Humans and Automated Driving Systems

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1. Overview
   - Goal of SIP activity and framework

2. Challenges and approaches
   - Systems & Humans
   - Systems & Other Traffic Participants
   - Systems & Society

3. Systems & Humans
   - Environment / Situation settings
   - System modeling, Scenario analysis

4. Summary
1. Overview

Goal of SIP activity

- Contribution to establish standardization and harmonization
- Nourish social acceptance for the realization and promotion

Framework

<table>
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<th>standardization &amp; harmonization</th>
<th>Design of sharing roles between driver and vehicle system</th>
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<td>System definition</td>
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<td>Human Factor</td>
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<td>Analysis of traffic accidents</td>
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Humans & Systems

Approach in 3 phases

- Authority and responsibility for safety
- Human-in-the-loop / Human-out-of-the-loop
  - Thought experiments
- Trading of control between driver and automation
- Human-machine interface and interaction
  - Demonstrative experiments

- Negative effects of automation, such as
  - Vigilance decrement
  - Complacency (Over trust)
  - Overreliance
  - Loss of system awareness or situation awareness
  - Mode error / confusion
  - Automation surprises
  - Misuse / Disuse / Abuse
  - Skill degradation
  - Result evaluation
**Humans & Systems – Human Centered Automaton**

**Human Machine Interaction System (HMIS)**

- Warning
- Driver (Human)
  - Operation
  - Monitoring / Decision
  - Assist System (Machine)
- Assist cycle
- No assist cycle
  - Cancel
  - Continued

**Starting point**

“Human Centered Automation” can
- Reduced both physical and mental workload
- Keep a driver stays in-the-loop of the system

- **Human Centered System in Honda Intelligent Driver Support System (HiDS)**, Society of Automotive Engineering Japan, March, 2003

Eye Angle [deg]

- Conventional
- HiDS

### Graph
- Horizontal
- Vertical

- Green: Conventional
- Red: HiDS
Beyond the ADAS

**Transition of role and authority**

- NHTSA Level 3
- Conditional Automation

Human-out-of-the-loop / -in-the-loop

**Use case**

- Relaxed
- Concentrated

**Scenario and Interaction**

- Role
- Authority
- Function
- Condition
- Task
- Status

**Transition event**

- Sudden cut-in
- Traffic jam at exit

**Resume driving task**

- NHTSA Level 2
- Partial Automation

Human-in-the-loop

- Transition of role and authority

- Cognition
- Judgment
- Control

- Transition event

- t
Human Friendly Interfaces in the mixed traffic

SIP - adus

Mobility Bringing Everyone a Smile

You first!

Thank you!
Nourishment of social acceptance

- Functions, Benefit
- Definition of the role of a driver

Minimization new risks due to automation

- Total number of accidents in conventional driving
- Accidents prevented by vehicle automation
- Accidents due to the risk of automation

Fig. 4-1: Theoretical potential for accident prevention in vehicle automation (Source: project group)

Source: BASSt study about the legal consequences of automation (Legal consequences of an increase in vehicle automation)

http://bast.opus.hbz-nrw.de/volltexte/2013/723/pdf/Legal_consequences_of_an_increase_in_vehicle_automation.pdf
1st: Scenario

Auto parking in closed area

Automated driving with mixed traffic participants

Automated driving in SA/PA

Automated driving in a compact city

Automated driving on a highway

2nd : Situation

- Overtaking
- Splitting part
- Merging part

3rd: Modeling - “Driver - System Interaction”

Driver

Information acquisition

- Information analysis
- Action selection
- Action implementation

HMI

Visual

Audio

Haptic

Actuator

A.D.S.

Information acquisition

- Information analysis
- Action selection
- Action implementation
**Research Questions:**
Should the driver respond acknowledgement to the system?

...
4th: Analysis - Example: “Automated Lane Change”

A complete view of the chart

Definition of role and authority

Descriptions about policy of transition

Descriptions of scenario and event

Check list based on Human Factors

Research Questions toward next step
Collaboration with other themes

Promoting Committee for SIP Automated Driving System Research Project

International cooperation WG

Next Generation Urban Transportation WG

System Implementation WG

- Dynamic map
- Data analysis and simulation technology
- Prediction based on information from ITS
- Sensing capability enhancement
- System security
- **Human Factors**

**Framework**

- Design of sharing roles between driver and vehicle system
- System definition
- Scenario definition
- Human Factor
- HMI evaluation
- Analysis of traffic accidents

- Design of demonstrative experiments & simulation
- Safety assessment
- Estimation of accident reduction
- Evaluation of driver acceptance
- Evaluation of social acceptance

Collaborate with ...

- Environment and Situation
- Scenario / Use Case
- System capability

...
4. Summary

**Activities and Framework**

- Design of sharing roles between driver and vehicle system
- System definition
- Scenario definition
- HMI evaluation
- Analysis of traffic accidents
- Design of demonstrative experiments & simulation
- Safety assessment
- Estimation of accident reduction
- Evaluation of driver acceptance
- Evaluation of social acceptance

**Starting point**

- Warning
- Driver (Human)
- Operation
- Monitoring / Decision
- Assist System (Machine)
- Continued
- Cancel

Human Centered Automation

**Systems and Humans**

- Human-out-of-the-loop/-in-the-loop
  - NHTSA Level 3
  - Partial Automation

- Human-in-the-loop
  - NHTSA Level 2
  - Conditional Automation

**Scenario / Situation / Use case**

- Transition event
- Timeline of Human Machine Interaction
- Research Questions
Now we have opened our door!

Thank you for your attention.