The HFAuto Project
and
A review and framework of task transitions in automated driving

Zhenji Lu, Joost de Winter, and Riender Happee

Chris Dijksterhuis

Department of BioMechanical Engineering,
Faculty of Mechanical, Maritime and Materials Engineering

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The HFAuto Project

- Marie Curie Action
  - Innovative Training Network
- Across 5 European countries
  - The Netherlands
  - Sweden
  - Germany
  - UK
  - France
- 7 full partners, 8 associated partners
- 3.6 M Euro
- Period 2013 – 2017
- 13 Early Stage Researchers (PhD-students)
  - 1 Experienced researcher
- Programme manager: Riender Happee
- http://hf-auto.eu/
The HFAuto Partners

Full Partner – Delft University of Technology (TU Delft)
Full Partner – Technische Universität München (TUM)
Full Partner – University of Southampton (SOTON)
Full Partner – University of Twente
Full Partner – Chalmers University of Technology
Full Partner – IFSTTAR
Full Partner – VTI
Associated Partner – Volvo Technology Cooperation (VTEC)
Associated Partner – Volvo Car Corporation (VCC)
Associated Partner – BMW
Associated Partner – Jaguar
Associated Partner – Toyota Motor Europe
Associated Partner – Continental
Associated Partner – TNO
Associated Partner – SWOV
HFAuto at TU Delft

- Zhenji Lu
- Joost de Winter
- Riender Happee
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- Christopher Cabrall
- Pavlo Bazilinskyy

- Silvia Varotto
- Haneen Farah
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HFAuto research aims

• To generate knowledge on Human Factors of automated driving towards safer road transportation.

• How should human-machine-interfaces (HMI) be designed to support transitions between automated and manual control?

• How can the automation understand the driver’s state and intentions?

• What are the effects of HAD on accident risk and transport efficiency?
HFAuto work packages

- Human behaviour during highly automated driving
- Human-machine interface of the future highly automated vehicle
- Driver-state monitor for highly automated driving
- Predicting real-world effects of highly automated driving
- Legal and market perspective of highly automated driving

Tasks and transitions in automated driving

Zhenji Lu and Joost de Winter

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## Levels of automated driving

<table>
<thead>
<tr>
<th>Levels of Driving Automation</th>
<th>Dynamic control</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Automated</td>
<td>Human</td>
<td>Human</td>
</tr>
<tr>
<td>Driver assistance</td>
<td>Human + Automation</td>
<td>Human</td>
</tr>
<tr>
<td>Partial Automation</td>
<td>Automation</td>
<td>Human</td>
</tr>
<tr>
<td>Conditional Automation</td>
<td>Automation</td>
<td>Automation</td>
</tr>
<tr>
<td>High Automation</td>
<td>Automation</td>
<td>Automation</td>
</tr>
<tr>
<td>Full Automation</td>
<td>Automation</td>
<td>Automation</td>
</tr>
</tbody>
</table>

*SAE int (2014) Automated driving. Levels of driving automation are defined in new SAE int standard J3016*

Does not fully describe the task distribution between the human and automation.
Tasks in automation driving; who does what?

Shared (simultaneous) Control
Transition; a change in driving state

Example
From
SAE level 1: Driver Assistance (ACC)
To
SAE level 4: Conditional Automation

Agent
Human Driver
Automation
Both

Tasks
Longitudinal control
Lateral control
Monitoring (initiate transitions)
Transitions, further characterised….

- Who initiates it?
- Who performs which tasks afterwards?

- Is a transition safety critical (mandatory vs. optional)?
  - Readiness check?
- Who has (final) transition authority?
  - E.g. transition by consent?
  - What about emergency situations?

Example situations
- Automation Failure
- Entering Platoon
- Take over request
- Only by consent?
- Emergency

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Focus in literature

- Engineering: driver initiated, automation control
  - Controllability problems

- HF literature: Take over requests (AI, DC)
  - Following self-detected limitation of automation
  - Warning / Request
  - Time critical

- HF literature: monitoring automation
  - Reliability, complacency
  - Reaction times
  - Situation Awareness

- Human Machine Interface design
Transition challenges include:

- Fundamental understanding of the process of transitions.
  - Transition phases
  - Cognitive vs. motor readiness
  - Initial human state
  - How to get the driver back into the loop?

- Monitoring human state
  - Biometrical parameters (driving behaviour)
    - Mental workload, Situation awareness – **Mental state classifications**
  - Readiness check
  - (Adaptive automation)
  - Is the human driver ready to resume control?
  - Should the human driver continue to drive?

- Driving state (mode) awareness
  - Clumsy, confusing automation
  - How many states should a vehicle maximally have?

- HMI design: auditory, visual, haptic, multimodal.
Thanks!

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http://hf-auto.eu/

c.dijksterhuis@tudelft.nl

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References


