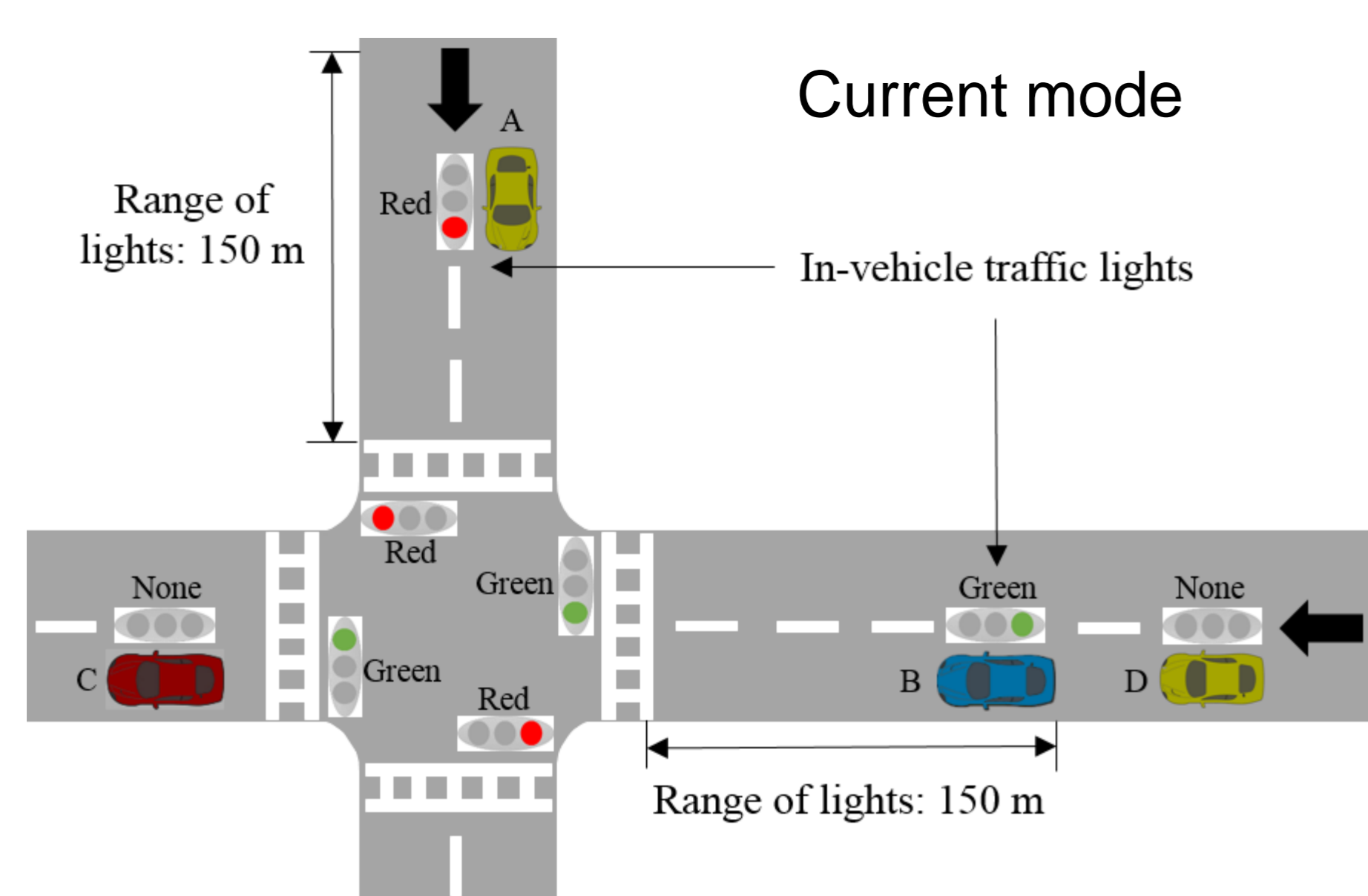


Introduction

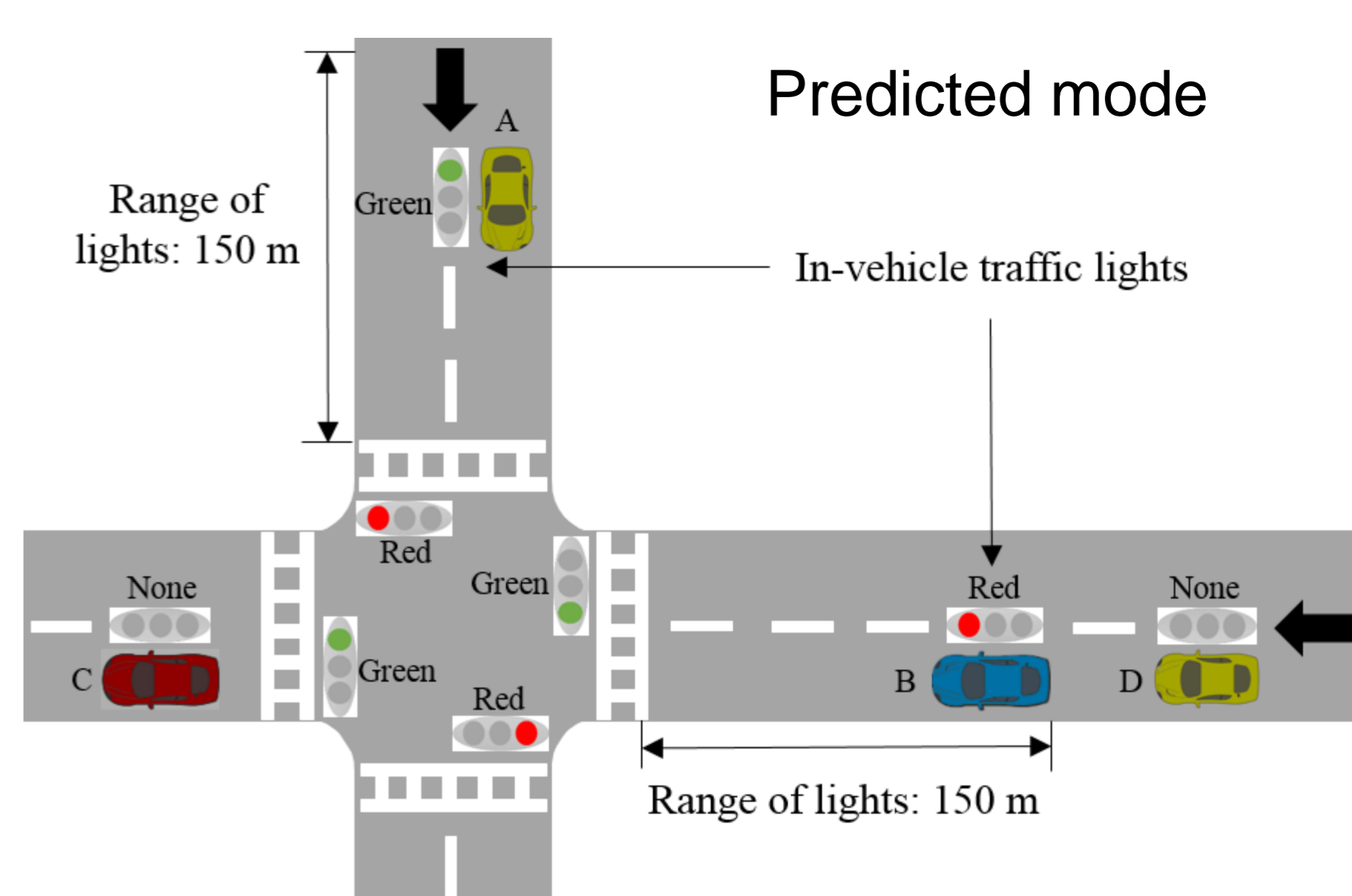
Emerging vehicular communication makes it possible to provide traffic light information to drivers inside vehicles with the application of in-vehicle devices. This study proposed two modes of in-vehicle traffic lights to assist drivers: a “current” mode and a “predicted” mode. Two kinds of in-vehicle devices were compared for displaying in-vehicle traffic lights: a normal 4.3-inch display and a head-up display. A driving simulator experiment was executed for eleven subjects, and driver behavior was evaluated for driving operations and eye-gaze behavior.

Inter-vehicle traffic signal



Current mode
The real time information of ground traffic lights of the upcoming intersection is displayed directly to drivers by in-vehicle devices.

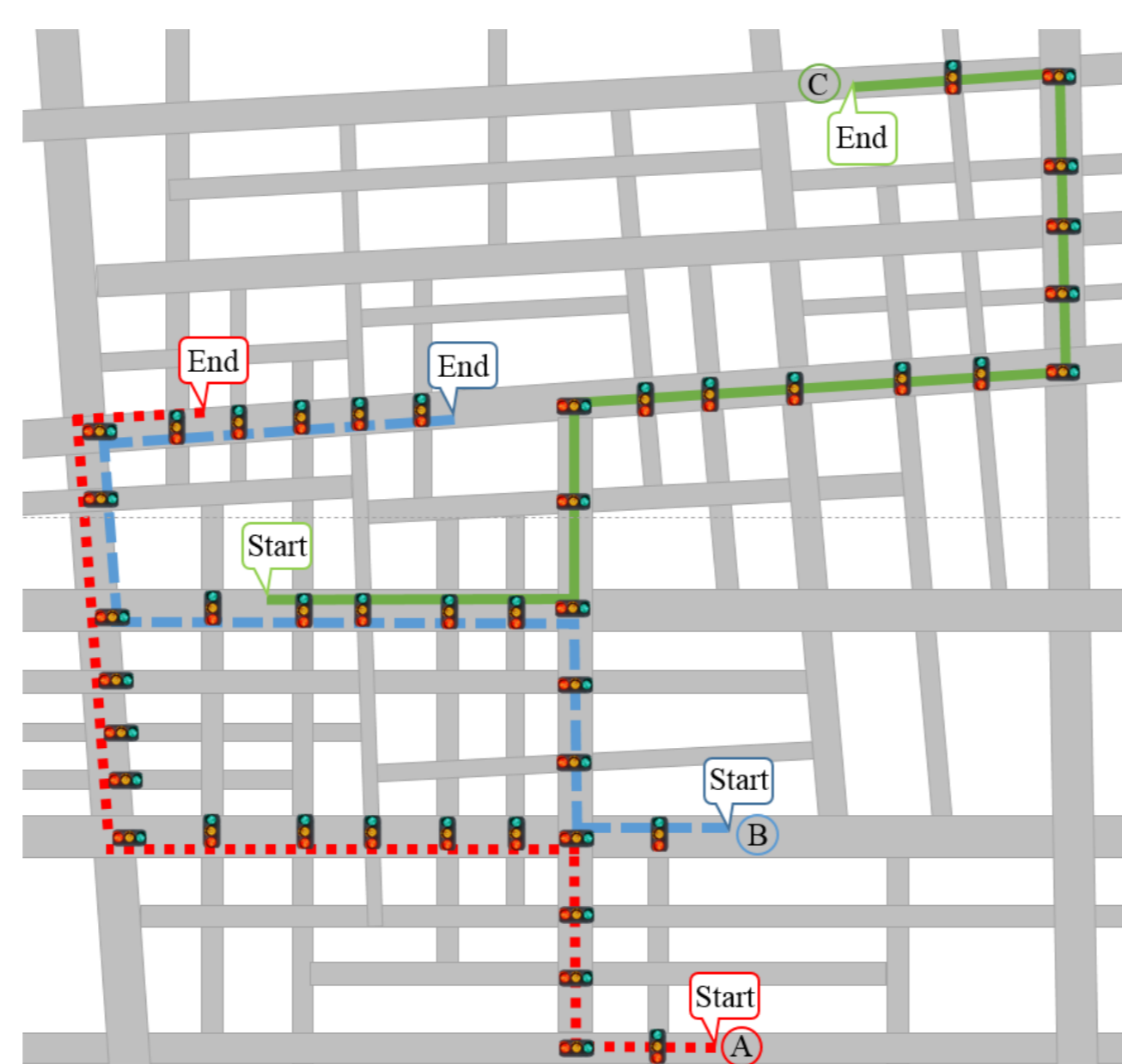
Predicted mode
This mode provides predicted ground traffic light information for the upcoming intersection based on the current driving speed of the vehicle.



Experiments



Inter-vehicle traffic signal displayed by HUD

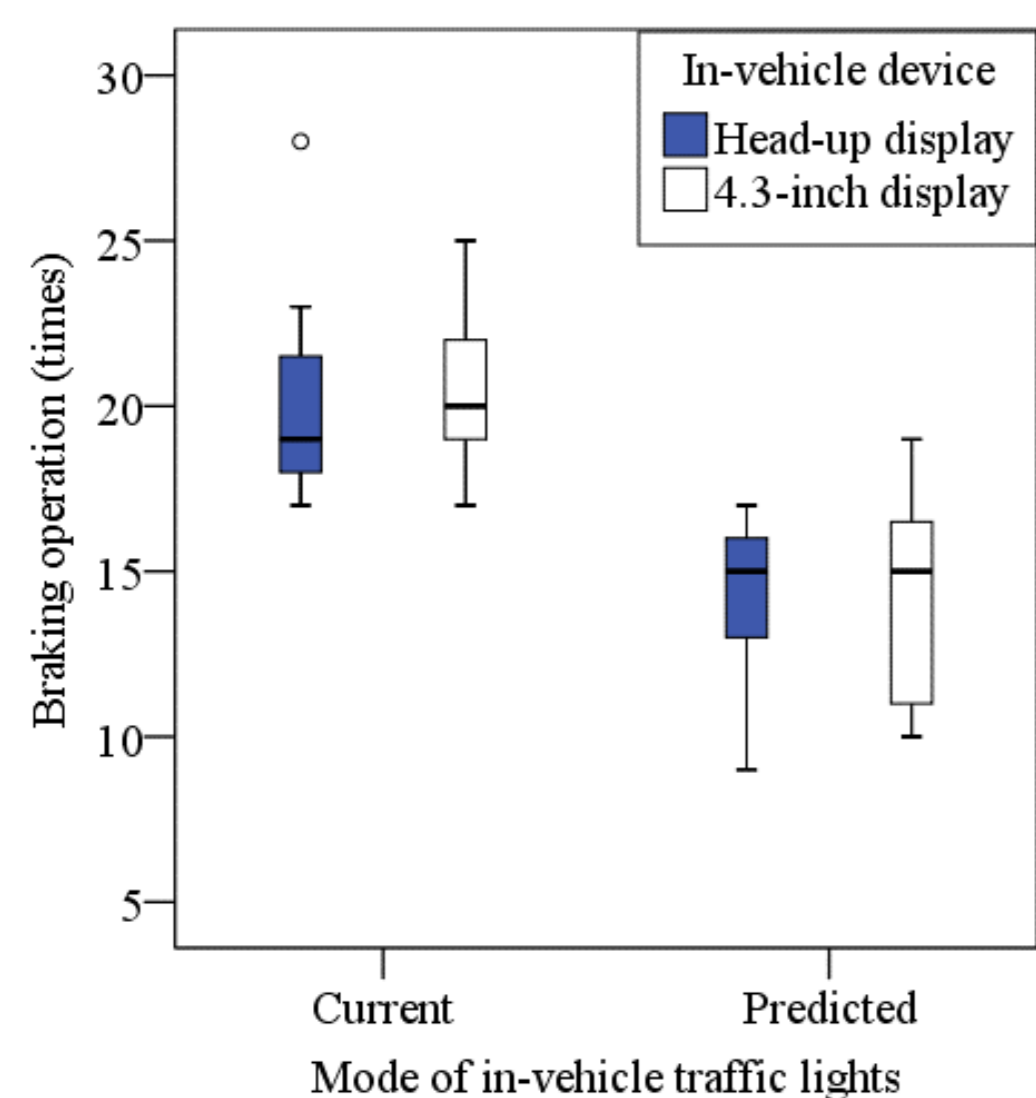


Three driving courses presented in three different colors

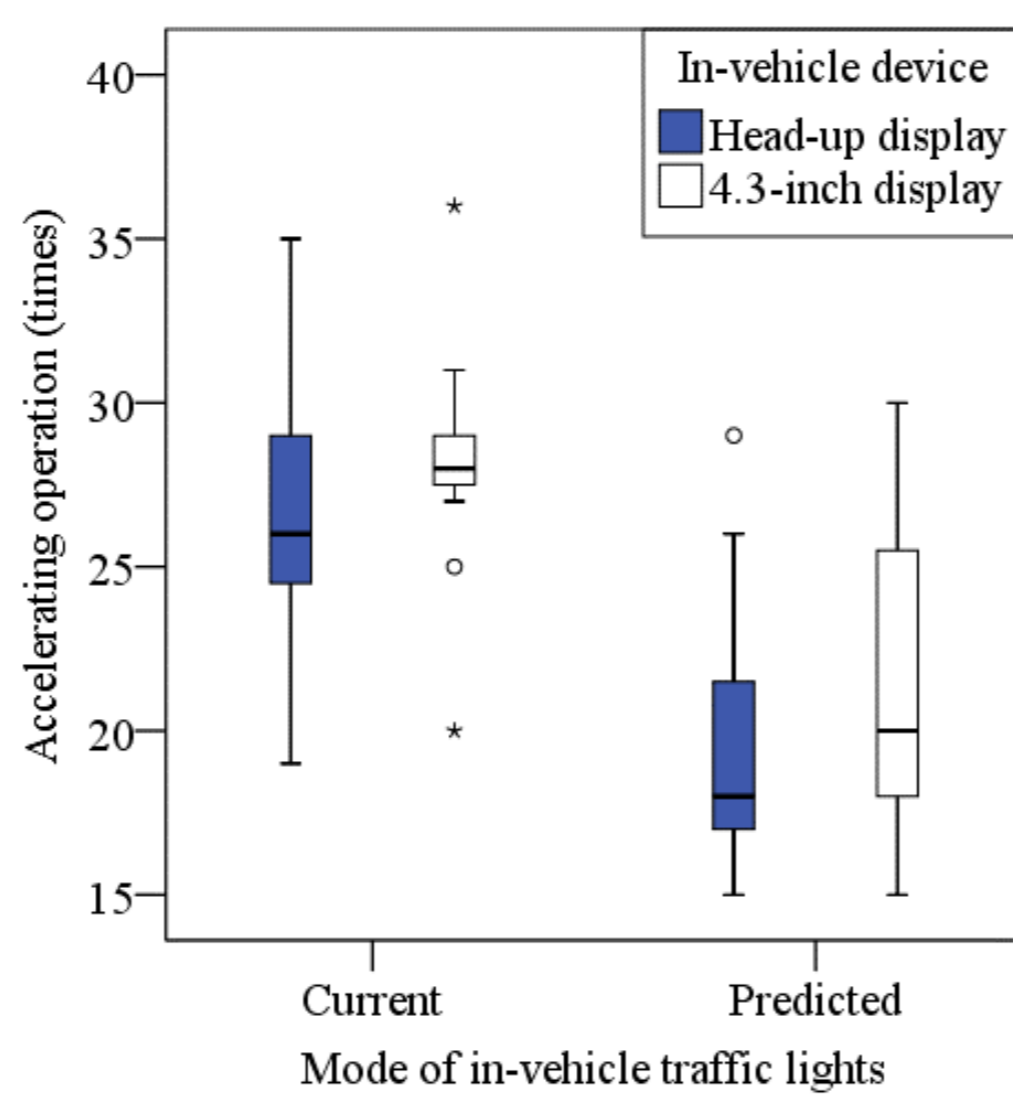
11 subjects including males and females, aging from 20s to 50s, participated in the experiments. An actually existing urban road network (Mitsumetoori, Kinshicho, Sumida-ku, Tokyo, Japan) was reproduced. Experiments were carried out under five conditions as shown in the following table.

No.	Inter-vehicle traffic signal	Display device
1	Normal	No
2	Current	HUD
3	Current	4.3
4	Predicted	HUD
5	Predicted	4.3

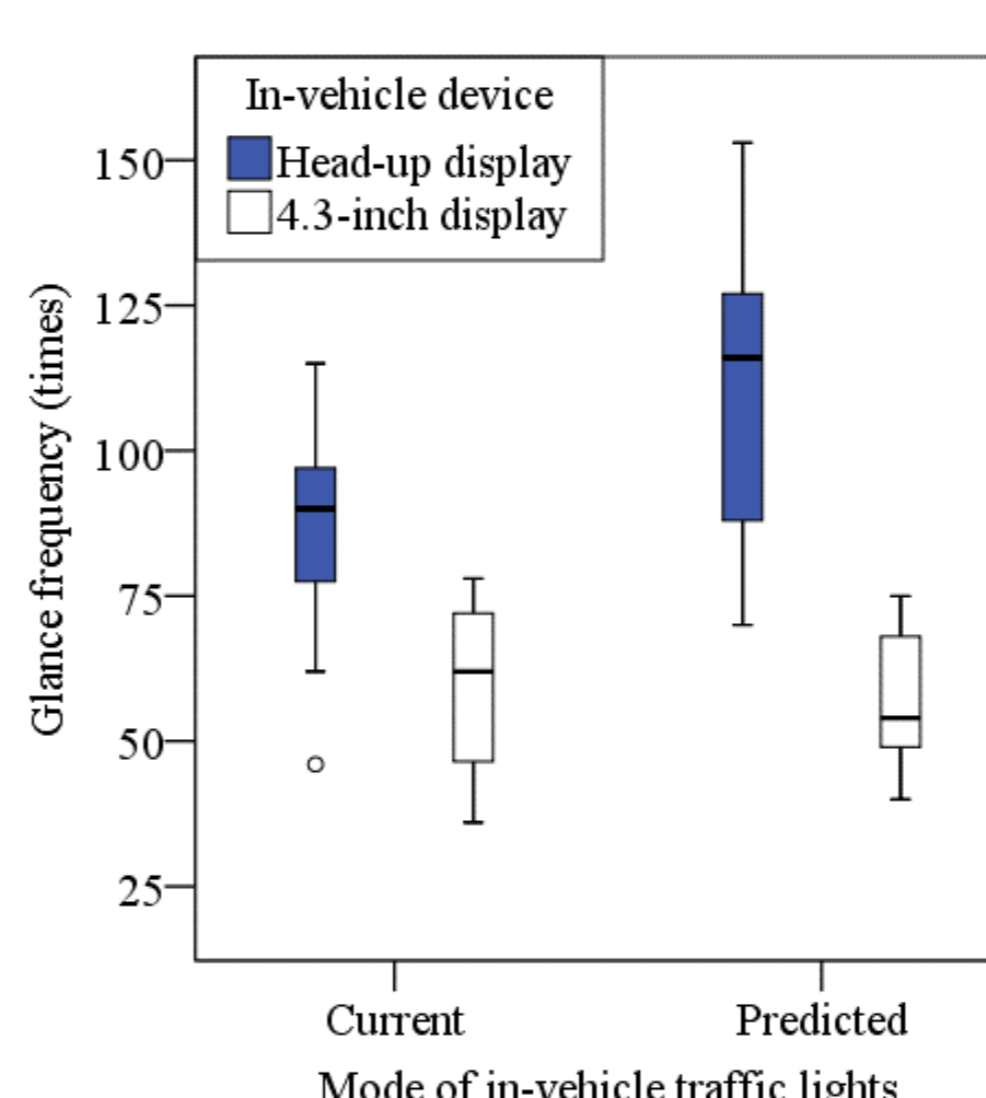
Results



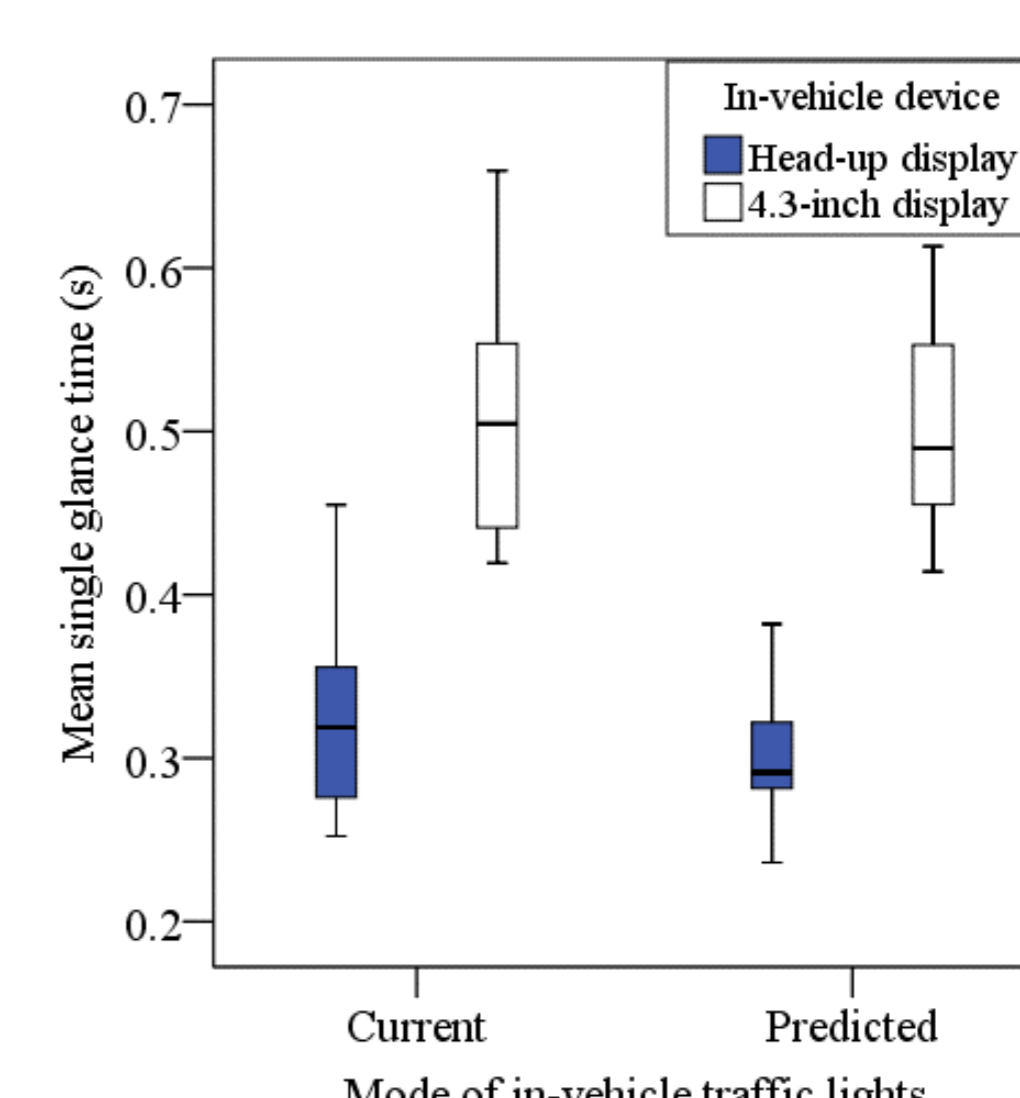
Number of braking operations



Number of accelerating operations



Glance frequency



Mean single glance time

The results demonstrated that disruptive braking and accelerating operations were significantly reduced under the predicted mode, and glance time was significantly shorter for the head-up display than for the normal 4.3-inch display. We concluded that the predicted mode easily prompts drivers to ecological driving, and that the head-up display is reliable for providing in-vehicle traffic light information.

Publications

Yang B., Zheng R., Yin Y., Yamabe S., Nakano K., 2016, Analysis of Influence on Driver Behaviour While Using In-Vehicle Traffic Lights with Application of Head-Up Display, IET Intelligent Transport Systems, pp. 1-7, DOI: 10.1049/iet-its.2015.0179.