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Can a driving simulator assess the effectiveness of Hazard Perception training in young novice drivers?

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Introduction

Hazard perception (HP) is receptive to training. Yet, there is no consensus on an optimal training program or acceptable measures to assess effectiveness. We aimed to evaluate a **simulator based hazard perception test** (SBHPT) for assessing improvements in HP skills of trained young-novice drivers, relative to a control group, and relative to a group of experienced drivers who served as gold standard.

Method

Participants. Thirty nine young- novice drivers, 17-18 year-olds with less than three months of driving experience, underwent one of four HP training conditions (AAHPT active, hybrid, RAPT and control) prior to the testing phase. Six experienced drivers (mean age 26, with more than 8 years of driving experience,) completed the test phase.

Driving Scenarios. Use of a variety of traffic environments is important as the driving environment dictates the type and frequency of hazardous situations. The simulated drive consisted of 8 urban and 6 residential scenarios merged into a single 18 km drive. Two pairs of urban and residential scenarios are detailed in Table 1. Sample snapshots are shown in Figures 1 and 2.

Table 1 Description of scenarios and events

Scenario	Description	Event
R1-R2	Residential road with parked vehicles either on the right side of the road or on the left, but not simultaneously on both sides.	In R1, one of the parked vehicles pulls out into the driver's lane (without signalling) which requires immediate braking (materialized). In R2, using the same road, there were no planned events (potential).
R3-R4	Residential road, the driver approaches a midblock crosswalk.	In R3, the crosswalk is partially obscured by parked vehicles and dictates slowing down. Following the crosswalk, a parked vehicle pulls out into the driver's lane which like in R1, requires immediate braking (materialized). In R4, the crosswalk is visible to the driver.
U1-U2	An urban main road with a sharp curve.	In U1, a stopped vehicle is located behind the apex of the curve, obscured from the driver until passing the apex. Looking across the curve is not possible due to vegetation (materialized). In U2, there were no other cars in the scene.
U3-U4	An urban main road with a midblock separation. The driver follows a bus. The bus stops at the bus station.	In U3, a pedestrian from the curb on the opposing side runs toward the bus station (materialized). In U4 no planned events happen (potential).

Figure 1. Sample snapshots of events in urban scenarios. Left: a curve in the road (U1-U2). Right: a bus parked in the station and a pedestrian (marked by an ellipse) crossing the road to catch it (U4).

Figure 2. Snapshots of events in residential scenarios. Left: a parked vehicle (arrow is for emphasis) pulls out into the driver's lane (R1). Mid: a crosswalk partially obscured by parked vehicles (R3). Right: a clear view of a crosswalk (R_4).

Results and analysis

Driver velocity was sampled every 2m. Average velocity among individuals of the same group (AAHPT active, hybrid, RAPT, control, experienced) was calculated for each point. Generating 600 sampling points per group per scenario. Using cubic smoothing spline, a smooth curve was fitted to each set of observations for each group (solid line in Figure 3). A statistical test was then conducted to examine whether the five separate curves, fitted for each group, could be replaced by a single curve (i.e., that all groups chose their speed in the same way). For all 8 scenarios, the group curves could not be combined into one. Since groups were different, additional descriptive examinations were made.

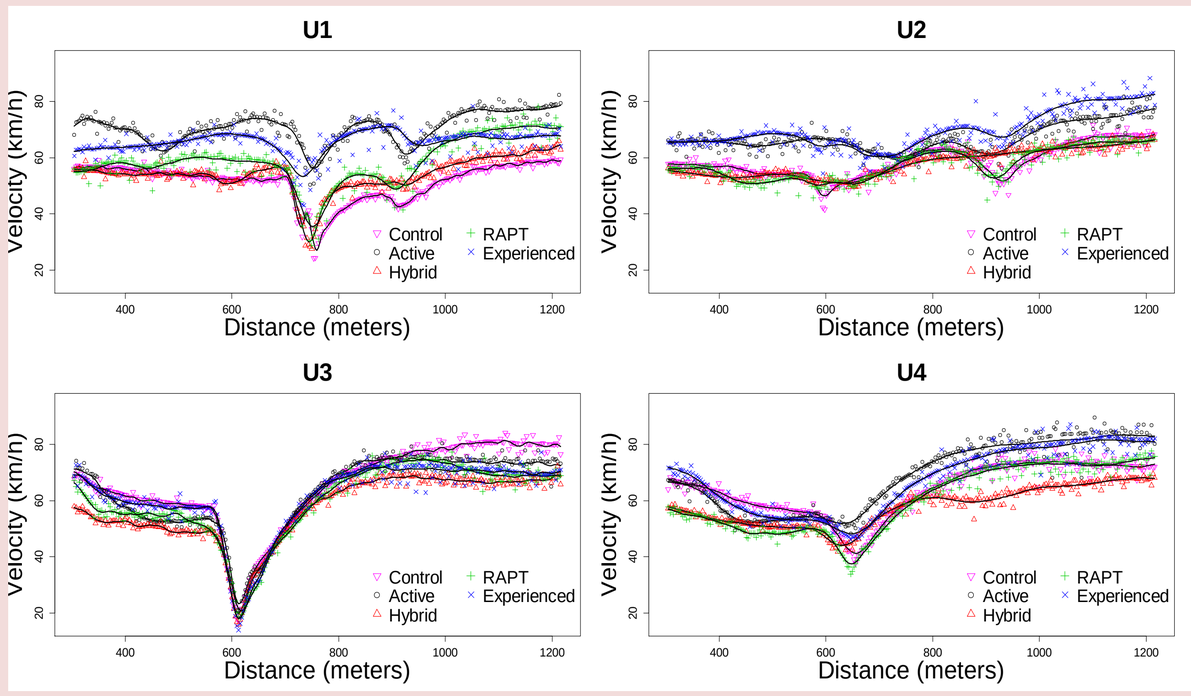

Figure 3. The distribution of longitudinal velocity sampling points per each group, per points along scenarios U1-U4. Solid lines are the fitted longitudinal velocity curves.

Conclusions

- Group-related metrics can discriminate among driver groups.
- Patterns of driving behaviour can be evaluated via driving speed.
- Comparisons to control, and to experienced drivers complemented; where the resemblance of trainees was higher to control, they tended to resemble the experienced group less.
- Events that require a complete stop are less diagnostic than events that require slowing down but not a complete halt.