Outlook
Information, Warning and Intervention strategies & future research directions

Anna Schieben & Tobias Hesse - German Aerospace Center (DLR)
interactIVe Final Event

20th-21st November 2013
Introduction

Work process in SP 3
Introduction
Information, Warning and Intervention (IWI) strategies & Human Factors Outlook

Outlook
Introduction
Functions covered by demonstrator vehicles

- **BMW**: Enhanced dynamic pass predictor
- **Fiat**: Continuous support with focus on haptic HMI solutions
- **Volvo car**: Collision avoidance, continuous support and SafeCruise
- **Ford**: Collision avoidance, continuous haptic support and automated driving
- **Volvo truck**: Collision avoidance and run-off road prevention by braking and steering, stability considerations for heavy vehicles
- **VW**: Collision mitigation with focus on cost-efficient sensors and algorithm approach
- **Conti**: Emergency steering assistance with focus on radar/vision combination

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Introduction
Modes of automation covered by demonstrator vehicles

Several modes of automation addressed:

- depending on the implemented functions
- depending on the situation
Introduction
Cooperation between driver and automation
Introduction
Information, Warning and Intervention (IWI) strategies – aspects

- Communication channel
- Communicate System Status
- Adaptivity and Adapability
- Trust, Mental workload, Situation Awareness, Driver mental model
- Sequence of interaction
- Arbitration
- State, Modes and Mode Transitions
- Prioritisation and Scheduling
- Layer of driving tasks
- Level of Assistance and Automation
Introduction
Information, Warning and Intervention (IWI) strategies – Deliverable 3.2

Detailed information on the IWI strategies in interactIVe
„Deliverable 3.2 - IWI Strategies“
Introduction
Information, Warning and Intervention (IWI) strategies - categories

Communication channel
Communicate System Status
Adaptivity and Adapability
Trust, Mental workload, Situation Awareness, Driver mental model

Sequence of interaction
Arbitration
States, Modes and Mode Transitions
Prioritisation and Scheduling
Layer of driving tasks Level of Assistance and Automation
IWI strategies
Communicate System Status

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Trust, Mental workload, Situation Awareness, Driver mental model
Communicate System Status
IWI strategies
Communicate System Status
IWI strategies
Communicate System Status

• Help the driver to build up a **correct mental model** about the automation

• Examples of InteractIVe IWI strategies:
  • **Group** continuous intervention / automation functions for normal driving into **modes of increasing degree of automation**
IWI strategies
Communicate System Status

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  • **Group** protection functions **using shield metaphor** (according to type of support and direction)
IWI strategies
Communicate System Status

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Communicate System Status

Communication channel

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Adaptivity and Adapability

Trust, Mental workload, Situation Awareness, Driver mental model

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Communicate System Status

- Use of **new technologies** (e.g. Head-up-displays) to improve driver’s understanding of the overall system
- Use of **integrated concepts** covering several assistance and automation functions
Outlook
Communicate System Status

- Use of **new technologies** (e.g. Head-up-displays) to improve driver’s understanding of the overall system
- Use of **integrated concepts** covering several assistance and automation functions
- Use information about the **automation state** → e.g. uncertainty information
- Use information about the **driver state** → e.g. adaption of functions and transitions
IWI strategies
States, Modes and Mode Transitions

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IWI strategies
States, Modes and Mode Transitions

Lowly automated
Semi automated
Highly automated
IWI strategies
States, Modes and Mode Transitions

Lowly automated  Semi automated  Highly automated

Lowly automated  Semi automated  Highly automated

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IWI strategies
States, Modes and Mode Transitions

- Driver-initiated transition
- Automation-initiated transition
- Emergency

- Lowly automated
- Semi automated
- Highly automated

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IWI strategies
States, Modes and Mode Transitions

• Help the driver and the automation to always be aware of who is in control
• Examples of InteractiVe IWI strategies:
  • Use *interlocked transitions*
IWI strategies
States, Modes and Mode Transitions

- Help the driver and the automation to always be aware of who is in control
- Examples of InteractIVe IWI strategies:
  - Use **interlocked transitions**
  - Display current and available **modes**
Outlook
States, Modes and Mode Transitions

Communication channel

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Outlook
States, Modes and Mode Transitions

- Exploration of the **drivers ability to take over** after longer periods of driving in highly automated modes
- **Transition design** for transitions directly after automatic emergency interventions
- Exploration of **behavioural adaptation** for vehicles equipped with automatic intervention in critical situations
IWI strategies
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IWI strategies
Arbitration

Lowly automated

Semi automated

Highly automated
IWI strategies
Arbitration

- Arbitration helps to solve situations in which the driver and the automation have different intentions
IWI strategies
Arbitration
IWI strategies
Arbitration

• Arbitration helps to solve situations in which the driver and the automation have different intentions

• Examples of InteractlVe IWI strategies:
  • The driver should be always able to control the system
Arbitration helps to solve situations in which the driver and the automation have different intentions.

Examples of InteractIVe IWI strategies:
- The **driver** should be always able to **control** the system.
- Define **degree of authority for automation** according to the criticality and urgency of a situation.
- E.g. **automation can initiate an intervention** without driver input in critical emergency situations.
Outlook
Arbitration

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Outlook Arbitration

• Decide on the **distribution of authority** in emergency situations
  • Define if and when the automation should have full control
  • Check for controllability issues in false alarm situations
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Arbitration

• Decide on the **distribution of authority** in emergency situations
  • Define if and when the automation should have full control
  • Check for controllability issues in false alarm situations

• Decide on the way the driver can **overrule** the automatic intervention
  • Define situations when the driver is allowed to overrule the intervention
    e.g. based on criticality, urgency or automation mode
  • Explore and define criteria to assess drivers‘ intention
  • Define criteria to decide on conscious vs. unconscious overruling of the driver
IWI strategies
Summary

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Outlook
Complex cooperative systems
Outlook
Complex, cooperative systems

• Cooperation with infrastructure, other road users and other vehicles brings new challenges for the Human Factors research

• **Modes and mode transitions & communicate system status**
  • Find solutions to integrate complex information not only from vehicle-based assistance systems but also from other entities

• **Arbitration**
  • Enlarge arbitration concepts to negotiations including surrounding traffic participants with different intentions
  • Work on concepts to decided which intentions to prioritize
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References


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