

interactive



Accident avoidance by active intervention for Intelligent Vehicles

www.interactIVe-ip.eu

Information, Warning and Intervention strategies

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interactIVe Final Event

Content

- Challenge
- Objectives
- Work & Outcome
- Future work



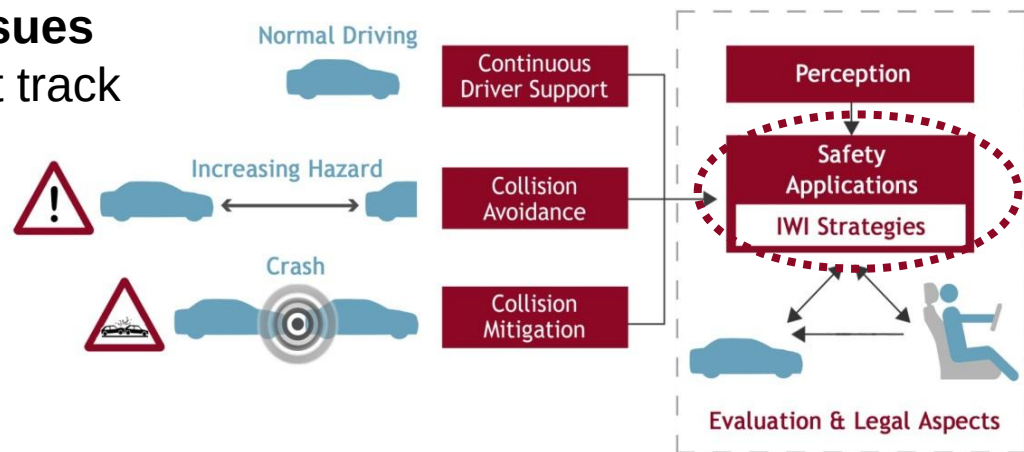
Challenge

- 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

SECONDS

INCA

EMIC

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

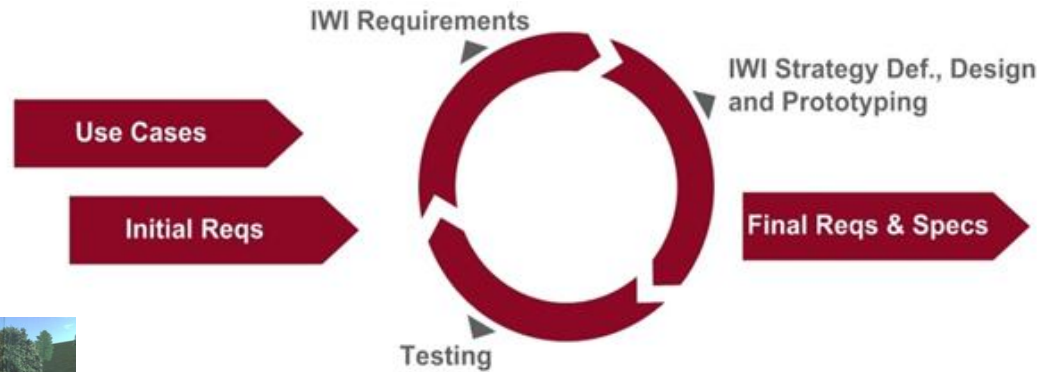
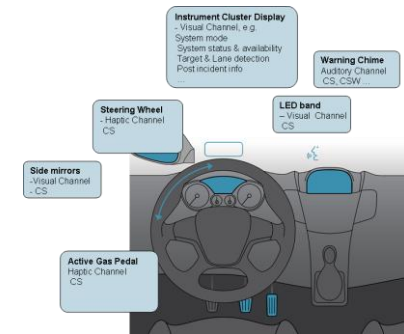
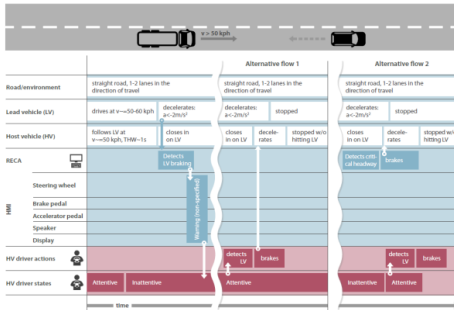
Volvo truck Run-off road prevention
side impact avoidance
collision avoidance rear-end

VW Collision mitigation for crossing traffic

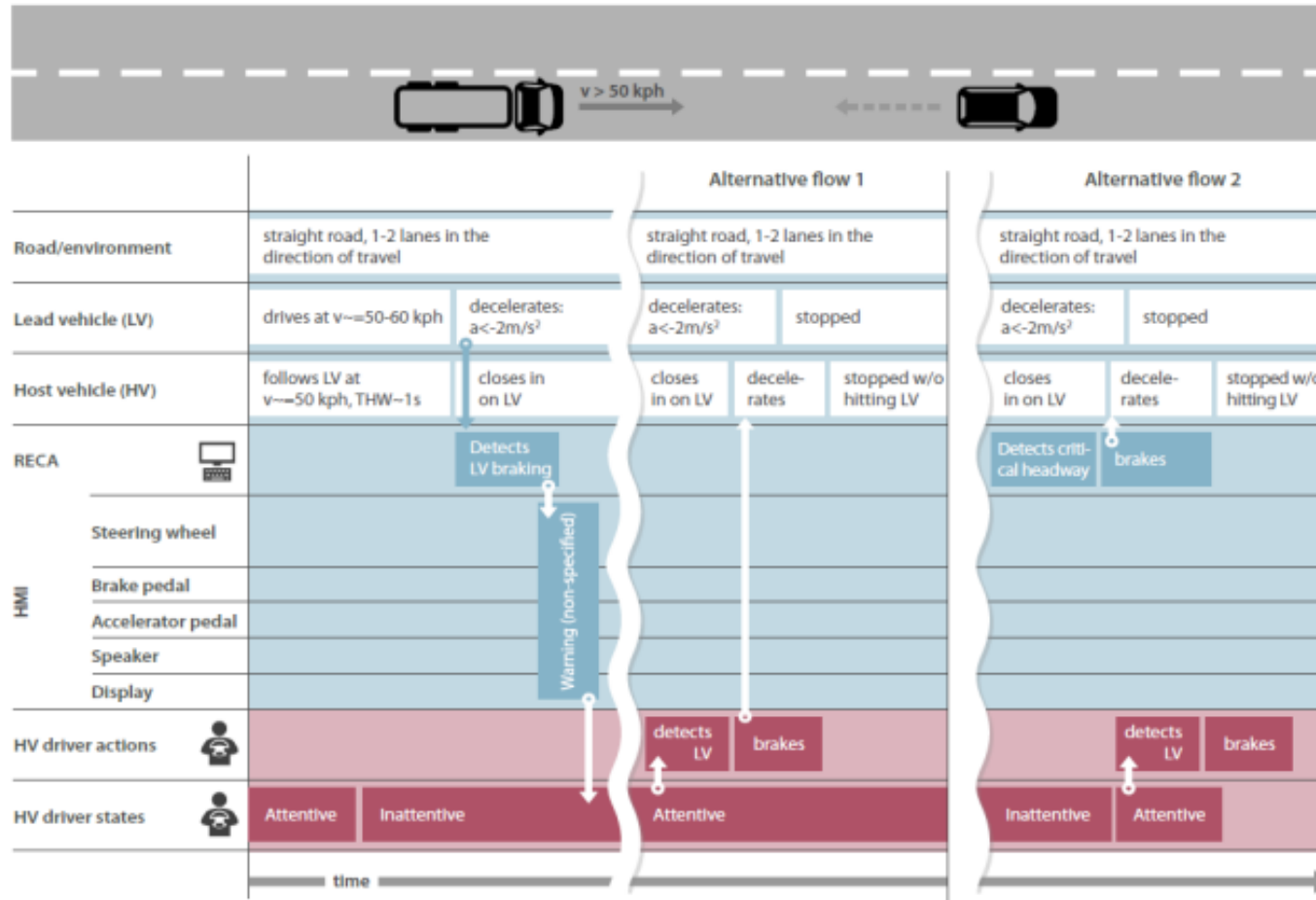
Conti Pedestrian collision warning
rear end collision avoidance



Work & Outcome: iterative development



Work & Outcome: Use cases

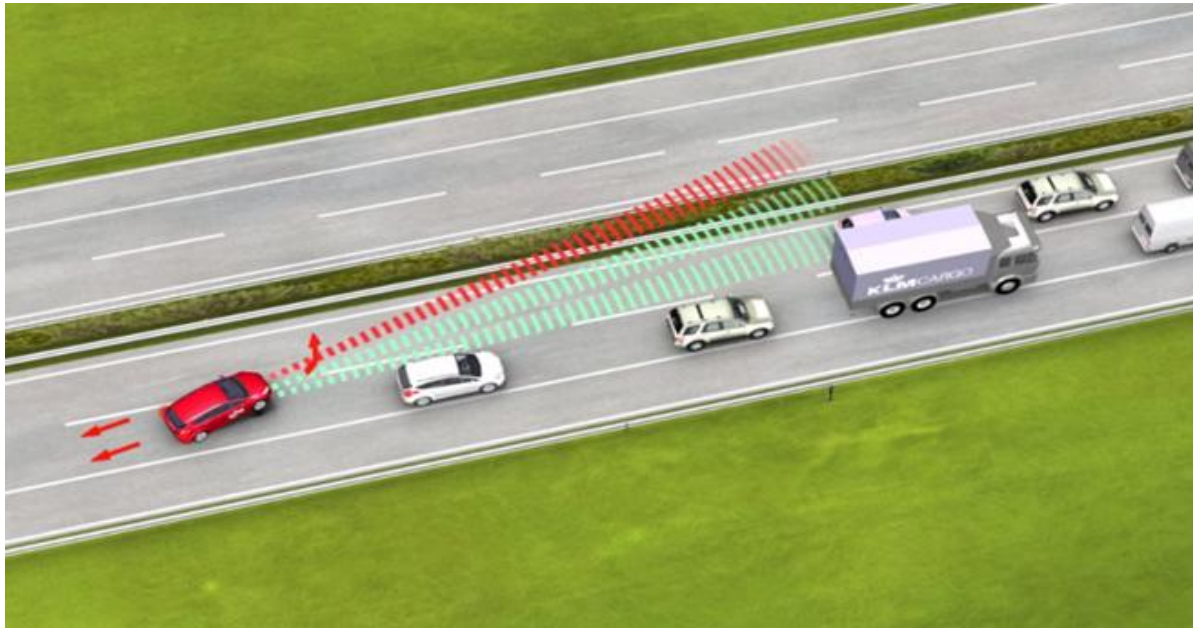


Work & Outcome: Testing in lab and test tracks

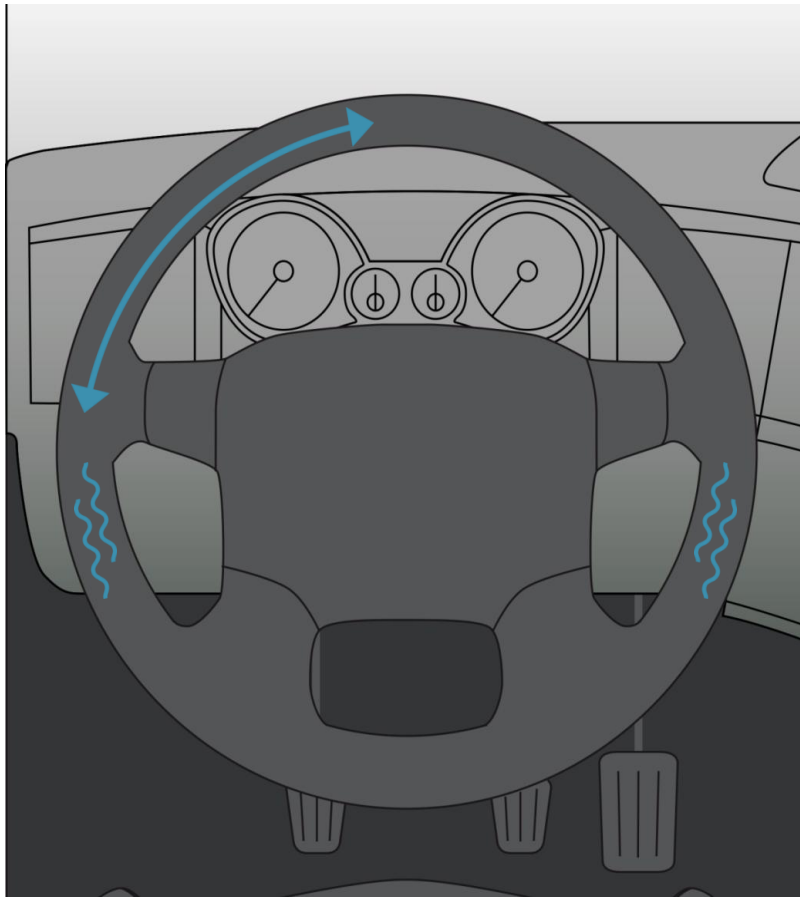


Work & Outcome: Testing (examples)

- Driver Reactions to an Active Steering Intervention to avoid a Rear End Collision



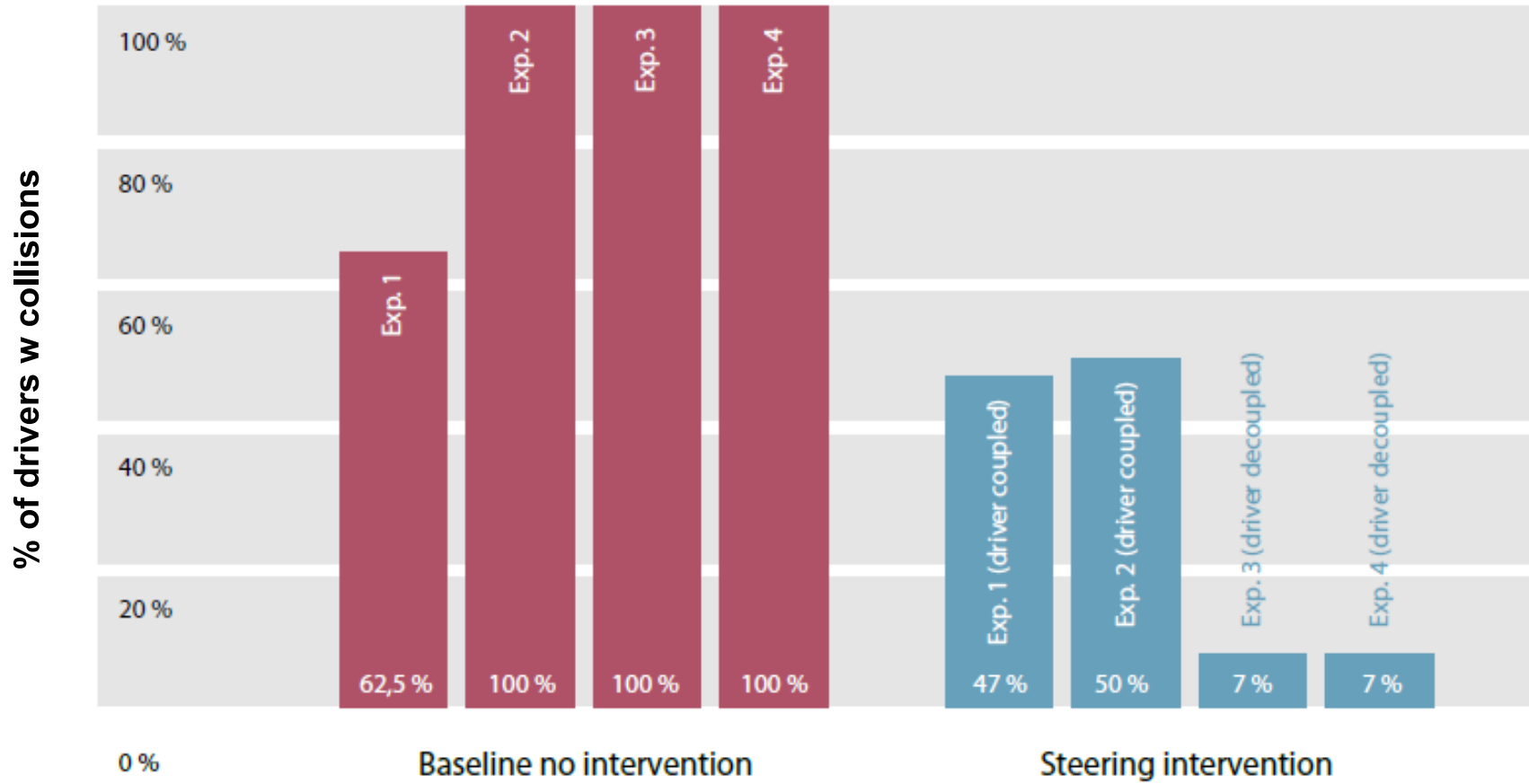
Work & Outcome: Testing (examples)



Research questions

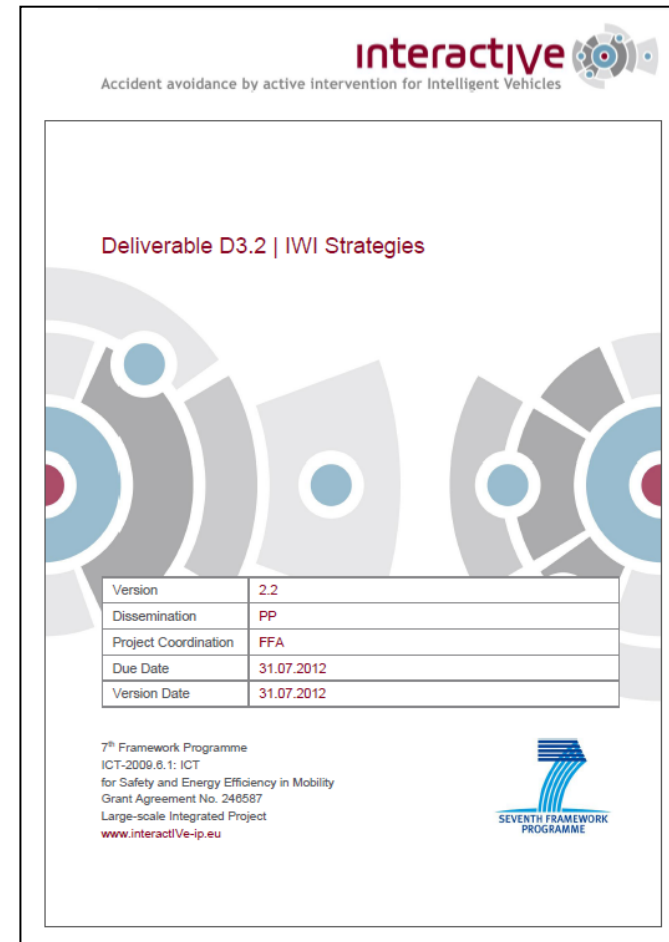
- Does drivers accept a sudden steering avoidance maneuver?
- Can drivers be convinced of system initiated steering maneuver by prompts/ directed warnings before intervention (directed double ticks in steering wheel, acoustic warning)
- Can drivers be de-coupled for a short period in order not to counteract the system intervention?
- Controllability issues?

Work & Outcome: Testing (examples)

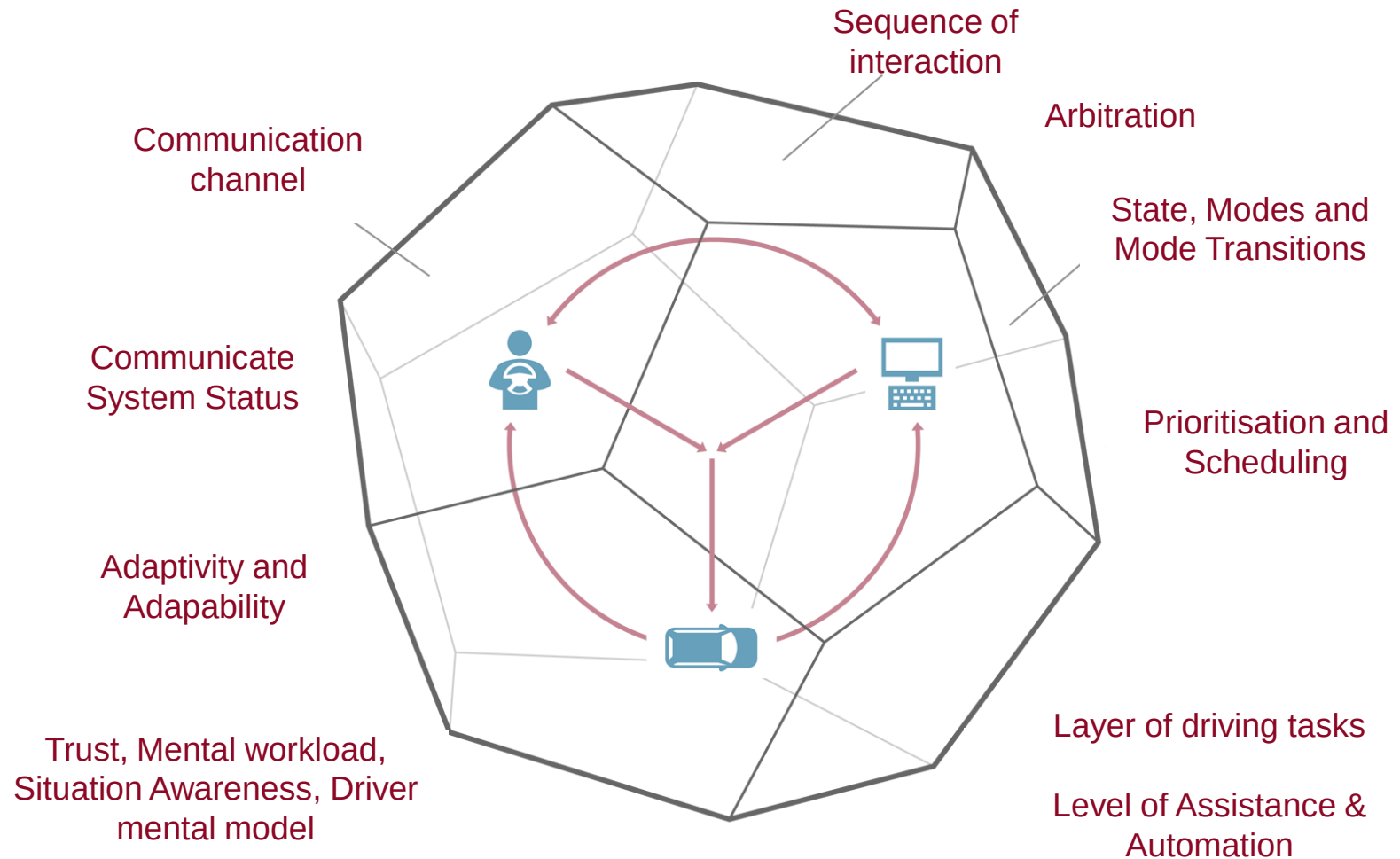


Work & Outcome: Information, Warning & Intervention (IWI) strategies

- **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

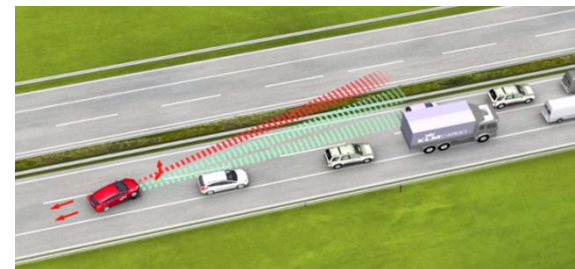
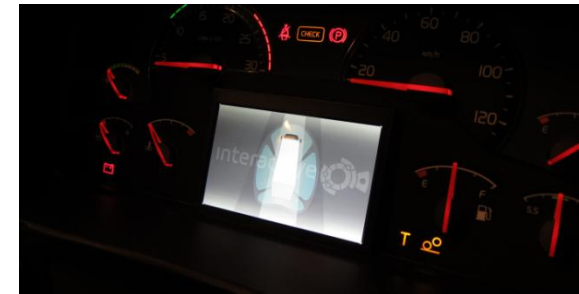
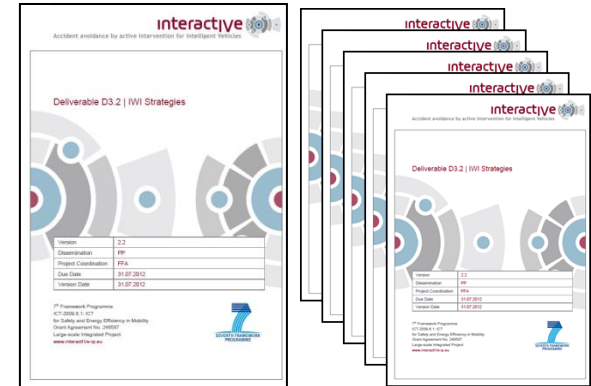


Information, Warning and Intervention (IWI) strategies – design categories



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 commission

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