Information, Warning and Intervention strategies

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interactIVe Final Event
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Challenge

- So far, there is **no fail proof software**

- To replace the human being with a machine only works if the task environment is very **static** and **predictable** and **a priori controllable**…

- So what to do with the driver
  - Option 1: The driver **monitors** the automated control system
  - Option 2: The driver acts as a **back-up** to the automation
  - Option 3: The human and automation can both participate in the control through **some sort of partnership**
Objectives: ensure **intended effects** of the systems are reached by taking the driver into account

- **Develop use cases** for all systems in all demonstrator vehicles
- **Create Information Warning and Intervention (IWI) strategies** for the interactIVe project demonstrators and beyond
- **Evaluate IWI strategy issues** through simulator and test track experiments
- **Develop common haptic, graphics and sound elements**
- **Support** function development by applying IWI strategies to specific demonstrators
Objectives: IWI strategies

- Information, Warning and Intervention (IWI) strategies should
  - define the actual function from a driver’s perspective
  - explain how, when and where information, warnings and interventions should be activated
- Cover the I/O components and the interaction with the driver through
  - visual,
  - auditory and
  - haptic output/input (e.g. as information and warnings) including active vehicle steering, braking, acceleration through actuators
Objectives: target interactIVe functions and beyond

- **BMW**: Enhanced dynamic pass predictor
- **Fiat**: Collision Warning static + moving vehicle + pedestrian, Side Impact Avoidance, Speed limit warning + curve speed warning
- **Volvo car**: SafeCruise, Side Impact avoidance, Collision Warning static & moving vehicle, curve speed- and speed warning
- **Ford**: Run-off road prevention, side impact avoidance, curve speed warning, collision avoidance rear-end
- **Volvo truck**: Run-off road prevention, side impact avoidance, collision avoidance rear-end
- **VW**: Collision mitigation for crossing traffic
- **Conti**: Pedestrian collision warning, rear end collision avoidance

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Work & Outcome: iterative development

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Work & Outcome: Use cases
Work & Outcome: Testing in lab and test tracks
Work & Outcome: Testing (examples)

- Driver Reactions to an Active Steering Intervention to avoid a Rear End Collision
Work & Outcome: Testing (examples)

Research questions

• Does drivers accept a sudden steering avoidance maneuver?

• Can drivers be convinced of system initiated steering maneuver by prompts/ directed warnings before intervention (directed double tics in steering wheel, acoustic warning)

• Can drivers be de-coupled for a short period in order not to counteract the system intervention?

• Controllability issues?
Work & Outcome: Testing (examples)

![Graph showing % of drivers with collisions for different experiments.](image-url)

- Exp. 1 (Baseline no intervention): 62.5% collisions
- Exp. 2 (Baseline no intervention): 100% collisions
- Exp. 3 (Baseline no intervention): 100% collisions
- Exp. 4 (Baseline no intervention): 100% collisions

- Exp. 1 (Steering intervention): 47% collisions
- Exp. 2 (Steering intervention): 50% collisions
- Exp. 3 (Steering intervention): 7% collisions
- Exp. 4 (Steering intervention): 7% collisions

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Work & Outcome: Information, Warning & Intervention (IWI) strategies

- **General IWI strategies** → Design Handbook
  - Main issues and Research questions
  - Findings in literature and expert opinion
  - Strategies – applied to interactIVE demonstrators and possible to apply to future functions
Information, Warning and Intervention (IWI) strategies – design categories

- Adaptivity and Adapability
- Communicate System Status
- Communication channel
- Sequence of interaction
- Arbitration
- State, Modes and Mode Transitions
- Prioritisation and Scheduling
- Layer of driving tasks
- Level of Assistance & Automation
- Trust, Mental workload, Situation Awareness, Driver mental model

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Work & Outcome: IWI strategies → demonstrator vehicles

- **Generic** IWI strategies and **applied** to demonstrators

- Examples of IWI strategies in demonstrators:
  - Integrated **visual (cluster and HUD) and audio design** for interactIVe functions
  - **Haptic design** (type of evasive manouvre, vibration characteristics, torque level)
  - **Sequence design** (information, warning, intervention, post-information)
Future work

- Broaden focus on HMI: from Human Factors Interface to the actual Interaction

- Improve systems design with shared control strategies

- Arbitration do not necessarily mean one negotiation but a continuous process

- Further explore driver and system initiated transitions (planned or unexpected)

- Explore how/if shared control can lead to
  - New types of human error – e.g. Mode confusion
  - New distribution of human errors – e.g. Increasing errors of omission versus comission
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Thank you.

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