Chapter 1

General introduction
Every day we make several trips from our home address to the office, our children’s school, our friend’s house, the grocery store and many more destinations. We use various transport modes, like the bicycle, the car or we go on foot. Do you ever think about the choice of your way of transportation? Before reading this PhD thesis, please think about why you choose the transport mode you generally use. Do you choose the fastest way, the nicest or cheapest way? Is it a habit? Or do you consciously choose every single time what transportation you use? When you think about the last trip by car you made directly from home, could you also have made this trip by an active transport mode? If yes, why didn’t you?

Whatever age we are and whatever activities we undertake, transport and mobility play a fundamental role in our daily lives and routines.[1] In the Netherlands, 70% of the trips made are shorter than 7.5 km.[2] Compared to other European countries, the Netherlands has the highest proportion of the population using the bicycle as mode of transport on a typical day. The Eurobarometer shows a proportion of 36% for the Netherlands, compared to a mean proportion of 8% for all 28 member states of the European Union.[1]

In the past decades, planning and transport policies have been predominantly focussing on the car.[3-5] In the earlier modernistic planning ideologies (1920-1970), the street was first and foremost seen as a space for transport and far less as a place for social meeting and playing.[3] For these purposes separate specialised spaces like parks and playgrounds were created. Within the street, transport was mainly seen as an issue of car transport. Initially, this focus on the car was obviously for good reasons, since increased mobility gave more people access to the activities, services, and goods that contribute to improved quality of life.[5] However, Jane Jacobs substantiates in her book “The Death and Life of Great American Cities” that this increase in car use and these modernistic planning ideologies had resulted in the destruction of social life in the American car oriented cities, simply because the street was not a social space anymore. The street as a public domain in which people meet, play, talk or observe each other was replaced by the road as a technical infrastructure for the car. This narrowing down of the public domain to urban places like parks and playgrounds would cause an end to urban space and city life and would result in lifeless cities devoid of people [4], implying that the focus on the car comes at the cost of pedestrian and cycling areas. As a result, urban living drastically changed, levels of congestion and pollution increased, and cycling and walking as means of transport decreased.[6, 7]

By the year 2015, achieving lively, safe, sustainable and healthy cities has become a general and urgent desire [3] and recently “Healthy urban living” is getting more and more attention. As mentioned by Jan Gehl, increasing the concern for pedestrians, cyclists and city life would strengthen immeasurably these four key objectives (lively cities, safety, sustainability, and health)
of cities.[3] The current dominance of an inactive, car-oriented lifestyle directly threatens public health. Physical inactivity is one of the main risk factors for health problems in Western Countries. Globally, almost 31% of those aged 15 years or older fail to meet the targets for physical activity recommended in the guidelines (at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous activity).[8] The Toronto Charter for Physical Activity states that transport policies and systems that prioritise active transport are amongst the best investments for stimulating physical activity since active transport is the most practical and sustainable manner to increase physical activity on a daily basis.[9] However, to give policy measures aimed at stimulating physical activity by encouraging the replacement of passive modes of transport by active transport, a reasonable chance of success, one should focus on short distance trips (see methods and study design).

Another health threat of urban living that is related to transportation is air pollution. With regard to air pollution, it has been estimated that 420,000 persons died prematurely from air pollution in the European Union in 2010.[10] In December 2013 the European Commission adopted a Clean Air Policy Package with air quality objectives for the period up to 2030. One of the aims is to reduce air pollution by traffic.[11] In order to meet these environmental pollution norms several actions have been undertaken: e.g. the development of more sustainable cars as well as the stimulation of more sustainable transport modes such as walking or cycling. Elevated levels of noise were estimated to contribute to almost 900 thousand additional prevalent cases of hypertension at the European level, of which 90% was mentioned to be due to exposure to road traffic noise.[12]

Stimulating active transport has a direct effect on health since it affects a person’s risk on traffic crashes, exposure to air pollutants as well as their level of physical activity.[13] Stimulating active transport use not only influences the level of physical activity, but also has beneficial health effects due to reduced air pollution emissions [14], greenhouse emissions [15] and noise levels [16]. The effect on road safety is controversial: some claim an improvement [17], while others found that this effect depends on age and gender [18].

The notion that urban design has the potential to influence health has been noticed by both those active in the public health domain, as well as by researchers and policy makers in the environmental and spatial domain. However, for all three domains this connection between the urban design and health is only a part of a broader scope in which also other factors are important.[19] The importance of an intersectoral approach in stimulating active transport has been recognized. Nevertheless, at this point in time, intersectoral collaboration remains challenging.
Transport plays a key role with regard to health and urban living, but not all health effects are positive. Is active transport healthier or do the negative effects outweigh the positive effects?

Since active transport affects health through different pathways (being active, air pollution, noise, urban design and traffic safety) it would be of value to combine the outcomes with respect to this different aspect into one overall health outcome that summarizes the aggregate impact on health by using a Health Impact Assessment (HIA). A HIA can be defined as “a combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population”.[20, 21]

Recently several attempts have been made to determine the health impact of a mode shift from car use to active transport.[14-16, 22, 23] Overall, in all HIAs that have been conducted, the positive effects of a mode shift from car use to active transport outweigh the negative effects. Two of these were performed in the Netherlands.[14, 16] Van Kempen et al. [16] investigated the health effects of a substitution of 10% of the short-distance car trips by bicycle trips. They evaluated the impact of the resulting change in traffic-related air pollution, road traffic noise, road safety and physical activity on the disease burden as expressed in Disability-Adjusted Life Years (DALY’s). Main results were a decrease in disease burden related to physical (in)activity at a maximum of 1.3% after one year. Small health benefits were found resulting from a reduction in road traffic noise levels and traffic-related air pollution and a possible negative effect on health could come from a higher risk of accidents. De Hartog et al. [14] investigated the health impact of a substitution of 12.5% of the short-distance car trips by bicycle trips. They evaluated the impact of the change in traffic-related air pollution, road safety and physical activity on all-cause mortality expressed in life-years gained or lost. Main results were a gain of 3-14 months of life-time as a result of increased physical activity, a loss of 0.8-40 days as a result of the increased inhaled air pollution doses and a loss 5-9 days as a result of the increased traffic accidents. It was concluded that the beneficial effects of increased physical activity due to cycling resulted in about 9 times greater gains in life-years for the people who made the shift than the losses in life-years due to increased inhaled air pollution and traffic accidents.

Main drawbacks of these HIAs are that, apart from the fact that these were theoretical exercises, much of the information needed for the assessment was unavailable or unknown, resulting in a relatively large number of assumptions. For example, assumptions were made with regard to the population at risk, the exposure to environmental hazards, and the change in population exposure and/or behaviour due to the intervention.[14, 16]
The outcomes of previous health impact assessments are positive. But still there are a lot of uncertainties. What kind of information is needed? And what will be gained by obtaining this information?

More in-depth knowledge is needed in order to decide if the assumptions made in HIAs are a correct representation of reality and thus if the presented health effects are a reliable prediction of the outcome of this intervention in practice. To have correct information at ones disposal will result in HIA outcomes correctly representing current practice and in policy documents deciding where to put the money in order to most efficiently promote public health.

In order to increase active transport use, insight is needed into what determines people's choice of transport mode. There are various theories as to what causes a decision (on transport mode) to result in a certain outcome. In the next section we will discuss two models that are frequently used for explaining transport behaviour: the Attitude, Social influence, self-Efficacy model (ASE-model), and the Elaboration Likelihood Model (ELM).

The ASE-model (Figure 1.1) assumes that the intention to behave in a certain way is affected by attitudes, social norms and self-efficacy, which in turn predicts behaviour.[24] The ASE-model originated from the Theory of Reasoned Action, but has incorporated insights from various other theories, such as Social Cognitive Theory, the Transtheoretical Model and the Precaution Adoption.[24] In this model the determinants of behaviour are influenced by personal characteristics (for example age, gender and educational level). The moment when and the reason why the intention is turned into actual behaviour is influenced by barriers and skills. An important set of barriers lies within the environment, or more specifically, in the interaction between individuals and their direct living environment (for example the type of neighbourhood someone is living in).[16]

In the ASE-model it is assumed that decisions are made conscious. However, when behaviour becomes habitual, the control of action is outsourced to the environment, which means that when the appropriate circumstances occur the sequences of actions are triggered automatically.[25] According to Aarts et al. this concept of habit may set a boundary condition for the applicability of the theories of reasoned or planned behaviour in predicting and explaining repeated behaviours such as transport choice, since most habitual behaviour arises without conscious intent and needs neither reasoning nor planning in order to occur.[26] Thus, changing intentions will not necessarily influence behaviour.[25]

In the Elaboration Likelihood Model (Figure 1.2) the notion that behaviour is not always conscious is given a place by including both a central and peripheral route of persuasion.[27] Persuasion by
Figure 1.1 The Attitude, Social influence, self-Efficacy model [24]

Figure 1.2 The Elaboration Likelihood Model [27, 30]
the central route results form a person’s careful and thoughtful consideration of the true merits of the information presented in support of an option. Thus, via the central route a conscious decision is made. This central route looks like the process of decision making as described in the ASE-model. One of the conditions that should be fulfilled for this central route is that the person is motivated and able to process the information. Persuasion by the peripheral route occurs as a result of a simple cue in the persuasion context (e.g., an attractive source) that induces without necessitating scrutiny of the true merits of the information presented. In case of habitual behaviour decision making will be via this peripheral route. This peripheral route looks like the pathway in case of a strong habit as displayed in the process model of strong and weak habits.[28, 29]

In these models different aspects are assumed to influence behaviour. Obviously, if behaviour may be considered to be a set of consciously made decisions this calls for a different intervention/policy approach than if behaviour may be approached as being habitual in nature. Therefore, for stimulating a mode shift effectively it is important to take into account these different processes of decision making.

Methods and study design

The research presented in this PhD thesis was conducted as part of the research project called the “ActIVE transport in Urban Environments” (AVENUE) project. The AVENUE project is commissioned and financed by the National Institute for Public Health and the Environment of the Netherlands as part of the strategic research program. The aim of this PhD thesis was twofold:

(i) to investigate the feasibility of policy measures and/or interventions aiming to induce a mode shift; and
(ii) to provide in-depth information on the personal and environmental characteristics of short car and active transport trips associated with transport choice.

In this thesis we address the following research questions:
1. Which interventions/policies have been implemented with the aim of inducing a mode shift from short car trips to walking and/or cycling and are these effective?
2. How is active transport stimulated in the Netherlands?
3. Which personal and environmental characteristics are associated with transport choice for short distance trips?
4. How are trip purposes associated with transport choice?
5. What are the motives for transport choice?
6. Do persons using active transport modes have a better perceived health than persons using the car?

The AVENUE project has a focus on nationally representative data for the Netherlands. Although, the Netherlands are characterized by a very high share of active transport trips relative to other European countries there are still health benefits to be gained by stimulating more active transport use [16]. With a raising awareness of the importance of stimulating active transport use around the world, insight into the factors positively influencing active transport use in an environment that is already designed with good active transport facilities would be of importance. Since use of active transport has health effects in several domains an integrated approach has been used including the following domains: health, air pollution, noise levels, urban planning and traffic safety. In this project a combination of qualitative (focus groups, policy analysis) and quantitative methods (systematic literature review, questionnaire and (secondary) data analysis) has been used. A more detailed description of the AVENUE project can be found in Appendix 1.

Study population

In this project we focussed specifically on adults aged 18 years or older. Reason for this is that in the Netherlands people below this age do not have a driver’s license and therefore are not part of the target population for interventions stimulating a modal shift from car use towards active transport. Trips included are trips made for one of the following purposes: (i) shopping; (ii) going to public natural spaces; (iii) going to sports facilities; and (iv) commuting1. It was expected that these purposes are of interest to policy makers and developers of intervention measures since they imply a clear set of stakeholders and partners involved in case an intervention or policy measures in this domain is considered.

In this thesis we focus only on trips made by car, cycling2 or walking. Although we do recognize that public transport often has an active component, we did not include trips made with public transport in our study. Reason for this is that for stimulating public transport other factors are relevant than for the stimulation of active modes such as walking and cycling. Furthermore, as can be seen from Figure 1.3, only 0.4% of the trips up to 7.5 km are made by public transport. Therefore, we assume that, at least for this distances, public transport will often not be considered as an alternative for car use.

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1 These are the trips included in our questionnaire. However, in the analyses based on data from Mobility Research Netherlands the trip purpose “taking or bringing persons” was included instead of “going to public natural spaces”

2 At the start of the research performed in this thesis the market share of the electric bicycle was still relatively low. Therefore, we did not include the shift from car to electric bicycle in this thesis. In retrospect this would have been an interesting study topic
Distances up to 7.5 km

To enhance the feasibility of measures aiming to induce a mode shift from car to active transport modes, car trips targeted should not exceed a feasible walking or cycling distance. Figure 1.3 shows the main modes of transport up to distances of 7.5 km in 2013. In general, 40% of the trips up to 7.5 km were made by car (33% as car driver and 7% as car passenger), 33% were made by cycling and 25% by walking. Common sense tells us that probably the distance at which walking is considered as an alternative for the car will differ from the distance at which cycling is considered as an alternative. Figure 1.4 shows that in the category of 5.1 to 7.5 km still 27% of the trips are made by active transport modes. Up to 5.0 km, at least 10% of trips were made by walking and up to 1.0 km walking and cycling appear to be competing transport modes.

We decided to define short trips as trips up to 7.5 km, considering both walking and cycling as alternatives. The fact that cycling seems to have priority over walking, at least for the larger distance categories corresponds with it being a faster transport mode. However, for the shortest distance categories (up to 1 km) a mode shift from car use to walking seems feasible. Therefore, depending on the specific policy measure or intervention planned for the future it will be more relevant to focus on walking or cycling as an alternative for the car. Since in this thesis we focus on both walking and cycling, it gives insight in factors influencing transport choice for both.
Outline of this thesis

Chapter 2 addresses the effectiveness of interventions aiming to induce a mode shift as well as the tools used in these interventions. In Chapter 3, the policies focusing on a mode shift implemented in the Netherlands are discussed. Chapter 4 focuses on the association between personal and neighbourhood characteristics with short-distance trips made by car, bicycle or walking in order to identify target groups for future interventions. Chapter 5 describes the association between combined trip purposes and transport choice. Chapter 6 addresses the association between perceived accessibility of facilities and transport choice and Chapter 7 focusses on the association between perceived route characteristics and transport choice for trips to sport facilities. In Chapter 8, motives for transport and route choice are discussed as well as the barriers for using specific transport modes. Chapter 9 describes the association between transport choice and perceived general and mental health as well as having a healthy weight. Finally, in the general discussion (Chapter 10) the main results are summarized and integrated, the methodological issues are discussed and implications of the main findings are given.
References

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