

Decoding Pedestrian Road Crossing Behavior: Insights from Behavioral Experiments and Cognitive Models

This presentation delves into an exploration of pedestrian road crossing behavior, integrating findings from four distinct experiments employing innovative methodologies. Experiment 1 utilized an online video approach, presenting pedestrians with a two-alternative choice experiment featuring approaching cars with varying velocities and time-to-arrival (TTA). Reaction times and crossing choices were recorded, and a drift-diffusion model was applied to illuminate the decision-making processes of pedestrians.

Building upon the insights gained from Experiment 1, Experiment 2 transitioned into a virtual reality (VR) environment, introducing human participants navigating on an omnidirectional treadmill. This experiment expanded the investigation by incorporating manipulations of TTA, velocity, and the approaching side of crossing cars. The immersive VR environment enabled a more ecologically valid investigation of pedestrian behavior by considering not only decision-making processes, but also observable behavior in the form of walking trajectory and velocity.

Experiment 3, a continuation of Experiment 2, introduced a novel dimension by examining scenarios involving two cars simultaneously approaching from both sides. Different combinations of TTA and speed were manipulated, offering a nuanced understanding of how pedestrians navigate complex traffic situations. The integration of dual-car scenarios within the VR environment enables a more holistic examination of decision-making dynamics in realistic traffic environments. Finally, Experiment 4 takes the complexity of the real world one step further by investigating the interaction of pedestrians with human drivers using a distributed simulation.

The presentation will introduce the combination of the application of cognitive models and the analysis of pedestrian behaviour in VR experiments. By integrating results from different experiments, our approach aims to understand the interplay between the perceptual information available to the pedestrian (e.g. TTA and speed) and the decision-making processes, as well as the action shown. Thus, the underlying cognitive mechanisms that control the behaviour of pedestrians when crossing a road will be illuminated. The results of these experiments have implications for the design of a safe interaction strategy of automated vehicles with pedestrians, for example in terms of communication strategies with eHMIs or trajectory planning.

