Human-Vehicle Integration in EU-AdaptIVe

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& EU-AdaptIVe SP3 colleagues
EU-AdaptIVe

Budget: EUR 25 Million
Funding (EC): EUR 14.3 Million
Coordinator: Volkswagen Group Research

28 Partners from: France, Germany, Greece, Italy, Spain, Sweden, The Netherlands, UK

www.adaptive-ip.eu
EU-AdaptlVe

Main goal: Research, develop & demonstrate highly automated vehicle functions
SP3: Human-Vehicle Integration

Main goals:  
- Support partners with Human Factors (HF) knowledge  
- Homogenize development by providing HF-requirements

- Collect technical functions to be developed within AdaptIVe

- Develop use cases for test and development of functions

- Collect existing HF-requirements

- Find still unresolved Human-Vehicle Integration research questions

- Conduct experiments

- Create new HF-requirements
## Functions & Use Cases

### Close distance maneuvers (SP4)
- Activation/Deactivation with/without driver in car
- Parking in/out
- Drive to parking lot
- Pass through construction site

### Urban Scenarios (SP5)
- Activation/Deactivation
- In lane lateral and longitudinal control
- Lane change (driver/system initiated)
- Handling of traffic lights/intersections/roundabouts

### Highway Scenarios (SP6)
- Activation/Deactivation
- Lane following
- Lane Change
- Enter/Exit motorway
- Cooperative Use Cases (using C2X-Technology)
- Driver State

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**Main Flow:** Driver initiated lane change

**28 functions in total**

**65 use cases in total**
Integration & structuring: 4A

Main idea: Cognitive informational processing = ‘common denominator’ in cognitive systems

Agent State → Awareness → Arbitration → Action

- Driver State
  - Distraction
  - Workload
  - Drowsiness
  - Trust...
- Automation State
  - Level of Automation
- Vehicle State
- Environment St.

- Situation Awar.
  - Perception
  - Comprehension
  - Projection
- Mode Awareness
- Role&Task Awar.

- Interaction
  - Modality
  - Meaning
  - Scheduling
- Decision
- Mode Transitions
- Adaptivity

- Ergonomics
- Usability
  - Controllability
  - Observability

TOWARDS INTELLIGENT MOBILITY
Better use of space
Using 4A for Human Factors requirements

1. Put state of the art in 4A as existing requirements
2. Look within 4A for new challenges
3. Formulate challenges as research questions
4. Answer research questions within experiments
5. Put exp. results in 4A as new requirements

Using 4A for Human Factors requirements
## Requirements Catalogue

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Human Factors requirement</th>
<th>Human Factors challenge</th>
<th>Impact on demonstrator &amp; other comments</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### 3.1 Agent State

<table>
<thead>
<tr>
<th>FRJ2 01</th>
<th>Mode awareness</th>
<th>Partial Automation</th>
<th>Cont. VTC, IM, YTEC, IM, MB</th>
<th>Mid-High</th>
<th>Current automation manoeuvres should not be displayed <em>depending on manoeuvre</em> and the manner in which the automation is controlling the vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Conditioned Automation</td>
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<tr>
<td></td>
<td></td>
<td>High Automation</td>
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</tbody>
</table>

### 3.2 Awareness

<table>
<thead>
<tr>
<th>FRJ2 02</th>
<th>Mode awareness</th>
<th>All-condition manoeuvres</th>
<th>Cont. VTC, IM, YTEC, IM, MB</th>
<th>High</th>
<th>Current automation manoeuvres should not be displayed <em>depending on manoeuvre</em> and the manner in which the automation is controlling the vehicle</th>
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### 3.3 Arbitration

<table>
<thead>
<tr>
<th>FRJ2 03</th>
<th>Mode awareness</th>
<th>All-condition manoeuvres</th>
<th>Cont. VTC, IM, YTEC, IM, MB</th>
<th>High</th>
<th>The automation cannot take the driver as an input back</th>
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<tr>
<td></td>
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<td></td>
<td>Data such as time to departure, speed, and other relevant data should be communicated to the driver.</td>
</tr>
</tbody>
</table>

## TOWARDS INTELLIGENT MOBILITY

**Better use of space**
**EU-AdaptIVE: 4A-Structure**

- **Agent State**
  - Driver State
    - Distraction
    - Workload
    - Drowsiness
    - Trust...
  - Automation State
    - Level of Automation
  - Vehicle State
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- **Awareness**
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- **Arbitration**
  - Interaction
    - Modality
    - Meaning
    - Scheduling
  - Decision
  - Mode Transitions
  - Adaptivity
- **Action**
  - Ergonomics
    - Usability
      - Controllability
      - Observability

**How do you mitigate complexity?**