Towards a self-driving future

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Preliminary and confidential
Research program

1. ‘Driver at the wheel?’: scenarios for a future traffic and transport system with automated vehicles
   - Uncertainties, vision and interactions
   - Broad societal consequences
   - No specific time horizon: four final stages

2. Transition paths (fore- and backcasting)
   - challenges over time

3. Perspective on policy options (in progress)
## Definition: SAE-levels of automation

<table>
<thead>
<tr>
<th>Level</th>
<th>Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No automation</td>
<td>Lane Departure Warning</td>
</tr>
<tr>
<td>1</td>
<td>Driver assistance</td>
<td>Adaptive Cruise Control</td>
</tr>
<tr>
<td>2</td>
<td>Partial automation</td>
<td>Parking Assistance</td>
</tr>
<tr>
<td>3</td>
<td>Conditional automation</td>
<td>Highway Chauffeur</td>
</tr>
<tr>
<td>4</td>
<td>High automation</td>
<td>Parking Garage Pilot</td>
</tr>
<tr>
<td>5</td>
<td>Full automation</td>
<td>Robot Taxi</td>
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</tbody>
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_Human driver monitors the driving environment_

_Automated driving system monitors the driving environment_
Driver at the wheel? Uncertainties and scenarios

- “Multimodal & shared automation”
- “Mobility as a service: any time, any place”
- “Letting go on highways”
- “Fully automated private luxury”
Transition paths
Transition paths
Sharing flourishes
Transition challenges
Man and machine (1 1/2)

- Best of two worlds?
  - human beings excel in complex unexpected circumstances
  - technology supports driver
  - higher traffic safety
  - improved traffic flow

- Or not?
  - driver looses attention: accidents
  - trust in technology undermined
Cooperative driving (1 1/2)

- Holy grail?
  - Efficient road use
  - Higher traffic safety
  - Less congestion
  - Less CO₂

- Or bridge too far?
  - Sensor and software reliability
  - Cyber security: hacks, privacy
Mixed traffic (1 3/4)

• Solves itself?
  – consumers appreciate safer traffic and efficient road use
  – investments in transition zones between highway and city

• Or showstopper?
  – consumer prefers to be in control
  – dangerous interaction
Urban dilemma (1 3/4)

- Separate modes?
  - L5 technology far away
  - Adjust city infrastructure
  - 1 3/4 lanes

- Or driver in control?
  - L5 technology nearby
  - Separate modes to costly
Self driving city (1 5)

- Contested space?
  - bikers and pedestrians take the road
  - car traffic comes to a standstill

- Or flexible interaction?
  - physical separation
  - technology
  - ‘pushy’ automated vehicle
  - culture
Transition highlights

- Full transition will take quite some time: 2060 - 2100
  - technology, consumers, government, stock of cars, infrastructure

- Path towards a future of sharing cars and rides
  - requires major shift on short and medium term
  - probable on long term

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<thead>
<tr>
<th>Level</th>
<th>Subject</th>
<th>Major transition challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>man and machine</td>
<td>best of both worlds or not?</td>
</tr>
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<td>1/2</td>
<td>cooperative driving</td>
<td>holy grail or bridge too far?</td>
</tr>
<tr>
<td>3/4</td>
<td>mixed traffic on highway</td>
<td>solves itself or showstopper?</td>
</tr>
<tr>
<td>3/4</td>
<td>city infrastructure</td>
<td>separate modes or driver in control?</td>
</tr>
<tr>
<td>5</td>
<td>self-driving city</td>
<td>contested space or flexible interaction?</td>
</tr>
</tbody>
</table>
Thank you for your attention

Scenario study *Driver at the wheel?*
english.kimnet.nl/publications/reports/2015/10/14/driver-at-the-wheel

Or google: ‘Driver at the wheel? KiM’