2018

Study Report

Enabling
the Value of Time

Implications for the interior design of
autonomous vehicles

A study in cooperation with:

Fraunhofer
IAO

Cordence
WORLDWIDE

HORVÁTH & PARTNERS
MANAGEMENT CONSULTANTS

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Foreword

Dear Readers,

Autonomous driving will change the automotive industry and mobility as we know it. New transport systems and transport options are being developed, which – thanks to intelligent control and complementary sharing concepts – can decrease the volume of traffic. However, traveling alone in one's own vehicle will also fundamentally change as a result of increasing automation. The idea that the time spent in a vehicle can be used for a range of activities is causing us to reevaluate what travel time means. Little by little, it is easy to see the benefits that the vision of a self-driving car offers with regard to working persons, people who require assistance and children without a driver's license: Mobility on demand and the opportunity to make efficient use of travel time by working or shopping, or by satisfying basic needs such as sleeping, talking, eating and drinking.

With this study, our goal was to determine and record the attitudes and requirements of future users of autonomous vehicles with regard to using travel time for more than just traveling. Central aspects during the process included user requirements regarding the design of vehicle interiors and the willingness to pay for individual equipment packages. Compared to the 2016 study – "The Value of Time – Potential for User-Centered Services Offered by Autonomous Driving" – the scope of this study was extended to include five countries and a total of 2,500 participants. The research parameters of this study enable the responses to be evaluated in accordance with demographic characteristics such as gender, distribution of age and income, single-person and multi-person households, urban populations and rural populations, or daily travel time.

The survey was carried out in fall 2017 by means of an online questionnaire. In addition to the general level of acceptance for activities during a journey, we analyzed the use and relevance of associated functions and equipment. The survey follows the premise that passengers in autonomous vehicles no longer have to fulfill the requirements of driving. The willingness of participants to use special "sharing vehicles" – referred to as "themed cabs" – was also investigated. Themed cabs are self-driving cars that can be ordered by users on demand as sharing vehicles for defined purposes.

We conducted the study in collaboration with the Fraunhofer Institute for Industrial Engineering IAO and the partners of the Cordence Worldwide alliance.

I hope you enjoy reading our findings.

Ralf Gaydoul
Partner and Head of
Competence Center Automotive
Horváth & Partners

Management summary

The previous study – "The Value of Time – Potential for User-Centered Services Offered by Autonomous Driving" in 2016 – was conducted with the aim of determining and recording users' interests regarding ancillary activities during automated driving. This process involved mapping out a range of different activities that study participants were interested in doing while undertaking a journey in an autonomous vehicle. The top five usage types

- Sleeping and relaxing

- Working and being productive

- Eating and drinking

- Entertainment

- Beauty, wellness and fitness

were adopted for the most recent study in order to determine the functional requirements regarding the layout and design of the interior of an autonomous vehicle from the perspective of users. Study participants were asked to evaluate predetermined equipment packages for the five usage types and to specify how much they would be willing to pay for these.

The user survey the study is based on was carried out as an online questionnaire in five countries: China, the USA, Japan, Germany and France. A total of 2500 participants were selected such that the study covered a representative distribution of demographic characteristics such as age and income distribution, place of residence and household size.

The first part of the survey involved investigating a number of questions, including the following:

- Which usage types do the study participants opt for in an autonomously driving vehicle?

- What distinctions do study participants draw in terms of evaluating the usage types for different journey purposes or depending on the number of passengers?

- What equipment options do the study participants expect to complement the preferred usage types and how much are they willing to pay for such options?

- How would the respondents configure an autonomous vehicle of their choice?

The second part of the study involved investigating participants' willingness to use autonomous themed cabs. Examples of these include "relaxation vehicles", "wellness vehicles" and "restaurant vehicles" – highly specialized "sharing vehicles" used on demand.

In general, the results of the study indicate considerable customer interest regarding the use of autonomous vehicles across all countries. Almost 50 percent of all respondents are looking forward to autonomous driving. The more time participants spend in a vehicle, the higher the level of acceptance for the concept. Particular groups of participants expressed particularly strong interest and represent important target groups from the perspective of vehicle manufacturers and service providers. These groups include, for example, people living in big cities, families, younger people with a higher income or public transport users. When comparing countries, China was identified as having a very high potential.

The usage type "sleeping and relaxing" is most accepted across all the countries included in the study compared to the other four usage types. Furthermore, equipment options associated with enhancing comfort – such as a comfortable lying position, an external screen or a quiet journey – are valued the most. The usage type "working and being productive" is of particular interest for long business journeys and the daily commute.

The authors classify the indicated willingness to pay for individual equipment options as rather low. In addition to autonomous driving functionality, the respondents are only willing to pay several hundred euros for each equipment option, such as a comfortable lying position. It is not surprising that study participants with a higher income are willing to pay higher amounts.

Aside from the acceptance level for ancillary activities in one's own vehicle, the concept of highly specialized sharing vehicles is very popular: 37 percent of the study participants really believe in and back the concept. The favorites in this regard are the "relaxation vehicle" and "sightseeing vehicle".

With regard to country-specific differences, it is important to note the following results:

- China is the country with the highest level of willingness to use autonomous mobility solutions – by a clear margin

    - Highest willingness to pay for automated driving functionality and individual equipment options

    - Highest affinity for innovation, digital services and products such as virtual assistants

- When compared to other countries, Germany has the lowest acceptance values for the respective usage types. The critical evaluation of the safety risk seems to be the predominant discouraging factor for German participants

- U.S. study participants exhibit a disproportionally strong aversion to the idea of no longer having one's own vehicle

- Study participants from France exhibit a high level of acceptance for sharing concepts

- Japanese study participants rate a variety of equipment options as far less appealing when compared to other countries

Background

Automated driving functions – the status quo

The self-driving car and its future are very prominent in the media and are pushing other innovations such as alternative drive and mobility concepts into the background – these are the findings of an analysis of international publications recently carried out by Horváth & Partners.[1] The subject is attracting worldwide attention as it is viewed as a (partial) solution for problems such as the increasing volume of traffic, harmful emissions and road safety. Furthermore, people are increasingly appreciating the benefits that self-driving vehicles can offer for working persons as well as people who have not driven a vehicle before, such as people who require assistance and even children. Equally important are the possible applications in the field of transport logistics – especially in urban areas. It is in these areas that emission-free and autonomous vehicles can help to significantly reduce noise pollution and pollutants as well as improve the efficiency of "last-mile delivery".

In terms of solutions available on the market, tangible concept studies are coming to the forefront of public attention. The "robo taxi" – "Sedric" – developed by Volkswagen or the "Audi Aicon" and "Smart Vision EQ fortwo" studies presented at the 67th International Motor Show IAA in Frankfurt in 2017 are examples of this. The first fully automated taxis are already being trialed in Singapore and the USA. Similar projects are also being undertaken in Germany, such as the autonomously driving shuttle service being tested by German railway company, Deutsche Bahn, in a rural region of Bavaria. Other fleet tests, such as BVG tests (Berliner Verkehrsgesellschaft – Berlin public transport company) on the grounds of the Charité hospital – will take place soon.

> "Those who just consider the technology have not yet recognized how autonomous driving will change our society."[2]

Dr. Dieter Zetsche, Chairman of the Board of Management of Daimler AG

Looking back at the "The Value of Time" (2016) study

If technology can take over the task of driving, people will gain time, which they can then use for a variety of purposes. New business areas open up because people are willing to pay for value-added services in autonomous vehicles. This was the key finding of the first study, "The Value of Time –

Potential for User-Centered Services Offered by Autonomous Driving", published by Horváth & Partners and the Fraunhofer Institute for Industrial Engineering IAO in 2016.

The study centers around a user survey carried out among 1,500 participants from Germany, Japan and California (USA). Possible concepts for activities during autonomous driving were considered on the basis of two different scenarios – "highly automated vehicle" ("feet off") and "the driverless capsule" ("brain off").[3] The graphic below summarizes the results of the previous study.

Three-quarters of motorists surveyed are prepared to pay for activities during autonomous driving

Seventy-five percent (75%) of users are prepared to pay for value-added services	Users are most willing to pay for services that meet their needs regarding communication, productivity and basic requirements	The countries involved in the study differ greatly in terms of relevance and ranking of service groups
Users from California (USA) exhibit the greatest willingness to pay for services	Even in the case of short travel times per day, end customers are prepared to pay for value-added services	Younger users are prepared to pay more than their older counterparts
Willingness to pay is largely independent of the vehicle segment	The willingness to pay a premium for an automated vehicle is significant across all vehicle segments – it is highest in the small car segment	The "Value of Time" varies according to country, age, income, and vehicle segment

Fig. 1:   Results of the "The Value of Time" (2016) study

Equipping the vehicles of the future

Positive feedback and the high level of interest from a very diverse range of market participants regarding the study results prompted collaboration partners, Horváth & Partners and the Fraunhofer Institute IAO, to continue the "The Value of Time" study. The successor study – "Enabling the Value of Time" – deals with the scenario of autonomously driving automobiles. Many concept studies regarding autonomous vehicles already try to provide an insight into the vehicle interiors of the future. Features such as large screens or groups of seats facing one another are often considered. However – to what extent do these equipment features actually reflect customers' personal tastes? And to what extent can premiums be charged for such equipment packages?

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[1] Horváth & Partners (2017): New Business Models for the Automotive Industry
[2] Heise Online (2015): Mobiler Lebensraum (only available in German)

[3] Horváth & Partners, Fraunhofer IAO (2016): The Value of Time – Potential for User-Centered Services Offered by Autonomous Driving

The relevant markets

In addition to the markets considered in the first part of the study – Germany, Japan and the USA (California) – France and China were also taken into account. The American market now takes into account the whole of the USA, as opposed to just California.

The most important characteristics of the five target markets, such as the significance of the automotive industry and the attitudes of end customers towards autonomous driving, are summarized below.

USA

With 17.5 million passenger car registrations in 2016, the USA is the second largest sales market in the world after China.[4] U.S. companies such as Tesla, Google, Uber and Lyft are revolutionizing the automotive sector. Nevertheless, the assessment of the U.S. citizens surveyed is less positive than that of citizens in other markets. Only 61 percent of those surveyed expect automated driving functions to become a reality.[5]

Regulations in the USA concerning autonomous driving are less restrictive than those in Germany. Road traffic law falls under the jurisdiction of the various states, resulting in regional differences.[4] At present, autonomous driving is already legalized in several US states.

France

With 2.0 million passenger car registrations in 2016, the French automotive market is the smallest sales market in this study.[4] Nevertheless, it represents an interesting perspective with globally active automotive manufacturers such as Renault and the PSA Group. Moreover, the French citizens surveyed are an interesting comparison group with regard to the German participants due to their regional proximity and cultural similarities.

Support for autonomous driving amongst French users is similar to that of the German participants. 67 percent of those surveyed see autonomous driving as a realistic scenario.[5]

Germany

With 3.4 million passenger cars, the German automotive market is the fourth biggest sales market in the world – based on passenger car registrations.[5] In addition, Germany takes the world's leading position in automotive production and innovative capability thanks to major OEMs such as Volkswagen, Daimler and BMW, as well as leading automotive suppliers such as Bosch, Continental and ZF.

The technology involved in autonomous driving is increasingly attracting the attention of the German public. 67 percent of those questioned as part of a Commerz-Finanz survey believe that the self-driving car will become a reality.[6] 13 percent believe that the technology involved in autonomous driving will be the trending topic of the automotive sector over the next five years.[7]

The People's Republic of China

With 23.7 million passenger car registrations in 2016, the Chinese automotive market is currently the largest single market in the world. Based on growth of 18 percent in 2016, it is to be expected that this development will become even more acute despite a decrease in growth.[4] With the production of 28.1 million vehicles, China is also the country that manufactures the most vehicles in the world.[8]

The Chinese market is an ideal market to be examined as part of this study due in particular to the very high level of acceptance regarding autonomous driving. According to a survey, 92 percent of Chinese respondents believe that self-driving cars will become a reality.[5]

Japan

With 4.2 million passenger car registrations in 2016, Japan is one of the three biggest sales markets in the world.[4] Japanese OEMs such as Toyota, Nissan and Honda are extremely well-known around the world and drive forward innovative vehicle developments.

Support for autonomous driving is higher in Japan than in the European markets investigated as part of this study, which was already evident in the previous study.[9] In this regard, it was ascertained that the Japanese participants have the highest acceptance levels with regard to paying for additional services.

[4] Dr. Wolfers, Benedict (2017): Selbstfahrende Autos: Ist das erlaubt? (In: RAW, March 2017, only available in German)
[5] VDA (Verband der Automobilindustrie – German Association of the Automotive Industry) (2017)
[6] Commerz Finanz (2016): 2016 Automobile Barometer – International

[7] Mobile.de (2016): E-Autos, autonomes Fahren & Co.: Was wollen die Deutschen wirklich? (only available in German)
[8] OICA (2017): 2016 Production Statistics
[9] Horváth & Partners, Fraunhofer IAO (2016): The Value of Time

The framework of the study and overview of results

Demographics of the sample

As part of this survey, 500 users from the five countries mentioned above – the USA, France, Germany, China and Japan – were surveyed. The average age of the respondents is 46.3 years. Figure 2 represents the apportionment of the study participants into six different age groups.

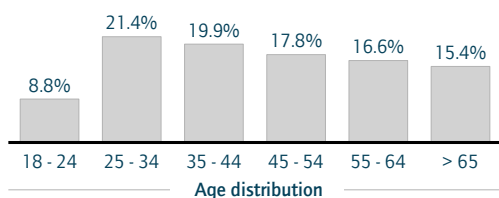**25- to 34-year-olds represent the biggest group in the sample**

Fig. 2:   Age distribution of study participants

Figure 3 gives an overview of where the study participants live. While there is a similar distribution structure in France, Germany, Japan and the USA, progressing urbanization is particularly evident in China, where 98.4 percent of surveyed participants live in urban areas.

Taking all of the countries into account, the majority of study participants live in an urban area
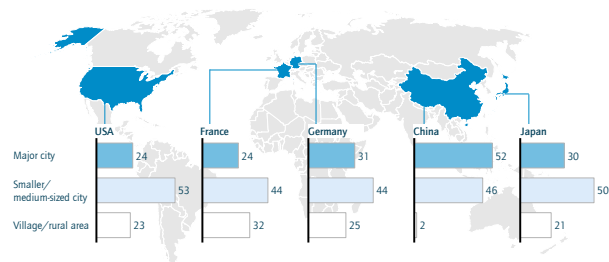

Fig. 3:   Distribution of the urban and rural populations of the markets examined in %

Slightly more than 80 percent of the study participants state that they use a car more frequently than public transport and almost 90 percent of the participants have their own car.

Structure of the study and premises

The study is based on the scenario whereby vehicles can drive autonomously. The authors of the study are acting on the assumption that privately used and publicly shared autonomous vehicles will coexist in the future. The first part of the survey addresses the usage types and the associated equipment options for privately used vehicles as this concept is considerably more familiar for most of the respondents. The second part of the survey focuses on the concept of shared mobility with autonomous themed cabs[10].

For the purposes of evaluating a privately used autonomous vehicle, it was assumed that vehicles are basically equipped and are thereby more or less the same as mid-range cars available on the market in terms of equipment. Basic equipment includes:

- Seats
- 10-Inch display for showing multimedia content and journey information
- Navigation system
- Input/operating device for multimedia/navigation system
- Internet and WLAN hotspot
- Air-conditioning system
- Speakers for multimedia and navigation services

[10] Specially equipped sharing vehicles

Overview of results

Limited willingness to pay for automated driving functions

As in the first "The Value of Time" study, drivers were asked about their willingness to pay for automated driving functions. The result: 30 percent of all respondents would pay more than EUR 1,500 for these functions; nevertheless, almost 50 percent would still pay more than EUR 500.

"Sleeping and relaxing" is the most relevant usage type

Five different usage types that can be carried out while traveling in an autonomous vehicle were used for evaluation:

- **"Sleeping and relaxing"**: Covers any type of rest – from switching off in a seated position to falling fast asleep in a lying position

- **"Working and being productive"**: Covers private and occupational office work, e.g., writing documents, deadline planning or activities related to continuing education and training, such as a language course

- **"Eating and drinking"**: Covers the consumption of small snacks and beverages as well as complete meals that can be cooled or warmed up in the vehicle

- **"Entertainment"**: Covers a range of activities, including watching television, playing video games, listening to music, reading books or playing board games

- **"Beauty, wellness and fitness"**: Covers activities such as personal care or applying make-up, as well as activities related to wellness and fitness such as fitness exercises

On the basis of the "Technology Acceptance Model"[11], the acceptance level for a usage type was determined via the level of agreement with the following three statements:

- I feel enthusiastic about …
- I find … useful.
- I would use … regularly.

All of the statements are to be evaluated on a five-point scale from "do not agree" (-2) to "agree" (+2). In line with the definition, a usage type is deemed to be accepted when the average agreement value of the respondents across all three statements is clearly positive (≥ 1).

The respective acceptance values are represented as percentages per usage type in Figure 4.

Usage type "sleeping and relaxing" interests the participants the most; while "beauty, wellness and fitness" interests the participants the least

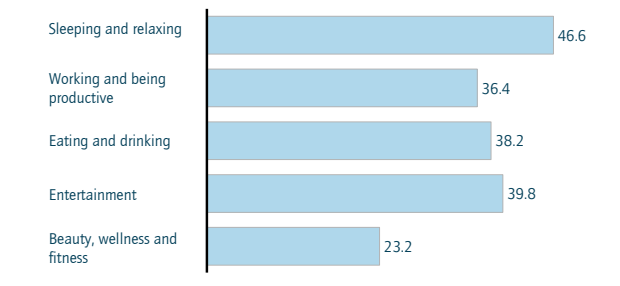|	
Sleeping and relaxing	46.6
Working and being productive	36.4
Eating and drinking	38.2
Entertainment	39.8
Beauty, wellness and fitness	23.2

Fig. 4:   Acceptance values for different usage types in %

"Sleeping and relaxing" is the most popular usage type by a margin, while "beauty, wellness and fitness" is significantly less popular. The other three usage types are at a similar level to one another. It is also interesting to note that there are no changes regarding this distribution across the various gender and age groups, even though the level of support amongst the younger study participants is generally higher.

When comparing results between countries, preferences for individual usage types are very similar to one another. "Sleeping and relaxing" is also the feature of greatest significance for participants across all of the countries. Only China stands out: The acceptance values for all of the usage types are considerably higher than those of all the other countries (cf. Fig. 5).

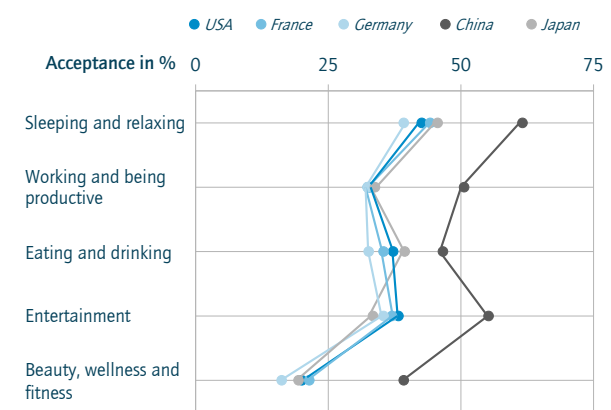Acceptance of usage types highest in China

Fig. 5:   Acceptance of usage types depending on country

[11] Davis, Fred D. (1989): Perceived Usefulness, Perceived Ease Of Use, and User Acceptance of Information Technology. (In: MIS Quarterly, Sep. 1989, 13 ⁄ 3)

High potential for usage types on long journeys

The extent to which each usage type is suitable for different types of journeys was also investigated as part of the study. To do this, the study drew on various journey purposes identified in other surveys.[12]

Figure 6 shows the "top 3" usage types per journey type. The percentages reflect the proportion of respondents who consider the respective type of journey to be suitable for a usage type. How suitable a type of journey is with regard to completing other activities while traveling is determined by means of the total number of entries across all usage types[13] and can be seen in the figure by way of the order of journey types (the most relevant type appears first).

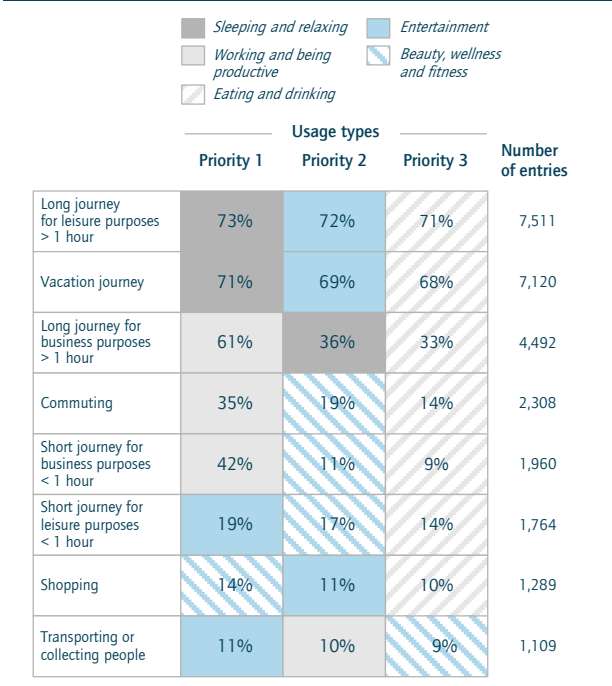*The potential of the usage types is particularly evident with regard to long journeys*

	Sleeping and relaxing	Entertainment
	Working and being productive	Beauty, wellness and fitness
	Eating and drinking	

	Usage types			Number of entries
	Priority 1	Priority 2	Priority 3	
Long journey for leisure purposes > 1 hour	73%	72%	71%	7,511
Vacation journey	71%	69%	68%	7,120
Long journey for business purposes > 1 hour	61%	36%	33%	4,492
Commuting	35%	19%	14%	2,308
Short journey for business purposes < 1 hour	42%	11%	9%	1,960
Short journey for leisure purposes < 1 hour	19%	17%	14%	1,764
Shopping	14%	11%	10%	1,289
Transporting or collecting people	11%	10%	9%	1,109

Fig. 6:   "Top 3" usage types per journey type

First of all, it is clear that usage type "sleeping and relaxing" is particularly relevant for long journeys; the three journey types – long journey for leisure purposes, vacation journey and long business journeys – are the most suitable for the defined usage types. In contrast, usage type "working and being productive" is particularly relevant for business journeys and commuting, which, taken alone, is not surprising in that respect. However, in the future it will be possible to do much more complex productivity-related activities in vehicles thanks to automated driving functions. There are no notable discrepancies in this regard across the categories of gender, age and countries.

Suitability of usage types varies depending on the number of passengers

Which usage types are particularly well-suited for only one passenger or several passengers? To determine the answer to this, the respondents were asked to select one to three usage types – the result is presented in Figure 7.

The suitability of the usage types sometimes varies significantly depending on the number of passengers in a vehicle
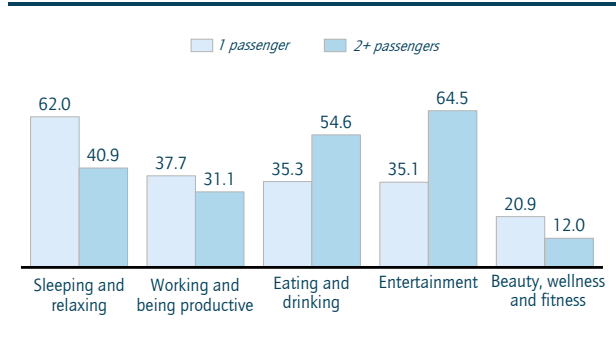

Fig. 7:   Suitability of usage types depending on the number of passengers in %

The suitability of the usage types for one person roughly corresponds to the general acceptance values already mentioned. However, if the suitability of the usage types is considered for two or more people, "eating and drinking" and "entertainment" surpass "sleeping and relaxing" – the preferred usage type in the case of one passenger. In turn, this usage type becomes considerably less popular in the case of multi-person journeys – as is precisely the case with usage type "beauty, wellness and fitness". Only "working and being productive" is evaluated similarly in both cases, which indicates that respondents can imagine working alone as well as in a group (e.g., a meeting).

Specific equipment options are considered for each use case

The second part of the survey determined the relevance of different functional characteristics of autonomous vehicles for different usage types. To increase the significance of the survey, only the equipment options that were identified as potentially relevant in advance were investigated per usage type. As a quiet journey, an external screen and a pleasant atmosphere could play an important role for all usage types, respondents were asked about these three equipment options in every case. The option of an intelligent personal assistant was also investigated for each usage type but was

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[12] BMVB (Bundesministerium für Verkehr, Bau und Stadtentwicklung – Federal Ministry of Transport, Building and Urban Development) (2008): Mobilität in Deutschland 2008 (Mobility in Germany 2008).

[13] One to three entries regarding journey types per usage type (5) and person (2500)

described individually in line with the respective activity. Each equipment option for a usage type is to be evaluated by respondents on a five-point scale from "not at all important" (-2) to "very important" (+2). The relevance of an equipment option (with regard to the respective usage type) stems, by definition, from the proportion of clearly positive evaluations on average (≥ 1). Figure 8 shows the most relevant equipment options for usage type "sleeping and relaxing" as an example.
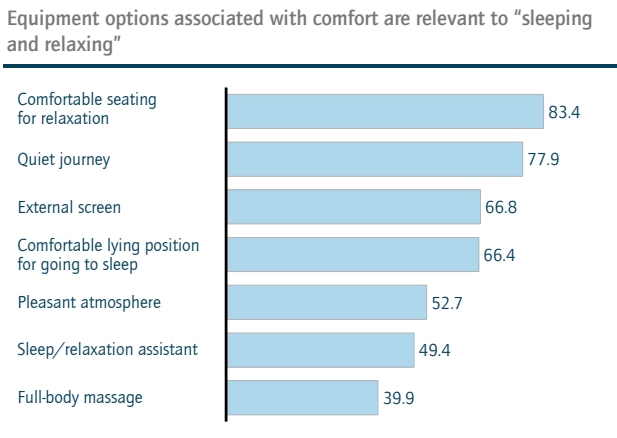
Equipment options associated with comfort are relevant to "sleeping and relaxing"

Comfortable seating for relaxation	83.4
Quiet journey	77.9
External screen	66.8
Comfortable lying position for going to sleep	66.4
Pleasant atmosphere	52.7
Sleep/relaxation assistant	49.4
Full-body massage	39.9

Fig. 8: Relevant equipment options for "sleeping and relaxing" in %

How would the study participants configure their own autonomous vehicle?

As part of the study, participants were able to select their preferred equipment options from a predefined list, containing a total of 18 different options. For this purpose, similar equipment options (such as "comfortable seating position for working" and "comfortable seating position for relaxing") were combined into one equipment option ("comfortable seating position for relaxing or working"). Figure 9 presents the six most relevant equipment options for all of the usage types.

Equipment options associated with comfort are of interest to participants across all of the usage types

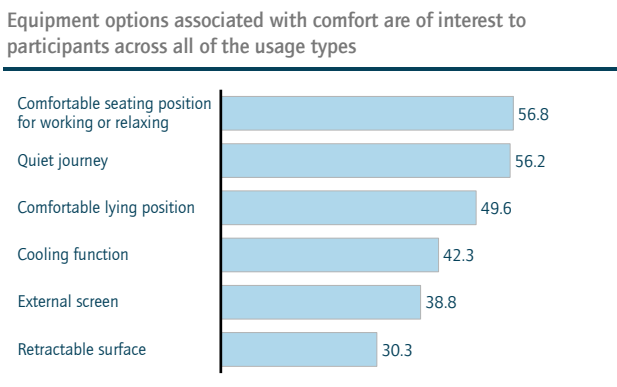|	
Comfortable seating position for working or relaxing	56.8
Quiet journey	56.2
Comfortable lying position	49.6
Cooling function	42.3
External screen	38.8
Retractable surface	30.3

Fig. 9: Attractiveness of different equipment options presented as a percentage of respondents who would select these

The figure shows that equipment associated with comfort is predominantly favored. This is in line with the equipment options for usage type "sleeping and relaxing", which was evaluated as the most relevant usage type in the case of single-person journeys.

Limited willingness to pay for equipment options overall

Willingness to pay was investigated for all of the equipment options presented on the basis of 15 stages – from "EUR 0" to "more than EUR 5,000". Figure 10 shows the progression of the willingness to pay for the equipment option selected – a comfortable lying position in this case. Approximately five percent of respondents are willing to pay a premium exceeding EUR 1,000. Overall, the study established a rather limited willingness to pay for the equipment options in general. Nevertheless, is should be noted that the amounts specified are to be considered as payments in addition to the cost of the respective equipment provided as standard – such as a driver's seat. From a demand perspective, it is not possible to verify the significantly increased revenue potential often desired with regard to specialized equipment required for automated driving functions.

Willingness to pay varies significantly in the case of a comfortable lying position as an equipment option

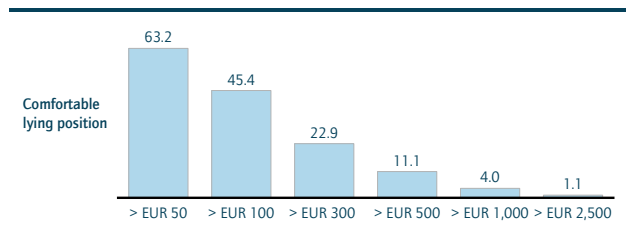| Comfortable lying position	63.2	45.4	22.9	11.1	4.0	1.1
	> EUR 50	> EUR 100	> EUR 300	> EUR 500	> EUR 1,000	> EUR 2,500

Fig. 10: Willingness to pay expressed as a percentage of the respondents who would pay the respective amount

Participants only find six themed cab concepts attractive

Autonomous themed cabs are sharing vehicles provided for mobility on demand; the configuration of such vehicles is optimized for particular usage purposes. As is the case with today's well-known ride-hailing services (Uber, Lyft), these vehicles are ordered as required via smartphone and are paid for once the respective journey is complete. Figure 11 lists the 12 themed cabs available for selection and how attractive they are from a user's perspective.

In keeping with the results regarding usage types in private vehicles, the "quiet car" is valued most highly. Almost as popular is the "sightseeing car" – a themed cab that supplements journeys with information on the respective surroundings. The "wellness car" did surprisingly well, even though usage type "beauty, wellness and fitness" received a low level of acceptance prior to this. By contrast, the "beauty car" and "fitness car" were really not favored by the respondents – as was also the case with the "gaming car".

While there are only a small number of differences between the results for each country, there is an interesting difference between the results for each age group: Approval for the "wellness car" and "sightseeing car" in particular increases significantly with the age of the respondents. In total, the acceptance value for autonomous themed cabs is quite high across all participants with a value of 37.2 percent.

With regard to paying for themed cab journeys, 39 percent favor the "fee per journey" option. In second and third place are "time-based fee" with 23 percent and "flat rate" with 22 percent. Only 16 percent of the respondents favor a "distance-based fee".

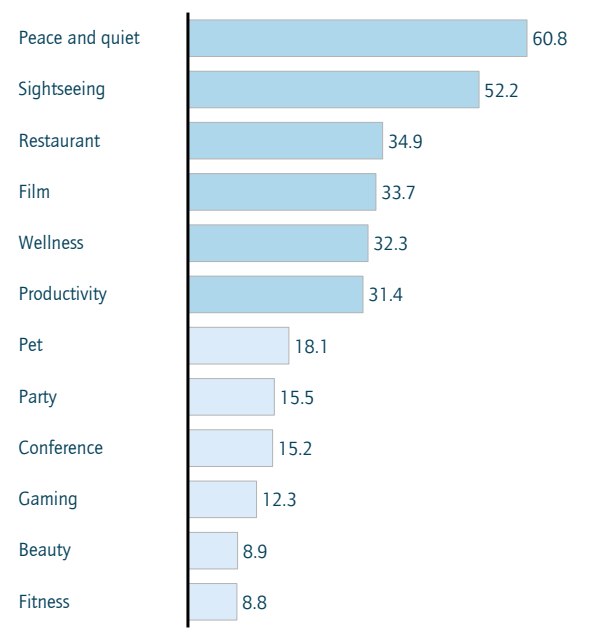Participants only find six themed cab concepts attractive

Peace and quiet	60.8
Sightseeing	52.2
Restaurant	34.9
Film	33.7
Wellness	32.3
Productivity	31.4
Pet	18.1
Party	15.5
Conference	15.2
Gaming	12.3
Beauty	8.9
Fitness	8.8

Fig. 11:   Acceptance for themed cabs across all of the countries in %

In-depth observations and results

This chapter reviews the ten key results of the study in detail and subdivides these results into three subject areas: acceptance and willingness to pay for automated driving functions and country-specific and demographic particularities. The respective analysis results of this study are reviewed in detail for each of these subject areas.

Acceptance and willingness to pay for automated driving functions

1) The more time study participants spend in a vehicle, the more eager they are for automated driving functions.

2) Virtual assistants as specialized digital extras are already attracting interest among users. In particular, these extras support the favored usage types.

3) Willingness to pay for automated driving functions does not depend on participants' eagerness for such driving functions.

Country-specific particularities

4) Participants from the USA show a high level of interest with regard to working in their own autonomous vehicle if the interior is configured accordingly.

5) A high number of participants from France are willing to use sharing options. In line with this, many French participants can forgo having their own vehicle.

6) Participants from Germany show the lowest level of interest in the usage types. However, German respondents are willing to spend more for equipment options than respondents from other countries.

7) China attaches a comparatively high value to usage types for single-person or multi-person journeys. There is a high level of interest in innovative equipment options.

8) Japan has a comparatively low level of interest in usage type "working and being productive" in an autonomous vehicle. Compared to the results from other countries, equipment options are evaluated less positively.

Demographic particularities

9) A large number of families are very accepting of autonomous vehicles.

10) Residents in large cities and younger people are very accepting of automated driving functions.

Acceptance and willingness to pay for automated driving functions

The more time study participants spend in a vehicle, the more eager they are for automated driving functions

"I generally spend too much time in my vehicle!" – this is a sentiment shared by 24.7 percent of study participants across all of the countries. This statement is especially true amongst participants in age groups 25 - 34 and 35 - 44. Often, this evaluation is also linked to a higher daily travel time. The participants in this group state that they spend 95 minutes in a vehicle each day, which is significantly longer than the comparative value of the average of all the respondents (70 minutes).

The statement "I spend too much time in my vehicle" correlates positively with higher acceptance values
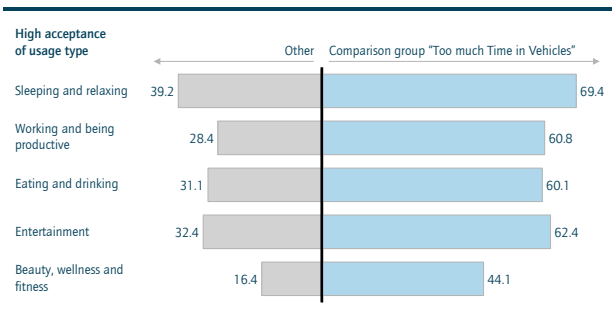

Fig. 12: Acceptance values for different usage types in %

Study participants who generally spend a lot of time in their vehicles exhibit significantly higher acceptance values for all of the usage purposes considered.

Figure 13 illustrates the analysis of participants' eagerness regarding automated driving functions as well as acceptance for individual transport options for goods and persons as well as themed cabs in relation to the "too much time in vehicles" comparison group.

Participants who believe they spend too much time in a car are very eager for autonomous themed cabs as well as autonomous transport options for goods and persons
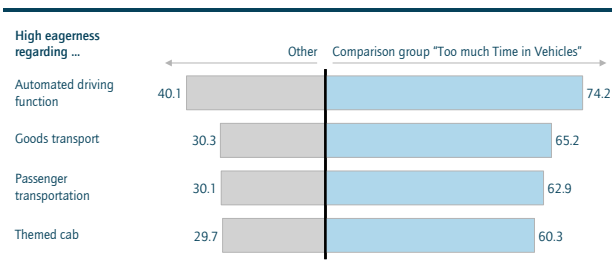

Fig. 13: Eagerness regarding automated driving functions in %

Willingness to pay is also higher amongst the group of participants who state they spend too much time in cars. Figure 14 illustrates this using the example of a comfortable seating position as an equipment option, which receives the highest level of approval. Willingness to pay is considerably higher amongst the aforementioned participants compared to the other participants, whereby approximately 15 percent of this group is willing to pay more than EUR 500 for this equipment option. In comparison, only 7 percent of the other study participants are willing to pay this amount.

Increased willingness to pay for equipment options in the participant group that spends too much time in cars
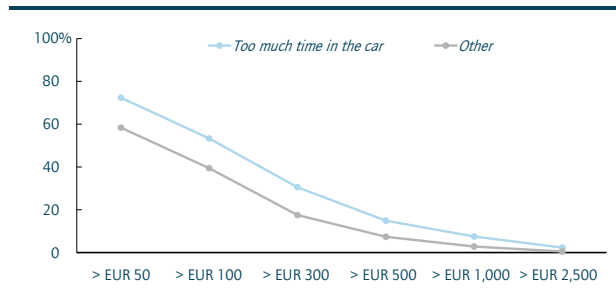

Fig. 14: Willingness to pay for a comfortable seating position expressed as a percentage of respondents who would pay the respective amount

Virtual assistants as specialized digital extras are already attracting interest among users. In particular, these extras support the favored usage types

Study participants were asked about their level of interest in different equipment options for the specified usage purposes. The virtual assistant could be selected as an equipment option. Virtual assistants are digital service providers that help vehicle passengers perform certain tasks; for example, virtual assistants can optimize document management or record speech for usage type "working and being productive".

On average, 40 percent of respondents rate virtual assistants as interesting. Virtual assistants receive the highest level of interest, more than three-quarters of respondents, in terms of being a supporting feature for usage types "sleeping and relaxing" and "working and being productive".

Figure 15 shows the distribution of customer interest in corresponding virtual assistants for the activities considered with values averaged over all the markets examined.

A virtual assistant is deemed most attractive for usage types "sleeping and relaxing" and "working and being productive"
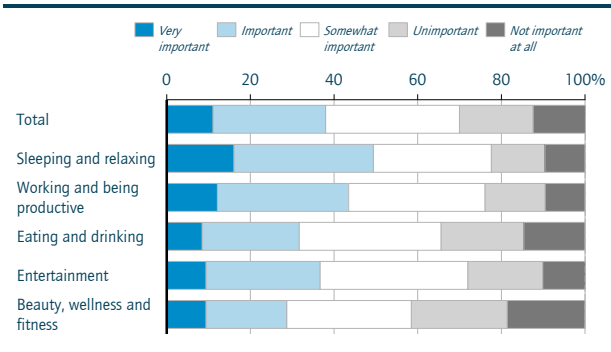

Fig. 15:   Attractiveness of virtual assistants

It is surprising that customers are least interested in services related to "beauty, wellness and fitness", particularly as such functions – the automated monitoring of body functions to determine a fitness plan, for example – are regularly discussed at the moment as part of innovation plans developed by automotive manufacturers and suppliers. In contrast, customers are extremely interested in usage type "sleeping and relaxing": Half of respondents express a general or very strong interest in the corresponding equipment options. Regardless of the activity, around a third of consumers are undecided with regard to rejecting or supporting the idea of virtual assistants. It can be assumed that a primary reason for this is that a large proportion of the respondents can only imagine the functions and benefits of virtual assistants with difficulty.

On the other hand, an analysis of study participants who already use virtual assistants in other areas of their lives shows that these respondents are more willing to pay than others. All in all across the countries examined, around 60 percent of respondents are willing to pay for virtual assistants (cf. Fig. 16).

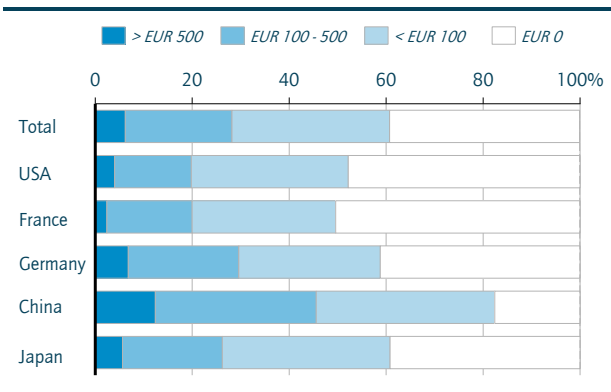**Willingness to pay for virtual assistants is highest in China**

Fig. 16:   Willingness to pay for virtual assistants

China was identified as the country with the highest willingness to pay by a margin, whereby 80 percent of respondents would pay for virtual assistants (up to EUR 100 and higher). In Japan and Germany, willingness to pay is similarly high and is the same as the overall average.

The results of the French market are very interesting as French respondents demonstrate the lowest willingness to pay, with only 50 percent saying they would pay for virtual assistants. By contrast however, French respondents show an above-average level of interest in virtual assistants in the case of "working and being productive" and "eating and drinking".

Willingness to pay for automated driving functions does not depend on participants' eagerness for such driving functions

Prior to observing country-specific levels of willingness to pay, analyzing the acceptance values for the various usage types provides some interesting insights, as shown in Figure 17 below.

Significant differences between acceptance values for usage types across the countries surveyed – Chinese consumers exhibit the highest acceptance values

	USA	France	Germany	China	Japan
Sleeping and relaxing	42.6	44.2	39.2	61.6	45.6
Working and being productive	32.8	32.4	32.4	50.6	33.8
Eating and drinking	37.2	35.4	32.6	46.6	39.4
Entertainment	38.2	37.0	35.4	55.2	33.4
Beauty, wellness and fitness	20.0	21.4	16.2	39.2	19.4

Fig. 17:   Acceptance values for usage types depending on country in %

It is striking that Chinese study participants exhibit the highest acceptance values in comparative terms – irrespective of the usage type. Particularly noteworthy in this respect is the acceptance value for usage type "sleeping and relaxing", which represents the highest measured value at around 60 percent.

When examining the markets in the USA, France, Germany and Japan, similar acceptance values are noted, with German participants demonstrating the lowest acceptance values for almost every usage type. Usage type "entertainment" is valued least by Japanese users.

With regard to analyzing willingness to pay for automated driving functions, China is once again at the forefront when compared to the other countries. Almost 65 percent of respondents would pay more than EUR 500 for such functions. In line with the analysis of acceptance values for usage types, it is clear that Chinese participants have a particularly high affinity for autonomous driving. Nearly three out of four study participants from China state that they are looking forward to automated driving functions.

Being very eager to attain automated driving functions does not necessarily correlate with a high willingness to pay, as Figure 18 shows.

Willingness to pay for automated driving functions is independent of general eagerness regarding these functions
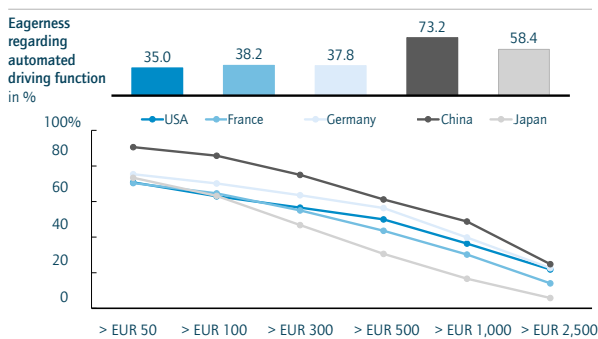

Fig. 18:   Country comparison regarding eagerness and willingness to pay in relation to automated driving functions

This is particularly clear when comparing results with the Asian countries China and Japan. While Chinese users back up their special position with a comparatively high willingness to pay, Japanese participants demonstrate the lowest willingness to pay despite being very eager for automated driving functions.

When analyzing the group of Japanese respondents in detail, there is an explanation for this striking divergence. Only approximately 14 percent believe that they spend too much time in their vehicles as a general rule. This assessment tallies with the specified daily journey time of 44 minutes per day, which is significantly lower than the overall average of 70 minutes. This appraisal suggests that participants do not view automated driving functions as offering high added value because they do not spend much time in their vehicles.

"The most popular cars in Japan are compact/small economic cars. Approximately 60% of respondents own a compact car, a city car or a small car. And people are not usually interested in paying extra for options beyond safety features and basic functionalities. This may explain the low willingness to pay for autonomous driving as an additional function."

Rika Kasamatsu, Business Development Partner, Genex Partners

In contrast to this, study participants from Germany and the USA exhibit a comparatively high willingness to pay despite not being very eager to attain automated driving functions. In view of the specified driving time, it is particularly clear in the context of the USA that added value with regard to autonomous driving can be explained on the basis of spending the highest amount of time in vehicles by a margin (91 minutes as opposed to 70 minutes for the sample overall).

"Americans are not anxiously awaiting autonomous vehicles, but they are willing to pay more for the service when it is available. If so, I believe that most Americans are used to spending a decent amount of time behind the wheel in order to get anywhere."

Mike Kelso, Principal, Northhighland

14

Country-specific particularities

Participants from the USA show a high level of interest with regard to working in their own autonomous vehicle if the interior is configured accordingly

Country-specific particularities are analyzed by means of a standardized procedure and are categorized into three subject areas:

- Suitability of different usage types depending on the number of persons in a vehicle
- Assessment of equipment options
- Country-specific particularities

In the USA, usage type "working and being productive" is of interest to users regardless of the number of passengers
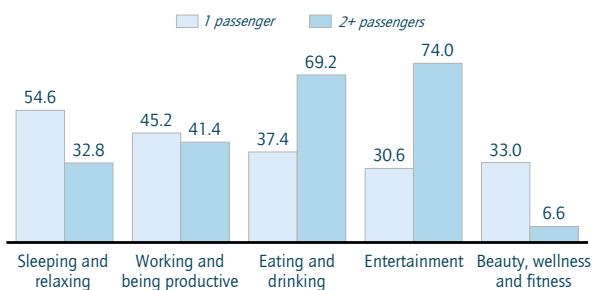

Fig. 19: Suitability of usage types based on the number of passengers in the USA in %

Figure 19 provides an overview of the suitability of the usage types investigated. Usage type "sleeping and relaxing" is deemed most suitable in the case of a journey with one passenger. In the case of two or more passengers, usage types "eating and drinking" and "entertainment" are of particular interest.

Usage type "entertainment" is a very interesting case due to the high discrepancy regarding its suitability depending on the number of passengers. In the USA, "entertainment" is deemed least suitable for a journey involving one passenger (30.6 percent). As soon as two or more people are traveling in a vehicle, suitability increases to 74 percent in the USA – the second highest value compared to results from the other countries.

It is also striking that when comparing results from the various countries involved, usage type "beauty, wellness and fitness" receives a high acceptance value of 33 percent for journeys involving one person, but this value decreases significantly for journeys involving multiple people.

If suitability is assessed across both categories (one or more passengers), respondents from the USA support usage type "eating and drinking" the most. With regard to evaluating themed cabs, US participants' interest in the "restaurant car" is comparatively high, reaching third place with 34.4 percent.

When cross-compared with all of the other countries, the USA is noticeably different with regard to usage type "working and being productive": it is valued most highly by US participants. By contrast, interest in a "productivity vehicle" as a themed cab is relatively low at 27 percent. Mike Kelso gives a possible reason for this:

"If a person or persons were in an autonomous vehicle, they would probably use the time to do some work (e.g. if they were stuck in traffic in an autonomous vehicle home from work). However, if they were to hire an autonomous car for a particular purpose, they would rather use their time to do something more enjoyable, such as relaxing, sightseeing, eating or enjoying some entertainment."

Mike Kelso, Principal, Northhighland

Figure 20 below gives an overview of the equipment options chosen by US participants for a car used for personal purposes.

In the USA, the high suitability of usage type "working and being productive" is reflected in the assessment of equipment options

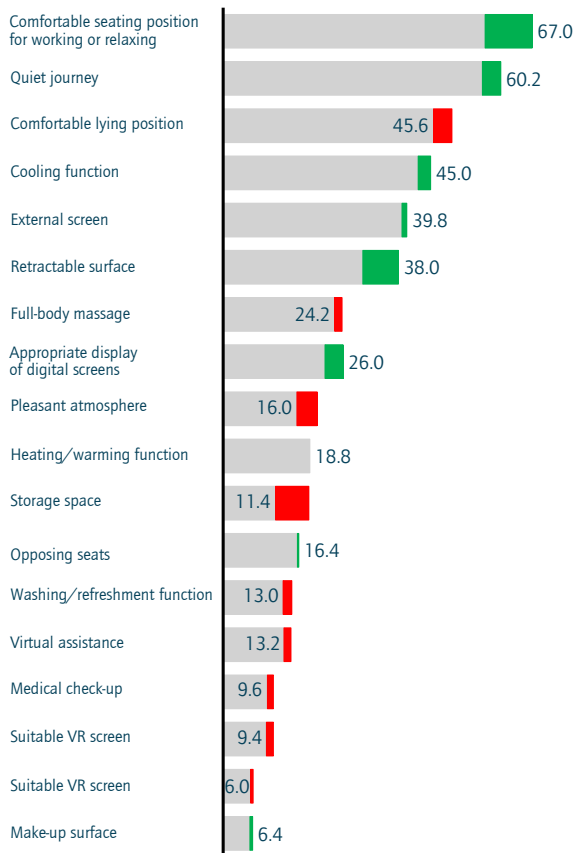| Equipment option	Value
Comfortable seating position for working or relaxing	67.0
Quiet journey	60.2
Comfortable lying position	45.6
Cooling function	45.0
External screen	39.8
Retractable surface	38.0
Full-body massage	24.2
Appropriate display of digital screens	26.0
Pleasant atmosphere	16.0
Heating/warming function	18.8
Storage space	11.4
Opposing seats	16.4
Washing/refreshment function	13.0
Virtual assistance	13.2
Medical check-up	9.6
Suitable VR screen	9.4
Suitable VR screen	6.0
Make-up surface	6.4

Fig. 20: Assessment of equipment options in the USA in %

The assessment shows that equipment options associated with usage types "working and being productive" and "eating and drinking" are valued more highly than other options. Examples of such equipment options include a comfortable seating position for working and relaxing, a quiet journey, a retractable surface or cooling function. On the other hand, high earners are less willing to pay for these special equipment options when compared to the average value across the other countries. This might be related to a number of factors, including the fact that certain items of equipment are already provided in expensive vehicle segments in particular.

Although American respondents spend significantly more time in vehicles than the respondents from the other countries due to an average daily journey time of over 90 minutes, 60 percent reject the assumption that they would spend too much time in a vehicle – more than in any other country. Approximately only one in every five people would agree with this assumption. It can also be assumed that American respondents are quite skeptical of innovation. Roughly only four out of ten Americans are looking forward to autonomous driving – almost 50 percent of respondents across all of the countries. In terms of sharing vehicles, Americans are also much more skeptical than respondents from

the other countries: 60 percent of Americans stated that they cannot imagine forgoing their own vehicle – even if suitable sharing options are available.

A high number of participants from France are willing to use sharing options. In line with this, many French participants can forgo having their own vehicle

Figure 21 gives an overview of the suitability of the various usage types with regard to the number of passengers present. It is clear that French participants deem usage type "sleeping and relaxing" to be most relevant in the case of journeys involving one passenger. Nearly three out of four respondents consider the activity useful, which is also the highest value for a journey with one passenger across the countries and usage types examined. When comparing the results across the countries, the usage type is also deemed very suitable for journeys involving two or more passengers. As such, French participants deem "sleeping and relaxing" as the most relevant. This result is also backed-up by participants' support for the "quiet car" as a special sharing vehicle. In this case, French respondents exhibit the second-highest acceptance value at 64 percent.

In France, usage types "sleeping and relaxing" and "eating and drinking" receive the highest acceptance values

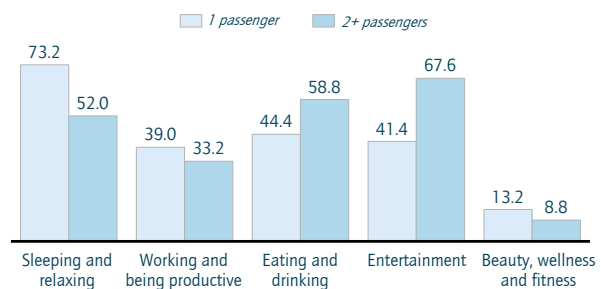| Usage type	1 passenger	2+ passengers
Sleeping and relaxing	73.2	52.0
Working and being productive	39.0	33.2
Eating and drinking	44.4	58.8
Entertainment	41.4	67.6
Beauty, wellness and fitness	13.2	8.8

Fig. 21: Suitability of usage types depending on the number of passengers in France in %

In the case of two or more persons, usage type "entertainment" is deemed most suitable. On the other hand, usage type "beauty, wellness and fitness" is markedly further down the scale; it exhibits the lowest acceptance values and thereby follows the distribution pattern observed across the countries.

Figure 22 shows the result of the different equipment options. Compared with the results of participants from other countries, French participants value a comfortable lying position much more highly. This result is consistent with the high level of support for usage type "sleeping and relaxing".

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This link is also apparent with regard to the equipment options, cooling function, retractable surface and opposing seats, in relation to usage type "eating and drinking".

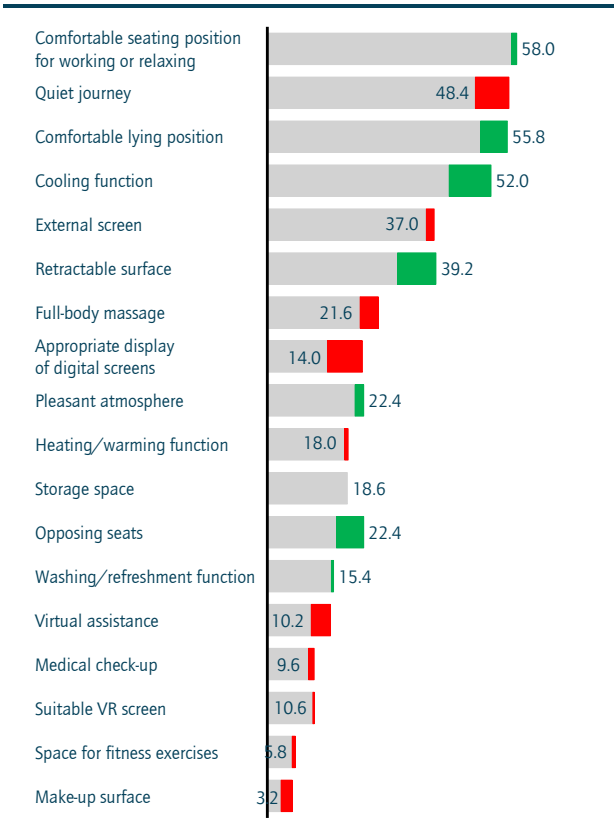**In France, equipment options linked to usage type "eating and drinking" are rated as important**

Comfortable seating position for working or relaxing	58.0
Quiet journey	48.4
Comfortable lying position	55.8
Cooling function	52.0
External screen	37.0
Retractable surface	39.2
Full-body massage	21.6
Appropriate display of digital screens	14.0
Pleasant atmosphere	22.4
Heating/warming function	18.0
Storage space	18.6
Opposing seats	22.4
Washing/refreshment function	15.4
Virtual assistance	10.2
Medical check-up	9.6
Suitable VR screen	10.6
Space for fitness exercises	6.8
Make-up surface	3.2

Fig. 22: Evaluation of equipment options in France in %

Attention has already been drawn to the result of low willingness to pay for automated driving functions amongst French participants above and it is the same situation with regard to analyzing the willingness to pay for individual equipment options, whereby willingness to pay is lower when compared to other countries – even for preferred options.

A particular characteristic of French study participants is the fact that this group is very willing to use sharing options and would therefore forgo having private vehicles.

"Vehicle sharing options (carpooling especially, but also short-term private vehicle rental) are already common practices in France. This is why autonomous vehicles can be seen as an opportunity to further develop these existing offers, and French people would be likely to use them."

Hervé de Perthuis, Partner, Oresys

In view of this, assessing themed cabs is another focal point of this study. The high level of acceptance for the "quiet car" determined when comparing results from all of the countries has already been mentioned. At 67 percent, the "sightseeing car" has the highest rate of acceptance amongst French participants. Compared to the results from Germany, China and Japan, this type of themed cab is rated more highly – by more than 20 percent to be exact.

The "restaurant car" has a low acceptance value, which does not tally with the high evaluation of usage type "eating and drinking". This would indicate that French participants can imagine consuming meals and beverages in their own vehicles but are not convinced by the idea of doing this in a shared vehicle.

Lastly, is it important to note that many French participants are willing to transport family members, children, friends or goods in their own autonomous vehicles – scenarios in which the respondents would not need to be within the vehicle themselves.

Participants from Germany show the lowest level of interest in the usage types. However, German respondents are willing to spend more for equipment options than respondents from other countries

When compared with the results from other countries, the acceptance values of German study participants with regard to the usage types are lagging behind, which has already been addressed above.

In Germany, "entertainment" is the favored usage type in the case of two or more passengers

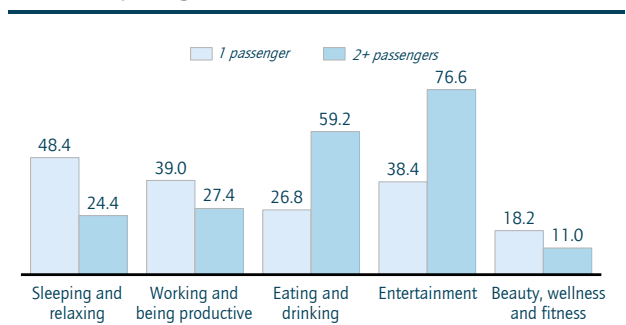|	1 passenger	2+ passengers
Sleeping and relaxing	48.4	24.4
Working and being productive	39.0	27.4
Eating and drinking	26.8	59.2
Entertainment	38.4	76.6
Beauty, wellness and fitness	18.2	11.0

Fig. 23: Suitability of usage types based on the number of passengers in Germany in %

Figure 23 gives a differentiated picture of acceptance values in Germany. Usage type "sleeping and relaxing" is deemed most suitable in the case of a single-person journey; however, in the case of two or more passengers, this accolade goes to "entertainment".

The biggest discrepancies between single-person and multi-person journeys are clear with regard to usage types "eating and drinking" and "entertainment".

When comparing results between the countries, Germany only adopts a high value for multi-person journeys in the case of usage types "eating and drinking" and "entertainment". With regard to usage type "sleeping and relaxing", German respondents give significantly lower values.

This trend is confirmed when analyzing German acceptance values for themed cabs. Although the "quiet car" takes first place with 55 percent, it is not valued as much as it is by respondents from other countries. With 37 percent, the "productivity car" takes the next place; the "restaurant car" follows with 25 percent and the "conference car" follows on with 18 percent.

In Germany, the comfortable seating position is valued most

Equipment option	Value
Comfortable seating position for working or relaxing	60.2
Quiet journey	57.4
Comfortable lying position	38.0
Cooling function	52.0
External screen	45.4
Retractable surface	25.4
Full-body massage	21.0
Appropriate display of digital screens	28.8
Pleasant atmosphere	20.4
Heating/warming function	18.0
Storage space	27.2
Opposing seats	19.2
Washing/refreshment function	14.8
Virtual assistance	20.4
Medical check-up	9.8
Suitable VR screen	10.2
Space for fitness exercises	2.6
Make-up surface	4.8

Fig. 24:   Evaluation of equipment options in Germany in %

A connection with the acceptance values for the usage types is also apparent with regard to equipment options for the perfect interior of an autonomous vehicle. There is a high level of interest in the comfortable seating position, quiet journey and comfortable lying position equipment options, which are closely linked to usage types "sleeping and relaxing" and "working and being productive". Nevertheless, with nearly 12 percent, the lying position option compares unfavorably with the results from the other countries.

Despite the generally low level of support for the different usage types and automated driving functions, German study participants exhibit a relatively high level of willingness to pay for automated driving functions when compared with the other countries. This insight also applies to willingness to pay with regard to equipment options – particularly in the case of functions in which German participants are very interested. An example is the lying position equipment option: Despite exhibiting a lower level of support when compared to the other countries, German respondents are the second group of respondents most willing to pay for this equipment option.

China attaches a comparatively high value to usage types for single-person or multi-person journeys. There is a high level of interest in innovative equipment options

This study report has referred to the fact that Chinese participants are very willing to pay for automated driving functions many times. Chinese study participants are the most accepting of each usage type, are the most eager for autonomous driving and are more willing to pay than respondents from the other countries.

"China's consumers are immersed in a world-leading, digitally savvy environment with regard to activities such as paying, taking taxis, chatting, working etc. An increasing number of start-ups and tech-giants such as Alibaba, Tecent and Baidu are competing for consumers' fragmented time with numerous product and technology innovations and business model developments. As a result, Chinese consumers are more likely to accept the latest innovations. Besides, online respondents usually have a higher level of exposure to digital environments than others so this may have impacted the results."

Yiming Jiang, Vice President, S-Point

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In China, there are no significant differences between acceptance values regarding single-person and multi-person journeys
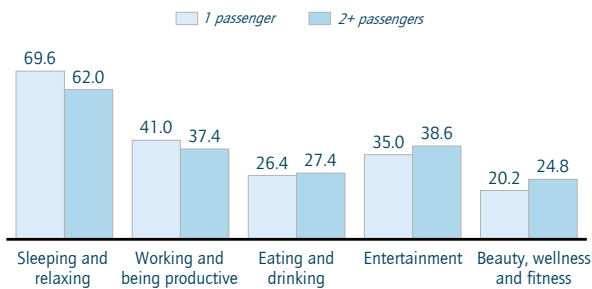

Fig. 25:   Suitability of usage types based on the number of passengers in China in %

Figure 25 illustrates the result of the country-specific evaluation of usage types for China. The subtle differences regarding the evaluation of usage types based on different numbers of passengers being present are striking and result in a very different scenario compared to the results of the other countries. However, what is the reason for there being such subtle differences in the results regarding Chinese traveling alone or with several people?

"A significant number of China's consumers live with three generations of family members. It is normal for them to look for bigger cars (such as SUVs) and to use their cars for a range of purposes. It therefore makes sense there is only a small distinction between their responses regarding the number of passengers."

Georgios Marketakis, Managing Director, S-Point

In China – as is the case with all of the other countries – usage type "sleeping and relaxing" is deemed most suitable for a journey with one passenger. In the case of two or more passengers and when compared with the results from the other countries, the value is the highest – a distinguishing characteristic for China. The attitude towards this usage type is also reflected in the fact that, in the case of themed cabs, the "quiet car" has the highest rating in China with 57 percent.

Usage type "working and being productive" takes second place. In turn, the suitability of this usage type is higher than the comparative value of the other countries. This also tallies with the highest level of interest for the "productivity car" – 38 percent – when compared to the results from the other countries.

The fact that usage type "eating and drinking" is deemed to be not very suitable is striking. Interest in usage type "entertainment" is also relatively low across the countries.

Chinese respondents are interested in equipment options for usage type "sleeping and relaxing" most
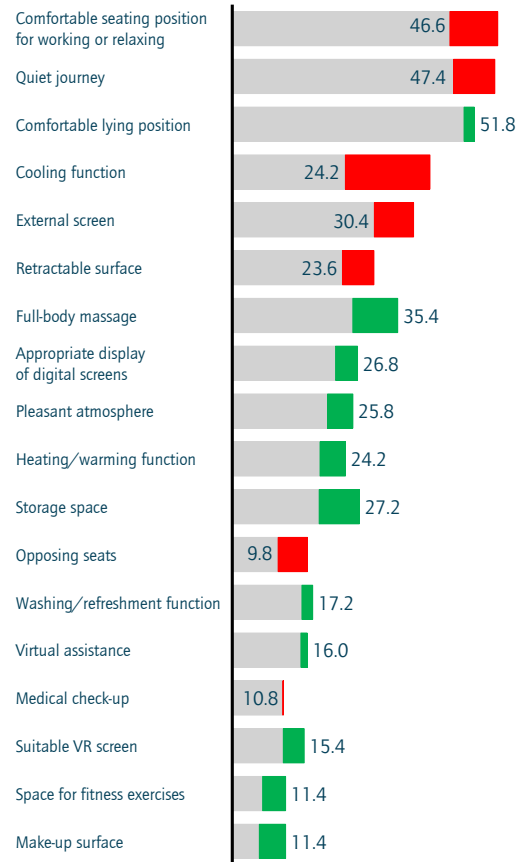

Fig. 26:   Evaluation of equipment options in China in %

With regard to assessing equipment options for the perfect interior (cf. Fig. 26), there are high acceptance values for equipment options associated with usage type "sleeping and relaxing". These options include equipment to ensure a comfortable seating position, a quiet journey and a comfortable lying position. However, the values for these are significantly lower than the country average (cf. red deviations).

The positive deviations from the overall average highlighted green in Figure 26 show that Chinese participants have a broader scope of interest in equipment options than the other study participants. This is particularly true for lower-ranked equipment options, such as the full-body massage option or storage space.

The high level of willingness of Chinese study participants to pay for automated driving functions has been presented above. This result can also be seen with regard to the high willingness to pay for equipment options. It is interesting that there are hardly any differences between income groups in this regard. To some extent, even participants with lower incomes exhibit a higher willingness to pay than Chinese participants with higher incomes. This applies to digital equipment options such as virtual assistants.

Japan has a low level of interest in usage type "working and being productive" in an autonomous vehicle. Compared to the results from other countries, equipment options are evaluated less positively

As explained above, Japanese users are very eager for automated driving functions, which is also reflected in the acceptance values for individual usage types.

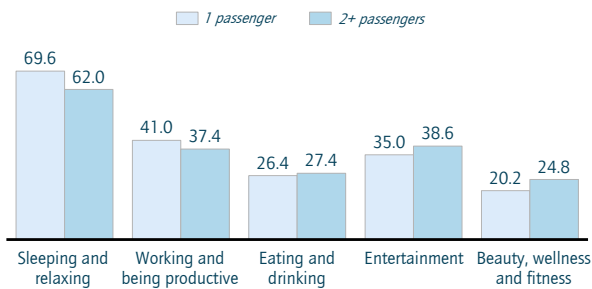Japan has a comparatively low level of interest in usage type "working and being productive" in an autonomous vehicle

Fig. 27:   Suitability of usage types depending on the number of passengers in Japan in %

What is striking is the fact that Japanese study participants deem usage type "working and being productive" as not very suitable, irrespective of the number of passengers (cf. Fig. 27).

This result is backed up by the low acceptance values for the "productivity car" and "conference car" sharing vehicles. The values of 24 percent and 9 percent respectively are the lowest values across all of the countries.

> "Working remotely is not common practice in Japan yet. Japanese usually commute and work at their office or workplace. Japanese also use more public transportation (for commuting) than driving their own vehicles, and even in the case of those who drive on weekdays, 50% spend less than one hour in a car. Japanese people are therefore less likely to consider driving time being used for work."

Rika Kasamatsu,
Business Development Manager, Genex Partners

Usage type "sleeping and relaxing" has the highest level of interest in Japan too. With 69 percent, the "quiet car" even has the highest value when compared to the other countries.

The high level of support for usage types "entertainment" and "eating and drinking" is also striking. This high level of support is backed up by the high rankings for the relevant themed cab concepts, such as "film car" with an acceptance value of 42 percent and the "restaurant car" with 46 percent.

If the selection of equipment options for the perfect interior is considered in this context, it is notable that Japanese participants consider almost every equipment option as less relevant than the average value across the other countries.

The equipment options rated more positively in Japan than the average value across the other countries can be assigned to usage type "sleeping and relaxing", with the exception of the "medical check-up" option. A quiet journey, comfortable lying position and an external screen are examples of these. The positive assessment is also reflected in the willingness to pay. With regard to a quiet journey, the full-body massage and the option of a medical check-up, Japanese study participants display a disproportionately high willingness to pay.

In Japan, participants rank a large proportion of the equipment options as less relevant than the average value
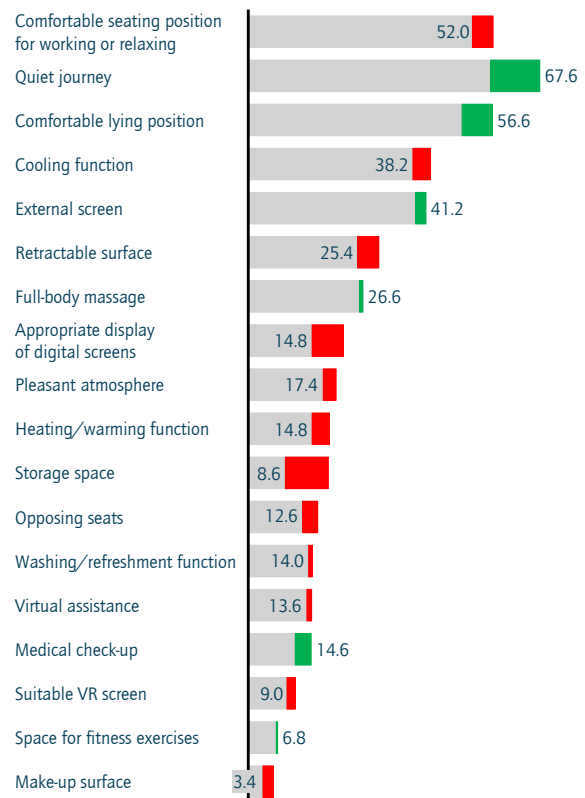

Fig. 28:   Evaluation of equipment options in Japan in %

Regardless of this, the Japanese display the lowest willingness to pay for automated driving functions when compared to respondents from the other countries – as already mentioned above. The main reason for this is the daily travel time of respondents in Japan, which is significantly lower than that of respondents from other countries.

20

Demographic particularities

A large number of families are very accepting of autonomous vehicles

When specifying the size of their household, study participants could opt to describe themselves as a family, couple or single. 42 percent of users specified living in a family (couples: 34 percent, single: 24 percent).

As a group observed in this study, the family…

- is 41 years old on average and thereby younger than the other participants (46 years old across the entire sample)
- is more likely to live in large cities (38 percent as opposed to the average of 32 percent) and
- believes that it spends too much time in cars (33 percent of family respondents as opposed to 24 percent of the other respondents)

Families evidently see time spent in vehicles more negatively than the rest of the study participants at present. This suggests that a higher level of support for automated driving functions and the associated services is to be expected amongst families, which is also supported by the results in Figure 29.

Study participants living in a family see the greatest added value in automated driving functions
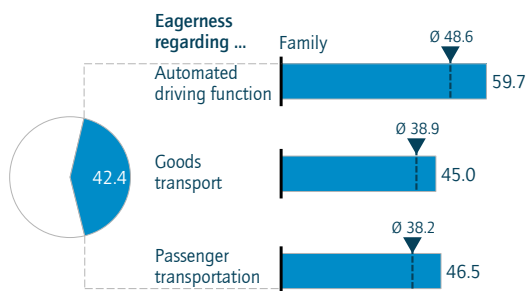

Fig. 29: Eagerness regarding automated driving functions in families in %

Across all of the countries surveyed, the observed group is most eager for automated driving functions and the autonomous transport of goods and persons.

Compared to single and couple households, families are also prepared to forgo having their own vehicle in future and make use of sharing options. The analysis of the acceptance values for the five usage types also backs up the high level of support for autonomous driving. Significantly higher values are assigned to each of the usage types.

For the most part, this observation is not dependent on the nationality of the study participants. Figure 30 shows that, with the exception of the Japanese study participants, the family participant group exhibits the highest acceptance values in each case.

Except for in Japan, the "family" participant group exhibits the highest level of acceptance regarding the usage types
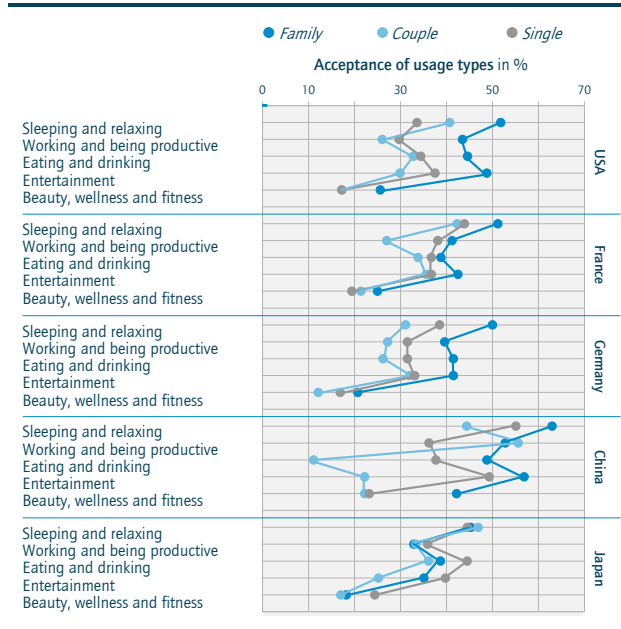

Fig. 30: Acceptance of usage types depending on the respective household size in %

With regard to income, this study also shows that the family participant group has a higher income than average. As such, this group drives more expensive vehicles. 56 percent of the vehicles are to be categorized as "compact executive cars". Vehicles categorized as "minivans" and "SUVs" are disproportionately represented within the family group.

Residents in large cities and younger people are very accepting of automated driving functions

City residents represent another important group that is characterized by a high level of eagerness as well as a high willingness to pay: They are more likely to have a higher income and are part of the two youngest age groups.

Furthermore, study participants who predominantly use public transport are very eager for automated driving functions across all of the countries examined.

With this in mind, the living situation and age are important criteria in terms of accepting innovative mobility solutions. Residents of large cities display the highest levels of acceptance across all of the mobility solutions, followed by residents of smaller cities. In contrast, the rural population exhibits the lowest acceptance values.

Figure 31 illustrates the acceptance level for autonomous driving from respondents living in a large city compared to participants from a rural area. Acceptance is measured on the basis of these three criteria:

■ Eagerness regarding automated driving functions

■ Interest in themed cabs

■ Interest in sharing options

Study participants from a large city see the new mobility concepts as more relevant
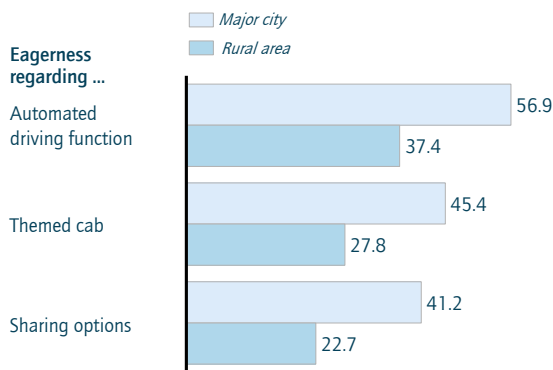

Fig. 31: Acceptance for new mobility concepts

There is a significant difference amongst the respondents with regard to eagerness and interest depending on where they live. This is particularly evident with regard to interest in sharing options. Nearly 80 percent of participants from a rural area clearly do not wish to forgo having their own vehicle. The fact that approval decreases as the distance from a large city increases is also linked to age distribution.

Predominantly younger people live in large cities, while predominantly older people live in rural areas
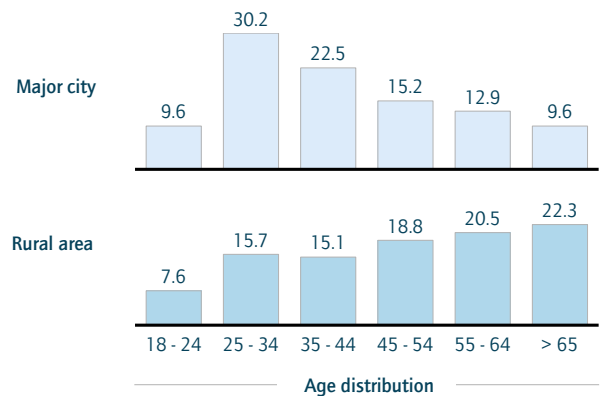

Fig. 32: Distribution of age depending on place of residence in %

In large cities, the group of participants from 25 to 34 years old represent the biggest group in the panel. In comparison, the group of participants over 65 years are represented in rural areas most (cf. Fig. 33). Analyzing eagerness for automated driving functions according to age groups proves that the group of 25- to 34-year-old participants exhibit the highest level of acceptance for autonomous mobility solutions. In turn, opposition to autonomous driving increases as the age of study participants increases.

Eagerness for automated driving functions is primarily seen amongst younger study participants
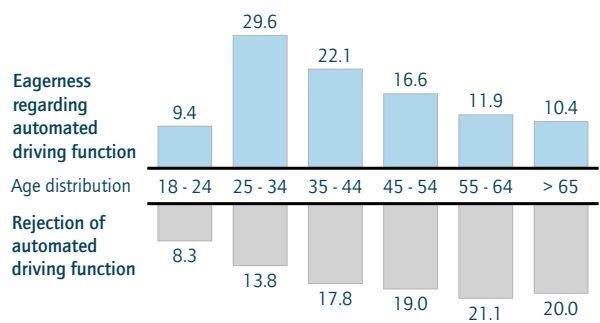

Fig. 33: Eagerness for and opposition to automated driving functions according to age in %

It is also possible to determine differences regarding equipment options depending on where respondents live. In general, residents of rural areas attach a comparatively high level of relevance to a comfortable seating position and seats that face one another. On the other hand, residents of large cities attach more value to a pleasant atmosphere and functions that support virtual and augmented reality applications.

Conclusion

A marketing approach specific to each target group

With a view to the development of automotive markets, China can become a leading market for automotive innovation. This is supported by users' high level of interest in autonomous vehicles and regulatory framework conditions. Both with regard to private vehicles and sharing fleets, companies operating in the market have the opportunity to adapt their range of products and services to the specific demands of the Chinese market.

In addition to China, the USA is another important target market. Due to the size of the market, long travel times and the high level of importance attached to having a private vehicle, the authors anticipate a large demand for vehicles with automated driving functions.

Regardless of country-specific observations, a high level of acceptance and willingness to pay were identified amongst the following target groups:

- Residents of large cities
- Younger age groups up to 45 years old
- Households with higher incomes

It is advisable for companies to develop an entry strategy for vehicles that are equipped such that they are ideal for usage types "sleeping and relaxing" or "working and being productive". In particular, seemingly trivial equipment options, such as a cooling function, are only attractive to these target groups, however, if they are inexpensive.

With regard to future mobility solutions in the case of shared themed cabs, companies can position themselves on the market with use-specific services. The "quiet car" and "sight-seeing car" in particular seem suitable for preliminary pilot projects.

Modular vehicle design

In the same way that there are modular wardrobes that can be individually adjusted, a modular principle could be applied to interior concepts for autonomous vehicles, thereby accommodating individual demand for use-specific configurations. For example: it is possible to develop interchangeable vehicle cabins with preconfigured interiors that optimally support the various usage types and are offered "on demand" if necessary, be it for "sleeping and relaxing" or "working and being productive". Initial concept proposals have already been presented by automotive manufacturers.

Toyota, for instance, has presented customized self-driving e-cars for industry customers at the 2018 CES conference; Toyota's design enables individual systems to be installed for shuttle services or parcel deliveries. During the development process, the enterprise is collaborating with a number of companies, including Mazda and Amazon, as well as ride-sharing services, such as Didi Chuxing and Uber. The vehicles are to be tested in a range of countries – including the USA – from early 2020.

The prospect of imminent changes being made to transport systems promises a high level of demand for mobility solutions involving autonomous vehicles and customer-oriented services in the supply sector. Sharing vehicles has the greatest power to sustainably reduce the volume of traffic and alleviate the extreme lack of parking spaces. Pilot projects in the P2P sector or "ride-pooling" segment are paving the way towards a reduced number of vehicles on our roads. Intelligently networked autonomous vehicles can become an integral part of intermodal transport systems in "smart cities" – for private transport as well as transport logistics. New business models and services related to autonomous mobility services, such as robo-taxis, will also emerge. There are no limits when it comes to creativity.

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