

RoadMind: Investigating Road-User's Behaviour in Immersive Experiences

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Introduction: Every year, thousands of traffic accidents happen simply because a driver didn't see the danger in time. But how do you safely study that? The answer might be wearing on a VR headset and driving through a virtual city.

Imagine sitting in a driving simulator with a VR headset on. A vivid urban environment unfolds in front of you, filled with pedestrians, cyclists, and cars. And sometimes, something unexpected happens. A cyclist rushes out from nowhere. A car brakes hard ahead of you. How do you react, and where exactly are your eyes in the moments before a near-miss?

That is precisely the situation 17 participants faced in this thesis project, conducted in collaboration with Ericsson. The goal was to investigate how drivers perceive and respond to traffic hazards in a virtual environment and what their eye movements can reveal about risky behaviour.

Using a Meta Quest Pro headset with built-in eye tracking, participants drove through three urban areas of varying complexity. All data was captured: gaze direction, head movement, and vehicle control inputs, all synchronized to the millisecond.

The results are both clear and somewhat surprising. It is not about how much you look, but it is about how broadly you look. Drivers who spread their visual attention across the full traffic environment collided far less often than those who kept their gaze narrowly focused. Curved roads were particularly dangerous: they forced drivers to look straight ahead, reducing peripheral awareness and increasing collision risk.

The study also produced a conceptual model describing how environmental complexity, visual engagement, and reaction timing connect to influence the likelihood of missing a hazard.

The research opens the door to exciting applications: roadside alert systems, smart cycling helmets, and training programs for new drivers. All made possible because VR technology can now capture what our eyes are actually doing.