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Automated Driving Applications and Technologies for Intelligent Vehicles

Challenges of vehicle automation

A human factors perspective

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// Potentials of automated driving

Increased safety	• Reduction of human error / weaknesses • Faster and stronger reactions
Increased comfort	• More efficient use of time • Release of attentional resources

//Ironies of Automation (Bainbridge, 1983)

The more complex an automated system is, the more important the role of the human operator becomes.

Automation takes over tasks that humans find annoying or are bad at.

- But: Operator has to monitor if the systems is doing the right thing

The more reliable the automated system, the lesser the human has to intervene and correct the automation.

- But: The lesser the human has to intervene, the harder it will be

// Possible side effects

Altered driver state	• Drowsiness • Reduced situation awareness	• Overreliance • Misuse	Inappropriate trust in Automation
System understanding	• Mode confusion • Mental model	• Loss of skills • Behavioural adaptation	Long term effects

// Crucial aspect:
Transitions of control between automation and driver

// Goal: Human-centered design

- Finding suitable strategies to hand back vehicle control to the driver
- Prevention of **automation surprises** in order to:
  - Increase **system understanding**
  - Increase **reliance**
  - Increase **acceptance**

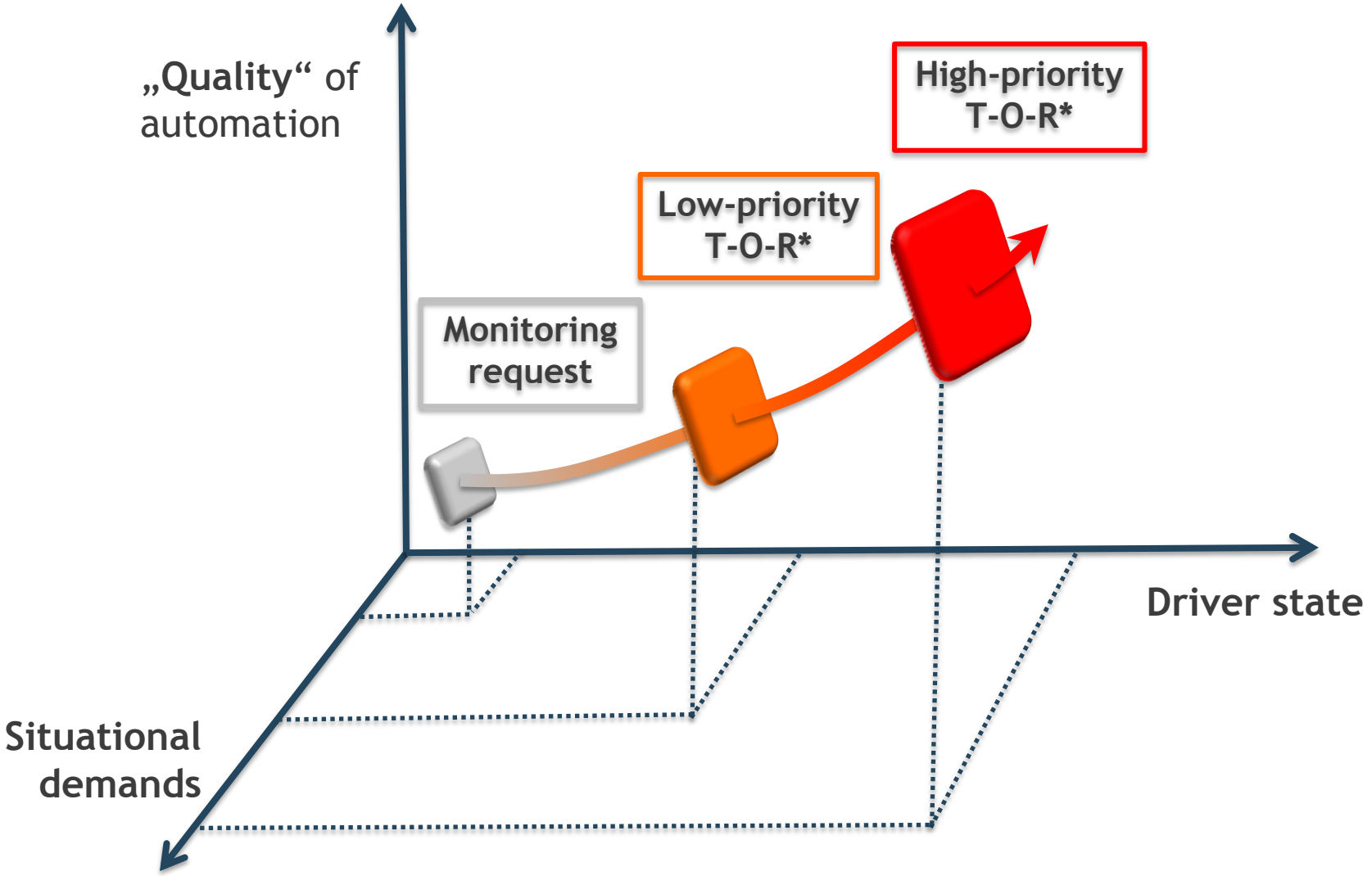
Positive automation effects will only affect traffic safety if the automation is actually used.

// Human-vehicle integration: Key Research questions in AdaptIVe

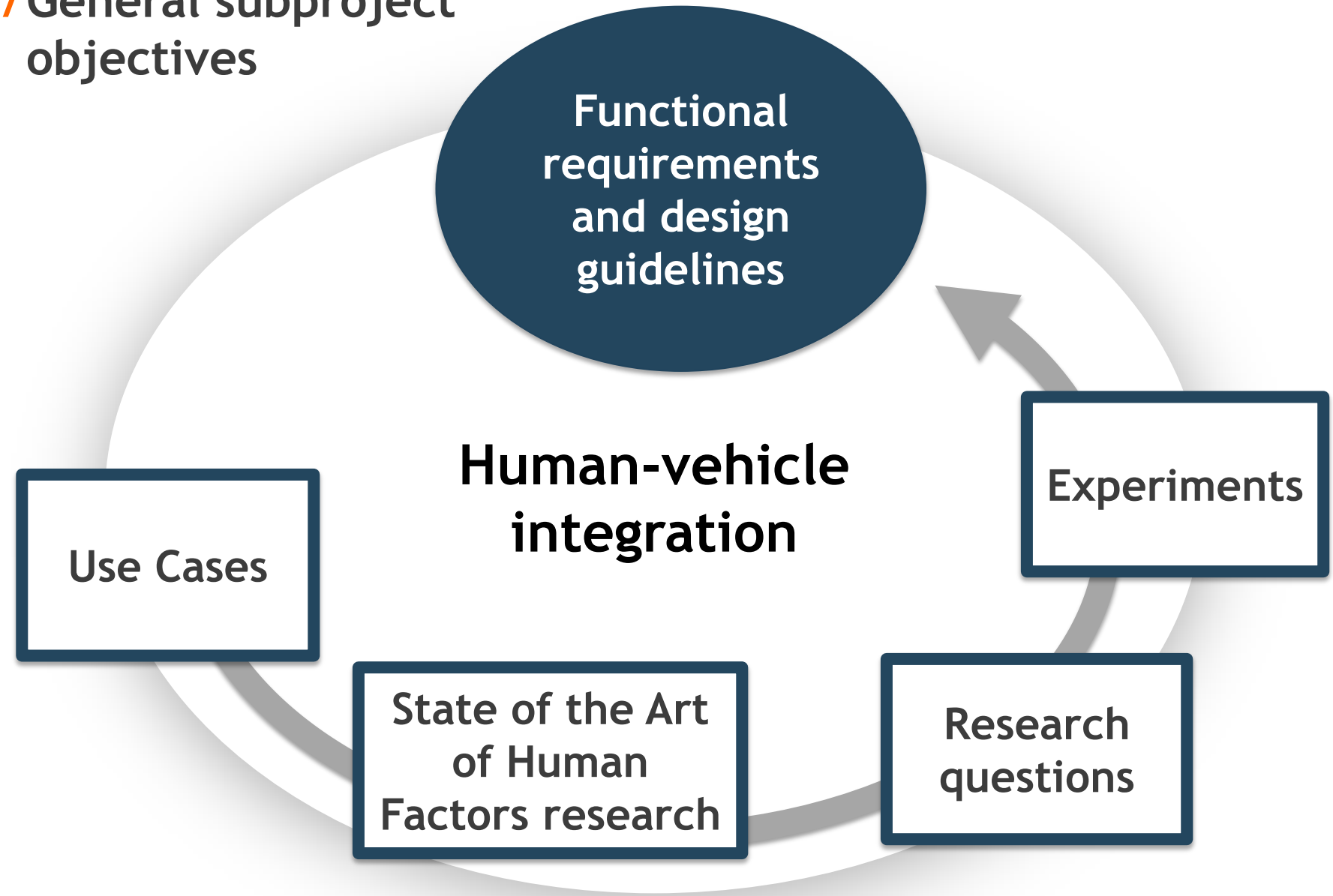
Driver in the loop	• Situation awareness • Mode awareness
Controllability	• Managing system limits/failures
Driver attention state	• Drowsiness • Secondary-task engagement
Transitions	• System- and driver-initiated
Shared control	• Driver and automation act in parallel
Interface design	• Modality and timing of information

// Integrated research approach

* Take-Over-Request



// General subproject objectives



// Use Cases

„Description of a specific sequence of interaction between the user and the system to achieve a specific goal.“

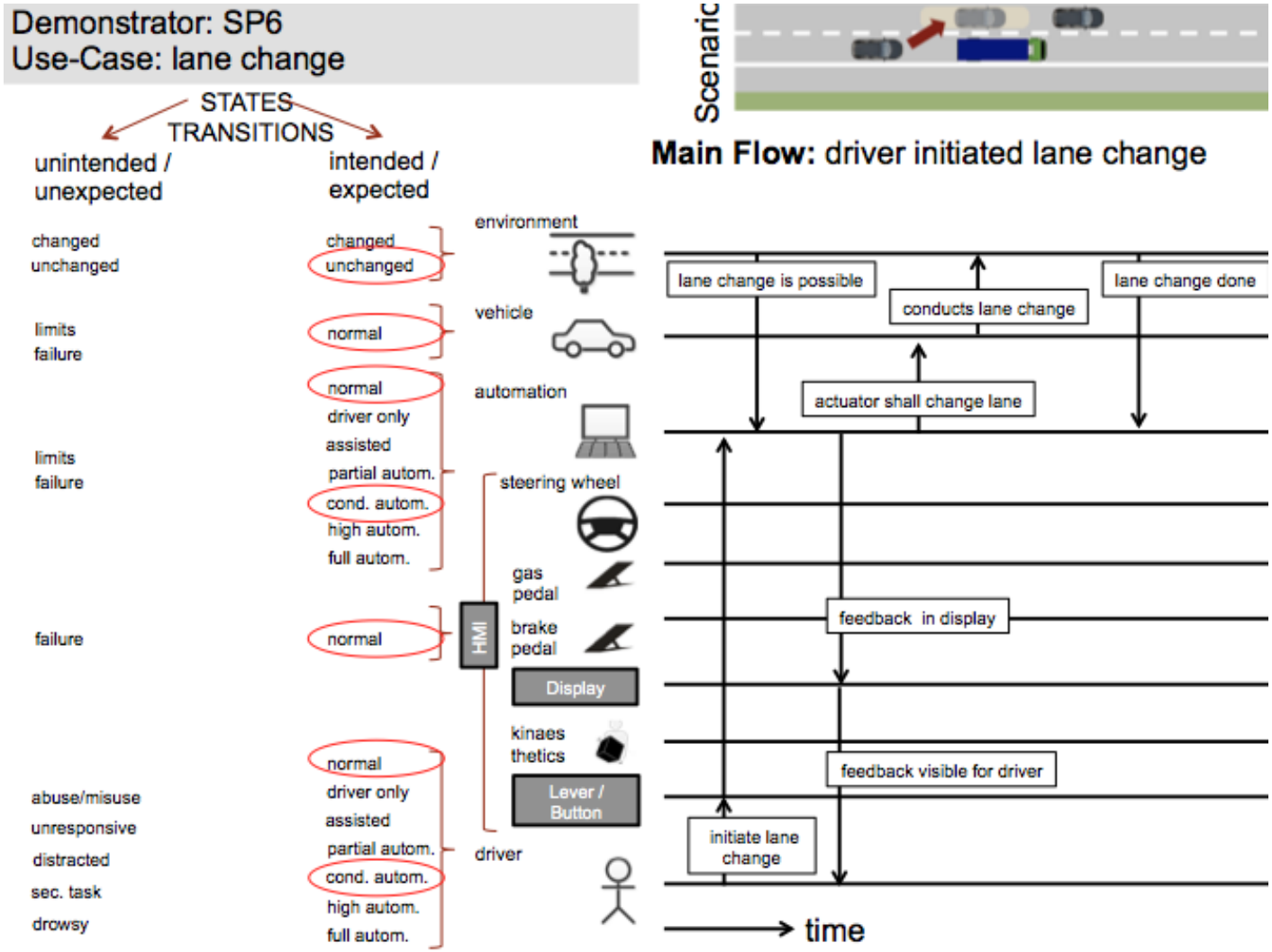
April 2014: Use-Case-Workshop at DLR Braunschweig

Results: Definition of first set of use cases

// Examples of defined Use Cases

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

// Use Case Example: Lane Change



// Next steps: Experiments

Leeds driving simulator

DLR driving simulator

WIVW driving simulator

FORD fixed based simulator

AB Volvo truck simulator

VCC fixed based simulator

DLR FASCar

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Thank you.

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