How do cyclists communicate their intent at intersections?

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Hi-Drive
Designing Automation

The main objective:

To quantitatively model the interaction between cyclists and vehicles at unsignalized intersections

BACKGROUND

- Cyclists' share of fatalities is increasing.
- In 2016, a student died in the observed intersection (Fig. 1) at Lindholmen in a bike-truck accident.
- We investigated the cyclist-vehicle interactions in three different studies.
- By devising predictive models, we help AVs (Automated vehicles) to safely interact with cyclists.

Fig.1: Observed intersection in Gothenburg, Sweden

Study 1 – Naturalistic field data

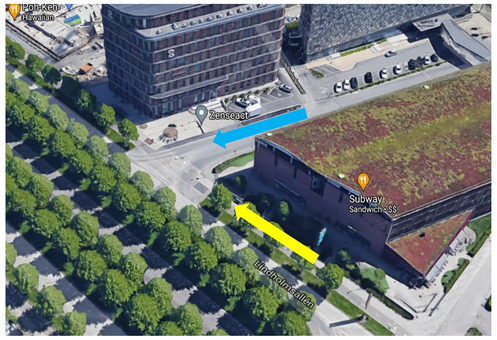

Fig. 2: Real intersection at Lindholmen, and the moving directions (car, and bicycle, blue and yellow arrow, respectively).

- We collected data from the same intersection as figure 1 (Fig. 2)
- 105 interaction events were captured between cyclists and vehicles. A logit model was developed to predict which road user will yield at the intersection.
- Kinematics (speed and distances), and cyclist's behavioral cues (pedaling and head movement), helped predict cyclists' yield decisions.

Study 2 – Riding simulator

- 27 volunteers rode a bike simulator in the same intersection, with an approaching motorized vehicle (Fig. 3).
- Independent variables: time to arrival to the intersection and visibility condition.
- Communication and eye contact plays an important role in cyclists' decision making

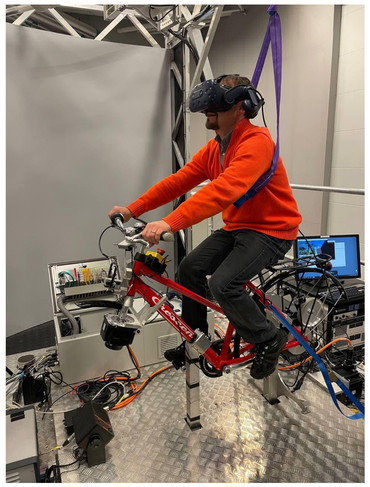

Fig. 3: Bike simulator compartment at VTI facilities

Study 3 – Driving simulator

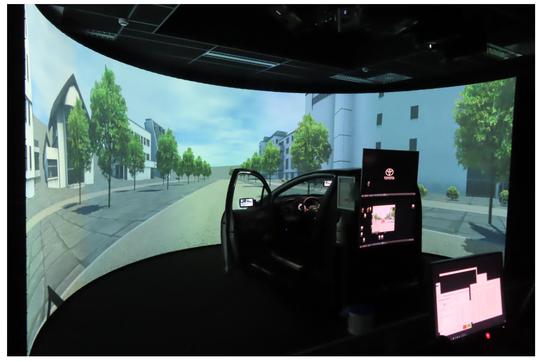

Fig. 4: Driving simulator at TME facilities

- The same intersection was simulated for 60 volunteer drivers (Fig. 4).
- Independent variables: time to arrival at the intersection, cyclist's speed, and visibility condition.
- Motion sickness was a challenge.
- The data analysis to determine what variables influence drivers' yield decisions is ongoing.

LATEST PUBLICATION

- Mohammadi, A., Piccinini, G., Dozza, M. (2023). How do cyclists interact with vehicles at unsignalized intersections? Modeling cyclists' yielding behavior using naturalistic data, Journal of accident analysis and prevention
- Mohammadi, A., Dozza, M. (2023). How do expert and non-expert drivers interact with cyclists at unsignalized intersections, 11th international cycling safety conference

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