Human-Vehicle Integration in EU-AdaptIVe

Johann Kelsch
& **EU-AdaptIVe SP3 colleagues**

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2015

TOWARDS INTELLIGENT MOBILITY
Better use of space

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EU-AdaptIVe

AdaptIVe
Automated Driving

FACTS

Budget:	EUR 25 Million
Funding (EC):	EUR 14,3 Million
Duration:	42 Month (Jan. 2014 – Jun. 2017)
Coordinator:	Volkswagen Group Research
28 Partners from:	France, Germany, Greece, Italy, Spain, Sweden, The Netherlands, UK

WEB

www.adaptive-ip.eu

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Main goal: Research, develop & demonstrate highly automated vehicle functions

CLOSE-DISTANCE // SCENARIOS

URBAN // SCENARIOS

HIGHWAY // SCENARIOS

LEGAL // ISSUES

HUMAN // FACTORS

EVALUATION //
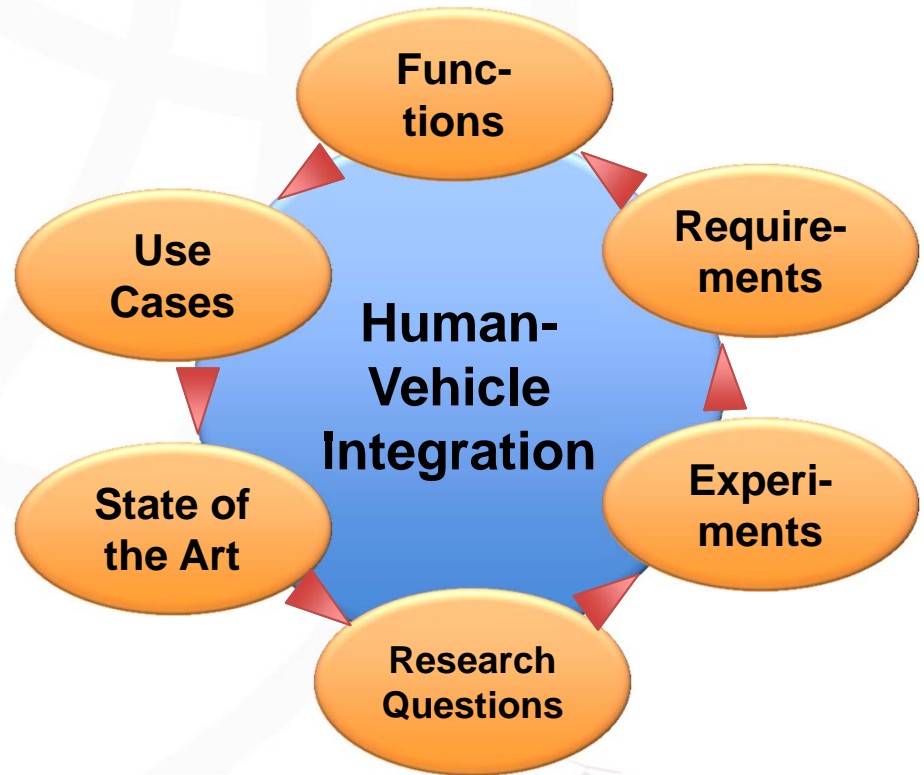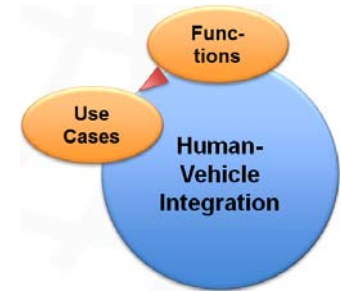
SP3: Human-Vehicle Integration

Main goals: - **Support** partners with Human Factors (HF) knowledge
- **Homogenize** development by providing HF-requirements

- **Collect technical functions** to be developed within AdaptIVe

- **Develop use cases** for test and development of functions

- **Collect existing HF-requirements**

- **Find** still unresolved Human-Vehicle Integration **research questions**

- **Conduct experiments**
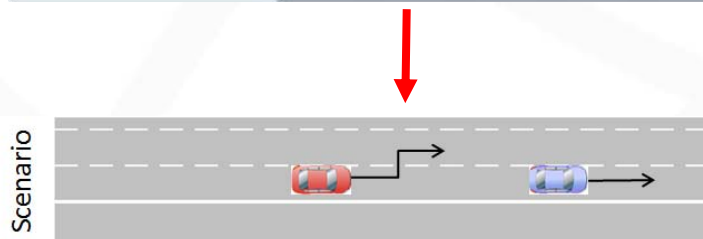
- **Create new HF-requirements**

Func-tions

Requirements

Use Cases

Human-Vehicle Integration

Experiments

State of the Art

Research Questions
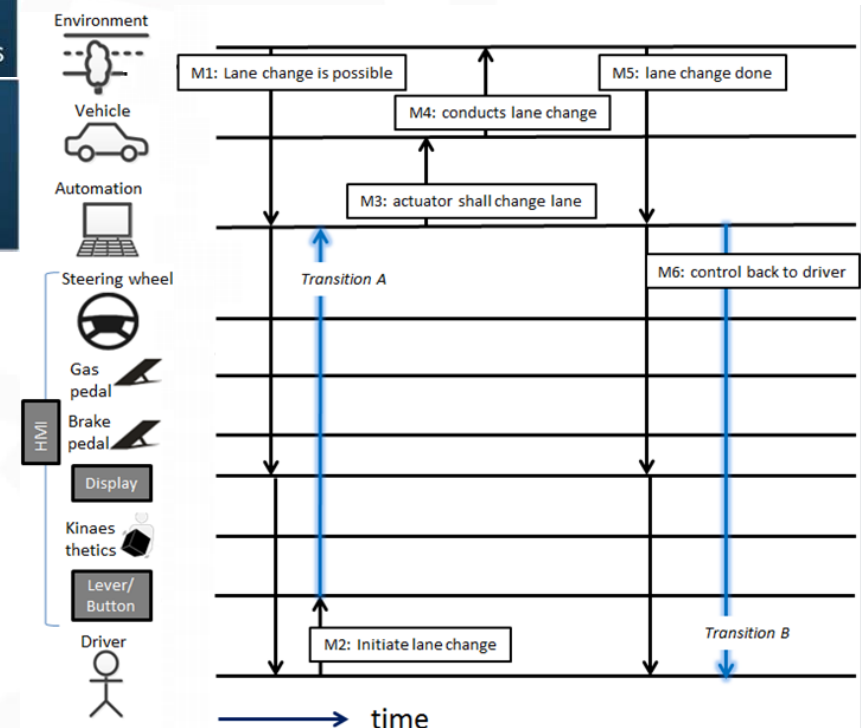
Functions & Use Cases

Close distance maneuvers (SP4)	• Activation/Deactivation with/without driver in car • Parking in/out • Drive to parking lot • Pass through construction site
Urban Scenarios (SP5)	• Activation/Deactivation • In lane lateral and longitudinal control • Lane change (driver/system initiated) • Handling of traffic lights/intersections/roundabouts
Highway Scenarios (SP6)	• Activation/Deactivation • Lane Following • Lane Change • Enter/exit motorway • Cooperative Use Cases (using C2X-Technology) • Driver State

28 functions in total

Main Flow: Driver initiated lane change
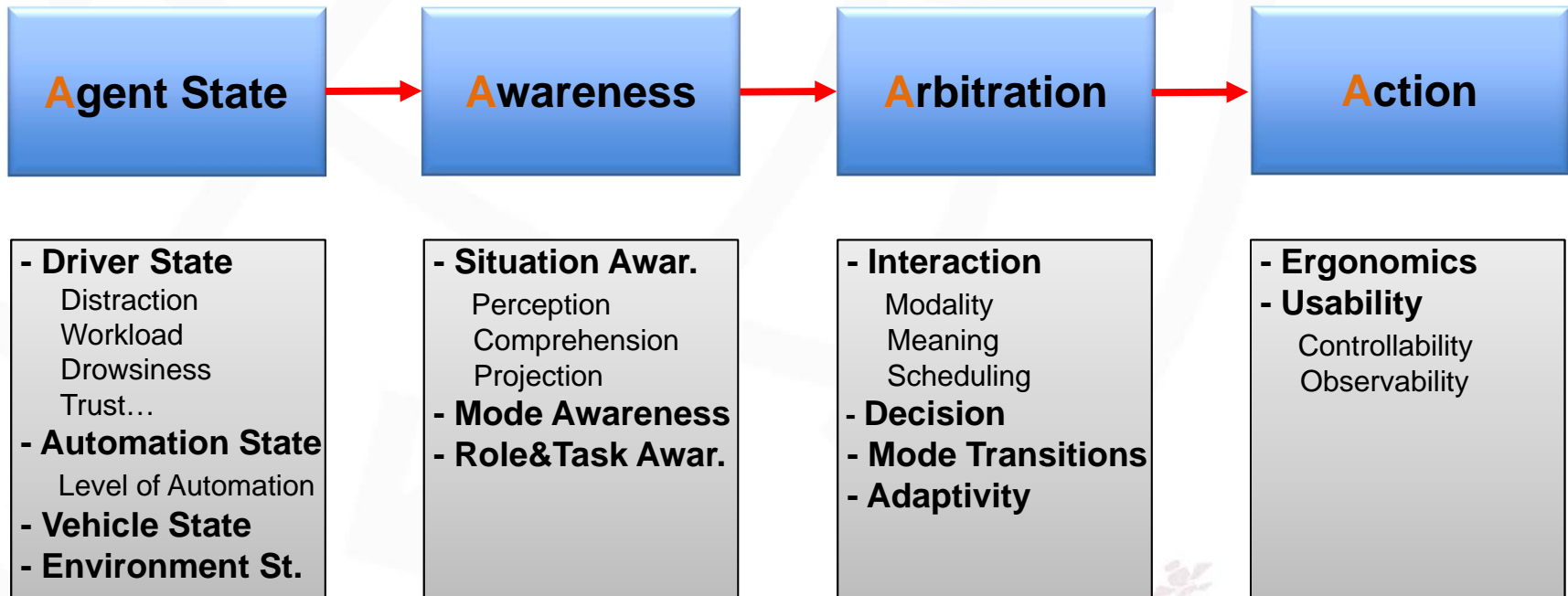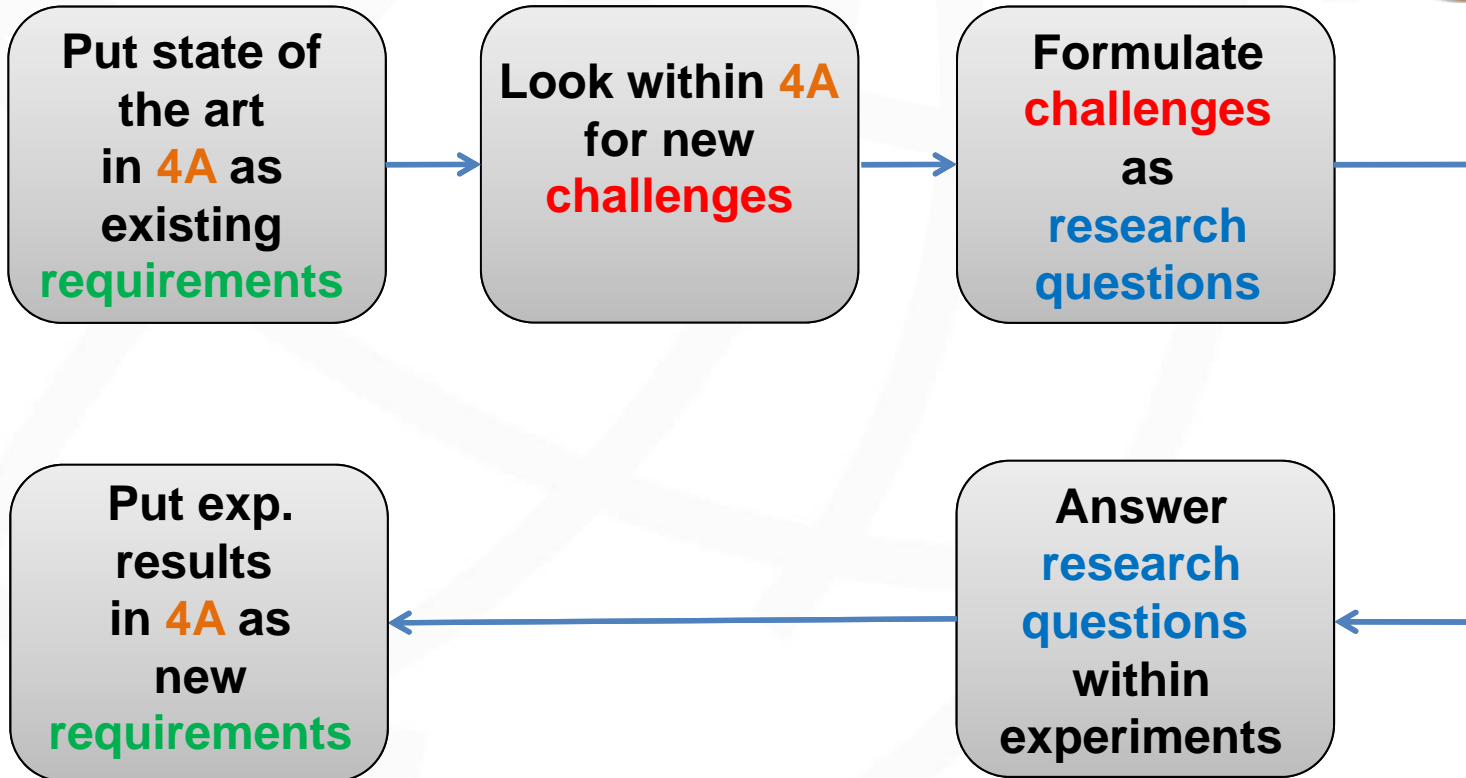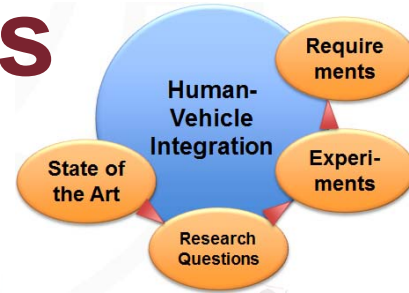
65 use cases in total

Environment

Vehicle

Automation

Steering wheel

Gas pedal

Brake pedal

Display

Kinaesthetics

Lever/Button

Driver

M1: Lane change is possible

M5: lane change done

M4: conducts lane change

M3: actuator shall change lane

M6: control back to driver

Transition A

Transition B

M2: Initiate lane change

time

Func-tions

Use Cases

Human-Vehicle Integration

Integration & structuring: 4A

Human-Vehicle Integration

Main idea: Cognitive **informational processing** =
= 'common denominator' in cognitive systems

Agent State → **Awareness** → **Arbitration** → **Action**

Agent State	**Awareness**	**Arbitration**	**Action**

- **Driver State**
  Distraction
  Workload
  Drowsiness
  Trust…
- **Automation State**
  Level of Automation
- **Vehicle State**
- **Environment St.**
	- **Situation Awar.**
	  Perception
	  Comprehension
	  Projection
	- **Mode Awareness**
	- **Role&Task Awar.**
		- **Interaction**
		  Modality
		  Meaning
		  Scheduling
		- **Decision**
		- **Mode Transitions**
		- **Adaptivity**
			- **Ergonomics**
			- **Usability**
			  Controllability
			  Observability

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Using 4A for Human Factors requirements


```
┌─────────────────┐     ┌─────────────────┐     ┌─────────────────┐
│  Put state of   │     │  Look within 4A │     │    Formulate    │
│    the art      │ ──> │    for new      │ ──> │   challenges    │
│   in 4A as      │     │   challenges    │     │       as        │
│   existing      │     │                 │     │    research     │
│  requirements   │     │                 │     │   questions     │
└─────────────────┘     └─────────────────┘     └─────────────────┘

┌─────────────────┐                             ┌─────────────────┐
│   Put exp.      │                             │     Answer      │
│   results       │                             │    research     │
│   in 4A as      │ <────────────────────────── │   questions     │
│     new         │                             │    within       │
│  requirements   │                             │  experiments    │
└─────────────────┘                             └─────────────────┘
```

Requirements Catalogue

EU-AdaptIVe: 4A-Structure

| Agent State | → | Awareness | → | Arbitration | → | Action |

Agent State
- **Driver State**
  Distraction
  Workload
  Drowsiness
  Trust…
- **Automation State**
  Level of Automation
- **Vehicle State**
- **Environment St.**

Awareness
- **Situation Awar.**
  Perception
  Comprehension
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- **Mode Awareness**
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Arbitration
- **Interaction**
  Modality
  Meaning
  Scheduling
- **Decision**
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- **Adaptivity**

Action
- **Ergonomics**
- **Usability**
  Controllability
  Observability

How do you mitigate complexity?

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AdaptIVe
Automated Driving

SP3

Stefan Wolter
FORD

Marc Dziennus
DLR

Mikael Ljung Aust
VOLVO CARS

Tyron Louw
UNILEEDS

Martin Brockmann
FORD

Natasha Merat
UNILEEDS

Mikael Söderman
VOLVO TRUCKS

Anna Schieben
DLR

Emma Johansson
VOLVO TRUCKS

Katharina Wiedemann
WIVW

Johann Kelsch
DLR

Nadja Schöming
WIVW

Ruth Madigan
UNILEEDS

Picture: Nadja Schöming

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