

Hand Support Reduces Carsickness and Neck Fatigue Caused by Smartphone Use in a Car

Kousuke Suzuki ¹⁾ Kazuhito Kato ¹⁾ Chikanori Honda ¹⁾

¹⁾ NHK Spring Co., LTD.

3-10 Fukuura, Kanazawa, Yokohama, Kanagawa, 236-0004, Japan

KEY WORDS: Car sickness, Ride comfort, Visibility, Smartphone, Armrest, Fatigue [C2]

There are growing concerns about increasing carsickness in a self-driving car as drivers perform various non-driving tasks including using smartphones during autonomous driving. This study aimed to reduce carsickness caused by using smartphones while traveling. Providing an outside view to the peripheral visual field is known to reduce carsickness. We developed a new type of hand support that enables passengers to keep their smartphones at shoulder height by supporting two points, a back of the hand and an elbow (Fig.1), and investigated the effects on carsickness and neck fatigue in field test.

In the experiment, twelve healthy volunteers participated. Participants sat in a minivan's second-row seat behind a driver's seat, read a novel on a smartphone, except for an outside view condition, during a 30-minute vehicle journey on urban roads and reported the carsickness ratings using a scale from 0 (no symptoms) to 6 (moderate nausea and want to stop) every minutes. After journey, they reported the display viewing ease (-3:very hard to 3:very easy) and the feeling of fatigue (0:not tired to 6:extremely tired) on a 7-point scale. Head and smartphones motion were also acquired using 6-DOF wireless motion sensors. Motion Sickness Dose Values (MSDV) were calculated for each axis. There were four experimental conditions: viewing outside without using a smartphone, and conditions of using a smartphone with different supports (Fig.2).

The results showed that the accumulated illness ratings for 30 minutes were significantly increased about three times using a smartphone with/without normal armrest compared to the condition of outside view. And the hand support significantly reduced carsickness about by half compared to using a smartphone with/without normal armrest (Fig.3a). In addition, the mean score of viewing ease on a smartphone display improved significantly, and the fatigue in the neck reduced to about one-quarter (Fig.3b, 3c).

And the results suggest that the hand support will be an effective measure in improving comfort when using a smartphone during autonomous driving.



a) Hand support b) Elbow support
Fig.1 Developed hand support

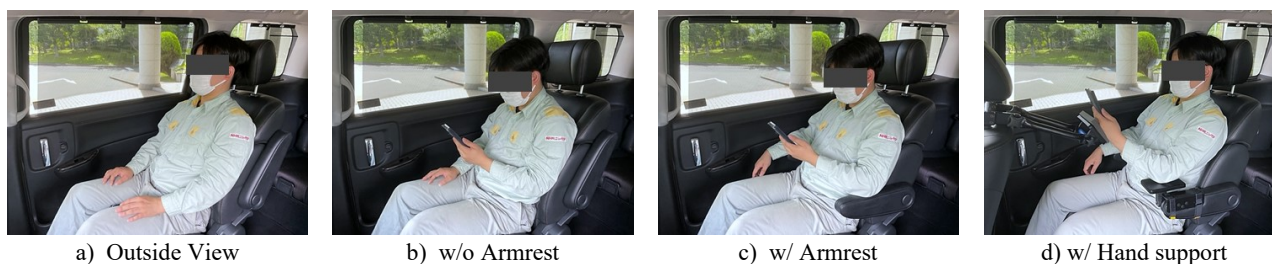
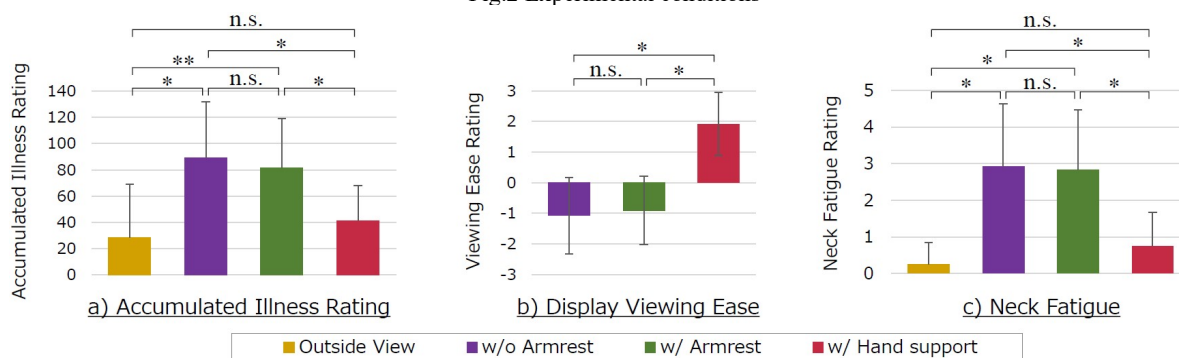


Fig.2 Experimental conditions



** : $p < 0.01$ * : $p < 0.05$ n.s.: not significant

Fig.3 Comparisons of subjective evaluation on carsickness, viewing ease, and fatigue