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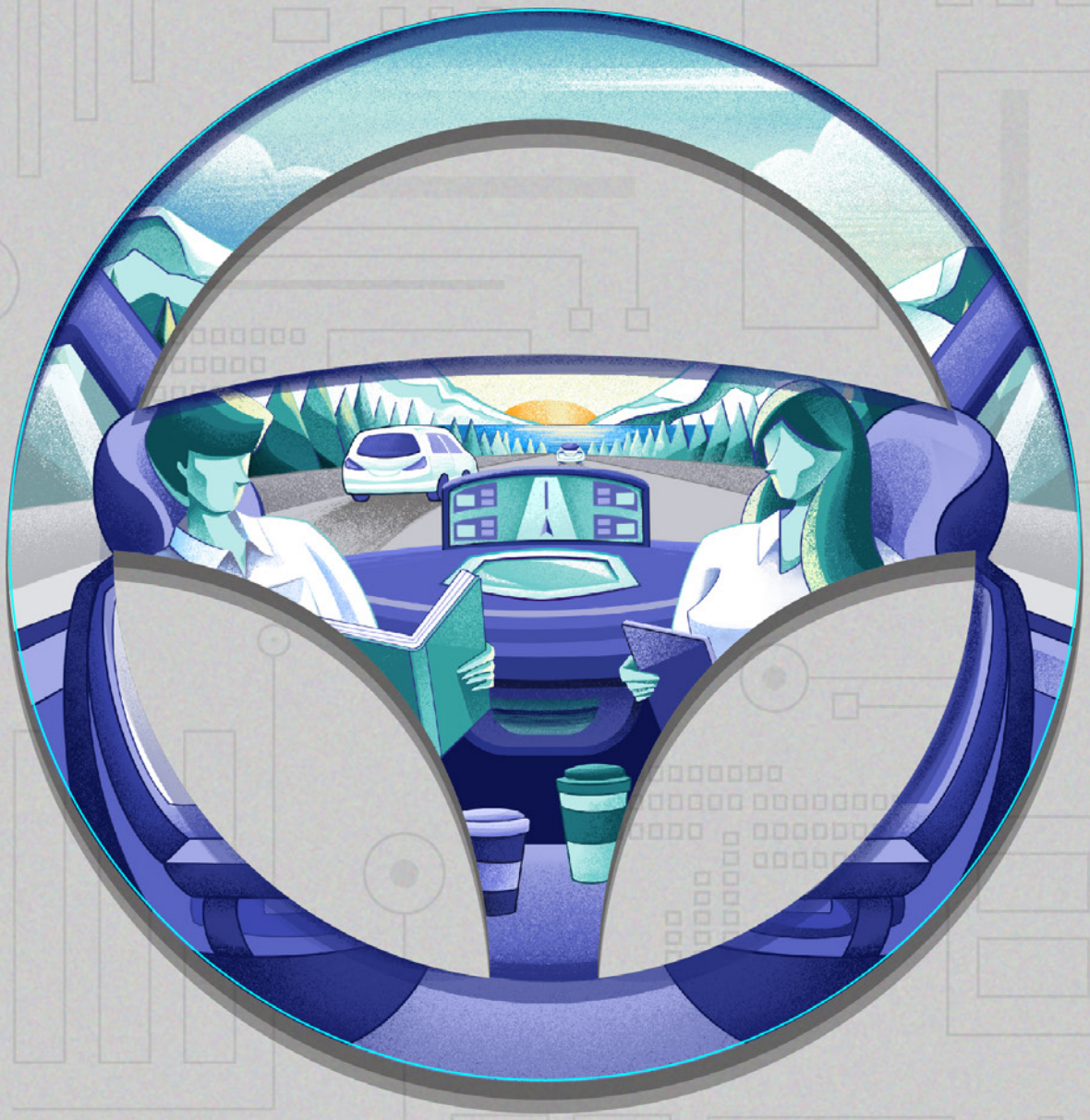

Forget the wheel

Reinventing vehicle interiors for an autonomous future

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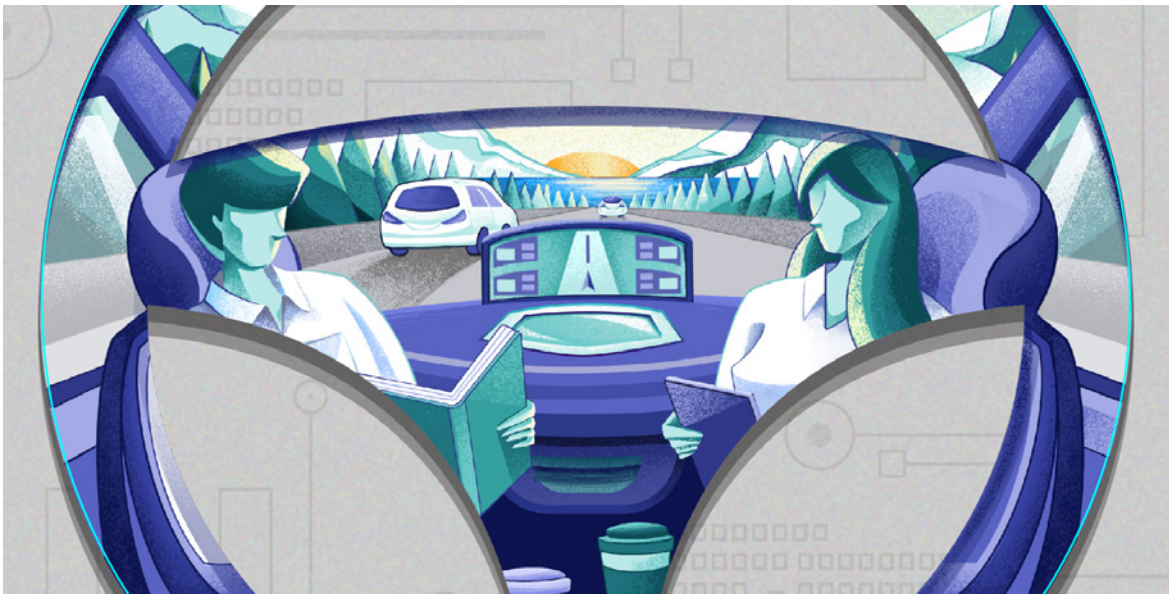


Introduction

The in-car experience on our horizon is not about driving. Whether work, play or something in between, purpose should be leading OEMs and product developers to an imaginative vision of what our cars could be.

WHAT IS SLICKER than the latest smartphone? It is a creation still taking shape today. You will find it on the road, not in your hand. From the outside, it looks like a car. On the inside, it looks like a living room, or a bedroom, or an office. The next big thing is the 'smartphone on wheels': an autonomous vehicle (AV) that is anything a passenger wants it to be.

For decades, original equipment manufacturers (OEMs) in the vehicle industry have doggedly pursued small, functional improvements to make driving safer, more comfortable and more pleasurable. New technologies sparked most innovations, improving the practicality of the vehicle or the driving experience, but this dynamic is about to shift. As the driver relinquishes their responsibility behind the wheel, their whimsy will be the new innovation catalyst. Senior executives, product developers and marketing executives of car manufacturers should sit up and lean in. What does the autonomous driver desire, once they take their hands off the wheel?

Whatever those wishes may be, OEMs will need to find ways to satisfy them while the car drives itself. This is going to pull the focus to user-centricity: attractive interfaces and easy-to-use services. But the potential is far greater than that. Instead of focusing on known forms of digital experiences, OEMs can shape the vehicle and its interior for entirely new purposes – creating, in essence, a smartphone with variable space dimension.

The interior experience of AVs could develop in a variety of ways over the next ten years. Deloitte has sketched a picture of four future scenarios – and the uncertainties they hinge on – to support managers, designers and developers in their task of shaping the car of the future.

Driving blind

Complications in realising AV potential

WE CAN LOOK to new e-mobility entrants from the Asian markets for a clear glimpse of an AV's potential: an entertainment device with large screens, an excellent sound system and comfortable seats. Although it is easy to imagine such a future AV user experience (UX), getting there will be a bumpy ride.

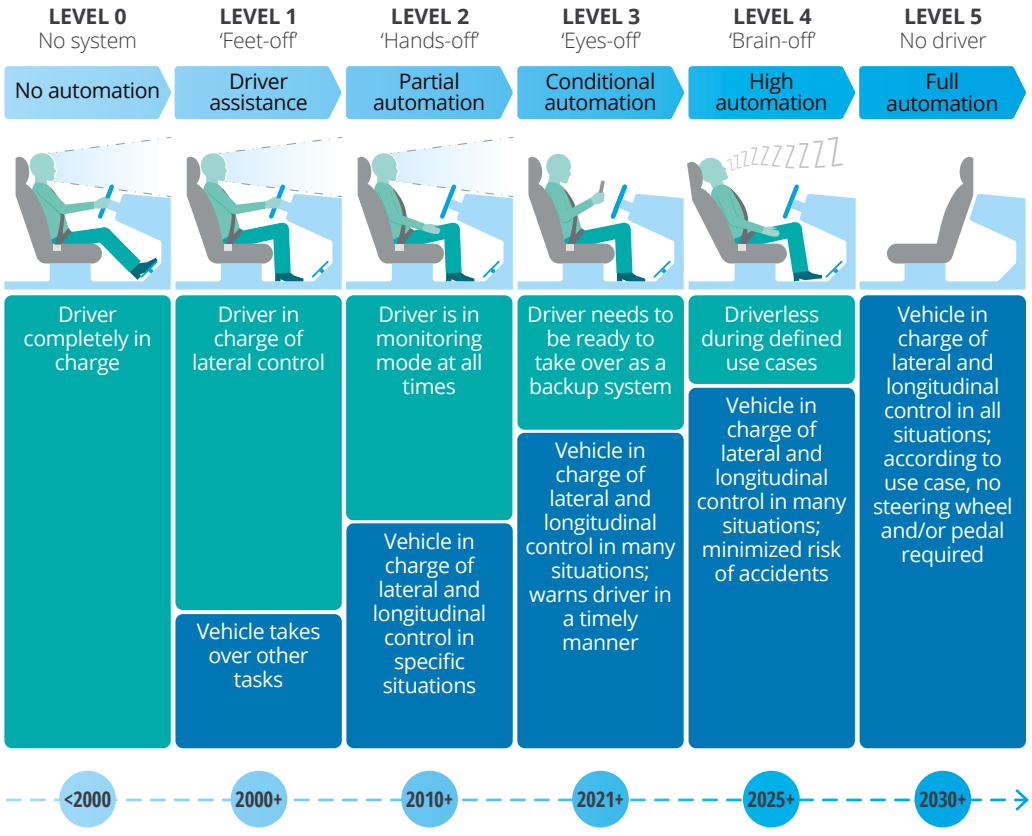
First, it remains unclear how fast we will arrive at full autonomy, from a technological perspective. Despite the hype surrounding autonomous driving, initial excitement for the technology has cooled recently, owing to slower-than-expected development, declining investments and increasing cost pressure. Then there are the following final hurdles that need to be crested before full autonomy becomes the norm.

THE REGULATION WAITING GAME

As of today, there are still no agreements on technological frameworks within the industry. We are still waiting on, for example, standardised sensor sets for Level 3 (and Levels 4 and 5) AV capabilities, and the regulation of training, testing, validation and improvement of machine learning algorithms (figure 1). When and where autonomous driving will be operational and embedded in a profitable business model depends on the state of the regulatory framework for the technology.

FIGURE 1

Autonomous driving levels – Where are we today?



(Expected) Start of commercial pilots and/or market introductions by established players

Source: Deloitte research, SAE International 2014.

Regulations also need to extend to behaviour behind the wheel. As potential AV weaknesses have been revealed (for example, erroneous image recognition, or unfounded emergency braking after false-positive classification [phantom braking]), it has become clear that drivers place too much trust in AV capabilities. To ensure their safety, regulators will need to address this issue, especially in the transitional Level 3 autonomy, which requires that drivers still pay attention to the road from time to time.

Only when legal standards for AV technologies and associated driver behaviour are established can autonomous driving be introduced to the mass market. In addition, designing, implementing and selling novel UX concepts demands that these legal frameworks are in place and as homogenous as possible across industrialised countries. Regulators and mobility companies should combine efforts and work hand in hand to agree on the necessary standards.

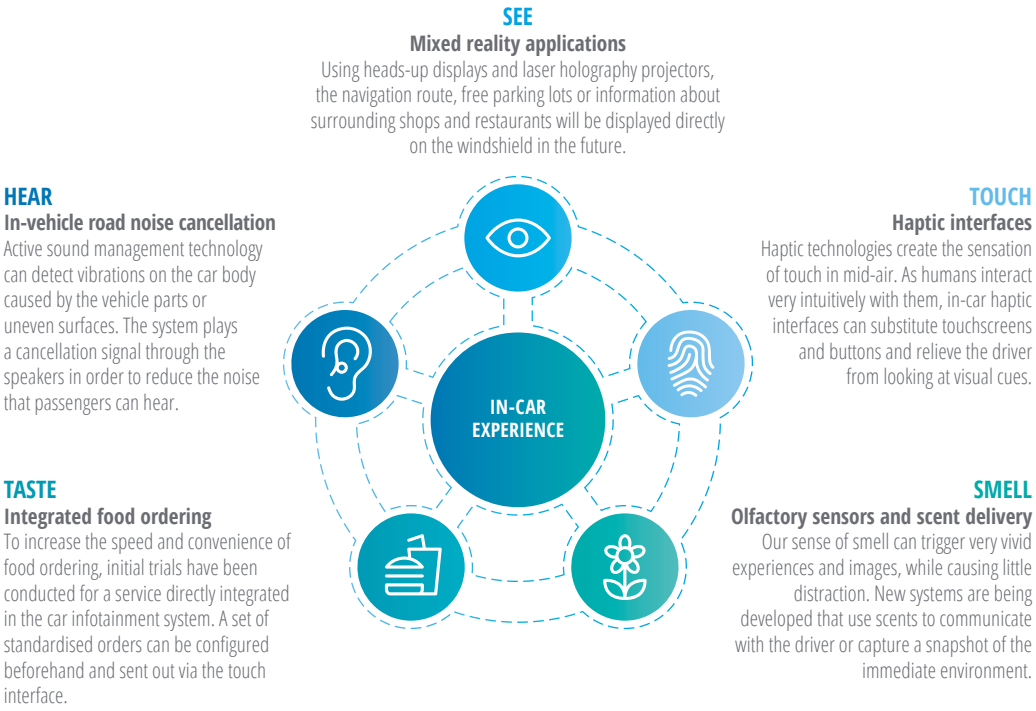
DEPENDS ON THE DATA

We expect the future in-car UX to rely on a myriad of new technologies and connected services, pinging live information about the surrounding environment and traffic, assessing the driver's health status and matching music to their mood. New business opportunities are opening up here, not only for car manufacturers, but also third-party software and service providers, assuming an open-platform approach.

Yet, just like autonomous driving capabilities themselves, ubiquitous connectivity and substantial, real-time data processing will be needed to enable complex service functionalities. Many will require speedy, stable mobile network connections, such as 5G, to run smoothly. For this reason, adoption might be slowed by the rate at which network infrastructure is developed for highways, the countryside, urban environments and tunnels.

FIGURE 2

Novel in-car technologies and services along the five senses



Source: Deloitte analysis based on expert websites.[2]

PLANNING AROUND THE PASSENGER

Apart from regulatory and techno-economic hurdles, one challenge is even more difficult to predict: customer behaviour. Once connected services are in place, there will be broad variation in the desire to use them, and even more so in the willingness to pay for them. Just like with app shopping today, there will be a rigorous selection process, based on what customer value the services offer and how much attention they can capture (figure 2).

If in-car technology is not current or attractive enough, consumers will turn to their personal handheld devices or rely on bridge technologies. In other words, they will find their way to the most convenient experience, with or without the OEM. A great example of this attitude lies in the use of Google Maps. Drivers frequently use the app on their phones as a substitute for built-in navigation systems, finding that its UX is more intuitive, and its functionality and traffic prediction capability are superior. Another example are car cassette adapters with AUX cables that drivers of older car models use to play music from their modern devices, despite lacking the required hardware in the vehicle.[2]

An additional, unsolved problem lies in motion sickness. Many vehicle passengers experience dizziness and nausea when reading or using the phone. This will make it very difficult for them to engage in any connected services in future AVs. Researchers continue to investigate motion sickness,[3] and OEMs are also at work: on visual cues that can match the car's movement via virtual reality, and adaptations of driving behaviour based on a passenger's biological data.[4]

Making the future tangible

AS WE HAVE pointed out, the future of AV-based interior design relies on a multitude of external factors, but also market players' ability to bring various technologies together. To envision the in-car AV experience, we have conjured up four potential future states. Before describing their merits and potential, it is necessary to acknowledge the complexity of the two major underlying uncertainties – each scenario depends heavily on their outcomes:

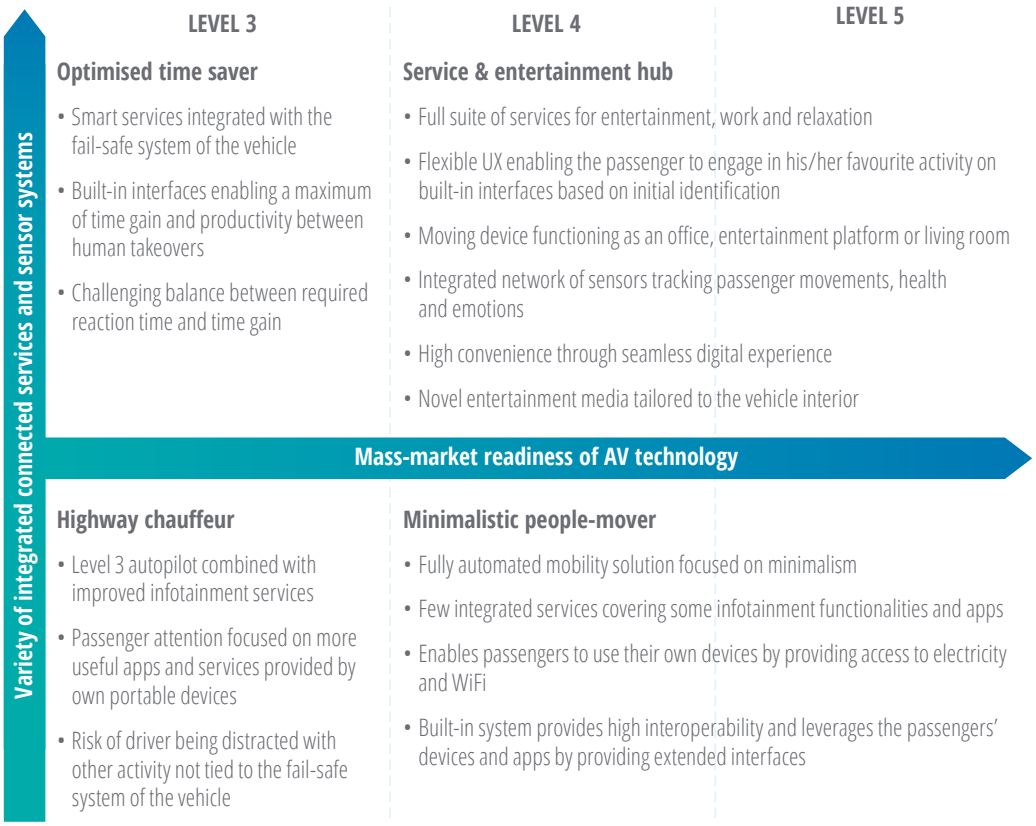
- **Mass-market readiness of AVs** – The availability of AVs in the mass market in 2030 will be the culmination of technological and regulatory advancements and successful cross-industry collaboration. But technological progress could stagnate with declining investments or significant regulatory hurdles, stalling the mass-market AV rollout at Level 3. It is very possible that the shortcomings of a single element in the required technological ecosystem, such as 5G networks, will deny the masses autonomous driving opportunities, for years. On the other hand, if there are major technological advances, a swift catch-up of safety and liability regulations, and homologation processes established, Levels 4 and 5 AVs could be available by 2030, at least in geofenced areas. Drivers could take their eyes off the street, unlocking vast design freedom for the interior UX. Given the high technology costs and likely spatial constraints, we can assume that such AVs would be operated in fleets for ride-hailing and public transportation.

- **Variety of integrated connected services and sensor systems** – This depends on OEMs' ability to orchestrate novel offerings, the benefit of services, the interfaces to – and compatibility with – handheld devices, and the regulations addressing driver attention. In the future, if regulators oppose in-car distractions, or if there are no viable business models for connected services beyond current infotainment systems, AVs could become mere mobility platforms characterised by functional minimalism. But if OEMs play their cards right and integrate a wide range of attractive services for passengers, AVs might become actual smart devices, adding new utility and entertainment to their mobility value.

With these uncertainties in mind, we present a structured scenario framework to broaden the perspective of potential future states of the market. The four scenarios in figure 3 reflect a wide range of outcomes, and are not mutually exclusive; they could very well coexist in different car segments or geographies.

FIGURE 3

Framework for future market states



Source: Deloitte analysis, 2020.

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ZOOMING IN ON FUTURE SCENARIOS

Scenario A, Service & Entertainment Hub

The identity of the passenger is recorded when she orders her ride and is verified via facial recognition before she enters the vehicle. Based on her profile, the seats are adjusted and an overview of her apps is arranged on the central interface. As the vehicle's operating system (OS) connects to her calendar, it suggests a destination and offers functions that fit the cause of the trip: If the passenger is on her way to a work meeting, the user interface provides a work surface and the emails and files associated with the meeting. On a leisure trip, the vehicle displays information about the environment and offers personalised entertainment options, such as the next episode of the series she watched last night. Integrated food ordering and shopping services allow the passenger to order just-in-time delivery.

Scenario B, Minimalistic People Mover

The passenger chooses a destination via his smartphone or an integrated voice assistant; the voice interface is high quality but does not provide many additional services. The interior focuses on a smooth experience, with screens and audio systems enhancing the passenger's devices: smartphone, tablet, smartwatch and/or other wearables. All devices are highly interoperable, irrespective of the OS. The passenger can connect via Bluetooth 10.0 upon entry and continue working or playing with whatever application he was using before entry.

Scenario C, Optimised Time Saver

The AV provides highly convenient services and apps optimised for the range of opportunities in the driving position. A retractable steering wheel opens up space for a table and an integrated tablet, on which the passenger can write emails, consume content or start a video chat with friends and family. Services, applications and even hardware settings (for example, displays, steering wheel) are closely linked to an advanced functional safety system that monitors passenger attentiveness. In case of a traffic hazard, this setup allows the passenger to immediately take over, by adapting or pausing irrelevant UX elements.

Scenario D, Highway Chauffeur

Technology has only advanced slightly from that available today, allowing the passenger to turn her attention toward her own devices, or to read or engage in other activities independent of the vehicle systems. Without sensor-enabled attentiveness monitoring, the vehicle relies on a fail-safe operational system embedded in the E/E architecture.

Gearing up for any scenario

AUTONOMOUS DRIVING IS inciting major value-chain shifts in the automotive industry. Throughout history, the car market has mostly followed a technology-push logic, by which OEMs have commercialised new technological developments. With the new freedom of self-driving cars, manufacturers and software providers now have to pay more attention to customers' behaviour; they must understand the details of what people demand, to deliver an attractive offering.

Most OEMs have already showcased futuristic concept cars and revolutionary interior AV designs, but it is still unclear what form these vehicles will take in their mass-market debut. The four scenarios outlined in this article provide a framework to navigate the possible options.

For example, Scenarios A and C bring attractive opportunities for variable and more complex interior configurations, depending on in-car use cases. But on the other hand, they highlight threats to traditional OEMs that lag behind in critical areas to develop and deliver novel services in a customer-centric fashion.

To rise to the challenge, OEMs and new entrants in the AV market should consider the following five critical questions.

How will autonomy affect the form factor of our vehicles?

Without a driver, and with an increasing number of unique connected services, the UX can better dictate the interior and the entire vehicle's design. If we apply the 'form follows function' principle, purpose-built vehicles could provide the precise hardware-software combination for either a business meeting or an overnight ride. AVs could also become all-in-one packages, combining relevant hardware features in a spacious and modular design, ready to be adjusted for the occasion of choice.

However, we are already seeing a growing variety of AV classes, ranging from tiny delivery vehicles to large-scale shuttles for public transit. The trend toward functional specialisation of vehicle classes will likely accelerate if car-sharing and ride-hailing become more mainstream. Instead of being bound to a personally owned vehicle model, passengers can consume mobility and more dedicated UX functionalities and services flexibly, based on their changing needs.

Moreover, the shift to electric drivetrains with flexible skateboard architectures and more modular vehicle designs enables further functional customisation. In light of the new form factors, OEMs will need to re-evaluate their vehicle portfolios and decide whether and how to shift from privately owned, all-rounder cars to shared, function-oriented AVs.

What will our underlying business model look like?

Until standardisation and significant economies of scale are achieved, the initial price and the running costs of autonomous driving systems will remain substantial. To cover these costs, OEMs will need to set up new pricing models for AVs. The autopilot functionality could be priced with a subscription model or on a pay-per-use basis, especially for Level 3 autonomy. For autonomous ride-hailing or robo-taxis, the fare is expected to eventually cover the costs of the technology, although one study has shed doubts on this business model.[5]

Connected services will add another layer of complexity to the pricing scheme. Consumers already rely on online services that are free (for example, WhatsApp), or based on advertisements (YouTube) or subscriptions (Microsoft Office, Spotify). They are used to increase seamless connections between their smartphones and other devices, such as Bluetooth speakers or smart home appliances. Within AVs, OEMs and software providers will need to: a) provide this basic type of connectivity for free, b) differentiate new in-vehicle services from the apps that users access on their handheld devices and c) find a suitable price point and pricing mechanism for their services and apps.

Will we control the customer touchpoint?

The customer journey of the future will go far beyond selecting, configuring and purchasing a car. The purchase marks the beginning of a continuously evolving product journey shared among OEMs and users, as well as platform and application providers. The monetisation of connected services is going to occur via a digital customer interface powered by an OS that provides the basis for the services and apps. Similar to the OS of computers and smartphones, there will be strong market forces pushing OS standardisation, as software companies seek to scale software to maximise their customer base. This becomes increasingly challenging when customers are scattered across technology platforms, and services and apps need to be developed for different operating systems.

The network effect tends to create natural oligopolies, or even monopolies; it will cause OEMs, technology companies and new entrants to race to establish the first mainstream OS as an app-store platform. The winner will be able to control potential future AV profit pools by guarding access to users and charging fees to third-party service providers. OEMs will need to understand and embrace the dynamics of the platform business model and catch up with technology companies regarding software capabilities. Or they will need to focus on the strengths of being hardware providers and enter long-term partnerships.

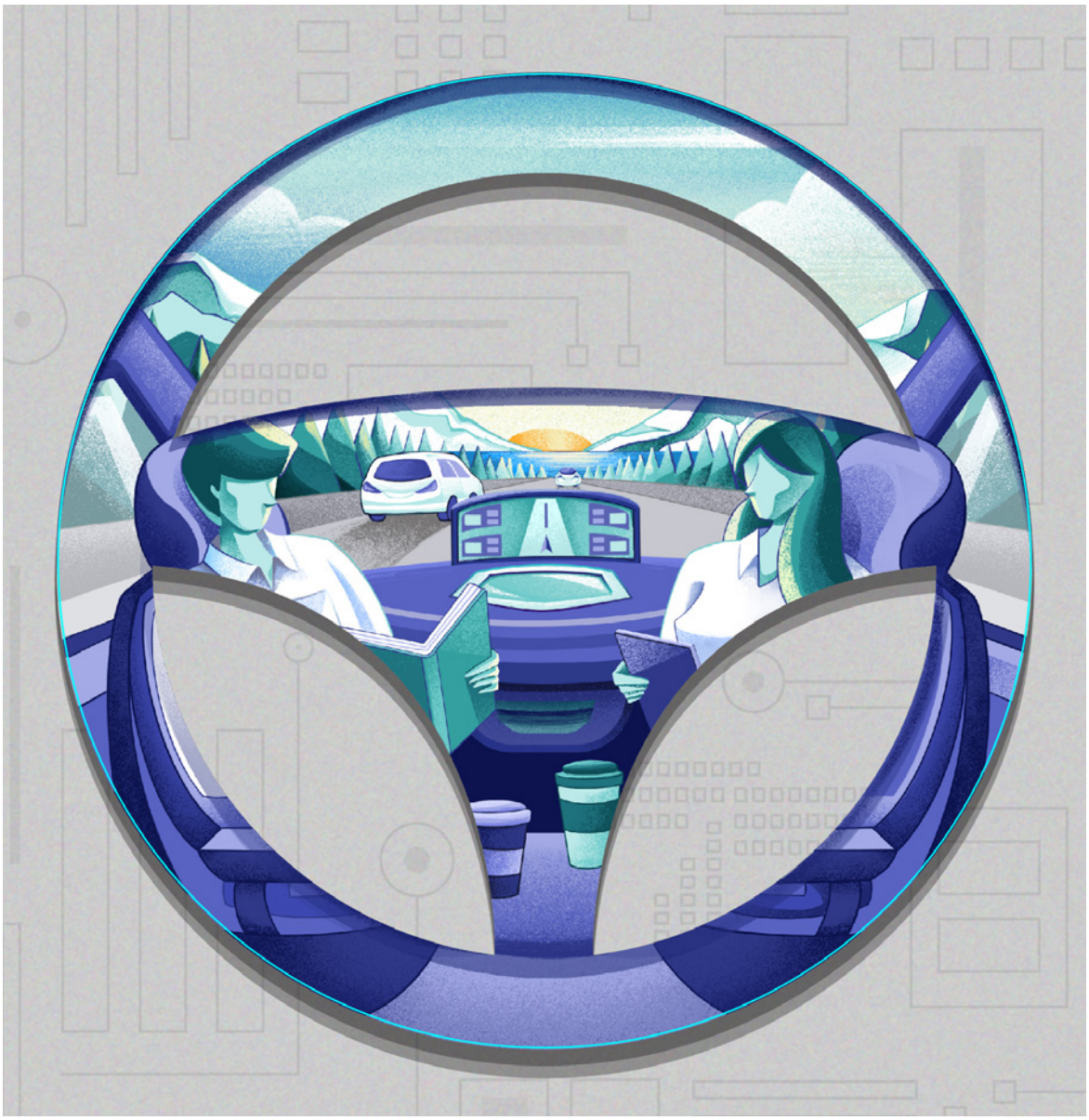
Do we need to overhaul our brand image?

The shift from driver to passenger experience will change the value proposition and the perception of OEMs, significantly. In light of autonomous driving, consumers might focus on entirely new evaluation criteria when choosing a car brand or mobility service provider. Depending on how quick and radical this shift is, and which future market state takes hold, OEMs will need to consider repositioning their brand. To convince customers about autonomous driving, there must be a strong focus on safety in the beginning. Later, with higher levels of autonomy, OEMs will seek to define clear, novel value propositions for their vehicles and adapt their brand image accordingly, focusing much more on convenience, flexibility and lifestyle.

How much should we invest in the UX of the Level 3 transition stage?

Level 3 autonomy, captured in the scenarios on the left side of figure 3, denotes an ‘eyes-off’ driving experience. In several accidents that involved an activated assist function, the driver relied too heavily on the partial autonomy function; the system became overloaded, and the driver was unable to react. This grey area of human-machine interaction highlights the risks of Level 3 autonomy and demands careful driver training.

As a result, this transition stage – on the way to full autonomy – will probably be highly regulated, especially with regard to driver attention. The interior UX will have to be focused on enabling a seamless and fast switch between driving and other activities. The potential for more elaborate connected services is very limited. The AV system will need to detect dangers and uncertainties far in advance, to alert the driver and receive input. OEMs should closely monitor regulatory guidelines and flexibly adjust their investments in Level 3 technologies and car models.



Forward drive

THE PLAYING FIELD for the future of mobility is wide open, but also more uncertain than ever before. One certainty is that the new reality is approaching faster than expected. Highway pilots could gain traction as soon as 2023. OEMs should be positioning themselves accordingly today and establishing their right-to-win by building up key capabilities (software development, UX development, consumer behaviour analysis, etc) and strategic partnerships.

Endnotes

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