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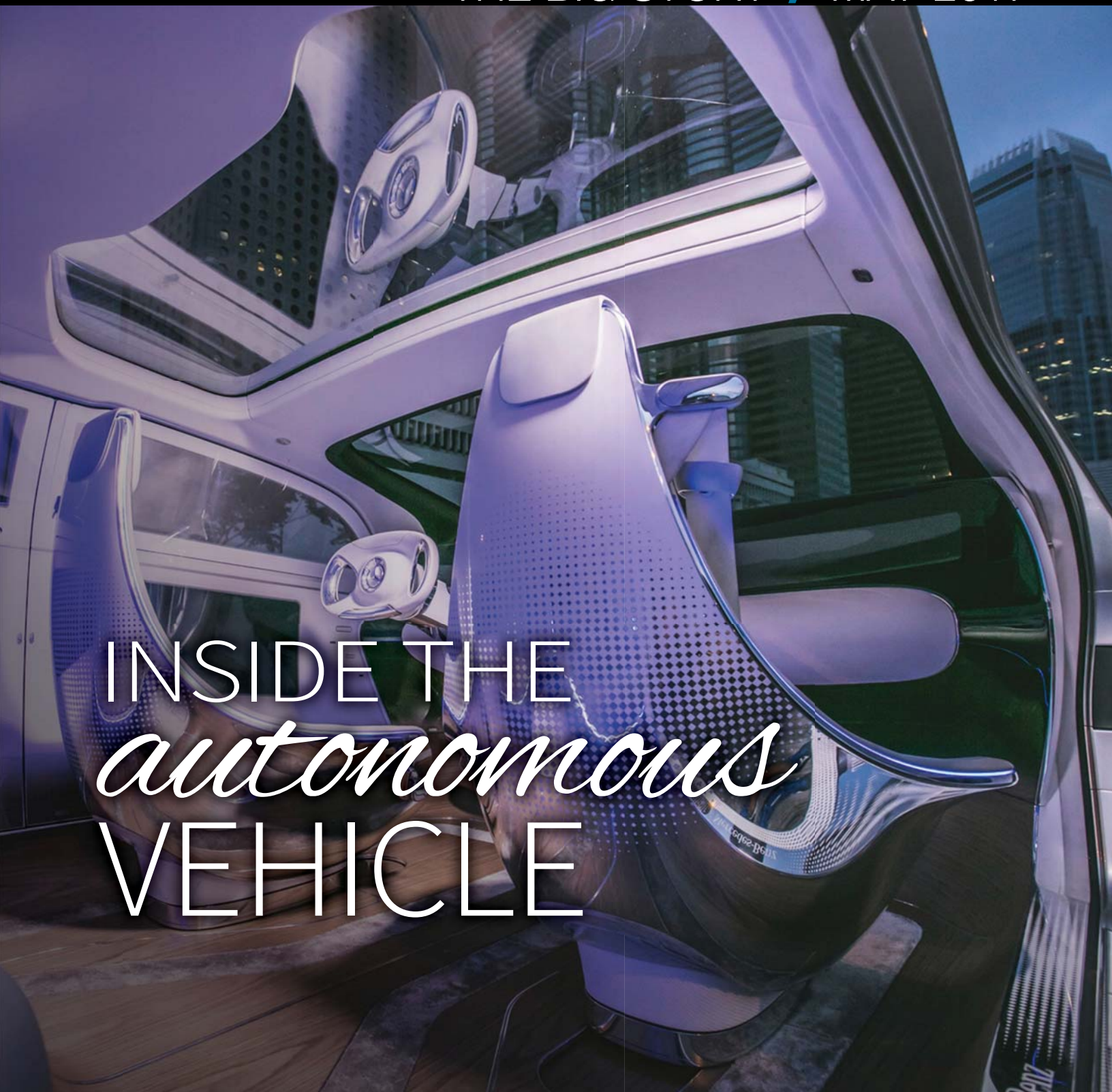

INSIDE THE *autonomous* VEHICLE

Mercedes F 015 (also shown on cover) features reconfigurable seats, hard floors.

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Time and space.

THOSE ARE THE GUIDING PRINCIPLES SHAPING AUTOMOTIVE INTERIORS IN THE FIRST WAVE OF AUTONOMOUS VEHICLES PLANNED FOR EARLY IN THE NEXT DECADE.

As cars become fully capable of piloting themselves, commuters will be freed up to do whatever they want whenever they want. Exactly what that will be and how best to enable it inside a moving vehicle is a puzzle the industry is working feverishly to solve.

It won't be easy, and it's unlikely to be a single solution that emerges, top automotive designers tell *WardsAuto*. Right now, on the drawing board in studios around the world are vehicles featuring a wide range of styling, seating configurations, capability

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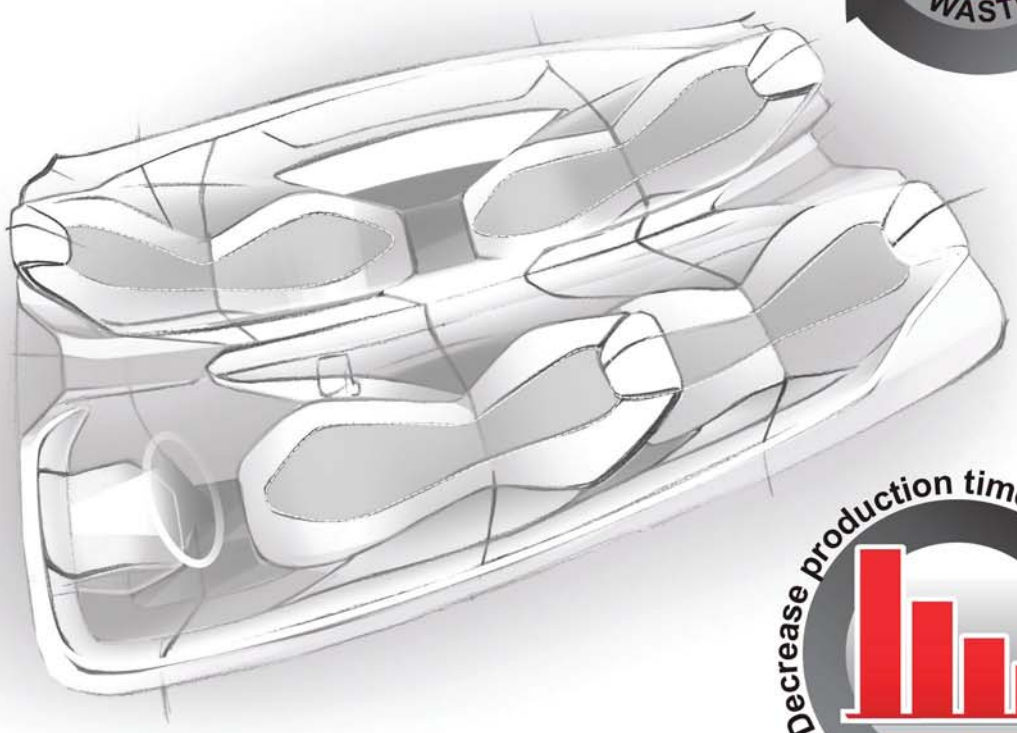

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Adient interior concept features seating designed for conversation.

and price points, and that eclectic mix is exactly what the market is likely to demand sometime in the next decade.

Even if they discover the precise design formula from among what's possible, automakers still will need help from regulators to turn the tech-laden, flexible interiors they envision into something road-legal. They'll also need a buyer base that's not only willing to pay for the technology but also isn't afraid to use it.

THE MARKET

Driving it all, ironically, will be the Millennials, a vexing buyer group that has seemed largely disinterested in car ownership but now is squarely in the crosshairs of automotive designers.

Born between 1982 and 2004, they will range in age from early 20s to early 40s around 2025, when U.K.-based Juniper Research predicts there will be 20 million autonomous vehicles on roads worldwide.

Millennials are a big chunk of the population, notes Cindy Juette,

the Fiat Chrysler Automobiles designer who oversaw the interior of the Portal autonomous people-mover concept unveiled earlier this year at CES in Las Vegas. "We know we'll be dealing with them for quite some time."

But others say forget what you know about Millennials, Baby Boomers and Gen Zs. The world is evolving into a post-demographic society where everybody essentially wants the same thing: eye-catching, highly functional and decidedly unique vehicles.

"Maybe we were fooling ourselves, (but) when I started in this industry, it was fairly easy to compartmentalize in terms of how

consumers were behaving based on demographics," says Tom Gould, director-innovation, design and craftsmanship for seat supplier Adient. "Since then, things continue to get exponentially more difficult to get your head around. What used to be one-size-fits-all really evolves quickly into a more individualized experience.

"Regardless of what region you look at, which age group you look at, it's getting harder and harder to pin down demographics."

"The whole idea was the car grows with you," designer Juette, above right, says of the Chrysler Portal concept, below.

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Clough: GM trying to figure out the best business case – or cases – when it comes to autonomous designs.

Eric Clough, director-Advance Architecture Design at General Motors, says it just might be the elderly, with their diminishing capacity to drive, who will be drawn to autonomous vehicles the most. But then again, who knows?

"It would be easy to assume it's going to be a generational thing," he says. "(But) there are many use-case scenarios that cross the spectrums of income, (language) and urban versus sub-urban as well. (Potential demand is) everywhere, if you really think about it."

There are still autonomous-vehicle skeptics out there, but they're getting harder to find both inside the auto industry and just outside its perimeter, where executives are sorting through potential business cases and design work is reaching an advanced stage.

"You don't see it on the floor right now, but most companies already have set their visions on (autonomous-vehicle designs)," Alfonso Albaisa, lead designer for Nissan, tells *WardsAuto* at last month's New York International Auto Show.

> "FOR MILLIONS OF AMERICANS LIVING IN LARGE CITIES, **THE NEXT VEHICLE THEY PURCHASE MAY BE THE LAST CAR THEY EVER OWN.**"

The good news is, a growing number of U.S. car buyers are eager for the advanced technology – maybe.

In a recent survey by consultant Deloitte, 43% of respondents expressed a desire for limited self-driving capability and 39% said they were interested in fully autonomous vehicles. Both figures are up several points from just two years ago.

By 2030, more than 5 million conventional cars per year could be replaced by fully autonomous electric vehicles for urban fleets and partially autonomous cars for personal use, The Boston Consulting Group predicts.

"The automotive industry is on the brink of a major transformation, and it'll be here faster than people realize," says Justin Rose,

Screens taking over, Nissan's Albaisa notes.

a Chicago-based partner who leads BCG's digital efforts for industrial goods companies. "For millions of Americans living in large cities, the next vehicle they purchase may be the last car they ever own."

THE RESISTANCE

Although eager for it, even younger buyers remain wary of autonomous-vehicle safety. In a survey of 158,000 consumers, most of them Millennials, Driving-Tests.org found considerable angst over the possibility of riding in a driverless car.

Asked to gauge their level of concern on a scale of 0-10, 38% rated it an 8 or higher. More respondents (24.0%) said the benefits of autonomous vehicles will not be worth the risk than those (20.5%) who believe they will.

"Automated driving is a new and complex concept for many consumers," says Kristin Kolodge, executive director-driver interaction and HMI for J.D. Power, which reports similar numbers in its own study. "They'll have to experience it firsthand to fully understand it."

Says Nissan's Albaisa: "(It's) kind of Buck Rogers at the end of the day. You have to take the customer through this journey, so there's going to be some transition."

Automakers are beginning to take on the task, warming up consumers with both auto show concepts as well as cars already in showrooms.

The new Chevrolet Bolt, for example, with its wide-opening doors, flat floors and expansive glass, was designed in part with an eye toward mobility and autonomy. Alfa Romeo's new Giulia sedan, with its flush infotainment screen that makes it appear more part of the dashboard than in it, highlights another design trend expected to flourish in the future.

A growing number of vehicles already come equipped with early autonomous technology such as adaptive cruise control, lane-keeping assistance and emergency braking, and limited semi-autonomous driving is possible today in some luxury models

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"Safety is one thing, but feeling safe is another," Fiat Chrysler designer Feliciano says.

from Mercedes-Benz, Tesla and, soon, Cadillac.

But the varying degrees of autonomous capability that will be available as the technology rolls out could cause mass confusion among consumers. Even Tesla's Model S, considered among the most advanced, represents only Level 2 technology, points out Nina Mital, a partner with design consultant PocketSquare, so automakers will have to find a way to be completely transparent about the capability of their vehicles.

"As a customer, how do I know where my car falls" along the autonomous-technology paradigm? she asks.

There's still much work to do there, GM's Clough agrees.

"The element of trust is something we talk about a lot," he says, describing his own angst in driving today's cars with advanced assist systems that help steer, stop and accelerate. "It takes some getting used to. The nearer-term less-capable solutions aren't really addressing (consumer confidence) well yet."

Wide open doors, flat floor autonomous hallmarks evident in Toyota Concept i.

Lighting, signs could be one way an autonomous vehicle could greet customer in a ride-hailing application.

"Safety is one thing, but feeling safe is another," says Emilio Feliciano, a Fiat Chrysler designer who fashioned the user-experience elements of the Portal concept. "I think (there's going to be) a balancing act between the technology, the software, the hardware and the interior space all working together to make people feel safe, comfortable and ready to accept the technology."

Toyota's Concept-i, unveiled this year, is a look at what might further bridge the gap between today and the fully autonomous future. Although there's a steering wheel, its airy, high-tech cabin looks ready for the driverless era, with sculpted pedestal seating and hard-surface flooring. Its artificial intelligence technology is designed to "build a relationship"

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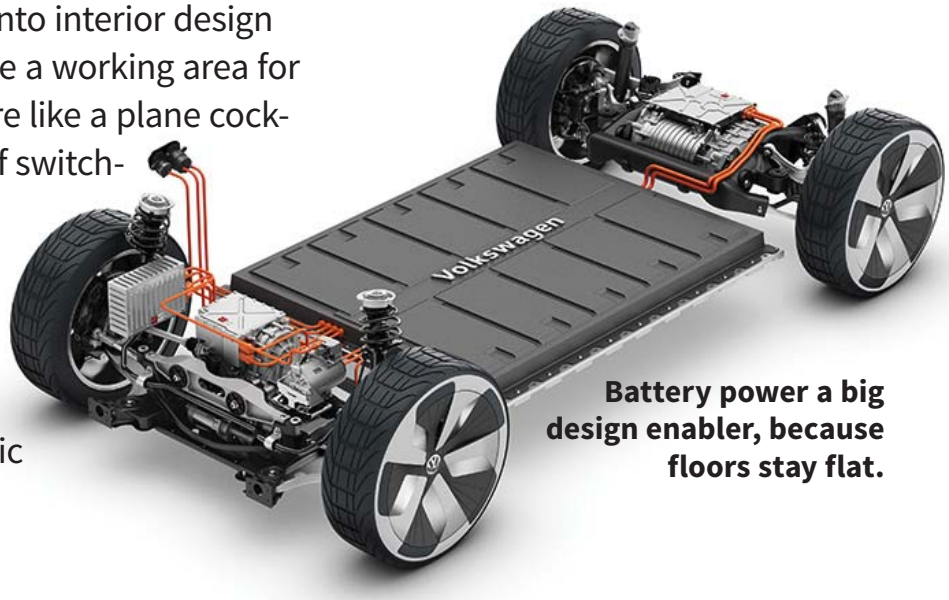
Look of future evident in VW's ID Buzz electric-vehicle concept.

with the driver and take over controls when needed, Toyota says.

The transition toward autonomous also is apparent in some of the electric-vehicle concepts Volkswagen has shown in recent months, such as its ID Buzz minivan and ID Crozz CUV.

"It you look into interior design today, you have a working area for the driver, more like a plane cockpit with a lot of switches," says Klaus Bischoff, head of car design for the VW brand. "With our new electric cars, we go down a different lane and offer something that is more a relaxed lounge-type of ride."

The ride-hailing, ride-sharing mobility movement will be another critical factor in getting people accustomed to traveling in a driverless car. By employing autono-



Battery power a big design enabler, because floors stay flat.

Boxy Honda NeuV appears built for car-sharing market.

mous vehicles initially in geo-fenced areas along well-mapped routes, automakers hope to perfect the technology and establish a safety and reliability track record that will settle the nerves of transportation consumers.

Some 66% of the world's population is expected to live in cities by 2015, which could make travel by way of a personal vehicle prohibitive. Deloitte says 52% of Americans today already question the need for vehicle ownership, including 64% of younger Gen Y and Z consumers.

"Probably the first experience people have with these (will be) an airport shuttle or something where it's low speed," Clough says. "But if someone who has never done it before gets into a car that's fully capable (of) doing 75 mph (121 km/h) down the freeway and weaving through traffic, that's going to be a whole different animal.

"We definitely need to look at ways to build trust. It's a big question out there that everybody is trying to innovate around."

THE CONCEPTS

The industry is split on whether to make autonomous vehicles without steering wheels and ped-

als or to allow a driver to take control when needed or desired. In the run-up to the technology, both solutions will be seen as the industry moves through today's Level 2 capability on to Levels 3, 4, and 5.

Industry insiders say work remains under way to ferret out exactly what autonomous-vehicle features will be possible, required and allowed, so road maps are not clearly drawn yet.

Technology is moving so quickly "instead of benchmarking (today's interior designs) we are forecasting trends 15-plus years out," says Carter Cannon, manager-Functional Integration for interior supplier IAC.

But recent concepts are beginning to exhibit some common threads, even between vehicles designed strictly for mass mobility and those aimed at personal use.

COMMON THREADS

Concepts vehicles often include:

- Easy entry/exit
- Flexible/reconfigurable seating
- Durable easy-to-clean materials
- Personalization opportunities
- Lots of glass
- Heavy doses of infotainment and connectivity

Electrification will play a role, particularly in mobility applications, because floors can be flat, allowing greater flexibility in design and more freedom for passengers to move about the cabin.

"I think it's almost a Venn diagram," Gould says of the design intersection between vehicles meant for fleets and those for personal use. "You'll have certain things that will be more inherent in owned vehicles and some that will be more inherent in shared vehicles. But then there will be an overlap. How significant that overlap will be is what we're trying to sort out."

In an article for *Core77* magazine, Intel Creative Director Matt Yurdana writes about the need for autonomous interiors to accommodate two types of riders: those who seek interaction and those demanding privacy.

Seats will have to be capable of being grouped or separated, he says. “Physical aspects of the interior might also be designed to help create discrete spaces. Could lighting be used to signal a need for privacy? What physical areas will enable us to charge, view and use our devices hands-free? How will the space accommodate the bags, cases, power cords, stands, headphones and other peripherals we bring in with our devices?”

It also will be critical not to include too much, Yurdana tells the 2017 WardsAuto Interiors Conference.

“We have to keep in mind what we (should) not design for,” he says. “Where are the places where we need to pull back on our design?”

If there’s a prototype for the new-mobility/autonomous world, it might be VW’s Sedric concept, unveiled at the Geneva auto show in March.

It’s basic and boxy, but it serves its purpose as an easy-in/easy-out vehicle for ride-hailing services. Styled like a miniature subway car, it features wide, sliding glass doors and a spacious lounge-like interior. Seats fold out of the way to make room for luggage and its panoramic glass provides passengers with a clear view of their surroundings.

BMW’s i Inside Future con-

VW’s Sedric concept looks like a mini subway car and is designed specifically for ride-hailing fleets.

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BMW's i Future seeks to create calming mood with under-the-seat greenery.

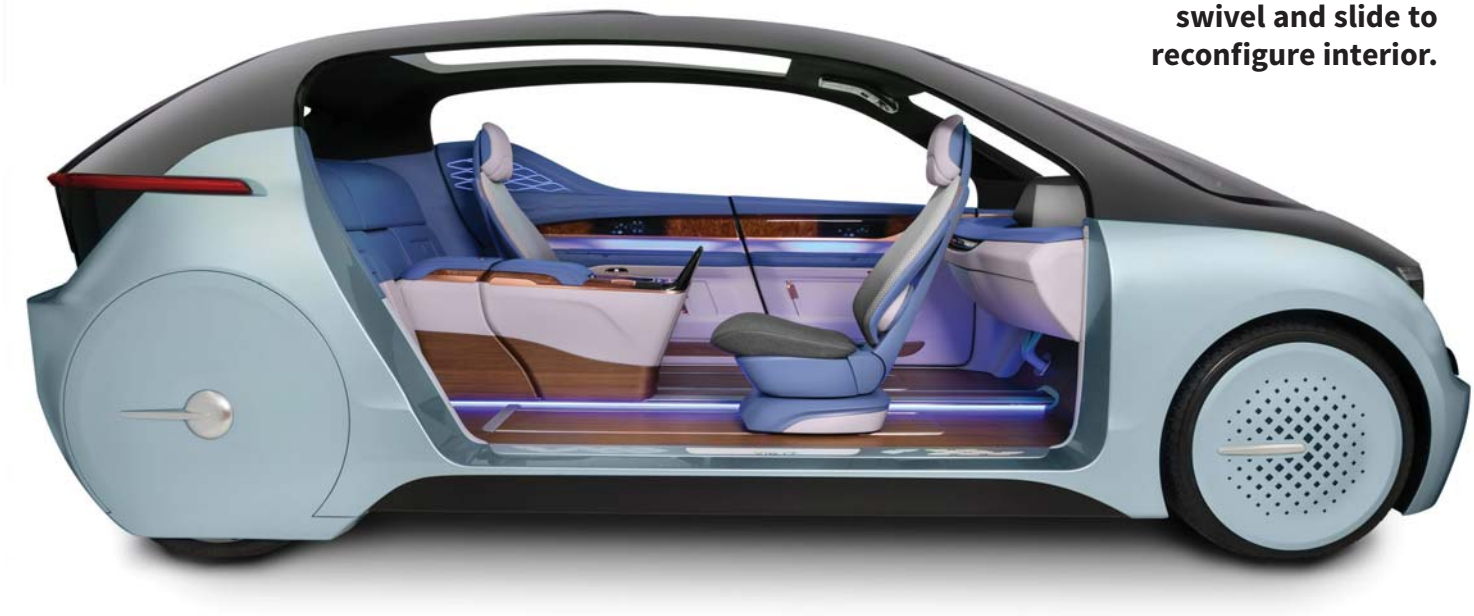
Holographic projection of controls takes BMW's gesture technology to next level.

cept interior shown at CES 2017 takes things a step further. It is designed to serve as an office, recreational space or emotional retreat for passengers, with reconfigurable seating and a small spot to grow vegetation.

The i Inside Future is an autonomous car that can be driven, so there's a more traditional driver's cockpit with a steering wheel. But some of its high-tech controls are holographic projections, free-floating inside the car and operated by pointing at them. It's a process BMW calls HoloActive Touch and takes its current gesture-control technology to the next step.

The Chrysler Portal is designed to cover all the bases. Though it flashes a futuristic exterior, it's a full-fledged peoplemover that fits perfectly into a ride-hailing fleet or can be used as a family hauler instead.

Its chief feature is its flexible pedestal seating for up to six pas-



Seats in Yangfeng concept swivel and slide to reconfigure interior.

sengers. Seats are lightweight (40 lbs. [18 kg]) and removable, and they slide along tracks in the floor to reconfigure the cabin depending on space-utilization and personal-interaction needs. Consumers could buy the vehicle with one seat, then add more as their passenger-carrying needs grow.

Infotainment also would be upgradable, allowing customers to purchase only what they need and add new features as their requirements change.

"Millennials not only are going to be a big majority of the drivers on the road, (they are at) the age where they're beginning to start maturing," FCA's Feliciano says. "So you go from being a student to having a job, to meeting someone, having a family and raising multiple kids."

"The whole idea was, the car grows with you," Juette says.

Designers also point to the Portal's sliding doors and expansive 5-ft. (1.5 m) aperture that make it possible for people to walk into the car nearly upright and load cargo more easily.

"We know Millennials are gravitating toward living in cities or densely populated areas," Juette says. "The big, sliding side doors

Portal's unusual X-brace roof structure key to cabin design, which features larger door openings and flexible seating.

offer "a safer way to navigate an urban scene."

Supplier Yangfeng Automotive's XiM17 Level 3 autonomous-interior concept shows off similar thinking. It has seats that move along tracks fore and aft and side to side. They also swivel for easier conversation. Pushbutton transmission controls are positioned at the top of the windshield, replacing the rearview mirror and allowing the center storage console to slide out of the way when reconfiguring seating. The steering wheel retracts into the dashboard when in autonomous mode and gesture controls are used to operate the climate system from various seating positions.

Many concepts shown so far, including Mercedes' F 015 unveiled in 2015, have hard floor surfaces rather than carpeting

GM's EN-V purpose-built commuter car for two evidence industry working on all types of designs, configurations for the autonomous future.

for easy cleaning, and designers expect more durable materials – some not even invented yet – to play a big role inside autonomous cars.

"The No.1 use of Uber is by people who have been out drinking," Clough notes. "And you know what happens after people have been out drinking for a while and then they get into a car."

Look for automakers to make seats thinner and lighter, to free up cabin space.

Chrysler's Portal uses Adient seats constructed of an ultrathin plastic comfort shell, similar to how some office chairs are made. Gould says the inches shaved from seats were critical in creating a 6-passenger vehicle with such a small footprint.

But the wide range of design approaches indicates automakers still are unsure what the market will demand. Narrowly defined, purpose-built vehicles such as VW's Cedric, or even GM's 2009 2-seat EN-V autonomous commuter car now undergoing an update, are likely to be part of the mix.

Consultancy McKinsey contends such purpose-built vehicles will cost up to 25% less to build than mass-market cars, because they will require less-powerful engines, have simpler, easier-to-clean interiors and require less-complicated manufacturing and distribution.

Millennials are purpose-oriented, says Stefan Weissert, director-Car Multimedia Div. for supplier

Bosch, so "the vehicle is (simply) a platform for the experience they want. We'll see different interiors (designed) for different purposes."

How these demands are met also will vary.

"(The Sedric) is certainly one (business) model," GM's Clough says. "Another model is you develop vehicles that can be adapted and made (into) autonomous variants. We're looking at all of that and trying to figure out the best business case is – or cases – that we want to play in.

"The fact is I don't think anybody really knows how that's going to work out."

THE HURDLES

Central is the concept of creating a "third living space" to go along with the home and office, where the vehicle occupant can choose to work, socialize, eat and drink or catch up on sleep.

"We call it tasking and relaxing," Dave Muyres, Yangfeng's executive director-Research and Advanced Development, says of seating supplier's new interior-design mantra.

The Portal serves as a prime example.

"We were inspired by modern architecture, studio spaces, places that were just beautiful spaces to be in," Juette says. "We assume as autonomy develops, we're going to have more time in this vehicle to use it differently, similar to how we spend time on our phones or in our jobs. We want the environment to reflect that."

But as customer expectations rise around how much more productive they'll be once the vehicle drives itself, so do the challenges for designers.

"One of the big problems is motion sickness," Gould says. "We can play with the chemistry of the seat foams and do other things that dampen the vibrations to the point where we can help control that, and in the future we hope to leverage that to a deeper level."

The expected proliferation of onboard or carried-in video screens adds to the challenge. Ford of Europe researchers found adult passengers who stared at

screens became car sick after just 10 minutes.

Positioning onboard screens higher, having passengers sit more upright and keeping the environment cool and the air moving can help prevent motion sickness, designers say. A definite no-go is the idea some have floated of replacing glass with giant video screens that project images rather than let passengers see outside.

"I don't understand about some of these futuristic ideas – why is it every time there's an autonomous concept, there's a big screen in front of the driver?" Hyundai-Kia design chief Peter Schreyer tells *Car and Driver* magazine. "What's wrong with windows? If you're being driven, aren't you going to want to look out?"

Clough calls suggestions of replacing glass with screens "a real recipe for motion sickness.

"There will still be screens, because there's an opportunity for the air time and eye time that advertisers could have and fleet operators would want to sell," he admits. "(But) it's got to be done really cleverly and not be overwhelming or block too much of your view. Whoever solves (the motion-sickness problem) first will have a real competitive advantage."

> "WHOEVER SOLVES (THE MOTION-SICKNESS PROBLEM) FIRST **WILL HAVE A REAL COMPETITIVE ADVANTAGE.**"

Seating flexibility also presents safety and engineering hurdles. Being able to spin seats around is "very physically hard to do in a car that's going to fit in a (driving) lane," Clough says.

In addition there are regulatory issues that have to be addressed, because all safety standards are written for forward-facing seats, and even out-of-position, unbelted occupants must be protected in event of a collision.

"How do you deal with that when you have side-facing or rear-facing seats?" Clough asks.

"It's a whole different animal."

A first step may be to require all occupants to buckle up for the vehicle to function, a direction Clough calls "one of the early linchpins" needed to make autonomous happen.

THE USER EXPERIENCE

Designers suggest at Level 3-4 autonomy, interiors will remain fairly conventional, with forward-facing driver's seats and safety systems similar to those of today. As the industry moves to full autonomy, seatbelts will move with the seats, and airbags will be positioned strategically to protect passengers depending on the seat's location.

"Things will move – and more than just seats," predicts Bob Kinney, vice president-Engineering and R&D for French supplier Faurecia. "God knows what possibilities will apply in the semi-autonomous and autonomous vehicles of the future."

Among certainties: Human-machine interface technology will be key to keeping passengers calm and confident as they ride along in autonomous vehicles.

Look for beltline-level screens to display critical information and some data to be projected onto glass and even other more decorative surfaces when needed.

"Screens are going to be… more accessible (for) a more communal feel as autonomy develops, because everyone is going to be able to participate (in the vehicle's operation)," FCA's Juette says. "To feel safe with new technology you need feedback."

Audio technology also will help inform passengers of what's going on around them. The Portal detects an oncoming ambulance or police car, transmitting sounds from its siren from one speaker to the next to signal its approach and movement past the vehicle.

"Even if you're not visibly seeing the ambulance behind you, we can cue that sound in and let everyone in the vehicle understand (where it is and how the autonomous vehicle is likely to react)," Feliciano says.

Designers also envision facial-recognition technology that will

Portal's screens positioned for easy viewing by all passengers.

automatically adjust music, lighting, temperature, seat and infotainment settings depending on who is in the car and where they are sitting. In mobility fleets, passengers could be recognized by their smartphones, with vehicles adjusting seats accordingly or, as in BMW's i Inside Future concept and Chrysler's Portal, offering the ability for each passenger to access unique entertainment programming without disturbing other riders.

"There's nothing that would prevent the ideal seating position for you to be mapped to anything you sit in," Clough says. "Once that information is known about your personal geometry, you can apply that. And that includes vehicle infotainment, the color of lighting – you can apply it to just about anything."

A change in accent lighting color could signal to ride-hailers their vehicle has arrived, for example.

"When your ride is here it's your color – so when the orange one is here, it's my ride," Feliciano says. "You can see it, even in the dark."

There also will be technology to recognize whether a passenger has left something behind, either

Toyota Concept i head-up display signals car's intentions.

by monitoring electronic devices as they enter and exit the car or using weight or vision sensors to detect objects such as purses or briefcases.

"The worst thing from a fleet-efficiency standpoint would be (if) somebody left something in the car," Clough says. "Now, it either gets stolen or lost or you've got to get it back to the original owner, and that involves a lot of time and money."

THE DESIGN PROCESS

All the added technology and dramatic shift in the way consumers will use vehicles is rejiggering the industry's approach to design.

"We are starting inside out on a lot on our vehicles," says Kevin Hunter, president of Toyota's Calty Design studio in the U.S. "What we like to call it is a holistic user experience. It's not about exterior styling driving everything anymore."

Looks are still important, but design priority now is focused on the complete package.

"It wasn't very long ago that everything started with and exterior sketch and we would try to make an interior fit into it," Clough says. Now it's all about

experiential design.

"And that really envelopes everything," he adds. "It's interface design, it's interaction design, it's interior/exterior. That's the biggest change in the mentality and discipline that has to happen. It's a rapidly changing world."

For one thing the ratio of screens to leather has flipped, notes Nissan's Albaisa. "(Where) the instrument panel and all the architectural elements (once) dominated screens, now screens are dominating those elements. So we're changing."

Portal designers say the concept's unique cabin structure, which relies on carbon-fiber X-brace, made the large door openings and expansive use of glass possible.

"The styling between the (interior and exterior) was definitely back and forth, but the theory of feeling open and light started with the interior," Juette says.

"It was kind of a form-and-function exercise. (It has) a very product-design feel, you can feel the structure even though there's a lot of glass."

Interiors are fetching greater attention from customers, so "our job as designers is to access this new world with new (human-machine-interface) systems, and to handle all this super-complicated information and connectivity," VW's Bischoff says.

That's got Adient executive Gould's heart racing.

"I tell everybody, it's just a fun time to be a designer," the Adient executive says. "We will all look back in the rearview mirror of our careers and say we got to be there when this was coming online." **WA**

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