

# Examination of Driving Behavior Indices to Detect Impatient State of Driver in City Driving

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Violation of safety obligations is influenced by impatience while driving. Therefore, we analyzed driving behavior in the normal and impatient states by simulating the impatient situation using a driving simulator as well. A driver's seat in which the experimental participant sits and the driving control devices (steering wheel, gas pedal, and brake) were placed. In addition, seven displays were set up to surround the experimental participants except behind them. The simulation software used was Sirius by Misaki Design. Tobii Pro Glass 3 from Tobii Technology was used as the eye measurement device. Three driving courses were set up in an urban area with different routes. Six different driving situations were set up for analysis. The only difference between the normal and impatient driving conditions was the presence of a time constraint.

Changes in driving behavior from normal conditions during impatient driving are shown below. The experimental data were from nine college students who had already obtained a regular driver's license. The driving time was shorter and the subjective evaluation value was larger, indicating that the driver was in a hurry and was in a hurry when driving in a hurry. **Side passing of parked vehicles:** Passing speeds were higher overall. The starting point of movement to avoid parked vehicles was faster overall. Side spacing increased for the seven participants. The move start point became earlier as the passing speed increased (Fig.1). However, there was no relationship between passing speed and side spacing. **Intersection left-turn:** Intersection entry speeds were higher for eight participants. In some cases, the curve bulge during the turn was less bulging and more straight driving. **Red light stop:** No change was observed in the overall distance from the car in front when stopped at a red light. No movement was observed to avoid the car ahead turning left after the light changed to green. This may be due to the high starting speed of the car in front. Acceleration during the 10 seconds following the change to a green light increased immediately after starting and the frequency of acceleration above 10 km/s<sup>2</sup> increased. Although the behavior was not characterized by significant limitations during the red light stop, it is possible that the change is more likely to occur after the change to a green light. **Lane change for two lanes:** The time required from the start to the end of the lane change decreased overall, but the time spent in the center lane did not change. This may be due to the higher lateral travel speed when changing lanes. **Pedestrian side passage:** Passage speeds were higher overall, although some participants remained the same. Lateral spacing became narrower overall. The side spacing became narrower as the passing speed increased (Fig.2). **Turn right at an intersection with oncoming traffic:** The decision to yield to oncoming traffic was changed for those participants who yielded during normal driving and no longer yielded during impatient driving. There was no change in the number of participants who made the same decision to yield or not to yield in both normal driving and driving in a hurry. We believe that the lack of time margin in the hurry condition affects whether or not oncoming vehicles yield or not. **Relationship between hazard level and driving behavior in a state of impatience:** Hazards were classified into three categories according to manifest level. The manifest hazard was defined as an oncoming vehicle in a right-turn scene with oncoming traffic present. The risk is estimated to be high for the object and is considered to be a risk hedging driving behavior. The predictive hazard was a pedestrian in a side-passing scene near a pedestrian crossing. It is thought that the driver was attempting high-risk behavior until just before passing the object on the side. In the side spacing, the pedestrian was not considered to be attempting the same risk-hedging behavior as the vehicle. In the potential hazard, the pedestrian was considered to be a blind spot in the side passing scene of a parked vehicle that could potentially jump out of the way. The tendency is for risk-taking behavior to be attempted. In other words, the higher the manifest level, the more likely it is to be a risk hedging behavior, and the lower the manifest level, the more likely it may be to be a risk-taking behavior.

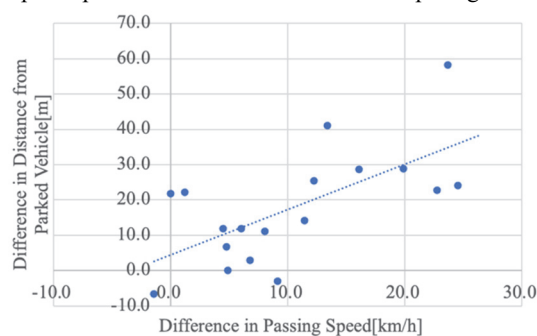


Fig.1 Distance from Parked Vehicle and Passing Speed

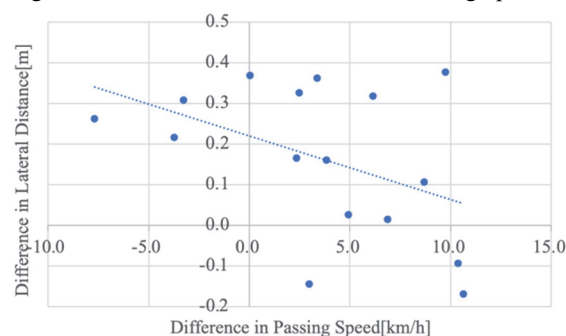


Fig.2 Lateral Distance and Passing Speed