



90% of respondents
want to be able to
intervene and take
control at any time in
autonomous vehicles.

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Executive summary

Technologically, the path towards autonomous driving seems to be largely mapped out. But will customers accept autonomous driving? Are they prepared to pay for this functionality? And in what situations would autonomous driving be especially valuable to them? Deloitte answers these and other questions from the customer perspective on technological possibilities with this study on “Autonomous driving in Germany – how to convince customers”. The following core statements emerged from the survey:

- 1) There are still strong doubts about safety – drivers want to retain control**
- 2) Test drives have the power to convince – manufacturer warranties also alleviate concerns**
- 3) Premium manufacturers enjoy a higher level of trust – good reputation becomes a competitive advantage**
- 4) Extra convenience is the main motivation for autonomous driving – customers want to communicate and work**
- 5) The more unpleasant the drive, the higher the willingness to pay – the majority prefers a classic one-off payment**

The future of mobility

The study results present various tasks, challenges, and opportunities for automobile manufacturers.

What is clear is that vehicle manufacturers should give the highest priority to safety during the gradual introduction of autonomous driving. Second, offering customers low-threshold opportunities for test drives in autonomous vehicles would convince them of the technology's capabilities.

By far the biggest challenges arise when looking toward the mobility market, which autonomous driving will change radically. With autonomously driven vehicles, fleet operators could provide passengers with a new form of individual mobility: almost anyone could be chauffeured as required at low cost. The trend from ownership toward sharing should receive another boost here.

For traditional manufacturers, such a development would not be at all negative. Admittedly vehicle fleets across Germany would shrink, although this is also an important point for local authorities, since fewer parking spaces would be required, and traffic due to searching for spaces would go down. However, since each vehicle would be used for higher mileage, it would need to be replaced by a newer model more frequently than today.

Vehicle manufacturers should align themselves with two trends in this scenario: on the one hand, their business will migrate toward B2B, meaning toward sales to fleet operators. On the other, the products themselves will be affected. Demand is likely to shift from standardized vehicles suited to commuting as well as family vacations, toward models that are tailored to the requirements of each particular journey.

Context: technology, society, legislation, and customer behavior

The development towards autonomous driving in road traffic has gained enormous momentum in the recent past. Traditional car manufacturers are in competition here with newcomers and technology companies from outside the sector.

The focus is on four fields of action: technology, society, legislation, and especially customer behavior.

With regard to technology, the main concern is refining sensor systems and making them more affordable, as well as forming a complete picture of all events around the vehicle from the sensor information with a high degree of safety. This is the foundation that allows vehicles to make the right 'decisions'.

The question here is how many wrong decisions, i.e. accidents, by autonomous vehicles society considers to be acceptable. Likewise, programmers are faced with an ethical dilemma when they are required to make rules for the vehicle in the following case: due to the mistakes of other road users, the vehicle has only two options, running over either a small child or an elderly person. Which is the 'correct' choice?

Another aspect for society is the risk of losing jobs. Ultimately, autonomous vehicles have the potential to replace everyone employed in driving jobs.

Finally, a regulatory framework needs to be created that permits autonomous driving, clearly regulating standards and defining responsibilities in the case of accidents. Which business models will win out in this area in the long run depends critically on demand. Therefore, the study highlights the fourth and at the same time most important aspect for the development of suitable business models: the acceptance of autonomous driving among customers and the willingness of drivers to pay for this technology.

Study design

In July 2016, Deloitte surveyed around 2,100 German drivers about their attitudes towards autonomous driving, their confidence in the technology, as well as their willingness to pay and utilize the technology.

The participants were classified according to demographic circumstances as well as their mobility behavior. Criteria here were age, place of residence (urban/rural), and income. With regard to mobility, the differentiation was between frequent and occasional trips, as well as between utilization of the car for commuting or personal purposes.

A consistent understanding of the topic is required to interpret the responses correctly, since the term 'autonomous driving' is sometimes used with different meanings. What is generally accepted is the division into partially automated, highly automated, and fully automated driving:

In partially automated driving, the vehicle takes over driving tasks from the driver in certain closely defined situations, for example in stop-and-go traffic at low speeds. However, drivers must be able to take back control completely at any time.

Highly automated driving allows drivers to hand over control of the vehicle completely to the computer in specific situations, such as stop-and-go traffic on the freeway. However, they must be able to take back vehicle guidance completely within a few seconds if the vehicle prompts them to do so.

In fully automated driving, potentially only on freeways or specific roads, drivers can withdraw entirely from all driving tasks and are not required to be available to take control. This affords new opportunities for passengers to use the time spent in vehicles on other activities.

Within the scope of this study, 'autonomous driving' always means that the driver withdraws completely from all driving tasks and can focus on other activities.

85% of respondents are convinced that autonomous driving will catch on in the long term.



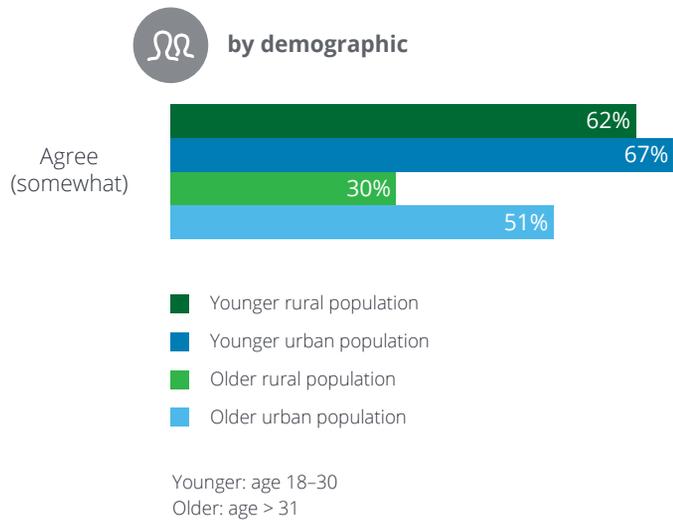
Autonomous driving in Germany

Autonomous driving attracts widespread interest

The study shows that the majority of German drivers are open to autonomous driving. Just over half of the respondents (53%) follow the topic “in the press and media with interest”. Thirty-one percent view it neutrally, only 15% show little interest in the topic at all.

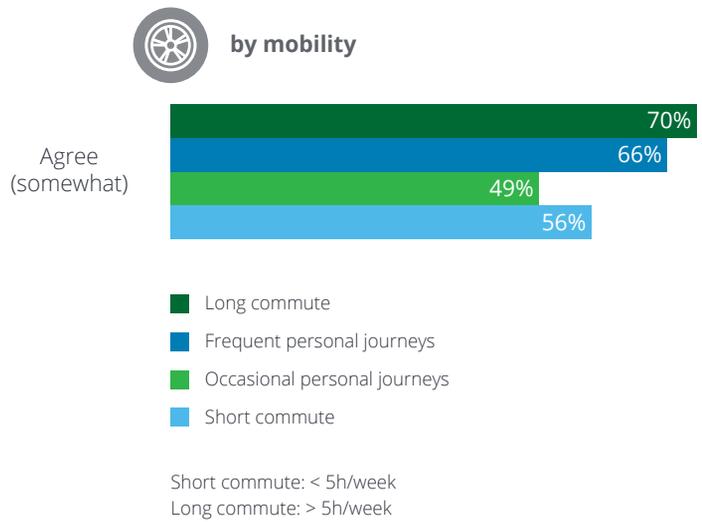
Sixty-one percent (19%: “agree”; 42%: “agree somewhat”) are interested in “trying out new developments in the area of autonomous driving”. The answer clearly depends on age and income: while 51 percent of the older urban population would like to try out autonomous driving, as many as 67 percent of the younger urban population are interested.

Figure 1 – “It appeals to me to try out new developments in the area of autonomous driving”



The differences that result from the different mobility classifications are of a similar magnitude. The more respondents use their vehicles, the higher their interest: 70 percent of those with long commutes, and 66 percent of those who make frequent personal trips, would like to test new developments in this field. For short commutes (56%) and occasional private journeys (49%), the desire for it is significantly lower.

Figure 2 - "It appeals to me to try out new developments in the area of autonomous driving"



There are still strong doubts about safety

About half of the respondents are prepared in principle to make use of autonomous driving. For almost 90 percent, it is important that they could take control of the vehicle at any time, since they have very strong safety concerns.

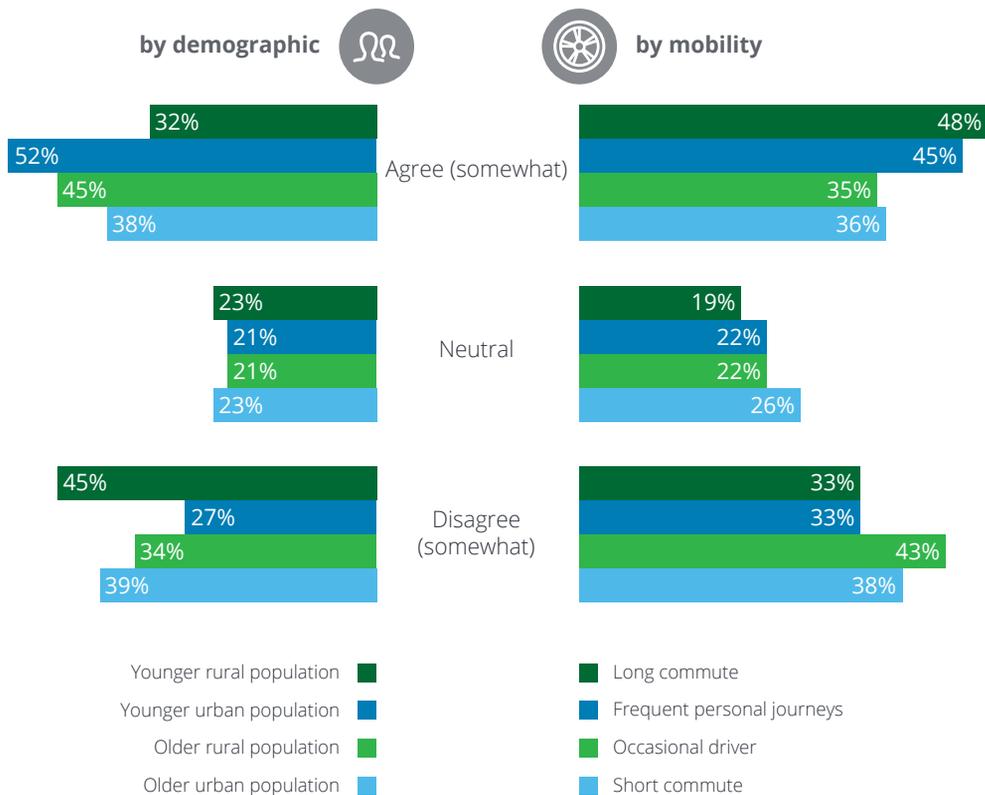
The study shows a fundamental lack of confidence in the safety of self-guiding vehicles: around two thirds (65%) of respondents are afraid that the technology is not reliable and that

there could be malfunctions due to construction or manufacturing errors. Fifty percent are afraid of hacker attacks on vehicles and data theft. This means that customer perception contrasts with the arguments of vehicle manufacturers, who promise that autonomous driving will deliver appreciably better safety and largely accident-free traffic.

Regarding the use of autonomous cars in autopilot mode with no driver, respondents are split on letting the

vehicle refuel or drive into a car park by itself – agreement and disagreement are more or less balanced. Marked differences show up in the segmented responses: only 38 percent of the older urban population can imagine letting the vehicle drive itself. Young urban populations are more open to such applications: 52 percent of them could imagine such use.

Figure 3 - "I can imagine letting my car drive without being in it"
(e.g. car park, gas station, carwash)



Test drives have the power to convince

Test drives turn out to be the key as well when trying to convince customers of the benefits of autonomous driving. Sixty-eight percent of respondents are more likely to use self-driving vehicles if autonomous driving were demonstrated to them under realistic conditions, for example during test drives or as part of car rental or car sharing offerings.

Manufacturer warranties are also a promising means of reducing concerns: 59 percent of respondents each are more

likely to make use of autonomous vehicles if manufacturers take on repair costs or liability in the case of accidents caused by computers.

What is surprising in this context is that the higher safety of automatically controlled vehicles, even if clearly proven by statistics, is only the fourth-placed reason why respondents would be motivated to try out the use of autonomous vehicles.

Figure 4 - "I would use autonomous vehicles if ..."

... autonomous functions are demonstrated to me under realistic conditions (e.g. as part of a test drive).



... manufacturers accept liability for any accidents caused in the autonomous driving mode.



... manufacturers guarantee safety (e.g. taking on repair costs if caused by the autonomous driving mode).



... the safety of autonomous vehicles is proven by statistics (e.g. lower incidence of accidents than non-autonomous vehicles).



... I could understand the technological mechanisms of autonomous functions (e.g. through explanations, diagrams).



... third parties create incentives for their use (e.g. lower car insurance).



Autonomous driving in Germany

In general, when drivers are faced with new technologies, they have clear preferences when forming an opinion about it. For more than 85 percent of respondents, "my own experience" represents the ideal solution.

Automotive manufacturers would therefore be well advised to enable as many drivers as possible to test out the use of autonomously driving cars so as to reduce the current lack of confidence (see further questions below) and to convince customers of the advantages.

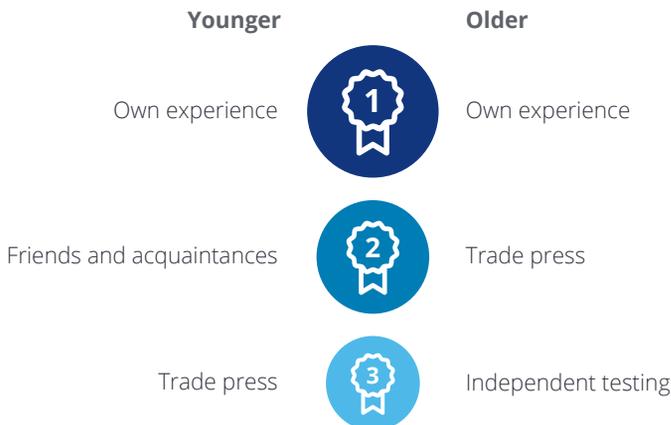
This could be done, for example, by retailers offering even more test drives, or with the use of autonomous vehicles in car sharing, where potential customers could come into contact with the new technology without obligation. To achieve greater persuasive power, it could be a

good idea as well to demonstrate fully automated driving on specific test roads that include extremely challenging and safety-relevant situations.

For the younger population, the opinions of friends and acquaintances are also very important. The majority (younger rural population: 63%, younger urban population: 55%) would use this source of information extensively, whereas only around a third of the older population is influenced strongly in this way (older rural population: 34%, older urban population: 35%).

Much more significant for customers than information from automotive manufacturers are the opinions of independent testing organizations about autonomous vehicles.

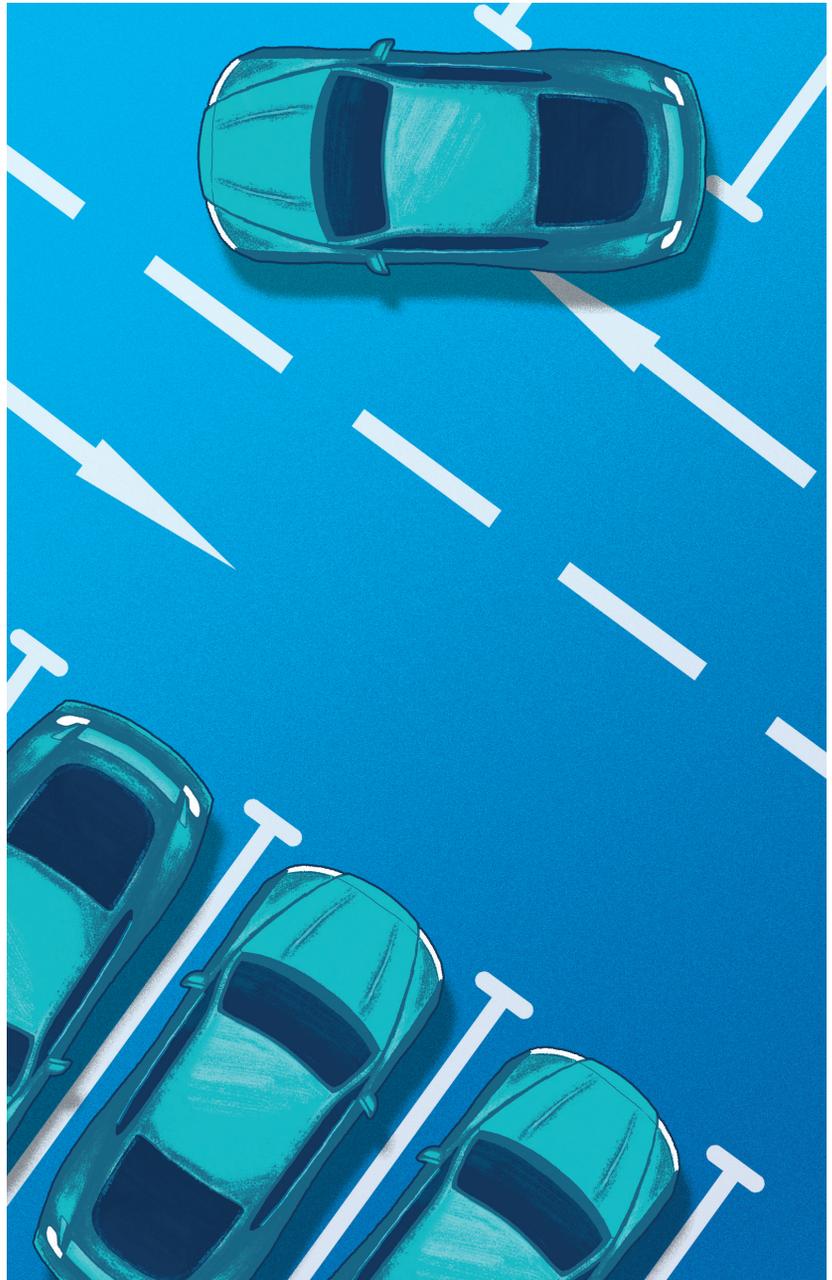
Figure 5 – Top 3 ranking:
"When thinking about automotive topics, I care most about:"



Premium manufacturers enjoy a higher level of trust

Across all segments, half of the respondents (51%) agree that they would trust an autonomous vehicle more if it was a premium brand, rather than a mass market producer or a start-up. This confirms the assumption that premium manufacturers worked hard in the past on having a good reputation, which is an advantage on the one hand, but which also generates higher expectations, for example in terms of product quality. This advantage is something that manufacturers should definitely exploit, rather than squander.

On the other hand, only 18 percent of respondents consider autonomous vehicles from new manufacturers they do not yet know as untrustworthy in principle – persuasive new competitors could make use of this opportunity in their entrance to the market.

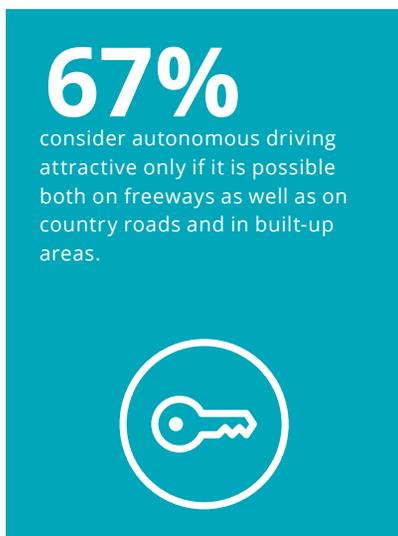


Extra convenience is the main motivation for autonomous driving

Half of the respondents consider both long distance travel and city transport to be the most important use cases for autonomous driving. For about 60 percent of study participants, higher convenience and gaining time would be the main motivation for the utilization of autonomous vehicles. This aspect is particularly relevant to younger urban people with high income.

For the majority of respondents, it is important that autonomous driving should work anyplace and anytime. Sixty-seven percent consider autonomous driving attractive only if it is possible both on freeways as well as on country roads and in built-up areas. Likewise, usage restrictions due to the weather, for example snow or fog, are unacceptable to 59 percent. Restricting automatic steering to certain areas, such as conurbations, is unacceptable to 57 percent of respondents.

It is interesting in this context that for younger urbanites with high income, the experience of driving themselves does not play a big role: 70 percent of them would not mourn driving if they gained convenience and time.



The more unpleasant the drive, the higher the willingness to pay

As already mentioned, convenience and time gains are seen as the most important advantages of autonomous driving. Accordingly, drivers are more prepared to pay if fully automated vehicles free them from driving tasks in particularly unpleasant traffic situations. At the top is congestion with stop-and-go traffic. Sixty-one percent would be prepared to pay extra if they did not have to drive themselves in such situations on the freeway; on country roads and in city traffic, it was 52 and 56 percent

respectively. This is especially true for older drivers with high income: 60 percent would pay more for congestion navigation on country roads or in urban traffic, and the figure goes up to 68 percent for congestion on the freeway.

Splitting responses by mobility behavior, the most significant differences are in urban traffic: the strongest willingness to pay is among those with long commutes at 62 percent, and those who make frequent personal journeys (58%). Fifty-

one percent of occasional drivers and 52 percent of those with short commutes would accept a premium.

Across all segments, every other person would pay extra for a vehicle that could find its own parking space. Searching for parking spaces is apparently especially stressful for older respondents: 55 percent of them would pay extra to have the vehicle carry out this task by itself. Among the younger respondents, the figure was 46 percent.

Figure 6 - "I would be prepared to pay extra for autonomous driving."

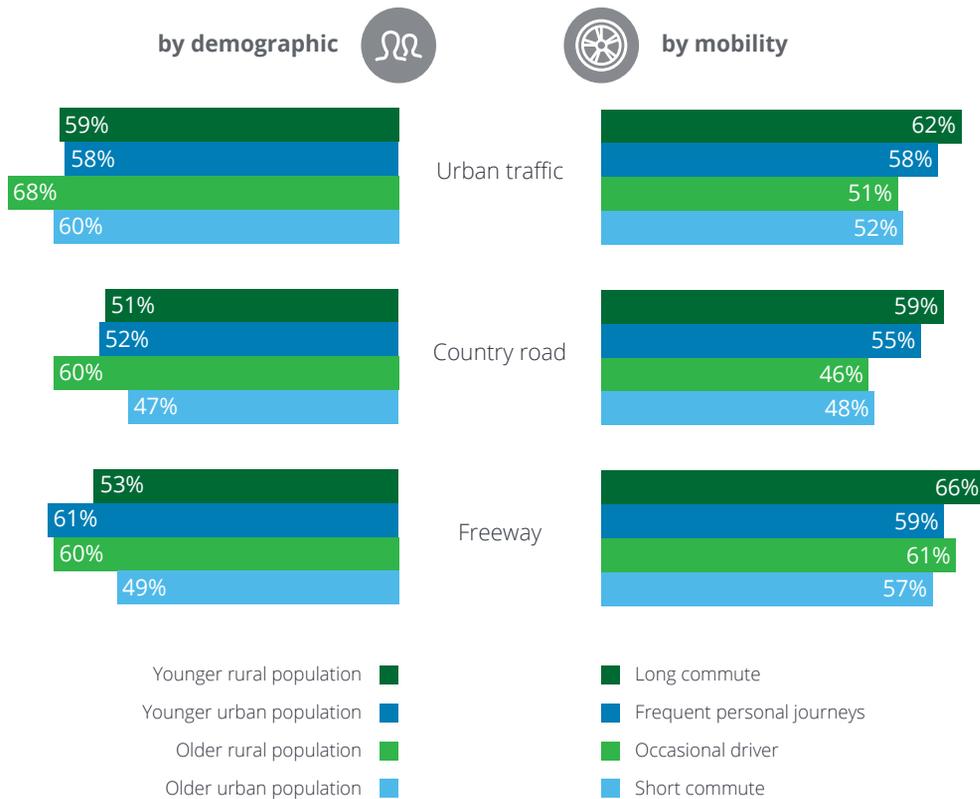


Figure 7 – Willingness to pay extra for autonomous driving in the following situations:



About a third (36%) would consider a premium worthwhile if the vehicle could enter and exit parking spaces itself. Twenty percent would still accept extra costs for autonomous driving in moving traffic, such as changing lanes.

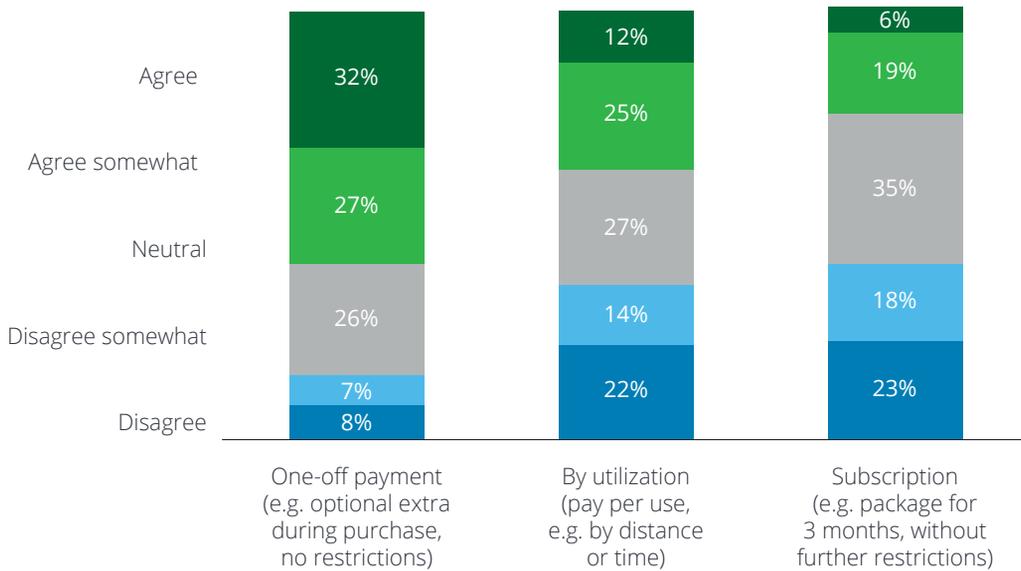
A second aspect of willingness to pay is the question of how the premium for additional functionality is paid. Fifty-nine percent of study participants prefer

conventional one-off payments during purchase to unlock autonomous driving functions for unlimited utilization. Only 15 percent explicitly reject a one-off payment, while 26 percent are neutral about it. Especially for those with long commutes (67%), as well as for younger urban populations with high income (65%), a one-off payment is the most popular option.

Payment models that depend on utilization, such as pay-per-use (by distance or time) and subscriptions, are currently less attractive to respondents than one-off payments during purchase. However, 39 percent of the urban population would prefer payment by use. In rural areas, this payment type meets with agreement for 34 percent. The least acceptance is for subscription models.

The study shows that models financed by advertising should only be considered with great care, because around 44 percent of respondents reject advertising in autonomous vehicles, 36 percent are open to it, and 20 percent have no preference either way. Especially for respondents who drive to work, that is, have long or short commutes, advertising during autonomous driving would not be attractive. Only 19 percent of them would accept advertising if it meant they had to pay less.

Figure 8 – Any premiums for autonomous driving should be paid for as follows



Interior concept: customers want to communicate and work

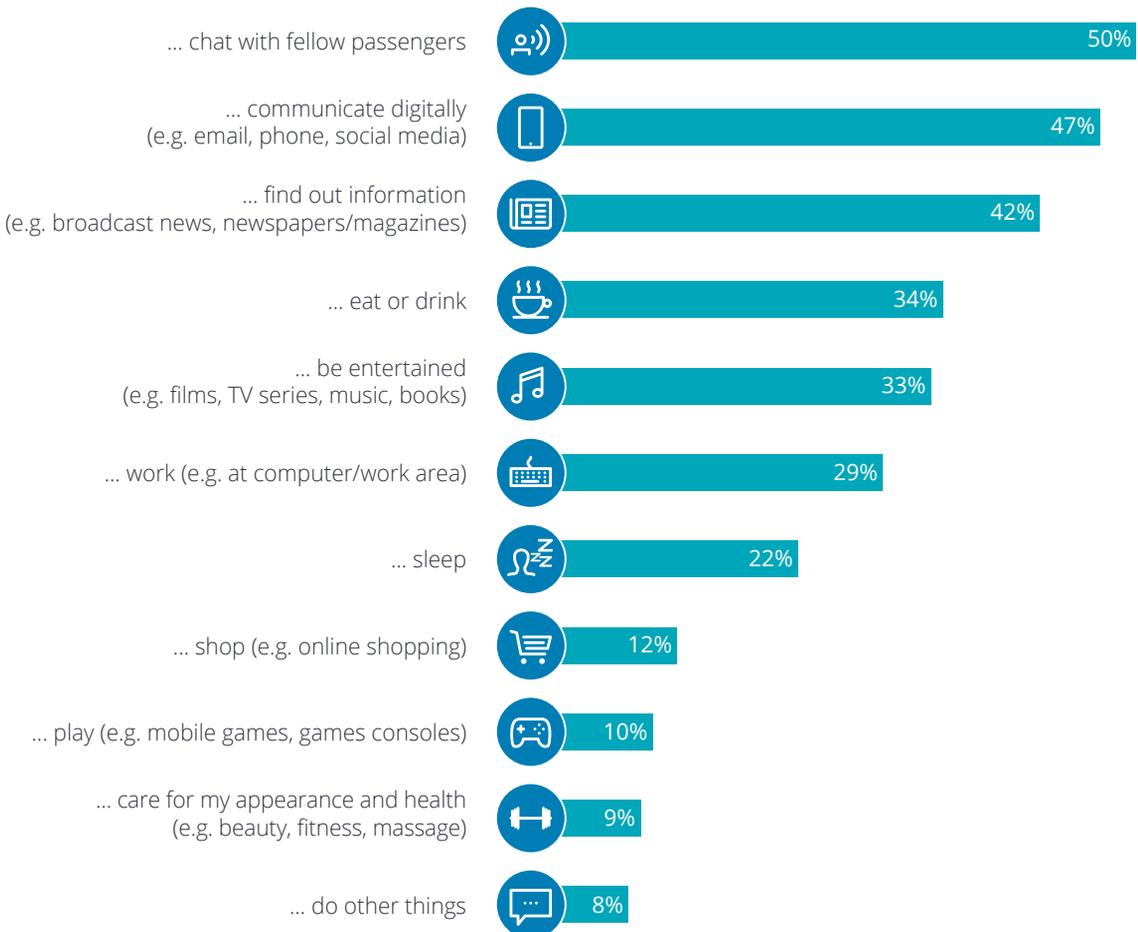
The respondents named a wide range of activities to utilize the time gained. About half would chat with other passengers; frequently mentioned were also "digital communication" (47%), "finding out information", for example broadcast news or newspapers/magazines (42%), eating and drinking (34%), "being entertained" (33%) and working (29%).

Those with long commutes would communicate digitally and work. This also explains why the majority want vehicles with built-in infotainment systems to offer the same functionality as mobile devices. Both those with long and short commutes also wish for vehicles to be equipped with better entertainment electronics than today's models.

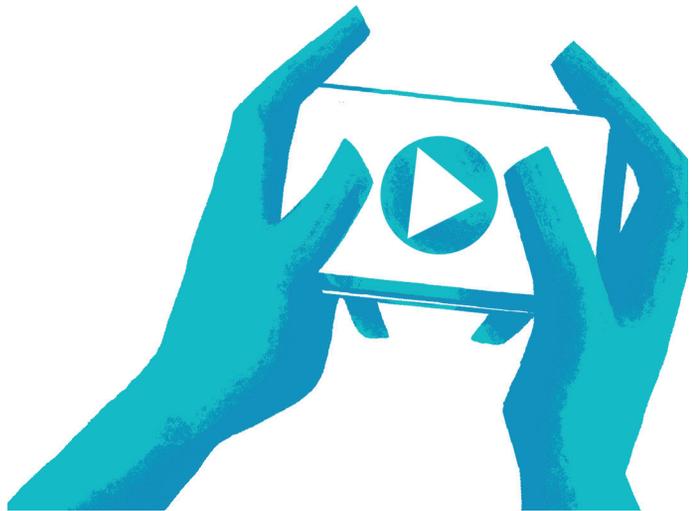
For private journeys, this aspect is not very important. In general, those who drive a lot expect the interior to adapt flexibly to current needs and activities.

Figure 9 – Making use of time gained through autonomous driving

"I would make use of the time gained through autonomous driving to ..."



For all respondents, independent of age and mobility behavior, it is most important to sit more comfortably in the vehicle than today. There is very little interest in functions which would enable the vehicle to monitor the health of its passengers (e.g. measuring resting pulse, blood pressure). The option of sleeping comfortably in the vehicle is of low importance to respondents – presumably because those surveyed cannot yet imagine giving up control while the vehicle drives independently.



Conclusions

Established premium manufacturers enjoy a particularly good reputation among customers with regard to technology. It is therefore important that manufacturers do not disappoint existing trust when it comes to autonomous driving, as well. Given customers' lack of confidence, safety should be of paramount importance, and remain so. Second, customers want to be convinced of the new technology, which is best done through personal experience. They should be offered low-threshold opportunities for experiencing the technology themselves, for example through extended test drive opportunities or in car-sharing fleets.

Expanding the outlook from this rather short-term view, new dimensions become visible very quickly: autonomous driving is much more than just a technical improvement of vehicles as a product. From the point of view of utilization, a completely new proposition emerges that could change the mobility market and our personal mobility strategies from the ground up. In parallel with the development of autonomous driving, the market will also shift more and more toward electromobility.

From these two trends, we can derive scenarios for a totally new mobility environment.

Use rather than own – the computer as chauffeur

With autonomous driving, reasons for owning vehicles will fall away for more people. If taxi rides were cheaper, many drivers would wave goodbye to their own car even today and let themselves be chauffeured. Autonomous vehicles create a completely new situation: the

technology is a little more expensive, but around two thirds of current (staffing) costs fall away, and in addition, vehicles can drive 24/7. This will accelerate the trend from ownership toward utilization.

One consequence of this will be that fewer vehicles will be in private ownership, with significantly more on the road as part of fleets, which creates new business models. Similarly, many vehicle manufacturers are thinking about becoming active as fleet operators of autonomous vehicles. Other candidates for operators are of course also newly emerging ride-sharing companies like Uber, as well as traditional operators and providers in local public transportation, and even local authorities themselves.

Fewer parking spaces – lower air pollution

Local authorities come into play here as stakeholders, because fleets of autonomous 'taxis' could replace many private vehicles, which would mean there is less traffic searching for parking spaces, and less space for parking is needed. Electrically operated fleets also pollute the air less locally.

As soon as the keyword 'local public transportation' is mentioned, new financing models appear, since public transportation is generally subsidized as part of basic public services. Thus, more traffic at the same cost, or the same mobility supply with lower costs, could be realized. For example, autonomous passenger vehicles or vans could run instead of busses on routes with less demand.

A possible effect on traditional vehicle manufacturers has already been mentioned: they could run their own fleets. Even if they do not do so, their business will shift towards B2B; this is because they will sell more vehicles to fleet operators and fewer to private customers, which will not be without impact on sales structures and the service industry.

More tailored vehicles – fewer standard models

There will also be a significant impact on product design. Currently, it is important to most vehicle buyers to own a vehicle that is suited to the commute to work (one passenger, no luggage) just as much as it is to the family vacation and bulk shopping with the family. This demand for universality falls away when customers are only thinking about the next trip, and request a matching vehicle for it. A trend toward clearly specialized vehicles that require new module concepts follows logically for the automotive industry.

Ultimately, there could be two fundamentally different categories of vehicles: models that only drive autonomously, which are capable of moving within conurbations and on roads with heavy traffic where the infrastructure for autonomous driving is available, as well as sufficiently exact and up-to-date mapping materials. Second, models for private customers that continue to be universally usable and capable of being driven in places where autonomous driving is not or only partially available. For these models, autonomous driving could be an option attracting additional payment.

Vehicle fleets shrink – replacements needed

With regard to automobile industry sales, the trend described from ownership toward utilization does not have to be a disadvantage. On the one hand, there is an opportunity for generating additional revenue as a mobility provider. On the other, while vehicle stocks may go down, they also need to be replaced more often since every vehicle drives more on average than is the case today.

From a technological point of view, therefore, the jump from ever more extensive and sophisticated driver assistance systems to fully automated driving is not very large, but the impact on the automotive industry and the mobility market is enormous – so let's talk about that.

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