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Application of the Persona Concept to Convey Socially Sustainable and Responsible Transport System Planning to Children and Juveniles Considering Autonomous Vehicles: Work Report on the Project AM4Kids – Future Workshop

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1 ABSTRACT

The automation in the transportation and mobility sector, particularly the use of autonomous systems in public transportation, presents novel challenges for various user groups despite offering numerous positive aspects. Autonomous vehicles, particularly in the domains of micro-public transportation and car sharing, have the potential to serve as a flexible mobility solution for individuals without a driver's license or those who are physically or mentally incapable of operating a vehicle. To ensure equitable access to this potential of independent and flexible mobility for all individuals, the design of autonomous transportation modes must be inclusive.

The Austrian“AM4Kids” project (August 2020 to October 2023) imparts knowledge on mobility and transport system planning to children and juveniles in the context of the progressive automation of transportation and mobility modes, focusing on the principles of inclusive mobility offerings. Children and juveniles have attended several workshops on mobility and inclusion for over three years. In the final stage of the workshop series, the children and juveniles develop their visions and ideas for automated mobility, discussing the opportunities, risks, and consequences for themselves and other groups.

One way to better understand and visualise the wide range of everyday lives of people with disabilities, their mobility patterns, and mobility options is to use the persona concept. This method aims at packaging real users’ motivations, needs, wishes and ambitions in a model to better integrate future research and technology development of automated mobility with the wants and needs of users. Personas do not represent the whole range of user diversity. However, they enable planners and developers to deal realistically with the situations and mobility needs of the relevant groups of people and allow specific analyses to implement user-oriented transport solutions.

This paper outlines the methodology applied and the results achieved to make them accessible to a broad professional audience. The project demonstrates that knowledgeably selected personas provide added value in developing technologies. They can also be employed in the further education and sensitisation of children and juveniles.

Keywords: awareness, persona, inclusion, automated mobility, children

2 INITIAL SITUATION

This paper is a follow-up to the 2022 paper entitled “Automated Mobility and Inclusion as Educational Topics for Children and Juveniles and as Tasks and Responsibilities of Mobility Planning: Work-Report on the Project AM4Kids” (Hohenecker et al. 2022).

The project assumes that people with disabilities do not have some “special needs” which would set them apart from non disabled transport participants. Instead, and in line with the social model of disabilities, the design of environments, infrastructures and vehicles neglects them as potential and actual users. They need awarness to be represented in the mindsets of traffic planners, traffic engineers and decision-makers. Exclusion, therefore, is not a consequence of bodily impairments but of failing to upgrade and to generalise chances of participation, e.g. in terms of universal design or design for all principles. The project aims to broaden the scope of reflection on how traffic systems, including infrastructures, vehicles and environments, are planned, designed and built and how human creativity can intervene and change these human-made structures. Contemporary (interface) design approaches must address these issues on a general and abstract level. They emphasise the diversity of road user groups by constructing “personas” (Cooper et al. 2007),

which are fictional but realistic characters with concrete situations and specific aims in their daily lives as well as broader biographical perspectives (see Chapter 3 in this paper). Personas are a fruitful starting point for pedagogical work as they are a dialogue partner in developing ideas for a future mobility system. They help children and juveniles in educational settings to develop forward-looking responsibility when they imagine future traffic systems and transport modes.

The focus is on children and juveniles who gain insight into transportation planning and the associated research fields and research processes within the framework of the project. The guiding statement is "Today's children and juveniles will be tomorrow's users and decision makers of automated mobility" (Hohenecker, Knoll et al. 2022). Children and juveniles shall learn about the wants and needs of diverse traffic participant groups, to deal in particular with the prospects for the development of automated mobility, and to develop and reflect their visions of the future in the subject area of mobility.

The project consortium of AM4Kids[1] is composed of sociologists, transportation planners, landscape architects, civil engineers and legal experts focusing on the needs of people with disabilities. Six different schools with fourteen overall classes participated in the project. Age groups from primary school to secondary school level 2 are represented. The classes vary in terms of school levels and in terms of pupils with disabilities involved as well as educational specialisation. Table 1 gives a brief overview of the numbers of participating school classes. For example, one school has some children with visual impairments and another school focuses on technical and engineering education.

school level	school classes and timeline	summarising unique characteristics
primary school (age group 6-10 years)	eight classes: in three different schools from 08-2020 until 10-2023	inclusive school and all-day school, volatile school, classes with special educational needs (integrative class)
secondary school level 1 (age group 10-14 years)	two classes: one school since 08-2020 until 10-2023 and two classes: one school from 01-2023 until 10-2023	school for children with visual impairment, classes with special educational needs (integrative class)
secondary school level 2 (age group 14-20 years)	two classes: one school from 08-2020 until 10-2023	vocational college, juveniles with technical & engineering education

Table 1: Overview of participating school classes per school level

The AM4Kids project comprises three phases. Children and juveniles went through all phases using age-appropriate teaching materials developed in the corse of the project.

Phase one focused on knowledge building about mobility and inclusion. Workshops conducted in phase 2 aimed at reflecting on their own mobility behaviour and learn about the needs of diverse traffic participant groups. In phase three, the children and juveniles develop their vision of the future of mobility.

The current paper refers to the project´s third phase and presents workshop materials and the results of this phase. Chapter 2.1 gives a summary of the project activities to date.

2.1 Previous project activities

The children and juveniles receive insight into mobility research within the project. They learn to observe mobility from different perspectives and reflect on their mobility patterns. The aim is to learn about mobility demands, needs and situational requirements of various traffic participant groups.

2.1.1 Phase 1 - Building knowledge

Phase one consists of expert lectures (task 1), sensitisation workshops about inclusion (task 2) and a time travel into the history of mobility (task 3). The expert lectures and workshops aim at explaining mobility and traffic system planning, give insight into our daily work and shall trigger curiosity about transport planning and inclusion in general. Moreover, the key figures and indicators of mobility and their meaning in practice are explained. In the sensitisation workshops, the needs and demands of visually impaired and blind people are addressed. The workshop started with a theoretical introduction to assistive devices and accessibility. The second part of the workshop was practical training where different kinds of visual impairments were

[1] Project consortium: B-NK GmbH (lead) and partners TU Wien-Verkehrssystemplanung, Universität Wien-Institut für Soziologie, Hilfsgemeinschaft der Blinden und Sehschwachen and ZIS+P Verkehrsplanung.

simulated, such as blindfolds or special glasses. Task three includes time travel, in which the children reflect on the film "Towards the year 2000 - a preview of Tomorrow's World", produced about 50 years ago. It shows how the producers at this time thought the world could look like 30 years later. The film should stimulate creativity of thinking about future scenarios. Past visions of future mobilities are reflected and analysed by asking what was predicted, discussed, implemented, and established back then for today.

2.1.2 Phase 2 – Reflection on mobility behaviour

In phase two, the reflection on mobility behaviour (task 4) took place. The children acted as transportation system planners, and they worked with age-appropriate mobility logbooks. We organised walks and spatial explorations in the course of which we analysed their school environment together and conducted transport planning methods such as surveying, counting, mapping and measuring. In task five, we developed three logbooks depending on the participating school and the age of the children and juveniles.

Tasks within the mobility logbooks were: documenting trips on three consecutive days, elaborating on the development of different modes of transport in the last decades and conducting interviews with familiar grown-ups about their mobility behaviour. Further, there was a task to design an imagined mode of future transport and to visualise their way to school in a drawing.

2.2 Autonomous driving and its impacts on people with disabilities

Accessibility is an essential prerequisite for the equality of people with disabilities. The unrestricted, barrier-free use of services, facilities and objects determines the radius of action and enables self-determined participation in society. To shape a sustainable and inclusive development of automated mobility, discussing this complex and multi-layered topic with children and young people today is essential. With a focus on inclusion, the aim is to understand how automation and digitisation enable or restrict the mobility of people with disabilities.

To develop inclusive mobility solutions a Design for All approach as an analytical lense. Following this basic idea for the planning and design of products, services and infrastructures, it should be possible for all people to use products, services and infrastructures without individual adaptation or special assistance. Design for All describes a design process that aims to achieve accessibility, usability and experienceability for as many people as possible.

With a focus on inclusion and automated mobility, the AM4Kids project deals with tomorrow´s traffic planning and mobility research. Automated mobility has much potential to increase independent mobility of people with disabilities, if various offerings address the needs and situations of people with disabilities. The following issues have to be adressed:

- The preparatory activities for a trip (pre-trip), such as obtaining information about the AM offer, the ordering, booking and payment process, the reservation of assistance services, etc., are to be carried out as far as possible on the person's own responsibility.
- All stages of the journey (on-trip) are barrier-free for people with disabilities. This starts when leaving the house door and concerns the access to the AM offer, the wait or stop, the change of inter- and multimodal means of transport, equipment, information on and around the route, stage or vehicle, the stay in the AM means of transport, stay qualities and equipment in the vehicle and ends when getting off near the destination as well as the departure to the destination address to the house door.
- The appropriate provision of information during the journey, as problems might occur during the journey. This involves a reflection of the experience (post-trip), any payment as well as any complaints to the operating company or the provision of services for the vehicle (e.g. charging the battery, luggage collection, etc.).

A central question is to what extent AM or a concrete AM offer is able to meet the specific requirements of people with disabilities to enable their independent mobility? For one, this is a question of technological development, but also of the socially acceptable costs of automated mobility for the different groups of people with disabilities. It is important that these groups can actively participate in the development of automated mobility to meet their needs sufficiently. The current situation is still way behind this requirment.

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3 PERSONA CONCEPT IN THE AM4KIDS PROJECT

Personas are fictional characters that represent the target audience of a product or service. They help designers and developers understand the needs, goals, and behaviours of their (potential) users and provide a „human face“ to the data and insights gathered during research. Personas are a valuable tool in user-centred design. (Cooper et al. 2007). However, the creation of personas can be influenced, e.g, by gender bias, leading to inaccurate or stereotypical representations of users. For example, a persona based on gender stereotypes may not accurately represent the needs and behaviours of the imagined target group, leading to a product that is not inclusive or accessible to all. (Marsden et al. 2015).

To create effective personas, designers and developers must be aware of their biases and strive to create inclusive and diverse representations of their target audience. With reference to gender, they have to address a range of gender identities and other factors such as age, ethnicity, and socioeconomic status. In the context of mobility, personas can be used to understand the diverse needs of different users, such as people with disabilities, older adults, commuters, tourists, and families with children.

For example, a persona for a person with a disability may include information about their mobility limitations, such as the need for accessible transportation and priority seating. They may also have specific needs for information, such as real-time updates on service disruptions or accessible route planning tools. A persona for a commuter may include information about their daily routine, such as the need for reliable and efficient transportation options. They may also have preferences for specific modes of transportation, such as biking or public transit, and may prioritise cost, convenience, and environmental impact.

Ten personas were developed in the R&D project “AM inclusive!” (Knoll et al. 2021). The goal of the personas is to package the motivations, needs, desires, and usage goals of real users into a model that decision-makers, responsible parties, developers, etc., can use to empathise with people with disabilities and develop user-centred decisions or technology developments accordingly. With the support of project partner Austrian Disability Council (ÖBR), feedback from people with disabilities was incorporated into the persona descriptions. The personas were constructed carefully to be typical and credible and contain as few gender stereotypes as possible. In the context of the project theme, Automated Mobility, the following information was used for the description of the personas:

- Name
- Sociodemographic information and background
- Mobility behaviour (regular routes, professional routes, etc.)
- Requirements for the mobility system (information, vehicle, accessibility, etc.)
- Technology and automation in everyday life today
- Wishes, needs, barriers

In the following, we present an example of a blind person using a guide dog:

Example of a persona: Michael - Blind person with a guide dog

Michael, now 30 years old, lost his vision at age 20 due to retinopathy pigmentosa, an inherited retinal degeneration. He relies on a guide dog for safety and assistance when navigating public spaces, particularly for using public transportation. While he has learned Braille, Michael finds standard tactile print with raised letters more accessible for reading. His guide dog accompanies him to work in an office, providing the support he needs to be spontaneous and independent during his daily commutes. When taking the bus, the dog helps Michael locate the entrances and exits, as the bus stops at different points within the bus stop. Michael requires a priority seat on the bus to accommodate himself and his guide dog, but the need for a quiet space for the dog is often overlooked in planning. He appreciates loudspeaker announcements, although they can be challenging to understand. Michael benefits from having an annual pass for public transportation, eliminating the need to worry about finding suitable tickets. However, he faces difficulties with the validation machines, which can be tricky to locate and insert the ticket correctly, especially as the bus wobbles during the journey.

Technology and automation in everyday life today: At home, Michael relies on a smartphone app to search for mobility information. The app helps him find the best time and connections for his commute using public

transportation. There are certain barriers that Michael encounters in public spaces and when using public transportation. When faced with new and unfamiliar routes, Michael usually looks for a companion to accompany him and his guide dog. While using his navigation app, Michael sometimes needs clarification for directions like left or right, and announcements may come too late. Accurate descriptions are crucial in these situations. Having his guide dog by his side would have helped Michael avoid obstacles caused by incorrect announcements. In Vienna's 22nd district, Seestadt Aspern, there has been a self-driving bus operated by Wiener Linien in test operation for some time now. Michael believes that automation will have a similar impact on him as long as he travels with his guide dog. The dog assists him in boarding and exiting the bus and helps him find a vacant seat that allows space for both himself and the guide dog without blocking others' way. Michael doesn't foresee significant changes due to self-driving vehicles. It's crucial for Michael that his guide dog is recognized as an assistance dog so that he cannot be denied entry to hospitals, doctor's offices, or stores with the animal. One significant concern for Michael is electric cars, as he has difficulty hearing them. He shares this concern with his colleagues who also have visual impairments.

This example demonstrates that, overall, individuals with disabilities have similar end goals and life aspirations as those without disabilities. However, the means and conditions to achieve these goals must be adapted to accommodate different sensory and motor abilities.

4 METHODOLOGY

The design of project phase three aims to sensitise children and juveniles to the topic of mobility in the context of current technical developments and inclusion. Hohenecker et al. (2022) described that the AM4Kids workshops promote creative and networked thinking among children. In phase three, the focus is on examining automated mobility from different perspectives. For this purpose, the project consortium developed Future Council workshops in an age-appropriate manner, depending on the participating school classes. Using personas, children and juveniles learn about the importance of developing mobility offers in a future-oriented and socially sustainable manner. The acquired knowledge enables the pupils to experience mobility from different perspectives and allows them to understand the implication of scientific concepts. It shows that in the course of childrens´ participation processes, the age-appropriate and step-by-step development of knowledge is indispensable for sustainable learning experiences.

The idea of Future Councils is based on the following goals:

- To impart knowledge about the automation of transportation system elements: Lectures, the lecturers explain the stages of automation and the term transport system. It is essential to convey the interaction of people, means of transport and the associated infrastructure. The diversity and heterogeneity of the users of a transport system are addressed, and the children and juveniles are sensitised to the different needs and demands. In an interactive exchange, the children and juveniles elaborate on which tasks in a transport system or means of transport have been automated throughout time and reflect on the advantages and disadvantages of these developments. Finally, driverless autonomous vehicles are presented, and their current and future application areas are discussed.
- Changing perspectives with the persona concept: After a short theoretical introduction to the persona concept, the children and juveniles read the description of their assigned persona in small groups. They learn about the persona’s transport needs and requirements and identify barriers and difficulties. They reflect on the mobility system affordances to be entirely usable by the persona.
- Develop future scenarios and solutions for the persona: Pupils develop visions of the future and scenarios for automated mobility and discuss where the opportunities, risks and consequences lie for themselves and other groups of people and the environment. They work independently in small groups to develop means of transportation and elements of a transportation system that they believe will improve the persona’s mobility situation.
- Reality Check of our Future Scenarios: Finally, a dialogue happens on eye level with researchers about their elaborated ideas within the workshop. The experts of the project consortium give feedback and discuss the relevance of their project ideas using the categories of society, politics, industry and users (results see chapter 5).

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4.1 Change of perspectives with the persona concept

The personas created within the project "AM Inklusive!" (Knoll et al. 2021) and used in the current project "AM4Kids" promote a change in perspective within the working groups. Personas help pupils understanding the needs of others, as well as provide insight into the everyday challenges of persons with disabilities in the transport system. The goal is to encourage pupils to develop mobility solutions for personas from an inclusive design perspective, followed by discussing visions and ideas in a Future Council. Scientists and planners accompany the children and juveniles in this process, offer feedback and insight into the interdisciplinary, multi-level exchange between disciplines. In the following, the used personas are outlined:

4.1.1 Michael – blind person with a guide dog

Michael is a blind person who uses a guide dog for safety and support in public spaces. Michael finds reading the standard tactile script with raised letters easier than Braille. He works in an office and usually takes the bus, with his guide dog showing him the next entry and exit points. Michael uses an app on his smartphone to find the best time and connection for his public transportation routes. He often seeks a companion to walk new and unfamiliar routes with him and his guide dog. Michael emphasises the importance of recognising his guide dog as an assistance animal, allowing him to enter hospitals, doctor's offices, or shops. He finds electric cars dangerous as he cannot hear them, which is also challenging for his visually impaired colleagues.

4.1.2 Amina – a person who is blind from birth

Amina is a 47-year-old blind woman who lives with her partner and works in an office. She uses public transportation to get to work and relies on an assistant to help her with tasks. Amina faces challenges when using public transportation, such as needing help to see which line or end station the vehicle is heading to. She uses a long cane to navigate and prefers to orient herself to linear structures. Amina uses apps on her smartphone to find the best connections when travelling alone and asks for help when buying tickets. She uses a Braille display and a screen reader to work on her computer at home. Amina wishes for more automated communication and announcements in public transportation and at stops to help her navigate.

4.1.3 Aleksandar – blind person with an affinity for technology

Aleksandar is a 28-year-old blind man who lives in a city with his wife and two children. He is interested in technology and has tried many different products. He discovered a new technology at a fair - shoes with sensors that warn him of obstacles through vibrations on his smartphone. Despite the sensor, he still needs to be attentive as it cannot detect downward stairs or obstacles at chest or head height. Aleksandar always carries a long cane with him. He is now a representative for the manufacturer of the sensor technology. He travels to work alone and uses a screen reader to navigate new routes. In his free time, he travels with his family using public transportation. Aleksandar wishes for better communication with vehicles and for electric vehicles to make more noise. He has tried a self-driving bus but found it challenging to locate the entrance and exit. He also uses a navigation app on his smartphone and wishes for better communication with traffic lights. He uses an acoustic signal at intersections to know when the light turns green. He is happy that future traffic lights will be operated by pressing a button instead of using a Euro-Key.

4.1.4 Maria – a person with visual impairment

Maria is a 67-year-old retired woman living alone in the countryside with a visual impairment. She needs help recognising contrasts, doing reading and locating bus stops difficult. While urban areas support the visually impaired, the countryside needs such infrastructure. Maria uses call-and-collect taxis to travel and recently acquired a smartphone to help with navigation and reading. However, she needs help with GPS accuracy and the need for large font sizes. Improving and expanding support systems for people with visual impairments is crucial to make their daily lives easier.

4.1.5 Justin – a person who uses an electric wheelchair

Justin is a 19-year-old who lives with his parents in the countryside and has had problems feeling and moving his legs and arms since birth. Over time, his mobility has decreased, and he now uses an electric wheelchair. While his home has been modified to accommodate his wheelchair, Justin faces challenges when using public transportation. Bus and train ramps can be difficult to access, and he often needs assistance from

other passengers or transportation staff. Justin wishes for more accessibility in vehicles, including easier-to-use ramps and better communication systems for signalling entry and exit. He also hopes for technological advancements in electric wheelchairs to make them more lightweight and suitable for off-road use. Despite these challenges, Justin remains optimistic and looks forward to finding employment and continuing to explore the world around him.

4.1.6 Jana – a person using a mechanical wheelchair

Jana is a 38-year-old woman who has been using a manual wheelchair for 23 years since an accident left her unable to walk. She is skilled with her wheelchair and uses public transportation, including the subway, tram, bus, and rapid transit systems. However, she faces limitations in many buildings and needs help to cross the streets. Jana uses an app on her smartphone to find traffic information and the fastest connections for her routes. She also buys her tickets through the app. Jana has not been able to try the self-driving bus yet, but she is interested in how the ramp works and where the emergency button and wheelchair space are located.

4.1.7 Franz – a person with a phobia

Franz has claustrophobia and experiences anxiety and panic in crowded and enclosed spaces. This fear affects his mobility, and he prefers to drive his car instead of public transportation. Franz's employer does not have a company parking lot, so he must pay for parking. He avoids rush hour and schedules his work freely to avoid crowds. Franz would like to use public transportation more often, but he needs to catch up on information about the occupancy of the vehicles. He prefers a driver who can intervene and support in certain situations rather than relying solely on technology.

4.1.8 Cecilia, a deaf person

Cecilia relies on lip-reading and sign language to communicate. She prefers to be accompanied by an interpreter when dealing with authorities or doctors. Cecilia uses a video conferencing service to communicate with her sister and has downloaded several smartphone apps to help her stay informed and communicate better. Public transportation has improved for people with disabilities, but important information may still be announced over the loudspeaker before appearing on the display. Cecilia and her partner own a car but mainly use it to shop or get to the nearest train station.

4.1.9 Ali, a person with hearing impairment

Ali relies on hearing aids and induction loop systems to communicate. Ali avoids speaking to people or asking for directions in public places due to his difficulty in hearing. He uses an app on his smartphone to find the fastest route for public transportation and is grateful for digital screens displaying information about public transportation disruptions. Ali also uses a car-sharing service to borrow a car and prefers to walk instead of using e-scooters, which he finds too dangerous.

4.1.10 Sarah, a person with learning difficulties

Sarah lives in a supervised shared apartment and works in a supervised workshop. Sarah finds it challenging to understand information and prefers to be accompanied by a friend or caregiver when travelling on new routes. She records spoken words to remember things and asks for help when buying tickets or navigating her smartphone. Sarah finds it overwhelming to use transportation apps and prefers to ask other people for directions. She wishes there was only one app for public transportation with information in easy language.

4.2 Future Council in secondary levels 1 and 2

The tasks of the Future Council differ between secondary level 1 (A) and 2 (B) in complexity and scope. The persona's characteristics are first collected in a profile in both workshop versions. Version A asks about the persona's challenges in public transport, whereas version B generally asks about mobility behaviour. This builds on knowledge about mobility and transport generated in the previous project phases.

In version A, the pupils collect ideas for a means of transport or elements of a future transport system, which could be helpful for the persona. From these, implementation possibilities are derived and recorded in writing and graphically.

In version B, they think about how the persona would feel when travelling in a public transport system with autonomous buses a) with an operator and b) without an operator. The task here refers to the requirements of

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the public transport system so that the persona can travel confidently in the given scenarios. From this, solution strategies are derived and discussed in plenary, commented by the project consortium. The children and juveniles document their process step by step on prepared Flipcharts as shown in Figure 1.

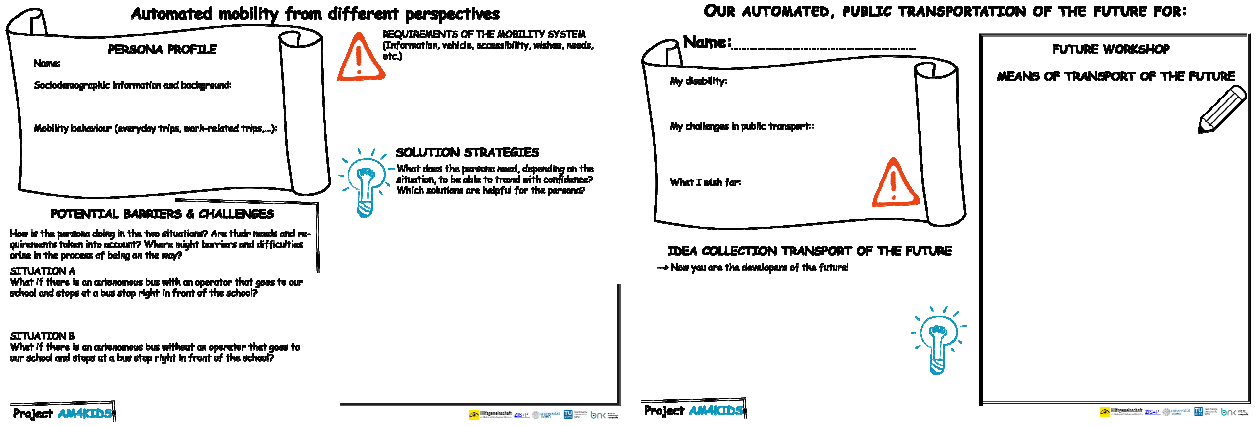

Fig. 1: Flipcharts with the Future Council's assignment for elaborating the content in small groups. Version A secondary level 1 (left), Version B secondary level 2 (right)

4.3 Future Council in primary school

The Future Council workshops have also been adapted to the needs and capabilities of children in primary school. Pupils had the opportunity to develop their ideas for means of transport for the future in a very creative and open setting. After the expert´s input, means of transport, the related developments in the course of history, automated and autonomous mobility as well as inclusion – adapted to the age group and prepared for easy understanding – the children were enabled to take researcher roles. Their work output was drawings and collages for fantasy-based ideas for future mobility modes. As the persona concept is too complex for this age group, it was not used explicitly in this context. As an alternative, the expert team prepared the following questions to give some instructions and to reflect the ideas and inventions together with the students:

- For WHOM did you develop the means of transport of the future?
- WHAT should your means of transport be able to do? What should be better than the means of transport you already know?
- HOW are your means of transport controlled? Is it automated?
- WHO can use your means of transport? Is it suitable for blind people? Is it suitable for people who cannot see/hear/walk well? Are there any helping tools?

In this way, the persona concept – in terms of putting oneself in the position of someone else and create solutions that help the needs of a particular user group – was integrated into the workshop format to sensitise the pupils accordingly.

5 RESULTS

The children of secondary level 1 presented their ideas mainly graphically with short notes for the explanation on their flipcharts. Figure 2 shows the persona “Michael” as an example of the result of one of the working groups. Michael has a visual impairment, and his assistance dog accompanies him. The children recognise some challenges, such as the need of sufficient space for Michael and his dog in public transport. Therefore, one focus of their reflections is that public transportation should also include space reserved exclusively for assistance dogs. In addition, they suggest that securities help with the ticket machines and that these are also provided with tactile Braille. It is important to them that a contact person is always available for the passengers. In addition, information about the current location and the route should be available for people with visual impairments in public transport, e.g. in the form of maps with Braille.

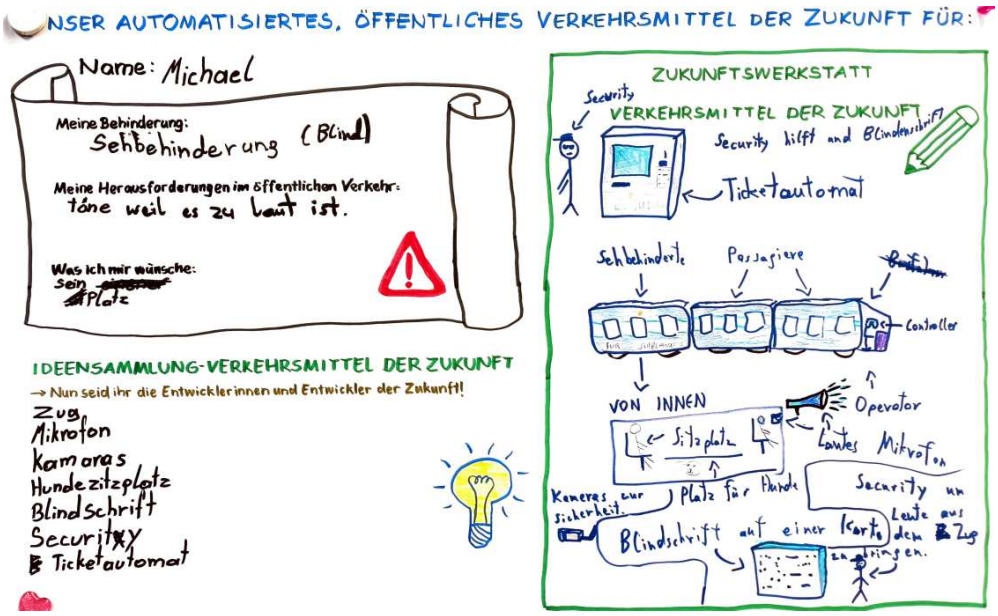

Fig. 2: Example of a flipchart about the persona Michael - created by secondary level 1 students

The task for the students of secondary level 2 is linked to a given process, which refers to the scenario of the autonomous bus in the surrounding area of the school as a mobility offer. The students initially identify barriers and challenges, derive requirements for the mobility system, and develop solution strategies. For example, they used the perspective of the persona "Ali," (impaired hearing). The group suggests that warnings at bus stops (especially platforms) are given via light signals on the ground. Using vibration to alert people to events or last-minute changes in public transportation is also part of the solution strategy. These additional information channels would be beneficial for all passengers, not only for people with hearing impairments. In the workshop, the secondary level 2 students focus on actual technical implementations and discuss them intensively in groups. They propose various apps for the different personas, tailored to their needs. The persona "Franz" avoids public transportation because he is claustrophobic and feels uncomfortable when too many people are in the vehicle. The students follow the solution strategy to equip public transport with weight sensors and light barriers to estimate occupancy in real-time. The resulting information will be stored in the routing apps of the public transport. The persona "Franz" would thus be able to plan his routes better even in new routes about which he has no experience. Figure 3 below shows an example of the flipcharts about the persona "Jana" and a section about the persona "Ali".

Fig. 3: Example of flipcharts about the personas "Jana" (left) and "Ali" (right) - created by secondary level 2 students

Personas helped pupils to consider the practical problems of traffic participants with disabilities and to develop practical solutions. In the case of Michael, for example, they found the following elements to be included in a more inclusive traffic system:

- Louder and clearer announcements
- Recognition of the dog

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- Improvement of the navigation app
- Tactile standard font.

The solutions developed by pupils in the workshops crystallised around two basic ideas. The first idea addressed realistic ways of adapting environmental conditions to the situation of persons with disabilities. Technical devices replaced or worked around the sensory impairments and broadened accessibility to traffic situations. On the other hand, pupils in technical schools integrated realistic design ideas with the technical devices they knew from their education. Blind persons need non-visual communication channels; wheelchair users need broader entrance and exit areas to access vehicles, etc. The second strategy used by younger pupils was developing less realistic (science fiction) vehicles and infrastructures like flying wheelchairs or highways for wheelchairs. These solutions projected known solutions of traffic participation for non-disabled people on people with disabilities and created a specific traffic system around their situation. From a pedagogical point of view, both strategies are meaningful and relevant and help pupils see the complexities of design problems regarding traffic participation.

6 DISCUSSION

The aim of an inclusive mobility system is to enable all people to move around on an equal footing and to participate fully in society. To this end, it is necessary to ensure a seamless, inclusive mobility chain from door to door.

- A mobility chain is schematically composed of the following elements:
- Pre-mobility: information + information + planning + implementation/ticket purchase.
- First mile: from the starting point to the 1st station or parking lot.
- First station: arrival to boarding + interactions on the spot/ such as ticket purchase, replacement transport, etc.
- In transit
- Intermediate/final station: exit mode of transport 1 to board mode of transport 2 or leave station
- Last mile: Final station to the actual destination
- Follow-up: Report problems encountered, reclaim, save the route for later trips, etc.

In between, waiting times and waiting places occur. Every mobility chain must meet the requirement of complemteness and inclusion. In reality, however, a large number of different and incomplete mobility chains occur. Therefore, the involvement of people with disabilities in planning mobility chains is essential. These considerations have to be taken into account in the context of the development of an inclusive offer for Automated Mobility and one should:

- Subject existing traffic information services to an inclusion usability check.
- Consistent implementation of the multi-sense principle: Reliable information transfer (pre-/post-trip) for passengers through analogue and digital functional diversity so that a transparent exchange of information between (automated) vehicle and passenger can be enabled.
- In developing applications for traffic information, pay attention to the needs of various people with disabilities.
- Barrier-free design of the road infrastructure, for example, utilising the comprehensive installation of tactile guidance systems, so that safe orientation to and from the (automated) vehicle is possible.
- Optimise physical design of (automated) vehicles; this refers to the need to design a vehicle that enables people with disabilities to get in and out independently
- Conduct regular usability tests and field checks with different groups of people with disabilities in public spaces and along the entire mobility chain

7 CONCLUSION

To conclude: Beyond its use in a design context, the personas concept is also a valuable device in pedagogical settings. Instead of reflecting on the situation of people with disabilities on an abstract level,

pupils learn to understand the situations of concrete traffic participants with their abilities and restrictions, their aims and demands. These aims and demands are not different from non-disabled traffic participants. Instead, the means and conditions must be adapted to meet their situations. To be sure, the solutions developed by the pupils, depend on their developmental and educational levels. Solutions developed by pupils from technical schools are much more realistic and geared towards working around sensory or bodily restrictions. Younger pupils tend to develop imaginary vehicles and infrastructures and create traffic systems for people with disabilities. While the first strategy adds communication channels and situational modifications to increase accessibility, the second strategy emphasises visions of mobility systems from the standpoint of other types of traffic participants (e.g. a highway seen from the perspective of wheelchair users). Both strategies bring design problems to the fore which can be further discussed and developed. Personas promote the attention of future mobility planners (more precisely: of pupils in the role of mobility planners of future traffic systems) to the diversity of user groups and the awareness of accessibility. Nevertheless, inclusive personas must not be misused as a substitute for the involvement of people with disabilities. The creed of participatory traffic planning says: “Nothing about us without us” and in this vein, traffic planning has to be done by people with and without disabilities together. Personas are an excellent educational tool to develop an inclusive mindset as it orients imagination to specific problems that open more ways to develop viable and sustainable solutions.

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