Human Factors issues in automated driving

Mercedes BUENO GARCIA
Automated driving is experiencing an increasing development in recent years.

**Benefits**

- SAFETY
- ENVIRONMENT
- MOBILITY

**Challenges** to be resolved from different perspectives:

- Technical
- Legal
- Ethical
- Human Factors
Human Factors objective

Understand interactions between humans and systems in order to:

- Improve performance and design of systems
- Improve acceptance and comfort of users

Human centered design process:

- Systems must be designed to fit the users rather than the opposite

Bad exemples
Automated cars will be driven, used and in interaction with **humans**

**Driving activity** is going to change: manual driving $\rightarrow$ automated driving

**Driver role** is going to change: 6 different roles

<table>
<thead>
<tr>
<th>No Automation</th>
<th>Driver Assistance</th>
<th>Partial Automation</th>
<th>Conditional Automation</th>
<th>High Automation</th>
<th>Full Automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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**Level 2 & 3** raise important concerns in **terms of safety**: The system performs most of the driving tasks but the driver is still required for monitoring environment and resume control of the vehicle.

- **Vigilance**: drivers will have a passive role during automated driving and we know that we are poor monitors

  → How drivers will resume control of the vehicle after a period of inactivity?

- **Non-driving activities** engagement is one of the main advantages of the automated driving, but they can affect takeover performance

  → How drivers will resume control of the vehicle after being engaged in non-driving activities?

  and increase motion sickness (e.g. reading)

  → Will drivers accept this technology?
**Level 4 & 5**, the system is capable to perform all driving tasks without driver intervention in all or almost all situations.

- **Interaction with other users in a mixed traffic**
  - Should automated vehicles communicate their actions and intentions and if yes, how (e.g. waiting for you to cross)?

- **Remote supervision and control**: in the future there will not be a safety officer inside automated vehicles
  - How to inform these safety officers about functioning and limits of the system?
  - How can they resume control of the vehicle remotely?
AUTOMATED VEHICLES AND HUMAN FACTORS – METHODOLOGY

Controllability
Replicability
Risky situations

Driving simulators

Reliability
Validity

Instrumented vehicles
Research focuses on:

• Transitions from automated to manual driving
  ✓ Determine the minimum requirements for a safety takeover response
  ✓ **Time** is important but also the **quality** of the takeover response

• Developing the interaction between the system and the driver
  ✓ Detecting drivers state will allow to adopt the strategy in case the driver is not able to takeover control (**driver monitoring**)
  ✓ Informing drivers about the functioning and limits of the system (**training & HMI**)

• Developing the interaction between the system and the other road users
  ✓ **External HMI**

This will contribute to the development of safe and accepted automated vehicles
Thank you for your attention

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