

Pedestrian Recognition of Vehicle Yielding Intentions Based on Vehicle Deceleration Behavior at Unsignalized Crosswalks

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At unsignalized crosswalks, pedestrians infer whether a vehicle intends to yield from changes in speed and deceleration behavior. Previous studies have shown that deceleration affects pedestrian judgment and that recognizing a vehicle as yielding is related to perceived safety. Here, a yielding judgment was defined as the participant judging that the vehicle was giving way to them. However, it remains unclear how initial speed and deceleration start position affect the yielding recognition rate and vehicle state at recognition. This study therefore examined these relationships using condition-specific recognition rates and vehicle speeds at recognition.

Thirty licensed drivers participated in an experiment on a closed test track; daytime trials from 19 participants were analyzed. Participants stood beside an unsignalized crosswalk, observed an approaching experimental vehicle, and pressed a button when they judged that the vehicle intended to yield; they did not actually cross. The initial-speed conditions were 20, 25, 30, and 40 km/h with the deceleration start position fixed at 35 m. The start-position conditions were 15, 25, 30, 35, and 45 m with initial speed fixed at 25 km/h. Yielding recognition rates were calculated for 19 participants. Vehicle-speed distributions at recognition were based on recognized trials from 18 participants.

In the initial-speed conditions, recognition rates were 92.3%, 100%, 83.3%, and 68.8% at 20, 25, 30, and 40 km/h, respectively (Fig. 1). In the start-position conditions, rates ranged from 83.3% to 100%, with the lowest rate at 15 m. Neither factor showed a monotonic relationship with recognition rate. At 40 km/h, the median vehicle speed at recognition was the lowest, and the interquartile range (IQR) extended toward lower speeds (Fig. 2). Together with the lowest recognition rate, this suggests that yielding judgments tended to be made only after the high-initial-speed vehicle had slowed sufficiently. In the 15 m condition, recognition similarly tended to occur at lower speeds, possibly because starting deceleration closer to the stopping position limited the time available to observe deceleration. However, variations in the median and IQR across conditions suggest that pedestrians do not rely solely on a single, fixed speed threshold.

These results indicate that yielding recognition depends on the combination of speed reduction and observation time, rather than on a single vehicle parameter or speed threshold alone. Not only speed reduction but also sufficient observation time may therefore be important for communicating yielding intent. Future analyses will examine time to judgment, speed reduction, subjective ratings, and participant-level differences to clarify effective deceleration profiles that support yielding recognition.

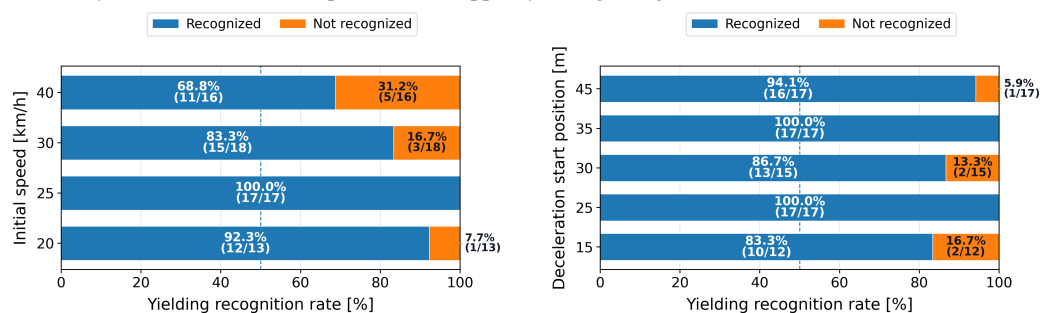


Fig. 1 Yielding recognition rates by initial speed (left) and deceleration start position (right).

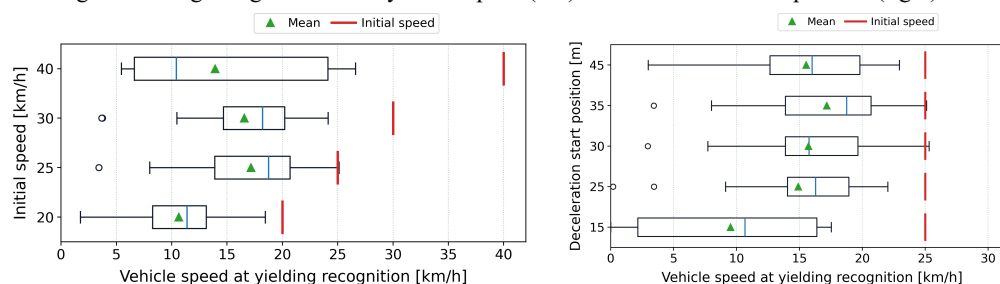


Fig. 2 Vehicle speeds at recognition by initial speed (left) and deceleration start position (right).