Technische Universität Wien
Department für Raumplanung
Soziologie
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Connected and Automated Driving – Aims, Interests, Outcome and Open Questions

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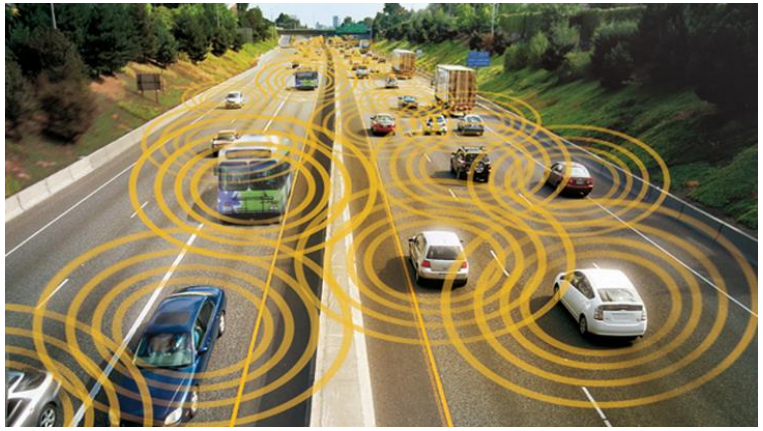


Innovation Network FutureCar

Phase IV – Meeting 6 „Autonomous & Automated Driving“

Friedrichshafen / hybrid, July 26th-27th 2022

Content

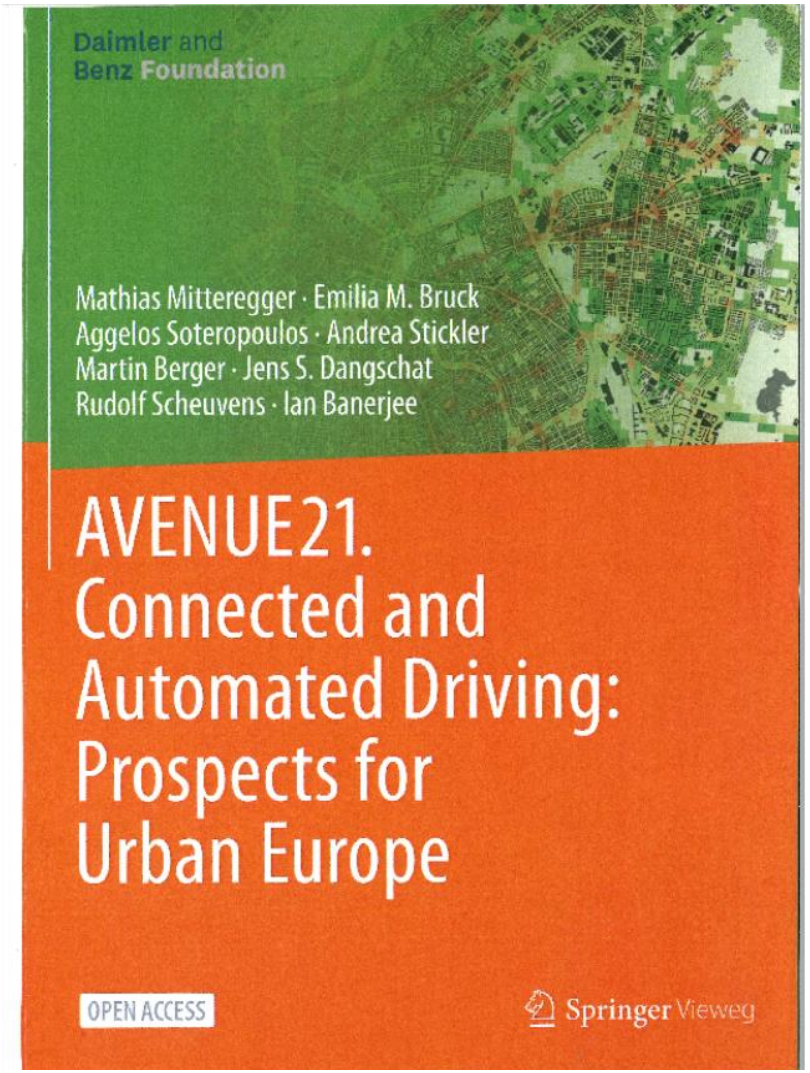
1. Science and technology studies (STS) as background of reflection of AVENUE21-project *
2. Technological transition as (one of) the big challenge – embedded in a broad and complex societal change
3. Aims & interests of connected and automated driving (CAD)
4. Some selected findings of AVENUE21
5. Three scenarios of future CAD
6. Eleven essential challenges to be considered

* AVENUE21 is an interdisciplinary research project, funded by the Daimler & Benz Foundation (2016-2021) and located at TU Wien´s future.lab-research center. https://futurelab.tuwien.ac.at/research-center/digitalisierung-und-raum/avenue21

1. STS as background of reflection of AVENUE21

upscpathshala.com

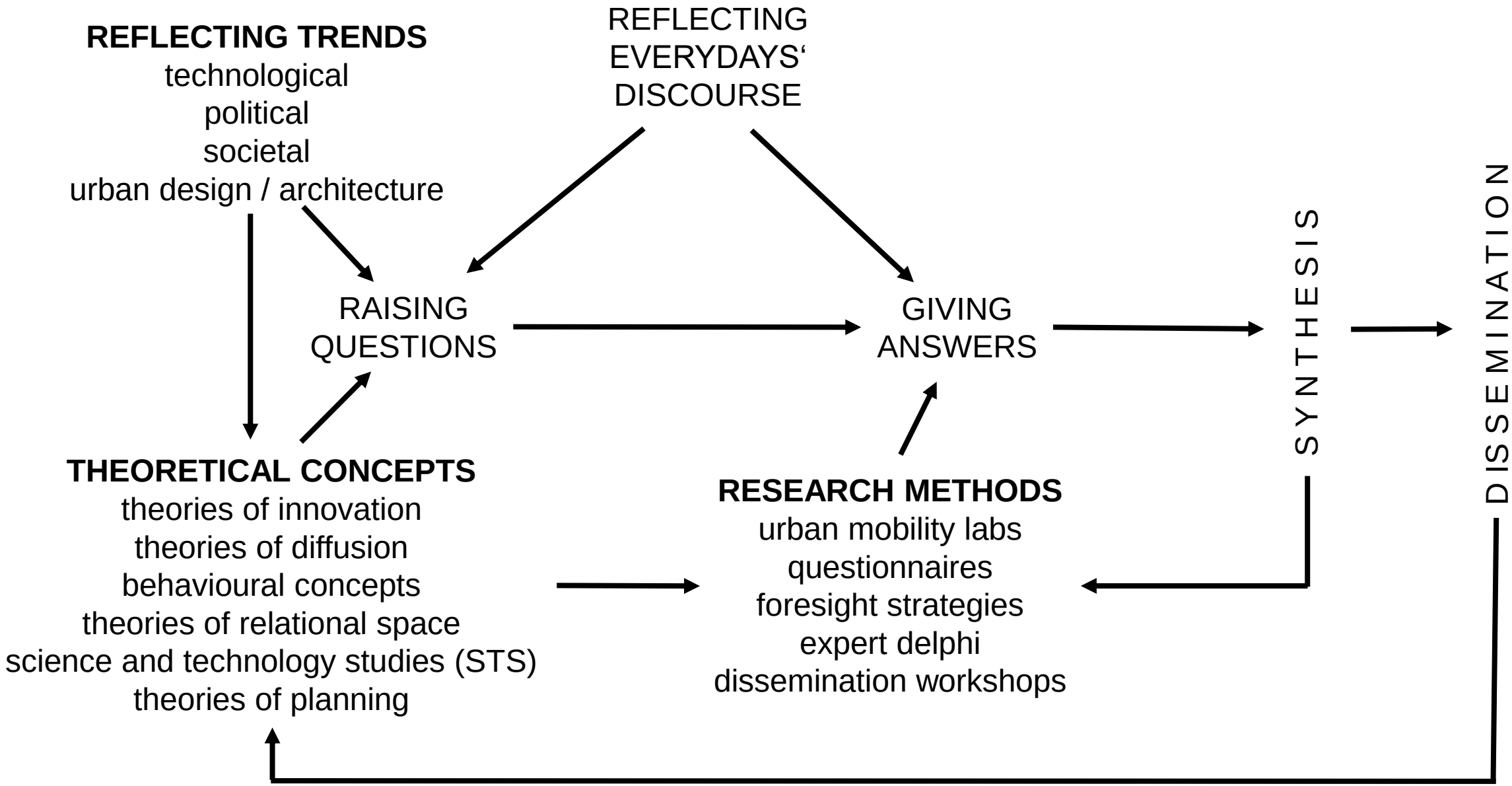
Research questions of AVENUE21



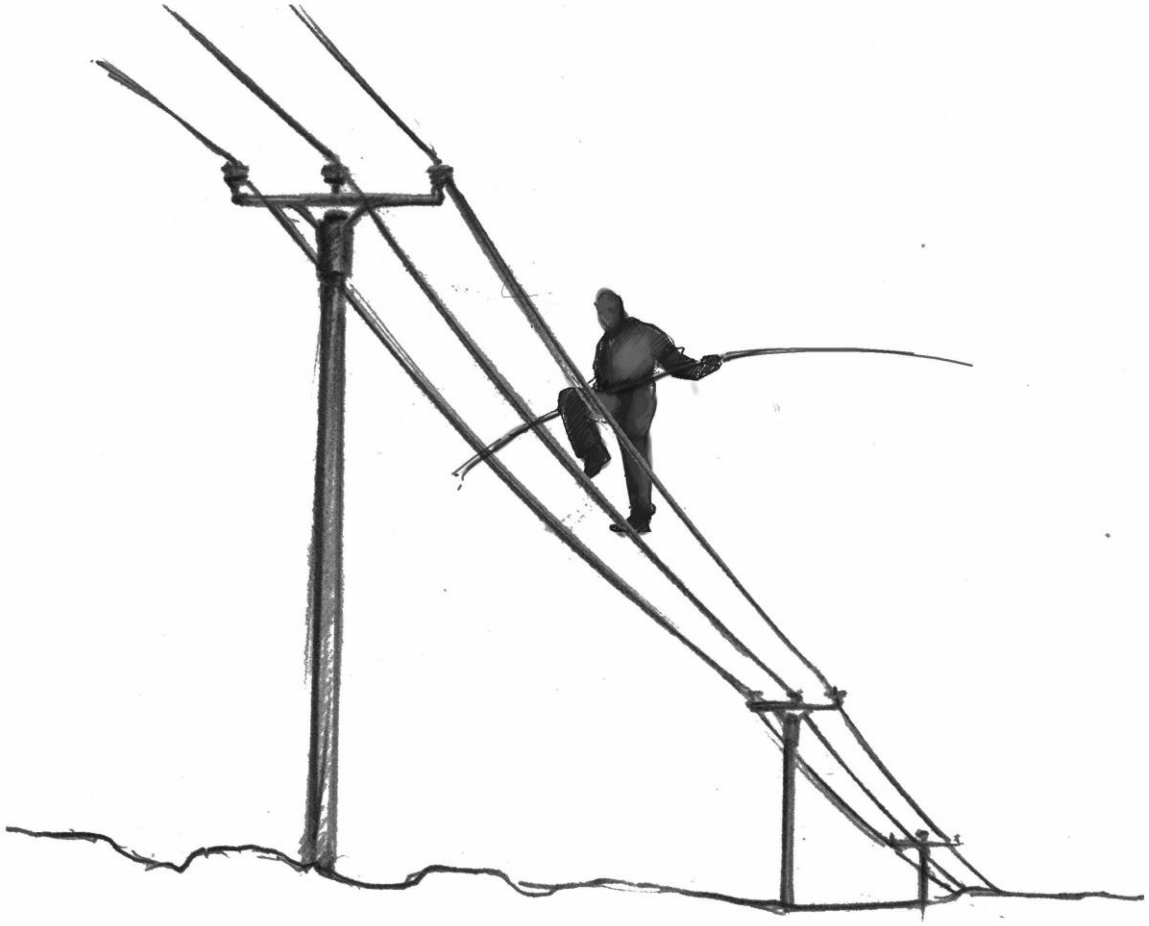
- According to EU and national policy strategies, connected and automated vehicles (CAVs) should be *safe, energy saving, transport efficiency raising, environmentally friendly and social cohesive* – is it so? And if 'yes': under which conditions?
- What are the *drivers behind this technological disruption*?
- What does CAD mean for *European cities* – discussed in the context of the *long SAE level 4*?
- How cities can meet the challenges of CAD and adopt the new technologies for *sustainable urban development*? – challenges for policies and transport planning
- Who like to be driven by a wheeled-robot? Why Europeans, particularly Germans and Austrians are so doubtful? What to do to overcome this skepticism?

https://link.springer.com/book/10.1007/978-3-662-61283-5 (Vol. 1, German)
https://link.springer.com/book/10.1007%2F978-3-662-63354-0 (Vol. 2, German) all of them are ready for downloads for free
https://link.springer.com/book/10.1007%2F978-3-662-64140-8 (Vol. 1, English)
Vol. 2 will be available at the end of 2022

AVENUE 21 research design



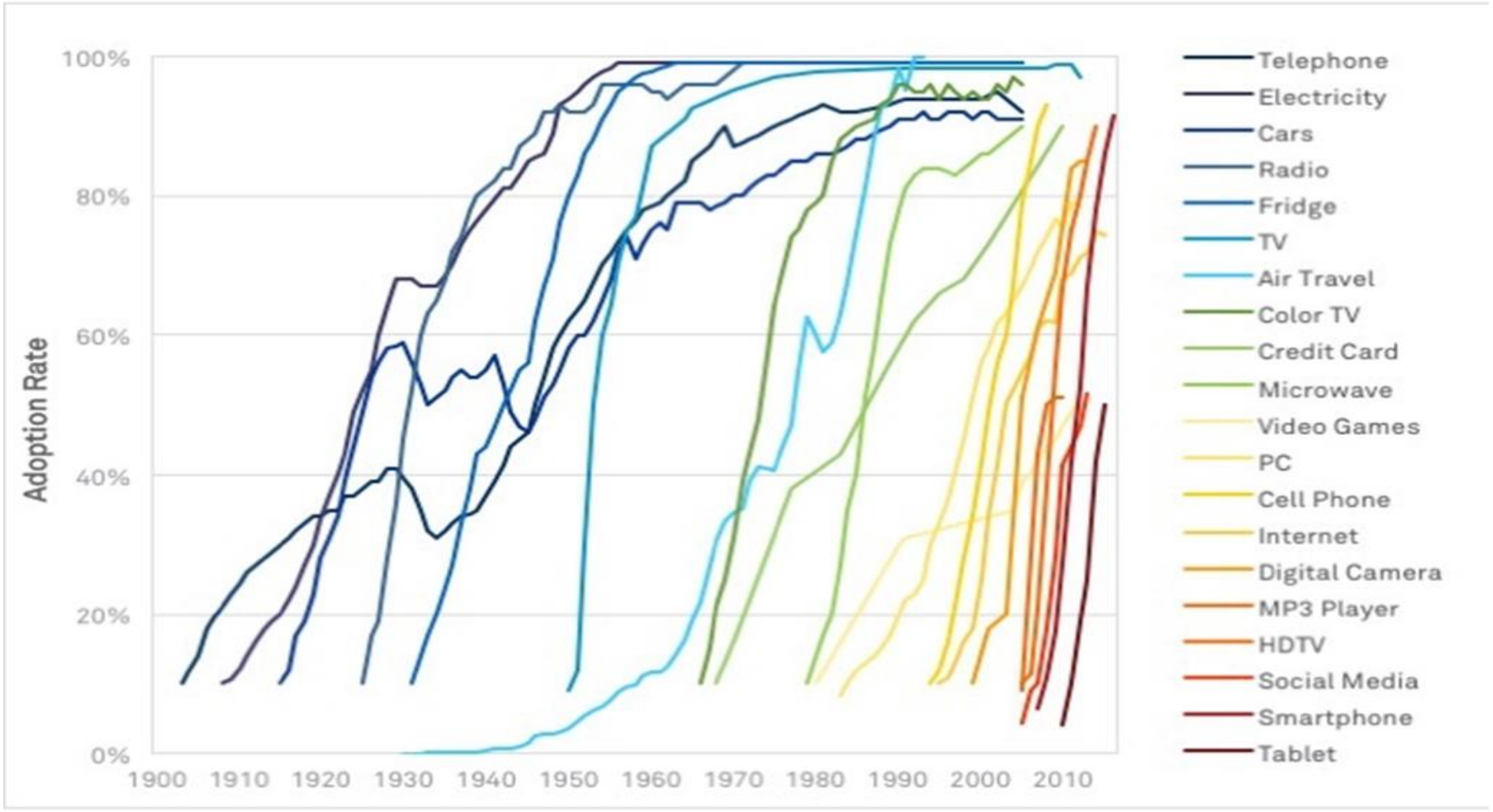
2. Technological transitions – what is ahead of us?



Aspenia online

Technological transitions

Digitalisation will dramatically change our world and will have a strong and complex impact on global competition, industries, labour markets, politics (ethics, regulation, research support, etc.) and particularly on our everyday life



increasing disruptiveness of technological transitions

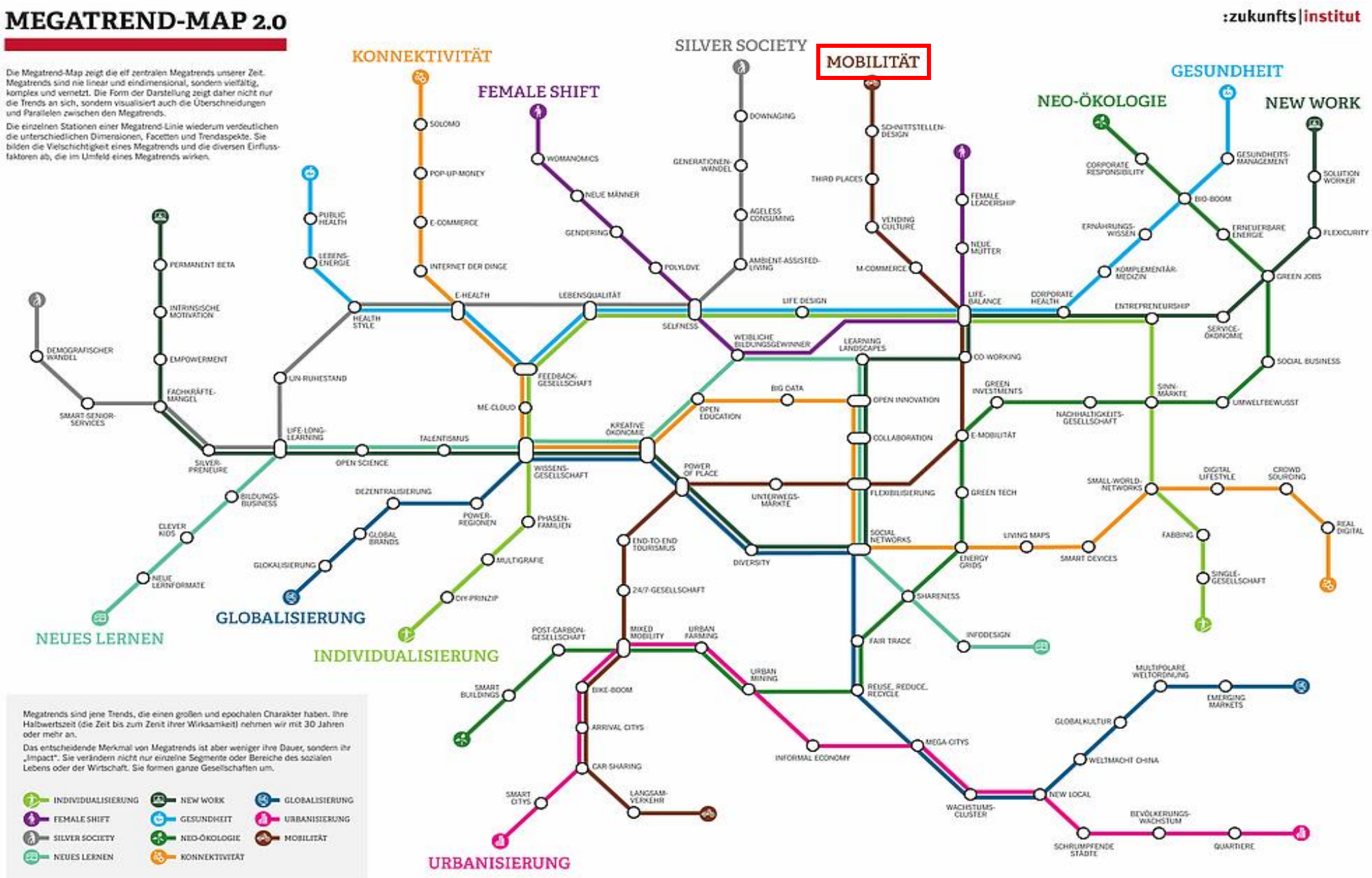
Automated driving is embedded in other technological and societal transformations

- ICT – Internet, Web 2.0 (communication, bubbles, political self-organisation)
- 5-G networks
- life-sciences (DNA-technologies)
- artificial intelligence, machine learning
- internet of things (IoT, connectivity)
- 3-D-printing (maker scene, DiY, co-creation)
- energy saving technologies (climate change)
- platform economies (sharing, etc.)
- value change (➔ polarisation of interests)
- changed and diverse life- and mobility-styles
- increasing socio-economic inequalities

➔ what does this mean for sustainable (sub-)urban development?

Technological transition as (one of) the big challenge – is always embedded in a broad and complex societal change

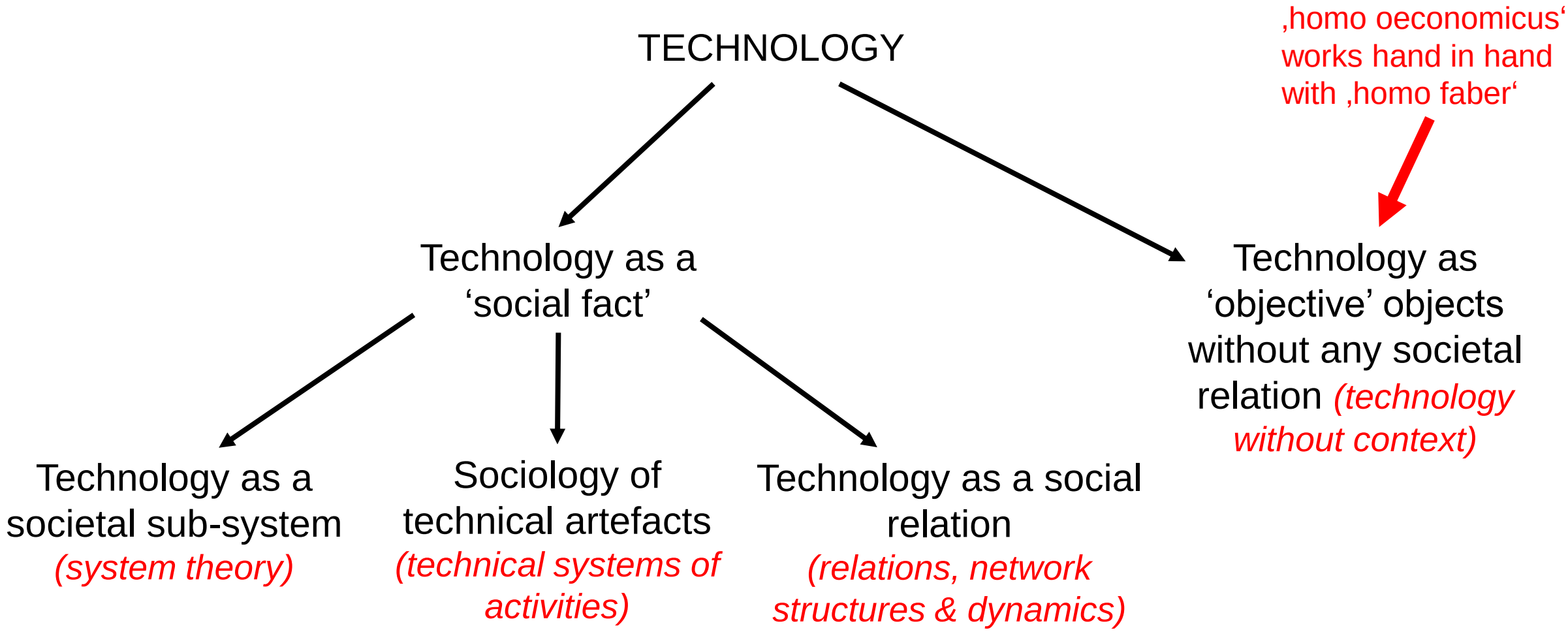
Current societal mega-trends



These trends need to be considered within the dynamics of technological transitions

System theory

Sociology of Technology explores the ways in which culture and social structures shape the design and use of technology, and how technology in turn influences cultural and social experience.



Large technical systems

ARCHITECT Magazine

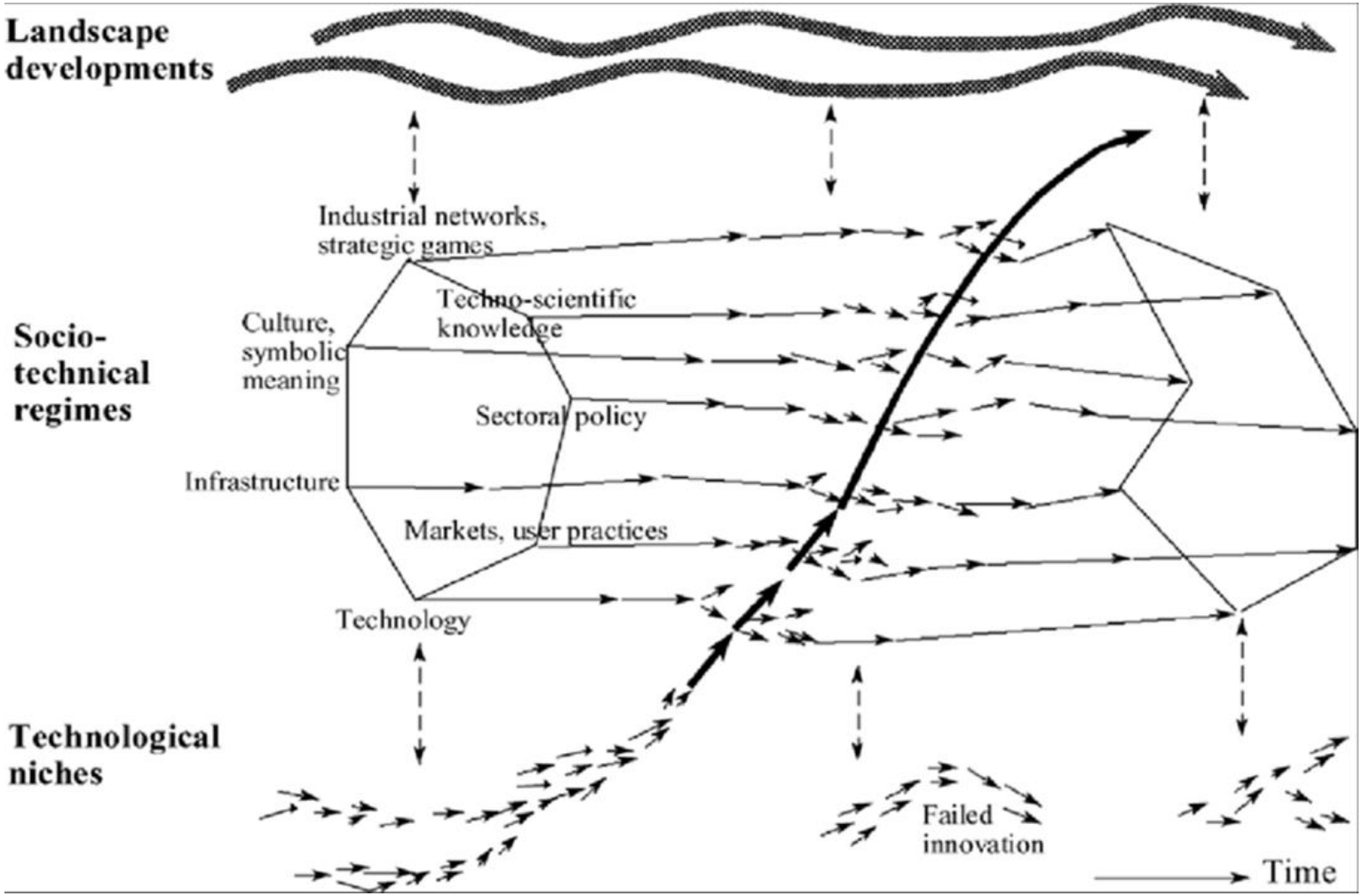
According to Hughes (1987)* large technology systems consist of

- a seamless system of physical artefacts,
- organisations (chambers, interest groups, families),
- institutions (politics, industries, research, etc.)
- natural resources (rare earth, silicon, etc.)
- scientific elements (knowledge, devices, etc.) and
- legislative regulations (road traffic regulations, research policies),

which becomes a reality by a stepwise process in which *technological stile* is most important within the transfer.

* Hughes, T.P. (1987), 'The Evolution of Large Technological Systems', in W.E. Bijker, T.P. Hughes, and T. Pinch (eds), The Social Construction of Technical Systems: New Directions in the Sociology and History of Technology, Cambridge, MA & London: MIT Press, pp. 51–82.

Technical development through the glasses of socio-technical regimes



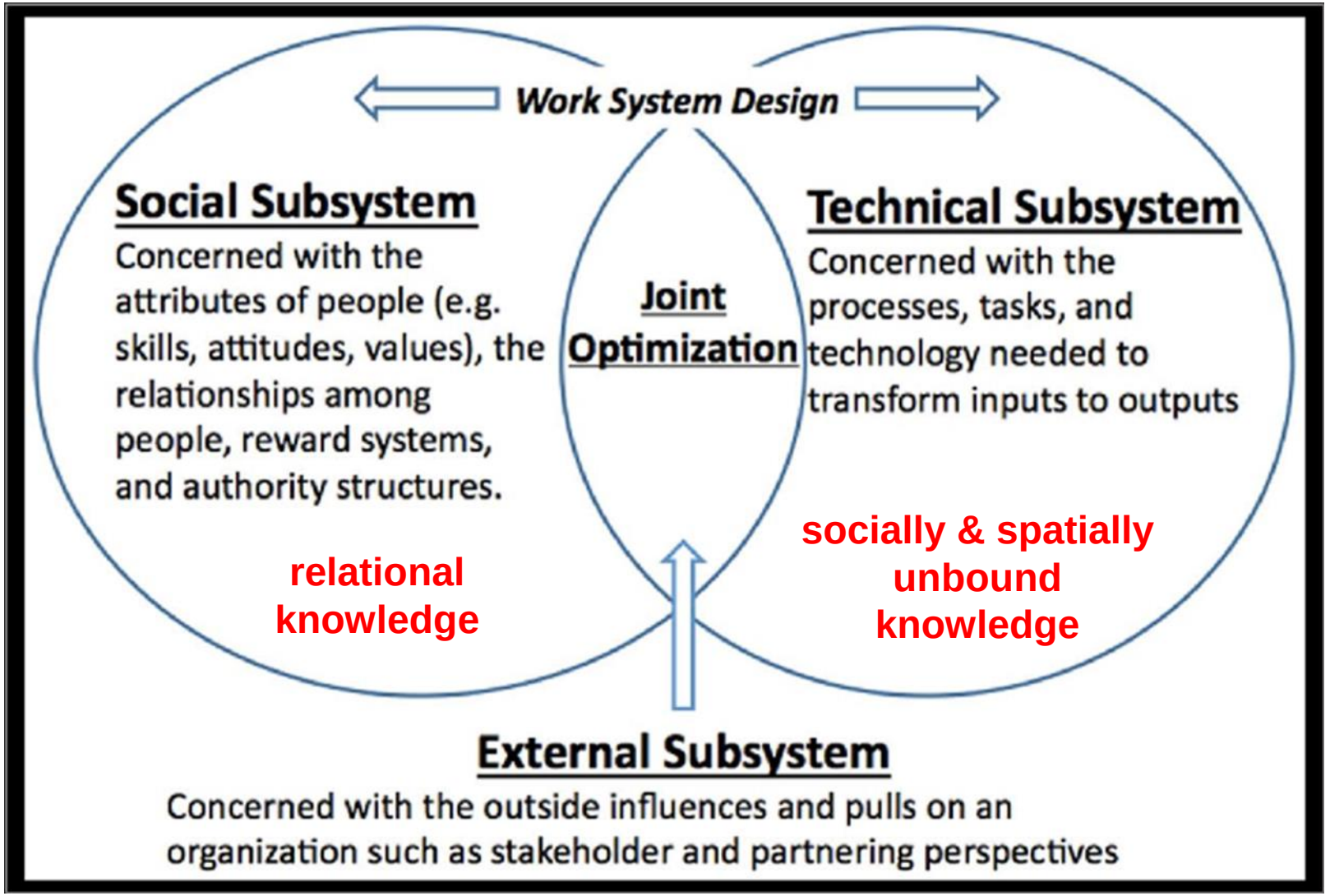
Geels, Frank W. 2011: The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions, 1 (2011): 24-40.

System theory II

About ‘people’

- people are acting not as consequence of facts but as result of their interpre-tation of these ‘realities’
- people are acting within a broad system of individual resources & constraints and societal norms & control
- Not ‘facts’ are affecting human behaviour, but its consciousness

➔ interpretation of rebound effects?



Sociology of technical artefacts

Technologies are making artefacts, which produces new relations between the maker and the user (inter-action). This means (potential) conflicts between the *principle of innovation*, the *principle of profit*, the *principle of use* and the *principle of humanities* (von Borries 1980*).

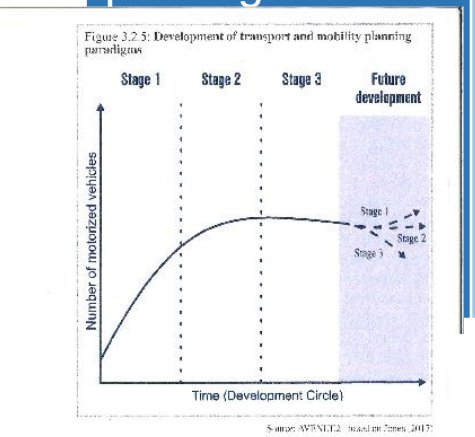
* von Borries, Volker, 1980: Technik als Sozialbeziehung: Zur Theorie industrieller Produktion. München: Kösel

Four elements are important to consider:

1. *normative elements:* function of technology to fulfil purposes, values, requirements and interests
2. *ocgnitive elements:* knowledge about technologies, technical control of their relations
3. *co-creating elements:* integration in co-designing processes
4. *activity elements:* the making and the use of technologies (lock-in & rebound effects vs. ‘innovations’)

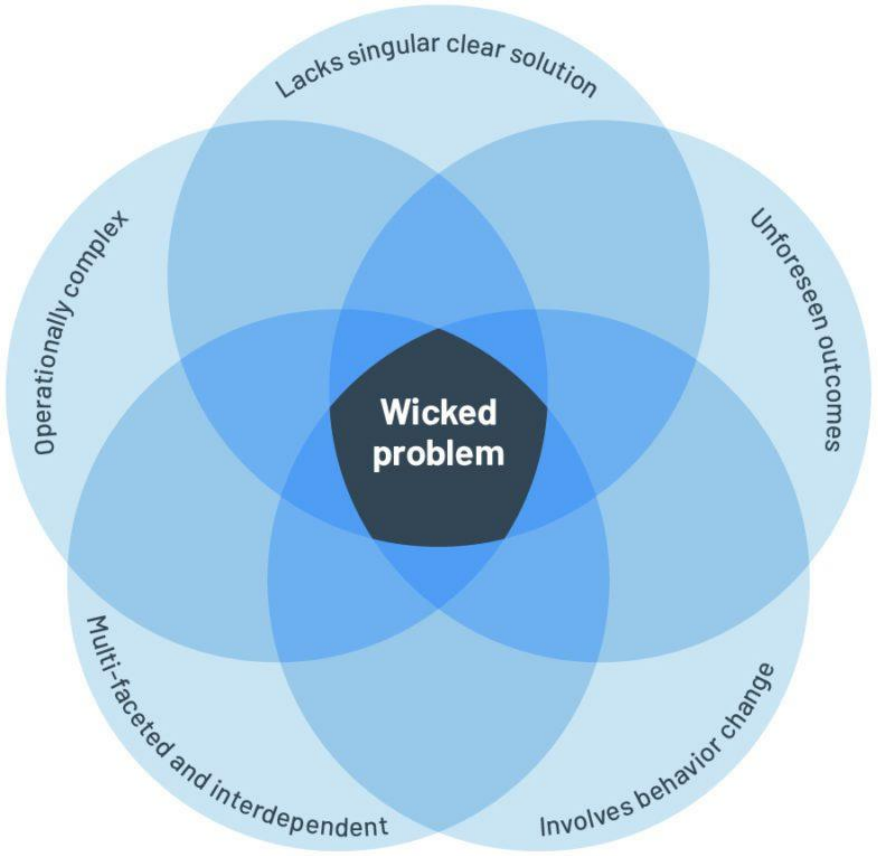
CAV within the transformation of automobility

	STAGE 1 accomodating traffic growth	STAGE 2 encouraging modal shift	STAGE 3 promoting liveable cities
caracteristics according to Jones (2017)*	▪ rapid growth in car owner-ship (among the wealthy) ▪ focus on the infra-structure and the vehicles ▪ economic growth becomes the objective ▪ lack of investment in walking and cycling infrastructures	▪ negative social and environmental effects become apparent ▪ regulatory approaches and public influence ▪ improvement of public transport ▪ parking management, restricting access	▪ focus on liveable spaces and sustainable forms of mobility ▪ aim to increase the quality and liveability of urban areas ▪ stricter control and socio-science approaches ▪ Car ownership starts to decline
spatial & trans-port planning paradigms	▪ The Articulated and Relaxed City (Göderitz 1957) ▪ Car-Friendly City (Reichow 1959) ▪ Traffic in Towns (Buchanan 1963) ▪ Athens Charter (CIAM 1933)	▪ 12 Principles of Cautious Urban Renewal (Hämer 1990) ▪ IBA Berlin (1984) ▪ Traffic-calming measures in residential areas: large-scale trials (DE), woonwerf concept (NL) ▪ New Charta of Athens 1991	▪ Association of German Cities and Towns, 2018 ▪ Sustainable Urban Mobility Plans (SUMP) (EU, 2015) ▪ Guidelines for Urban Road Design ▪ Leipzig Charter I 2007 (EU) ▪ Leipzig Charter II 2020 (EU)



Jones, P.M. (2017): The evolution of urban transport policy from car-based to people-based cities: Is this development path universally applicable?. In: Proceedings of the 14th World Conference on Transport Research. Shanghai

4 Levels of knowlege in wicked problems of technological transitions



intac.com

1. *Knowledge about the system: (big picture)* (technological, economical, ecological and social change, change and diversity of governance styles, social meaning of space, urbanisation, etc.)

2. *Knowledge about the main and relevant trends:* How these processes develop without intervention? How do they interact?

3. *Knowledge about the aims & goals*: developing new assisting systems vs. system integration in sustainable mobility concepts – acceptability, justice, feasibility, accountability

4. *Knowledge about transformation*: Who is interested in what kind of transition? What is the (global) power structure for reaching these goals? How to moderate and mediate these (potential) conflicts?

3. Aims & interests of connected and automated driving (CAD)

trafficTechnologyToday.com

Political aims and goals

EU and most national levels: CAD …

- makes a safer transport system,
- assist for a lesser energy use,
- will be more environment-friendly,
- strengthen the technological and industrial competitiveness and
- will be socially inclusive.

positive scripts of a strengthened automobility – real at the SAE 5 level ?

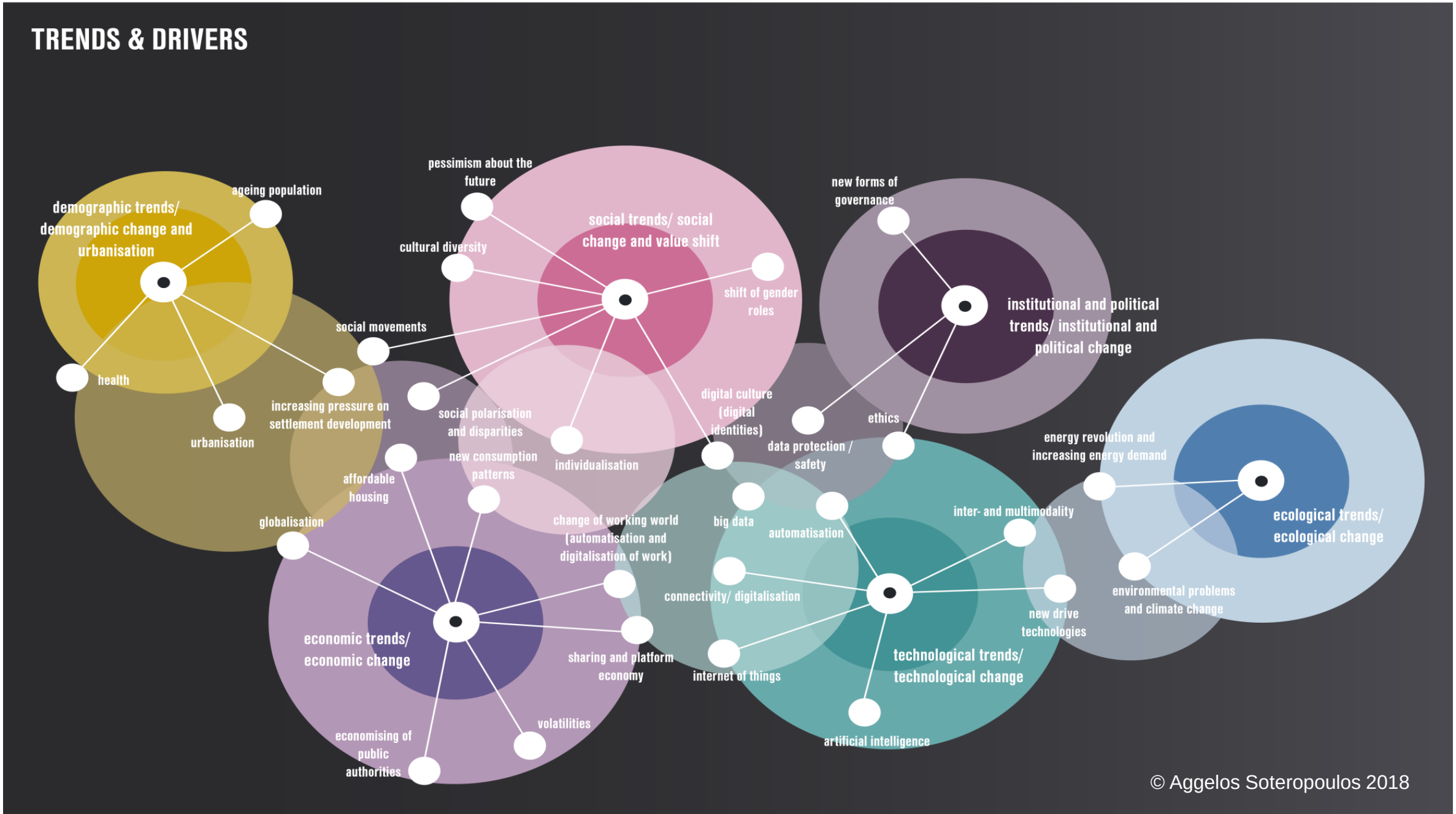
Most local and regional levels within Austria (those outside the car production clusters): CAD will …

- be in opposition to the local/regional development goals (sustainability, transport and mobility turn),
- improve the competition between centre an periphery (5G net),
- rise a broad scepticism among the citizens against ‘being-driven’
- have an impact on the attractivity of sub- and exo-urban sites (investments in working places and housing) (with pros and cons)

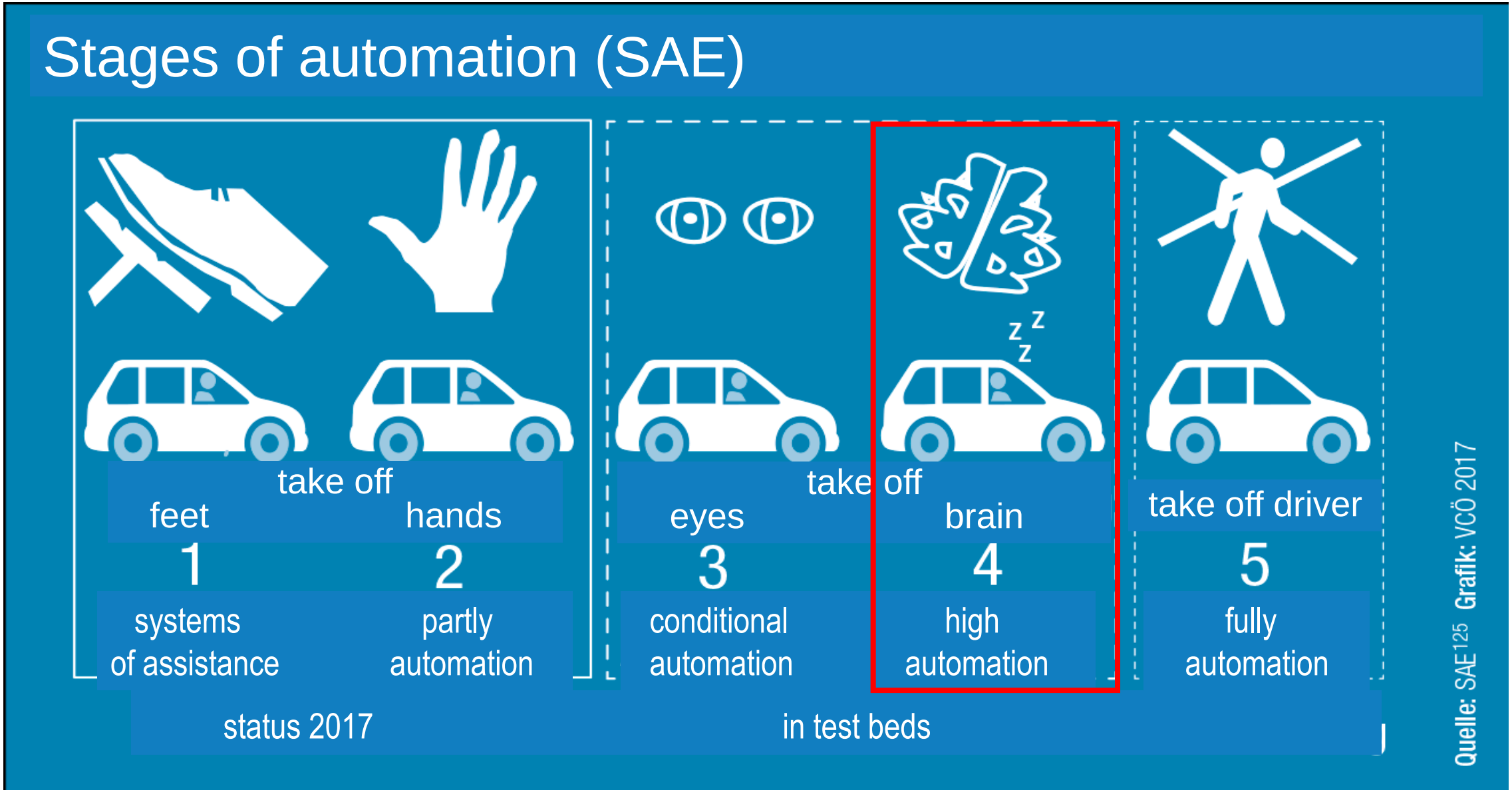
4. Some selected findings of AVENUE21

AHA-Nachhilfe.de

Knowledge about the system: trends and drivers of CAD

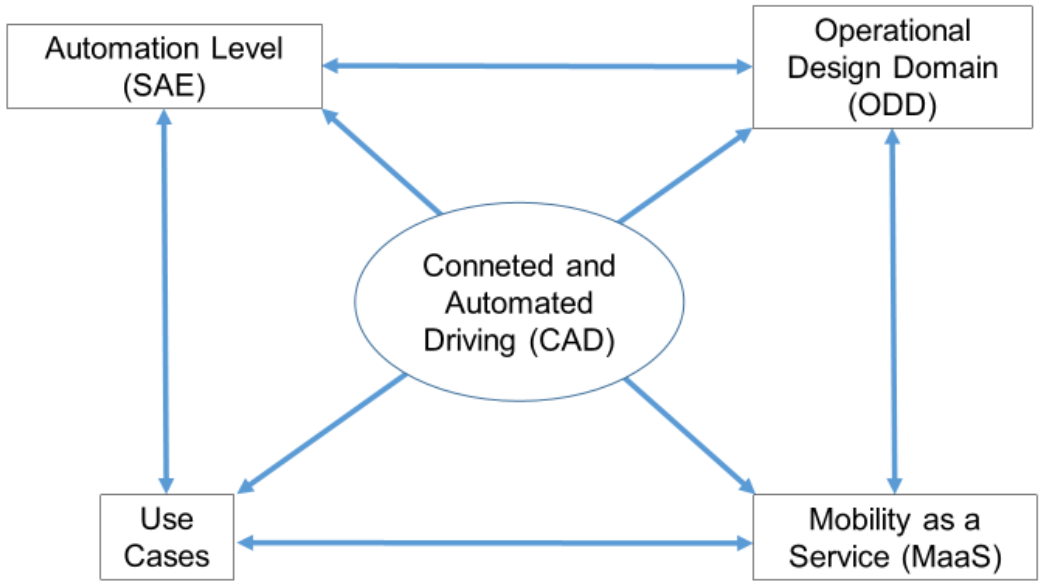


Connected and automated vehicles (CAV) – what are we talking about?



AVENUE21 is mainly about long level 4

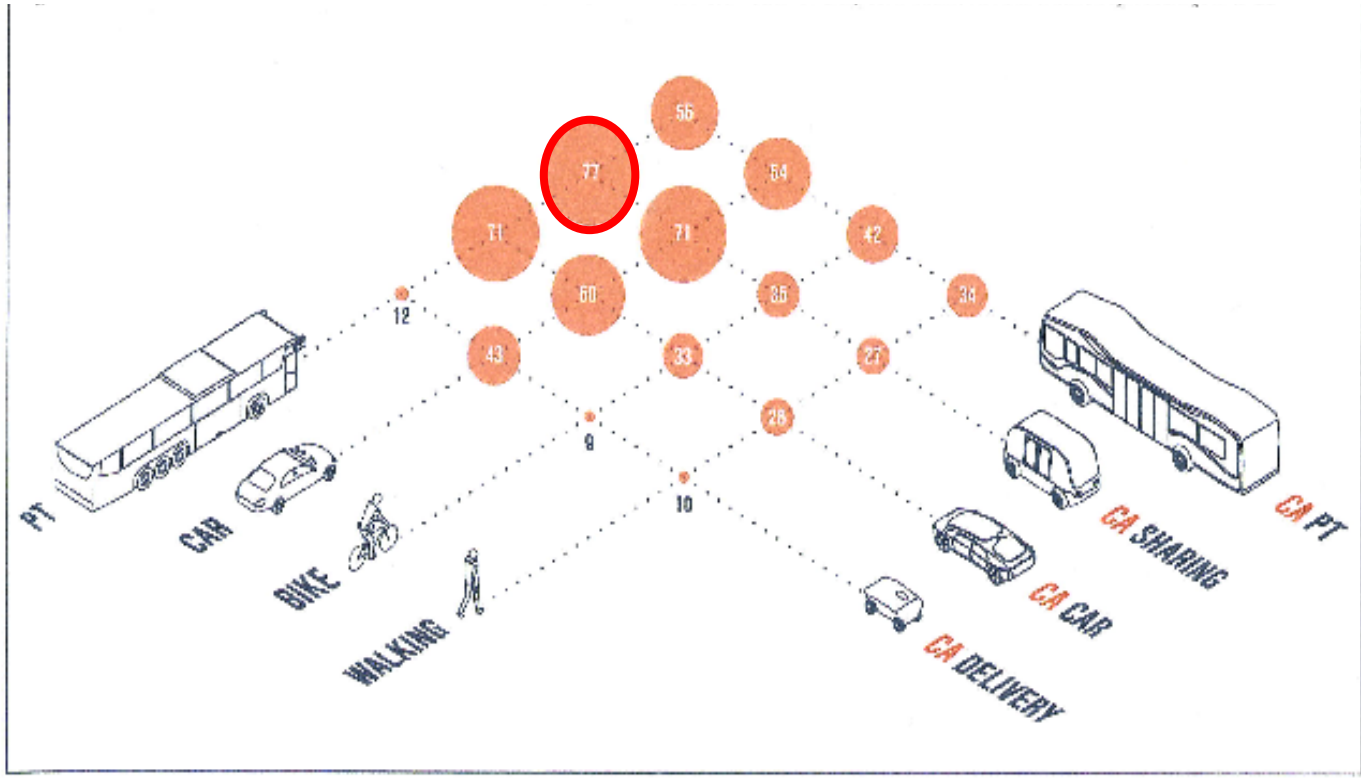
CAV and the need for transport and mobility system integration



The use of the (potential) technologies of SAE 4 and SAE 5 is not only about its technological development and market readiness, but how it is to be integrated in transport and mobility contexts

1. *ODD* – Where (highways, automated parking, inner cities) and when (whether conditions, etc.) it should work
2. *Use Cases* – private owned cars, shuttle busses, transport on demand, taxies, inner-city cargo, etc.
3. *MaaS* – how CAVs are integrated in future mobility systems? (first & last mile, sharing systems, intermodality, platform economy, etc.)

Suppression potential of CAV use cases against recent transport modes



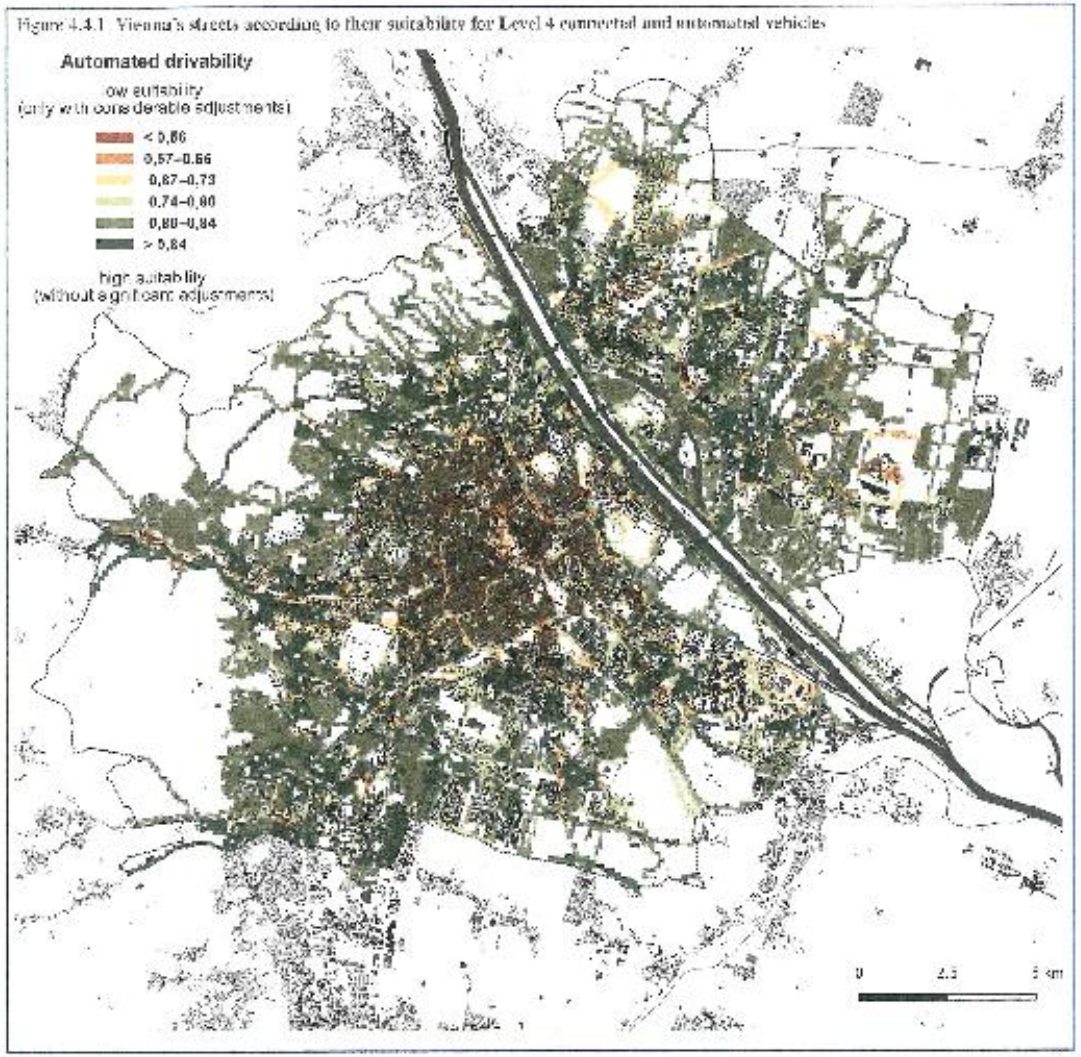
Results of two expert surveys (> 300 international participants)

Reading support: 77% of the experts agree that the existing traditional urban public transport will be replaced by CA carsharing

1. Traditional urban public transport will be jeopardised by many use cases of CAV
2. Within the car use, CA sharing will replace car ownership – but to a lesser degree than expected by most experts
3. Biking and walking will be replaced by easy to access CA modes

➔ All three results are contradicting the aims of transport and mobility turn as much as sustainable urban development

CAV drivability in Inner Cities (as example the densely built Vienna)



CAV drivability will be restricted for long within the inner cities of most European Cities (as much as in South Asian and African Agglomerations)

- due to the complexity of actors in the (narrow) streets,
- due to security in “Babylonian” street situations,
- due to tremendous development needs for software development (time and money ➔ Shladover, 2016**).

➔ CAVs within inner cities needs more space than the savings of the use of cars by car & ride sharing

** Shladover, Stephen E. (2016): The truth about “self-driving” cars. They are coming, but not the way you may have been led to think. Scientific American, Special edition, winter 2016: 79-83.

* Soteropoulos, A. (2021). Automated Drivability und straßenräumliche Verträglichkeit im Stadt-Land-Kontinuum am Beispiel der Stadtregion Wien. In: Mitteregger et al. (Hrsg.): AVENUE21. Politische und planerische Aspekte der automatisierten Mobilität. Springer Vieweg, Berlin & Heidelberg. https://doi.org/10.1007/978-3-662-63354-0_5.

Transformation knowledge: Where we want to go?

Image of late 1950s, USA

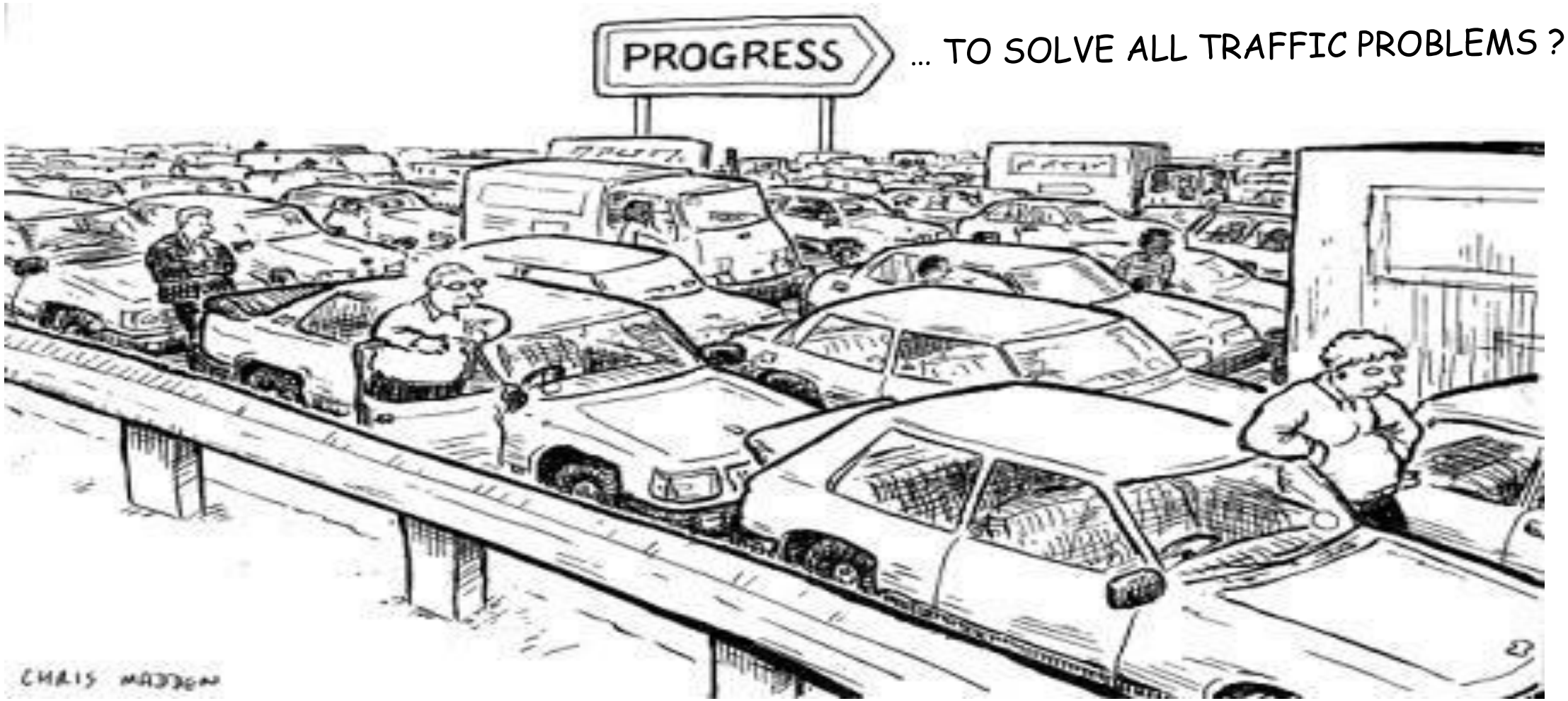
What do we want …

“CAV-Ready" Cities or "City-Ready” CAVs?

(Rupprecht et al. 2018)

Who is „we“?

Heaven Scenario: Positive implications of automatization: The bright & optimistic story of (fully) connected and automated driving (CAD)



The bright story of CAD

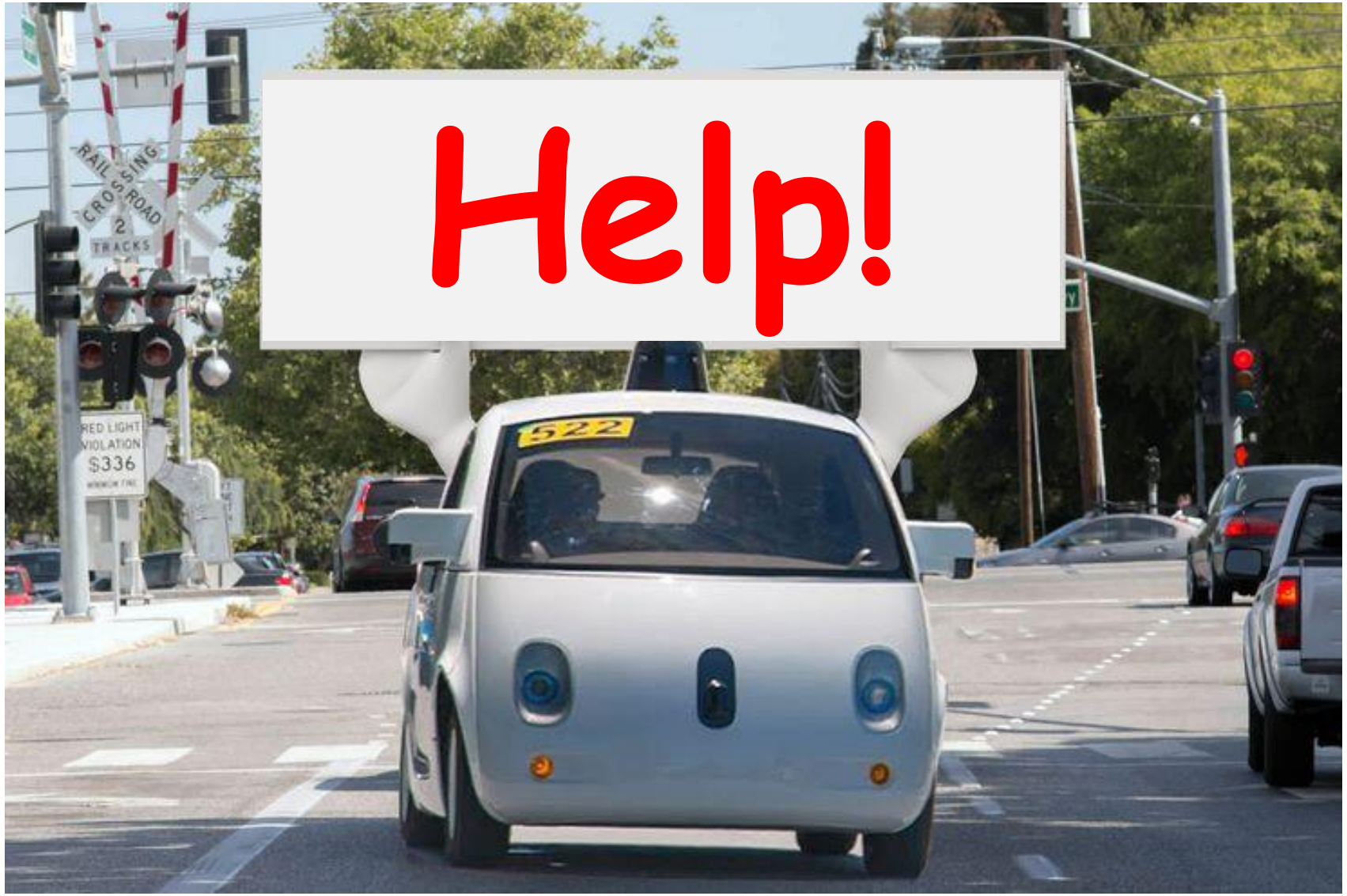
- CAD will make traffic safer (almost no accidents, cost savings, etc.)
- CAD can be organized …
  - by efficient speed control (CACC = Cooperative Adaptive Cruise Control)
    - almost no congestion
    - decrease in energy consumption
    - decrease of emission of greenhouse gases
  - to retrieve public space (in cities) and
  - to enable (re-)integration of mobility-impaired social groups

Under which conditions this will be realistic?

- CAD needs innovative technologies; thus, there is a push for competitive development of technologies (economic & technological competitiveness)
- Individual benefits for drivers (obtaining time of travelling and valet parking; comfort of seamless travelling; those who cannot traditionally drive by car can use CAVs from age 14 to 114)

➔ CAD makes transport safer, drivers more aware, accidents less likely and lowers emissions and support inclusivity of the society

Hell Scenario: Negative implications of automatization: The dark & sceptical story of (fully) connected and automated driving (CAD)



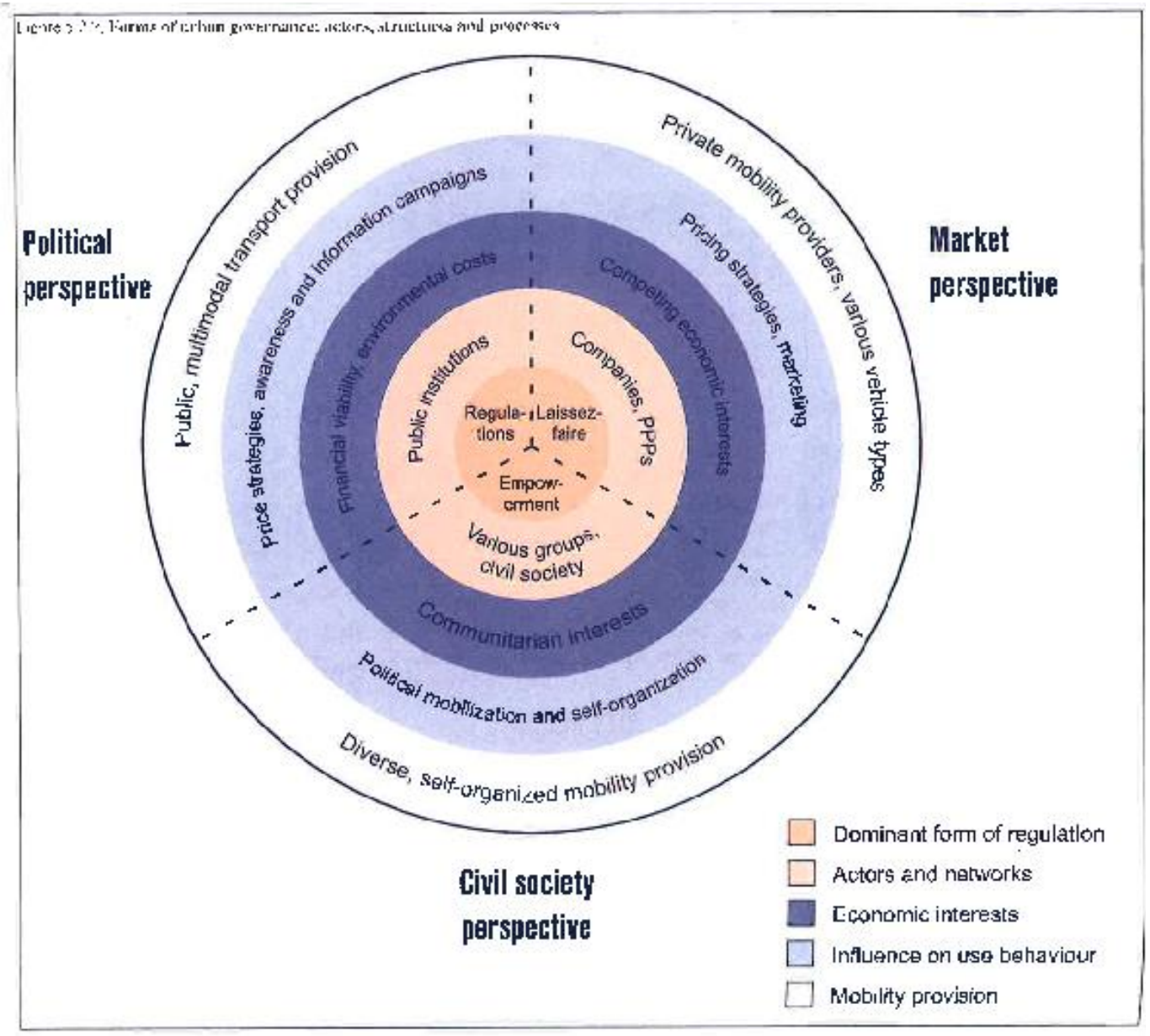
The dark story of CAD

- The positive assumptions are by far too optimistic and dependent from side-effects
- The interest of those pushing ACV is not improving mobility, but the harvesting of on-trip data (by Alphabet et al.) and/or to open awareness for positive aspects of digitalisation and/or to be one of the first test-beds (national states, regions, cities etc.)
- If comfort is the main driver of demand, traffic will improve and produce rebound effects
- CAD will be socially and spatially selective (due to prime costs and benefitting from time saving as much as centre vs. periphery competition)
- CAD will foster the interest of settlements in suburbia (private households and working places in service sector) and thus will increase travel distances and daily vehicle use
- CAD will out-compete public transport modes ➔ both aspects will undermine the aims of sustainable spatial planning
- Broad scepticism against CAD among citizens (ca. 60% in Germany), because of
  - broad mistrust against the reliability of the technological systems
  - mistrust against the potential hacking of cars
  - mistrust against 'big data' (Who owns the data?)
  - unwillingness to become an assistant driver

But we know little about who is risk prone or risk averse

5. Three scenarios of future CAD

AVENUE21 - scenarios



	market driven	policy driven	civil society driven
main interest	efficiency, profit	public interest, environment & climate protect. health orient.	sufficiency, self-determination, sustainability
transport policy aim	efficiency	modal shift	car traffic prevention
urban policy model	competitive city	socially inclusive city region	participative city region
role of state	weak – providing basic services	strong – shapes the mobility market	passive – opens for initiatives (makers)
underlying conditions	deregulation of mobility markets & neo-liberalisat.	systematic shape of the mobility markets & services	opening up the mobility markets to civil society niches
financing models	use and valorisation of data	tax means for (public) transport	mobility as a public good (commons)
mobility market str.	oligopoly of private actors	state-steered oligopoly	multisectoral networks

6. Eleven essential challenges to be considered

weeblytutorials.com

11 Essential Challenges

Against the background of the ‚Grand Challenges' CAD implies a couple of essential challenges in those political and research fields, which are strongly determined by its technological feasibility.

1. The calculation, whether an 'intelligent' traffic control system can *reduce the number and severity of accidents*, strongly depends from market penetration (the longer mixed situations exist within level 4, the more risky the traffic will be; 'Babylonian Confusion').

2. The degree of the *reduction of energy consumption and emissions of greenhouse gases* by an 'intelligent' traffic control system depends more from factors like post-fossil engines and the change of mobility styles (like speed control, acceptance of different kinds of sharing, use of active forms of mobility) than from CAD. And: Are there serious calculation of energy-use of the connectivity-demand?

3. The *development of CAVs can be conducted in an evolutionary manner* (step-by-step developments of driving assistance systems by car industry) or in *revolutionary manner* (disruptive – availability from the scratch by game changers from the IT branches and/or other parts of the world like China, Silicon Valley) – to plan and steer the development in Europe is one of the main tasks for policy makers and/or planners.

11 Essential Challenges ctd.

4. Even though most publications (predominantly from engineers' and architects' sides) act on the assumption that traffic will decrease and public space can be reclaimed, there are other voices arguing for the opposite that *traffic will grow due to comfort* (‚seamless transport') *and enlargement of potential users* (from 14 to 114 years of age) and will *create longer distance-trips*; for these voices more attention must be paid (cf. following points 5, 6, 7).

5. If ACV really generates benefits of comfort and time saving (no active car parking by drivers, 'time saving' while driving), than *ACV is a (too?) strong competitor for public transport* both within the agglomerations but as well between cities. Providers of public transport, therefore, need to react with new types of flexible and small vehicles, new business plans and new forms of co-operation.

6. For those people who really save time (for other important activities) *suburban places are becoming more attractive*, what will enlarge the trips and support the sprawling of the suburban zones.

7. Point 5 and 6 clearly *contradict the aims of sustainable settlement development* – again it is an open question whether an how regional/local politicians and spatial planners will handle it.

11 Essential Challenges ctd.

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8. In most European countries *scepticism among citizens against CAV* is high due to different reasons. How to handle the situation if citizens' interests are against technology policies? Moreover, there are no studies made for relevant target groups.

9. Who is *paying for the new infrastructures* which guarantees the V2V, V2I and V2X communication? Who owns which data (and what for)?

10. As all technologies have had an *impact on social inequalities and the equality of life-chances in the past*: What will be the socially and spatially differentiated impact of CAD? How these possible effects are considered?

11. To reflect the (socially and spatially diverse) *output and outcome* is needed; but social sciences should also consider *how technologies become to being*, what are the *narratives* and what are the *power structures* and the *interests* behind – in this case: the *prolongation of automobility.*

Core Question

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What do we (?) (in Europe) want …

1: Adopting cities (and urban life) for the technological needs of CAD

or

2: Support only those forms of automatization and connectivity which help to solve (most of) the existing problems of transport system and mobility?

But why the main power of interests seems to follow the first way?

Thank you for your attention and upcoming questions

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