

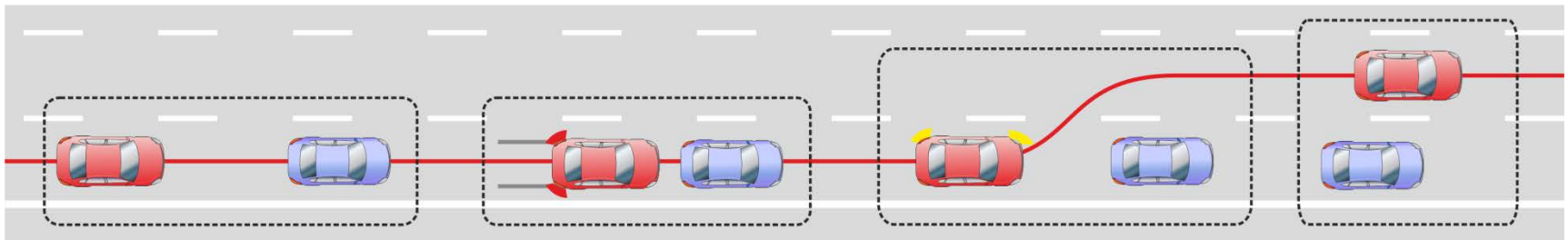
Eine Fallstudie für zu modellierende Fahrer-Fahrzeug- Interaktion:

Manöverbasierte Assistenz und Automation für die Autobahn

Julian Schindler

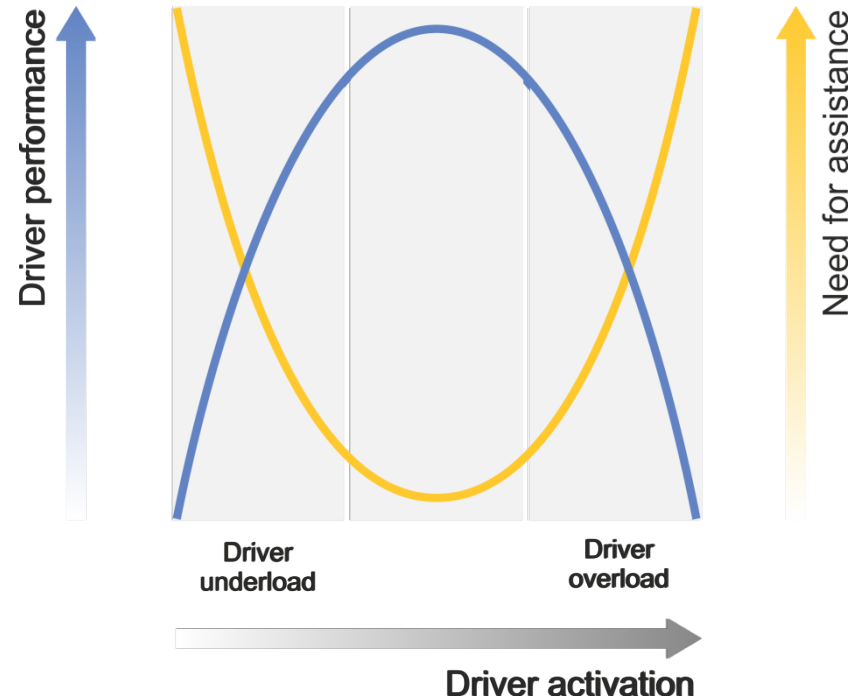
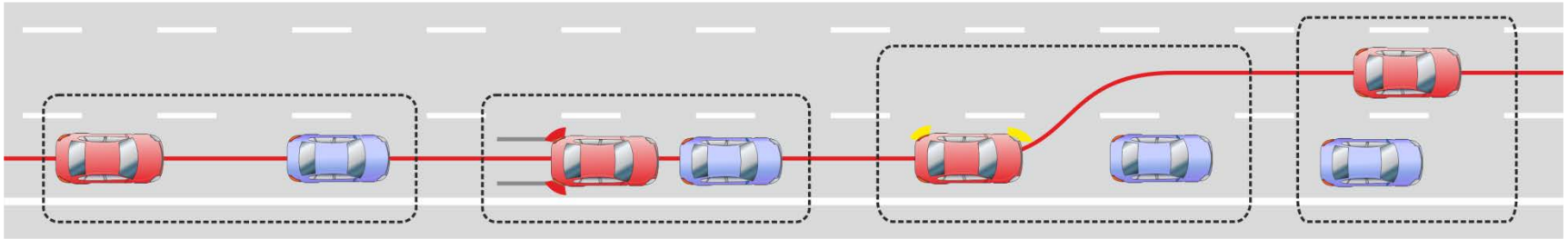
*Anna Schieben, Johann Kelsch,
Christian Löper, Gerald Temme*

- Development of an Advanced Driver Assistance System (ADAS)
 - Design Paradigm: Cooperative Manoeuvre-Based Automation (Driver \leftrightarrow Automation)
 - Based on EU-SP7-Project HAVEit
 - Fundamentals based on national DFG-Project H-Mode
- Scenario:



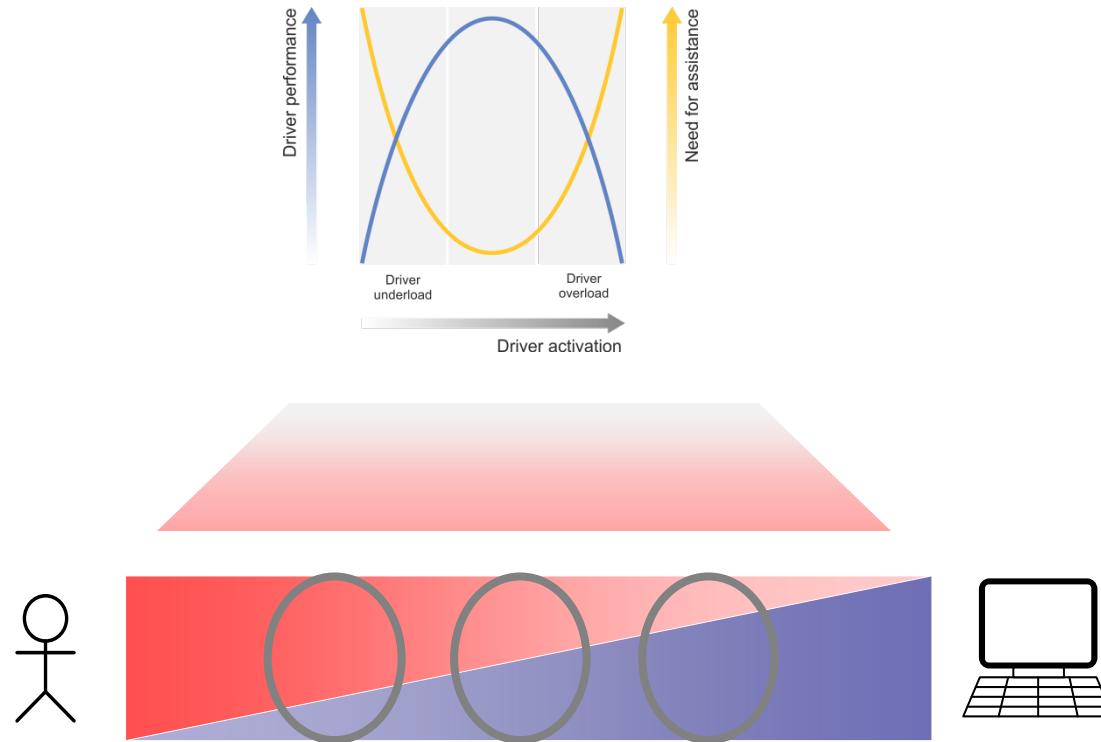
- Focus on manoeuvres Car Following, Emergency Braking, Lane Changes and Overtaking

Introduction



Quelle: HAVEit

Degrees of Automation



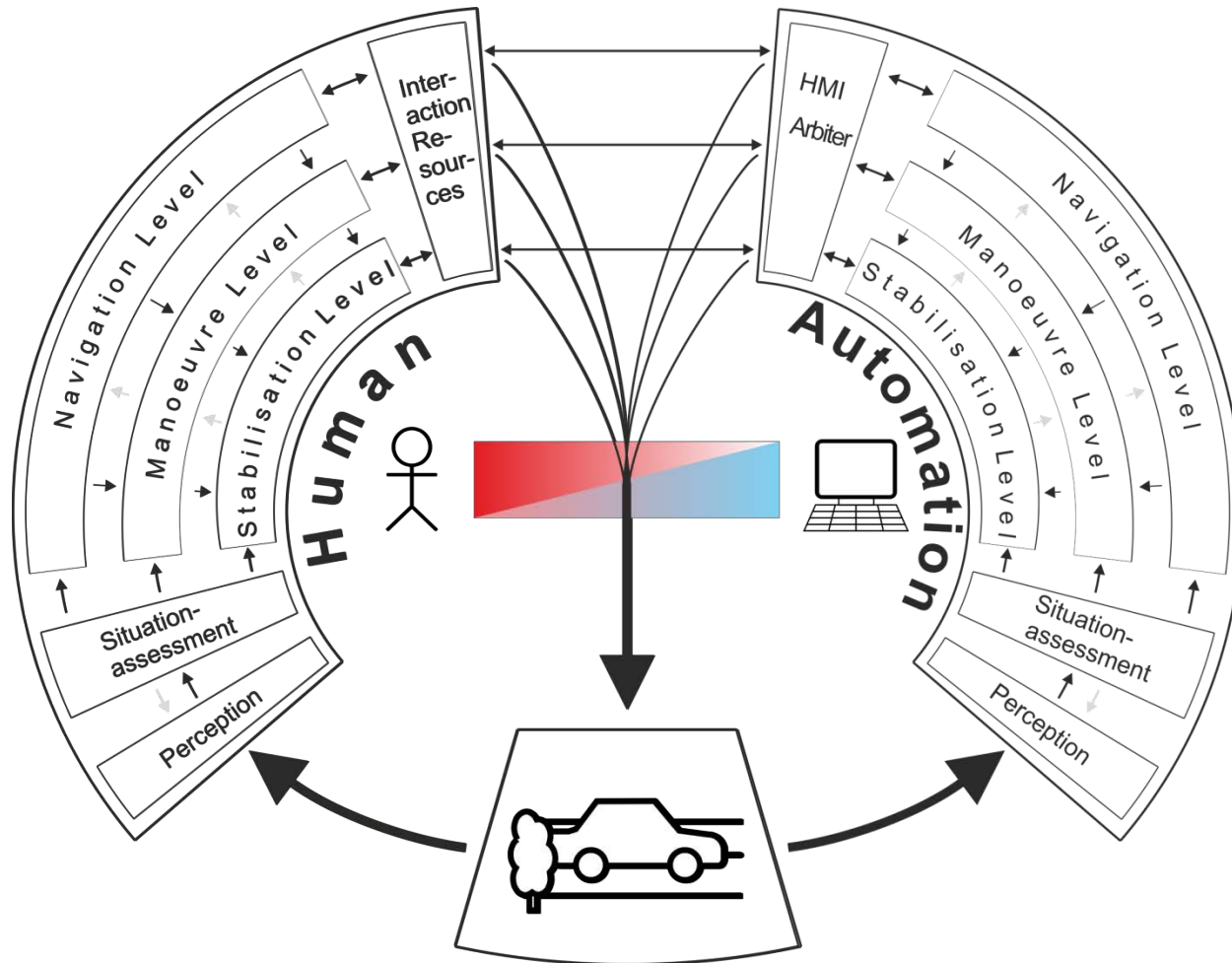
Automation Spectrum shows level of control:

- From Driver Only to Fully Automated

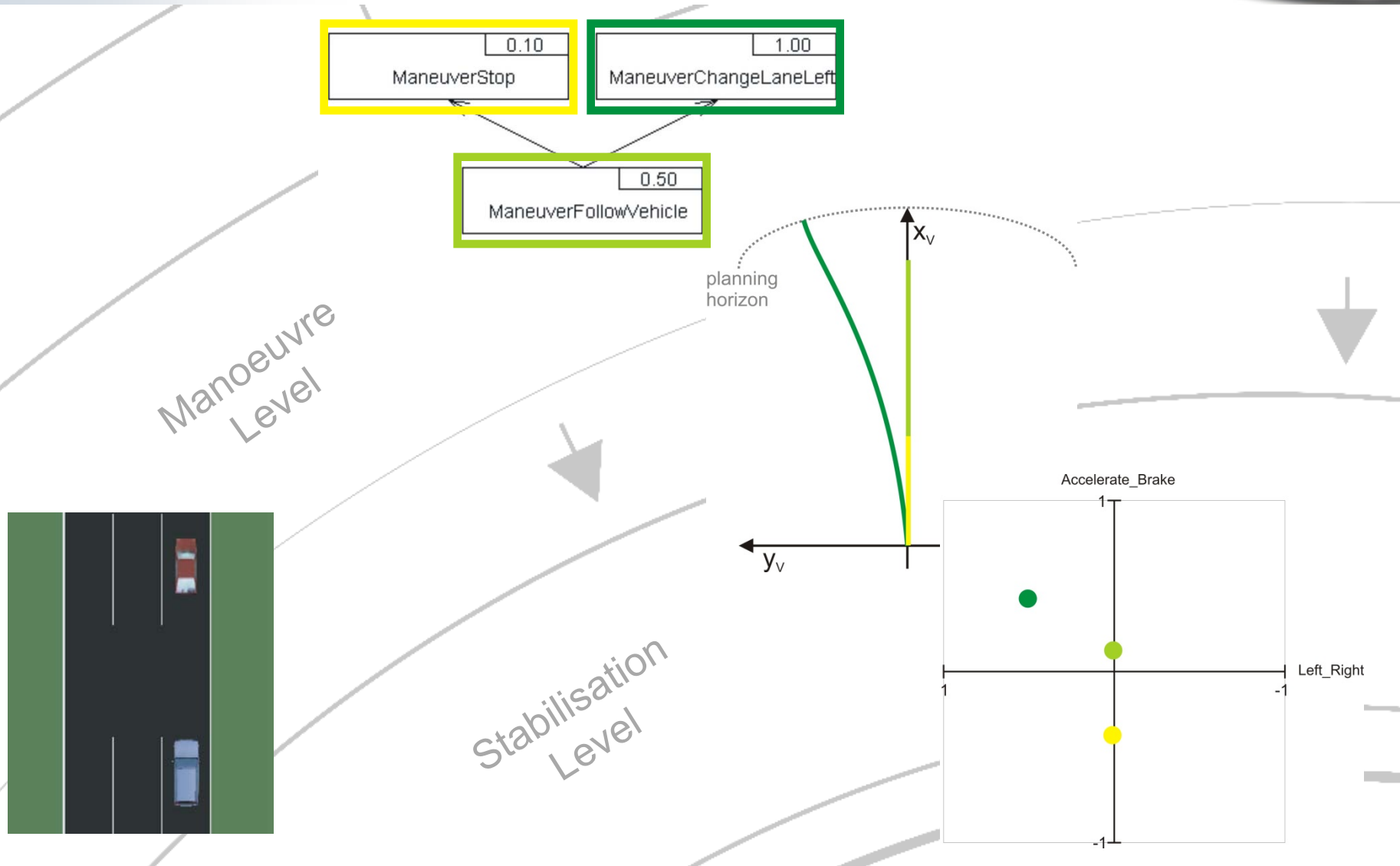
Cooperative Manoeuvre-Based Automation

- Automation behaviour must be reasonable
 - Fits the „Mental Model“ of the driver
- Compatibility between driver and automation
 - Outer compatibility
 - Accessibility
 - Controllability
 - Inner compatibility
 - Cognitive compatibility
 - compatible system of values

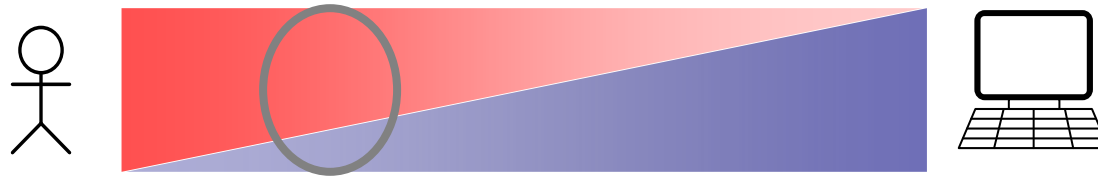
Cognitive Compatibility



Layers of Automation Behaviour



Degrees of Automation: Driver Assisted



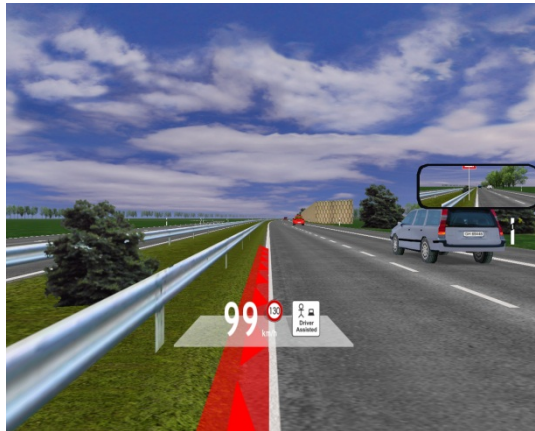
Driver Assisted

- Vehicle controlled by Driver
- Various multimodal warnings and hints
- Including Forward Collision Avoidance System
- BAST Classification: Driver Only

Driver Assisted

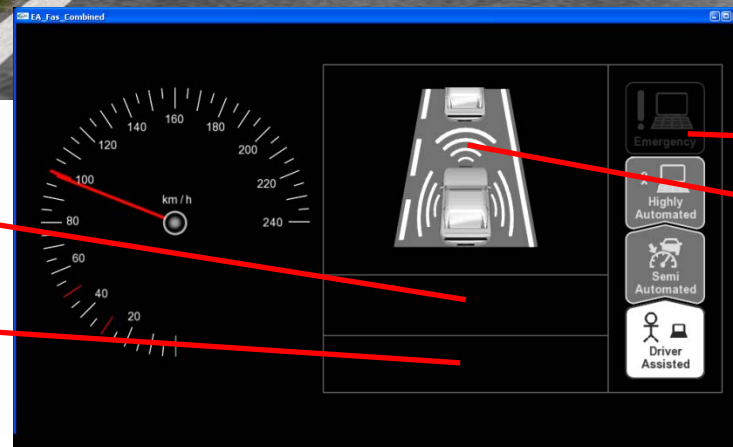
		Haptics			Visuals			Acoustic	
		Gas	Brake	Wheel	Kombi	HUD	Mir.	spat.	verb
Lat	BlindSpotWarning								
	LaneDepartureWarning								
	LaneKeeping								
Lat+ Lng	LaneChangeAssist								
	MergeInAssist								
Lng	ForwardCollisionWarning								
	IntelligentSpeedAdaptation								
	AdvancedCruiseControl								
Trans	System Limit Transition								
	System Failure Transition								

Driver Assisted



Warnings & Preconditions

Text Messages



Automation Spectrum
Sensor Monitor



Driver Assisted: BlindSpot and LaneDep. Warning

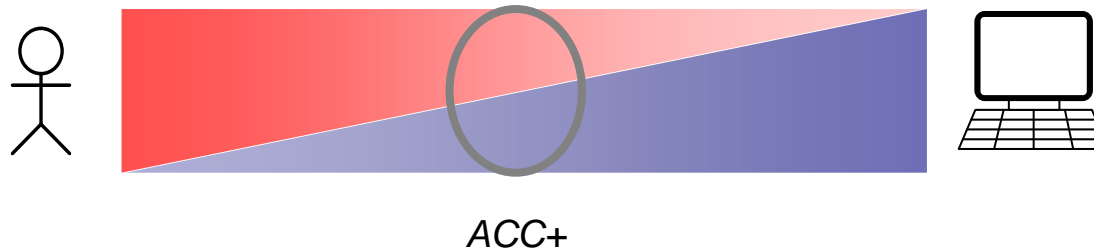


Example: Driver Assisted with LDW and FCW



Degrees of Automation:

ACC+



- Functionality of „Driver Assisted“
 - +
- Standard ACC-To-Stop
 - laterally controlled by driver
 - longitudinally controlled by automation
- „Natural Speed Adaptation“
 - Pedals used for Setspeed control
- Active Intelligent Speed Adaptation
- BAST Classification: Assisted

ACC+

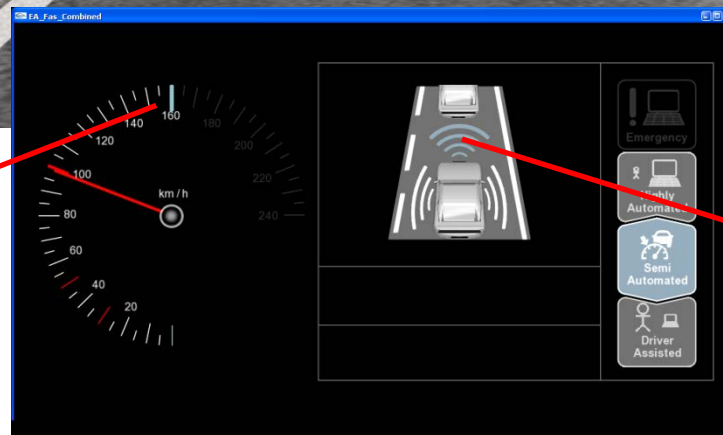
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Trans	System Limit Transition								
	System Failure Transition								

ACC+



Set Speed &
Distance

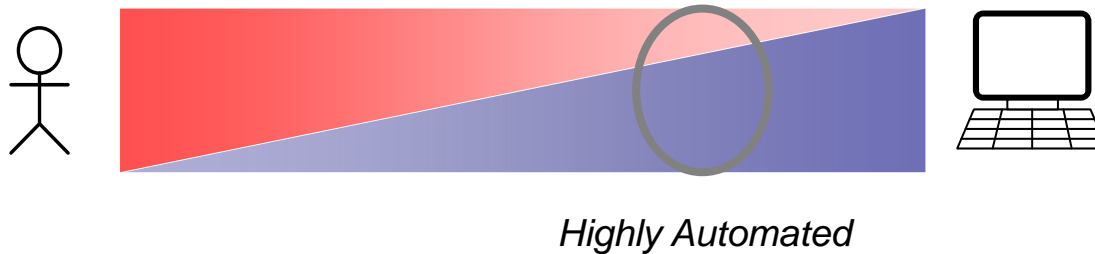
Automation
Speed
Capability



Sensor activity



Degrees of Automation: Highly Automated



- Functionality of „ACC+“
+
- Shared lateral control:
 - 80% by automation, 20% by driver
- Longitudinally controlled by automation
- Automation can drive on its own on the Autobahn
 - But: Lane Changes must be triggered by driver
- No permanent supervision by driver necessary
- BAST Classification: Highly Automated

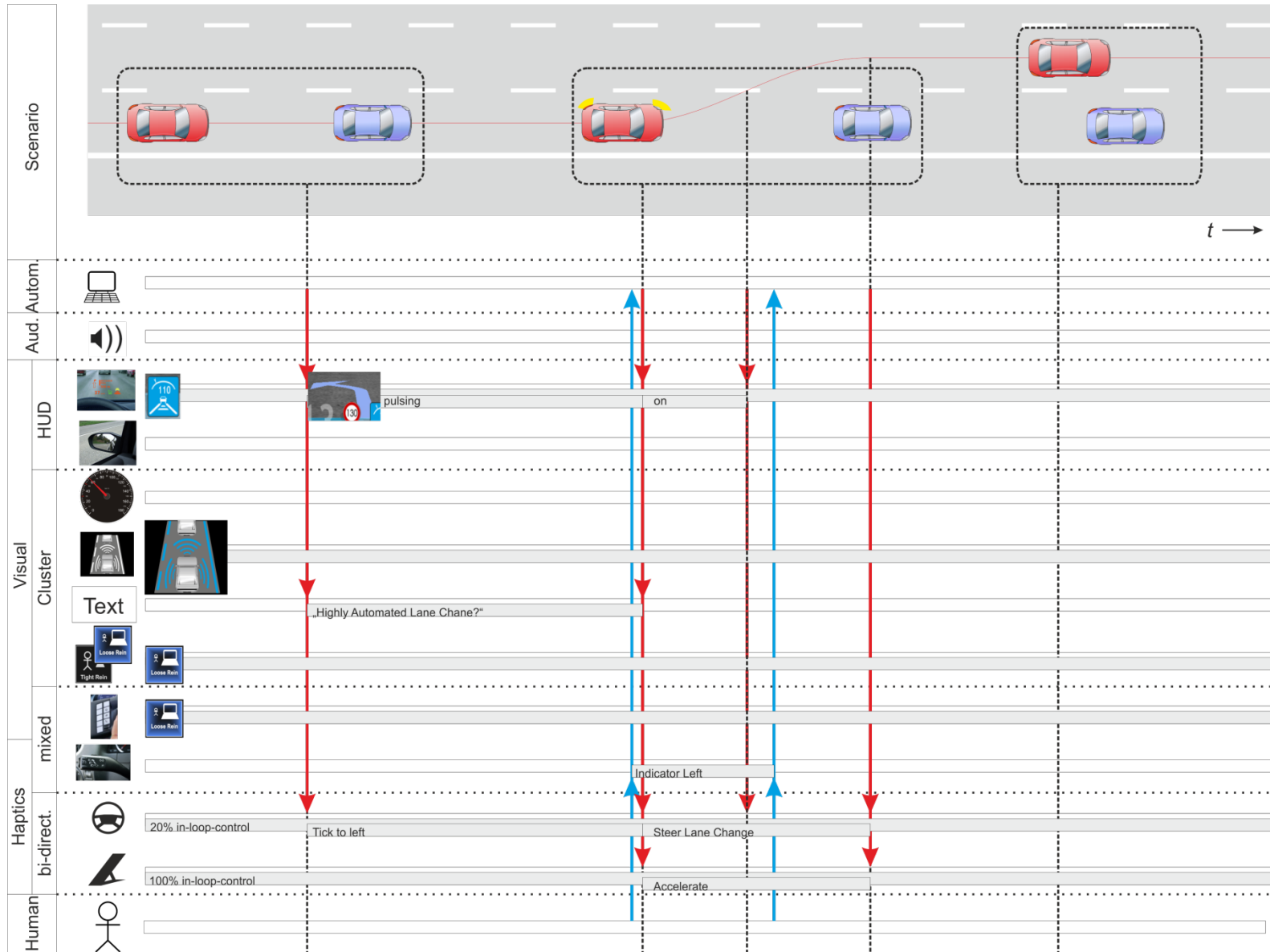
Highly Automated

		Haptics			Visuals			Acoustic	
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Highly Automated



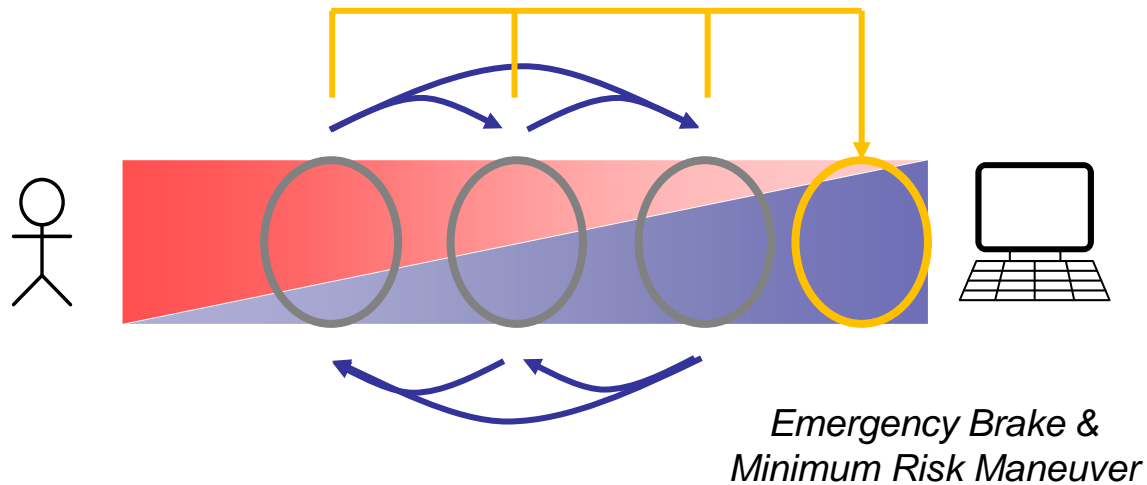
Highly Automated Lane Change Sequence



Example: Highly Automated LaneChange (LCA)



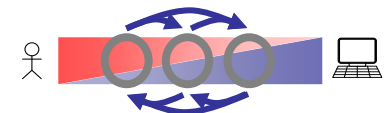
Degrees of Automation: Transitions and Emergency







Transitions (initialized by driver)

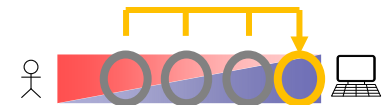
Possible Transitions

- Low to high
 - By pressing button on the steering wheel
- High to low
 - By pressing button on the steering wheel
 - By pressing throttle or brake pedal hard
 - „Border“ feelable on the pedals



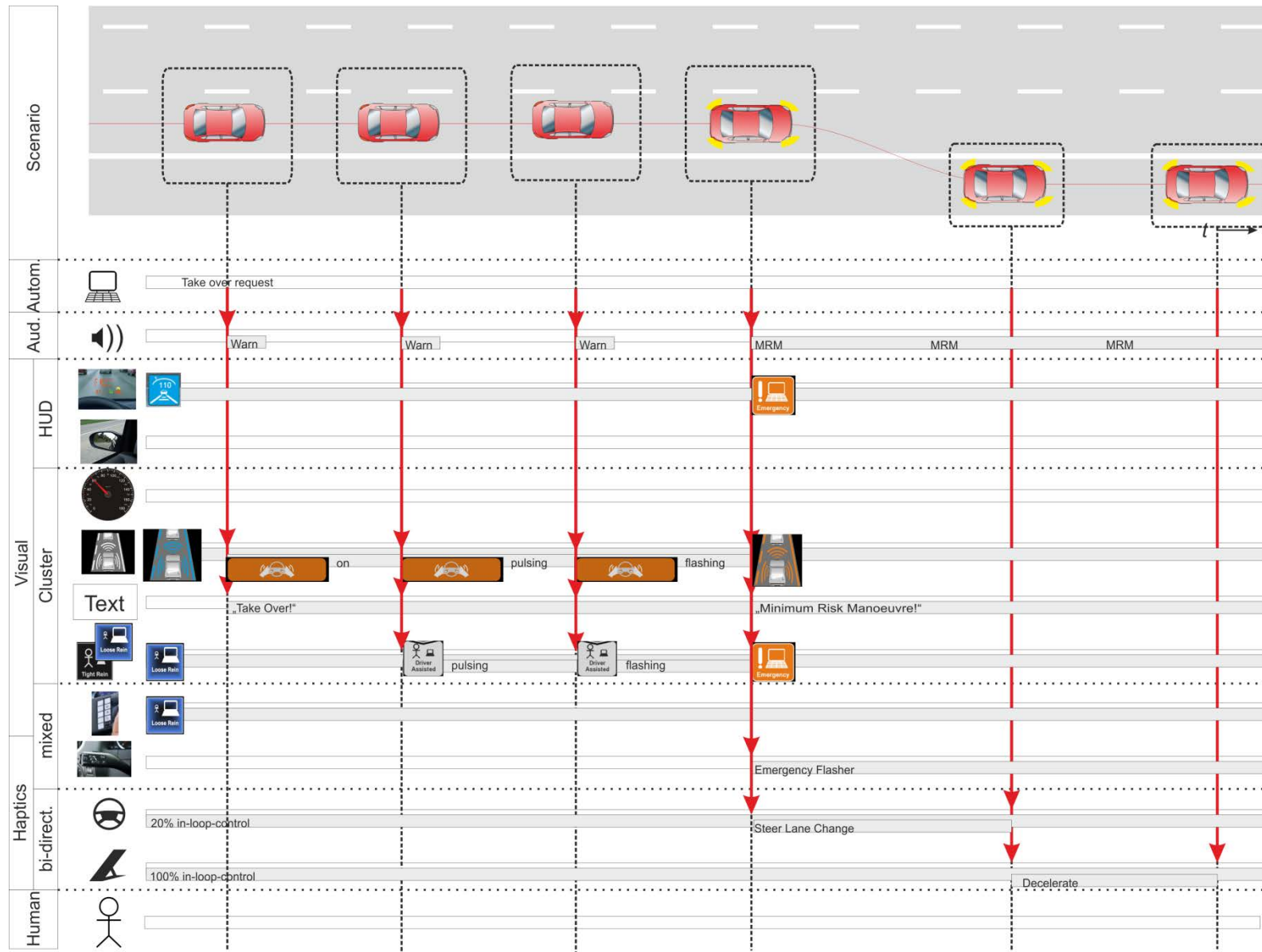
System Limits

- Driving faster than capable 
 - Driving on unsupported lanes
 - Low Sensor capability
 - No/unusual Lane Markings
 - Current Lane not marked as „Highway“ (in digital map)
 - Driving DA/ACC+ without hands on the wheel
 - For a longer time or
 - During transitions
 - Driving drowsy
 - Driving distracted
- HA/ACC+ selection impossible
 - HA/ACC+ selection impossible
 - Transition to lower level (i.e. HA→ACC+, HA→DA, ACC+→DA)
 - Warn, escalate to Transition to MRM
 - Needs special hardware
 - Capacitive Wheel
 - Eye tracker



Transition escalation

Example: Minimum Risk Manoeuvre



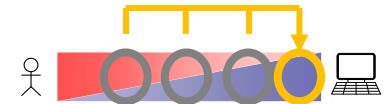
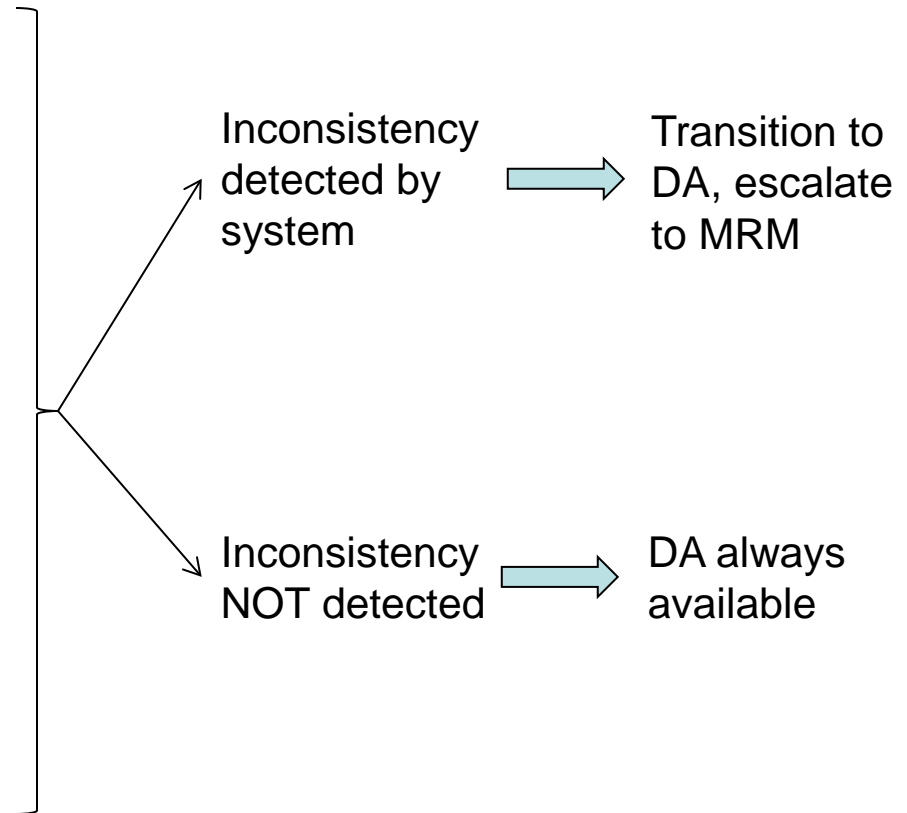
Transition escalation

Example: Minimum Risk Manoeuvre



System Failures

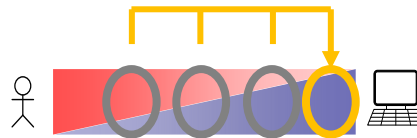
- Sensor failures
 - Lane type undetected/wrong detected
 - Lane direction wrong detected
 - Too many cars seen by sensor
 - Cars not seen by sensor
- System malfunction



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Vielen Dank für Ihre Aufmerksamkeit!

Fragen?