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Automated driving acceptance and expectations: a cross-national perspective

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Abstract

This study uses data from an online survey conducted in eight countries (China, Germany, Greece, Japan, Poland, Sweden, the United Kingdom, and the United States) to investigate acceptance of and expectations towards conditionally automated driving. Acceptance was assessed using three questions that captured respondents' willingness to use and to acquire an automated vehicle (AV), with answers showing substantial cross-country variation. 93% of respondents in China were enthusiastic towards automated driving systems (ADS), compared to 36% in the United Kingdom. Participants were asked about their expectations towards ADS, assessing which aspects would be better or worse in an AV than in a manually driven vehicle (MV), and rating the importance of each aspect in purchase decisions. Overall, driving safety, adherence to traffic rules, and the accuracy and reliability of performance were rated as the most important AV purchase decision aspects. However, these were not the areas where respondents expected the greatest performance gains compared with driving themselves, suggesting a potential mismatch between priorities and expectations. Country-level results showed that safety and reliability-related aspects were consistently valued, whereas the importance of convenience and novelty aspects varied. In terms of performance expectations, most countries anticipated AVs to perform better than MVs in all areas except ownership costs, though levels of optimism differed considerably across countries. These findings highlight the need for the industry to address specific public concerns, aligning system capabilities with user expectations across diverse national contexts.

Keywords: conditionally automated driving, willingness to use, preferences, purchase decisions, performance

Introduction

Automated driving systems (ADS) are widely anticipated to bring improvements to traffic safety and efficiency^{1, 2, 3, 4, 5} as well as to make travel more convenient by allowing the use of travel time for other purposes than driving.^{6, 7, 8} However, realising these potential benefits depends not only on technological advancement but also on public acceptance and trust in the ADS themselves.

Previous research has consistently suggested that acceptance of ADS is shaped by diverse factors,^{9, 10, 11, 12, 13} such as technology affinity, performance expectations, cost-benefit considerations, safety concerns, and broader social context. Cross-national studies have found significant differences in public attitudes towards ADS, with acceptance being often lower in wealthier countries.^{14, 15} In addition, profile-based analyses have shown that enthusiastic and sceptical users differ not only in willingness to use automation, but also in the benefits they expect from it.¹⁶ Evidence

on changes over time remains limited, but longitudinal research suggests that public interest in automated vehicles (AVs) does not necessarily increase as technology matures, and safety-related concerns persist or even intensify.¹⁷

Against this background, the present study contributes by jointly examining acceptance, purchase-decision priorities, and performance expectations across eight countries, with different levels of income and road safety, and different roles in the development of ADS. Variations in acceptance of and expectations towards conditionally automated driving were examined across different contexts, focusing on what users most value when deciding to purchase an AV. By investigating how ADS acceptance interacts with the importance people place on different AV purchase decision aspects, as well as their performance expectations in comparison to their own driving performance, this paper aims to inform ADS design and marketing practices for its deployment in diverse settings.

Data and methodology

An online survey was conducted in May 2023 with 7,896 participants with a valid driving licence in China, Germany, Greece, Japan, Poland, Sweden, the United Kingdom, and the United States.¹⁸ Participants ranged from 18 to 75 years old ($M=48$, $SD=13$); 48% were women. Age and gender distributions were similar across countries.

Participants were given a textual description of ADS, defined as systems that allow drivers to take their hands off the wheel and eyes off the road, but that require them to resume control of the vehicle whenever prompted. Acceptance of ADS was measured on a scale from *Strongly disagree* (1) to *Strongly agree* (5), regarding the respondents' agreement with three statements: "*I would use an ADS if I had it in my car*", "*The next car I buy/lease/rent will have an ADS if it is available*", and "*I would use the ADS during my everyday trips*". An ADS acceptance score was assigned to each respondent, based on their average of the numerically coded responses to the three statements. Participants with an ADS acceptance score below 2.5 were classified as **sceptic**, those scoring between 2.5 and 3.5 were considered **neutral**, and respondents with scores above 3.5 were identified as **enthusiastic**.

Participants were asked to rate the importance of certain factors (e.g., comfort, safety, emissions) in AV purchase decisions, on a scale from *Not at all important* (1) to *Very important* (5). For each aspect, participants rated how they expect AVs to perform compared to manually driven vehicles (MVs) on a scale from *Much worse* (1) to *Much better* (5). Full descriptions of the aspects and response scales are provided in Table A1 and Table A2 in the Appendix.

Linear mixed-effects models were used to examine differences between acceptance groups (sceptic, neutral, and enthusiastic) in the importance placed on AV purchase decision aspects and in their performance expectations. Each model included acceptance group, the relevant aspect type (importance or expectation), and their interaction as fixed effects, with a random intercept for participant to account for repeated ratings. Likert-scale responses were treated as continuous variables (1–5) and analysed using maximum likelihood estimation.

The survey was conducted in the framework of the Hi-Drive project, and adhered to the guidelines set forth by the Finnish National Board on Research Integrity TENK.¹⁹ Informed consent was obtained from all participants prior to their participation in the study. Participation incentives were provided either through a small monetary reward or the opportunity to win prizes via the online panel.

Results

Overall, 53% of participants were classified as enthusiastic, 23% as neutral, and 24% as sceptic towards ADS. However, the pattern varied considerably by country, with China displaying an exceptionally high share of enthusiastic respondents at 93%, and a very small share of sceptic respondents at 1%. Japan, Poland, and Greece exhibited relatively high enthusiasm, with 54%, 61%, and 55% respectively, and scepticism between 13–17%. In

contrast, the United Kingdom and the United States showed the highest levels of scepticism, at 40% and 41%, and the lowest levels of enthusiasm, at 36% and 38%. Germany and Sweden presented a more balanced distribution, with enthusiasm around 42–43% and scepticism between 30–37%. Figure 1 shows the distribution of these groups across the surveyed countries based on their acceptance scores.

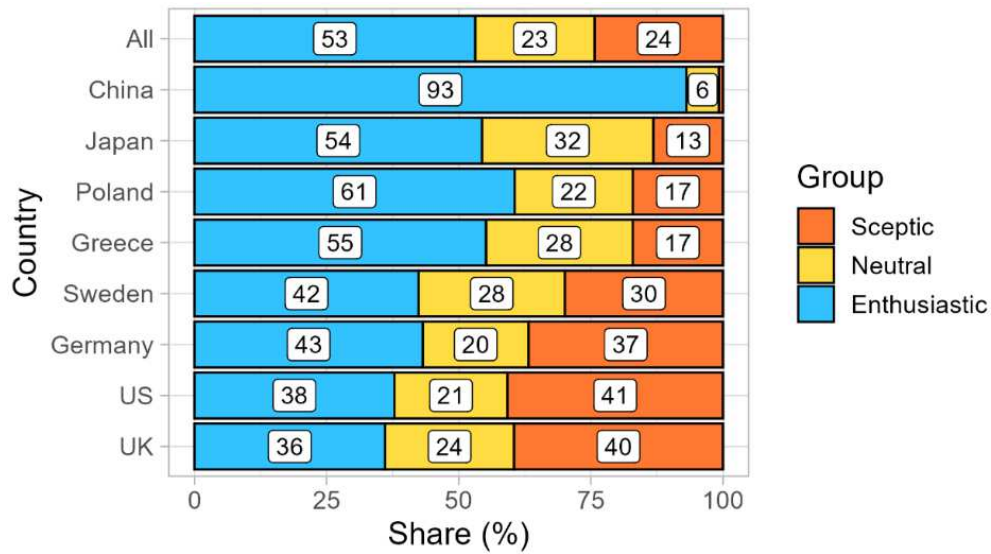


Figure 1. Overall and country-level shares of acceptance groups.

The importance of aspects for AV purchase decisions was examined for overall respondents and each of the acceptance groups (Figure 2). Compared to neutral and sceptic participants, enthusiastic respondents consistently assigned higher importance to all aspects. Overall, the most critical AV purchase decision aspects were *safety of driving*, *following traffic rules*, and *accuracy and reliability of the driving performance*.

Cost of owning a car also ranked highly and was seen by sceptic respondents as more important than *accuracy and reliability of the driving performance*. In contrast, aspects such as *carbon emissions from driving*, *driving as fast as the speed limit and traffic allow*, and *using the travel time for other purposes than driving* received the lowest importance ratings, particularly among sceptic respondents.

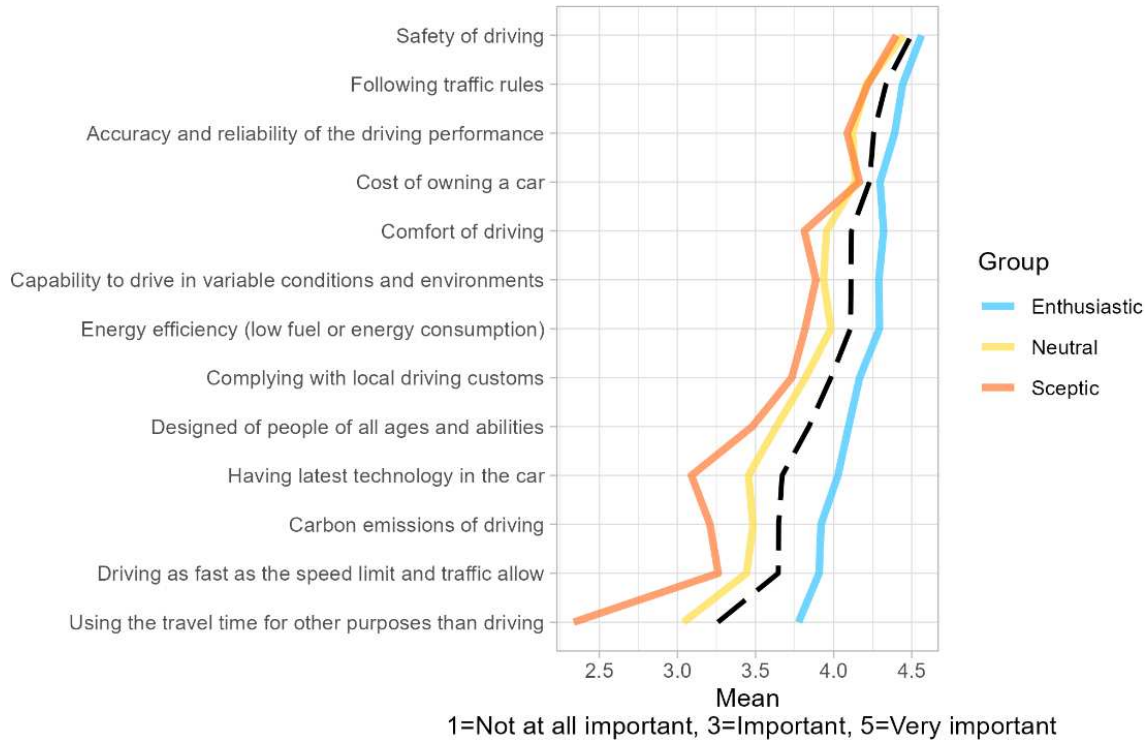


Figure 2. Importance of aspects for AV purchase decisions. Overall (dashed black line) and group (coloured lines) averages are shown.

To investigate in more detail the differences in importance ratings across acceptance groups, a mixed-effects model (Table 1) was employed. Statistically significant negative interaction terms indicated that group differences were more pronounced for aspects with lower overall importance ratings compared to the reference aspect, *safety of driving*. This was particularly evident for aspects such as *having the latest technology in the car* and *using the travel time for other purposes than driving*. Most interaction effects were highly statistically significant ($p < .001$), likely reflecting the influence of the large sample size.

Table 1. Mixed-effects model of the importance of AV purchase decision aspects by acceptance group.

	Effect β and significance level		
Intercept (reference aspect <i>Safety of driving</i> , reference group <i>Enthusiastic</i>)	4.562***		
Neutral	-0.115***		
Sceptic	-0.161***		
Aspect	Main effect of aspect	Interaction of aspect and Neutral	Interaction of aspect and Sceptic
Following traffic rules	-0.121***	-0.117***	-0.062, <i>n.s.</i>
Accuracy and reliability of the driving performance	-0.172***	-0.154***	-0.143***
Cost of owning a car	-0.265***	-0.042, <i>n.s.</i>	0.029, <i>n.s.</i>
Comfort of driving	-0.242***	-0.250***	-0.347***
Capability to drive in variable conditions/environments	-0.273***	-0.238***	-0.242***
Energy efficiency	-0.270***	-0.195***	-0.314***
Complying with local driving customs	-0.396***	-0.231***	-0.273***

Designed for people of all ages and abilities	−0.467***	−0.346***	−0.456***
Having latest technology in the car	−0.535***	−0.457***	−0.777***
Carbon emissions of driving	−0.643***	−0.320***	−0.550***
Driving as fast as the speed limit and traffic allow	−0.656***	−0.348***	−0.485***
Using the travel time for other purposes than driving	−0.787***	−0.621***	−1.279***

Note: *** $p < .001$, n.s. = not significant.

Next, the importance of AV purchase decision aspects was analysed at the country level (Figure 3). *Safety of driving*, *following traffic rules*, and *accuracy and reliability of the driving performance*, the most critical AV purchase decision aspect for overall respondents, received an average score above 4 (“fairly important”) in all surveyed countries. While safety- and reliability-related aspects were consistently prioritised, preferences related to convenience and novelty varied notably across national contexts. Participants in Sweden and the United Kingdom rated *using the travel time for other purposes than driving* as less than important (average scores below 3), whereas participants from Poland, Greece, and particularly China considered it more important, with above-average ratings.

Participants in China also placed exceptional importance on *having the latest technology in the car*: it was the only country where this aspect received an average score above 4. This suggests a high level of technology affinity among respondents in China, 93% of whom were classified as enthusiastic towards ADS.

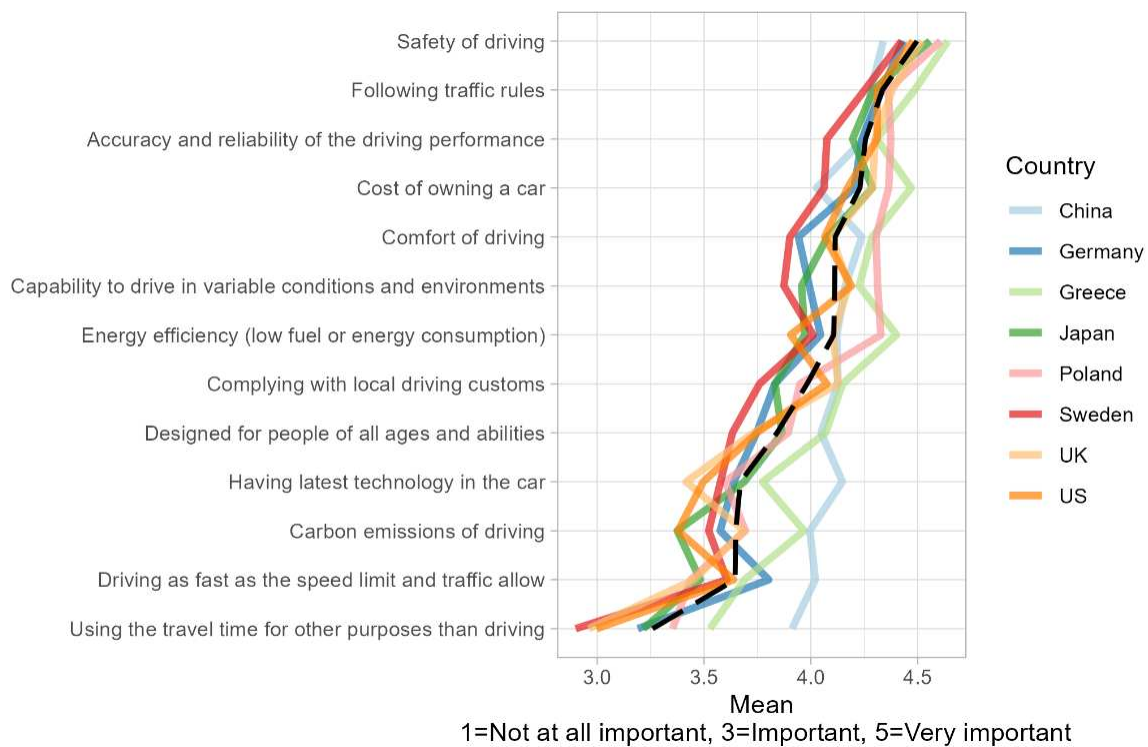


Figure 3. Importance of aspects for AV purchase decisions. Overall (dashed black line) and country (coloured lines) averages are shown.

For each purchase decision aspect, respondents rated how well they expect AVs to perform, compared to driving themselves (Figure 4). Overall, compared to sceptic and neutral respondents, enthusiastic respondents exhibited consistently higher AV performance expectations. Sceptic respondents expected AVs to underperform MVs in most areas, assigning ratings below 3 (“similar”) for nearly all aspects except for *using the travel time for other purposes than driving*, *energy efficiency*, and *carbon emissions from driving*.

Participants reckoned that *using the travel time for other purposes than driving* will be significantly better in AVs than in MVs, and saw this as the aspect with the greatest performance gains compared with driving themselves. Interestingly, participants rated this as the least important among the AV purchase decision aspects (Figure 2). *Comfort of driving* and *energy efficiency* also ranked highly, followed by *following traffic rules* and *carbon emissions from driving*. *Cost of owning a car* attracted the lowest performance expectations, despite being the fourth most important purchase decision aspect. Similarly, *safety of driving* was rated as the most important aspect for purchase decisions but did not rank highly among performance expectations.

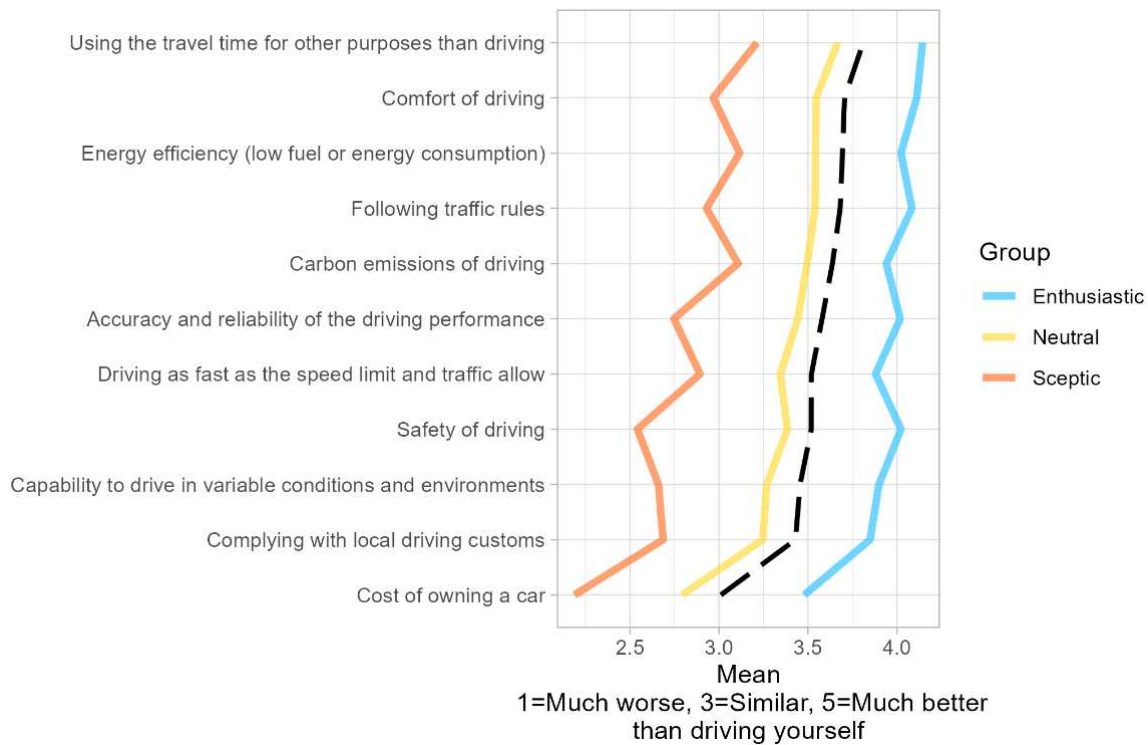


Figure 4. ADS performance expectations at the respondent level. Overall (dashed black line) and group (coloured lines) averages are shown.

A mixed-effects model (Table 2) was employed to examine the differences in performance expectations across acceptance groups. Statistically significant negative interaction terms indicate that differences between sceptics and enthusiasts were more pronounced for certain aspects with lower performance expectations than the reference aspect *using the travel time for other purposes than driving*, such as *safety of driving* and *accuracy and reliability of the driving performance*. Notably, for *carbon emissions from driving*, the interaction term for sceptics was statistically significant and positive, indicating that although their performance expectations for this aspect were lower in absolute terms, sceptic respondents were relatively more optimistic about this aspect compared to the patterns seen in the responses of the two other groups.

Table 2. Mixed-effects model of ADS performance expectations by acceptance group.

Respondent group	Effect β and significance level		
Intercept (reference aspect <i>using the travel time for other purposes than driving</i> , reference group <i>Enthusiastic</i>)	4.144***		
Neutral	-0.477***		
Sceptic	-0.931***		
Aspect	Main effect	Interaction of aspect and Neutral	Interaction of aspect and Sceptic
Comfort of driving	-0.033*	-0.089**	-0.212***
Energy efficiency	-0.121***	-0.004, <i>n.s.</i>	+0.024, <i>n.s.</i>
Following traffic rules	-0.060***	-0.067*	-0.224***
Carbon emissions of driving	-0.204***	+0.032, <i>n.s.</i>	+0.098***
Accuracy and reliability of the driving performance	-0.126***	-0.099**	-0.341***
Driving as fast as the speed limit and traffic allow	-0.264***	-0.059*	-0.055, <i>n.s.</i>
Safety of driving	-0.122***	-0.162***	-0.550***
Capability to drive in variable conditions/environments	-0.245***	-0.154***	-0.308***
Complying with local driving customs	-0.296***	-0.127***	-0.232***
Cost of owning a car	-0.665***	-0.210***	-0.360***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$, *n.s.* = not significant.

Next, performance expectations were analysed at the country level (Figure 5). Respondents in China, 93% of whom were enthusiastic towards ADS, demonstrated high performance expectations consistently across all purchase decision aspects. On the other hand, performance expectations in the United States and the United Kingdom, where the share of sceptic respondents was the highest among surveyed countries, were among the lowest for all aspects. Respondents in Japan exhibited performance expectations below the overall average (dashed black line) across most aspects, with the exception of *using travel time for other purposes than driving*, which received an average score above 4 (“somewhat better”). This suggests that while respondents in Japan hold generally moderate performance expectations, they recognised potential convenience-related gains in AVs.

Apart from ownership costs, expected to be worse for AVs than MVs by respondents in the United Kingdom, Germany, the United States, and Japan, all other aspects received scores above 3 (“similar”) in every country. This suggests that, across countries, respondents generally expect AVs to outperform MVs in all areas except ownership costs.

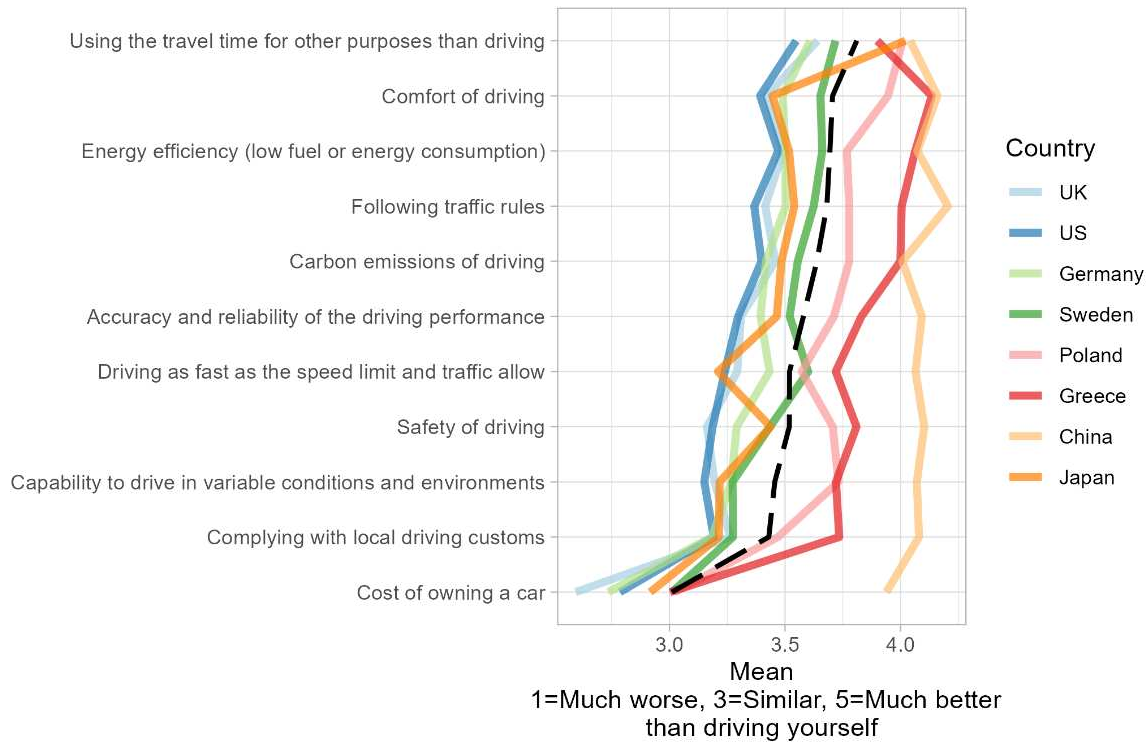


Figure 5. ADS performance expectations at the country level. Overall (dashed black line) and country (coloured lines) averages are shown.

Discussion and conclusion

This study examined public acceptance of conditionally automated driving, as well as the factors affecting AV purchasing decisions and their performance expectations in eight countries with different economic and cultural settings. Acceptance levels varied widely across countries. Respondents in China showed exceptionally high enthusiasm towards ADS, while participants in the United Kingdom and the United States were markedly more sceptical. Although the present study does not directly test the reasons for these differences, the pattern is consistent with earlier studies suggesting that public acceptance is shaped by technology affinity and broader social context. Previous research suggests that higher technology affinity in China may contribute to more positive views of new technologies, whereas lower willingness to use ADS in countries such as the United States may reflect personal values or a stronger enjoyment of driving.¹²

Across all countries, safety- and reliability-related aspects were the most important in AV purchase decisions. However, these were not the areas where respondents expected the greatest performance gains compared with driving themselves. Using travel time for other activities was the aspect with the highest expected performance difference in favour of AVs, even though it was rated as the least important purchase factor. Ownership costs received the lowest performance expectations, despite being the fourth most important purchase decision factor. Safety of driving did not rank highly among performance expectations either, although it was considered the most important purchase decision aspect. These mismatches suggest challenges to adoption, as people may not perceive clear benefits in the aspects they value most.

From a policy and public communication perspective, the emphasis on safety-related aspects in AV purchase decisions displayed in all surveyed countries has relevant implications. Policymakers should focus on transparent communication about safety performance, system reliability, limitations, and the conditions under which ADS can be expected to operate. Public communication should therefore address the specific concerns that are most relevant

to potential users, including how these systems handle complex traffic situations, and how they comply with traffic rules. In this sense, the results suggest that broader public acceptance of ADS is likely to depend less on novelty alone and more on whether AVs can demonstrate credible and understandable safety value.

Mixed-effects models were used to examine how respondent group (enthusiastic, neutral, and sceptic) influenced the perceived importance of AV purchase decision aspects and ADS performance expectations. Compared with sceptics, enthusiastic respondents assigned greater overall importance to purchase decision aspects and reported higher performance expectations. The latter finding is consistent with previous research.¹⁶ These differences were statistically significant, indicating that greater enthusiasm towards ADS is associated with greater performance expectations and an increased importance placed on AV purchase aspects, particularly those related to convenience and innovation rather than safety.

At the country level, despite the common focus on safety and reliability, views on convenience and novelty varied. Participants in Sweden and the United Kingdom placed low importance on using travel time for other activities, while those in Poland, Greece, and especially China rated it more highly. Respondents in China also assigned greater importance to having the latest technology in the car. In terms of performance expectations, respondents in China, most of whom were enthusiastic towards ADS, showed consistently high optimism across all aspects. On the other hand, respondents in the United States and the United Kingdom, where scepticism towards ADS was the highest, exhibited consistently lower AV performance expectations. These findings support the view that attitudes towards ADS are shaped by broader social contexts in which novel technologies are interpreted and valued differently.

The results should be interpreted considering the study design. The data were collected in a single survey conducted in May 2023, and do not allow conclusions about how public attitudes towards ADS may change over time. This is an important topic for future studies, particularly because earlier research has found that public perceptions may change as exposure to ADS increases.¹⁷ Longitudinal studies would be especially valuable for assessing whether current differences between countries persist or change as ADS become more visible in everyday mobility.

For the industry, understanding the priorities and expectations of different user groups across countries is essential for guiding global ADS development, as the findings suggest that design choices and marketing strategies should consider local preferences and concerns. Ultimately, successful deployment of ADS will depend on bridging the gap between what people value and what these systems can deliver.

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Appendix

Table A1. Questions related to the importance of aspects for AV purchase decisions.

Question		Response scale
Please rate the following aspects in terms of how important they would be for you in making a DECISION TO PURCHASE an automated car.	Capability to drive in variable conditions and environments	1 = Not at all important
	Having the latest technology in the car	2 = Slightly important
	Accuracy and reliability of the driving performance	3 = Important
	Driving as fast as the speed limit and traffic allow	4 = Fairly important
	Using the travel time for other purposes than driving	5 = Very important
	Safety of driving	
	Energy efficiency (low fuel or electricity consumption)	
	Carbon emissions from driving	
	Cost of owning a car	
	Comfort of driving	
	Complying with local driving customs	
	Following traffic rules	
	Designed for people of all ages and abilities	

Table A2. Questions related to AV performance expectations.

Question		Response scale
Please rate whether you expect using an automated car to be WORSE, SIMILAR, or BETTER than driving yourself for each of the following aspects.	Capability to drive in variable conditions and environments	1 = Much worse
	Accuracy and reliability of the driving performance	2 = Somewhat worse
	Driving as fast as the speed limit and traffic allow	3 = Similar
	Using the travel time for other purposes than driving	4 = Somewhat better
	Safety of driving	5 = Much better
	Energy efficiency (low fuel or electricity consumption)	
	Carbon emissions from driving	
	Cost of owning a car	
	Comfort of driving	
	Complying with local driving customs	
	Following traffic rules	