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INSTITUTE FOR MOBILITY

How Service design affects the Impacts of Shared Automated Vehicles

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Problem Statement

• Vehicle automation:



Modal shift from sustainable modes, travelling more, undoing congestion reduction, energy savings and environmental benefits, ...

How could the deployment of this technology into our mobility system happen? Can we maximize added value while minimizing undesirable modal shift?

→Insights into context-appropriate designs

- Tailored to local spatial structure and travel demand, AV technology, infrastructure in place, existing modes
- Heterogeneity of impacts



Case Study Leuven

- Shared Automated Vehicle (SAV) service
- On-demand & pooled
- Station-based service
 - 39 stations (•) in and around Leuven
- Level 4 AVs
 - Subnetwork (-) compliant with ODD
- Competition with other modes:
 - Car, Car passenger, PT, Bike, Walk





Subnetwork

- Automated suitability index¹
 - Traffic volume
 - Presence of vulnerable road users
 - Road infrastructure
 - Speed limit
- Not allowed in the city center
- Highways excluded





Model

- Trip-based model
- Implemented in Visum & extended with Python
- 3 components
 - Mode choice:
 - SAV market share dependent on LOS
 - Based on Provincial Traffic model of MOW
 - SAV utility function added based on literature
 - Tour planning
 - PTV Visum DRT module
 - Assignment
 - Deterministic User Equilibrium
 - Impact of SAVs on traffic
 - SAV = 1.2 PCU¹

¹Sonnleitner, Friedrich, Richter, 2022. Impacts of highly automated vehicles on travel demand: macroscopic modeling methods and some results. *Transportation (Amst).* 49, 927–950.



SAV service

- 4pm 5pm
- 0.4€/km
- Unlimited fleet size
- 4 seats per vehicle
- More weight on serving more passengers than using less vehicles



Modal shift



Performance







Heterogeneity of impacts

- SAV% increase with distance
- Drop in car% increases with distance
- Drop in bike% decreases with distance
- Drop in PT% larger on radial roads than on tangential roads





Different service designs

• Change in pick-up and drop-off stations







Different service designs

Change in pick-up and drop-off stations





Different service designs

Fleet size decrease





10/12 Notelaers, Verstraete, Vansteenwegen, Tampère, (2023). *The Influence of Service Design on the Impact of Shared Autonomous Vehicles* (under review)



Next steps & Conclusions

- Consistent from the perspective of different stakeholders:
 - Users: Will the service be used? Can it compete with the other services?
 - Suppliers: Is the service financially viable?
 - Society: Is this mode the most sustainable way to do this trip with?





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Next steps & Conclusions

- SAV share increases with distance
 - Station-based service
- Target long & tangential trips (instead of short and radial)
 - to avoid competition with biking and walking
 - to complement instead of compete with PT
- Can be achieved by appropriate service design
 - Location of PUDOs
 - Pricing structure
 - Fleet size
- Check consistency with perspective of other stakeholders



Thanks! Questions?

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