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Effect of Vehicle Body Styles on Speed Perception

Hiroaki Sato [1) 2)] Yuji Matsuki [3)] Kazunori Shidoji [4)]

1) Kyushu University, Graduate School of Integrated Frontier Sciences
744 Motooka, Nishi-ku, Fukuoka, 819-0395, Japan (E-mail: hiroaki-sato@outlook.com)
2) Higashi Fukuoka Driving School Co., Ltd
1-14-1 Maimatsubara, Higashi-ku, Fukuoka, 813-0042, Japan
3) Fukuoka Institute of Technology, Department of Information Electronics
3-30-1 Wajirohigashi, Higashi-ku, Fukuoka, 811-0295, Japan
4) Kyushu University, Faculty of Information Science and Electrical Engineering
744 Motooka, Nishi-ku, Fukuoka, 819-0395, Japan

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Factors that cause rear-end collisions include delayed detection (looking aside, not paying attention to the road ahead), excessive speed, and failure to maintain an appropriate distance. If the driver does not have an accurate understanding of the speed of the vehicle, the driver may not maintain an appropriate distance according to the speed of the vehicle, which may result in a rear-end collision. Even if a rear-end collision does not occur, the driver of the car in front may perceive that the driver of the vehicle that is following is driving too close to the car in front.

Because the driver must always pay attention to all directions while driving, the driver cannot look at the speedometer very often. In such cases, it is assumed that the driver evaluates the speed subjectively by judging the driving speed from various information, such as the optical flow perceived from the road surface, engine noise, wind noise, and vibration transmitted inside the car. In addition, because larger vehicles are generally quieter and more stable than smaller ones, it is assumed in this study that differences in vehicle size affect speed evaluation. It is also assumed that personality influences speed perception because there have been many studies on the effects of driver personality on traffic accidents and driving behavior. In addition, it is hypothesized that the relationship between speed and dynamic visual acuity is influenced by differences in the magnitude of dynamic visual acuity. This is because drivers with high dynamic visual acuity have a narrower field of vision during driving, which makes it easier for them to take in information from the surrounding landscape and to have a sense of speed.

Based on the above, in this study, the sense of speed, personality traits, and static and dynamic visual acuity of drivers while driving a car were measured, and the relationship between them was investigated.

The experimental design for the measurement of speed while driving a car was a three-factor design in which size (kei car/sedan), terrain (level/uphill/downhill), and speed (20 or 40 km/h) were within-participant factors. The order of the size experiments was counterbalanced so that half of the participants tested the sedan first, and the remaining participants tested the kei car first. To avoid the influence of the terrain and landscape on the results, participants were asked to make two laps on each side of the experimental course, and the results of the four laps were averaged to obtain the measured values. Participants were required to verbally signal "yes" at the moment they thought they had reached the specified speed during a pre-designated measurement section of the experimental course, and the speed at that moment was recorded using a GPS measuring device. The speed was measured at approximately 10 Hz by mounting the GPS measuring device on the roofs of the two vehicles to remove the effect of speedometer error resulting from the different vehicles.

Personality traits were measured using a five-factor personality test form. Visual acuity was measured for static and dynamic visual acuity (20 and 40 km/h) using a dynamic visual acuity meter.

The results of this study revealed the following. (1) The speed of sedans was higher than that of kei cars. (2) Sedans traveled faster on uphill and level roads than on downhill roads. (3) Sedans had higher measured speeds on uphill and level roads. (4) The effect of the size of the car and the terrain became larger as the speed increased. (5) Drivers with high decency scores tended to drive with a low speed uphill and downhill. (6) Drivers with high dynamic visual acuity at 20 km/h tended to drive faster on average, and those with high dynamic visual acuity at 40 km/h tended to drive slower on average. Based on these results, it is necessary to consider that such factors as vehicle type, terrain, and speed at the time affect the perception of speed and that good judgment and dynamic visual acuity also affect the perception of speed during driving. This will reduce the number of rear-end collisions and the number of drivers who feel they are being followed too closely.

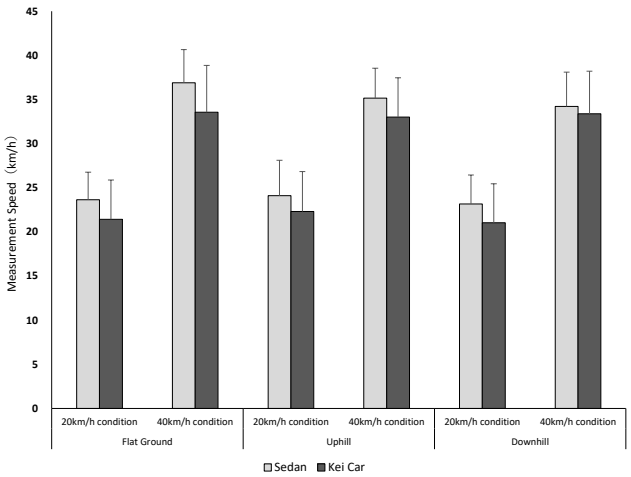

Fig.4 Measured Speed for Size and Terrain and Speed（km /h）
（$N = 30$）