Institute for Transport Studies
FACULTY OF ENVIRONMENT

UNIVERSITY OF LEEDS

Overview of Human Factors research on Automated Vehicles at Leeds

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ITS

Project overview

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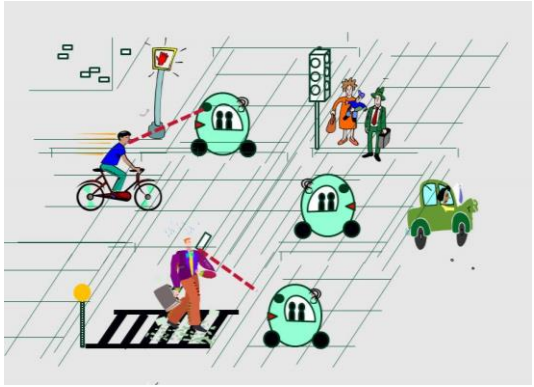
AdaptIVe
Automated Driving Applications and Technologies for Intelligent Vehicles

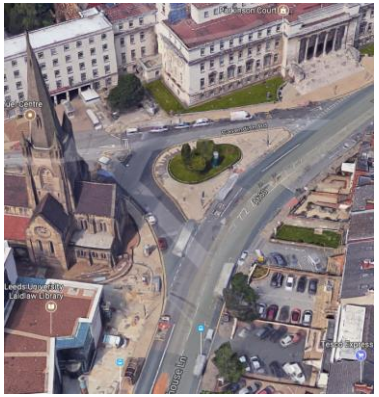
L3Pilot
Driving Automation

interACT
Designing cooperative interaction of automated vehicles with other road users in mixed traffic environments

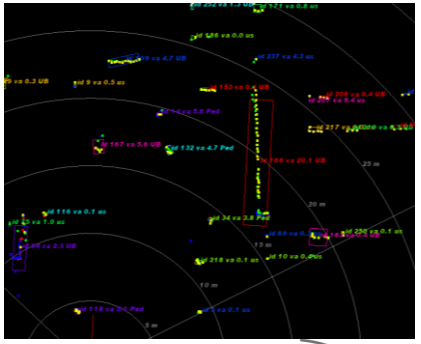
CARTRE
Coordination of Automated Road Transport Deployment for Europe

Co-funded by the European Union





- Naturalistic, cross cultural observation of present human-human interactions:
  - Questionnaires & Interviews
  - Video data analysis of interactions
  - Observation studies
  - LiDAR



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Automated Driving Applications and Technologies for Intelligent Vehicles

Overview of the Human Factors Experiments

Natasha Merat
Leader, Human Factors and Safety Group,
Institute for Transport Studies,
University of Leeds

//Project Facts

- January 2014-June 2017
- Lead by Volkswagen AG
- 28 partners from 8 countries
- The project volume amounts to € 25 million, € 14 million from European Union Seventh Framework Programme for research
- Supported by the European Council for Automotive R&D EUCAR.

//The Team

Ford

VOLVO

VOLVO

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

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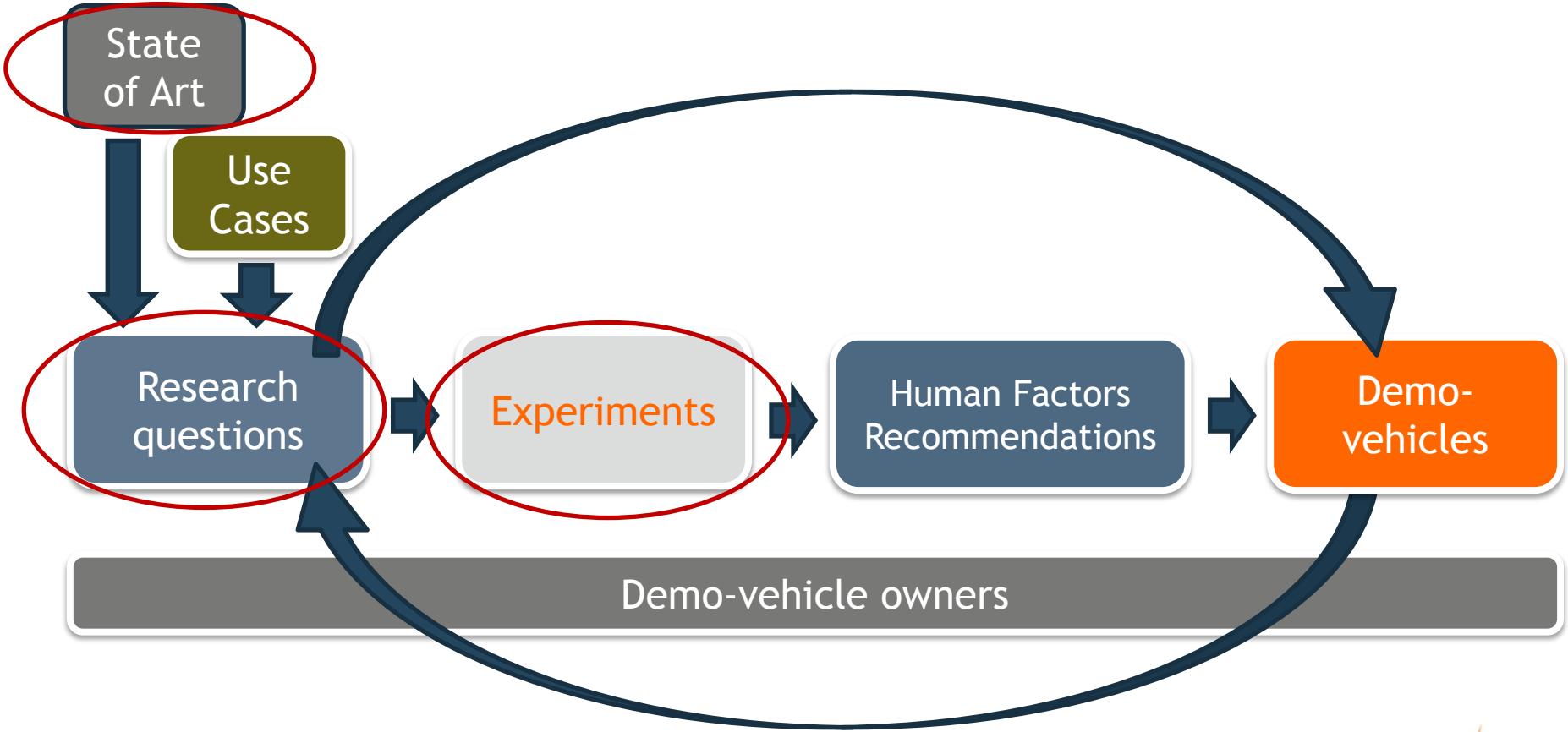
// Main Objective of Human Factors team

"Investigate how drivers' intentions and actions should be taken into account in the design of partly and highly automated vehicles"

SAE Levels 2 & 3

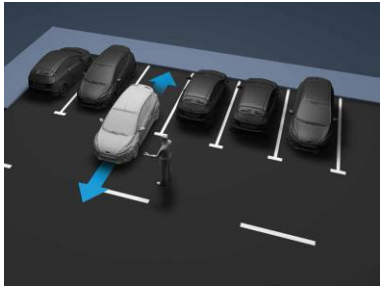
//An Iterative Process



// SoA and Categorisation of Research Questions – The 4As

Agent State	Awareness	Arbitration	Action
Drowsiness/ Fatigue	Situation Awareness	Interaction and Design	Ergonomics
Physiological/ Emotional state	Mode Awareness	Meaning and Scheduling	Controllability
Distraction	Role & Task Awareness	Modes and Transitions	
Workload		Modality	
Cultural Differences		Adaptivity	
Acceptance			
Automation State			
Vehicle State			
Environment state			

//Experiments



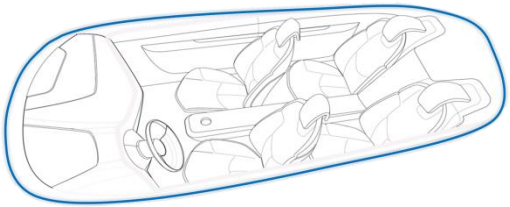
- 17 MAIN Research Questions
- 16 simulator studies
- 1 ADAS study for truck drivers
- 1 large web-based survey

- Over 400 car drivers
- 90 truck drivers
- 2743 web-survey respondents

//New Concepts, Methodologies and Measures

- Simulating the ‘out of the loop’ concept
  - *Can we achieve it?*
  - *Where do drivers look during automation?*
  - *Does this have an effect on their crash propensity?*

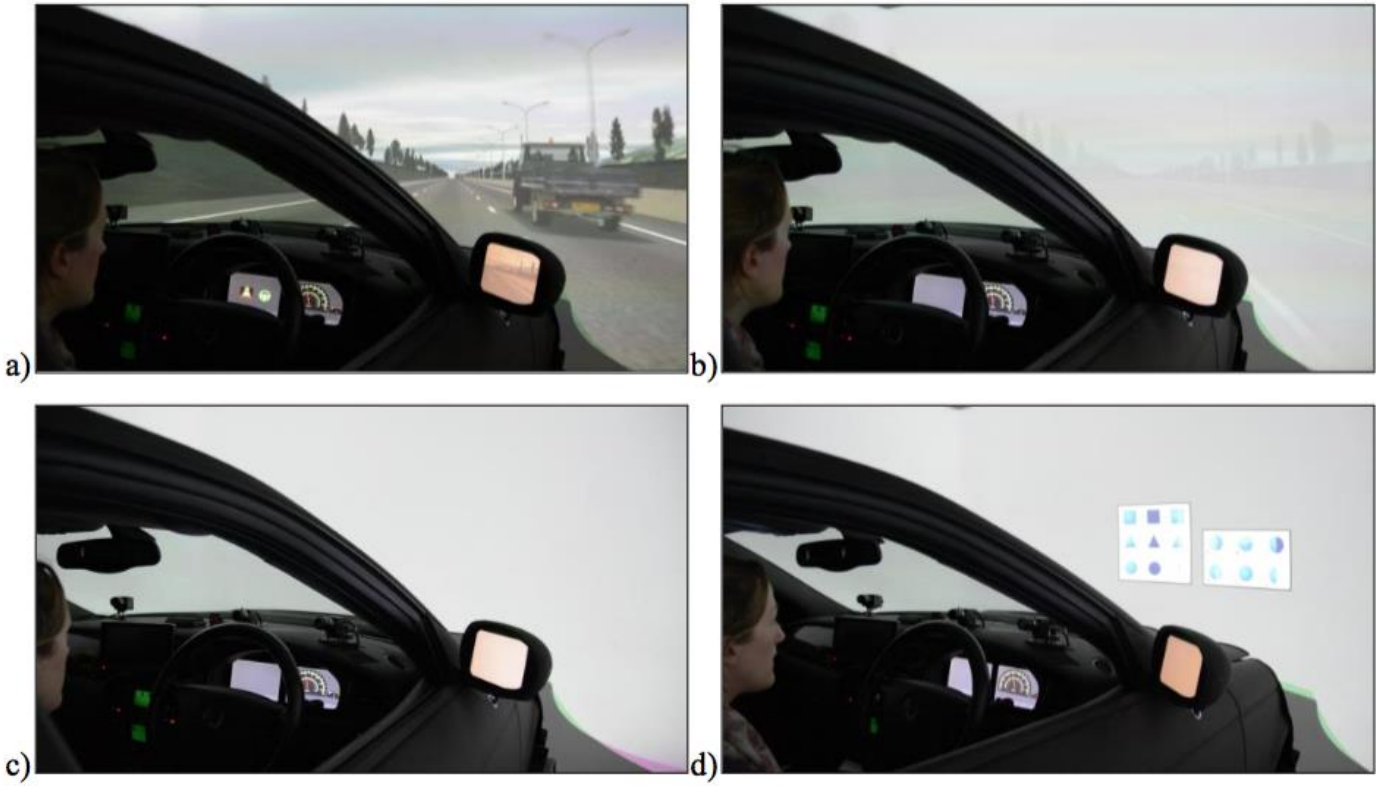
- Using the Ambient Light Display for driver support at different levels of automation
  - *Can we use the driver’s peripheral vision to provide information?*



// New Concepts, Methodologies and Measures

- How much time do drivers need to prepare for resumption of control?
- What is the optimal degree of information required for transition of control?
- Can an uncertainty signal keep drivers more aware of their surroundings?

//Simulating the “out of the loop” concept



//Design

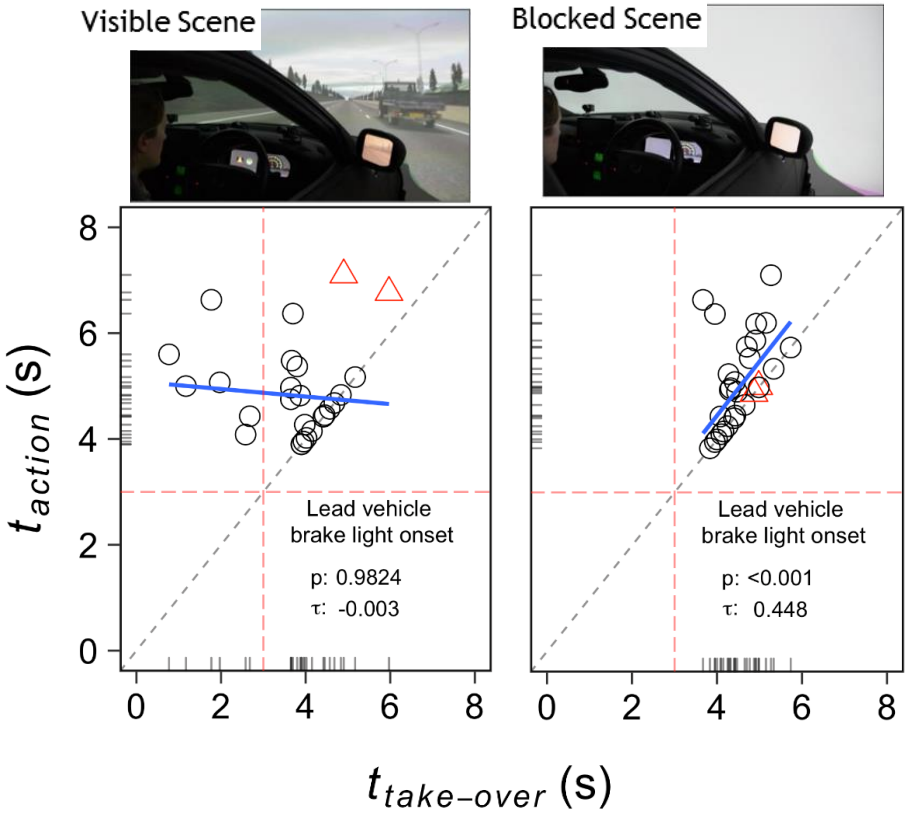
Uncertainty Alert, NOT Take Over request

Louw T; Madigan R; Carsten O; Merat N (2017) Were they in the loop during automated driving?
Links between visual attention and crash potential, Injury Prevention, 23, pp.281-286. doi: 10.1136/injuryprev-2016-042155.

// *Some* of the Findings *(Please refer to website for more details!)*

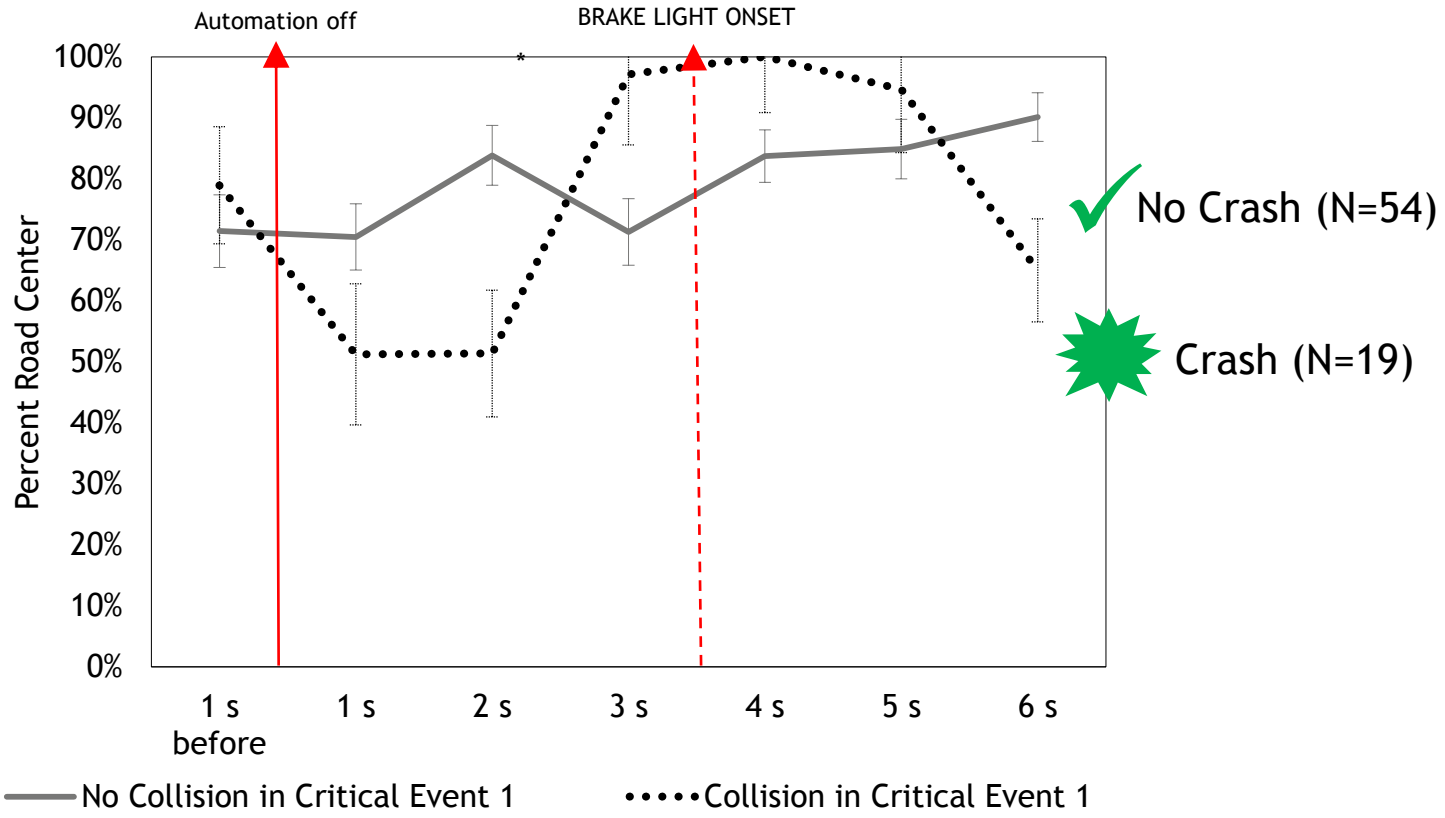
- Transition: Responses/reactions (e.g. touching steering wheel, or braking) in little as 3 seconds

- But this is ***not the same*** as safe and effective control!



Louw et al, 2017

// Eye-tracking data can be useful for understanding driver attention during resumption of control



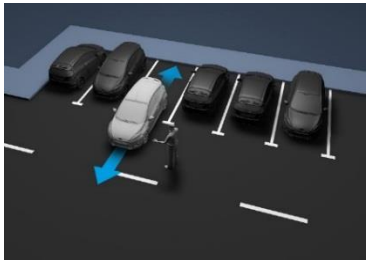
Louw T; Madigan R; Carsten O; Merat N (2017) Were they in the loop during automated driving? Links between visual attention and crash potential, Injury Prevention, 23, pp.281-286.

// *Some* of the Findings *(Please go to the website for more details!)*

- Engagement in other (2ndary) tasks increased resumption of control from automation

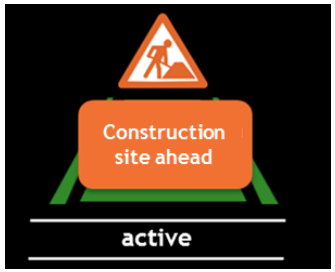
- Ambient Lightm Display can help with perception, comprehension and anticipation of information.

- No major cultural differences, across 12 countries, regarding usefulness of parking HMI



// *Some* of the Findings *(Please go to website for more details!)*

- Enhanced effectiveness of take-over request via:
  - Early take over announcements
  - Presentation of continuous information, regarding remaining time in automated mode
  - Displaying the necessary driving manoeuvre



// *Some* of the findings

- (Truck) HMI with fewer levels of automation preferred
- Less information on HMI preferred by truck drivers
- Higher traffic density resulted in quicker engagement of automation (Truck)

- Engaging/disengaging methods not intuitive
- Learning curve is shallow

//Challenges and Next Steps

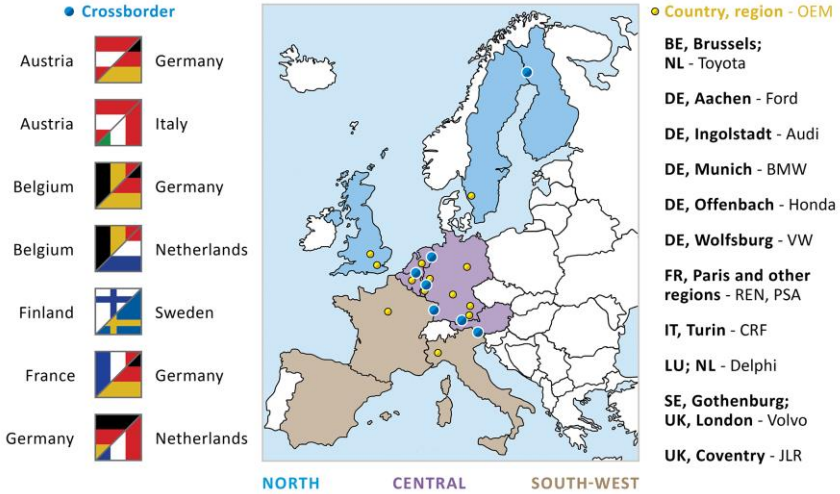
- Simulators are good for controlled studies but do not tell us about user experience in the real world
- Learning effects can be a problem – *one failure is enough to change behaviour*
- Experiments (what we ask people to do) need to become observations (what they actually do!)
- Difficult to study long-term effects of automation (e.g. fatigue, behavioural adaptation, skills degradation…….)
- Today's cabs will not tell us about tomorrow's problems
- We do not know much about different age groups and abilities

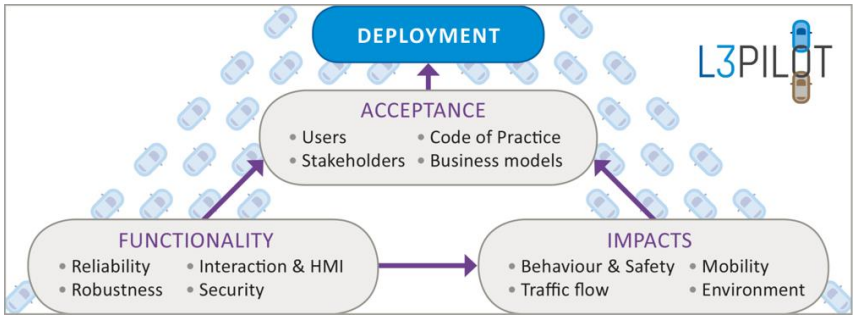
//Next: Piloting Automated Driving on European Roads

- Large-scale piloting of SAE Level3 function
- 1000 drivers, 100 vehicles, 11 European counties

L3Pilot Driving Automation

http://www.l3pilot.eu/





Co-funded by
the European Union

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Thank you.

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https://www.adaptive-ip.eu/index.php/deliverables_papers.html