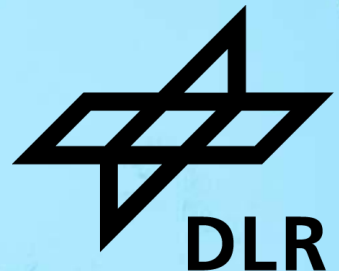


NEED FOR INTERACTION AND BEHAVIORAL INTENTION TO USE AUTONOMOUS BUS SHUTTLES

Dr. Alexandra König, Alina Ghoreschi and Jan Oppen

German Aerospace Center, Institutes of Transportation Systems & Transport Research



- User acceptance and trust are the basic prerequisites for actual use
- A more user- and needs-oriented consideration appears to be necessary

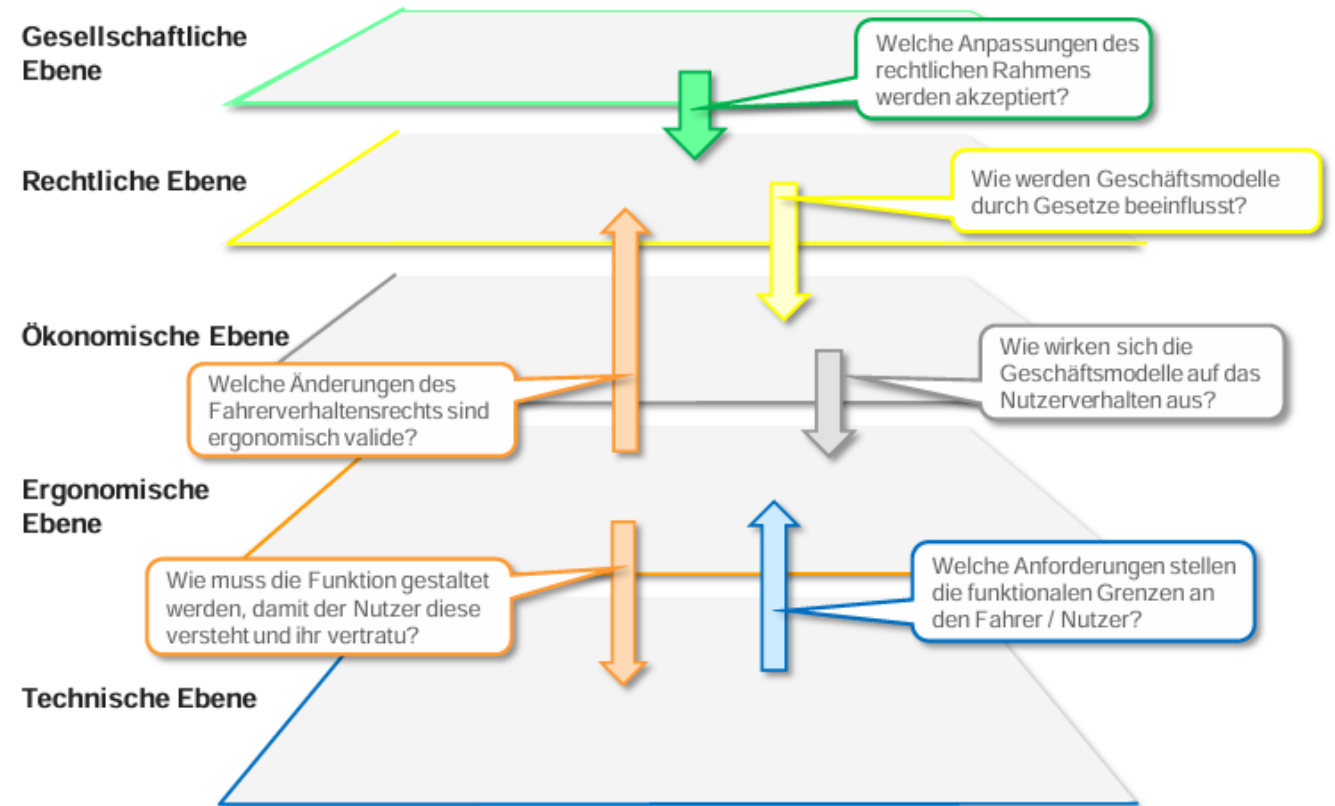


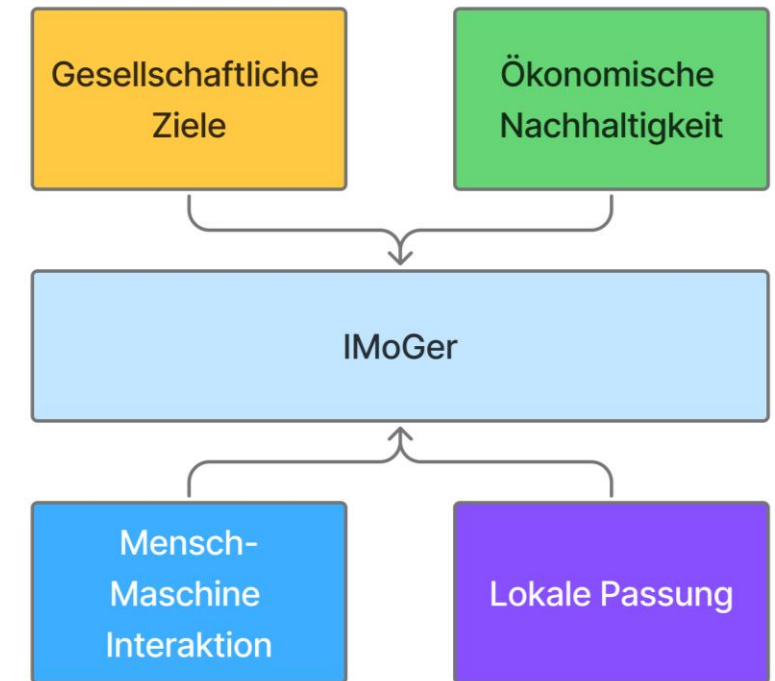
Bild 1. Ebenen der Herausforderungen und beispielhafte Wechselwirkungen

Source: Bengler et al. 2019, p. 3

From Technology Readiness to Societal Readiness

Societal Readiness (SR):

- Aligning innovations with societal goals and specific needs to increase the adoption potential of innovations in society
- SR is achieved primarily through communication with and close involvement of stakeholders in the innovation process

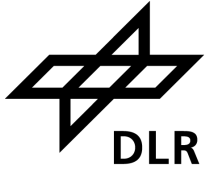


@DLR

Opper (2025), Milakis (2024)

Research project IMoGer

Innovative modular Mobility Made in Germany



- U-Shift concept: a modular L4 system for combined CEP logistics and public transport
- Duration: 12.2024 – 12.2027
- Budget: 39,2 Mio. €

Gefördert durch:



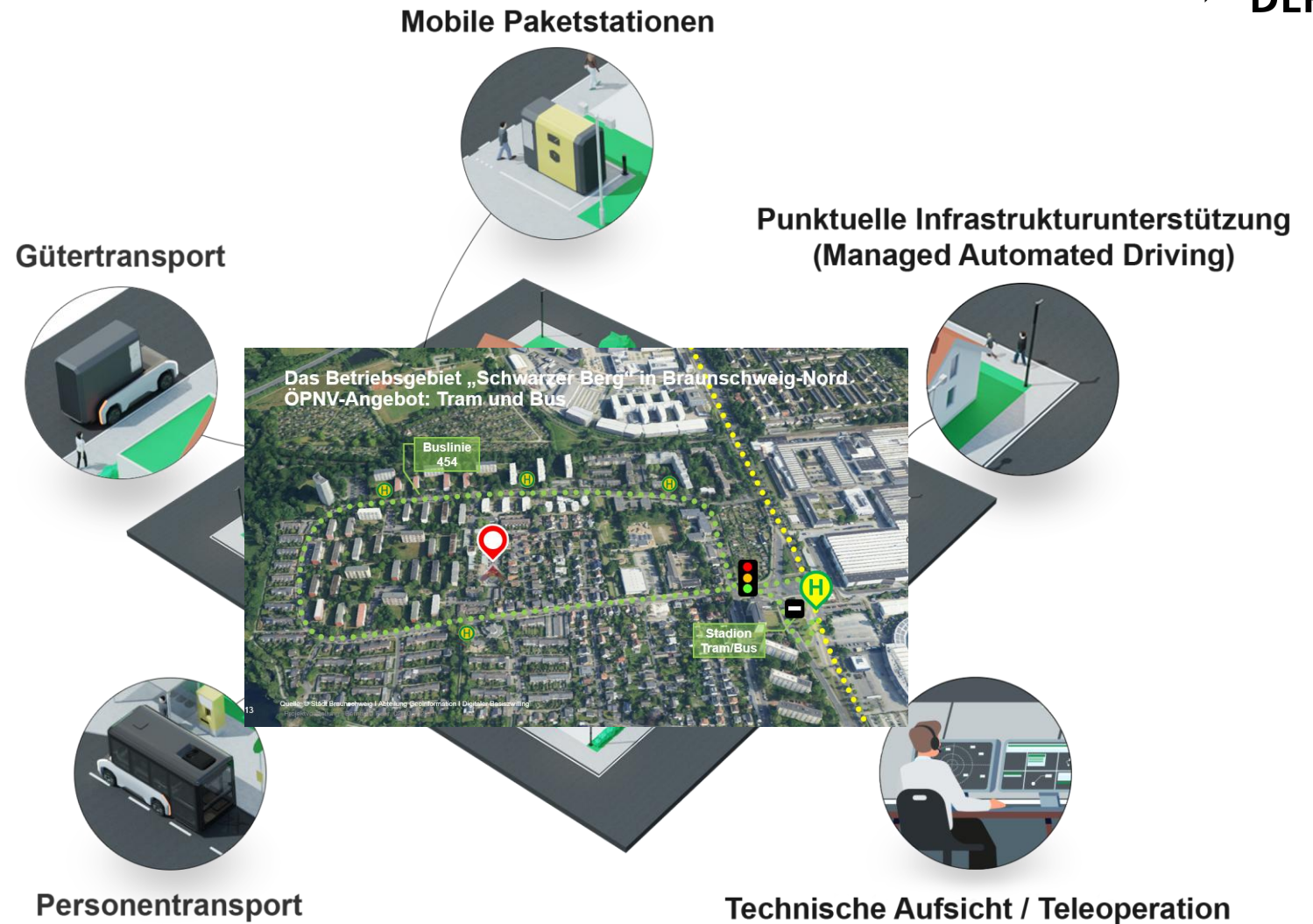
aufgrund eines Beschlusses
des Deutschen Bundestages



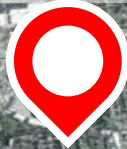
Research project IMoGer

Goals

- Development of a combined mobility service based on the U-Shift vehicle system
- Creation of a future-proof overall system architecture (focus on approval, implementation, scaling)
- Approval of the overall system according to AFGBV §16 Test Approval
- Testing of practicability with the goal of testing operator and business models and preparing regular operation
- Transfer to further application areas (Simulation)

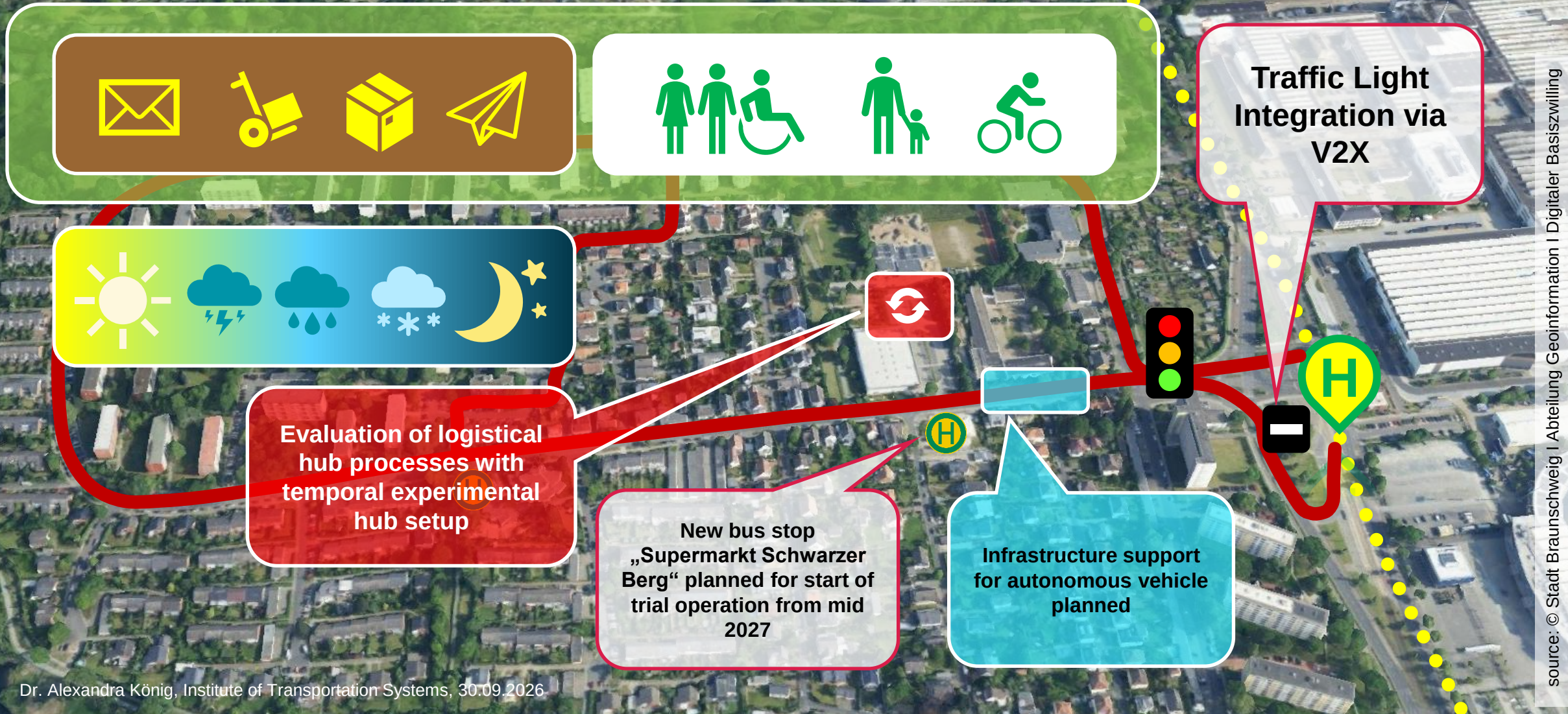


Schwarzer Berg in Northern Braunschweig

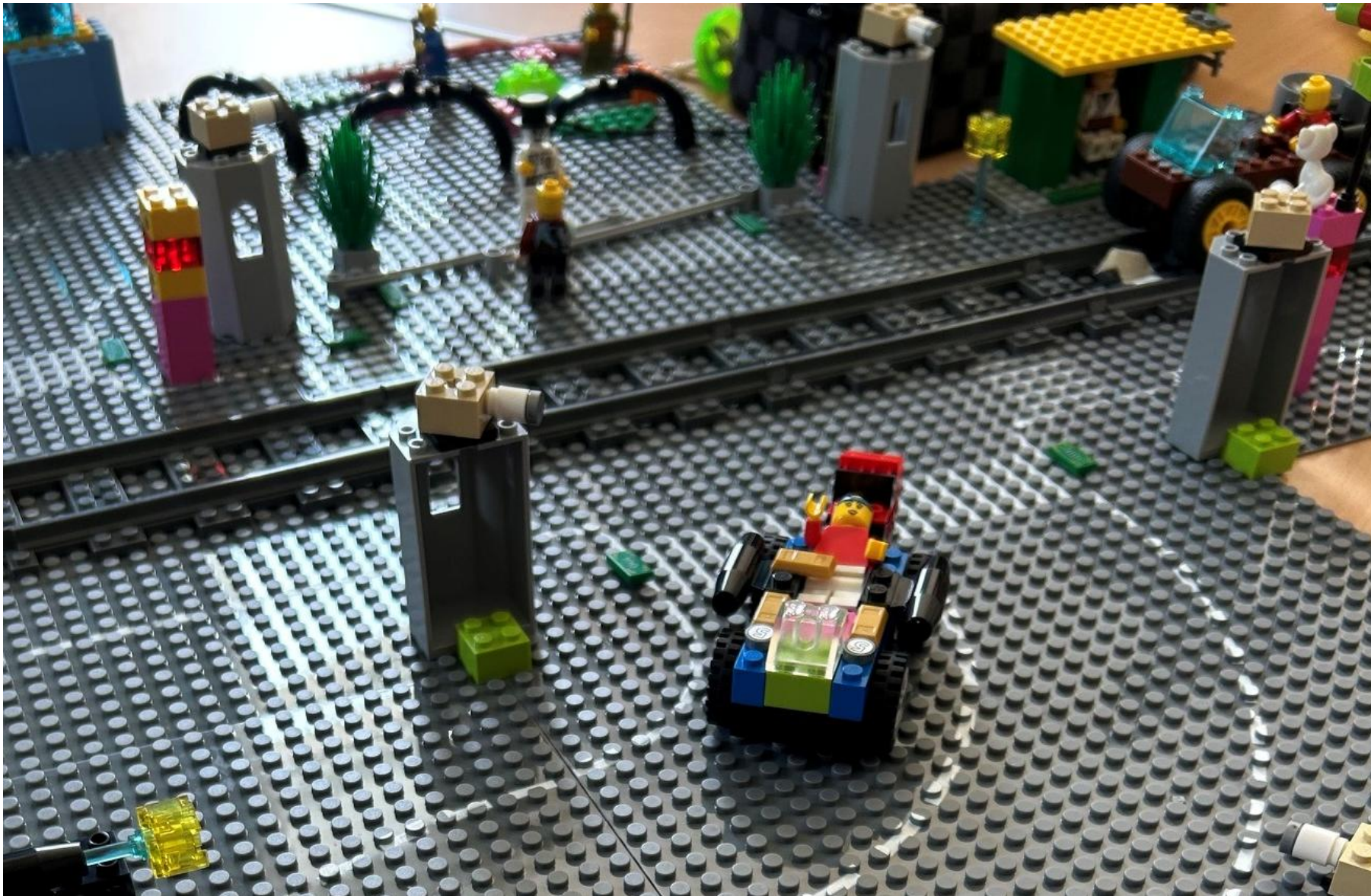


Combined trial operation under real-world conditions for CEP logistics* and passenger transport** from mid 2027;

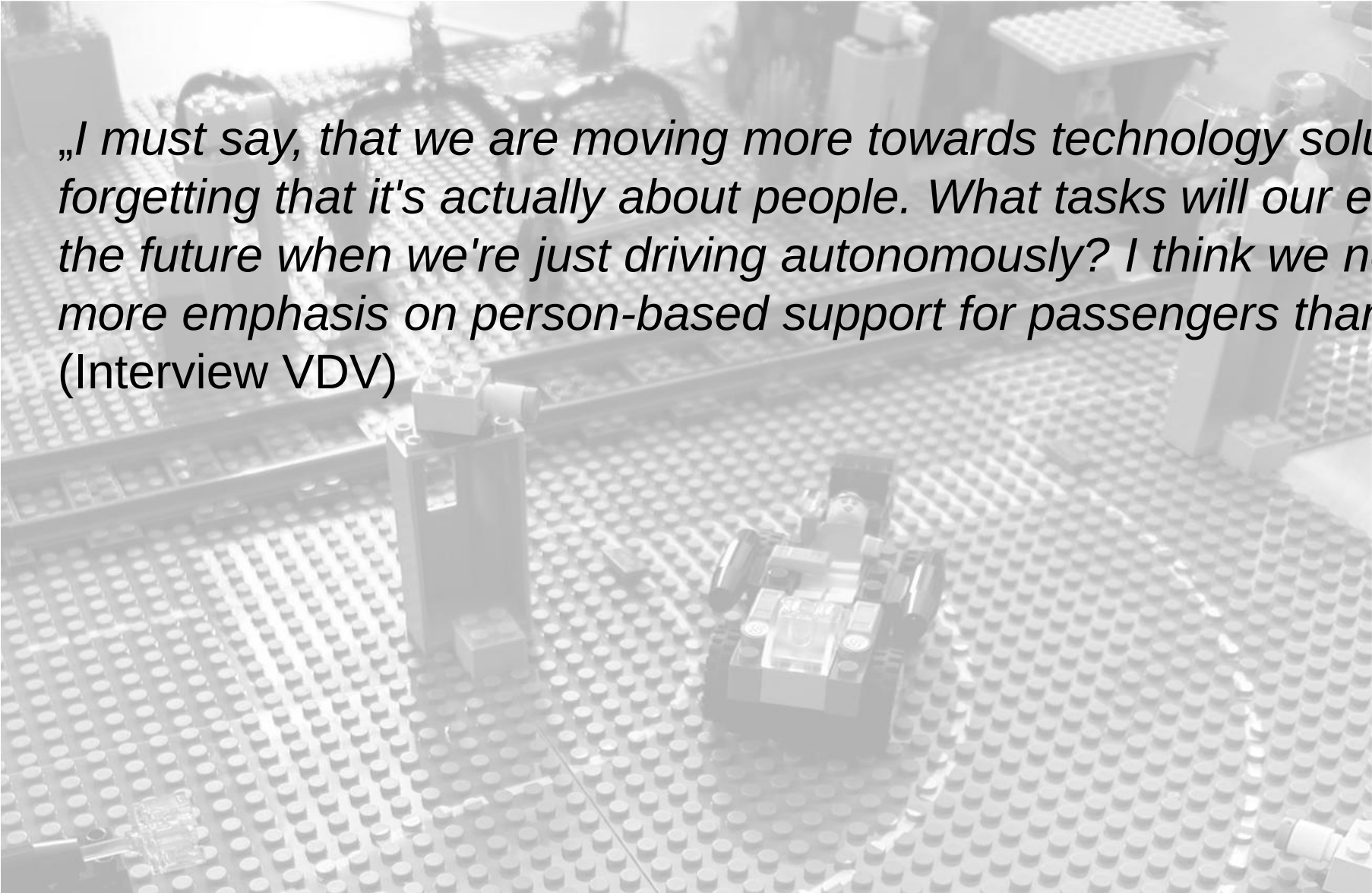
*Courier, express and parcel logistics; **with test persons only



In the future ...



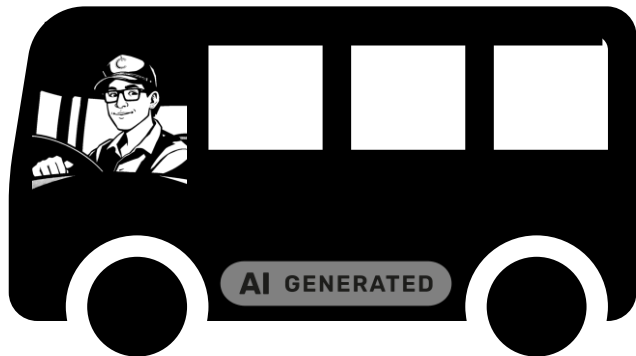
In the future ...

The background of the slide is a grayscale photograph of a LEGO city. In the foreground, there is a LEGO car with a driver figure on a grey LEGO baseplate. To the left of the car is a small LEGO building. In the background, there are various other LEGO structures, including a tall tower and some houses, creating a cityscape. The text is overlaid on this image.

*„I must say, that we are moving more towards technology solutions and forgetting that it's actually about people. What tasks will our employees have in the future when we're just driving autonomously? I think we need to put a lot more emphasis on person-based support for passengers than we do now.“
(Interview VDV)*

The role of driving personnel

Operators of public busses assume multiple roles and tasks besides driving:



- socio-emotional safety
- information provision
- monitoring function
- assistance for boarding and disembarking
- communicating with and regulating other traffic participants

▪ ...

Applies especially for:



(Bennett, Vijaygopal & Kottasz, 2019; Cordts et al., 2021; Kim, Anjani & van Lierop, 2024 Riggs & Pande, 2022)

- People having a high need for interaction (NFI) with service employees have a preference for personal contact with service employees in the context of technology-based self-service and tend to use technology-based services less frequently (Dabholkar & Baggozzi, 2002)
- NFI is defined as the importance of human interaction for the customer in service encounters



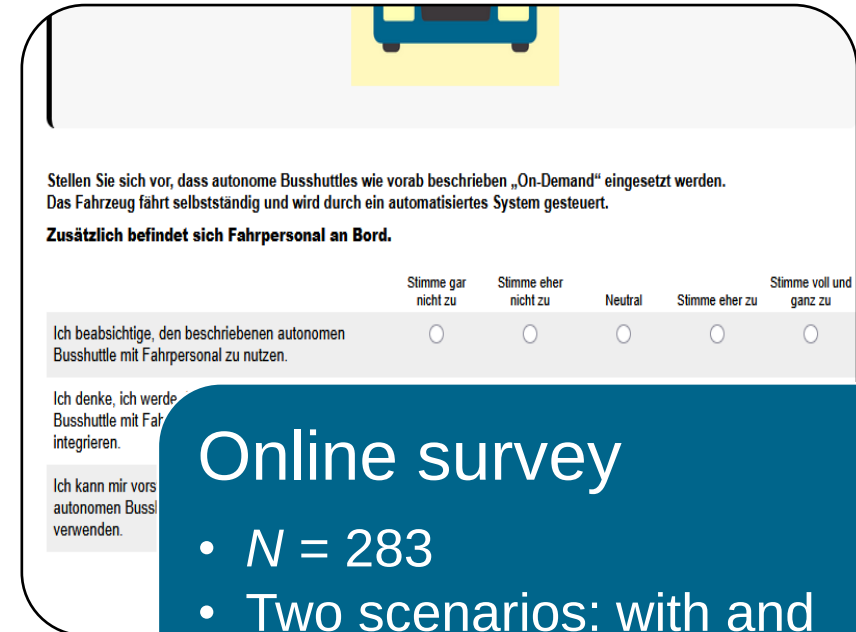
How does the need for interaction influence the intention to use public autonomous vehicles and what role does the presence of service personnel play in this context?

Methodological approach



Focus groups

- 5 groups with 33 persons with special needs (wheelchair users, senior citizens, caregivers, visually impaired persons and parents of young children)



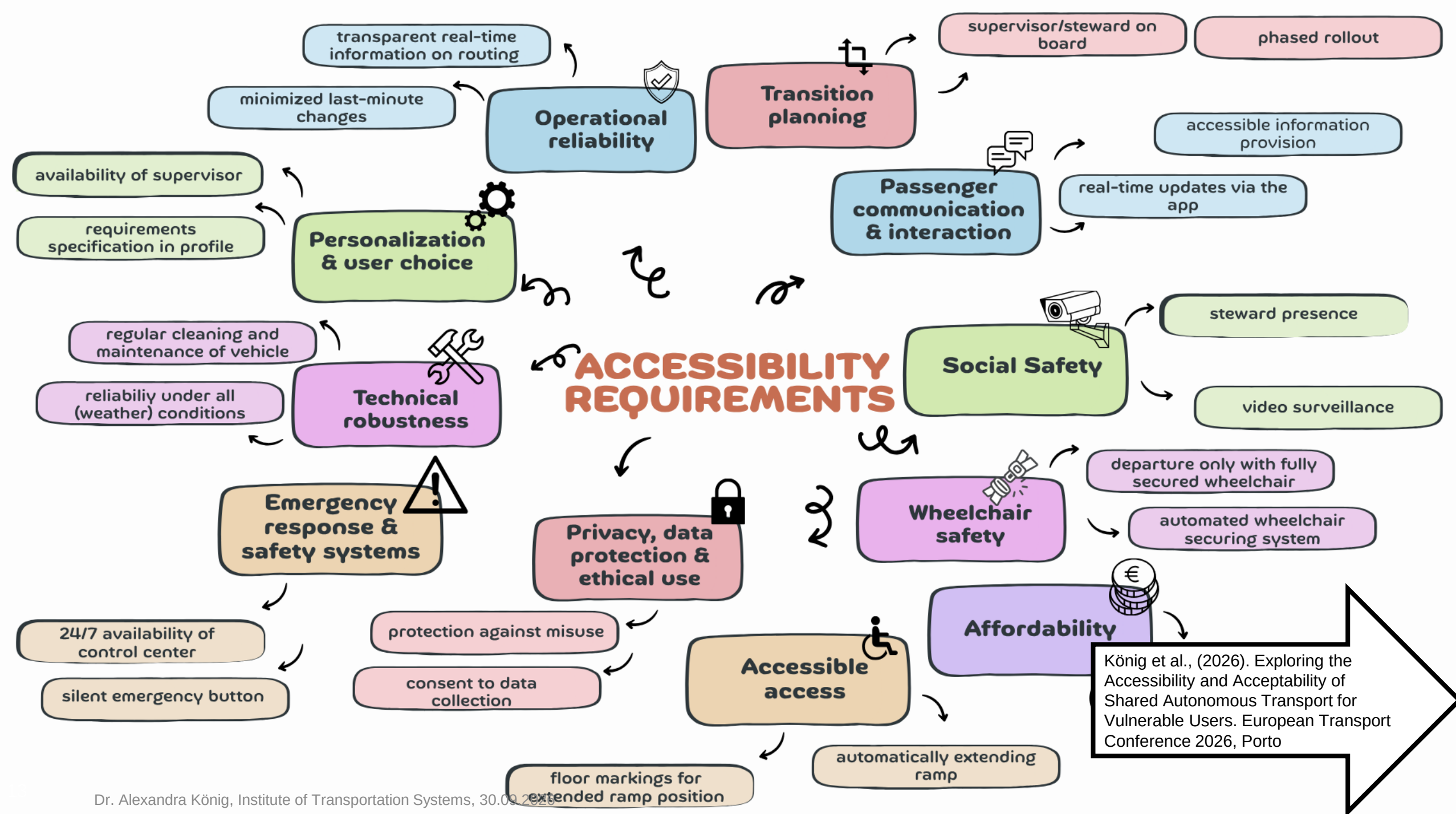
Stellen Sie sich vor, dass autonome Busshuttles wie vorab beschrieben „On-Demand“ eingesetzt werden. Das Fahrzeug fährt selbstständig und wird durch ein automatisiertes System gesteuert.

Zusätzlich befindet sich Fahrpersonal an Bord.

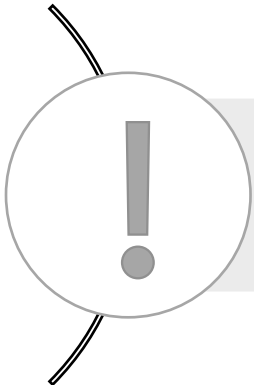
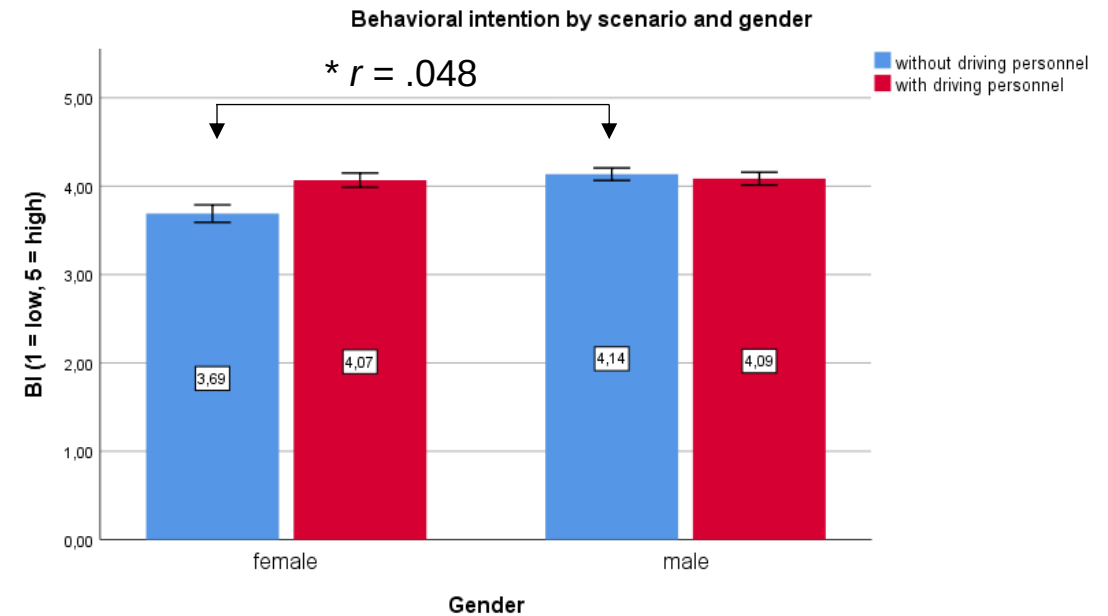
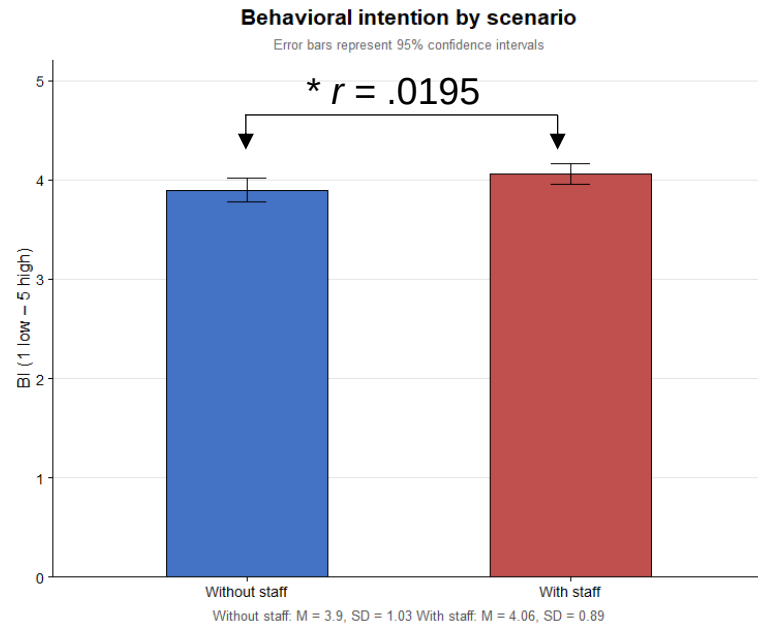
	Stimme gar nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme voll und ganz zu
Ich beabsichtige, den beschriebenen autonomen Busshuttle mit Fahrpersonal zu nutzen.	☐	☐	☐	☐	☐
Ich denke, ich werde den beschriebenen autonomen Busshuttle mit Fahrpersonal integrieren.	☐	☐	☐	☐	☐
Ich kann mir vorstellen, den beschriebenen autonomen Busshuttle zu verwenden.	☐	☐	☐	☐	☐

Online survey

- $N = 283$
- Two scenarios: with and without onboard personnel

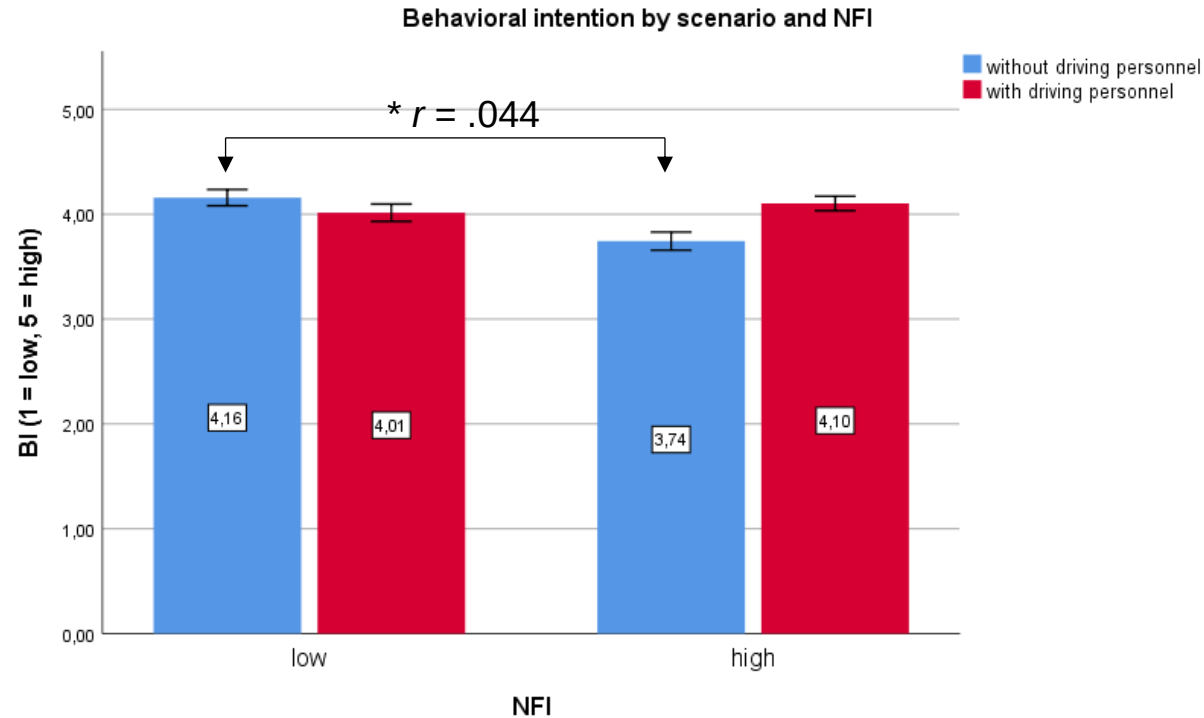


Results



The absence of on-board personnel reduces the intention to use autonomous bus shuttles, especially for women.

Results



The need for interaction moderates the effect between the presence of on-board personnel and the intention to use. The difference between individuals with low and high NFI was only significant when no driver was on board.



Stepwise transition

- Gradual transition is crucial, especially for vulnerable groups
- As technology matures and public trust increases, the presence of human personnel may be gradually reduced



Familiarization and „automation literacy“

- Facilitation of familiarization of users with the technology
- Strengthen automation literacy of society



Accessibility-per-default

- Automatic ramp should extend every time the door opens
- Two-channel principles as standard



Private ride option

- A private ride option requesting a supplementary payment should be offered to avoid the onboarding of other passengers



Incorporate SR in technology development

- Embrace the importance of societal readiness and its summative, formative and communicative aspects besides technology readiness



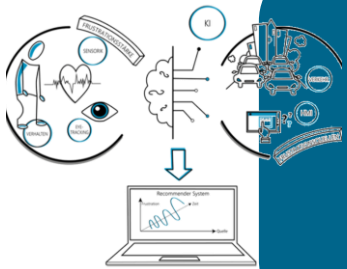
Design approaches for substituting the operator

- How can the psychological functions fulfilled by driving personnel, such as reassurance, immediate support, and social presence, be effectively replaced?
 - smart companion (AI-based mobility buddy)
 - hologram
 - remote operation



New tasks for personnel

- Service personnels' role for the use case of combined services of passenger transportation and CEP and other services
- Innovative operator and business models



User state monitoring

- How can we assess and predict human perception, appraisal and behaviour and provide tailored support?
 - Sensor data analysis based on cameras or physiological sensors to learn about user states such as discomfort

- Bengler, K. (2019). Automatisiertes und Vernetztes Fahren – ENTWURF V3. Abrufbar unter: https://www.uni-das.de/images/pdf/2019-11-15_roadmap_avs_v3.pdf
- Dabholkar, P. A., & Bagozzi, R. P. (2002). An attitudinal model of technology-based self-service: moderating effects of consumer traits and situational factors. Journal of the academy of marketing science, 30(3), 184-201.
- Oppel, J. (2025) Doing Societal Readiness: Societal Readiness als Erfolgskriterium in Transformationsprojekten. 20. Dortmunder Auto Tag, 2025-09-04, Dortmund. Abrufbar unter: <https://elib.dlr.de/217061/>
- Milakis, D. (2024). Integration of Technology, Market and Societal Readiness Levels for Transport Innovations. Kurzstudie, DLR

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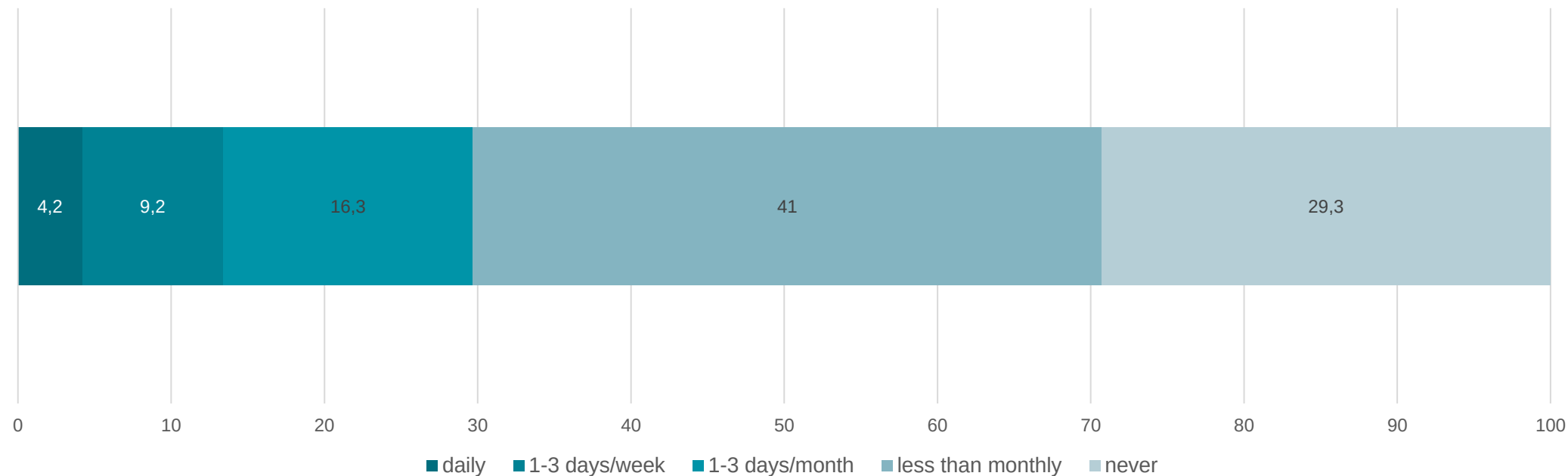


THANK YOU

Results



Frequency of interaction with driving personnel



The vast majority of people do not interact with bus drivers on a regular basis