The Role of Accessibility in the sustainable transformation of cities: the case of autonomous driving

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STRUCTURE

(1) Introduction / Initial situation: Accessibility Transport & Land Use – Interaction

(2) Problem definition: Autonomous Driving within the Interaction of Land Use and Transport

(3) Aspects regarding the impacts of autonomous driving
(1) Introduction / Initial situation:
Accessibility, Transport & Land Use – Interaction
Introduction / Initial situation I

- Urban and settlement development closely linked to transport and the development of new technological innovations in mobility ever since

Source: Kagermeier 1997: 25; Lehner 1964: 22f
Introduction / Initial situation II

Source: Bloomberg Philanthropies 2017: 74; Shiomo Angel et al. 2012
Interaction of Land Use and Transport

Transport supply → Accessibility → Land Use

Source: Wulfhorst 2003: 16; Wegener & Fürst 1999: 5f
Accessibility is influenced by Land Use and...
.... density, mixture, location, attractiveness, etc.
.... by the transport supply.
.....time, costs, comfort etc.
Interaction of Land Use and Transport

Source: Wulfhorst 2003: 16; Wegener & Fürst 1999: 5f
Accessibilty affects Land Use

„Those who love the countryside could not get away from it. At least not with the bus.“
Interaction of Land Use and Transport

Transport supply \(\rightarrow\) Accessibility \(\rightarrow\) Land Use

Transport demand \(\leftarrow\) Activities \(\leftarrow\) Land Use

Accessibility

Activities

Transport supply \(\rightarrow\) Accessibility \(\rightarrow\) Land Use

Transport demand \(\leftarrow\) Activities \(\leftarrow\) Land Use

Source: Wulfhorst 2003: 16; Wegener & Fürst 1999: 5f
Accessibility as a requirement for activities.
Interaction of Land Use and Transport

Transport supply \(\rightarrow\) Accessibility \(\rightarrow\) Land Use

Transport demand \(\leftarrow\) Activities \(\leftarrow\) Land Use

everyday behaviour (activities, means of transport, distances etc.)

long-term decisions (location choice, purchase of a vehicle etc.)

Source: Wulfhorst 2003: 16; Wegener & Fürst 1999: 5f
Transport demand and transport supply are interdependent.
Interaction of Land Use and Transport

Transport supply \rightarrow Accessibility \rightarrow Land Use

Transport demand \leftarrow Activities \leftarrow Land Use

- Accessibility to fast activities
- Slow transport supply
- Fast transport demand
- Fast accessibility
- Slow land use

Source: Wulfhorst 2003: 16; Wegener & Fürst 1999: 5f
(2) Problem definition: Autonomous Driving within the Interaction of Land Use and Transport
Problem definition

- Automated / autonomous Driving (AV) as a new technological innovation in mobility

- Different transport supply with changes in Transport demand (Alessandrini 2015: 148; Friedrich & Hartl 2016: 7, European Commission 2016: 1)
Autonomous Driving within the Interaction of Land Use and Transport

Automated / Autonomous Driving (AV)

Transport supply → Accessibility → Land Use
slow    fast      fast

Transport demand ← Activities ← Land Use
fast      fast      fast
slow

Source: Wulfhorst 2003: 16; Wegener & Fürst 1999: 5f

long-term decisions (location choice, purchase of a vehicle etc.)
everyday behaviour (activities, means of transport, distances etc.)
Changes of the Transport Supply

- Regarding:
  - Comfort
  - Time (e.g. driving time, time for accessing and egressing the vehicle)
  - Reliability

  - Costs / operating costs €
  - Safety

dependent on the different Use Cases AV
Impacts within the Interaction of Land Use and Transport I

• Change of Accessibility and Transport demand:

  • Fast: impacts on everyday mobility: activities, number of journeys, length of journeys, choice of means of transport (and decision of purchasing a vehicle)

  • Slow: possible impacts on the location choice of households, firms and public institutions and hence the settlement structure
Impacts within the Interaction of Land Use and Transport II

- Moreover influence of:
  - Individual characteristics and needs of persons, households and firms like e.g. household formation, generation of property etc.
  - Area attractiveness and Land availability / supply of dwellings
  - Politics (e.g. Mobility politics, Spatial politics)
  - Accompanying technological developments (Bertolini 2012: 20)
Impacts within the Interaction of Land Use and Transport III

• Simultaneously, impacts of a potential conversion of parking spaces due to AV on the availability of land and the construction activity of investors and therefore the supply (and prices) of dwellings (Moreno 2017: 5)
(3) Aspects regarding the impacts of autonomous driving
Aspects regarding the impacts of autonomous driving I

• Crucial is a better understanding of the following questions:

• Which use cases for autonomous driving could complement or replace the existing transport supply in different spatial structures?

• How or in what form and for whom does accessibility change through different use cases? Where do the impacts set in?
Aspects regarding the impacts of autonomous driving II

• different use cases of autonomous driving will change the transport supply; amongst other factors the change of the value of time plays an important role

• change of the value of time is rather subjective and depends on several factors:
  • use case
  • social group
  • possible activities within the vehicle and future working models
  • other boundary conditions
Aspects regarding the impacts of autonomous driving III

an example of a possible future:

• autonomous vehicles could promote ride sharing and are linked with a further development of sensors, deep learning, AI etc.

• within a ride sharing scheme, the person you ride with becomes very important and has also an impact on the value of travel time

• a social-emotional matching based on deep learning and AI might be feasible to further promote ride sharing with autonomous vehicles

• accessibility is thus not only determined my origin and destination (as well as acceptable waiting times and travel time increase), but also dependent on the current stimulus and the opportunities to ride with „same“ people
Conclusion

- Accessibility is a key factor within the interaction of land use and transport – change of accessibility will be crucial for (spatial) impacts of autonomous driving

- The change of the value of time is an important factor, but a lot more empirical research on the change of the value of time especially when riding with other passengers is needed

- A differentiation of the impacts regarding use cases, social groups and settlement structures is necessary
Thank You!

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