CHILDREN'S INDEPENDENT MOBILITY TO SCHOOL

FACTORS INFLUENCING CHILDREN'S INDEPENDENT MOBILITY TO SCHOOL IN RURAL AREAS

A CASE STUDY WITHIN THE MUNICIPALITY OF APELDOORN AND VOORST

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Preface

I am pleased to present to you my master's thesis *Children's Independent Mobility to School: Factors Influencing Children's Independent Mobility to School in Rural Areas.* This thesis marks the finalization of the master program Society, Sustainability & Planning at the University of Groningen. A long time I have struggled with writing my thesis, but from December 2023 until August 2024, I have been researching and writing this thesis. Hopefully, the results presented in this thesis will contribute to the knowledge in planning and children's independent mobility.

Over the past five years, I finished my bachelor Future Planet Studies at the University of Amsterdam and started this master program at the University of Groningen. Throughout the master program I developed an interest in the concept of child-friendly planning. Not only cities need to be child-friendly. Also the rural areas need to plan with children in the back of their minds, or even in collaboration with children. With writing my thesis I had the opportunity to look into this topic. Although, writing a thesis is not at all where my qualities lie, I am very pleased that I finally finished my thesis.

In expressing my gratitude, I would like to acknowledge several people who have played an important role in the completion of this thesis. First, I would like to thank my supervisor, Dr. Samira Ramezani, for constantly helping me through rough patches and the valuable guidance and feedback throughout the entire process of researching and writing my thesis. Furthermore, I would like to thank all the participants of the research for their time, their insights and their contributions to this research. Moreover, I would like to thank my dear friends Lot and Mirei, for their mental support and help during the process. It wasn't always easy, but with their help I always got back on track. Lastly, I want to thank my grandparents for letting me write at their house in their office space. Without everyone's help I couldn't have finished the thesis.

Have fun reading my thesis.

Demi Linthorst

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Abstract

In an era of rapid urbanization, understanding children's independent mobility (CIM) is essential for developing environments that support their healthy growth and autonomy. This research examines the factors that influence children's independent mobility to school in rural areas, focusing on two municipalities in the Netherlands: Apeldoorn and Voorst. While independent mobility in urban areas is well-documented, rural settings remain under-researched, necessitating a closer examination of these contexts. A qualitative approach is employed, using semi-structured interviews with 15 parents of children aged 7-12 years. These interviews reveal key themes affecting children's independent mobility, including parental perceptions, neighborhood design, and household characteristics. The findings indicate that factors such as parental encouragement, perceptions of neighborhood safety, and the availability of child-friendly infrastructure significantly impact children's ability to commute independently to school. Additionally, socio-demographic characteristics like age, and household dynamics play a crucial role in shaping children's independent commuting habits. A significant finding is the influence of parental perceptions on children's mobility licenses. Parents' concerns about traffic safety, social environment, and built environment affect their willingness to allow children to travel independently. The study also highlights the importance of neighborhood design, such as the presence of sidewalks, bike lanes, and green spaces, in promoting independent mobility. Furthermore, household characteristics, including parental work schedules and socioeconomic status, significantly affect transportation mode choices. The research concludes with recommendations for policymakers and urban planners to foster more child-friendly rural environments. By addressing barriers to independent mobility, such as enhancing infrastructure and promoting community engagement, children's ability to travel independently can be improved. This study contributes to understanding independent mobility in rural settings and provides a foundation for future research on child-friendly environments. The findings underscore the necessity for a holistic approach that considers the interplay between social, physical, and demographic factors in enhancing children's independent mobility to school.

Keywords: Children's Independent Mobility (CIM), Rural Areas, Parental Perceptions, Traffic Safety, Social Cohesion.

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CIM   Children's Independent Mobility

IM   Independent Mobility

Chapter 1: Introduction

This chapter provides a background on the chosen research topic. Moreover, the scientific and the social relevance of the research are discussed. Additionally, the research aim and research questions are introduced. At the end of the chapter, the structure of the thesis is explained.

1.1   Background

In 2018, 55% of the world's population lived in urban areas, and by 2050, this percentage is projected to increase to 68% (United Nations, 2018). This rapid urbanization has significant implications for children, who will grow up in increasingly urbanized environments. Within the Sustainable Development Goals, there is a strong emphasis on creating child-friendly cities. Goal 11 focuses on sustainable cities and communities, highlighting the need for safe and affordable housing and accessible and sustainable transport systems, with special attention to vulnerable individuals, including children (United Nations, 2015).

Another critical goal set by the United Nations is Goal 3: "ensure healthy lives and promote well-being for all at all ages" (United Nations, 2015). This goal includes reducing premature mortality from non-communicable diseases through prevention, treatment, and the promotion of mental health and well-being.

Goals 3 and 11 are aligned to promote healthy, sustainable urban environments where children can grow and thrive. However, cities are currently not as sustainable or safe as they need to be, lacking affordable and accessible transport systems for all, including children. Moreover, not all children are as healthy as they could be. In 2016, 18% of children between the ages of 5 and 19 were overweight (WHO, 2021). Additionally, two-thirds of European children and adolescents are not sufficiently active (Steene-Johannessen et al., 2020). Physical inactivity is a significant risk factor for global mortality, and the WHO recommends that school-aged children engage in at least one hour of moderate to vigorous physical activity every day (WHO, 2010). However, children are spending more time indoors, often leading to increased screen time (Carver et al., 2014). Screen time, which includes time spent with television and mobile devices, can have adverse effects on children's physical health and development (Oswald et al., 2020).

In the Netherlands in 2021, 12% of the children aged between 2 and 11 were overweight, 3% of this group is severely overweight (CBS, 2022). Moreover, only 18% of children perform the recommended one hour of exercise a day.

It is therefore important to promote active behavior amongst children (Carver et al., 2014). A good way to promote physical activity is through active transportation (Smith et al., 2017). Burghard et al. (2016) and Faulkner et al. (2009) state that parents and parenting have a great influence on the active transportation of their children. Parents are therefore important in the context of transport mode choice. A trip that children often take is to school, in the last decades the number of children that are brought to school by car has increased. While the number of children that walk or cycle to school has decreased (Wen et al., 2008; Faulkner et al., 2009). This does not only affect the physical health of the children, but also the development of autonomy and socialization skills (Lang, Collings, Kearns, 2011). Active transportation to school can be done by cycling or walking to school and this physical activity can easily develop into a habit (Carver et al. 2014). Faulkner et al. (2009) state that children who walk or cycle to school are more physically active overall than children who go to school by car or other modes of transport.

Besides physical activity, another factor that is important in a child's development is the freedom to move around the neighborhood without adult supervision. This is called children's independent mobility (CIM) (Vlaar et al., 2019). CIM provides a lot of opportunities and benefits like the development of cognitive skills, social interaction and several aspects of children's health and well-being (Vlaar et al., 2019). The different benefits are explained in the next paragraphs.

Cognitive development

During an unsupervised walk children learn to explore their environment and navigate through the public space, this enhances their way-finding skills, spatial awareness, and problem-solving abilities (Schoeppe et al., 2016). Children learn to plan their route, orient themselves and adapt to changes in their environment (Lopes & Neto, 2014).

Social development

When accompanied by friends or by interacting with others during the IM children learn to interact and engage with others. Children can also develop social skills such as dealing with unfamiliar situations and making choices (Christian et al., 2015). Experiencing places and interacting with people contribute to self-identity, security and social competency (Lin et al., 2017).

Physical health

While independent mobility does not always imply active behavior, it is commonly perceived as autonomous active travel, like walking or cycling, without adult supervision (Tranter & Whitelegg, 1994). In such instances, CIM directly correlates with physical activity. An increased proportion of daily trips

made independently is linked to greater daily physical activity. This is only the case if the independent mobility has the form of active transport (Marzi & Reimers, 2018).

Independence

Ryan and Deci's (2020) Self Determination Theory is a prominent framework for understanding psychological well-being, emphasizing the significance of three fundamental psychological needs: autonomy, competence, and relatedness. In this case autonomy links very well with CIM. Autonomy entails having a sense of control, initiative and ownership in one's actions (Ryan and Deci, 2020). In CIM this translates into children feeling empowered in managing their movements within their neighborhoods (Ryan and Deci, 2020). Being able to travel independently enhances children's independence and prepares them for navigating the world autonomously as they grow older (Schoeppe et al., 2016). Furthermore, a child's autonomy improves by walking or cycling unsupervised around the neighborhood (Legorburu et al., 2022). CIM can also improve self-confidence as the child learns to be on his own and solve their own problems (Riazi et al., 2019).

CIM is influenced by a lot of factors, but one of the most important factors that influences CIM is the perception parents have of the neighborhood environmental factors. Parents decide how far their child is allowed to go based on their perception of safety of the physical and social environment (Vlaar et al., 2019). Parents particularly take the safety of the physical and social environment into account when debating how far their child is allowed to go on their own (Vlaar et al., 2019). In the last decades the IM for children has decreased (Vlaar et al., 2019; Kyttä, 2004). Due to this trend children experience less benefits correlated with IM (Vlaar et al., 2019).

In the Netherlands various programs are set up by schools and municipalities to increase the active transport. A lot of these programs are specifically focused on children, like the action week done by the municipality of Enschede where the children that came to school on a bicycle could earn stickers (Enschede Fietsstad, 2023) and a similar project at a school in Klarenbeek where the bicycles of the children were checked, and they could also earn points (De Kopermolen, 2024). These programs stress the need for more active transportation, but are less focused on the IM. As mentioned, CIM has important benefits in the health and well-being of children. Tackling both in the same trip to school should therefore be the ultimate goal. In this way children are achieving more physical activity throughout the day and at the same time gaining more autonomy and social interaction.

1.2   Scientific relevance

Active transport to school and independent mobility are crucial for children's development. A lot of case studies on CIM are situated in urban areas (Broberg et al., 2013). There is a knowledge gap in the 'independent mobility' knowledge in rural areas and small towns which helps the understanding of child-friendly environments (Kyttä, 2004). Kyttä (2004) states that literature about the differences between IM in rural and lower-density environments and high-density settings is inconclusive. Moreover, there is a lack of recent research that has been done on IM in rural settings and low- density settings (Kyttä, 1997; Jones et al., 2000; Tillberg Mattsson, 2002; Pelletier et al., 2021; Carver et al., 2012). In the Netherlands, research on this topic is also limited. Helbich (2017) has addressed it in the context of urban areas, while the dynamics in rural areas remain less explored. Policymakers in the Netherlands have observed a shift in rural residents' orientation, with these residents increasingly relying on facilities situated in more urban areas for daily activities and services (Gieling et al., 2018). Consequently, efforts have been directed towards enhancing connectivity between villages and cities to ensure rural residents' access to necessary facilities (Gieling et al., 2019). However, improving connectivity between urban and rural areas does not necessarily mean that amenities will be closer to rural residents; it simply facilitates easier access to them. This shift implies long(er) commuting time for rural residents, and this includes the distances children must travel to school. While primary schools are often within walking or cycling distance, approximately a maximum of 2,5 kilometers, in both urban and rural settings (Gieling et al., 2019), secondary schools are typically located in more densely populated areas, potentially extending the commute for rural students (CBS, 2021). This can be an indicator that CIM is forced to increase when children finish primary school. Moreover, Vlaar et al. (2019) state that future interventions to increase CIM should focus on the attitude and behavior change among parents to grant their children more independent mobility. Increasing the understanding of parental perceptions on CIM in rural areas and low-density areas can contribute to understanding the level of child-friendliness in rural environments.

1.3   Research aim and questions

This research focuses on school-aged children in rural areas of the Netherlands, specifically targeting two distinct age groups: 7 to 9-year-olds and 10 to 12-year-olds. The rationale for selecting these age groups stems from their developmental stages and expected differences in independent mobility. Firstly, the older age group (10 to 12 years) likely exhibits more independent mobility compared to younger children (7 to 9 years). Moreover, focusing on these age groups aligns with findings from other European countries where children tend to gain more independence as they grow older (Jelleyman et al., 2019; Dodd et al., 2021). This comparative perspective enriches the research by contextualizing Dutch trends within a broader European framework.

For this research the municipalities of Voorst and Apeldoorn are chosen as a case study, within these municipalities there are a lot of building plans for new family homes, because these homes are wanted within the municipalities (Gemeente Voorst, 2024). This means that in the future, on top of the current families living there, more children will live within these municipalities. It is therefore important to accommodate a safe environment for these children. In addition, these municipalities both contain a lot of rural towns as well as city centers. The health and well- being of the (future) residents of these municipalities can increase if the active transport to school is stimulated. Along with this stands independent mobility, this is an important factor within a child's development. It is therefore important to assess the independent mobility of children on their journey to school.

This study aims to provide insights into which factors affect the children's independent mobility to school and what differences there are between the age group 7-9 and 10-12, this all within the context of two rural municipalities in the Netherlands. Therefore, the central question in this research is:

What factors affect independent mobility for children in different age groups on their journey to school in rural areas?

To come to an answer to the main research question, three secondary questions are being answered in the process. The first sub-question will cover how CIM is conceptualized and measured, looking at the different factors that affect the overall CIM. The second sub-question will dive into the factors affecting CIM that are at play within the rural areas in the municipalities of Voorst and Apeldoorn. The last sub-question will focus on the differences between CIM in different age categories and which factors are connected to these possible differences

1. *How is children's independent mobility conceptualized and measured in literature?*

2. *What factors affect children's independent mobility to school in rural villages?*

3. *What are the differences in children's independent mobility to school and factors affecting it between the different age groups of 7-9 and 10-12 in rural areas?*

1.4   Thesis Outline

Chapter two provides a theoretical framework to the research, this contains theories and research on child independent mobility and factors affecting these. Furthermore, in the third chapter, the research methodology is explained. In chapter four the results of the research are summarized. In chapter five the results are discussed and linked to the theoretical framework. Moreover, chapter six also contains the conclusion, recommendations for future research, limitations and the strengths of the research. Chapter 7 contains the references used in the research. In chapter 8 the appendices can be found.

Chapter 2: Theoretical Framework

This chapter elaborates on the concepts of children's independent mobility, and factors affecting it such as sociodemographic characteristics, social environment and the built environment related to CIM. This chapter concludes with a conceptual model to link different concepts together.

2.1   Children's independent mobility

2.1.1 Background on Children's independent mobility

As Cooper Marcus (2006) noted, "part of the process of growing up is learning to do without our parents, to move bit by bit from their nurturance and watchful eyes and to test ourselves in those parts of the environment that are 'not home' - it's a place of initial separation and autonomy". The term connected to the description of Cooper Marcus is children's independent mobility (CIM). The term "children's independent mobility" was first introduced in 1990 by Hillman et al. (1990) and was defined as "the freedom of children to travel around in their neighborhood or city without adult supervision". The term is interpreted in different ways depending on the researchers. Some define it as the independent travel to different destinations, or explicitly, independent walking to or from school and sometimes the independent play outside (Marzi & Reimers, 2018). To come to a better understanding of the different uses of CIM figure 1 adapted from Marzi & Reimers (2018) provides an overview of different definitions, measures and frequency of application in studies.

Figure 1. Definitions, measures, and frequency of application in studies of four children's independent mobility (CIM) indicators. Source: Marzi & Reimers, 2018, Shaw et al., 2013, Hillman et al., 1990, Broberg, et al., 2013,

Villanueva et al., 2012, Kyttä, 2004, Oliver et al., 2011, Johansson, 2006, Chaudhury et al., 2017, Villanuava et al., 2014, Oliver et al., 2016, Veitch et al., 2014, Badland et al., 2011, Mavoa et al., 2011, Ghekiere et al., 2017.

The four indicators of CIM displayed in figure 1 are based on the research done by Sharmin and Kamruzzaman (2017), later summarized by Marzi & Reimers (2018). CIM license refers to the permissions parents grant their children for mobility. CIM destination is employed as the second indicator, indicating children's independent travel to specific places like local stores, school, or a friend's house. Parents implement this to make sure the children do not roam to other locations and determine the actual mobility of the child. CIM range denotes the territorial expanse, mostly measured by distance from home, within which a child independently travels. Furthermore, the time a child spends outside on their own is used as CIM time. However, while these indicators of CIM are portrayed as being separate, there are a lot of overlapping factors between them. As mentioned parental views can impact CIM, therefore CIM license can also influence the time a child is allowed to go out or specific destinations to which they can travel on their own (Marzi & Reimers, 2018).

CIM has drastically declined in the last few decades (Schoeppe et al., 2016). Trend data from England showed a decrease in school children that are allowed to travel home from school alone, in 1971 86% were allowed to go home unsupervised, whereas in 1990 this percentage had decreased to 35%. In 2010 the percentage had decreased to 25% (Schoeppe et al., 2016). The decline has much to do with the changes in the urban space, the increase in traffic and increasing crime rates. Parents nowadays perceive the city to be a dangerous place and have therefore increased their protective behavior towards their children (Alparone & Pacilli, 2012).

Over the past few decades not only has the CIM decreased but also children have been granted autonomy at an increasingly older age (Romero, 2010). CIM was compared in 16 different countries in a cooperative research project of the Policy Studies Institute London, an increase in CIM grew with age (Marzi & Reimers, 2018). In literature different stages of independence are described. A young child has round the clock adult supervision, this is followed by occasionally being allowed to go out with older siblings or friends and at some point the child is granted full independence (Marzi and Reimers, 2018).

But at what age are children allowed to make trips without supervision? Jelleyman et al. (2019) state that in New Zealand the age at which it was most common for parents to let their child go out without adult supervision, but with friends, was 13 years. The age at which parents let their children go out entirely alone was 15 years. Whereas, the research conducted by Dodd et al. (2021) stated that children in the UK were allowed to go out alone around the age of 11. According to the Handbook Design for Children (Crow, 2000), children aged from 9 to 12 are deemed capable of crossing a street on foot, though until the age of 11, there remains a potential for spontaneous behavior and a longer reaction

time to perceived dangers. Within this age range, cycling to school requires concentration, confrontation with complex situations is difficult. So, from the age of 11 a child should be able to go out without supervision, however the stated research outcomes above show that this is not the case in all countries.

The urban form can also influence CIM. Child-friendly environments promote more opportunities to CIM (Broberg et al., 2013). To enhance the comprehension of urban characteristics promoting environmental child-friendly environments the Bullerby model by Kyttä (2008) is used. This model suggests that environmental child friendliness hinges on two key criteria: the ability of children to move around independently and their access to a variety of environmental opportunities for engagement and exploration (Broberg et al., 2013). The Bullerby model serves as a theoretical instrument for evaluating the child-friendliness of different environments (Broberg et al., 2013). Figure 2 displays the Bullerby model.

THE NUMBER OF ACTUALIZED AFFORDANCES

	LOW	HIGH
HIGH	WASTELAND	BULLERBY
LOW	CELL	GLASSHOUSE

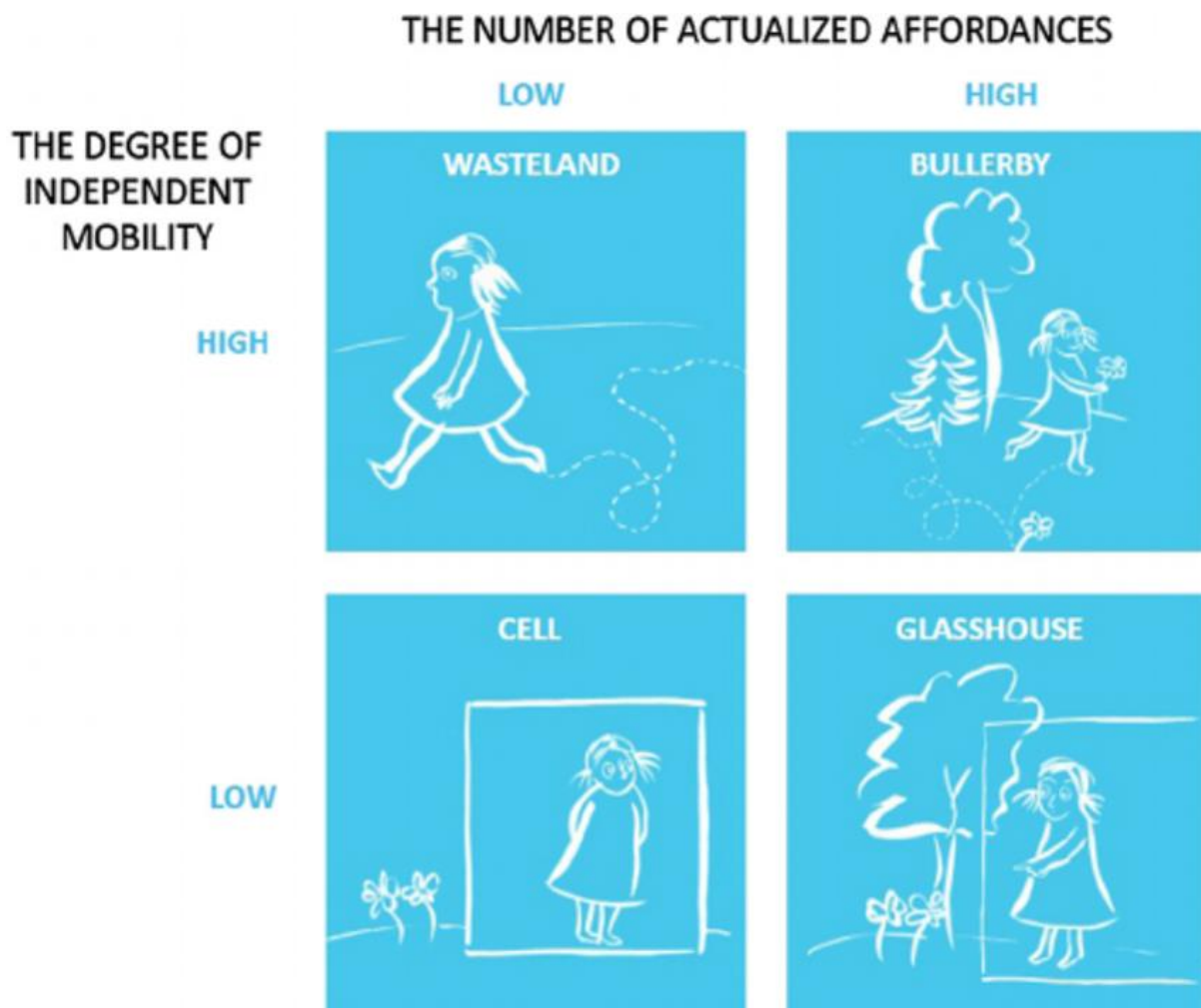THE DEGREE OF INDEPENDENT MOBILITY

Figure 2. Model that describes four hypothetical types of environments that emerge from the co-variation of children's independent mobility and the number of actualized affordances Source: Broberg et al., 2013.

Four types of environments are displayed, each containing a certain amount of affordances and independent mobility. The environments are wasteland, cell, glasshouse and Bullerby. Within the wasteland a child is allowed to wander a lot, however there are almost no affordances available. The cell environment is a place where a child is not allowed to go out unsupervised and the number of affordances are also low. This environment represents a more sheltered setting where children have moderate levels of independent mobility within familiar and controlled spaces. A child raised in a Glasshouse environment resides in a circumstance where external opportunities exist, yet lacks the ability to independently engage with them. Despite being aware of external opportunities, like recreational spaces of social interactions, the children are unable to engage with them unsupervised. This scenario arises when parental concerns about safety or societal norms restrict the CIM. Finally, the Bullerby environment. In this environment there is an abundance of mobility opportunities and affordances, the ideal scenario for CIM. Children have unrestricted access to diverse outdoor spaces where they can engage in unsupervised play and develop life skills. In a Bullerby environment there are thus greater opportunities for CIM.

2.1.2 Barriers to CIM

In the next sections the different factors influencing CIM will be explained. The barriers are categorized in three different sections, sociodemographic characteristics, social environment and physical environment. In 2018 Marzi and Reimers described these different environmental aspects that influence CIM. The next paragraphs will describe the different sets of factors that influence CIM.

2.1.2.1 Sociodemographic characteristics

The relation between socio-demographic characteristics and CIM are often researched (Alparone & Pacilli, 2012). These socio-demographic characteristics are age, gender, siblings, confidence and learned skills. As Christian et al. (2015) described, being a boy of an older age is strongly associated with more independent mobility. They also state that more IM is seen in children who have siblings or friends they can go with. Bagheri and Zarghami (2020) found that boys are allowed to go out further distances from home on their own than girls. Gender can therefore also be seen as an important factor.

As mentioned in paragraph 2.1.1, age is also an important factor influencing CIM. Dodd et al. (2021) found out that the parents that answered their questionnaire would allow their child to go out on their own at an average age of 10,74 years. However, this is very different from what Jelleyman et al. (2019) found, they concluded that children in New Zealand gained independent mobility at the age of 15. These discrepancies highlight the significant cultural and contextual differences in the perception of an appropriate age for children to gain independent mobility.

Household characteristics also play a significant role in shaping CIM. Various factors within the household environment can either facilitate or restrict this mobility. The composition of the household, including the number of children and their ages, impact CIM. Older siblings often pave the way for the younger ones, modeling independent mobility and sometimes supervising their younger siblings. In a household with multiple children the caregiver might allow the children to accompany each other to and from school (Mitra, 2013). Mitra (2013) also suggests a correlation between parental work-travel characteristics and escorted school trips, children and youths are less likely to walk or cycle to school when their parents commute to work in the morning.

The choice of transportation and the amount of CIM is also linked to household attitudes and beliefs in self-efficacy. As Mitra (2013) pointed out, children are more likely to be driven to and from school when caregivers perceive cars as a convenient and socially acceptable mode of transportation. Moreover, the social norms in the neighborhood, like knowing the children in the neighborhood, is positively associated with walking or cycling to school (Nyström et al., 2023).

A household's socioeconomic characteristics can influence school travel outcomes. For instance, access to private automobiles within a household likely facilitates the use of cars for school trips (Mitra, 2013). Ikeda et al. (2020) highlight the issue of inequity, here defined as unfair disparities arising from social, cultural, economic and environmental conditions. They found that children from low-to-mid-decile schools have significantly lower odds of using wheeled or public transport, suggesting that those in higher deprivation communities may lack adequate access to these travel modes (Ikeda et al., 2020). Furthermore, the accessibility and affordability of bikes, scooters, skateboards and public transportation need to be considered if the use of these transport modes is to be increased (Ikeda et al., 2020). Within their research scope in New Zealand school programs are introduced to increase the bike use on the journey to school. Overall, this shows that the choice of transportation mode is dependent on a variety of factors including socio-economic status, availability of resources and the local infrastructure.

The confidence level of a child and the skills they have learned are also pivotal factors that can contribute to or restrict their independent mobility. A child's confidence, often rooted in self-esteem and self-reliance, directly impacts their IM. Children who believe in their abilities are more likely to take the initiative to explore their environment, make decisions and engage in activities independently (Mitra, 2013). Ecological theories of human behavior highlight that a child develops and matures through active interaction with their environment (or their psychological perception of it) (Bandura, 1989; Bronfenbrenner, 1989). In the context of school travel, repeated exposure to the built and social environments helps children develop physical and cognitive skills necessary for navigating their neighborhood and handling potential dangers on urban streets (Mitra 2013). An increase in IM is also

seen when the child's confidence in their neighborhood and knowing their neighbors is higher (Love et al., 2020).

2.1.2.2 Social environment

The conceptualization of the social environment primarily revolves around parental concern regarding their children's safety, particularly concerning the perceived threat posed by strangers and safety of the neighborhood (Wolfe & McDonald, 2016, Marzi & Reimers, 2018, Dodd et al., 2021). Stranger danger is seen as a significant concern among parents. The friendliness of the neighbors, perceived social and traffic safety are also determinants in the social environments (Wolfe & McDonald, 2016). The social environment is further categorized in socio-cultural environment, perceived neighborhood from a parents perspective and perceived neighborhood from the child's perspective (Sallis et al., 2006). The same structure will be used here, however the perceived neighborhood from the child's perspective will be left out as this category will not be used within the scope of this research.

Socio-cultural environment

Within this sub category the parental concerns are also very important. It contains the confidence parents have in their child, the encouragement they give to their child, but also the rules and licenses they set for their child. Lastly, traffic safety is discussed.

As parental concerns are an important factor influencing CIM, the way parents or caretakers purview their children is also very important (Marzi & Reimers, 2018). Love et al. (2020) found that the confidence parents have in allowing their child to travel independently in the local environment reflects confidence in their child's competency. They also found that the parents' perception of their child's abilities is a key element in letting them explore independently and has a greater effect than the confidence levels of the child self (Love et al., 2020). Confidence in this sense includes cognitive skills, self-reliance and social connectedness (Nyström et al., 2023). Mitra (2013) also stated that the probability of walking to school alone increased when there was a higher confidence about the child's capability to be physically active. The confidence parents have in their child is therefore an important factor. Another aspect of confidence is that it works in two ways. It is not only the confidence the parents have in their child, the child is also gaining confidence by doing things by themselves (Nyström et al., 2023).

Parental encouragement is a critical factor in fostering children's independent mobility, significantly impacting their active commuting behavior (Panter et al., 210). When parents actively support and encourage their children to travel independently, Panter et al. (2010) found out that parents of children aged between 9 and 10 have a strong influence on their walking and cycling behavior. Encouragement

can come in various forms, such as granting different mobility licenses (Cordovil et al., 2015), but also showing the children there is a sense of trust Nyström et al., 2023)

The role of parental encouragement is not just about giving permission; it also involves modeling positive behaviors and attitudes towards independent travel (Burghard et al 2016). Parents who regularly engage in active transport and display confidence in their children's abilities tend to reinforce these behaviors. For instance, if parents frequently walk or cycle themselves and show enthusiasm for these activities, children are more likely to adopt similar habits (Burghard et al. 2016).

Parents can grant their children certain licenses in their mobility (Marzi & Reimers, 2018). Mobility licenses are a set of guidelines established by parents that determine the extent to which children are allowed to move around independently in their daily physical environment. These rules may include permissions for activities such as crossing roads or riding a bicycle on their own (Cordovil et al., 2015). In this way parents can restrict their children in their mobility, by for instance only granting them the license to go to the playground on their own. These parental guidelines play a crucial role in shaping the boundaries of children's independent mobility, influencing both their physical freedom and the development of their autonomy (Bhosale et al., 2017).

Adults, particularly parents, often lack awareness of children's capabilities in traffic situations. This uncertainty about what to expect from children fuels their fear of accidents, which in turn leads them to restrict their children's independent mobility (Massoumi et al., 2020). According to Massoumi et al. (2020) parents are the most influenced by concerns about traffic safety, when considering whether and when their children can travel to school independently. Traffic safety is therefore an important barrier to CIM. But how is traffic safety measured? Parents' perception of traffic safety are more influenced by their peers and community members, such as neighbors and other children, than by objective data about accidents in the school area (Massoumi et al., 2020). Massoumi et al. (2020) stated that this perception can create a negative feedback loop: if parents believe the traffic situation is unsafe, they are more likely to drive their children to school, which increases the perception of traffic danger and reduces children's experience in navigating traffic. This lack of experience can eventually lead to more accidents when children begin traveling to school independently (Massoumi et al., 2020). Helbich (2017) found a very different result regarding the influence of traffic safety in transport mode choice to school. Because of the omnipresent sidewalks and bike lanes in the Netherlands, traffic hazards have been minimized, and traffic safety is therefore not always a pressing concern (Helbich, 2017). However, these different results do not mean that traffic safety is irrelevant, but that it is different in a lot of contexts, parental perceptions on the matter are therefore valuable (Helbich,2017).

Perceived neighborhood

Parents can perceive the neighborhood in a very different way than their children. The perception of safety, neighborhood friendliness, crime and traffic are important factors in this category. According to Christian et al. (2015) traffic danger and stranger danger are the two main reasons why parents restrict their children's independent mobility. The fear of crime also belongs under the perceived safety of the neighborhood. Bagheri and Zarghami (2020) found that parents' understanding of crime against girls was higher than boys. This also shows that the different factors also interrelate to each other. Mikkelsen and Christensen (2009), state that the perceived risk from street crime and the increased number of cars in the urban environment are the main reasons why parents withhold their children from independent mobility. Due to this higher perceived risk European and North American children today are older when they are allowed to move outdoors without adult company than earlier generations (Marzi & Reimers, 2018).

Social safety is a significant concern for parents and can also lead them to limit their children's use of active modes of commuting. In South Africa, for instance, Holtmann and Van Vuuren (2007) found that children who commute to school by foot or public transportation are exposed to potential antisocial behavior and criminal activities. Similarly, Kruger and Landman (2007) observed that individuals using public or non-motorized transportation (NMT) were more likely to encounter crime and antisocial conduct compared to those traveling by car. Parents often perceive the potential consequences of kidnapping or assault as far more terrifying than the more common risks associated with traffic accidents (Godfrey et al., 1998). In this context, fears related to crime and child abduction can be significant barriers to active travel for children. Carver et al. (2013) also observed that a low level of social trust was associated with parents bringing their children to school or other activities.

Foster et al. (2014) note that parents of children with some degree of IM were less fearful of strangers compared to parents of children with no IM. Moreover, parents of children who were independently mobile reported higher perceptions of informal social control in their neighborhoods (Foster et al., 2014). These findings suggest that the relationship between social safety concerns and active commuting is a strong determinant for IM.

Social control and the perception of social safety can reduce the negative impacts of fear of crime (Foster et al., 2014). Parents who have larger social networks and are more socially integrated into their local community are more likely to grant their children greater independent mobility (Foster et al., 2014).

Other concerns parents have include risks posed by strangers and exposure to crime, bullying or antisocial behavior (Crawford et al., 2017). According to Crawford et al. (2017), areas with strong social

capital and cohesion significantly enhance children's independent mobility (CIM). Having acquaintances in the local neighborhood who can support children when needed serves as an important reassurance for both parents and children, mitigating their safety concerns. They also found that parents who are unfamiliar with their neighbors, particularly in metropolitan areas, express concerns about their child's safety (Crawford et al., 2017). In contrast to regional towns where everyone knows each other and parents feel safer because you know so many faces (Crawford et al., 2017). Crawford et al., (2017) also found that harm from strangers is a key concern for parents, parents did acknowledge that the risks of assault or abduction by strangers is low, however, any risk at all was often intolerable. Fear of crime has increased considerably in the last few decades (Alparone & Pacilli, 2012). Alparone and Pacilli (2012) suggest that fear of crime decreases significantly when individuals are well-integrated into local social networks and have strong, positive neighborhood relationships. A strong sense of community and neighborhood attachment are associated with lower levels of fear and crime (Alparone & Pacilli, 2012).

2.1.2.3 Physical environment

The urban form can influence the amount of CIM that is possible or allowed. Kyttä (1997) found that children living in rural villages have the greatest freedom to move around on their own. The lowest freedom was found in city environments. However, in more recent studies it was found that urbanized environments, nowadays, afford better possibilities for children's independent mobility (Broberg et al., 2013, Carver et al., 2012, Kyttä et al., 2012). The degree in which the built environment is built in a child-friendly way also influences CIM. Elements such as street connectivity, presence of sidewalks, access to green spaces, and traffic safety influence the extent to which children are able to navigate their neighborhood independently. Environments characterized by pedestrian-friendly infrastructure such as well-connected pathways and low traffic volumes, tend to foster greater levels of independent mobility among children (Villanueva, 2011). On the other side, environments with limited access to safe outdoor spaces or high levels of traffic congestion often restrict children's freedom to explore and engage with their environment without adult supervision.

According to Mitra (2013) there is a negative association between traffic safety and the likelihood of walking or cycling among children. Mitra (2013) also states that street connectivity, intersection density and street width can form a barrier to walking or cycling, as they can contribute to traffic safety concerns. Here traffic safety and the physical environment overlap.

Research by Panter et al. (2010) highlights that both children and parents generally perceive their neighborhoods as safe and conducive to walking and cycling. However, these perceptions tend to vary with the distance required to travel to school. As the distance to school increases, both children and parents report more negative perceptions of social support and route safety. Additionally, children and

parents had more negative perceptions of social support and route perceptions as the distance required to travel to school increased (Panter et al., 2010). The distance to school is therefore also interlinked with the social environment.

2.1.3 CIM for school travel

During the automobile century, school transport shifted from an active to a relatively passive activity, with automotive transport—such as private vehicles, public transport, or school buses—becoming dominant (Marzi, 2022). Parents or caregivers are typically responsible for deciding on the commuting mode for their children, with distance often being a key determinant in whether they opt for active transportation like walking or cycling (McMillan, 2005; Mitra, 2013). However, research by Westman et al. (2017) shows that even when schools are within a walkable distance, parents may still choose to drive their children, indicating that parental perceptions can outweigh the influence of urban form on transportation decisions. Traffic safety is another major concern for parents when deciding how their children will travel to school (Christian et al., 2015). Interestingly, in the Dutch context, bringing children to school by car can actually exacerbate traffic safety issues due to the peak in motorized traffic around schools during drop-off times (Masoumi et al., 2020).

By implementing interventions active school travel can be promoted (Jones et al., 2020). By implementing a 'walking' school bus, the physical activity of the children can increase, this implementation was also seen as being one of the most promising interventions (Jones et al., 2020).

In densely populated countries like the Netherlands, where primary schools and other facilities are often within close proximity, alternative forms of transport such as walking and cycling should be more feasible (Gieling et al., 2019). Most Dutch primary school students live within a convenient walking or biking distance from their schools, with 90 percent living within one kilometer and 97 percent within two kilometers (Crow, 2016). Despite this, approximately 30 percent of children are still chauffeured to school by car (Crow, 2016).

The choice of transport mode in the Netherlands is influenced by various factors, including the availability of bicycles, the work schedules of household members, household size, commuting distances, and whether parents possess driving licenses (Masoumi et al., 2020). While the Netherlands is renowned for its extensive cycling infrastructure and pedestrian-friendly urban planning, which supports independent mobility for children, the number of children being driven to school has increased in recent years (Helbich, 2017). The age at which children begin traveling to school independently

typically starts around 8 years old, with the proportion of children doing so rising significantly with age. By 12 years old, 91 percent of children travel to school on their own (Masoumi et al., 2020).

2.2   Conceptual model

In Figure 3 the conceptual model is illustrated, based on the literature previously introduced. It gives a visualization of how the concepts discussed in this chapter are interlinked and related to each other.

This conceptual model of Children's Independent Mobility to School (CIM to School) provides a comprehensive framework for understanding the various factors that influence whether and how children travel to school on their own. This model identifies three main categories that affect CIM: the social environment, the physical environment, and socio-demographic characteristics. Each of these categories plays a crucial role in shaping a child's ability and opportunity to commute independently.

The social environment is a significant determinant of CIM and is divided into two main subcategories: the socio-cultural environment and the perceived neighborhood. The socio-cultural environment includes factors such as traffic safety, parental confidence in their child's abilities, parental encouragement, and the specific rules or mobility licenses that parents establish for their children.

The perceived neighborhood, another aspect of the social environment, focuses on how parents view their local area. This includes perceptions of neighborhood safety, the friendliness of the community, and concerns about crime or strangers.

The physical environment is another critical component of the model, directly influencing the practicality and attractiveness of independent school commuting. The proximity of the school to the child's home is one of the factors; shorter distances make walking or cycling more feasible. The commuting patterns of parents themselves also play a role; parents who have longer commutes may be less available to accompany their children, potentially encouraging independent travel. The design of the neighborhood, including the availability of sidewalks, crosswalks, and bike lanes, contributes to the safety and ease of independent travel. Additionally, the quality of the journey environment, such as the presence of green spaces or the level of traffic congestion, can either encourage or deter independent mobility.

Socio-demographic characteristics provide the final piece of the model, covering specific attributes of the child, the parents, and the household. Child-specific characteristics, such as age, gender, confidence, and learned skills, all influence the likelihood of independent mobility. Household-specific characteristics, including the number of household members, ownership of bicycles, and possession of

driving licenses, also play a role. Larger households might have different dynamics that affect CIM, while access to bicycles or reliance on cars can either facilitate or reduce independent commuting.

Overall, this conceptual model of CIM to school demonstrates that children's ability to travel to school independently is the result of an interplay between social, physical, and demographic factors.
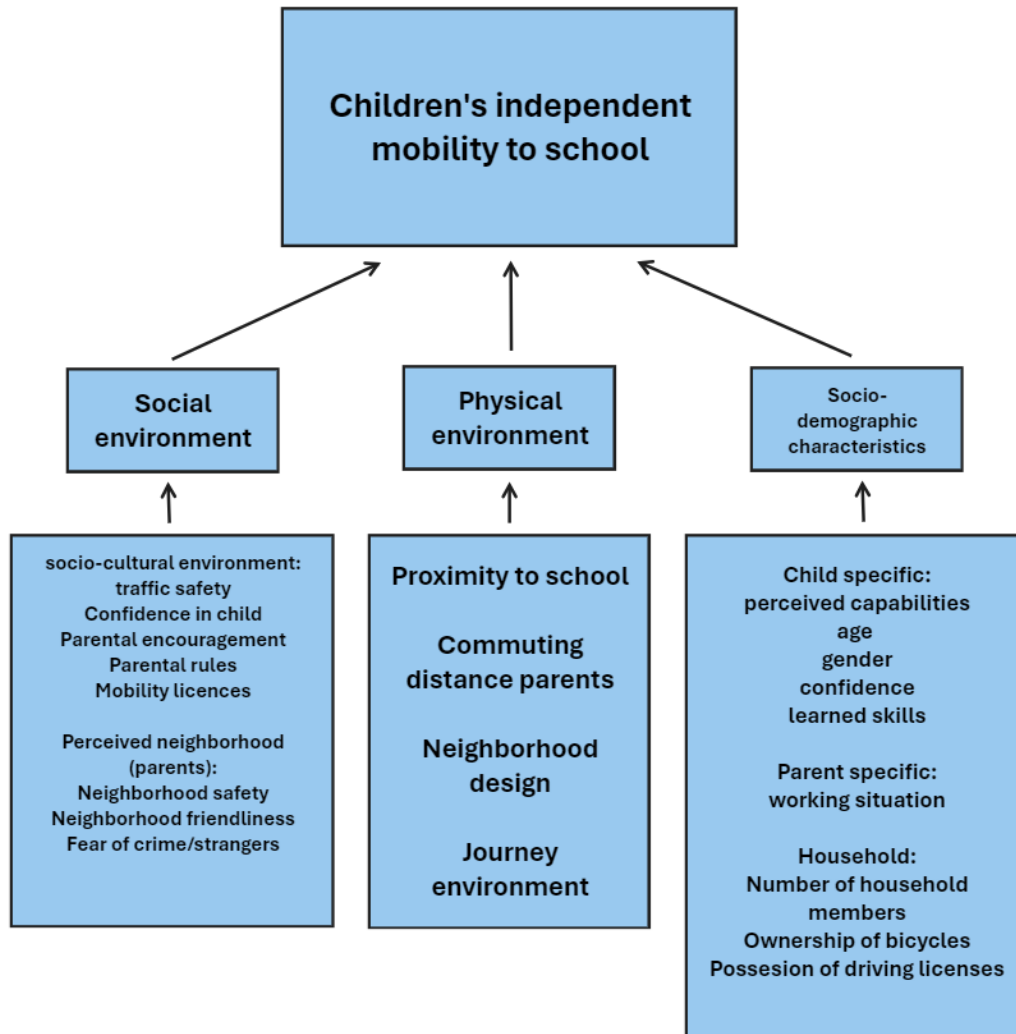
Figure 3. Conceptual Model. Source: Author

Chapter 3. Methodology

This chapter outlines the research design and data collection methods. A qualitative approach was employed, focusing on two (rural) municipalities situated in the Netherlands: Apeldoorn and Voorst. Semi-structured interviews were conducted with 15 parents of children aged between 7 and 12. The process of selecting cases and participants, as well as the strategy for analyzing the qualitative data, will be detailed. Finally, the chapter will address the ethical considerations and their significance in the research.

3.1   Research Design

Clifford et al. (2010) identify two primary methods for data collection in academic research: qualitative and quantitative approaches. Quantitative research is centered on numerical data and statistics, whereas qualitative research delves into understanding values, meanings, emotions, and intentions through methods like in-depth interviews and participant observation. A mixed-methods approach integrates both qualitative and quantitative techniques (Clifford et al., 2010).

These approaches can be utilized in either extensive, which is generally quantitative, or intensive (qualitative) research. Extensive research involves a large number of representative cases to explain causal relationships or processes, while intensive research focuses on a few cases to understand causes and effects in depth (Clifford et al., 2010).

This study uses a qualitative research approach, which is well-suited for capturing the experiences and perspectives of interviewees. The qualitative data gathered will help address the empirical secondary questions and ultimately answer the main research question. The findings will inform recommendations for both practice and future research.

Yin (2003) suggests that a case study approach is particularly effective for exploring 'how' and 'what' questions and for examining contemporary phenomena within real-life contexts. This research employs case studies to gain a comprehensive understanding of the subjects under investigation.

3.2   Case Selection and Description

The unit of analysis, or the case, is defined by setting spatial boundaries, theoretical scope, and a timeframe (Yin, 2003). For this research, the spatial boundary encompasses two rural villages within the national borders of the Netherlands, more specifically the villages are situated within the municipality of Voorst and Apeldoorn. The theoretical scope is established through a review of relevant literature.

Case selection is based on the degree of urbanity as classified by the CBS (Statistics Netherlands). The CBS categorizes areas by the density of addresses into five levels of urbanity: 1) very highly urban, 2) highly urban, 3) moderately urban, 4) little urban, and 5) non-urban.

Moreover, the quality of neighborhood amenities, including parks, playgrounds, and recreational facilities can impact children's willingness to venture outdoors and engage in active play. Within the Dutch context the presence of amenities is monitored in the Leefbaarometer (Leefbaarometer, 2022). This is a Dutch governmental livability index. Within this index five different dimensions are portrayed: physical environment, housing stock, amenities, social cohesion and nuisance and unsafety (Mandemakers et al., 2021). Housing stock is in the current case less important, so this dimension is not discussed further. The amenities dimension relates to the presence of neighborhood facilities. The different dimensions consist of environmental factors. The Amenities dimension consists of:

- Proximity to amenities: education, hospitality industry, culture, retail, and healthcare
- Amenity accessibility
- Amenity density
- Concentration of amenities
- Job accessibility

The physical environment dimension consists of:

- Natural environment
- Environmental quality
- Climate
- Natural resources
- Infrastructure and traffic

The social cohesion dimension consists of:

- Diversity
- Social control
- Density of population
- Population trends

The nuisance and safety dimension consists of:

- Registered crime
- Perceived crime
- Perceived Nuisance

For each municipality in the Netherlands a value of livability is connected based on the different dimensions. Below, table 1 shows the different degrees of urbanity and the differences in liveability indicators between the chosen municipalities. The municipality of Apeldoorn is classified as 'highly urban' and the municipality of Voorst as 'little urban'. As will become clear in the next paragraphs only the small rural villages belonging to each municipality are selected for the case study, these do not fall into the category of being highly urban.

Table 1: Case selection based on degree of urbanity and relevant livability indicators (CBS, 2024 & Leefbarometer, 2022)

Municipality	Degree of Urbanity	Leefbaarometer
Apeldoorn	2	Good
Voorst	4	Very good

Very insufficient
Amply insufficient
Insufficient
Weak
Sufficient
Amply sufficient
Good
Very good
Excellent

Figure 3:   Legend table 1 (Leefbaarometer, 2022)

Figure 4 shows a map with the location of the two municipalities.

Figure 4 : Map with location of the case studies (Leefbaarometer, 2024, adjusted by author)

Case - Municipality of Apeldoorn

The municipality of Apeldoorn is located in the province of Gelderland and had 168 211 inhabitants as of January 1, 2024 (CBS, 2024). Apeldoorn includes several villages with varying degrees of urbanity. For instance, the village of Beekbergen is classified as moderately urban, Hoenderloo is considered little urban, and Klarenbeek also falls into the category of little urban. These rural villages offer various amenities that cater to the needs of their residents. Beekbergen, for example, features local shops, schools, and recreational facilities. Hoenderloo is known for its proximity to nature reserves, making it a hub for outdoor activities and tourism. Klarenbeek provides essential services such as a primary school, small shops, and community centers, ensuring a close-knit community atmosphere. These amenities contribute to the overall liveability and appeal of the rural areas within the municipality of Apeldoorn. Figure 5 shows Klarenbeek (municipality of Apeldoorn) and its values for amenities, physical environment, social cohesion and nuisance and safety.

The map for amenities shows a dark pink color, indicating a very large negative contribution. This suggests that Klarenbeek may lack sufficient amenities such as shops, healthcare facilities, educational institutions, and recreational spaces.

The physical environment map displays a light green color, suggesting there is no deviation. This means the physical environment has not improved or declined relative to previous years.

For social cohesion, the map shows a green shade, which represents a positive contribution. This implies that Klarenbeek likely has strong community bonds and social networks, where residents actively participate in community activities and support each other.

The nuisance and safety map also features a green color, pointing to a positive contribution. This suggests that Klarenbeek experiences low levels of crime and disturbances, making it a safe place to live.

Klarenbeek (municipality of Apeldoorn)

| Amenities | Physical environment | Social cohesion | Nuisance and safety |

Very large negative contribution
Large negative contribution
Negative contribution
Small negative contribution
No deviation
Small positive contribution
Positive contribution
Large positive contribution
Very large positive contribution
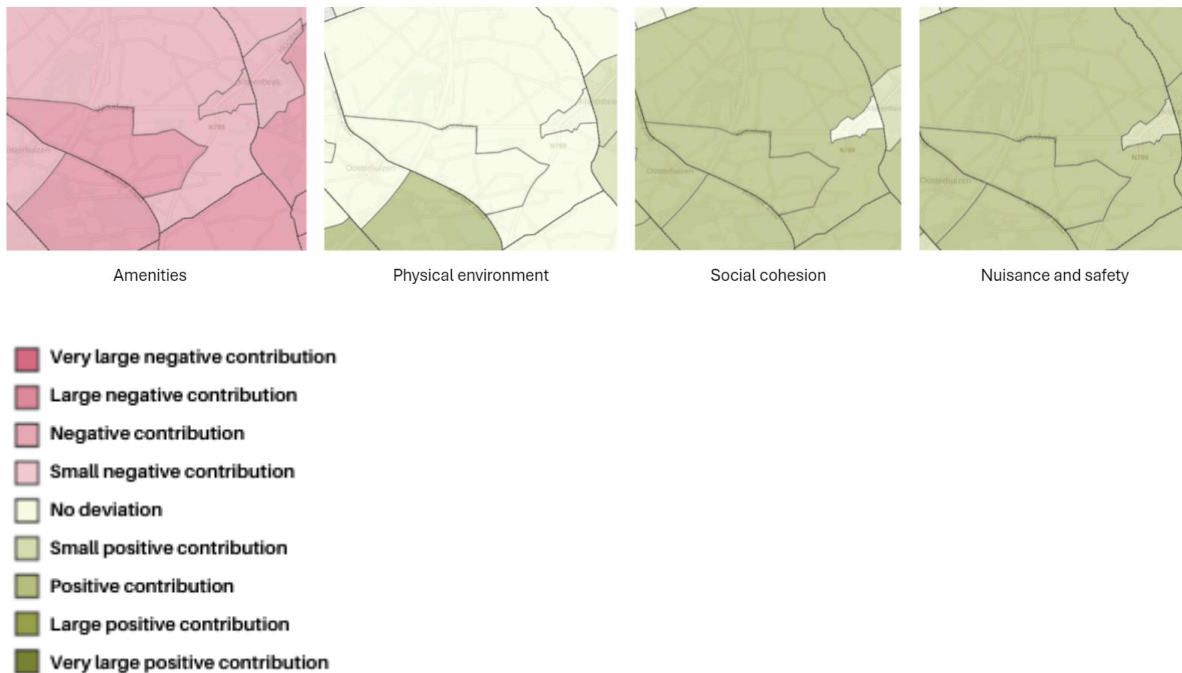
Figure 5: Map of Klarenbeek (municipality of Apeldoorn) and the different dimension of the Leefbaarometer (2022)

Case - Municipality of Voorst

The municipality of Voorst is located in the province of Gelderland and had 25 377 inhabitants as of January 1, 2024 (CBS, 2024). Voorst also includes several villages with varying degrees of urbanity. For instance, the village of Twello is classified as moderately urban, Terwolde is considered little urban, and Wilp-Achterhoek also falls into the category of little urban.

The municipality of Voorst also addresses liveability indicators such as nuisance and unsafety, aiming to maintain a peaceful and secure living environment for its residents. Within the municipality there is also a strong emphasis on education, with several primary schools distributed across its villages to cater to the educational needs of young residents. In Twello, there are multiple primary schools providing a variety of educational options for families. Terwolde also hosts a primary school that serves the local community, ensuring that children have access to quality education close to home. Wilp-Achterhoek features a primary school that forms a central part of the village, contributing to the community atmosphere within the village. Klarenbeek, although shared with the neighboring municipality of Apeldoorn, also has a primary school that serves its residents, further enhancing educational accessibility.

These schools are well-integrated into their communities, often working closely with local organizations and parents to support the holistic development of children. The presence of these educational institutions not only ensures easy access to education for all children in Voorst but also strengthens community bonds by serving as hubs for local activities and events.

These amenities, along with the beautiful physical surroundings and attention to liveability indicators, contribute to the rural areas' appeal within the municipality of Voorst. Figure 6 shows the different values of the livability dimensions for Klarenbeek (municipality of Voorst), Wilp Achterhoek and the Posterenk.

In Klarenbeek, amenities are marked by a dark pink color on the map, indicating a very large negative contribution. This suggests that there is a significant lack of essential services such as shops, and healthcare facilities. Despite the deficiency in amenities, Klarenbeek scores better on other aspects. The map for the physical environment shows a light green color, reflecting a small positive contribution. This suggests that the area has some favorable environmental aspects, such as green spaces and pleasant landscapes, which slightly enhance its livability. Additionally, social cohesion in Klarenbeek is depicted with a green shade, indicating a positive contribution. This means that there are strong community ties and active social networks. The aspect of nuisance and safety is also rated positively, with a green color on the map, suggesting that Klarenbeek experiences low levels of crime and disturbances.

Wilp Achterhoek and Posterenk share similar characteristics to Klarenbeek, particularly in the dimension of amenities. Here too, the map shows a dark pink color, indicating a very large negative contribution, highlighting a significant deficit in essential services and facilities. Similar to Klarenbeek within the municipality of Apeldoorn, Wilp Achterhoek and Posterenk show no deviation in their physical environment, shown as a light green shade on the map. Furthermore, the map indicates a positive contribution for social cohesion, shown by the green color, signifying that there are robust social networks and community engagement activities that foster a sense of belonging and communal spirit. Similar to Klarenbeek, the nuisance and safety aspect in Wilp Achterhoek and Posterenk is positively rated, with a green color suggesting that the area experiences low crime rates and minimal disturbances, contributing to a secure and safe living environment.

Klarenbeek (municipality of Voorst)

| Amenities | Physical environment | Social cohesion | Nuisance and safety |

Very large negative contribution
Large negative contribution
Negative contribution
Small negative contribution
No deviation
Small positive contribution
Positive contribution
Large positive contribution
Very large positive contribution
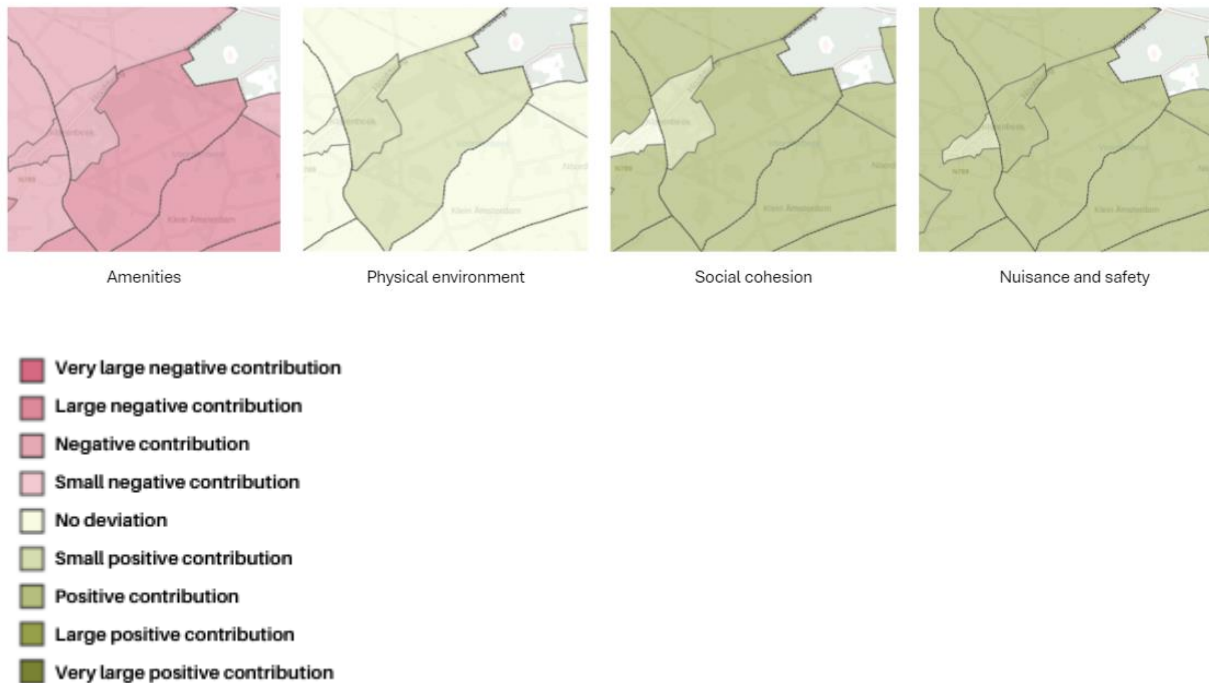
Figure 6: Map of Klarenbeek (municipality of Voorst) and the different dimension of the Leefbaarometer (2022)

Wilp Achterhoek and Posterenk (municipality of Voorst)

| Amenities | Physical environment | Social cohesion | Nuisance and safety |

Very large negative contribution
Large negative contribution
Negative contribution
Small negative contribution
No deviation
Small positive contribution
Positive contribution
Large positive contribution
Very large positive contribution

Figure 7: Map of Wilp Achterhoek and Posterenk (municipality of Voorst) and the different dimensions of the Leefbaarometer (2022)

As visible in the maps the chosen case study areas lack essential amenities. However, the social cohesion and the nuisance and safety dimension score very well according to the Leefbaarometer (2022). These livability factors play a role in whether or not children are allowed to venture on their own. The low

amount of amenities suggest that it is not attracting for children to go out independently. On the other side, the low perception of nuisance, high perception of safety and the social cohesion within these villages provide opportunities to more independent mobility.

3.3 Data Collection

3.3.1 Semi-structured Interviews

Three main types of interviews are structured, unstructured, and semi-structured. Semi-structured interviews are particularly popular in qualitative research (Clifford et al., 2010). This study utilized a qualitative approach with semi-structured, in-depth expert interviews. According to Clifford et al. (2010), in-depth interviews involve a verbal exchange where an interviewer seeks information by posing questions to the interviewee.

Semi-structured interviews, as described by Clifford et al. (2010), allow participants to respond openly using their own words, enabling them to elaborate on topics they find significant. This flexibility often leads to richer, more detailed information compared to structured interviews or questionnaires. Semi-structured interviews are characterized as informal and conversational, providing a conducive environment for participants to express their perspectives.

In preparation for semi-structured interviews, researchers typically create an interview guide containing a set of predetermined questions. The interview guide used in this study can be found in Appendix 1 and is based on the different sets of factors identified in the literature review and highlighted in the conceptual model.

3.3.2 Participant Selection

Participants in this research were selected using purposive sampling, a method where individuals are chosen based on their relevance and expertise related to the research topic (Clifford et al., 2010). Various methods were employed to recruit participants for semi-structured interviews, including phone calls, primary school contacts and personal networks. Additionally, snowball sampling was utilized, where participants referred others who might contribute valuable insights (Clifford et al., 2010).

Participant selection focused on parents residing within the municipalities of Voorst and Apeldoorn, specifically targeting those with children in two distinct age groups: 7-9 years old and 10-12 years old. To ensure a specific focus, only parents living in villages categorized as little urban within these municipalities were included.

Interested parents were contacted via email and phone calls to explain the research's purpose and invite their participation in semi-structured interviews.

The selection criteria emphasized diversity within the parent group, encompassing varying sociodemographic backgrounds, residential locations within little urban villages. This approach aimed to gather comprehensive insights into factors influencing children's independent mobility across different little urban village contexts within the municipalities. To sum up the requirements for the recruitment of parents to participate in a semi-structured interview:

1. The participant has children between the age of 7 and 12.
2. The participant is living within a village categorized as little urban within the municipality of Voorst or Apeldoorn.
3. The child(ren) are/is attending primary/secondary school.

Table 2 shows an overview of the fifteen participants that were interviewed.

Table 2: Overview of participants

Referred to as:	Parent/guardian	Number of children	Place of residence	Interview Date
P1	Mother	3 children	Wilp	30-04-24, offline
P2	Mother	2 children	Klarenbeek	01-05-24, offline
P3	Mother	2 children	Klarenbeek	02-05-24, offline
P4	Mother	3 children	Klarenbeek	03-05-24, offline
P5	Mother	2 children	Klarenbeek	04-05-24, offline
P6	Mother	2 children	Wilp-Achterhoek	06-05-24, offline
P7	Mother	3 children	Wilp-Achterhoek	07-05-24
P8	Mother	3 children	Klarenbeek	14-05-24, offline
P9	Mother	3 children	Wilp-Achterhoek	29-05-24, online
P10	Mother	2 children	Klarenbeek	14-05-24, offline
P11	Mother and Father	3 children	Klarenbeek	16-05-24, offline
P12	Mother	3 children	Klarenbeek	21-05-24, offline
P13	Mother	1 child	Klarenbeek	29-05-24, offline
P14	Mother	2 children	Klarenbeek	07-06-24, offline
P15	Mother	2 children	Klarenbeek	15-05-2025, offline

3.4   Data Analysis

Data analysis is a critical phase in research, involving the examination, summarization, and interpretation of the collected data. All participants who consented to audio recording were recorded using Apple Inc's Dictaphone application. Subsequently, the Dutch transcripts were generated using Good Tape (Denmark). These transcripts were then analyzed using the ATLAS.ti software. However, one participant could not meet in person and declined audio recording; instead, detailed handwritten notes were taken during this online session, which were later utilized in the analysis.

ATLAS.ti serves as a valuable tool for analyzing qualitative research data, particularly interview transcripts. This software facilitates coding, a process of categorizing text based on relevant topics and themes identified in the research. Through coding, the data analysis process is structured, allowing for the identification of patterns, differences, and similarities among codes (Clifford et al., 2010). This approach helps to uncover underlying categories and develop meaningful themes from the theoretical concepts explored in the research. ATLAS.ti (2024) enhances the depth of analysis and interpretation by helping researchers explore the complex phenomena within their data.

Deductive codes were used to label the data elements in this study. Deductive codes are created based on predefined concepts before the interviews begin. These concepts are derived from the theoretical framework and are organized into a deductive code tree, detailed in appendix 2.

3.5   Ethical Considerations

Research ethics are important for ensuring the integrity and protection of participants involved in qualitative research. According to Clifford et al. (2010), ethical behavior is essential for three main reasons: safeguarding the rights of individuals, communities, and environments affected by the research, maintaining public confidence, and meeting the growing demand for accountability.

In this study, ethical standards were upheld through rigorous adherence to informed consent procedures. Prior to each interview, participants were fully informed about the research content and had the autonomy to either accept or decline the participation. Additionally, they were given the right to stop the interview at any point. Furthermore, participants were assured confidentiality and data security throughout the research process. Audio recordings were used solely for transcription purposes and deleted after data analysis completion. Transcripts were shared with participants for review and approval, allowing them to provide feedback or make adjustments as necessary. Upon thesis completion, each participant will receive a copy of the final document.

Access to the raw data from recordings and transcriptions was restricted to the researcher and supervisor. All interview recordings and transcriptions were securely stored on a password-protected computer. The transcripts of the interviews were also anonymised and full transcriptions were not published online.

To make sure that the participants were fully aware of the ethical aspects of the interview, a letter of consent was signed by each participant, the form is attached as appendix 3. 14 out of the 15 interviews were held face-to-face, just one was done via a phone call.

Chapter 5 Results and Discussion

This section presents the findings of the research on CIM to school within two municipalities in the Netherlands. The results are organized into four main categories: descriptive results, physical environment, sociodemographic characteristics, and the social environment. These categories provide a comprehensive understanding of the factors influencing children's ability to travel independently to school in rural areas.

5.1   Descriptive results

5.1.1 General

The initial part of this section offers a general overview of the data collected from the interviews. This includes a summary of participant demographics, such as the number of children involved, their ages, and their school locations. Additionally, it covers basic patterns of school travel, including common modes of transport and average travel times. These descriptive results lay the groundwork for a more detailed examination of the factors affecting independent mobility.

Table 3 shows an overview of the children of the fifteen participants that were interviewed. The gender, age and the proximity to school are also displayed. The table shows that most children live very near a primary school. The few cases where the proximity to school is more than 5 kilometers are from children attending high school. As mentioned in the methodology two age groups are reviewed within this research, specifically the age group between the ages of 7 and 9 and the age group between 10 and 12. In table 3 all children of the participants, also the ones not included in the age groups, are included to see the overall household structure. Out of the 15 participants that were interviewed, nine participants reported having children between the ages of 7 and 9. For the other age group, 10 participants stated to have children between the ages of 10 and 12. In the next paragraphs the participants are mentioned by number, their children will be mentioned by age and gender, sometimes their age is mentioned between parentheses.

Table 3: Overview of children and their proximity to school

Participants	Gender of children (M/F)	Age of children	Proximity to school
1	M/F/F	11/8/6	3 km
2	F/M	17/9	6 km / < 1 km
3	F/M	12/10	<1 km / 10 km
4	M/F/F	13/10/8	2 km
5	F/F	8/5	<1 km
6	M/M	13/11	<1 km
7	F(✞)/F/F	N/A/ 12/5	<1 km
8	M/M/M	13/10/8	1 km
9	F/M/M	12/10/7	8 km / 2 km
10	F/M	14/11	10 km / <1 km
11	F/M/F	7/4/3	1 km
12	M/M/F	14/13/11	12 km / 2 km
13	M	10	1 km
14	F/F	7/4	<1 km
15	M/F	8/5	<1 km

5.1.2 Transport mode

The interviews revealed a clear preference for cycling as the primary mode of transport for children commuting to school. Several families, such as Participants 1, 2, 3, 4, 8, 9, 10, and 12, predominantly rely on cycling for the school commute. They emphasize the importance of teaching cycling skills from an early age and choosing safer, less trafficked routes to ensure the children's safety. In some cases, parents accompany younger children or establish systems where children cycle with friends to add an extra layer of security. Some participants also indicate that letting their children go independently makes their daily routine easier. As stated by participant 13: *"Well, in principle, he almost always goes by bike. Yeah, so I actually don't go to school anymore either. I quite like that." [P13].* She likes the freedom it gives her that there is no need to accompany her son (10) anymore.

Participants like 4, 5 and 11 mentioned a mix of cycling and driving, often dictated by weather conditions or parental work schedules. Driving is typically reserved for rainy days or when parents' work schedules demand it, ensuring flexibility and practicality. As illustrated by the following quotes: *"Cycling is always the first choice unless the weather really doesn't allow it. Only then will we take the car." [P4].* And: *"Varies, but my motto is always to use the bike. And that really is the goal. Unless it's pouring down heavily. But if it's just drizzling, they have to go by bike as far as I'm concerned." [P5].* Participant 13 also uses a mix of cycling and occasional car rides, especially after a week of consistent cycling her son sometimes asks to be brought to school by car (P13). Participant 7 highlights a combination of cycling and walking, with an emphasis on safety precautions like biking on sidewalks when necessary.

The choice of transport is influenced by various factors such as weather conditions and parental availability. Families prioritize cycling when feasible.

5.1.3 Children's Independent Mobility to School

The interviews reveal varying degrees of independent mobility among children commuting to school, categorized into three groups: unsupervised, accompanied by friends or siblings, and under parental supervision.

5.1.3.1 Unsupervised travel to school

Several participants report that their children travel to school independently. For instance, Participant 1's oldest child, male, aged 11, cycles alone, having transitioned to this independence around age 9 or 10, aided by the presence of older peers and a cousin in the beginning. Similarly, Participant 3's son, aged 10, and Participant 9's 12-year-old daughter navigate their routes solo, showing confidence and road awareness. Participants 6 and 7 also highlight their children's ability to cycle independently from the age of 8, managing their routes with minimal concern from parents.

5.1.3.2 Accompaniment by friends or siblings

For some families, independent mobility is supported by peer or sibling accompaniment. Participant 5's eight-year-old daughter, initially more cautious, now cycles independently with her younger sister, aged 5, who is still learning to navigate traffic safely. This relates to the different stages of independence described by Marzi and Reimers (2018), where children gain a bit more independence by age. One of the stages is traveling with a peer or sibling. In this case the oldest daughter (8), rides with her younger sister (5). Participant 5 also mentioned that for her, it is different with the second child, she states:

"Yes, [the oldest daughter] really does feel responsible for that [taking care of her sister on the journey to school]. Yes. She really does. But that is also funny, because as I said, with the second one, it happens

more quickly. When [oldest daughter] was in second grade, I definitely wouldn't have let her go to school alone" [P5]

This quote also shows whether or not children go to school independently is very context specific, and in this case is also influenced by the perceived capabilities of the oldest daughter. Participant 5 trusts her eldest to take care of her youngest. Participant 8 describes a similar scenario where her boys aged 8, 10, and 13 cycle together, demonstrating mutual support and enhanced safety. Participant 1 also notes that their middle child, female, aged 8, is on the verge of independence, often cycling with an older sibling or peer for added security.

5.1.3.3 Parental supervision

Despite a strong emphasis on fostering independence, many families continue to provide parental supervision when necessary, particularly for younger or less experienced children. Participant 1's youngest child, female, aged 6, requires close supervision due to impulsivity and a lower ability to assess danger accurately. This cautious approach ensures her safety while she learns essential road skills. Similarly, Participant 4's youngest child, female, aged 8, relies on parental guidance, especially on more challenging sections of the route, reflecting her developing cycling skills. During darker winter months, parents like those of Participant 2's nine-year-old son and Participant 3's, twelve-year-old daughter, who commute through rural areas, take extra precautions. For instance, Participant 2's son, although cautious and capable of assessing dangers, is supervised by his mother during the darker winter months, ensuring his safety on forest paths. Similarly, Participant 3's daughter uses a location-tracking app for added security during her longer commute. In the academic literature used to create the theoretical framework, the use of modern technology in supporting CIM was not deeply integrated. By using these GPS tracking apps, parents might let their children go out at a younger age, because they feel like they still have a bit of control over where their child is. Participant 15's daughters aged 8 and 5, are always accompanied by their parents. Their mother accompanies them three days a week, with parental working schedules determining whether they bike or are driven to school.

5.1.4 Children's Independent Mobility in General

In examining the independent mobility of children from various families in a rural Dutch setting, it becomes evident that their freedom to explore their surroundings varies significantly. The interviews illustrate a diverse spectrum characterized by varying levels of freedom and parental supervision. In paragraph 5.1.3 the CIM to school was examined. Here the CIM in general is discussed, the results complement the results in 5.1.3. At the lower end of the spectrum, younger children such as Participant 1's daughter, aged 6, Participant 15's, daughter, aged 5, and Participant 11's son, aged 4 are closely

supervised during their mobility activities. P1's daughter recently achieved a milestone by being allowed to visit the local playground independently, albeit under vigilant parental oversight. P15's daughter and P11's son being even younger, are escorted by their mother when they ride their bikes in the neighborhood.

Moving towards moderate independence, children like Participant 1's daughter, aged 8 and Participant 5's daughter, aged 8 demonstrate increasing autonomy while still benefiting from occasional parental guidance. P1's daughter (8) explores the village area on her bike, participating in neighborhood activities like hide-and-seek, without adult supervision. Similarly, participant 15's son, aged 8 is allowed to go to the playground on his own and can also explore the neighborhood, as long as he does not cross the main town road. Despite this burgeoning independence, parental supervision remains integral, especially in navigating potentially risky intersections or roads.

Towards the higher end of the independence spectrum, older children like Participant 1's son, aged 11 and Participant 4's son, aged 13 showcase mature levels of autonomy and responsibility in their daily travels. P1's son undertakes a diverse range of journeys, including cycling to school and other destinations such as the local football field or shops in the neighboring town Twello. His parents, recognizing his competence and maturity, have gradually expanded his boundaries, allowing him to navigate rural roads and intersections with confidence, this gradual expansion of his mobility licenses align with the different stages towards full independent mobility described by Marzi and Reimers (2018). Similarly, P4's son, confidently commutes to school, friends and other locations. Across these different stages of independence, parental roles transition from vigilant supervision to nurturing gradual autonomy.

5.2 Physical Environment

The previous sections discussed the levels of independence and most used transport modes amongst the participants. The next sections cover which factors influence the CIM within the current case study.

Here the physical environment and its impact on children's independent school travel is discussed. This includes an analysis of infrastructure such as sidewalks, bike lanes, and road safety measures. The geographical characteristics of the rural areas studied are also considered, including the distance between homes and schools and the presence of natural barriers.

5.2.1 Commuting distance parents

In exploring the commuting distances of parents to their workplaces, several key insights emerged from the interviews. For instance, families like the one from participant 1 exemplify the necessity of multiple

cars due to divergent work schedules. Here, the father's early mornings start in his own business and this contrasts with the mother's part-time work and freelance writing, which requires flexibility in transportation to manage their work.

In rural settings, such as those described by Participants 2, 3, 8, and 12, parents may commute short distances to nearby towns or face longer journeys to distant villages or cities, impacting their daily logistics and transportation choices. The following quotes showcase the differences in commuting time between the participants:

"My partner has his own business and works as a gardener. I work in the office for my partner and then two days at a care farm. [...] I'm quite often at home, but there are two days that I'm away. [...] I spend five minutes commuting" [P8].

"My husband really has a long way to go; he has to go all the way to [work location], which is about an hour and fifteen minutes without traffic. And for me, depending on which location I need to be at, I usually work in [work location], which is about 25 minutes, and if it's busier, about half an hour by car. Sometimes I go to [work location], and that's about three-quarters of an hour or so" [P7].

The proximity or distance to work influences how efficiently parents can manage their time between work and family responsibilities. Families like those represented by participants 9 and 13 benefit from living close to their workplaces, minimizing commute times to just a few minutes. Participants 10 and 14 illustrate how predictable work schedules and local employment can simplify daily routines, providing stability in transportation needs. In contrast, families where parents have irregular work hours or travel extensively, as depicted by Participants 5, 6, and 7, face challenges in managing unpredictable commuting patterns and the need for flexible transportation options. Participant 7 states: *"[Husband] leaves at a quarter to seven in the morning and comes home around seven o'clock in the evening, sometimes earlier. Occasionally, he works from home. I leave at a quarter past eight and usually make sure that the children are at school. Occasionally that is not possible and I have to leave earlier, but they manage on their own. In such cases, our eldest daughter (12) ensures that the youngest (5) gets to school"* [P7].

Here the influence of parental commuting to work on independent mobility described by Mitra (2013) is visible. The parents had the choice between bringing their children to school by car or trusting their eldest to bring their youngest to school. They chose the latter option. Participant 7 stated that this was possible because of the responsible behavior of their eldest and the low traffic journey to their school. Moreover, Participant 15 highlights how differences in parental commuting distances influence decisions regarding school transportation. Depending on who has a shorter or longer commute on any

given day, children may either bike or be driven to school (P15). This reflects how parental work locations and schedules directly impact the practical aspects of the transportation mode to school.

5.2.2 Neighborhood design

The design of a neighborhood significantly impacts the daily lives and safety of its residents, particularly for families with children. Based on the interviews, the participants reside in a range of neighborhood environments from rural to residential areas, each with distinct characteristics and challenges.

Families residing in rural areas, such as those described by Participants 1, 3, 6, 10 and 11, experience spacious surroundings with lower building density. These neighborhoods offer ample outdoor space and greenery, providing a tranquil environment. However, they also face challenges such as poor lighting, unpaved paths and muddy forest paths in winter. Participant 15 states: *"We choose the forest path because it's the safest way, as there are no cars there. "But when it rains a lot, the path becomes very muddy and difficult to pass through. Then we have to take the main road, which isn't as safe due to the traffic" [P15].*

In contrast, some families live in residential neighborhoods characterized by a mix of housing types and local businesses. Participants 4, 8, and 12 highlight that these areas can experience increased traffic due to nearby companies or busy roads. This necessitates a higher level of safety awareness for children, who must navigate the traffic, including trucks and delivery vehicles, when walking in the neighborhood or cycling to school. The participants highlighted the need to teach the children to stop and look before crossing certain points.

Several families, like those of Participants 2, 5, 7, 13, and 14, live in neighborhoods designed with safety in mind. These areas typically feature low traffic flow, speed bumps, and traffic calming measures. The neighborhoods are described as child-friendly, with ample opportunities for outdoor activities and social interactions. They often include amenities such as playgrounds and multifunctional centers (MFCs) that host various sports and community activities, providing central hubs for local social life. Despite these safety measures, occasional speeding and traffic from delivery trucks remain concerns.

Some families, such as Participant 15, live in a neighborhood with detached houses along roads used as shortcuts by cars. These roads are often poorly lit and frequented by agricultural vehicles and rallies, further reducing safety. Nonetheless, these families generally feel safe due to strong community ties and good relationships with their neighbors.

The analysis of neighborhood design reveals that the neighborhood itself does not play a significant role in children's independent mobility (CIM). However, the findings highlight that parents place a strong

emphasis on traffic concerns, impacting the degree of independence they allow their children. Participants frequently mention the need to teach children traffic safety, such as stopping and looking before crossing streets. The theoretical framework underscores the importance of the built environment in influencing CIM, noting that environments with pedestrian-friendly infrastructure encourage greater levels of independent mobility (Villanueva, 2011). This aligns with findings in residential areas where safety features enhance CIM by providing safer routes for children. Masoumi et al. (2020) also stress the importance of traffic safety as a barrier to CIM, corroborating the results that parents prioritize traffic concerns over neighborhood design when considering their children's independence.

5.2.3 Journey environment

Navigating the journey to school poses varying challenges and considerations for families, as learned from the interviews. Across these experiences, common themes emerged regarding traffic safety, route choices, and environmental conditions impacting the commute.

5.2.3.1 Traffic safety

Traffic safety is a dominant concern for parents as their children commute to school. Across various interviews, parents consistently highlight the importance of choosing the safest possible routes. Many families, like those of Participants 1, 3, 9 and 15, must navigate routes that include both dedicated bike paths and sections where children share the road with motor vehicles. While these paths are often scenic and quiet, they also require heightened vigilance due to potential interactions with agricultural machinery and occasional traffic congestion. Participant 10's family, for instance, has to contend with the busy Kopermolenweg, where speeding vehicles and sharp bends pose significant safety risks. Similarly, Participant 12's children must cross busy roads such as the Woudweg, necessitating careful navigation at tricky intersections.

Additionally, Participant 11 notes that the school area is often crowded with cars, particularly with many grandparents doing drop-offs and pick-ups. *"Well, I am surprised by how many cars are at the school. I am also always surprised by how many grandparents are there" [P11].* The crowdedness of the school area during peak hours is noted by many participants. Participant 2 also notes: "I notice that when you go there by car, people drive really fast. I feel a bit unsafe when I'm at the school because there are still parents that do not prioritize the children on a bike. And then they drive right in between the children, you know, they push their cars through" (P2). This aligns with the statement Masoumi et al. (2020) made that safety issues arise around schools due to the peak in motorized traffic around schools.

However, most parents consider the journey to school typically safe. It is noted, that participants say this after choosing the safest possible route for their children. However, the safest route often includes one dangerous crossing. Most participants mention crossing the main village road is one of their major concerns (P2, P4, P5, P8, P11, P12, P13, P14 and P15). Some also address that by making a safe crosswalk would make the route to school a lot more safe.

5.2.3.2 Route Choices

Route choices are a critical aspect of the school commute, balancing safety, convenience, and environmental conditions. Families like those of Participants 1, 3, and 9 manage a mix of quiet landways and designated cycle paths, covering distances that can range from a few minutes to approximately 30 minutes by bike. These routes often pass through rural lanes and residential areas, offering a balance between safety and efficiency. However, the presence of agricultural machinery and occasional traffic congestion along these routes necessitates careful planning and awareness.

Participant 4 chooses a route for the whole family through residential areas and a forest to avoid high-speed traffic areas. She always accompanies her youngest daughter (8), but the middle daughter (10), who sometimes cycles with friends, is also supposed to use the route chosen by her mother. This choice prioritizes safety, ensuring a calmer and more secure environment for the children. Similarly, Participants 8 and 13 navigate routes that require crossing major roads, which are considered dangerous, especially during busy mornings. These families choose paths that circumvent busier intersections, opting for quieter, less trafficked paths through woods and residential neighborhoods.

Participant 14's family adapts their route based on weather conditions, choosing more paved paths during adverse weather to avoid hazards like loose gravel and slippery conditions in the forest. This flexibility in route choice reflects a broader trend among families to prioritize the safest and most manageable paths for their children's commute.

Broberg et al. (2013), Carver et al. (2012) and Kyttä et al. (2012) stated that urbanized environments afford a lot of possibilities for CIM. The findings in the current study show that in rural areas these possibilities also exist. With the possibility to choose different routes participants ensure the safety of their children and with more forested areas to cycle through, trafficked areas can be avoided. This also offers a lot of possibilities for CIM.

5.2.3.3 Environmental conditions

Environmental conditions also impact the school journey, influencing route safety and the overall commuting experience. Participants 5, 14, and 15 encounter challenges such as gravel patches and

overgrown forest paths on the way to school, which can become particularly hazardous during rainy weather. These conditions necessitate adjustments to the route to ensure a safer commute. For instance, participant 14's family opts for more paved paths during adverse weather, while participant 15 highlights concerns about poorly lit routes and the difficulty of navigating certain paths in bad weather.

Overall, while the majority of journeys described are managed safely, ongoing challenges persist, including traffic congestion, adverse weather conditions, and the need for enhanced infrastructure such as dedicated bike lanes. These insights highlight the diverse approaches families adopt to prioritize the safety and efficiency of their children's daily commutes to school, reflecting the critical role of parental guidance in shaping these experiences.

The results reveal a significant divergence from the theoretical framework regarding the impact of weather conditions on transport mode choice to school. While the theoretical framework largely focuses on factors such as parental influence, safety, and social environment as primary determinants of transport choices, the influence of weather conditions is not mentioned in literature. The findings indicate that adverse weather conditions are a major factor in deciding whether children cycle or are driven to school, this is also articulated in the quotes from participant 4 and 5 in paragraph 5.2.1. And parents also have to be flexible in their route choice during adverse weather conditions. Moreover, many parents reported that they prefer driving their children during rainy or particularly cold days, despite generally encouraging cycling due to its health benefits and the autonomy it grant's children. This suggests that while theoretical models prioritize social and environmental factors, practical considerations such as weather significantly influence parental decisions and children's mobility.

5.3 Sociodemographic characteristics

In the third category, the sociodemographic characteristics of the families involved in the study are examined. This includes factors such as family structure and parental occupation. It is investigated how these characteristics correlate with children's independence in traveling to school, considering aspects like household characteristics, availability of resources, and the influence of their learned skills and confidence on mobility choices.

5.3.1 Household

Owning bikes and driving licenses are critical for children's independent mobility. All participants' children own bikes and can ride them. Additionally, all parents possess driving licenses and cars, which provide alternatives and safety nets, especially in adverse weather or during emergencies. Masoumi et al. (2020) stated that the possession of bicycles and driving licenses are critical components influencing

CIM. Within this case study, the ownership of these two components was not questioned, each participant noted that as soon as the children learn how to cycle, they will do this on almost a daily basis.

Moreover, older siblings play a pivotal role in enhancing the mobility of younger ones. Families often leverage this dynamic by allowing younger siblings to accompany older ones, thus fostering a learning environment where they gradually gain confidence and skills. In Participant 5's family, the oldest daughter (8) plays a crucial role in helping the younger sister navigate independently. The mother explained, *"The oldest daughter often takes the lead when they cycle together, showing the way and ensuring the younger one learns road safety by example" [P5].* This aligns with Mitra (2013) who states that older siblings often pave the way for the younger ones and supervise them. However, not all parents think the same about this. For example Participant 11 said this about giving their oldest the responsibility over another child: *"And I can't give a seven-year-old the responsibility for another child. Maybe it also has to do with my own situation, because I am, of course, the oldest in a family of four children. And I did not always find that enjoyable. That I always had to take care of others. Always having that responsibility" [P11].* This shows that whether or not parents let their youngest accompany their oldest is very specific per person and also influenced by their own upbringing.

5.3.2 Child's specific characteristics

Children's perceived capabilities and learned skills can influence their level of independent mobility. For instance, Participant 1's eldest child, male, aged 11, cycles independently due to his confidence and independence, which were fostered by traveling with older peers and relatives initially. Conversely, the youngest girl, aged 6, requires supervision due to impulsiveness and limited danger assessment skills. Similarly, Participant 6's youngest son, aged 11, demonstrates high confidence and proficiency in cycling, enabling independent commuting.

Confidence plays an important role in children's mobility. Participant 7's daughter began cycling to school independently at age 8 in part due to her high confidence, the other part being that the residential area was deemed safe by her mother. The level of confidence often varied and it could not be related to gender. For example, Participant 2's son, aged 9, is cautious but capable of biking independently. These results relate to the statement of Mitra (2013), noting that children with higher self-esteem and self-reliance are more likely to engage in independent mobility. Whereas Participant 8's middle child, also a boy, but aged 10, is less confident compared to his siblings. He does commute to school without adult supervision. His mother, however, wants him to cycle with his little brother. This suggests that within the current case study confidence levels are not the main reason why children gain more IM. Participant 8 also believed that confidence would grow by learning and gaining real life experience.

Furthermore, age impacts independent mobility. Older children generally show more independence. Participant 3's daughter, aged 12, navigates a 35-40 minute cycling route to secondary school, indicating higher independence compared to younger siblings. However, in the Dutch context secondary schools are situated in more densely populated areas (CBS, 2021), which makes it probable that parents have to increase their child's IM when they leave for secondary school.

Gender differences were less prominent in influencing independent mobility directly. This contradicts with the theoretical framework, where Bagheri and Zarghami (2020) stated that boys earlier gain a higher level of independence than girls. The variance could result from the significant social control in rural settings and the low perception of criminal activity.

By comparing the theoretical framework and the results, an interesting divergence regarding the average age at which children begin to travel independently arises. First, there were also some similarities. According to the Jelleyman et al. (2019) and Dodd et al. (2021), children gain more independence as they grow older, so children in the 10-12 age group should typically exhibit more independent mobility compared to younger children, this aligns with the findings. The theoretical framework suggests that independence is usually achieved as children enter the age of 11 years (Dodd et al., 2021). However, the interview results from this study indicate that children within the case study area often start traveling independently at a slightly younger age, around 8 to 9 years. Parents in the study reported that children in this age group are already cycling or walking to school without adult supervision. This difference may be influenced by several factors unique to the study's rural setting, such as lower traffic density and strong community ties, which contribute to a safer environment that encourages earlier independence.

5.3.3 Work situation parents

Working full-time is common among the participants (P1, P5, P6, P7, P8, P9, P10, P14 and P15). However, it is not common for both caretakers to work full-time. This is the case for participants 5, 9. For these parents it is particularly difficult to manage the commuting to school. Participant 5 recognizes the importance of cycling to school, because of physical activity and gaining autonomy, however due to both parents' busy working schedule they cannot fully accompany their children to school. When their mother takes them to school, the girls (aged 8 and 5), cycle to school independently. Their mother will go to school by car and see if her daughters made it on their own and accompany them inside the school. After the girls are both settled in their classes P5 will resume her way to work by car. The reason why she still comes to school is because it is common to say goodbye to the children attending the first two years of primary school, which applies to her youngest daughter. This example shows that parental

perceptions on the benefits of CIM also influence the CIM. In this case, participant 5 is well aware of the health benefits and the autonomy her children will gain by cycling on their own. As she commutes to school by car, she could also take the children with her, however, she wants to let her children experience the benefits of cycling on their own.

For the other family (P9), the mother works flexible hours so she can accompany the youngest child to school. In the afternoon se will leave at an earlier time to also pick up the youngest. The middle and oldest children are deemed confident and capable enough to commute independently.

For participant 14 this is different. One of the caretakers has a fulltime job, whereas the mother works three days. On her free days she will bring the children to school by bike. This also happens on one working day a week, she will then start working a bit later. The other days the children are brought to school by car. This is because their father is then responsible for bringing them to school, because of work commitments at specific locations he will bring them by car. This also applies to Wednesdays because the children are then picked up by a babysitter. Here the influence of work-travel on CIM mentioned by Mitra (2013) is visible, where parental commute choice to work also influence the commute choice to school. Due to the busy schedule of both parents the children are often brought to school by car.

As mentioned above parents' work situation or commitment can influence the transport mode used in the commute to school. However, not a clear relationship is found between the amount of working hours/parental commuting behavior and the choice of transport or level of independence.

5.4   Social Environment

The final category delves into the social environment, focusing on community norms, parental attitudes and peer influence. Interviews reveal how social factors, such as community cohesion, perceived safety, and parental networks, shape decisions about children's independent mobility. This section also addresses the role of local schools and community organizations in promoting or discouraging independent travel among children.

5.4.1 Socio-cultural environment

5.4.1.1 Mobility licenses

The interviews revealed that participants that have children aged between 7 and 9 take a nuanced approach to balance supervision and independence in their children's mobility. And therefore grant different mobility licenses than the parents with children in the older age group. In the family of participant 8, the 8-year-old child is allowed to cycle to school using safe paths but typically under the watchful eye of a sibling. Similarly, Participant 11 shares that their 7-year-old child cycles with their

siblings and adult supervision, but recently gained a bit more independence. This by cycling to her handball practice on her own. This is in line with Vlaar et al. (2019), who stated that younger children often receive more supervision.

For Participant 14, the eldest daughter, aged 7, expresses a desire for more independence, yet parental caution prevails due to a lack of confidence in her daughters' capability to assess traffic situations. This aligns with the study done by Love et al. (2020) where the confidence in a childs competency is reflected through their level of independent autonomy. A child's independent mobility is restricted when the parents do not deem them capable enough. This is also the case for participant 14, she states:

"And yes, I just want a bit more confirmation that she... That she follows the rules with concentration while on the way and clearly chooses the right path. That's really the only thing" [P14]

This concern for safety is mirrored in Participant 15's family, where the oldest child, aged 8, is gradually given more freedom to explore nearby areas but remains under parental guidance. The parents are starting to teach the child about road safety and the importance of vigilance, fostering a gradual build-up of independence. This gradual expansion of freedom is also stated by Marzi and Reimers (2018) in being the first steps to full independency. Furthermore, traffic safety concerns are very dominant within the parents perception of safety as noted by Massoumi et al. (2020). By teaching their children about road safety the participants prepare their children to participate in traffic. Participant 15 is teaching their son to participate in traffic situations, as demonstrated by the following quote:

"My son is now at the age where he asks, can I go to the MFC or the sports club by myself? Or can I go somewhere alone? Because one friend is allowed, and the other is not. It's the age where you might let them go alone sometimes. So, we are indeed practicing that, letting him stand by the road, and say, 'look,' and then, you know, left, right, left, and 'yes, it's possible, yes, well, go ahead then.' Yes. So, you know, we are practicing that. Yes. But it's also about letting go a little, where you think at some point, well, go ahead then, go on your own."

For the age group with children between 10 and 12 years old other mobility licenses are granted. Participant 9's children, aged 10 and 12, enjoy significant mobility freedom. They independently cycle to school and extracurricular activities, such as football practice, with their parents monitoring their routes via mobile apps and emphasizing road safety education to ensure they understand traffic complexities and risks. In participant 12's family, their daughter, aged 11, enjoys considerable freedom. She cycles independently to school and social activities.

Across the board, children aged 7-9 begin their journey toward independence with unsupervised trips within their neighborhood, such as going to nearby parks, visiting friends, or attending school. For instance, P2's son (9) and P4's daughter (10) are allowed to cycle short distances independently, provided they adhere to established safety protocols, such as stopping before crossing a road or crossing a road at a certain point. As children transition into the 10-12 age group, they are typically granted greater mobility licenses. This includes longer school commutes and trips to recreational areas or supermarkets in other villages without parental supervision. Examples like P3's daughter (12) and P7's daughter (12) illustrates this progression, as these children cycle independently to school and social activities, highlighting the shift toward greater autonomy and responsibility as they grow older.

In today's digital age, GPS devices and mobile apps have become essential tools for parents to monitor their children's whereabouts, providing both security and peace of mind. Participants in this study discussed how they use these technologies to track their children's movements. Participant 12 utilizes Google Family accounts to check their children's locations, ensuring they are on route to school or activities while maintaining a balance between oversight and freedom. Similarly, Participant 7 emphasizes the importance of GPS tracking via mobile phones to ease safety concerns, especially in unfamiliar areas, while granting children independence. Participant 6 uses the Life360 app to track their children's location and comments on how accurate the app is, particularly when they travel further from home. This tool provides reassurance but is primarily used for peace of mind rather than constant surveillance.

"..Yes. And I have Life360. So I can track them just fine. So that's also a good one. Yes. really. You can track them down to the kilometer... You can see exactly how fast they are cycling and where they stop" (P6).

Similarly, Participant 3 uses the 360 Live tracking app to monitor their children, offering control and assurance if children deviate from usual routes. They stress the importance of balancing monitoring with trust. Conversely, Participant 5 mentions using a GPS watch but acknowledges a gradual shift toward trusting their children's judgment, reducing reliance on constant tracking. This reflects a trend where parents foster independence while valuing the safety net that technology provides. The use of GPS tracking apps by parents can be seen as a beneficial tool towards full IM. In further research the influence of these apps on CIM could be researched.

Some parents worked with specific locations or territories the children were allowed to go on their own. This relates to the CIM range and CIM destination stated by Marzi and Reimers (2018). Participant 5 mentioned that her daughter (8) is now allowed to go to the supermarket and to her cousin. Participant

2 noted that in the early stages of letting her son gain more independence, he was only allowed to be around the neighborhood and not cross the main road. CIM destination is in this case the first step to gaining more independence, as participant 2's son is now allowed to cross the main road, but he still has to stay within the town borders.

5.4.1.2 Parental encouragement

During the interviews a lot of participants stated that they encouraged their children to venture on their own. As P3 stated: *"Cycling on their own is a way for them to mature and learn how to handle various traffic situations safely." (P3).* This aligns with the academic finding that parental encouragement is a critical factor in fostering children's independent mobility, significantly impacting their active commuting behavior (Panter et al., 2010). Participants also stated that it is necessary to show their children that they trust them to go out on their own, and that this is a necessity when it comes to learning to be out on their own. This is also illustrated by the quote from P8: *"Yes, because they have to learn it indeed. My father also said that you have to give them a lot of trust; otherwise, they'll never learn it. Yes, that's how it works, and it helps that we live in a village."* This statement resonates with the assertion that parental trust and encouragement can greatly influence children's confidence and independence (Nyström et al., 2023).

Parents valued different benefits of CIM and repeatedly stated that increasing their childs' independence and health are main reasons why they are encouraging their children to go out independently:

"We encourage cycling to school whenever possible, even on rainy days unless it's really bad. It's important for their independence and health" (P5).

"You give them trust, and they need to learn by experiencing things themselves. It's important they know how to get somewhere on their own" (P6).

These statements align with academic literature which highlights that parental encouragement and the granting of mobility licenses are crucial in promoting active commuting behaviors (Burghard et al., 2016; Cordovil et al., 2015). Additionally, the role of parental modeling of positive behaviors towards independent travel further reinforces these habits in children (Burghard et al., 2016).

In conclusion, the interviews revealed that many parents actively encourage their children's independent mobility, recognizing its importance in fostering maturity, independence, and health. Parents believe that allowing their children to venture out on their own helps them develop essential life skills, such as handling traffic situations and navigating their surroundings safely. Trust emerged as

a key theme, with parents like P3 and P6 emphasizing the necessity of trusting their children to cultivate self-reliance and confidence. The consensus among participants is that by encouraging activities like cycling to school, even in less-than-ideal weather, they are helping their children become more independent and physically healthy. This parental encouragement not only supports children's development but also strengthens their ability to trust in their own capabilities.

5.4.1.3 Confidence in child

As Love et al. (2020) stated, the perception parents have of their child's abilities is an important determinant in letting them explore independently. The interviews revealed that some parents did not see their child assessing dangerous situations well enough, and for that reason did not venture around on their own. This aligns with findings from Love et al. (2020), who noted that the confidence parents have in their children's competence reflects their perception of the child's ability to handle situations independently, which is a key factor in granting independent mobility. Participant 1 for example stated that she kept her youngest daughter (6) longer from cycling her own bicycle because: *"The youngest has always been a bit of a kamikaze pilot, rushing forward without listening to warnings. That's why I kept her on the bike with me for a long time until she was six and could ride her own bike."* Participant 1 is still hesitant to let her youngest daughter fully out of sight. The youngest child is only allowed to go to the nearest playground, which her mother can see from the window. Participant 8 has a similar situation where she assesses her middle child to be a bit of a dreamer: *"The middle child (10) is a bit of a dreamer. I'm not sure he always perceives danger properly, which is why we emphasize stopping and looking before crossing streets" (P8).* According to Marzi & Reimers (2018), parents grant mobility licenses based on their assessment of a child's capability, which can include specific rules like crossing streets safely. Despite this assessment of her middle child, the ten-year-old boy is allowed to go to school and other places within the village independently.

Parents also stated that their children are very capable of assessing traffic situations and handling them well by being very cautious. P9 stated about her eldest daughter (12) that *"she is capable of assessing dangers well and is very responsible when cycling through busier areas" (P9).* This finding supports Mitra's (2013) claim that parental confidence in a child's capability to handle physical activities can increase the likelihood of granting them independent mobility. Participant 10 stated that her eleven-year-old son has improved his ability to assess dangerous situations. She states: "Yes, now it's very good, but when I first... Yes, now good. Very good. Because he even says, 'Mom, you shouldn't cross yet.' So... 'Or. Wait a moment.' Or 'I'll wait a moment.' Now I can say that at this moment he is very good [at assessing dangerous traffic situations]." (P10). This improvement reflects the ecological theories of human behavior, as discussed by Bandura (1989) and Bronfenbrenner (1989), where repeated exposure to environments helps develop necessary skills.

These findings show that parents' assessment of their children's capabilities and the confidence they have in their children's abilities, influence the CIM. Parental encouragement, as noted by Panter et al. (2010), not only impacts the children's confidence but also the level of autonomy they are granted, reinforcing the idea that CIM is deeply tied to parental perceptions.

5.4.1.4 Communal encouragement

During the interviews a few participants pointed out that the school board is actively trying to enhance physical activity and promote active travel to school. One of these actions is that the children need to cycle or walk to their gym classes, which instills a routine of active commuting from a young age. This reflects the findings of Burghard et al. (2016), who state that by frequently walking or cycling and showing enthusiasm for these activities parents, or in this case teachers, can influence the children to adopt similar habits.

Additionally, the implementation of a traffic exam is another way this school promotes cycling. This exam is designed to educate children about road safety, traffic signs, and the rules of the road. It ensures that children have the necessary skills to cycle safely in traffic. Participant 4 noted that this exam prepares children for real-world cycling conditions, contributing to their overall confidence in traveling independently.

5.4.2 Perceived Neighborhood

Neighborhood safety, friendliness , fear of strangers and crime are factors that are tightly knitted together and influence CIM. In the next paragraphs the results concerning these aspects are discussed. As mentioned by Foster et al. (2014) the perception of social safety can reduce the negative impacts of fear of crime. This is also reflected in the interviews conducted. None of the participants mentioned they were afraid of criminal activities in the neighborhood. Most participants mentioned the advantage of living in a rural area, where you know a lot of people, this also contributed to the feeling of social safety.

The findings align with the literature, which states that environments characterized by social capital and neighborhood attachment contribute to children's CIM. According to Crawford et al. (2017), areas with strong social capital and cohesion significantly enhance CIM. Participant 7 pointed out that for instance, strangers stand out in their community, and the whole village is alert when a stranger appears.

"Because you also have quite a bit of social control here. Recently we had a homeless person here. Oh yes. The whole village was turned upside down." (P7)

This reflects the Bullerby Model by Kyttä (2008), which describes environments where strong social networks exist as "Bullerby environments," characterized by, amongst others, both a high level of

mobility opportunities and perceived social support. The statement also aligns with Foster et al. (2014), who found that parents of children with some degree of CIM were less fearful of strangers and reported higher perceptions of informal social control in their neighborhoods.

The alertness is also stated by participant 2 who states that strangers do walk in the neighborhood sometimes, but everyone is quite alert when this happens (P2).

Not only the alertness when it comes to strangers contributes to the feeling of safety in the neighborhood, also knowing their neighbors and knowing they can come to their neighbors if they, or their children, need help contributes to their feeling of safety. This is also illustrated in the following quote: *"How is the contact with the neighbors? Very good, the children also know that they can always go here. For support or help? Can you knock if there is something? Always." (P8).* Participant 7 also emphasized the supportive nature of their community, saying*, "Always. Yeah. Yeah. That's really nice,"* in reference to being able to rely on neighbors for help with the children (P7). Additionally, Participant 12 expressed that while they may not visit their neighbors weekly, they gather for neighborhood parties, indicating a friendly atmosphere where people come together for social events (P12).

Despite the social control due to the close-knit community revealed above there were some parents who expressed some concern for strangers. Participant 3, who lives in a very rural area, where the roads are not well lit, states that due to an unpleasant experience with strangers herself, is more concerned that strangers might talk to her children (P3). Her 12 year old daughter is allowed to go to school independently, however there are limits, as her route is through a lot of forested areas, she is accompanied by friends almost the whole journey to school. Moreover, they use a GPS tracking system to see exactly where their daughter is. The fear of strangers is in this case reinforced by the place that they live. Also participant 7 mentioned being afraid her children encountered strangers when venturing on their own. However, she is quick to say that her anxiety and caution is because she already lost a child (P7). These concerns were only stated in relation to daughters.

The use of neighborhood watch WhatsApp groups is prevalent across many interviews. Participant 4 highlighted the dual purpose of their neighborhood app, stating, *"We have a neighborhood app. For the fun stuff. If something is noticeable, then it is also neighborhood prevention,"* which underscores how these groups facilitate both social interaction and vigilance (P4). Participant 11 emphasized the peace of mind these groups provide, saying, *"We have a neighborhood app. And yes, that gives a sense of security because not everyone is home all day,"* (P11). This underscores how these groups facilitate both social interaction and vigilance, adding an extra layer of security for parents and children alike. According to Alparone and Pacilli (2012), fear of crime decreases significantly when individuals are well-integrated into local social networks and have strong positive neighborhood relationships.

Chapter 6. Conclusion

This research investigated the factors influencing Children's independent mobility within two rural municipalities in the Netherlands. This chapter is structured around the answers that are provided to the sub- and the main research question. Then the implications for planners are considered, followed by limitations of this research and recommendations for further research. At the end a reflection is given.

The study aimed to provide insights into which factors affect children's independent mobility to school and the differences between the 7-9 and 10-12 age groups, all within the context of two rural municipalities in the Netherlands. The case study highlights the multifaceted nature of children's independent mobility in rural settings. It involved interviews with 15 families, covering children from both primary and high school, and examined how physical infrastructure, social environment, demographic factors, and safety perceptions collectively shape children's degree of independence on their journey to school. The findings suggest that enhancing CIM to school in rural areas requires a holistic approach, addressing both physical and environmental barriers to foster a supportive environment that encourages active, independent travel to school.

CIM refers to the freedom children have to navigate their neighborhoods or cities without adult supervision. This concept is integral to child development, contributing to cognitive, social, and physical health benefits. CIM encompasses a range of activities, such as walking to school, playing outdoors, or visiting friends, without being accompanied by an adult. Researchers have further elaborated on this concept by identifying various indicators that define and measure CIM. Like CIM license, CIM destination, CIM Range and CIM time. Each of these indicators measure CIM in a different way. However, they are also interconnected, with overlapping factors influencing them.

The research results indicate that CIM in rural villages is influenced by a complex interplay of factors encompassing the physical environment, sociodemographic characteristics, and the social environment. The design of a neighborhood does not play a crucial role in influencing CIM. In rural areas, the built environment often features lower building density, providing ample outdoor spaces and greenery, which can promote a sense of safety and autonomy for children. However, challenges such as poor lighting, unpaved paths, and muddy forest routes in winter can hinder independent travel. Furthermore, adverse weather conditions are also mentioned as being a determinant factor to transport mode choice. This then results in less independent mobility as many participants described driving their children to school on rainy days. Traffic safety is a significant concern for parents, affecting the routes children are allowed to take. Families often prefer routes that avoid busy roads and intersections, prioritizing paths with lower traffic volumes and safer crossings. Many parents highlight the need to teach children traffic

safety, such as stopping and looking before crossing streets. The commuting distance between home and school is not recognized to affect CIM. In rural areas, primary schools are typically within walking or cycling distance, but secondary schools may be farther away, necessitating greater independence as children grow older.

Age is a significant determinant of CIM, with older children generally exhibiting more independence. The study found that children in the 10-12 age group often travel independently, reflecting a developmental stage where they gain more confidence and autonomy. Another finding of this study is that children within this case study experience independent mobility at a younger age than stated in the literature, the age at which children gain more autonomy lies around 8-9. Gender differences were less pronounced, contrasting with literature suggesting that boys typically gain independence earlier than girls. Children progress through different stages of independence, starting with supervised travel, then traveling with peers or siblings, and finally traveling alone. Parents often tailor their approach based on their child's perceived maturity and capability. Household dynamics, such as the presence of siblings and parental work schedules, significantly impact CIM. Older siblings often play a pivotal role in enhancing the mobility of younger ones, providing guidance and support during commutes. The working hours and commuting distances of parents influence the choice of transport and the level of supervision. Families with irregular working hours and long commutes may allow children more independence, while those with short commutes can accompany their children more easily.

Parental perceptions of their child's abilities and the neighborhood environment are critical determinants of CIM. Confidence in a child's competence to handle traffic situations and navigate routes safely increases the likelihood of granting independence. Parents grant mobility licenses based on their assessment of a child's capability. On the other side, the confidence level of the child itself is not a determinant to CIM. Encouragement from parents plays a crucial role in fostering CIM. Parents emphasize the importance of trust and encouragement in helping children develop confidence and autonomy. Community norms and cohesion also shape CIM. In rural areas, strong social networks and community ties create a supportive environment that encourages children's independent travel. The perception of safety within the community, including low crime rates and social vigilance, reassures parents and fosters CIM. Parents value knowing their neighbors and having support systems in place, which reduces concerns about safety and crime. Modern technology, such as GPS tracking apps, provides an additional layer of security, allowing parents to monitor their children's movements and offer reassurance without constant supervision.

Children in the 7-9 age group are typically at an early stage of developing independence. At this age, they are still acquiring the skills necessary to navigate their surroundings safely and independently. They

tend to require more supervision and guidance from parents or older siblings, primarily because of their developing cognitive and motor skills. This need for oversight is often reflected in the transportation modes chosen by parents for their school commutes. For instance, in the study, younger children are more likely to travel with an older sibling or a parent, especially if the route to school includes complex crossings.

In contrast, children aged 10-12 generally exhibit greater independence in their school commutes. This age group typically has a better understanding of traffic rules and more developed spatial awareness, allowing them to handle longer and more complex routes. As a result, children in this age range are often permitted to travel to school alone or with peers, marking a significant shift towards autonomy. Parents are more likely to grant mobility licenses to this older group, trusting them to manage their commutes independently and responsibly. This transition is a key milestone in a child's development, reflecting their growing maturity and capability to assess risks and make decisions.

Several factors contribute to the differences in CIM between these age groups. One major factor is parental perception of safety. For younger children, parental concerns about safety are heightened, leading to more stringent supervision and restrictions on independent mobility. Parents of 7-9-year-olds often emphasize safety protocols, such as stopping before crossing roads or walking on specific paths. Parents of 10-12-year-olds tend to have more confidence in their children's ability to assess danger and navigate independently. This confidence stems from the children's demonstrated responsibility and awareness of safety measures. As such, parents are more inclined to allow this age group to cycle or walk to school without direct supervision, although they may still use tools like GPS tracking to monitor their children's whereabouts indirectly. This indirect supervision allows children to experience autonomy while ensuring parental peace of mind.

Additionally, community factors play a significant role in influencing CIM for the different age groups. In rural areas, the community's social fabric and safety perceptions greatly impact parental decisions regarding children's independent travel. The study highlights that in communities with strong social cohesion and low crime rates, parents feel more comfortable granting their children independence. The interview results show that for both age-groups the high strong social control is beneficial to their range of independence. Children can take advantage of the supportive community network to explore their surroundings more freely.

Household dynamics also contribute to differences in CIM. Families with older siblings often leverage this dynamic by allowing younger siblings to travel with their older counterparts, facilitating a learning environment that builds confidence and skills in the younger children. This dynamic is more prevalent

in the 7-9 age group, where parental reliance on older siblings to provide supervision and guidance is common. In contrast, children aged 10-12 often undertake commutes independently, reflecting their readiness for greater autonomy.

In summary, the differences in CIM to school between the 7-9 and 10-12 age groups in rural areas are influenced by a combination of developmental stages, parental perceptions, and household dynamics. Younger children typically require more supervision and structured guidance due to their developing skills and safety concerns, whereas older children exhibit greater independence, benefiting from increased parental trust and community support. Understanding these differences and the factors present in rural areas is crucial for developing policies and interventions that support safe and effective CIM, promoting children's autonomy and well-being in rural communities.

Based on the insights gathered from the case study, policymakers can implement a combination of hard and soft policies to enhance CIM within the rural villages. These policies aim to address both infrastructural and socio-cultural aspects that influence children's ability to travel independently to school. By implementing these policies, local governments can create safer, more supportive environments that encourage active and autonomous travel for children.

Infrastructure improvements are a crucial element of these policies. Policymakers can invest in enhancing cycling and walking routes by adding dedicated bike lanes and pedestrian paths, which provide children with safe and clear pathways separate from motor vehicle traffic. In rural areas, road safety can be improved by installing better lighting, especially in neighborhoods with poor lighting and unpaved paths. This approach increases visibility and safety for children commuting to school. Additionally, designated crossing points and pedestrian crossings at major intersections will facilitate safe access for children in areas with heavy traffic.

Schools play a pivotal role in supporting children's independent travel by providing adequate facilities such as secure bike storage and designated drop-off and pick-up zones. These facilities help reduce congestion around school entrances and promote safer travel. Collaborating with local schools and communities to develop safe routes to school programs ensures that children have access to secure pathways, minimizing risks and encouraging more families to allow their children to travel independently.

Community engagement and education are essential soft policies that complement infrastructure improvements. Policymakers can organize workshops and seminars for parents, schools, and community members to educate them about the benefits of independent mobility. These sessions can teach road

safety skills and emphasize community vigilance in ensuring children's safety. By creating a sense of shared responsibility, community members can enhance overall safety and support for CIM initiatives.

Schools can collaborate with local community organizations to promote CIM by integrating cycling and walking into the curriculum and extracurricular activities. Community partnerships can organize events like group bike rides, walking clubs, and safety workshops, fostering a supportive environment for children's independent travel. Also the use of community organizations to gather traffic wardens at complex crossings can ease the perception of safety on the journey to school.

In conclusion, a combination of infrastructure improvements, traffic management, community engagement, and parental support can significantly enhance children's independent mobility in rural areas. By addressing both physical and socio-cultural aspects, policymakers can empower children to navigate their communities with confidence and autonomy, promoting their overall well-being and development.

When reflecting on the research process different strengths, weaknesses and limitations can be identified. During the research there were no major setbacks to be dealt with. The approach of participants went smoothly as the personal network of the researcher could be used. A strength of the research that can be identified is the number of participants that agreed to be a part of the study. Due to the variance of parents the results showed a complex relation between the different factors influencing CIM. This study's limitations include its focus on specific rural towns within two municipalities in the Netherlands, the findings may therefore not be generalizable to other rural towns or areas. Future research could explore CIM in different geographical contexts and examine a different range of towns located in different provinces of the Netherlands.

Another limitation of the research is the related to the participants that were interviewed during the data collection. For the size of the research this was a good number of participants, however the participants interviewed all cycled with or let their children cycle to school at least once a week. If the number of participants included was higher, the chance of talking to parents who bring their children by car was higher. For future research a higher number of participants is suggested. Moreover, it is suggested to include a more thorough selection process so it can be guaranteed that there is more variance in commuting choices. One of the findings of the research stated that weather conditions also influence CIM. Despite the significant impact weather can have on children's travel behavior, this research did not account for it in the theoretical framework. Further research is needed to explore the influence of weather conditions on CIM to gain a deeper understanding of how different weather patterns can affect children's mobility decisions and their parents' perceptions. Adverse weather may discourage walking or cycling, prompting parents to drive their children instead. Understanding

weather's role in CIM can help policymakers design infrastructure and policies that accommodate seasonal variations and encourage independent travel, even in challenging conditions.

Another finding was the use of technology, such as GPS tracking apps to track the location of the children. While this technology provides parents with a sense of security and reassurance about their children's whereabouts, its impact on CIM should be researched in more detail.

Lastly, this research utilized qualitative research methods, which, while offering in-depth insights into personal experiences and perceptions, have certain limitations. One significant limitation is the difficulty in determining the most influential factors on CIM due to the subjective nature of qualitative data. Qualitative methods, such as interviews and focus groups, provide rich, detailed narratives but lack the statistical power to quantify the relative impact of various factors on CIM. As a result, it becomes challenging to identify which specific factors are the most significant drivers of children's independent mobility. In contrast, quantitative research methods can address these limitations by employing structured surveys and statistical analyses to measure and compare the effects of different variables on CIM. It is therefore suggested to also include quantitative analysis in further research.

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Chapter 8. Appendices

Appendix 1: Interview Guide

Allereerst wil ik u bedanken voor uw deelname aan dit interview. Voordat ik het onderwerp van het interview introduceer, wil ik u graag wijzen op uw rechten en u de kans bieden om het toestemmingsformulier in te vullen.

start recording

Herhaal: Laat het duidelijk zijn dat we het interview op elk moment kunnen stoppen. Als er vragen zijn die je niet wilt of kunt beantwoorden, is dat ook prima. Laat het me gewoon weten.

Ik zal nu het onderwerp van het interview aan je voorstellen. Voor mijn masterscriptie voor de Master Society, Sustainability and Planning doe ik onderzoek naar de zelfstandige mobiliteit van kinderen op weg naar school. CIM wordt gedefinieerd als de vrijheid van kinderen om zich in hun buurt of stad te verplaatsen zonder toezicht van een volwassene. CIM heeft veel voordelen, kinderen leren te navigeren in de openbare ruimte en anticiperen op veranderingen in hun omgeving. Daarnaast leren ze om met anderen in de omgeving om te gaan en keuzes te maken. Ook voor de fysieke gezondheid kan zelfstandige mobiliteit goed zijn, meestal zullen kinderen fietsen of lopen als ze zelfstandig op pad gaan, dit kan leiden tot een toename van de fysieke activiteit. Ten slotte kan zelfstandige mobiliteit leiden tot het zelfstandiger worden van het kind. Het kind krijgt het gevoel van controle over situaties en dit bereidt hen voor op de toekomst.

Het gaat dus om een heel aantal voordelen die gekoppeld zijn aan zelfstandige mobiliteit. Alleen, kinderen gaan niet vaak op een zelfstandige manier op pad.

De onderzoeksvraag die ik wil beantwoorden is daarom: Welke factoren spelen een rol in de zelfstandige mobiliteit van kinderen in deze verschillende leeftijdscategorieën tijdens hun weg naar school, wonend in landelijke gebieden?

Nu heeft u een idee waar het onderzoek over gaat. Heeft u op voorhand nog vragen?

* kans op vraag en antwoord*

Begin interview

1. Kan je mij vertellen hoe de gezinssituatie eruit ziet?
   - leeftijden
   - geslacht
   - werksituatie
   - tijd naar werk/werktijden
   - rijbewijs
   - auto
   - fietsen
2. Kan je mij vertellen hoe je het karakter van je kind zou beschrijven?
   - zelfverzekerd
   - gevaar inschatten
   - weg vinden
   - omgang met anderen
   - hulp vragen
   - welke ontwikkelingsfase

- communicatie
- regels?

3. Kan je mij vertellen hoe je kind naar school gaat?
    - zelfstandig?
    - soort voertuig?
    - hoeveel dagen met welk voertuig?
    - route
    - aparte voet/fietspaden
    - verkeersregels op route?
    - openbaar vervoer naar school?
    - park/speeltuin op weg naar school?
    - tijd/km
    - welke factoren?
    - bang of angstig om kind zelfstandig naar school te laten?
    - geleerd om zelfstandig te gaan?

4. Kan je mij vertellen hoe je kind zich vermaakt in zijn/haar vrije tijd?
    - naar buiten?
    - denkt u dat er voordelen zijn aan zelfstandig op pad gaan?
    - welke zijn belangrijk?

5. Kan je mij vertellen hoe je woonomgeving eruitziet?
    - voertuigen
    - drukte
    - verkeersregels of borden
    - gevaarlijke plekken?
    - kind zelfstandig in de buurt?
    - zorgen over de veiligheid?
    - verbetering ergens?
    - hoe veilig is de buurt
    - criminaliteit? overlast?
    - onbekende mensen in de buurt
    - maatregelen om gezin te beschermen tegen vreemden
    - vertrouwen in lokale autoriteiten

6. Kan je mij vertellen hoe ver je kind zelfstandig van huis mag?
    - afstand
    - tijd
    - plekken
    - met anderen
    - welke leeftijd

7. Kan je beschrijven hoe vriendelijk de buurt is?
    - contact buren
    - welkom gevoel
    - buurtactiviteiten of initatieven?
    - steun of hulp?
    - comfortabel contact met andere ouders?
    - verbeteringen?

8. Kan je mij vertellen hoe uw woonplaats eruitziet?
    - voorzieningen/activiteiten
    - opzet woningen
    - hoeveelheid gebouwen
    - wegen zonder auto's

Dit waren de vragen vanuit mijn kant. Heeft u nog vragen?

Nu wil ik u heel erg hartelijk bedanken voor uw medewerking en als u na afloop nog vragen of opmerkingen heeft over het onderzoek over hoe de omgeving verbeterd kan worden om zelfstandige mobiliteit van kinderen te stimuleren, kunt u mij bereiken.

Appendix 2: Deductive Code Tree

Appendix 2: Deductive Coding Tree

Concepts	subcategory	Variable/ Dimension	Indicators
Social environment	socio-cultural environment	Traffic safety	- forms of transport - time of peak - traffic signs or rules - dangerous traffic places - perceived traffic safety - safety concerns - possible improvements
		Confidence in child	- developmental stage child - previous experiences - communication - confidence child - personal fears - education of child's abilities
		Parental encouragement	- social interaction - stimulate independence - physical activity - exploring - stimulate confidence - reducing screentime - learning about safety
		Parental rules	- dinner time
		Mobility licences	- distance - time - specific locations - allowed to go on their own

			- granted licenses at what age
	Perceived neighborhood (parents)	Neighborhood safety	- scale rate safety - which factors affect neighborhood safety - time of day - worries about crime - feeling of safety in specific locations - improvements
		Neighborhood friendliness	- scale rate friendliness - specific interactions - feeling welcome - neighborhood initiatives - helpfulness, support - contact with neighbors - improvements
		Fear of crime/strangers	- scale rate crime - encounter with crime - worries about crime - presence of strangers - measurements to handle crime - trust in authorities
Physical environment		Proximity to school	- kilometers - duration of trip by car - duration of trip cycling - duration of trip walking - school-specific walk- or cycle ability
		Commuting distance parents	- transport choice to work - duration of the trip in minutes

			- kilometers
		Neighborhood design	- degree of urbanization - land use mix - urban structure - density of buildings - car repellent streets
		Journey environment	- traffic - cycle lanes - pavement - crossings - parks - playgrounds
Socio-demographic characteristics	Child specific	Perceived capabilities	- navigational skills - ability to assess danger - interaction skills - ability to ask for help
		Age	years
		Gender	male/female/other
		Confidence	- insecurity - shyness - able to stand up for themselves
		Learned skills	- cycling - crossing roads
	Parent specific	Working situation	- branche - location - parttime/fulltime
	Household	Number of household	per individual

		members	
		Ownership of bicycles	- number - capability to cycle
		Possession of driving licenses	- per parent/ caretaker
CIM	Company to school	CIM to school	
		Parental supervision	
		With household member	
	Transport mode	Car	
		Cycling	
		Walking	

Appendix 3: Informed Consent Form

Geachte deelnemer,

Allereerst, bedankt voor het deelnemen aan dit onderzoek. Dit onderzoek gaat over de factoren die meespelen bij de zelfstandige mobiliteit van kinderen die opgroeien in een landelijke omgeving. Specifiek gaat het onderzoek over de zelfstandige mobiliteit op de weg naar school. Voordat het interview begint, zou ik u graag willen wijzen op de volgende informatie.

- In de publicaties van dit onderzoek zal u volledig anoniem blijven. Er zal naar u worden verwezen op de volgende wijze: 'Participant 1' or '2' etc. dat wordt gebaseerd op de volgorde van voorkomen in het onderzoek.
- Tenzij hier expliciet toestemming voor is gegeven zal er geen persoonlijke informatie gedeeld worden in het onderzoek, zoals geslacht of leeftijd.
- Om ervoor te zorgen dat u zich op uw gemak voelt tijdens het interview, is het belangrijk om te weten dat op elk moment het interview gestopt kan worden. Ook kan u een vraag niet beantwoorden, als u dat niet wil.
- Mocht u hier behoefte aan hebben, dan kan er een kopie van het interview worden opgestuurd, en kunt u hier nog aanpassingen aan maken.
- De informatie die u geeft in het interview zal alleen worden gebruikt voor dit onderzoek, dat uiteindelijk wordt gepubliceerd op de online scriptiedatabase van de Rijksuniversiteit Groningen. Deze website is openbaar toegankelijk. De volledige uitwerking van het interview zal niet openbaar toegankelijk zijn. Verder kunnen de resultaten gebruikt worden voor een(poster)presentatie die wordt gegeven tijdens de Graduate Research Day.

Als deelnemer heeft u de volgende rechten:
- Stop of pauzeer de opname of het interview op elk moment
- Een vraag niet beantwoorden
- Zoveel vragen stellen over het interview als je wil
- De onderzoeker vragen om het interview of delen hiervan te verwijderen tot publicatie

Ik ben me bewust van mijn rechten en geef toestemming om het interview op te nemen: JA/ NEE

Ik geef toestemming om mijn leeftijd te noemen in het onderzoek: JA/NEE

Ik geef toestemming om mijn geslacht te noemen in het onderzoek: JA/NEE

Mijn naam: _____

Handtekening: _____