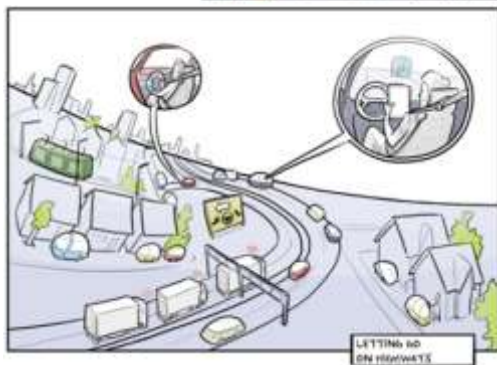
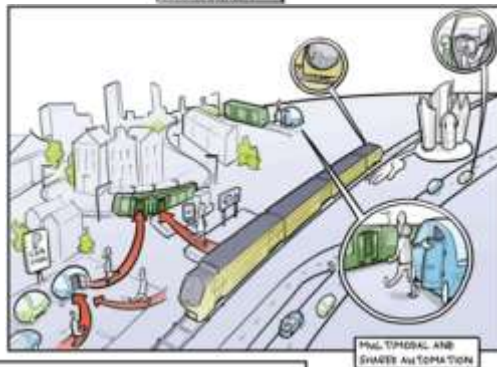
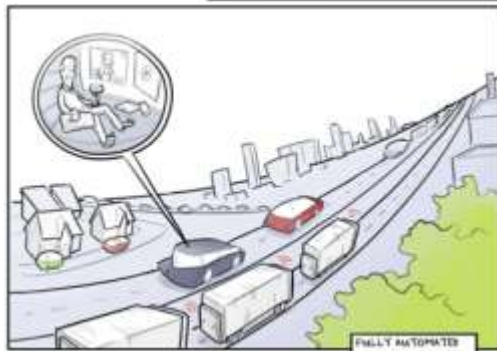
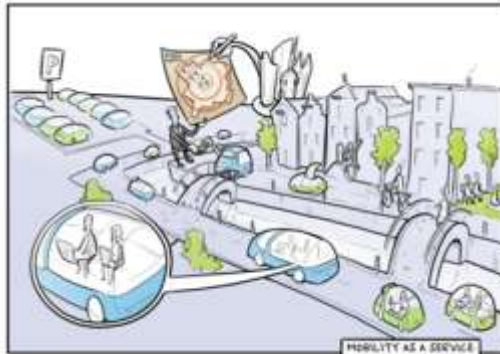




Ministry of Infrastructure and the Environment



Driver at the wheel?

Self-driving vehicles and the traffic and transport system of the future

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KIVI, Arnhem, 20 April 2016

KiM | Netherlands Institute for Transport Policy Analysis



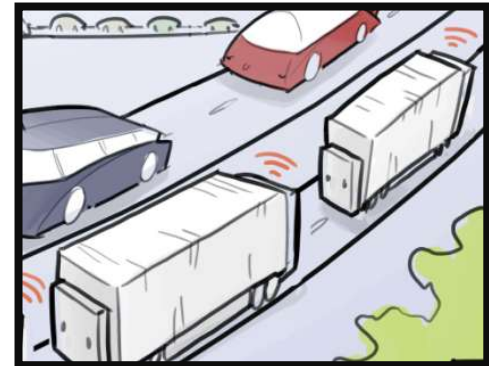
Research program

1. Scenarios for a future traffic and transport system with automated vehicles

- Vision and interactions
- Uncertainties and implications
- Broad societal consequences
- No specific time horizon: four final stages

2. Transition paths (backcasting)

3. Perspective on policy options





Building blocks

- Main uncertainties in transport system
 - Level of automation
 - Level of sharing (car ownerships and rides)
- Main drivers
 - Technology (*market / industry*)
 - Preferences / acceptance / attitude (*consumer / citizen*)
 - Policy and regulation (*government*)
- Impact
 - Other transport modes: PT, walking / cycling, transportation of goods
 - Society: safety, social inclusion, spatial planning, environment, economy
 - Transport demand: trips, kilometres



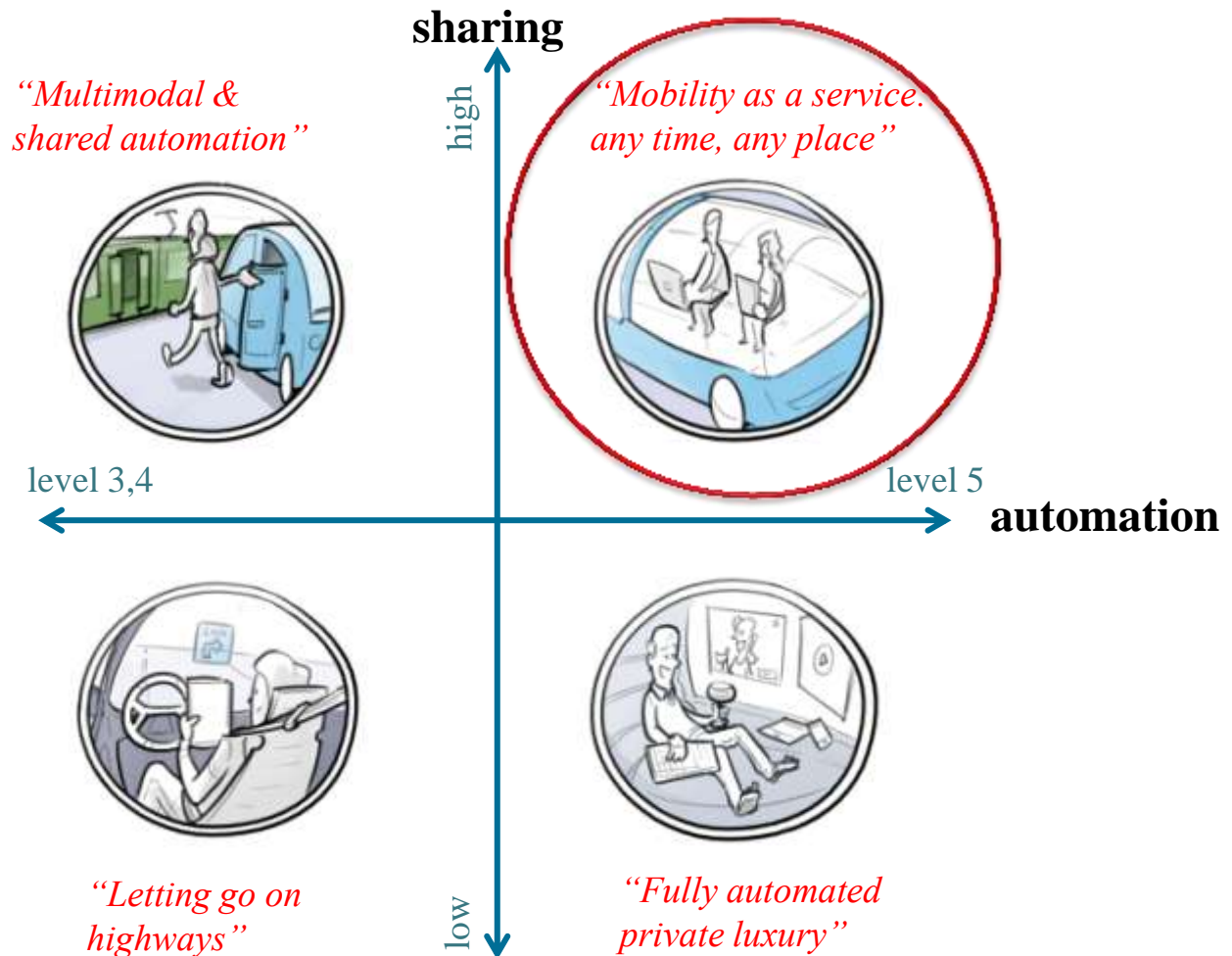


Definition: SAE-levels of automation

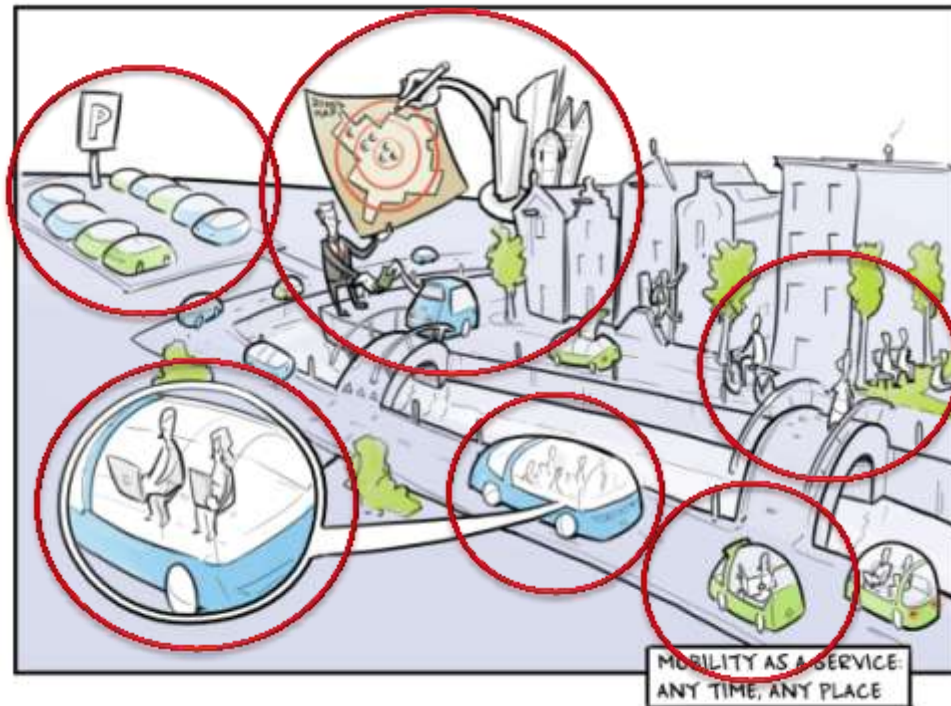
| Level | Name | Example |
|--|------------------------|-------------------------|
| <i>Human driver monitors the driving environment</i> | | |
| 0 | No automation | Lane Departure Warning |
| 1 | Driver assistance | Adaptive Cruise Control |
| 2 | Partial automation | Parking Assistance |
| <i>Automated driving system monitors the driving environment</i> | | |
| 3 | Conditional automation | Highway Chauffeur |
| 4 | High automation | Parking Garage Pilot |
| 5 | Full automation | Robot Taxi |



Uncertainties and scenarios



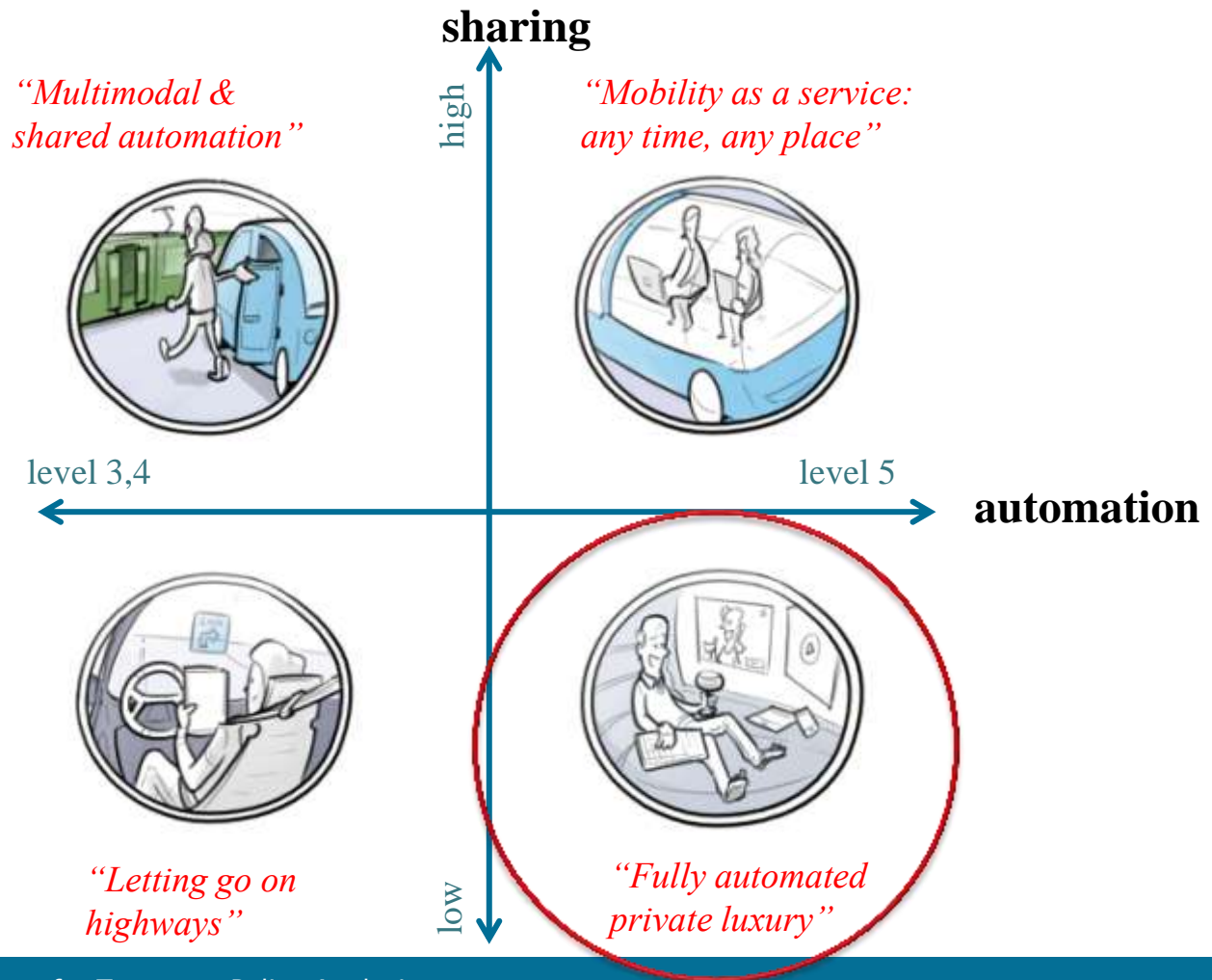
Mobility as a service: Any time, Any place



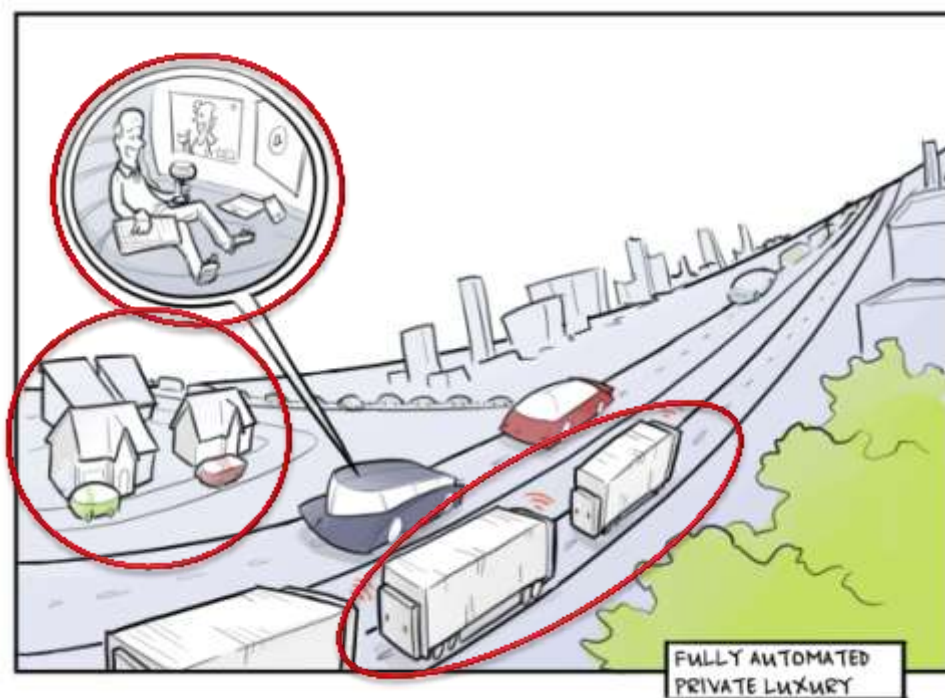
- Door to door travel by automated people movers
- Sharing flourishes: car ownership (large fleet owners) and rides
- Most traditional public transportation abolished
- Cars park themselves in parking areas on the outskirts of the city
- People opt to walk and cycle whenever possible
- Price/km within the city increases



Uncertainties and scenarios



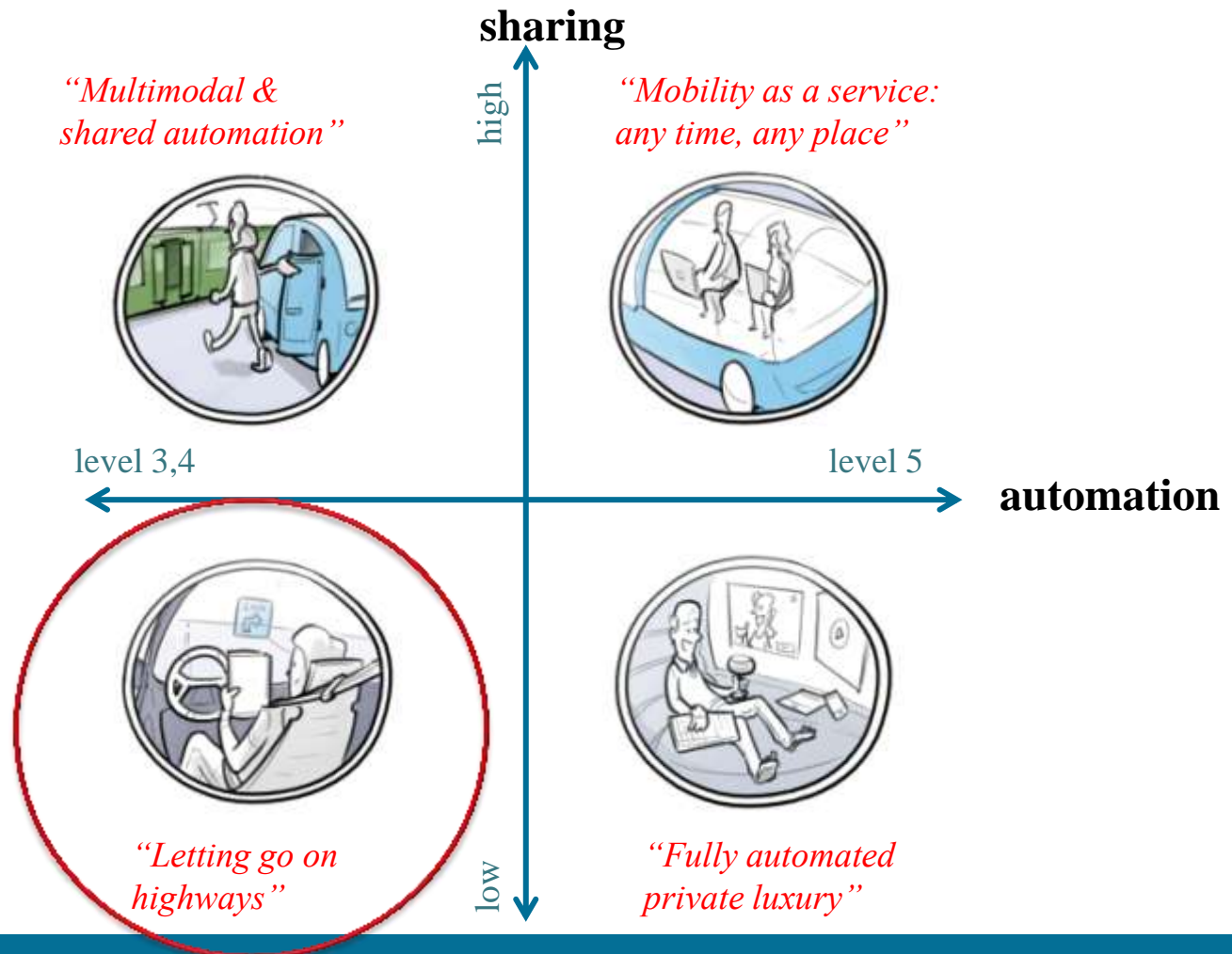
Fully automated private luxury



- 'Fully connected' cocoon, without a steering wheel
- Sharing car and rides only within household
- Most traditional public transportation abolished
- Uber-like system for people with no car
- Cars parked in front of the door
- People buy cars at car dealers
- Truck platoons on highways; no compartments for drivers

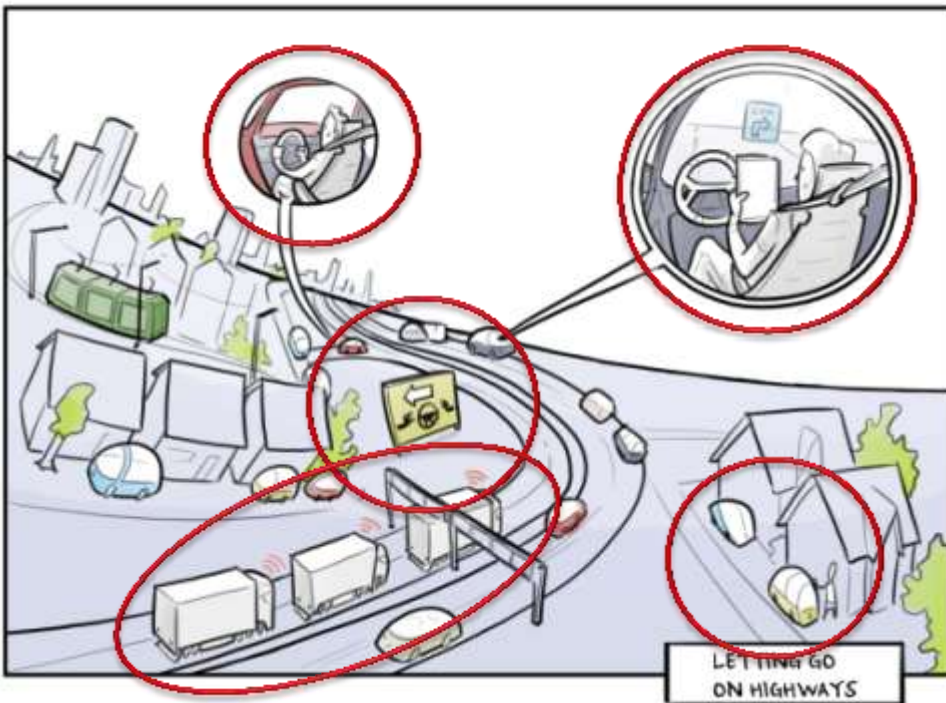


Uncertainties and scenarios





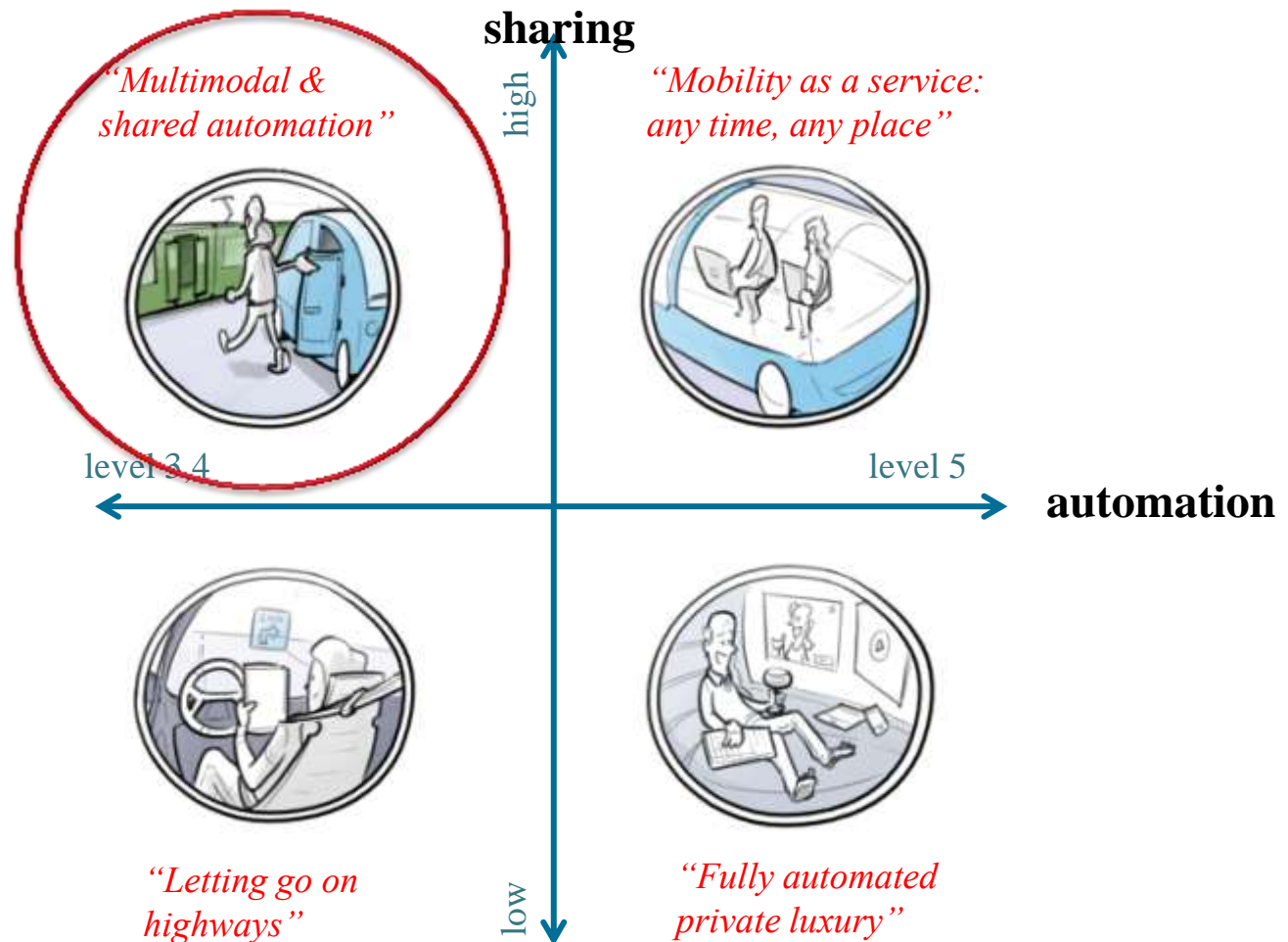
Letting go on highways



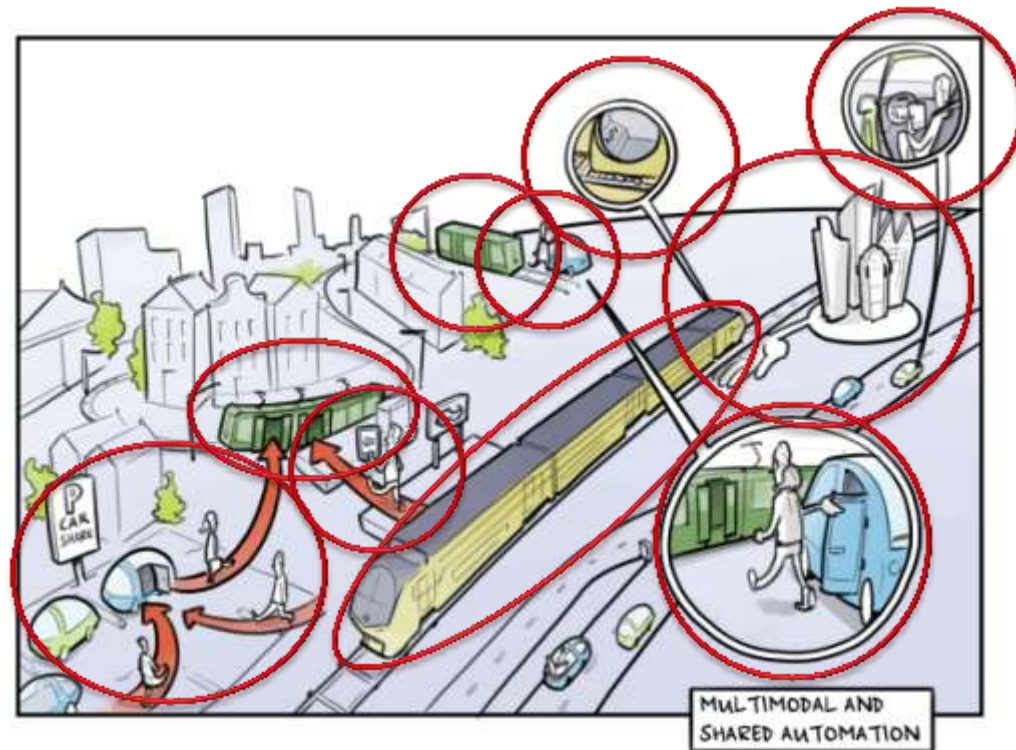
- 'No hands' on highways (level 3/4)
- 'Hands on' within the city, driver assistance systems available (level 1)
- 'Transition zone' from highway to city
- Automated parking in car parks
- Cars parked in front of the door
- Truck platoons on highways; drivers can rest



Uncertainties and scenarios



Multimodal and shared automation



- 'No hands' on highways (level 3/4)
- High level of sharing (cars and rides)
- Public transportation popular
- Trains/trams/metros without a driver and high frequency
- Government supports large-scale public transport in the city
- Efficient multimodal trips and transfers
- Digital travel assistant arranges the journey



Relations with policy making

- Investments in road capacity and traffic management
- Future of PT and related investments
- Stimulate cycling and walking?
- Organization of goods transport and logistics
- Car ownership/sharing and parking
- Spatial development (e.g., transition zones) and cities (parking)
- Interoperability of systems across boundaries (EU)
- Pricing policies: via private market?
- Environment, liveability and health
- Economy and employment



Table: First indication of effects from self-driving cars

| | <i>Mobility as a service: any time, any place</i> | <i>Automated private luxury</i> | <i>Letting go on highways</i> | <i>Multimodal and shared automation</i> |
|--|---|---------------------------------|-------------------------------|---|
| ROAD CAPACITY AND VOLUME OF CAR TRAFFIC | | | | |
| Capacity | + | + | o/+ | o/+ |
| Volume of car traffic | + | ++ | o/+ | o |
| OTHER TRANSPORT MODES | | | | |
| Public transportation | -- | -- | o | o/+ |
| Bicycle use | o/+ | - | o | + |
| Automated freight transport | ++ | ++ | + | + |
| WIDER SOCIETAL CONSEQUENCES | | | | |
| Number of parking places | -- | o | o | - |
| Spatial distribution | + | ++ | o | o/- |
| Social inclusion | ++ | + | o | o |
| Traffic safety | ++ | ++ | + | + |
| Environment and livability | + | - | o/- | o/+ |
| Auto makers market | - | + | o | -- |
| Number of car dealerships | -- | o | o | -- |
| Drivers (public transport and freight transport) | -- | -- | o | o |



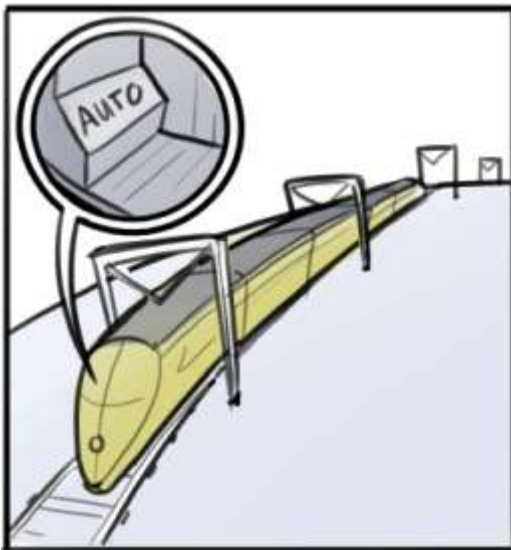
Thank you for your attention

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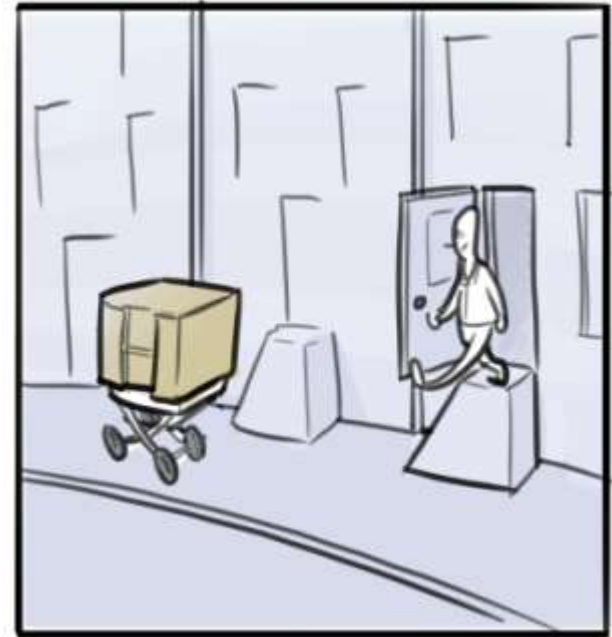
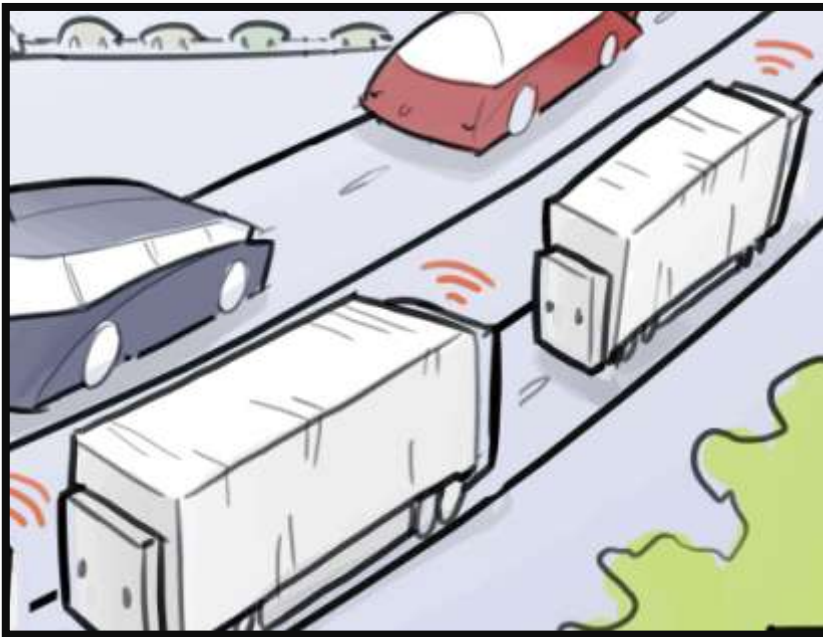


Mobility as a service: other modes and society



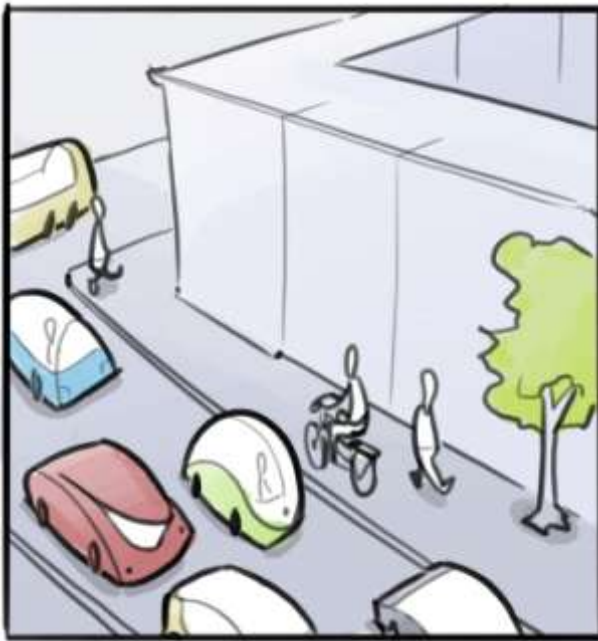


Goods transport

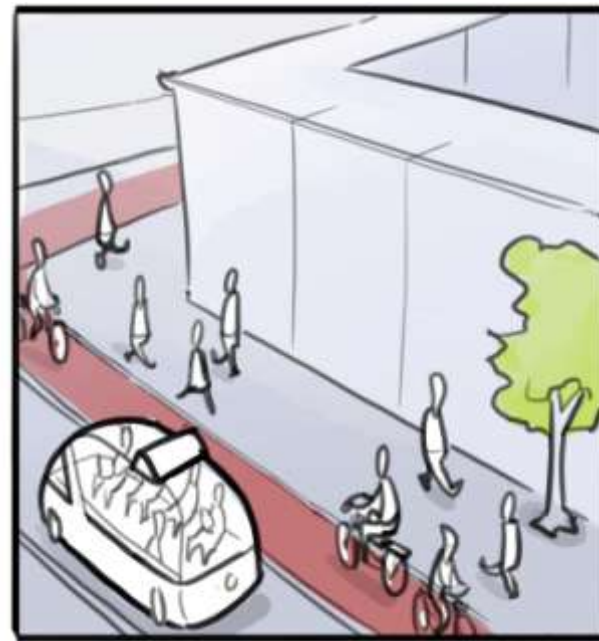




Cars and active modes in the city



Fully automated
private luxury



Mobility as a service:
any time, any place



Letting go on highways: societal consequences





Multimodal & shared automation: City and village

