FOUNDATION FOR TRAFFIC SAFETY

Effects of Training Content and Approach on Drivers' Understanding of and Performance with Advanced Driver Assistance Systems

INTRODUCTION

Advanced Driver Assistance Systems (ADAS), designed to assist drivers with various aspects of driving, are becoming increasingly common. Lane Keeping Assistance (LKA) is designed to prevent drivers from departing their lane unintentionally. Adaptive Cruise Control (ACC) is designed to maintain a driver-specified speed and gap to the vehicle ahead. Partial driving automation systems combine ACC with technology designed to keep the vehicle centered in its lane. These technologies have the potential to make driving safer and more comfortable; however, it is important for drivers to understand their capabilities as well as their limitations. Although previous research has shown that drivers' understanding of ADAS can be improved through training, not much is known about what features of training influence its effectiveness. The purpose of this research was to investigate how training content, style, and mode of delivery influence drivers' understanding of and performance with ADAS. This research consisted of two experiments. Experiment 1 investigated the impact of training content. Experiment 2 examined the impact of training mode and style.

METHODOLOGY

In Experiment 1, 60 participants were divided into three training groups. All participants received baseline training that explained what each ADAS feature was intended to do, how to activate and deactivate it, as well as information about its limitations (e.g., not working reliably in inclement weather). One group received only the baseline training, one group received the baseline training plus interactive question-and-answer style feedback, and one group received the baseline training plus additional training about driver-related issues (e.g., importance of avoiding distractions, maintaining situational awareness, not trusting the technology to do things it cannot do).

In Experiment 2, a separate group of 60 participants were divided into four training groups. Half of the participants received video-based training, and the other half received training inside of an actual vehicle. Within each of those two groups, half received a passive demonstration and half received interactive practice. Interactive video practice involved responding to periodic questions for

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the participant to apply what they had learned; interactive in-vehicle practice involved driving the vehicle on a closed course and operating the ADAS.

In both experiments, all participants completed questionnaires prior to training that measured their general driving experience and their knowledge of and experience with ADAS. Then they completed the training assigned to their group. After training, they completed another questionnaire to investigate whether their knowledge of ADAS had changed. They also drove in a driving simulator that simulated the functions of LKA, ACC, and a partial driving automation feature. Various measures of their decision-making and performance were examined when they encountered situations in which the ADAS was not designed to work reliably and driver intervention was required.

KEY FINDINGS

Results confirmed that all types of training examined in both experiments, regardless of content, style, or mode, generally increased the accuracy of drivers' knowledge about ADAS.

- Training that included feedback produced the greatest increases in knowledge.
- In-vehicle training resulted in greater knowledge gains than video-based training.
- Video-based practice led to marginally greater knowledge gains than video-based demonstration, but knowledge gains associated with in-vehicle training did not differ between demonstration versus practice.

Results related to driving performance measures were mixed.

- There was no evidence that any type of training led to significantly better decision-making in terms of deactivating the vehicle systems in situations where they would not work reliably.
- Some findings suggested that in-vehicle training might lead to better decision-making in situations most similar to situations in the training, and that video-based training might produce better decision-making across a wider range of scenarios, but those findings were inconclusive.
- Some training types led to faster response times or better steering control in some specific comparisons, but those results were inconsistent and were tempered by the lack of evidence that they led to better decision-making.

Overall, results confirm that drivers' understanding of the capabilities and limitations of ADAS can be improved through training, and provide valuable insights into the features of training that lead to greater gains in knowledge. More research is needed to understand the relationship between training drivers about ADAS and real-world safe driving performance.