TRA TRANSPORT RESEARCH ARENA

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A digital era for transport

solutions for society, economy and environment

interACT Work Package 2

How Do Traffic Participants Interact in Current Urban Scenarios and How this Helps when Designing Automated Vehicles

Motivation

Automated vehicles (AVs) will soon be introduced onto urban roads but road traffic will never be fully automated. **In the future,** we must ensure that the **AV can interact with other road users** in an intuitive, expectation conforming manner.

The **EU-Project interACT** aims to enable the safe integration of AVs into mixed traffic environments by designing, implementing and evaluating solutions for safe, cooperative and expectation conforming interaction of the AV with both its on-board user and other road users.

Methodology

Observations of traffic situations in **Leeds** (UK), **Athens** (Greece) and **Munich** (Germany) were conducted to analyze **current road user behavior**, using videos, LiDAR, eye-tracking, questionnaires and observation protocols. The different observation methods were temporally synchronized to create a holistic understanding of interactions in current urban traffic.

For the observation, two locations with two use cases each were chosen:

- Non-signalized **intersections**
- **Shared spaces**

The observation focused on interactions between two vehicles as well as interactions between vehicles and pedestrians.

Results

Most notably, **interaction** occurs only if the **velocity** of the vehicle in right of way is below a certain **threshold**. This means that at higher velocities interactions are highly unlikely and automated vehicles will not need to communicate with other road users. Furthermore, drivers tend to be **more cooperative** whenever they are **hindered to proceed** at their intended pace. Therefore, AVs might need to adapt their behavior accordingly.

Different **driving strategies** implicitly give hints to other road users about the driver's intention. For example, if a driver aims to let another vehicle turn on to his lane, he will open a gap, thus, signalizing the willingness to cooperate.

Novel communication interfaces, so called **external Human Machine Interfaces (eHMI)**, could enhance the interaction with other road users by **communicating the automation's intention** early. This may lead to a faster understanding of the automation's intention by the other traffic participants, which would potentially increase traffic flow.

Outlook

Interaction in traffic occurs today, which means that road users will expect AVs to behave in a comparable way. By using **implicit and explicit communication** automated vehicles could be introduced on to urban roads without disrupting accustomed traffic situations.

Observation of Urban Traffic

Fig. 1: Examples of the observation. Top left: T-Junction in Germany with schematic depiction of occurring interaction in between vehicles. Top right: Vehicle-Pedestrian interaction in Athens. Filmed from within the car including eye-tracking. Below: LiDAR images from a crosswalk in Munich.

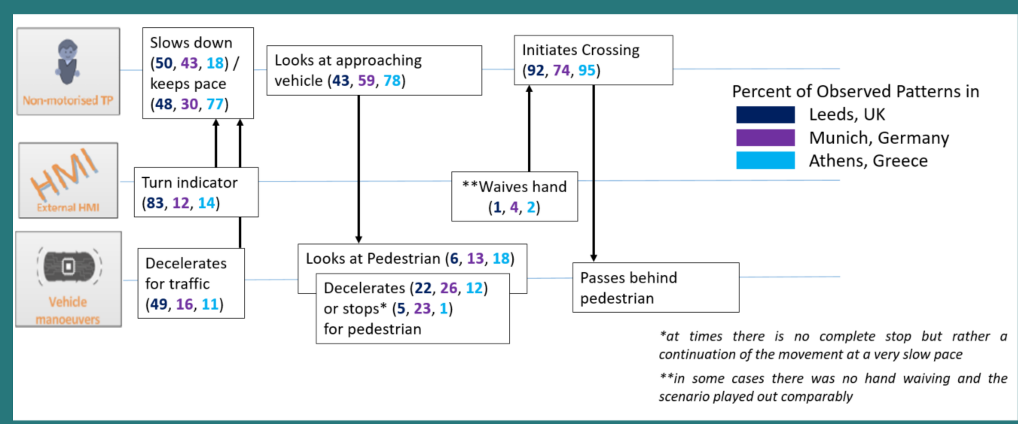

Fig. 2: Observed interaction patterns at intersections in Leeds, Munich and Athens. The frequency of occurrence (in %) was extracted from the manual observations at each intersection.

Potential Communication of AVs

Fig. 3: Pictures from the Pedestrian Simulator at the Technical University of Munich. Potential future communication strategies indicate intentions using different technologies. External Human Machine Interfaces can replace the driver in higher automation levels and extend communication ranges.

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

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