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Observing user perception and usage of ADAS from a survey in Italy

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Abstract

Technological developments in vehicles and advanced driver assistance systems (ADAS) can help reduce traffic accidents, often caused by inadequate driving behaviors. European General Safety Regulation 2019/2144 requires all new motor vehicles to be equipped with selected ADAS to support the driver in unsafe situations. The regulation aims to improve road safety but allows drivers to switch off the systems. This paper analyzed the level of knowledge and usage of recent technologies installed in new-generation vehicles through a survey distributed in September 2023, which collected 9078 responses. Correlations were examined, including how ADAS are used according to socioeconomic features or situations, such as brightness, road type, or weather conditions. Motivational information on the deactivations of the devices is also analyzed. The main motivation for this behavior was the "desire to be in full control of the car." The best-known and most used of those surveyed was the Cruise Control, whereas the least known was the Intelligent Speed Assistance.

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Keywords: ADAS; survey; user perception; safety; driving behaviour

1. Introduction

In 2022, approximately 20600 people died, and 1.13 million people were injured in a road accident in Europe (European Commission, 2024). The ambitious European goal “Vision Zero” aims for zero road fatalities by 2050. Several actions can help improve road safety by supporting driver tasks, as human behavior remains among the main

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causes of road accidents. In recent years, technological developments in vehicles, particularly advanced driver assistance systems (ADAS), have a role in supporting driving activities. According to SAE classification (Shi et al., 2020), ADAS can be classified as active safety systems (Level 0-2) because they provide momentary intervention without reducing the driver's role in performing the driving activities. Nowadays, these systems are commonly available in new vehicles in the market, for example, to help the driver maintain the trajectory in the lane continuously (LKA - lane keeping assistant) or adjust the longitudinal motion control considering the position and speed of the lead vehicle (ACC - adaptive cruise control). Similar functions in emergencies with warning or momentary interventions after detecting an obstacle or trajectory deviation are encouraged to correct driving behaviors for road safety (Federica Cossu et al., 2023).

European General Safety Regulation 2019/2144 requires all new motor vehicles, type-approved from 2022 or registered from July 2024, must be equipped with selected ADAS to enhance road safety: intelligent speed assistance (ISA); alcohol interlock installation facilitation; driver drowsiness and attention warning (DDAW); advanced driver distraction warning (ADDW); event data recorder (EDR); advanced emergency braking (AEB) and emergency lane keeping assist (ELKS)†. The regulation for AEB and ELKS established that the driver can switch off such systems at a time by a sequence of actions. Still, they shall be in normal operation mode upon each activation of the vehicle master control switch. Therefore, although the European regulation aims for the wide deployment of these systems to improve road safety, it can be complex to quantify their regular usage and benefits. The socio-economical and scenario factors influencing the knowledge and acceptance of ADAS are investigated in the literature with, for example, on-road field tests (Son et al., 2015), focus groups (Wood et al., 2024), or surveys.

For example, Nandavar et al. (2023) interviewed 48 Australian drivers to understand their motivations for choosing a vehicle with ADAS and the strategies used to increase awareness. A similar goal to Kaye et al. (2022), which surveyed a sample of 236 Australian drivers of vehicles equipped with at least one ADAS among those selected. In both studies, awareness of ADAS at the purchase stage is low and occurs mainly through a trial and error process. Palac et al. (2021) examined the responses of 996 US adults on their experience of using 13 selected Level 0 and Level 1 ADAS. The subject of their survey is not only related to the socioeconomic characteristics of the users or the methods used to find out how ADAS works but also the reasons for deactivation. The main findings include the ranking of the use of these ADAS and the reasons for the switch-off, mainly related to the lack of confidence in the technology. Lubkowski et al. (2021) also investigated the reasons survey participants gave (223 in 2019) for turning off selected systems, including LDW, AEB, and ACC. However, the conditions of ADAS use are less addressed in the literature.

This research draws a recent picture of the knowledge and use of ADAS, which are becoming widely used or planned as mandatory in new-generation vehicles: cruise control (CC), AEB, ACC, ISA, ELKS, and LKA. The paper analyzes a large (more than 9000 respondents) and recent dataset (2023) from an online survey in Italy.

2. Methodology

The knowledge and usage of recent technologies installed in new-generation vehicles are analyzed through an online survey by the research center Fondazione Caracciolo on drivers contacted as ACI members or web users. The interview, distributed in September 2023, allowed a non-probability sample of 9078 respondents to observe how drivers behave regarding selecting the most common ADAS. The sample size was considered interesting compared to available scientific literature studies.

2.1. Survey structure

The survey included questions of different types, such as multiple-choice questions, rankings with Likert scales, and free answers. The number of questions varied depending on the selection of answers, with an average of 30

† ADDW for vehicles type-approved from 2024 and registered from 2026.

questions. The number of items for the Likert scale questions was variable, with a maximum of 12. The overall structure of the questionnaire comprised the following sections:

1. introduction phase and verification of ACI membership status
2. assessment of drivers of buying a car
3. knowledge and use of ADAS
4. knowledge and use of autonomous vehicles
5. opinion on electric cars
6. collection of socio-demographic data, personality traits, and vehicle ownership type.

The current analysis focused on a subset of questions. The focus is on the users' knowledge and use of driver assistance systems; consequently, the answers to sections 4 and 5 of the survey are excluded from the current analysis. The data collected on the users' answers in section 3 are studied using socioeconomic characteristics (part 6) and purchase factors (2) to investigate possible correlations.

The introduction questions are characterized by a list of statements for which the respondents are asked to express on a 5-point scale their knowledge (1= no knowledge; 5= knowledge and conscious use) or degree of evaluation (1=strongly disagree; 5=strongly agree). The selection of rejection factors is presented with a multiple-choice question, and the items vary according to the characteristics of the technology. This analysis is limited to the sample declaring the specific ADAS's conscious switch-off. The conditions of use (light, weather, type of road, and traffic) are investigated with ADAS-specific multiple-choice questions for the sample that declared a conscious use of the system. Functional, symbolic, emotional, and individual measurement factors were used according to the literature to obtain a systemic representation of the causes of technology use or rejection.

2.2. Dataset description

The average age of the sample is 58 years, with a large prevalence of male gender (91%) and an education level of approx. 50% of the respondents have a high school diploma, and 20% have a master's degree. Detailed gender analysis on the dataset is excluded due to the low representation of the female sample. As for occupation, 37% are retired, while 60% of respondents are still employed: 45% are full-time employees, 13% self-employed, and 2% part-time. The sample, which includes frequent car users (82% declared a daily use), is concentrated and distributed in northern and central Italy (58 and 27%, respectively). 42.6% of the sample use a car less than five years old for their main trips. In addition, a self-perception of one's level of car knowledge was asked, and again, the sample is particularly characterized by a strong interest in the world of cars (50.4% constantly seek info) and consider themselves experts (50.3%). The inclination toward technology characterizes the sample: more than 60% of users agree that road safety problems can be solved with technology. These sample characteristics are also reflected in the answers to the question, "*When buying a car, what factors do you consider relevant to your choice?"*. Safety was the most selected answer according to the literature (Nandavar et al., 2023), followed by economic factors (purchase and maintenance) and car performance characteristics (performance and technological equipment). The car manufacturer, environmental impact, and incentive and disincentive policies seem less influential.

3. Results

The sample surveyed declared themselves to be fairly informed about ADAS. In fact, on the proposed knowledge scale from 1 (no knowledge) to 5 (extensive knowledge), more than 58% of respondents report knowledge even extensive (levels 4 and 5), and only 10% declare no knowledge. Deepening the factors influencing the perception and use of ADAS in the sample collected, Table 1 shows how the importance of the safety factor in the choice of car correlates with the perception of ADAS. In general, the sample surveyed was sensitive to safety issues, with 58% strongly agreeing that safety is a factor to be considered when purchasing a vehicle. Among those users, 34% stated they had good knowledge of ADAS, and 29% even had extensive knowledge.

Table 1. Knowledge of ADAS and safety factors influences the choice of vehicle.

		1. No knowledge	2	3	4	5. Extensive knowledge	#
Safety as a driver for car purchase	1. strongly disagree	17%	7%	15%	25%	36%	104
	2	11%	18%	15%	29%	27%	55
	3	14%	9%	27%	31%	18%	461
	4	11%	11%	26%	33%	19%	3154
	5. strongly agree	9%	7%	21%	34%	29%	5304
	Total	**10%**	**9%**	**23%**	**33%**	**25%**	**9078**

In the analysis of the further questions, which also included the use of ADAS in addition to knowledge, 10% of the sample who stated that they did not know ADAS was excluded (option 1 on a 5-point scale in the answer "*Please indicate your level of knowledge of ADAS*"). According to Palac et al. (2021), age is an influential factor in the use and knowledge of ADAS. Table 2 compares the respondents' age and level of expertise in ADAS. As might be expected, older people are less familiar with these systems. Conversely, younger age groups have more awareness, but their cars are not equipped with them. The main users who consciously deactivate ADAS belong to the 31-40 age group.

Table 2 Declared level of knowledge and usage of ADAS with the age of the respondents

Age	1. No knowledge	2. Minimal knowledge	3. Knowledge but not present in the car	4. Knowledge but conscious deactivation	5. Knowledge and conscious use
18-30	0%	5%	36%	10%	50%
31-40	1%	6%	26%	12%	54%
41-50	1%	8%	25%	9%	56%
51-60	1%	9%	26%	8%	56%
61-65	1%	10%	23%	8%	58%
65+	1%	13%	25%	10%	50%

Moreover, the absence of these systems is greater in the vehicles of low-income users, probably because of the typically additional cost that technologies require. Indeed, the annual income is an influential factor in the knowledge and use of ADAS. High-income users know and consciously choose to use it, unlike low-income users with limited knowledge (Table 3). No relevant differences in user responses according to place of residence were observed other than a higher conscious use in Northern Italy. Users without a high school diploma report having lower or no systems knowledge.

Conversely, those with a master's degree report more use. The sample is not balanced concerning gender because the sample includes 8270 male and 708 female responses (7516 and 566, respectively, in the cleaned sample). Given this consideration, the male sample is likelier to use ADAS than the female component.

Table 3 Declared level of knowledge of ADAS as a function of income

Income [€]	1. No knowledge	2. Minimal knowledge	3. Knowledge but not present in the car	4. Knowledge but conscious deactivation	5. Knowledge and conscious use	#
0-20.000	1%	13%	36%	8%	41%	1619
20.001-30.000	1%	12%	29%	9%	49%	2819
30.001-40.000	1%	9%	25%	8%	57%	1941
40.001-50.000	0%	8%	18%	10%	63%	967
50.001-60.000	0%	6%	20%	11%	62%	620
60.001-70.000	0%	10%	14%	8%	68%	296
70.001-80.000	0%	7%	15%	12%	65%	241
80.001-100.000	0%	6%	16%	10%	69%	264
100.001-150.000	1%	6%	12%	18%	64%	185
150.000+	2%	3%	11%	13%	70%	126

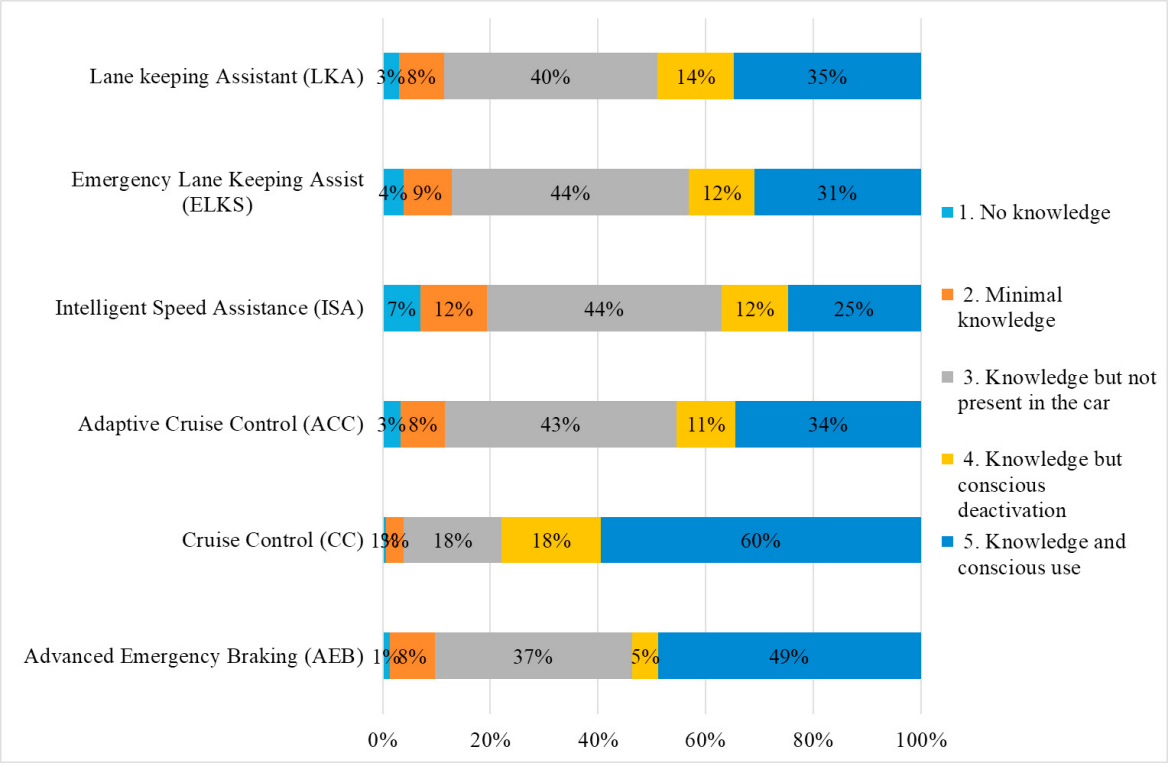

Fig. 1 Level of knowledge and use of selected ADAS systems on a 5-point scale

After initial general questions, the level of knowledge for the selected ADAS was investigated (Fig. 1). The number of respondents is again lower than the total (8166 of 9078) because the question was not asked in case of no knowledge

of ADAS. Although this filter was included, only some respondents declared a lack of knowledge of specific systems, with percentages below 4%, except for ISA (7%). On the other hand, CC (59.5%) and AEB (48.8 %) are the most consciously used systems. The intermediate level of awareness (3), which means the system is known but not present in the car, was a highly selected option (over 43 % for ACC, ISA, and ELKS) except for CC.

Selecting only those users who stated that they usually deactivate the system, the factors influencing this choice were investigated using multiple-choice questions. Some of these factors were defined based on the technological characteristics of the selected ADAS. In contrast, others were related to behavior and perception (having control of the vehicle, trust in the technology, or annoyance at acoustic and visual signals). Table 4 shows some relevant results regarding absolute and percentage responses on the sub-sample. The user could choose multiple factors or none. The main reason for deactivating driver assistance systems, regardless of the type of system, is the perception of not being in complete control of the vehicle. The only exception is LKA, which has a low response rate to this question. The idea is that the device distracts drivers, makes them lose the pleasure of driving, and causes the presence of annoying signals to be frequent reasons for deactivating LKA. Confidence in the technology and difficulty understanding how it works do not seem influential for users, unlike the results of Kaye et al. (2022) and Palac et al. (2021), except ACC, which appears complex. Among other results, sudden braking and steering typical of systems that intervene in emergencies (AEB and ELKS) worry respondents who deactivate them. For these systems, "false" alarms are considered a relevant factor by users. As far as the ISA system is concerned, users do not use it because they believe they can comply with speed limits without support, and, to a lower percentage, they are afraid of incorrect readings of signals by the technology.

Table 4 Rejection factors for selected ADAS of users intentionally switching them off (multiple-choice answer)

	AEB		CC		ACC		ISA		ELKS		LKA	
Rejection factors	#	%	#	%	#	%	#	%	#	%	#	%
I do not trust the technology	48	12%	92	6%	77	9%	48	5%	71	7%	81	7%
I get annoyed by signals (visual and/or audible)	56	14%	91	6%	64	7%	100	10%	154	16%	284	25%
It distracts me while driving.			157	10%	111	12%	111	11%			231	20%
It is not easy to understand its operation	20	5%	99	7%	232	26%	30	3%	12	1%	9	1%
I want to be in full control of the car	228	58%	1018	68%	547	61%	445	44%	562	57%	42	4%
It causes a loss of driving pleasure.			254	17%	203	23%	191	19%			196	17%
It causes too many "false alarms."	131	33%							289	29%		
Users (Knowledge but conscious deactivation)	***394***		***1503***		***895***		***1007***		***993***		***1158***	

After investigating the factors influencing rejection towards a specific ADAS, the contexts of usage are examined by selecting those who declared an informed use of the technologies in the sample of users. Fig. 2 shows the results, considering the answer was multiple choice (or no selection). The contexts of use investigated were common to all technologies and concerned brightness, weather, road type, and traffic level. The users expressed different preferences regarding the use of each ADAS. In some cases, there seems to be no particular preference: for example, many AEB and LKA users state that they activate it on all types of roads with no preference for brightness, weather, or traffic conditions. In other cases, however, some preferences emerge more clearly. The CC and ACC users prefer to use them in extra-urban contexts, with a prevailing usage of the CC at low levels of traffic congestion. Moreover, ISA and ACC users activate the system preferably during the night hours.

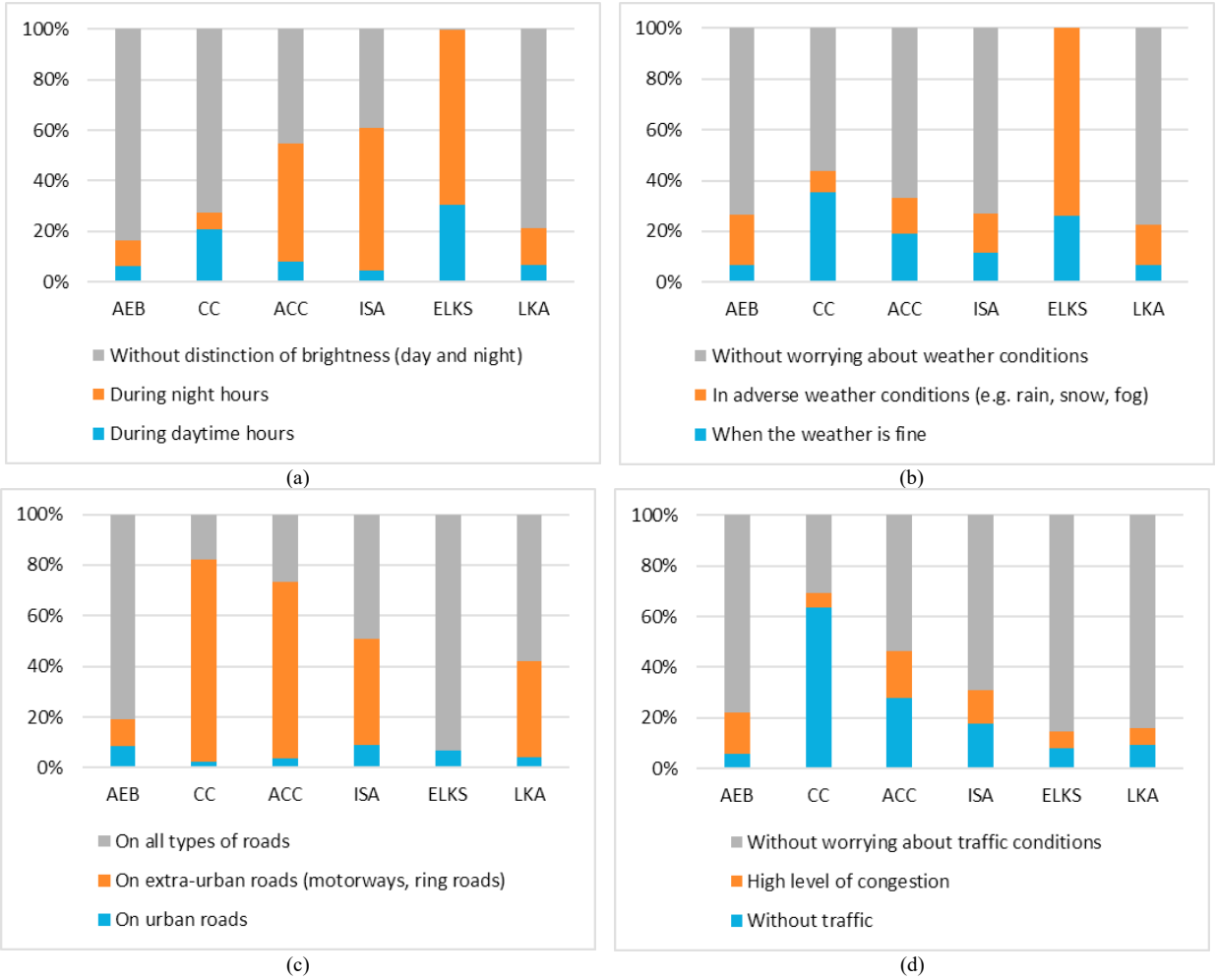

Fig. 2 Utilization factors for selected ADAS (multiple-choice answer): (a) brightness, (b) weather, (c) road type, and (d) traffic level.

Other findings include that the conscious use of ADAS is not related to automotive expertise but rather to the high frequency of vehicle usage. As emerged from the literature, training on ADAS would increase knowledge of it and confidence in the system itself over trial-and-error procedures (Kaye et al., 2022; Lubkowski et al., 2021). The surveyed sample confirms interest in increasing knowledge of ADAS by reacting positively (44% yes, 29% do not know) to the question, "*Would you attend a training course on the use of driver assistance systems (ADAS)?*". In addition, 78% of respondents believe this knowledge should be integrated into driver's license courses.

4. Conclusions

According to the results, a negligible minority of the sample does not know ADAS (1%), and a share of 10% cannot thoroughly understand them. In addition, some respondents, although aware of ADAS, do not use them because they are not installed in their vehicles or for personal reasons (25% and 9%, respectively). More than half of 9078 respondents declare that they consciously use ADAS. However, there are peculiarities after investigating the details of the specific technology, since individual preferences play a key role in activating assistance systems. In addition, the deployment of ADAS systems in vehicles is likewise relevant. Therefore, there is a clear correlation between the frequency of vehicle usage and the acceptance of ADAS. Moreover, a regular driving context allows more conscious control.

Socioeconomic characteristics seem to influence ADAS knowledge and use. Age and income, for example, are important factors, as shown in the literature, but the place of residence and education level only minimally affect the choice.

While proposing an interesting picture, the generic questions on vehicle technology solutions should be explored further by analyzing the specific ADAS. The answers clearly show that awareness and usage may differ depending on the system investigated. The limiting factor in using the selected ADAS seems to be the fear of losing control of the car, thus showing a lack of confidence in the technology. CC is the most well-known and used, unlike ISA. Brightness conditions only influence the use of ISA and, to a small extent, ACC, which are preferred at night. Adverse weather conditions increase confidence in ELKS, but they do not affect the use of other ADAS. Extra-urban roads are the preferred type for the use of CC and ACC. Finally, traffic conditions only involve using CC, which is preferred in uncongested situations. Users believe that training in using ADAS is necessary to increase their knowledge. This type of survey, conducted before and after, could be useful to evaluate the effects of specific training courses on the knowledge and use of ADAS.

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Reference

European Commission, 2024. Annual statistical report on road safety in the EU, 2024. European Road Safety Observatory, Brussels, European Commission, Directorate General for Transport.

Federica Cossu, Francesco Deflorio, Carlo Beatrice, Angela Carboni, Luca Cerimele, Chiara Ronzoni, Cecilia Tortora, 2023. L'auto di domani sicura, sostenibile e accessibile, 2023rd ed. Fondazione Filippo Caracciolo.

Kaye, S.-A., Nandavar, S., Yasmin, S., Lewis, I., Oviedo-Trespalacios, O., 2022. Consumer knowledge and acceptance of advanced driver assistance systems. Transportation Research Part F: Traffic Psychology and Behaviour 90, 300–311. https://doi.org/10.1016/j.trf.2022.09.004

Lubkowski, S.D., Lewis, B.A., Gawron, V.J., Gaydos, T.L., Campbell, K.C., Kirkpatrick, S.A., Reagan, I.J., Cicchino, J.B., 2021. Driver trust in and training for advanced driver assistance systems in Real-World driving. Transportation Research Part F: Traffic Psychology and Behaviour 81, 540–556. https://doi.org/10.1016/j.trf.2021.07.003

Nandavar, S., Kaye, S.-A., Senserrick, T., Oviedo-Trespalacios, O., 2023. Exploring the factors influencing acquisition and learning experiences of cars fitted with advanced driver assistance systems (ADAS). Transportation Research Part F: Traffic Psychology and Behaviour 94, 341–352. https://doi.org/10.1016/j.trf.2023.02.006

Palac, D., Scully, I.D., Jonas, R.K., Campbell, J.L., Young, D., Cades, D.M. (2021). Advanced Driver Assistance Systems (ADAS): Who's Driving What and What's Driving Use? Proceedings of the Human Factors and Ergonomics Society Annual Meeting 65, 1220–1224. https://doi.org/10.1177/1071181321651234

Shi, E., Gasser, T.M., Seeck, A., Auerswald, R., 2020. The Principles of Operation Framework: A Comprehensive Classification Concept for Automated Driving Functions. SAE Intl. J CAV 3, 12-03-01–0003. https://doi.org/10.4271/12-03-01-0003

Son, J., Park, M., Park, B.B., 2015. The effect of age, gender, and roadway environment on the acceptance and effectiveness of Advanced Driver Assistance Systems. Transportation Research Part F: Traffic Psychology and Behaviour 31, 12–24. https://doi.org/10.1016/j.trf.2015.03.009

Wood, J.M., Henry, E., Kaye, S.-A., Black, A.A., Glaser, S., Anstey, K.J., Rakotonirainy, A., 2024. Exploring perceptions of Advanced Driver Assistance Systems (ADAS) in older drivers with age-related declines. Transportation Research Part F: Traffic Psychology and Behaviour 100, 419–430. https://doi.org/10.1016/j.trf.2023.12.006