Towards more inclusive mobility services

A design roadmap for the introduction of a mobility-as-a-service ecosystem with considering the needs of elderly

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Preface

I would love to present to you my final thesis report which I have been working on for the past couple months. I dove into the complex world of mobility with little prior knowledge, which has made this a real challenge. Therefore, I hope that I can inspire many people with the process and end-result.

First, I would like to thank Label A for giving me this graduation opportunity. By starting with a list of mutual interests, we eventually managed to come up with a subject which was interesting for both of us and on which we could start with great enthusiasm. Thank you, Mike, our weekly meet-ups have kept me motivated, allowed me to let my hair down and inspired me about taking the next steps. Your experience as a SPD graduate reassured me about my results and made it easy to spar together about solutions and my process. I would also like to thank the other members of the team, for participating in sparring sessions, helping me with setting up the workshop and by contributing to validation/implementation sessions. I have enjoyed my time at label A to the fullest, I want to thank you for treating me like I was one of you. I enjoyed the lunches, walks, the 'vrijmibo's' and the fantastic trip.

I would also like to say thank you to my TU Delft supervisors. Thank you Suzanne, I am extremely grateful that you were my chair. Besides the fact that you had a lot of knowledge in the field of mobility, which helped me getting started, you were also very fond of my mental health and were open to meet more often to help with my motivation and enthusiasm. Thank you Matthijs, your profound questions helped me to not only depend on the knowledge of others, but also look at my thesis with a different perspective and encouraged me to be critical. You were always open to meet with me when something was bothering me and called me when you wanted to hear from me how I was doing.

Lastly, I would also like to thank my family and friends for their help and support throughout my studies and thesis. Thank you mom and dad, to always challenge my thoughts and be a home-base for me that I could always turn to for help during my studies. Thank you Sam, for helping me with my personal drive. Sometimes you were strict and confronting, but this helped me stay motivated and bring out the best in myself. Thank you Anouk, for being the best roommate I could wish for. Despite the long days I sometimes had at the office, you always made sure I could unwind at home and close of the day feeling good. Thank you Vief, we struggled together on our thesis this summer. The coffees we had together to vent our frustrations helped me make the best of it anyway. Our friendship is very valuable and I appreciate the many conversations we have had about our future, ambitions and struggles in life. I very much look forward to our travel plans.

To you, the reader, I hope you will enjoy reading and may it be useful in any way.

Nina

Executive summary

The issue of inclusion is receiving more and more attention. Additionally, mobility is undergoing a fundamental transformation toward inclusivity as a result of technological trends. This gave rise to the chance for this project, which aims to investigate how mobility may be more inclusive, draw in a larger audience, and address fresh narratives that genuinely speak to and belong to everyone.

The project began with a preliminary investigation into inclusion and the subject of inclusive design. With the use of this information, the project's subsequent study phase, which examined MaaS and SSAT, was able to gain valuable contextual insights. From the standpoint of the sector and the chosen target-group, elderly, significant challenges and opportunities were identified. As a result of synthesizing these data, it was determined that the main opportunity was in addressing the interaction between mobility organizations and elderly: to assist in fostering an iterative need-focused relationship.

The idea development and conceptualization phases of the project were spurred by this specific challenge. Here, a strategic roadmap concept was iteratively developed through brainstorming and validating, with as a future vision that elderly (regardless their disability) can travel within their region by using a Mobility-as-a-service (MaaS) app that can combine public, private and shared transport and offers the best alternatives for travel.

MaaS is a concept that unifies access-based mobility services like public transportation and others onto a single, user-friendly platform. Users will no longer need to make significant investments to maintain access to transportation as a result. They are able to carry out door-to-door travel at a time that works for them. Using this integrated system, transportation companies can build a network that more effectively serves the necessary region and its users. There is still a long way to go before a fast, flexible, reliable, seamless MaaS experience can be realised. Therefore a long-term approach must be adopted by using a design roadmap. This provides the opportunity to work towards the full potential of a MaaS system by keeping the elderly involved in the whole process.

The roadmap's greatest contribution to inclusiveness is that it, on the one hand, encourages the mobility sector to take a more active role in changing the behaviour of elderly and incorporating them in the design process of this new ecosystem. On the other hand, it shows that so much needs to be done to achieve this and that to this day we are far from inclusive when it comes to our mobility offerings.

In validation tests with experts, the roadmaps's desirability was investigated. These evaluation interviews provided an enriched understanding on how the roadmap contributes to available knowledge and how it can be used as a strategic way to encourage change and development of the MaaS concept. These insights combined were used to formulate the final recommendations. Next to that, the insights into inclusive design were used to give Label A advice on how to implement this in their current design process, in part by putting together a workshop to establish inclusive design principles with clients.

"The marvelous richness of human experience would lose something of rewarding joy if there were no limitations to overcome. The hilltop hour would not be half so wonderful if there were no dark valleys to traverse."

— Helen Keller (1960)

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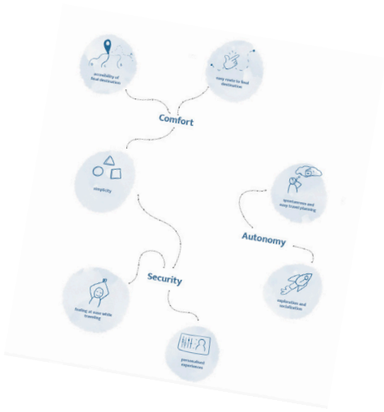
Reading guide

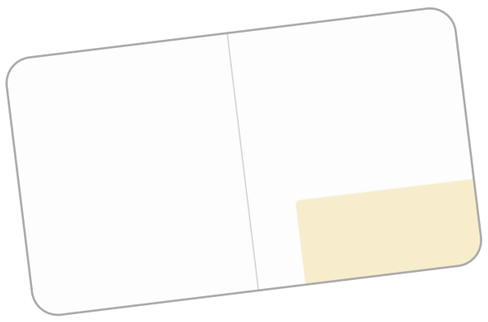
01 New chapter

This thesis has 10 main chapters. The beginning of a new chapter can be recognized by these full light-red pages. These pages consist of a chapter title with a description of the content.

02 Explanatory visuals

Some chapters come with explanatory visuals which give a visual summary of the text. These can be recognized by their blue colour and sketching style.





03 Key insights

In the light-yellow boxes after each chapter the key take-aways/conclusion of that chapter is given. No time to read the whole chapter? Just read these before continuing to the next chapter.

04 Glossary

These are the key terms that are used in this thesis:

SGT	Special-group transport
PT	Public transport
SSAT	Social Support Act transport
RMC	SSAT operator
MaaS	Mobility-as-a-Service
DRT	Demand responsive transport
AV	Autonomous Vehicle
SPD	Strategic Product Design
PS	Problem statement
DC	Design challenge
KiM	Kennis Instituut Mobiliteit

01 Introduction

This chapter gives an introduction to the project, the stakeholders involved and the initial assignment. Additionally, it provides an explanation to the project approach. The start of this project began with my interest in the mobility sector and the affinity for implementing a more user-centred approach towards new innovations.

1.1 Introduction
1.2 Involved parties
1.3 Initial assignment
1.4 Project approach
1.5 Key take-aways

Figure 1: Sketch of a Mobility-as-a-Service ecosystem which works with an application

1.1 Introduction

Although new innovations make it easier for people to manage things from home, we are still depended on mobility. Think of family visits, work appointments, shopping to get a real feel of products or hobbies make people move. Frequently, private vehicles are used for this. However, the way we travel today has a significant negative influence on the environment since it generates a lot of noise and greenhouse emissions. Even though the majority of the vehicles are parked most of the time, the amount of space that they all take up is huge.

Because we are beginning to recognize that private car ownership is inefficient, takes up a lot of space and is bad for the environment, there will be more alternative forms of transportation, frequently with well-developed public transportation as a backbone and with supplemental modes of transportation like car pools, bicycles, or electric automobiles that you may rent or borrow. Some citizens in cities are unable to use public transportation, while others choose for private options since public transportation falls short of their needs. Future cities must use novel strategies to ensure that everyone has access to effective transportation.

Accessibility is one of the biggest obstacles to building or upgrading public transportation. Long walking distances to the nearest stop for the users could be a problem, especially if the trip is only a short distance away yet it takes longer to walk to a stop then to walk the whole trip. Bikes, cars, e-bikes, cabs or other shared mobility innovations are all options for getting to public transportation stops or stations more quickly, but they all have drawbacks in terms of accessibility and expense, both monetary and/or environmental.

In the near future, more alluring solutions with greater capacity are anticipated, such as the concept of ‘Mobility-as-a-Service’ (MaaS). MaaS is a concept of combining services from several mobility providers into a single service, frequently through the use of an app or other digital platform. Public and private mobility providers can be included. Users will be transported more or less flawlessly to their selected locations by the solution, and they just pay for one journey. This could offer substantial societal benefits, including the reduction of emissions, traffic congestion, road injuries, and the overall discomfort associated with travel, in addition to providing personalized transportation solutions (Tomaino et al., 2020). But, with the extensive lack of proof of concept, MaaS still only shows potential and not certainty if it will actually achieve anything.

When developing new innovations within the mobility sector, to for example contribute to the MaaS ecosystem, it is important to remember that there is no such thing as “the traveller”. There are several sorts of travellers, each with their own set of habits, that must be thoroughly understood in order to develop an appropriate and diverse variety of products and services. Questions therefore are; is this new concept of MaaS realistic, can everyone in our society make use of such a service and what is required for comprehending this?

1.2 Involved parties

Label A
This project will be done in collaboration with Label A, a digital product agency. Label A is a fast growing company with now over 70 employees. They have designers, strategists and developers employed, which means that they can do the start-to-finish process of making an app in-house. The biggest field that they are active in is in the field of Mobility. They already designed and developed apps for mobility parties such as Check, GoSharing and Porsche. As they recently started with a shift in their way of working, they already assigned new jobs as 'strategist'. They want to challenge new clients even more when it comes to their service and take more of a strategic role in the process of the app development. Therefore, to ensure this, they want to be more knowledgeable about the future of mobility in order to more thoroughly challenge these new mobility customers.

RMC
RMC is one of those mobility clients which recently got into contact with Label A. They want to design a new app for their customers to travel easier from A to B. When it comes to mobility for elderly and for those who can no longer plan their own transportation or with the support of family or friends, RMC is a major player. As contact was made with this party, they wanted to provide inside data and information on their mobility services to help with this thesis. This information will eventually help to get a better view on their ideas of the future of mobility and will make me able to get into contact with their users.

TU Delft
This thesis is the result of the graduation project, part of the Master's program of Strategic Product Design at the faculty of Industrial Design Engineering of the Delft University of Technology. As the project focuses on the topic of mobility, the project was carried out with the Seamless Mobility Lab of the faculty.

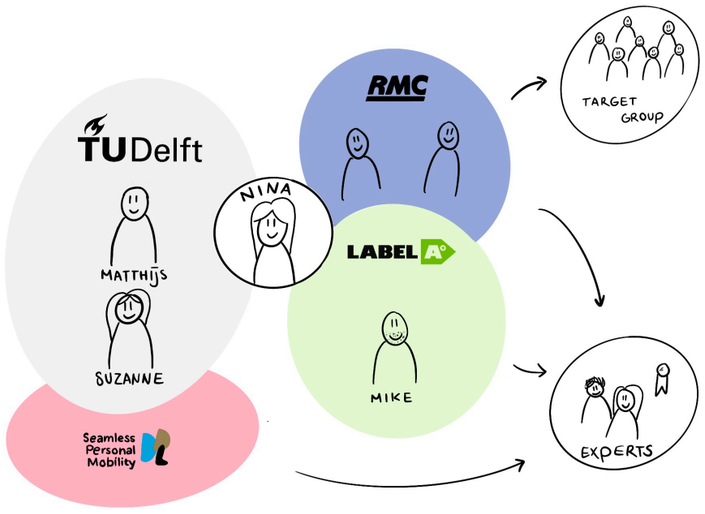


Figure 2: All the stakeholders and their relationships

1.3 Initial assignment

We see a lot of MaaS innovations are coming on the market, but when it comes to the vision of the future of mobility, improvements can still be made to become less 'one-sided', more accessible, and more representative for everyone.

The focus will be on discovering the future of mobility and provide Label A and other companies, which are active in the field of MaaS, with a roadmap which guides to this 'ideal' future, mainly by including the target-group into the research and review different opportunities given by the literature research. The eventual design goal is to give Label A a strategic foundation that can deliver concrete insights and provides guidance into implementation possibilities. A roadmap will showcase more of the feasibility of the concepts and will discover the pitfalls and opportunities for MaaS.

However, after the research phase, the goal of the initial project needed to be modified. It was found that a general future of MaaS was hard to explore and to broad to figure out. Therefore it was chosen to focus on a select target-group in a select area of operation. By doing this, more detailed user interviews and expert interviews could be done, which will make the roadmap's more reliable and thought trough.

1.4 Project approach

The double diamond method has been used as the research approach. The two diamonds that make up this guiding framework each have a divergent and a convergent stage. So, in total, it has four stages: explore, define, develop, and deliver.

In the **discovery phase**, the initial assignment was investigated to comprehend the context and the underlying issue (chapter 2). In this chapter the first focus is on inclusive design, as this is the lens through which we will be looking at the future of mobility. Next to that, topics as MaaS, Target-group transport and RMC are further explored. We close this chapter by setting our context of this assignment and choosing our target-group and the area to focus on. This served as the basis for the deep-dive (chapter 3), which examined the difficulties faced by the chosen target-group of elderly and what the signs of change are that contribute to their future.

After setting our context and getting a better understanding of current but also future initiatives for including the elderly, the **define phase** could start. Empathizing sessions and in-depth interviews with elderly were done regarding their demands and felt emotions during travelling (chapter 4). Universal needs and persona's were developed from these findings. The challenges and opportunities (chapter 5), which served as the foundation for the second diamond, were created by doing expert interviews. The discoveries from the discover phase were analysed and synthesized at the end of the define phase to define the eventual solution space and set up the design brief (chapter 6).

Then, the second diamond was entered and the **develop phase** started. Based on the direction of the project brief, a roadmap was designed to give a understanding of the future vision and show the steps to achieve this (chapter 7). For each horizon, the most crucial steps and the knowledge on which the steps are based are explained. In addition to the steps being based on existing knowledge, the roadmap also consists of proprietary concepts. These concepts will contribute to making the ultimate future of mobility more inclusive. These concepts were created through brainstorming sessions with other students, Label A staff and experts.

Finally, during the **deliver phase**, the roadmaps were validated and a strategic foundation for Label A was made (chapter 8). In order to examine the project's roadmap from multiple angles, the concept was also examined by a number of experts. The final limitations and recommendations for action were described using these findings (chapter 9). Next to that, the gained insights from this project were used to develop a workshop for Label A to do together with clients. This workshop will challenge them to come up with inclusive design principles to design new apps as inclusive as possible. This phase is concluded with a discussion that includes reflections on the project as a whole and the author's own reflections.

1.5 Key take-aways

- Within the mobility sector, accessibility is one of the most important building blocks when upgrading our current ecosystem
- It will become more important to look user-centred to the future of mobility, as these new innovations seem one-sided
- The initial assignment of this thesis is about how Label A can develop new applications in a more user-centred way and give them a understanding of the future of mobility to have more basic knowledge when talking to potential new mobility clients
- For readability,the report is structured according to the four phases of the Double Diamond

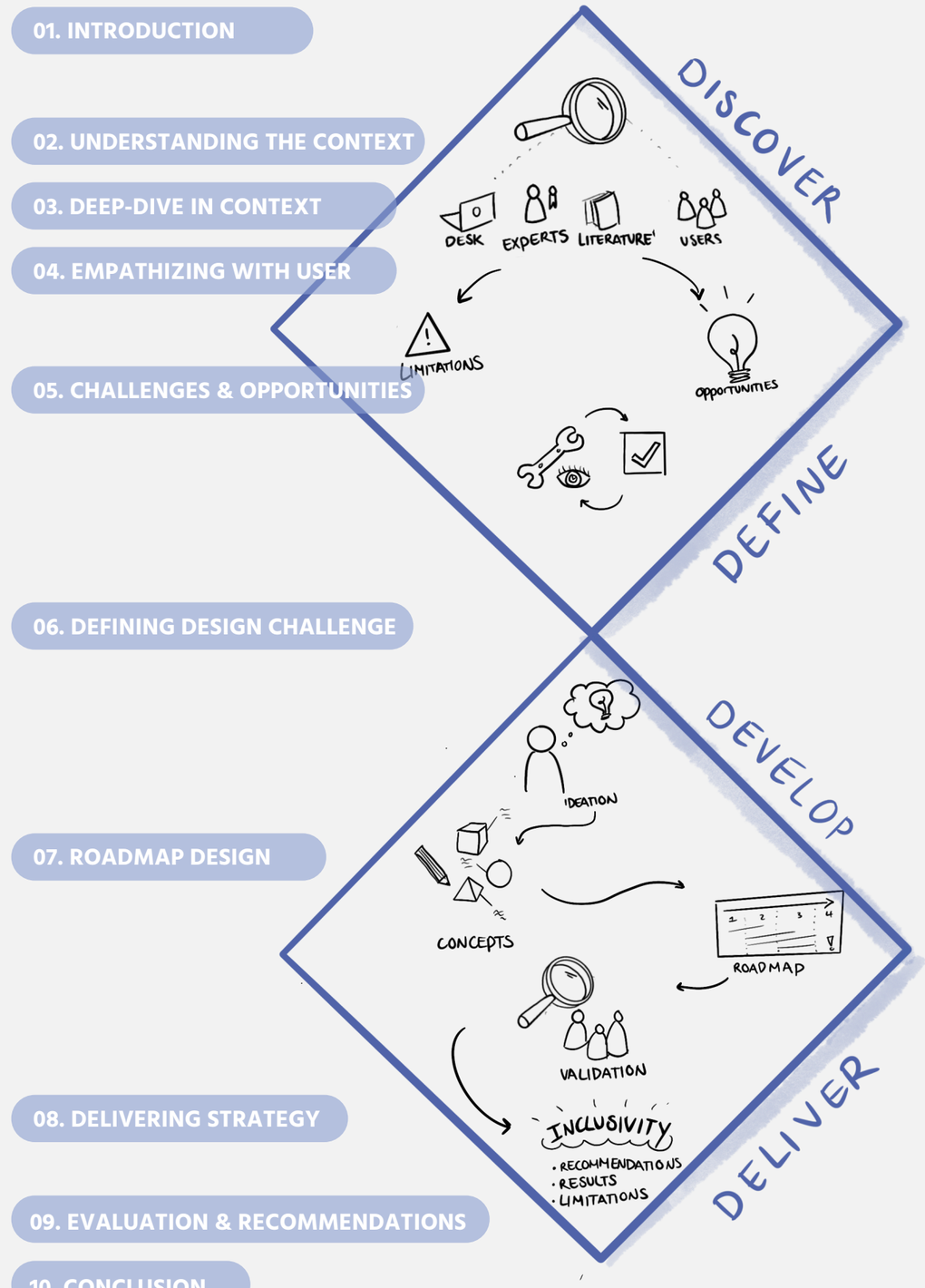


Figure 3: The used double-diamond method together with the devision of chapters

02 Understanding the context

This chapter is focussed on setting the context for this project. As the question ‘What is the future of mobility’ is a broad question, a target-group and area of focus is chosen. This is done by looking through a inclusive lens and analysing MaaS and Special-group transport.

2.1 Inclusive design
2.2 MaaS
2.3 Special-group transport
2.4 RMC
2.5 Setting the context
2.6 Key take-aways

2.1 Inclusive design

If we want to look at the future of mobility, one thing is very important; that the largest possible group of our society can use this future ecosystem of mobility. Age, race, gender, socioeconomic status and physical ability influence passengers' ability and, consequently, motivation to choose new transportation options. However, many people are still not allowed to use now-a-day transportation, shared mobility, or public transportation. These people are among the most vulnerable and disadvantaged group of our society, and they (maybe even more) depend on transportation systems to meet their basic requirements. That's why there is chosen to look through this inclusivity lens during this thesis and a general understanding of inclusive design is needed.

To come up with a more inclusive future for mobility, we mean going beyond basic access obligations. Rail and road transport legislation has long specified requirements for disabled passengers; yet inclusion is not a box ticking exercise, it is more than a blue badge or hand-rail. Creating inclusivity requires integrating a range of accessibility changes across an entire journey in ways which truly comprehend, appreciate and value their mobility requirements and aspirations (Intertraffic, 2022).

What is inclusive Design?

Inclusive Design is a general approach to designing in which designers ensure that their products and services address the needs of the widest possible audience, irrespective of age or ability (Clarkson & Coleman, 2015). It is important to recognize that this world is increasingly shaped by human intervention in which design can enable or disable people, because products and services are considered in terms of the capability demands that they place on the user. It is imperative that we design a world that best matches the diversity present within the population. By recognising that design can play either an enabling or disabling role, it becomes possible to develop strategies that address the challenge of designing for the whole population. So there needs to be kept in mind that the user is simply not 'a set of demands', but a real person that the designer should develop an empathetic relationship with, rather than treat them as "subjects" for usability experiments (Newell et al., 2010).

Inclusive Design vs. Accessibility design

There is a difference between Inclusive design and Accessibility (design), which is essential to understand because it is often used interchangeably. Accessibility is about creating products that are usable by everyone. Inclusive design, on the other hand, is a mindset that involves understanding user diversity. It is a methodology that is human centred and means including and learning from as many people as possible, with a range of perspectives. Accessibility is an attribute of Inclusive design (figure 4) and whilst Inclusive design is about designing for diversity, it is more than meeting a set of standards (Microsoft, 2016). As a result, while employing inclusive design should make a product more accessible, it is not a method for achieving all accessibility criteria. So the different types of accessibility can be kept in mind when using an inclusive design approach, like: visual accessibility (eye abnormalities), mobility (wheelchair-user concerns), auditory (hearing difficulties) and environmental accessibility (mobile device underground).

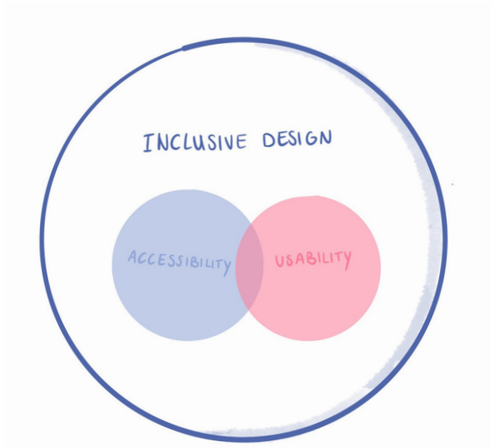


Figure 4: Accessibility and usability are key components of inclusive design

Why is inclusivity important?

Inclusive design enhances the user experience for a diverse audience. Approximately one billion people, or 15% of the world's population (Diability Inclusion Overview, 2022), experience some form of disability. Empathy for a diverse audience is a key component of inclusive design. It helps create an experience where users can feel like they belong, rather than feel excluded (Adobe, 2021).

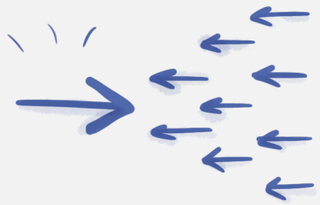
Second, inclusive design can also help boost your brand to position it as a market leader. Nearly two-thirds of consumers globally (63 percent) prefer to buy goods and services from companies that stand for a shared purpose that reflects their personal values and beliefs, and are ditching those that don't (Accenture, 2018).

And when looking at it more practically, because the user experience is accessible to a bigger and more varied consumer base, inclusive design may help improve sales. Users who do not feel empowered to utilize your design will never become clients since they will be unable to use your product.

Microsoft's design principles

In 2016, Microsoft released their 'Microsoft's Inclusive Design Tool kit' (Microsoft Design, 2016). Microsoft is a company that works on digital products, on which they apply these three leading principles. MaaS ecosystems mostly consist out of digital products, therefore these principles will be a guidance during this inclusive design process.

Recognise exclusion - This first principle is that disability happens when their is a mismatch between individuals and their environments, situations or society as a whole. We as designers can identify those mismatches and it is our responsibility to know how our designs can affect these interactions and even create these mismatches. These points of exclusion can eventually help us generate new ideas and come up with inclusive designs.



Recognize exclusion

Solve for one, extend to many

Learn from diversity

Figure 5: The three principles which are the building blocks of inclusivity in this thesis

Solve for one, extend to many - The second principle is about learning how people adapt to the world around them. When we spend time to understand the experiences of people with a limitation to some abilities, we can recognize more than just barriers that people encounter, but also the motivations that all people have in common. What's important here is to understand the adoptions of those people and seek for things that all those people share across their experiences.

Learn from diversity - The third principle is about putting people in the centre from the very start of the process because human beings are the real experts in adapting to diversity. In this way we can recognize different perspectives, which can help us recognize exclusivity gaps. So designing for people with permanent disabilities can feel like a real constraint, but it actually can result into designs that can benefit a much larger number of people. So empathizing and focussing on their pain-points can be a great ingredient for a successful inclusive design.

Challenges

Next to using the previous stated design principles, there are also specific challenges that are going to be kept in mind when people with disabilities are part of the formal user group within a product development environment (Balandin & Raghavendra, 1999)(Sleeman, 1998).

These include:

» It may be difficult to get informed consent from some users.
» The users may not be able to communicate their thoughts, or may be even "in competent" in a legal sense.
» The user may not be the purchaser of the final product.
» Payments may conflict with benefit rules.
» Users with disabilities may have specialised and little known requirements
» Different user groups may provide conflicting requirements for a product.

2.2 MaaS

When it comes to inclusive mobility, we see many agencies but also the municipalities pointing to the innovative solution called 'Mobility-as-a-Service'. In recent years, the increasing number of transport services offered in cities and the advancements in technology and ICT have introduced an innovative Mobility as a Service (MaaS) concept. It combines different transport modes to offer a tailored mobility package, similar to a monthly mobile phone contract and includes other complementary services, such as trip planning, reservation, and payments, through a single interface (Hietanen, 2014). This means that the users can plan, book and pay for their trip entirely according to their needs.

The layers of a MaaS ecosystem

To get a better understanding of MaaS en to discover it's pitfalls, the different layers and levels are explored. When you describe a MaaS ecosystem, a distinction can be made between 5 layers (van der Tas, 2022).

Layer 1: The user
The person it's all about. MaaS offers the ability to give you route with options that are completely tailored to you as a person and your needs. Therefore, especially when we look at inclusive design, where we want to take into account the people who have the most special needs and demand just a little bit more than the usual user, Maas is a good solution. An effective MaaS platform will provide users with the necessary information to evaluate their alternatives. Furthermore, by integrating with mobility service providers and technical partners such as payment services, the value extends beyond simply being properly informed to ensuring that trips can be scheduled easily and navigated with peace of mind (Savignano, 2022)

Layer 2: Integration
This is the integration on which the trip is composed. In many cases, it is referred to as an application on your phone, where one can plan, book and pay for the trip. If we look at the elderly, who often need human contact, it can also be a call centre in which they are helped via telephone. Also, in addition to the integration, there can be a website where everything can be arranged, so that people can do this at home, at ease, on their computer. Interoperability of MaaS platforms means that apps in other areas will automatically communicate with each other, and travellers have no need for a new app or registration to travel elsewhere. The MaaS platform (back end) is government property, and mobility providers can make use of it (provided they meet certain conditions). The MaaS apps (front end) running on it are therefore not necessarily in government hands, but the uniform connection of providers is regulated. The system is thus stable, and guards a level-playing field for mobility providers to increase their market position within any form of competition (Vervoerregio Amsterdam, 2021)

Layer 3: The wheels
With the wheels we mean the actual means of transportation. Think of the RMC vans, subways, shared mobility, but also private cars. In the case of a MaaS platform, it is useful to draw up a reference document. This document will be containing all the relevant matters that mobility providers need to comply with in terms of their physical and digital services in order to achieve a regionally coordinated system that offers users the best options and safety. Conversely, the non-user should not experience any inconvenience. At the time of writing, the municipality of Amsterdam is working on such a municipal conditions document. With conditions for providers of mobility and logistics services, in and through the digital domain. The conditions will have to ensure that these services contribute to the values and norms that Amsterdam sets for mobility. These include inclusiveness, a level playing field, low pressure on public space etc.

Layer 4: Infrastructure
Here is referred to the set of facilities and systems that make it possible to use transport; the roads, the mobility hubs, the elevators, the interchanges, etc. Van der Tas mentioned that now-a-days the infrastructure often has problems, for example, elevators or escalators that malfunction. This can mean that you can't make that transfer flawlessly if you have to change or get out of a subway. In this case, MaaS should provide real-time information about these infrastructural facilities, so that travellers, who for instance use a wheelchair, travel via routes where they can actually get at the station and transfer properly.

Layer 5: Support
The support, or in other words, the people who really offer a hand when it comes to planning, booking and paying for a particular ride. When looking at a MaaS application, this can be done by an AI bot that helps you with questions. It also includes the people who work at the helpline and help with using an app or making sure that people do make the right switch from one mean of transportation to another. What needs to be well integrated here, is learning from feedback. Feedback must be constantly sought from the target audience to ensure that the integration can be developed as well as possible and that the focus of the app will constantly be on taking the user's needs into account.

Levels of MaaS

In addition to the fact that MaaS consists of several layers, a particular MaaS development may include a level of integration. These levels can help with enabling the "comparison of" different services, understanding MaaS' potential effects and aiding the integration of societal goals into MaaS services (Sochor et al., 2018).

Level 1: Integration of information
The first level is only about providing information to the service user, where the user expects to receive free information on how to book a trip. Therefore, in the first level, the provider of the information is not responsible for the quality of the service on which it provides information. The biggest example in the Netherlands is the 9292 app, where one can plan their trip and get details arrival and departure times. Google Maps is also a good example of a Level 1 integration, where the large influx of data makes this tool more 'smart', because it integrates both personal planning information and relevant data.

Level 2: Integration of booking and payment
What the title suggests is, in addition to providing information about a particular trip, that there will be the option to pay immediately for the suggested service. It is now a one-stop shop where users can find, book and pay in one application. This often concerns single trips and can be seen as an extension of a Level 1 travel planner. The Level 2 operator is in charge of legitimate tickets, accurate bookings, and purchasing, but is not responsible for the actual travel services. Most of the MaaS pilots now-a-days are at a Level 2 integration.

Level 3: Integration of the service offer
When we arrive at a Level 3 integration, focus is placed on the complete needs of the user of the application. This means that in addition to proposing a certain route and the possibility of paying for it immediately, the total needs of a household are taken into account. This allows mobility packages to be offered in bundles, and payment will most likely be made by means of a subscription.

From this level, a MaaS operator will really compete with private car ownership. The MaaS operator takes responsibility for the service delivered to its customers, and for its customers towards the suppliers.

Level 4: Integration of the societal goals
In addition to the services listed above, the user will be urged to use a sustainable mode of transportation. They may also be encouraged to use public transportation during off-peak hours and therefore benefit from lower fares. There is a strong emphasis on using soft movement.

At this level, MaaS goes beyond simply connecting the demand for and supply of mobility. Supply and demand are now reflected by how well local, regional and/or national policies and goals are incorporated into the service.

MaaS examples
MaaS applications are worldwide in use, or still under construction. To understand how far we actually are in developing this new ecosystem and what it's potential is, different examples of MaaS are checked out.

Dutch pilot: Goan! (Level 2)
The Dutch government is organising seven pilots for MaaS-services, with one focussing on vulnerable target-groups. This is the pilot in Overrijsel, the MaaS-app GOAN!. This pilot is focussing on the application of MaaS to Social Support Act Transport. This pilot started in 2020 but isn't yet finished. GOAN! is an app with which travellers from Twente can plan, book and pay for their entire mobility journey.

Paul Pieterson on the Pilot: "Before the last lock-down, more than 60 travellers used the app several times and in 20 percent of the journeys a public transport journey replaced the WMO journey. Currently, not a single MaaS pilot in the Netherlands is profitable enough to continue without government support. The technology is in order everywhere, but the marketing and connecting travellers is the most difficult. It

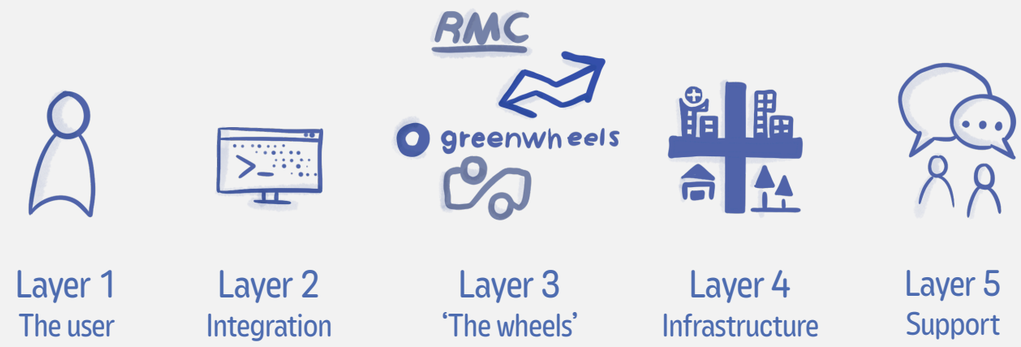


Figure 6: The five layers of MaaS

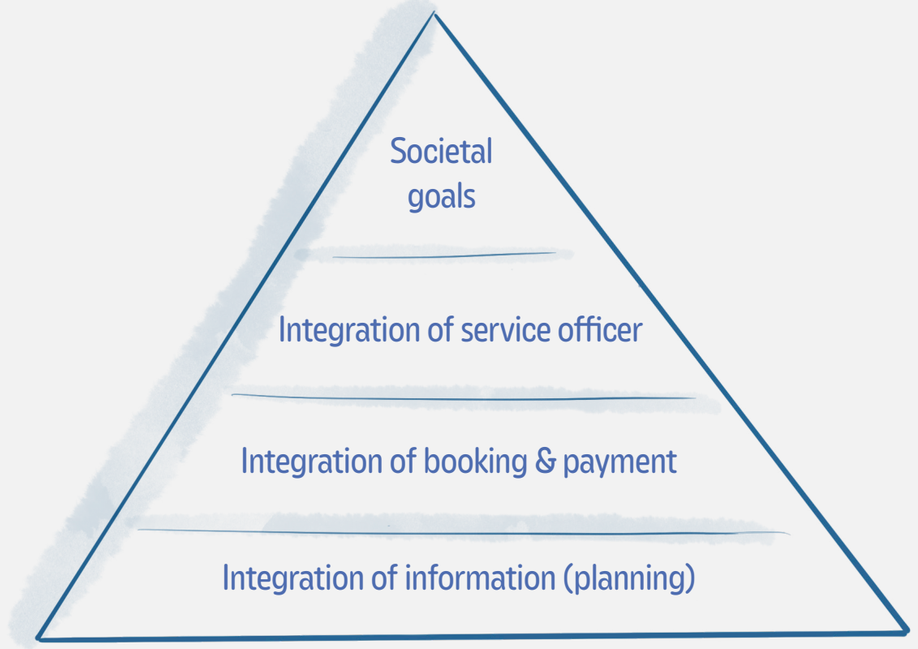


Figure 7: The different levels of MaaS (from bottom to top)

would be a shame if all knowledge is lost and transport and the GOAN! app come to a standstill as of 2 October. Other regions can learn from this." (OV Magazine, 2022). The Noaberhopper is a new initiative in Twente which is also a part of the GAON!-app. It is a bus which can bring you to a bus/tram/train station from your front-door and back. It is meant to bring Taxi and PT closer together. It operated from 9:00 - 21:00, so not in rush hours, to smooth out the crowds and to allow travellers to travel more spread out in the vehicles. It is part of the pilot and is now financed with a subsidy from the government and costs 0.50 cents per km per person. This means that if the pilot of GOAN! fails, Noarberhopper wouldn't be able to operate any further without this subsidy (Noaberhopper, 2022).

Figure 8: Logo of the GOAN! pilot (GOAN!, 2022)

Moves (Level 2)
The Moves app allows people to plan their entire trip, throughout the Netherlands, within one platform. Moves offers travellers a flexible choice to travel door-to-door with a combination of transport modes. However, it is limited to a number of transport operators. Thus, users can plan their public transport trip, arrange a cab, reserve a shared car or rent a scooter. This is an example of an app that reduces the need to use stand-alone apps.

Whim (Level 3)
We can see that more and more pilots and initiatives are entering the Dutch market, but actually all these MaaS solutions only offer an integrated mobility service via a pay-as-you-go option. We do not yet see a level 3 integration being achieved, where various mobility modes are offered via bundles and subscriptions.

However, this level of integration has been successfully piloted: Whim. Whim is one of the few examples where this level of integration has been tested on a large scale. Whim is a Finnish company launched in Helsinki in 2016. The subscribers have multiple options, ranging from a 'to go subscription,' which allows them to use different services flexibly and pay for each service purchased, to a 'unlimited subscription,' which allows them to use the various mobility services indefinitely for a fixed monthly fee (€499). Whim thus caters to a wide range of travellers, from frequent to infrequent commuters. According to a Whim review, users utilize public transportation more regularly, are more likely to hire a taxi than non-Whim users, and shared bicycles offer a solution for the first and last mile in particular. Users' travel habits are definitely

HUBS

When planning a trip with a MaaS application, it is likely that you will use multiple modes of transportation to travel from A to B. We also call this 'Multi-modal travel': A way of traveling that uses different modes of transportation to produce a seamless door-to-door travel experience (European Commission, 2019). Think of the combination of walking, using public transport and travel by a taxi.

To facilitate the switch between these modes, mobility hubs are established. A mobility hub is a place with a high concentration of seamlessly integrated modes of transport (i.e. shared vehicles) and facilities (i.e. charging stations) in an attractive urban design (Deloitte, 2022). So, it provides a convenient place to transfer between different modes, offered by, for example, a MaaS application. Less then a quarter of the municipalities already have mobility hubs, like the Municipality of Amsterdam. The most interesting type of HUBS for MaaS within a region is the 'Wijkhub', in this hub, different forms of mobility from the neighbourhood come together, with the primary goal of reducing the pressure on public space. The district hub can accommodate many functions, each with its own purpose (Gemeente Amsterdam, 2021). Important functions are:

» Storing private cars, bicycles, motorcycles and mopeds, mainly because parking spaces in the public space are limited. The neighbourhood hub is, in effect, the replacement for parking spaces that are normally constructed under buildings or on the street;
» Partial mobility, for the last mile into the neighbourhood, or as a follow-up journey to the rest of the city or city-out. Last-mile into the neighbourhood is primarily intended for residents, businesses and their visitors. We refer recreational visitors mainly to city and regional hubs;
» Connection to the urban public transport network;
» Charging of electric vehicles;
» Possibility of energy storage with emission free (shared) cars, bi-directional charging and connection to local energy generation/networks.

Figure 9: Visual representation of a mobility hub (interreg, 2021)

‘Potential’ groups

These pilots, examples but mainly the future vision of MaaS sounds promising, but if we look from an inclusive point of view, who are they focusing on now? One of KiM’s MaaS studies (Zijlstra et al., 2019) reveals a top 10 of characteristics that increase the likelihood of using MaaS. The more characteristics on someone from apply, the greater the chance that he or she will use the MaaS innovation. These characteristics are:

- Currently use public transport
- Live in households without cars
- Aged 25-34
- Highly educated
- Digitally skilled
- Frequent airline travelers
- Strong environmental concerns
- Go out a lot
- People who are well mobilised
- High income

This KiM conducted research into the profile of the groups within the Dutch population who were most likely to use MaaS, was commissioned by the Ministry of Infrastructure and Water Management’s MaaS team. Within the current government, this is a big player when it comes to the development of a MaaS ecosystem. But if we start to see MaaS as a tool to make mobility even more inclusive, the focus should be on the group that is even ‘least’ potential, to make sure everybody can participate in this new way of travel.

Therefore we need to recognize the exclusion which is happening in their focus and we should seek to find these points of exclusion. This can eventually help generate new ideas and come up with inclusive mobility designs. Thus, this less potential group may have characteristics such as:

- Currently unable to use public transport
- Aged 60-80
- Not Digitally skilled
- Have a (small) disability
- No big concern on sustainability

If we can focus more on these people when designing this new mobility future and learn from their diversity and adoptions in the now-a-day world, mobility will become more inclusive and useful for the largest possible group.

Figure 10: Recognize who you are excluding

2.3 Special-group transport

To design a more inclusive future, we should know who these people actually are and how they adapt to the world around them. In this way we can recognize more than just barriers that people encounter in their current mobility habits, but also the motivations that all people have in common.

Who are these people

The characteristics of this ‘less’ potential group is comparable with the characteristics of the vulnerable groups in our society, which are people with a disability, elderly and students in special education. An indication of the size of these groups in the Netherlands can be seen in figure 11.

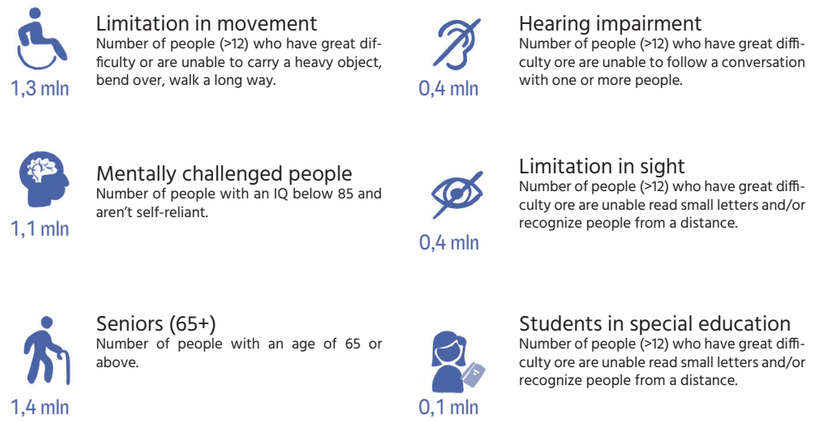


Figure 11: Different tartget-groups of SSAT

Special group transport

Next to own car use and public transport, a lot of these people use ‘Doelgroepenvervoer’, now referred to as Special-Group Transport (SGT), this is a form of Demand driven transport (DRT). DRT is a shared private or quasi-public transport for groups travelling where vehicles alter their routes each journey based on particular transport demand without using a fixed route or timetabled journeys (Interreg Europe, 2018).

Special-Group Transport gives people, from young to old, who can’t travel by regular means of transport, a possibility to travel from A to B. SGT cares for the participation of vulnerable groups into a more ‘inclusive’ society (It’s Public, 2021). There are different forms of SGT transport. The following forms are the responsibility of the municipality:

Social Support Act (SSA) transport - A citizen can claim mobility-related aids and facilities under the Social Support Act (Wmo 2015). Individual transportation facilities, such as wheelchairs and scooters, are distinguished from communal transportation services, such as regional taxis. You must have a specific indication to utilize SSA transportation, which is provided by the municipality.

Regeling	Verantwoordelijke	Budget in 2015 (begroting)	Aantal gebruikers	Aantal ritten in aangepast vervoer (persoon van A->B) per jaar	Gemiddelde combinatie graad per voertuig
AOV (Wmo)	OJZ, afd. Zorg	€ 16.000.000	40.000 geïndiceerden/ pashouders[3]	Ca. 1.000.000	1,18 – 2,5
Leerlingenvervoer	OJZ, afd. Onderwijs	€ 5.000.000	2.000 (waarvan 1100 gebruikers aangepast vervoer)	Ca. 88.000	5,3
Jeugdhulp (Jeugdwet)	OJZ, afd. Jeugd	€ 200.000	Ca. 250	onbekend	onbekend
Dagbesteding (Wmo)	OJZ, afd. Zorg	€ 1.209.974	onbekend	onbekend	onbekend
Schoolzwemmen	Sport en Bos, afd. Sport	€ 500.000	4000	Ca.320.000	Ca. 30-40
Schooltuinen	OJZ, afd. Onderwijs	€ 137.250	2000	Ca. 160.000	Ca. 30-40
Cultuurbus	Kunst en Cultuur	onbekend	onbekend	onbekend	onbekend
Participatie	PWI, afdeling Participatie	Nog niet bekend bij PWI	Kleine instroom, die komende jaren zal groeien 100-125 werknemers via Pantar	-	-

Figure 13: Regulations of the Municipality of Amsterdam, costs, numbers of users and trips (2015)

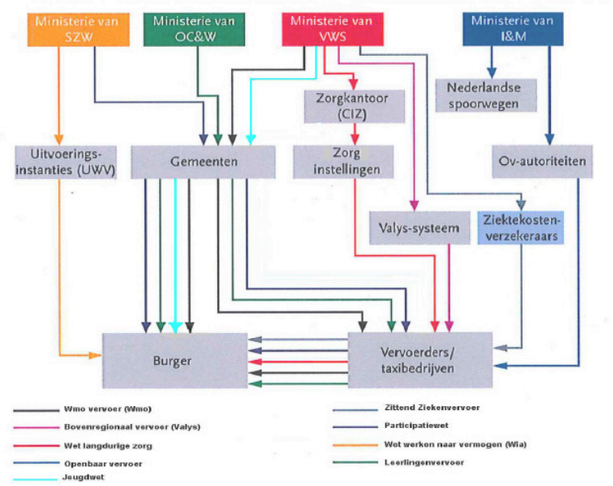


Figure 14: Diagram of schemes of mobility services in Amsterdam

Student transport - Student transport concerns the transport to and from educational institutions. The target group consists of pupils in special education or pupils who cannot attend regular education in their immediate living environment.

Transport under the Youth Act - Under the Youth Act, youth assisted transportation has been available since 2015. This is about transporting young people to and from daily activities or short-term stays.

Transport in the context of the Participation Act - This concerns transport for people with a work disability to and from sheltered employment.

In addition, there are forms of target group transport that are carried out by other authorities and funded by the government:

- Valys is a service that has been created for supra-regional transport with a social-recreational character in order to give more geographical action radius. SSA transport is limited to a maximum of 5 zones, while Valys can be used for 5 zones or more.
- Transport to and from work (Wia)
- Transport to and from vocational training courses (WOOS)
- Transport to daytime activities or day treatment (Wlz).
- Seated patient transport. This concerns transport by car (private car or taxi) or public transport to institutions or persons with whom patients receive care. This transport is paid for by the health insurer.

The diagram (figure 14) shows which schemes exist and which organizations are involved. The fact that the powers and implementation are fragmented, makes it difficult for the user to find his way through the different types of transport. The integral mobility needs of the customer (individual or family) are not met in the implementation, because the possibilities are viewed within the limits of one's own regulation. There is also a lack of clarity about the different rules for users and apparent inefficiency in implementation, not per scheme but overall (Forseti, 2021).

SSA-transport

Not all people in the different target-groups actually use their right to make use of SGT transport. The actual number of users per different category of SGT transport can be seen in figure 13. SSA transport is by far the biggest provision, with over a million trips per year. SSA transport is intended for visits (for example: family, friends, or the dentist) and for leisure activities (such as shopping, sports or a day out). Users can request a ride to an hour in advance, so the transport depends on demand. Transport is usually door to door. Users receive an 'AOV pass', which is a pass with which they can book the SSA-transport, based on an indication or when the applicant is 75> years old.

There are four types of transport: protected transport, traveling door-to-door together, door-to-door plus and room-to-room. RMC is the carrier of protected transport and door-to-door traveling together, Transvision provides door-to-door plus and room-to-room trips. From august 2022 onwards, RMC will be responsible for all SSA transport in the municipality of Amsterdam (Gemeente Amsterdam, 2022).

2.4 RMC

Now that we know that SSAT plays a major role within our national mobility offerings and we know it works, let's dive a little deeper into the organizations that make this type of transportation a reality. A big player within the SSAT is RMC. They are the largest operator in the Netherlands and the only SSAT operator in the Municipality of Amsterdam.

Together, RTC and RET founded RMC in 2003, which, in addition to Custom Transport, also houses student and staff transport. Since 2017, RMC has also provided SSAT in Amsterdam and student transport in The Hague, based on the Social Support Act (WMO). People can book a trip with RMC when they are in possession of an SSA-card. This can be done directly online (website or app) or by telephone via their call centre. RMC then plans the journey and let them know what it will look like. Their drivers take into account the possibilities, but also the limitations of the customers (RMC, 2022).

The Municipality of Amsterdam pays RMC a rate per trip, the more trips RMC makes, the more money they get. There will be a change from 2023 on, there will be a certain limitation on the amount of trips RMC can make a year, which means that if RMC does more trips, the rate per trip will drop and they will not make any profit and even make a loss. To help with reducing the amount of trips that are made, a new regulation is coming in which users can only travel approximately 1500 km a year, to make them aware of their travel behaviour.

What RMC sees, is that there is improper use of their services. People use it to go to the hospital or an other medical treatment facility. This is not the proposition of WMO and should be financed by VWS. When looking at door-to-door travel, we see that traveling to a medical institution (42%) and traveling to family/friends/acquaintances travels (32%) are the most common reasons for people to use SSA-transport. They expect that this 42% which is going to a medical institution, is not all just to visit someone, but also to have a medical treatment themselves (Mobycon, 2021).

Figure 15: Examples of busses which drive around in Rotterdam and Amsterdam (RMC, 2022)

Current data on RMC

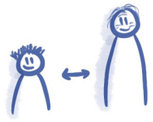
To understand the daily operations of RMC and the motivation of their users even more, there will be looked at raw data of all users. Over the past 5 years (since they started doing SSAT transport in 2017 in Amsterdam), RMC kept track on their users' data, to learn from these insights.

Made trips per year

When looking at the total trips that RMC made in the past years, they went from doing 1.076.801 trips in 2019 to only 497.296 trips in 2021 (see appendix B01). This is a major relapse in SSAT. Despite the reduction in use of SSAT, the municipality of Amsterdam still wants to reduce the use of SSAT. From 1 January 2022 onwards, if you use RMC transport, you may travel a maximum of 1500 kilometres per year with your AOV pass instead of unlimited.

Time between booking and actual trip

SSAT is characterized by a structural and repetitive character and is usually scheduled by RMC using as much as possible permanent drivers and vehicles. This is also an important element in the cutlery. The schedule is pre-filled (RMC, 2022). This means that SSAT trips are not the most spontaneous made trips, because people have to book in advance to make sure they can be on time. When looking at the data (see appendix B02) we can see that the time people are calling before their actual ride is way higher for the people who make an appointment for a trip via the telephone in comparison to the people who book with the app. So, when booking a trip with the app it appears to be more spontaneous. Although the time difference between app users and people who use their telephone is big, the difference in time for the people who book via telephone is decreasing every year, they are noticing they can book their trips in less time before their actual trip.



Age difference

So, who are these people that use the telephone to book their trip (more) in advance. We can see (appendix B03) that from the age of 50-60, more trips are booked via telephone than by using the mobile app or desktop and this difference only gets bigger when the age gets older. Until a point that we even see that of the people of age 70-80, almost 4/5 books their trip via a telephone call. Which means that for this group, the trips can be less spontaneous.

Type of disability

It is compelling to see these huge differences in phone usage by the users of RMC, but another big characteristic of these people is the type of disability they have (see appendix B04). In all age categories the people who booked the most trips were able to walk (don't need a wheelchair or walker). This means that the biggest group of users is actually able to walk a minimum of a short distance, which means they are potentially not only dependent on SSAT. When we look at this 'able to walk' group, we see that the Mobile-App usage is stagnating and then decreasing from the age of 50-60 onwards, which is in line with the findings at 'age difference'. So the biggest user group of RMC is able to walk, 60+ and books their trip via telephone.

2.5 Setting the context

To be able to aim for a more inclusive mobility future, the context needs to be framed. By using a more user-centred focus, the target-group needs to be more specific, as well as the geological area we are going to focus on. This is done to be able to do more in-depth research.

Target group

As we could see is that SSA transport is one of the largest types of transport done for people who now make use of SSAT. To focus even more on a specific user group, elderly are chosen as the target-group for our innovative future of mobility. The focus of the MaaS experts is now mainly on the 'most potential group', which are young people, with a great understanding of technology and who are the most mobile. Aren't we then forgetting about the elderly (65+)? We should not avoid the bigger challenge. When we look at inclusive design, we need to spend time to understand the experiences of people with a limitation to some abilities, only then we can recognize more than just barriers that people encounter, but also work towards the motivations that all people have in common. What's important here is to understand this challenging group, to be able to design for all. What makes this challenging group special is that this group makes the least use of mobile Apps. When implementing new MaaS systems, this will mostly be done via apps. It is therefore interesting to know how we can make this group switch and get to know their special needs when it comes to technology.

In addition, we currently have a 'Vergrijzing' in the Netherlands: people are getting older, more elderly people every year. Together with that, elderly want to live at home as long as possible, this is encouraged by the municipalities. Which means mobility of these older people becomes more important.

Area

The focus will be on transportation within the Amsterdam region. This choice was made because RMC is the only operator of SSAT within the municipality of Amsterdam, and the data they can provide is mainly about users within this region. With this chosen region, more specific research can be done on geological developments and interviews can be done with experts within the municipality of Amsterdam.

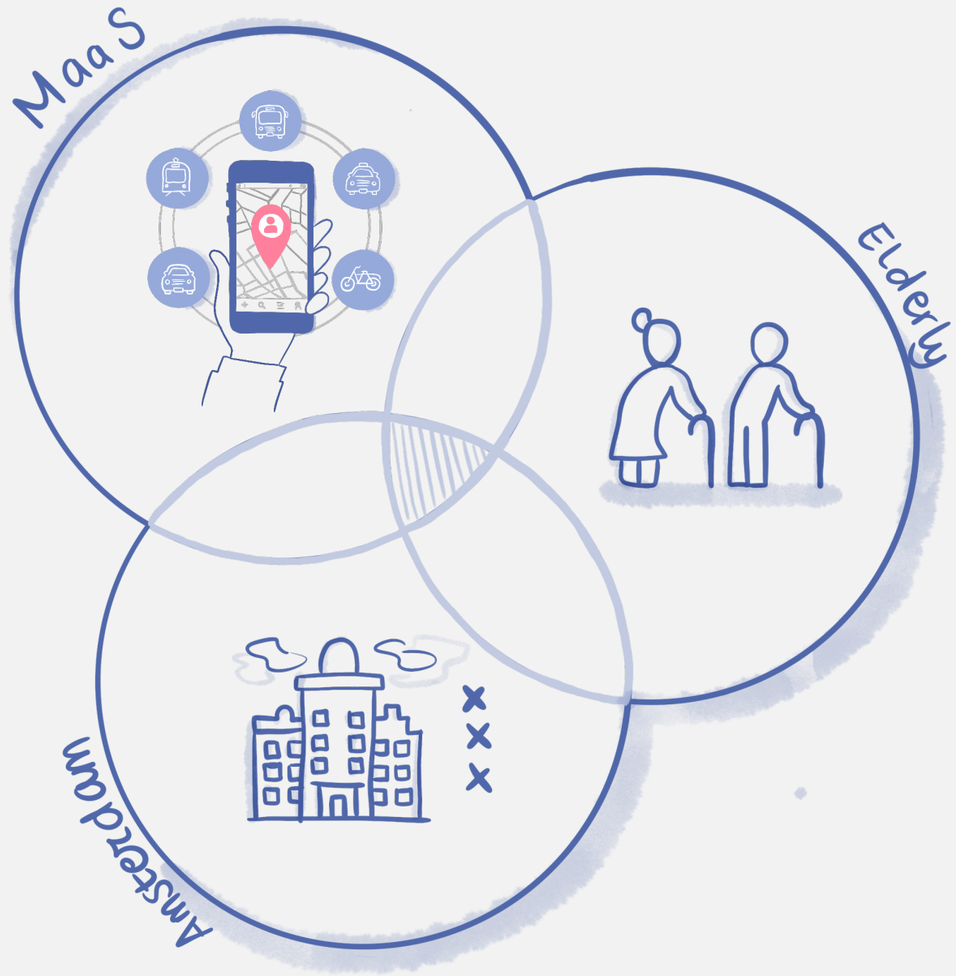


Figure 16: The context lays within the region of Amsterdam, focussed on elderly and seeking for a solution with MaaS

2.6 Key take-aways

- **MaaS is often seen as an "ideal future," but actually there is no fully successful example in europe yet from which we can derive this.**
- **A large group of people with some form of disability rely on the use of SSAT, but there is an attempt from the municipality to reduce this use, without providing good alternatives.**
- **The world of SSAT is complicated, different carriers must be used for different types of trips. Users are often unaware of this themselves, resulting in a lot of "illegal" use.**
- **MaaS seems to have potential, it is therefore of great importance that inclusive design plays a role in establishing this, making sure no-one is left behind.**
- **By looking through an inclusivity lens during this thesis, we focus on the less potential group, allowing us to create a future mobilization vision that as many people as possible can take advantage of.**
- **The most interesting group of users to look at is the elderly, they often suffer from physical disabilities and are least familiar with mobile apps, we can therefore learn a lot from this differentiation and design more inclusively.**

03 Deep-dive in context

This chapter dives deeper into the chosen context. It looks at theoretical information on our target-group and their options of transportation. The focus is on the future, what are current initiatives to encourage a change in behaviour of elderly in the future? And what are the travel motives of these elderly and how will they change? In addition to these questions there has been looked at current trends and signals of change, which will play a role in the development of our future vision.

3.1 Current initiatives
3.2 Travel motives of elderly
3.3 Signals of change
3.4 Key take-aways

3.1 Current initiatives

To understand how organisations and the municipalities are currently trying to improve on inclusivity in mobility in practice for this elderly target-group and to define what essences underlie the success of these initiatives, examples of current initiatives were gathered.

What we see in different researches of the municipality of Amsterdam but also the rapport of the Ministry of Infrastructure, is that next to making the whole mobility offer in a city more inclusive, SSAT needs to get more efficient. Their main reasons is to decrease the number of rides RMC makes, which is better for the environment and also cost-efficient.

Four different approaches can contribute to a more efficient target group transport system (Ministry of Infrastructure and the Environment, 2016):

Transition to public transport and vice versa; encouraging people with a mobility impairment to use regular public transport or to encourage people who currently use regular public transport (thin lines) to use target group transport.

An additional approach is the use of self-driving vehicles. Self-driving vehicles can be used for pre and post transport to and from public transport, but also to make the entire journey.

Chain travel; possibilities for integrating target group transport and public transport at the system level.

Combining journeys, integrating different forms of target group transport, priority and non-priority journeys,

Initiatives

Next to seeking more efficiency, the ministry of infrastructure has high ambitions to make mobility more inclusive in the short term. They want to do this by focussing on the integration of SSAT and public transport. In this way people with an disability can travel with public transport as well, making them less dependent on RMC and more immersed in the travel environment of the majority of the population. There are already some initiatives and measures to stimulate new travel behaviour and to make public transport more accessible among vulnerable target groups (see table 1).

Table 1: Initiatives to stimulate new travel behavior

Initiative	Description	Category	Sources
Accessibility information app	Developing apps that provide (personalized) information about stops and vehicles (or even public spaces) and on which, if necessary, the route can be planned for different modes of transport. E.g. Haltebuddy, a prototype from the Municipality of Amsterdam, Vervoerregio Amsterdam and the GVB or the Wayfinding app for the visually impaired from the Hogeschool van Amsterdam	Providing information	(Haltebuddy Prototype, 2022) (Digital Life Centre, 2019)
Travel assistance app	Making an app available that can guide people with a mobility impairment during their journey. The GoOV app offers travelers the opportunity to call a helpline and escorts to 'watch' during the ride. Buzz Buddy has the same capabilities but is a GPS device for people who cannot operate a smartphone.	Guidance	(GoOV, 2022)
Assistance by personnel	Expand the travel assistance for every public transportation mean. On NS-stations there is already personnel to help with getting on-board or off-board a train.	Guidance	(NS, 2022)
Assistance by volunteers	Deployment of a pool of volunteers who travel together with vulnerable travelers. See for example the German app MobiMate which matches travellers in need of assistance to travelers on the same route. In the project Eigenwijs op reis by Handjehelpen, volunteers train children in special education in Utrecht to travel independently to school.	Guidance	(CROW, 2020) (Handjehelpen, 2022)
Eén-stap-verder-service	Deploying a service where people with disabilities receive personal guidance at stations to the connecting station public transport, taxi or pick up/drop off location. With the Eén-stap-verder-service, NS is already deploying NS employees to help people with a visual impairment.	Connection OV	(NS, 2022)
OV-coaches	Set up public transport coaches so that they teach people who are vulnerable or feel unsafe to travel independently. Also public transport ambassadors can help with this: these are seniors with a lot of knowledge about public transport who voluntarily guide other elderly people make in public transport.	Stimulate new travel habits	(Doe mee met het OV, 2022)
Free OV-card	Making available a free public transport card or a card with a discount for people with reduced mobility. With Sentire, for example, people with a visual impairment already travel with public transport at a lower rate.	Stimulate new travel habits	(Sentire, 2022)
OV- and WMO-card all in one	Stimulate target-group transport passengers to use public transport by offering one pass for Wmo transport and public transport. In Limburg there is the Voor Elkaar Pas for transport from Arriva and Wmo carrier Omnibuzz. Valys also has a Travel Pass for both Valys transport and public transport.	Stimulate new travel habits	(Voor Elkaar Pas, 2022)
OV-opstapdagen	Organizing 'introduction days' for vulnerable travelers who do not know how public transport works. West-Brabant 'OV-opstapdagen' for people over 65 in which they learn how the chip card works and how the bus works in practice.	Stimulate new travel habits	(DTV Consultants, 2022)
Guidelines for WMO-consultants	Establish clear guidelines for Wmo consultants that record when someone has no choice but to travel by Wmo transport and offer those consultants handles on how they can encourage applicants to use public transport. In 'Eigen kracht versterken' by the Manicipality of Dalfsen, consultants are trained to point out the possibilities of public transport to users.	Stimulate new travel habits	(Gemeente Dalfsen, 2022)

3.2 Travel motives of elderly

To understand whether mobility will continue to play a major role for our chosen target group in the future, we will look at their motives for getting around. Indeed, it is possible that the needs of the elderly to travel will no longer play a role in the future due to technological advances or changing norms and values, for example. To identify different travel motives of elderly, data from a satisfaction survey on SSAT for the Municipality of Amsterdam (Mobycon, 2021) was combined with the user data (RMC).

The current motives (from biggest to smallest) are (see appendix C):

- Medical institutions
- Neighbourhood Centres
- Shopping centres
- Friends/family
- Entertainment/theatres/cinemas

Medical institutions
The greatest motive for travel for the elderly is to medical institutions. Most often for themselves, but also to visit the sick. With the rise of video doctors and online help, the need for this type of travel will decrease somewhat, but because there is often also a social aspect to it, the older target group will still often continue to make these trips in the future. Also because a large part of the target group is used to doing it face-to-face (even the people who are now in their 50s). These are mostly medical institutions which are nearby.

Neighbourhood Centres
The idea of community centres is to ensure that older people have an activity to do and can socialize with others. Therefore, this will continue to be of great importance to this target group in the future. These centres are most of the time located within the region of the homes of the elderly.

Shopping centres
With the development of online shopping, it is expected that this will spill over as we shift generations. This means that in the future fewer trips will have to be made to shopping centres, as much can be delivered to the home. Still, there are exceptions where it is seen as an outing, or when there are things to buy that really want to be looked at.

Friends/family
It is very important for this target group to visit and talk to friends and family regularly. Now that there is the possibility of video calling, and this is also being made increasingly easier for the elderly, it is expected that this will start to decrease somewhat. These are also often trips outside the region, which needs to be arranged more nationally when it comes to an innovative mobility solution.

Entertainment
This is very dependent on the type of elder and the type of entertainment they are looking for. A lot of entertainment these days can be done online, allowing seniors to play cards with each other, watch movies and draw on, say, an iPad. We expect that older people will become more and more proficient at using these, which will reduce these kinds of trips a little bit. Still, they will often want social contact with others, so these kinds of short trips, often within the region, will still be applicable.

3.3 Signs of change

The expected change in older people's motives for travelling is expected to remain that way. Along with the initiatives that are already in place to change the behaviour of these elderly people, there are also other factors that could make the future of mobility look different for our target group. These I call 'signs of change' . From the beginning of the project, I kept my eyes open for interesting trends and developments during the literature research, but also through qualitative socializing. In my opinion this plays a vital role, because the different trends and signs can be the building blocks of the eventual future vision of the roadmap.

Demographic

Citizens of Amsterdam

The city if Amsterdam is chosen to be our context, since RMC is responsible for SSAT transportation within this region. When we look at the population, we see that at the beginning of 2015, Amsterdam had 98,000 citizens over-65s (12% of the population) and the number of over-65s will continue to increase. In 2012, 14% of the households of Amsterdammers aged 55 and older made use of one or more AWBZ or WMO provisions, such as personal care, guidance or daytime activities. That equates to more than 20,000 households (Gemeente Amsterdam, 2016). This number of households will also grow in the coming years, due to "Vergrijzing"; Age expectations are getting higher, more elderly people (CBS, 2022b). Not only elderly are a big part of the users of SSAT, but also people with a disability. 31% of Amsterdammers aged 18 and older suffer from one or more long-term illnesses, disorders or handicaps, whether or not due to old age. About three quarters of Amsterdam residents with chronic complaints feel hindered in their leisure activities, such as sports and travel (74%) and therefore have a potential demand for mobility. This concerns about 185,000 Amsterdammers. (Gemeente Amsterdam, 2016).

Economic

Citizens of Amsterdam

The PBL and CPB expect that the Dutch economy will grow in a balanced way again (Manders & Kool, 2015). In that case, the prosperity of the Dutch population will increase and the financial position of both citizens and governments will improve. As a result, people are more willing to give substance to individual forms of transport. On the other hand, governments are in a better position to make financial contributions to SSAT or MaaS related innovations.

Ecological

Sustainability

The occupancy rate of the vehicles is lower than what is possible (CROW, 2016a). Sustainability is an increasingly important topic. Although making SSAT more efficient is intended to save costs, it can also contribute to environmental objectives.

Social-Cultural

Individualization

People want and get more freedom of choice to make their own choices (Domotex, 2017). On the one hand, people will want to make less use of SSAT, because they prefer to look for solutions themselves. On the other hand, people will be less able to fall back on help from others and will therefore be more dependent on themselves. This leads to an increase in SSAT, because then there are fewer alternatives, or they are simply not aware of them.

Transport demand

The average Dutch person is traveling more and more, and this is expected to continue. Especially after the COVID-19 period, the traveling of Dutch people has exponentially grew. This ensures that there is more demand for transport. (Van Mersbergen, 2021)

Urban

Better navigation

An important signal of change is that municipalities enlist transportation and infrastructure planners to improve the navigation within cities. An initiative in London (Transport for London) uses human-centred design principles to help citizens and visitors find their way around the city more easily. They use maps to indicate how far one could walk in 5 or 15 minutes, taller signs, transport interchange information and other traditional directional signs (Applied, 2022).

More inclusive infrastructure

The University of Washington created AccessMap, a map-based program that allows users to enter a destination and obtain suggested routes based on configurable settings such as limiting uphill or downhill inclines and the maximum duration they may walk (Salman, 2020).

Mobility

New demands for mobility

Because the focus is on bundling the public transport offer, there is a task for pre and post transport; small-scale flexible forms of transport to the public transport nodes are needed. This makes it possible that these forms of transport can be integrated with SSAT. In addition, due to the strong public transport connections in urban areas and on long distances, SSAT will evolve from a door-to-door system to a part of the chain relocation. Compared to the current situation, SSAT will then be fragmented. An important caveat here is that regular public transport must be available to travel to the major public transport hubs. When this is not possible, there will be a greater demand for SSAT (CROW, 2014).

Self driving cars

The self driving car is a technological development that can make demand-driven transport possible (Dailey et al., 2017). This can ensure that SSAT can be designed more efficiently. Mainly due to the development of 'Vehicle-to-everything' (V2X), which refers to passing information from a vehicle to any entity that may affect the vehicle and vice versa (Thales, 2021).

Seamless experiences

In order to improving mobility experiences, transit leaders are already focusing on establishing integrated digital platforms, enabling varied payment modes, and boosting data utilization to better understand their clients. This is one method of providing passengers with a more seamless experience by introducing multi-modal options digitally (Metro Magazine, 2018).

Political

Decentralization

Decentralization of governmental tasks from central government to municipalities. Since 2015, municipalities have been responsible for youth care, work and income, as well as care for the long-term sick and the elderly. Various domains from which SSAT is derived have therefore been delegated to municipalities. It is also expected that these municipalities will have more to say on the budgets for mobility than they have now (Rijksoverheid, 2019).

Tendering

As of 1 July 2016, the Procurement Act 2012 was amended; changes have been introduced for the tendering of target group transport. The moment a tender appears to be 'abnormally low', an explanation can be requested from the tenderer. However, the question is when the registration is 'abnormally low'. However, because the target group transport market is under pressure, it is a frequently heard complaint that tendering authorities pay too little attention to quality and too much to price (CROW, 2016b). Although, there are signals that they are shifting towards inclusive thinking. This means that they are lowering regulatory barriers for providers that address inclusion. For example, new rules from the Disctrict of Columbia's DDOT say that operators of dock-less vehicle services must offer rental offers that don't require smart-phones. They must also offer prices for people with low incomes and distribute their cars more equitably across the area (Disctrict of Columbia, 2020).

Indexing

Municipalities have become stricter with indexing; access to WMO is made more difficult. This is due, on the one hand, to the austerity measures and, on the other hand, to the policy to increase people's self-reliance and to call on people's own network. The stricter assessment has a dampening effect on the use of WMO transport. (Movisie, 2022)

Technology

On demand transportation

ICT applications in combination with the use of big data and streaming technology make transport on demand (real time) possible. The core of these new concepts is the coupling of supply and demand. The user can indicate that he wants a ride from A to B, if necessary with specifications regarding the vehicle (accessibility, quality, etc.). This message is immediately forwarded to vehicles connected to the application, which are located in the immediate vicinity, where the vehicle meets the requirements of the user and where the requested route fits (Kramer, 2017). Together with the development of Intelligent Mobility Meters (IMM), which counts the number of pedestrians, cyclists and vehicles in particular areas, better transportation schemes can be made and on-demand transportation becomes more of a reality (Mobility 21, 2019).

Digital helping aids

GoOV, Buzz Buddy, Be my eyes (for the visually impaired) are examples of digital aids that enable users to use public transport independently (again). These tools are a combination of positioning, travel planning and information, possible remote support (helpline) and small cameras (Be my eyes). A pilot with more than a hundred users of student transport in Arnhem shows that a combination of the use of the GoOV app and training results in almost 85% of the participants being able to make the journey by public transport independently. (GoOV, 2022)

Ticketless public transport

In the Netherlands, OVpay is a new way of checking in and out in public transport. With this development, PT users are given the freedom to choose with what they can check in and out. It can be with your contact-less debit card, credit card or your mobile phone. It is already possible in several places in the Netherlands and soon it will be available everywhere (OVpay, 2022).

3.3 Key take-aways

- As the government wants to encourage the use of PT for elderly, there are already some initiatives to realise this. However, these initiatives are on a small scale and we see no decrease in number of trips per year when looking in the data of RMC.
- The combination of PT and SSAT is a well-discussed topic, this can be a first step to making transportation for vulnerable elderly more efficient.
- Travel motives of elderly seem to stay the same in the future, as they seek for personal contact, prefer shopping in real life rather than online and they are less susceptible to new technology. This makes mobility even more important in the future for them.
- Trend analysis has provided information on advancements in a variety of fields that present both opportunities and threats for the creation of a new MaaS service.
- The world of mobility is rapidly changing, as autonomous vehicles and helping aids come to the market, it will become more accessible to travel from A to B by other means. Municipalities see this as well, and encourage new mobility parties to become more ‘inclusive’.

04 Empathizing with consumer

In this chapter, empirical research was conducted to better understand and examine elderly's behaviour, wants, and values. By first doing empathizing sessions by driving with a RMC van, general knowledge and empathy was gained. More specific interviews could then be conducted, where seven contextual needs were defined. To make the various elderly more tangible and useful, persona's were created to be used in the final roadmap.

4.1 Empathizing session RMC
4.2 Defining the needs
4.3 Persona's
4.5 Key take-aways

4.1 Empathizing session RMC

To get an understanding on the perspective and the needs regarding inclusive mobility, a qualitative field research was done with the users of RMC. And what better way to put ourselves in the shoes of this target group than to simply ride along with an RMC driver for a day and talk very informally with these people. The main goal of this part of was to gain empathy for the users and to understand the context of operation of RMC better.

Interviews

Since the topic of inclusion and the experience of mobility for this vulnerable target-group can be a very personal subject, a conversational and rather informal research style was chosen to gain visitors' insights in a relaxed and friendly way. These interviews were conducted while driving in the passengers seat of a RMC bus for the entire working day. During this day I had the opportunity to talk to five people, and observe an additional of two people. The interviews lasted for about 10 minutes each, because the questions were only asked when the participant was alone in the bus (to overcome bias). A pre-defined interview guideline was used to have guide the interviews and get the best out of those short 10 minutes (see appendix D).

Next to interviewing the participants, a lot of insights were gained from conversations with the driver of the bus, Cora (see figure 17). She was already working as a SSAT driver for over 12 years.

After the interviews and conversations, the most important quotes were noted and clustered into different key insights.

Figure 17: Cora standing next to the RMC van

Key insights

Driver

The driver sometimes doesn't even have time to go to the toilet, because it is so busy and has to follow through with her schedule. It is noticed that it is more busy every day and there is no change in business since the new regulations. A TOMTOM is used next to the app of RMC (see figure 18) because the route on the app isn't always easy to work with. But her TOMTOM doesn't have any delays on it so the time of arrival is guessed by the driver. Also the route on google-maps is not altered to the height of the bus, so it can give a route which is not available for this bus to go through.

Arrival time

The driver needs to call the passenger 8 minutes in advance to tell them they will be there in 8 minutes, so they can prepare and already go to their front door (saves time). When the passenger doesn't pick up, she/he doesn't know the exact time of arrival of the bus. It is somewhat rare that the bus arrives on time (the time that was in the planning and given to the passenger).

Perception of SSAT

People see SSAT as 'a cheap taxi', taking public transport requires to transfer a few times, this is way easier and gets you from door to door, although they experience it less spontaneous. When there is a bit of a hurry in the trip or people aren't feeling it to travel a long time in the bus, they consider other types of transportation.

Communication/booking

Booking via telephone is most common, because they experience it as 'the easiest way'.They have to write their journey down to remember the times they will be picked-up.

Combining

Everyone had no problem with combining their ride with other passengers, they found it quite fun almost every time it occurred. Although combining is often not a problem, most of the time that day the bus was empty. It was driving from the drop-off location from the previous passenger to the hop-on location of the next one.

Figure 18: The set-up of the driver

Figure 19: The lay-out of the back of the van

Insights other interviews
The municipality of Amsterdam also conducted a series of interviews with users of DDT (Gemeente Amsterdam, 2015). The key insights of these interviews are also clustered and are an addition to the self-gained insights.

Planning
The different schemes do not match the mobility needs of the user, who has to use several schemes to arrange his transport. Gaps or overlaps arise and the user has to follow multiple registration procedures and administrations. People also appear to be poorly acquainted with the terms, rights and obligations of the schemes.

Communication
The communication and information provision between carrier and user/carer is a frequently mentioned point for improvement, especially in the event of incidents, delays and problems. For example, they are told that a carrier will not call the customer, even if the carrier knows that he will be late (ie longer than 15 minutes after the agreed time). The customer then waits unnecessarily long at the front door. It has also happened that a carrier several times has a wheelchair-unsuitable vehicle driven to a regular customer who is wheelchair-dependent, despite several reports and complaints.

Waiting times
The waiting times: carriers use time margins. The following applies to the AOV: 15 minutes before the agreed time you must be ready or seated, the carrier can arrive up to 15 minutes after the agreed time. Only then does the arrival time start to count as 'too late'. So if a carrier is 20 minutes late, the customer will already be waiting at the front door with a coat on for 50 minutes.

4.2 Defining the needs

Now that we have ridden along with an SSAT van and have a better understand of the context, we can ask more targeted questions and delve deeper into the needs of these elders. The main goal of this part of the research was to develop a foundational understanding on what the universal needs of these elderly are, when it comes to mobility. To create a more reliable atmosphere, because these interviews really go into depth, they were conducted 1-on-1, unlike the previous empathizing session.

For this research eight participants (see table 2) were recruited through purposive sampling, balancing differentiation in age, mobility and type of booking (phone or app). The participants were contacted via a list which was provided by RMC of the people who use RMC the most. The interviews lasted about one quarter to half an hour and the questions asked during the interview were based on an interview guide which can be found in appendix E.

After doing the interviews, the tapes were transcribed to quotes of the participants (appendix F). These quotes were all moved to Miro, an online collaboration environment, to be analysed, clustered, and interpreted. Each quote was displayed on a coloured post-it note that was linked to one of the participants in this environment. This allowed us to cluster quotes while also readily tracing back to which participant the quote belonged to.

Participant	Gender	Disability	Age	Mainly book via
1	Female	Able to walk short distances	86	Calling
2	Female	Able to walk short distances	90	Calling
3	Male	Walk a few steps	79	Calling
4	Male	Rollator	76	Calling
5	Female	Wheelchair	68	Calling/App
6	Female	Rollator	72	App
7	Female	Able to walk short distances	67	App
8	Male	Able to walk short distances	80	App

Table 2: Elderly participants in the user-needs interviews

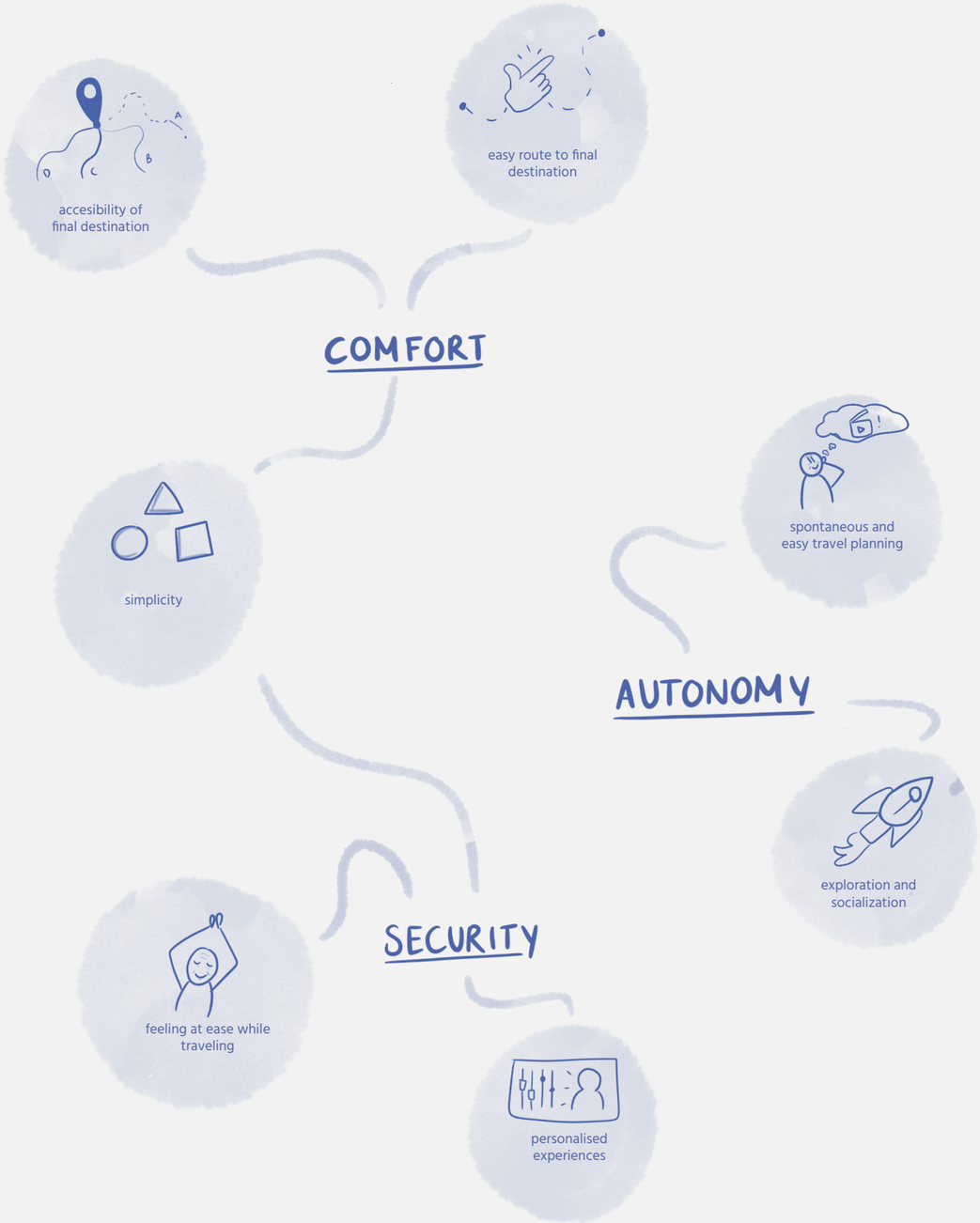


Figure 20: Contextual needs devided over the three main psychological needs

Psychological Needs

There are 13 psychological needs: Autonomy, Beauty, Comfort, Community, Competence, Fitness, Impact, Purpose, Recognition, Relatedness, Security and Stimulation (Desmet & Fokkinga, 2020). After doing the interviews, three key needs were the most important for the elderly. Firstly autonomy, having the freedom to determine their actions and to make their own decisions, doing things by themselves without needing other people to help them. Secondly comfort, having an easy, simple, relaxing life, rather than experiencing strain, difficulty or over-stimulation. They need a feeling of the world being a place of clarity and simplicity. Thirdly and lastly, security, feeling that their conditions and environment keeps them safe from harm and threats, rather than feeling that the world is dangerous, risky or a place of uncertainty.

Contextual needs

The clusters of the needs are then divided under the defined psychological needs. These contextual needs of the elderly are in the context of mobility and the future of mobility. The clusters of these quotes can be found in appendix G.

1. Need for accessibility of the final destination
Most of the participants agreed on the fact that the accessibility of the end destination was of great importance when deciding to travel somewhere. This factor also determines which mean of transportation is chosen by the elderly. When the final destination is accessible and easy to travel to by, for example, using PT, they would do so. When not the case, RMC was often the only solution they could think of. When the final destination was outside RMC's service area and it was poorly accessible by public transport, the trip is often not made.

2. Need for spontaneous and easy travel planning
Traveling with RMC still often brings difficulties, the time you have to book in advance is getting longer and longer, sometimes you do have to wait for an hour for a van to arrive or there is no possibility of getting a ride at all. On the other hand, older people still have the need to make spontaneous trips and to arrive on time. They want to continue doing fun things and not feel that it is just hard to be able to plan a trip short in advance. It feels to them like they have to keep scheduling their entire week to make sure they can arrange transportation on time.

3. Need for personalised experiences based on disabilities
It is important for seniors, especially those with disabilities, to be heard and seen when using transportation options. What attracts them to RMC is that they are experienced with these types of disabilities and they know how to help these people. They already feel that they are so different from the general population, so they expect that they will be taken into account without affecting others.

4. Need for an easy route towards the final destination
For almost all participants, how complex the route is to the final destination has an effect on how they feel about a trip, as well as how they travel. They often choose the easiest route, where they have to change trains the least, use the least different types of transport and are not dependent on delays.

5. Need for feeling at ease when travelling
For many of the elderly, PT is experienced as something hectic, they get heart palpitations from it, or they are simply afraid that no one will want to help them or stand up for them. It is therefore important for these elderly people to have a sense of security when they are traveling. Traveling should remain easy and they like to know what to expect when it comes to the trip itself.

6. Need for exploration and socialization
It is important to many of these seniors that the social aspect of traveling and planning a trip remains. In addition, despite their age and even their disability, they find it rewarding to continue to discover things. The dependence that some have on the RMC because they see it as their only option is diametrically opposed to their need to be able to just go out spontaneously and be among people.

7. Need for simplicity
Many participants find simplicity very important, many of those who are used to using only their home phone find the use of apps difficult. This is because they are not familiar with the benefits of apps, for example, once they would be able to use them. Also, the way the ride goes should be simple; not having to change trains too much, having to walk stretches between stops or using multiple ways to pay for the trip. Simply put, they need little complexity so they can have greater peace of mind.

4.3 Persona's

The research described in the previous two chapters, together with the literature research, allows us to empathize with elderly. To even enhance this emphasizing more and to be able to use these insights in the roadmap, persona's were created. Persona's are an efficient means of expressing ideas about certain user groups from literature and actual research. A persona is a depiction of a character that incorporates shared wants and requirements into a media such as a descriptive story, anecdote, drawing, or photographs. This medium allows you to interact with possible user groups and gain design inspiration (This is service design thinking, 2015).

The persona's were created based on insights and a plotted overview made by Max Sampimom, who did his thesis in the area of Demand-driven transport (see figure 21). The dimensions of his persona division was used as an inspiration to choose the characteristics on which the persona's would be judged.

The persona descriptions
These persona's tell the general story of the different elderly, together with their skills with mobile phones and their level of disability. Each persona is illustrated with a quote. These quotes are actual quotes from elderly that were interviewed. This makes the persona more relatable and gives a better idea on what information the persona's are based. As every persona has it's own motives for behaviour, a few challenges are given when we will be designing for such a specific persona. The different persona's can be seen on the next following pages.

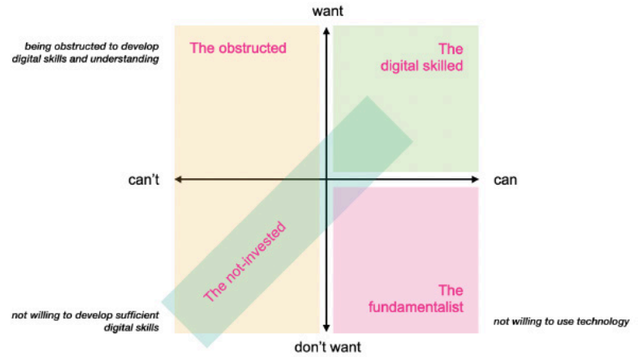


Figure 4.3: An overview of the personas plotted in the field of willingness over capabilities to use ICTs.

Figure 21: Overview of plotted persona's (M. Sampimom, 2021)

The 'woke'

These digitally skilled elderly know very well how to use their smartphone or surf on the internet. They are motivated to use new types of technology and travel with different means. They really see SGT as something for seniors who really can't travel any other way

Technology
Use their phones for whatsapp, downloading apps, calling and other daily stuff. Like to learn about new technological features.

Mobility

"I always book via the app, I think it works very simply and is arranged faster for me than when I call"

The pessimist

These are the elderly that have a (very) low level of mobility. They are in a wheelchair or need their rollator at all times. They do although have a high level of technology knowledge, but simply think that AOV vervoer is the only possible and comfortable way for them to travel.

Technology
Knows how to use different apps and/or websites and has an above average knowledge on new technologies.

Mobility

Design challenges
- Make them see the bigger picture, what alternatives there are and that these ar not less comfortable
- Create a more positive mindset
- Really get to the bottom of their disability and know exactly what they can or can't do

"I'm in a wheelchair and don't have a lot of arm strength to roll myself forward for long, so this is my favorite mode of transport if you ask me, although it sometimes takes a bit of time to get to my final destination."

The low-understander

These elderly have a low understanding of the technological developments now-a-days. They travel mostly by AOV vervoer because they can call them to arrange this. The alternatives are well-known to hem but they simply don't know how to get access to this information. They are motivated to change their behaviour and to learn new things.

Technology
Has a low understanding of technology but is motivated to learn but simply doesn't know how or by who.

Mobility

Design challenges
- Guide them in how they can change their behaviour and how they can seek for help
- Make things as simple as possible
- Keep them motivated

"I have an old cell phone that I can only use for calling and texting haha, I don't have any other apps. Therefore I don't really have an overview of the other ways of traveling that are useful for us, because my wife is of course in a wheelchair and I can't push her"

The considera

These seniors make proper consideration before booking a ride. They look at the alternatives public transport has to offer and choose the route that suits them best. Their preference is often for SGT anyway if they have to switch often.

Technology
They have a mobile phone or laptop and know the basics when it comes to booking trips or looking for different routes.

Mobility

Design challenges
- Keep them engaged with using their phones to seek for transportation alternatives
- See special group transport only as a big luxury
- Clarify all the possibilities

"I often just go with public transport if I don't have to change trains too often, but in Uithoorn the connection is often just not that good"

The obstructed

A very disabled elderly who isn't able to use mobile or web devices themselves and are reliant on other persons when they need to make an appointment for transportation. These elderly are not able to travel on their own.

Technology
The only way this user is connected to mobile/web technology is via their carer/partner/family etc.

Mobility

Design challenges
- To create a need from the elderly themselves to challenge themselves in using other types of transportation
- How to effectively reach the carers of the elderly
- To be able to combine this type of elderly with other users/people who travel
- The carer needs to trust the transportation mean and driver/attendant

The 'ease-of-use' elderly

An elderly person who is able to use public transport offered to her/him, but thinks this will cost more effort to transfer from A to B than just ordering a direct ride with 'AOV vervoer'. They have no severe limitations to their mobility and are able to walk at least 10 minutes.

Technology
They have their own mobile phone and are quite familiar with apps as 9292 and the RMC app.

Mobility

Design challenges
- Motivate them to use other transport means than just AOV vervoer when they have to transport 1 or more times
- Change their mindset when it comes to transportation

"if I have to use public transport then I have to transfer so often, this is actually a cheap taxi for me"

4.4 Key take-aways

- While we have seen that the Municipality of Amsterdam wants to reduce SSAT, we see that drivers perceive it as equally or even busier. There is no shift yet present to other types of transportation.
- Elderly sometimes see SSAT as their only option, despite its drawbacks such as lateness, poor communication, harassment or difficulty in booking
- Elderly people desire comfort, it should be an easy route and not require too much effort from them
- Often people have a preconception that older people don't go away from home much anymore, but we see that they actually still have a lot of need for spontaneous outings, where they can socialize and explore.
- New forms of mobility are quickly labelled as difficult and inconvenient, this is a major challenge in changing the travel behaviour of these elderly people
- The different persona's allow us to better understand these different types of seniors, and provide more targeted goals when it comes to the final roadmap.

05 Challenges and opportunities

This chapter describes to process of defining the challenges and opportunities when it comes to designing an inclusive mobility system for elderly in the future. By talking to six experts in the field of MaaS and inclusivity, five challenges and three corresponding opportunities were found. These can eventually help us to build on a better-supported design challenge and future vision.

5.1 Expert interviews
5.2 Define challenges and opportunities
5.3 Key take-aways

5.1 Expert interviews

After analysing SSAT as a whole, exploring the recent policy changes, analysing the current initiatives for inclusive mobility and defining the needs of the elderly, the key challenges and opportunities were yet to be defined. To define these, it was chosen to collect and analyse MaaS and inclusivity experts' and practitioners' views on becoming more inclusive as a mobility ecosystem, and to collect their ideas on how inclusive experiences can best be enabled and what the future of an inclusive mobility ecosystem looks like. These opinions were gathered by performing semi-structured interviews.

The interviews were guided by a semi-structured approach (appendix H). This guide included questions on how participants (experts or practitioners) have encountered problems or identified possibilities related to inclusion in their experience with MaaS. Next to that, discussions took place on the topics of mobility in general and SSAT. The interviews lasted around an hour and were conducted using Google Meets or in a real-life meeting. Following the interviews, the conversations were taped and transcribed into quotations. These quotes were then posted on a Miro board (appendix I).

Within this setting, the quotes were first grouped and analysed independently for each participant. This provided an early summary of the challenges and opportunities perceived by each individual participant. Following that, the quotes were clustered based on similarities across participants in order to identify common dangers, which could eventually led to insights. As a result of this, five significant difficulties, now 'challenges', and three important opportunities emerged from the data, according to the experts (appendix J). Finally, these challenges and opportunities were linked to one another since they appeared to be mutually beneficial. The next chapter will go over each challenge and opportunity.

Expert	Profession	Organisation
Jurgen van Leeuwen	Head Backoffice & ICT	RMC
Daan van der Tas	Project leader MaaS & inclusivity	Gemeente Amsterdam
Joost van Heeckeren	Stationsmanager	NS
Hans Jeekel	Professor Technology, Innovation & Society	TU/e
Marcel Sloot	Senior projectmanager Collectief Vervoer	CROW
Anne Durand	Researcher for Transport Policy Analysis	KiM

Table 3: Expert participants in the interviews

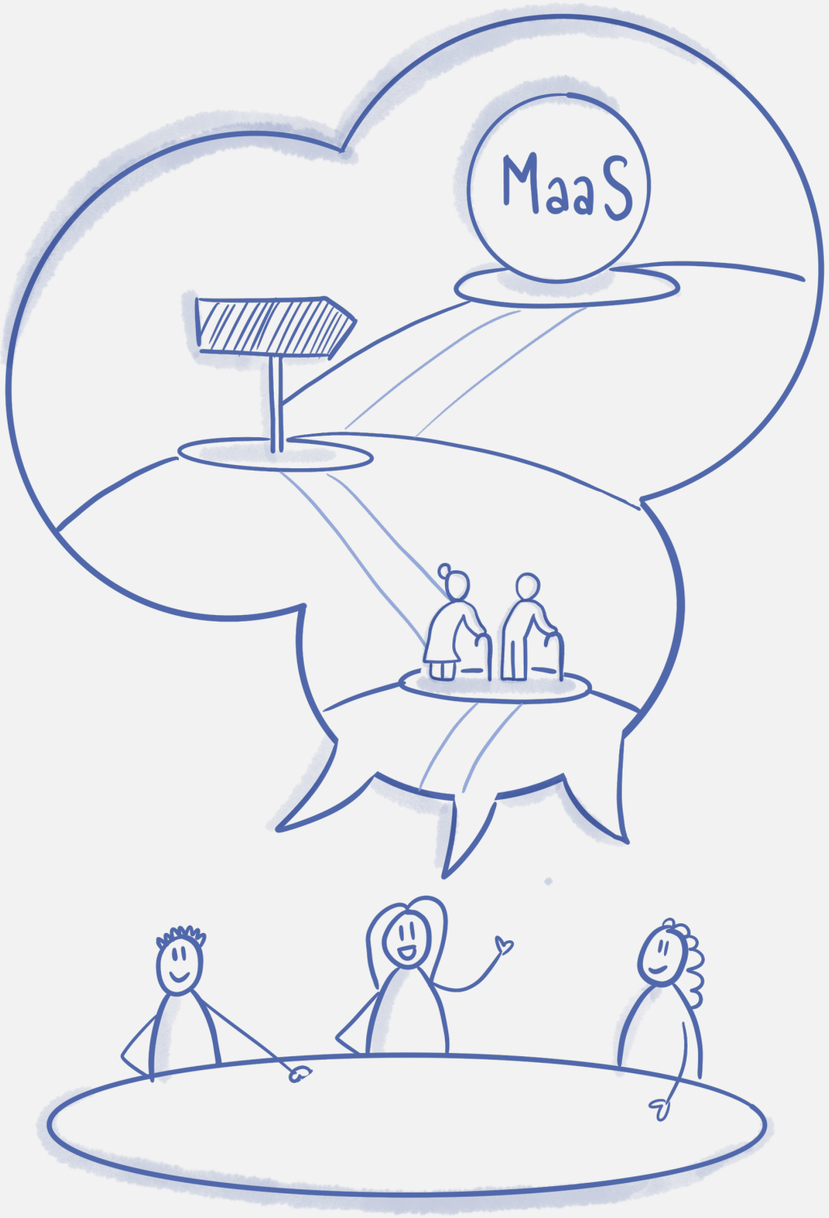


Figure 22: Sketch of discussions between me and the experts on the future of MaaS and participation of elderly

5.2 Challenges and opportunities

Challenges

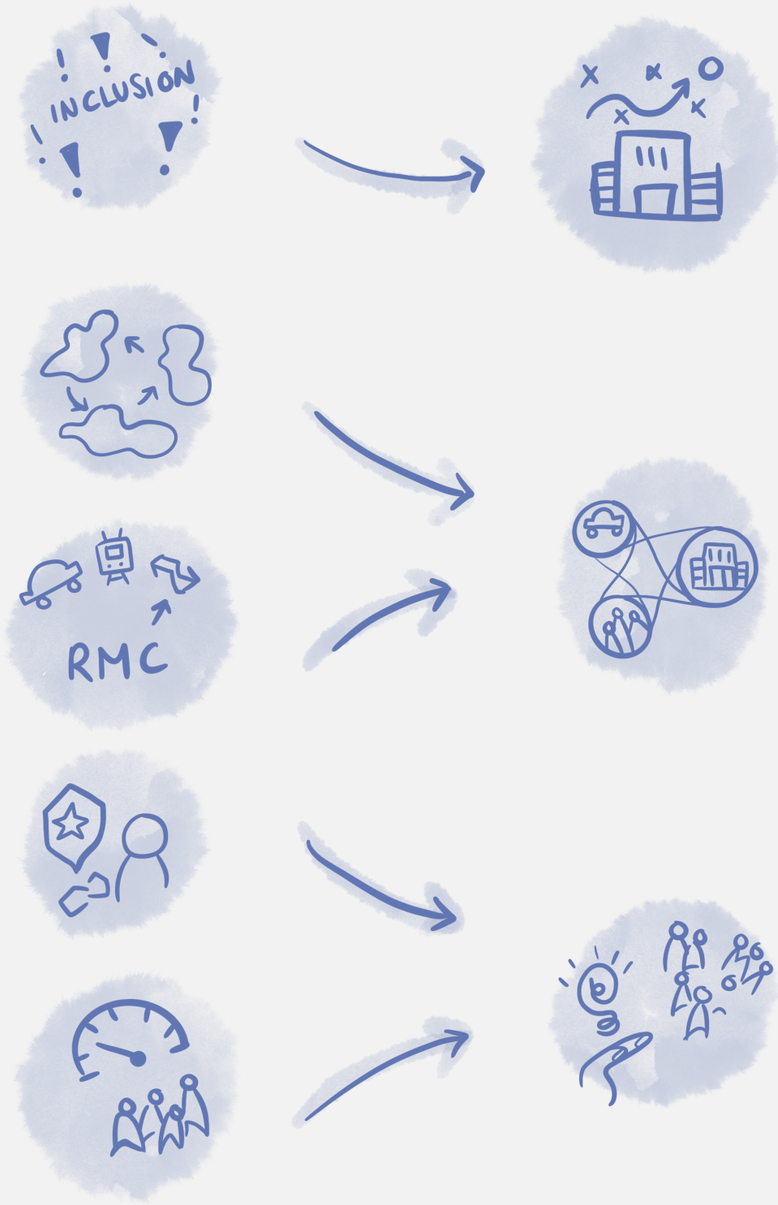
1. *Inclusive design should be a priority in organisations and municipalities/governments.*
   This key challenge emerged from the insight that becoming more inclusive requires a lot of time, attention, and collaboration. First of all, it became clear that inclusion should not be approached as a one-time project, executed by a few, but rather as a continuous process, carried out by all. Just like sustainability is on every companies' agenda, inclusivity should be as well.

2. *Overcome the 'mobility islands'*
   New mobility initiatives and innovations operate mostly on their own and often launch their own app. There is not yet a shared vision or a shared approach, and it is vague who is going to take the responsibility to initiate this transition.

3. *Transitions to other types of mobility*
   The moment you have a disability, it is very chic that you are picked up by a special bus, but the intention is actually that it is pleasant for everyone, and that you can just sit on the bus just like everyone else. Which is also cheaper for society. The challenge is to take people from the special vans into regular public transport. It does not make it cheaper for the user, so the municipality has to ensure that this switch is made.

4. *Overcome illegal usage of SSAT but keep the users close*
   There is a lot of illegal use going on in SSAT, but which is not checked. People do not have to indicate for a ride why they are taking a certain ride. The moment you start taking things from users (selling a no), then you have something to explain. Certainly in Amsterdam, citizens know where to find the media and politics, which makes it difficult to control the rules really tightly.

5. *Design for a less potential group*
   When we look at the target group of SSAT, we see that it is mainly older people. Nowadays they book their trips most of the time via telephone and they often have less understanding of the newest technologies and apps. A large part of the mobility sector is looking at an innovative future where MaaS will play a major role, but it should not be forgotten that these older people also need to be able to participate in such a new mobility future.



Opportunities

1. *Developing a long-term strategy to make inclusion a long-term priority.*
   In response to Challenge 1, it appears that communities should seize the opportunity to develop a long-term inclusion strategy and progressively create the resources required to carry it out. This opportunity is based on the concept "Just take the first step." Furthermore, seizing this opportunity will necessitate openness and the creation of space for municipalities and mobility 'suppliers' to listen to one another and harness the potential of diversity inside.

2. *Working together with other mobility providers and municipalities to be able to create new partnerships and to learn from each other*
   In response to challenge 3 and 2, it became clear that MaaS could become more inclusive, and provide more inclusive experiences, by working together with other organisations, institutions and municipalities. Establishing these collaborations and getting the right parties involved will allow MaaS systems to be inclusive in all 5 layers; The user: the person who matters. The integration layer: the app, the call centre or your laptop. The wheels: the vans, trams, shared mobility. The infrastructure: the roads, the hubs, the lifts, transfer places. Support: the people who really lend you a hand. If you look through those layers through the lens of inclusivity, you will see that there is still so much that needs to be done. With emphasis on the information provision of the mobility offers, which include features that are important for that inclusive target group (size of wheelchair, etc.)

3. *Design a solution for the people that are going to be left out by limiting the use of SSAT*
   A shared future vision for mobility within the municipality of Amsterdam seems a long way off. However, they are already limiting the use of SSAT, forcing a large group to switch to other means of transport, without any guidance. It is a clear and present problem that already requires initiatives and solutions.

5.3 Key take-aways

- Not every expert in the mobility scene sees MaaS as a realistic 'ideal' future. There is so much that needs to change in the policy area that action should have been taken long ago.
- Inclusivity already plays a major role in many institutions, but often people do not know how this can be guaranteed and it is more of an advertising term that they can use to the outside world.
- A major success factor of MaaS lies in attracting mobility parties willing to share their data. It is therefore important to show those parties the benefits of this.
- People will have to move away from their daily habits when it comes to transportation, by creating collaborations between different parties we can try to make this transition as easy as possible.
- We should not overlook the fact that some elderly people are already getting into trouble because of the mileage limit of SSAT, which is why we need to start coming up with solutions now for this group in order to make it easier to use other types of transportation.

06 Defining the design challenge

This chapter describes the transition between the research phase and the design phase of this thesis. By combining three key insights, an opportunity gap was found. With this gap, a problem statement and design challenge could be formulated.

6.1 Defining solution space
6.2 The design brief
6.3 Key take-aways

6.1 Defining the solution space

To make the problem clearer and choose a particular area where we are going to look for the solution, the search for an opportunity gap begins. This is a particular area in which the opportunity is greatest to realize inclusive mobility. This gap is found by looking at the 3 most important key insights, which when combined, provide the vision for the project.

The three most important key insights

To define the solution space for the inclusion of elderly in the future of mobility, an opportunity gap was found between three key insights. These insights come from different results of the discover phase. The most important insight of this gap originates from the overview of challenges and opportunities gathered via expert interviews (chapter 5). This is insight number 1: 'The need of the municipality of Amsterdam to make the elderly transition to other types of mobility, without encouraging the mobility islands, by making these mobility providers work together to be able to create new partnerships and learn from each other'. This is a insight that is derived from key challenges 2 and 3 (Overcome the 'mobility islands' and making transitions to other types of mobility) and opportunity 3 (Design a solution for the people that are left out by limiting the use of SSAT).

To better define the opportunity gap, two other insights were added to the main insight. The first additional insight, comes from the previous identified visitors' needs , and is noted as insight 2: 'The need of elderly to plan trips in a spontaneous and easy way, where they are not dependent on a schedule and therefore do not have to rush' The second insight, that was added comes from the overview of inclusion initiatives (chapter 3.1), displayed as key insight 3: 'Providing help in the transition towards other alternative means of transportation as a promising way to address different needs regarding a way of travelling .'

The solution space

The solution space within these three insights can be seen in figure 23. The combination of these complimentary findings revealed that the largest opportunity gap is in addressing the interaction between mobility and the elderly, and how to enhance this relation by keeping the elderly involved in this rapid changing technological world. It was discovered that the current connection is more of a one-way traffic connection. In this connection, the elderly believe that they must adapt to current mobility improvements and initiatives in order to continue traveling. Many of them believe that mobility is too tough to obtain, that all of these new or unknown initiatives and innovations are just for the young, who can cope with new applications. At the same time, it was discovered that there are significant universal demands among these seniors to be able to go around and do pleasurable things without the risk of becoming lost. However, it became evident that the present connection with SSAT, as well as mobility in general, is a barrier to meeting these demands and offering more personal, meaningful, and inclusive experiences.

These discoveries inspired the project's vision: to increase inclusivity by strengthening the connection between the elderly and mobility. Moving away from one-way traffic and working towards a better relationship which aims to learn from elderly and their needs.

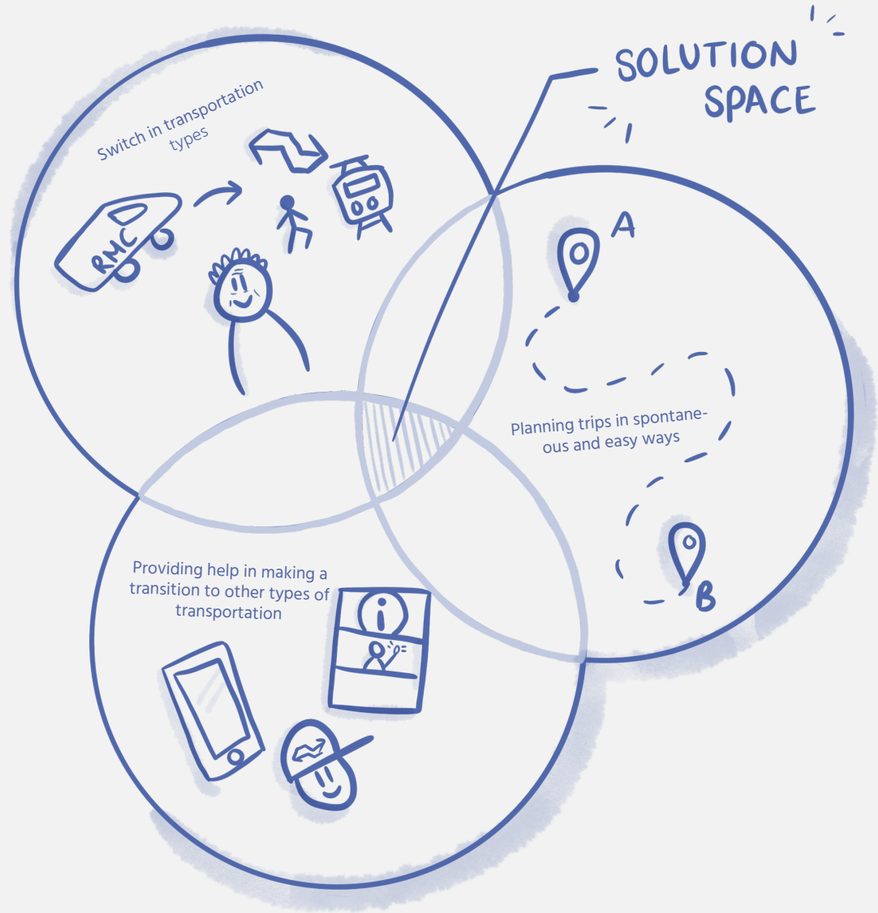


Figure 23: Solution space between the three key insights

6.2 Design brief

To define how this envisioned project vision could be established, it was important to define a design brief that clearly identifies: the problem to be solved, the design challenge (what should be designed, for whom, how and why), and which principles could assist in designing for this challenge. Formulating this design brief is the final step in the define phase and marks the starting point for the second diamond. This brief is meant to encourage and guide the designer through the remaining design phases of the project.

Problem statement

The initial assignment asked to discover how mobility can become more inclusive, in order to include a broader user group into the envisioned innovative future of mobility. However, it was found that to make the experience of mobility more inclusive, we should focus on the most difficult group of users, which have the least potential and is now barely focused on; the elderly. These discoveries inspired the project's vision: to increase inclusivity by strengthening the link between the elderly and mobility. Moving away from one-way traffic and toward a mutual symbiotic partnership in which both parties benefit and meet their requirements. This crucial conclusion is also reflected in the fact that SSAT is limited for these persons, with no alternatives presented or brought to their attention. The discovery phase revealed that the underlying fundamental problem that must be addressed lies in assisting mobility and the elderly to re-establish a mutual partnership, in which the elderly are incorporated into the entire design process of new initiatives or plans for the future of infrastructure and mobility.

The following problem statement was created:

> "How can we encourage better communication between mobility technologies/organisations and the elderly in order to become more inclusive and generate more integrated inclusive mobility experiences?"

Design Challenge

When the problem statement was developed, a design statement could be derived for the eventual roadmap.

This design statement is:

> "To provide a path for those organizations with clout in the mobility sector that are committed to being more inclusive, guiding them in developing a shared vision by involving the elderly into the steps, enabling them to be more inclusive and to develop more integrated inclusive mobility solutions."

6.3 Key take-aways

The three most important key insights were recognized:

1. **The need of the municipality of Amsterdam to make the elderly transition to other types of mobility, without encouraging the mobility islands, by making these mobility providers work together to be able to create new partnerships and learn from each other.**
2. **The need of elderly to plan trips in a spontaneous and easy way, where they are not dependent on a schedule and therefore do not have to rush.**
3. **Providing help in the transition towards other alternative means of transportation as a promising way to address different needs regarding a way of travelling.**

With these key insights the problem statement and design statement were formulated:

PS: How can we encourage better communication between mobility technologies/organisations and the elderly in order to become more inclusive and generate more integrated inclusive mobility experiences?

DS: To provide a path for those organizations with clout in the mobility sector that are committed to being more inclusive, guiding them in developing a shared vision by involving the elderly into the steps, enabling them to be more inclusive and to develop more integrated inclusive mobility solutions."

07 Roadmap design

In this chapter, a future vision for the roadmap was formulated with using a customer journey, together with taking into account all key insights of previous chapters. With this future vision, a roadmap design was made. This chapter also provides a detailed explanation of the different elements of the roadmaps. It goes into detail on the various topics such as market, initiatives, regulatory changes and a new business for RMC.

7.1 Future vision
7.2 Strategic & Tactical roadmaps
7.3 The horizons
7.4 The elements
7.5 Horizon 1
7.6 Horizon 2
7.7 Horizon 3
7.8 Conclusion

7.1 Future vision

The world of transportation and mobility is changing, with access to digital technologies giving previously unavailable insights and efficiencies. Means of transportation are increasing in diversity, this makes it increasingly difficult for these mobility islands to survive and also to continue to monitor the whole thing.

The municipality of Amsterdam's vision is clear: "A regional MaaS application: The information required for inclusive travel is fully in place, so that you as a user, regardless of your budget, can travel from A to B with as many options as anyone else. And that you can give the personal settings that you need to the system, so that you can use the service. All 5 layers are then really in order." (Daan van der Tas, Project-leader MaaS & Inclusivity at the Municipality of Amsterdam). But this does not yet give a good picture of how transport within the region of Amsterdam will be arranged in 10 years' time and what the role of the elderly is within this process and this future.

As we could see in the design brief in the previous chapter, the goal of the roadmap is to provide those steps for organisations in the mobility sector to realise an inclusive mobility ecosystem in the future for elderly. In order to provide these steps, a future vision is needed.

Future vision

On a design roadmap, the future vision points to the destination. As an expression of a desired future, the vision provides a strategic reference point - a focused direction that leads to stronger motivation (Simonse, 2018).

By looking at the design challenge, together with the future of mobility, a customer journey was created in collaboration with Mike van Hamersveld (Label A) in a brainstorming session (see figure 24). When looking at this customer journey and additionally taking into account the key take-aways from all previous chapters, a future vision could be made:

> "In 2032, elderly (regardless their disability) can travel within their region by using a Mobility-as-a-service app that can combine public, private and shared transport and offers the best alternatives for travel by taking the real needs into account. With the focus on the transition from mainly using special group-transport to other types of transport."

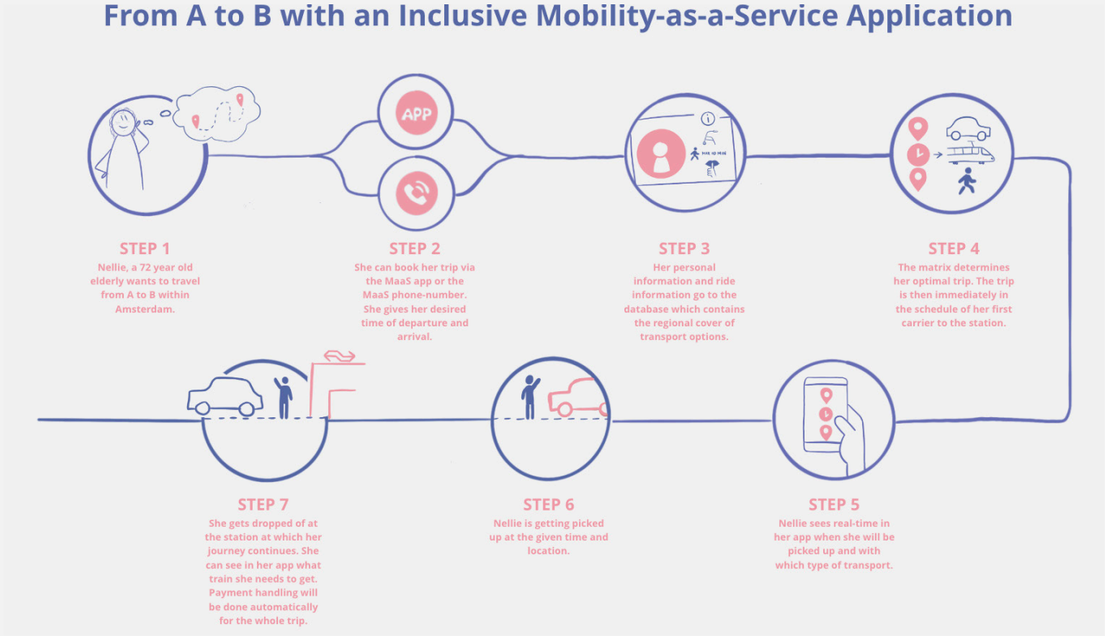


Figure 24: Customer journey of an elderly using a MaaS application in the future

7.2 Strategic and Tactical roadmap

A strategic and a tactical roadmap have been created. A strategic roadmap is a bridge (or link) between strategy and execution. It visualizes the key elements of each horizon and shows the progression towards the final future vision (see page 50-51). Next to that, a tactical roadmap van composed. Tactical roadmaps outline what needs to be done, by when, in order to achieve specific outcomes. This includes an understanding of key stakeholders, their roles and responsibilities and having a framework in place to manage progress (see page 52-53)

Next to the fact that these roadmap were compiled by looking at literature research, doing interviews, speaking to experts and looking at existing strategies and pilots, feedback sessions were organised with two experts. The first session was with Anne Durand, her knowledge on digitalization and the part that elderly play in this was now used to improve the roadmap. The second feedback session was with Marcel Sloot. Because of his expertise on public transport but also as a researcher at CROW, he could give more generic feedback on the roadmap and ensured that important steps were not overlooked.

Before these feedback sessions, an early concept of the roadmap, the future vision and the horizon was given to the experts. Together with some background information on the persona's, the interviews and the talks with other experts. During these sessions, discussions took place which resulted into a few questions, some proposed alterations and also establishing a focus and goal of the roadmap. A selection of these comments and discussion point can be seen in appendix K.

Figure 25: Visual representation of a tactical and strategic roadmap

7.3 The horizons

The horizons on a roadmap can be seen as the large building blocks to achieve the future vision. Thinking about the future means learning to think differently. Emerging change will challenge our current assumptions, and over time today's decisions, policies, and products will become obsolete. To future-proof our thinking, the roadmap is divided into horizons. Three horizons have been defined in this roadmap. Each horizon explains an important theme, these themes build on the horizon(s) before it, making the roadmap dependent and making it necessary to always look back at the previous result when entering a new horizon.

Horizon 1: Getting familiar with mobile integrations
The aim of the first horizon is to get the elderly familiar and handy with new mobile integrations. This is mainly done to be sure new mobility alternatives and innovations are understood and easy applications can be made for the elderly target-group. At this point, the elderly are not yet familiar with MaaS solutions. They will have to learn to use other means of transportation and move away from their habit of traveling by, for example, SSAT. In this horizon, the first steps are also taken towards the creation of a MaaS application including the first regulatory steps to succeed.

Horizon 2: Inclusivity in mobility alternatives
The goal of this horizon is to establish a wider range of mobility options that will enhance the mobility of the elderly. After the elderly have become more familiar with the technology of mobility apps, one can look for ways to motivate them to use other types of transportation.

The focus here is on the enrolment of a shared mobility scooter, to be able to bridge the distance between different stations. Also, the first versions of the MaaS solution will be able to be tested by the elderly. A control centre to plan routes with is a first step for this, in order for the elderly to become familiar with traveling by multiple modes of transportation.

Horizon 3: Transition to an all-in-one solution
In this horizon, we will work towards an inclusive MaaS application that combines all transportation offers to an app that can be used by all people in the region of Amsterdam. At this point, all mobility providers share their data to ensure that everything can be offered from one point. Elderly people can travel via a fixed price/km using modes of transportation that are desired and possible.

In this horizon, the focus is on a regional enrolment of this app, where the interaction between the app and the elderly is still of great importance. Feedback will need to be continuously monitored. Also, the first possibilities for expanding to other regions will be looked at in order to have a national MaaS plan in a distant future.

7.4 Roadmap elements

To ultimately achieve the future vision in 2032, a number of elements must be taken into account. These elements have been carefully chosen to highlight the most important steps and developments in the process.

Market

This section looks into the trends and their relationship to developments within public transport and the development of hubs. The trends and developments here are also important for the development of certain initiatives. The trends that will be mentioned here can all be found in chapter 3.3.

Initiatives

The initiatives are concepts that can help with the transitions that need to be made to become more inclusive in the end. These correspond to the focus of the designated horizon. Among these initiatives is also the development of the MaaS application, which starts in the first horizon and develops into the last. Because the initiatives are important to achieve the ultimate future vision, the role of the elderly is also explained. In order to design inclusively, the target group must be properly involved.

Technology

The technology element is mainly focused on data analysis and data sharing. To create a MaaS ecosystem, the mobility islands will have to stop and data will have to be shared. As this will of course not happen all at once, you can see here how the shift is made from analysing the data in-house of all these parties separately, to sharing it within a joint City data standard mobility system. The City Data Standard Mobility (CDS-M) is being created in order to offer a standardized method for transferring mobility data between mobility providers and governments. CDS-M improves understanding of mobility data, increasing insight into the use of (partial) transportation and the potential effects on public space, such as accessibility and liveability (Gemeente Amsterdam, 2022).

Regulatory

Governments have a key role to play in promoting and supporting innovation, and with the proliferation of MaaS this will continue (Arup, 2019). Along with the fact that almost all experts have warned that there is a lot to be done when it comes to regulatory rules and steps, the biggest steps are explained in this roadmap.

Awareness

The interviews with experts (see appendix J) show that creating awareness among the different parties in the mobility sector is key to achieving a successful MaaS ecosystem. Here, the focus is on which parties need to make a switch in commitment/ mindsets and when. As this is already explained in the roadmap and speaks for itself, it will not be further discussed in this report.

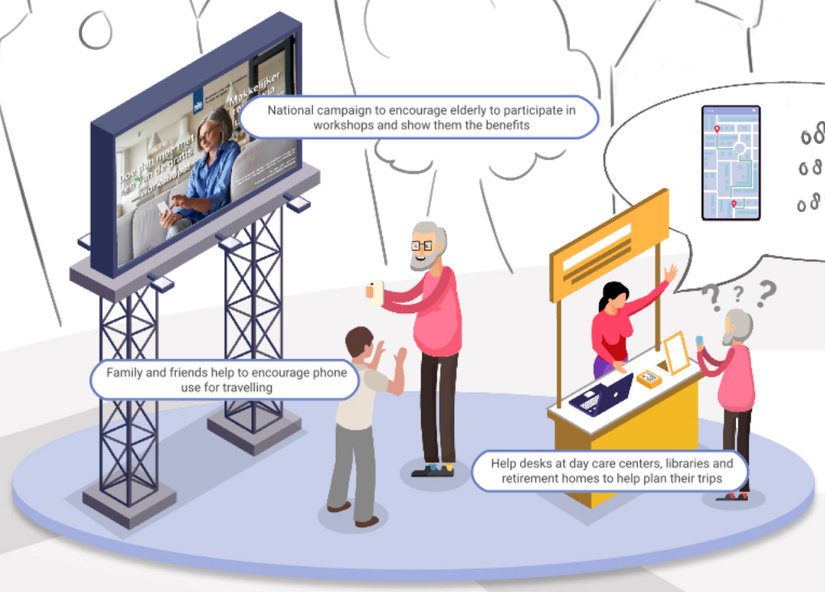
Behaviour Change

This element focusses on the change of behaviour of elderlies, who mainly use SSAT, towards mobility. The persona's defined in chapter 4.3 of this project are mapped on the roadmap across the horizons to show a change from left to right. To understand the change of behaviour, take the persona's side by side, this will not be further discussed in this report.

Business for RMC

Because a case study was done on RMC's operations and customers, it also looks at the how the current business (SSAT) is deforming as it moves toward the future vision. This can be a source of inspiration for RMC and present them with steps and actions to achieve it.

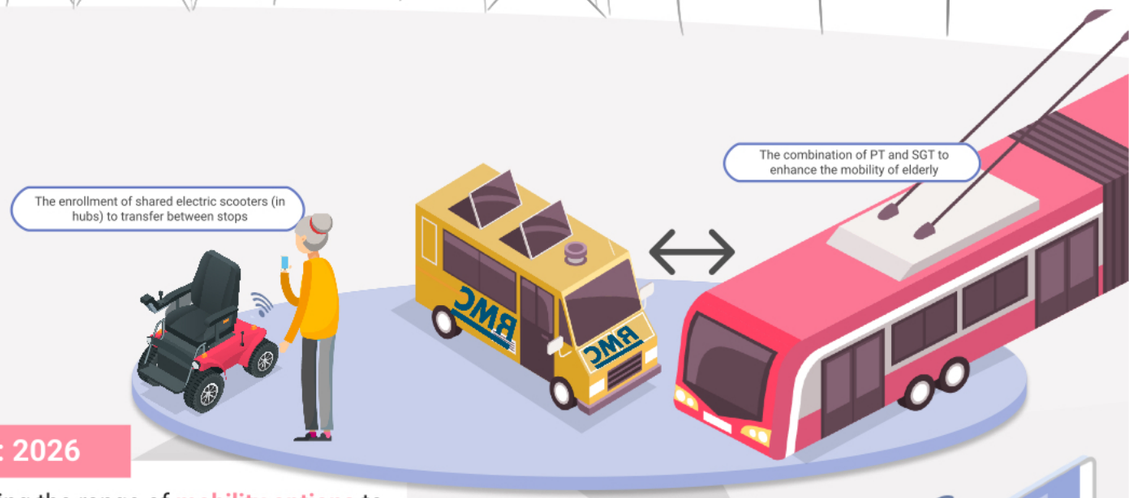
A **Roadmap** for the development of an inclusive MaaS application that is accessible to use for elderly



GETTING FAMILIAR WITH MOBILE INTEGRATIONS

Horizon 1: 2023

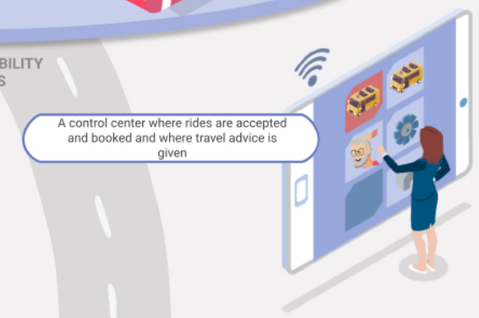
Get the **elderly more familiar** with mobile integrations to **enhance the innovativeness** of new mobility initiatives.

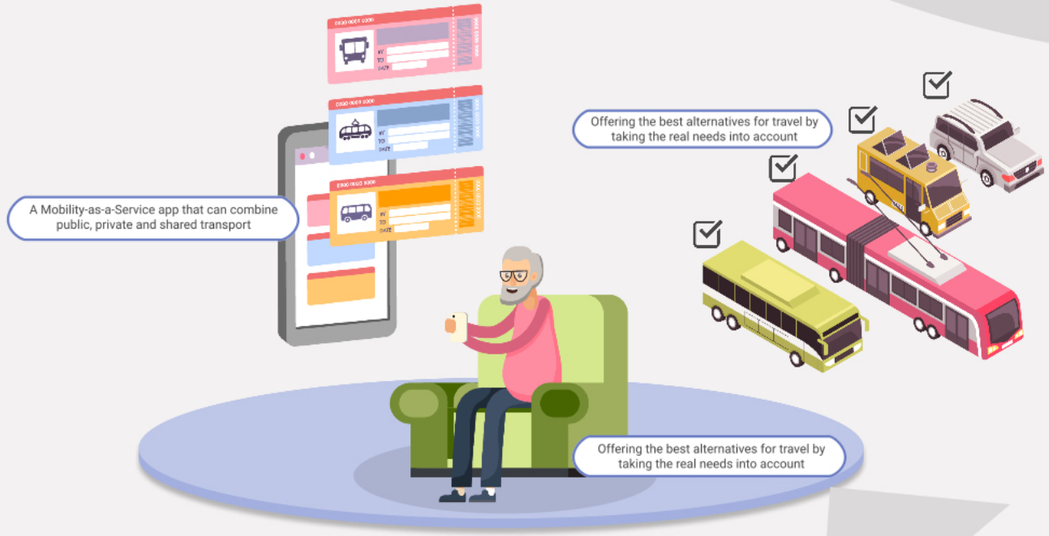


INCLUSIVITY IN MOBILITY ALTERNATIVES

Horizon 2: 2026

Broadening the range of **mobility options** to ensure that older people are able to move around more **seamless**





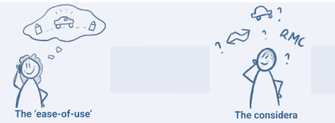
AN INCLUSIVE MAAS APPLICATION

TRANSITION TO AN ALL-IN-ONE SOLUTION

Horizon 3: 2029

Work towards an **inclusive MaaS application** that combines all transportation offers to an app that can be used in **the region of Amsterdam**

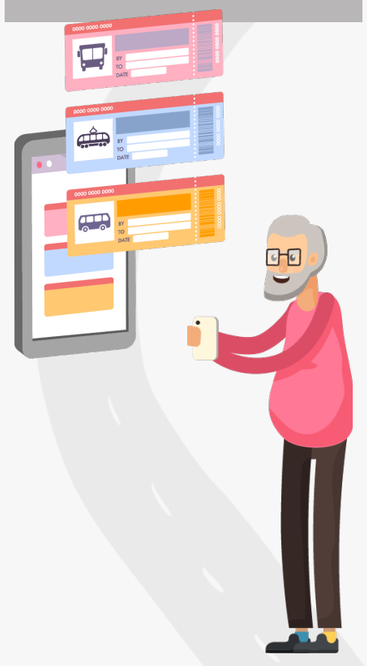
In 2032, elderly (regardless their disability) can **travel within their region** by using a **Mobility as-a-Service app** that can **combine public, private and shared transport** and offers the **best alternatives for travel** by taking their **real needs** into account. With the focus on the **transition** from mainly using special group transport to **other types of transport.**

		2023	2026	2029	Beyond
		Horizon 1	Horizon 2	Horizon 3	
		Getting familiar with mobile integrations Making our target group, the elderly, familiar and handy with new mobile integrations to enhance the innovativeness of new mobility initiatives	**Inclusivity in mobility alternatives** Broadening the range of mobility options to ensure that older people are able to move around more seamless	**Transition to an all-in-one solution** Work towards an inclusive MaaS application that combines all transportation offers to an app that can be used by all people in the region of Amsterdam	
MARKET	Trends	Ticketless public transport Intelligent Mobility Meters (IMM) Helping pedestrians better navigate urban areas	Suggested routes based on customized settings Offering integrated multimodel options digitally Lowering regulatory barriers for providers that address inclusion	Combination of ICT applications and big data streaming Vehicle-to-everything (V2E)	
	Developments PT	OVpay → Improve signage and accessibility of PT	Collection and monitoring data from PT infrastructure	Customize PT schedules using data analysis	
	Developments Mobility HUBS	Enrollment of more HUBS based on data	HUBS more geared to mobility for the elderly		
INITIATIVES	Concepts for initiatives	**Ticket windows** at day care centers, retirement homes and libraries **National Campaign** to encourage elderly to take technology classes and for other people to look out for these elderly	**Control Center** A central point where rides are accepted and booked and where travel advice is given **Shared electric scooter** Providing this shared scooter (in HUBS) so that the elderly can transfer more conveniently between stops	**Enrollment of MaaS application** Learn from previous releases of application and enroll and design a regional MaaS application with making the needs of the elderly a priority	
	MaaS application	Strategy for design of MaaS application → Gather needs of elderly for travel → Easy accessible route planning apps	Learn from feedback and make alterations → Enroll first MaaS app → Find enthusiastic base of elderly for testing	Updating MaaS application with more mobility providers → Stimulate constant feedback from base → Regional MaaS application	
	Elderly involvement	Participate in interviews → Test app and give feedback	Encourage other elderly in behavior change/app usage → Participate in interviews for mobility alternatives/ station places	Test new MaaS app updates → Participate in quarterly calls on app	
REGULATORY	Actions by municipality of Amsterdam	Promoting public transport amongst SGT users → Tender a project developer for the MaaS application → Locally organized teaching classes	Start analyzing data PT & SGT → Develop or tender new types of transportation	Start collaborating with other municipalities	
	Actions by province Noord-Holland	Start peeking out collaborations	Set-up control center → Sit down and agree on money flows with governments	Seeing in which other regions next enrollment will take place	
	Actions by government	Focus on lockets in libraries for travel planning and coaching → Enroll national campaign	Stricter requirements for WMO indication → Merging budgets for mobility	Bigger budgets for testing MaaS app → Prepare follow-up plan with takeaways from Mass testing	
TECHNOLOGY	Data analytics	In-house at providers City Data Standard Mobility (CDS-M)			
	Data sources	Public transport, IMM, DRT	Public transport infrastructure, HUBS	Shared mobility parties	
RMC BUSINESS	Actions	Working on a common vision with the municipality of A-dam → Sharing real-time data	Offer transport at OV rate	Analyze and prioritize travel data → Advise the municipality on inclusion of elderly in MaaS application	
	Business model	**Focus on being a special group transporter** • Cut out all 'illegal' use of SGT • Promoting the switch to public transport	**Combine trips with Public Transport** **Also become a house-stop and stop-house transporter** **Working together with PT to enhance the mobility of the elderly**	**Focus on specialized transport** **Pupils with disabilities** **People who can't use any other types of transportation** **Becoming travel advisory** **Collecting all data and analyze mobility patterns per group** **Advise municipalities and other mobility providers**	
AWARENESS	Creating awareness	**Elderly** They need to see the benefits of learning to cope with technological innovations, making their lives easier **Deputies and aldermen** Get them to empty the table, start from scratch, how can we create an inclusive mobility plan without all these different regulations and budgets **Government** Small initiatives regarding technological proficiency for the elderly are poorly monitored, national campaigns are needed	**Public Transport Companies** Stop seeing MaaS providers as a threat (cheaper and easier solution), but as a great collaborative option **Mobility sector** Jabbering about pilots and small projects is not helping. Start looking at what the actual situation is and how they can start improving it. **Government** Revisit budgets for mobility, if it remains separate it hinders innovation and makes it difficult to establish collaborations	**Shared mobility parties** These mobility islands are not contributing towards an inclusive mobility integration, they should work together **App-development companies** They need to be able to zoom out, and see for whom they are really designing. The design teams should be diverse, age, ethnicity, gender, etc.	
BEHAVIOR CHANGE	Elderly	 **The low-understander** **The pessimist**	 **The 'ease-of-use'** **The considera**	 **The 'woke'**	

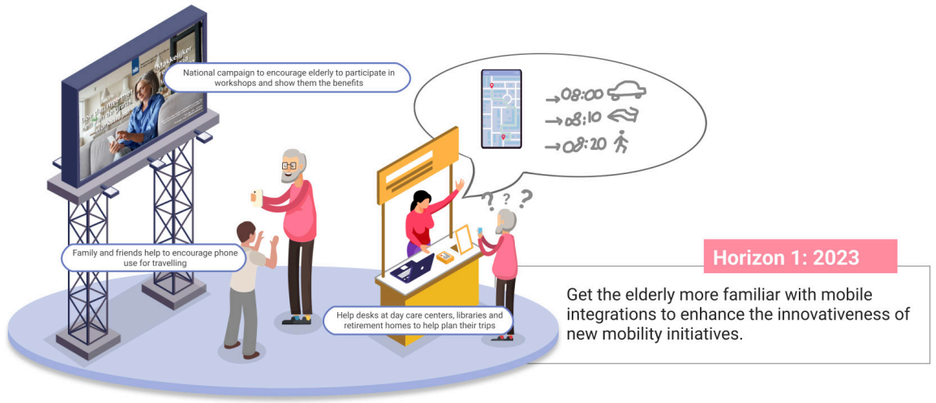
VISION FOR 2032:

AN INCLUSIVE MAAS APPLICATION THAT IS ACCESSIBLE TO USE FOR ELDERLY

In 2032, elderly (regardless their disability) can travel within their region by using a Mobility-as-a-service app that can combine public, private and shared transport and offers the best alternatives for travel by taking the real needs into account. With the focus on the transition from mainly using special group-transport to other types of transport.



7.5 Horizon 1



Vision

Part of a MaaS ecosystem and future vision, is that an app can be used to make it easier to book, pay for and track rides in real time. Therefore, it is very important to better introduce the older generation to mobile usage.

The use of public transport is also mostly arranged through apps, think of 9292 and the NS app. To make the transition from SSAT to PT, the use of apps will need to be encouraged to make it easier for older people to travel.

Market

The trends and the collaborating developments are focussed on being the first steps towards making travelling with other alternatives then SSAT easier.

Ticketless public transport is on the rise, making it easier for everyone to check in for public transport. OVpay is a development which makes it possible for people to check in with their debit-card or smart-phone (OVpay, 2022). This is a first step towards a MaaS system where everything can be paid for in one simple system. Because we see that older people often still like having a separate card for public transport, this development will have little influence on the travel behaviour of older people. However, they can already be made aware of this way of travelling, so that they are not frightened at later stages by the switch to OV-less travel.

Because the switch for the elderly will have to be made between using SSAT to public transport, signposting will have to be improved at stations/transfer points. Because of the trend of human-centred initiatives to improve the navigation in urban areas, signage can be improved around PT. This can be done by thus incorporating the elderly in the design process.

The enrolment of new hubs will also be realised in this horizon, this is the starting point for later developed of shared mobility that is more focused on the elderly. By looking at where most elderly people are located and what routes they travel through the use of IMM, these hubs can be rolled out in more strategic locations.

Initiatives

Ticket windows

During a interview with Anne Durand, she mentioned that for people who want to be able to see someone and talk to someone, they gather desks in libraries. Where people (elderly) can fix their taxes or do other things that have to do with the government. This is nationally maintained.

We discussed that it will also be convenient for the elderly to be able to get help with trip planning by using, for example, their phones at those same ticket windows. By arranging this nationally, workers who are now behind such a desk can also be trained to be able to give advice on mobility and phone use.

Also, the locations of these counters can be expanded to community centres, shopping malls and other areas where many older people live, to ensure the promotion of different means of mobility and to encourage more use of apps.

National Campaign

People's families help a lot with digital difficulties of the elderly, which makes them more dependent on others. They need to ask for help. If we zoom out, in society we are more expected to do things on our own, independently, having actual humans on the line will cost money (KiM, 2021).

There have been classes and workshops, but these cost money. And the government needs to be willing to pay for it. Because these classes and workshops aren't regulated nationally, there is little data on the success and feedback of these initiatives (interview A. Durand).

There will therefore need to be a national campaign to encourage mobile use among older people, funded by the government, as an investment in the technical skills of the elderly.

This national campaign can focus on two key points, first, workshops will need to be promoted. Most of these will be held in community centres in certain neighbourhoods in Amsterdam where many elderly people live. Posters will have to stimulate these elderly to participate (see figure 26), but word-of-mouth advertising from the elderly to each other is also counted on. In this horizon, the focus will also need to be on collecting data on the satisfaction and functioning of these workshops in order to improve them and ensure that they can really help. Feedback sessions will also need to focus on the motives of elderly to come and attend these workshops, to be able to encourage more participants in the future.

Second, a campaign can be held that is targeted at friends and family of the elderly, to help the elderly understand travel planning apps. In this way, the elderly do not have to come up with the question themselves, but a "push" factor is created among family members to help them with these types of apps, to encourage travelling with public transport (see figure 27).

Figure 26: Example of a campaign that can be used to motivate elderly to take place in the workshops

Figure 27: Example of a campaign that can be used to motivate people to stimulate use of travel-apps

Development MaaS application
The first steps towards a MaaS application will also have to be taken right away. The municipality will have to call upon project organizers to come up with a proposal for a strategy, in order to award a tender to the party with the best strategy that fits in with the inclusive idea.

This project leader will then have to start collecting the "real needs" of the elderly, in order to form profiles of the users, and find out what information is important when planning a particular route. What then needs to change within the MaaS applications of, for example, 9292 and NS, is to make the app more accessible for the elderly. This means simpler apps with multiple options that relate to the limitations of the elderly. In this way, the elderly can also use these apps more easily in order to be able to travel by public transport in a more motivated way.

Elderly involvement
The involvement of the elderly is mainly in the interviews with a project leader. In these interviews the real needs, when it comes to travelling, should be taking into account. Not only elderly who are using SSAT as their main transportation mean, but also elderly with other mobility preferences should be interviewed, to make sure that all their needs can be fulfilled. The elderly will also be included in the testing of new signage for on stations and will be evaluating new updates of now-a-day MaaS applications to ensure the improvements.

Regulatory
As was described under the national campaign and ticket windows initiative, these are initiatives that need to be regulated nationally in order to maintain quality and place more value on results and feedback. This means that the government will have to take action to make this a reality. Their main focus will therefore be on enrolling the national campaign and realising ticket windows with employees who are well-informed about their function.

Because the province is the principal of public transport, they will also need to look at collaborations of this large organization with smaller mobility providers, and see what needs to be changed when it comes to budget (interview M. Sloot).

Since the municipality has decided to put a cap on the use of SSAT, they will have to be responsible for encouraging the transition from elderly to PT. With the help of the campaign, they will also need to find other ways to ensure that seniors can make this transition properly. This could include making other means of transportation cheaper or rewarding seniors who use SSAT less than their limit. Furthermore, the municipality will have to give a tender to the project developer with the best strategy for a MaaS application. Also, the municipality is responsible for choosing the places where the national campaign will be promoted, and where the new ticket windows will be stationed.

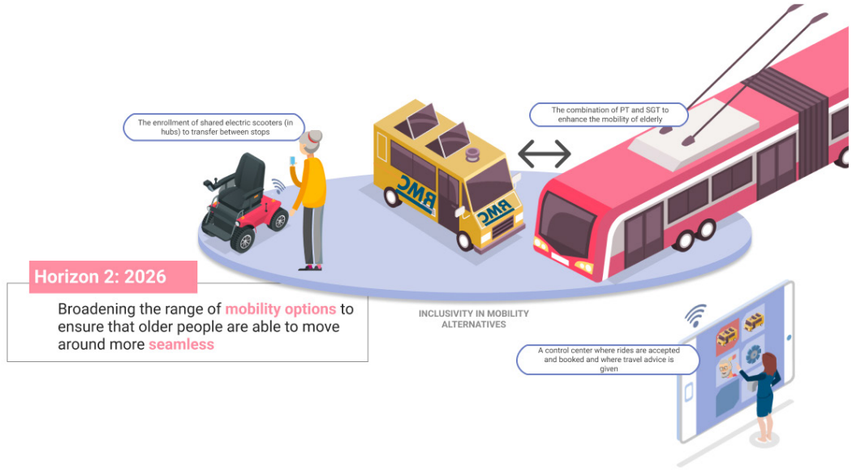
Technology
When looking at all the different mobility providers in a region, we see a lot of mobility islands. This means that these providers all have their own data, all do their own data analytics and all draw their own conclusions on mobility in-house. Data must be transmitted amongst the various mobility parties in order to construct a regional MaaS application. This information must be shared with the government as well.

In this first horizon, it is likely that only PT will still want to share their data together with SSAT, because they both already see the benefits of sharing their data and have the same 'ideal' future in mind, an inclusive MaaS solution.

Business RMC
As mobility will change, the business model of RMC will also change. The first goal RMC will have to strive for is to cut out the illegal use of the services they provide. Since a limit is imposed on them in terms of the number of rides they make, they will have to ensure that only legitimate rides are made. They can do this by monitoring more strictly, but at the same time also giving alternatives for example PT.

At the same time they will have to work on a common vision with the municipalities when it comes to the future of SSAT. Thus, separately they are working on a vision but have yet to come to a synergy together. They can also do this by already sharing their data with the municipalities to promote the development of the MaaS app.

7.6 Horizon 2



Vision
Having to change means of transportation often or having to walk a long time between stops can be an obstacle for the elderly to travel anywhere. In this horizon, it is important to increase the range of mobility opportunities for these elderly people, allowing them to travel more easily and seamlessly.

Also, the first steps are made towards combining different means of transport providers, in order to work towards a whole ecosystem. Elderly people can already book these combinations by using control centres, where they can immediately be guided in this transition.

Market
An obstacle for older people to use, for example, public transport is that they are unsure if the platform or stop is easily accessible with their disability. To make this a more certain element, public transport will need to start collecting real-time infrastructure data on, for example, elevators to platforms, escalators, platform heights in combination with vehicle boarding heights, how full a particular vehicle is, etc. This will eventually help to generate better personalised routes for elderly which have customized 'settings', as type of disability or how far they are able to walk/climb stairs.

A sign of change is that municipalities are lowering certain boundaries for companies on innovations that promote inclusiveness. Therefore, the entry into the market of new modes of transportation, that can better help older people transition, will become easier. Thus, these new forms of partial mobility can be included in HUBS that are more strategically placed to benefit the elderly.

Initiatives

Control centres

A control centre can be used as a smart nerve centre between policy and implementation. A control centre is one central place where rides are accepted and planned and where (if call centre/app are included) travel advice can be given. The tasks and organization of this centre can be filled in by municipalities as desired. Including as many facilities as possible offers the most possibilities for the user and for increasing efficiency. Finally, it is possible to have the control centre carry out tenders, contract management and indication; this is especially useful in regional cooperation (It's Public, 2021). Currently, the provinces of Zeeland (called GVC) and Noord-Brabant (PZN) are already using such a control centre. So it is not a completely new initiative, the advantages are that it is easily implementable, because there is already an example, and therefore it has been proven to work.

Control centres can only be used for target group transport and/or public transport. Therefore, this centre is a stepping stone to a MaaS platform, but not the beginning of the end result. It will mainly help in bringing PT together with SSAT.

A few benefits of a control centre are (CROW, 2018):

- Integral, efficient planning: with full insight into supply and demand, capacity can be scaled up or down, facilities can be combined and vehicles can be efficiently deployed for different target groups
- Convenience for users: all information and bookings are made via one counter
- Independent travel advice supports shift to public transport: dispatch centres can point out the best option to travellers, including (better) alternatives for public transport that cost less, such as public transport and shared mobility. It is also possible to give an indication per journey
- Concentration of expertise in one place: by building up knowledge, one can invest in high-quality monitoring and data analysis to increase efficiency. Also overhead costs are easier to reduce in case of multiple facilities and regions
- Transport capacity is more flexible and more open to small operators: It is easier to purchase a fixed capacity to be purchased in combination with a flexible shell

Shared electric scooter

The second initiative in this horizon is to bring shared electric scooters to the mobility market. As we could see in need 3 and need 4 (chapter 4.2), elderly have a need for personalised experiences based on their disabilities and for an easy route towards the final destination. By focusing on making it easier for the elderly to change stops, or to get from a stop to their final destination, the concept for a shared electric scooter is given to spark some inspiration.

As a result of the interviews with elderly, specified experiences with new innovations for elderly (interview Jurgen) and the research done, a list with a few specs for this concept were made.

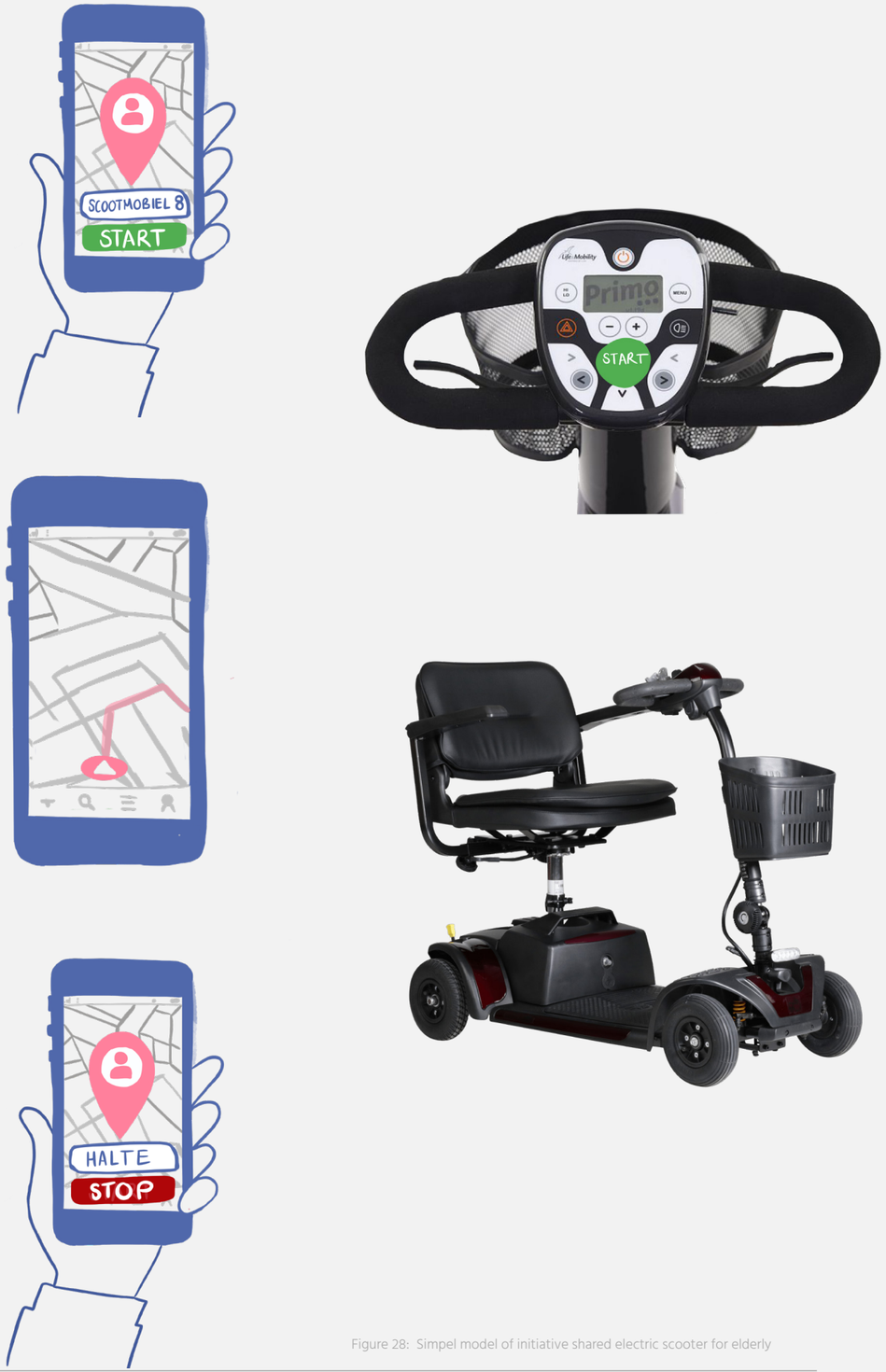


Figure 28: Simpel model of initiative shared electric scooter for elderly

The shared electric scooter:
- Easy to start/stop
- Phone must be able to be put on the scooter so route can be followed
- Pay with OV-chipcard
- Available in Hubs nearby locations where elderly come often
- No need for additional app to activate scooters
- Easy-to-use scooter, not very different from the scooters elderly regularly use
- A 24/7 support option where they can call to when things don't go to plan

To enhance the inspiration, a customer journey is made on the usage of these kind of shared mobility scooters (see figure 28). It all starts by an elderly arriving at a stop and she needs to travel to a bus station, which is a 10-minute walk away from this subway stop. Through the control centre, she has been told that it is possible to use an electric mobility scooter for this stretch. She arrives at the stop, walks to the scooter, which is located in a mobility hub, and checks the number with the one in her app. She then clicks start (step 1), the scooter turns on and all she has to do is click the clear start button on the scooter. After this, she immediately sees the route on her phone to the bus stop (step 2). She can click the phone on the scooter which will show her how to drive on the way. Once she arrives at the bus stop, she can click the stop button on her phone, which will make the scooter turn off automatically. The travelled kilometres it took her to get to the bus stop are automatically deducted from her OV balance.

Furthermore, further research and discussion on shared mobility for elderly is needed. We need a better understanding of the opportunities and pitfalls offered and we need to evaluate how individuals with multiple limitations are able to use or not use these services.

Development MaaS application
The use of navigation apps that can be customized to the personal needs of the elderly will need to be tested, and feedback needs to be collected. With this, they can begin to roll out a MaaS app, with the working of it being completed by the control centre. From the feedback sessions with the elderly and the testing, we can now look at creating an enthusiastic base of elderly who can be contacted more often to test the different functionalities of this first MaaS application.

Elderly involvement
What we hope will happen is that the seniors who are excited about this new way of traveling will influence other seniors. There is a need to view social influence as an important part of social development that can have positive consequences (van Hoorn et al., 2016).

If seniors let it be known that it's all actually very easy and attainable, other seniors will also be more likely to be motivated to change their travel habits (Foulkes et al., 2018).The elderly should also be involved by the design process of the shared electric scooter app. UX- and UI-testing will be key. Also the places to station those scooters need to be tested via interviews. IMM can also be used for this purpose.

Regulatory
At governmental level, they will have to start imposing stricter requirements on the granting of a WMO indication in this horizon. After much has been done about the illegal use of RMC in the previous horizon, already fewer people will use SSAT. But because other means of transport are made more accessible and shared mobility for elderly is introduced, a WMO indication can be looked at more strictly. For example, if the elderly can walk a bit, it is already possible for them to make use of public transport, even though this is not seen as 'easy' for them. In order to also realize combining SSAT with PT, they will need to start merging budgets for mobility. This will ensure that the entire trip can be offered at a PT rate, making it easier for the users and more convenient.

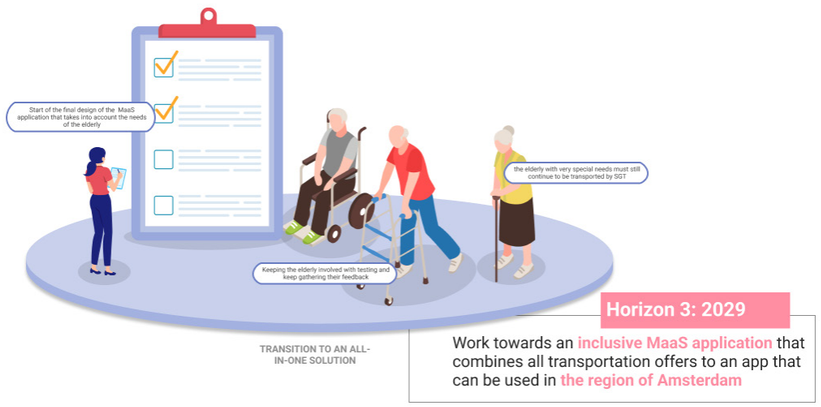
A control centre is the responsibility of the province. They will therefore have to look at the examples in Zeeland and Noord-Brabant, and then set up a control centre themselves in Noord-Holland. Also, the province will have to sit down with municipalities to agree on the flows of money. The municipalities have a say in tenders and lists of requirements. They will have to look together at making transportation offerings possible with one and the same rate, and which can be paid for in the same way.

Municipalities will be responsible for analysing the new data generated in horizon 1 in order to set up proper control centres together with the provinces. They are also responsible for tendering new mobility initiatives, such as the shared scooter, so that hubs become more inclusive and older people can travel more easily.

Technology
With PT and SSAT already sharing their data with the CDS-M, the gathered data on the infrastructure around the PT will also be added. Together with that, HUBS will also generate data on availability and usage, this will contribute to the eventual quality of analysis and the proposed routes by the control centre.

Business RMC
After RMC made progression when it comes to cutting the illegal use of their services, they can focus on being part of a mobility ecosystem. Instead of only being a door-to-door transporter, they can merge with PT to make less kilometres a year, have budget spare for other purposes within the company and to be an essential key for a successful MaaS ecosystem.

7.7 Horizon 3



Vision

Now that PT and SSAT are combined, there is a control centre to book these combined rides and the offer of mobility is enlarged, the final steps towards an all-inclusive MaaS solution within the region of Amsterdam can be taken.

The last horizon is all about the transition towards this final MaaS ecosystem, getting the regulatory things fixed, involve the elderly in the last feedback sessions and the regional enrolment of the application, so the majority of the elderly, but also the majority of the inhabitants of the region of Amsterdam, can benefit from this new way of transportation.

Market

As a lot of data has been gathered in the previous horizon's, PT can now start customizing their schedules on real-time data instead of having them fixed on certain times every day. ICT applications in combination with the use of big data and streaming technology will make public transport more dependent on the desired use and needs. Together with Vehicle-to-everything developments, all transportation means will become dependent on each other, and on the passengers. Around this time, it is expected that pilots with Autonomous Vehicles will begin. Incorporating successful pilots into the platform not only makes it more appealing, but it also makes a MaaS ecosystem much more stable, on demand and reliable.

Initiatives

Enrolment of final MaaS application

Because this is the horizon before the desired future vision, it will be all about enrolling a successful and inclusive application, together with a well thought-trough mobility system which is targeted at the largest range of people possible. To be able to design such an application in an inclusive way, elderly should be involved during the whole process, to learn from the people that are the toughest to design such an ecosystem for.

Development MaaS application

Eventually, more mobility providers will want to contribute to this solution, as it enhances the needs of the population of a region and they will see their users switch to these well-integrated MaaS solutions. As as multiple forms of mobility are added to the app, it will continually update. This means that we will need to continue to encourage feedback from elderly on how the app works and how clear it is. At the end of this horizon, the final application will go live.

Elderly involvement

The elderly are of great importance in this final phase, they will be asked to come for testing more often and they will have to give updates on their needs when it comes to mobility, now that so much has changed.

Regulatory

As the future vision of an inclusive MaaS ecosystem is coming closer, the government will need to grant bigger budgets to be able to test the application even more and to start different tests on the mobility providence. As these tests will not only be valuable for the region of Amsterdam, the results can be used for expanding this ecosystem to a national level. The government should therefore already start with debating on next-steps on national level for a MaaS ecosystem.

As the province of Noord-Holland is now working towards their first successful MaaS application and transportation system, they can already start their strategy on expanding this to other regions around Amsterdam. This will eventually make it possible to use this application for inter-regional travel as well.

Municipalities will start collaborating with other municipalities, sharing insights, giving advice but also inspiring them to want the same.

Technology

As shared mobility parties are expected to join the CDS-M data analysis tool last, because 'they will have no interest in sharing data and organizing an ecosystem, because they are often driven by profit' (Jeekel, interview). They need to find out that this new way of mobility, the MaaS ecosystem, will be preferred by many people because it is faster and more complete. They need to see the benefit of cooperating and will hopefully decide to share their data.

Business RMC

As the MaaS ecosystem becomes more of a reality, a large part of SSAT will come to an end. Elderly people, as well as others, with or without disabilities, now have the ability to travel in other ways than before, when they felt their travel needs could only be fulfilled by RMC. Therefore, RMC will have to move away from special group transportation, and focus only on true special transportation for people who cannot travel by any means other than door-to-door vans. Because RMC is an organization who has been transporting elderly people for a very long time, have been collecting data from elderly people and knows a lot about the wishes and motivations of these people, they can start using that data to play a role as key advisory company for implementing MaaS systems. They can advise other municipalities, mobility providers and even share their knowledge with other countries, to make sure that inclusivity of this vulnerable target-group is and stays a priority when designing new mobility ecosystems.

7.8 Conclusion

- One of the key outcomes of these roadmaps, which cannot be emphasized enough, is that validation with the target audience is incredibly important. Especially with such a target group that has a harder time changing behaviour and is often newer to using applications/online services.
- By creating the roadmap with knowledge gained and validating it with experts in the interim, an attempt was made to paint an as complete picture as possible of the main steps to be taken.
- Key elements were chosen to focus on with this roadmap, which in a way have to do with inclusiveness. There are other interesting elements in addition to those given, which only confirms that an immense amount needs to be done to realize this future vision.
- Action must be taken at two different ends of the spectrum. On the one hand, much must be done from within the organizational side, which includes regulation. If this is fully regulated, on the other hand, there must also be a change in the attitudes of the elderly and their motivation to change behaviour.
- The purpose of the roadmap was primarily to be a source of inspiration and an awareness of reality. What mainly emerges is that realization of this future vision is only possible if all the different parties mentioned cooperate and value inclusivity. So the chances of this becoming a real future are slim, and change is drastically needed.

08 Delivering strategy

As the roadmaps are a final deliverable for the design challenge, a strategy was made for Label A to incorporate different inclusive design insights into their way of working. A proposal is made and validated to make inclusiveness a priority in new app developments in various ways.

8.1 Implementation
8.2 Workshop inclusivity
8.3 Evaluation workshop

8.1 Implementation

Developing the roadmap and all the key insights that come with it, contribute to Label A's knowledge on the future of mobility, but mainly of MaaS, from an inclusive point of view. Label A will have to promote inclusivity to their new customers to ensure that new services and products, coming onto the market, will take into account vulnerable or less potential target groups. To make sure new clients, but also all employees of Label A, take inclusivity serious, an implementation strategy was made. This strategy was made by talking to employees within Label A, including the sales team, designers, front-end developers and directors.

This strategy dives deeper into the design process/way of working of Label A and finds sweet spots to encourage inclusive thinking or challenging. To find these spots, an understanding is needed of the current design process of Label A when working with a new client.

Way of working
The first steps in the process are performed by the sales team. They are in contact with new clients and together they draw up a plan for developing the new digital solution. The sales phase ends with an proposal that includes the estimated number of sprints needed to implement this digital solution. Because Label A works with a method called 'scrum', the number of sprints give an indication on how long the development is going to take.

Scrum is a lightweight framework that helps people, teams and organizations generate value through adaptive solutions for complex problems. The fundamental unit of Scrum is a small team of people, a Scrum Team. The Scrum Team consists of one Scrum Master, one Product Owner (client), Designers and Developers. Within a Scrum Team, there are no sub-teams or hierarchies. It is a cohesive unit of professionals focused on one objective at a time, the product goal. Within this scrum process they make use of sprints. Sprints are fixed length events of one or two weeks to create consistency. A new sprint starts immediately after the conclusion of the previous sprint. In these sprints, through discussion with the product owner, the developers select items from the product backlog (list of what is needed to improve the product) to include in the current sprint. The scrum team refines these items during this process, which increases understanding and confidence. In sprint 0, the focus is on the kick-off of the project and the preparations are executed. Examples of activities in this sprint are: writing user stories, coming up with design principles, define way of working and setting up a technical base.

At the end of sprints, the product can be tested with the user group. This can be a certain feature or a whole flow that was developed during the sprint. The quantity of tests is discussed with the client and should be agreed upon during the offer talks with the sales team. When the sprints are done and the product is tested, the final product is presented to the client and launched to the App-store (in case of an app) and to the internet (in case of a website). However, it sometimes happens that more sprints are needed than previously estimated and agreed upon in the original offer. This will always be done in consultation with the client, after which sprints may be added to the process.

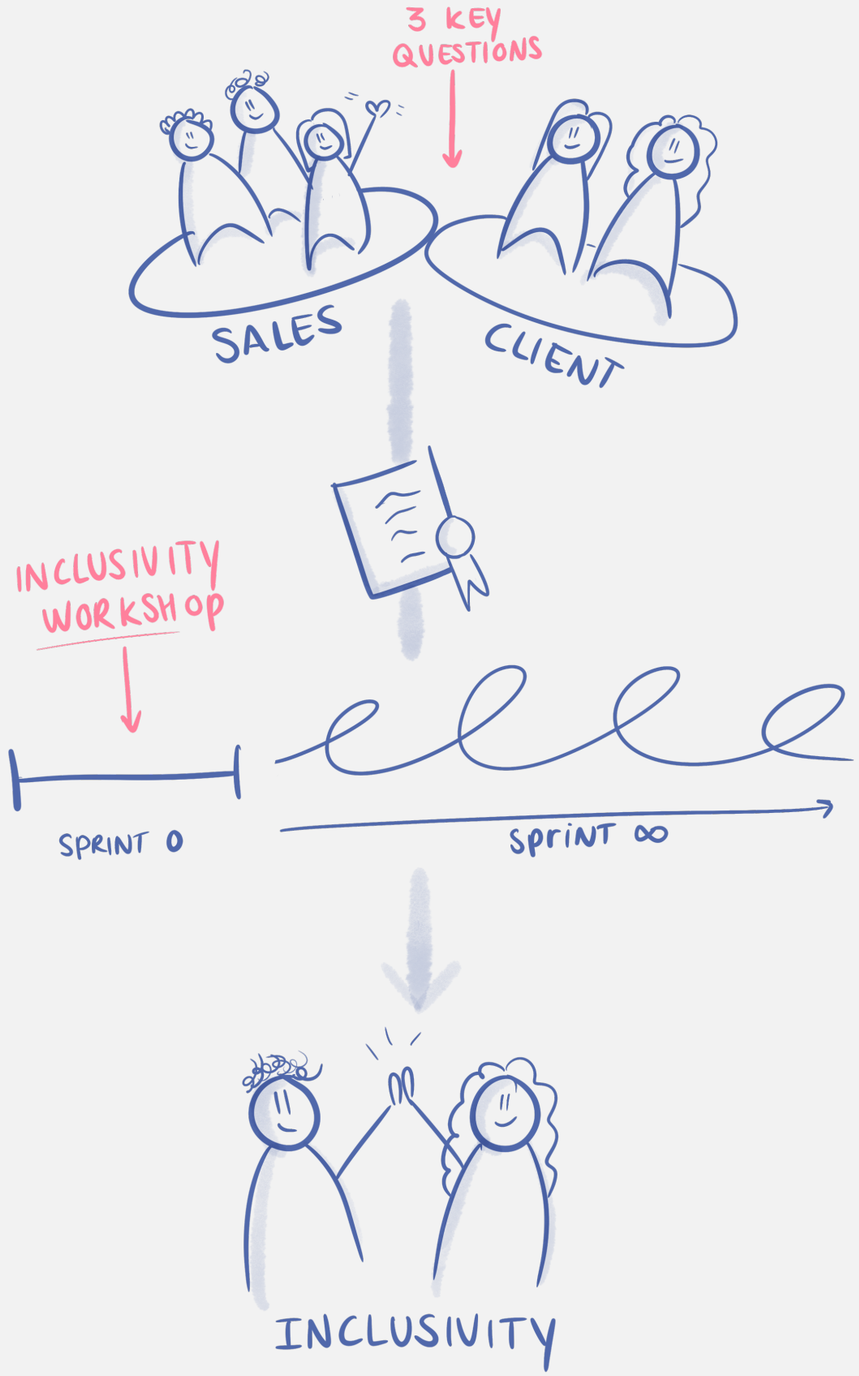


Figure 29: Visual representation of inclusivity strategy for Label A

Questions sales team
It was briefly explained what the current way of working is within Label A. Now, a few things are explained within the process by which they can begin to implement inclusivity. To encourage the client to think more inclusively on their product/service, the sales team can asked several questions before the scrum team will start with the sprints. These proposed questions and their reasoning are presented here:

- What is the product mission?
The purpose of the product is crucial. The sales team should make sure that they are informed about it. They need to get involved in the discussion on the kind of change the client's product will bring about by asking them to provide a detailed explanation. It will assist the Label A in comprehending the tone of the solution that they are developing for and producing content that will appeal to its target market. The mission relates to both the larger social philosophy that underpins the product as well as the issue that it answers. The product stands apart from rivals due to its mission. So, make sure the client together with the sales team thoroughly get the purpose of the product.

- What is the worst case scenario?
Although we are unable to predict the future, the sales team can challenge the client's assumptions by asking this question. It is an excellent method for considering users who could mistakenly have been left out. Designing with the needs of those who the rivals might also exclude in mind is a terrific idea. It might work to their benefit. By meeting the demands of a larger segment of society, it is possible to expand the target market and increase product popularity. When the sales team anticipates all the worst-case possibilities and discover a way to mitigate or completely avoid them, it becomes a reality. No room should be left for a poor user experience.

- Who is your target-group and who might you be excluding?
We are used to making things for the circumstances we encounter every day and design for users who have similar interests. However, the client might be shutting off people who are different. The significance of inclusivity must therefore be emphasized during the sales talks. The client needs to do their research on the target market before designing the product, right? There must not be ignored the demands of misunderstood social groups. However, Label A needs to make sure that the demands of every member of this specific target group are satisfied.

Inclusivity workshop
After the process of the sales-team ends and the questions are answered, sprint 0 can start. In this sprint, a workshop can be done together with the client and the scrum team to come up with inclusive design principles to take into account during the design process. Design principles are a set of rules and considerations that help teams and individuals make design decisions. They state intentions, provide references, and create a united vision and shared standard for team members.

Part of the job as a UX/UI designer at Label A is to define and adopt design principles specific to the company and the products they are designing. If we want the team to take an inclusive design approach, inclusivity needs to be embedded into the design principles that guide the efforts. Therefore, together with the client, inclusive design principles can be made to be able to look back on the whole design process. To guide the development of these principles, different themes are used to spark creativity.

8.2 Workshop inclusivity

The envisioned inclusivity workshop is a proposal for Label A to do together with their clients to come up with inclusive design principles. To test if the envisioned workshop (see appendix L), was considered convenient and a good addition to the existing work method of label A, it was tested. It has been tested with a team, consisting of a designer, a front-end developer and a scrum master. With these roles present, we have all the roles that are most often part of a project team together. These are also the roles on a project team that can influence how inclusiveness is expressed during the project. The goal of the session was to gain feedback on the comprehensibility of the subject inclusivity and to get a better understanding of the different roles they play in a team and how we can incorporate inclusion in these roles.

Content of the workshop
The session started with an introduction on inclusivity, what it means, what it doesn't mean and what pillars are useful to keep in mind when thinking of inclusivity. After a basic understanding was created, a case study was presented. As a case, RMC was chosen. A brief introduction was given on the company, what they do and what they want a new application for.

After that, a quick brainstorm session was held on the target-group of RMC. Thinking of who these people can be and what limitations these people have when it will come to using the service/app. This helped to get a better understanding of the users and be more capable of coming up with inclusive design principles for them. Then, each participant was given some post-its, to write the design principles on. On the screen, different starting points were given to help make these inclusive design principles. After the different principles were coined (see appendix M), the participants were asked to choose the three most important ones, which (imaginably) should be taken into account during the whole process with RMC as a client.

After the workshop, a discussion took place. The focus was on their opinion on how to implement this and in this discussion the key questions were:
- How can we challenge you to take these principles into account?
- Who should be responsible for monitoring these principles?
- Who should define the users/which users are going to be left out?
- Next to the principles, in your processes, where can inclusivity play a role?
- When can we best do testing with the target audience?

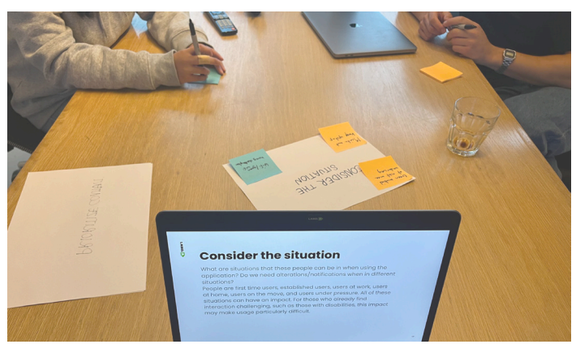


Figure 30: Picture token during the inclusivity workshop

8.2 Workshop evaluation

Content of inclusivity workshop

The content of the workshop was clear to all participants. The introduction of what inclusivity means helped them have a better understanding of the term, which also made it easy for them to set up the design principles. The different topics presented on principles were also considered helpful. These allowed the participants to be inspired and really come up with new inclusive design principles together. It was also clear what the purpose of the principles is and why it is important to establish them. In fact, all participants have thought about inclusiveness themselves but still found it difficult to determine how this should be reflected in their practices.

Taking responsibility for the creation of design principles

During the evaluation of the workshop, it was discussed who should take responsibility of the creation and observance of these inclusive design principles. As this thesis-internship is almost at his end and I will be leaving the company, someone has to make sure inclusivity is not forgotten and this topic is really implemented into their sprint 0.

The conclusion of the discussion is that every member of the team should be accountable for taking the inclusive design principles into consideration. To accomplish this, the final thesis presentation will also be presented to all employees of Label A. This will make sure everyone knows what inclusivity is, why it is important and how this can be implemented into the current way-of-working. Next to that, the lead of the design team will be accountable for executing the inclusivity workshop with the clients. The lead needs to test this proposed workshop with new clients to iterate and should check with the design team if the workshop actually took place in the different projects. The sales team will be accountable for proposing this into the offer to new clients, to show this is an activity Label A does with all clients to maintain inclusivity.

Defining the users

RMC was used as an example case to come up with the different inclusive design principles. Because I already had a lot of knowledge on the user-group of RMC, the disabilities and limitations of the user group were already presented. At the end of the workshop, we discussed who, in a real design process, should be accountable for defining the user-group and how extended this is. All participants agreed on the fact that the client should be able to explain the full potential of their target-group and should list possible limitations. Mainly for this reason, the third question was added to the implementation strategy for the sales team (*Who is your target-group and who might you be excluding?*).

Inclusivity in the different roles

Next to coming up with design principles, it was discussed what role inclusivity could play in the different professions within Label A. Every participant had the chance to reflect on their work and seek for different points were inclusivity can actually have an impact. What stood out here was that every participant had thought about incorporating different inclusivity values into their work. They did miss the unanimity within a team on this topic, which made them quickly forget about the topic as well.

Scrum master - They can start challenging the client start challenging what happens during a project and whether it stays in line with the product vision/mission. They need to start asking the client more often why, for example, they want to know certain things about the user, why they don't want to add other features as well and what things can be left out to make it simpler and more accessible. They can also determine together with the client what all user-stories should meet when it comes to user disabilities.

Design - They need to create a way of working that is applicable to every project. For example, even if there are no visually impaired people in the user group, they can still come in the future. It is up to the design team to ensure the inclusive design principles, that each interface takes into account the target group. So the rest of the team will also have to address them if they see that the principles are not reflected in the design. They are also first on the scene when a client asks for a new feature, so they should immediately think about the inclusive principles when this happens.

Front-end Developer - They are, for example, responsible for making it possible that websites can be read aloud. Area-tags also play a role in inclusivity, you hang certain things on these tags, like headers and buttons (code-wise). This allows the user to step through the website smoothly and this piece of recognition is useful for the user as well. The design indicates this, but the front-end team should really need to keep implementing this as they go along. Alt-texts for images are also an important part that could be implemented more. This could possibly just be automated in the future as well.

Testing with the target-group

To further ensure inclusivity in the design process, more and earlier testing with users will be needed. Now-a-days, the client often selects groups to test with, but Label A will have to put more emphasis on the diversity of these user groups. In that way, they can find out how inclusive their design really is. Certainly by setting up the principles, we can let the client see what other kinds of users there might be who can also help with testing. Another take-away, is that in the future, before the real sprinting starts, the most important flows of the design needs be tested in order to get there as early as possible.

09 Evaluation and recommendations

This chapter gives an evaluation of the roadmaps, focussing on future recommendations and limitations. To end this chapter, a letter was made for the municipality of Amsterdam to show different insights, frustrations and a call to action on inclusive mobility.

9.1 Roadmap evaluation
9.2 Final recommendations

9.1 Roadmap evaluation

To evaluate the roadmaps, three different specialists were asked to provide their opinions and viewpoints. The combination of their thoughts provided a deeper knowledge and richer reflection on the project's outcomes from many points of view, because they all brought unique perspectives and varied levels of involvement to the project. The evaluations aimed to find out what experts thought of the roadmaps worth, how they would improve it, and what they would suggest for future advances.

The evaluation discussions took place in one-on-one sessions with each expert and lasted about one hour. Beforehand, the roadmaps were send to the experts, together with an explanation on the elements and the horizons. At the start of the session, a ten-minute presentation was given to introduce the topic of inclusion and create a base-level knowledge on what it means for our future. After that, there was room for discussion on the future vision, the roadmaps as a whole and the different steps which are presented in them. The recommendations and comments of the experts were clustered (see appendix H) and presented here by topic.

Providing opportunities for multiple platforms

In the evaluations it was pointed out that, in the roadmaps, it seemed like there is going to be one platform/application in the future which will control the MaaS ecosystem. It was important to recognize that a MaaS monopoly is not wanted. Young people want a different kind of mobility offer than employees or the elderly, so, as a platform, you can focus on a particular target group. Also because mobility is still quite regional, e.g. cab networks are very regional and bike rentals are often regional, so you would expect to get different platforms for different locations, so they can adapt well to those needs and parties in that specific area. So don't expect to see a complete inclusive solution for everyone, but platforms starting to see opportunities in inclusivity and focus on special audiences.

"It is the government's job to keep an eye on MaaS and steer it in the right direction to prevent one party from creating a monopoly. We want to give everyone a chance within the mobility market." - Bon

Multi-modality

Another outcome of the evaluation was the concern about promoting multi-model trips to elderly through the MaaS service. Despite the GOAN! pilot, which focusses on multi-modal travel by connecting SSAT with other mobility services, it is undesirable to make elderly people switch so often. In practice, 80% is door-to-door instead of inter-modal, because it becomes so complex. For the elderly, getting in and out is annoying, physical disabilities play a role there. What also plays a role is the commercial incentive, those cab companies don't want to give away their potential kilometres of travel, so they prefer to drive that whole trip.

"There is a lot of talk about multimodal, but these are the most complex trips out there, they are too stressful for many people, and those masses who go for MaaS seem to overlook it because they just want to tie everything together, which is totally undesirable especially for the elderly" - Toon

Support

Another finding from the sessions was the significance of strategically gathering and utilizing insights to develop empathy for the elderly and advance the MaaS service. Given that the interactions of the users with the service provide a feedback channel regarding each individual's experiences, wants, and values, the service can develop into a constant supply of insights. An opportunity is to enhance this insight channel with the call-centre of the MaaS service. Here they should have one central phone-line for people to call to book their trip, give immediate feedback on their last trip and get help when needed.

"An awful lot of people value personal contact, calling the switchboard because they feel more confident that they have been heard. The Internet is too impersonal and direct feedback is missing. That aspect should breathe very much into that app" - Toon

The platform owner

As was concluded, one MaaS platform is not desirable. What should be taken into account is that these platform developers only have one chance when it comes to their target-group. In particular elderly are often a though one to persuade to change their behaviour and try a new innovation. Although various points of feedback sessions and incorporations of elderly in the design process are given, the end result should meet everyone's expectations to succeed. The accessibility of the stations are all not in order yet, so you really need to have and be able to guarantee the accessibility of the different public transport stations before you launch such a platform.
Also, it is up to the owner of the platform to determine how the users pay for the ride, does this work with a subscription or do you pay per ride. More research will need to be done on how the elderly can best start paying in such an app and how that can best be arranged for them.

"Developing such an app sounds easy but it is also difficult, you only have 1 chance with the consumer, if you download the app and you find that the schedule or dates are not right/working, people throw that app away immediately." - Bon

Context is key

It also came clear in the evaluation sessions that it is not only about the different universal needs of the elderly or their intended change of behaviour, but also about their context. What often is forgotten, is that context is very important, where are people coming from where are they going, how far is it to walk and can you expect them to be able to walk those distances in certain situations. In particular, it's making it clear what options you have, so showing in the app what the best trip is. If it's raining, for example, it will tell you that you really should take a cab today. Is the weather nice? Oh, then you can walk to that bus stop around the corner. That makes it easier for the elderly to become accessible.

"NS has been on strike, soon there will be snow and sleet again, so you have seasonal effects. A 90-year-old is not going to walk to the bus stop if it's snowing. Which is good, because then nothing happens to her that could cost us money." - Toon

Getting parties on board

The evaluations on the concept's technological viability showed that it is definitely feasible, but the execution is where the true difficulty lies. Mobility parties do have cold-water fear, so this MaaS platform needs to be positioned in a way that if they join such a platform, these parties can increase their customer base. You keep your own users in the app, but that MaaS app can only get new customers. But they often still find it daunting to join. So when you want to have a platform aimed at the elderly, make sure the mobility parties know what they are getting into and make the benefits clear as a platform owner.

"All those mobility parties are using standards for data exchange, if you have a platform with different carriers, that data is now sent the same way by everyone. So if a new carrier comes into the market and uses those standards, it can be connected to any platform. So new platforms can also easily coexist." - Bon

9.2 Final recommendations

Already future recommendations and alterations were established using the information from the expert validation. Additionally, the evaluation of the inclusivity workshop for Label A gave a better understanding on how to implement the inclusive strategy. Final recommendations for the field of mobility are made in this chapter to wrap up the delivery phase of this thesis. It is strongly advised that future developments of in the field of MaaS take these recommendations into consideration.

Define the costs

This study identifies a gap in the market and the future direction for elderlies involvement in new MaaS innovations. A roadmap was created to help organize its service development activities in accordance with the suggested future vision. A thorough business case for a final MaaS ecosystem could not be defined within the confines of this thesis. As a result, it is important to conduct a financial analysis of the necessary investments and to make an estimation of the maintenance and operational expenses associated with developing such an inclusive MaaS service. Additionally, an estimation of the anticipated earnings and investment return of the service itself is necessary. Because the elderly are often accommodated by municipalities when it comes to mobility, they also expect that with such a MaaS platform, they will not have to pay full price for the service. It is therefore very important to find out whether it therefore has any value at all to set up something like this, cost-wise, for this target group.

Take action and ownership

During this thesis, many people have been spoken to in the field of mobility. Several organizations are pointing to other organizations to take the lead with developments within MaaS, and involving special target groups in this. In this, it is claimed that inclusivity is the gasoline that all stakeholders within the field of mobility need inside the field and alter ingrained business and operational habits, one needs to take strong ownership and have a visionary mentality. These elements are required to utilize that fuel, and become a truly inclusive MaaS service. The Municipality of Amsterdam will be the easiest to take a lead on this, as they have a lot of knowledge, already have a vision for MaaS, and will have to take responsibility for restricting the elderly from using SSAT.

Stay realistic, keep your head down

Strong ownership and a visionary mindset are necessary but not enough. The suggested roadmaps serves as the fundamental direction while interacting with elderly along the road of development. It takes a whole mobility field that completely embraces and accepts an inclusive mindset to put this MaaS service into action. The evaluation's conclusion serves as tangible evidence that a service that involves numerous iterations and constant consumer interaction can produce a useful and interesting platform concept. However, the eventual roadmap didn't even focus on all necessary aspects when it comes to setting up such a service. Meaning that the road towards the envisioned future vision is even more complex than was presented in this thesis. Therefore, we need to stop romanticizing the MaaS concept, calling it the 'ideal future', without even knowing its proof of concept and realising all changes that need to happen to realise it. And as Toon said beautifully: "We need to stop seeing MaaS as a revolution, but more as an evolution. We need to start making real steps to accommodate this evolution and stop waiting on a radical revolution."

Inclusivity is not advertising material

What stood out throughout the process of this thesis is that almost everyone knows about the term 'inclusivity'. In some way, it seems to be the new trend after sustainability. It sometimes seems that organizations think they are being and thinking inclusive, by knowing what it is and saying they take it into account. Even when we Google the term, we see many parties using it to promote their services, while they have often made little effort to really consider it in their proposed product or service.

What is recommended here, and certainly also referred to Label A, is to use the term only when it has actually been thought about and has a place in the company's way of working. Having an inclusive mindset is different than having an inclusive approach towards problems. By incorporating the inclusive workshop into the design process of label A, it is therefore hoped that they can encourage other organisations to think about the concept.

10 Conclusion

This chapter describes the overall conclusion of the project, by discussing the assignment, process, findings, and ends with a personal reflection on the whole thesis process.

10.1 Discussion
10.2 Final conclusion
10.3 Personal reflection

10.1 Discussion

The initial assignment of this thesis was to research what the future of MaaS looks like through an inclusive lens. In other words: what should be the next step for all these mobility parties. After initial exploratory research, it was found that, in general, current innovations within the mobility sector are more technology-driven rather than consumer-driven. This withholds them from developing a ecosystem that is truly inclusive for the majority of the population in an increasingly digital world. So in order to define the next step for the mobility sector, a more holistic approach is necessary accompanied by the following problem statement: How can we encourage better communication between mobility technologies/organisations and the elderly in order to become more inclusive and generate more integrated inclusive mobility experiences?

Extensive research was conducted that shows an opportunity gap: to increase inclusivity by strengthening the connection between the elderly and mobility. Moving away from one-way traffic and working towards a better relationship which aims to learn from elderly and their needs.. The subsequent iterative design phase resulted in a roadmap that shows organisations within the field of mobility how to empathize with the needs and emotions of elderly within the design process of a new MaaS ecosystem. The roadmap comes with a step-by-step demonstration on how to use this input, as well as a manifestation of the outcome. Together with a strategy for Label A, organisations within the mobility sector can become more inclusive from the start of the design of a new product/service.

Reflection on the problem statement

The results of workshop, along with the subsequent expert validation, demonstrate that the gained inclusivity knowledge can be utilized to develop digital service concepts that are engaging, personable, and empathic while also gaining a thorough understanding of the users. The roadmap is also supplied with a plan on how to implement it even more, utilizing data and partnerships. In addition to concrete starting points for future recommendations, more people need to start realizing whether it is feasible and otherwise we need to start changing our current mobility system now. The roadmap can be utilized to confront organisations on not having a inclusive mindset when it comes to mobility, and to show what needs to be done/changed to even make this a realistic goal.

Reflection on the design statement

Reflecting on the formulated design statement, it can be concluded that the final design fulfils the objectives set forth in the design brief: It shows an example on how to comprehend and sympathize with elderlies, how to incorporate feedback sessions, shows the sector to concentrate on the changes that need to be made to realise this and is a confrontation to these different organisations that change has to come. However, ownership for change, a visionary attitude, and further changes toward a culture in which inclusivity is completely embraced are necessary to assure that the roadmap will actually be used and further developed inside the mobility sector.

Reflection on inclusion

Three inclusive principles were a guidance during this inclusive design process (chapter 2.1). To reflect on inclusion of the roadmap and the proposed strategy for Label A, these principles were used.

Recognise exclusion - Clearly, it was quickly recognized that little effort/attention is currently being paid to the elderly when it comes to offering mobility/support. The roadmap aims to improve the interaction between new mobility/platform providers and the elderly. In order to better learn from their needs and establish a more inclusive service. Besides that, the proposed strategy for Label A enables them to recognise and anticipate on exclusion sooner, from the start of every new project, by allowing clients to share their thoughts on inclusivity and raise awareness on what makes people feel excluded.

Solve for one, extend to many - the new roadmap made use of universal needs of elderly (chapter 4.2). As a result, the roadmap was designed to tap into these needs. This allows it to work towards an inclusive future vision which is desired for as many people as possible. The inclusive design principles can help clients of Label A to extend their service/product beyond their envisioned target-group, making it more inclusive and more useful for more people.

Learn from diversity - The roadmap has put the elderly in the centre of the design of a new mobility ecosystem. The different test and feedback moments allows the elderly to share their experiences and recommendations. At the same time, it allows the MaaS provider as well as the different mobility providers and the elderly to learn from each other, and so, stimulate all to learn from diversity.

Relevance for Label A

Reflecting on the initial assignment, the insights and the final roadmap of this thesis do not only contribute to Label A's interests, but can be used as an inspiration for changes in their method of working with new clients. The roadmap and inclusivity strategy has the potential to be used within other organizations as well, but Label A as an app developer and the opportunities they have to challenge their own customers makes their position, being at the beginning of the process for new innovation, unique and a big opportunity to implement inclusive design.

Relevance for the field of design

The deliverables of this thesis, such as the final roadmaps and the workshop to come up with inclusive design principles, can be included into a wide range of design scenarios and within different organisations. This thesis provides a strong argument for taking a more inclusive approach to designing applications/services for special target-groups to gain deeper insights within the field of design. It highlights that it is necessary to build genuinely beneficial services and strategies that reach beyond the 'potential' user group. If you, as a designer, take up the challenge to re-frame the provided problem, look beyond the easiest target-group to design for, follow your intuition, and take a design-led approach towards the first assignment, all people can feel served with this new designed innovation. Mobility is important for everyone, so no one should be left behind.

10.2 Final conclusion

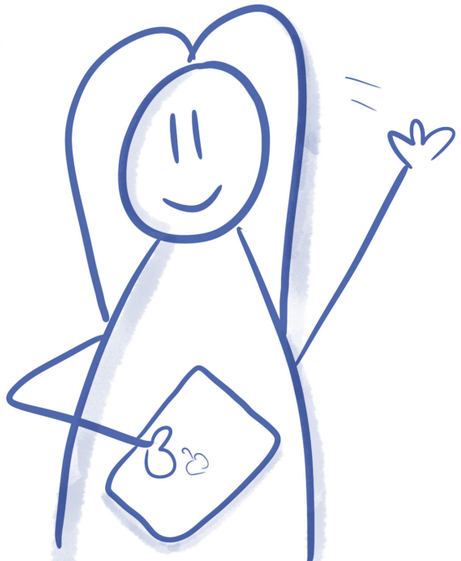
Mobility-as-a-Service is a concept that unifies access-based mobility services like public transportation and others onto a single, user-friendly platform. It can carry out door-to-door trips in a fashion that meets the user's requirements at a certain moment. MaaS-journeys ought to be quick, adaptable, trustworthy, and easy to use. Since the platform and infrastructure provide a smooth travel experience, these journeys ought to be simple to complete.

MaaS can help society since it makes personal mobility more efficient, requiring less urban space and having a less negative impact on the environment. The problem here is that businesses working on MaaS development, such cities, transportation firms, and knowledge institutions, are focusing on 'potential' target audiences. This results in fewer potential groups being overlooked and a lack of inclusivity, although mobility ought to be accessible to all.

This leads to the target group of 'elderly': they often suffer from physical disabilities and are least familiar with mobile apps, we can therefore learn a lot from this differentiation and design more inclusively. Gaining an understanding of their needs and diving deeper into the steps which need to be accomplished to actually make this inclusive MaaS platform a reality, a roadmap was created. Before an inclusive MaaS-experience can be realized, more work must be done. As a result, a design roadmap must be used in a long-term strategy. By keeping the future in mind, this offers the chance to develop towards MaaS's full potential.

What a difficult conclusion is to draw, but a realistic one, is that actually too much needs to happen to realise this concept for the target group of elderly. In general, so many steps need to be taken to make a MaaS platform a success without even focussing on less potential target-groups, that it almost seems impossible. In addition, elderly need to become interested in MaaS and access based mobility through changing their current behaviour. This needs to be an active goal that different parties within the mobility sector should work on. But, these parties see this target-group as 'the less potential', so awareness needs to be created that these people shouldn't be left behind.

A major party will have to stand up for the welfare of the elderly when it comes t
their mobility possibilities in the future. But to make a start, an inclusivity strateg
has been devised for the company Label A. They can get new clients, who want t
develop solutions within the mobility area, familiarized with inclusivity and challeng
them to include that less potential group in their new service or product. In this wa
they can already make a small contribution to broadening certain audiences, whic
will hopefully allow more companies to see how easy it is to be able to include the
in their focus as well.



10.3 Personal reflection

What a crazy ride it was. By starting the project with a somewhat vague assignment, to give me the possibility to explore and seek for an interesting goal, it already started as a big challenge. I never thought that this day, actually writing the last page of my thesis, would come so soon.

From the start, the topic of the project remained in the "fuzzy front end'. Although my interest, I did not know much about mobility, app development or MaaS, so I had to analyse the topics more in-depth to come up with a better understanding of the possibilities. During this phase, it has been challenging for me to zoom out and see the bigger picture. As I felt lost, I decided to just make choices, scope the project, and go with it. Indeed, the danger was that I would linger far too long in the research phase, necessarily wanting to justify all my choices and just keep finding new info. My supervisors said, just take that step and keep going, if it turns out not to be the right choice you can always go back and make another choice. This really helped me to continue the process.

What made the topic of this thesis so exciting to me is that I had the opportunity to be able to delve deeply into a particular target group and actually speak with these people. In addition, I had many opportunities to speak with different experts within the field of mobility, and after gaining a lot of knowledge, even had some really good discussions. Utilizing the perspectives of all stakeholders to select the appropriate issue is a key learning of this project. However, it enabled me to control the complexity and go deeply enough to develop a detailed roadmap design. Collaboration with stakeholders has also taught me how to communicate with other people. Finding a good method of communication with stakeholders that have different areas of expertise is always difficult because they speak different languages than a designer.

Furthermore, I have enjoyed my experiences at Label A. The employees have been very welcoming and willing to help. I got many enthusiastic reactions while discussing and presenting ideas and people were genuinely interested. This motivated me to reach out to even more people. That's why I'm pleased with the outcome of the thesis, even though I see a truly inclusive future of MaaS as somewhat bleak, I can still do my part by getting inclusivity well under the radar within this company.

Looking back at my personal ambitions in the beginning of the project, I think I have quite managed to succeed in these. Firstly, I wanted to become a better visual thinker. By making this thesis with a lot of drawings, icons, flowcharts and explanatory visuals, I challenged myself to type less and to show more. I also used miro a lot, which helped me think with more depth then only text. My second ambition was to help a user group who was left out by the current way of thinking. I think I really managed this by looking at the 'least potential' group for the use of MaaS and challenge myself to include this group into a future MaaS vision.

To conclude, it was not easy but I learned a lot. There have been times when I have really been through it all and at times I did think about quitting, but I am so incredibly satisfied with the end result and could not have had better guidance from Label A as the TU Delft.

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