Understanding the Human Factors Challenges of Automated Vehicles: Overview of the Work Conducted in Leeds

UNIVERSITY OF LEEDS

Natasha Merat, Tyron Louw, Yee Mun Lee, Ruth Madigan, Fanta Camara, Oscar Giles, Gustav Markkula, Richard Romano, Charles Fox, Daryl Hibberd, Albert Solernou Crusat, Foroogh Hajiseyedjavadi, Erwin Boer

Institute for Transport Studies, University of Leeds, Leeds, UK

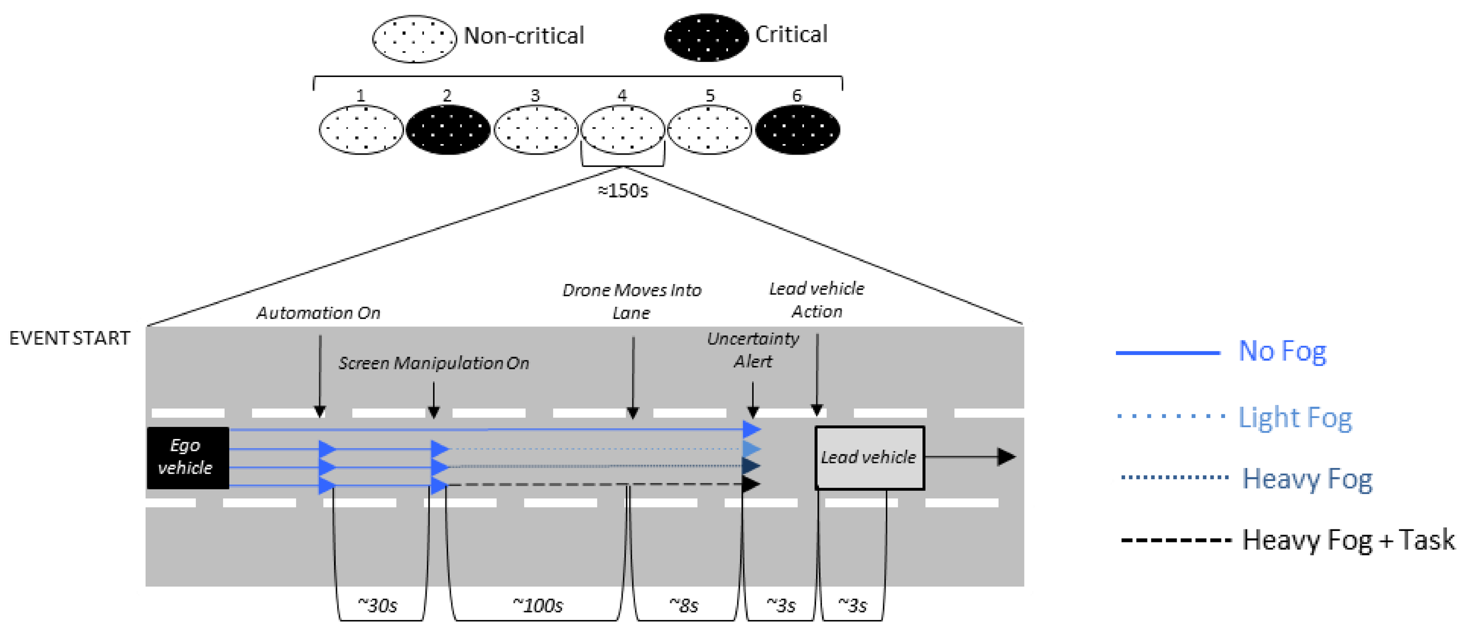
AdaptIVe – Automated Driving

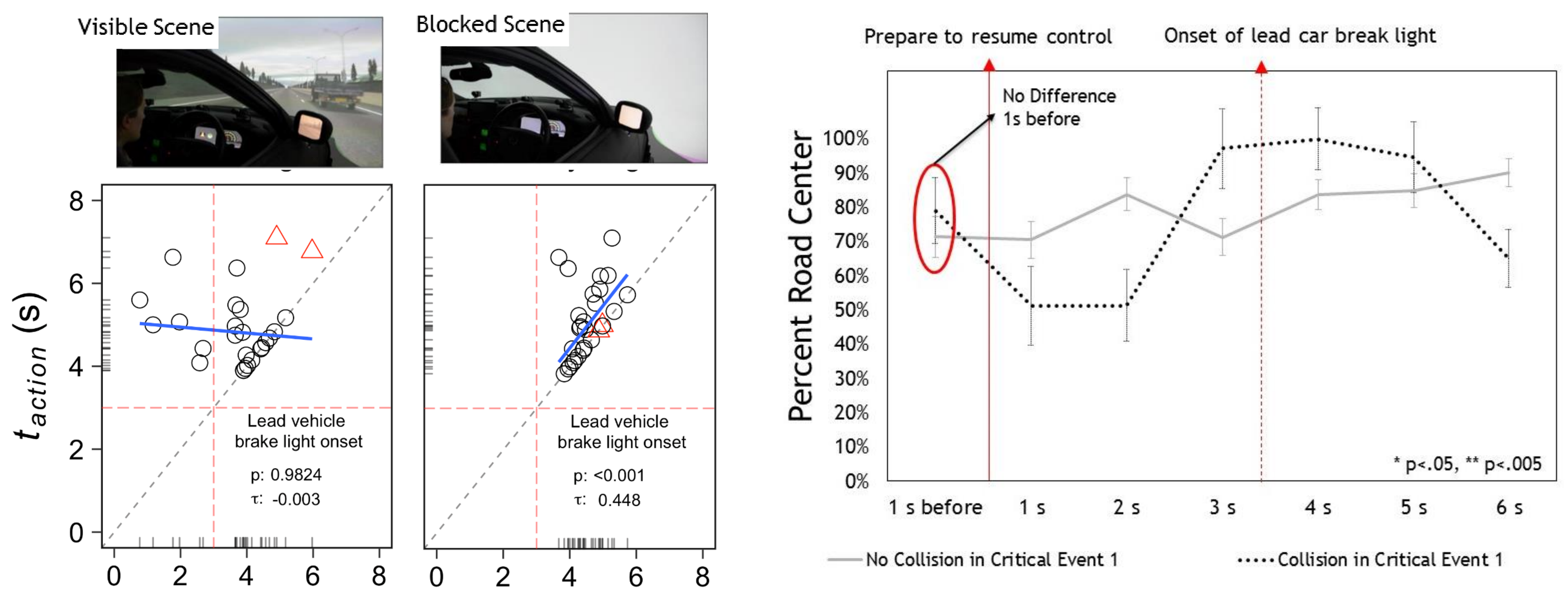
Coordinated by VW

www.adaptive-ip.eu

Main Objectives:

- Can we simulate the "out of the loop" phenomenon?
- Does performance change as a result?
- Is there any difference in pattern of eye movements?





Drivers' action vs take-over response (right) and eye movements (left)

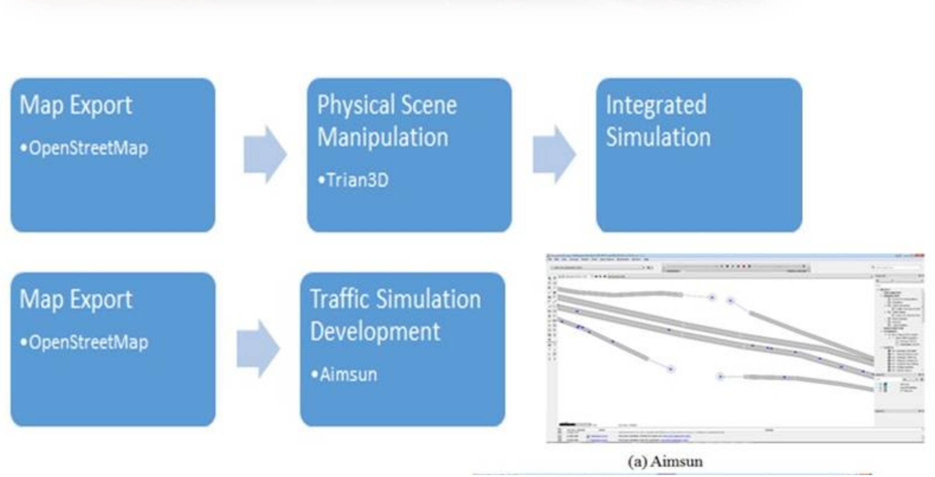
HUMAN DRIVE

Led by Nissan Motor Manufacturing (UK) Limited

http://humandrive.co.uk

Main Objective:

- Using machine learning to develop natural, human-like vehicle control
- Collecting driver behaviour in "the same" real and simulated world.
- Investigating performance for three levels of risk, and for quite challenging environments, such as U.K. narrow lanes and roundabouts.



Human factors questions:

- Do drivers prefer their "own" driving style, compared to that of the automated vehicle?
- How is trust and acceptance affected?
- What can auto-confrontation tell us about design of new systems?

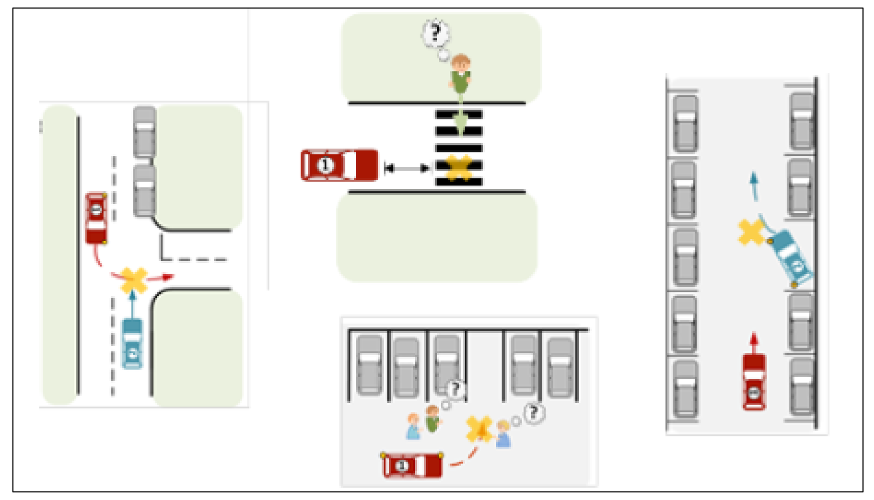
interACT

Led by DLR German Aerospace

www.interact-roadautomation.eu

Main Objectives:

- Study road users' interactions at un-signalised junctions, using observation protocols, questionnaires and videos
- Establish what types of communications are used between pedestrians and drivers
- Investigate if this information can be used to design external interfaces (e-HMI) for automated vehicles



The agreed use cases (above) and an overview of the Leeds site (right). X and Y denote position of observers

Questionnaires (67 UK)

- Demographic data
- Vehicle and driver information used to investigate crossing intention
- Road User Behaviour Questionnaire (Elliott & Baughan, 2004)
- Effect of other people, priority, safety and familiarity on behaviour.

Observation Protocol (243 UK)

- Behaviour of pedestrians during approaching and crossing phase, including movement of head, hands and feet.
- Behaviour of approaching vehicles, e.g. signals provided, vehicle movement, and drivers' eye, head and hand movement

Selected Papers

1. *Camara F; Romano R; Markkula G; Madigan R; Merat N; Fox C (2018) Empirical game theory of pedestrian interaction for autonomous vehicles, Proceedings of Measuring Behavior 2018 .*
2. *Fox C; Camara F; Markkula G; Romano R; Madigan R; Merat N (2018) When should the chicken cross the road?: Game theory for autonomous vehicle - human interactions, To be confirmed .*
3. *Madigan R; Louw T; Merat N (2018) The effect of varying levels of vehicle automation on drivers' lane changing behaviour, PLoS ONE, 13, . doi: 10.1371/journal.pone.0192190.*
4. *Markkula GM; Romano R; Madigan R; Fox CW; Giles OT; Merat N (2018) Models of Human Decision Making as Tools for Estimating and Optimizing Impacts of Vehicle Automation, Transportation Research Board Annual Meeting 2018.*
5. *Louw T; Markkula G; Boer E; Madigan R; Carsten O; Merat N (2017) Coming back into the loop: Drivers' perceptual-motor performance in critical events after automated driving, Accident Analysis and Prevention, 108, pp.9-18.*
6. *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*

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European Commission