UNIVERSITY OF LEEDS

Adapt/I/Ve

Automated Driving Applications and Technologies for Intelligent Vehicles

Overview of the Human Factors Experiments

Natasha Merat
University of Leeds

Final Event
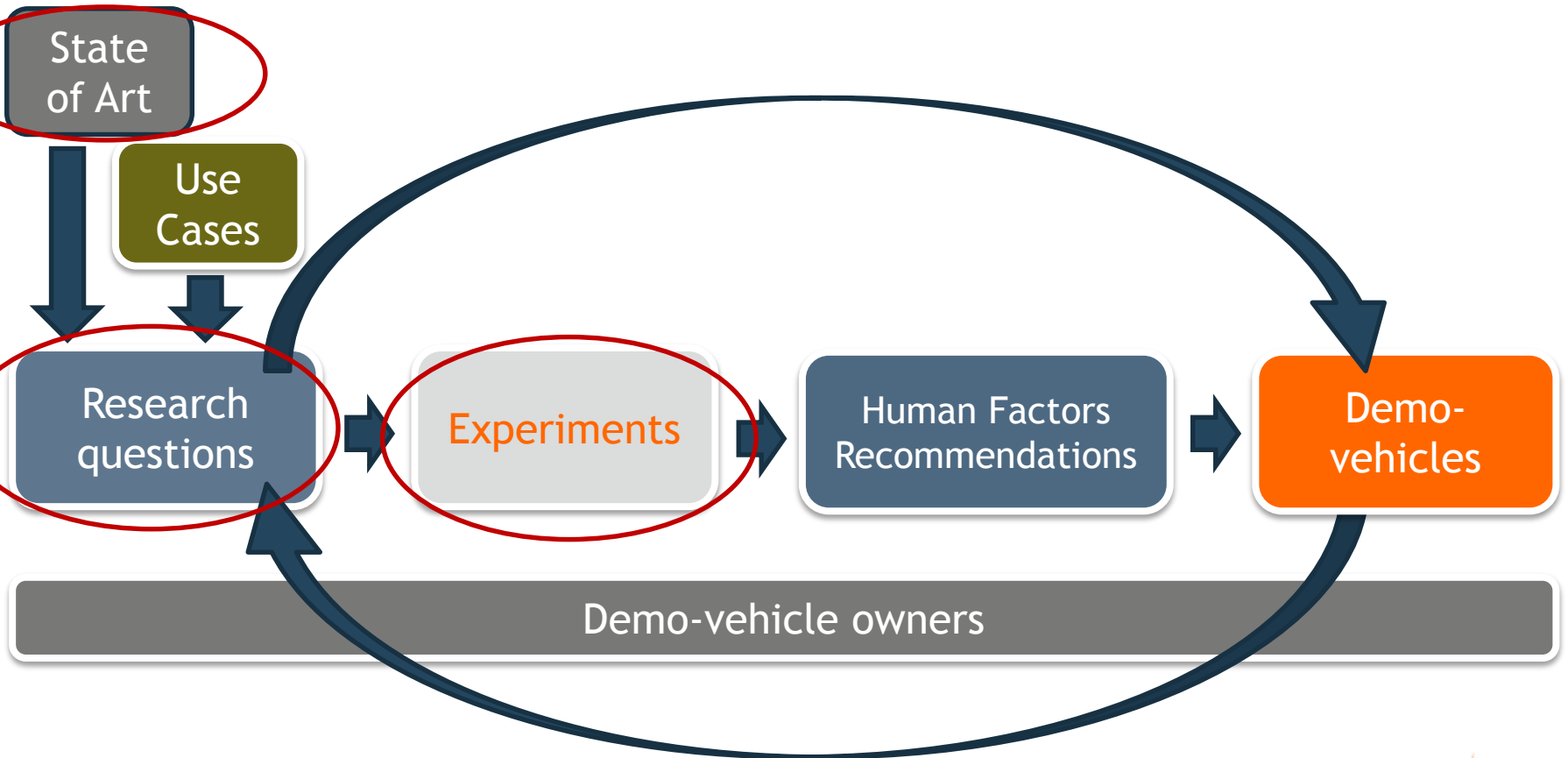Aachen, Germany
29 June 2017

//Main Objective

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

SAE Levels 2 & 3

AdaptIVe Final Event, Aachen

Adapt**I**Ve

//The Team

AdaptIVe Final Event, Aachen

Adapt∥Ve

//An Iterative Process

AdaptIVe Final Event, Aachen

Adapt|I|Ve

//SoA and Categorisation of Research Questions

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			

AdaptIVe Final Event, Aachen

AdaptIVe

//Experiments

- 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

- 17 MAIN Research Questions

AdaptIVe Final Event, Aachen
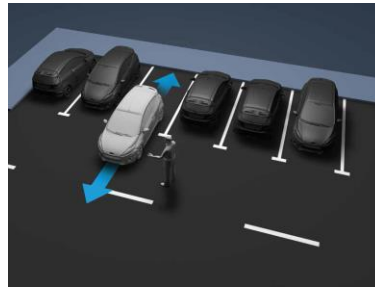
//New Concepts, Methodologies and Measures

- 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?*

AdaptIVe Final Event, Aachen
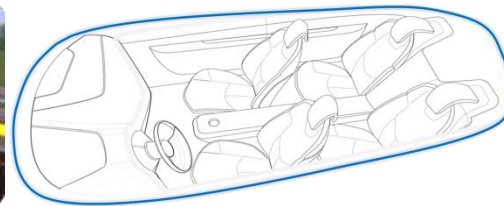
//New Concepts, Methodologies and Measures

- 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?
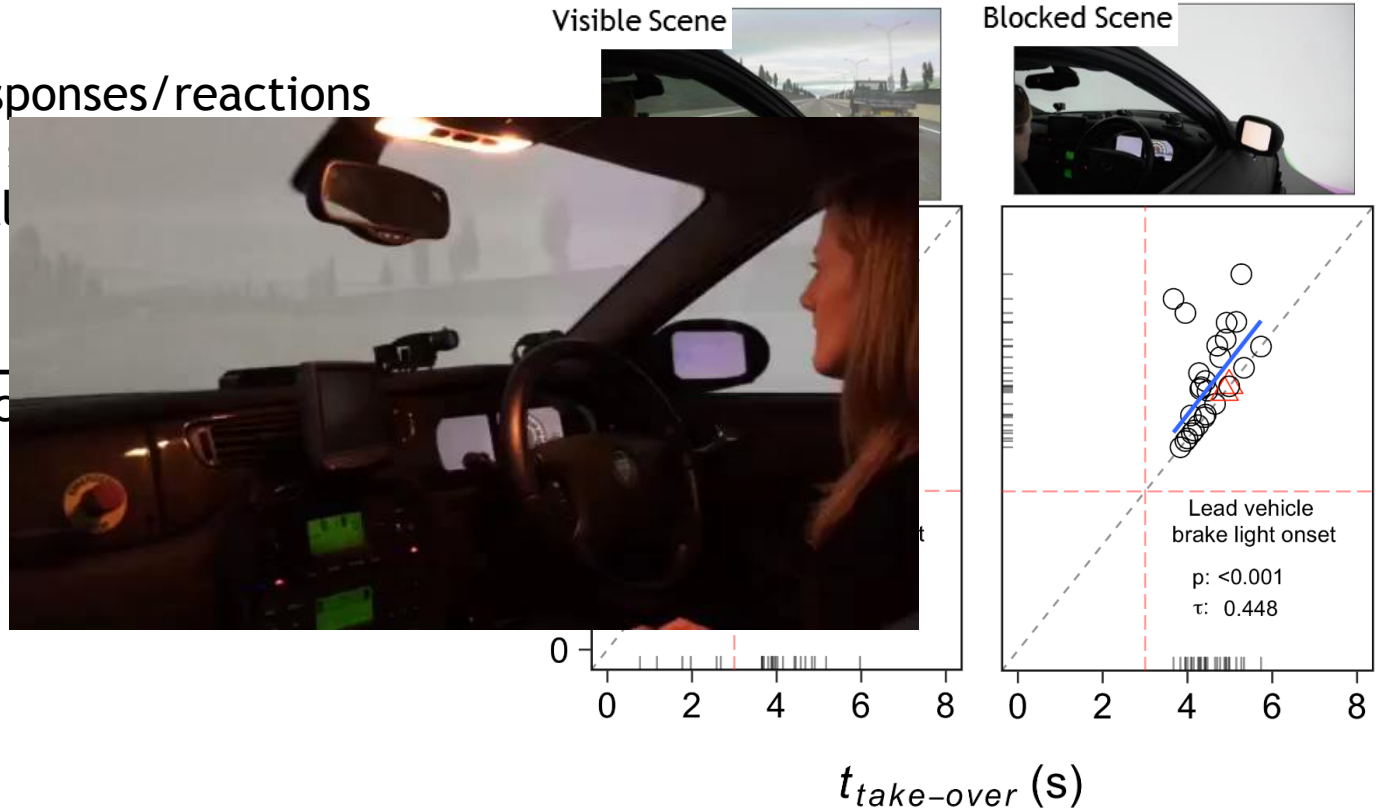
//New Concepts, Methodologies and Measures

- Can we provide effective, yet non-intrusive HMI for unpredicted, resumption of control?

- Is there a difference between continuous and discrete interaction for valet parking?

- Transition: Responses/reactions (e.g. touching braking) in littl

- But this is **not** and effective o

Louw et al, submitted

Visible Scene

Blocked Scene

Lead vehicle brake light onset

p: <0.001

τ: 0.448

$t_{take-over}$ (s)

Adapt!Ve

Eye-tracking data can be useful for understanding driver attention during resumption of control
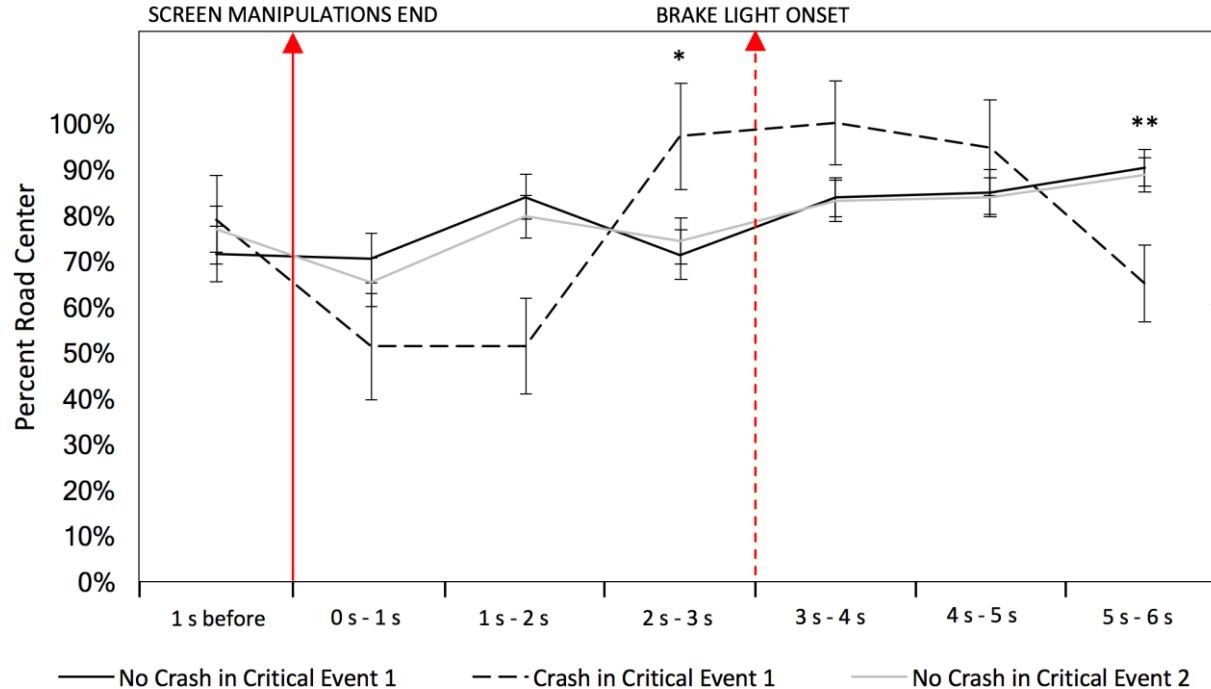
Louw T; et al, (2016).

AdaptIVe Final Event, Aachen

// *Some* of the Findings *(Please go to the posters 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

Adapt|Ve
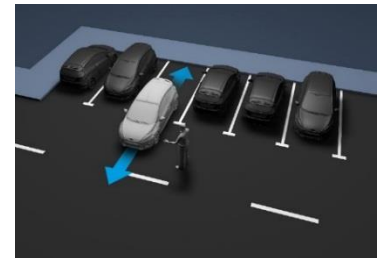
//*Some* of the Findings *(Please go to the posters for more details!)*

- 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

AdaptIVe Final Event, Aachen

//*Some* of the findings *(have you been to the posters yet? They have biscuits!)*

- (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

AdaptIVe Final Event, Aachen

Adapt**I**Ve

//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)
- Today's cabs will not tell us about tomorrow's problems
- We do not know much about different age groups and abilities

AdaptIVe Final Event, Aachen

Adapt|IVe

Co-funded by
the European Union

Adapt⫶Ve

**Automated Driving Applications and
Technologies for Intelligent Vehicles**

Thank you.

Natasha Merat
n.merat@its.leeds.ac.uk