

The valuation of the residential environment (Fig: 4.18) on the experience of comfort and safety shows differences between the residential environments. Cycling journeys started in the outer-center are experienced as the most comfortable and safe with 10,7% of the trips experienced as predominantly negative, 42,4% experienced as predominantly positive and 46,9% as positive. Trips started within the inner-city are valued as most negative with 18,6% valued as predominantly negative, 49,4% as predominantly positive and 32% as positive.

The amount of green (Fig: 4.19) along a cycling route shows that a percentage above 20% green within 40.000m² is experienced as most comfortable and safe. But the other categories show not that much differences.

Fig: 4.18 Valuation residential environment

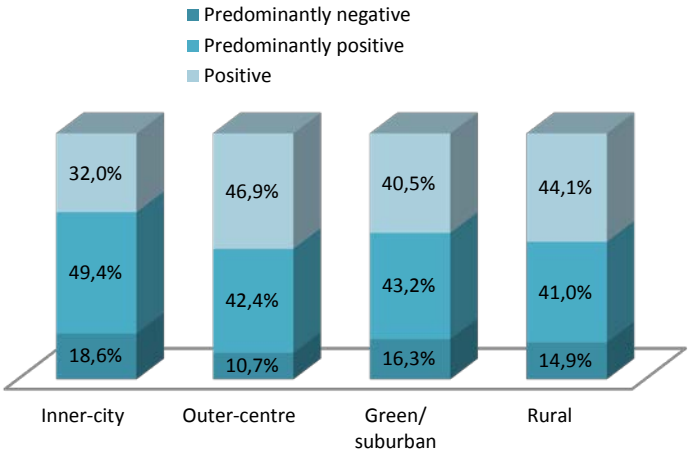
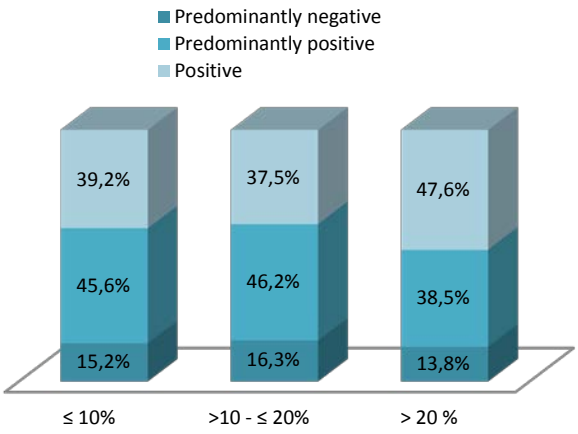


Fig:4.19 Valuation green percentage



The variable address density shows not much differences within the valuation. Subjective safety is valued within the whole range almost the same, although the figure indicates that how higher the address density the valuation of comfort and safety is experienced little lower (Fig: 4.20). Building diversity (Fig: 4.21) indicates that a higher building diversity does not result in a more positive or negative valuation of subjective safety.

Fig: 4.20 Valuation adress density

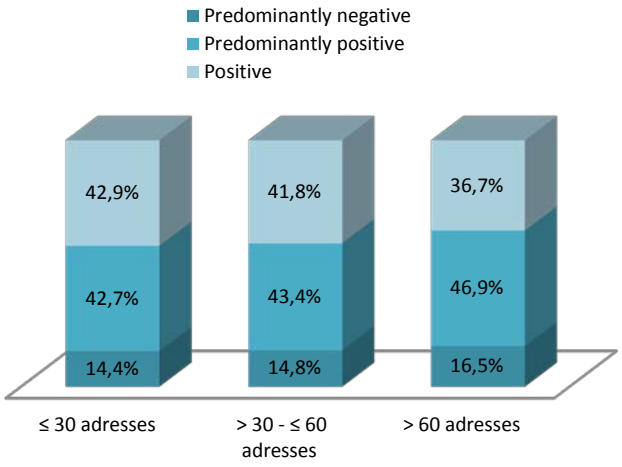
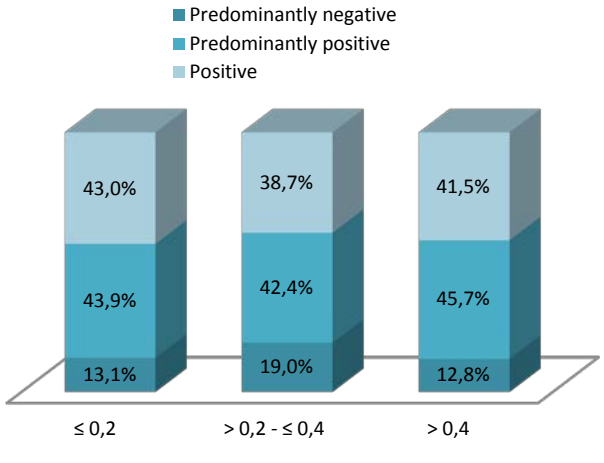


Fig: 4.21 Valuation building diversity



4.3.3 Personal & household characteristics

The influence from age (Fig: 4.22) shows in general that how older a cyclist how more positive the experience of journey is valued. Where cycling trips done by people below 22 are for 17,7% experienced as predominantly negative, from the trips driven by the group above 65 just 11,7% have a predominantly negative experience. Looking to positive experiences than 45,5% of the oldest group and 19,8% of the youngest group experience a high amount comfort and safety.

Gender (Fig: 4.23) has influences on the valuation of experiences of subjective safety during cycling. From the trips driven by male 9,4% is experienced as predominantly negative, 44,5% as predominantly positive and 46,2% as positive. By female this distribution is 18,6% as predominantly negative, 43,6% as predominantly positive and 37,6% as positive. This indicates that male experience more comfort and safety during a cycling journey than females.

Non-western ethnicities experience (Fig: 4.24) less subjective safety than native Dutch people. 19,2% of the cycling journeys are experienced as predominantly negative in respect with 14,7% by the native Dutch people.

Fig: 4.22 Valuation age

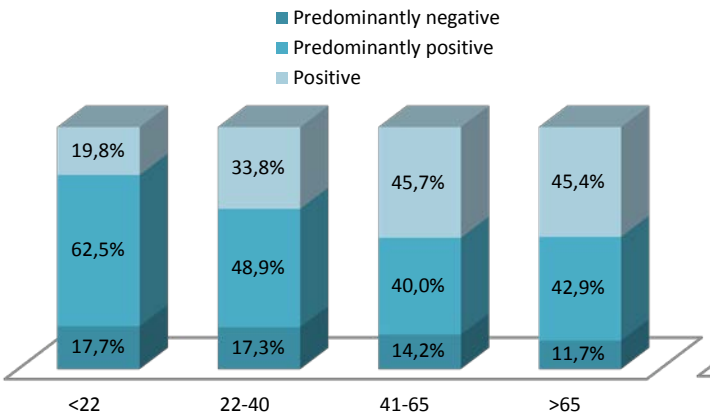


Fig: 4.23 Valuation gender

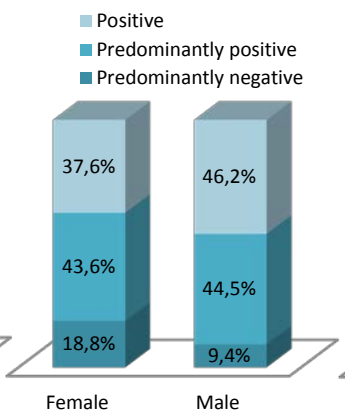
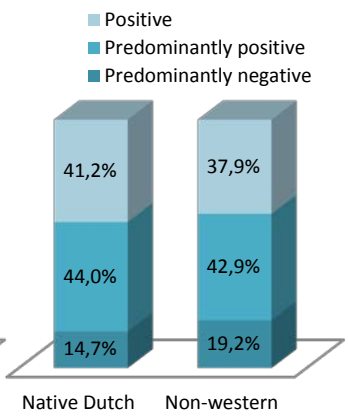


Fig: 4.24 Valuation etnicity



Household income (Fig: 4,25) indicates that how more one earns how higher valued the experience of journey. The amount of journeys experienced as predominantly negative show that, the < €2000,- income group has 19,4%, the ≥ €2000,- - < €3000,- income group has 13,2% and the highest two categories have 5,2% respectively 5,3%. There is just a nuance between the amount of predominantly positive and positive valued journeys that can possible indicates an effect for the highest income group within the multiple linear regression. The highest income group values 50,4% of the cases as predominantly positive and 44,2% as positive. The category unknown can be disregarded because this does not measure any influence for the multiple linear regression.

Looking to the influence of the education level (Fig: 4.26) than can be observed that the middle education level has an positive influence on the experience of journey, 13,8% of the journeys is experienced as predominantly negative in respect to 16,9% (lower education level) and 15,9% for the higher education level. The category unknown can be disregarded because this is just 1% of the cases and does not measure an important effect.

Fig: 4.25 Valuation household income

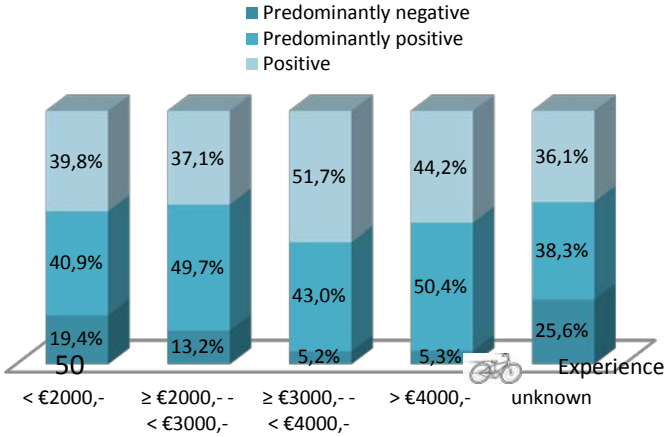
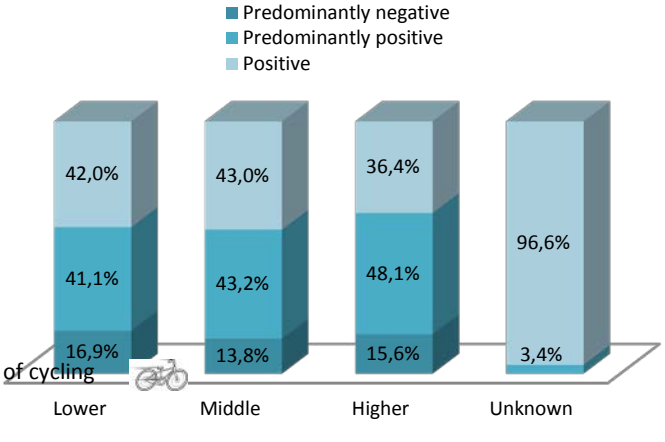


Fig: 4.26 Valuation education



4.3.4 Trip characteristics

For the trip motives (Fig: 4.27) it becomes clear that the category leisure and commuting to work and study show differences in respect to errands and social visits. Commuting is experienced as less comfortable and safe with 18,7% of the journeys experienced as predominantly negative, 49,2% as predominantly positive and 32,1% as positive. Leisure trips are experienced as more comfortable and safe whereby 11,3% are experienced as predominantly negative, 42,7% as predominantly positive and 45,9% as positive. Travel time (Fig: 4.28) does not like to show any differences for valuation of the experience of journey within the time range.

fig: 4.27 Valuation trip motive

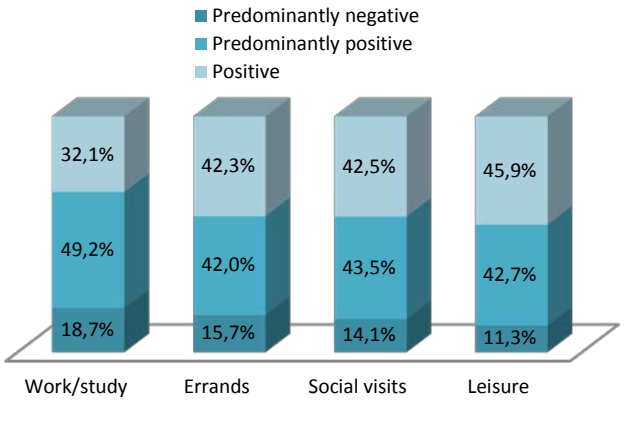
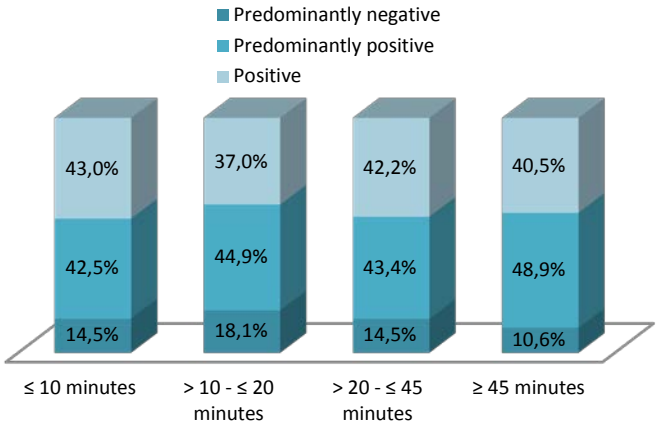


Fig: 4.28 Valuation travel time



4.3.5 Final remarks

The descriptive statistical analysis showed for the different variables how they are valued in respect to experience of journey. Within this section some presuppositions for the multiple linear regression are given based on the descriptive statistics and the sample composition.

The presuppositions for the weather variables in respect to the valuation for the experience of journey is that these variables play a role. How more wind and precipitation how more negative the experience of journey is valued. For temperature the experience of journey is more positive valued. Reason that this plays a role is because the experience of journey is trip specific and not based on earlier experiences. For all variables counts that the differences between valuation for the lowest values of the variable are different valued than for the highest value within the range.

For the built environment the descriptive statistics show that only the variable residential environment has probably influence within the valuation of experience of journey because of the differences between the valuation of the different categories.

Personal and household characteristics show that different variables can have influences. For example, age, gender, ethnicity and household income. Where the categorical and dichotomous variables have much differences of valuations between categories, the age variable indicates that younger people value the experience of comfort and safety lower than older people.

For trip characteristics the presupposition is that the trip motive variable commuting to work has a small influence because of the differences within respect to leisure trips.

4.4 Multiple linear regressions

As argued in chapter 3, two multiple linear regressions are performed and show answers on the research questions. For both multiple linear regressions the assumptions that must be met are discussed first. The first assumption that is met is that the dependent variables are on interval scale. The literature review and the descriptive statistics showed that there is reason to test the effects for the selected independent variables on the dependent variables. Second assumption that is met is that there is no multicollinearity. Which means that there are no strong correlations between independent variables with values <-,9 and >,9 according to Vocht (2011, p.156) and Field (2013, p.233). How higher the values of the correlation between different variables how more these variables measure the same effect. These correlations are measured by a bivariate correlation matrix by Pearson for the independent interval and ratio variables (Appendix 3). This matrix is the same for both multiple linear regressions because the same independent variables are used. The third met assumption are the normality and linearity for both models. Both models have a normal distribution of cases and have a positive statistical relation. This is measured with a histogram and a normal curve for both models (Appendix 4; 5). Further do both models met the assumptions for linearity and homoscedastity. This is measured by scatterplots for both models (Appendix 4; 5). The scatterplots show that the cases are distributed evenly over the regression.

4.5 Results experience of place

Independent variables	Values	B	Sig.
(Constant)		*3,347*	*0,000*
Natural environment			
Air temperature hourly	°C	**,011**	***,000**
Wind speed hourly	Meter per second	-,007	,300
Precipitation sum in mm hourly	Mm/hour	-,061	,150
Built environment			
Residential environment (Rural=ref)	Inner-city	**-,187**	***,000**
	Outer-center	**-,066**	****,048**
	Green-suburban	-,040	,200
Green percentage (buffer 200m)	%	,000	,484
Address density (buffer 200m)	Number	**-,002**	***,000**
Building diversity (buffer 200m)	Index	**-,211**	***,000**
Personal & household characteristics			
Age in years	Age	,001	,201
Gender (Female=Ref)	Male	,018	,441
Ethnicity (Native Dutch=Ref)	Non-western	-,014	,755
Household income (HHI < €2000 = ref)	HHI €2000-€3000	**-,076**	***,005**
	HHI €3000-€4000	-,003	,931
	HHI >€4000	**-,086**	****,043**
Education (ED Lower = ref)	ED Middle	-,049	,088
	ED Higher	-,021	,521
Trip characteristics			
Travel purpose (Leisure = ref)	Work/Study	**-,101**	***,001**
	Errands	**-,100**	***,000**
	Social Visits	**-,143**	***,000**
Travel time	Minutes	**,003**	***,000**

*Sig on: *α <0,01, ** α <0,05 level.

Table 4.4: Multiple linear regression; Experience of place (N=2815)

This paragraph shows the results of the multiple linear regression analysis with experience of place as dependent variable. Experience of place measures the place perception with a value judgment of the environment where the cycling journeys are made. Appendix 4 shows the complete SPSS tables. Table 4.4 is the summary of the most important outcomes including the beta coefficients and the significance of all the independent variables on the dependent variable experience of place.

The fit of the model measured by Nagelkerke R-square is ,118 and means that these independent variables declare 12% of the variance explained within the dependent variable experience of place that can be declared by the variables within the factors natural environment, built environment, personal & household characteristics and trip characteristics. Overall the whole model is significant by α <0,01 which means that there is a relationship between the independent variables and experience of place. Within the model different variables are evident which are significant on α <0,01, and α <0,05 level.

4.5.1 Natural environment

The descriptive statistics showed that weather influences have an influence on bicycle use and to less extend on experience of place. This confirms the argument of Van Twuijver et al (2006) that bad weather conditions are a reason to not use the bike.

The results of the multiple linear regression show that temperature has a significant influence, with 99% reliability. Which means that the effect of this variable has a significant impact on the valuation of experience of place. When the temperature increases with 1°C the amount of value experience of place increases with 0,011, which means how higher the temperature how higher the place perception is valued, except when the temperatures are below 0°C in this case the influence of the temperature is negative for the experience of place. This met the assumption forthcoming of the descriptive statistics.

The wind speed, and precipitation level have no significant influences on place perception as expected. According to (Buijs & van Kralingen, 2003) have value judgments about place perception associations with influences from experiences of the past and with appreciation. The weather circumstances during a cycling journey are just a moment in time. This is one of the reasons that the weather influences have not that much influences within place perception. Temperature is an exception because a higher temperature has probably associations with appreciation of the cyclist. In this case cyclist experience more personal and traffic safety.

4.5.2 Built environment

Within the Rotterdam City Region there are defined four different residential environments with different characteristics. For the place perception the influences of the residential environment has influence on the valuation. In respect if a cyclist lives within a rural area cyclist living in the inner-center experience the place during cycling more negative. The same counts for people living in the outer-center or people who live in a green-suburban area.

The residential environment variable inner-city and outer-center in respect to rural have a significant effect on the experience of place (resp. α <0,01, and α <0,05). When someone lives in the inner-city, the experience of place during cycling is valued -,187 in respect to a cyclist who lives in a rural area. When a cyclist lives in the outer-center the cycling experience is valued - ,066 in respect to a rural living cyclist. According to Böcker & Thorsson (in press) this shows that the living area of a respondent has an influence on bicycle behavior and that there are place-based effects. Helbich et al (2014) shows differences in experience with place-based weather influences, the results of this research shows that this counts also for experience of place. In this case it means that cycling journeys starting within the city-center are valued lower for place perception than cycling journeys who starting in a rural area. Cyclist living in a rural residential environment experience more personal and traffic safety than cyclist from other rural environments.

Although there might be a higher cycling share, a higher traffic volume and more cycling infrastructure within area's where densities are higher according to Kunreuther & Noland (1995) and Martens (2004; 2007), it does not mean that the place perception during cycling is valued higher too.

The results of this regression show that. Because the address density and the building diversity are significant with 99% certainty and have a negative influence for place perception. For the address density it means that how higher the addresses density the experience of place is negative influenced by -0,002 per unit. This means that within a dens city environment people experience the quality of the place during cycling lower than in a less populated area. People experience less personal safety and traffic safety in a dens city environment. Probably the influences of the higher traffic volume as argued by Pikora (2003) plays a role. Although the variable is significant, the influence is not really big and has just influences when the address density is extreme high. For a long trip where the average address density is low the influence is minim. For a short trip within the city center the influence is higher due to the higher average address density. Further the influences of the building density index on place perception shows the same effect as the address density. Building diversity shows a decrease of -,211 per unit and is also significant with 99% certainty.

The results show that address density and building diversity are influencing variables according to Erwing (2005). A higher building diversity and address density along the route do result in a decrease of valuing experience of place especially for short trips within the inner-city. It gives also an explanation why people who live within the inner-city or outer- center experience a lower place perception during cycling than people who live in a rural area. These variables can strength each other when the address density is high and the building diversity index too.

4.5.3 Personal & household characteristics

Personal and household characteristics have to a less extend influences on place perception. This is the presupposition from the descriptive statistics and can be confirmed by the results of the multiple linear regression. Within this influencing factor two variables are significant. These are the household income categories between €2000,- and €3000,- and the category above €4000,- in respect to the lowest income group (≤€2000,-). These variables are significant with respectively 99% and 95% certainty. Cyclists within these income groups in general, have a somewhat lesser degree of place perception during a cycling journey in respect to people who urn less than €2000,- a month. The effect shows a decrease of respectively -,076 and -,086 in respect to the lowest income category. These tiny differences show the equality within the Dutch society in respect to bicycle use between different income groups (Pucher & Buehler, 2008, Garrard et al., 2008). For the income group between €2000,- and €3000,- these differences are not related to bicycle use because the bicycle share within this group is almost the same in respect to the lowest income group. For the highest income group these differences can have probably associations with a lower bicycle use because people within this income category cycle less and therefore this group experience less place perception during cycling (Harms et al, 2007).

The variables age, gender, ethnicity and education are not significant within place perception. This is according to most researchers (Garrard et al, 2008; Heinen et al, 2010; Oijen et all, 2011; Pucher & Buehler, 2008; Van Acker et al, 2010) that cycling in the Netherlands is almost for everyone and has associations with the tradition of Protestantism and the egalitarian society. Although place perception is something that is personal (Tilstra, 2011), no big differences for place perception are found between different cyclist with different personal and household characteristics in the Rotterdam City Region.

4.5.4 Trip Characteristics

For place perception the trip motives and travel time are significant variables which met the assumptions from the descriptive statistics. Every trip purpose is significant on α <0,01 level in respect to leisure. Cycling for commute to work or study (B=-,101), running errands (B=-,100) and cycling for social visits (B=-,143) have a negative influence in respect to leisure on the experience of place. This means that people who commute by bicycle, run errands or make social visits experience less personal and traffic safety. This is probably due to the fact that leisure cyclist experience the place more intensively than cyclists who cycle with other purposes (Stinson & Bhat; 2005). For commute trips traffic safety is less important than a shorter travel time in respect to a leisure trip for

example. This can be one of the reasons that cycling for commute has a lower place perception. For leisure trips experience of place is often the goal, the other trip purposes can be seen as a daily habit although people still have the choice to use the bike (Heinen, 2010; Pelzer, 2010; Van Acker et al, 2010).

Travel time is significant within the factor trip characteristics with 99% certainty, for every cycle minute longer, the place perception increases with 0,003. This has probably to do with the fact that people can choose if they go cycling. Frequent cyclists experience cycling more positive than people who cycle less according to Harms (2010). Most of the people like it to go cycling and when people have a longer cycling journey they experience the place more intense. The descriptive statistics shows as well that longer trips are valued higher than other trips. Most leisure trips are on average also longer than trips with other purposes.

4.5.5 Final remarks experience of place

Place perception is the experience of personal safety and traffic safety during a bicycle journey. Cyclist base their value judgment of the environment on previous experiences based on spatial elements such as infrastructure, urban form and traffic influences. By interpreting the statistical analysis and the theoretical framework, answers are formulated to the following research question;

To which extend do factors related to bicycle culture influence value judgments about the place during cycling and which variables are significant?

The most influencing factors within place perception are the built environment and the trip characteristics. Within the built environment the address density and building diversity are significant variables even as the living environment variables. These built environment variables are related to value judgments about the spatial area where people live and how people experience the influence of traffic volume and the layout of the environment where they cycling through. A more dens and diverse area result in a lower valued place perception where people experience less personal and traffic safety.

The trip characteristics are associated with how livable a place is experienced. Length of the trip and purpose are often related, because people who choose to cycle prefer leisure trips and value longer trips as more positive to experience the environment. Cycling journeys for commute, social visits and for errands are valued lower for place perception. Probably because these kind of trips can be seen more as a habit than leisure trips.

Because cycling in the Netherlands is seen as a habit and is used as transportation mode by almost everybody the differences in place perception between different personal and household characteristics is almost absent. This shows the relation with the equality of the society in respect to the Dutch bicycle culture.

4.6 Results experience of journey

Independent variables	Values	B	Sig.
(Constant)		3,728	,000
Natural environment			
Air temperature hourly	°C	**,011**	***,000**
Wind speed hourly	Meter per second	**-,030**	***,000**
Precipitation sum in mm hourly	Mm/hour	**-,353**	***,000**
Built environment			
Residential environment (Rural =ref)	Innercity	**-,093**	****,032**
	Outer-center	**,142**	***,000**
	Green-suburban	**-,084**	****,027**
Green percentage (buffer 200m)	%	-,001	,538
Address density (buffer 200m)	Number	**-,001**	****,039**
Building diversity (buffer 200m)	Index	**,146**	****,036**
Personal & household characteristics			
Age in years	Age	**,005**	***,000**
Gender (female=Ref)	Male	**,083**	***,003**
Ethnicity (Native Dutch=Ref)	Non-western	**-,118**	****,027**
Household income (HHI < €2000 = ref)	HHI €2000-€3000	,001	,981
	HHI €3000-€4000	**,262**	***,000**
	HHI >€4000	**,236**	***,000**
Education (ED Lower = ref)	ED Middle	,001	,978
	ED Higher	**-,100**	***,012**
Trip characteristics			
Travel purpose (Leisure = ref)	Work/Study	**-,166**	***,000**
	Errands	-,018	,580
	Social Visits	-,008	,867
Travel time	Minutes	,000	,614

*Sig on: *α <0,01, ** α <0,05 level.

Table 4.5: Multiple linear regression; Experience of journey (N=2815)

This paragraph shows the results of the multiple linear regression analysis with experience of journey as dependent variable. Experience of journey measures how cycling journeys are experienced by emotions that appear during a cycling journey. The combination of these emotions valuing the experienced subjective safety during a cycling trip which is according to (Heinen et al, 2010; Pelzer, 2010; Stinson & Bhat, 2005) the most important part of the experience of a cycling journey. Appendix

5 shows the complete SPSS tables. Table 4.5 is the summary of the most important outcomes including the beta coefficients and the significance of all independent variables on the dependent variable experience of journey.

The fit of the model measured by Nagelkerke R-square is ,135 means that these independent variables declare 14% of the variance explained within the dependent variable experience of journey that can be declared by the variables within the factors natural environment, built environment, personal & household characteristics and trip characteristics. Overall the whole model is significant by α <0,01 which means that there is a relationship between the independent variables and experience of journey. Several variables play a significant role on α <0,01, and α <0,05 level within the experience of journey are also evident. Below, all significant variables are described and ordered per influencing factor.

4.6.1 Natural environment

The different weather variables have a significant influence within the experience of journey. Air temperature, wind speed, and precipitation are all significant with 99% certainty. An increase of the temperature with 1°C gives an increase within the experience of journey with ,0011. When the temperatures are above 0°C the influence on the experience of journey is positive, temperatures below 0°C have a negative effect. According to Sabir (2011) temperatures above 25°C have also a negative influence, especially for safety aspects within traffic. The descriptive statistics showed that this effect is translated within the bicycle use. Wind speed and precipitation show negative influences, an increase of wind speed and an increase of precipitation give a decrease in the valuation experience of journey from respectively -,034 per meter per second wind speed and -,344 per mm precipitation per hour.

The presuppositions of the descriptive statistics in relation to the weather variables are met. Part of the experienced subjective safety during a cycling journey is dependent on the weather as argued by Sabir (2011). These results show that the weather variables according to Pelzer (2010) are important but that it is difficult to understand which single variable is the most important for the experience of comfort and safety. Looking to one variable than can be concluded that precipitation has the biggest influence for experience of journey but also for bike use. This is important because bicycle use and experience are strongly related to each other (Pelzer, 2010). The descriptive statistics show that bicycle use declines with an amount of precipitation of 0,5 mm per hour, while the average precipitation level is 0,6 mm per second. While for wind speed the average is 3,2 meters per second (2 Beaufort) and bicycle use declines with wind speeds from 8 meters per second (5 Beaufort). Precipitation has got a higher beta coefficient and therefore it has for experience of journey the most negative impact. A combination of extremes like, high wind speeds, much precipitation, and extreme low temperatures are according to the results of this regression experienced as less comfortable and safe. 'Normal' average weather does not have much influences on experience of journey.

4.6.2 Built environment

According to Erwing (2005) have built environment variables associations with bicycle use. Proximity plays an influencing role and is according to Saelens et al (2003) influenced by diversity and density. For experience of journey in the Rotterdam City Region the residential environment of a cyclist, address density and building diversity have a significant influence.

The residential location of a person says something about which influence the residential location has in relation to the subjective safety of a bicycle journey. When someone lives in the inner-city the comfort and safety of a trip is experienced -,093 lower in respect when a cyclist lives in a rural residential environment with 95% certainty. When someone lives in the outer-center it means that people experience ,142 more subjective safety during a cycling journey than someone who lives in a rural residential environment with 99% certainty. For people who live in a green or suburban residential environment their experience shows a decrease of -,084 comfort and safety during a cycling journey in respect to a rural living person with 95% certainty.

A higher address density have positive influences on bicycle use but for the experience of comfort and safety during a bicycle journey it has a marginal negative influence when the address density is higher with 95% certainty. The building diversity plays a positive role in the experience of journey. This gives an increase of ,146 per unit with 95% certainty. Also this influence is marginal because building diversity is measured by an index value which has an average of ,32 within the sample. But it indicates that for the experience of a cycling journey it generates more subjective safety when there are different kinds of functions within proximity (Heinen et al, 2010).

Within the experience of journey the variables distance and proximity of functions play a role but also the perception of traffic safety during a specific trip (Heinen et al, 2010; Pikora, 2003). When the area is highly populated the experienced subjective safety is lower. A higher addresses density in an area means that there is less place for a diverse land use mix. Diversity is an important factor for bicycle use (Saelens et al, 2003). An higher building diversity results according to Ewing (2005) in an increase for experience of journey. More functionality is related to more diversity which results in experience (Pikora, 2003).

4.6.3 Personal and household characteristics

Personal and household characteristics are important influencing factors within cycling behavior but according to different researches it is difficult to say which variables are important (Heinen et al, 2010; Pelzer, 2010). The results of this regression analysis show that different variables have associations with experience of journey. This means that the presuppositions forthcoming of the descriptive statistics are met.

Age is a significant variable within the experience of journey with 99% certainty. When someone is older one has more experience how to ride a bike. This declares the increase of ,005 value of experience of journey per age year. This is according to Stinson & Bhat (2005) because younger people are in general less experienced cyclist than middle aged persons. In the Netherlands people from all ages use the bike which is part of the habit within the cycling culture but younger people are less experienced cyclist in general (Pelzer, 2010; Pucher & Buehler, 2008; Garrard et al., 2008).

The performed analysis shows, a male has a higher experience of comfort and safety than a female (,083 with 99% certainty). This also holds true according to Stinson & Bhat (2005) but they argue that women experience less safety because they are less experienced cyclist than men. In contrast, Pucher & Buehler (2008) and Garrard et al. (2008), state that due to the high Dutch safety standards for bicycle infrastructure, the distribution of cycle journeys between gender is more or less equal. Moreover according to Pelzer (2010.p.28), in the Netherlands gender differences are hardly relevant within this context. The small difference in this analysis reflects this argument.

In respect with native Dutch people, experience non-western people less (B=-,118) subjective safety during a bicycle trip. This shows the effect as argued by the municipality of Rotterdam (2007). Ethnic minorities are not used to the Dutch bicycle culture, they cycling less than native Dutch and are not used to ride a bike within the busy city traffic therefore they feel less comfortable and safe during a bicycle trip (Oijen et all, 2011).

People with an higher monthly household income experience more comfort and safety than households with an income less than €2000,-. Especially the classes between €3000,- and €4000,- (B=,262) and above €4000,- (B=,236) experience a significant higher subjective safety with 99% certainty. This shows that although people who earn more and cycling less that they experience more subjective safety during their trips. This confirms the finding that 67% of the Dutch people associate cycling with joy (Harms et al, 2007 P.32). It shows that people with a higher income probably have more opportunities to choose between transport modes and that they have more opportunities to plan if they use the bike in comparing with someone with a lower income. This results in an higher valued experience of journey.

For education the higher education level in respect to the lower education level is significant with 99% certainty. A person with a higher education level experience less (B=-,100) subjective safety than a lower educated person. A middle educated person experiences almost the same amount

comfort and safety as a lower educated person. Higher educated persons cycle more than lower educated persons, this effect is also visual within the descriptive statistics. If the cycling group is bigger, differences between experiences will be that as well. This is the reason that the experience of journey is lower for the higher educated cycling group. But, according to Van Twuijver et al (2006) education level has not that much influences on bicycle experience in the Netherlands.

4.6.4 Trip Characteristics

For the trip characteristics it becomes clear that from the trip motive variable commuting to work or study in respect to leisure has a significant influence with 99% certainty and that this gives a negative outcome (B=-,166) on the experience of journey. This means that this group experiences less comfort and safety than people who cycle for leisure purposes. Also the other purposes experience less comfort and safety but these outcomes are not significant. This outcome for commuting purposes is according to Stinson & Bhat (2005) who argue that experienced cyclists prefer the shortest travel time above a bit more comfort, more traffic safety and a longer distance. Within the results of this regression analysis the travel time has no influences on the experience of comfort and safety. But the argument that the experience of subjective safety is less important for commuting purposes comes back within the results.

4.6.5 Final remarks experience of journey

Experience of journey is the amount of subjective safety that is experienced during a cycling journey. This experience is expressed by emotions that appear during a cycling journey and are personal, place and time dependent. For most of the cyclists, the experience of journey is associated with a positive experience. The literature and the results of the statistical analysis shows that many variables from different influencing factors are significant and have influences. This led to answers on the research question;

To which extend do factors related to bicycle culture influence emotions which appear during a cycling journey and which variables are significant?

For the experience of journey the natural environment, built environment and the personal characteristics have the most influences on the experienced subjective safety of a cyclist during a specific bicycle journey.

The weather influences (temperature, wind speed and precipitation), have a significant influence due to the fact that weather is place and time dependent and thus has a direct influence on the experienced comfort and safety during a bicycle journey. How more extreme the weather circumstances how more physical effort from cyclist is needed. Which results in more negative emotions during the trip and thus a more negative experience of subjective safety.

Within the built environment the kind of residential environment, the building diversity and address density play a significant role. A cyclist who lives within the inner-city or in a green suburban environment experience less subjective safety in respect to a cyclist from a rural area while someone from the outer-center experience more comfort and safety. A high address density results in less experience of comfort and safety where a high building diversity results in more subjective safety. The balance between proximity of functions and the experience of the traffic safety during a specific bicycle trip plays the most important role.

Personal and household characteristics are an important factor for experience of journey because the experience of journey is personal. Younger people have less cycling experience and experience a lower subjective safety. Male experience more comfort and safety than woman. Ethnic minority's experience less comfort and safety than native Dutch. For household income level the experience of comfort and safety is higher for the highest income groups than for lower income groups.

Which kind of trip purpose or travel time someone has, make not that much sense. Although the experience of a commuting trip is a little lower. Which means that commuters experience less subjective safety in comparison with people who cycling for leisure purposes.

5. Discussion and conclusions

Within this thesis, cycling is approached from users' perspective by performing a quantitative research on bicycle experience by analyzing bicycle journeys. This is a missing link in existing scientific research about cycling. Most research is focused on transport mode choice or the influences from certain factors on bicycle use (Heinen et al. 2010; Pucher & Bueheler 2008; Rietveld & Daniel 2004). Other researches are a combination by performing a qualitative analysis about the influences on bicycle use and experience (Pelzer, 2010). Research to experiences from users' perspective is important, because advantages and disadvantages from several influencing factors within a certain area can be found (Harms et al, 2007). It is difficult to make an absolute distinction between bicycle use and experience, because bicycle use is related to experience and vice versa. Bike usage results in cycling experience. The greater the bicycle use is within certain places, the more positive cycling is experienced by users (Harms et al, 2007p.63). The purpose of this research, was to make an overview of the factors which have influences on cycling experience and which of these factors can be improved by governments to further stimulate cycling.

This research is done within the Rotterdam City Region because of its diversity of residential environments (Böcker & Thorsson, in press; Helbich et al, 2014), the large population and the diversity of inhabitants. Also the relatively low bicycle share in this region compared to Dutch the modal split is an important fact. Within the Rotterdam City Region, 20% of all journeys is a cycling journey as to 27% of all journeys within the Dutch modal split (Fietsberaad, 2010).

Within the society, cycling is getting more important as an alternative, sustainable, healthy and clean transport mode. In the past decades a lot of infrastructure is developed and much research is done to improve cycling. When performing research to bicycle behavior, it is important to understand the bicycle culture because it is country specific with specific aspects. One of these aspects is that cycling in the Netherlands is often seen as a habit, which makes it difficult for scientists to understand some specific effects (Heinen et al, 2010; Pelzer,2010; Pucher & Bueheler 2008; Rietveld & Daniel 2004; Van Acker et al, 2010).

Bicycle culture is the interplay of social constructed environments, influenced by history, which makes bicycle use and experience of cycling possible. Every country has an unique bicycle culture, which is dependent on the physical environment (geographical circumstances like the landscape, climate and built environment), the institutional environment (policies that stimulate cycling) and the social/cultural environment. In the Netherlands, cycling is done by almost everybody, which is related to the tradition of Protestantism and the egalitarian society (Pelzer, 2010). Not every social constructed environment related to bicycle culture can be experienced directly during cycling. Therefore, four different bicycle culture related factors are formulated, which have direct influences on bicycle behavior. These factors are the natural environment, the built environment, personal and household characteristics and trip characteristics. These factors consist of variables which have influence on the intensity of, and the interaction with the environment. These are, according to Pelzer (2012), the most important elements of the experience during cycling. For this research, the intensity of the environment is translated in experience of place (place perception) and the interaction with the environment in experience of journey.

Place perception is a value judgment about the place during a cycling journey. Several influencing factors during a cycling journey result in the experience of personal safety and traffic safety. Personal safety means that someone experiences a pleasant, livable built environment. Traffic safety concerns the experience of the amount and kind of traffic, the speed (limit) and safety features of the infrastructure along the cycling route (Pikora, 2003).

The experience of journey shows influences from emotions that appear during a cycling journey. These emotions influence the subjective safety (comfort and safety) during a bicycle trip. '*Subjective safety refers to how individuals perceive safety, and is mostly measured in terms of the stated safety experience of users or other respondents'* (Heinen et al, 2010 p.63). This safety aspect is more comprehensive than the personal and traffic safety aspects and refers for example to the risk

of theft, violence and other aspects that can have influence on safety during a bicycle journey (Titze et al, 2007).

Place perception is influenced by experiences from the past, experience of journey is, time, trip and place dependent. This is confirmed by (Buijs & van Kralingen, 2003), which is an important nuance in experience, because the spatial elements within an area are relatively established as other influences are dependent on time and place.

The descriptive statistics demonstrated that place perception is valued positive in 51% of bicycle journeys, versus 85% (predominantly positive) in journey experience. This shows that in general, place perception is valued more negative than experience of journey within the Rotterdam City Region. Harms et al (2007 P.32) argue that 67% of the Dutch population associates cycling with joy and that 4% of the population experiences cycling as negative. The Fietsersbond (2014, III) showed that 84% of the Dutch people experience a cycling trip as something positive. This last number is comparable with the outcome of the descriptive statistics for experience of journey within the Rotterdam City Region. The next section demonstrates the influences on cycling experience per influencing factor.

5.1 Experience of cycling

Within this thesis answers are provided on the subsequent research question:

Which factors related to bicycle culture play the most important role in the valuation of place perception during cycling and the experience of a bicycle journey in the Rotterdam City Region?

For the experience of cycling, safety related aspects are essential. This is influenced by variables out of several influencing factors. According to Pucher and Bueheler (2008), investments for cycling safety were focused on building cycling infrastructure since the 1970s. By investigating the experience of cycling, this research demonstrates that other factors have influence on the perception of safety too.

5.1.1 Natural environment

Weather variables affect the experience of a bicycle journey. However, certain aspects also affect the degree of influence weather variables have, on the experience of cycling. Initially, weather circumstances have an influence on bicycle use (Sabir, 2011). When temperatures are below 0°C or above 25°C, when there is more precipitation than 0,5 mm per hour and when the wind speed is faster than 5 Beaufort (8 meter per second), bicycle use decreases. This indicates that people go cycling depending on the weather. But weather influences also have an impact during the experience of a bicycle journey.

For the valuation of the place during cycling, temperature is significant but has a relatively small influence. Higher temperatures result in a higher experience of personal and traffic safety. Weather is time and place dependent, therefore it has a smaller impact on place perception, because place perception is based on earlier experiences (Buijs & van Kralingen, 2003). Because the spatial elements within an area are roughly stated.

Weather circumstances influence the emotions that appear during cycling, affect the amount of physical effort that is needed during cycling and results in a valuation for the amount of comfort and safety of a cycling trip. For the experience of comfort and safety, temperature, wind speed and precipitation have significant influences. The results of the regression analysis show that the more 'extreme' the weather circumstances, the more negative subjective safety is experienced. Overall precipitation has the greatest impact on the experience of cycling. This is also confirmed by Sabir (2011).

5.1.2 Built environment

The built environment variables are important for the experience of cycling which is confirmed by Erwing (2005), Pikora et al (2003) and Titze et al (2008). Within the Rotterdam City Region, the

residential environment of a cyclist, address density and building diversity play a role. These variables have different influences on the safety perception of a cyclist.

The residential environment variables demonstrate that cycling is experienced different between distinctive residential environments (inner-city, outer-center, green-suburban and rural). For place perception, it means that people who live within an inner-city area or an outer-center area experience less personal safety and traffic safety during their cycling journey than someone who lives within a rural area.

For experience of journey, all residential environment variables are significant. In respect to a rural living cyclist, the subjective safety during a bicycle journey is experienced safer for someone who lives in the outer-center. Cyclists living in the inner-city and in green-suburban areas experience less subjective safety in respect to a rural living cyclist. For these variables aspects like distance to and proximity of functions play a role for the perception of safety according to Heinen et al (2010), Pikora (2003) and Saelens et al (2003). This research shows as well that according to Böcker & Thorsson (in press) and Helbich et al (2014), experience of cycling is also dependent on place based variables.

For every bicycle trip, the address density and the building diversity are significant. Within the experience of place, the personal and traffic safety is experienced more negative when the address density and the building diversity is higher. This is according to Pikora (2003), who argues that a denser populated area generates more traffic volume, which results in less experienced personal and traffic safety during a cycling journey.

For experience of journey a higher address density is valued more negative and a higher building diversity is valued more positive. This indicates that a more monotonous and dens area along the cycling route, results in less experienced subjective safety. A higher building diversity results in more subjective safety, because of the closer proximity of functions which generates more liveliness on the streets. This is important for a bicycle friendly city according to Pucher & Buehler (2008).

The influences from the built environment variables demonstrate that the address density and building diversity are part of the experienced safety during cycling. A higher address density and more mixed functions within an area do result in a higher traffic volume what is negative for the experience of personal safety and traffic safety. In contrast, more diversity of functions results in more subjective safety for cyclists. In addition to the variables address density and building diversity does the residential environment of a cyclist also play a role within the experience of cycling. Someone who lives in the inner-city has more functions within proximity but experiences less subjective safety, traffic safety and personal safety during cycling, due to a higher traffic volume than experienced by a rural living cyclist. A cyclist living in an outer-center area experience less personal safety because the area is more monotonous and less functions are within proximity but the subjective safety is experienced higher than within a rural area. People who live in a green/suburban area experience less subjective safety during cycling because the area is more monotonous than a rural living area. For both residential environments the proximity of functions has a negative influence.

5.1.3 Personal and household characteristics

Personal and household characteristics are seen as important influencing factors for bicycle behavior and use because of the influences from the society, personal interest and the influence on appreciation of the user (Buijs & van Kralingen, 2003; Heinen et al, 2010; Pelzer, 2010; Van Acker et al, 2010).

For bicycle experience whitin the Rotterdam City Region different variables have a significant influence. Again, between place perception and the experience of journey are differences. For place perception, age is not significant while for the experience of journey it is. The outcome of the regression shows that how older a cyclist is, how higher valued the experienced subjective safety. According to Stinson & Bhat (2005) this is because of the fact that younger cyclists are in general inexperienced compared with older cyclists.

Males experience more safety than females, again for experience of journey this is a significant variable but the difference is small. This is ratified by Pelzer (2010.p.28) who argues that in the Netherlands gender differences are hardly relevant within this context because of the high safety standards from the infrastructure, which makes the Netherlands one of the most safe bicycle countries.

Non-western ethnic minorities experience significant less personal and traffic safety than native Dutch people. This confirms the observed effect as argued by the municipality of Rotterdam (2007). Non-western ethnic minorities cycle less because they are not used to cycling, they are not used to the bicycle culture and the traffic within the city. They are not used to the tradition of Protestantism and an egalitarian society (Oijen et al, 2011). Non-western ethnic minorities also experience less subjective safety but this is not significant. According to Harms et al (2007 P.32) this is due to the fact that people have the same emotions, despite their cultural background.

For household income there are also some effects that have a significant influence. Within place perception the income group between €2000,- and €3000,- and the income group who earn more than €4000,-, show a significant negative effect in respect to the lowest income group (€2000,- and lower) but the influences are small. While the income groups between €3000,- and €4000 and above €4000,- show a positive effect for the experience of subjective safety in respect to the lowest income group. For place perception it shows that according to Pucher & Buehler (2008) and Garrard et al (2008) there is much equality within the society when it comes to the experience of cycling in respect to income. This results in small nuances in the valuation of place perception between income groups. For experience of journey the differences between subjective safety show that the least cycling groups (highest incomes) experience their journey more safe. This has probably to do with appreciation, this groups have more opportunities to choose the bike if they want and under preferred circumstances (Buijs & van Kralingen, 2003).

The education level is almost not relevant for the experience of cycling. Although for experience of journey the highest education degree, experience less comfort and safety in respect to the lowest education degree. This is a small nuance and has probably to do with the amount of bicycle use between the different education levels. This shows that education level has according to Van Twuijver et al (2006) not much influences within the experience of cycling in the Rotterdam City Region.

For the experience of cycling in the Rotterdam City Region the influences of personal and household characteristics showed that the bicycle culture has two faces. On the one hand have personal and household characteristics for Native Dutch people not that much influences during the experience of cycling trough the tradition of Protestantism and the egalitarian society (Oijen et al, 2011). In contrast, ethnic minorities experience significant less safety during cycling. This research indicates that non-western ethnic minorities, experiencing cycling more negative because they are not used to the bicycle culture. This is according to the municipality of Rotterdam (2007) who showed that ethnic minorities experience cycling much more negative than Native Dutch people. Further can be confirmed that the Dutch bicycle culture is seen as something normal, a habit, for native Dutch people. This counts as well within the Rotterdam City Region because of the small, almost absent influences of personal and household characteristics within the experience of cycling. This shows that the results of this research do not total confirm the researches of Heinen et al (2010) and van Acker et al, (2010) that the differences between personal and household characteristics are important within transportation research. Especially for cycling in the Netherlands this is different and shows the influence of the equality between people in the Dutch bicycle culture according to Pelzer (2010). It indicates that cultural differences are important within the experience of cycling.

5.1.4 Trip Characteristics

Travel time is a significant variable for place perception. How longer the travel time how more personal and traffic safety is experienced. During trips for commuting to work or study, running errands and visiting friends significant less personal and traffic safety is experienced than during

leisure trips. This shows that leisure trips and longer trips are done with the goal to experience the place according to Stinson & Bhat (2005).

For experience of journey commuting to work or study, in respect to leisure, is a significant variable. During a commuting trip, the subjective safety is negatively influenced. This has probably to do with the idea according to Stinson & Bhat (2005) that experienced cyclist prefer the shortest travel time above a bit more comfort and traffic safety. Cyclist that commuting to work or study are in general more experienced cyclist.

5.2 Policy recommendations

This research showed that the experience of cycling is associated with the perception of different safety aspects. Another conclusion is that cycling is experienced as relatively safe within the Rotterdam City Region. Although according to the conclusions of this research there are some variables that needs some attention.

Age and ethnicity are within the factor personal and household characteristics significant variables and indicate that younger aged cyclist and ethnic minorities experience less safety during cycling. Further the research indicated that there are place based effects that have associations with the residential environment, the address density and building diversity.

To improve the amount of bicycle journeys, it is needed to focus cycling campaigns on younger people and especially ethnic minorities. According to Ligtermoet &Partners (2012) it is important to focus cycling campaigns on target groups because oriented solutions can be found. For younger aged people cycling education is already provided at primary schools. It is important to keep stimulating this because it will also help the younger generation of ethnic minorities to make them used to the bicycle culture. According to Ligtermoet &Partners (2012) there are moments in lifetime that are critical to get used to cycling. This is related to the experience of cycling from other people which are a stimulated factor and when these experiences are positive than it is more easy to stimulate other people especially when it comes to new generations.

This research showed that the residential environment of people, the address density and the building diversity have influences on the safety perception of a cyclist. According to Pucher and Buehler (2008) since the 1970s stimulating cycling is focused on building cycling infrastructure and to less extend on other factors. But this research shows that it is important to understand the experience of cyclist within the built environment because this has influence on the perception of safety. This are place based effects within different types of residential environments, different address densities and differences in the building diversity. The experiences of the built environment can be monitored by GPS tracking during bicycle journey's. After that can be analyzed where cyclist experience less traffic safety, personal safety and subjective safety with the purpose to improve the built environment within this places and stimulate cycling by not just focusing on building cycling infrastructure. It is important to focus bicycle policies also on place based factors.

5.3. Strengths and limitations

This thesis demonstrated what people experience during cycling by providing an overview from four influencing factors. This factors showed influences related to bicycle culture, what it means and which role it plays in the Netherlands. Because cycling is often seen as a habit, scientist take some circumstances and related effects for granted. Which means that some effects are not visual anymore without the context of the bicycle culture compared with bicycle cultures in other countries (Pelzer, 2013; Van Acker et al, 2010). Within this research this aspect is taken into account which is a strength of this research. Especially the conclusions forthcoming of the personal and household characteristics show that it is important to integrate this factor within transportation research. The literature study showed much differences in other countries between several personal and household characteristics. In contrast to between experiences effected by personal and household characteristics in the Netherlands.

For bicycle culture within the Rotterdam City Region is demonstrated, by the statistical analysis and confirmed by literature, that not much differences are found between the experience of

cycling influenced by personal and household characteristics. There is one important exception which is related to the experience of cycling by ethnic minorities. This group experiences cycling much different than native Dutch people. Although different scientific and other studies (Oijen et al, 2011; Gemeente Rotterdam, 2007) showed that ethnic minorities do have a different experience of cycling there is a limitation within this research. The amount of cycling journeys done by ethnic minorities within this research is relatively low compared with the amount of ethnic minorities living within the entire Rotterdam City Region. This implies that the results regarding ethnic minorities within this research are often an indication, without hard conclusions. A recommendation is to focus an additional research on the experience of cycling from ethnic minorities compared with the experience of cycling of Native Dutch people to find the differences for the bicycle experience.

Another strength of this research is that it was possible to create a broad overview of all kind of different influencing factors with several variables because of the availability within the dataset. The advantages are, that in general, enough cases for the statistical analysis are available. Also the quality of the dataset is high because it is developed by a specialized company (INTOMART GFK) and Utrecht University (Universiteit Utrecht et al, 2013). Although there was a limitation within the factor built environment. Despite a leak of variables about bicycle related infrastructure and bicycle related facilities within the dataset, this study cannot provide detailed conclusions about the influences of the built environment on bicycle experience. The theoretical framework showed that according to Pelzer (2010), Heinen et al (2010) Van Twuijver et al, (2006) and Pucher & Bueheler (2008) can be concluded that also infrastructure variables and variables about bicycle facilities are important for the experience of cycling. This can be used in addition on the conclusion of this research. Because this research indicated that the personal and traffic safety are influenced by the residential environment of a cyclist, address density and the building diversity but it gives not enough depth to argue why this variables have influence for the experience of cycling. An example for additional research is to study the relation between bicycle experience and the built environment. By using also infrastructure related variables it results in more detailed conclusions for the experience of cycling associated with the built environment.

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Appendixes

Apendix 1: Selection original variables

Original variables used for dependent variables.

Variable	Description	Scale	Values
Greenness	Valuing experience of greenness of the environment.	Ratio	1= Very less green 2= Less green 3= Not less/not much green 4= Much Green 5= Very much green
Exposure	Valuing experience of the exposure of the environment.	Ratio	1= Very sheltered 2= Sheltered 3= Not sheltered/not open 4= Open 5= Very open
Aesthetics	Valuing experience of the aesthetics of the environment.	Ratio	1= Very pretty 2= Pretty 3= Not pretty/not ugly 4= Ugly 5= Very ugly
Liveliness	Valuing experience of the liveliness of the environment.	Ratio	1= Very lively 2= Lively 3= Not lively/not monotonous 4= Monotonous 5= Very monotonous
Crowdedness	Valuing experience of the crowdedness of the environment.	Ratio	1= Very crowded 2= Crowded 3= Not crowded/not quiet 4= Quiet 5= Very quiet
Friendliness	Valuing experience of the friendliness of the environment.	Ratio	1= Very jovial atmosphere 2= Jovial atmosphere 3= No jovial, no aloof atmosphere 4= Aloof atmosphere 5= Very aloof atmosphere

Variable	Description	Scale	Values
Happiness	Experienced emotions during cycling	Ratio	1= Very sad 2= Sad 3= Not sad/Not happy 4= Happy 5= Very happy
Fear	Experienced emotions during cycling	Ratio	1= Much fear 2= Fear 3= Not fear/Not fearless 4= Fearless 5= Much fearless
Irritation	Experienced emotions during cycling	Ratio	1= Very satisfied 2= Satisfied 3= Not satisfied/Not irritated 4= Irritated 5= Very irritated
Calmness	Experienced emotions during cycling	Ratio	1= Very calm 2= Calm 3= Not calm/Not restless 4= Restless 5= Very restless
Alertness	Experienced emotions during cycling	Ratio	1= Very alert 2= Alert 3= Not alert/Not preoccupied 4= Preoccupied 5= Very preoccupied
Tiredness	Experienced emotions during cycling	Ratio	1= Very full of energy 2= Full of energy 3= Not full of energy/Not tired 4= Tired 5= Very tired

Apendix 2: Factor analysis

For the dependent variables it is needed to create dependent variables from the five point scale ratio variables that together form the dependent variables. The expectation after the theoretical framework is that the variable experience of place will measure value judgments of the place. The variable experience of journey is a combination of different emotions. According to Levelt (2003) the combination of this variables about emotions will indicate how people experience comfort and safety. This is the most important aspect of experience of journey.

With this factor analysis the presuppositions that different variables will merge together to less variables without losing much strength of data will be measured (Field, 2013). Further this factor analysis is a statistical check to merge variables. In this way the combination of variables will be tested and decisions can be made to put variables together or not. This Factor analysis is also meant to check how many dependent variables have to be created for this research.

Together with the factor analysis it is important to measure the intern consistency which is needed to find if different variables have too much influences on each other (Apendix 2A). This can be tested with a reliability analyst expressed as Cronbach's α. If Cronbach's α has an outcome between ,5 and 1,0 it means that the variables are intern consistent (Field, 2013; Vocht, 2011). Than the combination of variables can used as one variable. When Cronbach's α is below ,5 variables have to be removed which means that the combination of variables does not mean anything. In this case another combination of variables needs to be tested with Cronbach's α. When the right combination of variables is found the factor analysis can be done (Field, 2013; Vocht 2011).

The results of the factor analyst and the reliability analyst are visible in table A and show that there emerge three different factors consisting out of in total 10 different variables from the original 12 (Apendix 1). Due to the fact that the variables alertness and energetic are no emotions but moods they do not fit within one factor as expected according to the literature because moods have influence on emotions, therefore this variables are not included in the factor analysis. According to SPSS Wizard (2014), SPSS finds factors on basis of correlations and when the colorations are high they will be put in the same factor while it is not actually possible according to literature.

The presupposition was that two variables, experience of journey and experience of place would appear after the factor analyst. The results show that there emerged 3 factors namely experience of journey, experience of place and experience of place 2.

Table A Summary factor analysis (N=3032)

	Rotated Factor Loadings		
	Experience of journey	**Experience of place**	**Experience of place 2**
Greenness	,02	**,82**	-,17
Exposure	,01	**,44**	,01
Aesthetics	,20	**,76**	,21
Liveliness	,14	,28	**,84**
Crowdedness	-,09	-,14	**,88**
Friendliness	,36	**,54**	,24
Happiness	**,80**	,19	,01
Fearless	**,79**	,05	-,01
Satisfied	**,88**	,10	,06
calmness	**,86**	,07	,03
Eigenvalues	2,97	1,88	1,61
%of variance	29,7	18,8	16,1
α	,86	,57	,07

The factor analysis is verified by the Kaiser-Meyer-Olkin (KMO) and shows a value of ,759. which shows that the model has a 'good' adequacy. Based on this factor analysis is decided to create two dependent variables because the Chronbach's α of 'experience of place 2' is below ,5. This value is according to Field (2013) the limitation and therefore this variable will not be used.

Within this research there will made use of two dependent variables, namely experience of place and experience of journey. Experience of journey is a combination of the variables happiness, calmness, satisfied and fearless. Experience of place consisting out of exposure, greenness, aesthetics and friendliness. The dependent variables have a Cronbach's α of ,86 and ,57 which means that the intern consistency satisfies the requirements. Also the eigenvalue is above 1 which means that the factor analysis has got enough fit according to the Kaiser's criterion (Field, 2013). The eigenvalues represent the amount of variation from the different factors. The percentage of variance shows that experience of journey represents 29,7% of the total variance of the different variables and experience of place 18,8%.

Appendix 2A: Reliability analyses

Factor 1:

Reliability Statistics

Cronbach's Alpha	N of Items
,864	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
happiness	12,14	4,964	,684	,838
calmness	12,06	4,437	,749	,812
Satisfied	12,08	4,414	,774	,800
Fearless	11,93	5,084	,648	,852

Factor 2:

Reliability Statistics

Cronbach's Alpha	N of Items
,586	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
greenness	9,85	3,151	,448	,444
exposure	9,70	3,969	,203	,646
aesthetics	9,66	3,477	,497	,420
friendliness	9,44	3,870	,359	,522

Factor 3:

Reliability Statistics

Cronbach's Alpha	N of Items
,072	2

Appendix 2B: Tables factor analysis

Rotated Component Matrix[a]

	Component		
	1	2	3
greenness	,022	,817	-,167
exposure	,009	,444	,006
aesthetics	,201	,756	,206
liveliness	,144	,279	,841
crowdedness	-,085	-,138	,879
friendliness	,356	,542	,243
happiness	,795	,188	,012
Fearless	,793	,054	-,007
Satisfied	,875	,100	,060
calmness	,864	,069	,026

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,759
Bartlett's Test of Sphericity	Approx. Chi-Square	10067,740
	df	45
	Sig.	,000

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,425	34,246	34,246	3,425	34,246	34,246	2,969	29,693	29,693
2	1,651	16,514	50,760	1,651	16,514	50,760	1,879	18,789	48,482
3	1,386	13,857	64,617	1,386	13,857	64,617	1,614	16,135	64,617
4	,957	9,571	74,188						
5	,607	6,072	80,260						
6	,517	5,173	85,432						
7	,463	4,631	90,063						
8	,426	4,257	94,320						
9	,341	3,413	97,733						
10	,227	2,267	100,000						

Extraction Method: Principal Component Analysis.

Appendix 3: Correlation matrix

Pearson correlation matrix independent interval/ratio variables.

Correlations

		air temperature hourly	wind speed hourly	precipitation sum in mm hourly	Green percentage (buffer 200m)	Address density (buffer 200m)	Building diversity (buffer 200m)	age in years	trip duration in min
air temperature hourly	Pearson Correlation	1	.069**	-.039*	-.002	.023	.004	.018	-.058**
	Sig. (2-tailed)		.000	.018	.911	.213	.811	.271	.001
	N	3604	3604	3604	2842	2842	2842	3604	3588
wind speed hourly	Pearson Correlation	.069**	1	.221**	.017	.000	-.014	-.020	-.019
	Sig. (2-tailed)	.000		.000	.353	.990	.457	.219	.251
	N	3604	3604	3604	2842	2842	2842	3604	3588
precipitation sum in mm hourly	Pearson Correlation	-.039*	.221**	1	.015	-.042*	-.025	-.025	-.006
	Sig. (2-tailed)	.018	.000		.423	.026	.189	.129	.716
	N	3604	3604	3604	2842	2842	2842	3604	3588
Green percentage (buffer 200m)	Pearson Correlation	-.002	.017	.015	1	-.456**	-.442**	-.002	-.009
	Sig. (2-tailed)	.911	.353	.423		.000	.000	.923	.643
	N	2842	2842	2842	2845	2845	2845	2845	2831
Address density (buffer 200m)	Pearson Correlation	.023	.000	-.042*	-.456**	1	.581**	-.039*	.074**
	Sig. (2-tailed)	.213	.990	.026	.000		.000	.038	.000
	N	2842	2842	2842	2845	2845	2845	2845	2831
Building diversity (buffer 200m)	Pearson Correlation	.004	-.014	-.025	-.442**	.581**	1	.005	.000
	Sig. (2-tailed)	.811	.457	.189	.000	.000		.771	.980
	N	2842	2842	2842	2845	2845	2845	2845	2831
age in years	Pearson Correlation	.018	-.020	-.025	-.002	-.039*	.005	1	-.070**
	Sig. (2-tailed)	.271	.219	.129	.923	.038	.771		.000
	N	3604	3604	3604	2845	2845	2845	3607	3589
trip duration in min	Pearson Correlation	-.058**	-.019	-.006	-.009	.074**	.000	-.070**	1
	Sig. (2-tailed)	.001	.251	.716	.643	.000	.980	.000	
	N	3588	3588	3588	2831	2831	2831	3589	3589

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 4: Regression analysis; Experience of place

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,344[a]	,118	,112	,55078

a. Predictors: (Constant), trip duration in min, Dummy Outer-center, precipitation sum in mm hourly, Dummy ED Middle, Dummy Work/Study, Green percentage (buffer 200m), male (1=male/0=female), air temperature hourly, Dummy HHI >4000, Dummy Social_Visits, wind speed hourly, ethnicity (1=non western/0=native Dutch), Dummy HHI 3000-4000, age in years, Dummy Green-Suburban, Dummy HHI 2000-3000, Building diversity (buffer 200m), Dummy Errands, Address density (buffer 200m), Dummy ED Higher, Dummy Innercity

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	113,575	21	5,408	17,828	,000[b]
	Residual	847,273	2793	,303		
	Total	960,848	2814			

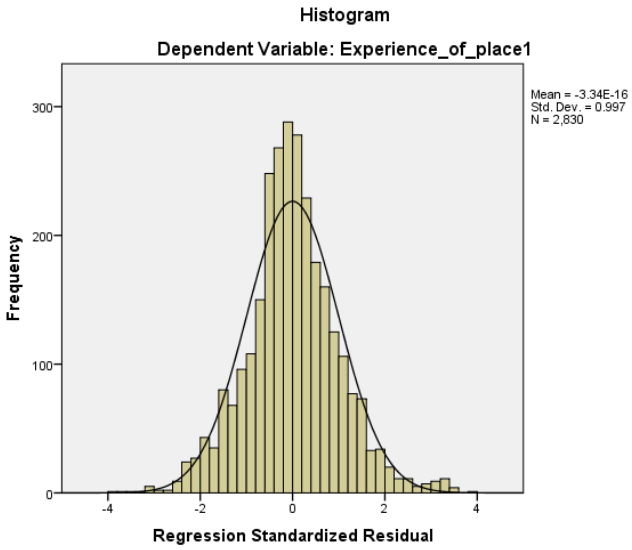
a. Dependent Variable: Experience_of_place1

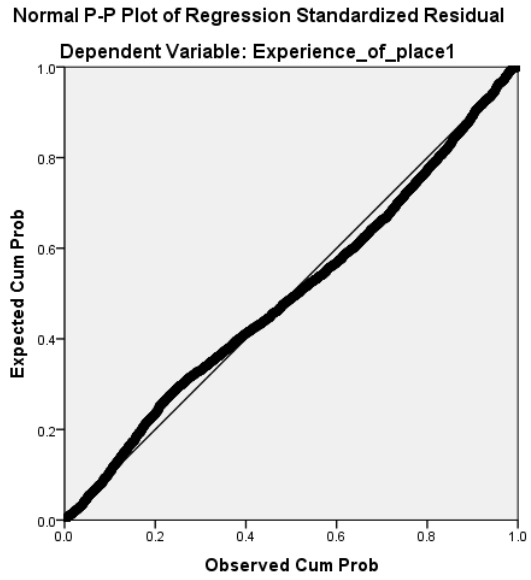
b. Predictors: (Constant), trip duration in min, Dummy Outer-center, precipitation sum in mm hourly, Dummy ED Middle, Dummy Work/Study, Green percentage (buffer 200m), male (1=male/0=female), air temperature hourly, Dummy HHI >4000, Dummy Social_Visits, wind speed hourly, ethnicity (1=non western/0=native Dutch), Dummy HHI 3000-4000, age in years, Dummy Green-Suburban, Dummy HHI 2000-3000, Building diversity (buffer 200m), Dummy Errands, Address density (buffer 200m), Dummy ED Higher, Dummy Innercity

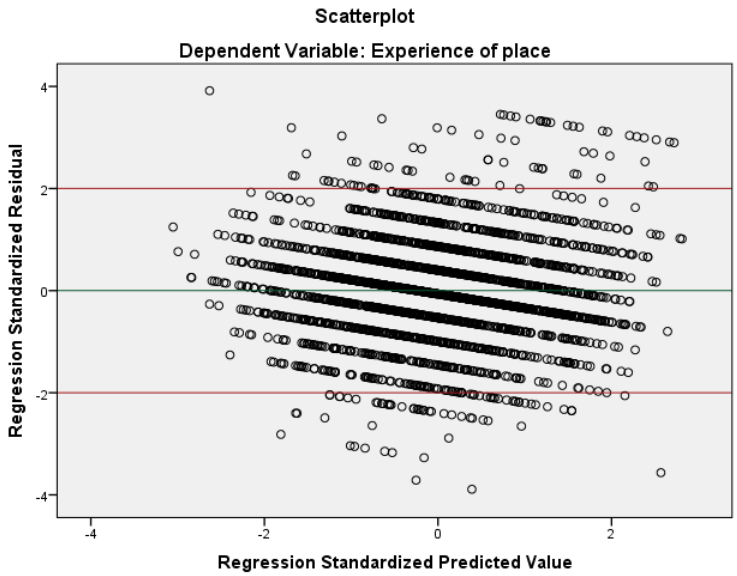
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3,347	,073		45,582	,000	3,203	3,491
	air temperature hourly	,011	,001	,154	8,461	,000	,008	,013
	wind speed hourly	-,007	,007	-,019	-1,037	,300	-,021	,006
	precipitation sum in mm hourly	-,061	,042	-,026	-1,438	,150	-,144	,022
	Dummy Innercity	-,187	,036	-,138	-5,174	,000	-,258	-,116
	Dummy Outer-center	-,066	,033	-,050	-1,977	,048	-,131	-,001
	Dummy Green-Suburban	-,040	,031	-,029	-1,282	,200	-,102	,021
	Green percentage (buffer 200m)	,000	,001	,016	,700	,484	-,001	,002
	Address density (buffer 200m)	-,002	,000	-,103	-4,198	,000	-,003	-,001
	Building diversity (buffer 200m)	-,211	,058	-,082	-3,660	,000	-,325	-,098
	age in years	,001	,001	,026	1,279	,201	-,001	,003
	male (1=male/0=female)	,018	,023	,015	,770	,441	-,028	,064
	ethnicity (1=non western/0=native Dutch)	-,014	,044	-,006	-,312	,755	-,100	,073
	Dummy HHI 2000-3000	-,076	,027	-,057	-2,818	,005	-,128	-,023
	Dummy HHI 3000-4000	-,003	,030	-,002	-,087	,931	-,062	,057
	Dummy HHI >4000	-,086	,042	-,040	-2,028	,043	-,169	-,003
	Dummy ED Middle	-,049	,029	-,041	-1,706	,088	-,106	,007
	Dummy ED Higher	-,021	,033	-,017	-,642	,521	-,085	,043
	Dummy Work/Study	-,101	,031	-,072	-3,243	,001	-,162	-,040
	Dummy Errands	-,100	,027	-,084	-3,670	,000	-,154	-,047
	Dummy Social_Visits	-,143	,038	-,077	-3,770	,000	-,217	-,069
	trip duration in min	,003	,000	,104	5,478	,000	,002	,003

a. Dependent Variable: Experience_of_place1


Histogram
Dependent Variable: Experience_of_place1
Mean = -3.34E-16
Std. Dev. = 0.997
N = 2,830
Frequency
300
200
100
0
-4
-2
0
2
4
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Experience_of_place1
Expected Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0
Observed Cum Prob


Scatterplot
Dependent Variable: Experience of place
Regression Standardized Residual
4
2
0
-2
-4
-4
-2
0
2
Regression Standardized Predicted Value

Appendix 5: Regression analysis; Experience of journey

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,368[a]	,135	,129	,66208

a. Predictors: (Constant), trip duration in min, Dummy Outer-center, precipitation sum in mm hourly, Dummy ED Middle, Dummy Work/Study, Green percentage (buffer 200m), male (1=male/0=female), air temperature hourly, Dummy HHI >4000, Dummy Social_Visits, wind speed hourly, ethnicity (1=non western/0=native Dutch), Dummy HHI 3000-4000, age in years, Dummy Green-Suburban, Dummy HHI 2000-3000, Building diversity (buffer 200m), Dummy Errands, Address density (buffer 200m), Dummy ED Higher, Dummy Innercity

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	191,200	21	9,105	20,770	,000[b]
	Residual	1224,323	2793	,438		
	Total	1415,523	2814			

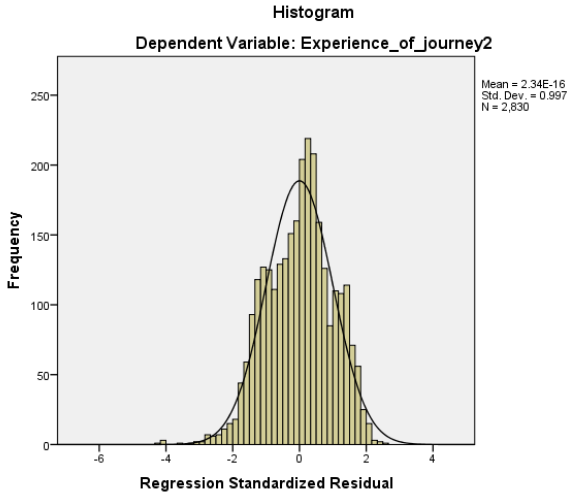
a. Dependent Variable: Experience_of_journey2

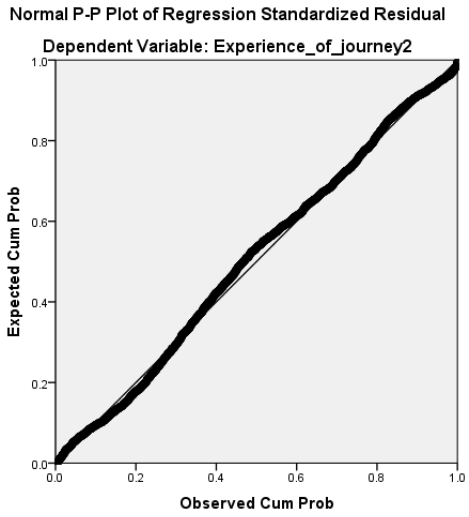
b. Predictors: (Constant), trip duration in min, Dummy Outer-center, precipitation sum in mm hourly, Dummy ED Middle, Dummy Work/Study, Green percentage (buffer 200m), male (1=male/0=female), air temperature hourly, Dummy HHI >4000, Dummy Social_Visits, wind speed hourly, ethnicity (1=non western/0=native Dutch), Dummy HHI 3000-4000, age in years, Dummy Green-Suburban, Dummy HHI 2000-3000, Building diversity (buffer 200m), Dummy Errands, Address density (buffer 200m), Dummy ED Higher, Dummy Innercity

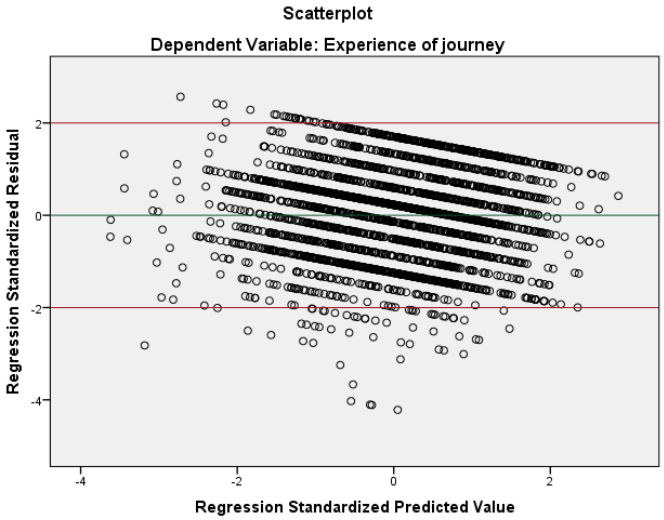
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3,728	,088		42,238	,000	3,555	3,901
	air temperature hourly	,011	,002	,135	7,459	,000	,008	,015
	wind speed hourly	-,030	,008	-,065	-3,600	,000	-,046	-,013
	precipitation sum in mm hourly	-,353	,051	-,126	-6,952	,000	-,452	-,253
	Dummy Innercity	-,093	,043	-,057	-2,140	,032	-,178	-,008
	Dummy Outer-center	,142	,040	,088	3,545	,000	,063	,220
	Dummy Green-Suburban	-,084	,038	-,050	-2,216	,027	-,158	-,010
	Green percentage (buffer 200m)	-,001	,001	-,014	-,616	,538	-,002	,001
	Address density (buffer 200m)	-,001	,001	-,050	-2,066	,039	-,002	,000
	Building diversity (buffer 200m)	,146	,069	,047	2,102	,036	,010	,282
	age in years	,005	,001	,116	5,680	,000	,004	,007
	male (1=male/0=female)	,083	,028	,057	2,950	,003	,028	,138
	ethnicity (1=non western/0=native Dutch)	-,118	,053	-,041	-2,215	,027	-,222	-,013
	Dummy HHI 2000-3000	,001	,032	,000	,024	,981	-,062	,064
	Dummy HHI 3000-4000	,262	,037	,143	7,183	,000	,191	,334
	Dummy HHI >4000	,236	,051	,090	4,623	,000	,136	,336
	Dummy ED Middle	,001	,035	,001	,028	,978	-,067	,069
	Dummy ED Higher	-,100	,039	-,067	-2,528	,012	-,177	-,022
	Dummy Work/Study	-,166	,037	-,097	-4,435	,000	-,239	-,092
	Dummy Errands	-,018	,033	-,013	-,553	,580	-,083	,046
	Dummy Social_Visits	-,008	,046	-,003	-,168	,867	-,097	,082
	trip duration in min	,000	,001	-,009	-,504	,614	-,001	,001

a. Dependent Variable: Experience_of_journey2


Histogram
Dependent Variable: Experience_of_journey2
Mean = 2.34E-16
Std. Dev. = 0.997
N = 2,830
Frequency
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Experience_of_journey2
Expected Cum Prob
Observed Cum Prob


Scatterplot
Dependent Variable: Experience of journey
Regression Standardized Residual
Regression Standardized Predicted Value