

Acceptance of Automated Vehicles by Other Drivers during Interaction in Different Motorway Situations

-Effects of the drivers' knowledge and External HMIs on their Anxiety about Automated Vehicles -

Akira Ohtani ¹⁾ Yoshinori Egami ²⁾ Azusa Kuriyama³⁾ Kenji Sato ⁴⁾ Keisuke Ishii ⁵⁾

¹⁾²⁾³⁾⁴⁾ Japan Automobile Research Institute

2530 Karima, Tsukuba-shi, Ibaraki, 305-0822, Japan (E-mail: aohtani@jari.or.jp)

⁵⁾ Japan Automobile Manufacturers Association, Automated Driving Human Factor Subcommittee
1-1-30 Shibadaimon, Minato-ku, Tokyo, 105-0012, Japan

KEY WORDS: Human engineering, Human interface, Human machine interface, Automated driving, Interaction [C2]

A key challenge in promoting the extensive use of automated vehicles(AVs) is its acceptance by road users such as pedestrians, bicycle users, and other drivers around AVs. Previous studies have explored the scope of pedestrians' acceptance of and interactions with AVs on urban streets. However, few studies have examined the acceptance of AVs by other drivers in the vicinity on motorways despite the expectation on AVs to spread rapidly on motorways than urban streets.

This study investigated impacts of the other drivers' knowledge and external human machine interfaces(HMIs) on their acceptance of the AV when they drove on motorway.

A driving simulator experiment was conducted to investigate whether the other drivers' acceptance of the AVs was influenced by their knowledge and external HMIs or not. We defined the acceptance of other drivers toward AVs based on expression of anxiety in their interaction with it. Twenty-nine drivers participated in this study and experienced three different traffic scenes where they interacted with the AV while driving on motorway, namely, merging, following, and cut-in scenes. Participants were instructed to answer questions on their anxiety when they interacted with the AV in each scene. The participants were divided into two groups based on whether they were informed about features of the AVs or not. The AV in the study was equipped with a blue patrol lamp on its roof. The lamp was turned on while the vehicle was running automatically. The participants interacted with the AV as it was running either automatically or manually in each scene. We adopted a mixed experimental design, comparing a condition of the other drivers' knowledge of the AVs was between participants and a condition of external HMIs was within participants.

The main results of the experiment were as follows :

- For all three traffic scenes, the other drivers rated their anxiety toward the interaction with the AV as less than 50% on average, suggesting an acceptable limit of anxiety.
- The other drivers were less anxious about the interaction with the AV in the following scenes than in merging and cut-in ones.
- The other drivers' knowledge of the AVs and external HMIs had no significant impacts on their anxiety toward the interaction with the AV in both merging and cut-in scenes.
- The other drivers without knowledge of the AVs felt more anxious about interacting with the vehicle when the blue patrol light was on than when it was off in the following scene.

Based on the above results, we can infer that the other drivers' appropriate knowledge of AVs is important to reduce their anxiety. For the other drivers to have appropriate knowledge of AVs, educating them is necessary. The other drivers having actual interactions with AVs in their transitional phase is important.

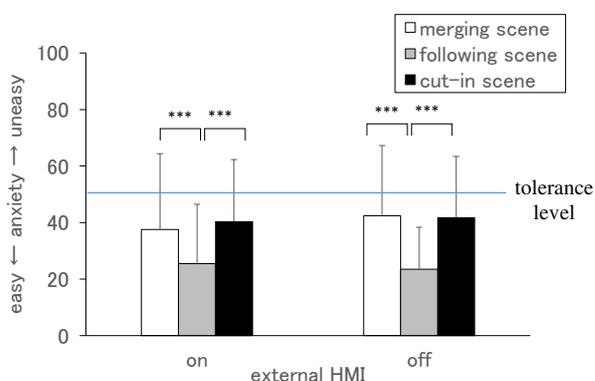


Fig.1 Differences in Subjective Scale of Anxiety among Road Situations and External HMIs

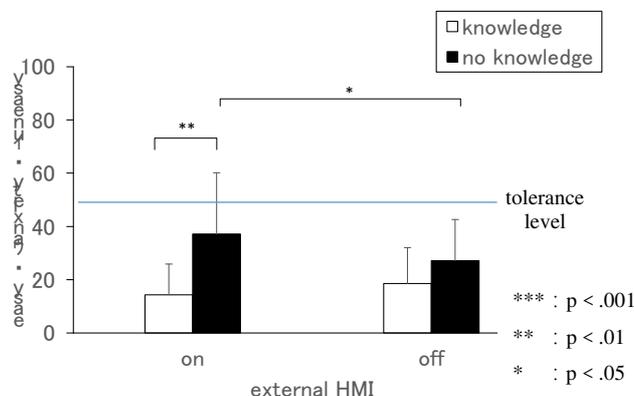


Fig.2 Differences in Subjective Scale of Anxiety among Drivers' Knowledge and External HMIs in the following scene