Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs

Human-Systems Integration for Driving Automation Systems

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OVERVIEW

Give a general overview of current HSI discipline that is currently emerging

HSI challenges for automated driving

Introduction to the HADRIAN approach

In the remainder of this session and the next one, presenters will present different facets on this topic
Integrating humans and technical systems has a long tradition
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- Human Factors Engineering (HFE): since World War II
- Human Computer Interaction (HCI): since 1980s
- Human Centered Design (HCD): since 1990
- Human Systems Integration (HSI): since 2000’s:
  - INCOSE Working group to define HSI: https://www.incose.org/incose-member-resources/working-groups/analytic/human-systems-integration
  - HSI is the transcultural and transdisciplinary technical and management process used to ensure that the human elements of a system are appropriately addressed and integrated within the wider systems engineering lifecycle and management approach to a project.
Monitoring automation
- Humans are good controllers but bad monitors, e.g. Endsley (2018)

Switching responsibilities
- Driver out-of-the-loop problem, e.g. Hancock (2019)

Collaboration between human and automation
- Trust calibration, e.g. Hoff & Bashir (2015)

Understanding what is going on now
- Mode awareness, e.g. Abbott et al. (2013)

Understanding what will happen next
- Indicating intent, e.g. Merat et al. (2018)
HADRIAN APPROACH FOR HSI IN AUTOMATED DRIVING

- Human needs as starting points for system development
- Holistic versus solipsistic system definition
- Iterative design and risk and opportunity management
- Naturalistic research with virtualization methods

- Human centred design for the new driver role in highly automated vehicles
- Coordinator: VIF
- Duration: 42 Months
- Start: Dec 2019
- Funding: 8 Mio EUR
MAIN HADRIAN INNOVATIONS

Holistic Design Approach

Investigate Driver Role per SAE J3016 and possible Extensions

Fluid Interactions
Mobility needs (e.g. Diehlmann & Häcker, 2013) as starting points for identifying how to integrate automated driving to improve people’s lives

- **Harold**
  - Used to drive his whole life
  - Recently received driver license restrictions
  - Wants to stay mobile!

- **Sven**
  - Very good truck driver, hard to replace
  - Stands under lots pressure while experiencing long stretches of monotonous driving
  - Long times away from family

- **Florence**
  - Time pressure to run successful business
  - Work during transport as productivity gain
  - Public transport options limited and lack of confidentiality
HADRIAN INNOVATIONS FOR DRIVING AUTOMATION SYSTEM (DAS)

Harold
• Used to drive his whole life
• Recently received driver license restrictions
• Wants to stay mobile!

“DAS supports Harold so he can keep driving manually”
• Information assistant visually simplifies driving tasks so that driver can continue manual driving
• Guarding angel safety functionality
• Driver monitoring

Sven
• Very good truck driver, hard to replace
• Stands under lots pressure while experiencing long stretches of monotonous driving
• Long times away from family

“DAS to keep Sven connected, engaged, and optimize his time away”
• Active driving automation suggestion
• Predictable automated driving at level 3 and 3 + driving
• Driver monitoring and active, dynamic functionality offering

Florence
• Time pressure to run successful business
• Work during transport as productivity gain
• Public transport options limited and lack of confidentiality

“DAS tailored to predictably allow specific working tasks during automated driving”
• Plannable work through automated route selection
• Predictable automated level 3 and 3 + driving
• Driver monitoring and active, dynamic functionality offering
### NEXT STEPS

**Vorgangsnamen**

- **Project HADRIAN**
  - WP1 - Technical, human and environmental constraints for driver role characterization
  - WP2 - Development of Driver State Monitoring
  - WP3 - HMI Development and Evaluation
  - WP4 - Field Demonstration
  - WP5 - Safety and Impact Assessment
  - WP6 - Ethical and legal considerations
  - WP7 - Project Management & External Liaison

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### Fit2Drive
- Detects hazardous driver states to intervene where safe.

### Head-Up Display
- Highlights critical information or provides explanatory information necessary for safety and comfort.

### Fluid Tutoring
- Context sensitive, step-wise driver education.

### Haptic steering wheel
- Allows active and passive signalings to help transitions between manual and automated driving.

### Turning seat and IUI concept
- Allows the driver to quicker and safer return to manual driving after periods of high-level automated driving.

[https://hadrianproject.eu/](https://hadrianproject.eu/)
The following presentations in this session provide background from several HADRIAN consortium partners:

Age-related Differences in the Interaction with Advanced Driver Assistance Systems - A Field Study (VIF): Neuhuber, Lechner, Emre, Stocker, Kubicek

A fluid-HMI approach for Haptic Steering Shared Control for the HADRIAN Project (Tecnalia): Vaca-Recalde, Marcano, Sarabia, González, Perez Diaz

Fluid Interface Concept for Automated Driving (ViF): Pretto, Mörtl, Neuhuber

Evaluating HMI-Development Approaches from an Automotive Perspective (IKA): Bavendiek, Ostad, Eckstein

Two more HADRIAN partners will present in HSI session 2 just after this one (plus other presenters):

Toward Driver State Models that Explain Interindividual Variability of Distraction for Adaptive Automation (ViF): Höfler, Mörtl

Hand-Skin Temperature Response to Driving Fatigue: an Exploratory Study (University of Granada): Gianfranchi, Di Stasi, Diaz-Pedra
REFERENCES