Transportation Research Part F: Psychology and Behaviour 101 (2024) 199–217

Contents lists available at ScienceDirect

Transportation Research Part F: Psychology and Behaviour

journal homepage: www.elsevier.com/locate/trf

The gender gap in the acceptance of automated vehicles in Europe

Guilhermina Torrao [a,b,*], Esko Lehtonen [b], Satu Innamaa [b]

[a] Aston University, Aston Street, Birmingham B4 7ET, United Kingdom
[b] VTT Technical Research Centre of Finland Ltd., P.O. Box 1000, FI-02044 VTT, Finland

ARTICLE INFO

Keywords:
Automated vehicle
Country
Gender gap
Intention to use
Social equality and transport planning

ABSTRACT

Previous research suggests that there might be a gender gap in the acceptance of automated vehicles (AVs): males are typically found to have a higher intention to use AVs than females, although opposite results have been reported in different countries. The conflicting results have yet to be addressed, and only a few studies have attempted to explain the country-level differences based on quantifiable socio-economic indicators.

We investigated the gender gap in the acceptance of AVs (SAE Level 3) using a questionnaire study among 8412 car-drivers in eight European countries as part of the European L3Pilot project. For this study, the gender gap in the acceptance of AVs is defined as the difference in the willingness to use, buy and activate the automated driving function in AVs between men and women. Results showed two distinct realities for Europe: in one group of countries, females were less willing to use AVs than males, while in another group, both males and females had similar acceptance towards AVs with higher ratings overall. These country groups were different in terms of Gross Domestic Product (GDP) per capita and the Gender Equality Index (GEI). The gender gap in the acceptance of AVs was larger in countries with a higher GDP and GEI.

The study findings suggest that the gender gap in the acceptance of AVs is not universal, and the countries' progress in economics and gender equality are related to people's attitudes toward AVs. This finding enhances policy development and planning future transport solutions to ensure that all potential users can benefit from AVs.

1. Introduction

Studies have reported gender binary[1] differences in the acceptance of automated vehicles (AVs) (Payre, Cestac and Delhomme, 2014; Schoettle and Sivak, 2014; Hohenberger, Spörrle and Welpe, 2016; Haboucha, Ishaq and Shiftan, 2017; Nielsen and Haustein, 2018; Liljamo, Liimatainen and Pöllänen, 2018; Anania et al., 2018; Nordhoff et al., 2018; Nordhoff et al., 2020).[2] Often, previous studies have found that men show higher general acceptance of AVs than women, which in this study, we call the gender gap in the acceptance of AVs. This gap seems to enforce the gender binary stereotypes of men being more technology-oriented than women, such

* Corresponding author.
E-mail address: g.torrao@aston.ac.uk (G. Torrao).

[1] The research has not typically considered non-binary genders. The studies on AV acceptance typically use quantitative methods, which would require a substantial amount of respondents who identify themselves as non-binary, which is often not the case.

[2] Most of these studies were conducted through online surveys and were mostly quantitative in nature. More information about the research designs used can be found in Table A, Appendix 1. Table A also provides insight into the direction of effect for gender, with "M↑" indicating higher acceptance of AVs for males and "F↑" indicating higher acceptance of AVs for females.

https://doi.org/10.1016/j.trf.2023.11.002
Received 19 December 2022; Received in revised form 25 September 2023; Accepted 7 November 2023
Available online 18 January 2024
1369-8478/

as “Men tend to describe technology as a toy, while women tend to describe technology as a tool” (Kelan, 2007).

It is often noted in literature that men tend to be more open to trying out new technologies in their early stages of introduction as compared to women (Schoettle and Sivak, 2014; Abay and Mannering, 2016; Venkatesh, Thong and Xu, 2012). This belief has led to the assumption that men are more likely to accept AVs technology than women. Still, such gender stereotypes should be investigated critically.

Studies carried out at the country level have shown a general trend of men having higher acceptance of AVs compared to women, as reported in France by Payre et al. (2014) and Piao et al. (2016), in Denmark by Nielsen and Haustein (2018), in Finland by Liljamo, Liimatainen and Pöllänen (2018), and Czech Republic by Havlíčková et al. (2020). Although studies conducted at the country level suggest a general gender gap for the acceptance of AVs, with men being more positive than women, this trend is not consistently observed across multiple countries. Studies involving participants from different countries often yield mixed results. Haboucha, Ishaq and Shiftan (2017) found that Israelis were more likely to accept AVs, with men being more favourable towards them than women, but this gender gap was not observed in North America. Another study by Anania et al. (2018) revealed that Indian women were more willing to ride in AVs than Indian men, while in the U.S., the opposite was true. For a summary of the results, please refer to Table A in Appendix 1.

Most of the previously mentioned studies have only reported the gender gap in the general acceptance of AVs, but have not explained it (Payre, Cestac and Delhomme, 2014; Piao et al., 2016; Haboucha, Ishaq and Shiftan, 2017; Nielsen and Haustein, 2018; Liljamo, Liimatainen and Pöllänen, 2018; Moody, Bailey and Zhao, 2020; Wilson et al., 2022). Other studies have attempted to explain it. It has been proposed that men anticipate pleasure instead of anxiety with AVs to explain men’s higher willingness to use AVs, while the opposite was true for women (Hohenberger, Spörrle and Welpe, 2016). Another study suggested that women are highly influenced regarding the potential risks of AVs, while men seem not to be influenced by perceived risks (Kapser, Abdelrahman and Bernecker, 2021). However, both these studies were carried out in Germany. Therefore, it is not known whether these explanations could be generalised cross-culturally and if they could also explain inconsistent effects found in some cross-country studies (Haboucha, Ishaq and Shiftan, 2017; Anania et al., 2018). Another study in the U.S. reported that women were less willing to use AVs than men, and the explanation was attributed to women’s fear of AVs (Rice and Winter, 2019). A similar explanation was suggested in the UK for the gender gap in AVs acceptance. In the UK, men were associated with a greater propensity for risk-taking than women, which could lead to men perceiving AVs as less risky and having a positive attitude towards AVs (Hulse, Xie and Galea, 2018). Regardless, the authors highlighted that cultural identity threats could not fully explain the gender differences observed in the study (Hulse, Xie and Galea, 2018). In the Czech Republic, negative feelings were reported by 40 % of women toward connected and automated vehicles as opposed to only 33 % of men (Havlíčková et al., 2020). However, the authors emphasised that the results were inconclusive and did not offer a definitive explanation for this gender disparity.

It is worth noting that most studies addressing the gender gap in the acceptance of AVs have been conducted in countries with higher development status. Additionally, the reported findings from the studies attempting to explain the gender gap have been based on samples from a single country. As a result, it is challenging to determine the extent to which the explanations provided for the gender gap in the acceptance of AVs could be applied globally or account for the differences between how women and men rate their intention to use AVs across different countries.

In contrast, some studies have claimed that the gender gap in the acceptance of AVs does not exist. Wilson et al. (2022) found that gender had no statistically significant effect with both males and females feeling equally positive about AVs, which is in contradiction with studies that have reported only males being positive towards AVs (Payre, Cestac and Delhomme, 2014; Kyriakidis, Happee and de Winter, 2015; Piao et al., 2016; Nielsen and Haustein, 2018; Liljamo, Liimatainen and Pöllänen; 2018, Moody, Bailey and Zhao, 2020). Nevertheless, Wilson et al. (2022) did not report participants’ country of residence, which would benefit the results comparison with other single-country or multi-country studies. In addition, studies applying the Unified Theory of Acceptance and Use of Technology models have used gender as a moderating factor for the intention to use AVs and reported that gender had a small to a non-existent role in the intention to use AVs (Madigan et al., 2017; Nordhoff et al., 2020; Kapser, Abdelrahman and Bernecker, 2021).

Beyond the mixed results regarding the effect of gender gap in the general acceptance of AVs, previous studies’ explanations do not seem to be sufficient to fully explain why mixed results have been found for some countries. Hence this study explores how the gender gap in the intention to use AVs may arise from varying social or cultural attitudes prevailing in a given country.

To examine cross-national effects on general attitudes towards AVs, some studies have extended the analysis to measurable country covariates, with the GDP being the most used to explore what country-level factors could explain the attitudes towards AVs. GDP has been explored in quantitative research based on cross-sectional surveys, as shown in Table A in Appendix 1 with the studies conducted by Bazilinskyy, Kyriakidis and de Winter, 2015, Kyriakidis, Happee and de Winter, 2015; Nordhoff et al., 2018; Moody, Bailey and Zhao, 2020. For example, Nordhoff et al. (2018) found that males had a higher acceptance of AVs than females across all countries, but this effect was not statistically significant within countries. For national differences, country developmental status (GDP per capita) was predictive of the countries’ mean acceptance score, with respondents from higher-income countries expressing more negative ratings of intention to use AVs (Nordhoff et al., 2018). Similarly, Moody, Bailey and Zhao (2020) found that country-level awareness of AVs was positively correlated with GDP per capita and negatively correlated with the Gini index (which measures income distribution or consumption among individuals or households within an economy).

Even though not targeting the acceptance of AVs, some quantitative studies supplemented the survey data with other indicators to account for the country’s gender equality development. More recently, some studies considered the World Economic Forum’s Gender Gap Index (GGI) as a suitable proxy for gender equality culture in the country of origin (Falk and Hermle, 2018; González and Rodríguez-Planas, 2020; Marcén and Morales, 2021). Falk and Hermle (2018) investigated what contributes to gender-associated differences in preferences, such as the willingness to take risks, patience, altruism, positive and negative reciprocity, and trust, by conducting a global preference survey and studying 80,000 individuals in 76 countries. Their study revealed that gender differences in preferences are more prominent with higher levels of economic development and gender equality.

Despite the ample attention to AVs acceptance in the past few years, none of the previous studies had investigated indicators of societal equality beyond the economic ones to examine the cross-country variability in in the gender gap of acceptance of AVs. The European Commission's Joint Research Centre has recognised the European Gender Equality Index (GEI) (EIGE, 2020) as a trustworthy tool for measuring gender equality in the European Union. It assesses the inequalities between women and men across crucial areas such as work, knowledge, money, and health. To the authors' knowledge, no research has been conducted on the gender gap in the acceptance of AVs and GEI.

This study aims to increase the understanding of the gender gap in the acceptance of AVs by analysing survey data collected from eight European countries. For this study, AVs (SAE Level 3) refers to a conditionally automated car designed to handle all the driving tasks in specific environments. Specifically, when driving in automated mode, the system handles steering, acceleration, and braking, stays in the lane, and keeps a safe distance to the vehicle in front. For the purpose of the present study, we measure the gender gap in the acceptance of AVs by the difference in the willingness to use AVs, willingness to buy AVs and willingness to activate the automated driving function in AVs between men and women.

In this study, we specifically examined two research questions related to the gender gap in the acceptance of AVs:

1: Does Europe have a gender gap in the acceptance of AVs?

2: Does gender equality and GDP influence the cross-country variability of the gender gap in the acceptance of AVs within Europe?

Our research aims to fill a critical gap in the analysis of gender mainstreaming within the context of AVs. By examining GDP and GEI as country-level covariates in our analysis of the gender gap in AV acceptance, we seek to provide valuable insights into the relationship between economic development, gender equality and the gender gap.

2. Method

2.1. Questionnaire

Data from the L3Pilot project's Impact Assessment Survey (IAS) was used as the basis for this study. IAS was designed to investigate general views of the acceptance of AVs (SAE Level 3) and their impacts on travel behaviour among European car drivers. It was conducted under the EU funded L3Pilot research project (l3pilot.eu). Details on the IAS design, procedure, recruitment, and data quality assurance are available in L3Pilot deliverable D7.4 Impact Evaluation Results (Bjorvatn et al., 2021). Access to the IAS questionnaire can be found in Appendix 2 of this article. The 88-question online survey was organised to gather responders' information across the following groups: 1) Intention to use AVs (questionnaire items Q2-Q4); 2) Travel behaviour before the COVID-19 pandemic (Q5-Q48); 3) Travel behaviour if AVs would be available (Q48-Q64); 4) Willingness to pay for automated driving functions (Q65-Q75); and finally, 5) Socio-demographic characteristics (Q76-Q88). Questions included in the analysis of this study were selected from groups 1 and 5.

The IAS introduced the participants to conditionally automated cars with a comprehensive statement on the environment where the automated driving function could be activated. When activated, the automated driving function takes care of longitudinal and lateral control of the vehicle, allowing the driver to engage in other activities.

Regarding the general acceptance of AVs (SAE Level 3), respondents were presented with a group of three questions that are of most relevance to this study:

USE " *I intend to use a conditionally automated car in the future*";

BUY "*I plan to buy a conditionally automated car when it is available*".

And ACTIVATE "*I would very likely activate the automated driving function*".

For each participant, the survey collected socio-demographic and background information, including age, gender, annual gross income, educational level, employment status, adults living in their household, number of children, area of residence, vehicle kilometres travelled, and experience with advanced driving assistance systems (ADAS) covering automated emergency braking (AEB), lane-keeping assistance (LKA), adaptive cruise-control (ACC) and self-parking assist system (SPAS). The measurement of socio-demographic questions varied accordingly to the subject questionnaire item (e.g. participants' age).

2.2. Data

The online survey was carried out in eight European countries: Germany, Italy, Netherlands, Poland, Romania, Spain, Sweden, and the United Kingdom (UK). Data was collected between December 2020 and January 2021.

A total of 8432 participants took part in this survey with the following gender distribution: 4347 men, 4065 women and 20 were of gender category "other". As this study focuses on the gender binary difference (men vs. women), the non-binary gender group was removed (20 participants), resulting in 8412 responders (4347 men). The average age of participants was 43.0 years old (SD = 13.60), with the mean of men being 43.30 years old (SD = 13.60) and women, 42.90 years old (SD = 13.70). The average age of participants and standard deviations were comparable across all countries: Poland (M = 41.10, SD = 13.90), Romania (M = 41.30, SD = 13.00), UK (M = 43.00, SD = 13.70), Italy (M = 43.20, SD = 12.30), Netherlands (M = 43.70, SD = 14.10), Sweden (M = 44.20, SD = 14.50), and Germany (M = 44.90, SD = 13.60).

The questionnaire data was supplemented with country covariates indicative of economic development and social equality. Likewise (Kyriakidis et al., 2015; Nordhoff et al., 2018; Moody et al., 2020), we applied the GDP per capita as provided by the World

Bank (https://data.worldbank.org/indicator/NY.GDP.PCAP.CD) to account for the country's economic progress and country differences rather than individual differences.

As this study focuses on Europe to assess differences between men's and women's acceptance of AVs, we used the European GEI scores to indicate the country's progress in gender equality and differences in gender equality within each country. GEI data was provided by the European Institute for Gender Equality (EIGE) (EIGE, 2020). The GEI scores for the EU and the Member States are based on the gender gaps between women and men and levels of achievement in six core domains: Work, Money, Knowledge, Time, Power and Health (EIGE, 2020). The GEI gives the EU and the Member States a score from 1 to 100 where a score of 100 would mean that a country had reached full equality between women and men.

As the mean GEI overall score is based on multiple domains, it can be further analysed at the domain level. It is essential to understand the different domains in which gender inequalities can occur, and those are presented as follows. The GEI Knowledge measures how education is affected by gender, while the GEI Power focuses on decision-making positions in the political, economic, and social spheres. The GEI Health measures gender equality related to health behaviour, status, and access to healthcare. The GEI Work measures how equal access to employment and good working conditions can benefit both men and women. The GEI Money measures gender inequalities in access to financial resources and economic situations. Lastly, the GEI Time measures how gender inequalities can affect the allocation of time for care, domestic work, and social activities.

2.3. Data analyses

Analyses were conducted using IBM SPSS Statistics version 26 and R version 4.2.1 (linear regressions models). The dependent variables of interest for this study were the target questions (USE, BUY, ACTIVATE) that were measured in terms of responders' level of agreement using a five-point scale from 1 (Strongly disagree) to 5 (Strongly agree). The mean ratings of these items were calculated, with higher scores demonstrating a greater agreement with the general acceptance of AVs.

The gender gap in the acceptance of AVs across different countries was investigated using linear regression models. The same models were fitted for USE, BUY and ACTIVATE as a dependent variable. Gender, country and their interaction were used as the independent variables. Because the countries could be divided into two groups based on the magnitude of the gender gap, the analysis was repeated by using the country group instead of the country as an independent variable.

Even though the samples between countries were meant to be similar, individual-level socio-demographic variables could partially explain the found country level difference. To investigate this, we run the same regression models using the socio-demographic variables as control variables. The variables included age, education level, employment status, number of children under 18 in the household, living area, household income (urban or rural), annual driven kilometres, and experience with ADAS (advanced driving systems). For modelling purposes, the variables were converted into categorical or dummy variables. For instance, employment status was transformed into a dummy variable indicating whether one works full-time or not. Similarly, "Income-high" and "Income-moderate" dummy variables were used to represent income levels. Similarly, for the number of children, "Having children" means yes; otherwise, no. For the environment, type" Urban" means yes; otherwise, no. For higher education, "Having higher education" means yes; otherwise, no. For annual vehicle kilometres, "Drives at least 10,000 km per year," meaning yes; otherwise, no. Finally, for experience using ADAS, "Uses ADAS" means yes; otherwise, no.

Furthermore, gender gap in the acceptance of AVs (SAE Level 3) was computed for each dependent variable (USE, BUY, ACTIVATE) as follows:

$\mathrm{USE}: \ \mathrm{Gender\,Means\,Difference} = \mathrm{Mean\,USE(men)} - \mathrm{Mean\,USE(women)}$; for willingness to use AVs;

$\mathrm{BUY}: \ \mathrm{Gender\,Means\,Difference} = \mathrm{Mean\,BUY(men)} - \mathrm{Mean\,BUY(women)}$; for willingness to buy AVs;

$\mathrm{ACTIVATE}: \ \mathrm{Gender\,Means\,Difference} = \mathrm{Mean\,ACTIVATE(men)} - \mathrm{Mean\,ACTIVATE(women)}$; for willingness to activate the automated driving function.

In addition to the linear regression models, non-parametric Mann-Whitney U tests and t-tests were used to test the differences between different groups of participants.

Due to the expectation that the target dependent variables (USE, BUY, ACTIVATE) may be related to the country's socio-economic development status, Spearman correlation rank-order correlation coefficients (ρ) were calculated between country respondents' gender gap in AVs acceptance and country GDP per capita and country GEI scores. While previous work (Kyriakidis et al., 2015; Nordhoff et al., 2018; Moody et al., 2020) used countries' mean general acceptance score for the correlation analysis with GPD per capita, our study used the gender gap in acceptance of AVs (expressed in terms of gender means difference as explained previously). For the GEI analysis, which is the first time being investigated in the context of AVs, correlation coefficients were calculated initially between the gender gap in AVs acceptance and GEI overall score and following between the gender gap in AVs acceptance and each GEI domain score (Work, Money, Knowledge, Time, Power and Health).

3. Results

3.1. Gender gap in the acceptance of AVs

Overall in the sample of 8412 participants (4065 women), men participants were more likely to use AVs, compared to women with M = 3.37 (SD 1.21) and M = 3.20 (SD 1.84), respectively. Similarly, men participants' ratings showed a higher willingness to buy (M = 3.15, SD = 1.18 vs. M = 2.97, SD = 1.17), and willingness to activate the automated driving function (M = 3.53, SD = 1.19 vs. M = 3.36, SD = 1.18) compared to their women counterparts. Details of participants' responses and results regarding the questionnaire items and summary statistics are shown in Tables B-F in Appendix 3.

Overall, the gender difference was statistically significant with men more willing to use, buy, and activate AVs (Table 1). This means that the data shows a gender gap in Europe when the potential country differences are not considered. Still, it should be noted that the effect is very small for the gender alone ($R^2 \leq 0.01$). However, as illustrated in Fig. 1, the overall level of acceptance and the gender gap varied greatly by country. For example, for the willingness to use AVs, the largest gender gap was found in the Netherlands (M = 0.38, SD = 0.14), while for Spain, it was only (M = 0.04, SD = 0.10) (Fig. 1 a) and Table G in Appendix 4). Interestingly, women in Poland exhibited even greater acceptance towards AVs than men.

It is apparent from Fig. 1 that there are two distinct patterns regarding the gender gap in the acceptance of AVs in Europe. At the country level, Group 1 countries, namely Germany, Netherlands, Sweden, and the UK have a wider gender gap and lower scores compared to Group 2 countries, including Italy, Poland, Romania, and Spain. The participants from the Group 2 countries have higher scores for willingness to use, buy and activate AVs than those from Group 1 (Group 1: USE M = 2.97, SD = 1.25), BUY M = 2.79, SD = 1.21, ACTIVATE M = 3.20, SD = 1.24; Group 2: USE M = 3.61, SD = 1.06), BUY M = 3.34, SD = 1.07, ACTIVATE M = 3.70, SD = 1.07). The differences among Group 1 and 2 respondents were statistically significant for all the target variables (USE, Mann-Whitney U = 6273257.50, $p < 0.0001$; BUY, Mann-Whitney U = 6570592.00, $p < 0.0001$; and ACTIVATE, Mann-Whitney U = 6796085.50, $p < 0.0001$).

When looking at the gender difference with the countries grouped, there is no statistically significant difference between the men and women among the respondents from the Group 2 countries (Table 2). For Group 1 countries, the statistically significant interaction of gender and country group shows that women in Group 1 are less willing to use, buy and activate AVs than men in those countries (USE: Group 1 gender gap = 0.30 vs Group 2 gender gap = 0.03; BUY: Group 1 gender gap = 0.33 vs Group 2 gender gap = 0.02; ACTIVATE: Group 1 gender gap = 0.30, vs Group 2 gender gap = 0.04). That is in addition to the fact that the men in Group 1 countries had lower scores than men in Group 2 countries ($p < 0.0001$) (Table 2). It is worth highlighting that for Group 2, the acceptance of AVs, including men and women (e.g. for USE, M = 3.61, SD = 1.06) was even higher than for men alone in Group 1 (M = 3.12, SD = 1.27) (Table G in Appendix 4).

For completeness of analysis, we also tested the gender gap difference by each country separately using t-tests (Table G). The

Table 1
Linear regression models for USE, BUY and ACTIVATE and gender with and without control variables.

Model	Independent variables	Coefficient estimates *Without control variables*	*With control variables*
Model 1: USE and Gender	Gender- Women (ref. Men)	−0.17*** (0.03)	−0.06* (0.03)
	Age		−0.01*** (0.00)
	Working fulltime		0.22*** (0.03)
	Having children		0.17*** (0.03)
	Environment – Urban		0.24*** (0.03)
	Income- Medium (ref. Low)		0.15*** (0.03)
	Income- High		0.11*** (0.03)
	Having higher education		0.24*** (0.03)
	Drives at least 10000Km per year		0.21*** (0.03)
	Uses ADAS		0.25*** (0.03)
	Constant	3.37*** (0.02)	3.01*** (0.06)
	R^2	0.01	0.12
Model 2: BUY and Gender	Gender- Women (ref. Men)	−0.18*** (0.03)	−0.07* (0.03)
	Age		−0.01*** (0.00)
	Working fulltime		0.22*** (0.03)
	Having children		0.26*** (0.03)
	Environment – Urban		0.21*** (0.03)
	Income- Medium (ref. Low)		0.06* (0.03)
	Income- High		0.02 (0.03)
	Having higher education		0.20*** (0.03)
	Drives at least 10000Km per year		0.21*** (0.03)
	Uses ADAS		0.36*** (0.03)
	Constant	3.15*** (0.02)	2.90*** (0.06)
	R^2	0.01	0.15
Model 3: ACTIVATE and Gender	Gender- Women (ref. Men)	−0.18*** (0.03)	−0.08** (0.03)
	Age		−0.01*** (0.03)
	Working fulltime		0.17*** (0.03)
	Having children		0.16*** (0.03)
	Environment – Urban		0.21*** (0.03)
	Income- Medium (ref. Low)		0.14*** (0.03)
	Income- High		0.12*** (0.03)
	Having higher education		0.19*** (0.03)
	Drives at least 10000Km per year		0.17*** (0.03)
	Uses ADAS		0.22*** (0.03)
	Constant	3.53*** (0.02)	3.16*** (0.06)
	R^2	0.01	0.09

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

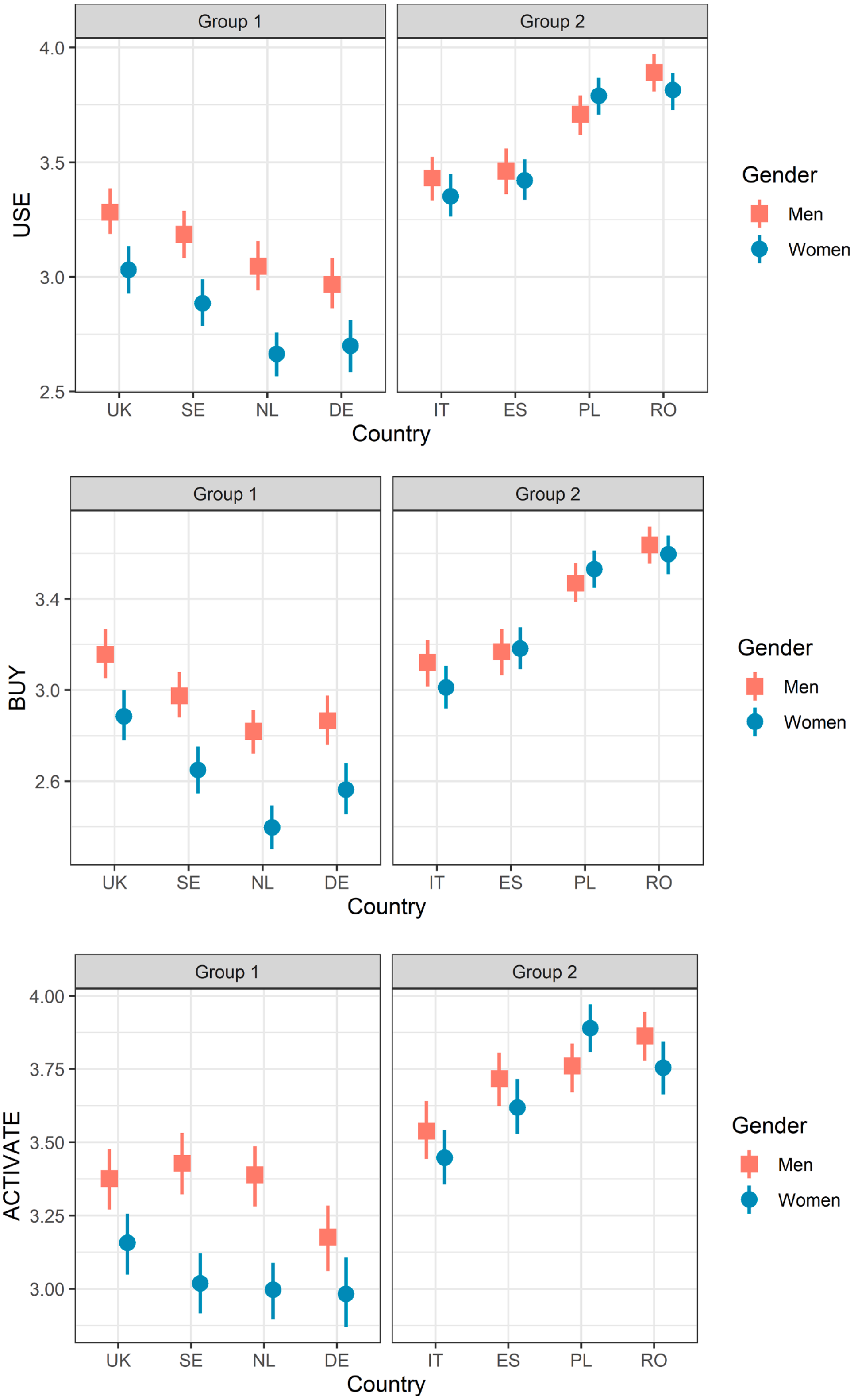

Fig. 1. Mean and 95% confidence intervals for a) USE, b) BUY, and c) ACTIVATE AVs by European country and country Group.

Table 2
Linear regression models for USE, BUY and ACTIVATE and gender with country group with and without control variables.

Model	Independent variables	Coefficient estimates *Without control variables*	*With control variables*
Model 1: USE and Gender with country Group	Gender- Women (ref. Men)	−0.04 (0.04)	0.02 (0.03)
	Group 1 country (ref.Group 2)	−0.51*** (0.04)	−0.44*** (0.03)
	Age		−0.01*** (0.03)
	Working fulltime		0.19*** (0.03)
	Having children		0.14*** (0.03)
	Environment – Urban		0.15*** (0.03)
	Income- Medium (ref. Low)		0.16*** (0.03)
	Income- High		0.13*** (0.03)
	Having higher education		0.18*** (0.03)
	Drives at least 10000Km per year		0.18*** (0.03)
	Uses ADAS		0.29*** (0.03)
	Women*Group 1 (ref. Men and Group 2)	−0.26*** (0.05)	−0.18*** (0.03)
	Constant	3.63*** (0.03)	3.37*** (0.06)
	R^2	0.08	0.17
Model 2: BUY and Gender with country Group	Gender- Women (ref. Men)	−0.03 (0.04)	0.03 (0.03)
	Group 2 (ref.Group 1)	−0.40*** (0.04)	−0.33*** (0.03)
	Age		−0.01*** (0.03)
	Working fulltime		0.20*** (0.03)
	Having children		0.24*** (0.03)
	Environment – Urban		0.13*** (0.03)
	Income- Medium (ref. Low)		0.06* (0.03)
	Income- High		0.04 (0.03)
	Having higher education		0.15*** (0.03)
	Drives at least 10000Km per year		0.19*** (0.03)
	Uses ADAS		0.40*** (0.03)
	Women*Group 1 (ref. Men and Group 2)	−0.30*** (0.05)	−0.22*** (0.05)
	Constant	3.35*** (0.03)	3.14*** (0.06)
	R^2	0.06	0.18
Model 3: ACTIVATE and Gender with country Group	Gender- Women (ref. Men)	−0.05 (0.04)	−0.01 (0.04)
	Group 2 (ref.Group 1)	−0.38*** (0.04)	−0.32*** (0.03)
	Age		−0.01*** (0.00)
	Working fulltime		0.14*** (0.03)
	Having children		0.14*** (0.03)
	Environment – Urban		0.14*** (0.03)
	Income- Medium (ref. Low)		0.14*** (0.03)
	Income- High		0.13*** (0.03)
	Having higher education		0.14*** (0.03)
	Drives at least 10000Km per year		0.15*** (0.03)
	Uses ADAS		0.25*** (0.03)
	Women*Group 1 (ref. Men and Group 2)	−0.26*** (0.05)	−0.19*** (0.05)
	Constant	3.72*** (0.03)	3.39*** (0.06)
	R^2	0.05	0.12

***p < 0.001; **p < 0.01; *p < 0.05.

gender gap was found for all Group 1 countries (Germany, Netherlands, Sweden, and the UK) with all the dependent variables ($p < 0.01$). However, for Group 2 countries (Italy, Poland, Romania, and Spain), there was no statistical significance between men and women in the acceptance of AVs, except for Romania and Spain, which showed a statistically significant difference in the gender gap for willingness to activate AVs ($p < 0.05$). Nevertheless, there was no statistically significant effect for the willingness to use or buy AVs in these countries.

All the regression models were run with and without the socio-demographic control variables. Despite the small differences in the magnitude of the coefficients, the interpretation of the results does not change. Thus, it can be concluded that the socio-demographic variability between men and women are unlikely to cause the observed results on the gender gap and country group differences in the acceptance of AVs within Europe.

3.2. Influence of country covariates in the gender gap in the acceptance of AVs

In the previous section, we found that the gender gap in AVs acceptance exists among the participants from the Group 1 countries but not among the participants from the Group 2 countries. In the current section, we focus on the differences between these countries in terms of GPD and GEI and correlate GPD and GEI to the country level scores. Table 3 shows the gender gap in acceptance of AVs with the intersection of the GDP per capita and GEI in the studied European countries. The comparison shows that GDP per capita is statistically significantly higher in Group 1 compared to Group 2 (M = 47559.50 US$ vs. M = 21821.43 US$), $t(6) = 4.84$, $p = 0.003$. For GEI measures, countries in European Group 1 showed a higher mean GEI score (M = 74,53, SD = 6.83) compared to countries in Group 2 (M = 61.43, SD = 8.07), $t(6) = 2.48$, $p = 0.048$.

Transportation Research Part F: Psychology and Behaviour 101 (2024) 199–217

Table 3
Gender gap in the acceptance of AVs (SAE Level 3), GDP and GEI (overall score and stratified by each component) across European group country.

European country		**Country rating**			**Country Covariates**							
Country Group	**Country**	**Gender Gap in Acceptance**			**GDP per capita**	**GEI[2]**	**GEI Domain score**					
		USE	**BUY**	**ACTIVATE**	**Current US$[1]**	**OVERALL**	Work	Money	Knowledge	Time	Power	Health
Group 1	Germany	0.27	0.30	0.19	45723.60	67.47	72.12	84.85	54.03	65.02	59.52	90.61
	Netherlands	0.38	0.42	0.39	52304.10	74.10	77.84	86.15	67.33	83.86	57.22	90.04
	Sweden	0.30	0.32	0.41	51925.70	83.83	82.89	86.79	74.20	90.09	84.21	94.51
	UK	0.25	0.27	0.22	40284.60	72.73	76.95	80.40	70.14	69.89	59.97	92.75
Group 2	Italy	0.08	0.11	0.09	15656.20	63.51	63.34	79.00	61.90	59.30	48.83	88.37
	Poland	−0.08	−0.06	−0.13	31676.20	55.81	67.31	75.52	57.19	52.50	29.99	83.10
	Romania	0.08	0.04	0.11	12896.10	54.45	67.64	62.96	52.38	50.27	37.55	71.24
	Spain	0.04	−0.01	0.10	27057.20	71.96	73.16	77.77	67.62	63.98	69.45	90.15

1: Data for 2020; https://data.worldbank.org/indicator/NY.GDP.PCAP.CD; **2**: Data for 2020; https://www.statista.com/statistics/1209683/the-eu-gender-equality-index-by-country.

Regarding the gender equality measures, all the countries in Group 1 scored higher than those in Group 2 for the GEI overall score, except for one. As shown in Table 3, Spain had a higher gender equality overall score (71.96) in Group 2 compared to Germany (67.47) in Group 1. However, it is worth noting that Spain had a lower gender gap in AVs acceptance, lower GDP per capita, and lower scores for some domains of the GEI (Money, Time, and Health) than any country in Group 1.

We also investigated whether the progress in gender equality across various domains like work, money, knowledge, time, power, and health would affect how both men and women accept AVs across the European countries in this study. The analysis of GEI domain scores between the two European groups shows significant statistical differences (at $p < 0.05$ level) between countries in Group 1 and countries in Group 2 for Work ($p = 0.018$), Money ($p = 0.035$), and Time ($p = 0.021$). Upon examining the data for GEI Money and GEI Time, it is evident that all the countries in Group 1 have higher gender equality values than those in Group 2. For instance, Germany scored significantly higher than Spain in GEI Money, with scores of 84.85 and 75.52, respectively. Despite this, the difference between the two European groups was less apparent in GEI Work, with Spain (73.16) in Group 2 scoring higher than Germany (72.12) in Group 1. The data shows that the two European groups are relatively equitable regarding gender Knowledge, Power, and Health, as no notable differences were found in these GEI domains. Fig. 2 illustrates the relationship between the gender gap in the acceptance of AVs and GEI Money, GEI Time, and GEI Work for the eight European countries.

Fig. 2 demonstrates a very good fit between the gender gap in willingness to activate automated driving function and the country's GEI Time, as shown by the proximity of the country data points (blue dots and red squares series along the regression line). Countries in Group 1 that exhibit more time equality between men and women (GEI Time $\geq$ 70 %, in Table 3) show a higher gender gap for the willingness to activate the automated driving function, thus a higher gender gap in the acceptance of AVs.

In contrast, countries in Group 2 exhibit lower gender equality for GEI Time, as evidenced by Table 3 and indicating a greater inequality in how women and men spend their time. However, it is worth highlighting that there is no significant gender gap in the acceptance of AVs, including the willingness to activate the automated driving function, as presented in Section 3.1. Notably, women in Group 2, despite experiencing lower gender equality for GEI Time, are more willing to activate automated driving function ($M = 3.67$, $SD = 1.04$) than their women counterparts in Group 1 ($M = 3.04$, $SD = 1.23$), with this difference in rating being statistically

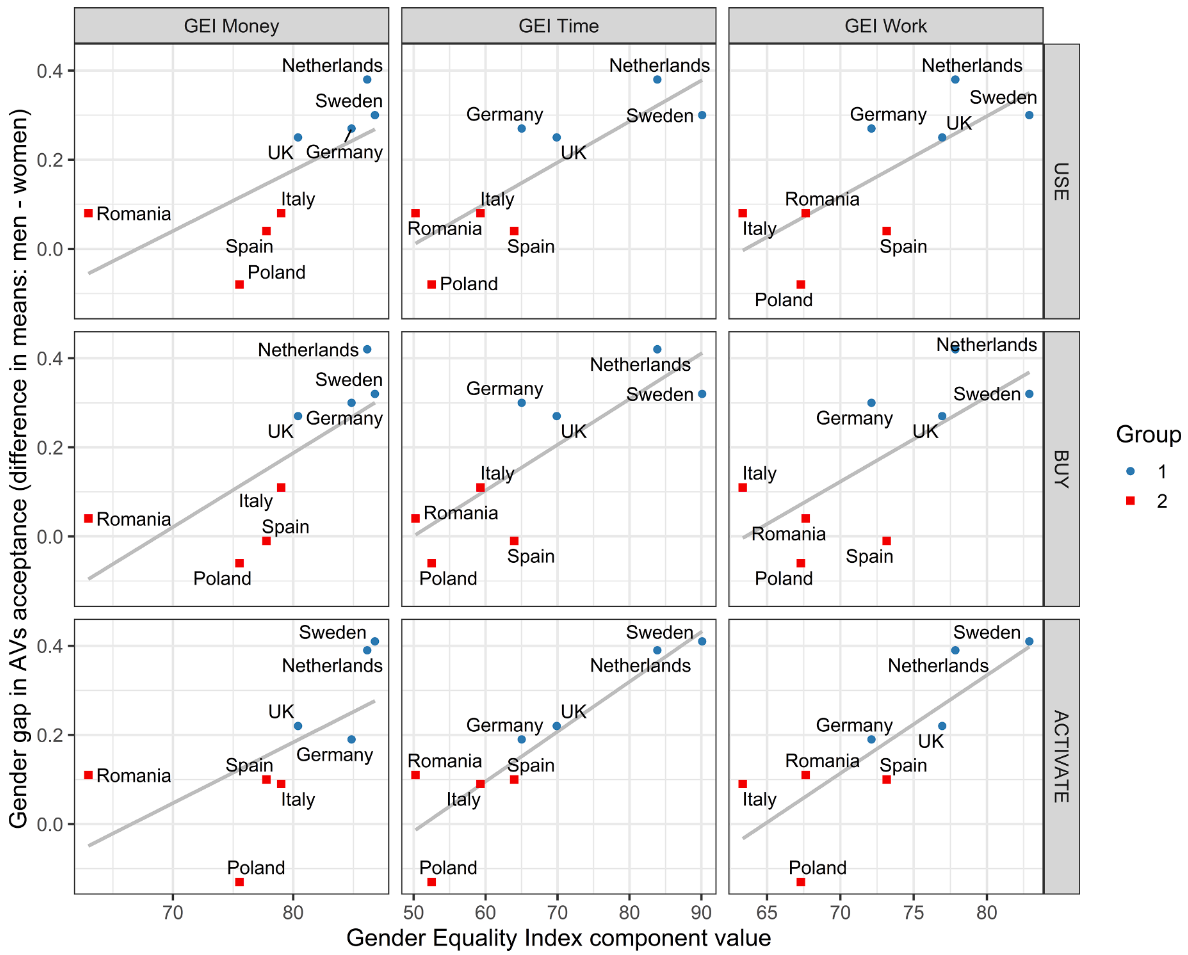

Fig. 2. Relationship between gender gap in the acceptance of AVs (difference in means (Men- Women) in intention to use AVs (1st row), buy AVs (2nd row), activate AVs (3rd row and GEI domains for Money, Time, and Work. Regression line added for each panel.

Table 4
Spearman rank-order correlations (ρ) matrix between gender gap in the acceptance of AVs (SAE Level 3) and GDP, GEI and GEI domains based on the overall sample.

Item	USE	BUY	ACTIVATE	GDP	GEI	Work	Money	Knowledge	Time	Power	Health
USE	1.000										
BUY	1.000**	1.000									
ACTIVATE	0.881**	0.881**	1.000								
GDP	**0.929****	**0.929****	0.786*	1.000							
GEI	0.738*	0.738*	0.810*	0.857**	1.000						
Work	0.690	0.690	**0.905****	0.714*	0.905**	1.000					
Money	**0.905****	**0.905****	0.810*	0.976**	0.881**	0.738*	1.000				
Knowledge	0.357	0.357	0.524	0.524	0.857**	0.714*	0.595	1.000			
Time	0.833*	0.833*	**0.857****	0.929**	0.976**	0.881**	0.952**	0.762*	1.000		
Power	0.452	0.452	0.643	0.548	0.810*	0.762*	0.643	0.786*	0.762*	1.000	
Health	0.571	0.571	0.690	0.690	0.833*	0.738*	0.786*	0.762*	0.857**	0.905**	1.000

**Correlation is significant at the 0.01 level. *Correlation is significant at the 0.05 level.

significant $p < 0.001$.

To better understand the relationship between the gender gap in the acceptance of AVs and the country's covariates, Spearman rank-order correlations were calculated for the overall sample (as at the group country's level, there would be only 4 data points for each covariate). Table 4 shows the correlation coefficient between the gender gap in the acceptance of AVs, GDP per capita, GEI's overall score and GEI's domains based on the overall sample. Table 4 also highlights the rank-order correlations (ρ) for the willingness to use, buy, and activate the automated driving function of AVs.

There is a significant relationship between the gender gap in AV acceptance and the country's covariates. The results demonstrate that the gender gap in willingness to use AVs is strongly correlated with both GDP and overall GEI, with statistically significant values of $\rho(6) = 0.929$ ($p = 0.01$) and $\rho(6) = 0.738$ ($p = 0.037$), respectively. Moreover, the gender gap in willingness to use AVs is also strongly correlated with GEI Money ($\rho(6) = 0.905$, $p < 0.01$). Similarly, the gender gap in willingness to buy AVs positively correlates with GDP per capita and overall GEI, with the same rank order values observed in willingness to use AVs. Interestingly, the gender gap in willingness to buy AVs is also highly correlated with GEI Money ($\rho(6) = 0.905$, $p < 0.01$). Furthermore, for the gender gap in willingness to activate the automated driving function, there was a strong, positive correlation with GDP ($\rho(6) = 0.786$, $p = 0.01$) and overall GEI ($\rho(6) = 0.810$, $p = 0.015$). Additionally, the gender gap in willingness to activate AVs was also strongly correlated with GEI Work ($\rho(6) = 0.905$, $p < 0.01$) and GEI Time ($\rho(6) = 0.857$, $p < 0.01$.

4. Discussion

4.1. Gender gap in the acceptance of AVs

It has been reported in numerous studies that there is a noticeable disparity in the acceptance of AVs between genders. Specifically, these studies suggest that men tend to exhibit higher acceptance of AVs than women (Payre, Cestac and Delhomme, 2014; Kyriakidis et al., 2015; Piao et al., 2016; Nielsen and Haustein, 2018; Liljamo, Liimatainen and Pöllänen, 2018; Hulse, Xie and Galea, 2018; Nordhoff et al., 2020; Rice and Winter, 2019; Havlíčková et al., 2020). Even so, some studies (Madigan et al., 2017; Nordhoff et al., 2020; Kapser, Abdelrahman and Bernecker, 2021) have reported that gender has an insignificant role in the acceptance of AVs. Moreover, cross-country comparisons (Haboucha, Ishaq and Shiftan, 2017; Anania et al., 2018) have found that the gender difference in the acceptance of AVs can be the opposite in different countries.

The current study comparing men and women in eight European countries found that the gender gap in AVs acceptance - with women having a lower acceptance for AVs than men – was present only in the half of the studied countries. Specifically, this gap was found in Group 1 countries, including Germany, Netherlands, Sweden, and the UK. On the other hand, no statistically significant difference between men and women was observed in the other half of the countries, Group 2 countries including Italy, Poland, Romania, and Spain. It is worth mentioning that for Group 2, the acceptance of AVs for both men and women was higher than even for males alone in Group 1. Thus, the commonly held belief that males are more favourable towards AVs may only be partially accurate and should not be generalized, as evidenced by the findings of our multi-country European study.

In order to ensure that any differences found between men and women in different countries were not due to country differences, we also considered other socio-demographic factors as control variables. However, even after accounting for other factors, the gender gap effects were still present. It must be emphasised that gender alone does not account for much variation in the acceptance of AVs. Even after adding other socio-demographic variables (control variables) to the regression models, the proportion of explained variance was never more than 18 %. This finding corroborates with other studies that suggested that social-demographic factors, including gender, cannot thoroughly explain why some people are more willing to accept AVs than others (Moody et al., 2020; Nordhoff et al., 2020). This means that gender is not a strong predictor of AVs acceptance.

Our research aimed to thoroughly investigate and uncover other potential factors contributing to the gender gap in the acceptance of AVs. We noted that this gap was observed in certain countries but not in others, which piqued our interest and led us to explore other potential factors that may be influencing this disparity. With this in mind, we examined the observed gender gap of the countries included in this study with their respective GDP per capita and GEI to determine any patterns or relationships. Our results show that the higher the GEI or the GDP per capita in the country, the greater the gender gap in the acceptance of AVs – women having a lower acceptance for AVs than men – meaning that women were more sceptical in willingness to use, buy and activate the automated driving. It has been noticed by previous studies, including Kyriakidis et al. (2015), Nordhoff et al. (2018), and Moody et al. (2020), that higher GDP per capita is associated with a more sceptical view of AVs. For instance, Nordhoff et al. (2018) found that GDP per capita was correlated with countries' mean general acceptance score (ρ = -0.48). Our research supports this association, as our results revealed that participants from countries in Group 1, such as Germany, Netherlands, Sweden, and the UK, with higher GDP per capita, had a lower acceptance rate for AVs compared to countries in Group 2, such as Italy, Poland, Romania, and Spain, with lower GDP per capita.

We also found that the gender gap in the acceptance of AVs was more pronounced in Group 1 countries. This is a unique aspect of our study as we analysed the gender gap, which previous studies did not do, as they only looked at overall acceptance rates without considering the perspectives of men and women separately. In comparison to the study conducted by Nordhoff et al. (2018), our analysis has revealed a much stronger and positive correlation between GDP and gender gap for intention to use and intention to buy AVs (ρ = 0.929).

Our study further examined the correlation of the gender gap in the studied countries with the GEI. We found that Group 1 countries with higher gender equality had a higher gender gap, with women exhibiting lower acceptance of AVs than men, compared to Group 2 countries with lower gender equality, where women showed similar acceptance of AVs as their male counterparts. The novelty of the current results is that we uncovered the gender gap in the acceptance of AVs, and we have successfully established a connection between GPD and GEI with regards to this gender gap. To our knowledge, none of the previous studies have managed to do so.

The current findings regarding the gender gap in the acceptance of AVs could be explained in terms of the theory by Falk and Hermle (2018). They concluded that greater availability of material resources removes the human need for subsistence and hence provides the opportunity for attending to gender preferences. A more egalitarian distribution of economic and social resources enables women and men to express gender-specific preferences independently (Falk and Hermle, 2018). Within the context of the current study, it could be interpreted that women in countries with higher gender-equality are freer to express their preferences of not to being interested to use, buy or activate the automated driving in AVs.

This suggests that the country-level difference in the gender gap could be predicted using GDP and GEI and should not be taken as universal. This does not imply that the previous findings which have suggested men being more attracted to technology (e.g. Havlíčková et al., 2020; Kelan, 2007) or women being more risk averse (e.g. Hulse, Xie and Galea, 2018; Kapser, Abdelrahman and Bernecker, 2021) would not be helpful for understanding that gender difference in the acceptance of AVs. Such explanations can still be useful in understanding gender differences in the acceptance of AVs, however, need to be considered within the larger socio-cultural context.

Our study also investigated the impact of gender equality progress in various areas such as work, money, knowledge, time, power, and health on the acceptance of AVs by men and women across European countries. Our findings clearly indicate a correlation between gender equality progress and AVs acceptance, albeit with varying degrees of influence depending on the specific GEI domain. Gender inequalities can be attributed to women's role in carrying out more unpaid work (as previously mentioned) and entrenched socio-cultural norms. We found that gender equality plays an essential role in the gender gap in the acceptance of AVs as demonstrated by gender equality overall score significantly correlated with the gender gap rating for willingness to use, willingness to buy and to activate the automated driving. In particular, gender equality in terms of money and time was strongly and positively correlated with the gender gap for all the target variables, e.g., for willingness to activate the automated driving function (ρ = 0.857). Time is a fundamental aspect of gender equality, and it has knock-on effects on several aspects of a person's life (EIGE, 2021). Countries with higher gender equality for time (GEI Time), such as Sweden, are more equalitarian regarding women's and men's involvement in care/housework and leisure activities. On the other hand, countries in Group 2, such as Romania, exhibit lower gender equality over time, resulting in more inequality in women's and men's involvement with those activities. On the other hand, women in Group 2 countries are more willing to activate the automated driving function than their counterparts in Group 1 countries. This suggests that women in countries facing more gender inequality in terms of time may be more inclined to activate AVs to alleviate the burden of their care-related tasks and driving duties. In a different study conducted by the authors using the same IAS sample to investigate the use of time while driving in automation, it was found that although women from Group 1 were less willing to activate automated driving, they were still more likely to engage with working or leisure activities during automated driving compared to women from Group 2 (Torrao and Lehtonen, 2023). Thus, it might be possible that women from Group 2 face more inequality than women's counterparts from Group 1; the formers would perceive the automated driving journey as an opportunity not to work at all but to 'do nothing' as they are already very busy during their daily lives. Despite more women than ever before being active in the labour force in Europe, gender roles at home remain unequal. In Europe, gender inequalities are beyond the paid work; they can derive from women's role in childcare, and household tasks, which impacts women's value of time daily. Women continue to do the bulk of unpaid care work, such as taking care of children, grandchildren, elderly, or people with disabilities daily, with a gender gap of 13 % (38 % of women compared to 25 % of men) (EIGE, 2020). Gender inequalities can profoundly impact a person's life, especially in countries with lower GDP and GEI. Our analysis indicates a strong correlation between gender inequality, particular regarding time availability and women's acceptance of AVs.

4.2. Implications

Women and caregivers make 50 % more trips than men and non-caregivers (Metze and Tovaas, 2019). This shows the gendered distribution of labour and social parenting norms are also reflected in transportation, with women having more responsibility for conducting child-serving travel (Craig and van Tienoven, 2019). Gender differences in transportation underline a complex relationship between economic and educational factors and cultural, societal, and religious norms about women's roles that constrain their activities (Rosenbloom, 2021). Besides, gender roles at home remain unequal globally despite progress in various areas. In the context of AVs, there is limited knowledge of whether the gender gap in the acceptance of AVs is exists or why the gender gap might be more visible in some countries than others. Prior to the introduction of AVs, it is fundamental to consider to what extent gender equality and available resources (e.g. monetary) may influence the gender gap in acceptance of AVs modern and developed society.

This study found that countries with higher GDP per capita and superior gender equality showed a more significant gender gap in acceptance of AVs. In comparison, for countries with lower GDP and modest gender equality measures, the gender gap was not statistically significant. For Europe, in 2020, the GEI score was 67.9 %, and it has been predicted that it will take more than 60 years to achieve gender equality across European countries (EIGE, 2020). Asymmetries between the two genders' societal roles and access to resources are explicit, and there is the likelihood that AVs will be introduced and escalate in the vehicle fleet faster than gender equity will be achieved. Nonetheless, new and smart technologies for mobility should improve transport and access opportunities for all (Levin, 2019). Reflecting on whether AVs could be a way to increase or decrease the gender equality, this study's results point out the direction that for societies with a higher GDP and better gender equality, the gender gap in the acceptance of AVs may increase with women positioning themselves less willing to use AVs. On the other hand, in societies with lower GDP and worse gender equality, the introduction of AVs may not increase nor reduce the gender equality by the acceptance of AVs. When implementing AVs technology, it is crucial to consider its potential impact on different groups of people, including women across various European countries. In the countries with a higher GPD, the women might have better financial resources to purchase AVs and the road infrastructure might be more ready for use, but their low acceptance may lead them not to do so. On the other hand, in countries with a lower GPD, women may not have an equal possibility to purchase and use AVs. Consequently, if the benefits of automated driving technology are, on the first hand, primarily available for men, this could create a situation where men mainly benefit from automated driving technology, which could further hinder gender equality. This finding is important for policymakers when developing strategies to address gender disparities in these countries.

It is important to remember that transportation improvements should result in a balanced distribution of benefits among users in terms of private and public transport. Martens et al., (2012) proposed that to ensure a fair distribution of transportation benefits, the maximum gap between the lowest and highest accessibility, both by mode and in space, should be limited while maximizing average access. This means all users should have the same access to opportunities, regardless of gender or country of origin. It is crucial for transportation planning to take the gender perspective into account at all stages of decision-making and planning. Our research findings show that a country's GDP and GEI measures could potentially predict the gender gap in AVs acceptance internationally. It is important to anticipate and mitigate potential gender gaps due to AVs deployment. Policymakers should consider the country's GDP and GEI measures for policy development and future transportation planning, particularly when discussing the implementation of AVs, to ensure that new solutions are accessible and do not perpetuate existing inequalities.

It is evident from our thorough analysis of the gender gap in the acceptance of AVs that biological sex differences are not enough to explain the gap. Instead, the uneven distribution of resources and needs among genders may ultimately impact travel behaviour, modal choice, and the future adoption of AVs. Addressing these disparities is crucial to ensure that AV technology is accessible and beneficial to all individuals and gender inclusive.

4.3. Limitations

The study focused on the automation of passenger cars, and thus the results may not generalize into acceptance of automated public transport.

Though the participants in the survey were provided with a description of what a “conditionally automated car” meant, the participants did not physically experience AVs, which could influence their responses.

To account for country covariates' influence in general acceptance towards AVs, in this study, the gender gap (the difference in means) was used rather than comparing males with women rating at the individual level. Thus, the correlation analysis depended on data representing eight GDP and eight GEI scores corresponding to each country, resulting in a small sample ($N = 8$) for the correlation analysis.

Additionally, it would have been beneficial to conduct a survey that encompasses a larger number of European countries to gain a more comprehensive understanding of the gender gap throughout Europe. Nevertheless, this study analysed the responses of 8412 participants, more than 1000 per country, which is a considerable sample size.

Some mobility pattern differences (such as type and purpose of trip, as well as traveller's sequential activities through space and time during the journey) and other factors (e.g. built environment, cost of travelling) may contribute to the observed differences in gender gap rating in the acceptance of AVs between the two European groups of countries identified in this study that were not captured by the data collected for this analysis. Last, the survey only focused on privately owned AVs, not automation of shared AVs or automation of public transport, which might be more relevant for the current users and gender inclusive transport solutions.

5. Conclusion

Our investigation aimed to examine whether there exists a gender gap in the acceptance of conditionally automated passenger cars (SAE Level 3) using a questionnaire study in eight European countries: Germany, Italy, Netherlands, Poland, Romania, Spain, Sweden, and the United Kingdom (UK).

Our analysis shows that the gender gap in the acceptance of AVs exists in Germany, the Netherlands, Sweden, and the UK but not in Italy, Poland, Romania, or Spain. These countries, where the gender gap was present, had higher Gross Domestic Product (GDP) per capita and Gender Equality Index (GEI) than the countries where the gender gap was not present. When also examined the countries' progress in gender equality across various GEI domains, the equality levels at work status, money, and time were the most important predictors for the gender gap in the acceptance of AVs.

The results show that while the gender gap in the acceptance of AVs could be found, it should not be held as universal. Explanations given for the gender gap should also be considered within the larger socio-cultural context. Supplementing survey-based studies with country-level statistics like GEI scores can be a good approach to predicting gender differences in the acceptance of AVs. Nevertheless, it is worth noting that despite the existence of gender differences, their magnitude is small.

As we move forward with AV technology, equal opportunities must be provided for all potential users, regardless of gender or region. Future research is necessary to understand the mechanisms that produce the gender gap globally and ensure that AV technology offers mobility solutions that are accessible and inclusive to all.

CRediT authorship contribution statement

Guilhermina Torrao: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Esko Lehtonen:** Conceptualization, Methodology, Data curation, Investigation, Supervision, Writing – review & editing. **Satu Innamaa:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgments

The online survey leading to this study results was funded by the European Commission Horizon 2020 program under the project L3Pilot, grant agreement number 723051. Responsibility for the information and views set out in this publication lies entirely with the authors. The authors would like to thank partners within L3Pilot for their cooperation and valuable contribution.

Appendix 1. Literature relevant studies addressing the gender gap

Table A
Literature relevant studies analysing general attitudes and intention to use AVs and how gender effect was depicted by study design approach.

Study	Data Sample			Study focus	Effect of gender
	N	Gender (M[1]%)	Countries	Response variables	Direction
(Anania et al., 2018)	1021	52 %	India and U.S.	Willingness to ride (WTR) AVs	F ↑ for India F ↓ for U.S.
(Bazilinskyy, Kyriakidis and de Winter, 2015)	1,952*	74 %	112 countries	Attitude towards automated driving	Unknown
(Haboucha, Ishaq and Shiftan, 2017)	721	54 %	Israel, U.S. and Canada	- Use and acceptance AVs (private and shared)	M↑ for Israel only
(Havlíčková et al., 2019)	1065	49 %	Czech Republic	General attitudes in automated mobility (connected and automated vehicles)	M↑
(Hohenberger, Spörrle and Welpe, 2016)	1603	49 %	Germany	Willingness to use AVs	M↑
(Hulse, Xie and Galea, 2018)	925	64 %	UK	- General attitude towards AVs (perceptions and acceptance) - Road user risk-taking perceived risk	M↑
(Kapser, Abdelrahman and Bernecker, 2021)	501	49 % quota sampling.	Germany	- Autonomous delivery vehicles - Behavioural intention	Depending on UTAUT2 construct
(Kyriakidis, Happee and de Winter, 2015)	4,886	69 %	109 countries (40 countries N = 25)	User acceptability, concerns, and willingness to buy for all levels of driving automation: Partially automated driving Highly automated driving Fully automated driving	M↑
(Liljamo, Liimatainen and Pöllänen, 2018)	2036	49 %	Finland	Attitudes towards automated vehicles (positive vs negative)	M↑
(Madigan et al., 2017)	315	55 %	Greece	Intention to use autonomous shuttles	No effect
(Moody, Bailey and Zhao, 2020)	33,958	Quota sampling	51 countries	- Awareness of AV technology - Perceptions of AV safety, - and number of years until AVs are safe to use	Individual level: M↑
(Nielsen and Haustein, 2018)	3040	49 %	Denmark	Interest and attitudes towards self-driving cars	M↑
(Nordhoff et al., 2018)	7,755	69 %	116 countries	-Intention to use share AVs -Willingness to buy AVs	M↑, across countries only.
(Nordhoff et al., 2020)	9,118	51 %	Finland, France, Germany, Italy, Spain, Sweden, Hungary, and UK	Behavioural intention for CAVs	M↑
(Payre, Cestac and Delhomme, 2014)	421	36 %	France	Intention to use AV a fully automated car	M↑
(Piao et al., 2016)	425	46 %	France	General attitudes (Attractiveness and concerns of automated taxis, /sharing automated cars)	M↑
(Rahimi, Azimi and Jin, 2020)	818	52 %	U.S.	Attitudes toward AVs	F Millennials ↓
(Rice and Winter, 2019)	97	47 %	U.S.	Willingness to ride in driverless vehicles	M↑
(Rodrigues et al., 2021)	400	56.8 %	Portugal	- Adoption of AVs technologies - Willingness-to-pay for ADS	Unknown
(Schoettle and Sivak, 2014)	1,533	48 %	U.S., the U.K., and Australia	- Public opinion regarding self-driving-vehicle technology	M↑
(Wilson et al., 2022)	1378	59 %	Unreported	- Investigated the motivations for private ownership of highly automated vehicles	M↑ and F↑

1 Males (M); **2** Females (F); Willingness to Ride (WTR); Gross Domestic Product (GDP) per capita; GDP PPP - GDP per capita per Purchasing Power Parities: * Comments extracted from responders across international survey; Multilevel Structural Equation Modelling (MSEM).

Appendix 2. L3Pilot project's Impact Assessment survey

Bjorvatn et al., 2021, L3Pilot Deliverable D7.4: Impact evaluation results.

Afsane Bjorvatn, Yves Page, Felix Fahrenkrog, Hendrik Weber, Elina Aittoniemi, Per Heum, Esko Lehtonen, Anne Silla, Jonas Bärgman, Marcel Borrack, Satu Innamaa, Teemu Itkonen, Fanny Malin, Karl Pedersen, Michael Schuldes, Henri Sintonen, Thomas Streubel, Walter Hagleitner, Thierry Hermitte, Johannes Hiller and Guilhermina Torrao.

Impact Assessment Survey can be found on D7.4, A2.2 Annex: Impact assessment survey.

https://l3pilot.eu/fileadmin/user_upload/Downloads/Deliverables/Update_14102021/L3Pilot-SP7-D7.4-Impact_Evaluation_Results-v1.0-for_website.pdf.

Appendix 3. L3Pilot Impact Assessment survey responses Summary statistics for the acceptance of AVs (N = 8412)

Table B
Summary statistics for the acceptance of AVs (SAE Level 3), which includes the willingness to use, willingness to buy and willingness to activate AVs, based on overall data. (Table Appendix).

Gender	**Sample**	***USE***		***BUY***		***ACTIVATE***	
	N[1]	M[2]	SD[3]	M[2]	SD[3]	M[2]	SD[3]
Males	4347	3.37	1.21	3.15	1.18	3.53	1.19
Females	4065	3.20	1.18	2.97	1.17	3.36	1.18
All	8412	3.29	1.20	3.07	1.18	3.45	1.19

1: "N" means number of responders; **2:** "M" means Mean; **3**: "SD" means Standard Deviation.

Table C
Summary statistics for the acceptance of AVs (SAE Level 3) across European country and organised by increasing means rating for USE, BUY and ACTIVATE.

Target Variable	**Country**	**N[1]**	**M[2]**	**SD[3]**	**SE[4]**
USE	Germany	1042	**2.84**	1.31	0.04
	Netherlands	1079	**2.86**	1.21	0.04
	Sweden	1037	**3.04**	1.24	0.04
	UK	1047	**3.16**	1.21	0.04
	Italy	1071	**3.39**	1.11	0.03
	Spain	1059	**3.44**	1.14	0.04
	Poland	1055	**3.75**	0.98	0.03
	Romania	1022	**3.86**	0.93	0.03
BUY	Netherlands	1079	**2.61**	1.12	0.03
	Germany	1042	**2.72**	1.29	0.04
	Sweden	1037	**2.82**	1.19	0.04
	UK	1047	**3.02**	1.21	0.04
	Italy	1071	**3.07**	1.13	0.03
	Spain	1059	**3.17**	1.12	0.03
	Poland	1055	**3.50**	0.98	0.03
	Romania	1022	**3.62**	0.97	0.03
ACTIVATE	Germany	1042	**3.08**	1.33	0.04
	Netherlands	1079	**3.20**	1.19	0.04
	Sweden	1037	**3.24**	1.24	0.04
	UK	1047	**3.27**	1.21	0.04
	Italy	1071	**3.49**	1.15	0.04
	Spain	1059	**3.67**	1.11	0.03
	Romania	1022	**3.82**	0.96	0.03
	Poland	1055	**3.83**	1.00	0.03

1: "N" means number of responders; **2:** "M" means Mean; **3**: "SD" means Standard Deviation, **4**: "SE" means Standard Error.

Table D
Q2- Willingness to use L3 AVs by gender and by country (sample size distribution in counts and percentages).

Gender	Country	***N*** Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total	**%** Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total
Male	Germany	107	85	131	159	61	543	19,71	15,65	24,13	29,28	11,23	100
	Netherlands	99	69	155	171	61	555	17,84	12,43	27,93	30,81	10,99	100
	UK	65	60	146	182	79	532	12,22	11,28	27,44	34,21	14,85	100
	Sweden	73	89	146	145	96	549	13,30	16,21	26,59	26,41	17,49	100
	Poland	29	46	78	264	105	522	5,56	8,81	14,94	50,57	20,11	100
	Romania	15	32	108	260	155	570	2,63	5,61	18,95	45,61	27,19	100
	Spain	56	42	148	197	105	548	10,22	7,66	27,01	35,95	19,16	100
	Italy	44	50	154	194	86	528	8,33	9,47	29,17	36,74	16,29	100
	Sub-Total	488	473	1066	1572	748	4347	11,23	10,88	24,52	36,16	17,21	100
Female	Germany	138	67	143	109	42	499	27,66	13,43	28,66	21,84	8,42	100
	Netherlands	106	109	183	107	19	524	20,23	20,80	34,92	20,42	3,63	100
	UK	76	81	160	147	51	515	14,76	15,73	31,07	28,54	9,90	100
	Sweden	92	63	177	121	35	488	18,85	12,91	36,27	24,80	7,17	100
	Poland	10	38	102	287	96	533	1,88	7,13	19,14	53,85	18,01	100
	Romania	13	18	99	232	90	452	2,88	3,98	21,90	51,33	19,91	100
	Spain	39	43	169	184	76	511	7,63	8,41	33,07	36,01	14,87	100
	Italy	49	49	179	194	72	543	9,02	9,02	32,97	35,73	13,26	100
	Sub-Total	523	468	1212	1381	481	4065	12,87	11,51	29,82	33,97	11,83	100

Table E
Q3- Willingness to buy L3 AVs by gender and by country (sample size distribution in counts and percentages).

Gender	Country	***N*** Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total	**%** Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total
Male	Germany	119	80	147	149	48	543	21,92	14,73	27,07	27,44	8,84	100
	Netherlands	93	109	193	125	35	555	16,76	19,64	34,77	22,52	6,31	100
	UK	68	80	156	157	71	532	12,78	15,04	29,32	29,51	13,35	100
	Sweden	86	96	172	136	59	549	15,66	17,49	31,33	24,77	10,75	100
	Poland	27	57	141	238	59	522	5,17	10,92	27,01	45,59	11,30	100
	Romania	22	44	159	239	106	570	3,86	7,72	27,89	41,93	18,60	100
	Spain	66	67	192	155	68	548	12,04	12,23	35,04	28,28	12,41	100
	Italy	71	68	170	164	55	528	13,45	12,88	32,20	31,06	10,42	100
	Sub-Total	552	601	1330	1363	501	4347	12,70	13,83	30,60	31,35	11,53	100
Female	Germany	152	75	147	89	36	499	30,46	15,03	29,46	17,84	7,21	100
	Netherlands	128	148	170	68	10	524	24,43	28,24	32,44	12,98	1,91	100
	UK	89	87	178	116	45	515	17,28	16,89	34,56	22,52	8,74	100
	Sweden	102	103	167	96	20	488	20,90	21,11	34,22	19,67	4,10	100
	Poland	19	61	126	272	55	533	3,56	11,44	23,64	51,03	10,32	100
	Romania	16	33	129	213	61	452	3,54	7,30	28,54	47,12	13,50	100
	Spain	46	66	199	149	51	511	9,00	12,92	38,94	29,16	9,98	100
	Italy	63	92	203	146	39	543	11,60	16,94	37,38	26,89	7,18	100
	Sub-Total	615	665	1319	1149	317	4065	15,13	16,36	32,45	28,27	7,80	100

Table F
Q4- Willingness to activate L3 ADF by gender and by country (sample size distribution in counts and percentages).

Gender	**Country**	***N*** Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total	**%** Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total
Male	Germany	90	75	117	171	90	543	16,57	13,81	21,55	31,49	16,57	100
	Netherlands	61	56	130	222	86	555	10,99	10,09	23,42	40,00	15,50	100
	UK	61	50	140	190	91	532	11,47	9,40	26,32	35,71	17,11	100
	Sweden	55	66	140	165	123	549	10,02	12,02	25,50	30,05	22,40	100
	Poland	22	48	80	255	117	522	4,21	9,20	15,33	48,85	22,41	100
	Romania	15	39	110	251	155	570	2,63	6,84	19,30	44,04	27,19	100

(continued on next page)

Table F (*continued*)

Gender	Country	*N* Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total	% Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Sub-total
	Spain	40	45	101	206	156	548	7,30	8,21	18,43	37,59	28,47	100
	Italy	46	48	111	222	101	528	8,71	9,09	21,02	42,05	19,13	100
	Sub-Total	390	427	929	1682	919	4347	8,97	9,82	21,37	38,69	21,14	100
Female	Germany	110	54	132	141	62	499	22,04	10,82	26,45	28,26	12,42	100
	Netherlands	73	90	168	152	41	524	13,93	17,18	32,06	29,01	7,82	100
	UK	71	66	145	177	56	515	13,79	12,82	28,16	34,37	10,87	100
	Sweden	80	68	148	147	45	488	16,39	13,93	30,33	30,12	9,22	100
	Poland	14	40	70	276	133	533	2,63	7,50	13,13	51,78	24,95	100
	Romania	10	40	89	225	88	452	2,21	8,85	19,69	49,78	19,47	100
	Spain	31	31	135	219	95	511	6,07	6,07	26,42	42,86	18,59	100
	Italy	41	72	119	225	86	543	7,55	13,26	21,92	41,44	15,84	100
	Sub-Total	430	461	1006	1562	606	4065	10,58	11,34	24,75	38,43	14,91	100

Appendix 4. L3Pilot Impact Assessment survey gender gap results by country

Table G
Summary statistics and gender gap in the acceptance of AVs (SAE Level 3) by country.

Target Variable	Country	N[1] Male	Female	M[2] Male	Female	SD[3] Male	Female	Gender gap Difference in Means (*t*-test)
USE	Germany	543	499	2.97	2.70	1.30	1.31	**0.27****
	Netherlands	555	524	3.05	2.66	1.26	1.12	**0.38****
	Sweden	549	488	3.19	2.89	1.28	1.19	**0.30*****
	UK	532	515	3.28	3.03	1.21	1.20	**0.25*****
	Sub-total	545	506	3.12	2.82	0.04	0.08	0.30
	Italy	528	543	3.43	3.35	1.12	1.10	0.08
	Poland	522	533	3.71	3.79	1.06	0.88	−0.08
	Romania	570	452	3.89	3.81	0.96	0.9	0.08
	Spain	548	511	3.46	3.42	1.18	1.08	0.04
	Sub-total	542	508	3.62	3.59	0.09	0.12	0.03
BUY	Germany	543	499	2.87	2.56	1.28	1.28	**0.3*****
	Netherlands	555	524	2.82	2.40	1.15	1.05	**0.42*****
	Sweden	549	488	2.97	2.65	1.22	1.13	**0.32*****
	UK	532	515	3.16	2.89	1.21	1.19	**0.27*****
	Sub-total	545	506	2.95	2.62	0.05	0.10	0.33
	Italy	528	543	3.12	3.01	1.18	1.09	0.11
	Romania	570	452	3.64	3.60	1.00	0.93	0.04
	Spain	548	511	3.17	3.18	1.17	1.07	−0.01
	Poland	522	533	3.47	3.53	1.00	0.95	−0.06
	Sub-total	542	508	3.34	3.32	0.10	0.08	0.02
ACTIVATE	Germany	543	499	3.18	2.98	1.32	1.33	**0.19****
	Netherlands	555	524	3.39	3.00	1.19	1.16	**0.39*****
	Sweden	549	488	3.43	3.02	1.24	1.21	**0.41*****
	UK	532	515	3.38	3.16	1.21	1.20	**0.22*****
	Sub-total	545	506	3.34	3.04	0.06	0.07	0.30
	Italy	528	543	3.54	3.45	1.16	1.13	0.09
	Poland	522	533	3.76	3.89	1.03	0.95	−0.13
	Romania	570	452	3.86	3.75	0.98	0.94	0.11*
	Spain	548	511	3.72	3.62	1.17	1.05	0.10*
	Sub-total	542	508	3.72	3.67	0.09	0.09	0.04

p < 0.001; **p < 0.01; *p < 0.05;
Gender gap in AVs acceptance.

References

Abay, K. A., & Mannering, F. L. (2016). An empirical analysis of risk-taking in car driving and other aspects of life. *Accident Analysis & Prevention, 97*, 57–68. https://doi.org/10.1016/j.aap.2016.08.022

Anania, E. C., Rice, S., Walters, N. W., Pierce, M., Winter, S. R., & Milner, M. N. (2018). The effects of positive and negative information on consumers' willingness to ride in a driverless vehicle. *Transport policy, 72*, 218–224. https://doi.org/10.1016/j.tranpol.2018.04.002

Bazilinskyy, P., Kyriakidis, M., & de Winter, J. (2015). An international crowdsourcing study into people's statements on fully automated driving. *Procedia Manufacturing, 3*, 2534–2542. https://doi.org/10.1016/j.promfg.2015.07.540

Bjorvatn, A., Page, Y., Fahrenkrog, F., Weber, H., Aittoniemi, E., Heum, P., Lehtonen, E., Silla, A., Bärgman, J., Borrack, M., Innamaa, S., Itkonen, T., Malin, F., Pedersen, K., Schuldes, M., Sintonen, H., Streuble, T., Hagleitner, W., Hermitte, T., … Torrao, G. (2021). Deliverable D7.4 / Impact Evaluation Results. https://l3pilot.eu/fileadmin/user_upload/Downloads/Deliverables/Update_14102021/L3Pilot-SP7-D7.4-Impact_Evaluation_Results-v1.0-for_website.pdf.

Craig, L., & Van Tienoven, T. P. (2019). Gender, mobility and parental shares of daily travel with and for children: A cross-national time use comparison. *Journal of transport geography, 76*, 93–102. https://doi.org/10.1016/j.jtrangeo.2019.03.006

European Institute for Gender Equality (EIGE), 2020. Gender Equality Index 2020: Key findings for the EU. Available at: https://eige.europa.eu/publications/gender-equality-index-2020-key-findings-eu (Accessed: 3 September, 2021).

European Institute for Gender Equality (EIGE), 2021. EIGE-2021 Gender Equality Index 2021 Report: Health. https://eige.europa.eu/publications/gender-equality-index-2021-report/domain-time (Accessed 16 February 2022).

Falk, A., & Hermle, J. (2018). Relationship of gender differences in preferences to economic development and gender equality. *Science, 362*(6412), p.eaas9899. https://doi.org/10.1126/science.aas9899

González, L., & Rodríguez-Planas, N. (2020). Gender norms and intimate partner violence. *Journal of Economic Behavior & Organization, 178*, 223–248. https://doi.org/10.1016/j.jebo.2020.07.024

Haboucha, C. J., Ishaq, R., & Shiftan, Y. (2017). User preferences regarding autonomous vehicles. *Transportation Research Part C: Emerging Technologies, 78*, 37–49. https://doi.org/10.1016/j.trc.2017.01.010

Havlíčková, D., Gabrhel, V., Adamovská, E., & Zámečník, P. (2019). The role of gender and age in autonomous mobility: General attitude, awareness and media preference in the context of Czech Republic. *Transactions on transport sciences, 10*(2), 53–63. https://doi.org/10.5507/tots.2019.013

Hohenberger, C., Spörrle, M., & Welpe, I. M. (2016). How and why do men and women differ in their willingness to use automated cars? The influence of emotions across different age groups. *Transportation Research Part A: Policy and Practice, 94*, 374–385. https://doi.org/10.1016/j.tra.2016.09.022

Hulse, L. M., Xie, H., & Galea, E. R. (2018). Perceptions of autonomous vehicles: Relationships with road users, risk, gender and age. *Safety science, 102*, 1–13. https://doi.org/10.1016/j.ssci.2017.10.001

Kapser, S., Abdelrahman, M., & Bernecker, T. (2021). Autonomous delivery vehicles to fight the spread of Covid-19–How do men and women differ in their acceptance? *Transportation Research Part A: Policy and Practice, 148*, 183–198. https://doi.org/10.1016/j.tra.2021.02.020

Kelan, E. K. (2007). Tools and toys: Communicating gendered positions towards technology. *Information, Community and Society, 10*(3), 358–383. https://doi.org/10.1080/13691180701409960

Kyriakidis, M., Happee, R., & de Winter, J. C. (2015). Public opinion on automated driving: Results of an international questionnaire among 5000 respondents. *Transportation research part F: Traffic psychology and behaviour, 32*, 127–140. https://doi.org/10.1016/j.trf.2015.04.014

Levin, L. (2019, July.). How to Integrate Gender Equality in the Future of "Smart" Mobility: A Matter for a Changing Planning Practice. In *International Conference on Human-Computer Interaction* (pp. 393–412). Cham: Springer. https://doi.org/10.1007/978-3-030-22666-4_29.

Liljamo, T., Liimatainen, H., & Pöllänen, M. (2018). Attitudes and concerns on automated vehicles. *Transportation research part F: traffic psychology and behaviour, 59*, 24–44. https://doi.org/10.1016/j.trf.2018.08.010

Madigan, R., Louw, T., Wilbrink, M., Schieben, A., & Merat, N. (2017). What influences the decision to use automated public transport? Using UTAUT to understand public acceptance of automated road transport systems. *Transportation research part F: traffic psychology and behaviour, 50*, 55–64. https://doi.org/10.1016/j.trf.2017.07.007

Marcén, M., & Morales, M. (2021). Culture and the cross-country differences in the gender commuting gap. *Journal of Transport Geography, 96*, 103184. https://doi.org/10.1016/j.jtrangeo.2021.103184

Martens, K., Golub, A., & Robinson, G. (2012). A justice-theoretic approach to the distribution of transportation benefits: Implications for transportation planning practice in the United States. *Transportation research part A: Policy and practice, 46*(4), 684–695. https://doi.org/10.1016/j.tra.2012.01.004

Moody, J., Bailey, N., & Zhao, J. (2020). Public perceptions of autonomous vehicle safety: An international comparison. *Safety science, 121*, 634–650. https://doi.org/10.1016/j.ssci.2019.07.022

Nielsen, T. A. S., & Haustein, S. (2018). On sceptics and enthusiasts: What are the expectations towards self-driving cars? *Transport policy, 66*, 49–55. https://doi.org/10.1016/j.tranpol.2018.03.004

Nordhoff, S., De Winter, J., Kyriakidis, M., Van Arem, B., & Happee, R. (2018). Acceptance of driverless vehicles: Results from a large cross-national questionnaire study. *Journal of Advanced Transportation, 2018*. https://doi.org/10.1155/2018/5382192

Nordhoff, S., Louw, T., Innamaa, S., Lehtonen, E., Beuster, A., Torrao, G., Bjorvatn, A., Kessel, T., Malin, F., Happee, R., & Merat, N. (2020). Using the UTAUT2 model to explain public acceptance of conditionally automated (L3) cars: A questionnaire study among 9,118 car drivers from eight European countries. *Transportation research part F: Traffic psychology and behaviour, 74*, 280–297. https://doi.org/10.1016/j.trf.2020.07.015

Payre, W., Cestac, J., & Delhomme, P. (2014). Intention to use a fully automated car: Attitudes and a priori acceptability. *Transportation research part F: Traffic psychology and behaviour, 27*, 252–263. https://doi.org/10.1016/j.trf.2014.04.009

Piao, J., McDonald, M., Hounsell, N., Graindorge, M., Graindorge, T., & Malhene, N. (2016). Public views towards implementation of automated vehicles in urban areas. *Transportation research procedia, 14*, 2168–2177. https://doi.org/10.1016/j.trpro.2016.05.232

Rahimi, A., Azimi, G., & Jin, X. (2020). Investigating generational disparities in attitudes toward automated vehicles and other mobility options. *Transportation research part C: emerging technologies, 121*, 102836. https://doi.org/10.1016/j.trc.2020.102836

Rice, S., & Winter, S. R. (2019). Do gender and age affect willingness to ride in driverless vehicles: If so, then why? *Technology in Society, 58*, 101145. https://doi.org/10.1016/j.techsoc.2019.101145

Rodrigues, R., Moura, F., Silva, A. B., & Seco, Á. (2021). The determinants of Portuguese preference for vehicle automation: A descriptive and explanatory study. *Transportation research part F: Traffic psychology and behaviour, 76*, 121–138. https://doi.org/10.1016/j.trf.2020.10.009

Rosenbloom, S. (2021). Women's Travel Patterns, Attitudes, and Constraints Around the World. International Encyclopedia of. *Transportation*, 193–202.

Metze, A., & Tovaas, K. (2019). Inclusion Project D3.3. Compilation of 50 case study profiles; overviews and in-depth investigations. *Transportation Planning and Technology, 36*(1), 76–92.

Torrao, G., & Lehtonen, E. (2023). Do males and females prefer different non-driving related activities during automated driving in future journeys? *Transportation Research Procedia, 72C*, 1539–1546. https://doi.org/10.1016/j.trpro.2023.11.621

Schoettle, B., & Sivak, M. (2014). *A survey of public opinion about autonomous and self-driving vehicles in the US, the UK, and Australia*. Ann Arbor: University of Michigan.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS quarterly*, 157–178. https://doi.org/10.2307/41410412

Wilson, C., Gyi, D., Morris, A., Bateman, R., & Tanaka, H. (2022). Non-Driving Related tasks and journey types for future autonomous vehicle owners. *Transportation research part F: traffic psychology and behaviour, 85*, 150–160. https://doi.org/10.1016/j.trf.2022.01.004