Enhancing the transport IoT of the future: towards extended reality HMIs

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Enhancing the transport IoT of the future: towards extended reality HMIs

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This project aims to explore whether augmented reality (AR) technology is suitable for communication between automated vehicles (AVs) and vulnerable road users (VRUs).

Several AR designs have been proposed, and user tested to measure factors such as interpretability, and trust, with increasing ecological validity .

Background

- Removal of **driver explicit cues** in urban environments would give rise to **confusion** in **vulnerable road users** (VRUs).
- Currently proposed **external human-machine interfaces** (eHMIs) **suffer** from **several drawbacks**, especially when **multiple interaction partners** are involved.
- We propose a **solution** whereby the **interface** is **presented individually** to the **VRU** using **AR technology.**
- So far, several interfaces have been **designed**, and are currently being **evaluated** using **questionnaires**, **simulators**, and **real-world studies**.

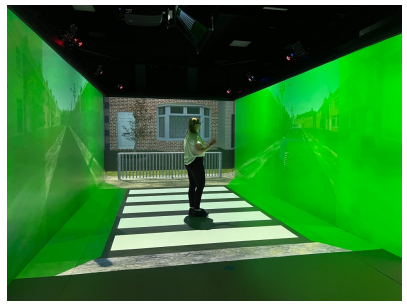

Fig. 1: Simulating road crossing behavior guided by the designed AR interfaces in the Highy Immersive Kinematic Experimental Research (HIKER) pedestrian lab at the University of Leeds.

Interfaces

The design process behind these Interfaces has been presented in:

Tabone, W., Lee, Y. M., Merat, N., Happee, R., & De Winter J. C. F. (2021). Towards future pedestrian-vehicle interactions: Introducing theoretically-supported AR prototypes. *Proceedings of the 13th International Conference on Automotive User Interfaces and Interactive Vehicular Applications* (pp. 209–218).

User evaluation

- Conducted an online questionnaire study with N=992 participants across five countries.
- **Traditional** and **familiar** traffic design elements seem to work **better** than other concepts generated by **experience-based design** methodology.
- Preference towards **traditional** and **familiar** traffic elements.
- Increased **ecological validity** by perfoming user evaluation in a **pedestrian simualtor**.
- Intitial results indicate **higher intutitiveness** scores from the online study, but **similar pattern** for **interface preference**.
- Next stage is to **further increase** the ecological validity by evaluating the **AR interfaces** in **a real-world** study.
- A **design guideline** is also possibly achievable following all stages of **user evaluation**.

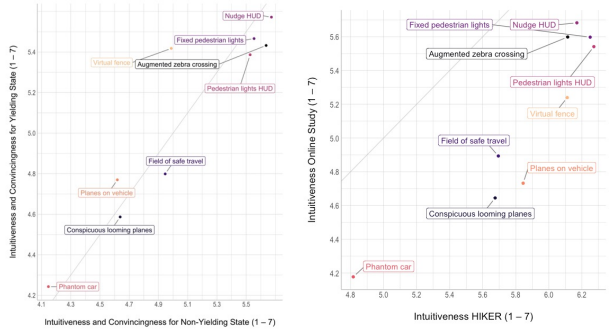

Fig. 2: Self-reported intuitiveness ratings across all interfaces for the online study (left) and ratings for the online, and pedestrian simulator study (right). Notice the emerging patterns between both scatter plots.

Latest Publication

Tabone, W., Happee, R., García, J., Lee, Y. M., Merat, N., Lupetti, L., & De Winter J. C. F. (2022). Augmented reality interfaces for pedestrian-vehicle interactions: An online study. *Under review*.

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