interACT

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

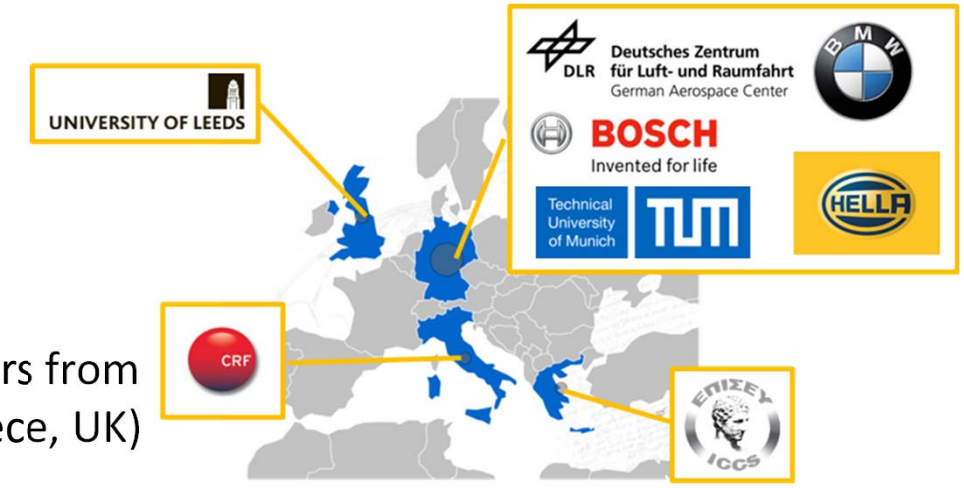
The EU project interACT – Designing cooperative interaction of automated vehicles with other traffic participants

Dr. Angelos Amditis

ICCS

Project facts

- **Programme:** EU/H2020-**ART04** - *Safety and end-user acceptance aspects of road automation in the transition period*
- **Duration**: 36 months
- **Period**: May 2017 – April 2020
- **EU Funding**: 5.527.581 €
- **Coordinator:** Anna Schieben, DLR
- **Partners:** 8 industrial and academic partners from 4 European countries (Germany, Italy, Greece, UK)
- **Project Officer:** Claudia Ciuca (INEA)
- **US - EU twinning project**: AVIntent (NHTSA)



Integrating automated vehicles in mixed traffic

Challenges of interACT

- The interACT project addresses the following challenges:
  - Safe integration of AVs (SAE level 3 and above) into complex, mixed traffic environments
  - Solutions for expectation-conforming interaction of AVs with other road users and on-board users
  - Increase in user acceptance and ease-of use by appropriate AV design
  - Increase the overall safety and reliability of AVs in mixed traffic environments

The challenge

5th Enabler

Methodology for assessing the quality of interaction

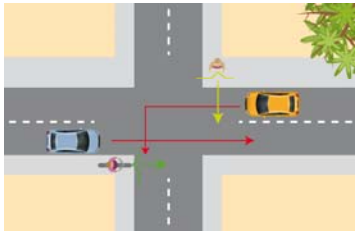
1st Enabler

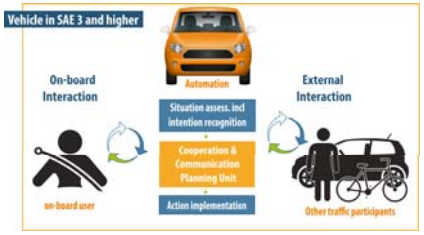
Psychological models

Achieve a safe, highly accepted and efficient integration of Automated Vehicles in mixed traffic environment

4th Enabler

Novel HMI elements





3rd Enabler

CCPU & safety layer

2nd Enabler

Intention recognition & behavioural predictions

Project objectives

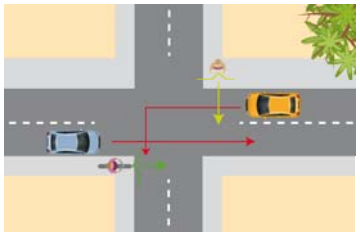
- **Develop psychological models of interaction** between different road users
- Novel technical methods for **assessing the intentions and predicting the behaviour** of other road users
- Develop the **Cooperation and Communication Planning Unit** (CCP Unit)
- Novel **human-vehicle interaction designs and HMI elements** for expectation-conforming behaviour of the AV
- **Safety layer and fail-safe trajectory planning** using formal verification to ensure safety and reduce certification costs
- Establish **new evaluation methods** for studying interaction of road user with AVs and user acceptance

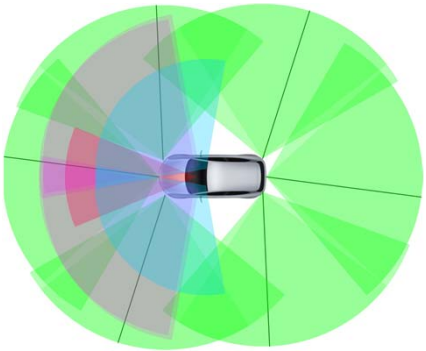
1st Objective:

Psychological models – results achieved

- Observational studies successfully conducted in three EU countries
- Findings used:
  - to refine the design of explicit and implicit communication strategies for AVs
  - to improve the situation assessment algorithms of the AV;
  - to design suitable interaction strategies and algorithms for the *CCP Unit* which ensure that the AV behaves in an intuitive and expectation-conforming manner
- Further details: https://www.interact-roadautomation.eu/cad-webinar-series-ix-interact-project/

2nd Objective:
Intention recognition & behavioural prediction

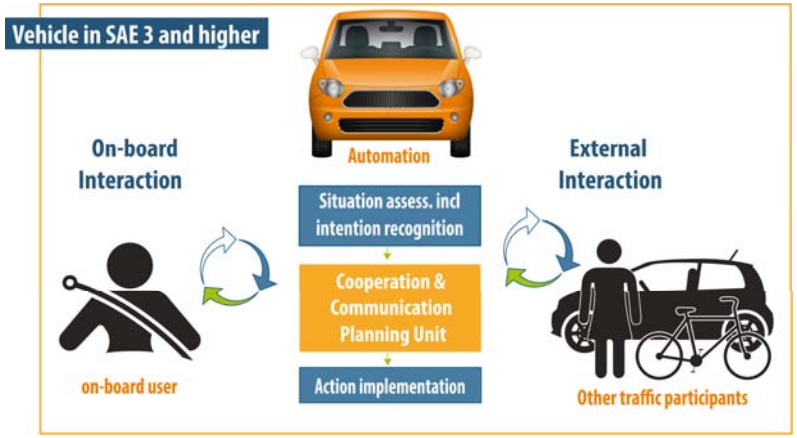




- Tracking system, which covers 360 degree around the ego vehicle (laser scanner, radar sensors, stereo video cameras)
- Pedestrians intention recognition and behaviour prediction incl. gesture recognition and smart phone data
- Extension of the time horizon for reliable prediction of vehicles movement from 1-2s, as is the case with physics-based prediction models today
- Further details: https://www.interact-roadautomation.eu/cad-webinar-series-xii-designing-cooperating-interactions-of-avs-with-other-road-users-interact-project/

3rd Objective:
Cooperation and Communication Planning Unit

- Matches the traffic situation with an interaction scenario (from a digital catalogue)
- Select an interaction strategy (integrated and time-synchronised planning of AVs behaviour and explicit HMI on-board and external), plans and monitors its execution
- Safety layer, calculating and initiating a minimum risk solution, if needed

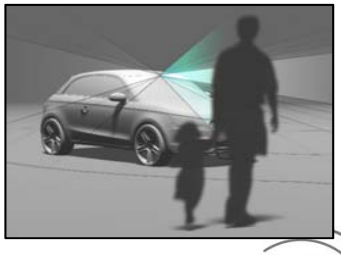


- Further details: https://www.interact-roadautomation.eu/cad-webinar-series-xii-designing-cooperating-interactions-of-avs-with-other-road-users-interact-project/

4th Objective:

Novel HMI elements

- Solutions for the three-way cooperation between all agents
- Under development:
  - 360° LED light band
  - Directed single lamp
  - On-board HMI LED band and additional displays



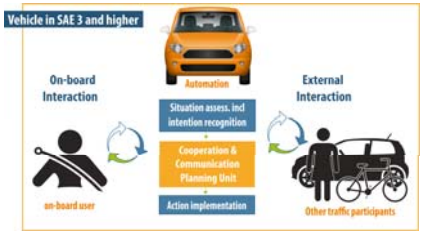
Upcoming activities

The challenge

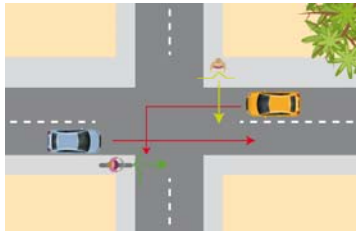
5th Objective
Methodology for assessing the quality of interaction

1st Objective
Psychological models

4th Objective
Novel HMI elements



3rd Objective
CCPU & safety layer



2nd Objective
Intention recognition & behavioural predictions

The challenge

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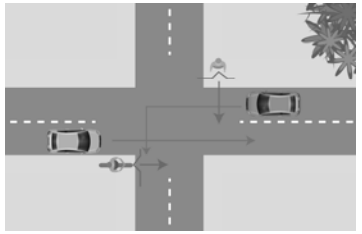
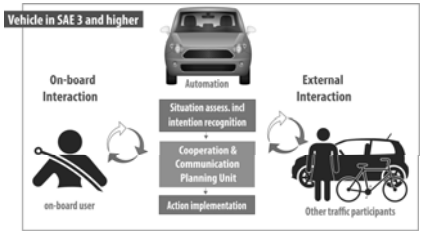
5th Objective
Methodology for assessing the quality of interaction

1st Objective
Psychological models

4th Objective
Novel HMI elements





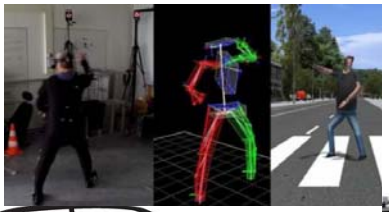
3rd Objective
CCPU & safety layer

2nd Objective
Intention recognition & behavioural predictions

5th Objective:

Methodology for assessing the quality of interaction

- Measuring cooperation capabilities of AVs with other road users is a completely new area of research.
- Develop methodologies required to measure and quantify how the on-board user, the AV and other road users establish and use each-others' intentions and behaviour
- Impact assessment and safety and user acceptance



Expected or potential impacts

- Impact on easy-of use and user acceptance of automated vehicles
- Impact on societal changes in the traffic environment
  - Traffic safety
  - Traffic flow
  - Changes in Mobility
- Impact on validation procedures for automated vehicles
- Impact on leadership position of EU vehicle industry (standardization and product innovations)

interACT video

interACT

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http://interact-roadautomation.eu

Thank you

Any questions?

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