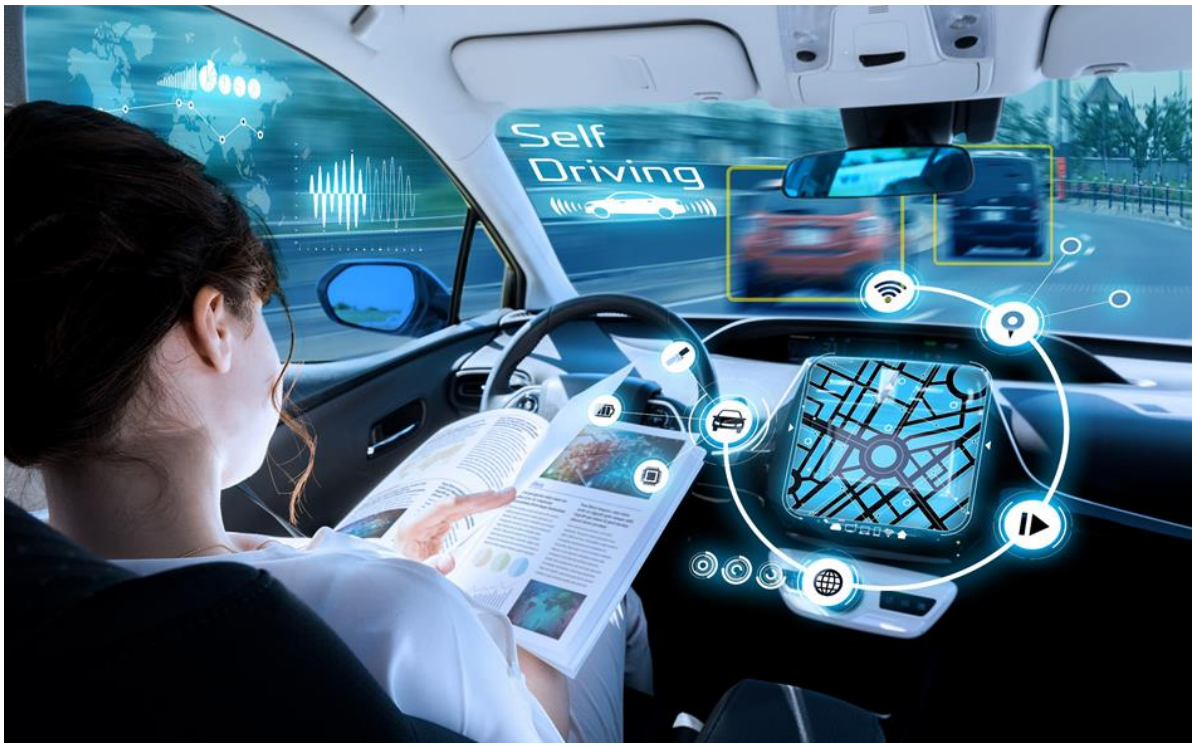

Driver attitudes towards vehicle automation. International comparison based on ESRA2 data from 32 countries

ESRA2 Thematic report Nr. 16

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List of Abbreviations

Country codes

AT	Austria
AU	Australia
BE	Belgium
CA	Canada
CH	Switzerland
CZ	Czech Republic
DE	Germany
DK	Denmark
EG	Egypt
EL	Greece
ES	Spain
FI	Finland
FR	France
HU	Hungary
IE	Ireland
IL	Israel
IN	India
IT	Italy
JP	Japan
KE	Kenya
KR	Republic of Korea
MA	Morocco
NG	Nigeria
NL	Netherlands
PL	Poland
PT	Portugal
RS	Serbia
SE	Sweden
SI	Slovenia
UK	United Kingdom
US	United States
ZA	South Africa

Region codes

Europe20	Region that includes Austria, Belgium, Switzerland, Czech Republic, Germany, Denmark, Greece, Spain, Finland, France, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Serbia, Sweden, Slovenia and United Kingdom
NorthAmerica2	Region that includes Canada and United States
AsiaOceania5	Region that includes Australia, Israel, India, Japan and Republic of Korea
Africa5	Region that includes Egypt, Kenya, Morocco, Nigeria and South Africa

Other abbreviations

ESRA	E-Survey of Road Users' Attitudes
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers

Executive summary

Objective and methodology

The ESRA project (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research organisations, public services and private sponsors, aiming at collecting comparable (inter)national data on road users' opinions, attitudes and behaviour with respect to road traffic risks. The project is funded by the partners' own resources and covers countries all over the world.

The basis is a jointly developed questionnaire which is translated into national language versions. The themes covered include: self-declared behaviour, attitudes and opinions on unsafe traffic behaviour, enforcement experiences and support for policy measures. The survey addresses different road safety topics (e.g. driving under the influence of alcohol, drugs and medicines, speeding, distraction) and targets different types of road users.

The first edition of the ESRA survey (ESRA1) was carried out in three waves between 2015-2017. Data was gathered from almost 40,000 road users in 38 countries across 5 continents. The present report is based on the second edition of this global survey, which was conducted in 2018 (ESRA2_2018). In this wave data from more than 35,000 road users were collected across 32 countries and the sample was expanded in a second wave in 2019.

Hence, the ESRA database is a comprehensive dataset, which enables a wide range of analyses which are useful for understanding road safety risks and the effectiveness of measures. An overview of the project and the results are available on: www.esranet.eu

This thematic ESRA report on automated passenger vehicles focuses on two issues, 1) interest in automated passenger vehicles, and 2) perceptions of the benefits of automated passenger vehicles. Automated passenger vehicles are categorized into semi- and fully-automated vehicles for the purposes of this research. Semi-automated passenger vehicles are defined as a vehicle that can control all critical driving functions, under limited circumstances, but the operator is required to respond when prompted to resume control of the vehicle. Fully-automated passenger vehicles are defined as a vehicle that controls all critical driving functions and monitors all traffic situations, under defined circumstances, and the operator is not prompted to resume control of the vehicle. The analysis of aspects related to self-declared interest in semi- and fully-automated passenger vehicles, and the beliefs about the likelihood of the potential benefits of semi- and fully-automated vehicles are explored in this report. In addition, the factors that affect interest in automated passenger vehicles was also investigated.

Key results for interest in using automated passenger vehicles

The results for interest in automated passenger vehicles are separated into semi-automated and fully-automated vehicles. The results show that interest in using semi-automated vehicles is highest in the region of AsiaOceania5 (68.8%), and lowest in the region of NorthAmerica2 (38.4%). Across all regions, males were more interested in using semi-automated vehicles compared to females. Interest in using semi-automated vehicles was highest among younger age groups, and generally decreased with increasing age in Europe20, NorthAmerica2, and Africa5. However, in AsiaOceania5, interest in using semi-automated vehicles was similar across age groups, with no significant difference between the youngest (18-24) and oldest (65+) age groups.

The results show that interest in using fully-automated vehicles is highest in the region of AsiaOceania5, and lowest in the region of NorthAmerica2. Males were more interested in using fully-automated vehicles compared to females, except for Africa5, where females expressed slightly higher, but not significantly different levels of interest than males. The effect of age on interest in using fully-automated vehicles was comparable across regions, as younger age groups had greater interest in using these vehicles compared to older age groups.

Key results for the perceptions about the potential benefits of using automated passenger vehicles

The likelihood of certain benefits occurring if everyone were to use an automated passenger vehicle was examined. These potential benefits included fewer crashes, reduced severity of crash, less traffic congestion, shorter travel time, lower vehicle emissions, better fuel economy, more time for functional activities, and more time for recreational activities.

Fewer crashes

AsiaOceania5 (65%) and Africa5 (60.8%) had the highest percentage of respondents who believed there would be fewer crashes if everyone were to use a semi-automated vehicle. Across all regions, male respondents were more likely to perceive that semi-automated passenger vehicles would result in fewer crashes. In Europe20, AsiaOceania5 and Africa5, the oldest age group (65+) were least likely to believe this benefit would occur if everyone used a semi-automated vehicle.

A similar pattern was found when examining how likely it was that there would be fewer crashes if everyone used a fully-automated passenger car. Both AsiaOceania5 and Africa5 had a higher percentage of respondents who thought that the use of fully-automated vehicles would lead to fewer crashes. Males in all four regions had higher percentages, indicating that males were more likely to believe that fully-automated passenger cars would offer this benefit. With respect to age, the younger age groups from NorthAmerica2 (18-24, 25-34, 35-44) had higher percentages of respondents who believed that the use of fully-automated vehicles would lead to fewer crashes compared to the older age groups (45-54, 55-64 & 65+). However, in AsiaOceania5, both the youngest (18-24) and oldest (65+) age groups had similar beliefs (58.2% and 57.6% respectively) about the likelihood of this benefit. In Europe20 and Africa5, the percentage of respondents who thought that this benefit was likely to occur was similar among younger age groups, however, those aged 65 and up were less likely to believe that fully-automated vehicles would reduce crashes.

Reduced severity of crash

Respondents in AsiaOceania5 were most likely to believe there would be a reduced severity of crash if everyone were to use a semi-automated vehicle, compared to all other regions. Respondents in NorthAmerica2 were the least likely to believe this benefit would occur. Males in all four regions were more likely to believe that using semi-automated passenger cars would reduce crash severity. Younger (18-34) respondents across all regions reported significantly higher percentages, indicating that they thought the use of semi-automated passenger cars would result in reduced crash severity, compared to those aged 65+.

Respondents in AsiaOceania5 were also most likely to believe that there would be reduced severity of crash if everyone were to use a fully-automated vehicle (68.7%), compared to all other regions. NorthAmerica2 had the lowest percentage of respondents who thought this benefit was likely to occur, compared to all other regions. Males in all four regions were more likely to believe that using fully-automated passenger vehicles would reduce the severity of crashes. In most regions, those in the youngest age group (18-24) were more likely to believe this benefit would occur, compared to those aged 65 and up. The exception to this was in AsiaOceania5, where the percentage of respondents who believed that this benefit was likely did not differ significantly between the youngest (18-24) and oldest (65+) age groups.

Less traffic congestion

Over half of respondents in AsiaOceania5 believed that there would be less traffic congestion if everyone were to use a semi-automated vehicle, whereas only about 1 in 3 respondents in NorthAmerica2 thought that it was likely for this benefit to occur. Males in Europe20, AsiaOceania5, and NorthAmerica2 were more likely to indicate that semi-automated passenger vehicles would reduce congestion. In all four regions, percentages in the youngest three age groups (18-24, 25-34 and 35-44) did not differ

significantly, whereas those in the oldest age group (65+) were least likely to indicate that this benefit would occur.

Respondents in AsiaOceania5 (64.0%) were the most likely to believe that there would be less traffic congestion if everyone were to use a fully-automated vehicle. In NorthAmerica2, respondents were least likely to believe that this benefit would occur. A higher percentage of males in each region indicated that fully-automated vehicles were likely to reduce traffic congestion. In Europe20 and NorthAmerica2, the percentage of respondents who believe that this benefit would occur decreased with increasing age, however this was not the case in the two other regions. In AsiaOceania5 and Africa5, the percentage of respondents who believed this benefit was likely to occur peaked in the age groups of 25-34 and 35-44, before decreasing in older age groups.

Shorter travel time

Just over half of respondents in AsiaOceania5 believed that there would be shorter travel time if everyone were to use a semi-automated vehicle. However, less than one in three respondents in NorthAmerica2 believed that this benefit would likely occur. In Europe20, AsiaOceania5, and NorthAmeria2, males were more likely to believe that semi-automated vehicles would reduce travel time. However, in Africa5, females were more likely than males to believe that semi-automated vehicles would reduce travel time, although the difference was not significant (58.5% and 57.3% respectively). In Europe20 and NorthAmerica2, analysis by age shows that the proportion of respondents that believe semi-automated passenger vehicles are likely to reduce travel time decreases with increasing age of the respondent. This was not the case in AsiaOceania5 and Africa 5.

The percentage of respondents who believe that fully-automated passenger vehicles would likely reduce travel time was higher in AsiaOceania5 (63%), compared to all other regions. In Europe20, AsiaOceania5, and NorthAmerica2, a higher percentage of males that indicated this benefit was likely. In Africa5, females were more likely than males to believe that fully-automated vehicles would reduce travel time. The percentage of respondents in Africa5 who believed that travel time would be shorter if everyone used a fully-automated vehicle did not differ significantly between most age groups (18-24, 25-34, 35-44, 45-54, and 55-64), indicating that respondents in these age groups had similar beliefs. However, respondents aged 65 and up who believed this benefit would occur was significantly lower, compared to all other age groups. This was not the case for other regions.

Lower vehicle emissions

Respondents in AsiaOceania5 were the most likely to believe there would be lower vehicle emissions if everyone were to use semi-automated vehicles, compared to all other regions. NorthAmeria2 had the lowest percentage of respondents who believed this benefit was likely to occur, compared to the other regions. Overall, males were more likely to believe that this benefit was likely, compared to females in all regions. Across all regions, the percentage of respondents who believed this benefit was likely peaked between the age groups of 25-34 and 35-44, before decreasing in those aged 65 and up.

AsiaOceania5 had the highest percentage of respondents (68%) who believed that lower vehicle emissions was a likely benefit of fully automated vehicles, followed by Africa5 (63.2%). Males were more likely to indicate that this benefit would occur, compared to females in all regions. Younger adults were more likely than older adults (65+) to believe that lower vehicle emissions were likely if everyone were to use a fully-automated vehicle, across all regions.

Better fuel economy

Over 70% of respondents in AsiaOceania5 believed that semi-automated passenger vehicles would likely offer the benefit of better fuel economy. However, less than half (48.1%) of respondents in NorthAmerica2 thought that better fuel economy was likely, and this was the region with the lowest percentage of respondents who believed this benefit was likely to occur. Males were more likely to believe that semi-automated vehicles would offer better fuel economy, across all regions. Age was a significant factor ($p<0.01$, Cramer's $V<0.09$). Analysis by age group demonstrated that in all regions,

the percentage of those who believed this benefit was likely to occur was highest in respondents age 25-34 and 35-44 and decreased with increasing age.

Respondents in AsiaOceania5 had the highest percentage of respondents who believed that fully-automated vehicles would offer the benefit of better fuel economy, followed by Africa5 and Europe20. Those in NothAmerica2 had the lowest percentage compared to all other regions. Males across all regions were more likely to believe that this benefit would occur. Older adults (65+) were less likely to believe that fully-automated vehicles would offer this benefit, compared to younger age groups, in all regions except NorthAmerica2. The oldest and youngest respondents in NorthAmerica2 did not differ significantly, as those aged 18-24 (50.3%) had similar beliefs as respondents 65 and up (44.5%).

Time for functional activities

AsiaOceania5 had the highest percentage of respondents (61.0%) that thought semi-automated vehicles would offer the benefit of more time for functional activities, such as working. Whereas those in Europe20 were the least likely to believe that this benefit would occur (38.4%). Gender differences in Europe20, AsiaOceania5 and NorthAmerica2 demonstrated that males were more likely to believe that semi-automated passenger vehicles would allow time for functional activities such as working. In Africa5, the percentage of females that thought this benefit was likely to occur was higher than males, but this difference was not significant. Across all regions, there was no significant difference between the percentage of respondents in the first three age groups (19-24, 25-34, 35-44), indicating that these respondents held similar beliefs about the likelihood of this benefit. However, respondent aged 65 and up had the lowest percentage of respondents who believed this benefit was likely to occur.

Respondents were asked if fully-automated passenger cars would offer the benefit of having time for functional activities such as working. Those in Europe20 and NorthAmerica2 had similar beliefs (47.3% and 48.9% respectively). Conversely, AsiaOceania5 had the highest percentage (67.6%) of respondents who believed that fully-automated vehicles would offer the benefit of allowing time for functional activities, when compared to all other regions. Overall, there was a higher percentage of males who believed this benefit was likely to occur compared to females, and this difference was significant in Europe20 and NorthAmerica2. Respondents in the older age groups across all regions had significantly lower percentages compared to younger age groups.

Time for recreative activities

Just over half (57.6%) of respondents in AsiaOceania5 believed that semi-automated vehicles would allow more time for recreative activities not related to driving. Less than 40% of respondents in Europe20 and NorthAmerica2 (37.6% and 39.7% respectively) believed that semi-automated passenger vehicles would offer the benefit of having time for recreative activities not related to driving, such as reading, sleeping, and eating. In all regions, males were more likely to indicate that the use of semi-automated passenger cars would likely offer the benefit of time for non-driving related recreative activities such as reading, sleeping, and eating. Differences by age group showed that in all four regions, the percentage of respondents who believed that this benefit was likely to occur was significantly higher in the youngest age group (18-24) in comparison to those aged 65 and up.

Respondents appeared more optimistic about the likelihood that fully-automated passenger cars would offer the benefit of having time for recreative activities not related to driving, such as reading, sleeping, and eating. Over 65% of respondents in AsiaOceania5 believed that this benefit was likely to occur, which is significantly higher than all other regions. Just under half of the respondents in Europe20 and NorthAmerica2 held similar beliefs that fully-automated vehicles would allow time for non-driving recreative activities (46.9% and 49.7% respectively). In all regions, males were more likely to note that this benefit was likely. Differences by age group showed that in all four regions, the percentage of respondents who believed that this benefit was likely to occur was significantly higher in the youngest age group (18-24) in comparison to those aged 65 and up.

Key recommendations

Policy recommendations at national and regional level

- Continue to study the impact of age, and gender on interest in automated passenger vehicles and ensure that public education of automated vehicle technology is tailored to the specific cohort of drivers. In this study, male respondents and those aged 18-34 were most interested in automated passenger vehicles. Conversely, older respondents had lower levels of interest in automated passenger vehicles compared to other age groups. As a result of the different driving behaviours and habits of these distinct populations of drivers, public education must be responsive to the specific needs of each cohort.

- Begin conversations with drivers in advance of publicly available automated passenger vehicles. Although trust is important, drivers must first have a proper understanding of the capabilities and limitations of the technology, and misconceptions about the role of the driver must be dispelled.

Specific recommendations to particular stakeholders

- [To Non-Governmental Organizations (NGOs)] Contribute to education and awareness raising campaigns to increase knowledge on the capabilities and limitations of automated passenger vehicles, while conveying the implications on road safety.

- [To vehicle manufacturers, other companies and research organisations] Continue to develop and promote automated technology that can assist drivers and improve road safety.

The ESRA project has demonstrated the feasibility and the added value of joint data collection on road safety attitudes and performance by partner organizations in a large number of countries across the world. The intention is to repeat this initiative on a triennial basis, retaining a core set of questions in every wave, allowing the development of time series of road safety performance indicators. This will become a solid foundation for a joint international monitoring system on road safety attitudes and behaviour.

1 Introduction

Road injuries remain a leading cause of death worldwide (World Health Organization, 2018) with 1.35 million deaths in 2016. The advent of automated vehicle technology holds the potential for an unparalleled advantage to road safety, with reductions in the frequency and severity of crashes, as well as benefits in many other areas such as advances in public transport, freight, road congestion and the environment. The benefits of automated vehicle technology are numerous, but there remain significant concerns that accompany the widespread implementation of this technology on public roads, including established standards for vehicle technology, infrastructure, data security, as well as legal and ethical issues, and the appropriate use of the technology by the operator.

A classification system of automated vehicle technology has been established by both the National Highway Traffic Safety Administration (NHTSA) and the Society of Automotive Engineers (SAE), where the separate levels of automation are defined (Society of Automotive Engineers, 2018; NHTSA, 2017). These classification systems are largely intended to establish a common set of nomenclature for use in the field of engineering, research, and development. For the present research, automated vehicle technology is divided into two categories: semi-automated and fully-automated vehicles. Semi-automated vehicles, corresponding to SAE and NHTSA level 3 automation, allow the operator to assign the vehicle control of all critical driving functions, including monitoring the road, steering, and accelerating or braking in certain traffic and environmental conditions, but the operator is required to respond when prompted to resume control of the vehicle. Fully-automated vehicles, corresponding to level 4 and 5 of SAE and NHTSA classifications, is defined as a vehicle that controls all critical driving functions and monitors all traffic situations, and the operator does not take control of the vehicle at any time.

Public opinion and acceptance of automated vehicle technology remains one of the most significant hurdles to widespread implementation of these vehicles. An online survey of respondents from the United States (n= 501), the United Kingdom (n= 527), and Australia (n= 505) examined key topics such as general opinion and familiarity with automated vehicle technology, expected benefits and concerns with the implementation of this technology, and overall interest in the technology (Schoettle and Sivak, 2014). Results demonstrated that there was an overall positive view of automated vehicle technology and interest in using the technology, with acknowledgement of the potential benefits. However, there was high concern about issues such as vehicle control, performance, and data privacy. When examining the attitudes towards different levels of automation, results demonstrated that respondents in the U.S. and U.K. were more concerned about riding in fully-automated vehicles compared to semi-automated vehicles. Conversely, respondents in Australia expressed greater concern towards riding in semi-automated vehicles. To further expand on these results, researchers conducted this same survey in China (n= 610), India (n= 527), and Japan (n= 585), using the same questionnaire and topics of interest (Schoettle and Sivak, 2014b). The overall findings from the six countries reaffirmed that respondents had a generally positive view of automated vehicle technology. All countries had high expectations about the potential benefits and possessed similar concerns about the technology. However, the majority of countries were unwilling to pay more for automated vehicle technology. In comparison to those in the U.S., U.K., and Australia, respondents in China and India had a more positive view of automated vehicle technology and expressed greater interest in using it. However, respondents in India were over three times more likely than other countries to express that they were very concerned about riding or driving in a fully-automated vehicle. Respondents in Japan had a neutral view of automated vehicle technology and expressed the lowest willingness to pay more for this technology.

Attitudes towards automated vehicle technology also vary by certain individual variables. The literature demonstrates that gender plays a significant role in respondent attitudes, with males holding more positive attitudes towards automated vehicle technology. An online survey of 5000 respondents in 109 countries examined the acceptance, concerns, and willingness to use semi-automated and fully-automated vehicles, as well as how certain personal variables are associated with opinions about this technology. Results demonstrated that males had less concerns about fully-automated vehicles and

were willing to pay more for the technology than women (Kyriakidis, Happee, and de Winter, 2015). Moreover, respondents who reported higher mileage and those with previous experience with adaptive cruise control demonstrated a higher willingness to pay more for increasing levels of automation in their vehicle. A more recent study that focused solely on autonomous vehicles examined the responses of over 1000 U.K. participants with an online survey exploring respondent perceptions about safety and acceptance of autonomous vehicles (Hulse, Xie, and Galea, 2018). Respondents were asked to rate the level of perceived risk associated with different forms of transportation (autonomous car, human operated car, autonomous train, human operated train, motorcycle, bicycle) from the perspective of different populations (i.e. passenger, driver, pedestrian). Perceived risk was measured on a scale of 1 to 7, with 1 indicating "extremely low", and 7 indicating "extremely high". Females' average perceived risk of being a passenger in an autonomous vehicle was higher than the average perceived risk by males, and females rated the perceived risk of being a passenger in an autonomous vehicle as higher than being a driver of a traditional human operated car. General attitudes were also measured, and respondents were asked to select one of six statements that best reflected their attitude towards autonomous cars. Respondents were also given the option to select "other" and describe their attitudes in their own words. The five provided statements that respondents could choose from were categorized as positive, conditionally positive, uncertain, conditionally negative, and negative. Results demonstrated that although few attitudes towards autonomous vehicles were negative, the majority fell under the category of "uncertain", where participants agreed with the statement that they "need to know a lot more about the intrinsic road safety capabilities of these vehicles". A smaller percentage of respondents expressed agreement with positive statements about autonomous vehicles. When examining differences by gender, a higher percentage of males agreed with a positive statement about autonomous vehicles, whereas a higher percentage of females agreed with the statement about uncertainty.

Literature also demonstrates the effects of age on attitudes towards automated vehicle technology. An online survey of 2662 respondents examined knowledge, attitudes and practices in relation to semi-automated and fully-automated vehicles and showed that younger drivers were more likely to report greater willingness to use automated vehicles and demonstrated greater trust in the various potential capabilities of the technology. However, younger drivers were also more likely to report that they would engage in risky behaviours with this technology, specifically, that they would no longer need to pay attention to the road environment while using a semi-automated vehicle. Younger drivers were also more likely to report that they would engage in other risky behaviours with semi-automated vehicles, such as fatigued driving, performing non-driving activities (texting, reading, working), sleeping or napping, or drinking and driving (Robertson, Meister, Vanlaar, and Hing, 2017). To further understand the effects of age, a follow-up study was conducted to examine the knowledge, attitudes and practices of older drivers towards automated vehicles. Focus groups were conducted with older drivers and further analyses were performed with the online survey data. Focus group results demonstrated that the knowledge of automated vehicle technology was generally low, but that older drivers were interested in learning more. Results also highlighted the attitudes towards this technology, including expected benefits of safety and increased mobility, along with some important age-specific concerns held by this cohort of drivers, such as the learning curve associated with adopting a new technology. Further analyses of the survey results echoed these findings, and it was determined that feelings of safety and knowledge about automated vehicles are positively related to perceived ease of use and willingness to use automated vehicles (Robertson, Woods-Fry, Vanlaar, and Hing, 2019).

This thematic ESRA report aims at describing self-declared interest and perceptions of the potential benefits of semi- and fully-automated passenger cars in a sample from 32 countries worldwide. Factors that influence the self-declared interest and perceptions of the potential benefits of semi- and fully-automated passenger cars are also identified within each of the four regions: Europe20, NorthAmerica2, AsiaOceania5, Africa5.

The ESRA2 findings are used to answer the following research questions:

- What is the level of self-declared interest in using semi-automated passenger vehicles?
- What is the level of self-declared interest in using fully-automated passenger vehicles?
- What are the perceptions about the potential benefits of using semi-automated passenger vehicles?
- What are the perceptions about the potential benefits of using fully-automated passenger vehicles?

2 Methodology

The ESRA project (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research organisations, public services and private sponsors, across 46 countries aiming at collecting comparable (inter)national data on road users' opinions, attitudes and behaviour with respect to road traffic risks. The initiative is funded by the partners' own resources.

ESRA is an extensive online panel survey, using a representative sample (at least N=1,000) of the national adult populations in each participating country. A jointly developed questionnaire is translated into national language versions. The themes covered include: self-declared behaviour, attitudes and opinions on unsafe traffic behaviour, enforcement experiences and support for policy measures. The survey addresses different road safety topics (e.g., driving under the influence of alcohol, drugs and medicines, speeding, distraction) and targets all types of road users. The first edition of the ESRA survey (ESRA1) was carried out in three waves between 2015-2017. Data were gathered from almost 40,000 road users in 38 countries across 5 continents.

The present report is based on the first wave of the second edition of this global survey (ESRA2_2018). It was conducted in 32 countries in 2018. In total the ESRA2_2018 survey collected data from more than 35,000 road users. It will be further elaborated in a second wave in 2019 (ESRA2_2019). The participating countries in ESRA2_2018 were:

- Europe: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, United Kingdom;
- America: Canada, USA;
- Asia and Oceania: Australia, India, Israel, Japan, Republic of Korea;
- Africa: Egypt, Kenya, Morocco, Nigeria, South Africa.

The project has been initiated and is coordinated by the Vias institute (BE). Twelve institutes: BASt (DE), bfu (CH), CTL (IT), IATSS (JA), IFSTTAR (FR), ITS (PO), KFV (AT), NTUA (EL), PRP (PT), SWOV (NL), TIRF (CA) and Vias institute (BE) – combined their expertise and resources to analyse the common data and to disseminate the results. The results of the ESRA2_2018 survey will be published in a Main Report and fifteen thematic reports (Table 1).

Table 1: ESRA2 Thematic Reports

Driving under influence	Child restraint systems	Cyclists
Speeding	Unsafety feeling & risk perception	Moped drivers & motorcyclists
Distraction (mobile phone use)	Enforcement	Young road users
Fatigue	Vehicle automation	Elderly road users
Seat belt	Pedestrians	Gender aspects

There are also country fact sheets in which the main results per country are compared with a regional average. An overview of the project and the results are available on www.esranet.eu.

The present report summarizes the ESRA2_2018-results with respect to vehicle automation. An overview of the data collection method and the sample per country can be found in ESRA2 methodology.

The report includes the analysis of several aspects related to vehicle automation: self-declared interest, and beliefs and perception about the potential benefits.

Most of the questions of the survey were presented on Likert scales, which were dichotomized for the analysis. A description of the scales and the correspondent dichotomization are presented in the beginning of each section.

For the descriptive analysis, all the results are presented by region (Europe20, NorthAmerica2, AsiaOceania5 and Africa5) and age group. A weighting of the data was applied to the descriptive analyses. This weighting took into account small corrections with respect to national representativeness of the sample based on gender and six age groups: 18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65y+; based on population statistics from United Nations data (United Nations, 2019). For the regions, the weighting also took into account the population size of each country in the total set of countries from this region. More information about the weighting is available in Appendix 2: ESRA2 weights. Note that in the African countries a lower percentage of people has access to, and use, the internet (in Kenya and Nigeria less than 30%). Within the African countries the numbers of 65+ respondents who answered the ESRA2 survey were quite low (with the exception of South Africa), so that the answers of this particular age group in African countries cannot be considered to be representative.

Due to the nominal nature of the data, the Chi-square Test for Independence was used to assess if the answers depend significantly on region, gender and on age group. Pairwise comparisons were used to identify the pairs of groups (region, gender, age groups) that differ significantly. The strength of the association between variables was assessed through the Cramer's V coefficient. The following thresholds were considered to classify the strength of associations (Cohen, 1988): association with region (3 degrees of freedom) – small=0.06, medium=0.17, large=0.29; association with gender (1 degree of freedom) – small=0.10, medium=0.30, large=0.50; association with age group (5 degrees of freedom) – small=0.04, medium=0.13, large=0.22.

Multiple linear regression models were also estimated to explore what factors were associated with self-declared interest in semi- and fully-automated passenger vehicles. These additional analyses and results are located in Appendix 3.

3 Results

3.1 Descriptive analysis

This section includes the descriptive statistics of questions related to self-declared interest in automated passenger vehicles: semi-automated passenger vehicles and fully-automated passenger vehicles. It also includes results on the perceptions of the potential benefits of semi-automated and fully-automated passenger vehicles. Due to the large number of survey respondents, a p-value of 0.01 or less was used as an indicator of statistical significance.

3.1.1 Self-declared interest in automated passenger vehicles

To assess self-declared interest in automated passenger vehicles, all road users were asked 'How interested would you be in using the following types of automated passenger car?'. Two items of interest were included:

Semi-automated passenger car: Drivers can choose to have the vehicle control all critical driving functions, including monitoring the road, steering, and accelerating or braking in certain traffic and environmental conditions. These vehicles will monitor roadways and prompt drivers when they need to resume control of the vehicle.

Fully-automated passenger car: The vehicle controls all critical driving functions and monitoring all traffic situations. Drivers do not take control of the vehicle at any time.

All questions were answered on a Likert scale from 1 (not at all interested) to 7 (very interested) - the percentages of 'interested' (answers 5 to 7) are presented in the results.

Figure 1 shows that region is a significant factor in the self-declared interest in using a semi-automated passenger vehicle ($p<0.01$). The strength of the association of the self-declared interest and region was medium (Cramer's $V=0.22$). Proportions of respondents who reported being 'interested' were significantly higher in AsiaOceania5 (68.8%) compared to all other regions ($p<0.01$). Within AsiaOceania5, results by country show that India (72.1%) had the highest percentage of self-declared interest in using a semi-automated vehicle, whereas Australia had the lowest percentage of interest (37.1%).

Proportions of self-declared interest in using a semi-automated passenger car in Africa5 (58.2%) were significantly different than all other regions ($p<0.01$). Results by country show that Kenya (73.9%) and Nigeria (67.2%) have the highest percentage of interest in using a semi-automated vehicle.

Europe20 and NorthAmerica2 did not differ significantly from each other and had the lowest percentages of interest in using semi-automated passenger cars (40.7% and 38.4% respectively). Within Europe20, the United Kingdom (30.9%) had the lowest self-declared interest. Within NorthAmerica2, the United States (38.3%) had the lowest proportion of interest in using a semi-automated passenger car, which was only slightly lower than the proportion in Canada (39.8%).

Figure 1 shows that region is also a significant factor in the self-declared interest in using fully-automated passenger vehicles ($p<0.01$). The strength of the association of the self-declared interest and the region was medium (Cramer's $V=0.28$). The proportion of interest in fully-automated passenger cars was significantly higher in AsiaOceania5 (66.3%) compared to all other regions ($p<0.01$). Within AsiaOceania5, India (69.4%) had the highest percentage of interest in using a fully-automated passenger vehicle, whereas Australia had the lowest percentage (32.6%).

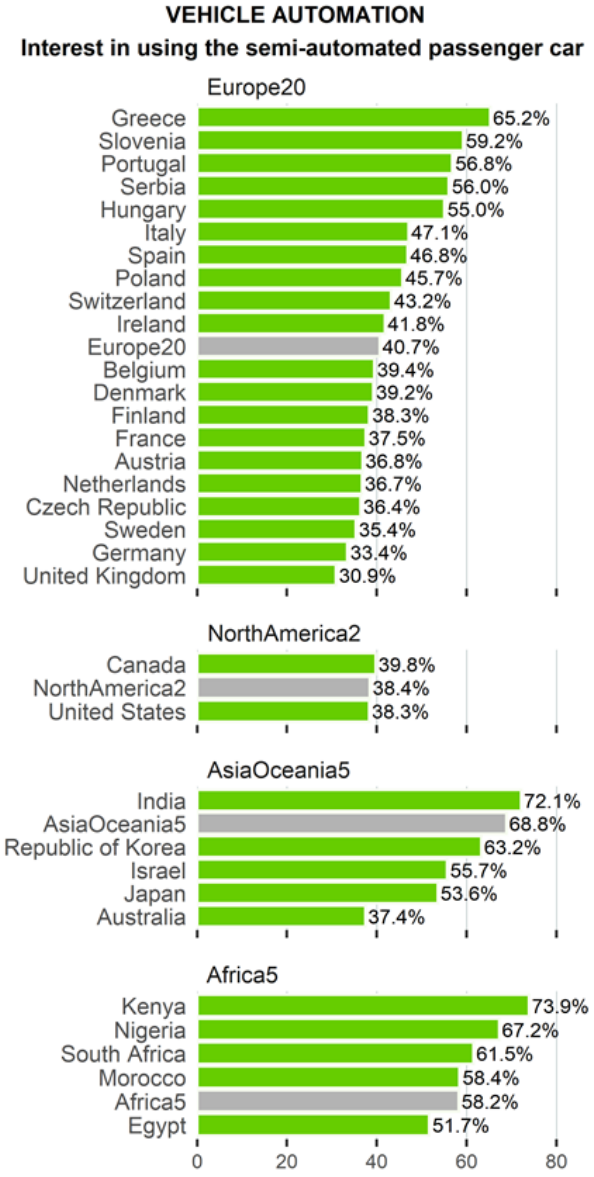
The proportion of interest in using a fully-automated passenger vehicle was significantly different in Africa5 (56.8%) compared to the other three regions ($p<0.01$). Within Africa5, the results by country show that Egypt has the highest percentage of interest in using fully-automated passenger cars (64.4%), followed by Kenya (62.2%).

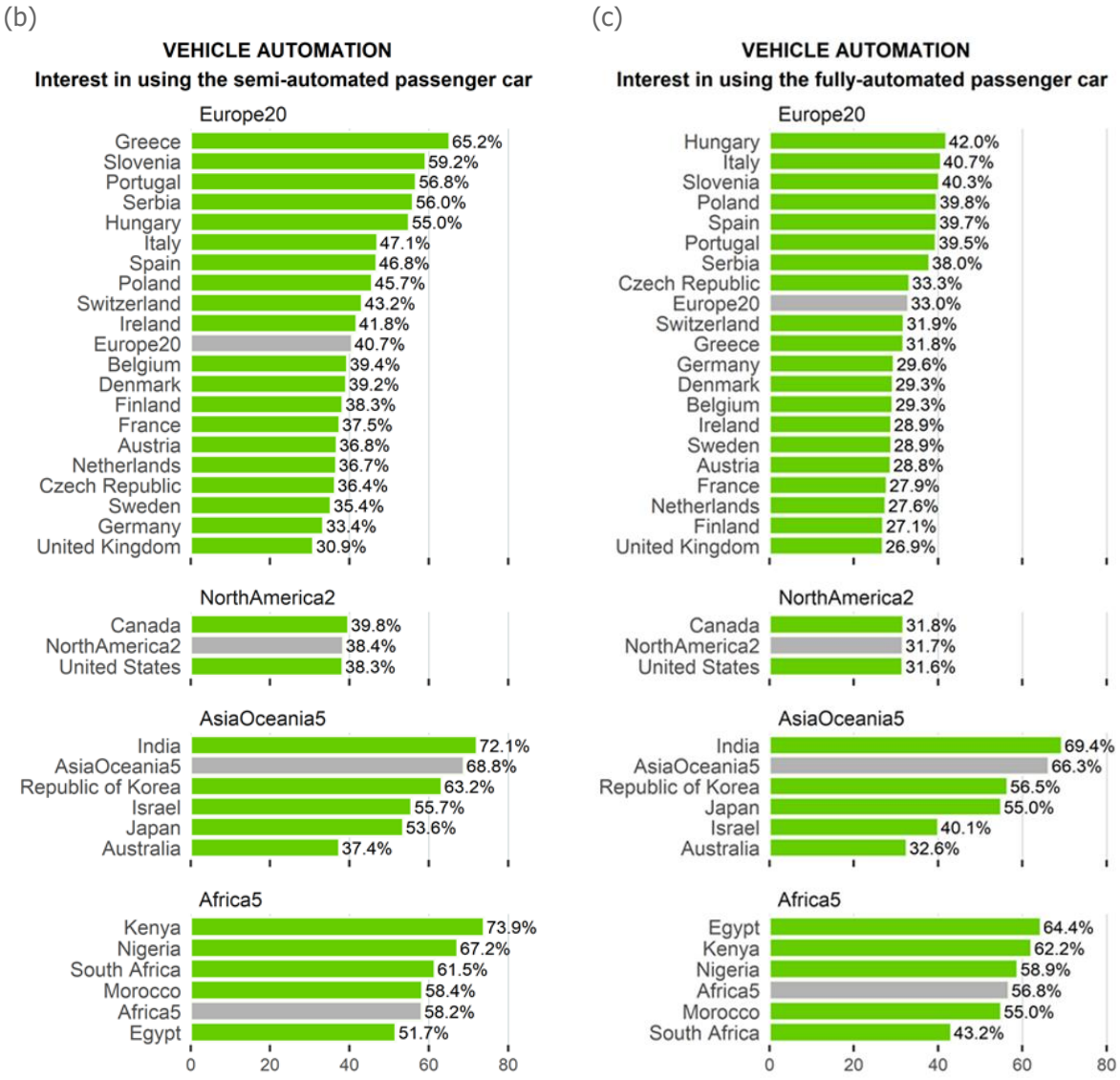
In opposition, Europe20 had the second lowest percentage of interest in using fully-automated vehicles (33%), followed by NorthAmerica2 (31.7%). There was no significant difference between these two regions ($p>0.01$). Within Europe20, the United Kingdom (26.9%) had the lowest self-declared interest.

Within NorthAmerica2, the United States and Canada had very similar percentage interest, with 31.6% and 31.8% respectively.

Figure 2 shows the percentage of interest in using a semi-automated passenger vehicle compared to the percentage of interest in using a fully-automated passenger vehicle by region. Results show that there is a higher percentage of interest in using a semi-automated passenger vehicle consistently across all regions. The difference in percentage of interest was greatest in Europe20, as interest in using a semi-automated passenger vehicle was 40.7%, compared to 33% interest in using a fully-automated passenger vehicle. Similarly, the percentage of interest in using a semi-automated passenger vehicle in North America2 was 38.4%, compared to 31.7% interest in using a fully-automated passenger vehicle. However, in AsiaOceania5 and Africa5, the interest in using semi-automated passenger vehicles was only slightly higher than interest in using fully-automated passenger vehicles.

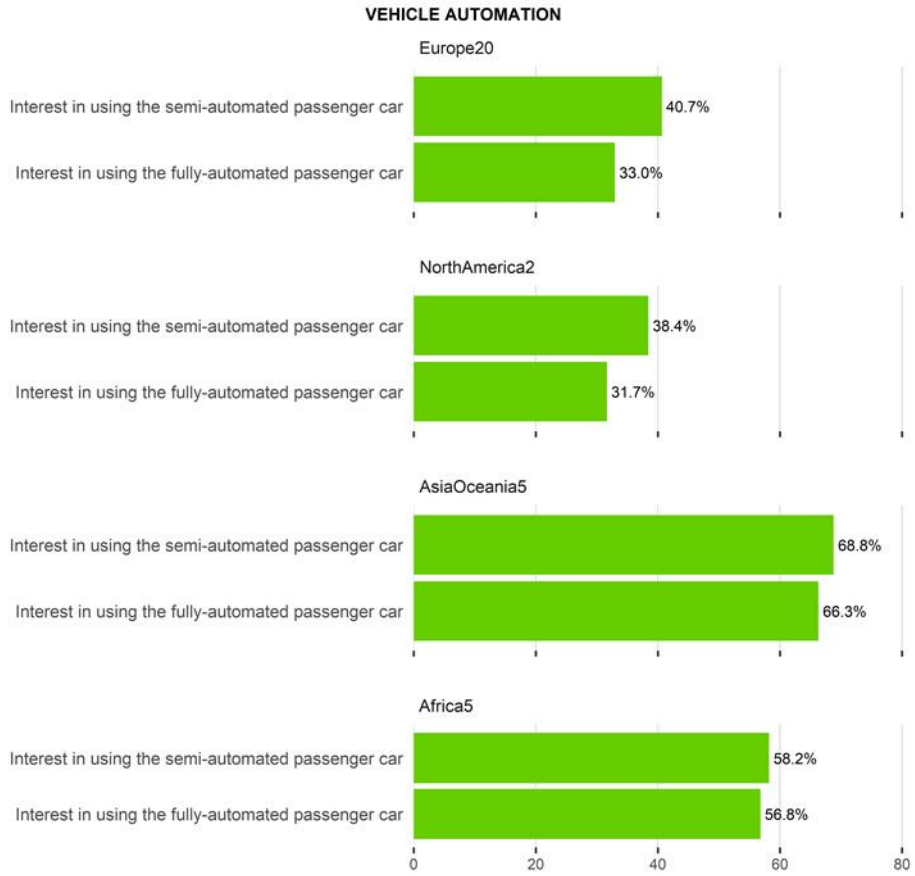
(a)





Reference population: all road users

Figure 1: Self-declared interest in using an automated passenger car (a-c) by region and country.



Reference population: all road users

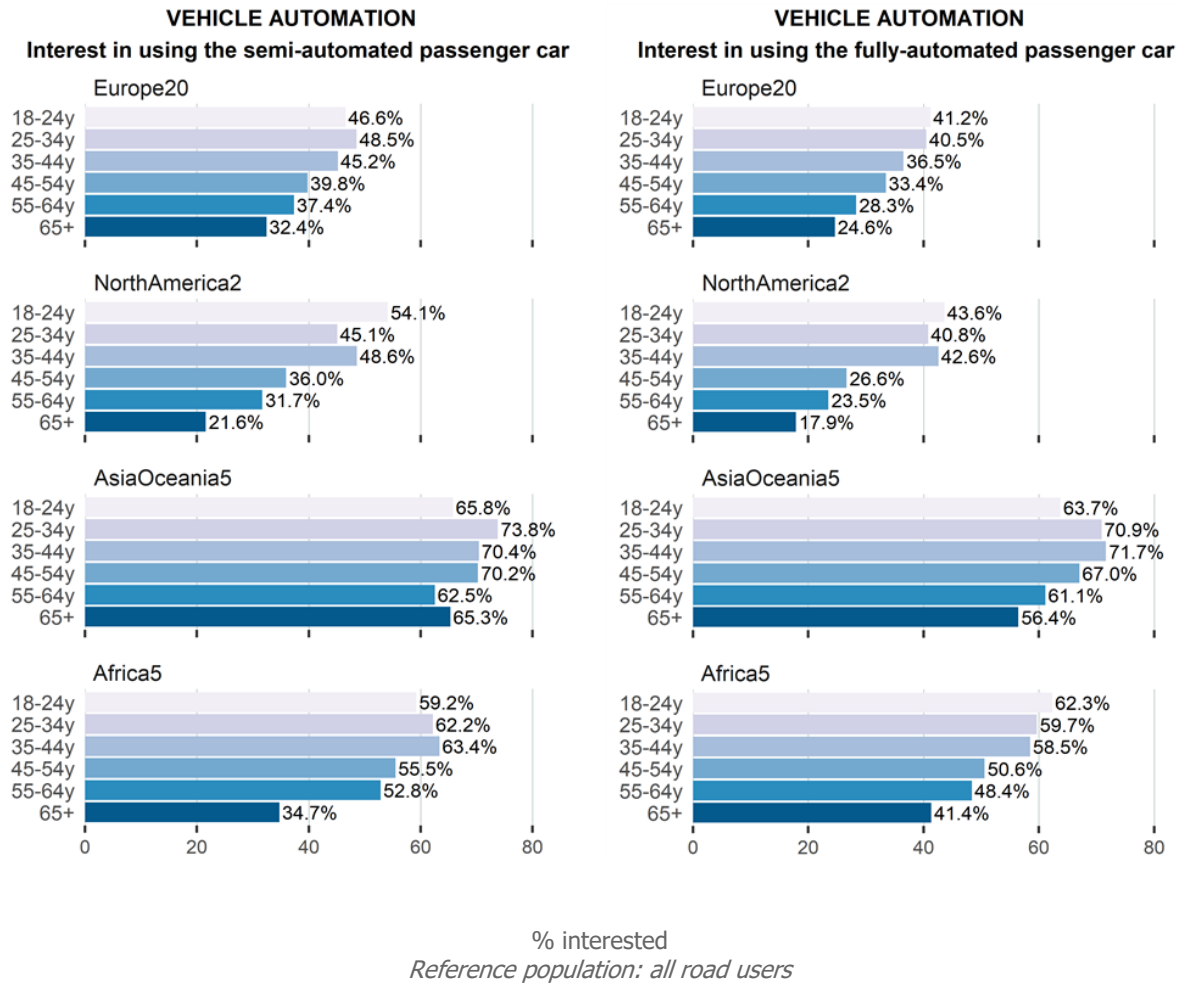
Figure 2: Self-declared interest in using an automated passenger car by region.

The analysis by age group (Figure 3) shows that in all regions age is a significant factor in the self-declared interest in using a semi-automated vehicle ($p<0.01$, Cramer's $V<0.22$). In the regions of Europe20, NorthAmerica2 and Africa5, the percentage of interest of those aged 18-24 is significantly higher than those aged 65+ ($p<0.01$) (Figure 3). Conversely, in AsiaOceania5, the percentage of interest remains relatively steady with age, and there is no significant difference between the percentage interest expressed by those aged 18 to 24 and the oldest age group (65+).

Age is also a significant factor in all regions in the self-declared interest in using a fully-automated passenger vehicle ($p<0.01$, Cramer's $V<0.22$). Figure 3 shows that self-declared interest in fully-automated passenger vehicles generally decreases with increasing age in Europe20, and NorthAmerica2. This pattern was not present in AsiaOceania5 and Africa5. Interestingly in AsiaOceania5, NorthAmerica2, and Africa5, those aged 55-64 and 65+ held similar levels of interest in fully-automated vehicles, as the percentage of respondents who indicated they would be interested did not differ significantly between these two age groups ($p>0.01$).

Results by gender (Figure 4) demonstrate that gender is only a significant factor in the self-declared interest in using a semi-automated passenger car in Europe20 and NorthAmerica2 ($p<0.01$, Cramer's $V<0.10$). In these two regions, males consistently demonstrated significantly higher percentage of interest in using semi-automated passenger cars ($p<0.01$). This was also true in AsiaOceania5 and Africa5, but the differences were smaller and not statistically significant.

Gender is only a significant factor in the self-declared interest in using fully-automated passenger cars in Europe20, and NorthAmerica2 ($p<0.01$, Cramer's $V<0.10$) (Figure 4). In these two regions, males demonstrated significantly higher percentage interest in using fully-automated passenger vehicles ($p<0.01$). This same pattern was present in AsiaOceania5, but the difference between males and females was not signifciant. Conversley, in Africa5, females expressed slightly more interest that males in using a fully-automated passenger vehicle but this difference was not significant ($p>0.01$) (56.9% of females versus 56.7% of males).



Reference population: all road users

Figure 3: Self-declared interest in using an automated passenger car by region and age group.

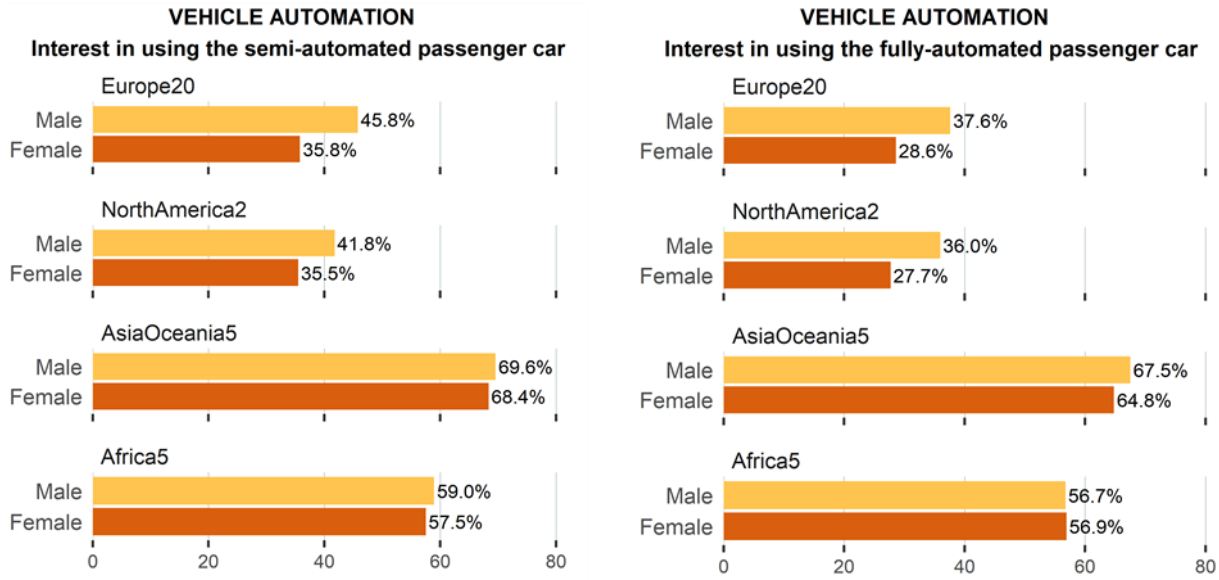


Figure 4: Self-declared interest in using an automated passenger car by region and gender.

3.1.2 Potential benefits of automated passenger vehicles

To assess perceptions about the potential benefits of automated passenger vehicles, all road users were asked 'How likely do you think it is that the following benefits will occur if everyone would use a: semi-automated passenger car; fully-automated passenger car'. Eight items of interest were included:

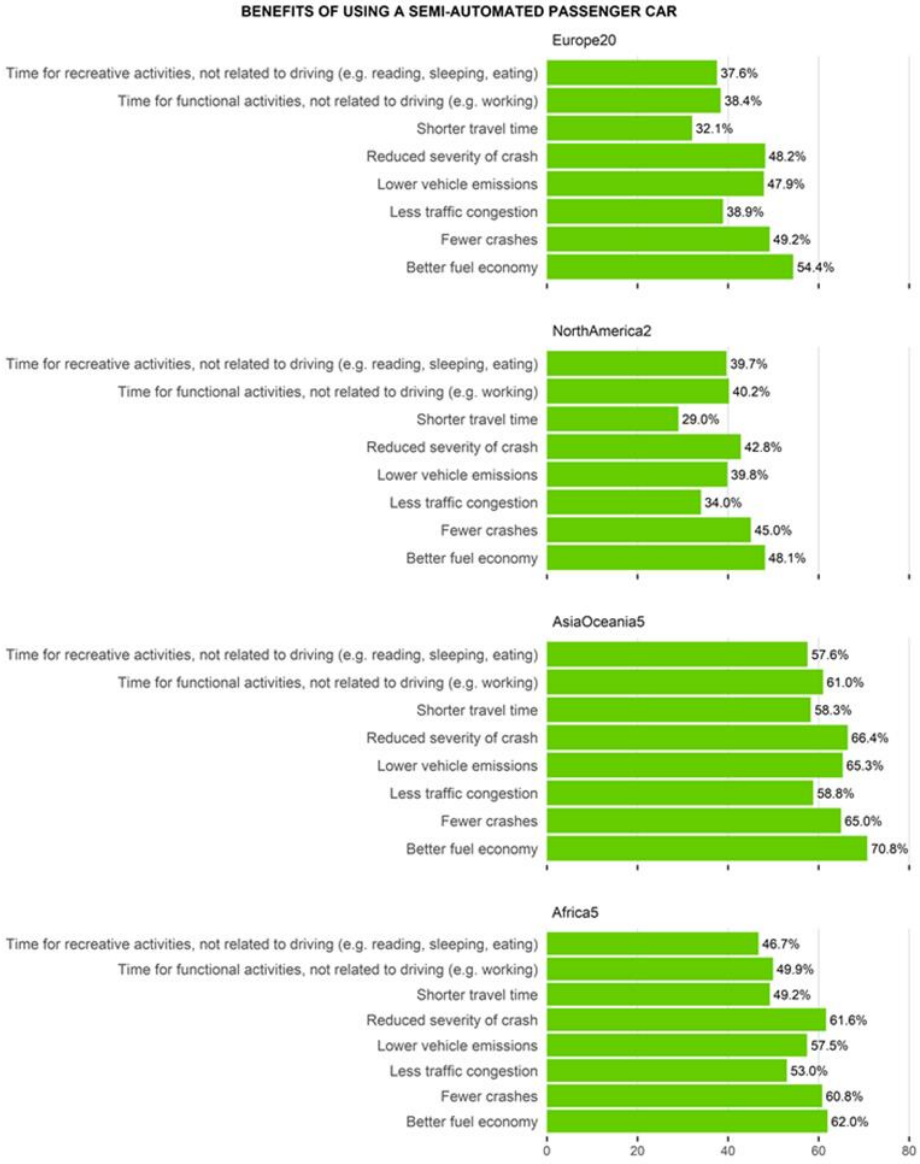
- fewer crashes;
- reduced severity of crash;
- less traffic congestion;
- shorter travel time;
- lower vehicle emissions;
- better fuel economy;
- time for functional activities, not related to driving (e.g. working);
- time for recreative activities, not related to driving (e.g. reading, sleeping, eating).

All questions were answered on a Likert scale from 1 (very unlikely) to 7 (very likely) - the percentages of 'likely' (answers 5 to 7) are presented in the results.

Fewer crashes

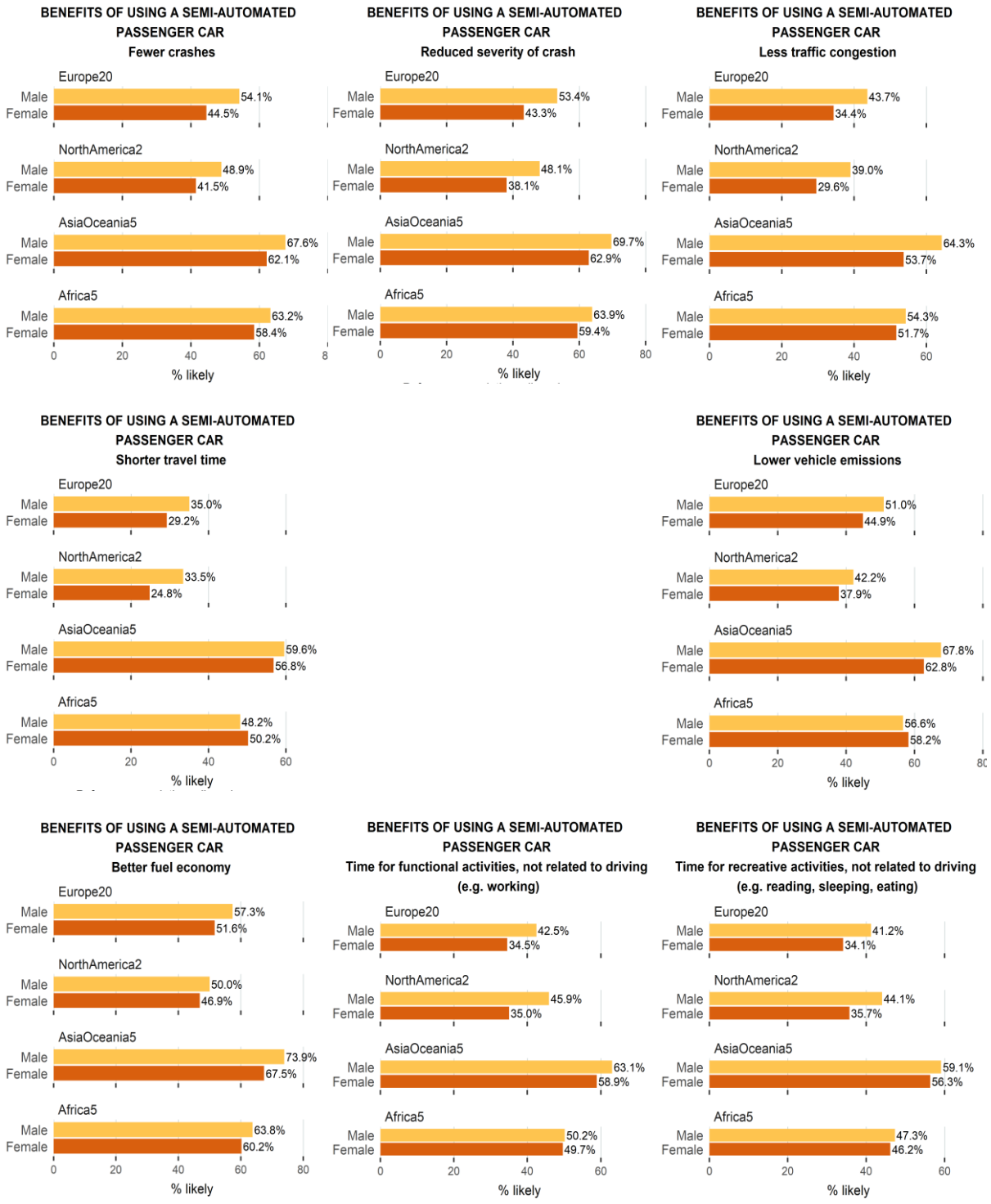
Region was a significant factor in perceiving that it was likely fewer crashes would occur if everyone would use a semi-automated vehicle, although the strength of the association was small ($p<0.01$, Cramer's $V=0.134$) (Figure 5). Respondents in AsiaOceania5 (65%) and Africa 5 (60.8%) had significantly higher percentages of respondents who perceived it to be likely that the use of semi-automated vehicles would result in fewer crashes ($p<0.01$). Gender is also a significant factor (Figure 6) ($p<0.01$, Cramer's $V<0.10$), as male respondents across all regions were significantly more likely to perceive that semi-automated passenger vehicles would result in fewer crashes ($p<0.01$). Age was

also associated with the perception that semi-automated passenger vehicles would result in fewer crashes (Figure 7) ($p<0.01$, Cramer's $V<0.13$). In Europe20, AsiaOceania5 and Africa5, the oldest age group (65+) had significantly lower percentages of respondents who thought that the use of semi-automated vehicles would result in fewer crashes ($p<0.01$).



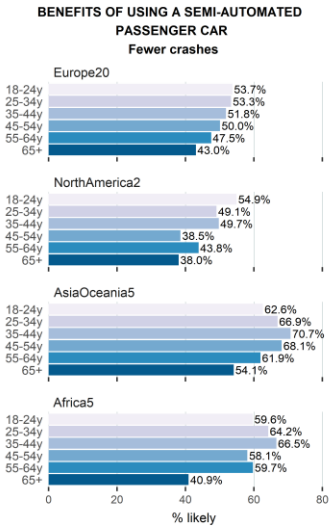
Reference population: all road users

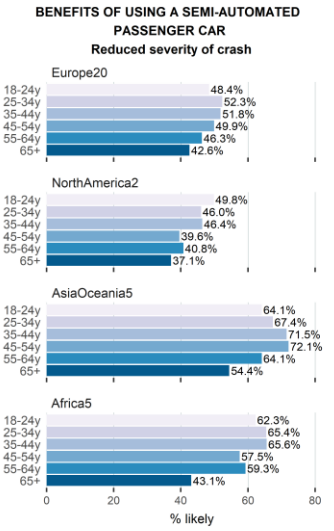
Figure 5: Likelihood of benefits occurring if everyone would use a semi-automated passenger car and by region

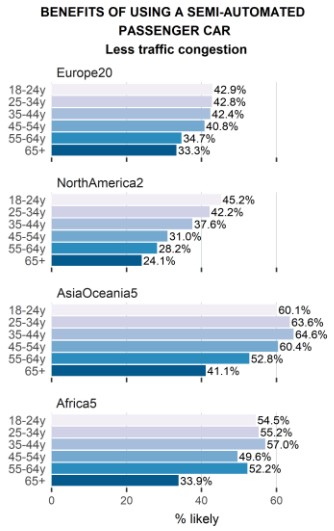


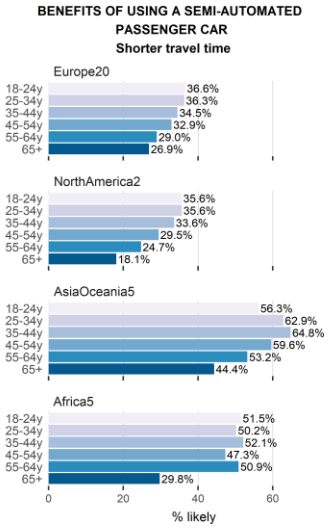
Reference population: all road users

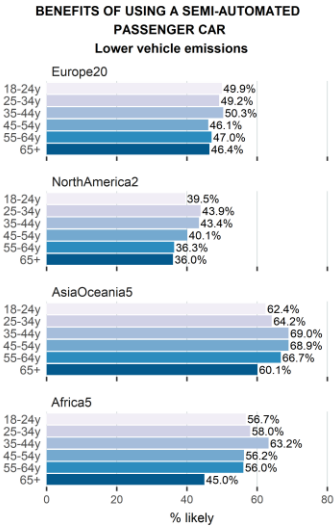
Figure 6: Likelihood of benefits occurring if everyone would use a semi-automated passenger car, by region and gender.

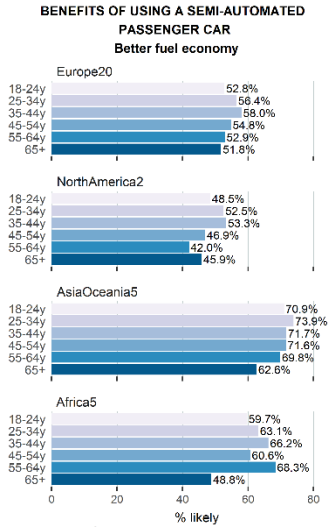


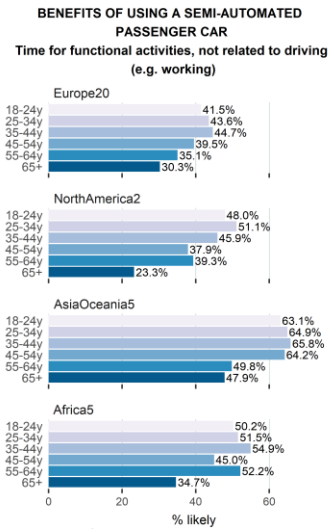


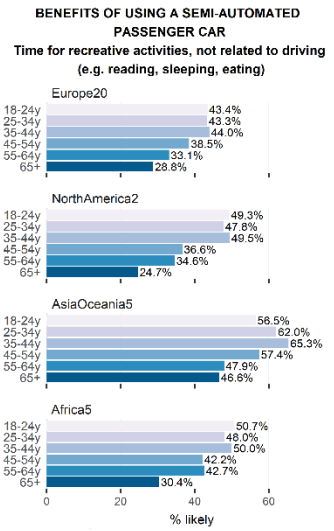








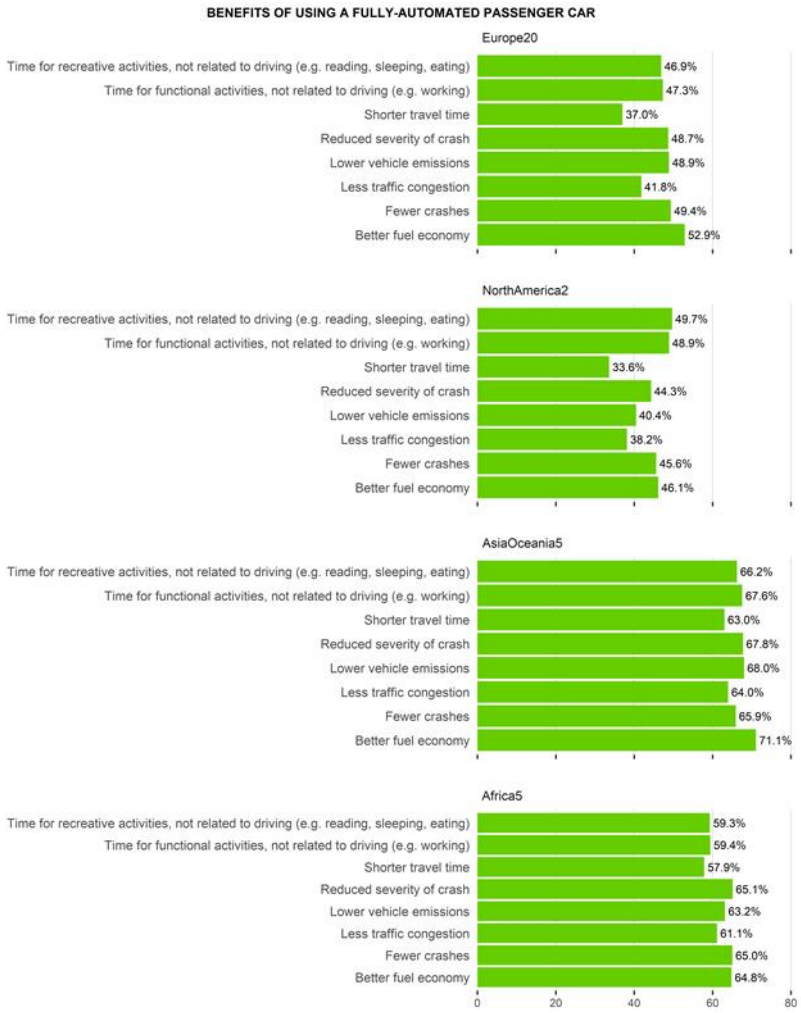




Reference population: all road users

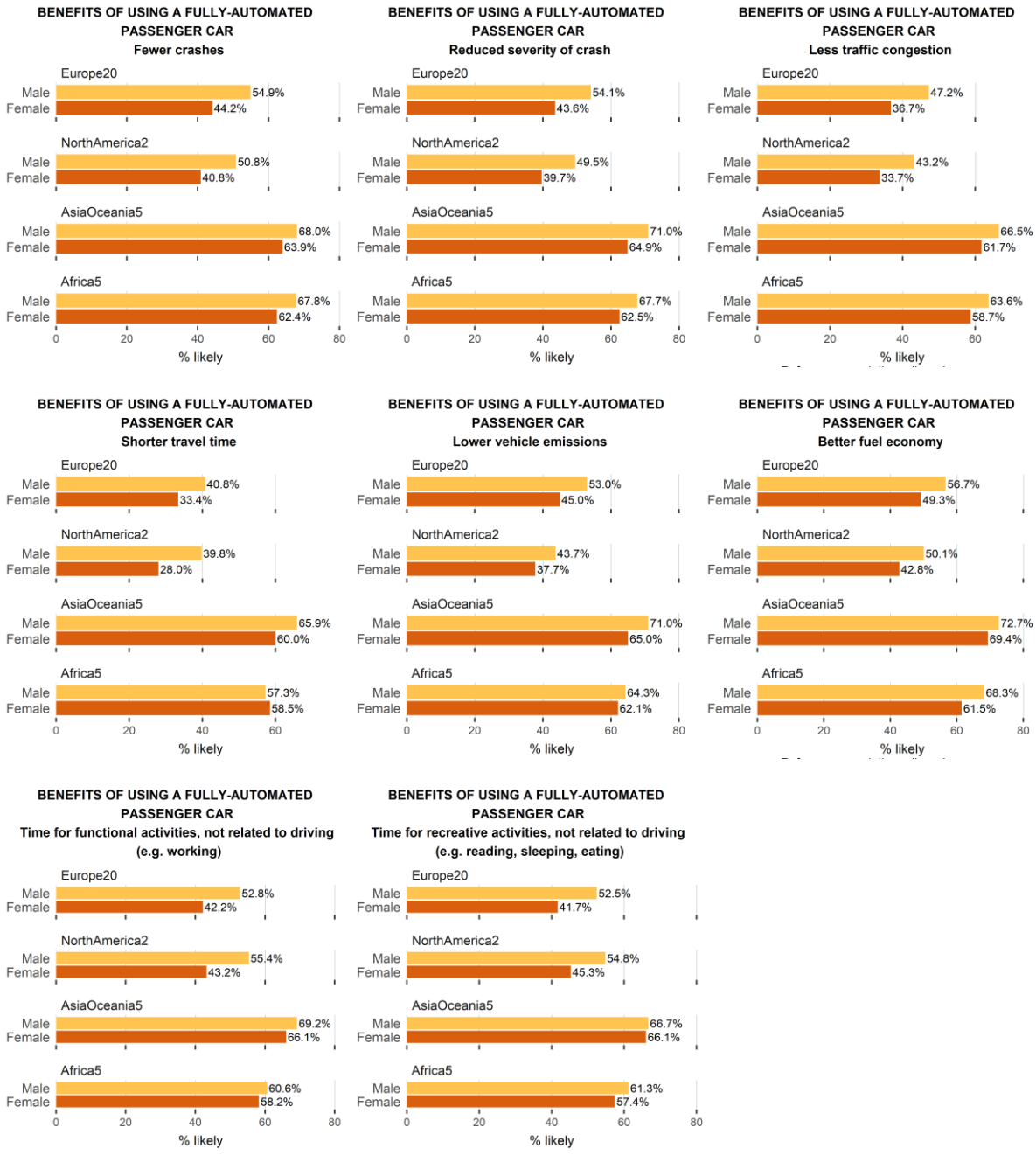
Figure 7: Likelihood of benefits occurring if everyone would use a semi-automated passenger car, by region and age

A similar pattern was found when respondents were asked how likely it was that there would be fewer crashes if everyone used a fully-automated passenger car. Region was a significant factor (Figure 8) ($p<0.01$, Cramer's $V=0.15$). Compared to Europe20 and NorthAmerica2, AsiaOceania5 (65.9%) and Africa5 (65%) had significantly higher percentages of respondents who thought that the use of fully-automated vehicles would lead to fewer crashes ($p< 0.01$). Gender was also a significant factor (Figure 9) ($p<0.01$, Cramer's $V<0.11$), and males in all four regions had significantly higher percentages, indicating that males were more likely to believe that fully-automated passenger cars would offer the benefit of fewer crashes ($p<0.01$). With respect to age as a significant factor (Figure 10) ($p<0.01$, Cramer's $V<.14$), the younger age groups from NorthAmerica2 (18-24, 25-34 & 35-44) had significantly higher percentages of respondents who believed that the use of fully-automated vehicles would lead to fewer crashes compared to the older age groups (45-54, 55-64 & 65+) ($p<0.01$). Where as in AsiaOceania5, both the youngest (18-24) and oldest (65+) age groups had similarly low percentages (58.2% and 57.6% respectively), significantly lower than the percentages of those in the middle age groups ($p<0.01$). Therefore, in this region, respondents in the middle age groups thought it was more likely using fully-automated passenger vehicles would reduce the number of crashes, compared to the perceptions of their younger and older counterparts. In Europe20, the percentage of respondents who thought that this benefit was likely to occur did not differ significantly in younger age groups (18-24 and 25-34), however, the age category of 65 and up had a significantly lower percentage of respondents (42%) who believed that fully-automated vehicles would reduce crashes ($p<0.01$). A similar pattern was observed in Africa5, where there was no significant difference in the percentage of younger respondents (18-24, 25-34 & 35-44) who believed this benefit likely to occur, whereas respondents aged 65 and up were significantly less likely (45.2%) to report that fully-automated vehicles would result in fewer crashes ($p<0.01$).



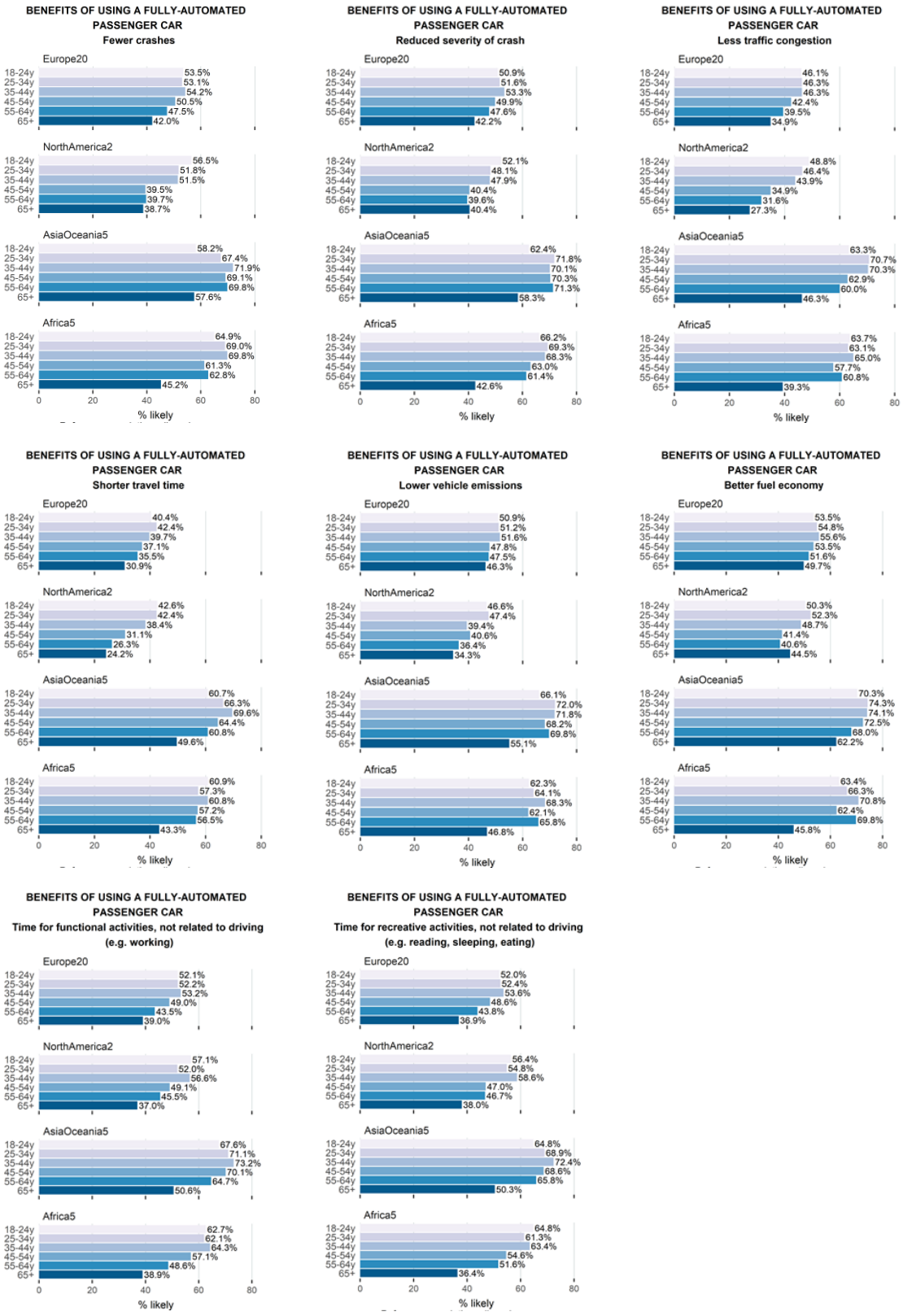
Reference population: all road users

Figure 8: Likelihood of benefits occurring if everyone would use a fully-automated passenger car by region.



Reference population: all road users

Figure 9: Likelihood of benefits occurring if everyone would use a fully-automated passenger car by region and gender.



Reference population: all road users

Figure 10: Likelihood of benefits occurring if everyone would use a fully-automated passenger car, by region and age.

Reduced severity of crash

Region was a significant factor in the percentage of respondents who reported that using a semi-automated passenger car would reduce the severity of crashes ($p<0.01$, Cramer's $V=0.16$). A significantly higher percentage of respondents in AsiaOceania5 (66.4%) perceived this benefit to be likely, compared to all other regions ($p<0.01$) (Figure 5). Whereas in NorthAmerica2, the percentage of respondents who thought this benefit was likely to occur was significantly lower (42.8%), compared to all other regions ($p<0.01$). Gender was also a significant factor (Figure 6) ($p<0.01$, Cramer's $V<0.10$), where males in all four regions had significantly higher percentages than females, indicating that males were more likely to believe that using semi-automated passenger cars would reduce crash severity ($p<0.01$). Age was a significant factor (Figure 7) ($p<0.01$, Cramer's $V<0.12$), and younger (18-34) respondents across all regions reported significantly higher percentages, indicating that they thought the use of semi-automated passenger cars would result in reduced crash severity, compared to those aged 65+.

Region was a significant factor in the percentage of respondents who reported that using a fully-automated passenger car would reduce the severity of crashes ($p<0.01$, Cramer's $V=0.17$) (Figure 8). A significantly higher percentage of respondents in AsiaOceania5 (67.8%) perceived this benefit to be likely, compared to all other regions ($p<0.01$). Whereas in NorthAmerica2, the percentage of respondents who thought this benefit was likely to occur was significantly lower (44.3%), compared to all other regions ($p<0.01$). Gender was a significant factor ($p<0.01$, Cramer's $V<0.11$) (Figure 9). Males in all four regions had significantly higher percentages, indicating that males were more likely to believe that using fully-automated passenger vehicles would reduce the severity of crashes ($p<0.01$). Age was a significant factor ($p<0.01$, Cramer's $V<0.14$) (Figure 10). Respondents in the youngest age group (18-24) had significantly higher percentages, compared to those aged 65 and up ($p<0.01$). The exception to this was in AsiaOceania5, where the percentage of respondents who believed that this benefit was likely did not differ significantly between the youngest (18-24) and oldest (65+) age groups.

Less traffic congestion

Region was a significant factor in the percentage of respondents who reported that using a semi-automated passenger car would reduce congestion ($p<0.01$, Cramer's $V=0.17$) (Figure 5). A significantly higher percentage of respondents in AsiaOceania5 (58.8%) indicated this to be a likely benefit ($p<0.01$), whereas only about 1 in 3 respondents in NorthAmerica2 (34%) thought that it was likely for this benefit to occur. Gender was a significant factor in Europe20, AsiaOceania5, and NorthAmerica2 ($p<0.01$, Cramer's $V<0.11$) (Figure 6). Males in these three regions were more likely to indicate that semi-automated passenger vehicles would reduce congestion ($p<0.01$). Age was significantly associated with this belief ($p<0.01$, Cramer's $V<0.16$) (Figure 7). In all four regions, percentages in the youngest three age groups (18-24, 25-34, and 35-44) did not differ significantly.

Region was a significant factor in the percentage of respondents who reported that using a fully-automated passenger car would reduce congestion ($p<0.01$, Cramer's $V=0.20$) (Figure 8). Respondents in NorthAmerica2 (38.2%) were least likely to believe that fully-automated vehicles would reduce traffic congestion, and those in AsiaOceania5 (64.0%) were the most likely to believe that this benefit would occur ($p<0.01$). Gender was a significant factor ($p<0.01$, Cramer's $V<0.11$) (Figure 9). A significantly higher percentage of males in each region indicated that fully-automated vehicles were likely to reduce traffic congestion ($p<0.01$). Age was a significant factor ($p<0.01$, Cramer's $V<0.16$) (Figure 10). In NorthAmerica2, the percentage of respondents who believe that this benefit is likely decreased with increasing age. This was not the case in the three other regions.

Shorter travel time

Region was a significant factor in the percentage of respondents who perceived that travel time would likely be shorter if everyone were to use semi-automated vehicles ($p<0.01$, Cramer's $V=0.22$) (Figure 5). Just over half of respondents in AsiaOceania5 (58.3%) believed that this benefit was likely to occur. However, less than one in three respondents in NorthAmerica2 (29%) believed that this benefit would

likely occur. Gender was a significant factor in Europe20, and NorthAmeria2 ($p<0.01$, Cramer's $V<0.10$) (Figure 6). In these three regions, males were significantly more likely to believe that semi-automated vehicles would reduce travel time ($p<0.01$). There was no significant difference between males and females in Africa5, as 48.2% of males and 50.2% of females believe that semi-automated vehicles would reduce travel time. Age was a significant factor ($p<0.01$, Cramer's $V<0.15$) (Figure 7). In Europe20 and NorthAmerica2, analysis by age shows that the proportion of respondents that believe semi-automated passenger vehicles are likely to reduce travel time decreases with increasing age of the respondent. This was not the case in AsiaOceania5 and Africa 5.

Region was a significant factor in the percentage of respondents who believed that travel time would likely be shorter if everyone were to use fully-automated vehicles ($p<0.01$, Cramer's $V=0.22$) (Figure 8). The percentage of respondents who believe that fully-automated passenger vehicles would likely reduce travel time was significantly higher in AsiaOceania5 (63%), compared to all other regions ($p<0.01$). Gender was a significant factor in Europe20, AsiaOceania5, and NorthAmerica2 ($p<0.01$, Cramer's $V<0.13$) (Figure 9). In these three regions, there was a significantly higher percentage of males that indicated this benefit was likely ($p<0.01$). Age was a significant factor in all regions ($p<0.01$, Cramer's $V<0.16$) (Figure 10). Notably, the percentage of respondents in Africa5 who believed that travel time would be shorter if everyone used a fully-automated vehicle did not differ significantly between most age groups (18-24, 25-34, 35-44, 45-54, and 55-64), indicating that respondents in these age groups had similar beliefs ($p>0.01$). However, respondents aged 65 and up had significantly lower percentages, compared to all other age groups ($p<0.01$). This was not the case for other regions.

Lower vehicle emissions

Region was a significant factor in the percentage of respondents who believed that there would likely be lower vehicle emissions if everyone were to use semi-automated vehicles ($p<0.01$, Cramer's $V=0.14$) (Figure 5). A significantly higher percentage of respondents in AsiaOceania5 believed this benefit was likely to occur, compared to all other regions ($p<0.01$). NorthAmeria2 had the lowest percentage of respondents who believed semi-automated vehicles would reduce vehicle emissions, compared to the other regions ($p<0.01$). Gender was a significant factor in Europe20, and AsiaOceania5 ($p<0.01$, Cramer's $V<0.06$) (Figure 6). The percentage of males who believe that this benefit is likely is significantly higher than females in the regions of Europe20 and AsiaOceania5 ($p<0.01$), but there are no significant gender differences in the other two regions. Age was a significant factor in Europe 20, AsiaOceania5, and Africa5 ($p<0.01$, Cramer's $V<0.09$) (Figure 7). Results by age group demonstrate that in AsiaOceania5 and NorthAmerica2, there was no significant difference between the youngest (18-24) and oldest (65+) age groups. However, this was not the case for Europe20 and Africa5.

Region was a significant factor in the percentage of respondents who believed that there would likely be lower vehicle emissions if everyone were to use fully-automated vehicles ($p<0.01$, Cramer's $V=0.17$) (Figure 8). Respondents in AsiaOceania5 had the highest percentage (68.0%), significantly higher than the other three regions ($p<0.01$). Gender was a significant factor in Europe20, AsiaOceania5, and NorthAmerica2 ($p<0.01$, Cramer's $V<0.08$) (Figure 9). Males were significantly more likely to indicate that this benefit would occur ($p<0.01$), except in the region of Africa5 where this difference was non-significant. Age was a significant factor ($p<0.01$, Cramer's $V<0.11$) (Figure 10). Older adults (65+) in AsiaOceania5 (55.1%) and Africa5 (46.8%) had significantly lower percentages of respondents compared to other age groups in their respective regions who believed that fully-automated vehicles would reduce vehicle emissions ($p<0.01$).

Better fuel economy

Region was a significant factor in the percentage of respondents who believed that there would likely be better fuel economy if everyone were to use semi-automated vehicles ($p<0.01$, Cramer's $V=0.13$) (Figure 5). Over 70% of respondents in AsiaOceania5 believed that semi-automated passenger vehicles would likely offer the benefit of better fuel economy. The percentage in AsiaOceania5 was significantly higher compared to all other regions ($p<0.01$). However, less than half (48.1%) of respondents in NorthAmerica2 thought that this benefit would occur, which was significantly lower compared to all

other regions (p<0.01). Gender was a significant factor in Europe20, AsiaOceania5, and Africa5 (p<0.01, Cramer's V<0.07). Males in Europe20 and AsiaOceania5 were significantly more likely to indicate that semi-automated passenger cars would offer better fuel economy (p<0.01), but there was no significant difference between males and females in the region of NorthAmeria2 and Africa5. Age was a significant factor (p<0.01, Cramer's V<0.09). Analysis by age group demonstrated that the percentage of respondents in Europe20 and Africa5 who believed that this benefit was likely to occur increased significantly between age groups 18-24 and 35-44 (p<0.01). However, when comparing respondents aged 35-44 to the oldest age group (65+) for these two regions, percentages significantly decreased (p<0.01). This pattern was not observed in AsiaOceania5 or NorthAmerica2.

Region was a significant factor in the percentage of respondents who believed that there would likely be better fuel economy if everyone were to use fully-automated vehicles (p<0.01, Cramer's V=0.16) (Figure 8). Those in AsiaOceania5 were significantly more likely than those in all other regions to believe that this benefit would occur (p<0.01). Gender was a significant factor (p<0.01, Cramer's V<0.07). Males across all regions were significantly more likely to believe that fully-automated passenger vehicles would offer the benefit of better fuel economy (p<0.01). Age was a significant factor (p<0.01, Cramer's V<0.12). The percentage of respondents aged 18 to 24 who believed that this benefit was likely to occur was significantly higher than those aged 65 and up in the region of Europe20, AsiaOceania5, and Africa5 (p<0.01). However, there was no significant difference between the youngest and oldest age groups in NorthAmerica2.

Time for functional activities, not related to driving (e.g. working)

Respondents were also asked how likely they thought it was that semi-automated passenger vehicles would offer the benefit of having time for functional activities not related to driving, such as working. Region was a significant factor (p<0.01, Cramer's V=0.17) (Figure 5). AsiaOceania5 had a significantly higher percentage of respondents (61.0%) that thought this benefit was likely to occur (p<0.01), compared to all other regions. Whereas the percentage of respondents in Europe20 and NorthAmerica2 who believed this benefit was likely were the lowest in these two regions (38.4% and 40.2% respectively), and there was no significant difference between them (p>0.01). Gender was a significant factor in Europe20, AsiaOceania5, and NorthAmerica2 (p<0.01, Cramer's V<0.11) (Figure 6). Gender differences in these three regions indicated that males had significantly higher percentage belief that semi-automated passenger vehicles would allow time for functional activities such as working (p<0.01). In Africa5, the percentage of females that thought this benefit was likely to occur was higher than males, but this difference was not significant (p>0.01). Age was also a significant factor (p<0.01, Cramer's V<0.19) (Figure 7). Interestingly, in AsiaOceania5, the percentages of respondents who believed this benefit was likely to occur did not differ significantly across the first four age groups (18-24, 25-34, 35-44, 45-54) (p>0.01), however, the percentage of respondents aged 55-64 and 65+ who indicated this benefit was likely to occur was significantly lower compared to the younger age groups (p<0.01).

Respondents were asked if fully-automated passenger cars would offer the benefit of having time for functional activities such as working. Region was a significant factor (p<0.01, Cramer's V=0.16) (Figure 8). Respondents in Europe20 and NorthAmerica2 had similar beliefs (p>0.01), as 47.3% and 48.9% respectively thought that it was likely for fully-automated passenger vehicles to offer this benefit. Conversely, AsiaOceania5 had the highest percentage of respondents who believed that fully-automated vehicles would offer the benefit of allowing time for functional activities, when compared to all other regions (p<0.01). Gender was not a significant factor in the region of AsiaOceania5 and Africa5 (p>.01) but was significant in the other two regions (p<0.01, Cramer's V<0.12). Overall, there was a higher percentage of males who believed this benefit was likely to occur compared to females, and this difference was significant in Europe20 and NorthAmerica2 (p<0.01). Age was also significantly associated with the believe that this benefit would occur (p<0.01, Cramer's V<0.14), and respondents in the older age groups across all regions had significantly lower percentages compared to younger age groups (p<0.01).

Time for recreative activities, not related to driving (e.g. reading, sleeping, eating).

Less than 40% of respondents in Europe20 and NorthAmerica2 (37.6% and 39.7% respectively, $p>0.01$) believed that semi-automated passenger vehicles would offer the benefit of having time for recreative activities not related to driving, such as reading, sleeping, and eating (Figure 5). Region was a significant factor ($p<0.01$, Cramer's $V<0.15$). Gender was only a significant factor in Europe20 and NorthAmerica2 ($p<0.01$, Cramer's $V<0.09$), where males were significantly more likely to indicate that the use of semi-automated passenger cars would likely offer the benefit of time for non-driving related recreative activities such as reading, sleeping, and eating ($p<0.01$). This was not the case for AsiaOceania5 and Africa5, where there was no significant difference between males and females. Age was a significant factor ($p<0.01$, Cramer's $V<0.19$) Differences by age group showed that in all four regions, the percentage of respondents who believed that this benefit was likely to occur was significantly higher in the youngest age group (18-24) in comparison to those aged 65 and up ($p<0.01$).

Respondents appeared more optimistic about the likelihood that fully-automated passenger cars would offer the benefit of having time for recreative activities not related to driving, such as reading, sleeping, and eating. Over 65% of respondents in AsiaOceania5 believed that this benefit was likely to occur, which is significantly higher than all other regions ($p<0.01$), and just under half of the respondents in Europe20 and NorthAmerica2 held similar beliefs that fully-automated vehicles would allow time for non-driving recreative activities (46.9% and 49.7% respectively, $p>0.01$). Gender was a significant factor in Europe20, NorthAmerica2, and Africa5 ($p<0.01$, Cramer's $V<0.11$). In these three regions, males were significantly more likely to indicated that this benefit was likely ($p<0.01$). In AsiaOceania5, the difference was not significant. Age was a significant factor ($p<0.01$, Cramer's $V<0.15$), and differences by age group showed that in all four regions, the percentage of respondents who believed that this benefit was likely to occur was significantly higher in the youngest age group (18-24) in comparison to those aged 65 and up ($p<0.01$).

To examine the factors associated with self-declared interest in automated passenger vehicles, two multiple linear regression models were developed. The model predicting interest in semi-automated vehicles explained 33% of the variation in self-reported interest. The model predicting interest in fully-automated vehicles explained 30% of the variation in self-reported interest. In both models, there were many effects that were significant, however the effects were small and held limited practical relevance. The in-depth results of these models are available in Appendix 2.

4 CONCLUSION

This thematic ESRA report on automated passenger vehicles focuses on two aspects, 1) self-declared interest, and 2) perception about the potential benefits of automated vehicles. The results show that AsiaOceania5 had the highest proportion (68.8%) of respondents who reported being interested in semi-automated vehicles compared to all other regions (38.4% - 58.2%). Similar results were found for self-reported interest in fully-automated vehicles. AsiaOceania5 had the highest proportion (66.3%) of respondents who reported being interested in fully automated vehicles, compared to all other regions (31.7% - 56.8%). When comparing the interest in semi-automated vehicles to that of fully-automated vehicles by region, the percentage of interest in using a semi-automated passenger vehicle was consistently higher than the percentage interest in using a fully-automated passenger vehicle across all regions.

The effect of age on interest in automated passenger vehicles was similar across regions. Interest in semi-automated vehicles was highest among the younger age groups, but generally decreased in older respondents aged 65 and up. AsiaOceania5 was an exception, as the interest was similar between younger and older age groups. The effect of age on interest in fully-automated vehicles was comparable, as younger age groups had greater interest in using these vehicles compared to older age groups. Gender had an effect on interest in automated passenger vehicles in most regions. Specifically, interest in semi-automated vehicles was higher in males than in females, but this difference was only significant in some regions. Interest in fully-automated vehicles was also higher in males, except for in Africa5, where females had slightly higher interest, but this difference was not significant. Findings of the effects of age and gender on interest is supported by existing literature demonstrating that males are less concerned about using automated vehicles (Kyriakidis et al., 2015) and younger male drivers have higher acceptance and trust in automated vehicles, and are more likely to rely on the technology, compared to other age groups. Moreover, research demonstrates that older drivers are more likely to find automated vehicles stressful, and are much more reticent and less likely to rely on this technology until the level of safety is more concretely demonstrated (Robertson et al., 2017). The current results are in line with this research, as older age groups generally had lower levels of interest in semi- and fully-automated passenger vehicles. Consequently, these findings suggest that as increasing levels of automation become available, driver age and gender will play a significant role in adoption of this technology, thus dictating the educational approaches adopted for different cohorts of drivers. Specifically, younger drivers that receive education to reduce the probability of risk-taking behaviour with automated driving features would help mitigate serious road safety issues that may occur; and, older drivers that receive education to lessen the technological learning curve would help increase the probability that they would actually use the technology to benefit their mobility.

The likelihood of certain benefits occurring if everyone were to use an automated passenger vehicle was examined. These potential benefits included fewer crashes, reduced severity of crash, less traffic congestion, shorter travel time, lower vehicle emissions, better fuel economy, more time for functional activities, and more time for recreational activities. Results showed that the perceived likelihood of each benefit occurring if everyone were to use a semi-automated vehicle was significantly higher in AsiaOceania5, compared to all other regions. Similarly, results showed that the perceived likelihood of each benefit occurring if everyone were to use a fully-automated vehicle was significantly higher in AsiaOceania5, except for the potential benefit of fewer crashes. Existing research on the potential benefits of automated vehicles suggests that benefits related to safety, driving conveniences, and operational efficiency are the most important benefits to individuals (Kim, Park, Oh, Lee, and Chung, 2020) Similarly, the current study demonstrates that benefits related to safety and efficiency were perceived as most likely to occur if everyone were to use an automated passenger vehicle, since most regions generally had a higher percentage of respondents who indicated that the benefit of fewer crashes, reduced severity of crash, and better fuel economy were likely to occur.

RECOMMENDATIONS

Policy recommendations at national and regional level

- Continue to study the impact of age, and gender on interest in automated passenger vehicles and ensure that public education of automated vehicle technology is tailored to the specific cohort of drivers. In this study, male respondents and those aged 18-34 were most interested in automated passenger vehicles. Conversely, older respondents had lower levels of interest in automated passenger vehicles compared to other age groups. As a result of the different driving behaviours and habits of these distinct populations of drivers, public education must be responsive to the specific needs of each cohort.
- Begin conversations with drivers in advance of publicly available automated passenger vehicles. Although trust is important, drivers must first have a proper understanding of the capabilities and limitations of the technology, and misconceptions about the role of the driver must be dispelled.

Specific recommendations to particular stakeholders

- [To Non-Governmental Organizations (NGOs)] Contribute to education and awareness raising campaigns to increase knowledge on the capabilities and limitations of automated passenger vehicles, while conveying the implications on road safety.
- [To vehicle manufacturers, other companies and research organisations] Continue to develop and promote automated technology that can assist drivers and improve road safety.

The initial aim of ESRA was to develop a system for gathering reliable and comparable information about people's attitudes towards road safety in a number of European countries. This objective has been achieved and the initial expectations have even been exceeded. The ESRA has become a global initiative which already conducted surveys in 46 countries across 6 continents. The outputs of the ESRA project have become building blocks of a global road safety monitoring system that goes beyond monitoring road traffic casualties and also includes indicators for possible underlying causal factors.

The ESRA project has also demonstrated the feasibility and the added value of joint data collection on road safety attitudes and performance by partner organizations in a large number of countries. The intention is to repeat this initiative on a triennial basis, retaining a core set of questions in every wave allowing the development of time series of road safety performance indicators. This will become a solid foundation for a joint global monitoring system on road safety attitudes and behaviour.

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Appendix 1: ESRA2_2018 Questionnaire

Introduction

In this questionnaire, we ask you some questions about your experience with, and your attitudes towards traffic and road safety. When responding to a question, please answer in relation to the traffic and road safety situation in [COUNTRY]. There are no right or wrong answers; what matters is your own experience and perception. Thank you for your contribution!

Socio-demographic information

Q1) In which country do you live? _____

Q2) Are you ... male – female – other (only in country who officially recognizes another gender)

Q3a) In which year were you born? Dropdown menu

Q3b) In which month were you born? Dropdown menu

Q4_1) What is the highest qualification or educational certificate that you have obtained? none - primary education - secondary education - bachelor's degree or similar - master's degree or higher

Q4_2) What is the highest qualification or educational certificate that your mother has obtained? none - primary education - secondary education - bachelor's degree or similar - master's degree or higher - I don't know

Q5a) Which of the following terms best describes your current professional occupation? white collar or office worker (excluding executive)/employee (public or private sector) →Q5b - blue collar or manual worker/worker →Q5b - executive →Q5b - self-employed/independent professional →Q5b - currently no professional occupation →Q5c

Q5b) Do you have to drive or ride a vehicle for work? (Please indicate the job category that is most appropriate for you) yes, I work as a taxi, bus, truck driver, … - yes, I work as a courier, mailman, visiting patients, food delivery, salesperson, … - no

Q5c) You stated that you currently have no professional occupation. Which of the following terms best describes your current situation? I am … a student - unemployed, looking for a job – retired - not fit to work - a stay-at-home spouse or parent - other

Q6) What is the postal code of the municipality in which you live? _____

Q7) In which region do you live? Drop down menu

Q8a) How far do you live from the nearest bus stop, light rail stop, or metro/underground station? less than 500 metres → Q8b - between 500 metres and 1 kilometre → Q8b - more than 1 kilometre → skip Q8b

Q8b) What is the frequency of your nearest bus stop, light rail stop, or metro/underground station? at least 3 times per hour - 1 or 2 times per hour - less than 1 time per hour

Mobility & exposure

Q9) Do you have a car driving licence or permit (including learner's permit)? yes - no

Q10) During the past 12 months, how often did you use each of the following transport modes in [country]? How often did you ...? at least 4 days a week - 1 to 3 days a week - a few days a month - a few days a year - never
Items (random): walk minimum 100m (pedestrian; including jogging, inline skate, skateboard, …) - cycle (non-electric) - cycle on an electric bicycle/e-bike/pedelec - drive a moped (≤ 50 cc or ≤ 4 kW; non-electric - drive a motorcycle (> 50 cc and > 4 kW non-electric) - drive an electric moped (≤ 4 kW) - drive an electric motorcycle (> 4 kW) - drive a powered personal transport device such as an electric step, hoverboard, solowheel,… - drive a car (non-electric or non-hybrid) - drive a taxi - drive a bus as a driver - drive a truck/lorry - drive a hybrid or

electric car - take a taxi or use a ride-hail service (e.g. Uber, Lyft) - take the train - take the bus - take the tram/streetcar - take the subway - take the aeroplane - take a ship/boat or ferry - be a passenger in a car - use another transport mode

Q11) Over the last 30 days, have you transported a child (<18 years of age) in a car? yes - no
Items: below 150cm - above 150cm

Self-declared safe and unsafe behaviour in traffic

Q12_1a) Over the last 12 months, how often did you as a CAR DRIVER …?
You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.
Binary variable for all items: at least once (2-5) - never (1)
Items (random):

- drive after drinking alcohol
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- read a text message or email while driving

Q12_1b) Over the last 30 days, how often did you as a CAR DRIVER …?
You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.
Binary variable for all items: at least once (2-5) - never (1)
Items (random):

- drive when you may have been over the legal limit for drinking and driving
- drive after drinking alcohol
- drive 1 hour after using drugs (other than medication)
- drive after taking medication that carries a warning that it may influence your driving ability
- drive faster than the speed limit inside built-up areas
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- drive faster than the speed limit on motorways/freeways
- drive without wearing your seatbelt
- transport children under 150cm without using child restraint systems (e.g. child safety seat, cushion)
- transport children over 150cm without wearing their seatbelts
- talk on a hand-held mobile phone while driving
- talk on a hands-free mobile phone while driving
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while driving
- drive when you were so sleepy that you had trouble keeping your eyes open

Q12_2) Over the last 30 days, how often did you as a CAR PASSENGER …? You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.
Binary variable for all items: at least once (2-5) - never (1)
Item:

- travel without wearing your seatbelt in the back seat

Q12_3) Over the last 30 days, how often did you as a MOPED DRIVER OR MOTORCYCLIST …? You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.
Binary variable for all items: at least once (2-5) - never (1)
Items (random):

- ride when you may have been over the legal limit for drinking and driving
- ride faster than the speed limit outside built-up areas (but not on motorways/freeways)
- ride a moped or motorcycle without a helmet
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while riding a moped or motorcycle

Q12_4) Over the last 30 days, how often did you as a CYCLIST …? You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.
Binary variable for all items: at least once (2-5) - never (1)
Items (random):

- cycle when you think you may have had too much to drink

- cycle without a helmet
- cycle while listening to music through headphones
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while cycling
- cycle on the road next to the cycle lane

Q12_5) Over the last 30 days, how often did you as a PEDESTRIAN …? You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.
Binary variable for all items: at least once (2-5) - never (1)
Items (random):

- listen to music through headphones as a pedestrian while walking in the streets
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while walking in the streets
- cross the road when a pedestrian light is red
- cross the road at places other than at a nearby (distance less than 30m) pedestrian crossing

Acceptability of safe and unsafe traffic behaviour

Q13_1) Where you live, how acceptable would most other people say it is for a CAR DRIVER to….? You can indicate your answer on a scale from 1 to 5, where 1 is "unacceptable" and 5 is "acceptable". The numbers in between can be used to refine your response.
Binary variable: acceptable (4-5) – unacceptable/neutral (1-3)
Items (random):

- drive when he/she may be over the legal limit for drinking and driving
- drive 1 hour after using drugs (other than medication)
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- not wear a seatbelt while driving
- transport children in the car without securing them (child's car seat, seatbelt, etc.)
- talk on a hand-held mobile phone while driving
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while driving

Q14_1) How acceptable do you, personally, feel it is for a CAR DRIVER to…? You can indicate your answer on a scale from 1 to 5, where 1 is "unacceptable" and 5 is "acceptable". The numbers in between can be used to refine your response.
Binary variable: acceptable (4-5) – unacceptable/neutral (1-3)
Items (random)

- drive when he/she may be over the legal limit for drinking and driving
- drive 1 hour after using drugs (other than medication)
- drive after taking a medication that may influence the ability to drive
- drive faster than the speed limit inside built-up areas
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- drive faster than the speed limit on motorways/freeways
- not wear a seatbelt while driving
- transport children in the car without securing them (child's car seat, seatbelt, etc.)
- talk on a hand-held mobile phone while driving
- talk on a hand-free mobile phone while driving
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while driving
- drive when they're so sleepy that they have trouble keeping their eyes open

Attitudes towards safe and unsafe behaviour in traffic

Q15) To what extent do you agree with each of the following statements? You can indicate your answer on a scale from 1 to 5, where 1 is "disagree" and 5 is "agree". The numbers in between can be used to refine your response.
Binary variable: agree (4-5) – disagree/neutral (1-3)
Items (random):
Normative believes & subjective norms (including injunctive norms from Q13)

- Most of my friends would drive after having drunk alcohol.
- Most of my friends would drive 20 km/h over the speed limit in a residential area.

Behaviour believe & attitudes

- For short trips, one can risk driving under the influence of alcohol.
- I have to drive fast; otherwise, I have the impression of losing time.

- Respecting speed limits is boring or dull.
- For short trips, it is not really necessary to use the appropriate child restraint.
- I use a mobile phone while driving, because I always want to be available.
- To save time, I often use a mobile phone while driving.

Perceived behaviour control (here: self-efficacy)

- I trust myself to drive after having a glass of alcohol.
- I have the ability to drive when I am a little drunk after a party
- I am able to drive after drinking a large amount of alcohol (e.g. half a liter of wine).
- I trust myself when I drive significantly faster than the speed limit.
- I am able to drive fast through a sharp curve.
- I trust myself when I check my messages on the mobile phone while driving.
- I have the ability to write a message on the mobile phone while driving.
- I am able to talk on a hand-held mobile phone while driving.

Habits

- I often drive after drinking alcohol.
- Even when I am a little drunk after a party, I drive.
- It sometimes happens that I drive after consuming a large amount of alcohol (e.g. a liter of beer or half a liter of wine).
- I often drive faster than the speed limit.
- I like to drive in a sporty fast manner through a sharp curve.
- It happens sometimes that I write a message on the mobile phone while driving.
- I often talk on a hand-held mobile phone while driving.
- I often check my messages on the mobile phone while driving.

Intentions

- I will do my best not to drive after drinking alcohol in the next 30 days.
- I will do my best to respect speed limits in the next 30 days.
- I will do my best not to use my mobile phone while driving in the next 30 days.

Quality control items

- Indicate number 1 on the answering scale.
- Indicate number 4 on the answering scale.

Subjective safety & risk perception

Q16) How safe or unsafe do you feel when using the following transport modes in [country]? You can indicate your answer on a scale from 0 to 10, where 0 is "very unsafe" and 10 is "very safe". The numbers in between can be used to refine your response.
Items (random) = Items indicated by the respondent in Q10 are displayed.

Q17) How often do you think each of the following factors is the cause of a road crash involving a car? You can indicate your answer on a scale from 1 to 6, where 1 is "never" and 6 is "(almost) always". The numbers in between can be used to refine your response.
Binary variable: often/frequently (4-6) - not that often/not frequently (1-3)
Items (random)

- driving after drinking alcohol
- driving after taking drugs (other than medication)
- driving faster than the speed limit
- using a hand-held mobile phone while driving
- using a hands-free mobile phone while driving
- inattentiveness or day-dreaming while driving
- driving while tired

Support for policy measures

Q18) Do you oppose or support a legal obligation to …? You can indicate your answer on a scale from 1 to 5, where 1 is "oppose" and 5 is "support". The numbers in between can be used to refine your response.
Binary variable: support (4-5) – oppose/neutral (1-3)
Items (random)

- install an alcohol "interlock" for drivers who have been caught drunk driving on more than one occasion (technology that won't let the car start if the driver's alcohol level is over the legal limit)
- have zero tolerance for alcohol (0,0 ‰) for novice drivers (licence obtained less than 2 years)
- have zero tolerance for alcohol (0,0 ‰) for all drivers

- install Intelligent Speed Assistance (ISA) in new cars (which automatically limits the maximum speed of the vehicle and can be turned off manually)
- install Dynamic Speed Warning signs (traffic control devices that are programmed to provide a message to drivers exceeding a certain speed threshold)
- have a seatbelt reminder system for the front and back seats in new cars
- require all cyclists to wear a helmet
- require cyclists under the age of 12 to wear a helmet
- require all moped drivers and motorcyclists to wear a helmet
- require pedestrians to wear reflective material when walking in the streets in the dark
- require cyclists to wear reflective material when cycling in the dark
- require moped drivers and motorcyclists to wear reflective material when driving in the dark
- have zero tolerance for using any type of mobile phone while driving (hand-held or hands-free) for all drivers
- not using headphones (or earbuds) while walking in the streets
- not using headphones (or earbuds) while riding a bicycle

Q19_1) What do you think about the current traffic rules and penalties in your country for driving or riding under the influence of alcohol? agree – disagree
Items:
- The traffic rules should be stricter.
- The traffic rules are not being checked sufficiently.
- The penalties are too severe.

Q19_2) What do you think about the current traffic rules and penalties in your country for driving or riding faster than the speed limit? agree – disagree
Items: Q19_1

Q19_3) What do you think about the current traffic rules and penalties in your country for using a mobile phone while driving or riding? agree – disagree
Items: Q19_1

Enforcement

Q20_1) On a typical journey, how likely is it that you (as a CAR DRIVER) will be checked by the police for... You can indicate your answer on a scale from 1 to 7, where 1 is "very unlikely" and 7 is "very likely". The numbers in between can be used to refine your response.
Binary variable: likely (5-7) – unlikely/neutral (1-4)
Items (random)
- … alcohol, in other words, being subjected to a Breathalyser test
- … the use of illegal drugs
- … respecting the speed limits (including checks by a police car with a camera, fixed cameras, mobile cameras, and section control systems)
- … wearing your seatbelt
- … the use of hand-held mobile phone to talk or text while driving

Q21_1) In the past 12 months, how many times have you been checked by the police for using alcohol while DRIVING A CAR (i.e., being subjected to a Breathalyser test)? never – 1 time – at least 2 times - I prefer not to respond to this question
Binary variable: at least once - never (removing "I prefer not to respond to this Q)

Q22_1) In the past 12 months, how many times have you been checked by the police for the use of drugs (other than medication) while DRIVING A CAR? never – 1 time – at least 2 times - I prefer not to respond to this question
Binary variable: at least once - never (removing "I prefer not to respond to this Q)

Involvement in road crashes

Introduction: The following questions focus on road crashes. With road crashes, we mean any collision involving at least one road vehicle (e.g., car, motorcycle, or bicycle) in motion on a public or private road to which the public has right of access. Furthermore, these crashes result in material damage, injury, or death. Collisions include those between road vehicles, road vehicles and pedestrians, road vehicles and animals or fixed obstacles, road and rail vehicles, and one road vehicle alone.

Q23_1a) In the past 12 months, how many times have you personally been involved in road crashes in which you or somebody else had to be taken to the hospital? ___ times (number; max. 10) if 0 → Q23_2a; if >0 → Q23_1b → Q23_2a
Binary variable: at least once - never

Q23_1b) Please indicate the transport modes you were using at the time of these crashes.
Items indicated by the respondent in Q10 are displayed; Threshold = 'at least a few days a year'.
Number to be indicated after each transport mode; note the sum should be equal to the number indicated in Q23_1a

Q23_2a) In the past 12 months, how many times have you personally been involved in road crashes with only minor injuries (no need for hospitalisation) for you or other people? ___ times (number; max. 10) if 0 → Q23_3a; if >0 → Q23_2b → Q23_3a
Binary variable: at least once - never

Q23_2b) = Q23_1b

Q23_3a) In the past 12 months, how many times have you personally been involved in road crashes with only material damage?
___ times (number; max. number 10) if 0 → skip Q23_3b; if >0 → Q23_3b → next Q
Binary variable: at least once - never

Q23_3b) = Q23_1b

Vehicle automation

I2) Introduction: The following questions focus on your opinion about automated passenger cars. We talk about two different levels of vehicle automation:
Semi-automated passenger cars: Drivers can choose to have the vehicle control all critical driving functions, including monitoring the road, steering, and accelerating or braking in certain traffic and environmental conditions. These vehicles will monitor roadways and prompt drivers when they need to resume control of the vehicle.
Fully-automated passenger cars: The vehicle controls all critical driving functions and monitoring all traffic situations. Drivers do not take control of the vehicle at any time.

Q24) How interested would you be in using the following types of automated passenger car? You can indicate your answer on a scale from 1 to 7, where 1 is "not at all interested" and 7 is "very interested". The numbers in between can be used to refine your response.
Binary variable: interested (5-7) - not interested/neutral (1-4)
Items:

- semi-automated passenger car
- fully-automated passenger car

Q25_1) How likely do you think it is that the following benefits will occur if everyone would use a semi-automated passenger car? You can indicate your answer on a scale from 1 to 7, where 1 is "very unlikely" and 7 is "very likely". The numbers in between can be used to refine your response.
Binary variable: likely (5-7) – unlikely/neutral (1-4)
Items (random):

- fewer crashes
- reduced severity of crash
- less traffic congestion
- shorter travel time
- lower vehicle emissions
- better fuel economy
- time for functional activities, not related to driving (e.g. working)
- time for recreative activities, not related to driving (e.g. reading, sleeping, eating)

Q25_2) How likely do you think it is that the following benefits will occur if everyone would use a fully-automated passenger car? You can indicate your answer on a scale from 1 to 7, where 1 is "very unlikely" and 7 is "very likely". The numbers in between can be used to refine your response.
Items (random) = Q25_1

Bonus question to be filled in by national partner

Q26) .....? You can indicate your answer on a scale from 1 to 5, where 1 is "…." and 5 is "….". The numbers in between can be used to refine your response.
Items (random; 4 items)

Q27) .....? You can indicate your answer on a scale from 1 to 5, where 1 is "…." and 5 is "….". The numbers in between can be used to refine your response.
Items (random; 4 items)

Social desirability scale

Introduction: The survey is almost finished. The following questions have nothing to do with road safety, but they are important background information. There are no good or bad answers.

Q28) To what extent are the following statements true? You can indicate your answer on a scale from 1 to 5, where 1 is "very untrue" and 5 is "very true". The numbers in between can be used to refine your response.
Items (random):

- I always respect the highway code, even if the risk of getting caught is very low.
- I would still respect speed limits at all times, even if there were no police checks.
- I have never driven through a traffic light that had just turned red.
- I do not care what other drivers think about me.
- I always remain calm and rational in traffic. (if needed pop-up: rational = non-emotional)
- I am always confident of how to react in traffic situations.

Appendix 2: ESRA2 weights and sample sizes

The following weights are used to calculate representative means on national and regional level. They are based on UN population statistics (United Nation, 2019). The weighting took into account small corrections with respect to national representativeness of the sample based on gender and six age groups (18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65y+). For the regions, the weighting also took into account the population size of each country in the total set of countries from this region.

Individual country weight	Individual country weight is a weighting factor based on the gender*6 age groups (18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65y) distribution in a country as retrieved from the UN population statistics.
Europe20 weight	European weighting factor based on all 20 European countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.
NorthAmerica2 weight	North American weighting factor based on all 2 North American countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.
AsiaOceania5 weight	Asian and Oceanian weighting factor based on all 5 Asian and Oceanian countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.
Africa5 weight	African weighting factor based on all 5 African countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.

Appendix 3: Multiple Linear Regression Models

To examine which factors are associated with self-declared interest in semi-automated passenger vehicles and which factors are associated with self-declared interest in fully-automated passenger vehicles, two multiple linear regression models are estimated below. In each model, the outcome is an ordinal variable indicating the level of self-reported interest (1= not interested at all – 7= very interested) in semi- or fully-automated vehicles.

Overall, each model explained at least 30% of the variance, with many effects that were significant at the p-value of $p<0.01$, however the size of the effects was small. Both models were composed of different predictors, however there were some similarities, including the effect of age, gender and education on interest. As such, males, younger adults and those with higher education were more interested in semi- and fully-automated vehicles.

Regression model estimation for the self-reported interest in semi-automated vehicles

To further examine the association between self-reported interest in semi-automated vehicles and all measured variables potentially related to interest, a multiple linear regression model was estimated. The results of the regression indicated that the model significantly predicted self-reported interest in semi-automated vehicles, $F(35, 34884) = 486.15$, $p < 0.001$, explaining 33% of the variation in self-reported interest ($R2= 0.327$) (Table 2). Gender was a significant predictor, with self-reported interest being higher for males compared to females ($b= 0.19$, $p < 0.001$). Age was also a significant predictor, $F(2, 34884) = 115.38$, $p<0.001$. When compared to age 55 and up, those aged 18 to 34 years ($b= 0.39$, $p<0.001$) and 35 to 54 years ($b= 0.23$, $p<0.001$) had higher levels of interest in semi-automated vehicles. Degree was also a significant predictor, $F(4, 34884) = 50.99$, $p<0.001$. When compared to those with a master's degree or higher, those with no formal education ($b= -0.49$, $p<0.001$); primary education ($b= -0.37$, $p<0.001$); secondary education ($b= -0.19$, $p<0.001$) had less interest in semi-automated vehicles. Whereas those with a bachelor's degree or similar ($b= 0.07$, $p= 0.010$) had greater interest in semi-automated vehicles. Similarly, professional occupation was a significant predictor of self-reported interest, $F(4, 34884) = 11.50$, $p<0.001$. Compared to persons that at the moment of the survey did not have a professional occupation, white-collar/office workers/employees ($b= 0.11$, $p<0.001$); executives ($b= 0.20$, $p<0.001$); self-employed/independent professionals ($b= 0.16$, $p<0.001$) had greater interest in semi-automated vehicles. In contrast, the interest of blue-collar or manual workers did not differ significantly from those without professional occupation ($b= 0.03$, $p= 0.432$).

Urbanization was also a significant predictor. When compared to those in semi-urban or rural areas, those in urban areas had higher levels of interest in semi-automated vehicles ($b= 0.07$, $p<0.001$). Additionally, possession of a driver's license was a significant predictor. Compared to those without a license, respondents who possessed a driver's license had greater interest in semi-automated vehicles ($b= 0.20$, $p<0.001$).

Mode of transport was also a significant predictor. In comparison to those who walked less than once per week, those that walked at least once per week had higher self-reported interest in semi-automated vehicles ($b= 0.09$, $p<0.001$). Compared to those who used a motorcycle less than once per week, those who used a motorcycle at least once per week had greater self-reported interest in semi-automated vehicles ($b= 0.15$, $p<0.001$). Compared to those who used an electronic motorcycle less than once per week, those who used an electronic motorcycle at least once per week had less interest in semi-automated vehicles ($b= -0.30$, $p<0.001$). Compared to those who used a taxi less than once per week, those who used a taxi at least once per week had higher self-reported interest in semi-automated

vehicles (b= 0.18, p<0.001). Compared to those who took the bus less than once per week, those who took the bus at least once per week had higher levels of self-reported interest in semi-automated vehicles (b= 0.10, p<0.001). Finally, compared to those who were a passenger in a vehicle less than once per week, those who were a passenger in a vehicle at least once per week had greater interest in semi-automated vehicles (b= 0.11, p<0.001).

Opinions about the causes of road crashes were also a significant predictor of self-reported interest in semi-automated vehicles. Those who believed that drugs were often the cause of a road crash involving a car had greater interest in semi-automated vehicles (b= 0.03, p<0.001). However, those who believed that using a hands-free mobile phone while driving was often the cause of a road crash had less interest in semi-automated vehicles (b= -0.02, p<0.001). Support for certain policy measures was also a significant predictor of interest in semi-automated vehicles, where higher levels of support for the legal obligation of zero tolerance for alcohol (0.0 ‰) for novice drivers corresponded to lower interest in semi-automated vehicles (b= -0.04, p<0.001). Furthermore, higher levels of support for the legal obligation to install Intelligent Speed Assistance in new cars corresponded to greater interest in semi-automated vehicles (b= 0.14, p<0.001). Higher levels of support for the legal obligation to install Dynamic Speed Warning signs corresponded to greater interest in semi-automated vehicles (b= 0.08, p<0.001). Higher levels of support for the legal obligation to have a seatbelt reminder system for the front and back seats in new cars corresponded to greater interest in semi-automated vehicles (b= 0.05, p<0.001). Finally, higher levels of support for a legal obligation to have zero tolerance for using any type of mobile phone while driving for all drivers corresponded to lower interest in semi-automated vehicles (b= -0.07, p<0.001).

Involvement in a crash within the past 12 months was a significant predictor of interest in semi-automated vehicles (b= 0.19, p<0.001). Perceptions of the potential benefits of semi-automated vehicles were also significant predictors of self-reported interest in semi-automated vehicles. Those who believed there would likely be fewer crashes if everyone would use a semi-automated passenger car had higher interest in these vehicles (b= 0.26, p<0.001). The belief that there would likely be reduced crash severity (b= 0.17, p<0.001), reduced congestion (b= 0.04, p<0.001), reduced travel time (b= 0.06, p<0.001), reduced emissions (b= 0.03, p<0.001) if everyone would use a semi-automated passenger car corresponded to greater interest in these vehicles. Furthermore, those who believed it was likely that there would be better fuel economy (b= 0.06, p<0.001) and more time for functional activities not related to driving (b= 0.03, p<0.001) if everyone would use a semi-automated passenger car corresponded to greater interest in these vehicles.

Finally, feelings of safety when using private motorized transport was also a significant predictor of self-reported interest in semi-automated vehicles. Higher levels of perceived safety corresponded to higher levels of interest in semi-automated vehicles (b= 0.02, p<0.001).

Table 2. Multiple linear regression model for the self-reported interest in semi-automated vehicles

Parameter	Estimate	Standard Error	t-value	Pr > |t|
Intercept	-.22	0.08	-2.90	0.0037
Gender				
1 – male	0.19	0.02	9.92	<0.0001
2 – female	0.00	.	.	.
Age				
18-34	0.39	0.03	15.14	<0.0001
35-54	0.23	0.02	9.36	<0.0001
55+	0.00	.	.	.
Degree				
No degree	-.49	0.14	-3.53	0.0004
Primary education	-.37	0.05	-7.45	<0.0001
Secondary education	-.19	0.03	-6.53	<0.0001
Bachelor's degree or similar	0.07	0.03	2.56	0.0104
Master's degree or higher	0.00	.	.	.
Professional status				
White collar or office worker (excluding executive)/ employee (public or private sector)	0.11	0.02	4.50	<0.0001
Blue collar or manual worker/worker	0.03	0.03	0.79	0.4319
Executive	0.20	0.04	5.03	<0.0001
Self-employed/independent professional	0.16	0.03	5.13	<0.0001
Currently no professional occupation	0.00	.	.	.
Urbanization				
Urban	0.07	0.02	3.70	0.0002
Semi-urban and rural	0.00	.	.	.
Driver's license				
Yes	0.20	0.03	6.96	<0.0001
No	0.00	.	.	.
Mode of transport				
Walk				
1: At least once per week	0.09	0.02	3.78	0.0002
0: Less than once per week	0.00	.	.	.
Motorcycle				
1: At least once per week	0.15	0.04	3.82	0.0001
0: Less than once per week	0.00	.	.	.
Electronic motorcycle				
1: At least once per week	-.30	0.06	-4.90	<0.0001

Parameter	Estimate	Standard Error	t-value	Pr > |t|
0: Less than once per week	0.00	.	.	.
Taxi				
1: At least once per week	0.18	0.04	5.01	<0.0001
0: Less than once per week	0.00	.	.	.
Bus				
1: At least once per week	0.10	0.02	4.17	<0.0001
0: Less than once per week	0.00	.	.	.
Passenger in a car				
1: At least once per week	0.11	0.02	5.71	<0.0001
0: Less than once per week	0.00	.	.	.
Causal factors of road crashes				
Driving after taking drugs	0.03	0.01	5.92	<0.0001
Using a hands-free mobile phone while driving	-.02	0.01	-3.37	0.0008
Support for policy measures				
Zero tolerance for alcohol (0,0 ‰) for novice drivers	-.04	0.01	-4.55	<0.0001
Install Intelligent Speed Assistance (ISA) in new cars	0.14	0.01	15.65	<0.0001
Install Dynamic Speed Warning signs	0.08	0.01	7.68	<0.0001
Seatbelt reminder system for the front and back seats in new cars	0.05	0.01	4.77	<0.0001
Zero tolerance for using any type of mobile phone while driving (hand-held or hands-free) for all drivers	-.07	0.01	-10.08	<0.0001
Crash	0.19	0.02	7.93	<0.0001
Benefits of semi-automated vehicles				
Fewer crashes	0.26	0.01	30.95	<0.0001
Reduced crash severity	0.17	0.01	19.74	<0.0001
Reduced congestion	0.04	0.01	5.58	<0.0001
Reduced travel time	0.06	0.01	8.19	<0.0001
Reduced emissions	0.03	0.01	3.94	<0.0001
Fuel economy	0.06	0.01	7.76	<0.0001
Increased time for functional activities	0.03	0.01	4.48	<0.0001
Perceived safety				
Feelings of safety using motorized transport	0.02	0.00	5.01	<0.0001

Regression model estimation for the self-reported interest in fully-automated vehicles

To further examine the association between self-reported interest in fully-automated vehicles and all measured variables potentially related to interest, a multiple linear regression model was estimated. The results of the regression indicated that the model significantly predicted self-reported interest in fully-automated vehicles, F(29, 34890) = 524.88, p<0.001, explaining 30% of the variation in self-reported interest (R^2= 0.303) (Table 3). Gender was a significant predictor, with self-reported interest being higher for males compared to females (b= 0.23, p<0.001). Age was also a significant predictor, F(2, 34890) = 138.57, p <.001. When compared to age 55 and up, those aged 18 to 34 years (b= 0.44, p<0.001) and 35 to 54 years (b= 0.27, p<0.001) had higher levels of interest in fully-automated vehicles. Degree was also a significant predictor, F(4, 34890) = 14.39, p<0.001. When compared to those with a master's degree or higher, those with lower levels of education had less interest in fully-automated vehicles (no formal education (b= -0.45, p<0.01); primary education (b= -0.18, p<0.001); secondary education (b= -0.13, p<0.001)). However, the interest of those with a bachelor's degree or similar did not differ significantly from those with a master's degree or higher (b= 0.02, p= 0.625).

Mode of transport was also a significant predictor. Compared to those who used a motorcycle less than once per week, those who used this form of transport at least once per week had greater self-reported interest in fully-automated vehicles (b= 0.18, p<0.001). Compared to those who used a powered personal transport device less than once per week, those who used this form of transport at least once per week had more interest in fully-automated vehicles (b= 0.24, p<0.001). Compared to those that drove a car less than once a week, those who used this form of transport at least once a week had less interest in fully-automated vehicles (b= -0.17, p<0.001). Compared to those that drove a hybrid or electric car less than once a week, those who used this form of transport at least once a week had greater interest in fully-automated vehicles (b= 0.27, p<0.001). Compared to those who used a taxi less than once per week, those who used this form of transport at least once per week had higher self-reported interest in fully-automated vehicles (b= 0.34, p<0.001). Compared to those who took the bus less than once per week, those who took the bus at least once per week had higher levels of self-reported interest in fully-automated vehicles (b= 0.13, p<0.001). Finally, compared to those who were a passenger in a vehicle less than once per week, those who used this form of transport at least once per week had greater interest in fully-automated vehicles (b= 0.10, p<0.001).

Opinions about the causes of road crashes were also a significant predictor of self-reported interest in fully-automated vehicles. Those who believed that alcohol was often the cause of a road crash involving a car had less interest in fully-automated vehicles (b= -0.05, p<0.001). Those who believed that using a hand-held mobile while driving was often the cause of road crashes also had less interest in fully-automated vehicles (b= -0.05, p<0.001). However, those who believed that using a hands-free mobile phone while driving was often the cause of a road crash had more interest in fully-automated vehicles (b= 0.03, p<0.001). Support for certain policy measures was also a significant predictor of interest in fully-automated vehicles, where higher levels of support for the legal obligation of zero tolerance for alcohol (0.0 ‰) for novice drivers corresponded to lower interest in fully-automated vehicles (b= -0.05, <.001). Furthermore, higher levels of support for the legal obligation to install Intelligent Speed Assistance in new cars corresponded to greater interest in fully-automated vehicles (b= 0.17, p<0.001). Higher levels of support for the legal obligation to install Dynamic Speed Warning signs corresponded to greater interest in fully-automated vehicles (b= 0.07, p<0.001). Higher levels of support for the legal obligation to require cyclists under the age of 12 to wear a helmet corresponded to lower interest in fully-automated vehicles (b= -0.06, p<0.001). Finally, higher levels of support for a legal obligation to not using headphones (or earbuds) while riding a bicycle corresponded to lower interest in fully-automated vehicles (b= -0.05, p<0.001).

Involvement in a crash within the past 12 months was a significant predictor of interest in fully-automated vehicles (b= 0.22, p<0.001). Perceptions of the potential benefits of fully-automated vehicles were also significant predictors of self-reported interest in fully-automated vehicles. Those who believed it was likely that there would be a reduction in crash severity (b= 0.24, p<0.001) if everyone would use a fully-automated passenger car corresponded to greater interest in these vehicles. The belief that there would be reduced congestion (b= 0.10, p<0.001), reduced travel time (b= 0.14, p<0.001), reduced emissions (b= 0.03, p<0.001) if everyone would use a fully-automated passenger

car corresponded to greater interest in these vehicles. Furthermore, those who believed it was likely that there would be more time for functional activities not related to driving (b= 0.06, p<0.001) and recreational activities not related to driving (b= 0.04, p<0.001) if everyone would use a fully-automated passenger car corresponded to greater interest in these vehicles.

Table 3. Multiple linear regression model for the self-reported interest in fully-automated vehicles

Parameter	Estimate	Standard Error	t-value	Pr > |t|
Intercept	0.62	0.08	8.19	<.0001
Gender				
Male	0.23	0.02	11.00	<.0001
Female	0.00	.	.	.
Age				
18-34	0.44	0.03	16.35	<.0001
35-54	0.27	0.02	11.04	<.0001
55+	0.00	.	.	.
Degree				
No degree	-0.45	0.15	-2.93	0.0033
Primary education	-0.18	0.05	-3.41	0.0007
Secondary education	-0.13	0.03	-4.22	<.0001
Bachelor's degree or similar	0.02	0.03	0.49	0.6249
Master's degree or higher	0.00	.	.	.
Mode of transport				
Motorcycle				
1: At least once per week	0.18	0.04	4.34	<.0001
0: Less than once per week	0.00	.	.	.
Powered personal transport device				
1: At least once per week	0.24	0.05	4.33	<.0001
0: Less than once per week	0.00	.	.	.
Car				
1: At least once per week	-0.17	0.02	-7.87	<.0001
0: Less than once per week	0.00	.	.	.
Hybrid/electronic car				
1: At least once per week	0.27	0.04	6.05	<.0001
0: Less than once per week	0.00	.	.	.
Taxi				
1: At least once per week	0.34	0.04	8.81	<.0001
0: Less than once per week	0.00	.	.	.

Parameter	Estimate	Standard Error	t-value	Pr > |t|
Bus				
1: At least once per week	0.13	0.03	5.25	<.0001
0: Less than once per week	0.00	.	.	.
Passenger in a car				
1: At least once per week	0.10	0.02	4.63	<.0001
0: Less than once per week	0.00	.	.	.
Causal factors of road crashes				
Driving after drinking alcohol	-0.05	0.01	-5.17	<.0001
Using a hand-held mobile phone while driving	-0.05	0.01	-4.53	<.0001
Using a hands-free mobile phone while driving	0.03	0.01	4.68	<.0001
Support for policy measures				
Zero tolerance for alcohol (0,0 ‰) for novice drivers	-0.05	0.01	-4.88	<.0001
Install Intelligent Speed Assistance (ISA) in new cars	0.17	0.01	18.05	<.0001
Install Dynamic Speed Warning signs	0.07	0.01	6.61	<.0001
Require cyclists under the age of 12 to wear a helmet	-0.06	0.01	-4.83	<.0001
No using headphones (or earbuds) while riding a bicycle	-0.04	0.01	-5.46	<.0001
Crash	0.22	0.03	8.23	<.0001
Benefits of fully-automated vehicles				
Reduced crash severity	0.24	0.01	29.03	<.0001
Reduced congestion	0.10	0.01	10.93	<.0001
Reduced travel time	0.14	0.01	15.85	<.0001
Reduced emissions	0.03	0.01	3.92	<.0001
Increased time for functional activities	0.06	0.01	5.54	<.0001
Increased time for recreational activities	0.04	0.01	3.86	0.0001