

Driver attention during partially automated driving: Insights from reference drivers' glance behaviour

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Introduction

Driver Monitoring Systems (DMS) are meant to ensure sufficiently engaged drivers while using an L2 driving assistance feature. However, setting effective criteria for assessing driver engagement is a challenging task. This work investigates three selected hypotheses on glance behavior as shown by reference drivers:

- **H1:** The duration of long glances towards secondary task-related areas decreases with vehicle speed.
- **H2:** Glance behavior towards mirrors is similar between supervised driving and manual driving.
- **H3:** Traffic relevant objects in the frontal scene are fixated at least once while they are visible.

Method

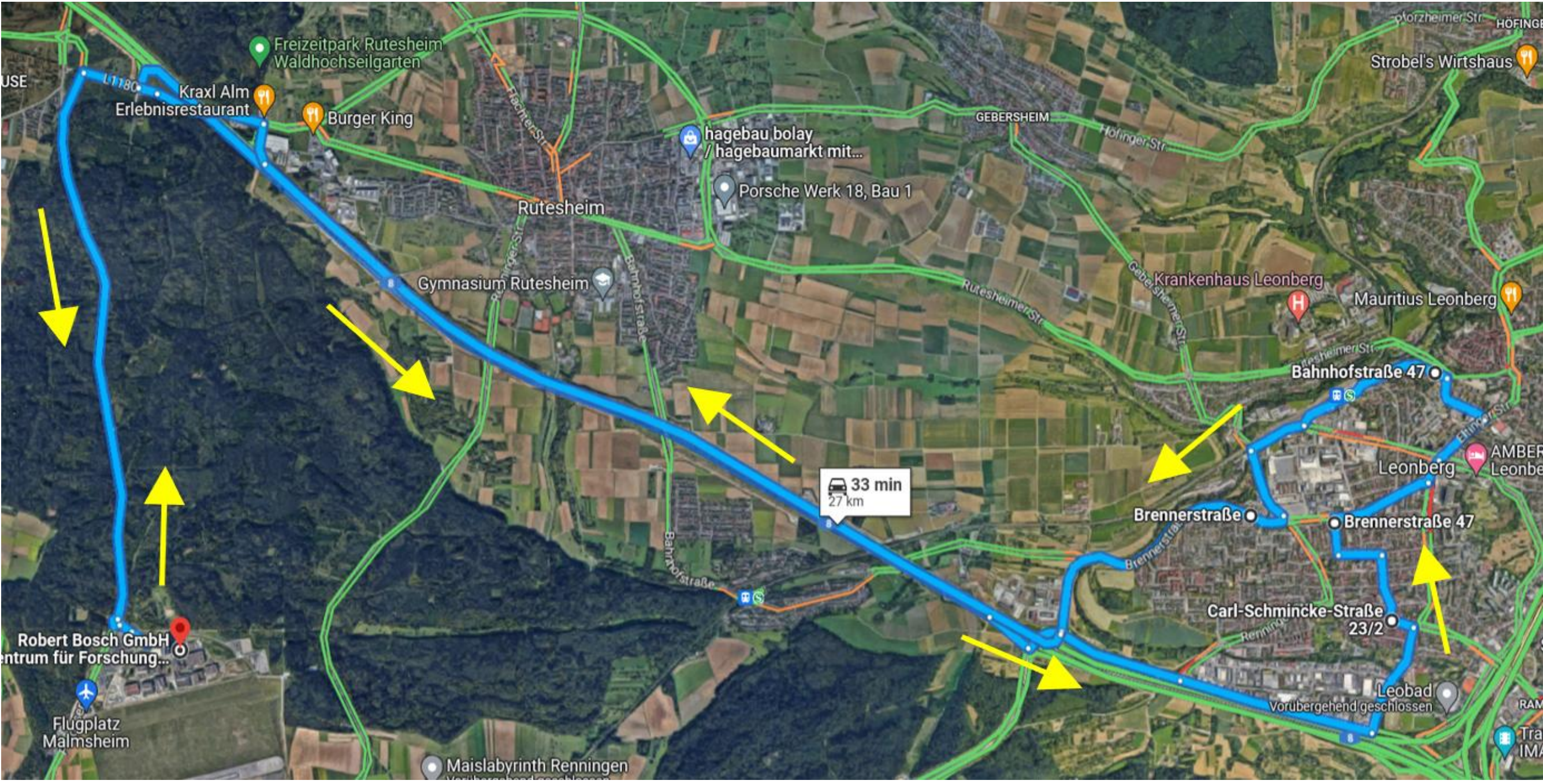
Sample: Four experienced driving instructors were recruited as "reference drivers".

Vehicle: A passenger car was modified to simulate a SAE Level 2 hands-free feature using a Wizard-of-Oz approach.

Procedure: Each driver completed multiple drives on a public track (rural, motorway, urban) under three conditions:

- "max": L2 feature supervision only (maximum attention)
- "tablet": L2 feature supervision + tablet-based secondary task
- "man": Driving the vehicle in manual mode

Data: Data recording included eye-tracking, vehicle data, and continuous manual annotation of the driving situation.



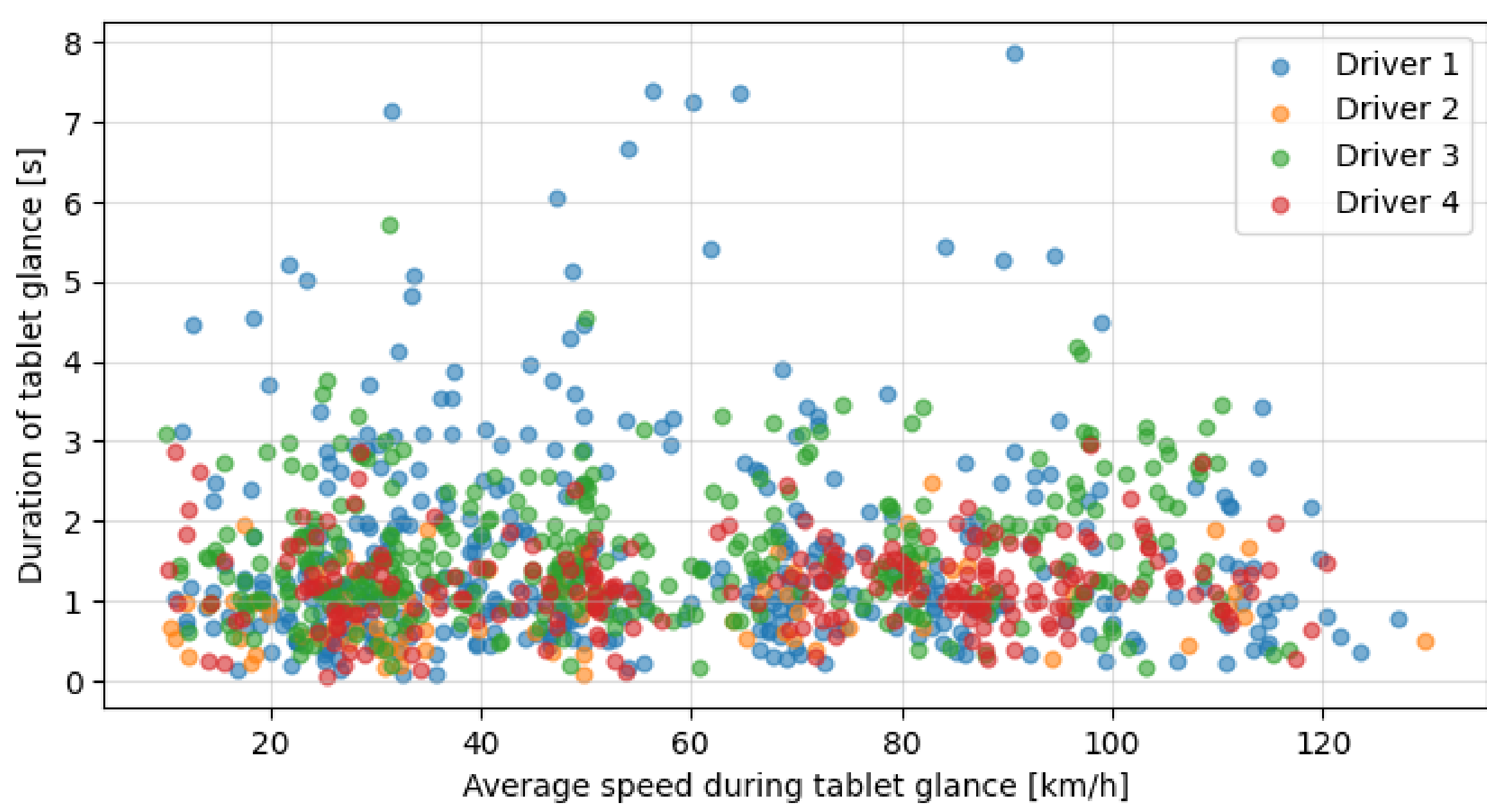
Conclusion

Analysis of driving instructors' (contextual) glance behavior can serve as a reference how to set criteria for driver engagement assessment. Accurate warning algorithms should be tuned to avoid false alarms (e.g., by not warning reference drivers) while remaining highly sensitive to detect inappropriate glance behavior.

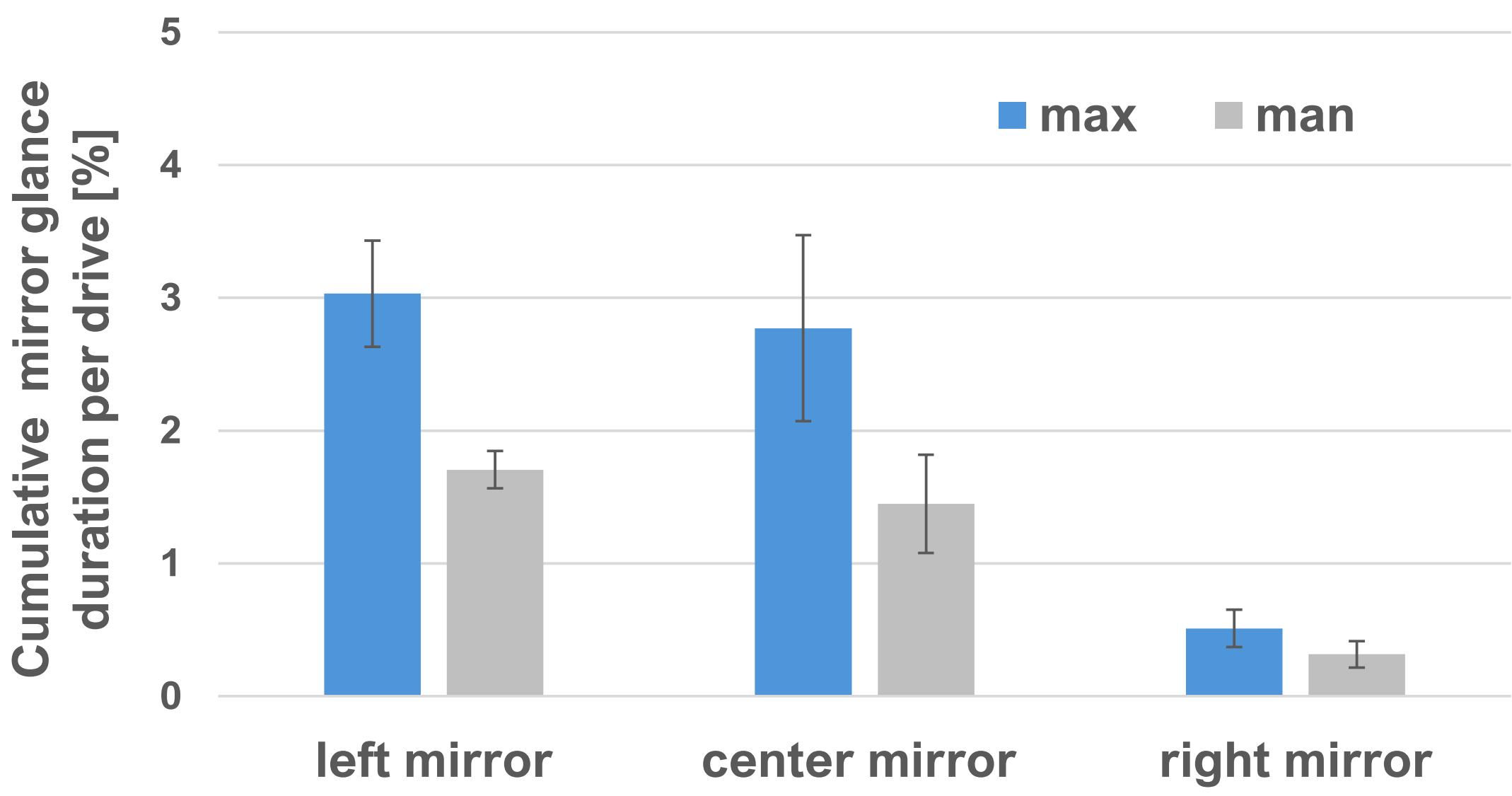
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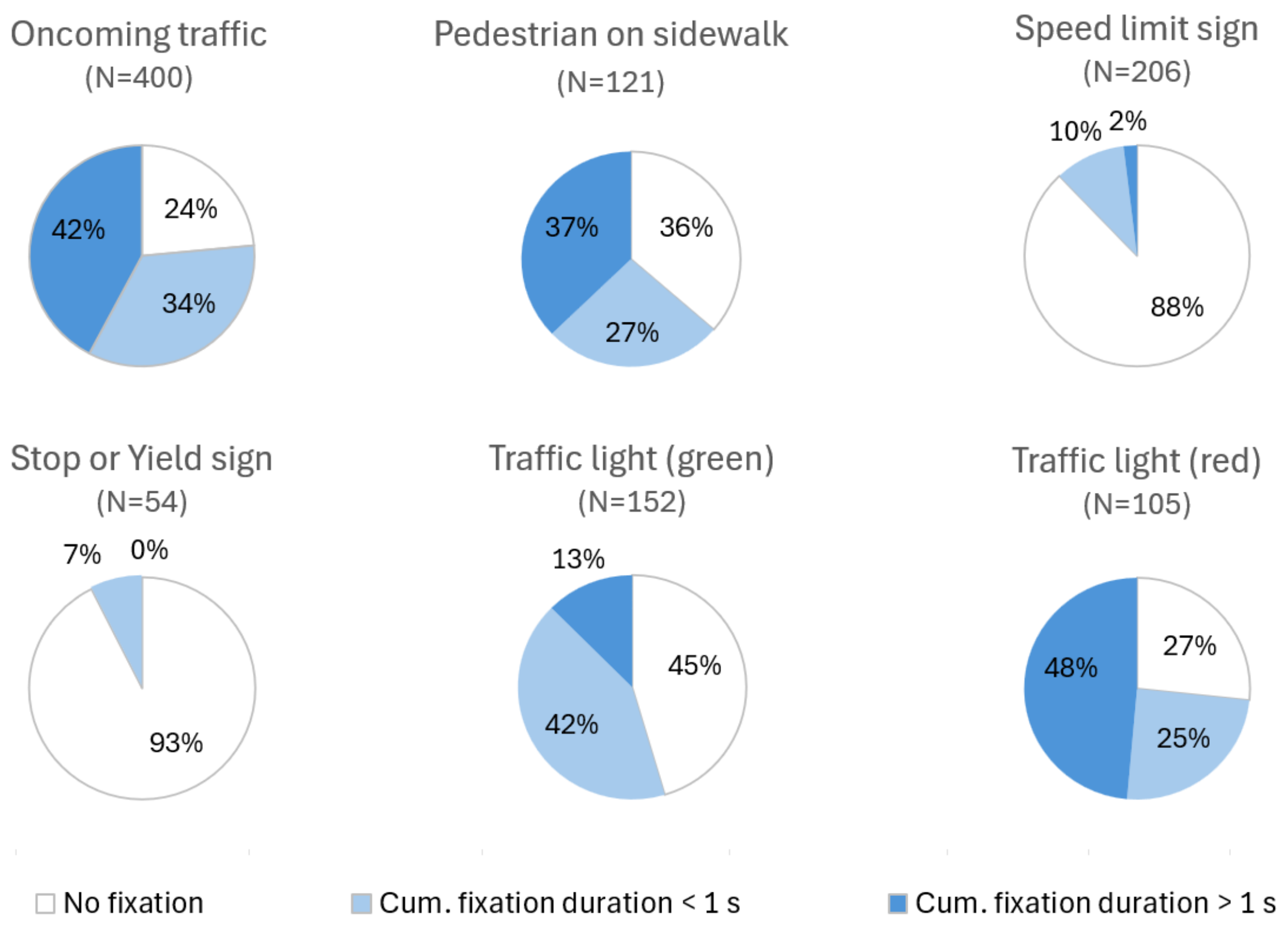
Results



Speed-dependency (H1): No clear relationship was found between vehicle speed and the duration of glances to the tablet. The correlation was negligible or even slightly positive. Experienced drivers do not seem to reduce off-road glance duration simply as a function of speed, suggesting a more complex risk assessment strategy.



Mirror usage (H2): Reference drivers showed significantly more mirror monitoring (left and right mirrors) when supervising the L2 feature compared to manual driving. Contrary to common assumptions, supervising an L2 system may lead to increased explicit monitoring of the environment (e.g., via mirrors) compared to manual driving.



Fixation of Scene Elements (H3): A surprisingly high percentage of safety-relevant objects were not glanced at by reference drivers. Situational awareness does not seem to require foveal fixation of every safety-relevant object.