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Extended abstract

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Title: Provider Hopes versus User Needs and Public Interest– What does the Automated Future hold for Public Transportation?

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INTRODUCTION

Autonomous driving (AD) is expected to have multiple and lasting effects on mobility behavior and the entire transport system. A growing body of literature on AD suggests partially ambivalent and often negative impacts, such as a modal shift away from public transportation (PT) and active modes of transportation to individual motorized traffic (e.g. *1, 2*), longer distances travelled due to a changed residential self-selection and the choice of distant locations for activities (*3, 4, 5;* for instance), induced traffic as AD will provide access to individual mobility for non-drivers like adolescents or elderly (*4, 6*) and due to empty miles (*7*). Positive effects, however, are suggested regarding an increase in road and intersection capacity (*9, 10*), reduced vehicle ownership (*11*), and reduced costs (*12,* see *13* for a comprehensive list of implications).

In the field of PT, the emerging technology of automated vehicles may have the potential to help with classical weak points and challenges and contribute to its future robustness. This is what PT providers hope. At the same time, risks are seen: PT itself might become obsolete or PT providers might lose their direct access to customers and be degraded to mere carriers. In addition to PT providers, there are other relevant stakeholder groups, in particular users and local authorities. Their expectations and needs may be varied and contradictory and it could prove difficult to reconcile them.

In this contribution, we place a focus on AD in PT which has been widely neglected so far. In particular, there is little research on how AD might impact PT, how it addresses the challenges PT and municipalities face, and how the integration of such vehicles into existing systems can be achieved in the best possible way. In order to identify favorable settings for AD, we consider and discuss the acceptance requirements of users, providers and local authorities and derive insights on if and how automated driving in PT supports the political goals in the transport and urban development sectors. We seek to answer to the overarching question of how favorable future development pathways for PT in the context of AD may look like, taking into account the acceptance of stakeholders.

METHODOLOGY

We applied a qualitative research approach to explore the new research field of automated driving with a focus on user acceptance and stakeholder perspectives. We used the method of case contrasting regarding the sampling and coding strategy (*14*). We conducted three workshops: two workshops with users and one with municipal and PT experts in two German cities.

The subject of all of the workshops was the discussion on needs, requirements and challenges regarding AD in PT. In the workshops the participants were introduced to selected use cases and their brief descriptions one after the other. In this paper, we present three use case types: ***Use Case Type A - Classic bus model but automated***, ***Use Case Type B - Feeder system/ First and last mile*** and ***Use Case Type C - Individualized on-demand mobility,*** that were previously developed in the study.

In the analysis, we created new categories from the empirical evidence for users and experts, sensitive to the partially different focal points the different groups had set. In a further step, we merged both category systems into one and derived three relevant comparison categories - *regulation and standards*, *financing and affordability*, and *optimization of supply* - to make the acceptance requirements of users and experts comparable and identify intersections and conflicts.

FINDINGS

Our findings reflect on the comparison of user, provider and local authorities' perspectives on AD in PT by the three comparison categories mentioned above.

Regarding *regulation and standards,* for the users it is relevant that reasonable and sufficient user protection standards are set that hold for all of automated driving providers. A major issue of concern is insecurity and discomfort regarding fellow passengers, particularly regarding ridesharing in small vehicles with a rather

intimate atmosphere or at night. A further need of regulatory action affects the equal spatial distribution and supply availability, new and automated offers should be located in areas which currently lack or have insufficient PT supply before extending an already sufficient supply. PT providers worry about maintaining access to their customers. They see the risk of being reduced to mere carriers by the so-called platform economy and of *cherry-picking* among customers and routes. For them, a careful deregulation regarding the presently restricted passenger transportation law is a chance to keep up with upcoming private providers. Local authorities see their responsibility in supporting a strong PT as part of a sustainable city and they see the risk of an increase in motorized traffic and a modal shift away from walking and cycling or mass transportation. They require PT providers to improve accessibility where it is needed and not where it is most profitable.

Regarding *financing and affordability, w*hile users expect savings potential through automation and lower fares due to the removal of human drivers, PT providers see economic efficiency as key potential of automated driving and expect saving opportunities. Similarly, while users are hesitant of extra offers and premium-tariffs for special and individualized services providers see the chance for new profitable business models. Both, users and local authorities see a conflict between individualized traffic and PT respective to public funding. In their view, the core business of PT should remain the provision of mobility as a public good and be accessible, affordable and functional, rather than comfortable and responsive to individual demands.

Finally, with respect to *optimization of supply,* for users it is relevant to integrate AD-offers in the overall transport system and improve its connectivity and quality. Remarkably, they are skeptical about an on-demand service due to less calculable arrival times. Similarly, potential problems are associated with smaller vehicles for bearing the risk problems associated with boarding and exiting. Providers, the same as users, see great potential in an integrated transport system to make transfers easier and more comfortable. However, when it comes to cross-provider offers they also see the challenge of conflicting interests and business models. Regarding the use of smaller vehicles the picture is ambivalent. On the one hand, there is the potential for a more efficient capacity management with small vehicles, on the other hand the challenge to provide sufficient capacities without huge investment and capital commitment. While they also see the risk of an increase in motorized traffic they point to the possible benefits of automated driving in bundling transport demand, especially if new users – in particular car drivers – can be attracted to ridesharing and PT. The local authorities, however, are critical about the optimization in terms of more flexibility and demand-responsiveness. They would like to see automated on-demand offers only as additional service and only in limited areas.

CONCLUSION

Against the background of our findings on expectations and needs of different stakeholders we derived hints for favorable use cases addressing the question of recommendable future pathways for public transport.

We first would like to remark on the difference between the user perspective versus the provider and municipal perspectives: In the workshops users were confronted with a scenario in which fully automated driving would be technically and legally possible. In contrast, the municipal and PT experts were supposed to reflect on their actual challenges and activities regarding automatization. Nevertheless, there are many intersecting subjects in which the partly conflicting, partly complementary positions of users, providers, and local authorities develop.

The first use case type (A) - *Classic bus model but automated* is not likely to conflict with the user needs and political goals of the local authorities as it is essentially business as usual. Considering the exploitation of potentials of AD from the providers´ point of view, this use case does not meet the requirements. Neither is a serious optimization of supply resulting in a raised attractiveness to be expected nor is it a way to face the competition for innovative mobility concepts like dynamic ridesharing.

Use case type B - *Feeder system/ First and last mile* shares many potentials of type C but does comply better with the user needs and political goals. It meets the needs of affordability as it is likely to be integrated in the general PT fares system. Regarding the political goals as well as potentials by bundling transport demand and feeding the mass transportation systems, type B works against congestion and might reduce traffic. Moreover, the level of individualization is moderate so that it does not counteract the assumed principle of PT.

Regarding needs, potentials, as well as political goals, the assessment of use case type C - *Individualized on-demand mobility* is quite ambivalent. A potential benefit of individualization aspects lies in making PT and ridesharing more attractive especially to car drivers. Type C also bears the potential to save money and achieve higher returns. On the other hand, consumer protection standards are challenged and the general availability also in peripheral regions as well as affordability might be difficult to realize. Thus, the political ideal of an equal and democratic PT could be undermined.

Consequently, the acceptance and success of automated driving within public transportation will crucially depend on the chosen use cases. Our findings indicate that AD is far from being the single panacea to ensure PT's relevance into the future. Rather, the core business needs to be improved in the classic weak points of PT while the classic strengths of PT should not be jeopardized. Use case type C - *Individualized on-demand mobility* represents a pathway of PT that risks these strengths. With its particular role, PT in line with reasonable regulation can play out their influence for shaping a more sustainable transport. Against this background, a favorable pathway of PT could be use case type B - *Feeder system/ First and last mile* for being system-integrated and oriented towards intermodality that keeps the strengths and addresses the weak spots.

REFERENCES

1. Childress, S., B. Nichols, and S. Coe. Using an activity based model to explore possible impacts of automated vehicles. *Transportation Research Record: Journal of the Transportation Research Board*, 2493, 99–106, 2015.

2. Heinrichs, D., and R. Cyganski. Automated driving: how it could enter our cities and how this might affect our mobility decisions. *disP-The Plan*. Rev. 51 (2), 74–79, 2015.

3. Bahamonde Birke, F.J., B. Kickhöfer, D. Heinrichs, and T. Kuhnimhof. A systemic view on autonomous vehicles: Policy aspects for a sustainable transportation planning. *Kuhmo-Nectar Conference of the International Transportation Economics Association*, Barcelona, Spain, 21-23, June, 2017.

4. Anderson, J.M., N. Kalra, K.D. Stanley, P. Sorensen, C. Samaras, and O.A. Oluwatola. *Autonomous Vehicle Technology: A Guide for Policymakers*. Santa Monica, CA: RAND Corporation, 2016. http://www.rand.org/pubs/research_reports/RR443-2.html. Accessed July 26, 2018.

5. Heinrichs, D. Autonomous Driving and Urban Land Use. In: Maurer, M., Gerdes, J.C., Lenz, B., Winner, H. (Eds.). *Autonomous Driving. Technical, Legal and Social Aspects.* Springer Open, Heidelberg, pp. 213–232.

6. Litman, T. *Autonomous Vehicle Implementation Predictions: Implications for Transport Planning*. Victoria: Victoria Transport Policy Institute, 2018. https://www.vtpi.org/avip.pdf. Accessed July 26, 2018.

7. Zhang, W., S. Guhathakurta, and E. B. Khalil. The Impact of Private Autonomous Vehicles on Vehicle Ownership and Unoccupied VMT generation. *Transportation Research Part C: Emerging Technologies, 90,* 156–65, 2018.

8. Stephens, T. S. et al. *Estimated Bounds and Important Factors for Fuel Use and Consumer Costs of Connected and Automated Vehicles*. National Renewable Energy Laboratory, 2016. https://www.nrel.gov/docs/fy17osti/67216.pdf. Accessed July 26, 2018.

9. Talebpour, A., and H. S. Mahmassani. Influence of connected and autonomous vehicles on traffic flow stability and throughput. *Transportation Research Part C: Emerging Technologies, 71*, 143–163, 2016.

10. Kamal, A. S., J. Imura, T. Hayakawa, A. Ohata, and K. Aihara. A Vehicle-Intersection coordination scheme for smooth flows of traffic without using traffic lights. *IEEE Transactions on Intelligent Transportation Systems, 16(3)*, 1136–1147, 2015.

11. Fagnant, D.J., and K. Kockelman. Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations. *Transportation Research Part A: Policy Practice 77*, 167–181, 2015.

12. Keeney, T. *Mobility-As-A-Service: Why Self-Driving Cars Could Change Everything.* ARC Investment Research, 2017. http://research.ark-invest.com/hubfs/1_Download_Files_ARK-Invest/White_Papers/Self-Driving-Cars_ARK-Invest-WP.pdf. Accessed July 26, 2018.

13. Milakis, D., B. van Arem, and B. van Wee. Policy and society related implications of automated driving: A review of literature and directions for future research. *Journal of Intelligent Transportation Systems*, Vol. 21, No. 4, pp. 324–348, 2017.

14.   Kelle, U., and S. Kluge. *Vom Einzelfall zum Typus. Fallvergleich und Fallkontrastierung in der qualitativen Sozialforschung.* VS Verlag für Sozialwissenschaften, Wiesbaden, 2010.

15.   Bergold J., and S. Thomas. Participatory Research Methods: A Methodological Approach in Motion. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 13 (1), Art. 30, 2012.