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Ms. Sophie Shulman
Deputy Administrator
National Highway Traffic Safety Administration
1200 New Jersey Ave, SE
Washington, DC 20590

Agency Information Collection Activities; Notice and Request for Comment on Human Interaction with Driving Automation Systems
Docket No. NHTSA-2023-0063

Dear Deputy Administrator Shulman:

The Insurance Institute for Highway Safety (IIHS) thanks the National Highway Traffic Safety Administration (NHTSA) for the opportunity to comment on this study series proposal, *Human Interaction With Driving Automation Systems*. Machines behave differently than human drivers, even when the driving automation still requires a human to be involved. With most automakers offering at least partially automated systems in many models of their vehicle lineups, the relevance of these research questions is only growing. It is important to understand how people interact not only with the technologies in their own vehicles, but also with other vehicles equipped with driving automation systems.

We commend NHTSA's sampling approach to target licensed members of the public from a wide age range in order to make generalizable conclusions from the data. While it is reasonable to expect age and overall driving-experience (e.g., in terms of years licensed) effects, there is an additional participant factor missing from the sample characteristics listed. It is unclear what levels of driving automation the study series will investigate; however, IIHS research has shown that having experience with partial driving automation (Level 2) affects driving behavior while using the technology (Mueller et al., 2022). Although Level 3 driving automation is exceedingly rare, some vehicles for sale today are nevertheless equipped with it in, for example, the United States and Japan. Level 4 driving automation is not available for private consumer purchase, but it is available in ride-hailing fleets (e.g., Waymo ride-hailing services in Phoenix, AZ, and San Francisco, CA). Therefore, we recommend factoring experience, both as a driver and as a passenger where applicable, with each level of driving automation tested in the sampling approach and/or data analysis.

The research proposal indicates that vehicle kinematics will be measured, which are fundamental for gauging participants' ability to control the vehicle in these scenarios; however, there are other behaviors that reflect higher levels of cognition that ought to be considered too. Reactive and proactive changes in behavior around object detection, trip planning, and navigation updating are important safety-related indicators of how people interact with their vehicles. Experimental manipulation of the simulated driving scenarios could be used to objectively evaluate different levels of situational awareness of the surrounding traffic and wayfinding ability and accuracy.

We recommend that NHTSA also measure behind-the-wheel behavior, such as gaze and hand activity, because where the driver is looking and what their hands are doing will affect other behavior related to vehicle control. Moreover, secondary activity, both driving-related and non-driving-related, is a normal phenomenon in driving with and without automation support. Even if these studies exclude non-driving-related activities, participants will still have to interact with the interfaces to operate and understand the driving automation. These driving-related secondary activities include glances to and physical interaction

with interior displays (e.g., instrument panels) and operating steering wheel controls to activate different types of system support. These activities are considered secondary because they are not involved in the immediate physical control of the vehicle, such as steering and accelerator/brake pedal use. In some cases, driving-related secondary activities may affect a driver's ability to control the vehicle if they occupy the driver's attention for too long. Their inclusion in the set of dependent variables will be important for understanding differences between participants and any changes in vehicle-kinematic behavior in the different driving scenarios.

Related to this, we recommend paying close attention to the driver management strategies incorporated in the design of the simulated vehicle, if they apply depending on the types of driving automation that will be simulated in these studies. For systems that require the driver to be involved in the operation of the vehicle (Levels 0 to 3), design factors around driver monitoring, attention reminders, and last-resort countermeasures should be considered as they will shape the observable behind-the-wheel behavior, physical vehicle control, and interactions with the simulated vehicle's interfaces.

Furthermore, the design philosophies currently behind Level 0 to 3 systems in production vary considerably among manufacturers so as to produce unique relationships between their customers and the technologies in their vehicles. As such, no two systems of a given level of driving automation should be considered the same. Even when their lane keeping and speed and distance management designs are similar, systems under the same driving automation domain can still be designed with fundamentally different driver-vehicle interactions. For instance, some systems require that the driver's hands be on the wheel at all times whereas others permit periods of hands-free operation, and some systems are designed with cooperative lane-centering support that requires the driver to stay regularly involved in the steering of the vehicle. These factors may produce confounds in the data if they are not considered in the design of the simulated systems under test.

Programming how the simulated vehicle responds to different traffic conflicts or ambiguous driving scenarios in the study series will have ramifications on participant behavior. The realism of disruptions in system performance matters, both in terms of a sudden cessation of support as well as inappropriate system behavior—the specifics around which depend on the simulated level of driving automation and the driving scenarios tested. Assuming these studies will simulate driving automation that has been implemented in the registered vehicle fleet or the commercially available ride-hailing fleet, if care is not taken to ensure those disruptions are realistic and conform with what is technically possible and likely, using what is known based on current implementations, they may affect participant behavior in ways that are outside the scope of the research and thus limit the generalizability of the findings.

Sincerely,

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References

Mueller, A. S., Cicchino, J. B., Benedick, A., De Leonardis, D., & Huey, R. (2022). Bears in our midst: Familiarity with Level 2 driving automation and attending to surprise on-road events. *Transportation Research Part F: Traffic Psychology and Behavior*, *90*, 500–511. https://doi.org/10.1016/j.trf.2022.09.016