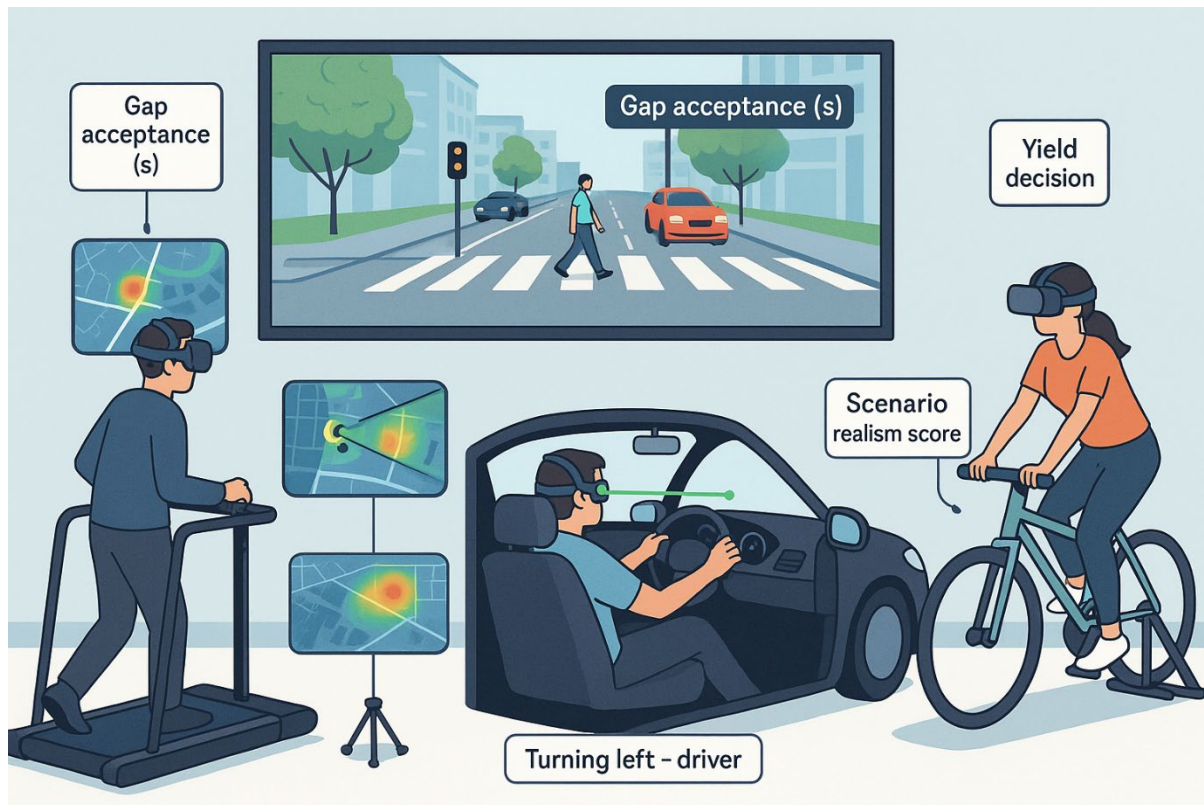


Validating traveller behaviour in virtual reality



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Immersive VR is used to recreate busy intersections for pedestrians, cyclists, and drivers, measuring gap acceptance, yielding, attention, and turning behaviour.

INTRODUCTION

When validating and investing in long-term, uncertain initiatives—such as innovative, future mobility—conducting an early risk assessment of mobility concepts is essential. These concepts can carry significant safety and financial risks over the long run. Reflecting these concerns, the United Nations prioritizes human safety in its sustainable transportation agenda, aiming to halve traffic accidents and injuries. Traffic hazards affect both individuals and nations, leading to fatalities,

temporary or permanent disabilities among citizens, and reduced access to activities and services. Mobility designers must therefore anticipate the potential risks that early concepts may introduce—and avoid them where possible.

OBJECTIVE

We aim to develop and validate virtual-reality (VR) traffic simulators as a reliable method to assess road users' behavior when they

interact with simulated scenarios of future mobility concepts. The goal is to generate knowledge about what makes VR simulators effective—i.e., capable of producing believable scenarios in which road users behave as they would in reality. Our work targets three road-user modalities: pedestrians, cyclists, and drivers.

Pedestrians: Crossing Behavior and Gap Acceptance

Controlling systems (e.g., traffic police or electronic traffic systems) and semi-controlling systems (e.g., zebra crossings or traffic-calming infrastructure) directly influence pedestrians' crossing behavior. In their absence, pedestrians tend to make crossing decisions by accepting time gaps between vehicles. Our purpose is to develop and validate a VR pedestrian traffic-safety research simulator and use it to study and validate pedestrians' gap-acceptance behavior. To do this, we virtually simulate factors that affect crossing behavior and then measure pedestrians' actions and behaviors within those scenarios. We developed a first version of the simulator and tested it in 2024; a second version is currently under development.

Drivers: Turning Behavior and Gap Acceptance

We also aim to study drivers' gap-acceptance behavior by developing and validating a VR driving safety research simulator focused on turning maneuvers. The objective is to establish this simulator as a research method that can replicate influencing factors such as visibility, driver attention, situational awareness, and the behavior of other drivers.

Cyclists: Yielding to Pedestrians

Finally, we study cyclist behavior when yielding the right of way to pedestrians by developing and validating a VR cyclist traffic-safety research simulator. This tool is designed to examine interactions between pedestrians and cyclists—specifically, yielding behavior—and to simulate

factors such as infrastructural changes and other environmental elements, while measuring cyclists' actions and behaviors in realistic scenarios.



KEY RESULTS TO DATE

Our pedestrian-focused VR simulator results indicate that increasing the realism of a single UX element is not sufficient to create believable simulation scenarios. Due to strong interdependencies among simulator elements, enhancing one component can increase or decrease overall simulator and scenario realism.

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