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

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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

HFauto
HUMAN FACTORS OF AUTOMATED DRIVING

http://hf-auto.eu/

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
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Associated Partner – Volvo Technology Cooperation (VTEC)
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Associated Partner – BMW
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Associated Partner – SWOV

HFAuto at TU Delft

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

- Silvia Varotto
- Haneen Farah
- Marjan Hagenzieker
- Bart van Arem










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

SAE levels; (1: Driver Assistance), 2: Partial Automation, 3: Conditional Automation, 4 High Automation.

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HUMAN FACTORS OF AUTOMATED DRIVING

Tasks and transitions in automated driving

Zhenji Lu and Joost de Winter

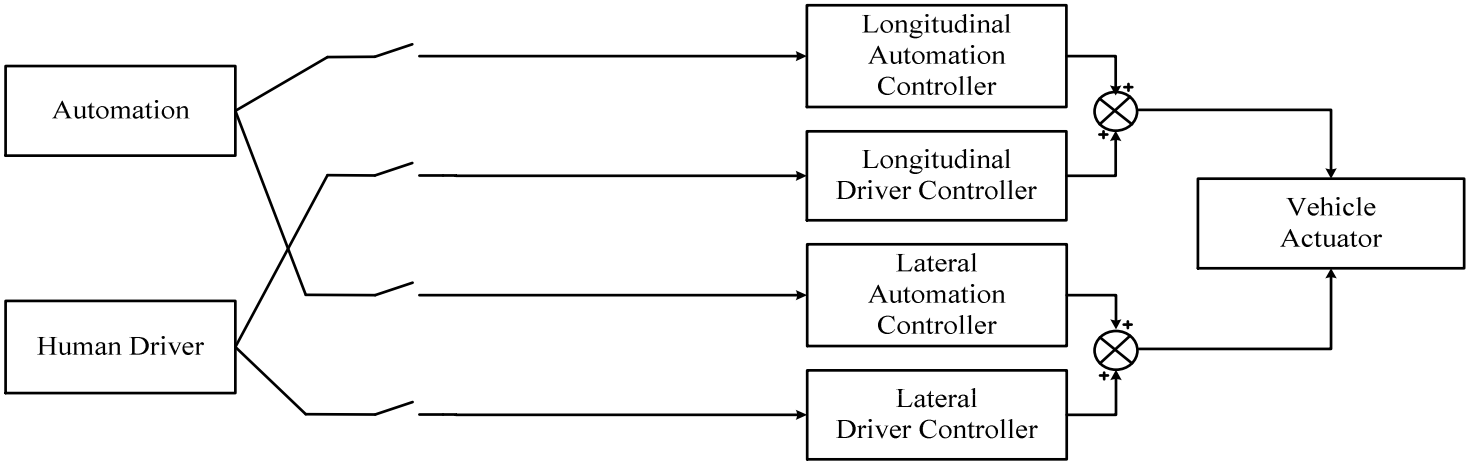
Levels of automated driving

	Dynamic control	Monitoring
Non-Automated	Human	Human
Driver assistance	Human + Automation	Human
Partial Automation	Automation	Human
Conditional Automation	Automation	Automation
High Automation	Automation	Automation
Full Automation	Automation	Automation

Does not fully describe the task distribution between the human and automation

SAE INT (2014) AUTOMATED DRIVING. LEVELS OF DRIVING AUTOMATION ARE DEFINED IN NEW SAE INT STANDARD J3016

Tasks in automation driving; who does what?

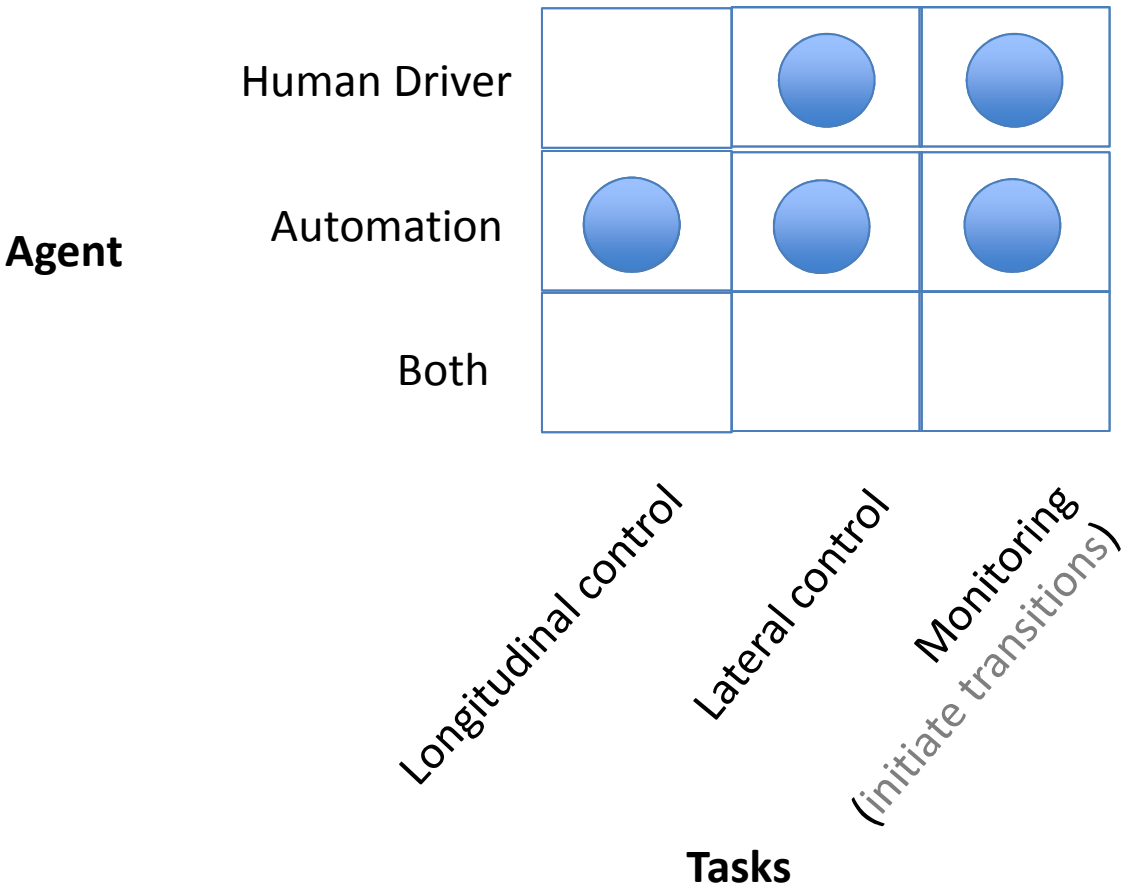


Shared

(simultaneous)

Control

Transition; a change in driving state



Example

From

SAE level 1: Driver Assistance (ACC)

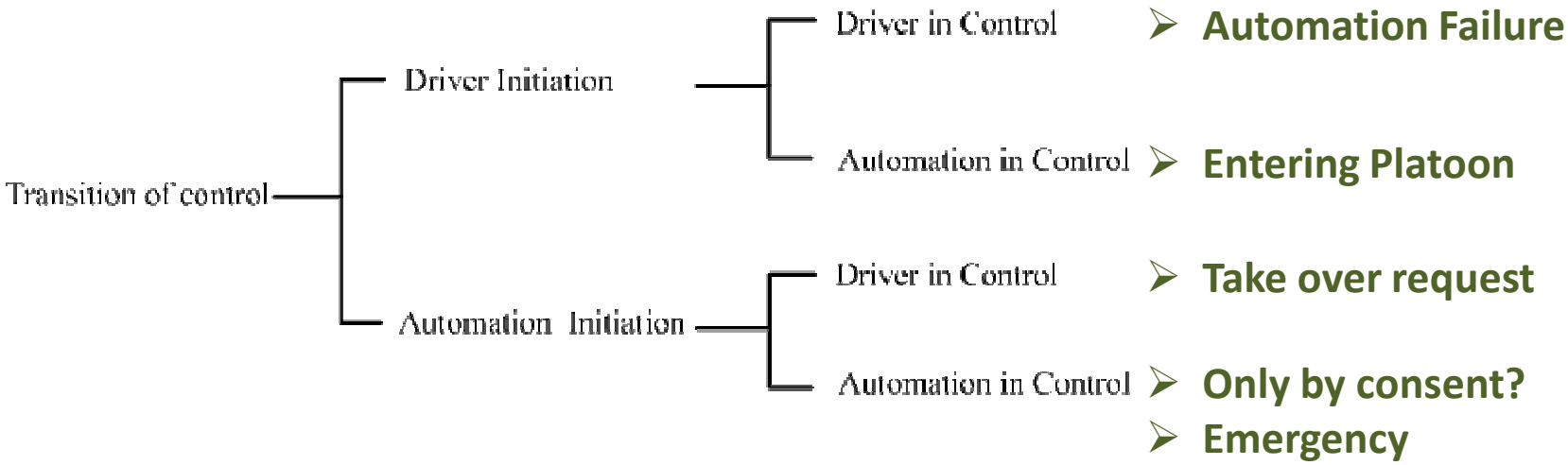
To

SAE level 4: Conditional Automation

Transitions, further characterised….

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

Example situations



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

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!

HFAuto
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