

Automated Vehicle Interactions in Urban Traffic

Ethnography-based design insights to tackle communication between automated vehicles and vulnerable road-users in uncertain, mixed, urban traffic situations

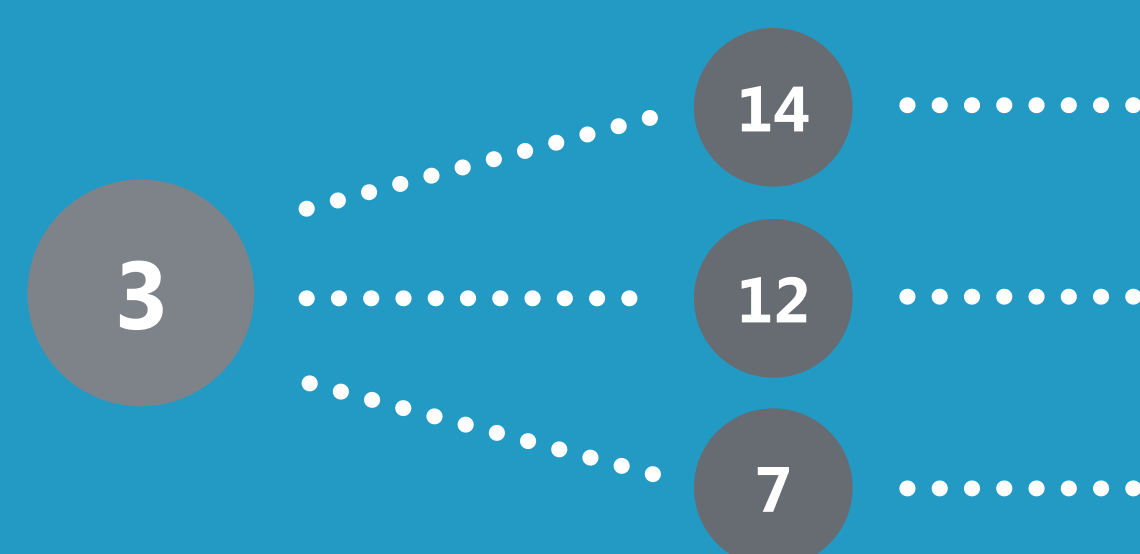
Motivation

The complexity of unregulated mixed traffic situations remains one of the biggest challenges for deploying Automated Vehicles (AVs) in urban environments. An absence of messages and information from AVs regarding their future behaviour as well as their potential inability to negotiate with other traffic participants might reduce trust and the feeling of safety of Vulnerable Road Users (VRUs) in urban traffic. AVs providing early, reliable information to VRUs, on the other hand, could clarify complex situations more effectively in the future. So far, little research has been done on understanding the meaning and dependence of signals exchanged between drivers and VRUs. By applying ethnographic methods, the goal of this study was to understand the VRU's perception of such signals and vehicle behaviour in a naturalistic environment, in relation to individual experiences and cultural background. Using these insights for the design of external Human-Machine Interfaces (eHMI) of AVs, this research aims to improve the decision-making process of VRUs when interacting with AVs in complex, urban, mixed traffic situations, providing a more effective and intuitive means of communication.

The study

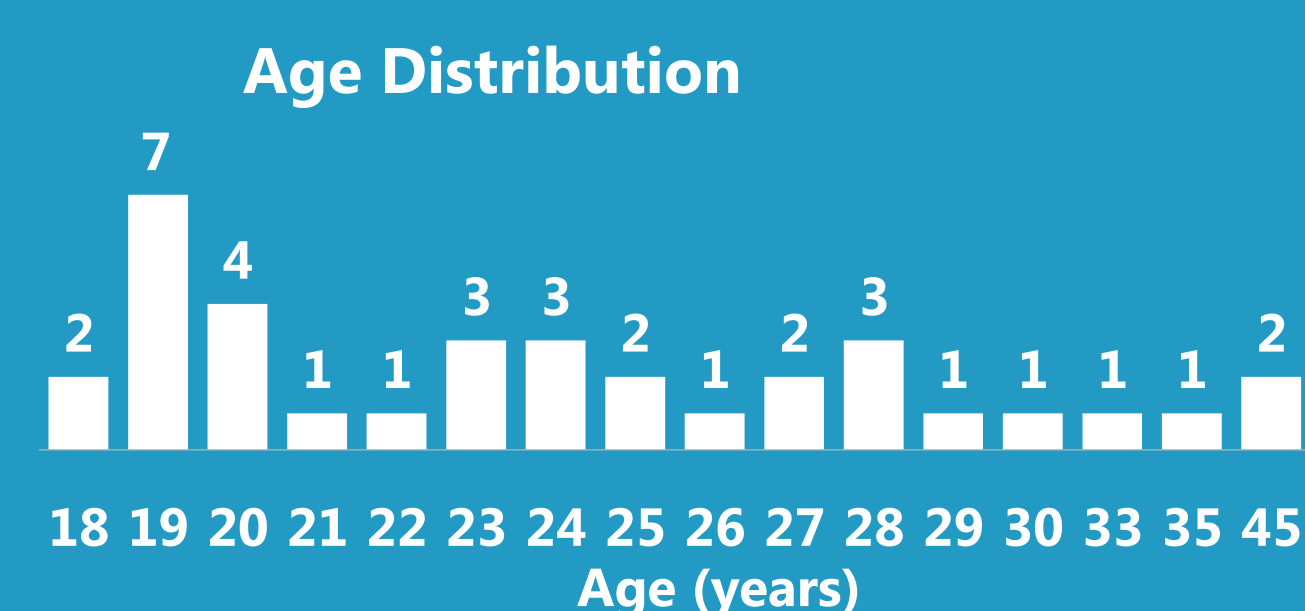
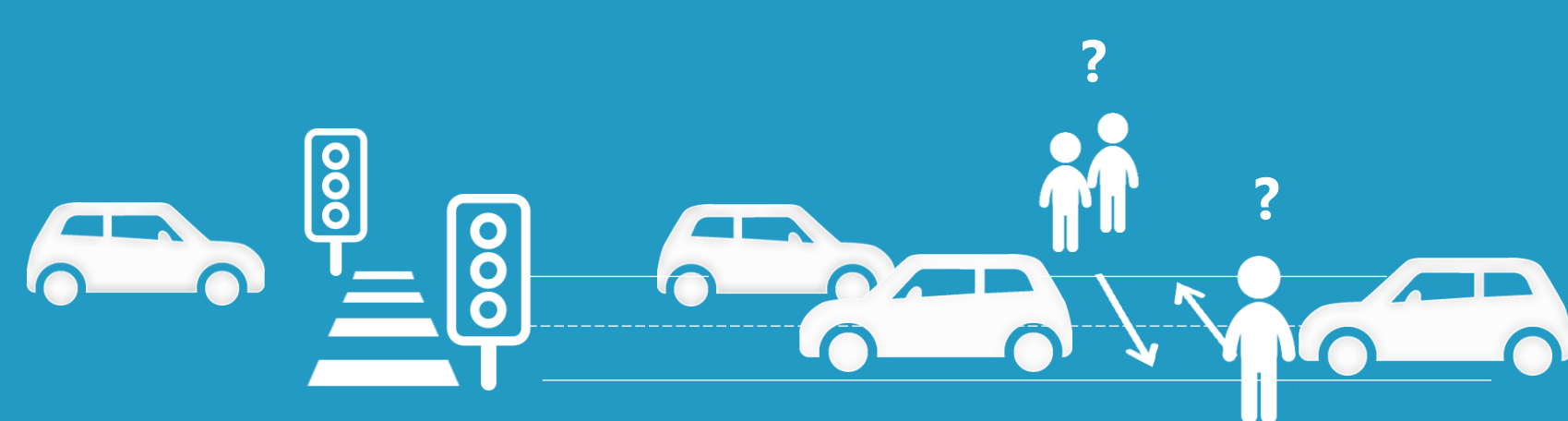
The research was conducted in Leeds, UK, in collaboration with the EU H2020 project, interACT, focusing on pedestrians' decision-making processes. The researchers observed pedestrians crossing in between gaps of upcoming traffic and conducted 34 semi-structured interviews with 42 pedestrians directly after their crossing manoeuvre.

Phases of data collection **Observations & interviews** **Focus of the data collection- and analysis phase**

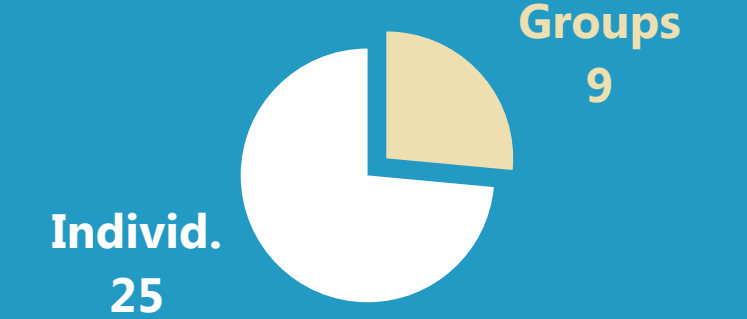


Building own theoretical frameworks to analyse pedestrians' decision-making
Exploring influence factors on pedestrians' decisions using own theoretical frameworks
Limitation on pedestrian's **decision-making when having driver contact**

Gender Distribution



Individuals vs. Groups



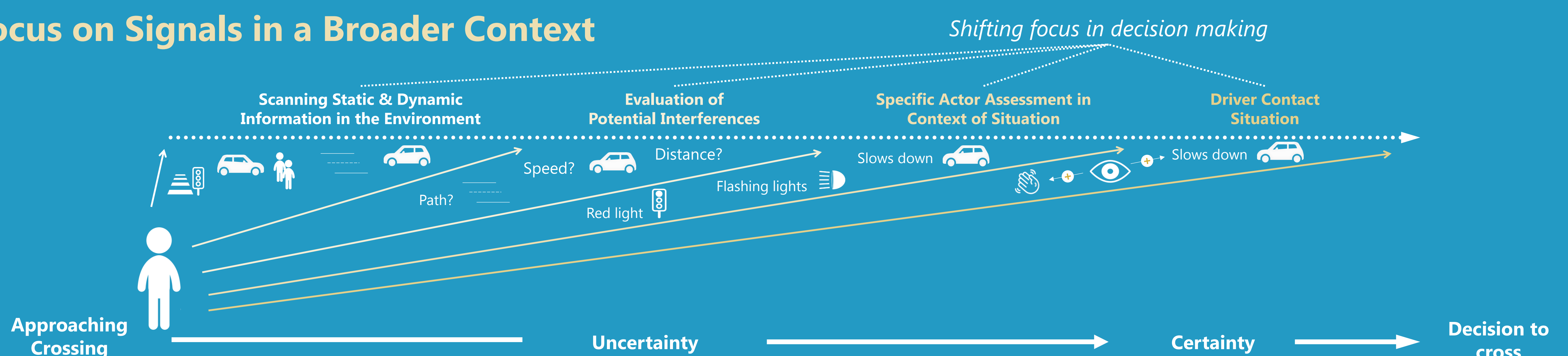
Preliminary Conclusions

- The same signal might convey a completely different thing depending on the situation. Today, VRUs are used to not only understand signals as they are but know what they mean in the context of a situation. Understanding the meaning and relevance of a signal, therefore, relies on our ability to perceive and comprehend them in relation to static, and dynamically changing information of the traffic environment. Thus, a signal from the car or a driver is usually not the only single piece of information that needs to be understood by VRUs in this dynamically changing context.
- Vehicle-based signals might not be immediately understood by VRUs. Rather, these signals evoke an uncertain expectation of the VRU on future behaviour of the vehicle. Furthermore, the study showed that expectations depend on the individual's understanding of a signal in the context of a particular situation, as well as on the individual's cultural background.
- As one of the main findings when focusing on driver contact situations, VRUs reported an increased feeling of safety and acknowledgement when having had eye contact, or seen where the driver looked in combination with another clarifying signal such as a hand wave from the driver or further deceleration of the vehicle, informing the VRU that it is safe to cross.

eHMI Relevance

- The results of this study suggest that eHMI signals will likely be just another piece of information in the broader context of a situation, evoking a specific expectation of the VRU on future behaviour of the AV.
- New eHMI signals should be evaluated in regards to the certainty by which a VRU is able to predict future behaviour of AVs.
- ... and to what extent this certainty varies when the context of the situation changes, or the cultural backgrounds of the VRUs differ.

Focus on Signals in a Broader Context



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