ERASMUS UNIVERSITY ROTTERDAM

The Drive of the leisure Driver

Abstract

Paradoxically, the prevalent status of the automobile today has become a threat to the accessibility of urban centers. Car-usage is very popular for both day-to-day travels as well as for leisure travel. This research investigates car-usage among leisure travelers and in particular the key characteristics of car users as well as their dependence on the car to realize a trip. Using an extensive personal survey, car users and the determinants of their behavior are mapped. This paper also adds a methodological contribution as it introduces a tracking-application developed at Erasmus University in which participants were followed for one day in the Dutch leisure city of Scheveningen. Apart from demonstrating the importance of what others have already found, new findings show that distance to the leisure location is positively related to car-usage – which contrasts the premise that public transport is competitive over longer distance. Additionally, the measured physical activity of people that use the car for leisure travel is proven to be considerably lower than customary, which could point to some limiting factor, or selection effects.

Master Thesis

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1. Introduction

The allure of the sound of a motorized vehicle to some is intriguing. These people associate it with feelings of freedom, masculinity, status and flexibility (Kharizsa et al., 2015). Famous industrial designer Raymond Loewy once said that the American automobile industry of mass production would change the habits of every modern society, and it did. By the beginning of the 20th century the world progressed in a much faster pace, because of better and more affordable accessibility to cars. Quicker distribution of goods and people inflated economic development of the western world (Setright, 2002). Nowadays, the Dutch society identifies independence as one of the synonyms for car-ownership (Fortuin, 2017). Based on that, one could tell that Dutch people are longing for independence, since in January 2019, 8.5 million cars were owned in the Netherlands in relation to a total population of 17 million people including elderly and children (CBS, 2019-a).

Ironically, the prevalent status of the automobile today is also a threat to independence, as collectively our society experiences congestion due to everyone exercising their car-based freedom. The dominance of the car reduces the accessibility of urban centers, requires dependencies on foreign supplies of oil for many countries, degrades communities and socially excludes some of them that do not own motorized vehicles (Sovacool, 2009). Furthermore, accidents that involve cars are responsible for hundreds of direct Dutch fatalities per year (CBS, 2019-b). Additionally, everyday travel time by car has increased by more than 20 percent over the last three years and is expected to increase over 35 percent over the next five years, according to the Dutch knowledge institute for mobility (Unen, 2018). In comparison, changing travel behavior from private car-use to the use of public buses would consume 24 times less space in the city per passenger (Servant, 1996). However, the actual number of cars in the Netherlands suggests that the Dutch population considers the aforementioned negative aspects as subordinate to the benefits of car-use or in other words a tipping point has not yet been reached. To researchers working in the field of sustainable mobility, this seems incomprehensible, which in turn gives rise to activist scientists defaming car users on social media. This research studies the individual heterogeneity within the population to determine the underlying characteristics of car users and the factors that motivate their car use. More detailed knowledge of the motives for car-use as well as the characteristics allow policy makers to explore new avenues for alternative mobility strategies, as the traditional policies of attempting to switch car users to public transport are not successful at sufficiently large scale to offset the growth in mobility.

This research project is focused on leisure travel, since potentially, this is the group of car users that is most easily convinced to switch. The modal choice behavior for leisure travel is interesting, as this group of travelers more often makes choices outside of their routine behavior and therefore deliberately chooses for a specific form of transport (Van Acker, Mokhtarian, & Witlox, 2011). Along these lines, relevant patterns of habitual behavior can be offset against deliberate choice patterns for a specific modal choice (Kurz et al., 2015).

In addition, this study is focused solely on car users. While some may argue a 'control group' is needed, this study takes a different approach. Policy focused on convincing car users to change their behavior, requires insight in the specific considerations of car users. While many approaches are based on demonstrating differences between car users and public transport users, this study believes that such between-group *collective* heterogeneity is not instructive in promoting alternatives to the car, it is within-group *individual* heterogeneity that provides opportunities for switching. Already in 2002, research showed that within homogenous socio-economic and socio-demographic groups still different travel patterns appeared (van Wee, 2002).

In essence it is a different question: what explains the a priori choice for a mode? Or, which nudges are effective in ignoring the a priori choice in favor of a different choice? This can be made clearer with an example: habit is often quoted as one of the reasons for repeated car use. However, such habits are formed because of individual considerations, which can range from disability, to time savings, to practical issues, to cost considerations, to the need to carry luggage or supplies. Each of these considerations yields a different propensity to switch to alternatives to the car. Therefore, building upon the previous studies that have documented differences between groups, this study aims to dive deeper into the within group differences of car users.

There is a strong foundation to build upon. Scholars have found proof for a diverse set of causes resulting in more or less car-use compared to the use of public transport. Themes in former research center around personal characteristics such as income, gender and living family life. On the other hand, spatial characteristics such as accessibility and density in the place of residence play a significant role (Schwanen, Dieleman, & Dijst, 2001; Cao, Mokhtarian, & Handy, 2007; Kitamura, 2009; Schwanen, 2011; Van Acker, Mokhtarian & Witlox, 2011). The outcome of the specific researches is, as acknowledged by scholars, highly dependent on the region of study. Furthermore and to the knowledge of the author, with the exception of the study by Van Acker, Mokhtarian & Witlox (2011), none of these scholars focus specifically on leisure travel modal choice. Accordingly, the present study also adds knowledge on leisure travel behavior for Dutch citizens within The Netherlands.

As argued, the present research will focus solely on the motives to reach a leisure destination using the car as mode of transport using survey and experimental data on what car-users themselves mention as motives for using the car for leisure purposes – this is in line with a *stated preference* approach. Furthermore, data on income, family composition, demographics, and place of residence is used to investigate the underlying motivation to travel by car – which is in line with a *revealed preference* approach. Additionally, the present study is focused on Dutch citizens only, traveling to the city of Scheveningen for leisure. This study uses a logistic model to link the willingness to come to Scheveningen in the absence of a car to travel behavioral motives. Car users are thus presented with the hypothetical case that their car would not have been available. Forcing them to reconsider their travel choices. This provides insight into the composition of the car user group and the degree to which they consider themselves to be car dependent. In addition, an experiment is executed in which a smartphone application developed at Erasmus University Rotterdam, is used to track the participants during their time of visit in the leisure city of Scheveningen. This provides revealed patterns which may be instructive in discovering additional 'hidden' determinants of car use.

The main research question is accordingly formulated as:

"What drives car-use as mode of transport for leisure travel by Dutch citizens?"

The remainder of the paper is organized in seven sections. The remainder commences with an extensive literature review of past research in the topic of travel behavior. The data and variables that are prevalent in past research and are used in the current are discussed in section 3 and 4. In section 5 the results will be presented, and the present research will conclude with a conclusion and limitations.

2. Composition of previous findings in the field of modal choice

The use of cars for every day transport has been popular ever after cars became affordable to the public at the beginning of the 20th century. Henry Ford developed a way of mass production for cars that made production much cheaper and therefore affordable to the public (Batchelor, 1994). Back in the days it was the sudden change of technology and availability that drove the popularity of motorized transportation (Sovacool, 2009). In modern times, cars are not more accessible in monetary terms than in the past decades. The opposite all the more true. Yet what are the factors that attract drivers to their cars and withhold them from alternative forms of transport? In line with the rest of the current research, this section focusses especially on the use of cars for leisure travel purposes.

The remainder of this section provides a selected overview of previous findings on modal choice of leisure travelers. Research into modal choice is centered on a number of themes that can be captured into five major themes, specifically: (1) Personal characteristics associated with modal choice; (2) Spatial characteristics, scale and the feasibility of different modes; (3) Motives as determinants of modal choice; (4) Habits and habitual behavior that limit the propensity for change; (5) Policies directed at enacting behavioral change. The subsequent sections will cover these five themes respectively.

2.1 Personal Characteristics

People are different and it is among others these differences that shape the attitude of an individual towards a specific form of travel behavior. Previous literature found specific measurable and subjective characteristics of people to be correlated with either a higher likelihood of travelling by car or public transport (Schwanen, Dieleman, & Dijst, 2001; Kitamura, 2009; Schwanen, 2011; Van Acker, Mokhtarian & Witlox, 2011). The outcome is of past studies is however often contradicting and dependent on the area of study, which leaves room for further analysis in this field.

Nevertheless, some common ground can be identified. Scholars from the first decade of the 21st century are conclusive about different travel behavior among genders, stipulating that women are more likely to use public transport compared to men. Men in turn are more frequent car users (Schwanen, Dieleman, & Dijst, 2001). In a survey conducted in Dutch cities in 1998, Schwanen, Dieleman & Dijst (2001) show that women are 1.69 times more likely to use public transport compared to men, even when controlling for family composition. Furthermore, previous results show that women tend to travel more for leisure purposes such as shopping and visits and use public transport especially for these trips (Civitas, 2014). Van Acker, Mokhtarian & Witlox (2011) find that in Belgium there is considerable heterogeneity within leisure travel with regard to modal choice. They find that out of the three different types of leisure trips: family visits, active leisure activity and fun shopping, public transport is hardly used for the first two activities, but quite often for the last activity. They identify selection bias as the primary reason for this relationship: in fun-shopping activities women have a substantially larger share. This, however, still does not explain *why* women are more prone to use public transport for this activity. Basaric et al. (2016), attribute the higher propensity of women to use public transport to the fact that women have more environmentally focused norms and values that make public transport more attractive. The line of reasoning is however, not fully convincing, as it is interesting to note that across Europe, women travel more frequently but much shorter distances (Schwanen, Dieleman, & Dijst, 2001). Research on Dutch citizens by the Dutch organization of statistics shows that women travel significantly more by bus, tram and metro. In line with this, the likelihood of owning a car is substantially lower for women compared to men (CBS, 2016). It is in that case the question what the driving factor is behind this lower rate of car ownership. Potential explanations may be the explanation of Basaric et al. (2016) on norms and values, but could also be traditional role models, where families with a single car primarily make the car available to the working partner (often men), in families with one-stay-at-home parent. As such, studies controlling for actual car ownership may provide additional insight in the debate on gender and car / public transport use.

Next to gender, previous research identifies age as a driving factor of modal choice. Alsnih & Hensher (2003) describe that the travel needs of seniors grow more complex with their age and a car will therefore fit better to their demands. Nevertheless, empirical results on age and travel behavior show this relationship to be mostly insignificant or very weak (Basaric et al, 2014; Schwanen, Dieleman, & Dijst, 2001). Notwithstanding but self-evident, Polzin, Chu & Rey (2000) state that children travelling alone, and elderly are associated with captive riders of public transport. In addition, there is also covariation between age cohorts and families with children. However, this factor should be treated separately, as it is the presence of children that drives choices, not so much age in these cases as will be discussed in the remainder.

Income is fundamental to the demand for public transport and car-use as each mode will have its income-elasticities, but through substitution the price-elasticity of both modes also interacts. As such two mechanisms are at work. It is important to distinguish between the demand for transport and fulfilling that demand using a particular mode. In essence there is a relationship between quantity of transport consumed and income, but also between model choice and income. Some income groups may simply not be able to afford a car, or conversely may face barriers to entry in public transport. previous research shows controversy on the sign of the relationship between income and travel behavior. Yet, Kitamura (2009) uses data from the United States [U.S.] to show that "lower income groups have higher shares of expenditure on non-private transportation, indicating their dependence on public transport". The opposite holds for higher income groups. Dieleman et al. (2002) connect this to the desire of high-income groups to live in suburban areas with larger plot sizes that are less accessible by public transport. On the contrary, Holmgren (2013) finds that income affects public transport usage directly in a positive way, but also indirectly through car ownerships negatively. Naturally, an increase in income leads to more trips in the first place, but combined with a change in car-ownership leads to shift from public transport usage to more car-usage (Paulley et al., 2006). Both effects combined however, find a total income effect close to zero (Holmgren, 2013). The controversy in the literature may be attributable to the mixed effects of the income-transport relationship and the income-modal choice relationship.

More consensus prevails on the influence of **children** on the travel behavior of families. In the young years, up to five years old, the presence of children has a strong inhibiting effect, reducing the outgoing leisure travel behavior of parents overall as well as favoring car use as small children require many practical resources which need to be carried (Allaman et al., 1982; Kitamura, 2009). According to Chakrabrati & Joh (2019), the impact of school-age children on car-usage is largest. They state that the presence of school-age children "is on average associated with relatively higher car use and lower levels of public transport use". This is explained by the arising time-crunch and the flexibility desired (Schwanen, 2011). Often, these families engage in complex patterns of trip-chaining as work, leisure, schooling, (fun)-shopping and these activities are all interweaved into an increasingly condensed calendar. An individual travel mode, such as the car, in that case leads to considerable flexibility and time savings.

Recently, pre-existing **attitudes** towards either car-use or the use of public transport as a decisive factor gain attention in research. Already in 2002, research showed that within homogenous socio-economic and socio-demographic groups still different travel patterns appeared (van Wee, 2002). Van Acker, Mokhtarian & Witlox (2011) find that independent of measurable variables [i.e. gender, family composition, income, etc.], a positive attitude towards cars leads to more car-usage compared to the use of public transport. Simply put, people that like cars and car driving have a more car-oriented lifestyle and obviously use their cars more than comparable people. The same works for public transport (Van Acker, Mokhtarian, & Witlox, 2011). Aforementioned demonstrates that travel behavior is not fully attributed to measurable personal characteristics or the subsequently discussed spatial characteristics, but even more by the attitude, values and preferences of people (Kitamura, 2009).

2.2. Spatial influences

Next to the personal characteristics that drive people into a specific form of travel behavior, spatial characteristics of the place of residence of people influence travel behavior alike. The correlation and causality issue between the built environment and travel behavior has been of great interest for researchers in the field of urban planning since the nineties of the last century (Van Acker, Mokhtarian, & Witlox, 2011). Most previous research has been built around the problem of how neighborhoods shall be organized as to shift car-usage into the use of public transport or active forms of transport, thereby reducing the amount of carbon dioxide and increasing livability. The dominant scholars in the field state that the built environment is highly associated with travel behavior (Van Acker, Mokhtarian, & Witlox, 2011; Cao, Mokhtarian, & Handy, 2007; Chatman, 2005; Handy, Cao, & Mokhtarian, 2005). According to Van Acker, Mokhtarian & Witlox (2011), the built environment is assumed to have a larger impact on leisure [optional] trips than on routine [business] trips. In optional trips, people act outside of their routine behavior and are therefore less influenced by their pre-existing attitude towards a certain mode of transport, as discussed in the previous section. Still, what are the specific spatial characteristics that influence leisure travel behavior?

Among others Cao, Mokhtarian & Handy (2007) find increases in neighborhood or regional destination **accessibility** as the most important factor in scaling down car-usage. More specifically, a higher level of accessibility to destinations provides citizens with viable alternative transportation options. Destination accessibility is explained by the ease of access to trip attractions. In line with this, Ewing & Cervero (2001) show that Vehicle Miles Traveled [VMT] per capita declines as a linear function of regional accessibility. Moreover, they calculate a typical elasticity of -0.20 of VMT to regional destination accessibility, hence a 10% increase in destination accessibility is linked to a 2% decline in VMT. Furthermore, they show that total trip frequencies are roughly independent from VMT, what makes them conclude that “any drop in auto trips with greater accessibility is roughly matched by a rise in transit or walk/bike trips”.

Although in close relationship to accessibility, the relationship between travel behavior and population **density** receives a lot of attention in previous literature. Albeit the relationship gets more challenged recently, it is generally found to be negative with respect to car usage, accompanied with a typical elasticity of -0.05 (Ewing & Cervero, 2001). According to Brownstone & Golob (2008), a reduction in population density of roughly 40% of the mean value of their sample, leads to a 4.8% increase in VMT. Brownstone (2008) notes however that, despite significant, the magnitude of the relationship between density and VMT is too small therefore requiring extreme changes in the built environment. Aforementioned is in line with Downs (2005), stating that "increasing the population density of an established metropolitan area requires extreme densities and infill development" and is therefore difficult to achieve. On the other hand, Schimek (1996) shows that a higher population density is associated with a larger concentration of jobs in the inner suburbs, resulting in higher quality public transport provision and therefore more usage, hinting on a positive relationship between density and accessibility. Buehler & Pucher (2012) add accordingly that public transport operators are often not able to serve low-density suburban areas due to monetary restrictions and unprofitability, thereby also connecting density to accessibility.

2.3 Motives for car-use

Improvements in the Dutch public transport sector and for example the rise of the electric bicycle are named to be able to decrease car-usage and car-possession in the Netherlands. Nevertheless, reality is that the growth of car-usage still slightly grows year after year (Hoenjet et al., 2018). The growth is likely to be caused by specific underlying motives. The specific motives are in the first place derived from the personal- and spatial characteristics that were discussed in section 2.1 & 2.2. A particular set of personal and spatial characteristic of an individual is likely to lead to one or more of the motives specified in the remained of this section.

By investigating the motives people have in using a dedicated travel mode, Anable & Gatersleben (2005) separated their sample group from Swedish respondents into commuters and leisure travelers. Their findings show that especially for leisure travelers the instrumental and affective factors of flexibility, convenience, travel-time, cost and freedom are all significant and important. Anable & Gatersleben (2005) show that flexibility and convenience score as most important, whereas for public transport the sustainable argument counts most. One could expect that these motives are in strong correlation to the personal- and spatial characteristics discussed in section 2.1 & 2.2. For instance, people carrying children would favor convenience whereas individuals living in less accessible and less densely populated areas would rank flexibility as a more important motive for traveling by car. Furthermore, cars are indeed more convenient for combining more different activities at the same time, a concept called trip-chaining (Schwanen, 2011), as discussed in section 2.1. Steg, Vlek & Slotegraaf (2001) likewise state that the attitude of people towards aforementioned factors of car-use is surprisingly more positive than for other forms of transport, even if public transport provision is more efficient on specific routes. Despite that Anable & Gatersleben (2005) rank flexibility and convenience higher than costs in motives for mode choice, Hensher et al. (2003) conclude that lower tariffs would contribute to better customer satisfaction and therefore lure more people from cars into public transport. Hence, Hensher et al. (2003) & Paulley et al. (2006) find strong correlations and elasticities between fares of public transport provision, public transport usage and car usage. The elasticities show a negative relation between fares and public transport usage. De Vos et al. (2016), performed a similar research and found comparable results.

Apart from the aforementioned instrumental motives, many scholars agree on that affective-symbolic motives play a role in mode choice. For many people, driving is by itself a positive and enjoyable activity (Bergstad et al., 2011). In the case of leisure trips, "emotions that people feel during the trip [feeling of speed, movement, control] do effect the final transport mode choice and seeking such emotions represents a basic reason for the trip by itself" (Lois & López-Sáez, 2009). This might change the purely utilitarian focus of researching the field of mode choice. A specific mode of transport simply adds to the utility of an individual, giving rise to the argument that mode choice is not simply a rational process.

2.4 Habitual behavior of car users

Basic motives originating from both personal- spatial characteristics, as previously described, do not fully explain travel behavior. These individual motives and considerations are on the basis of forming habitual behavior, especially when the journey is undertaken more than once (Eriksson et al., 2008). The habit of using a car, and therefore habitual behavior of car users, may be a habit that is strongly resistant to change. Once turned into a habit, car-use as a preferred mode of transportation is resistant to change, even with economic or more time efficiency present as a reason for change. Human cognition is involved in the decision process, yet one cannot expect car-users to change behavior in a mere response to one of the factors previously dicussed (Simsekoglu et al., 2017).

Scholars agree on that travel mode choice is strongly dependent on the habits of the traveler (Simsekoglu et al., 2017; Eriksson et al., 2008; Cantillo et al., 2007; Aarts et al., 1997). Following the results of Simsekoglu et al. (2017), people tend to stick with their past decisions. Erstwhile an individual start using a specific mode of transportation that is repeatedly used under relatively stable conditions, the likelihood that this travel mode develops into habitual behavior is highly likely, independent of the purpose of the trip. Furthermore, they state that when travel mode choice turns into a habit, the decision is automatically performed without deliberate thinking. Habitual behavior makes people cognitively closed (Simsekoglu et al., 2017). This is supported in research by Aarts et al. (1997) who show that individuals with a strong transport habit acquire less information about alternative travel options. They state that "habit reduces the elaborateness of information use in judgements of travel use". In other words, individuals for whom car-use has turned into a habit, tend to look less into information about alternative travel options. Cantillo et al. (2007) find that, as discussed earlier in the present paper, the habit is derived from a previous valuation of alternatives. Hence, the valuation originates in the past comparison of alternatives based on different motives, socio-demographics characteristics, and spatial characteristics. The findings of Cantillo et al. (2007) are in line with those by Verplanken & Aarts (1999) who state that habitual mind-sets focus solely on past experience and forego on making the association between past- and future behavior. A change in the factors discussed in the previous section [e.g. flexibility, fares, travel time, etc] would therefore be ineffective on the assumption that travelers do not try or look for substitutes. All the more, Moller & Thogersen (2008) find in a Danish study that past behavior is more influential in mode choice than the attitude towards either public transport or car-usage. On the other hand, they present that leisure travel has less potential to become habitual as it is not extensively performed. Ouellette & Wood (1998) do, however, mention a high frequency of operation as one of three prerequisites for habit formation. Linking aforementioned to travel choice would suggest that travel habits are less influential in leisure traffic. This corresponds to the previously mentioned statement by Van Acker, Mokhtarian & Witlox (2011) saying that in optional trips, people act outside their routine behavior and are therefore less influenced by their pre-existing attitude.

2.5 How to enact behavior change?

Many Western-European cities have implemented policies to reduce car usage in and to cities as to diminish pollution and improve air quality in the inner cities. Upon till now, only a few of these low emission zones have proven effective (Kruyswijk, 2019). To effectively reduce car-usage in urban areas, in-depth knowledge about the motives of car-usage is fundamental to act upon (Steg, 2005). The conversion of automobile drivers to the use of public transport is a solution to the negative consequences of car-use such as congestion and various adverse environmental effects (Fuijii & Kitamura, 2003). For decades already, it is of interest for policymakers; What initiates a behavioral change from a car-user to a public transport user? Most of the scholars in this field point this discussion towards what policymakers can do to break car-use habits. In other words, what incentives or sanctions proof effective in decreasing car-use.

Interventions to reduce automobile usage can be identified as either structural or psychological. The difference between both interventions is that structural initiatives are based on changing legislation to reduce attractiveness of car-use [e.g. road closure, road pricing, etc.], whereas psychological initiatives change attitudes as effectuate voluntarily change of transport choices (Garling & Schuitema, 2007; Fujii et al., 2001). Both structural and psychological interventions can influence car-use (Graham-Rowe et al., 2011).
Fujii et al. (2001) performed a natural-experiment by temporarily closing down a freeway for eight days. The results showed that the participants that normally commuted by car substantially overestimated the commuting time by public transport. Furthermore, during the closure, the use of public transport by commuting drivers increased from 9% up to 20%. These results show that, once habitual car-users are forced to try alternatives, attitudes towards alternatives might change and habits might be unfrozen. However, the scholars also affirm that the stronger the car-habit is, the less change is identified in travel behavior. Fujii & Kitamura (2003) also execute a natural-experiment by providing one-month free public bus tickets to habitual car-users. Although their sample consists of only 43 drivers, their findings are in line with Fujii et al. (2001). Fujii & Kitamura (2003) state that one month after the experiment, the habitual drivers have a 20% higher frequency of bus-use than before the experiment. Confirming on Fujii et al. (2001), Fujii & Kitamura (2003) further find that habitual car-users significantly overstate expected travel time by public transport. Both these temporal structural interventions show that there is no necessity for permanent structural changes to reduce car-use. Temporal [and therefore cheaper] structural changes already suffice (Fujii & Kitamura, 2003). On the other hand, Foxx & Schaeffer (1981) offered weekly lottery-prices for employees of an American company that reduces non-essential personal driving. They only state a positive effect during the experiment period, but no significant effect after.

The field of psychological interventions clearly has been studied less than the previous. Garvill et al. (2003), among others, researched the effect psychological initiatives. In their experiment, information about alternative modes of transport was provided to increase awareness about alternatives. The results show that a temporal decrease in car-use was observed, especially for those individuals with a strong car-use habit. This contradicts the research after structural initiatives by Fujii et al. (2001) & Fujii & Kitamura (2003) who state that especially those with a strong car-habit are the most difficult to reach and change. Eriksson et al. (2008) attempted to change behavior of habitual car-users by forming implementation intentions for planned changes in travel behavior. They found that travel choice behavior developed into a more deliberate choice of travel. Confirming Garvill et al. (2003), they accordingly found that individuals with a strong habit were more likely to reduce car use after the intervention than those with weak habits. Other scholars find no effect on psychological intervention on a reduction of car use (Fujii & Taniguchi, 2005; Tertoolen et al., 1998).

2.6 Summary

The previous, selected review of existing studies on modal choice and the influence of personal characteristics, spatial characteristics, motives and habitual behavior demonstrates that relationships are complex, and heterogeneous within groups. Not all car users have the same preference, for the same reasons or under the same circumstances. Furthermore, as soon as habitual behavior overtakes deliberate choice making, previous research suggests that motives do not have influence on travel behavior any more. Breaking with habitual behavior would be sole chance to enact behavior change from that point onwards. As such, this leads to interesting avenues for further study. In this study eight hypotheses are selected related to the previous, which are tested in the empirical section.

Testable hypotheses:

H_1: Men have a stronger positive attitude towards car-use compared to women.

H_2: The relationship between income and car-use for leisure travel is positive but with diminishing returns.

H_3: The relationship between having children and car-use for leisure travel is positive.

H_4: Density and accessibility are negatively related to car-use for leisure travel.

H_{5a}: Travel-time is a motive for choosing the car as mode of transport over alternative forms for leisure travel.

H_{5b}: Convenience is a motive for choosing the car as mode of transport over alternative forms for leisure travel.

H_{5c}: Flexibility is a motive for choosing the car as mode of transport over alternative forms for leisure travel.

H_6: Habitual behavior is positively related to car-use for leisure travel.

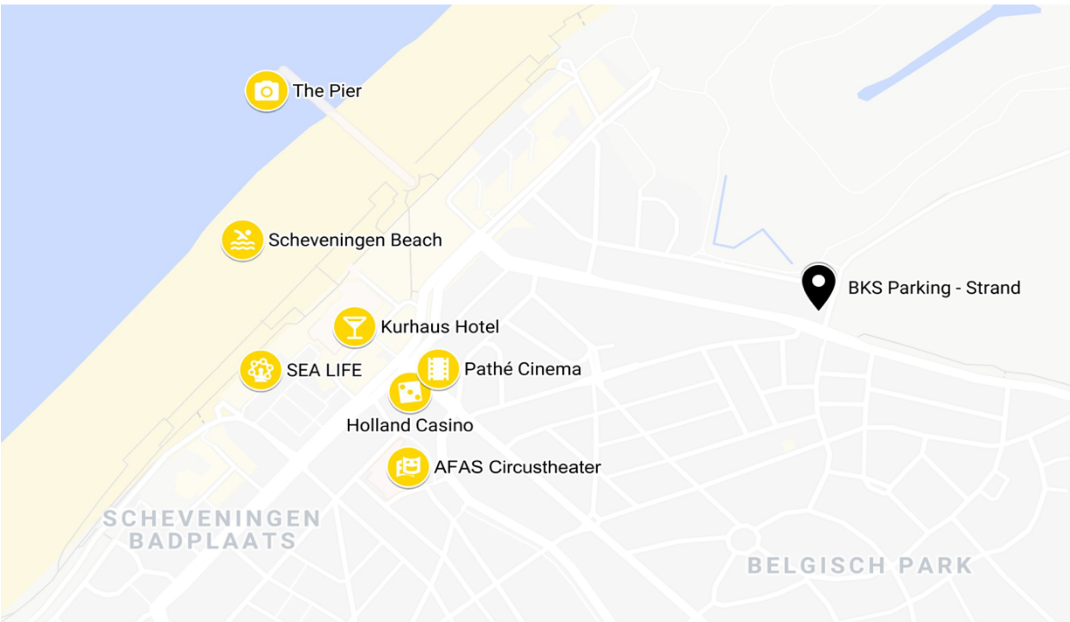
3. Physically investigating car use to a leisure city

The hypotheses identified in chapter two are tested on a group of dedicated car users, namely the users of a parking garage in the Dutch leisure city of Scheveningen. Using different research, users of the garage are observed during two separate moments in time. During the first measurement, stated preference-based research is used, while the second measurement attempts to capture also revealed preference. The two separate observations are discussed in the next sections.

3.1 Measuring stated preference using a survey of car users

A survey was conducted by the author and a group of researchers on the underlying attitudes and motives for traveling by car for leisure activities. The first survey was conducted on white Sunday 2019, which is officially a public holiday in The Netherlands. The full survey, which has also been used as feasibility research for the experimental tracking-application, is to be found in appendix A. The main target group for the survey were people who travel by car for leisure activities. To reach the target group efficiently, the city of Scheveningen in the Netherlands was used as a sample location. The city is not just known as the most popular beach area in the Netherlands, but is also home to all kinds of amusements, a shopping district and many cafes (Van Kampen, 2016). An overview of the city of Scheveningen, its location and the most important urban amenities is demonstrated in figure 1. The map in figure 1 also portrays the survey location, named BKS Parking – Strand.

Figure 1: Map of amenities in Scheveningen.



Source: maps.google.com, accessed on the 26th of August.

The survey was conducted during peak hours at the exit of a parking garage close to all the main amenities of the beach-city (see figure 1). In total, 111 respondents completed the survey during a full day of surveying. After data cleaning and dropping respondents that traveled for work related activities, 108 out of the 111 responses were retained for analyses [97%]. In the survey, questions were posed related to the motive for traveling by car, assuming that other modes were also accessible. Using this question stated preferences of the respondents were noted. Answer options were related to aforementioned literature and encompassed; travel time, flexibility, the availability of a car, habitual behavior, practicalities, costs, and other consideration (to capture unforeseen answers). A maximum of two motives could be selected by each respondent. Additionally, the personal attitude towards other modes of transport was measured by a question measuring how likely [Likert-scale] their visit to Scheveningen was in a situation in which the car had suddenly become unavailable. This last question is of particular interest, as it forces the respondent to reconsider their travel behavior. It simultaneously resets the travel decision – removing the bias of habitual behavior – and it relates back to the attitude towards other forms of transport. Furthermore, after completing the survey, respondents were asked to fill out basic details about themselves such as; gender, 4-digit ZIP-code and age, making it possible to draw implications about the revealed preference of the respondents. Out of the 111 respondents, a number of 99 people were willing to provide their ZIP-code [89%]. Figure 1 displays the residential location of the respondents. The center of ZIP-code area was used as residential location, hence the respondents did not provide exact addresses. It must therefore be mentioned that the residential location is not the exact address of the respondent. Nevertheless, as the surface of a Dutch ZIP-code area differs in a range between 1.1 km^2 and 8.3 km^2 (Kaal & Gabry, 2007), the residential location is expected to be reasonably accurate – allowing it to be an input in the analysis.

The residential location is used to calculate the distance in both kilometers and minutes to the survey location. To calculate these, data is retrieved from Google Maps. Furthermore, the ZIP-code is used to determine the urbanity level of the residential location. Following the logic used by Zwaneveld & Berveling (2009), areas that are characterized as [more] urban presumably have more and better public transport connections in the Netherlands. The variable "Urbanity level" could therefore be used as a proxy for accessibility. Furthermore, due to the high expected correlation between the variable "density" and "urbanity level", it is decided to omit "density" on beforehand. The data used for "Urbanity level" is provided by the Centraal Bureau voor de Statistiek [CBS] (2019-c). Table 1 provides summary statistics for the survey.

Figure 2: Residential location of respondents survey 1

Source: maps.google.com, accessed 26th of August 2019

Table 1: Summary statistics survey 1

	Sample Survey *Summary Statistics*
Gender, male	50.93%
Age, cohorts	18 – 39 (41.67%) 40 – 65 (47.22%) 65+ (11.11%)
Mean / range distance, kilometers Mean / range distance, minutes	79.49 / 1.8 - 236 61.66 / 5 - 150
Within 15 kilometer, number of people	10
Motives for traveling by car	Travel time (31.45%) Practicalities (28.93%) Flexibility (16.35%) Habitual behavior (11.95%) Costs (8.18%) Car Availability (3.14%)
Company car, yes	18.52%

3.2 Experiment

As a second form of data-retrieval, an experiment has been carried out in cooperation with parking operator BKS in the city of Scheveningen on Friday the 9th of August 2019. The intention of the experiment is to capture *revealed behavior (as a form of revealed preference)* of car users to identify unique behaviors, traits or other factors which provide insight into this group. The ambitions of the experiment were not fully reached, but nevertheless the experiment does provide interesting insights. In this section the experiment, the ambition, the actual data and the resulting insights will be discussed.

During the experiment, respondents were asked to participate in a study of Erasmus University Rotterdam for one full day. They were asked to consider installing an application on their phones. The whereabouts of the participants in Scheveningen would be followed by this application installed on their phones for the rest of the day. The application kept track of the routes people walked through the leisure city, the speed of their movements, and it posed questions to the participants triggered by specific geofences. These specific mini-surveys provided information on the opinion of the participant of a certain location, information about their a priori travel choices, and information about their spending behavior in the city of Scheveningen.

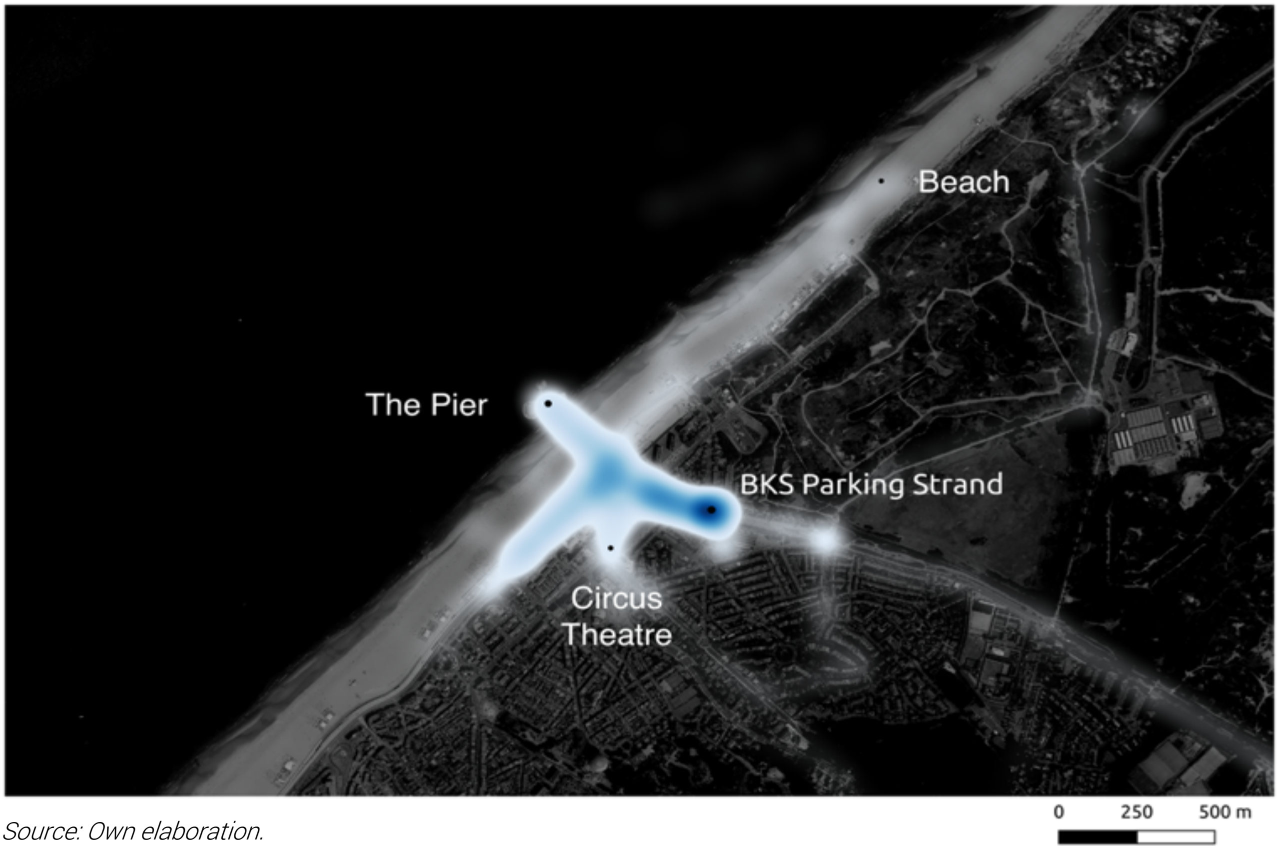
One of the geotriggered mini-surveys was aimed at identifying the personal attitude towards other modes of transport in the situation in which a car is unavailable[1]. In contrast to survey 1, only 8 people answered this question. The low number of respondents for this question can also be attributed to the fact that the geofence-trigger was situated at the beach. That, in combination with the mediocre weather that day led to only a low number of visitors to the beach. Furthermore, a personal survey was taken to register the demographics and socio-economics of the participant before the track started. Participants were offered an incentive amounting up to 25% discount on their parking costs in Scheveningen in return. The incentive and the application were actively addressed and conveyed by a team of four surveyors that effectively approached the people that exited the parking garage. The response rate tallied and was approximately 35%.

In total, the application was downloaded by 86 unique users and 77 participants [90%] completed the personal survey. Figure 3 displays the heat-map of where the concentration of walking people that used the application was most dense. In other words, the map shows the most appealing locations for clients of the BKS parking

[1] Unfortunately, this question was intended to be included in the general survey presented to all respondents. However, due to an irreversible design flaw, it was only presented to a limited number of respondents.

garage Scheveningen. The darker the hue of the white shade, the more registrations of walking people with the application. The heat-map clearly shows the weather effect on the day of the experiment. On a bright day, it is expected to have an increasing number of registrations of the beach. Table 2 below presents the summary statistics of the experiment.

Figure 3: Heat-map concentration of walking people



Source: Own elaboration.

3.3 Summary

By executing both the survey and the experiment, a total of 183 data point has been acquired. Data on travel behavior, attitude to different modes of transport, walking speed and routes, weather conditions, and demographics were acquired. Further deepening on these two datasets will be presented in the remaining two sections.

Table 2: Summary statistics experiment

	Sample Experiment *Summary Statistics*
Gender, male	55.84%
Age, cohorts	18 – 39 (37.66%) 40 – 65 (55.84%) 65+ (2.60%)
Mean distance, kilometers	72.95 12 participants from abroad
Mean income, euros	€49,181.82 22 participants with no answer
Motives for traveling by car	Practicalities (42.86%) Travel time (28.57%) Flexibility (28.57%)

4. Assessing motives, characteristics and behavior of car users

The data retrieved from both the general survey as well as from the experiment that was undertaken is assessed in this section. In this section a proper research design to answer the research question is formulated. It is stipulated that by dichotomization of the dependent variable a binary logistic regression model can be used instead of the straightforward model of ordinal logistic regression. This research design is adopted to come to the results presented in the next section.

4.1 Survey 1

The dataset of the first observation allows for the analysis of the heterogeneity between car users on the question whether they would still have visited Scheveningen without access to their car. This case was illustrated verbally as: What if your car had become unavailable, for instance if it would have broken down. This allows for identification of the captive audience of the parking garage and of the group of car users that is not captive, but made a more deliberate choice to pick the car over (in their view) viable alternatives.

In the remainder, this variable is named "No_car" as it measures whether the individual would still travel to Scheveningen for leisure in the situation that a car is not available. The variable "No_car" should therefore function as the dependent variable throughout the analyses. The variable is measured on a Likert-scale base with five options: 1 no [n=43], 2 probably not [n=22], 3 maybe [n=7], 4 probably yes [n=7], 5 yes [n=28]. The data presented is ordinal, since a typical Likert-scale is used "in which responses can be ranked, but the distance between responses is not measurable" (Sullivan & Artino, 2013). Hence, the distance between the answer options cannot be assumed to be equidistant, even though numbers are attached to it (Sullivan & Artino, 2013). According to Field (2009) and Liu & Koirala (2012), analyses with more than two ordered categories in the dependent variable should be tested using ordinal logistic regression. Hence, an OLS-model or a multinomial logit model would ignore the ordered aspect of the outcome (Long & Freese, 2014).

The ordinal logistic regression model estimates the probability of being at or below a specific attitude-level as prescribed by the survey question, given a collection of independent variables. The explanatory and control variables are taken from the previous literature as described in section 2 and tested in the survey. The ordinal logistic model calculates an underlying probability score for being in the i^{th} response category. The score is estimated as a linear function of the independent variables and a set of cut points (Min, 2013). The model is built on the proportional odds assumption. The assumption prescribes that the effect of each explanatory variable is assumed to be equal across the different categories of the ordinal variable. The proportional odds assumption is often violated as it is strongly affected by sample size (Liu & Koirala, 2012). For this reason, it is expected that the assumption is violated for the current sample. A Brant test is conducted to verify this. The Brant test shows that for the majority of independent variables the assumption does not hold, judging the ordinal logistic regression model inappropriate for the analyses.

After further analyses using a multinomial logistic regression [*mlogit*] to evaluate the difference in significance between the five distinct answer options in the dependent [Appendix B], it is decided to group the answers in two groups. The results of the mlogit show that only significant difference exist between those respondents that answered for; 1, no and 5, yes. It is recognized that dichotomization of the Likert-variable leads to a loss of valuable variation in the sample, as is put forth by among others MacCallum et al. (2002). However, as Ravichandran & Fitzmaurice (2008) put it, in a relatively small sample, too many categories can be inordinate and inappropriate for statistical analyses. The dependent Likert-variable has therefore been dichotomized into "negative" [0] for answers "no", "probably not" and "maybe" and into "positive" [1] for answers "probably yes" and "yes". The goodness-of-fit test of both the ordinal and the binary logit models show a better fit for the binary model, resulting in a higher adjusted Count R-squared [0.228 vs 0.452]. Accordingly, a binary regression model is used in the remainder of the paper.

In the current case, where a dichotomous dependent variable is tested and more than 1 independent variable is used, a logistic regression model is adopted. To test hypotheses H_1, H_4, H_5 and H_6, the following logistic model [1] is used (Moore & McCabe, 2006):

$$\begin{aligned}\log(\text{No\_car\_binary}) &= \beta_0 + \beta_1 \ln\text{\_distanceminutes} + \beta_2\text{urbanitylevel} + \beta_3\text{age} + \beta_4\text{male} \\ &+ \beta_5\text{reason\_traveltime} + \beta_6\text{reason\_flexibility} + \beta_7\text{reason\_costs} \\ &+ \beta_8\text{reason\_caravailability} + \beta_9\text{reason\_practicalities} + \beta_{10}\text{reason\_habit} \\ &+ \beta_{11}\text{companycar} + \beta_{12}\text{within15km} + \beta_{13}\text{TraveltimexCompanycar}\end{aligned}$$

where,

Table 3: List of variables

log(No_car_binary)	*dummy* - the willingness to come to Scheveningen without a car (1 yes)
ln_distanceminutes	*continuous* - log of distance in minutes to the survey location
urbanitylevel	*categorical* – degree of urbanity of place of residence (1 max – 5 min)
age	*categorical* – age cohorts of respondents (1 min – 3 max)
male	*dummy* - gender (1 male)
reason_traveltime	*dummy* - respondents that name travel time as reason for coming by car
reason_flexibility	*dummy* - respondents that name flexibility as reason for coming by car
reason_costs	*dummy* - respondents that name costs as reasons for coming by car
reason_caravailability	*dummy* - respondents that name the availability of a car as reason for coming by car
reason_practicalities	*dummy* - respondents that name practicalities (weather, children, etc) as reason for coming by car
reason_habit	*dummy* - respondents that name habit as reason for coming by car
companycar	*dummy* - respondents that travelled by company car
within15km	*dummy* - respondents that resided within 15 kilometers of the survey location
TraveltimexCompanycar	*interaction effect* - reason_traveltime * companycar

To avoid biased coefficient estimates or invalid statistical inferences, the model needs to fit sufficiently well. Therefore, a thorough assessment of the model fit is necessary. The assumptions of the logistic regression model are as follows (Menard, 2002):

1. The conditional probabilities are a logistic function of the independent variables.
2. No important variables are omitted.
3. No extraneous variables are included.
4. The independent variables are measures without error.
5. The observations are independent.
6. The independent variables are not linear combinations of each other.

In the event that assumption one, two and three are violated, a specification error of the model stipulates. A Link-test is based on the idea that if the equation is properly specified, no further independent variables should hold significant unless by chance (Reed College, 2019). The Link-test can therefore be used to detect a specification error in the models. Table 4 below shows that the variable "_hat" is significant and that the variable "_hatsq" is insignificant, concluding that the link function is correctly specified and that it is unlikely to encounter omitted variable bias. Nevertheless, it is known from the literature described in section two that not all independents variables are captured by the model due to limitations to the survey sample. The other independent variables will, however, be captured by the experiment. Table 5 & 6 show the Pearson and the Hosmer-Lemeshow goodness-of-fit tests respectively. An insignificant outcome of the chi-statistic indicates a good model fit, as the null hypotheses state that the observed and the expected are the same across all outcomes [Pearson] or doses [Hosmer-Lemeshow] respectively (Hosmer et al., 2013). In other words, the null hypotheses of the tests are that the model is correctly specified. A Hosmer-Lemeshow test is used additionally as the number of covariate patterns of the Pearson test was exactly equal to the number of observations, what could lead to biased results. By following the logic of Hosmer et al. (2013), the data is regrouped by ordering on the predicted probabilities and then forming ten nearly equal-sized groups. As both tests show an insignificant outcome for the model, the conclusion is that the model fits reasonably well.

Table 4: Link-test for specification error

No_Car _Binary	Coefficient	Standard Error	Z	P>|z|
_hat	0.9563125	0.2399941	3.98	0.000
_hatsq	-0.0455267	0.1107627	-0.41	0.681
_cons	0.0541112	0.3215558	0.17	0.866

Table 5: Pearson goodness-of-fit test

Number of observations	99
Number of covariate patterns	99
Pearson chi2(85)	84.64
Prob > chi2	0.4906

Table 6: Hosmer-Lemeshow goodness-of-fit test

Number of observations	99
Number of groups	10
Hosmer-Lemeshow chi2(8)	6.39
Prob > chi2	0.6041

At last, the correlation matrix below in table 7 displays that multicollinearity is not an influential issue in the model. The matrix arrays that collinearity on the 1% significance level is found between the independent variables distance & urbanity level, reason travel-time & age, reason flexibility & reason practicalities, reason costs & reason practicalities, and between reason travel-time & reason habit. As these are all theoretical standalone variables and the standard errors are not very large, these collinearities will most likely not cause biased results.

Table 7: Collinearity matrix (model 1)

	ln_dis	urban	age	Male	r_travel	r_flex	r_cost
ln_dis	1.00						
urban	0.39*	1.00					
age	-0.05	-0.00	1.00				
male	-0.00	-0.02	0.02	1.00			
r_travel	0.14	0.19	0.26*	0.02	1.00		
r_flex	0.03	-0.03	-0.00	-0.05	-0.13	1.00	
r_cost	0.21	0.07	-0.04	0.14	-0.12	0.06	1.00
r_carav	0.01	-0.15	-0.23	0.13	-0.12	-0.02	0.05
r_prac	0.02	-0.05	-0.14	-0.09	-0.24	-0.35*	-0.32*
r_habit	-0.03	0.10	-0.15	0.02	-0.38*	0.02	-0.02
compcar	-0.07	-0.27*	-0.21	0.18	-0.20	-0.05	0.04
within15	-0.61*	-0.29*	-0.14	-0.07	-0.23	0.04	-0.02
travxcomp	-0.06	-0.09	-0.10	0.13	0.24	-0.12	-0.08

	r_carav	r_prac	r_habit	compcar	within15	travxcomp
r_carav	1.00					
r_prac	-0.10	1.00				
r_habit	0.01	-0.20	1.00			
compcar	0.24	0.07	0.16	1.00		
within15	-0.07	0.05	-0.06	0.01	1.00	
travxcomp	-0.05	0.17	-0.10	0.46*	0.08	1.00

4.2 The experiment

Ideally, a similar strategy to indicate the attitude of people towards alternative modes of transport in the situation that a car is unavailable as in model [1] would be followed. The geofence-trigger that posed precisely the same main question as in model [1] was on purposely positioned at the beach, as this location is ultimately known for the spending of leisure time. Due to the bad weather conditions however, this location was only visited 8 out 86 times [9%]. The preference to still use the valuable data that the use of the application provided triggered a change of strategy. A comparison will be drawn between the data with which the leisure car users in the city of Scheveningen provided and data about the average Dutch citizen, provided by the Dutch Bureau of Statistics using different databases. Ideally, it would have been able to compare the data with a control group that used public transport to come to the city of Scheveningen. The limitations of this research made this withal unattainable. Nevertheless, using aforementioned comparisons, it can be shown whether the leisure car-user is different in a demographic or socio-economic way relative to the average Dutch citizen.

Furthermore, as explained in section 3, the application kept track of the routes the respondents walked and the speed of their movements. This data will be plotted and made visible using the program QGIS [Quantum-Geographic-Information-System]. Using QGIS, the data retrieved from the application can be linked to geographic locations and be made visible accordingly. QGIS will be the basic comparison tool that will be used to visualize the data of the experiment.

5. Presenting motives, characteristics and behavior of car users

This section presents the motives, characteristics and behavior of car users as revealed from the survey and the experiment. The empirical results of the previously formulated research are presented in this section. The estimation results of model 1 are presented in table 8. For better interpretation of the results presented in table 8 it is necessary to recall the dependent variable "No_car_binary", the willingness to come to Scheveningen without a car. Furthermore, the results should be treated carefully as they present the log-odds.

Table 8: Estimation results model 1, dependent variable No_car_binary.
Pseudo R2: 0.3271

Independent variables	Model 1 Coefficients	
ln_distanceminutes	2.356545	***
urbanitylevel	-0.6141995	**
age	-0.2594133	
male	-1.387508	**
reason_traveltime	-3.954124	***
reason_flexibility	-0.5575981	
reason_costs	-1.584135	
reason_caravailability	0.0474729	
reason_practicalities	-3.542767	***
reason_habit	-1.117448	
companycar	-1.165285	
within15km	1.352782	
TraveltimexCompanycar	6.657472	***
Constant	-4.150015	

*Note: *significant at 10% level, **significant at 5% level, *** significant at 1% level*

5.1 Survey 1

As discussed before in the methodology section 4, model 1 is the first out of a series of two models. The first model functions as a base to the development of the experiment. In other words, the results of model 1 are used to find out which motives for car usage need to be investigated further.

From the previous literature presented in section 2, six hypotheses related to model 1 were presented, namely:

- H_1: Men have a stronger positive attitude towards car-use compared to women.
- H_4: Density and accessibility are negatively related to car-use for leisure travel.
- H_{5a}: Travel-time is a motive for choosing the car as mode of transport over alternative forms for leisure travel.
  H_{5b}: Convenience is a motive for choosing the car as mode of transport over alternative forms for leisure travel.
  H_{5c}: Flexibility is a motive for choosing the car as mode of transport over alternative forms for leisure travel.
- H_6: Habitual behavior is positively related to car-use for leisure travel.

As expected, the test results stipulate that sign for "male" is negative, resulting in further proof that men have a stronger positive attitude towards car-use and are less susceptible to using other forms of transport for leisure travel than a car, compared to women – even in a setting where habitual behavior is cancelled out by design. This is further portrayed in the comparison cross-tabulation in Appendix C. The results are in full support of hypothesis [H_1]. Additionally, it is found that urbanity level of the place of residence is significant at the 5% level and showing the expected, negative sign. For this statistic, knowledge about the measurement-scale of the variable is vital. As displayed in section 4, "urbanitylevel" is a categorical variable with five distinct levels ranging from 1 [maximally urbanized] to 5 [minimally urbanized]. Taking aforementioned into consideration, urbanity level is negatively related to car-use for leisure travel. In other words, the more urbanized and therefore the more densely populated and accessible a place of residence is, respondents are more inclined to use other forms of transport for leisure travel. These results are also in full support of hypothesis [H_4]. Moreover, travel time and practicalities are both positively related to car-use. Respondents that name travel time or convenience as reason for traveling to Scheveningen by car are less inclined to use other forms of transport and rely more on a car as part of their leisure travel behavior. Consequently, both hypotheses H_{5a} and H_{5b} are supported on the 1% significance level, stating that travel-time and convenience are clear motives for car-usage. No substantial proof is provided to support hypotheses H_{5c} (flexibility as a motive) and H_6 (habitual behavior). This is in contradiction with many previous literatures that state the importance of habits in travel behavior. Furthermore, at the moment when the question was posed, many respondents had to overthink the question "would you still have come in absence of a car". The fact that the respondents needed to seriously overthink this question clearly states the self-evidence of the availability of a car. Moreover, it is very well possible that the respondents presented the surveyors with the socially accepted answer. On the other hand, the result is in line with Van Acker, Mokhtarian & Witlox (2011) who state that for leisure travel, people act outside of their routine behavior with regards to mode of transport choice.

Interesting new insights come from variables that have not been researched previously in respect to this topic. One of these new insights stems from the travel distance in minutes from the survey location in Scheveningen. The log of distance in minutes is positive and significant at the 1% level, meaning that respondents that resided further away from the leisure location are more inclined to still come to Scheveningen by alternative forms of transport in the absence of a car than respondents that live closer by. This actually implies that longer trips should be more often undertaken by alternative forms of transport than shorter trips, ceteris paribus. Feasible explanations for this behavior could stem from planning behavior from travelers. Those that travel a more time-consuming journey tend to be heavy planners for pleasure trips and decide less on the spot (Gitelson & Crompton, 1983). In other words, people that have to travel for longer are more determined to go regardless of the form of transport as it is highly likely that they have specific plans for the day.

Some other unexpected result emanates from the interaction between the respondents that name travel time as a reason for coming by car and those that arrived by company car. The interaction-effect is significant at the 1% level and strongly positive. Put differently, the respondents that both name travel time as a reason for coming by car and also arrived by company car to Scheveningen are less dependent on their car for leisure travel. This is particularly interesting and counterintuitive as one would expect - time-sensitive people that consider other forms of transport more time consuming and, on top of that, travel for free by car - to travel by car. As portrayed in Appendix D, the interaction variable only has 5 [4.63%] positive observations. Therefore, this result is considered to be a result of chance.

5.2 The experiment

The experiment undertaken on the 9th of August 2019 is the second form of data retrieval from a series of two. As this way of doing research in the field of leisure modal choice is fairly new, it is expected to contribute substantially to existing research.

From the previous literature presented in section 2, two hypotheses related to the experiment were presented, namely:

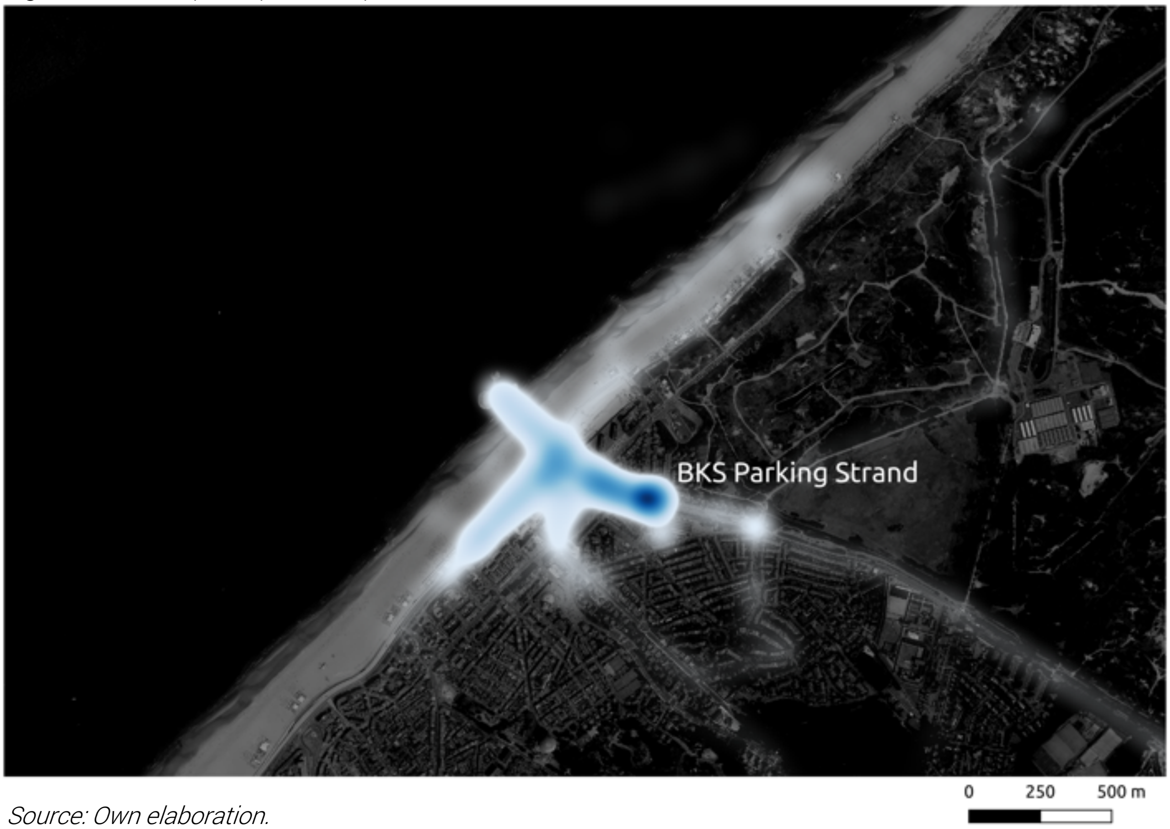
- H_2: The relationship between income and car-use for leisure travel is positive but with diminishing returns.
- H_3: The relationship between having children and car-use for leisure travel is positive.

First of all, the comparison between data retrieved from the application and data about the average Dutch citizen leads to interesting insights. As portrayed in table 2, the mean income per household of the sample is around €49,181.82 per year. This number is calculated by taking the average of each income category, multiplied by the percentage of respondents that chose for this category. It must be said however, that 22 respondents out 77 did not wish to share this information. The figure in Appendix E displays the distribution of disposable income per household in The Netherlands, as put forth by the CBS (2018). The distribution chart shows that the average disposable household income for Dutch citizens is around €28.800 yearly and that merely 7.8% of Dutch households have a higher yearly income than €48.000. The mean income of the sample could be calculated as more than 58% higher compared to the average Dutch household income. Location specific arguments could not lay on the basis of this difference, as the mean distance of which the participants resided from the experiment location is 72.95 kilometer. Furthermore, foreign participants did not play a large role in this statistic either, as out of 12 foreign respondents for this question, 8 [67%] did not want to share information on this. Based on the sample, it is therefore likely to state that the income of leisure car-users is on average higher than the income of the average Dutch household. Despite this, hypothesis H_2 cannot be rejected using this dataset. A positive relationship between car-use and income is apparent, but nothing can be claimed regarding diminishing returns to income.

Another striking difference is that of household decomposition. According to the Dutch CBS (2019-d), in 2018 children were present in almost 45% of all households in the Netherlands. In the present dataset, 53.25% of the participants were part of a household with children, which is more than 18% above the national average. The difference is not as large as is the case with income, but it is still considerable. The contrast is even more evident when taking the findings of Kitamura (2009) into consideration. As discussed before in section 2, he explains the strong inhibiting effect of households with children. Therefore, the broad expectations are that households with children are generally less outgoing (Kitamura, 2009). Nevertheless, the findings of the current research demonstrate a large portions of leisure travelers with children, hinting on an unequivocal relationship between the two; "households with children travel more by car for leisure travel. The finding that people with children are more likely to travel by car for leisure purposes was already stated by Schwanen (2011) and the present research stipulates the same result. The largest group of participants with children [61%] has them in the age-cohort until the age of 11 years old. This is in line with research by Chakrabrati & Joh (2019), who state that the effect of primary-school-going-children on car usage is the largest. In their research they focused solely on everyday traffic movements. The current findings demonstrate that a positive relation between having children and car-use also holds for for leisure travel which leads to strong evidence for hypothesis H_3.

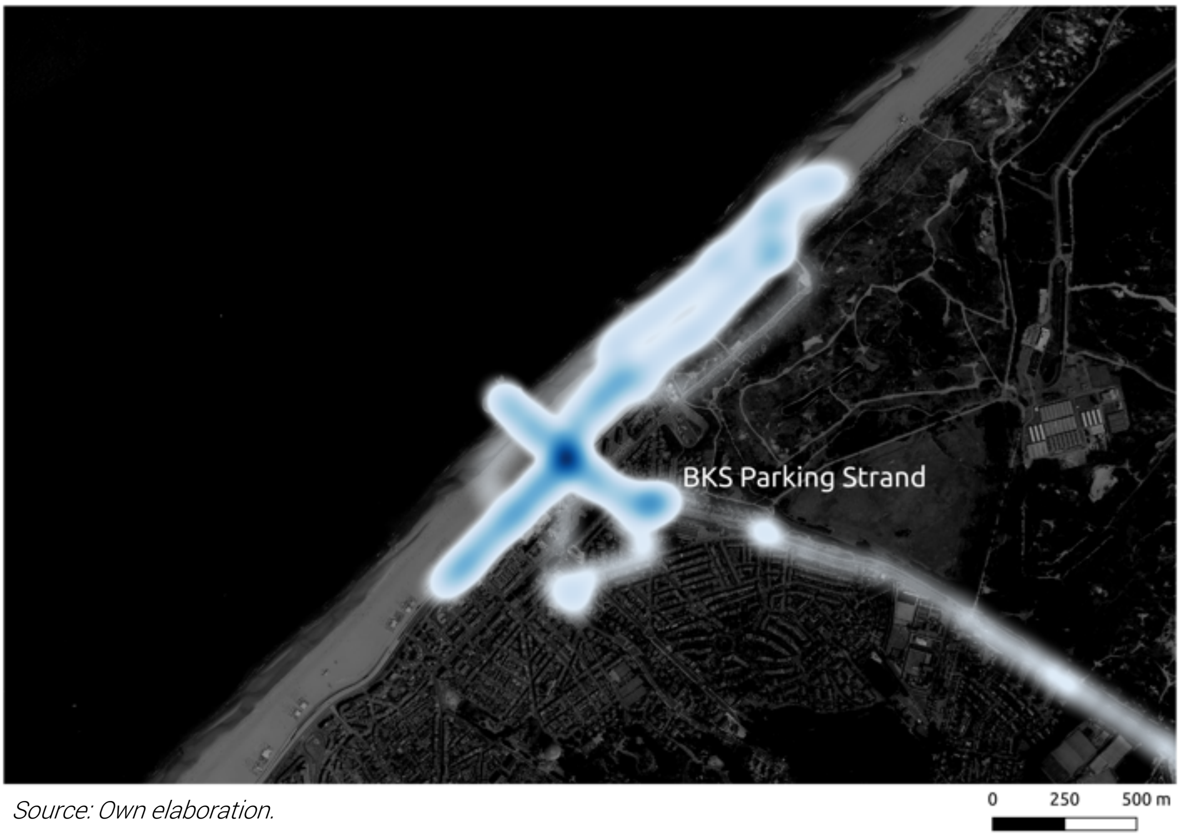
To be able to compare the experiment results with those of the survey, the same question related to the personal attitude towards other modes of transport in the situation in which a car is unavailable was posed to the participants. All respondents that answered this question, indicated that none of them would have come to Scheveningen in the situation that no car was available. Additionally, none of the respondents had considered the public transport as an alternative mode. This finding is in sharp contrast to the findings of the survey. Most respondents [42.86%] used practicalities [family, weather, etc.] as an argument. The obvious difference between the two samples is the weather conditions on the respective days. Bad or mediocre weather conditions [rain, strong wind, below average temperatures] clearly are an indicator for the choice of car-usage over other modes. Furthermore, those that indicated not to come to Scheveningen in absence of a car apparently walked longer distances than those that did not answer the question. This comparison is portrayed in the two heat-maps in figure 4 & 5.

Figure 4: Heat-map complete sample



Source: Own elaboration.

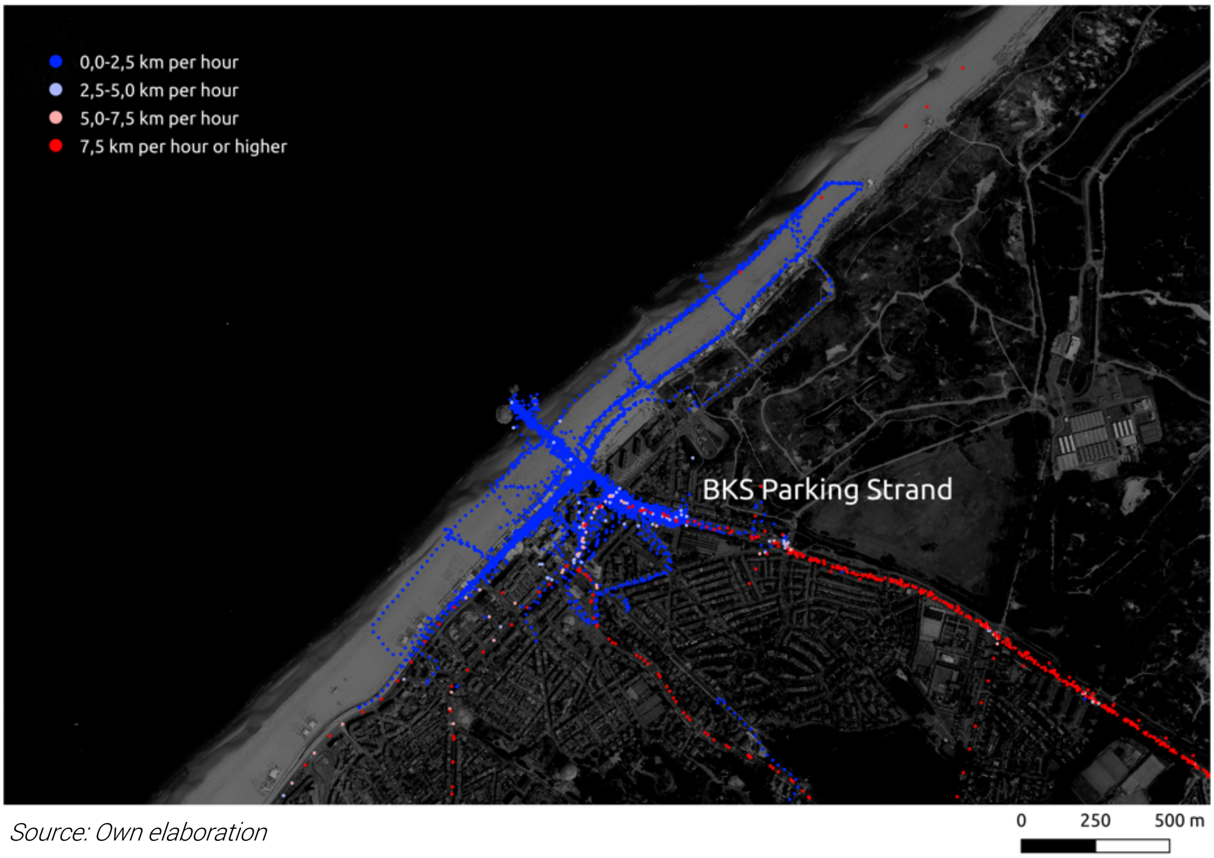
Figure 5: Heat-map of participants with a negative attitude to alternative forms of transport



Source: Own elaboration.

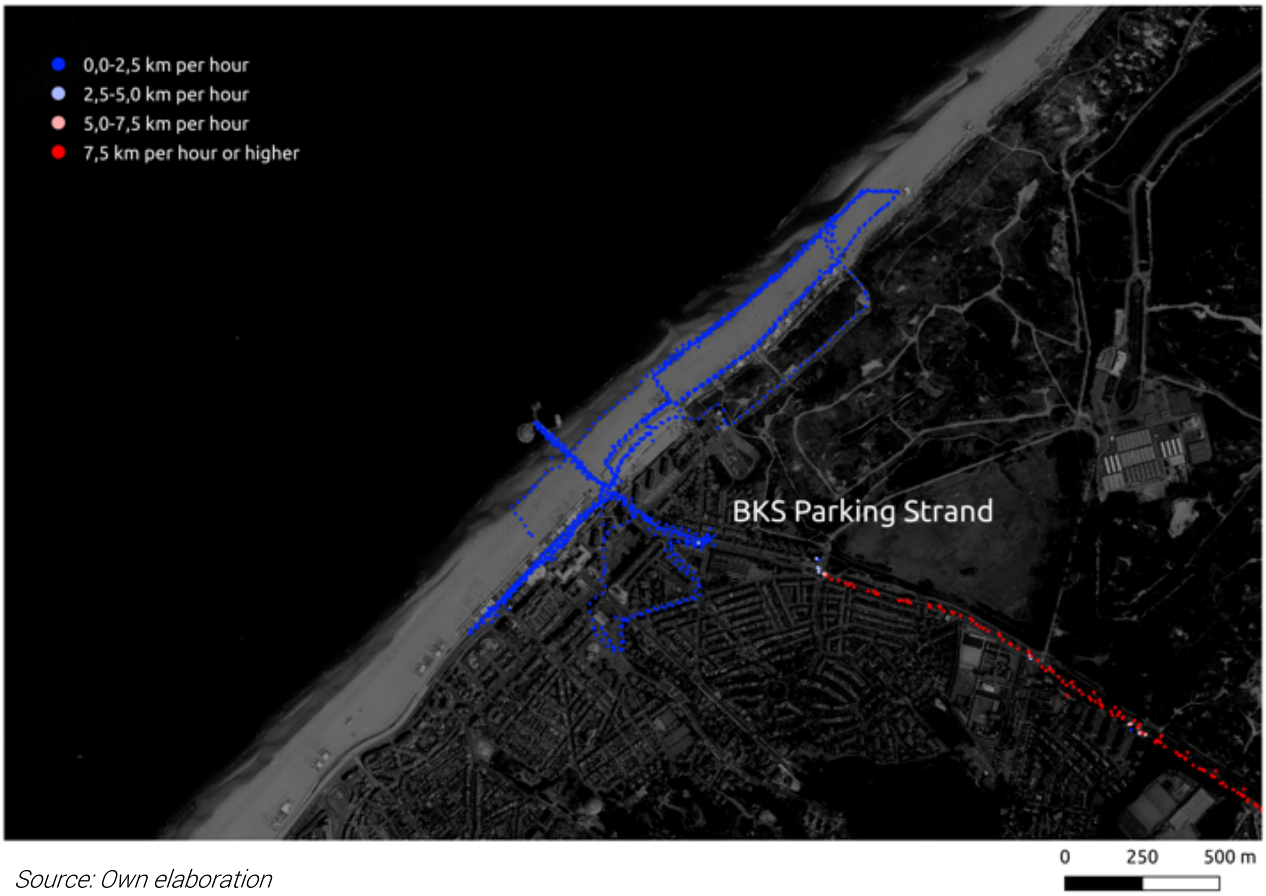
Potential explanations for this could be that those that are most expressive in their preference of car-usage have a more active and adventurous lifestyle. Aforementioned would explain the relatively longer walking distances of these respondents. These thoughts are in line with Van Acker, Mokhtarian & Witlox (2011) that link a more physical active lifestyle to more car usage. However, this would not explain the relatively low average walking speed of the sample. As shown in figure 5 & 6, the average walking speed of the sample is mostly between 0 and 2.5 kilometer per hour and there is no significant difference between the participants that responded not to come to Scheveningen in absence of a car. Bohannon (1997) proved that the most comfortable walking speed of adults in between the age of 20 and 79 years of age is on average 136.7 centimeters per second, or 4.92 kilometers an hour. Knowing this, the current sample shows a considerably low walking speed. An explanation for this might be the leisure motive of their visit. People visit the place in their free time and have no specific goal as where to go to. However, this does not explain the reason to walk slower than a comfortable pace. Something that does explain a slower walking speed is the presence of younger children. The relatively large portion of participants with children relates to this. More research into this topic is however advised and is beyond the current research.

Figure 6: Average walking speed of the complete sample



Source: Own elaboration

Figure 7: Average walking speed of participants with a negative attitude to alternative forms of transport



Source: Own elaboration

6. Conclusion

This section will conclude on the results that are previously discussed in section 5.
By means of a survey and a tracking-experiment, data was acquired to answer to question as to what drives car-usage for leisure travel. In other words, what are the motives for car-usage for leisure travel?

The key finding of this research is that car users as a group are inherently heterogeneous. A large scale stated preference survey shows that some car users are very flexible to switch to other modes of transport when confronted with the sudden unavailability of the car, whereas others forgo the trip.

The following determinants of car dependency, and as such, the heterogeneity of the car user group was identified, namely: gender, accessibility, travel-time, and convenience proof to drive car-usage, stated and revealed, in the way that might be expected. Males show a larger tendency to use the car for leisure travel than women do. Furthermore, people in general from a less urbanized and therefore less accessible location demonstrate a more car dependent attitude, jointly with those that value travel-time and convenience. Additionally, the tracking experiment clearly determines that income and having children are both, as expected, positively related to car-usage. By means of the real-life tracking-experiment, contribution to existing research has been formed. The current research stipulates that residence distance to the leisure location and the weather are of major importance. Distance is related to mode of transport in a way that was unexpected. The larger the distance to the leisure location in time, the greater the tendency to come by alternative forms of transport. In other words, public transport, which is the sole alternative to the car on longer routes, is more popular on more time-consuming trips compared to shorter trips. This is an interesting alley for further research. Finally, it is revealed that leisure travelers that use a car as a mode of transport have a considerably slower walking speed. This hints on an additional hidden determinant of car use relating to the overall physical state of the car-user. More research into this topic is advised as to reveal how different states of physical health influence the a priori choice for specific modes.

7. Limitations

As this paper is the first which uses a tracking-experiment to research travel modal choice, substantial more research is necessary to come to stable conclusions. Furthermore, the tracking-application needs to be more stabilized before it is being used for further research again. The current drawback of the application was that a lot of data got lost due to broken connections with the application. Further development would create a solid base for repetition of the current research. Moreover, the application-data used for the present research has been retrieved on a singular day with bad weather conditions. Repetitions of the experiment on more days with different weather conditions would be highly valuable as this would increase the dataset and thereby increasing the value of the research and its findings. Finally, the conclusions of the experimental data should be interpreted with caution as no control group that arrived in Scheveningen by other modes of transport was researched. Ideally, this group would consist of a mix of respondents that arrived by public transport, by foot, or by bicycle.

References

Aarts, H., Verplanken, B., & Van Knippenberg, A. (1997). Habit and information use in travel mode choices. *Acta Psychologica*, *96*(1-2), 1-14.

Alsnih, R., & Hensher, D. A. (2003). The mobility and accessibility expectations of seniors in an aging population. *Transportation Research Part A: Policy and Practice*, *37*(10), 903-916.

Allaman, P. M., Tardiff, T. J., & Dunbar, F. C. (1982). New approaches to understanding travel behavior. *NCHRP Report*, (250).

Anable, J., & Gatersleben, B. (2005). All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research Part A: Policy and Practice*, *39*(2-3), 163-181.

Batchelor, R. (1994). *Henry Ford, mass production, modernism, and design* (Vol. 1). Manchester University Press.

Bergstad, C. J., Gamble, A., Hagman, O., Polk, M., Gärling, T., & Olsson, L. E. (2011). Affective–symbolic and instrumental–independence psychological motives mediating effects of socio-demographic variables on daily car use. *Journal of Transport Geography*, *19*(1), 33-38.

Bohannon, R. W. (1997). Comfortable and maximum walking speed of adults aged 20—79 years: reference values and determinants. *Age and ageing*, *26*(1), 15-19.

Brownstone, D. (2008). Key relationships between the built environment and VMT. *Transportation Research Board*, *7*.

Brownstone, D., & Golob, T. F. (2008). The impact of residential density on vehicle usage and energy consumption. *Journal of urban Economics*, *65*(1), 91-98.

Buehler, R., & Pucher, J. (2012). Demand for public transport in Germany and the USA: an analysis of rider characteristics. *Transport Reviews*, *32*(5), 541-567.

Cantillo, V., Ortúzar, J. D. D., & Williams, H. C. (2007). Modeling discrete choices in the presence of inertia and serial correlation. *Transportation Science*, *41*(2), 195-205.

Cao, X., Mokhtarian, P. L., & Handy, S. L. (2007). Do changes in neighborhood characteristics lead to changes in travel behavior? A structural equations modeling approach. *Transportation*, *34*(5), 535-556.

CBS. (2016). *Transport en mobiliteit 2016.* Den Haag.

CBS. (2018). *Income distribution.* Retrieved from: https://www.cbs.nl/en-gb/visualisaties/income-distribution

CBS. (2019-a). Personenauto's; voertuigkenmerken, regio's, 1 januari. Retrieved from: https://www.cbs.nl/nl-nl/maatschappij/verkeer-en-vervoer/transport-en-mobiliteit/infra-vervoermiddelen/vervoermiddelen/categorie-vervoermiddelen/personenauto-s

CBS. (2019-b). 11 procent meer verkeersdoden in 2018. Retrieved from: https://www.cbs.nl/nl-nl/nieuws/2019/16/11-procent-meer-verkeersdoden-in-2018

CBS. (2019-c). *Kerncijfers wijken en buurten 2017.* Statline CBS.

CBS. (2019-d). *Personen in huishoudens naar leeftijd en geslacht, 1 januari.* Statline. Retrieved from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37620/table?fromstatweb

Chatman, D. G. (2005). *How the built environment influences non-work travel: theoretical and empirical essays* (Doctoral dissertation, University of California, Los Angeles).

CIVITAS, (2014). CIVITAS, Policy Note: Smart choices for cities - Gender equality and mobility: mind the gap!, 2014.

Cox, J., F. Diebold., J. Garret., M. Pagano., & J. Royston. (1998). A publication to promote communication among Stata users. *Stata Technical Bulletin (STB). West*, *83*.

De Vos, J., Mokhtarian, P. L., Schwanen, T., Van Acker, V., & Witlox, F. (2016). Travel mode choice and travel satisfaction: bridging the gap between decision utility and experienced utility. *Transportation*, *43*(5), 771-796.

Dieleman, F. M., Dijst, M., & Burghouwt, G. (2002). Urban form and travel behaviour: micro-level household attributes and residential context. *Urban studies*, *39*(3), 507-527.

Downs, A. (2005). *Still stuck in traffic: coping with peak-hour traffic congestion*. Brookings Institution Press.

Eriksson, L., Garvill, J., & Nordlund, A. M. (2008). Interrupting habitual car use: The importance of car habit strength and moral motivation for personal car use reduction. *Transportation Research Part F: Traffic Psychology and Behaviour*, *11*(1), 10-23.

Ewing, R., & Cervero, R. (2001). Travel and the built environment: a synthesis. *Transportation research record*, *1780*(1), 87-114.

Fortuin, A, (2017). *Hoe krijgen we vader uit de auto?* In *NRC Handelsblad*.

Foxx, R. M., & Schaeffer, M. H. (1981). A company-based lottery to reduce the personal driving of employees. *Journal of Applied Behavior Analysis*, *14*(3)

Fujii, S., Gärling, T., & Kitamura, R. (2001). Changes in drivers' perceptions and use of public transport during a freeway closure: Effects of temporary structural change on cooperation in a real-life social dilemma. *Environment and behavior*, *33*(6), 796-808.

Fujii, S., & Kitamura, R. (2003). What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change. *Transportation*, *30*(1), 81-95.

Fujii, S., & Taniguchi, A. (2005). Reducing family car-use by providing travel advice or requesting behavioral plans: An experimental analysis of travel feedback programs. *Transportation Research Part D: Transport and Environment*, *10*(5), 385-393.

Gärling, T., & Schuitema, G. (2007). Travel demand management targeting reduced private car use: effectiveness, public acceptability and political feasibility. *Journal of Social Issues*, *63*(1), 139

Garvill, J., Marell, A., & Nordlund, A. (2003). Effects of increased awareness on choice of travel mode. *Transportation*, *30*(1), 63-79.

Gitelson, R. J., & Crompton, J. L. (1983). The planning horizons and sources of information used by pleasure vacationers. *Journal of Travel research*, *21*(3), 2-7.

Graham-Rowe, E., Skippon, S., Gardner, B., & Abraham, C. (2011). Can we reduce car use and, if so, how? A review of available evidence. *Transportation Research Part A: Policy and Practice*, *45*(5), 401-418.

Handy, S., Cao, X., & Mokhtarian, P. (2005). Correlation or causality between the built environment and travel behavior? Evidence from Northern California. *Transportation Research Part D: Transport and Environment*, *10*(6), 427-444.

Hensher, D. A., Stopher, P., & Bullock, P. (2003). Service quality––developing a service quality index in the provision of commercial bus contracts. *Transportation Research Part A: Policy and Practice*, *37*(6), 499-517.

Hoenjet, H., Jorritsma, P. & Van der Waard, J. (2018). Autogebruik in huishoudens met meerdere auto's. *Kennis instituut voor mobiliteitsbeleid.*

Holmgren, J. (2013). An analysis of the determinants of local public transport demand focusing the effects of income changes. *European Transport Research Review*, *5*(2), 101-107.
Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (Vol. 398). John Wiley & Sons.

Kaal, H. & G. Vanderveen (2007). Hoe groot is jouw buurt? *KENNISLINK*.

Kharizsa, A., Priyanto, S., & Jopson, A. (2015, January). CORRELATION AMONG CAR DEPENDENCY, SOCIAL STATUS AND CAR USE IN JAKARTA. In *Journal of the Civil Engineering Forum* (Vol. 1, No. 1).

Kitamura, R. (2009). Life-style and travel demand. *Transportation*, *36*(6), 679-710.

Kruyswijk, M. (2019). Hoe beperken andere Europese steden vervuilende auto's?. *Het Parool.*

Kurz, T., Gardner, B., Verplanken, B., & Abraham, C. (2015). Habitual behaviors or patterns of practice? Explaining and changing repetitive climate-relevant actions. *Wiley Interdisciplinary Reviews: Climate Change*, *6*(1), 113-128.

Liu, X., & Koirala, H. (2012). Ordinal regression analysis: Using generalized ordinal logistic regression models to estimate educational data. *Journal of modern Applied Statistical methods*, *11*(1), 21.

Lois, D., & López-Sáez, M. (2009). The relationship between instrumental, symbolic and affective factors as predictors of car use: A structural equation modeling approach. *Transportation Research Part A: Policy and Practice*, *43*(9-10), 790-799.

Long, J. S., and J. Freese. 2014. Regression Models for Categorical Dependent Variables Using Stata. 3rd ed. College Station, TX: Stata Press.

MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological methods*, *7*(1), 19.

Menard, S. (2002). *Applied logistic regression analysis* (Vol. 106). Sage.

Min, H. (2013). Ordered Logit regression modeling of the self-rated health in Hawai ‘i, with comparisons to the OLS model. *Journal of Modern Applied Statistical Methods*, *12*(2), 23.

Møller, B., & Thøgersen, J. (2008). Car use habits: an obstacle to the use of public transportation?. In *Road pricing, the economy and the environment* (pp. 301-313). Springer, Berlin, Heidelberg.

Moore, D. S., & McCabe, G. P. (2006). *Statistiek in de praktijk: Theorieboek*. Den Haag: Academic service.

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological bulletin*, *124*(1), 54.

Paulley, N., Balcombe, R., Mackett, R., Titheridge, H., Preston, J., Wardman, M., ... & White, P. (2006). The demand for public transport: The effects of fares, quality of service, income and car ownership. *Transport policy*, *13*(4), 295-306.

Polzin, S. E., Chu, X., & Rey, J. R. (2000). Density and captivity in public transit success: observations from the 1995 nationwide personal transportation study. *Transportation Research Record*, *1735*(1), 10-18.

Reed College. (2019). *Stata Help Linktest*. Retrieved from: https://www.reed.edu/psychology/stata/analyses/parametric/Regression/pe/linktest.html

Ravichandran, C., & Fitzmaurice, G. M. (2008). To dichotomize or not to dichotomize?. *Nutrition*, *24*(6), 610.

Schimek, P. (1996, July). Land use, transit and mode split in Boston and Toronto. In *ACSP/AESOP-conference, Toronto*.

Schwanen, T., Dieleman, F. M., & Dijst, M. (2001). Travel behaviour in Dutch monocentric and policentric urban systems. *Journal of Transport Geography*, *9*(3), 173-186.

Schwanen, T. (2011). Car use and gender: the case of dual-earner families in Utrecht, The Netherlands. In *Auto motives: Understanding car use behaviours* (pp. 151-171). Emerald Group Publishing Limited.

Servant, L. (1996). L'automobile dans la ville. *Cahiers du IAURIF*, 114.

Setright, L. J. K. (2002). *Drive on!: a social history of the motor car*. Granta Books.

Şimşekoğlu, Ö., Nordfjærn, T., & Rundmo, T. (2017). Predictors of car use habit strength in an urban Norwegian public. *Transportation*, *44*(3), 575-588.

Sovacool, B. K. (2009). Early modes of transport in the United States: Lessons for modern energy policymakers. *Policy and society*, *27*(4), 411-427.

Steg, L. (2005). Car use: lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice*, *39*(2-3), 147-162.

Steg, L., Vlek, C., & Slotegraaf, G. (2001). Instrumental-reasoned and symbolic-affective motives for using a motor car. *Transportation research part F: Traffic psychology and behaviour*, *4*(3), 151-169.

Sullivan, G. M., & Artino Jr, A. R. (2013). Analyzing and interpreting data from Likert-type scales. *Journal of graduate medical education*, *5*(4), 541-542.

Tertoolen, G., Van Kreveld, D., & Verstraten, B. (1998). Psychological resistance against attempts to reduce private car use. *Transportation research part A: Policy and practice*, *32*(3), 171-181.

Unen, D. (2018). *Aantal files neemt de komende vijf jaar stevig toe.* In *NRC Handelsblad.* Retrieved from: https://www.nrc.nl/nieuws/2018/10/30/aantal-files-neemt-komende-vijf-jaar-stevig-toe-a2753218

Van Acker, V., Mokhtarian, P. L., & Witlox, F. (2011). Going soft: on how subjective variables explain modal choices for leisure travel. *European journal of transport and infrastructure research.-Delft*, *11*(2), 115-146.

Van Kampen, A. (2016). 13 popular beaches in the Netherlands. *I AM EXPAT*.

Van Wee, B. (2002). Land use and transport: research and policy challenges. *Journal of transport geography*, *10*(4), 259-271.

Verplanken, B., & Aarts, H. (1999). Habit, attitude, and planned behaviour: is habit an empty construct or an interesting case of goal-directed automaticity?. *European review of social psychology*, *10*(1), 101-134.

Zwaneveld, P. J., & Berveling, J. (2009). *Het belang van openbaar vervoer: de maatschappelijke effecten op een rij*. Kennisinstituut voor Mobiliteitsbeleid.

Appendices

Appendix A)

Feasibility Research Survey.
This survey was originally written in Dutch. It has been translated to English for the purpose of this paper.

Q1: On the street, you are asked to download a smartphone application for research purposes. How important are the following concepts in relation to your decision to download the application?

1. The size of the application
   Answer: 1(Not important) – 5(Very important)

2. The state of your smartphone battery
   Answer: 1(Not important) – 5(very important)

3. The reward that comes in return of participation
   Answer: 1(Not important) – 5(very important)

4. The information that is given by the researcher who provides the application
   Answer: 1(Not important) – 5(very important)

5. The certainty that my data are not made public
   Answer: 1(Not important) – 5(very important)

Q2: Most applications ask you to read a privacy statement. What do you do?

a. I close the application
b. I agree without reading the privacy statement
c. I quickly browse through the privacy statement and agree afterwards
d. I carefully read the privacy statement and agree afterwards
e. I carefully read the privacy statement and only agree if I totally agree
f. Other

Q3: If you download the application (TRACKEUR) on your phone, your location will be sent to the research team regularly. By participating in this, you help us doing academic research. Would you opt in?

a. Yes
b. Probably yes
c. Maybe
d. Probably not
e. No

Q4: Say we would like to offer you one of the following rewards in return for your participation, which option would you like most?

a. A parking ticket to park today with 40% discount
b. A parking ticket to park for free during your next visit
c. A one-in-ten chance to win a Bol.com gift-card with a value of €50
d. The chance to win a sea-life arrangement

Q5: How likely is it that you will download our smartphone application when we offer you 40% discount on your parking ticket?
Answer: 1(Very not likely) – 5(Very well likely)

To test different discount rates, this question used five different discount rates, namely 1) 20%, 2) 40%, 3) 60%, 4) 80%, 5) 100%. Each respondent was only shown one discount rate.

Q6: What did your choice to come to Scheveningen by car influence most? (Choose a maximum of two options).

a. Travel time
b. Flexibility
c. Costs
d. Availability of a car
e. Practical considerations (family, weather, etc…)
f. I often do it this way

Q7: You came by car today. Is this a company car?

a. Yes
b. No
c. I don't want to say

Q8: In the sudden situation that a car would have been unavailable, would you still have come to Scheveningen?
Answer: 1(Yes) – 5(No)

Q9: What is your reason for visiting the city of Scheveningen?

a. Work
b. Spending free time
c. Family visit
d. Shopping
e. Other

Q10: What is your gender?

a. Male
b. Female
c. Neutral or I don't want to say

Q11: What is your age?

a. 18 – 40
b. 40 – 65
c. 65+

Q12: What are the four digits of your zipcode? (0000 for I don't want to say & 9999 for international).
Answer: ….

Appendix B)

```
Multinomial logistic regression                 Number of obs     =         98
                                                LR chi2(52)       =      90.36
                                                Prob > chi2       =     0.0008
Log likelihood = -91.329118                     Pseudo R2         =     0.3310
```

no_car2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
1	(base outcome)					
2						
ln_distanceminutes	-.7137043	.6767052	-1.05	0.292	-2.040022	.6126134
urbanitylevel_zipcode	.5577936	.3197626	1.74	0.081	-.0689295	1.184517
age2	-.5516304	.5423403	-1.02	0.309	-1.614598	.511337
Male	.1250215	.6518522	0.19	0.848	-1.152585	1.402628
Reason_Traveltime	-.9700169	1.004992	-0.97	0.334	-2.939765	.9997315
Reason_Flexibility	.5227042	.8209396	0.64	0.524	-1.086308	2.131716
Reason_Costs	-1.579406	1.318572	-1.20	0.231	-4.163759	1.004947
Reason_Caravailabil~y	.0022249	1.762583	0.00	0.999	-3.452374	3.456824
Reason_Practicalities	-.1181881	.9386204	-0.13	0.900	-1.95785	1.721474
Reason_Habit	-1.868473	1.083619	-1.72	0.085	-3.992327	.2553821
companycar2	1.213744	1.120946	1.08	0.279	-.9832706	3.410759
Within15km	-21.54735	15159.14	-0.00	0.999	-29732.91	29689.81
TraveltimexCompanycar	-.0112922	2.239804	-0.01	0.996	-4.401228	4.378644
_cons	2.06137	3.048036	0.68	0.499	-3.912671	8.035412
3						
ln_distanceminutes	-.3756926	2.356788	-0.16	0.873	-4.994911	4.243526
urbanitylevel_zipcode	1.732955	1.179607	1.47	0.142	-.5790324	4.044942
age2	1.675766	1.454082	1.15	0.249	-1.174183	4.525715
Male	-.2854312	1.563225	-0.18	0.855	-3.349296	2.778434
Reason_Traveltime	33.63084	4434.359	0.01	0.994	-8657.553	8724.815
Reason_Flexibility	19.61988	3084.037	0.01	0.995	-6024.982	6064.221
Reason_Costs	17.3885	3084.037	0.01	0.996	-6027.213	6061.99
Reason_Caravailabil~y	5.988962	15855.23	0.00	1.000	-31069.68	31081.66
Reason_Practicalities	19.0205	3084.037	0.01	0.995	-6025.582	6063.623
Reason_Habit	-19.0238	6059.845	-0.00	0.997	-11896.1	11858.05
companycar2	-20.41779	7846.958	-0.00	0.998	-15400.17	15359.34
Within15km	39.59606	4434.36	0.01	0.993	-8651.589	8730.781
TraveltimexCompanycar	-31.08062	21158.5	-0.00	0.999	-41500.98	41438.82
_cons	-61.75037	6942.436	-0.01	0.993	-13668.68	13545.18
4						
ln_distanceminutes	.1340228	1.279113	0.10	0.917	-2.372993	2.641039
urbanitylevel_zipcode	-.2854759	.5413677	-0.53	0.598	-1.346537	.7755852
age2	-1.181495	.9696236	-1.22	0.223	-3.081922	.7189323
Male	-1.211102	1.088662	-1.11	0.266	-3.344841	.9226374
Reason_Traveltime	-2.604418	1.778849	-1.46	0.143	-6.090898	.8820615
Reason_Flexibility	1.419744	1.256453	1.13	0.258	-1.042858	3.882346
Reason_Costs	-.3216512	1.888714	-0.17	0.865	-4.023463	3.380161
Reason_Caravailabil~y	-17.96674	18603.79	-0.00	0.999	-36480.72	36444.78
Reason_Practicalities	-2.658884	1.969777	-1.35	0.177	-6.519575	1.201808
Reason_Habit	-2.007897	1.840649	-1.09	0.275	-5.615503	1.599709
companycar2	-19.48066	9781.373	-0.00	0.998	-19190.62	19151.66
Within15km	-.0490761	1.984557	-0.02	0.980	-3.938737	3.840585
TraveltimexCompanycar	24.1123	9781.373	0.00	0.998	-19147.03	19195.25
_cons	2.957522	5.074351	0.58	0.560	-6.988024	12.90307
5						
ln_distanceminutes	2.701512	.8994017	3.00	0.003	.9387173	4.464307
urbanitylevel_zipcode	-.395993	.3309699	-1.20	0.232	-1.044682	.2526961
age2	.004669	.6310724	0.01	0.994	-1.23221	1.241548
Male	-1.73376	.7728587	-2.24	0.025	-3.248535	-.2189849
Reason_Traveltime	-5.834292	1.581279	-3.69	0.000	-8.933542	-2.735041
Reason_Flexibility	-1.004486	.9580297	-1.05	0.294	-2.88219	.8732175
Reason_Costs	-3.020779	1.437148	-2.10	0.036	-5.837536	-.2040213
Reason_Caravailabil~y	.675162	1.642612	0.41	0.681	-2.544299	3.894623
Reason_Practicalities	-4.68273	1.490877	-3.14	0.002	-7.604794	-1.760665
Reason_Habit	-2.398847	1.142147	-2.10	0.036	-4.637414	-.1602794
companycar2	-.6219471	.9944809	-0.63	0.532	-2.571094	1.3272
Within15km	1.790456	1.605941	1.11	0.265	-1.357131	4.938044
TraveltimexCompanycar	7.391085	2.510425	2.94	0.003	2.470743	12.31143
_cons	-4.778163	3.380381	-1.41	0.158	-11.40359	1.847262

Appendix C)

Comparison Cross-Tabulation gender, survey 1.

	Male		
No_car_binary	0	1	Total
0	33	40	73
1	20	15	35
Total	53	55	108

Appendix D)

Interaction variable Traveltime*Companycar

Traveltime xcompanycar	Frequency	Percent	Cumulative
0	103	95.37	95.37
1	5	4.63	100.00
Total	108	100.00	

Appendix E)

Distribution of disposable income per household in The Netherlands in 2017.