

TRANSPORT FINDINGS

How do Car Owners Familiarize and Adapt to Unfamiliar Vehicle Technologies?

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Findings

Many drivers lack relevant knowledge about advanced driver assistance systems (ADAS), and how they learn about ADAS is mainly haphazard. We conducted interviews with six experts from the automobile industry and eight drivers. Few drivers actively engage with ADAS features and settings in their vehicles and many fail to check or familiarize themselves with ADAS in an unfamiliar car. Moreover, the research highlights that it is not rare for drivers to misinterpret typical ADAS responses as technical issues.

1. Questions

Most new cars are equipped with advanced driver assistance systems (ADAS) that can provide information, assist the driver, or overtake steering, breaking and acceleration, in certain situations. Many ADAS are standard equipment on most new passenger cars, such as adaptive cruise control (ACC) and lane keeping assistants (LKA) (A. K. Høye 2019, 2020).

Although increasing uptake of ADAS is expected to improve road safety, several types of ADAS adversely affect driver behavior (de Winter et al. 2014; Hungund, Pai, and Pradhan 2021; Banks et al. 2018; Mueller et al., 2022) For example, drivers often become inattentive, engage in secondary tasks, or get confused.

To understand and counteract such maladaptive behaviors, we need more knowledge on how drivers familiarize and adapt to ADAS.

On this background, we explore the following questions:

- How do drivers learn about ADAS?
- What are the implications for their understanding and use of ADAS?

2. Methods

We use data from six expert and eight driver interviews. Expert interviews were conducted in January-March 2023 with representatives of car rental/sharing companies, an insurance company, and an automobile organization. Topics covered in the interviews include how and if actors in the automobile industry reflect on issues related to advanced technologies in cars, if and how they collect data on accidents related to ADAS-use, knowledge of incidents, feedback from costumers/members related to use of ADAS technology, and what ADAS-related challenges costumers/members report.

Table 1. Characteristics of participants in the driver interviews (n=8).

Participant	Sex	Age	Driving experience (years)	Days of driving per week	ADAS in own car ^a	Integrated screen in current car
1	Female	49	31	3-4	Intermediate	Yes
2	Male	53	36	5-7	Basic	Yes
3	Male	55	38	3-4	Basic	No
4	Female	55	25	3-4	Advanced	Yes
5	Male	22	2	3-4	No ADAS	No
6	Male	42	23	5-7	Advanced	Yes
7	Female	53	35	5-7	Advanced	Yes
8	Male	65	45	1-2	Advanced	Yes

^a This refers to the participants own cars, and classify car models into four groups: **No ADAS**; **Basic ADAS** (Cruise Control, Electronic Stability Control). **Intermediate ADAS** (at least one of Adaptive Cruise Control, Lane Departure Warning / Lane Assist, Parking Assist, etc.); **Advanced ADAS** (integrated regulation of speed and lateral control, e.g., Tesla Autopilot, Pilot Assist).

Driver interviews were conducted with participants in a driving study on a closed track in August 2023. One of the tasks in the study was to drive an unfamiliar new car with ADAS. To investigate how drivers interact with ADAS in an unfamiliar new car, participants were told to imagine that they had rented the car and were going for a drive, while talking through how they prepare to safely drive the car. Participants were interviewed twice: after preparing to drive the car, and after the driving session.

Given the qualitative nature of our study, a diverse sample of eight participants was deemed sufficient to gain in-depth insights and varied perspectives. The inclusion of expert interviews further strengthened the empirical foundation of our research. Interviews were transcribed and analyzed with Thematic analysis (Braun and Clarke 2006).

Details on study design and interview guides are provided in supplementary files 1 and 2. [Table 1](#) shows characteristics of participants in the driver interviews.

3. Findings

Drivers know little and learn about ADAS mainly by trial and error

Thematic analysis ([Table 2](#)) revealed that drivers usually receive no ADAS training from car dealers or from rental services. Drivers don't seek information in user manuals or the internet. Instead, they learn to use the systems in their own car by trial and error, or don't use them at all, and they have little knowledge about ADAS. Drivers also report that they don't regard exploring the car's technology as safety-critical. These results are consistent with previous research (A. Høye, Uhlving, and Egner 2023).

Moreover, complaints to both automobile companies from car owners and car rental/sharing companies reveal that drivers regularly misinterpret warnings or actions of ADAS as technical errors, or get confused and scared when they perceive the car as out of their control ([Table 2](#)).

Table 2. Main themes and selected quotes from driver and expert interviews.

Theme	Quote
Limited knowledge about ADAS	<u>Expert, car sharing company</u>: “The customer thinks it’s something wrong with the car, since it gives a jolt in the steering wheel. That is our theory, since they report fault on the front wheel suspension. Later examination reveal nothing wrong. This function (Lane Assist) is active by default. The driver does not need to turn it on.” <u>Expert, car leasing company</u>: “We’ve had cars returned and tested for technical issues, but nobody can find anything wrong with the car, but the customer insists that the car is dangerous, experiencing jerking in the steering wheel or pulling to the side (Lane Assist).” <u>Expert, automobile organization</u>: “Lane assist will drag you toward the curve, if there is no white center line there. This is particularly scary with oncoming traffic. We often get this kind of feedback. (...) They feel someone else is in control of the car, and they find themselves in an unforeseen situation, become jumpy and afraid that the car will drag them over in the opposite lane.” <u>Expert, automobile organization</u>: “Another thing is if the emergency brake is activated in a curve, or suddenly thinks there is something in the road. Either a message in the dashboard appears, or the car will hit the brakes. Many experience that as quite dramatic and think there is something wrong with the system. Can I file a complaint, or return the car?”
Limited driver education	<u>Expert, automobile organization</u>: “Driver assistance systems are not in the minds of those that purchase cars. There is a pressing need for better education on ADAS. You have to get people to understand what the systems are and how they are used. There is very little information out there about this.” <u>Participant 8</u>: “When we got the car, we just got the key. There was no training (...)” <u>Participant 2</u>: “...It’s a used car, so I have never had any training.”
Insufficient learning strategies	<u>Participant 7</u>: “I don’t use driver assistance systems. I just use the systems that are installed in Tesla. I think Lane Keeping Aid is automatically on. It also keeps distance from the car in front. It brakes if I get too close. These systems are always on.” <u>Participant 2</u>: “I never use it. Don’t know how to. It’s difficult to remember, not very intuitive. I haven’t bothered to learn it. (...) I know it’s possible to find a user manual on the internet, but who has time for that?” <u>Participant 8</u>: “Of course, you can go on the internet, but I haven’t spent much time on it. It’s a bit self-taught. It’s a bit dangerous because there are things I don’t know even after half a year.”

When preparing to drive the unfamiliar car, participants used quite similar strategies. They adjusted basic settings like mirrors and seat position and checked how to deactivate the handbrake, but few thought of checking or familiarizing with ADAS before driving. Only one of eight actively investigated the ADAS (checked which ADAS the car was equipped with, which ADAS were active, how to turn ADAS on/off) and three others explored the car’s integrated screen (mostly to find the navigation system and connect their mobile phones).

Those who more actively explored the technology in the car, including ADAS, were mainly younger drivers. The older participant did not do anything to check or familiarize with ADAS in the unfamiliar car, despite several owning cars with similar ADAS-functionality. Such differences should be investigated in more detail and considered when developing strategies for improving drivers’ knowledge about ADAS.

Drivers use mainly ADAS’ default settings

The participants in our driving study generally kept all ADAS-default settings. Those who have ADAS in their own car, also use them mostly at default settings, which is consistent with other studies (A. Høye, Uhlving, and Egner 2023).

The most used systems among our study participants are ACC, LKA, and parking assist. Reasons for not using ADAS were partly that they were not deemed useful, and partly a lack of knowledge about how the systems work or how to change settings. The most common reason for deactivating ADAS in other studies, is that many drivers find warnings, especially frequent acoustic warnings from LDW, annoying (e.g. Gaspar and Brown 2020).

Drivers' knowledge about ADAS is safety-critical and has large room for improvement

We observe that drivers often lack knowledge about ADAS, few explore ADAS features and settings in their own cars, and don't think to check or familiarize with ADAS in an unfamiliar car. It is not uncommon that drivers misinterpret ordinary ADAS-responses as technical malfunctions.

The lack of drivers' knowledge about ADAS revealed in our study is an obvious challenge. It is safety-critical because drivers are unaware of the systems' capabilities and limits, which is associated with inappropriate expectations about ADAS performance, overtrust, misinterpretation of warnings, and inappropriate use (Banks et al. 2018; de Winter et al. 2014; A. Høye, Uhlving, and Egner 2023).

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SUPPLEMENTARY MATERIALS

Supplementary file 1

Download: <https://findingspress.org/article/116293-how-do-car-owners-familiarize-and-adapt-to-unfamiliar-vehicle-technologies/attachment/223399.pdf>

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