



# Cruise controls

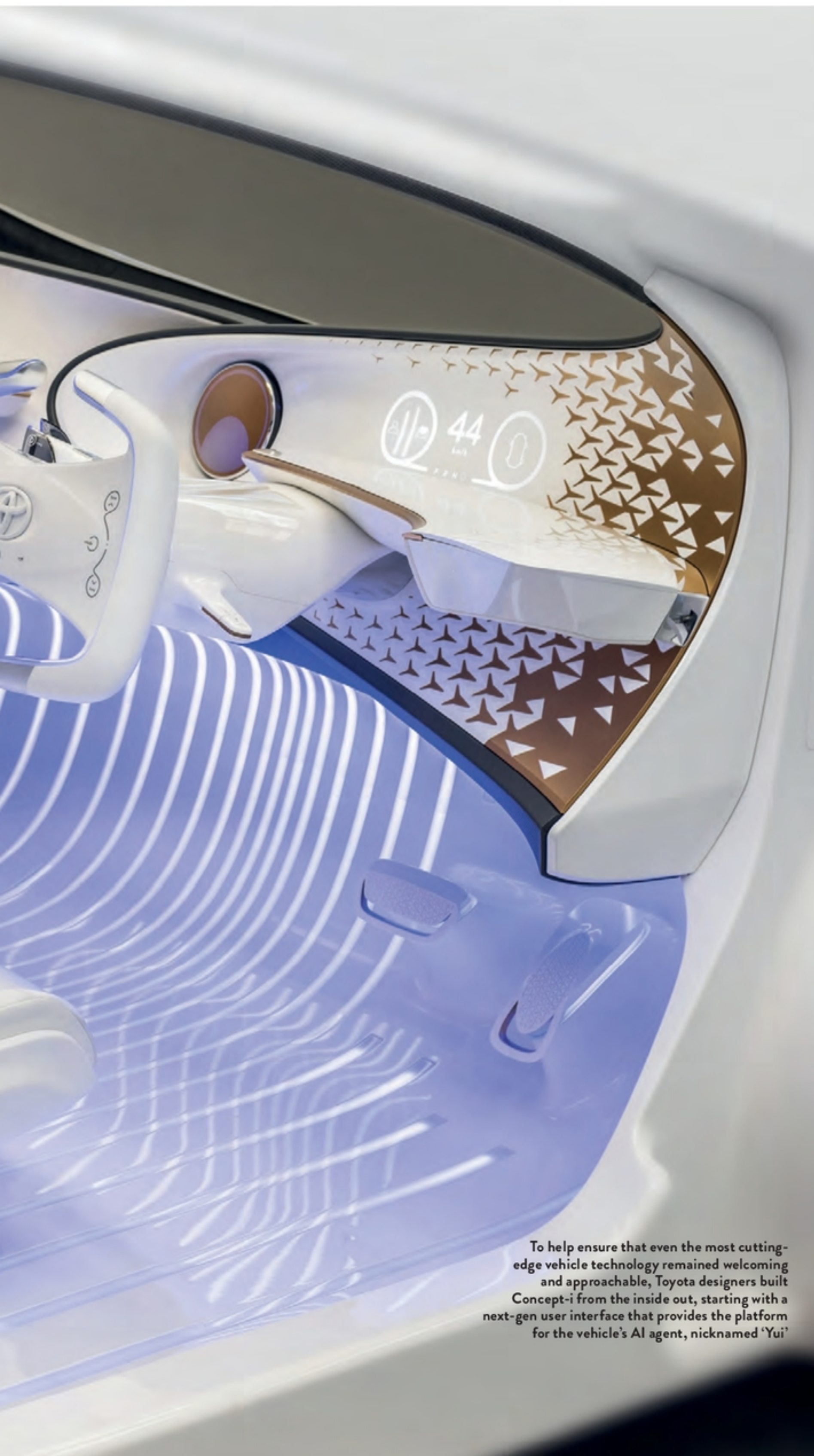
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HOW DRIVERLESS VEHICLE TECHNOLOGY  
IS PRESENTING DESIGNERS AND OEMs  
WITH A COMPLETELY NEW AND RADICAL  
APPROACH TO THE WAY IN WHICH  
INTERIORS ARE CREATED AND OPERATE

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BY LEM BINGLEY





To help ensure that even the most cutting-edge vehicle technology remained welcoming and approachable, Toyota designers built Concept-i from the inside out, starting with a next-gen user interface that provides the platform for the vehicle's AI agent, nicknamed 'Yui'



It's well understood that autonomous vehicles (AVs) will deploy a complex barrage of sensors to make sense of the world around them. Less obviously, they may also need a suite of sensors looking inward, to detect what's going on inside the cabin.

"The driver monitoring camera is going to be core technology," predicts Dr Erik Coelingh, VP at autonomous technology provider Zenuity. "You need a camera to understand the status of the driver – where the driver is looking and their hand positions," he explains.

"If you want to warn them, maybe you have to do it differently in cases where the driver has their eyes on the road, as opposed to their eyes on the center display."

Zenuity is a joint venture owned by Volvo Cars and Autoliv, a supplier of components including airbags, cameras, radars and active safety systems. Prior to joining Zenuity, Coelingh led work on active safety systems at Volvo, including automated emergency braking and pedestrian detection.

Occupant cameras will be particularly important in transitional cars that can be either human driven or fully robotic – perhaps with a fold-out steering wheel and pedals – as handing over control from one mode to another is unlikely to be quick: "We've done testing with self-driving cars and ordinary people," Coelingh says.





**“YOU WILL PROBABLY NEED NEW CONCEPTS – NEW TYPES OF AIRBAGS, NEW TYPES OF BELTS, ONCE YOU START TO LIE DOWN”**

“When we put the car in a sudden, unexpected situation, people are just not prepared for that.”

If an AV is to surrender control safely, it must first make sure that the driver is awake, has grasped the wheel, is facing in the right direction, and knows which pedal is which. “I’ve done those kind of tests, in a simulator, and it takes a couple of seconds before you can get your hands on the wheel and

**ABOVE**  
Development of Sedric results from cooperation between the Future Center Europe in Potsdam and Volkswagen Group Research in Wolfsburg

**BELOW LEFT**  
Concept-i’s sleek interior features sweeping lines and a design that helps Yui to use light, sound and even touch to communicate critical information

understand where you are,” Coelingh says. “Am I on a highway? Which lane am I in? What traffic is around me? What’s happening? You cannot do that immediately.”

#### ALL-SEEING EYES

Interior sensors are also likely to remain vital in AVs designed never to be piloted by a human, especially those deployed by shared mobility providers, while cameras that can detect antisocial behavior will also be key, predicts Andrew Hart-Barron, head of interior design at VW Group’s Future Center Europe. “As a user, you might get a certain rating if you constantly leave the car dirty with rubbish in it, or you could encourage users to clean the vehicles and get credits,” he suggests. Alternatively, the car could regularly inspect itself and spot when it needs to visit a depot.

Hart-Barron oversaw the interior of the VW Sedric concept unveiled in March. Conceived as a shared-service AV for urban journeys, Sedric is a monobox electric car with a battery and drivetrain under the floor. Hart-Barron points out that it doesn’t feature a trunk, or enclosed interior storage.







“Sedric doesn’t have tons of pockets; it has a couple of neat little elastic bands for holding things. And if you have a massive amount of stuff, you can load one of these vehicles up on its own and jump in another one.”

With nowhere to hide possessions, interior monitoring can easily notify a user before a dropped item can become lost property. Han Hendriks, chief technology officer at supplier Yanfeng Automotive Interiors, makes a similar point. The company’s XiM18 autonomous interior concept, unveiled at the 2017 Frankfurt Motor Show in September, includes 3D mapping cameras connected to real-time analytics software for detecting stray items, as well as other more pressing functions.

XiM18 features sliding, swiveling seats that can be set up in different configurations. Interior monitoring is vital for occupant safety, Hendriks says. “We need to know where the seats are, in what position, so we know whether the airbag in the instrument panel needs to go off or not, depending on where the occupants are,” he points out.

Safety also explains why Yanfeng’s XiM18 lets the passenger seat face backward, but not the driver’s seat – it can slide to give plenty of legroom, or swivel inward through 18° to ease conversations, but won’t swivel through 180°. “We assume, for the next generation of autonomy, that the driver can take control of the vehicle,” Hendriks says. “If the seat is sliding forward and turning 180°, we believe that is too complicated to happen in a short window.”

William Chergosky, chief designer at Toyota’s Caltex Design Research facility, similarly notes that handover requires great care. “It’s potentially very

dangerous, so that’s why at Toyota we’re pursuing this idea of either full autonomy, or a guardian angel where it’s assisting you in the background,” he says.

Toyota’s Concept-i show car, revealed in January, includes a very unusual communications device: it can tap occupants on the shoulder. “There are different levels and types of tap,” he

as more occupants focus on work or entertainment inside a vehicle. VW’s Sedric features an OLED display integrated into the windshield. “You can see through it, even when you’re watching something, so your brain still gets that you’re moving,” says Hart-Barron. “That cuts down on motion sickness.”

Toyota’s Concept-i also employs the windshield. “The path that the car is taking in automated mode is projected there for the driver or the passengers to see,” Chergosky explains. “So there’s a visual cue that the car won’t suddenly make a right turn; you’re seeing what’s going to happen. Having your brain register that

means there’s a psychology-physiology connection that, theoretically, keeps you from getting car sick.”

While direction arrows are relatively straightforward, Coelingh is skeptical about using the windshield for true augmented reality, where digital imagery is added seamlessly onto an occupant’s view of the world outside. “It holds promise, but also huge challenges,” he says. “There are some fundamental optical limitations on how big you can make a head-up display. The other aspect is that if you really want to augment something, then you have to know the position of the driver’s eyes.”

## “SEDRIC DOESN’T HAVE TONS OF POCKETS; IT HAS A COUPLE OF NEAT LITTLE ELASTIC BANDS FOR HOLDING THINGS”

says. “There’s the gentle tap to let you know about something minor, or in the case of an emergency it’s a sharp tap that really lets you know: pay attention, there’s something going on here.”

While AVs will be expected to avoid accidents, they may still get caught up in crashes caused by others or take violent evasive action. “As long as that is the case, you would still need all the restraints, the bags, the belts,” Coelingh observes. “And you will probably need new concepts – new types of airbags, new types of belts, once you start to lie down.”

Similar innovation may also be needed to ward off motion sickness,

**RIGHT** The XiM18 showcases the way people experience vehicle interiors, if they no longer have to drive. It is designed to enable the use of four different interior modes: drive, family, meeting and lounge settings

