



THE PULSE OF AUTONOMOUS DRIVING

An international user typology
and an emotional landscape of
autonomous driving





AICON

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FOREWORD BY DR. LUCIANO FLORIDI

The Future of Autonomous Driving may be Variety

Mobility is an essential part of life in many societies. Every day, all over the world, cars play key functions (e.g., in transport or leisure) and social roles (e.g., as statements or status symbols). They are part of our history and culture. Any transformation of mobility affects the very essence of contemporary societies. And it is hard to imagine a more profound transformation of mobility than autonomous driving. So, understanding attitudes towards its benefits and shortcomings means being able to address societal welfare and individual wellbeing more successfully. Hence, this study is more than just a welcome addition to our knowledge of the phenomenon; it is a necessary step for any policy- and law-making decision, as well R&D and business strategy, that intends to be proactive and informed in delivering a better world.

The survey contains a wealth of information and insights about people's attitudes to autonomous driving in China, France, Germany, Italy, Japan, South Korea, Spain, United Kingdom, and United States. For example, structuring the responses into 5 typologies of drivers is helpful to understand overall attitudes. Here, I would like to outline two interesting points emerging from the study and draw a general conclusion.

Consider the tension between technological *novelty* and *change*. The majority of those surveyed expressed *interest* (82%) and *curiosity* (62%) about autonomous driving. However, a majority also raised *concerns* about loss of control (70%), technically unavoidable residual risks (66%), and the lack of a legal framework (65%). This is not as odd as it seems. Appreciating a novelty requires only an open mind but involves no actual risks or costs. Embracing a change implies a commitment that raises concerns about risks and costs (only 28% of people are willing to pay more for autonomous vehicles). Autonomous driving is both a realistic novelty and an unprecedented change. To translate high levels of interest and curiosity into low levels of concerns one needs to provide better technology, more safety, and robust ethical and legal frameworks. Thus, high expectations about these latter variables are understandable.

Consider next that only a minority (8%) “feel able to explain the subject”. This may seem worryingly low and even cast doubts on the value of the survey. It is not, and it should not. Take cars with automatic transmission. In 2018, only 3.7% of the vehicles sold by CarMax (the largest used-car retailer in the United States) had manual transmission. Cars with automatic transmission are by far the default option in the United States. Yet, arguably only a very small percentage of customers may “feel able to explain” the difference between Constantly Variable Transmission, Dual Clutch Transmission, and Simple Automatic Transmission. Attitudes are usually based on beliefs and experience rather than scientific knowledge. It would be a mistake to conclude that people’s attitudes about something they cannot explain are insignificant or unreliable. What matters is that 90% of the people surveyed “have heard of the technology” and 30% “know it well”.



Dr. Luciano Floridi, Oxford Internet Institute, Professor of Philosophy and Ethics of Information and Director of the Digital Ethics Lab, University of Oxford, and member of the scientific network of the initiative *&Audi*

A general conclusion that emerges from the survey may be summarised by a single word: *variety*. The question about the future of autonomous driving is not *when* or even *where*, but *how* it will take place. It will be a matter of what options, choices, and degrees of autonomous driving are offered to customers. Their needs, preferences, attitudes, and circumstances differ. They are best addressed by a flexible variety of alternatives. In bad sci-fi movies, there are only new cars and a handful of models. Reality is greasy and sticky, like a real engine. Public policies and business strategies about autonomous driving will need to make *variety* a feature, not a bug. Hopefully also ensuring that autonomous vehicles will be environmentally more sustainable than the ones we drive today.

EXECUTIVE SUMMARY

Autonomous driving has the potential to improve mobility substantially. More than 95 percent of accidents today are caused by humans.¹ Autonomous driving can make traffic on our roads safer and more convenient. Set against this are some relevant challenges – from the legal framework to individuals’ trust in the technology. Alongside rational arguments, emotions also shape the societal debate about autonomously driving cars.

Audi’s initiative *&Audi* aims to contribute to the introduction of autonomous driving in the interests of individuals and of society. The initiative’s approach is to tackle the challenges along the way to autonomous driving together with various social stakeholders. Since 2015, Audi has therefore been bringing together experts on this topic from the fields of science, business and public life. One goal is to establish appropriate expectations in society about the possibilities and limits of this technology. To achieve this, it is essential to understand what moves people.



With the representative online study entitled *The Pulse of Autonomous Driving*, the initiative *&Audi* examines the question of how rational arguments, emotions, values and lifestyles shape people's attitude to autonomous driving. A total of 21,000 people from nine countries on three continents (China, France, Germany, Italy, Japan, South Korea, Spain, the United Kingdom and the United States) were interviewed about their attitudes to autonomous driving. The result is a trio of the emotional landscape, the human readiness index and the user typology.

The **emotional landscape** shows the respondents' great interest (82 percent) and high curiosity (62 percent) in autonomous driving across all countries. They see potential for individuals and for society in the new technology: from easier access to mobility (76 percent) to more convenience (72 percent) and more safety (59 percent). More than half of respondents are fundamentally willing to try out autonomous driving. The greatest willingness towards giving up control is to be seen with regard to autonomous parking and driving in traffic jams on highways. Nonetheless, it is clear that there are also concerns, above all regarding loss of control (70 percent) and technically unavoidable residual risks (66 percent). Knowledge about autonomous driving generally appears to be low: only eight percent say they can explain the subject.

The **human readiness index (HRI)** provides information on how attitudes towards autonomous driving are related to sociodemographics: The younger the respondents are and the higher their level of education and income, the more positive their attitude towards autonomous driving becomes. There are also differences between the countries in the survey: the Chinese are euphoric about it, and South Koreans, too, take an above-average positive view of the technology. The Spanish and Italians are the pioneers in Europe. Germans and the French are still cautious, similar to Americans, the Japanese and the British.

The **user typology** considers attitudes towards autonomous driving in the context of people's lives. This approach leads to five user types. The "suspicious self-driver" would like to preserve the status quo and would only use autonomous driving if and when it becomes fully established. "Safety-oriented reluctants" are also reserved about autonomous driving. In their view, autonomous cars should first be tested for years before they are approved. The "open-minded co-pilot" sees the advantages of the technology and wants measures to be taken by industry, science and politics to put the cars onto the road safely. "Status-oriented trendsetters" are also enthusiastic about self-driving cars because this allows them to show off their progressive lifestyle. The "tech-savvy passenger" trusts the technology and hopes for its comprehensive introduction.

The results of the study help to conduct a differentiated public debate about how the technology can be introduced for the benefit of individuals and society. The study identifies key fields for action that play a part in determining the social acceptance of autonomous driving: there is room for improvement in knowledge about autonomous driving. The aim is to establish an appropriate level of expectations about the opportunities and limits of the technology in society. The user typology also shows how attitudes towards autonomous driving vary, depending on the context of people's lives. Varying needs should be met with specific benefits of autonomous driving. Moreover, it is clear that, in order to meet people's concerns, hopes and demands, it is necessary to have interdisciplinary interaction between business, science, politics and other societal stakeholders.

METHODOLOGY

The quantitative online survey was conducted in cooperation with the Ipsos market research institute. The survey was carried out between December 2018 and March 2019 in China, France, Germany, Italy, Japan, South Korea, Spain, the United Kingdom, and the United States, using the Ipsos online panel. A total of 21,000 people were activated to participate in the survey via a personalized e-mail.¹

Results have been weighted using the most recent population data to ensure that the final sample reflects the demographic structure of the overall target population in each country and that each country is equally represented in the analysis.² In the established markets with high Internet penetration, the results can be regarded as representative of the working-age population (18-69 years; 18-59 years in South Korea). Internet penetration in China is lower; the results in that country are therefore representative of an urban, prosperous and connected population. Another factor is that the maximum age of the respondents in China is 54, and the education distribution is characterized by well-educated respondents. The higher proportion of younger and well-educated respondents may have influenced the survey results.

Additionally the local automotive experts at Ipsos, who are involved on a daily basis in international market research related to mobility, carried out a cultural check in the nine countries of the survey. They examined the study results in the context of societal, statutory and other characteristics of these countries. Non-confidential studies of a similar type and research-on-research investigations were also taken into account, thus ensuring a differentiated view of the study results.

For the development of user typology, relevant variables for attitude to autonomous driving were first identified by a random forest driver analysis, and then a five-cluster approach based on a statistical analysis was chosen.³ The sinus meta milieus⁴ served to identify the respondents' value orientation and lifestyles. On the basis of a standardized statement allocation, the respondents were allocated to one of the nine sinus meta milieus. As an international version of the sinus milieus, which have been established for many years, the sinus meta milieus take cultural differences into account and thus allow comparisons between countries.⁴

The following definition of autonomous driving was presented to respondents: with autonomous driving, a driver is no longer required, at least within a specific application (for example, when parking or in the city center at speeds up to 30 km/h). In the distant future, one can also imagine autonomous vehicles that do not need a driver on the entire route from A to B. Such vehicles could, for example, be operated without a driver both in the city center and on the highway.

Due to rounding, it is possible that not all diagrams in this study add up to 100 percent and the proportions of the diagrams may vary slightly.

1 Sample size of n=21,000 (China (n=3,000), France (n=2,000), Germany (n=2,000), Italy (n=2,000), Japan (n=3,000), Spain (n=2,000), South Korea (n=2,000), United Kingdom (n=2,000) and USA (n=3,000))

2 China: census 2010; France, Germany, Italy, Spain: Eurostat 2013; Japan: census 2015; South Korea: census 2015; United Kingdom: Eurostat 2012; United States: American Community Survey 2016

3 At Random Forest the existing variables are sorted according to their significance for predicting the target variable (here: attitude to autonomous driving). The most relevant eleven variables were selected and fed into a clustering process. With the help of gap statistic, five different user types were generated.

4 Sinus Markt- und Sozialforschung GmbH. (without date). SINUS Meta-Milieus. Retrieved July 30, 2019, from <https://www.sinus-institut.de/en/sinus-solutions/sinus-meta-milieus>





01

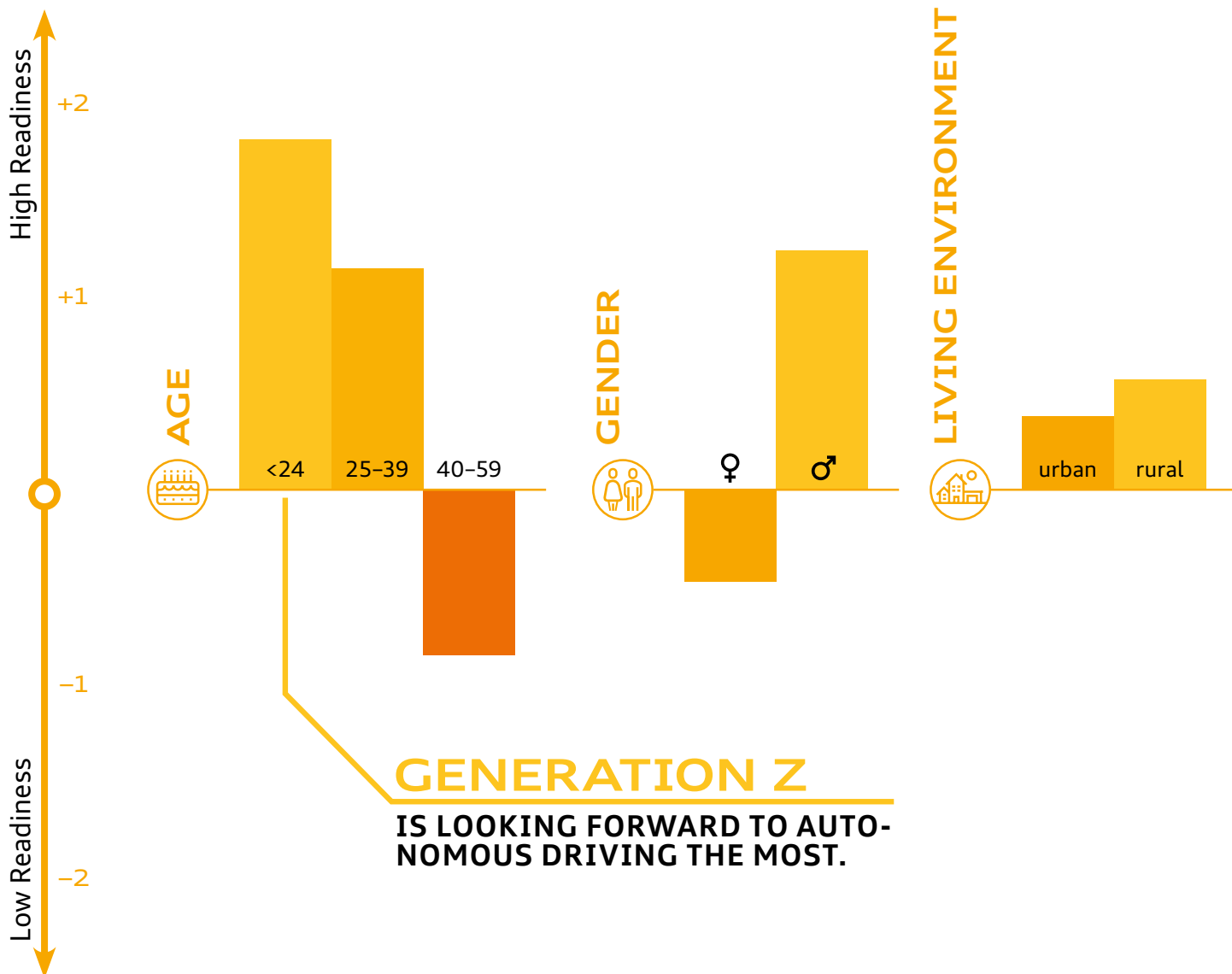
**HUMAN
READINESS
INDEX**

THE HUMAN READINESS INDEX OF AUTONOMOUS DRIVING

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What do people think about autonomous driving? How interested are they in this technology? And what emotions guide them? The human readiness index (HRI) tells us how attitudes to autonomous driving are linked to sociodemographics. To do this, it combines interest, knowledge, emotions

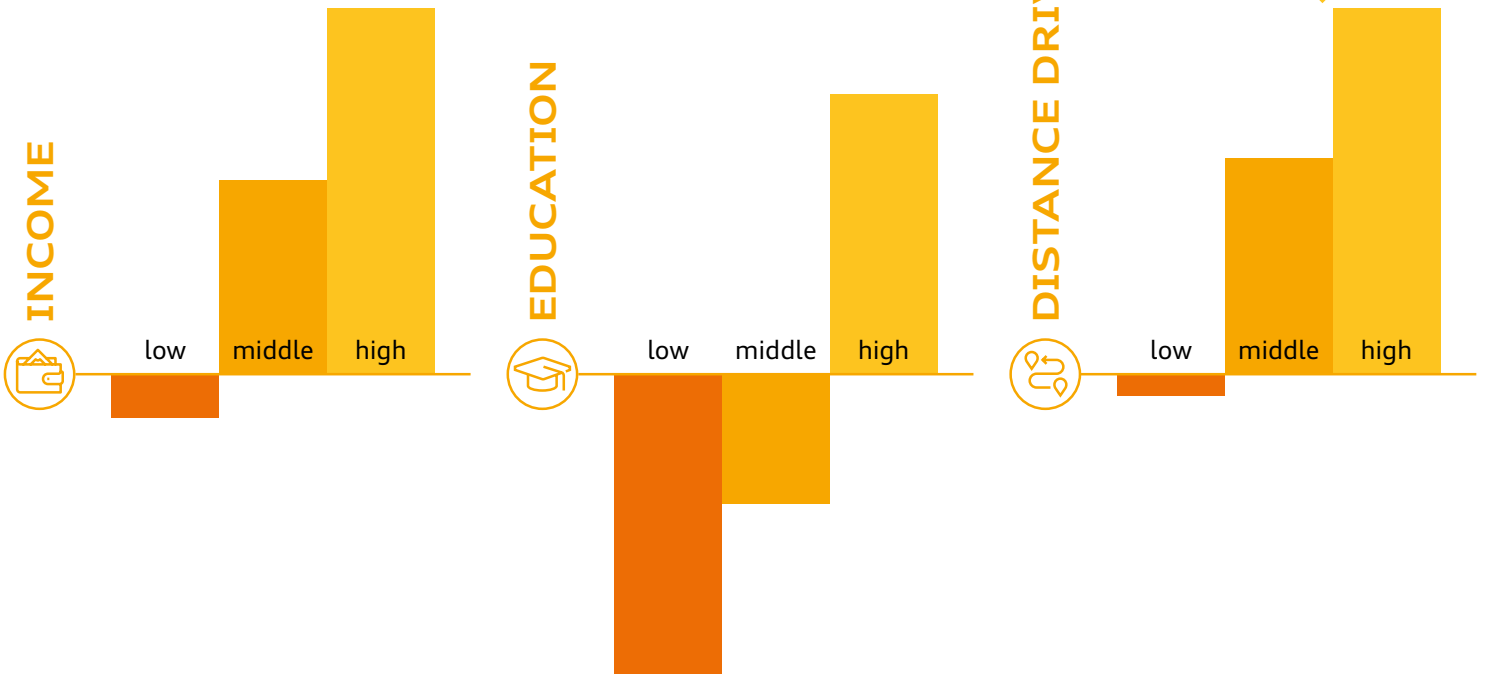
and willingness to use in relation to autonomous driving to produce a numerical indicator on a scale from -10 to +10. The results show that across national borders, Generation Z is especially open to autonomous driving (+1.9). The same is true of men (+1.3), well-educated persons (+1.3)

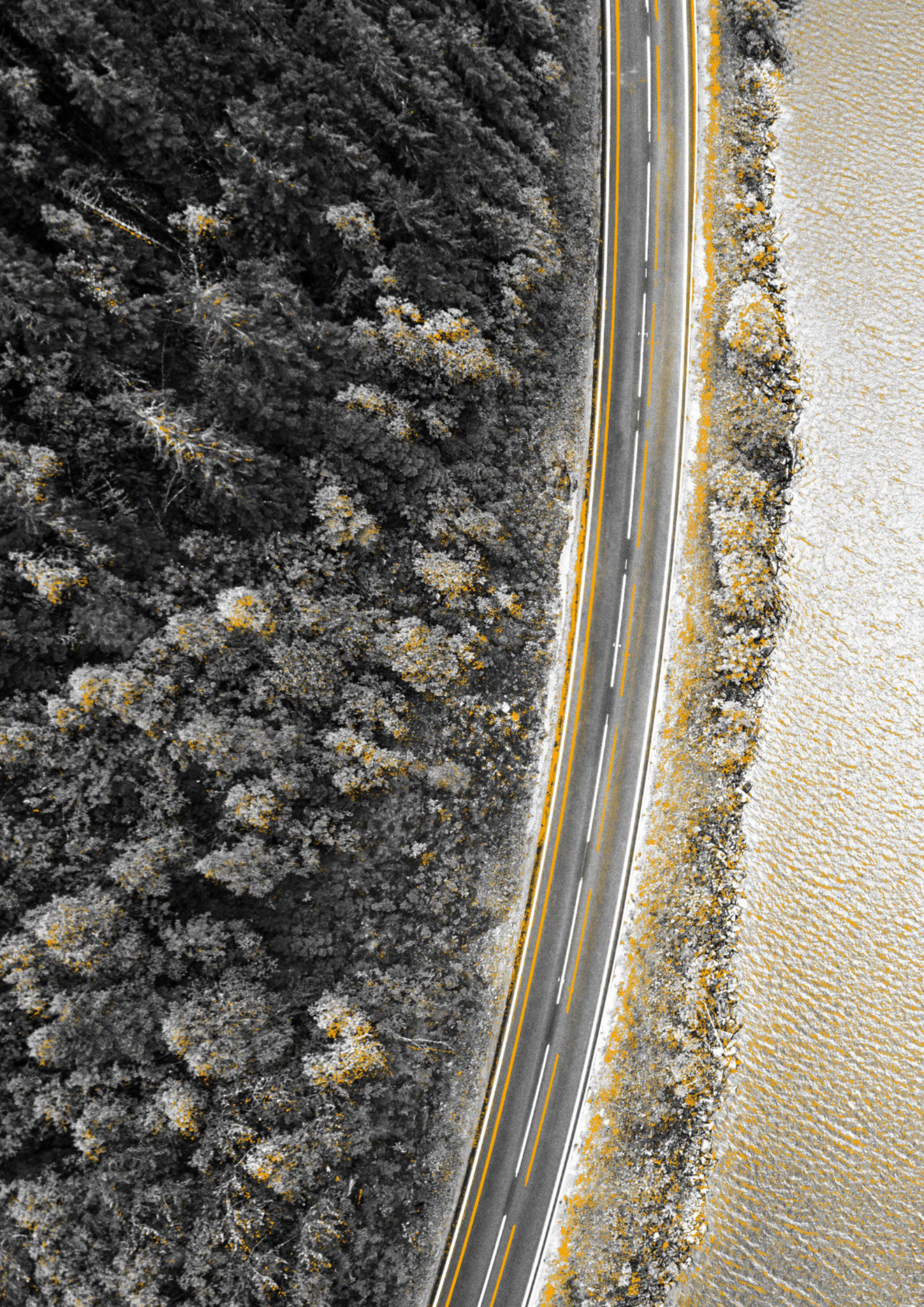




and those with higher incomes (+1.7). Frequent drivers also tend to have a positive attitude to autonomous driving (+1.7). There is little difference between city-dwellers (+0.4) and the country population (+0.6).

FREQUENT DRIVERS ARE PARTICULARLY OPEN TO AUTONOMOUS DRIVING.





02

**EMOTIONAL
LANDSCAPE**

THE WORLD IS TALKING ABOUT AUTONOMOUS DRIVING

Autonomous driving is a hot topic across national boundaries: 90 percent of the people surveyed have heard of the technology. 22 percent actually say they know a lot about autonomous driving. Only eight percent, however, feel able to explain the subject.

Knowledge of autonomous driving, international

8%

know it very well and can explain the topic

22%

know it well



10%

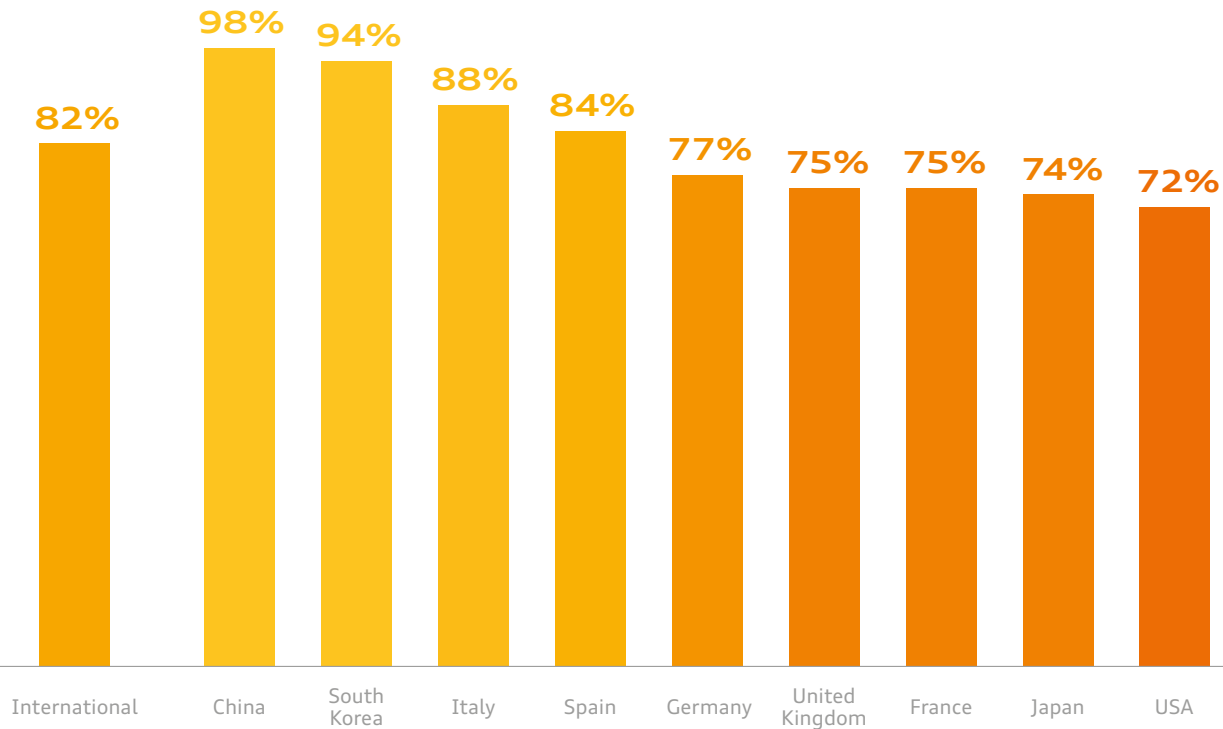
have never heard about it

60%

have already heard about it

But who knows most? Car enthusiasts, the younger generation and people with high incomes and close ties to education are best informed about autonomous driving. The Chinese and South Koreans lead the international comparison: almost half of them (both 45 percent) say they know a lot about the technology. In Japan, on the other hand, almost a quarter of respondents (24 percent) have never heard of autonomous driving, followed by the United Kingdom (14 percent).

Interest in autonomous driving



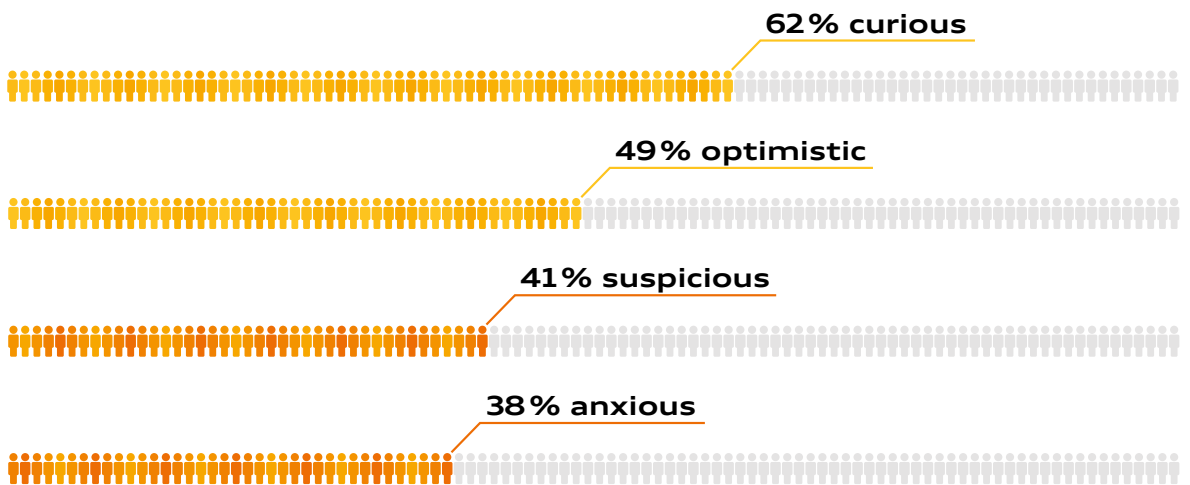
The Chinese are strongly interested

Across all countries, 82 percent of respondents show general interest in autonomous driving. The level of interest is similar to the level of knowledge: the Chinese (98 percent) and South Koreans (94 percent) are most interested. Europeans are more reserved: while 84 percent of respondents in Spain are interested in cars that drive autonomously, in France three quarters give this response. A quarter of the French state that they are not interested in the technology at all. The figure is similar in the United States (28 percent) and Japan (26 percent).

A MOOD OF CAUTIOUS OPTIMISM

In attitudes to autonomous driving, not only rational arguments play a part. People's feelings are also relevant.

Emotions regarding autonomous driving, international



The Spanish and Italians are optimistic

Almost two thirds of respondents are curious about autonomous driving. Just under half of respondents are optimistic about the technology. The Chinese are the most enthusiastic. 84 percent of them are curious, followed by South Koreans (67 percent) and Americans (64 percent).

In Europe, it is above all the Spanish (54 percent) and Italians (51 percent) who are optimistic about self-driving cars. In Germany about one third (34 percent) view autonomous driving optimistically.

Americans are skeptical

On average across the countries, 38 percent of respondents are anxious about autonomous driving. The Chinese (11 percent) and Germans (25 percent) experience relatively little anxiety about the technology. The British (46 percent), South Koreans (52 percent) and Japanese (53 percent) are more anxious.

Across all countries, 41 percent of respondents are suspicious about the technology. Japan (32 percent) and France (34 percent) are less suspicious. South Koreans, by contrast, are skeptical: almost one in two (48 percent) feel suspicious about autonomous driving – this in spite of the simultaneously high level of interest. Suspicion is stronger only in the USA (62 percent) and the United Kingdom (54 percent).



Nearly three quarters of Generation Z are curious

Younger drivers are particularly open to autonomous driving. Across the countries in the survey, almost three quarters (73 percent) of respondents from Generation Z are curious about the technology. For baby boomers between the ages of 40 and 60, the figure is more than one in two (59 percent). With negative emotions such as fear and suspicion, however, there are almost no differences between the age groups.

Car sharers and ride sharers are especially open

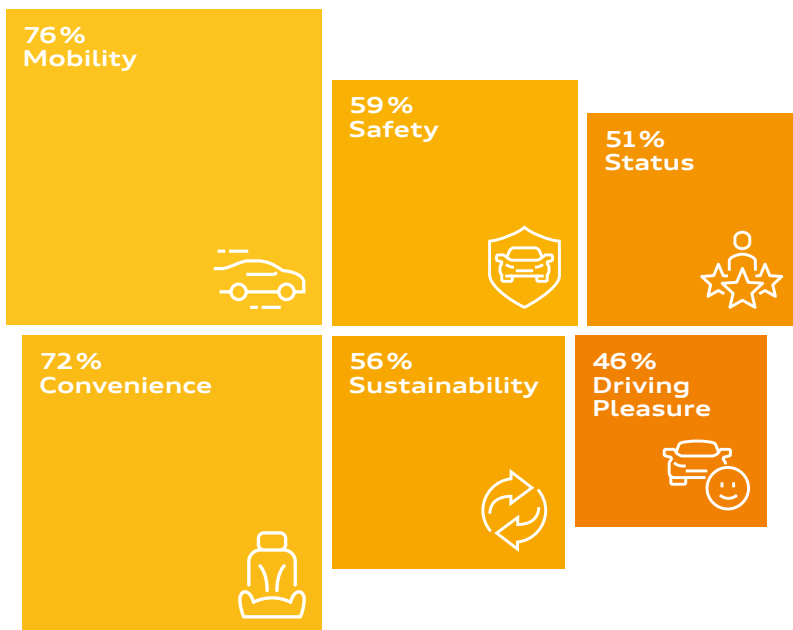
The majority of respondents who already use new mobility services such as car sharing are also strongly interested in autonomous driving (70 percent). They are also especially optimistic (79 percent) and curious (81 percent) with regard to self-driving cars. People who regularly use ride-sharing services also show strong interest (81 percent). This is in contrast to those who mainly travel in their own car or by train: 32 percent of drivers and about half (49 percent) of regular train passengers show strong interest in autonomous automobiles.

Differences also become apparent depending on the driving situation: city and highway drivers are comparatively optimistic about autonomous driving (54 percent each). People who travel by car mainly in rural areas are more suspicious (47 percent). Furthermore, people who already use driver assistance systems are especially curious about autonomous driving (71 percent).

MOBILITY FOR ALL

Respondents see the greatest added value from self-driving cars in easier access to mobility for the elderly, children, persons with handicaps and people without a driving license (76 percent). Regular users of car-sharing and ride-sharing services (86 and 88 percent), in particular, see potential here.

Perceived benefits of autonomous driving, international



Access to mobility, more convenience for the driver, and greater safety hold most potential

There is agreement that autonomous cars will take strain off drivers (75 percent). The majority of respondents are also convinced that self-driving cars will make road traffic safer (59 percent). On the question of whether the pleasure of driving will increase, opinions differ (46 percent). Only just over a third (39 percent) believe that autonomous vehicles will lead to less traffic on the roads.

South Koreans see most advantages

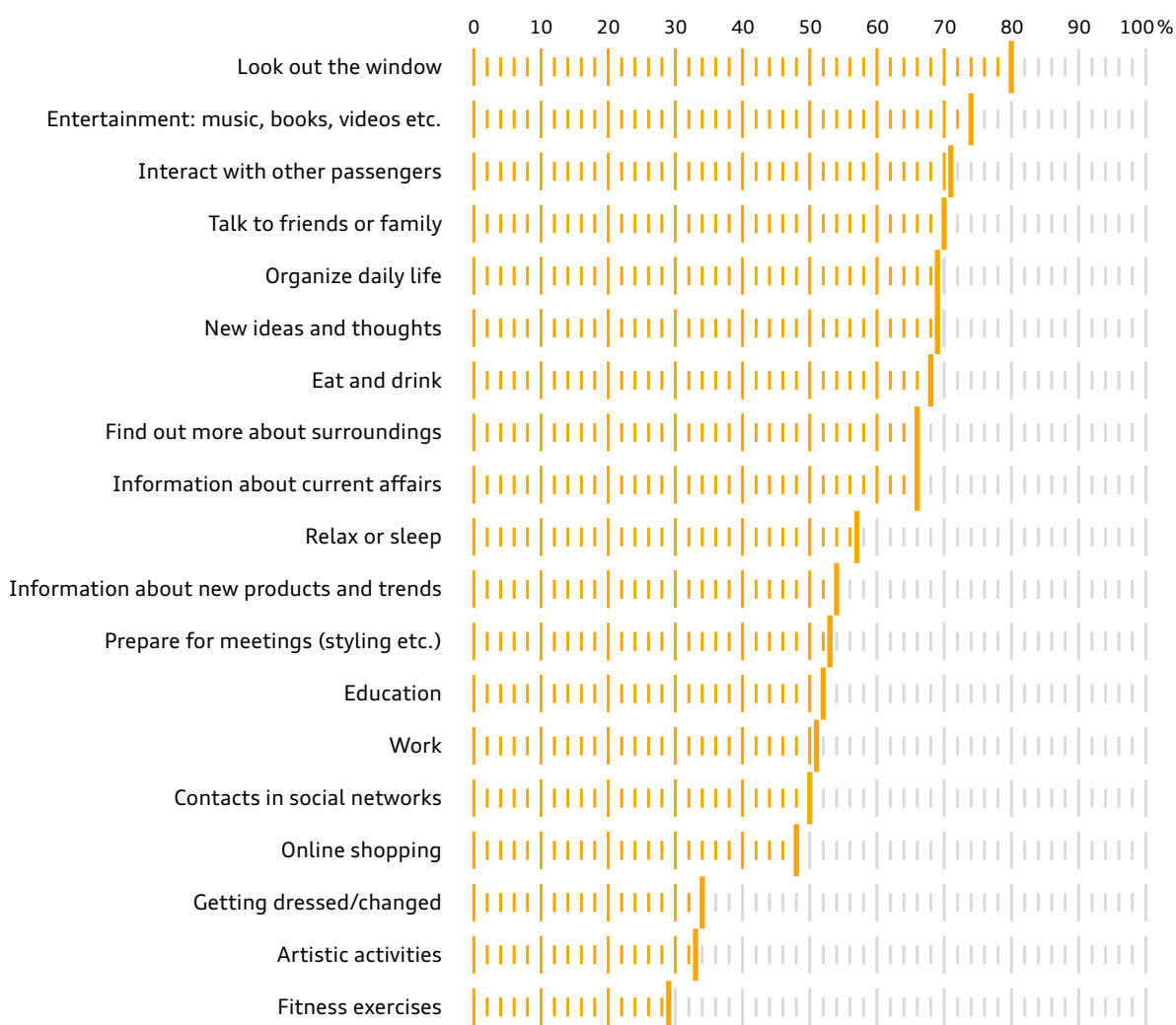
The Chinese and South Koreans have particularly high hopes of the new technology: above all, easier access to mobility (90 and 84 percent), more time for other things (84 and 69 percent) and better traffic flows (84 and 66 percent). The French are more reserved; 43 percent of respondents expect increased safety.

What to do with the time gained? Relax and maintain social contacts

When the car takes over the task of driving, people will have their hands and heads free for other things that are important to them; two thirds of respondents (68 percent) see this as added value. But what will we do with the time gained? The level of interest is highest for enjoying the view, listening to music or watching movies. Talking to friends and family is also very popular.

The situation is different with more physical activities: respondents can hardly imagine doing fitness exercises or trying on clothes in a self-driving car. The same applies to artistic activities.

Use of time in autonomously driving cars, international



FEAR OF LOSS OF CONTROL

With autonomous driving, the human transfers control to a machine. Consequently, in addition to the technology's potential, reservations and risks play a central role in the general debate.

Critical aspects of autonomous driving, international

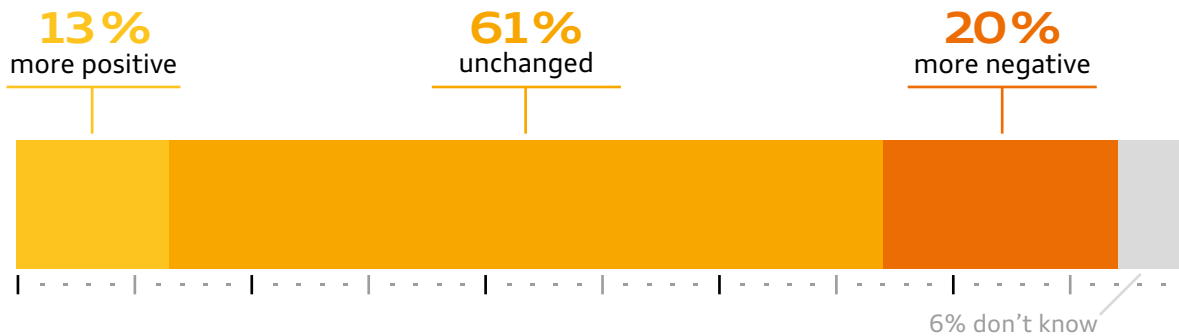


The most widespread concerns relate to a possible loss of control (70 percent), technically unavoidable residual risks (66 percent) and the lack of a legal framework (65 percent). On the other hand, only one in three sees it as a problem that autonomous driving might reduce the pleasure of driving.

The Spanish see the lack of a legal framework as problematic

The Chinese euphorically look forward to self-driving cars and are particularly interested, open and curious. At the same time, 85 percent fear a possible loss of control. That is 15 percent more than the international average. The Spanish (81 percent) and Americans (77 percent) also regard this aspect as particularly critical – in contrast to South Koreans (55 percent) and Germans (57 percent), who have less concern about a potential loss of control. South Koreans (55 percent), are little concerned about the lack of a legal framework, whereas the Chinese (79 percent), Spanish (78 percent) and Italians (71 percent) take a critical view of this point.

Change of attitudes to autonomous driving after reports of accidents with automated cars, international



ACCIDENT REPORTS MAKE LITTLE IMPRESSION

The media have reported about the first accidents with automated cars. More than half of the people surveyed (55 percent) have heard of such accidents – especially in the United States (62 percent), Germany and South Korea (both 60 percent). For almost two thirds of those respondents, reports of accidents have not led to a change in their attitude to autonomous driving. 13 percent even state that the reports have positively affected their view of autonomous driving.

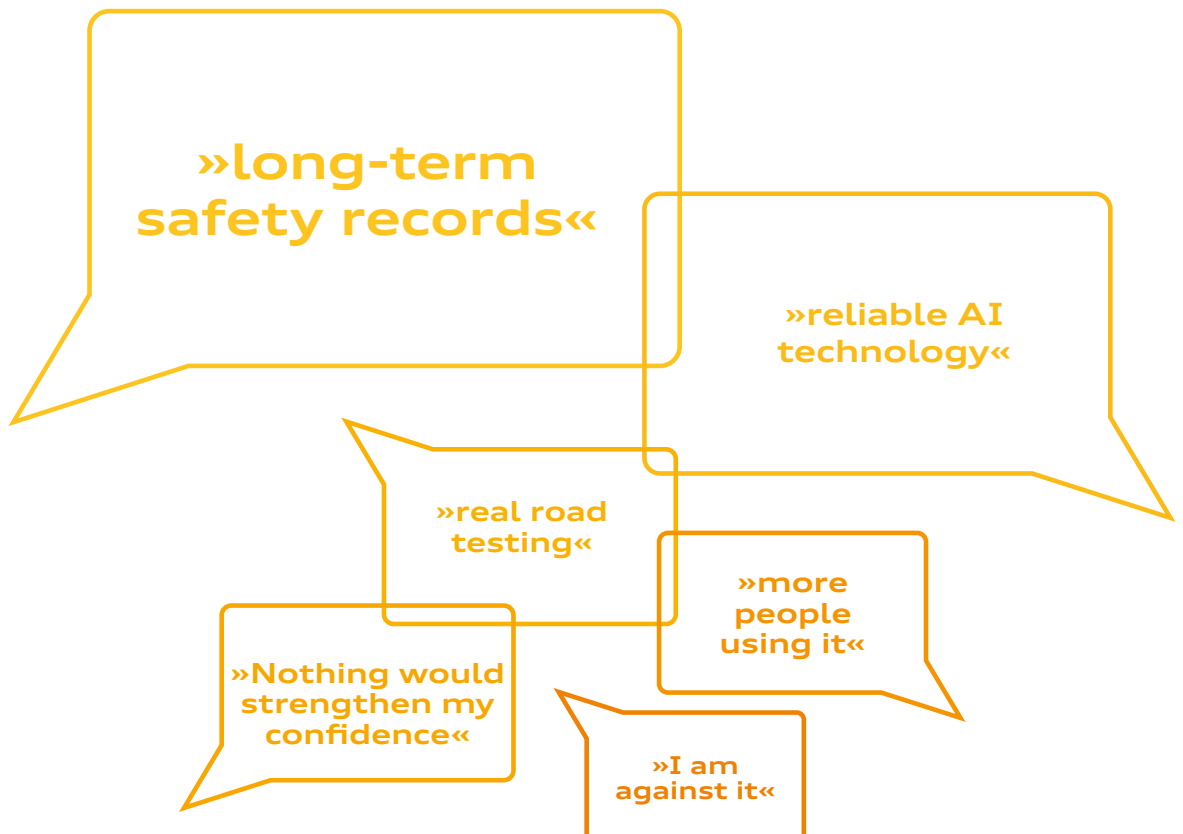
Here too there are national differences: the Chinese are little influenced by reports about accidents (54 percent), and if they are influenced, their attitude has even become more favorable (27 percent). In the case of Italians (25 percent), Americans (24 percent), and South Koreans (24 percent), accidents increased their reservations more often.

TRUST THROUGH CERTIFIED SAFETY

What would reinforce the respondents' trust in autonomous driving? Across the countries surveyed, almost a quarter of respondents (24 percent) stated that evidence of safety would strengthen their trust. In particular, the Chinese (39 percent), South Koreans (28 percent), Japanese (27 percent) and Americans (25 percent) expect a confidence-building effect from certification of safety. Furthermore, they want the technology to be proved reliable in real-life traffic (19 percent). At the same time the respondents call for extensive research on the subject (12 percent), especially the British (22 percent).

The Chinese (42 percent) and South Koreans (32 percent) also put their faith in the development of technology: the further development of a 5G mobile phone network as the basis for autonomous driving, research on the subject of machine learning, and the securing of the algorithms would strengthen their trust in autonomous driving. The Spanish (17 percent), Americans (17 percent), British (16 percent), Italians (13 percent), French (13 percent) and Germans (13 percent) wish to become accustomed to the technology: experience and time spent in autonomous cars would increase their trust, for example in the context of test drives with experts.

What would strengthen trust in autonomous driving? Open question, international





GREAT INTEREST IN TRYING IT OUT

Practice is better than theory. More than half of respondents would like to test autonomous driving in accordance with this motto. China is ahead: eight out of ten Chinese would travel in self-driving cars; in Germany the proportion is one in three. High willingness is also evident among frequent drivers (55 percent) and regular users of driver-assistance systems (64 percent).

This is influenced by the question of whether others have already had experience of the technology. The majority of respondents (52 percent) would test autonomous driving when others have already tried it. This applies above all in the United States (61 percent), Spain (58 percent) and the United Kingdom (60 percent).

Acceptance highest in highway jams and for autonomous parking

Drivers' willingness to take their hands off the wheel is highest for parking or in traffic jams on highways: about one third can imagine giving up control completely in these situations. The situation is different on country roads: Only one in five would drive there autonomously. Irrespective of the driving situation, many respondents would like to be able to take over control themselves at any time, even as passengers (41 percent). Interestingly, there is no difference here between frequent and infrequent drivers.

Having one's own car is very popular: internationally, almost one person in two (48 percent) can imagine driving autonomously in his or her own car. For taxi services, this willingness drops to 38 percent, for car-sharing to 34 percent and for ride-sharing to 32 percent.



53 %

of respondents would like to test autonomous driving.



35 %

would use autonomous parking.



34 %

would use autonomous driving in a highway traffic jam.



28 %

would use autonomous driving on a highway.



25 %

would use autonomous driving in a city center.



22 %

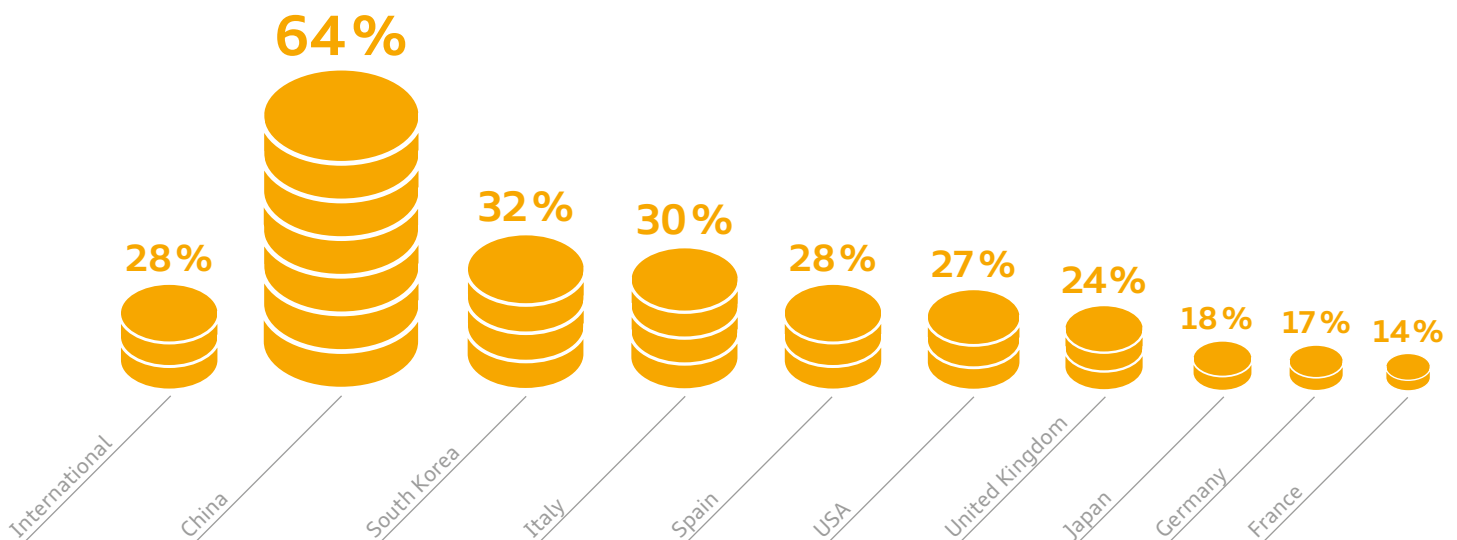
would use autonomous driving on a country road.

Automobiles are more than a means of transportation. They can express the owner's lifestyle and represent prestige. 21 percent see autonomous cars as a status symbol with which they are perceived as pioneers or opinion leaders. The Italians (30 percent), South Koreans (28 percent) and Chinese (27 percent) are most likely to emphasize the status idea, regardless of their income.

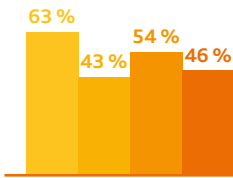
The Chinese show high willingness to pay

On the international average, 28 percent of respondents are prepared to spend more money on self-driving cars. In China there is even a clear majority (64 percent). In South Korea, too, there exists an above-average willingness to pay (32 percent). The willingness to spend money on autonomous driving is lowest in Germany (17 percent) and France (14 percent).

Willingness to pay more for autonomous driving vehicles

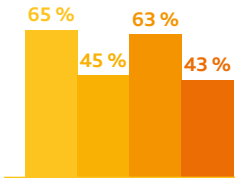


LEGEND



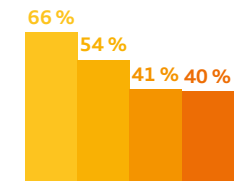
UNITED KINGDOM

The British consider the benefits of autonomous driving to be low compared with other countries. They tend to see advantages in terms of easier access to mobility and convenience. In addition to a possible loss of control, ethical concerns play an increasingly important role. The majority of Britons would initially allow others to try out autonomous cars and wait for the technology to prove its safety.



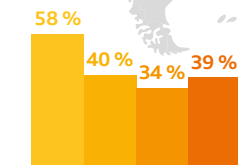
USA

The Americans hope that self-driving cars will above all provide easier access to mobility and more driving pleasure. Critical aspects are dominated by the loss of control, followed by concerns about misjudgments by autonomous cars and technically unavoidable residual risks. Americans demand further research and testing as a basis for trust.



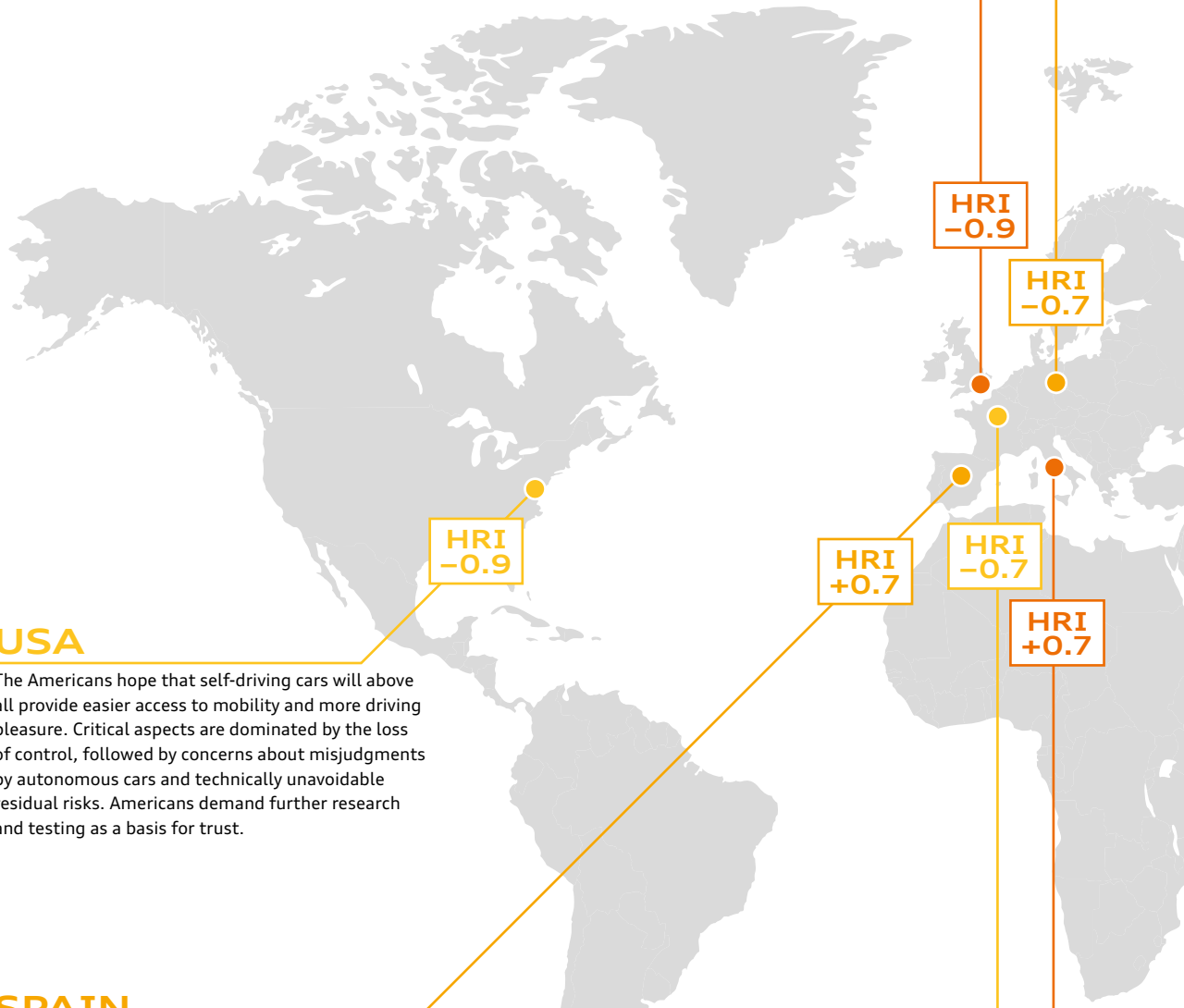
SPAIN

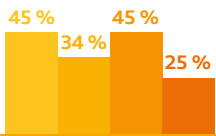
The Spanish are the pioneers in Europe when it comes to acceptance of autonomous driving. They see potential in the areas of safety and convenience. At the same time, they are concerned that autonomous cars could misjudge traffic situations and that the legal framework is lacking. Overall, many Spanish believe it is only a matter of time before people feel comfortable with the new technology.



FRANCE

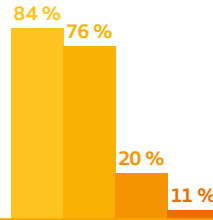
The French are comparatively cautious about autonomous driving. They see potential for easier access to mobility, increased convenience and more driving pleasure. They take a critical view, by contrast, of loss of control when driving and technical safety risks. More than in other countries, many French people say that their confidence could not be increased at present. The technology would first have to prove itself in real road traffic.





GERMANY

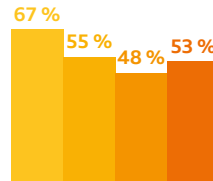
The Germans are comparatively cautious with regard to autonomous driving. They are neither particularly euphoric nor particularly critical in comparison with other countries. The Germans tend to see advantages in terms of convenience, while they are critical of the lack of a legal framework, technically unavoidable residual risks and ethical issues. Unlike other countries, the Germans currently see no concrete measures that could strengthen their confidence in autonomous driving.



CHINA

The Chinese are euphorically looking forward to self-driving cars. They are very interested in the technology and expect it to result in less traffic, more safety and more driving pleasure. Critical aspects play a minor role in comparison with other countries. When these aspects are addressed, the focus is on loss of control. Extensive tests in real road traffic could further strengthen the confidence of the Chinese.

HRI
+5.1

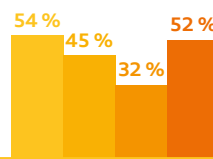


SOUTH KOREA

For South Koreans, autonomous driving primarily means more safety. They see the technically unavoidable residual risks and the loss of control while driving as critical aspects. They generally deal with the topic pragmatically: as soon as access to autonomous cars is possible, many South Koreans can imagine that criticism of the technology will diminish.

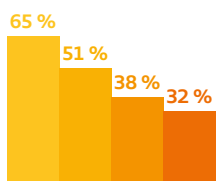
HRI
+1.2

HRI
-0.9



JAPAN

The Japanese are cautious about autonomous driving compared with other countries. They tend to believe it will improve road safety and access to mobility. Their expectations regarding an improvement in status are comparatively low. Before the Japanese get into a self-driving car, the technology must first be proven safe through extensive testing.



ITALY

Italians primarily expect autonomous driving to bring easier access to mobility and increased convenience. For them, self-driving cars represent an increase in status more often than in other countries. The lack of a legal framework is viewed with above-average criticism by Italians. Proof of the technology's safety, such as independent seals of approval, could boost confidence among the Italians.



03

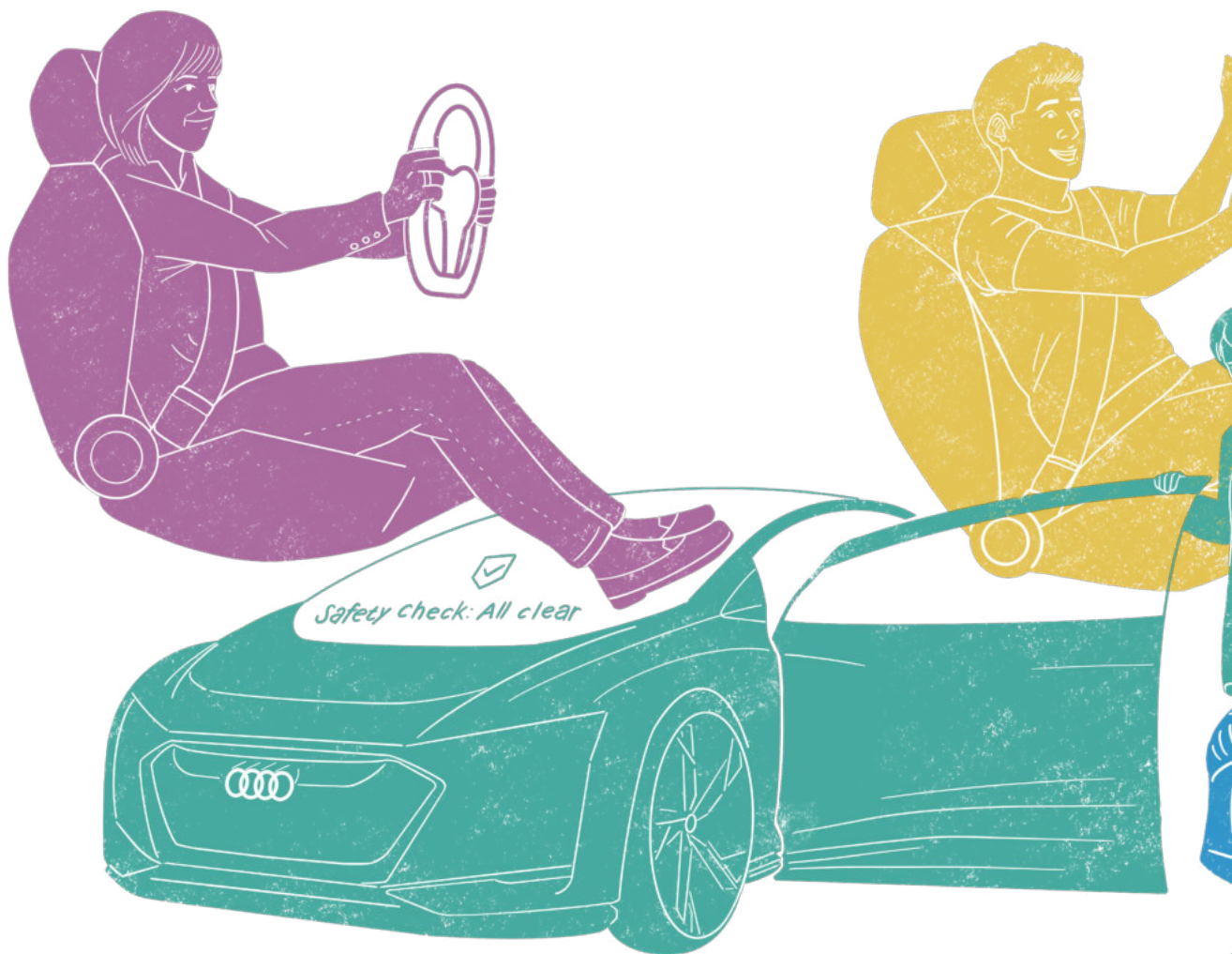
**USER
TYPOLOGY**

AUTONOMOUS DRIVING IN THE CONTEXT OF PEOPLE'S LIVES

Five user types and their hopes, concerns and demands in relation to autonomous driving

From rejection to enthusiasm: across national borders, diverse patterns in attitudes to autonomous driving can be identified. To understand this better, it is important to view them in the context of the different living environments of the people concerned.

On the basis of a statistical analysis, the 21,000 respondents from all nine countries were clustered into user types. The most revealing criteria for acceptance proved to be interest, emotions, willingness to use, willingness to pay and the perceived benefit of autonomous driving.



To these criteria were then added personal characteristics of the respondents. These include socio-demographic characteristics, values and lifestyle and the current mobility behavior of the respondents.

Five user types for autonomous driving result from this: the suspicious driver, the safety-oriented reluctant, the open-minded co-pilot, the status-oriented trendsetter and the tech-savvy passenger.



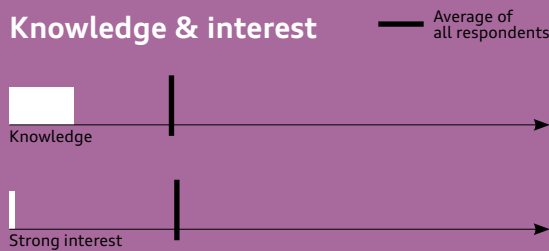
THE SUSPICIOUS DRIVER

»I want to keep control of my car myself. I simply don't trust the technology – autonomous vehicles only work in theory.«

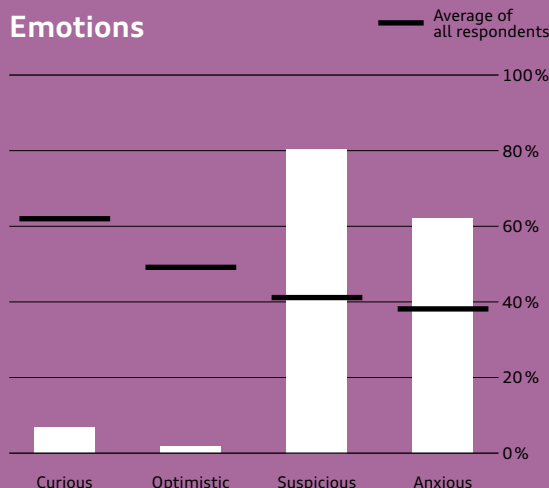
Scenarios for use



Knowledge & interest



Emotions



At a glance

Interest in autonomous driving? Not in the case of the suspicious driver. People of this type prefer to take the wheel themselves. As fans of safety, they are fundamentally critical of the unknown – and this also applies to new technologies. In a nutshell: they prefer the status quo. Suspicious drivers have no emotional attachment to the car. For them a car is an item of use for handling everyday tasks. They do not need the latest technology for this. They will not turn their attention to self-driving cars until a large majority of people are already driving autonomously on the roads. 14 percent of all respondents fall into this category. This type is most often encountered in Germany (26 percent), followed by the USA (23 percent) and France (21 percent). The human readiness index (HRI) of the suspicious driver is -8.4.

Life and values

Suspicious drivers are over 50 years old on average and female (57 percent). They also have a low level of education and income. As supporters of the tried-and-tested, they do not get much involved with new developments and prefer entirely manual driving. New technologies often make them feel unsure. This is also revealed by their traditional and safety-oriented values. They give priority to the status quo – changes are accepted when they cannot be avoided.



Current mobility behavior

For suspicious drivers, having their own car is above all a means to an end – it is necessary in everyday life, but not a status symbol. They use the car for classic reasons: for a journey to work, to buy things of daily use, or to transport family members. Low fuel consumption and high reliability are particularly important to them. To get from A to B, they do not need any new technologies – these are seen as unnecessary extras. They also know almost nothing about the driver assistance systems that are available today. Even if they know them, they do not use them.

»I can't trust the technology until I know that it has been thoroughly tested.«

Attitude to autonomous driving and willingness to use it

Suspicious drivers take a critical attitude to autonomous driving. They know little about the technology and have little interest in changing anything. They would not get into a self-driving car until the majority of people are already using the new technology and it has proved to be safe – for example through extensive test results or reports of success in real-life operation. One reason for mistrust is the feared lack of control when the steering wheel is handed over to a machine. In consequence, they see no significant advantage in autonomous driving apart from easier access to mobility. Thus they also can hardly imagine using the newly gained time in the car for other things – if at all, then for listening to music or reading books. The HRI, too, demonstrates this. With a value of -8.4, the suspicious driver has the lowest HRI in the user typology.



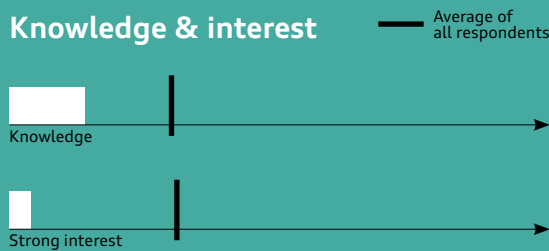
THE SAFETY-ORIENTED RELUCTANT

»Autonomous cars should first be tested for years before they are approved.«

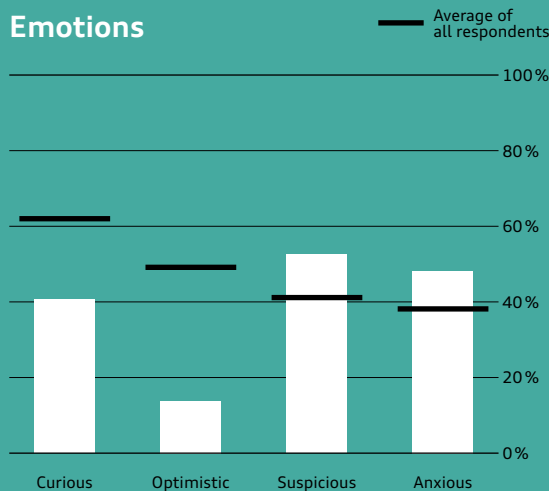
Scenarios for use



Knowledge & interest



Emotions

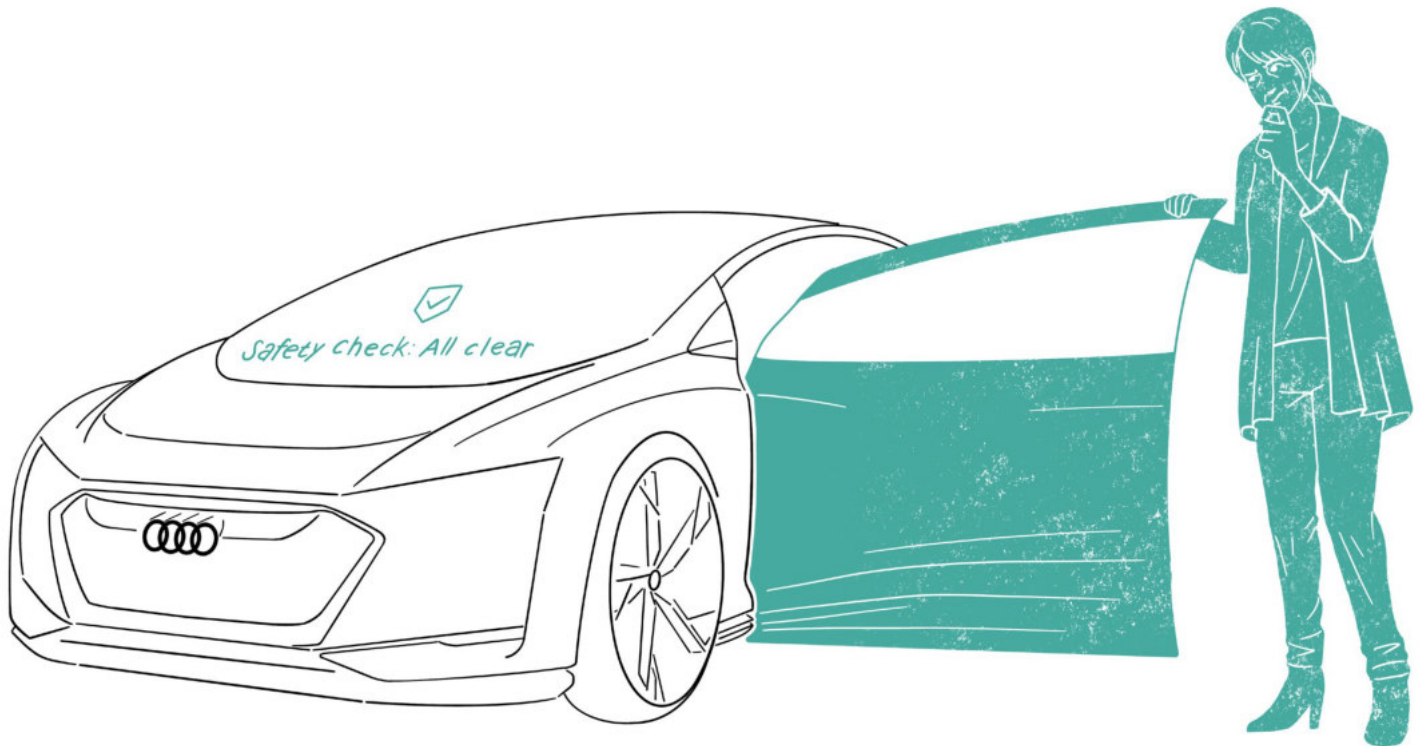


At a glance

Safety-oriented reluctants tend to be reserved about autonomous driving. In general, they attach little importance to cars. They have low interest in autonomous driving and do not know much about it. Nevertheless, they do have some curiosity: for example, they can imagine the autonomous car taking control in congestion on a highway, so long as they can intervene at any time, or for parking. Safety is the key point for them, and they are less interested in looking for adventure. This type, at 24 percent of respondents, is the second-largest group in the typology. The safety-oriented reluctant is found most often in Japan (31 percent), France (30 percent) and the United Kingdom (28 percent). The human readiness index (HRI) of this type is -2.8.

Life and values

Safety-oriented reluctants are spread across all age groups. Generation Z (up to 24 years old) is over-represented in this group, however. People of this type are mostly female (57 percent), and their levels of education and employment are slightly below average, as is their income. A good balance is important to them: as members of the middle class, they seek a path between traditional and modern values. Although safety-oriented reluctants want to keep up with new developments, they do not wish to be in the vanguard. They want to secure what has already been attained – and therefore are less interested in the thrill of adventure than in the security provided by family and friends.



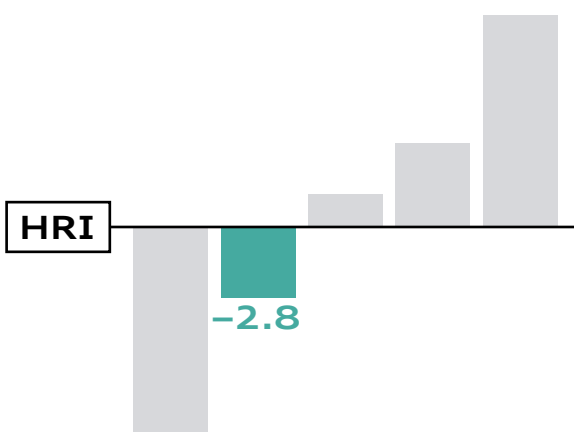
»It will take more research before this technology is truly mature and evidence that it does not fail in extreme situations.«

Current mobility behavior

For safety-oriented reluctants there are more important things in life than cars. They mainly use cars for everyday needs. They want their own car to be economical with fuel, so as to keep down costs. They want comfort and convenience – but not at any price. The pleasure of driving is of secondary importance to them. Safety-oriented reluctants have either heard nothing about driver assistance systems or at least have not used them.

Attitude to autonomous driving and willingness to use it

Autonomous driving is of relatively little interest to safety-oriented reluctants, and their level of knowledge about it is low, too. Neither their positive nor their negative emotions towards self-driving cars are especially strong: they are not very optimistic, slightly curious and perceive several critical aspects. They are concerned about the loss of control and technically unavoidable residual risks, followed by lack of legislation. They see potential mainly in that autonomous driving gives access to mobility for more people who were unable or unwilling to drive a car before. However, they do not expect greater safety and a specific individual benefit. Safety-oriented reluctants can imagine autonomous driving in congested highway traffic, but always with the option of intervening – or for parking. They would spend the time gained in the car mainly with entertainment, looking out of the window or keeping up social contacts. Safety-oriented reluctants would try out autonomous driving primarily when others have gained experience with it first. Their reserved attitude is reflected in the HRI, with a score of -2.8.



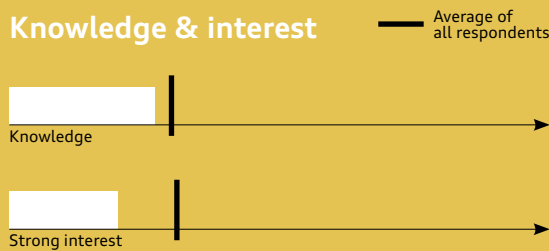
THE OPEN-MINDED CO-PILOT

»I would like more tests and measures in the fields of politics, business and science, for example lanes for autonomous vehicles. Because autonomous driving can provide great benefits in principle.«

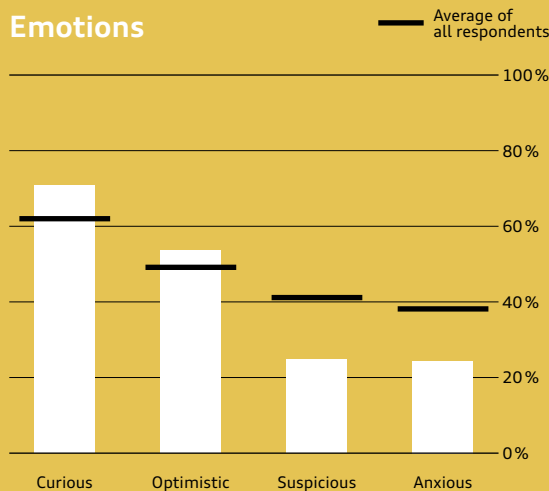
Scenarios for use



Knowledge & interest



Emotions



At a glance

Open-minded co-pilots basically regard autonomous driving in a positive light. However, they do not see things in black and white. They expect greater safety from autonomously driving cars, but wish to be able to take control at all times. Most of all they would like to have their own car for autonomous driving. Here it is important to them that self-driving cars have previously been tested in real situations on public roads, ideally in a variety of different weather and road conditions. 30 percent of respondents are in the open-minded co-pilot category. They are the largest user group in the typology, especially well represented in Japan (35 percent), Italy (33 percent) and Spain (32 percent). The human readiness index (HRI) of the open-minded co-pilot is +1.3.

Life and values

Open-minded co-pilots are represented equally in all age groups and in the split between female (49 percent) and male (51 percent) respondents. Their income is average, with a slightly above-average level of education. Co-pilots are happy for daily life to be eventful. They like fun, action and entertainment. They see themselves as unconventional or even rebellious, and like to be spontaneous. The open-minded type often looks for something new and likes to try it out – for example new technologies such as autonomous driving.



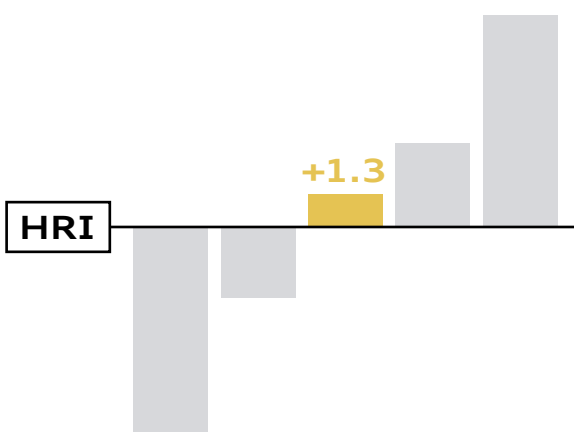
»Although the technology is still being developed, I would like to try out self-driving cars. Nevertheless, I definitely want to be able to intervene at all times.«

Attitude to autonomous driving and willingness to use it

Current mobility behavior

The journey to work, shopping and other errands: for open-minded co-pilots, the car is a functional item that provides the necessary flexibility. They do not drive very much and rarely use driver assistance systems. From a car they expect above all a high degree of safety, low fuel consumption and convenience.

Open-minded co-pilots tend to be curious and optimistic in relation to autonomous driving. Their level of interest in trying out the new technology is high. From autonomous driving they hope to gain easier access to mobility for all, greater convenience, a better environmental footprint, and greater safety on the roads. They are also convinced that there will be more time for leisure and social contacts in the autonomous car. Open-minded co-pilots manifest low levels of distrust and anxiety towards autonomous cars. The loss of control and unavoidable residual risks are the most likely cause of concern to them. Here they hope that automobile makers will make further progress through research in the fields of artificial intelligence and information technology. They would consider leaving the steering to the car in a wide variety of situations, from congestion to country roads. All of this is, however, subject to one condition: it must always be possible to operate the car manually when required. For all their enthusiasm for innovation – this safety back-up is needed. The relatively open attitude of this group is expressed in an HRI value of +1.3.



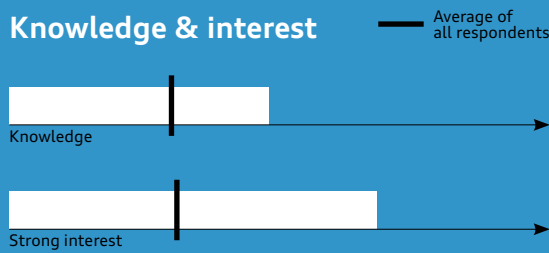
THE STATUS-ORIENTED TRENDSETTER

»I would like to have more autonomous cars in my immediate surroundings. I can imagine that reservations still exist, but if the big car manufacturers take care of the technology, then I'm sure that it will be good.«

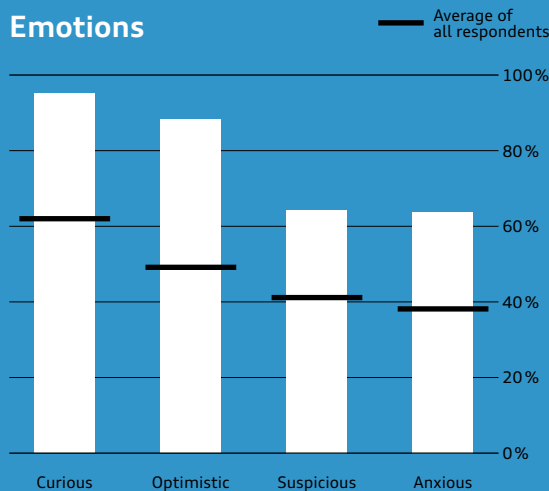
Scenarios for use



Knowledge & interest



Emotions



At a glance

Life can always get even better: in search of excitement and adventure, for status-oriented trendsetters new technologies are just the thing. They are correspondingly open to the idea of trying out autonomous driving. More than others, status-oriented trendsetters believe that it will improve their image. Nevertheless, they take a thoughtful look at the technology: they regard safety aspects more critically than many others. They would also like to know more about the systems and algorithms. Ultimately they are convinced that the technology will win out if reputable manufacturers take care of developing it. In total 16 percent of respondents are status-oriented trendsetters. This type of person is found most frequently in South Korea (28 percent) and the USA (22 percent). The status-oriented trendsetter has a human readiness index (HRI) of +3.3.

Life and values

Young, male, with a good income – that is the profile of status-oriented trendsetters. They have a relatively high level of education, and are communicative and open. They live a unique and exclusive life. Fun and success are especially important. Status-oriented trendsetters look for ways to get the best for themselves. In their search for adventure, new technologies that promise exceptional experiences are exactly what they want. They believe that new technologies play a part in determining the fitness of societies for the future.



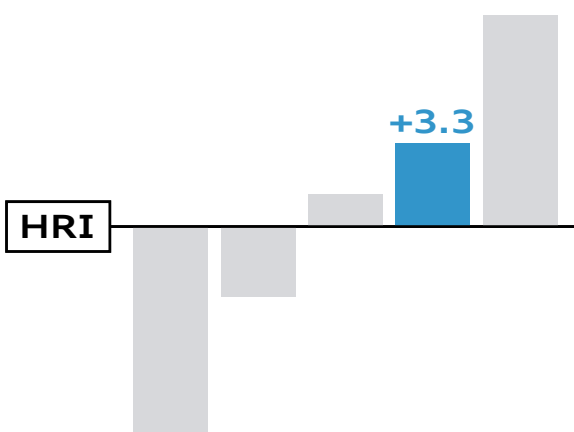
»I have great curiosity about the new technology, especially when vehicles have higher levels of automation.«

Current mobility behavior

For this user type, who is greatly interested in status, cars stand for luxury and a successful life. For them, the car also provides a high degree of everyday flexibility. They also want their cars to be above all safe and environmentally friendly. Trendsetters often drive their cars in cities, to go to work or to carry out everyday activities. They already use driver assistance systems.

Attitude to autonomous driving and willingness to use it

This user type knows considerably more than others about autonomous driving. Status-oriented trendsetters are optimistic and curious about the technology, but are also aware of critical aspects. Their trust would be strengthened if autonomous cars could be seen on the road in their immediate surroundings. Tests by independent institutions are also essential for them. They also expect that autonomous cars will have a positive effect on their own image and on the perception of themselves as pioneers. Whether on a highway or a country road, or in autonomous parking: trendsetters are open towards autonomous driving in all scenarios of use. They are open to autonomous driving in the form of car-sharing and ride-sharing. Trendsetters would use the time gained through self-driving cars mainly for entertainment and social contacts. They can also imagine using the time in the self-driving car for education. The HRI of +3.3 reflects a favorable attitude to autonomous driving.



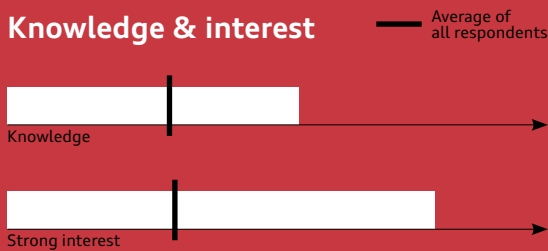
THE TECH-SAVVY PASSENGER

»I can hardly wait to see the introduction of autonomous driving across the board so that I can use it myself at last. The technology provides enormous advantages – that’s why we have to keep up with the times and trust it.«

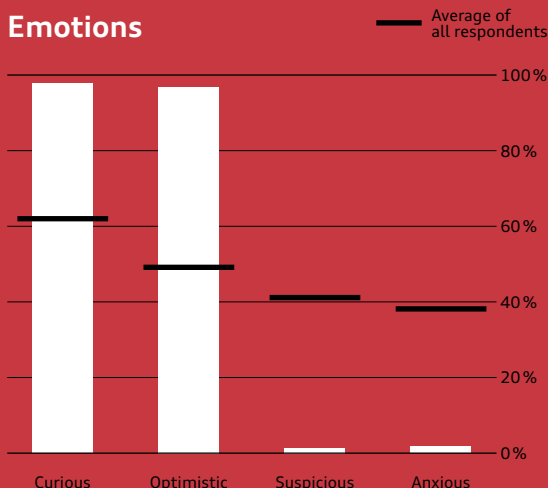
Scenarios for use



Knowledge & interest



Emotions

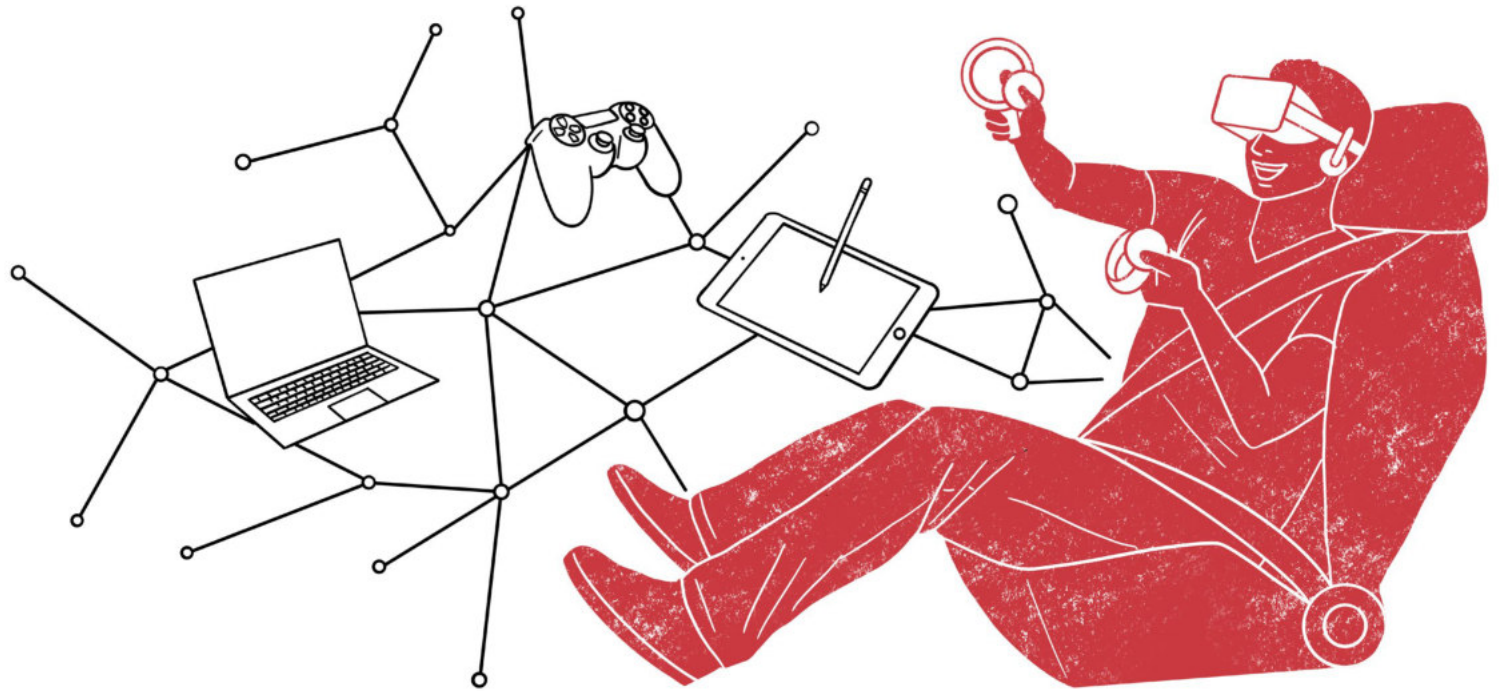


At a glance

Tech-savvy passengers would ideally like to get aboard self-driving cars today. For them it is only a question of time before autonomous driving becomes reality. Openness and flexibility play a key role in their lives. They are the only user type for whom loss of control is not the principal concern. Their reservations are more about issues such as the lack of a legal framework. They are not afraid of being merely a passenger and hope to gain easier access to mobility, greater convenience and above all greater safety on the road. As technology fans, these passengers are highly aware of environmental issues. In total, 16 percent of respondents are tech-savvy passengers. They are found most often in China (46 percent). The human readiness index (HRI) of the tech-savvy passenger is +8.4.

Life and values

Generation Z of the 18 to 24-year-olds is especially well represented in the category of the tech-savvy passenger. Men are also over-represented (61 percent). Especially in their level of education and income, tech-savvy passengers are above the average. They always welcome new ideas and innovations. They want to be in the vanguard of society. For them this also involves critical questioning of new developments and looking at them in the context of society as a whole. For example, tech-savvy passengers call for new supervisory authorities for the quality control of self-driving cars. They also see obligations for politicians, who should first use the technology themselves in order to build trust.



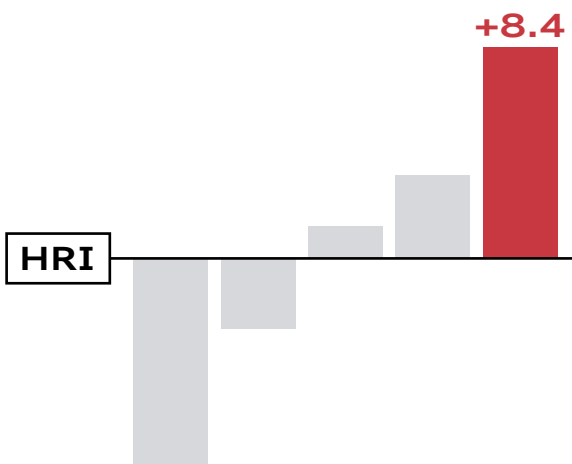
»Autonomous driving is the future, which cannot arrive soon enough!«

Current mobility behavior

Cars mean above all flexibility for tech-savvy passengers. They travel primarily in the city and like to drive – as long as this is environmentally responsible. Sustainability is especially important to them. In accordance with this, low fuel consumption is important to them, followed by a high level of safety and great convenience. They already use driver assistance systems. Tech-savvy passengers also use bicycles and public transport systems alongside cars.

Attitude to autonomous driving and willingness to use it

Tech-savvy passengers are highly interested in autonomous driving and know more about it than others. They have a favorable view of the technology and specific expectations. They regard autonomous driving with curiosity and optimism to a degree of almost 100 percent. In their opinion, a reserved attitude is an obstacle to developing innovations. They also propose improving the data security of autonomous cars through smart systems. Whether on the highway or in the city, in their own car, a taxi or in car-sharing and ride-sharing – they feel at ease as passengers. In the newly gained time they want to use entertainment services, enjoy themselves with friends, or deal with organizational matters. So that autonomous cars get on the road quickly, they call for comprehensive support for them – for example an initial operation with full coverage for local transportation. Thorough tests, transparent technology and new, independent institutions that supervise safety and quality should ensure trust. The HRI of +8.4 shows the most positive attitude to autonomous driving in comparison of the types.







04

CONCLUSION

CONCLUSION

The results of the study help to conduct a differentiated public debate about how the technology can be introduced for the benefit of individuals and society.

The respondents view autonomous driving with cautious optimism: 82 percent are interested and 62 percent are curious. They believe that the technology holds potential for individuals and society – from easier access to mobility and greater convenience to more safety. Yet clear reservations are also evident: 38 percent of respondents are anxious, expressing concerns relating primarily to loss of control, unavoidable residual risks and the lack of a legal framework. The level of knowledge about autonomous driving seems to be low: only eight percent say that they are able to explain the subject.

The human readiness index shows that there are differences in attitudes to autonomous driving according to sociodemographic characteristics: Generation Z, high earners, and well-educated persons are those who most welcome autonomous driving. Country-specific differences are evident, and can be viewed against the background of the economic, political and societal characteristics of the countries in question.

The Chinese are euphoric about autonomous driving. This is consistent with the fundamental openness of China to technological innovations. Many Chinese have achieved their economic status through years and years of support for and implementation of innovations and new technologies. South Koreans, too, lie above the average in their positive attitude to autonomous driving. This is consistent with their high acceptance of IT and innovative technologies. The Japanese take a more conservative approach to innovations and new technologies, especially when they are associated with risks. With regard to the ageing of their population, Japanese hope above all that autonomous driving will provide easier access to mobility for people who cannot or do not want to drive a car.

Amongst the European countries that were examined, differences are apparent that can also be understood in the context of the cultures of those countries. The French, British and



Germans are generally seen as reserved – and also take this position in respect of autonomous driving. The Spanish and Italians are more welcoming of innovation and more open to what is new. This also applies to autonomous driving.

In the USA, the level of openness to innovations is generally higher than in Europe, corresponding to the traditional American pioneering spirit. In relation to autonomous driving, Americans are more critical, however, as they have greater safety concerns. As the results of the study suggest, the attention devoted in the media to accidents with automated driving may play a part here.

Even greater differences become apparent when examining attitudes to autonomous driving across national borders in the context of the user typology. People's needs are shaped in the context of the worlds that they inhabit. It is therefore important not to view attitudes to autonomous driving in isolation from their living environment.



The study identifies key areas for action that help to determine the social acceptance of autonomous driving:

Enhancing knowledge

The results show that there is room for improvement in the level of knowledge about autonomous driving. There is potential to increase knowledge of technical aspects and of the social benefits and limits of the technology. The aim is to establish an appropriate level of expectations about the opportunities and limits of the technology in society.

Addressing needs

The user typology draws attention to differences in attitudes to autonomous driving according to the context of people's lives. Varying needs should be met with specific offers of autonomous driving. These offers can range from information to experience of technology in diverse use cases.

Working cooperatively

Certified safety, a legal framework, reliable technologies: the study shows which measures would strengthen trust in autonomous driving. It is clear that, in order to address people's hopes and demands, interdisciplinary cooperation between business, science, politics and other societal stakeholders is needed.



STAKEHOLDER RELATIONS
good relations to regulators

processes that generated the thinking about the problem
trade-offs are getting anticipated

LEGAL
these users a step ahead of the legal system
liability situation shifted

OR MANUFACTURERS LEAD TO ACCEPT LEGAL ISSUES/CONSEQUENCES

DESIGN PROCESS
design decisions that engaged with different perspectives

design of features that anticipate people's concerns

IMPROVE EXPERIENCE
playground to explore alternatives during customer's driving
possibility to engage users early with iterative debate

PEOPLE HAVE BEEN CONVINCED WITH DESIGN

INITIATIVE *&AUDI*



Artificial intelligence will fundamentally change our lives, our mobility and our world of work. The mission of the initiative *&Audi* is to contribute to the responsible use of new technological possibilities. For this purpose, since 2015 Audi has brought together international opinion leaders and movers in the field of AI from business, science and politics. This interdisciplinary network discusses how AI can be applied for the benefit of the individual and society, thus raising awareness that our future can and should be actively shaped in the age of AI.

The initiative *&Audi* focuses on two topics in which artificial intelligence plays a key role and where Audi can contribute its expertise to the dialogue: autonomous driving and the future of the world of work.

**Publisher**

AUDI AG
Communication Trends
85045 Ingolstadt

Press contact

Maj-Britt Peters, Audi Communication Trends
maj-britt.peters@audi.de, +49 841 89 718226

Press kit

www.audi-mediacycenter.com/en/pulse-of-autonomous-driving

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