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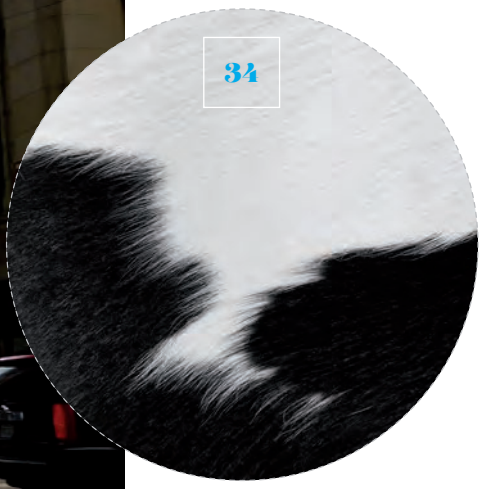

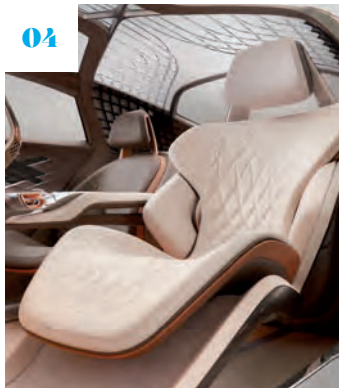

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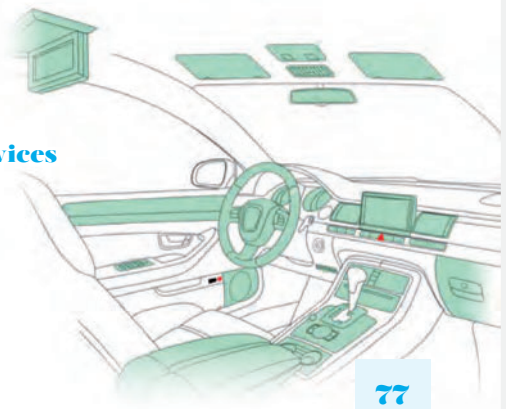
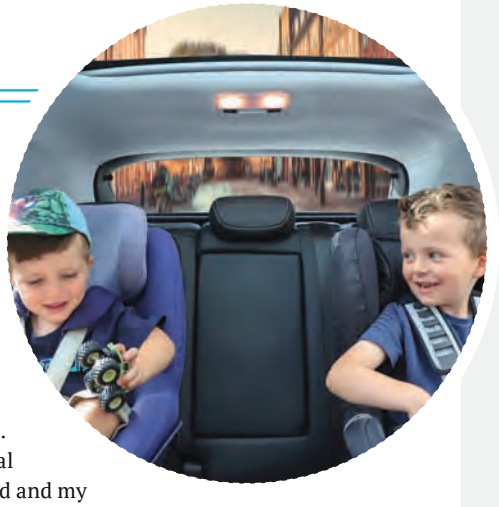


FROM THE EDITOR



I've always been a bit obsessed with small, sporty cars. Before I'd even passed my driving test I begged my stepdad for a Renault 5 GT Turbo. I'd seen the car on the television and instantly fell in love. After passing my test, my stepdad compromised and bought me a Renault 5 Campus. I loved this little car even though it wasn't the high-performance hatchback I was after. It had a little 'pop-up' sunroof, a spacious cabin despite the car's small overall size, and comfortable seats.

Back then I couldn't understand why anyone would want a large, practical car. They just seemed so boring. But then I fell pregnant with my first child and my obsession with small hatchbacks had to suddenly come to an end. Buying a family-friendly car was new territory to me. I didn't really know what I was looking for apart from space and comfort. But it turns out there is so much more to consider when buying a kid-friendly vehicle.

For the *Child's Play* feature, *AIW* tested a Vauxhall Grandland X SUV, which Vauxhall has marketed as an extremely family-friendly car. And I have to say that I agree. I took my two boys (aged two and four) out in the car and they loved it. In fact, the eldest made the bold claim that it was "the best car ever" and that he could "see the end of the world" from his seat.

The Grandland has a low beltline, which means kids can see more out of the windows, and its panoramic roof floods light into the cabin. Acoustically, the car is quiet in the interior, which enabled me to easily speak to and hear the children while driving (I'm not sure if this is a plus point!). It was also extremely spacious in the cabin. Unlike my car (the BMW 3 Series), you can fit two child seats in the rear and still have plenty of space for a middle seat passenger.

Overall, the Grandland X SUV was a hit with both me and my children. And the best bit about testing it? My boys are now making their entrance into the modeling world – see page 22 (and above) for their debut!

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Subscriptions
£90/US$120 for two issues

Published by
UKi Media & Events, a division of UKIP Media & Events Ltd

ISSN 2514-8982 (print)
ISSN 2514-8990 (online)
Automotive Interiors World.
Printed by William Gibbons & Sons Ltd, Willenhall, West Midlands, WV13 3XT, UK.

Automotive Interiors World is published twice a year by UKi Media & Events, Abinger House, Church Street, Dorking, Surrey, RH4 1DF, UK. Airfreight and mailing in the USA by agent named Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th Street, Jamaica, New York, 11434. Periodicals postage paid at Jamaica, New York 11431.
US Postmaster: Send address changes to: *Automotive Interiors World*, c/o Air Business Ltd, c/o Worldnet Shipping USA Inc, 155-11 146th Street, Jamaica, New York, 11434.
Subscription records are maintained at UKi Media & Events, Abinger House, Church Street, Dorking, Surrey, RH4 1DF, UK.
Air Business is acting as our mailing agent.

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LUXURY REDEFINED

LEFT & RIGHT
Bentley used 10,000 LEDs throughout the vehicle interior and exterior. Each can be individually programmed to produce an animated lighting effect, such as a flame running along and through the car

To mark its centenary celebration, Bentley unveiled its EXP 100 GT concept, designed to represent the brand's vision for motoring in 2035. *AIW* looks at some of the interior highlights

BY **GUY BIRD**

SEATING

The EXP 100's cabin features an unusual two-to-four seating configuration, partially dependent on whether the car is being driven by its occupants or autonomously. As Brett Boydell, Bentley's head of interior design, explains, "In its start position, this cabin would have two seats, no [visible] steering wheel and no pedals – a fully autonomous interior, but capable of being driven. We see being able to have command of the vehicle as a luxury, so it was important to keep it."

According to Boydell, the concept was designed to only have forward-facing seats to allow for a lower and shapelier roofline than would've been possible if they rotated. However, rear seat squabs deploy from a panel in the rear bulkhead if required. The seats also use biometric technologies to sense a passenger's comfort level in autonomous mode.

The seats' aluminum frames are finished with carbon fiber and Fenland Oak accents – a 5,000-year-old wood reclaimed from river beds in Cambridgeshire, UK, and then treated with copper. The upholstery features a more freeform version of Bentley's famous diamond-pattern stitch quilting on the upholstery, either using Bridge of Weir leather or a vegan-friendly leatherette made from wine-making waste by Italian supplier Vegea.

LIGHTING

'Collaboration' is a big theme of the EXP 100, based on the idea that to future-proof its brand for 2035, Bentley will have to increasingly work with specialists beyond its core competencies. One such example is the lighting, where independent expert Moritz Waldemeyer was brought on board for both the exterior and interior lighting.

"He invented new systems to make the lighting possible," says Boydell. "The lighting starts on the grille, goes up the hood from the 'Flying B' mascot, extends into the interior, flows through the doors, and then back into the rear lights.

"There are 10,000 addressable LEDs throughout the car, so every single one can 'play a tune'. He takes something like the animation of a flame, and just has it running through the whole car [as light]. This was totally new for us," he adds.

RIGHT
The crystal AI-enabled personal assistants combine luxury craftmanship with modern technology

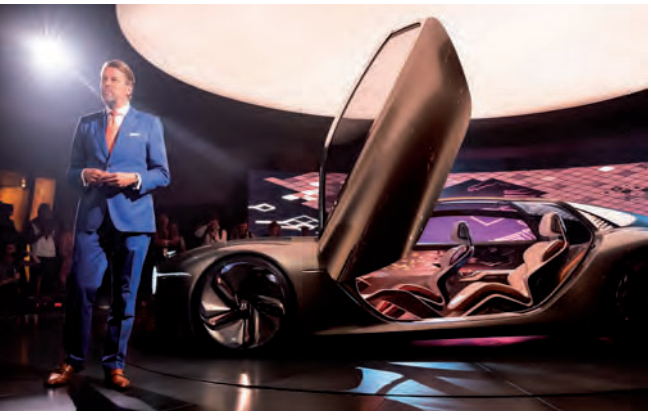
The lighting works in harmony with the shapes and materials to enhance aesthetic form for better cabin ambience and also refracts through the two crystal AI-enabled Bentley Personal Assistants, lighting up to act as functional confirmation that the car has understood the user's gestures or voice commands.

SMART AI COCKPIT

Combining new technology and centuries-old craftsmanship is another strong theme in the EXP 100, as can be seen from the cut-crystal 'AI Bentley Personal Assistants', with one nestling diagonally below the windscreen cowl and the other housed horizontally within the rear center armrest.

The craftsmanship of these physical objects comes from Cumbria Crystal, "which also supplies crystal ware for period TV drama series *Downton Abbey*", says Boydell – while the high-tech part is the car's ability to understand users' needs and then confirm them through clever lighting effects via the 'crystal portals'. As Boydell enthuses, "We had these cuts that disperse the light at the base that almost feel like an effervescent popping above. I wanted the AI interface to look like neurons firing, like it's responding to you."

"YOUR CAR'S AI SYSTEM WILL UNDERSTAND YOUR JOURNEY THEN PRE-ORDER AND LOAD THE CARTRIDGES THAT WILL ASSIST WITH THE TRIP"



BELOW
Drivers will be able to make the most of driving manually or autonomously thanks to the fluid seating configuration

As with several other future-facing concepts, the EXP 100 GT suggests that the onboard AI-driven computer could act as a knowledgeable chauffeur, offering points of interest along the route, plus possible diversions to luxury experiences nearby.

CENTER CONSOLE CARTRIDGE SYSTEM

Despite its vision for the year 2035, the exterior silhouette of the EXP 100 is familiar and within the traditional GT vernacular, if exaggerated in proportion (5.8m in length).

Pitched as a full-electric vehicle with four in-wheel motors, its long hood no longer needs to house a large combustion engine underneath.

As such, Boydell re-imagined the space to house four cartridges that "unlock experiences" and deliver them physically to the cabin via a chute into the cabin's center console, a bit like a luxury personalized vending machine.

"Your car's AI system will understand your journey then pre-order and load the cartridges that will assist with the trip," he says, "whether that be sushi for lunch, refreshing hand towels or some cufflinks, because you need to change or put on make-up."

This future cabin, circa 2035, will also have the ability to capture these extraordinary journeys – and not only the view from the car via outward-facing cameras, but also the soundtrack and smell of the location too. Boydell's team still wanted something physical for this digital memory playback moment though, in this case, another piece of crystal.

"It drops into the central rotary [control] and has a digital imprint of your journey and experience," he says. "Most things in reality will exist in the ether, but we thought it would be nice to have something a bit more ceremonial. That way you could say, 'remember that journey?' and then think about it, the same smells, air, view and sounds."

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Collector's item

To mark the Ghost's 10th anniversary, Rolls-Royce has launched the Ghost Zenith Collection, a limited edition of 50 truly unique vehicles. *AIW* looks at five standout interior features

1. ART

Each Ghost Zenith features its own unique artwork embedded in the center console. The design is inspired by the original blueprint of the 200EX concept vehicle – the precursor to the Ghost – which was enlarged to the point of distortion and then divided into 50 sections.

2. HEADLINER

The famed Rolls-Royce starlight headliner has been given a twist with a unique shooting star configuration. More than 1,300 individually mapped and hand-woven fiber-optic lights give the impression of falling stars firing across the cabin roof.

3. MARQUETRY

Each door has been fitted with a complex piece of marquetry trim, created using either wood, technical fiber, or piano finished veneer. The design is further enhanced by the illuminated door pockets and leather upholstery.

4. INGOT

In a further tribute to the 200EX, Rolls-Royce has included a commemorative ingot in each Zenith, made from the concept's melted-down Spirit of Ecstasy hood ornament.

5. EMBROIDERY

The rear control panel and armrest features embroidery inspired by the seating details of the original 1907 Silver Ghost. This embroidery elegantly transitions from the rear seats to the center console in the front.

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Reinventing the wheel

Hyundai Motor Europe is working toward pre-series prototypes of its virtual cockpit concept, and discovering that end users don't always want fewer buttons

BY **ALEX GRANT**

Despite the proliferation of touchscreens in consumer technology, the perfect balance of digital and physical controls within vehicle interiors is open to debate, butting personalization and flexibility against the potential for life-risking distractions. Finding an intuitive middle ground has been the five-year goal of a groundbreaking project at Hyundai Motor Europe (HME), now approaching its fifth generation and potentially reshaping cabins across the group's product range.

"We wanted to create the most flexible interface, not just for the OEM, but for the user as well," explains senior HMI engineer Regina Kaiser. "We wanted an interface that is customizable to [customer] preferences and gives the OEM freedom to use the technology in different model lines."

The project is run by a team of four engineers at HME's Technical Center in Russelsheim, Germany, working with engineering firm EDAG, and is exploring how new technology can reduce the button count in future models without alienating or distracting end users. Focused on the instrument cluster, steering wheel and center console, early clinics analyzed the company's own products and those of rivals, and according to Kaiser the feedback was consistent: European drivers like touchscreens, but don't want to get mired reading instruction manuals before using them.

They also don't necessarily know what they want next, she says: "Sometimes it's hard to ask people what they want in their car in 5 to 10 years. If you show them something, then it's easier for them to imagine how the future could look, and that's always a good starting point for discussion."

LEARNING FROM FEEDBACK

These clinics haven't always gone as expected. The earliest concept, shown in 2015, replaced the steering wheel rocker switches with two cross-shaped touchpads, giving audio and visual feedback to driver inputs. Users adjusted quickly, prompting a fully digital second generation a year later. This used larger touchpads on each side of the wheel with cursor-operated controls for the digital instrument cluster and grouped all other controls into a large central touchscreen, including climate settings.

Kaiser admits it didn't hit the mark: "Customers liked the clean surface, but having no idea which buttons did what was giving them a hard time. We thought it would bring the most flexibility to the development of the steering wheel, but it was not what customers wanted."

However, some of that thinking carried forward to the third generation. Shown in 2017, this featured two customizable touchscreens on the steering wheel, and augmented audio and visual responses with haptic feedback. Functions were displayed beneath the surface of the screens, improving end-user confidence, but it also introduced an ergonomic issue. The controls were set too far from the rim of the wheel for them to reach easily.

TECH TESTING

Prototypes are requiring progressively less modification as the concept advances toward preproduction. The latest version is integrated in an i30, adapted using 3D-printed parts to accommodate two large displays and a bespoke steering wheel. Using a mainstream model, Kaiser believes, highlights an ambition not to limit the technology to high-end vehicles.

LEFT
The cockpit was tested at Hyundai Motor Europe's Technical Center in Russelsheim, Germany

BELOW LEFT
The i30 test car featured a touchscreen display instead of buttons or a trackpad

BELOW
Regina Kaiser, senior HMI engineer, HME

Designs for the wheel were ergonomically tested using the RAMSIS software tool, curing previous reachability issues and adding two larger touchscreens. These can feature up to five buttons, or just one per side – for example, to quickly answer an incoming telephone call. Working with Kyocera, dual piezo actuators beneath the surface offer much stronger haptic feedback than previous prototypes; a 'click' when pressed, or a visual response to lighter touches.

Most functions are managed via the central display, which features softer haptic feedback than the steering wheel, recognizing that it is more likely to be used by the passenger or when the car is stopped. The screen features a three-dimensional bar to guide fingers operating the horizontal volume control, and according to Kaiser this could allow climate settings to be integrated without being difficult to operate. However, she believes a mixture of physical and touchscreen controls is more likely.

"Distraction is definitely a challenge, but if you have a touchscreen then you

The Hyundai virtual cockpit prototype in the i30

"FROM A USABILITY PERSPECTIVE, IT'S ALWAYS BETTER IF YOU HAVE MULTICHANNEL FEEDBACK"

always have to have some additional feedback, which might mean a clicking sound when you press a button," she says. "From a usability perspective, it's always better if you have multichannel feedback. Audio and visual is good; if you have three with haptic feedback then touchscreens are not as distracting as you might think."

LAYERING DATA

The prototype's centerpiece is its instrument cluster – a 12.3in multilayer display (MLD) supplied by Aptiv, with graphics designed by German specialist Innovation Mecom. It features two screens separated by a 6mm gap, enabling three-dimensional effects and for critical data such as vehicle speed to 'float' on the transparent top layer, where they are easier to read at a glance. Particular attention was paid to menus for ADAS functions and developing a more intuitive set of graphics to show what the settings relate to.

This is as much about usability as it is good first impressions, says Kaiser: "You have the graphical user interface, and the user experience on top, and they both need each other. If you have nice graphics but you can't interact with it, then it's just useless. If you have some cool interaction, like the steering wheel, but not the graphics, you can steer with it, then it's also useless. You need both.

"With the touch displays getting bigger and bigger, you need to keep a close eye on what you are showing on the screen and how easily this info can be processed by humans. That's why the customer is playing such an important role; we can only learn from the user."

THE NEXT GENERATION

To date, the concept has been demonstrated to between 300 and 400 people. For the last two years, HME has worked with the Würzburg Institute for Traffic Sciences, which Kaiser believes has made it easier to find specific groups of people. Eye-tracking tests, conducted in the institute's simulators and on the road, have shown distraction levels below guidelines set by the Alliance of Automobile Manufacturers and NHTSA in the USA, and all age groups have adapted quickly.

"What was interesting to see was that the younger generation were heavy users right away, while older generations tended to interact with their pointing finger. That would change in a driving situation, where they are holding the wheel," she says.

Having struck the right balance, the next stage is already underway. Generation five is focused on improving packaging, as the prototype has no space for airbags, and readying the technology for production. Although focused on Europe, the project has also been showcased at the global company headquarters in Seoul, and Kaiser believes some of the findings could be adapted for use group-wide.

"We are always in close contact with our Korean colleagues, to inform them about the latest trends and developments. Of course, it's always nice if they are taking over some of your ideas and concepts and developing them for the entire company," she says.


holoride

Headset go

How is virtual reality being used in the car interior to improve passenger experience and enhance driving performance? Three leading VR developers share details on their groundbreaking technologies for the automotive sector

BY **JACK ROPER**

Infinite possible worlds could soon blossom forth inside cars with the advent of virtual reality (VR) solutions making transit time productive, educational or even euphoric. Instead of gazing glumly at the passing landscape, children will embark on miraculous odysseys back in time, into deep space or down the channels of the human body, while adults escape to blissful meditative realms or continue working in immersive virtual offices. Elsewhere, people will teleport themselves into strange cars in distant cities, conversing with the driver as if beside them.

Fully immersive VR may have fewer driver-centered applications than augmented reality (AR), which enhances a real-world view with virtual elements, for instance in head-up displays (HUDs). But as high-resolution headsets like the Oculus Quest evolve, VR developers are exploiting the proliferation of data from car sensors and cameras to fashion startling new passenger experiences in parallel dimensions.

GAMING EXPERIENCES

Spun out from Audi in 2018, Holoride has created a backseat VR gameplay experience dynamically responsive to the passing environment and real-time car physics. The passenger dons a VR headset and the roadside scene is transformed into a fantasy landscape. The passenger could be riding a rocket, for example, which swerves or accelerates with the motion of the car as they dodge asteroids or shoot aliens.

"Using a secure local connection, we read existing car IMU datapoints: navigation data, localization, acceleration, braking, steering angle and the 6DOF pose of the car," explains Holoride CEO Nils Wollny. "Our software uses this to procedurally generate content while the car is moving. Autonomous driving algorithms smooth out missing datapoints and the experience

always feels fresh, offering a different experience for each new route. We call this elastic content."

Holoride's software creates elastic experiences by uniting elements from a triangle of industries: car makers, headset manufacturers and digital content creators. In 2020, Holoride will launch a Software Development Kit (SDK), enabling games developers and film studios to produce motion-synchronized platform content. This plugs into a games-engine, providing a toolset for storytelling around possible traffic events and allowing creators to reuse existing games assets.

Motion-synchronized VR demands that content responds instantaneously to real-time physics data, and predictive algorithms are vital to ensuring Holoride system latencies remain vanishingly small. "We know the car will stay on the road in 99.9% of cases and that there are four ways it can behave at an intersection," says Wollny. "Navigational data lets us anticipate how the story will shape over time and predicting events reduces latencies significantly." Despite the gameplay's open-world feel, no complex mapping is required since the virtual environment is rendered around the car in real time.

Travel sickness can occur when a passenger views visual content such as a book or smartphone in a moving car, whereas VR sickness results from immersion in highly dynamic content while the body remains static. In both cases, nausea arises from the discrepancy between visual information and physical sensations, but Holoride's system remedies this by harmonizing VR content with vehicle movements. "We match real car *g*-forces so that what you see meshes with what your body feels," explains Wollny. "We have good figures for reducing motion sickness, but can't always cure it completely in people who are particularly sensitive." This palliative capacity could prove a boon not only for carsick children, but also professionals accessing motion-synchronized enterprise environments.

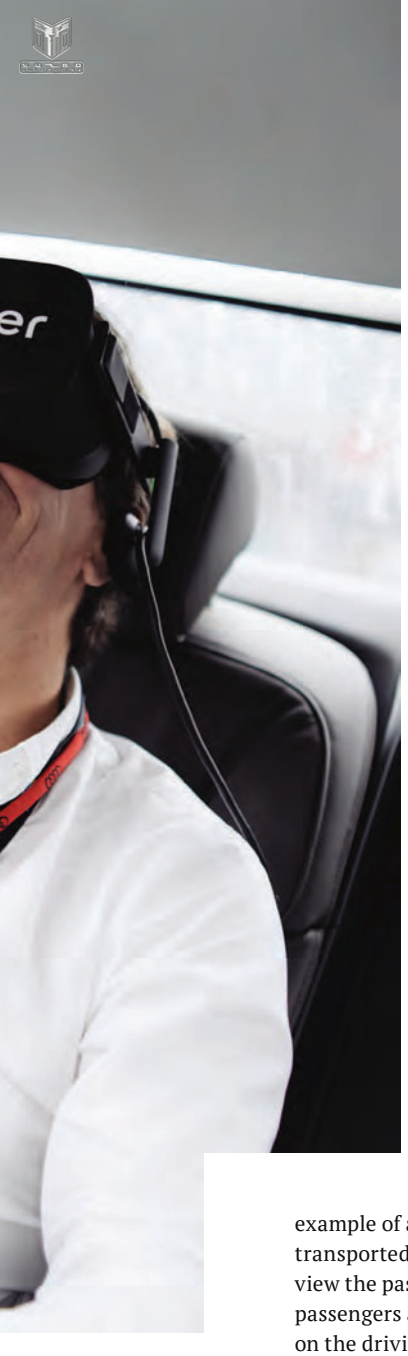
VIRTUAL AVATARS

Valeo's Voyage XR system uses 'teletransportation' to beam an avatar into the car interior. Valeo uses the

BELOW
Nils Wollny, Holoride CEO

RIGHT
Holoride provides a real-time backseat gameplay experience

BELOW RIGHT
The VR headset transforms the roadside into a fantasy landscape



USING VR FOR AUTOMOTIVE TESTING AND INTERIOR CONFIGURATION

Created by Varjo Technologies, the VR1 is the world's first human-eye resolution virtual reality (VR) headset. "Standard professional-grade headsets have one display per eye, as inter-pupillary distances vary from person to person and physical adjustment creates the best experience," explains Varjo CEO Niko Eiden. "We've added a second, higher-resolution display in the center for each eye, creating the illusion that the two displays are overlaid using semi-transparent mirrors. It's four displays, two per eye – one super-sharp and one for full field-of-view."

This provides 60 pixels/degree of sight, so users perceive content as if viewing reality itself with 20/20 vision. The VR1 will be applied to car design processes and could also be used to virtually configure cars for end customers in collaboration with VW-Audi, although Varjo has no immediate plans for immersive VR in cars.

Volvo is currently test-driving new cars with Varjo's mixed reality (XR) headset, the XR1, which purports to improve on conventional augmented reality (AR) devices. "AR uses see-through optics to show reality and augment it with virtual elements," says Eiden. "But with optical systems you can only add light, not darkness or shadow. Our XR device uses a video see-through setup with high-resolution, low-latency cameras in front of a VR glass. You no longer see reality through an optic, but through the cameras, creating a digital interface which enables us to dim a room."

Volvo can augment a driver's video see-through view of the test-track with digitally rendered hazards such as pedestrians or even a virtual moose. Varjo's headsets also incorporate eye-tracking, which could be used to analyze driver behavior or even develop vehicle control systems based on eye-movements alone in future.

High-resolution VR has many potential use cases, according to Eiden. "We want to change how people work," he says. "Human eye-resolution means we can show a monitor or work desk just as it would appear in reality, enabling immersive or interactive sessions wherever you are, which could relay fantastically into cars. Future cars will have a multitude of cameras. If those cameras could be shared, instead of using Google Earth, you could select a street in New York and beam straight into somebody's car, seeing the street outside in real time. This tech hasn't existed before. It's still a blue ocean and every day feels like pioneering work."

example of a grandmother being transported into a car, where she can view the passing scenery, talk to other passengers and even pass comment on the driving. Snug in her fireside armchair, Grandma dons a headset and enters a virtual model of the car interior with the driver shown in an animated avatar and a video-feed of the car's real surroundings visible through the windows, creating a composite sense of presence. Digital array microphones allow two-way real-time conversation, with Grandma's avatar appearing in the driver's rearview mirror while her voice seems to come from the back seat. Surround-view cameras provide the exterior video and the driver's movements are captured by gesture-recognition cameras and translated to the avatar that Grandma sees.

"It's simple, affordable and requires no specific hardware as we use existing cameras, merging the video-stream with a virtual interior," comments Guillaume Devauchelle, innovation manager at Valeo. "We don't need a 360° surround-view so it's a limited data-stream that works perfectly well with 4G. The 3D camera inside the vehicle cabin will become mandatory for drowsiness-detection: it's not rocket-science hardware."

The drive toward autonomy means a rapid multiplication of vehicle cameras and sensors and upcoming safety regulations will mandate new forms of hardware for VR developers to use. Because significant numbers of babies die in hot cars each summer, onboard life-detection systems become compulsory for new US cars from 2022 and Valeo plans to capitalize on the sensors involved. "Life-detection systems can monitor heartbeat and breathing, so we can tune parameters to recognize when you are out of your comfort zone," Devauchelle explains. "People will not want to pay for additional hardware, so we build on existing systems."

The virtual grandma is an essentially humorous illustration of Voyage XR's potential, but Valeo foresees core applications in beaming helpline advisors into cars. "You will see and

hear the emergency operator in the back seat thanks to the digital mirror and speakers," explains Devauchelle.

"It will enable operators handling thousands of calls to establish a common understanding of the scene, telling you which button to press or assessing your fitness to drive. It's an effective productivity device and a nice channel of communication."

Such a system could enable an operator to remotely monitor autonomous vehicles (AVs) and perhaps even intervene in the event of malfunction, although taking control of a car requires communication time-shifts not exceeding a few milliseconds, which the current 4G system could never guarantee.

SAFE OR DISTRACTING?

Parents also stand to benefit from automotive VR. When a newly qualified teenage driver asks to borrow the car for an evening with friends, Voyage XR could enable anxious parents to beam themselves aboard to check their child is driving safely and observing speed limits. "Parents will dream about this feature," says father-of-three Devauchelle. "The first time you let your daughter drive by themselves is not that comfortable, so this ability to see and support will certainly be appreciated." Market research suggests parents may be willing to pay twice as much as the most hardened gamers for Holoride technology, for example, promising to dispel "Are-we-there-yet?" syndrome in bored young passengers.

Driver distraction causes more than 3,000 fatal road accidents each year in the USA alone and new VR products mustn't add to the problem. Could a virtual grandmother appraising your driving from the rear seat create unwelcome cognitive distraction? There are no safety constraints on actual grandmas talking in the car, Devauchelle observes, and avatar-based conversations need be no more off-putting.

Meanwhile, Holoride recommends using its system only on the back seat to avoid distracting the driver visually. But could content governed by driving events result in VR gamers urging drivers to swerve or accelerate so that they don't hit the aliens? Wollny is confident that intelligent game design will preclude such scenarios from occurring.

Although few technical obstacles remain, Valeo expects to market Voyage XR within five years, when its safety concept is established. Personal data sent remotely must be safeguarded – a problem Holoride avoids by using a local connection to the car, which obviates any need to send data via a cloud.

Questions of ethics must also be considered. Holoride's video trailer depicts people on a level-crossing virtually rendered as ducks, which turn into skeletons when the gamer shoots them. Depersonalizing pedestrians could be perceived as problematic, especially if more violent game

HOLOGRAPHIC MODULE SHOWCASED ON NEW VW GOLF GTI AURORA

As ghostlike entities of reconstructed light, holograms are laser-generated illusions that a camera cannot capture. Yet at Worthersee 2019, Volkswagen showcased a Golf GTI Aurora concept car featuring an operable holographic display which controls the vehicle's 3,500W sound system. It materializes in the air above the hardware, manifesting chunky buttons and a volume slider. These floating control elements can actually be manipulated in mid-air to control the volume or select albums or artists, presented as hovering cubes. The hologram appears to process user inputs as a physical interface, but Volkswagen remains tight-lipped regarding the exact technical specifics of this patent-protected, proprietary system.

"We create a floating image using software algorithms and visual technology components," says Mark Möller, head of development at Volkswagen Group Components. "The system automatically recognizes and implements the user's requirements, making it intuitive and logical to operate."

The miracle of pressing buttons made of air is conjured using sensors to detect the user's fingertip-movements, prompting the hologram to change responsively and so creating a sense of physical interaction. For now, the module dominates the Aurora's rear-trunk: hardly an optimal position for sound-system controls. In future, holograms could liberate valuable space in human-machine interfaces because, unlike physical control elements, they can simply vanish until needed.

While emphasizing that operable holograms are viable using today's technology, Volkswagen concedes they will not be appearing in its production vehicles for some considerable time.

RIGHT
Valeo's Voyage XR system beams an avatar into the car's interior to enable real-time conversations

BELOW
A virtual model of the car's interior is shown in the Valeo headset

franchises begin contributing platform content in future. "We only included that to illustrate how the SDK extends to new datapoints, like lidar awareness of people crossing," Wollny explains.

"Ethical guidelines and permission processes familiar from app stores will ensure there is nothing questionable before experiences hit cars."

MARKET PENETRATION

Valeo expects early Voyage XR uptake from rental firms, transit operators and fleet managers who need to monitor vehicles remotely. Holoride's roadmap involves first refining its system in controlled, test-track environments before extending it to mobility services, where a driver can on-board people and maintain devices. The company aims to introduce standalone VR experiences to private passenger cars in 2021 – a market they see as vast and untapped.

"Each day, over a billion car journeys are made with a passenger on board, including 50 million commercial trips performed by Didi, Grab, Lyft and Uber worldwide," says Wollny. "This passenger economy will expand further once AVs arrive, and our core technology can grow with the flow."

Crucially, Holoride also promises car makers a transformative new model for monetizing car data. "Manufacturers are excluded from the value-chain for media consumed in cars today," he continues. "We will compensate them for the datapoints that enable our experiences, creating an entirely new revenue stream."

Once the doors are closed and the journey underway, cars provide an ideal safe space for VR where passengers need not feel vulnerable immersing themselves in an alternative world. Beyond entertainment, use cases include virtual work desks, where spatial computing transforms transit into productive time, and motion-synchronized relaxation spaces for nervous passengers of future mobility forms such as hyperloop capsules or passenger drones. But it is the potential for new constellations of educational content that animates Wollny most passionately. "There are infinite opportunities for interactive edutainment that will make kids leave the car smarter than when they entered," he says. "Imagine you're in the rear seat but traveling back in time, across continents, through space, beneath the sea or inside the human body, experiencing a bug's life or seeing different species on safari. We want to make traveling by car a wonder, rather than a compromise."

"LIFE-DETECTION SYSTEMS CAN MONITOR HEARTBEAT AND BREATHING, SO WE CAN TUNE PARAMETERS TO RECOGNIZE WHEN YOU ARE OUT OF YOUR COMFORT ZONE"

Guillaume Devauchelle, innovation manager, Valeo

Child's play

Vauxhall's chief designer, Richard Shaw, discusses the importance of family-friendly interiors

BY **LEON POULTNEY**

The scene depicted in a recent Vauxhall commercial for its Crossland X SUV is one that any parent with active kids will recognize: the beloved children clomping across a muddy field after a game of rugby (insert any other messy sport here) covered head-to-toe in muck.

But in a twist, the Crossland X advert focuses on the other, let's say, well-to-do mums and dads frantically rushing around in order to preserve their cherished 4x4s. Shopping bags are used to cover pristine white leather seats, kids are hosed down with water bottles, and one driver seemingly refuses entry to their muddy urchin. Not so with the Crossland X owner, who is happy to put its hardy interior to the test.

"Most people here at Vauxhall, from design through to engineering, are family people," explains Richard Shaw, head of design at Vauxhall. "Of course, we have a lot of data we can draw upon when designing a new car, whether that's from customers or focus groups, but a lot of people within the company are parents and understand the various needs."

This thinking, Shaw believes, helps the company to create vehicles that can withstand the rigors of daily use. But like most great interiors, the foundations begin on the outside.

"It seems simple, but even something as essential as a belt line can have a real impact on the interior. Vehicles specifically designed with families in mind will feature a lower belt line around the rear doors. This is so children get a good view out of the vehicle, rather than staring at a blank piece of plastic," says Shaw.

Once the foundations have been laid, designers can turn their attention to the cabin interior, often putting themselves in the child's seat (quite literally) and working on solutions that will make life inside the car more pleasant for everyone involved.

BELOW
Richard Shaw, head of design, Vauxhall

BOTTOM
Vauxhall Crossland X

The front seats found across the Vauxhall portfolio, for example, have been heavily scrutinized by engineers, who have sought to balance driver and front passenger comfort with maximizing interior space. The solution? Shaw claims that the rear of the front seats have been "shrink-wrapped" to the frame to ensure greater legroom in the rear. After all, being constantly kicked in the back on a long journey is incredibly irritating.

"There are lots of little tricks that designers can use to make the interior feel more comfortable," says Shaw. "A panorama roof that is offered on the larger Grandland X and Insignia Sports Tourer, as well as Combo Life and the smaller Corsa, lets more daylight flood into the cabin.

"CERTAIN WEAVES HAVE A NASTY HABIT OF ATTRACTING DUST OR COLLECTING DOG HAIRS"

LEFT
Smooth seating fabrics, such as the Florey or Peanut black upholstery in the Crossland X, are easier to maintain than many porous weaves

I remember my dad had an old Fiat coupe with a sunroof that opened right above our heads. I used to love looking up out at the stars. It made the journeys speed by," he says.

MATERIAL WORLD

Arguably one of the most important elements of any family-proof car is the choice of interior materials. Soft cream leather just isn't going to stand up to the harshness of muddy boots, spilled drinks and dropped food.

Naturally, most manufacturers subject their materials to the toughest tests, but Shaw believes that the team at Vauxhall go the extra mile to ensure interiors remain comfortable, but last the lifetime of the vehicle.

"It can even come down to the weave used in materials," he says. "Certain weaves have a nasty habit of attracting dust or collecting dog hairs."

On the Crossland X, for example, customers can choose from a Florey or Peanut black fabric design on the seats. These options feature a smooth-to-the-touch surface, but also offer differing 3D designs that lend the interior a completely different look.

PARENT ASSISTANCE

Research by Nissan revealed that nearly two-thirds of parents (63%) struggle to fully concentrate on the road when their children are misbehaving in the car, and nearly half of those parents realize they're less safe behind the wheel as a result.

Parents say the level of distraction means they've taken their eyes off the road and their hands off the steering wheel. They've also run traffic lights, forgotten to indicate, braked suddenly, swerved into the next lane, and even been forced to stop the car completely.

"Any parent knows that family outings aren't always straightforward," says Jean-Philippe Roux, general manager of crossovers at Nissan Europe. "The smallest passengers often bring the biggest surprises when you're trying to concentrate on the road, which can create a stressful time for the parent behind the wheel."

Crying and screaming tantrums top the misbehavior list (65%), followed by backseat battles between siblings or friends (58%), kicking the back of the driver's seat (49%), undoing their seat belts (43%) and throwing toys around the car's cabin (39%).

Many reveal they're taking desperate measures to reduce the danger and distraction caused by driving with kids – 15% of adults completely avoid using highways or busy roads when their kids are in the car, while others distract them with tablets or smartphones (37%), toys (41%) or sing-along music (53%), or keep them quiet with sweets (22%).

As a result, parents are increasingly turning to in-car technology to keep the family safe on the road. The research highlighted that avoiding distractions is one of the biggest concerns for parents when choosing which car to buy, with one in three (34%) saying they would actively look for driving assistance systems when choosing their next car. These could be emergency braking, lane departure warning and adaptive cruise control.

"We have a number of technologies that provide a smooth, easy-to-clean surface, while still offering an attractive appearance and design, such as printing designs onto the fabric, and sonic welding, which can create a 3D relief for the material without having separate stitching," Shaw explains.

Once the perfect fabric is selected, Vauxhall then subjects it to years of testing, which goes beyond the typical robotized backside scraping up against the fibers for days on end. Shaw says the fabrics are used day-to-day by real families until they pass the test. And the hardest test of all? Sunscreen.

"Sunscreen is just so aggressive when it comes into contact with certain materials, you wouldn't believe it. It's the equivalent of bird droppings on the exterior, you really don't want to leave it on there," he says.

"Our color and trim department work closely with suppliers and our in-house laboratory to ensure the final composition of the material is then developed to be resistant to any chemical reaction that would otherwise take place, to ensure they don't end up bleached after a family summer holiday," adds Shaw.

Color choice is also extremely important and in order to avoid the situation where parents are forced to cover their seats with shopping bags, Vauxhall ensures all of the major contact points in the interior are kept dark.

"The Grandland, for example, has quite a light interior. The lightness

FUTURE-TECH FOR FAMILIES

Speaking at BMW's NextGen conference, which sought to unveil cutting-edge concept cars and highlight a future design direction for the group, BMW design director Adrian van Hooydonk touched on a number of interior trends that he believes could make family life easier.

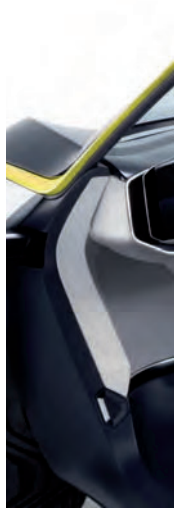
"If you look at the iNext concept, we are showing an interior with no switches and a wood surface in between the seats that is also a touch surface. On the rear seats, there is fabric that is also a touch surface," he says.

"Today, these surfaces are separate, but we see these things merging in the future. Similarly, our engineers are already working on windscreens and windows that become the head-up display, so we can do away with the secondary device completely," he adds.

On top of this, van Hooydonk feels that as increasing levels of autonomy become mainstream, his engineers will be able to "offload" some of the active safety functionality, such as airbags and seatbelts, to free up space inside for entertaining passengers.

"People spend a significant amount of time inside their cars, and in the future it will be easier to talk on the phone, read emails and do tasks other than driving. Our vision focuses on Shy Tech, which is the opposite of high-tech and only becomes obvious when it is needed," he adds.

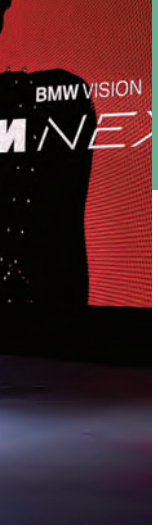
Although very much a premium player, BMW focused on the family unit at the NextGen event, creating cars that would be useful and exciting for the next generation. The BMW iNext, for example, sees Intelligent Beam technology installed, which projects imagery onto surfaces within the interior. van Hooydonk points out that this could bring children's books to life, by beaming moving images to the pages as they read along.



ABOVE
BMW's iNext concept features touch surface controls to improve the user experience for families

LEFT
The rear panels of the front seats in the Grandland X have been shrunk to the frame to ensure greater legroom for children

"THE FUTURE FOR US IS HEAVILY GEARED AROUND THE SOUND EXPERIENCE AND THE WHOLE ENTERTAINMENT EXPERIENCE WILL BECOME MORE IMPORTANT"



RIGHT & BELOW
Vauxhall's GT X Experimental concept vehicle committed all interior buttons and dials to digital displays with the aim of keeping the driver's focus on the road

comes through the door inserts, but the bits you sit on, the armrests and the doors are kept dark so it can be used every day, yet remain looking fresh for longer," Shaw explains.

LOOKING FORWARD

Surprisingly, something as simple as a cupholder can cause automotive interior designers a headache. The need for space to house a large bottle of water in the door bins can easily affect interior roominess, or the decision to add a cupholder suitable for a baby bottle can have an adverse effect on the ergonomics of a cockpit. Shaw and his team have been dealing with such problems for decades and luckily have reams of marketing data and customer profiles to draw on when first embarking on a new project.

But the evolution of revolutionary technologies, such as economically viable and reliable electric drive systems, presents a whole host of new interior challenges, especially when it comes to young families.

"Electric vehicles are so quiet and the lack of noise from an internal combustion engine means passengers start focusing on small sounds from windscreen wipers or wind noise caused by the wing mirrors," explains Shaw. "The future for us is heavily geared around the sound experience and the whole entertainment experience will become more important. Not all passengers will want to listen to the same thing, so we are looking into things like sound zone technology, which allows individuals to create a personal space. After all, mums and dads need a break from that same Peppa Pig sing-along CD once in a while."

Technology is also making cars safer in so many ways, but Shaw believes the decluttering of surfaces drastically reduces distraction for the driver and, in turn, makes life on the road with a family that much safer. Drivers with 'boisterous children', as Shaw puts it, don't need the added layer of disruption that complicated button layouts and confusing menus can cause.

Last year's GT X Experimental electric concept car showed off an interior where all buttons and dials were committed to screens. Dubbed the Pure Panel, this expansive infotainment setup enabled all major functions to be adjusted by voice control and for eye-tracking software to be able to adjust the seats.

"It is a revolutionary time for automotive design," concludes Shaw. "Imagine a future where the windows become interactive screens that can entertain the child with stories or information about the surroundings."

Beauty within

Renault looks to the horizon, with a greater emphasis on interior comfort and connectivity

BY **DAN SYMONDS**


Menu
Navigation
Multimédia
Téléphone
Apps
Véhicule
Système

Renault's reputation has been built on producing small, desirable hatchbacks at an affordable price. Outlandish exterior designs and powerful engines won plaudits while the interior often played second fiddle. The Clio remains Renault's magnum opus, but in the past decade the brand has spread to nearly every other automotive category, with notable success in the electric vehicle (EV) and compact-SUV markets. Renault is even making inroads in the luxury SUV segment with its second-generation Koleos.

"The new Koleos is an important step for us," explains Antoine Genin, vice president of interiors, trim and color at Renault. "We were a specialist in small cars 10 years ago and now we're building in all categories. Together with the Espace and Talisman, the Koleos makes up the high end of the Renault range."

To truly compete in an already oversaturated D segment, Renault needed to create interior spaces that match the external desirability of its vehicles. With this in mind, the latest Koleos received an interior facelift to further enhance its high-end qualities.

"On the Paris Initiale version, for example, we offer a choice of Nappa leather upholstery in 'black titanium' or 'light sand gray'," adds Genin. "The seats have also been embellished with double topstitching to emphasize the design, and there is the option for a sunroof that extends over the rear seats. All these things are indicators of high-end models."

A key element of the 2019 Koleos is the large 8.7in navigation and infotainment screen positioned vertically near the center of the dashboard. The tablet is fully compatible with Apple CarPlay and Android Auto, enabling the occupants to remotely synchronize and mirror their mobile devices. A voice-recognition system activated from the steering wheel also enables the driver to manage phone calls, emails, apps, satnav and radio with minimal distraction.

Other new touches include satin chrome inserts on the steering wheel, gear lever and air vents, as well as foam materials on the dashboard and door trim. Changes have also been made to the seating comfort and configurations, with a reclining rear bench seat and extendable front seat cushions. The driver's seat can even be equipped with a massage program.

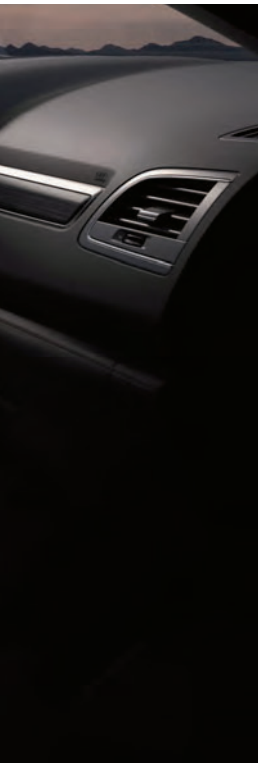
However, even with these improvements Genin acknowledges the customary design of the Koleos's interior, in that all these features can be found on other high-end SUVs across the market.

"For the D segment you have to follow codes. You cannot do something totally

"TOGETHER WITH THE ESPACE AND TALISMAN, THE KOLEOS MAKES UP THE HIGH END OF THE RENAULT RANGE"

"THIS IS WHERE RENAULT IS STARTING THE NEW REVOLUTION, IN THE INTERIOR, STARTING WITH THE NEW CLIO MARK 5"

ABOVE
The Zoe comes complete with the new smart cockpit and seat upholstery made from safety belt scrap and plastic waste



LEFT & INSET
The Koleos comes equipped with luxury features including cup warmers/chillers and an 8.7in multimedia screen

different, especially for a brand like Renault which is a relative newcomer to this segment," he says. "The Koleos is in a market that doesn't expect a revolutionary design in the interior. We first have to catch the competition, then we can be innovative."

SMART THINKING

While Renault may be playing it safe with the Koleos, the company has revolutionary plans for its interiors in the B and C segments, starting with the upcoming versions of the Clio, Zoe and Captur.

"With the Captur we want to target customers who don't need very big cars but still want to have a comfortable, dynamic looking interior with lots of features," explains Genin. "This is where Renault is starting the new revolution, in the interior, starting with the new Clio Mark 5 in October 2019, and later the Captur and Zoe. With the new Clio 5 we undertook an interior revolution, with new architecture, interior layout and form language."

Central to the overhauled interior is the 'smart cockpit', featuring a new-look steering wheel with backlit controls and more compact airbag compartment. This is complemented by a 10in digital instrumentation meter and navigation system – a first for the Clio. The cockpit also boasts a 9.3in multimedia screen – the biggest used by the company to date – which is angled toward the driver to minimize distraction. It comes equipped with the latest infotainment, navigation and EasyLink applications.

"With a bigger screen we can bring a lot more features," says Genin. "We take our inspiration from the smartphone world, because everyone has a smartphone and they expect it to be fluid and fast, to quickly swap from one page to another. Of course, in a car you're expected to concentrate on the road, so we've put a lot of work into the passive quality of the system.

"The multimedia experience is different from some of our competitors' systems because we wanted to keep it very simple," he says. "The screen, for example, is vertical rather than horizontal because you can see more when you follow your route. This is also the standard format when you use your smartphone. We started with the customer requirements and then designed the cockpit, rather than designing for the sake of design."

To complete the look, Renault raised the position of the center console for enhanced ergonomics, with a shorter gear lever for a more comfortable grip. The skin of the console can also be customized to suit a particular interior design scheme (choice of 18) and features special lighting on its outer edge. It also boasts a number of storage compartments, one of which contains a wireless smartphone charging area.

Furthermore, Renault introduced several new advanced driver assistance (ADAS) functions, such as its highway and traffic jam companion and adaptive

cruise control systems, all of which are activated or disengaged using the Easy Link multimedia touchscreen.

CAPTUR AND ZOE

Like the Clio, the Captur and Zoe both feature the new smart cockpit, although each interior has received its own subtle alterations to suit the model's target market. The Iconic version of the Zoe, for example, has been fitted with 100% recycled seat upholstery made from safety belt scrap and plastic waste (PET), to appeal to the environmentally minded driver. The material is created using carded yarn manufacturing, rather than melting or chemical transformation, resulting in CO_2 savings of up to 60% over traditional materials.

"We're also looking at animal-free or vegan interiors for our electric vehicles," Genin says. "We already use recycled fabrics for the Zoe's dashboard and seats, but this is something we can take further. We're not a premium brand; we make popular cars, so this is certainly a new direction for us to go in."

Like the Clio, the new Captur features a redesigned floating center console with a special pad for wirelessly charging mobile devices. For vehicles fitted with a dual clutch transmission, the floating center console features an 'e-shifter' gear selector with an illuminated outer edge that can also be customized to suit the rest of the vehicle. By raising the console and reconfiguring the cockpit, Renault has been able to introduce even more storage space to make full use of its compact design.

Likewise, the extra room afforded by a new electronic parking brake on the Zoe means the center console has double the storage space of previous versions and comes complete with a chrome electronic gear selector and driving mode toggle.

BLANK CANVAS

Looking to the future, Renault is determined to stay ahead of the curve and incorporate the latest technologies into its vehicles wherever possible:

"We are already thinking about the next generation as we are facing many future revolutions," says Genin. "The car of tomorrow will highly likely look very different from the car of today. It is the first time in 30 years of designing interiors that no one can be certain about what the future holds. It's like

EZ-ULTIMO CONCEPT

At the 2018 Paris Motor Show, Renault unveiled its idea of a high-end vehicle for modern times, inspired by French elegance. The EZ-Ultimo, one of three concept cars promoted that year, is an all-electric, autonomous limousine, designed to provide the occupants with a premium mobility service for transfers to the airport, hotel or any other business or leisure activity.

The upper part of the bodywork comprises 600 diamond-shaped plates that act as a one-way mirror to preserve the privacy of the passengers, while still being transparent from the inside. The EZ-Ultimo cabin is presented as an intimate cocoon that feels more akin to a living room than a vehicle interior. There is a herringbone wooden floor, a decorative marble band around the belt line, and leather trim and velvet seating upholstery. Two pale gold lamps illuminate the interior, while a low-angled LED highlights the parquet floor.

While mimicking the classic Haussmann-style apartments found throughout Paris, the EZ-Ultimo will still be equipped with the latest infotainment and communication technologies, underpinned by a 5G network and wireless charging surfaces.

ABOVE & RIGHT
The Captur's smart cockpit has been angled toward the driver to minimize distractions

BELOW
Antoine Genin, VP of interiors, trim and color, Renault

"IT IS THE FIRST TIME IN 30 YEARS OF DESIGNING INTERIORS THAT NO ONE CAN BE CERTAIN ABOUT WHAT THE FUTURE HOLDS"

working with a blank sheet of paper, it's very exciting."

One such revolution, according to Genin, will be the advent of autonomous driving, although the exact impact this will have on interior design is less than certain. "Autonomous driving will not come as quickly as everyone initially thought, but we will have to take into account a design where the driver isn't driving all the time."

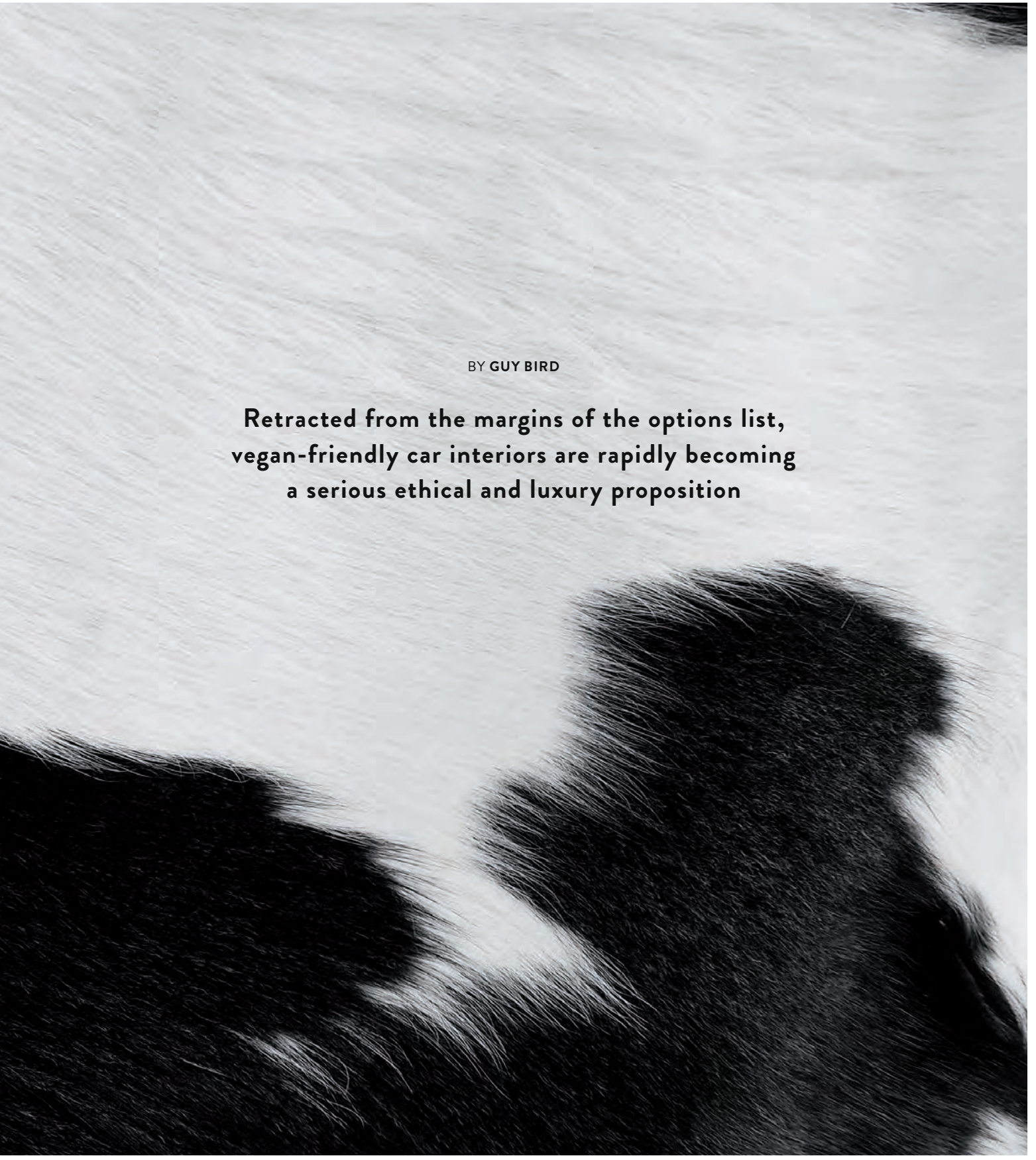
According to Genin, the combination of autonomous driving with electric drive systems will provide more space in the cabin, allowing a greater focus on display technologies and connectivity, although the former will likely change from what we know today.

"The electric drive system means you can hide components like the heating, ventilation and air conditioning [HVAC] under the hood, meaning there's more space in the cabin," he says. "There will also be a revolution in what comes after the screen. Displays can only get so big in a vehicle, so we will probably have head-up displays projected on the windshield and passenger windows instead."

Although these developments hold great potential for the auto industry, Genin stresses the danger inherent in focusing too strongly on technology and losing the values that distinguish a brand from other manufacturers.

"Ultimately the most important thing that makes a difference is the brand identity in your car," he says. "We have a unique chance to find added value as there are so many technological possibilities, but we have to remember what makes a Renault different from other OEMs. It's not enough to be better; you have to be unique."

{WHATEVER THE LEATHER}



BY **GUY BIRD**

Retracted from the margins of the options list, vegan-friendly car interiors are rapidly becoming a serious ethical and luxury proposition

atering for vegan car customers wasn't high up the menu of most vehicle manufacturers until very recently. Vegans – those who eschew products that cause cruelty to or exploitation of animals in their production – were routinely treated as a minority within an already vegetarian minority and often viewed with suspicion and derision – too 'right-on', too 'self-righteous' or simply 'boring' – by the meat-eating majority.

But times are changing. Active vegans are on the increase globally and no longer driven just by concerns about animal welfare and/or their personal health. Since Donald Watson coined the term when he co-founded The Vegan Society in 1944 in the UK, numbers have risen very slowly, but in 2018, these numbers were estimated at 3.5 million in the UK alone. Global numbers are harder to ascertain, but vary from 550-950 million, with some of this increase coming from those who see veganism as a positive step in the fight against climate change too. Indeed, The Vegan Society quotes a study by the Oxford Martin School, which suggests that: "If the world went vegan, it could reduce greenhouse gas emissions by two-thirds and avoid climate damages of US$1.5tn."

Those are big numbers. Whether car makers – already in the crosshairs of the climate change debate for their collective emissions – believe those figures or not, at the very least it makes good economic sense to appeal to a rapidly growing section of society that does.

PETA APPROVED

The high-profile People for the Ethical Treatment of Animals (PETA), which famously campaigned against the fur trade in fashion decades ago, now endorses certain automotive businesses it deems to be helping the vegan cause. This includes a Compassionate Business Award presented to the all-electric Volvo offshoot and startup brand Polestar for the standard vegan-friendly interiors on its forthcoming Polestar 2 model. The brand offers vegan-friendly alternatives to areas of a premium car's interior that would be traditionally wrapped in real leather – including the seats, steering wheel, gearshift surround, and certain interior coatings on doors, and more.

ABOVE
Tesla now includes vegan-friendly seating materials as standard in all its new vehicles

LEFT
Volvo's Polestar 2 was awarded PETA's Compassionate Business Award for its interior

"THE CAR INDUSTRY HAS BEEN SLOWER TO CAPITALIZE ON THE DEMAND FOR VEGAN PRODUCTS"

Yvonne Taylor, director of corporate projects, PETA

All-electric car company Tesla is another that has promoted its vegan seating for some time, and now sells its latest Model 3 electric saloon with a steering wheel wrapped in premium synthetic leather rather than animal hide. CEO Elon Musk cited that the main delay in that decision was finding a vegan material that would be durable enough for heated steering wheels, due to "all the various oils and other gunk that we carry around on our hands", according to an article in *Electrek*.

PETA seems remarkably sympathetic to car companies' work in this regard: "While fashion brands, airlines, hotels, and even fast-food chains have been actively promoting their vegan options for some time to attract consumers,

VOLVO'S PLASTIC REPLACEMENT

Concern at the amount of plastic polluting the planet – more than 75% of the 8.3 billion tons of plastic created by man still exists as some form of waste – is finally filtering down into action within the car industry. As is so often the case, safety-conscious and now very much eco-conscious Volvo looks to be leading the way. It has already stated that from 2025 at least 25% of the plastics used in every newly launched Volvo car will be made from recycled material.

In 2018, to demonstrate what could be achieved, the company unveiled a version of its XC60 T8 Twin Engine plug-in hybrid SUV that looks identical to the existing model, but had several of its plastic components replaced with equivalents containing recycled materials. The car's interior used renewable fibers and plastics from discarded fishing nets and maritime ropes for its tunnel console, the floor carpet contained fibers made from PET plastic bottles and a recycled cotton mix from clothing manufacturers' offcuts, while the seats also used PET fibers from plastic bottles. Volvo even recycled its own products, utilizing used Volvo car seats to create sound absorption material for under the hood.

Elsewhere in its business, Volvo has pledged to eliminate single-use plastics from all its global offices and events by the end of 2019 and is aiming for climate-neutral global manufacturing operations and half of its sales made up of fully electric, emission-free vehicles by 2025. Meanwhile, Volvo's production numbers and profits are booming. Clearly its message is resonating with a large and like-minded customer base.

the car industry has been slower to capitalize on the demand for vegan products," says Yvonne Taylor, PETA's director of corporate projects. "This is ironic, given many of the biggest automobile companies have been using vegan leather for its high quality and durability for decades. The good news is that we are now seeing the biggest names fast-tracking vegan-friendly automobile options. A number of manufacturers of high-performing, animal-free fabrics now use the PETA-Approved Vegan logo to help companies identify their vegan leather- and wool-look fabrics at a glance. To assist consumers looking to purchase cars with interiors that are compatible with their humane values, PETA and our international affiliates regularly update supporters on the latest animal-free interior options coming to market. And behind the scenes, our corporate affairs team shares information about innovative new vegan fabrics with automobile design teams too."

PREMIUM ALTERNATIVES

Beyond new automotive names such as Tesla and Polestar – perhaps without legacy supplier agreements with leather-producing companies – PETA points to Toyota's SofTex material that dries more quickly, weighs half as much, and has come out on top in several durability tests. Or Mercedes-Benz's fairly long-standing Artico offering, which looks and feels like leather. Even Ferrari, whose customers, some may perceive, represent unreconstructed consumerism without ethics, now offers Mycro Prestige vegan leather as an upgrade for its California T convertible. Luxury British car brand Bentley – renowned for its sumptuous interiors featuring swathes of quilted soft leather – is thinking vegan too.

"Our color and trim team have been working on a vegan leather for years, but this is the first time we've shown what we're working on," confides Brett Boydell, head of Bentley interior design, when discussing its recently unveiled EXP 100 GT concept car. "It's early in its development. The Italian supplier is Vegea, which works with waste from the wine industry [grape skins] and mixes that with an eco-resin to effectively create a leatherette."

That might be fine for a concept car envisioning the world in 2035, but Boydell says Bentley's vegan leather will arrive sooner in production form than many of the other ideas on the EXP 100, adding, "I think we're the first automotive partnership with Vegea and it could be next year that we have it available for our customers."

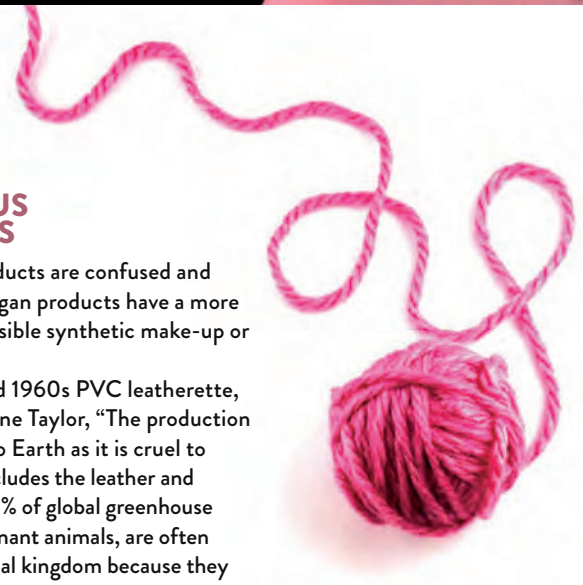
Mainstream brands are going vegan too as PETA's Taylor continues: "Companies including Chrysler, General Motors, Honda, Kia, Nissan and Subaru all offer vegan interior options for selected models." Of that breed, VW is another good example. Vegan-friendly interiors can be selected in nearly every VW car if you order cars with vinyl, microfiber, textile (PES) and diverse other animal-free materials, according to Janine Zyciora from VW Design.

However, that doesn't mean the whole car is vegan. Rubber and plastic used to make tires can be vulcanized and toughened using tallow (mutton fat) and the steel used for a car's frame can be lubricated with animal fat. Even internal cabin screens in entertainment systems contain liquid crystals that could be based on cholesterol taken from animals. So it's complex. However, VW does appear to be trying hard. It recently showed its latest EV concept – the ID Roomzz – with 'apple leather' made from the skins, cores and pulp discarded by the apple juice industry featured on its seats. "For this you need ambitious suppliers," continues Zyciora. "Testing for the materials in our cars is most sophisticated, much more than for clothing or furniture." The good news is that it is slated to make production on its cars by 2023. In a similar move,

"TESTING FOR THE MATERIALS IN OUR CARS IS MOST SOPHISTICATED, MUCH MORE THAN FOR CLOTHING OR FURNITURE"

Janine Zyciora, VW Design

ABOVE
VW's latest EV concept – the ID Roomzz – features 'apple leather' seating fabric made from the actual skins, cores and pulp of apples

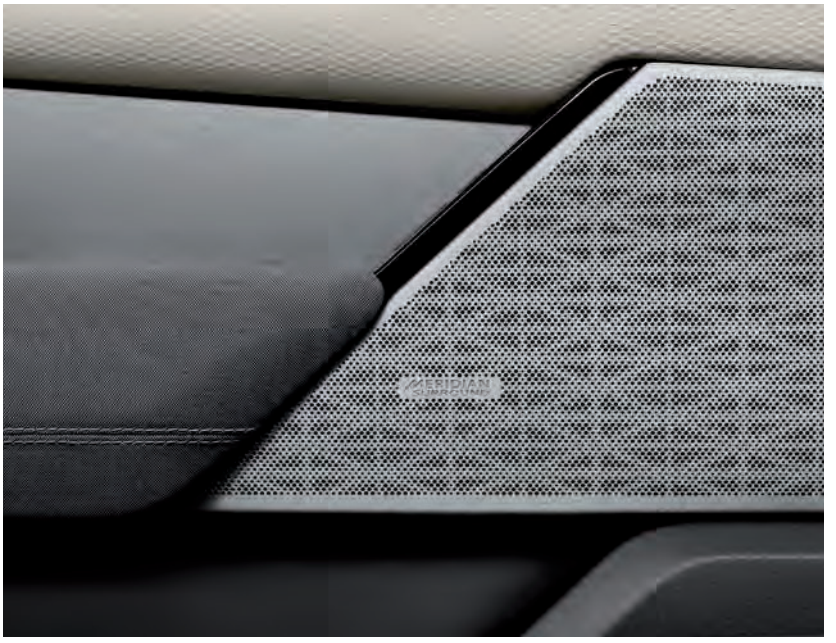


VEGAN FRIENDLY VERSUS SUSTAINABLE INTERIORS

Sometimes vegan and eco-friendly products are confused and are seen as interchangeable. But can vegan products have a more detrimental eco impact, given their possible synthetic make-up or complex production?

This might have been the case with old 1960s PVC leatherette, but not now. According to PETA's Yvonne Taylor, "The production of animal-derived materials is as toxic to Earth as it is cruel to animals. "Animal agriculture – which includes the leather and wool industries – is responsible for 14-18% of global greenhouse gas emissions. Cattle and sheep, as ruminant animals, are often referred to as the 'Humvees' of the animal kingdom because they generate huge amounts of methane, a greenhouse gas 25 times more potent in its warming effect than carbon dioxide.

"Data from the Higg Materials Sustainability Index (MSI) found that the production of leather and wool has a greater impact on climate change than the majority of its synthetic counterparts," she continues. "Today, with the availability of a multitude of materials – both natural fabrics and recycled synthetics – that don't contribute to either environmental degradation or animal abuse, PETA encourages caring people to demand vegan car interiors that no animal had to suffer and die for."



ABOVE
Kvadrat's non-leather alternative was used on the door panels of the Range Rover Velar

FAR LEFT
Bentley partnered with Vegea for the interior of the EXP 100 GT

VW Group brand Škoda showcased a material made from pineapple leaves called Piñatex in the floor mats of its 2018 Vision RS concept.

PHYSICAL PROPERTIES

It would seem there are many new and innovative vegan car interior design options to replace leather, but can they really be as robust or luxurious as the actual thing? Mick Bradley, production director at Envisage Technologies – a subsidiary of bespoke automotive engineering firm Envisage Group – sees work still to be done, but also creative options too. "We are not specifically looking into vegan-friendly products, although many materials and processes we have investigated due to their sustainability also fall within this category. These include mycelium, coconut 'leather', fruit 'leather', banana fiber fabric and coffee-based materials," he qualifies. "These materials require more development to reach production-viable vehicle application due to factors such as durability and UV resistance.

While many vegan-friendly materials are new to the automotive market, materials such as microfiber or woven and knitted fabrics are already available, but have long been considered at a lower premium to leather. However, with opinions changing on 'leather as luxury' in certain markets, and the increasing use of textiles as a premium material, it gives designers greater opportunity to work with vegan-friendly materials."

Bradley's last point is apposite. Not only are so-called 'pleathers' getting better in quality and sustainability terms, but the idea of non-leather alternatives being just as long-lasting and luxurious is gaining traction too – possibly from trends outside of the automotive world, including architectural interiors. One example is Danish material maker Kvadrat, long known in the furniture world for its high-end natural textiles, and which recently collaborated with Land Rover to develop its first automotive-grade 30% wool, 70% polyester material.

Featured first on the armrests, door panels and seat bolster edges of the 2017 Range Rover Velar, it was billed as a sophisticated alternative to leather, just as robust and in some aspects better, as Amy Frascella, Land Rover's chief designer of color and materials, explains: "The premium-level textile by Kvadrat passes all the same specification tests as our leather upholstery and you could argue it has some technical specifications that leather doesn't, in terms of breathability for example."

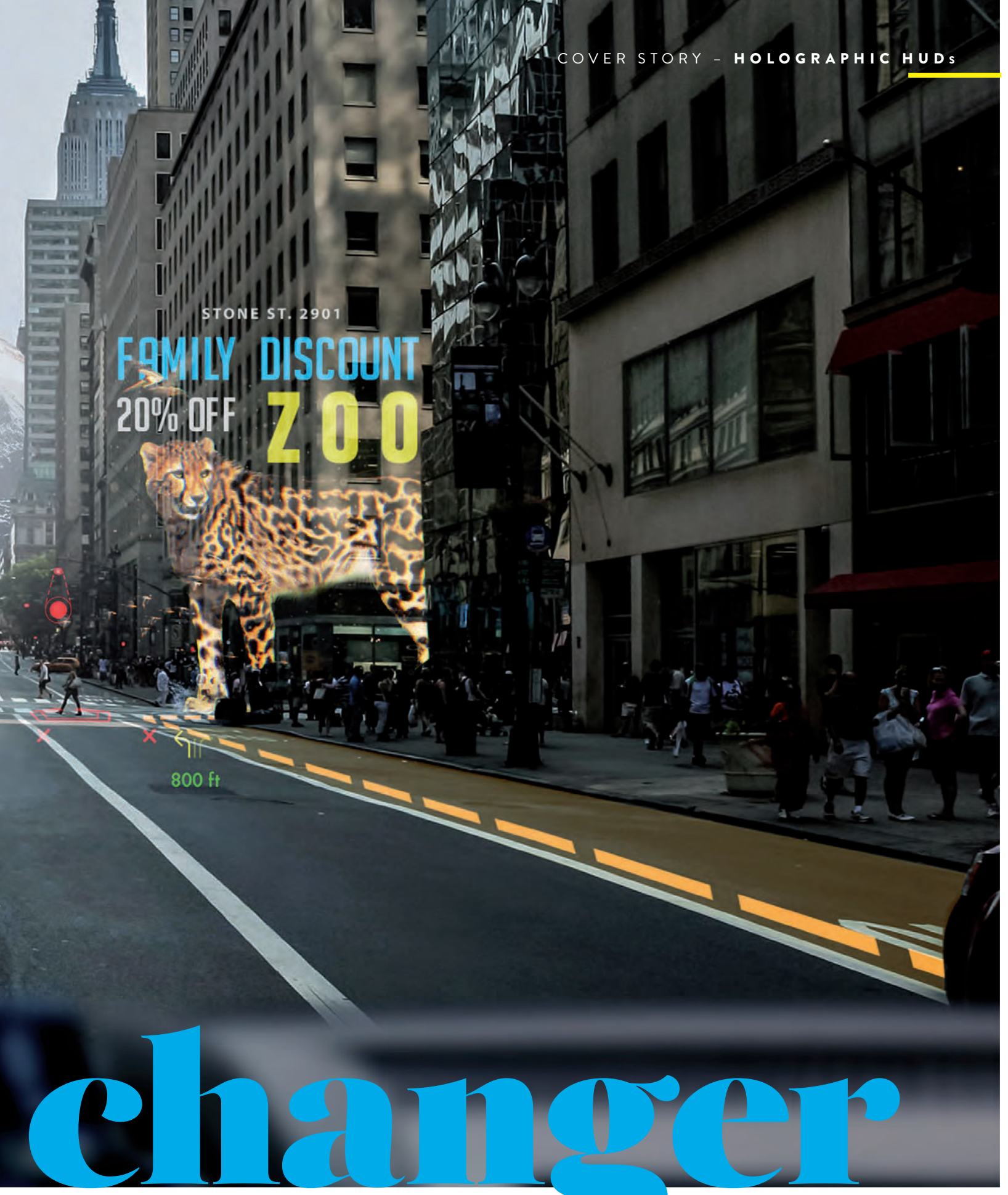
Kvadrat is quick to say that the wool required for its materials doesn't involve cruelty to sheep either. Njusja de Gier, senior vice president for marketing, tries hard to do the right thing herself: "I eat vegan and drive electric, but am not completely vegan – I still have leather shoes and bags. We set strict standards to animal welfare. Farmers must comply with national legislation and respect the Five Freedoms of animal welfare. Wool used in Kvadrat textiles is free range and comes from New Zealand, Australia, and some from Norway."

If vegan-friendly car interiors can combine equivalent quality or better with a cleaner conscience than materials that involve harm to animals (and the planet) – and it would appear that some already can and many more are on their way – they have the potential to become mainstream within a decade, which is not something anyone would have said about vegans a decade ago.

No longer confined to the world of video games, augmented reality head-up displays are being assessed by vehicle manufacturers today

Game

BY **DAN SYMONDS**



changer

The incorporation of true augmented reality (AR) head-up displays (HUDs) in vehicles is close to realization, with several developers claiming to offer a commercially viable solution for everyday motoring.

Unlike previous renditions, these HUDs don't simply float the speedometer and navigation instructions in front of the driver, they monitor the vehicle's surroundings and translate that information into transparent, multi-depth visual cues, helping to lighten the driver's cognitive load without wearing a headset or special glasses.

Combined with the right hardware, the HUDs can be used to illuminate the desired lane when approaching a junction, indicate the proximity of the car in front using traffic light color coding, highlight points of interest such as parks or venues, and even draw attention to potential hazards such as encroaching pedestrians.

"We're seeing a real interest in our technology because we're able to manipulate the outside world and convey in very subtle or obvious ways what's going on around you," says Dr Jamieson Christmas, founder and CEO of Envisics, a key developer of holographic HUD technologies.

Other early adopters include WayRay and DigiLens (Continental), with each claiming to have sophisticated AR HUD systems ready for integration.

MULTIPLANE PROJECTIONS

The key to the emergence of these new true AR technologies is not so much the projectors themselves – which have grown in sophistication, but are designed to be as simple, durable and cost-efficient as possible – but rather the inclusion of numerous sensor suites and the increased onboard computing power of future vehicles. The projector is simply another type of display, like an LCD screen, but capable of projecting multiple objects simultaneously, and now at different depths.

"We're a blank canvas," says Christmas. "We enable the OEMs to take our technology and present information in new and interesting ways. We're agnostic to whatever graphics they want to portray and how they portray them."

Whereas current holographic HUDs take the information fed to a satnav display and present it as a 2D hologram, these new HUDs tap into sensors used for advanced driver assistance systems (ADAS) and even radar and lidar sensors for autonomous driving functions.

"The depth perception really comes from well beyond the waveguides," confirms Chris Pickett, CEO at DigiLens. "It's really the sensors and the cameras on the car that combine with software that allow you to understand where the road is, where it travels, and where the objects are. We simply provide a display that allows you to portray that information as you want to. If you can display it on an LCD panel, you can display it on our waveguide," he says.

With each OEM wanting to develop their own graphics and features for the

"WE'RE ABLE TO MANIPULATE THE OUTSIDE WORLD AND CONVEY IN VERY SUBTLE OR OBVIOUS WAYS WHAT'S GOING ON AROUND YOU"

Dr Jamieson Christmas, founder and CEO of Envisics

ABOVE
Envisics' holographic projectors are engineered to be cost-effective and suitable for mass production

RIGHT
WayRay's True AR SDK toolset provides OEMs with the means to create their own navigation, safety alert and infotainment features

AR display and functions, the level of involvement for the HUD manufacturers in developing the software varies.

"We're partly involved in the software side in terms of understanding the requirements and assisting with data visualization, but most of that is carried out by our partners," says Pickett.

"For example, Continental works with Elektrobit for a lot of its software needs."

In contrast, Envisics works hand-in-hand with the OEM to deliver an end product. "Where an OEM has a particular feature they want to achieve, we simply define an interface standard and they send us the graphics in an open format," says Christmas. "We translate those into something the system understands and that can be relayed in three dimensions. We are trying to be as generic as possible."

PRODUCT VARIATIONS

While the end product may appear the same to the untrained eye, it's important to remember that Envisics, DigiLens and WayRay have approached the holographic AR display in different ways, meaning each has its own metrics for the level of brightness, field of vision, power usage, unit cost and unit size.

DigiLens, for example, has continued to adapt its already successful optical waveguide technology, making the hardware more compact, while

ABOVE
Envisics works with OEMs to create intuitive and unobtrusive AR projections, helping to lighten the cognitive load of drivers rather than distract

WAYRAY: NAVION

For its Navion aftermarket holographic HUD unit, WayRay developed a proprietary holographic optical element – a photopolymer film that retains the properties of a periodic nanostructure after the recording process.

Navion is arguably the most sophisticated aftermarket holographic HUD unit available on the market today, capable of displaying turn-by-turn AR directions in the built-in visor. The unit also comes with an HD camera for simultaneous localization and mapping (SLAM) in real time.

HUD EVOLUTION

The idea of leveraging AR HUDs for use in the automotive industry is nothing new. In one of the earliest demonstrations in 2010, General Motors (GM) unveiled a full-screen AR HUD project in partnership with Carnegie Mellon University and the University of Southern California.

This early system looked to transform the entire windshield into a phosphor screen, enabling a laser to outline the highway or illuminate objects such as road signs or traffic signals. This first incarnation was a rather large and crude simulation, but did offer an alternative to using a cathode-ray tube (as found on GM's 88 Oldsmobile Cutlass Supreme) or a separate phosphor screen between the steering wheel and windshield, like you'd find in an aviation cockpit.

The exact history of who did what first is debatable, but in September 2014, Jaguar Land Rover offered customers the option to include an advanced integrated laser HUD with the Range Rover Evoque – a landmark moment.

For £1,000 (US$1,200), the Evoque could be equipped with a holographic projector that displayed road speed, gear position, traffic sign recognition, and turn-by-turn navigation, all floating in the windshield in front of the driver. This system represented an important step toward a true holographic AR HUD as it relied on external sensors and signals to operate the sign recognition and satnav functions, rather than the speedometer and gears, which use internal sensors.

This holographic unit was the creation of Two Trees Photonics, later to become Envisics, a tech startup originating from Cambridge University in the UK. The journey began with research by Prof. Bill Crossland in 2001, which was further developed by Dr Jamieson Christmas while working for Alps Electrics. This research offered a new approach to holographic displays, leveraging LCoS technology, rather than mirrors or an optical waveguide. The result was an extremely bright display capable of generating several holographic images simultaneously.

"We focused very hard on making the first display for Jaguar Land Rover as reliable as possible and tried to closely mimic an LCD display that was projected outside the car," explains Christmas. "It was therefore quite conservative and didn't offer the multiplane depth experience of the most recent display."

expanding its range to cover a greater area of the windshield.

"Our photopolymer is assembled into volume Bragg gratings (used in fiber optics), superficially transferring the light across a large panel," says Pickett. "With mirror-based HUDs you've got to take the pupil from the projector and expand it through the use of several parabolic mirrors, and you simply don't have the space in modern dashboards."

Envisics, meanwhile, leverages its liquid crystal on silicon (LCoS) technology, which focuses all the light from the projector to each point within the eyebox, making it extremely efficient and bright.

"We looked at the problem of how you manipulate the speed of light," says Christmas. "We developed a device based on the concept of using LCoS. We found that when we exposed the special liquid crystal materials to an electric field, they electronically changed their density. So, we developed a device that allows us to electronically change the speed of light."

For its most recent design, Envisics uses two million light speed modulators, each 15 times smaller than the thickness of a human hair. The algorithms developed by Christmas are able to calculate and control all 2,000,000 of these points over 700 times per second.

TESTING AND DEVELOPMENT

Envisics and WayRay have publicly demonstrated a holographic AR display that includes dual-plane features that react to the driver's surroundings.

With Envisics, this includes a near-field image at 2m (6.6ft) and road coverage images at 20-100m (66-330ft). However, it's important to note that these simulations are intended to demonstrate the holographic projector's capabilities. They are not real-world installations working on-the-fly. If you were to place an object between the simulator and the screen, it would not be flagged as a potential hazard.

Although we are yet to see the finished article on a production vehicle, WayRay has publicly announced partnerships and funding from the likes of Porsche and Hyundai, and Envisics and DigiLens claim to be working with a lead OEM to bring a real-world application to market.

"I DON'T THINK REGULATIONS REALLY CONTEMPLATE BEING ABLE TO HAVE A HUGE AMOUNT OF DATA VISUALIZED IN FRONT OF YOU AND HOW THAT DATA SHOULD BE PRESENTED"

Chris Pickett, CEO, DigiLens

RIGHT Mirror AR HUD will not fit under modern dash

FAR RIGHT Compact waveguide AR HUD

MID-AIR HAPTICS

The brainchild of Bristol, UK-based tech startup Ultrahaptics, mid-air haptic technology has emerged as another way of keeping driver concentration firmly on the road. By providing tactile feedback for virtual buttons or controls, drivers are able to intuitively control infotainment and audio systems without looking in the cabin.

"The current thought is that gesture control isn't overly effective because you still have to look inside the car to make sure the instruction has been received," explains Charlie Alexander, director, product management - automotive and platforms at Ultrahaptics. "We provide confirmation that the gesture has been received using ultrasound pulse technology."

When deployed in vehicles, the Ultrahaptics setup utilizes hand tracking cameras and several ultrasonic arrays, either combined as a pad or scattered around the cabin.

"We've been able to use our Stratos hardware in several smaller clusters of arrays located around the cockpit," says Alexander. "We've been able to use half the number of transducers as you don't typically need the same haptic range in the cabin of a vehicle as, say, an advertising display. The Stratos can kick out haptics up to 80cm (31in), but in the cockpit you only need 30cm (12in)."

"We have a lead OEM partner and we're looking at a final release date of 2022," confirms Christmas. "Obviously, there will be a three- to four-year lead-in period beforehand, so we're currently on that path to demonstrate the reliability and maturity of the second-gen technology."

Indeed, Christmas is so confident of Envisics' current HUD projector that the company has already begun working on the next generation of displays. "We're already working on the third and fourth generation of the technology, and we're a good way through that process," he says.

Likewise, Pickett believes Continental will be looking at a similar release date. "It's looking very good for 2022," he says. "Continental has tremendous relationships with the OEMs. We have a lead customer and several other relationships beyond that OEM, but we're at various stages with each."

The company also recently acquired USA-based motion camera specialist Leap Motion, meaning it now has its own specialist division dedicated to the software, algorithms and cameras needed to create the end product.

"OEMs are already deploying cameras in their vehicles for mood tracking or monitoring the driver's head position," says Alexander. "We're now able to take the software and machine learning algorithms from Leap and apply them to the very same cameras. This saves space and money."

In a study with Nottingham University, Ultrahaptics proved that the combination of haptic feedback and gesture movement reduced the number of distracted driver glances by 25%.

Alexander believes this can be improved further by combining the mid-air haptic controls with holographic technology to create a multimodal vehicle human machine interface (HMI).

"The interface is changing," says Alexander. "It's no longer just the touchscreens and touchpads, it's the holograms, windscreen displays and other AR applications. It's the most natural correlation of technologies."

However, legislative issues could yet cause problems for the developers, given that this new technology has the power to distract, as well as enhance, driver awareness. For example, rules would need to be put in place to control advertising.

"I don't think regulations really contemplate being able to have a huge amount of data visualized in front of you and how that data should be presented," considers Pickett. "So that's something we'll work through and is certainly something we're already working on."

ABOVE & RIGHT
Ultrahaptics partnered with Bosch and Harman to develop early automotive applications for mid-air haptic controls

BELOW
Ultrasonic arrays can be combined as a pad or scattered around the cabin in clusters

A NEW DAWN FOR DISPLAYS

If successful, these new holographic HUDs will redefine how OEMs approach the use of displays within cabin design. Not only will they help drivers keep their eyes on the road, leading to improved safety, but they will also provide OEMs with a way to convey their brand identity in a world increasingly concerned with comfort and the user experience. As Christmas explains, "When you bring technology like this to bear, you enable the car companies to literally project their branding outside the car."

As we have seen with smartphones, certain technologies have a tendency to adopt a universal design once they reach a certain level of maturity. The same could be predicted for autonomous vehicles, where a greater focus will be placed on the interior rather than exterior design. Holographic HUDs will not only help the vehicle to communicate with the driver, but may also offer another way of displaying media for the rest of the occupants, and in a way that conveys the auto maker's brand identity, much like the difference between an Android and iOS operating system.

Tailor made

FCA's color and trim unit is developing diverse solutions for an increasingly varied portfolio of products, helped by an innovative approach to matching high-street trends, as department head Rossella Guasco explains

BY **ALEX GRANT**

If the original Fiat 500 kick-started Italian automotive culture, then its 2007 successor made it global. This was the catalyst of rapidly changing fortunes for a brand now available worldwide and the spearhead of a model range that's sold three million units since launch. That enduring desirability owes a lot to the influence of the Colour and Materials unit at FCA's Centro Stile in Turin, Italy, and a streamlined development process that's now benefiting the entire group.

Innovation in materials has become an important process since Rossella Guasco, head of the unit since its inception just over a decade ago, joined the company in the mid-1990s, and the 500 has been a recurring theme. Not only because she was part of the team behind the 2004 Trepiùno concept that previewed it, but because her team has delivered more than 30 special editions of the city car since, including high-fashion, classic Cordura fabrics and even hand-varnished mahogany from yachts.

Her affection for the Cinquecento is clear: "The 500 is incredible, because it has no limits," she smiles. "It sometimes surprises us, because we change one color, or material, and it will do something new. Cars get older with time, but this one could be forever young. That's exactly what we think when we work on this car."

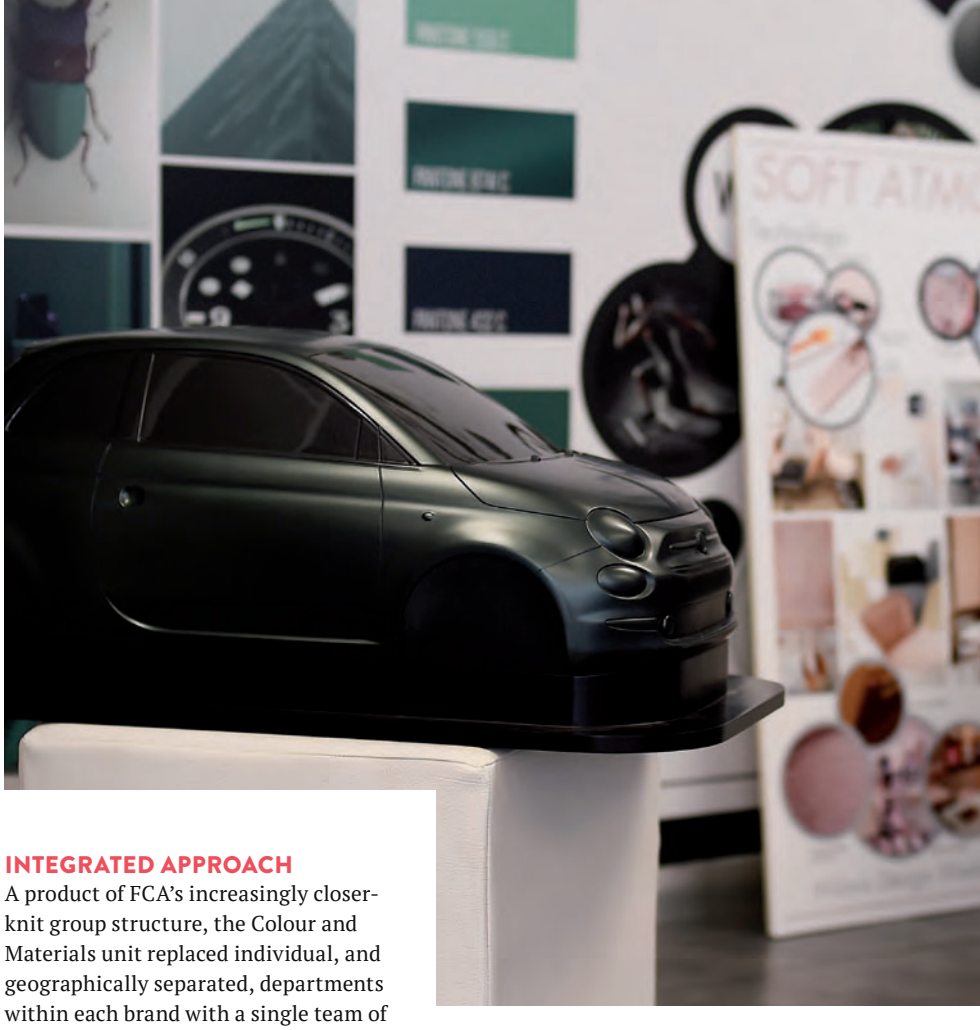
FIAT'S CENTOVENTI OFFERS CUSTOMIZABLE CABIN

At this year's Geneva Motor Show Fiat showcased the new Centoventi, which the auto maker wants to be the most affordable EV on the market. The small EV has been designed to offer a blank sheet to owners – it is highly customizable, and features can be added to suit the needs of the owner. One of the most noteworthy features of the new Centoventi is its expandable battery pack, meaning more battery cells can be added if owners want more range.

In the cabin, Fiat has developed a plug-and-play concept, which includes a reconfigurable cockpit. The dashboard features small holes into which components can be added. The holes use an interlocking mounting system, which Fiat has patented. According to the auto maker, there are 114 accessories available, such as a sound system, seat cushions, glovebox, a bottle holder and other storage. The door panels can also have extra storage or speakers added in a similar way to the dashboard. All accessories are available online or 3D printed, and are fitted at home.

The Centoventi has room on board for four passengers. The seat cushions and headrests can be changed to suit the needs of the owner. The front passenger seat can also be replaced with a storage box or a child seat. Furthermore, the rear bench can rotate to make a large load area. Owners can also opt to have a 'Lingotto' instrument cluster fitted – a fully digital 20in display. Integrated in the display are HMI driving assistance and safety functions, such as direction indicator, blind spot alert system, braking system and battery charge status. Owners can also choose an additional display ideal for showing carsharing messages, according to Fiat.

Fiat hopes to put the Centoventi into production in the next two to three years.



INTEGRATED APPROACH

A product of FCA's increasingly closer-knit group structure, the Colour and Materials unit replaced individual, and geographically separated, departments within each brand with a single team of 19 based in Turin. From here, the unit collaboratively identifies trends then filters them into brand-appropriate solutions via their still-separate design teams. Guasco typically assigns team members to a brand for three to five years, which instills a deep-rooted sense of what's appropriate for its products and helps with continuity.

"We speak a lot inside the team, but don't interpret the same materials the same way for two different brands. If I give a color to the Fiat, Maserati or Alfa Romeo teams, they will have completely different interpretations. At the end of a 10-year path you can work on every brand," she explains.

Fashion trends change faster than traditional development cycles could keep pace with, so the unit introduced a pre-approval process, which offers the flexibility to take special editions to market as fashions reach the high street. "For special versions we have a process comparable with a new product, so it will take 16-17 months and it's quite impossible to be up to date with the trends," Guasco explains.

"Because of the research that we do daily, we start to select some features, colors and materials in advance of a new car receiving approval. Not the 3D components, but the flat components, which reduces the development time," she continues, adding that the gap between identifying a trend and having it in showrooms is now around eight months. Patterns from pinstriped suits and three-dimensional Matelassé fabric are new this year, according to Guasco.

ABOVE The Colour and Materials unit at FCA's Centro Stile in Turin, Italy

LEFT The Fiat Centoventi's reconfigurable cockpit

RIGHT
The Maserati Levante Trofeo features sports seats with a premium full-grain 'Pieno Fiore' natural leather

A SUSTAINABLE FUTURE

Despite the Colour and Materials unit's group-wide role, different brands within it offer unique opportunities. Guasco cites the "blank sheet" Centoventi concept as a recent highlight; it has a vivid, modular interior featuring trainer-inspired low-waste 3D knit material and lightweight polyolefin resin for the seats that enable UV-resistant pearlescent, metallic and saturated pigments to be injected into the batch process, removing the need for fabric covers.

It's also responding to new challenges; Fiat uses 'eco-leather' in high-grade 500s, for example. Sustainability is a rising concern for the company, especially as an electric version nears production. "Sustainable materials are an important aspect of our lives, it's not just a trend. When we talk about sustainability we don't just talk about materials; it's a different process to design the components. When you design a new program, you can consider this aspect, but when you work on an existing program it's a little different," she explains.

"THE VISION OF A NEW MASERATI, AND HOW TO INTERPRET TRADITIONAL MATERIALS IN CONTEMPORARY WAYS USING DIFFERENT TECHNIQUES, IS A VERY STIMULATING PROJECT WE HAVE INTERNALLY"

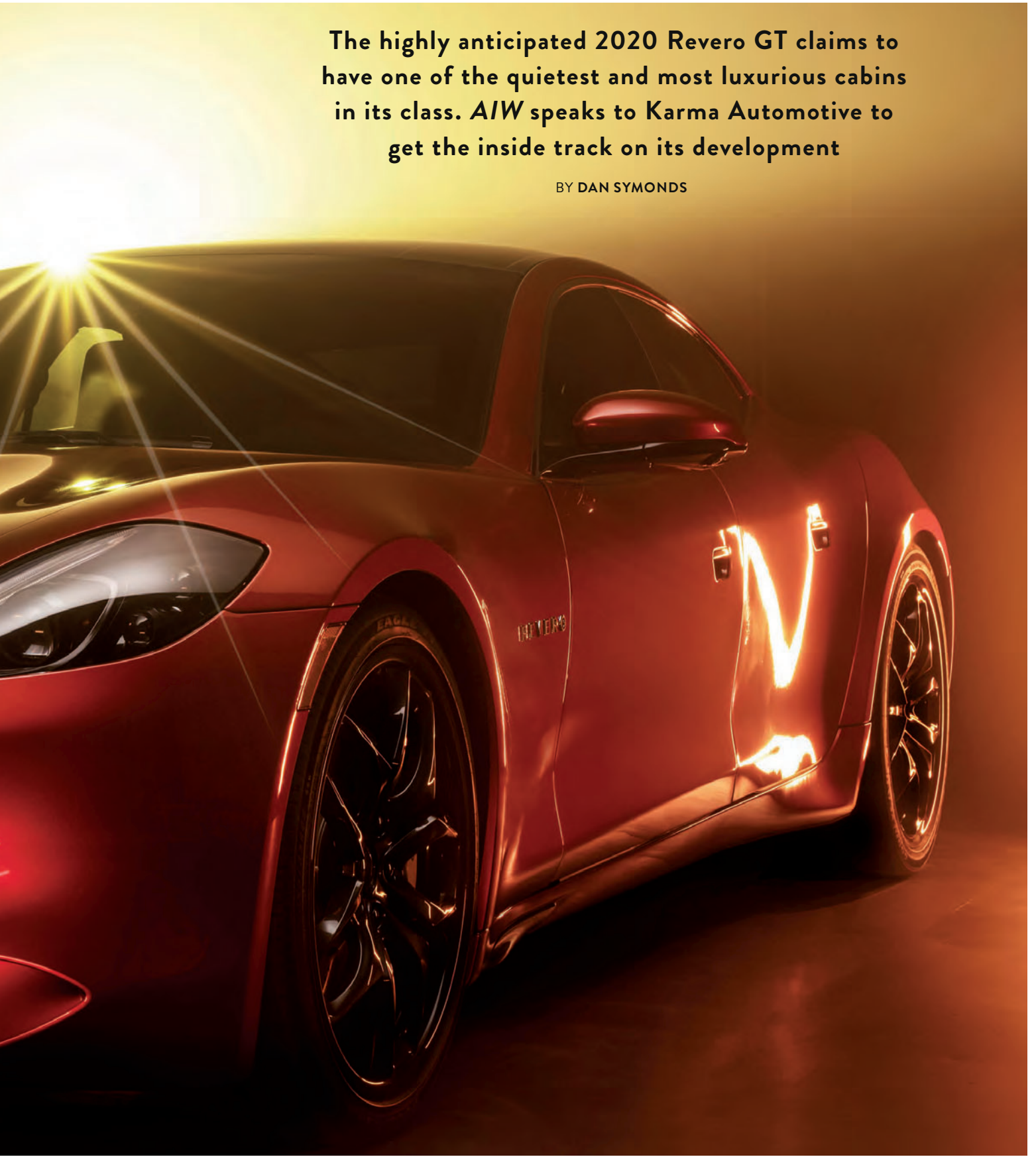
"But as a car producer, we need the sustainability behind the materials; it's no less important than the aesthetic approach. So we are working on that."

At the other end of the FCA portfolio, Guasco sees Maserati offering a chance to experiment with the most tactile and luxurious materials. The car maker recently presented a bespoke Levante SUV featuring Pieno Fiore premium leather trim, colored using aniline and oils but with no surface finish, to allow it to develop its own character in use. Its carbon-fiber inlays and center console were woven with copper wire.

"The vision of a new Maserati, and how to interpret traditional materials in contemporary ways using different techniques, is a very stimulating project we have internally," says Guasco. "'Made in Italy' and the value of its history is very important, but it's important for EMEA design [as a whole]. Even if we share research with other [global FCA] design teams, to better know the tastes of the different regions, it's important to keep a very European, Italian design DNA."

LEFT
Rossella Guasco claims that the latest Fiat 500's interior reflects the trends in high street fashion

Sound bites



The highly anticipated 2020 Revero GT claims to have one of the quietest and most luxurious cabins in its class. *AIW* speaks to Karma Automotive to get the inside track on its development

BY **DAN SYMONDS**

Karma Automotive's name is far from whimsical. In 2012, Fisker Automotive, which produced the Fisker Karma, went bankrupt following complications with its battery supplier. The assets were subsequently bought by Wanxiang Group and used to create Karma. Fans of the original car, Karma soon launched the Revero – an all-new series hybrid created in the image of the Fisker Karma.

Three years later, Karma is now preparing to ship its second model – the highly anticipated 2020 Revero GT – a vehicle that Karma claims delivers best-in-class performance against its more-established European rivals.

"The 2020 Revero GT is an entirely new car and is a reflection of the new Karma and our electrical design and engineering capabilities," says Eric Keipper, vehicle integration director at Karma Automotive. "It's faster, smarter and stunning to look at. It also met and exceeded our target for ride handling – particularly steering – which was benchmarked against several of the industry's leading luxury performance brands."

Having preserved the vehicle's frankly stunning looks and electric drivetrain, the company's next priority was to deliver a premium customer experience, in terms of both cabin noise and interior comfort.

"We've surveyed our customer base and it's a strong voice we hear," says Keipper. "They want and demand a very quiet ride, to the point where the cabin is able to eliminate all sounds from outside the vehicle."

To set suitable NVH targets, Karma benchmarked the GT against its main European rivals – the BMW i8, the Mercedes S550e and the Porsche Panamera PHEV.

"Being a luxury brand means we have to be quieter than everybody else," says Keipper. "We had to provide a truly comfortable cabin interior, with a comfortable level of sound no matter how aggressively you're driving or how fast you're going."

ABOVE
Karma combined cutting-edge driver technologies with high-quality fabrics and trims, creating an elegant yet modern interior for the Revero GT

SILENCE IS GOLDEN

Karma's long-term goal is for its vehicles to become entirely electric, but in the absence of sufficient charging infrastructure, the Revero GT retains a small 1.5-liter BMW engine to generate additional electricity for the car's twin electric motors when the battery is depleted.

"We're different from a lot of hybrids in that the only thing we use the onboard generator for is to create more electricity to keep the vehicle moving," explains Jud Knittel, lead NVH engineer at Karma. "That way our customers don't have to worry about range."

This vehicle architecture presents a unique and difficult set of challenges when aiming to create one of the most quiet and comfortable rides available: "We need to manage the cabin noise with the engine both on and off," adds Knittel. "We can't count on the engine to mask the noise, yet we have to manage the noise when it's running."

"IT DOESN'T MATTER HOW LOUD A NOISE IS, YOUR EAR ADJUSTS; BUT IF IT'S ANNOYING, IT DOESN'T GO AWAY, NO MATTER HOW QUIET YOU MAKE IT"

On top of the whine from the EV drivetrain and noise from the engine, Karma had to deal with the usual problems of wind and road noise, as well as contend with sounds from components such as the AC unit, fans, hydraulics and vacuum pumps, all of which are powered by their own electric motors and produce their own signature noise.

"An electric car doesn't make any of the same sounds as a combustion engine vehicle, so it brings a closer focus and scrutiny on the noises it does make," says Knittel. "We recognize that the power necessary to drive a vehicle is always going to make noise. We just minimize it where we can, and if we can't make it unnoticeable we follow psychoacoustic principles to make sure it's not annoying. It doesn't matter how loud a noise is, your ear adjusts; but if it's annoying, it doesn't go away, no matter how quiet you make it."

Using the benchmarked vehicles, Karma defined several critical strategic targets and performed root cause analysis whenever the Revero GT came up short. If the sound couldn't be eliminated entirely, or made it acceptable, the engineers decoupled the path so that it remained isolated and outside the cabin.

"We used the source-path-receiver model," adds Knittel. "In some cases, we attenuated the source, and in others, we attenuated the path."

SOUND SOLUTIONS

Working to a universal framework, the Karma team was able to systematically identify and eliminate unwanted cabin sounds, including BSR. For the IC engine and electric powertrain, Karma deployed a combination of traditional vehicle treatments, including heavy layer damping barriers and decouplers in key locations such as the dash and carpet, as well as lightweight materials to absorb the high-frequency noises generated by the inverters, motors and gearbox.

"We actually used a combination of all the options out there, trying to optimize each area of the vehicle to its best point," says Knittel.

For the electric components, Karma double isolated the motors and gearboxes, enclosed the inverters, closed out the battery tunnel and isolated the AC compressors and pumps.

To avoid squeaks from interior components and panels rubbing against one another, Karma used similar materials where possible and added a Teflon or felt material in the joints where it couldn't. It also evaluated all moving parts such as the glove box doors and consoles, ensuring there was just enough interference to make appropriate contact and avoid rattles, but not enough to get in the way of smooth closing. It also looked at the

BOSE ROAD NOISE CONTROL

In January 2019, Bose unveiled an offering from its portfolio of active sound management solutions for cars – Bose QuietComfort Road Noise Control (RNC). It joins the company's Engine Harmonic Cancellation (EHC) and Engine Harmonic Enhancement (EHE) suite of offerings for OEMs.

Bose QuietComfort RNC minimizes unwanted sound in the cabin by using the vehicle's existing sound system. It uses a combination of accelerometers, proprietary signal-processing software, microphones and the vehicle's audio system to electronically control unwanted sound.

Accelerometers mounted on the vehicle body enable a Bose algorithm to continuously measure vibrations that create noise. This information is then used to calculate an acoustic cancellation signal, which is delivered through the vehicle's speakers to reduce the targeted noise. Microphones inside the cabin monitor residual noise levels, allowing the system to adapt the control signal for optimized performance over different road surfaces, while automatically adjusting over time as the vehicle ages.

QuietComfort RNC is planned to be in production vehicles by the end of 2021.

BOSCH NVH TESTING CENTER

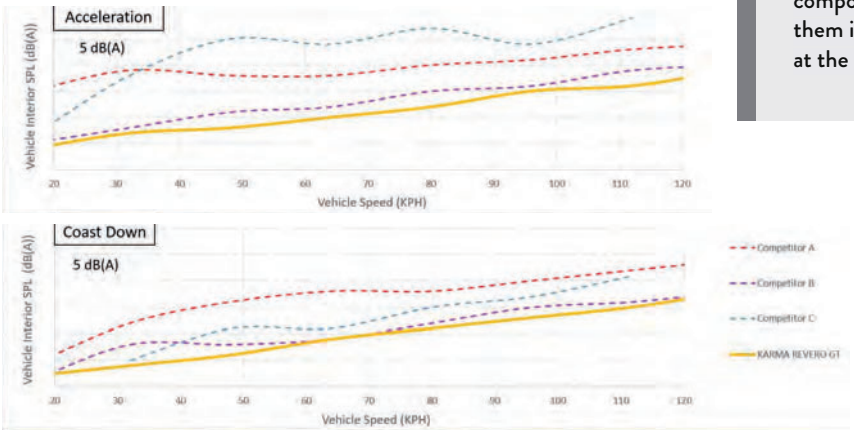
To keep pace with the growing demand for quieter vehicles, Bosch Engineering built a new acoustics test center in Abstatt, Germany. The center can be used for troubleshooting NVH developments with legacy vehicles, or can be leveraged by OEMs for the entire vehicle development process.

With a soundproof hemi-anechoic chamber isolated from the outside world, it provides an efficient means of testing and comparing new or modified components and calibrations under uniform conditions.

The centerpiece of Bosch Engineering's acoustics test center is a specially equipped chassis dynamometer. It is suitable for vehicles with a combustion engine, a hybrid drive or an electric drive, and for all-wheel, front-wheel and rear-wheel drivetrains.

A well-insulated testing room and silent rollers reduce background noise to a minimum so that engineers can measure even very low sound pressure levels. This is particularly useful for testing electric vehicles, as the acoustics of powertrain peripherals are far more perceptible.

The lab, sound studio and chassis dynamometer are in separate rooms. The lab is equipped with precision instrumentation for measuring vibration and sound pressure levels and conducting modal analyses to break down dynamic NVH behavior. The sound studio features high-tech equipment, including headphones for binaural reproduction and a 13-speaker array for higher-order Ambisonics reproduction. This setup enables engineers to compare diverse components' acoustic behavior in the virtual realm without having to install them in the actual vehicle. They can also switch between two NVH scenarios at the push of a button for A/B comparisons.



TOP
Bosch Engineering's new acoustics test center in Abstatt, Germany

ABOVE
Figure 1: EV acceleration and coasting noise against benchmarked vehicles

retention strength and durability of the leather wrapping, a prominent feature throughout the cabin.

Following component level testing, Karma's NVH team worked closely with the assembly plant to get feedback on its installation processes, to make sure everything could be put together easily and adhered to the product assembly documents.

"Our target for BSR is zero, and the assembly plant really rallied around that," stresses Keipper. "We have a target of a million miles for the engineering fleet, which we will exceed by the launch date. Part of that is ensuring that we have root-cause solutions for all the BSR we've found."

Being a boutique firm with a small NVH team, Karma relied on assistance from several third-party suppliers, particularly Siemens, to provide expertise, software, equipment and even additional manpower in specialist fields where required.

The result is one of the quietest series hybrids available today, boasting less interior cabin noise than leading luxury brands (Figure 1).

"Our internal data shows that we're quieter in both acceleration and coasting in electric mode than the benchmarked vehicles," confirms Keipper. "So we're pretty proud of the way that the NVH all came together. Even the user interface, the infotainment system and the sound for the audio system have proved to be benchmark worthy."

It's an effort that Knittel feels has thrown down the gauntlet to fellow hybrid manufacturers, which will now have little choice other than to follow Karma's example.

"When the Lexus came out in the USA in the 1990s, it was the quietest vehicle NVH developers had come across," says Knittel. "Lexus had set a threshold for IC vehicles, and other premium brands had to catch up. With the GT Revero, we feel that we've set that threshold for luxury electric vehicles."

COMFORT ZONE

Having created one of the quietest cabins around, Karma could now focus on bringing a premium feel and sense of luxury to the Revero GT's interior.

"We have different packages for our interior. Some feature carbon fiber, others have trim made from reclaimed wood sourced from Southern California's King Gillette Ranch in the Malibu Creek Watershed," says Knittel.

For the leather upholstery, Karma has a long-standing relationship with Scotland's Bridge of Weir, a company that claims to have the lowest carbon footprint of any leather maker in the world, with thermal energy and

"OUR TARGET FOR BSR IS ZERO. THE ASSEMBLY PLANT REALLY RALLIED AROUND THAT"

ABOVE The Revero GT's interior can be customized to reflect a wide variety of tastes

ACOUSTIC TESTING MATERIALS

Brüel & Kjær's portable impedance meter makes fast measurements of the acoustic properties of materials without having to remove a material sample. The kit consists of an easy-to-use handheld instrument, the company's LAN-XI data acquisition system and PC software. Because the device can measure objects *in situ*, it is ideal for verification after installation of acoustic treatments, and for quality control after all manufacturing processes have been completed.

The instrument has a sound-source activation switch and status indicator integrated in the handle. An automated pass/fail routine enables operators to simply hold the instrument in contact with the *in situ* test article, and then receive a clear go/no-go signal from an LED. Measurements are viewable on a PC in real time for ease of monitoring and the software has dedicated routines for measuring quality-control parameters.

filtration plants to recycle water and convert any waste materials into energy.

"Bridge of Weir has been our supplier for a long time and is one of the things that distinguishes our luxury electric vehicle from others," says Keipper. "Not only is the leather of great quality but the company has a great sustainability story."

Available in eight colors and three multitone themes, the GT's leather seats have also been fitted with a ventilation and heating system for added comfort, with six-way controls to minimize pressure on the seat bottom and backrest.

According to Karma, the vehicle also boasts an industry first, with 3D touch-sensitive haptic controls in the steering wheel, where the user pushes lightly on one of two control pads to select one function, before pushing slightly harder to select another.

These controls are linked to the Revero's new and improved low-power infotainment system, featuring a more intuitive user interface. This is complemented by a 635W audio system, developed by Karma in-house, with eight speakers and a subwoofer to deliver what the company calls "mini concert hall acoustics". Active noise cancellation also uses two microphones in the headliner to help mute engine noise. Other features include 360° parking assist, blind-spot detection and cross-traffic alerts.

ELECTRIC DREAMS

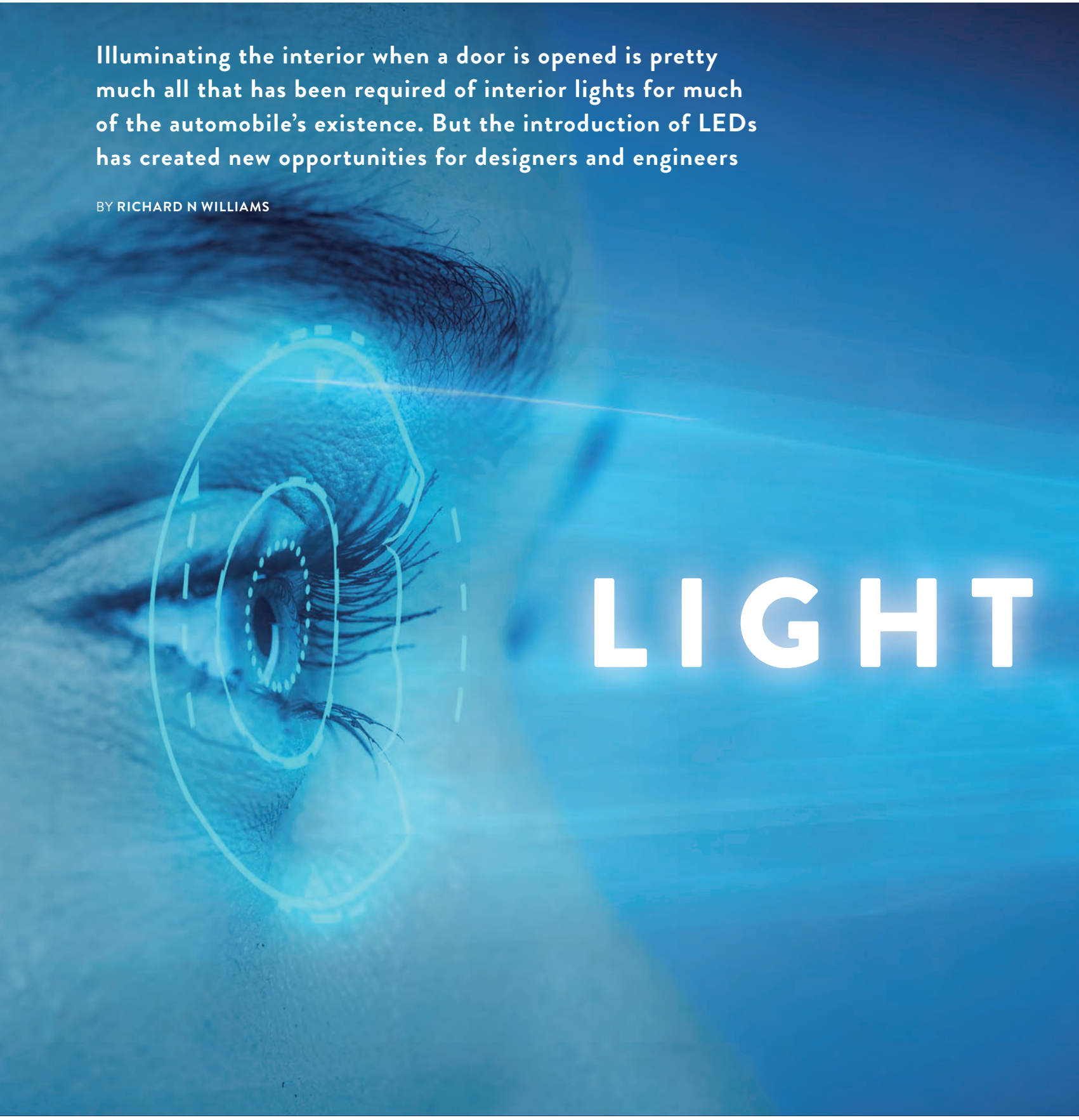
The financial backing by Wanxiang Group has enabled Karma to move forward with renewed confidence. The team has already unveiled its new SC1 Vision Concept for an all-electric sports cabriolet, and announced plans for a fully electric global vehicle platform it refers to as Project e-Klipse, designed to spawn several new models, the first of which is scheduled for release in 2021.

"For our next model, we're starting with a clean sheet of paper," says Knittel. "We can take all kinds of approaches and just try things out. Lower frequencies have to be absorbed by heavier materials, but in EVs every kilogram you add to the car reduces range a little, so that's why we've had to balance lightweight materials and heavy layer materials in the GT. In our future vehicles we'll be purely focused on electric, so we will definitely focus more on lightweight materials because we won't have engine noise to deal with."

To further streamline future vehicle development and material selection, Karma plans to adopt the latest simulation and modeling technologies, helping to keep down costs while evaluating key parameters.

"I think we're going to be radically increasing our modeling efforts," adds Knittel. "We're going to have to try to predict the impact of material choices on the driver's ear. That will also enable us to experiment more with concept materials to see what the effect will be."

BELOW Interior of Karma's SC1 Vision Concept



Illuminating the interior when a door is opened is pretty much all that has been required of interior lights for much of the automobile's existence. But the introduction of LEDs has created new opportunities for designers and engineers

BY **RICHARD N WILLIAMS**

THE WAY

Much of the focus on lighting in the automotive industry has been on the outside of the car, with innovations such as adaptive headlights and more illumination improving driver safety. Now, lighting developments on the inside of the vehicle are offering similar advantages – and it has all been driven by the introduction of LEDs.

"The amount of functional lighting inside a car has traditionally been quite small," says Michael Koherr, research engineer for advanced lighting at Ford. "The only functional lights were the entrance lamp and the map light, but not many of us use maps anymore."

Koherr believes the introduction of LEDs inside the car has given engineers and designers many more opportunities. "Light can be better controlled with LEDs," he explains. "It is the only solution for the interior of the car if you want to control color or the feeling of light. The overall strategy for interior lighting now is to use it to make us feel good – mood lighting."

According to Jeffrey Helms, global auto sales director at engineered materials firm Celanese, which offers high-performance polymers for various lighting applications in the automotive sector, "There's a lot going on in car interior lighting."

DESIGN CHALLENGES

Working with Tier 1s and OEMs, Helms is seeing all sorts of innovation in interior lighting. "There's a lot more lighting in cars now, especially around the instrument panel. We have had backlighting forever, but we are seeing more use of lighting to help drivers identify different areas.

"Most evolution is coming from the Tier 1s, who are creating what the OEMs want, and we have to work with them to see how we can execute it. But it is all being driven by design," he says.

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Helms admits that this design-led approach has increased the demand requirements for many of the components housing lights. “Heat management is important,” he explains. “Whether you go incandescent or LED, you have to manage the thermal dissipation, which as we know is important for plastics.”

Koherr from Ford agrees with him that designers are leading innovation in interior lighting and that this is a challenge for engineers. “Interior lighting is mainly driven by interior styling,” he says. “Designers are looking at ways to get more sculpture from lighting, to shape it. We have to see how we can add functionality to it.”

One area being looked at by engineers is the intensity of light inside a car. “There are a lot more lights inside a car now, so we have to find a combination of feeling and functionality,” explains Koherr. “When you are driving at night and your eyes are used to the darkness, an interior light that comes on may be too bright. You might get a reflection on the windshield that could distract you.”

ADAPTIVE LIGHTING

Whilk Gonçalves, expert on lighting and signalization at Groupe PSA, also says light intensity is among the key objectives for lighting engineers these days. “If you want something to be visible in the day and night you have to have a range of intensity. It should be different in the sun and at night,” he says.

He points out that light intensity should also differ in different areas of the car. “In interiors we have some very dark areas, such as the footwells, which are all in the shade, so the light depends on where we are employing the lighting effect,” says Gonçalves.

“Adapted driving systems are needed so that it’s brighter in the day and dimmer at night,” says Koherr, pointing to some other examples where it could be used inside a car.

“Let’s say you have a grab handle on the door that illuminates so that you can see where to hold it,” he suggests. “Well, you don’t need that light on all the time – that could be a distraction for the driver – so sensors connected to the lights can turn it on when you need it.”

Sensors inside the car can play other roles, too. “The whole area of cockpit

LIGHTING FIGHTING FATIGUE

Researchers have discovered that lighting has far more of an effect on human beings than we once thought. Light receptors in the retina respond to the blue light in the daylight color spectrum and regulate biological processes in the body. These include controlling levels of cortisol (stress hormone) and melatonin (sleep hormone).

To avoid keeping users awake, mobile devices such as cell phones now have night modes to prevent excessive release of stress hormones caused by too much blue light from LED illumination.

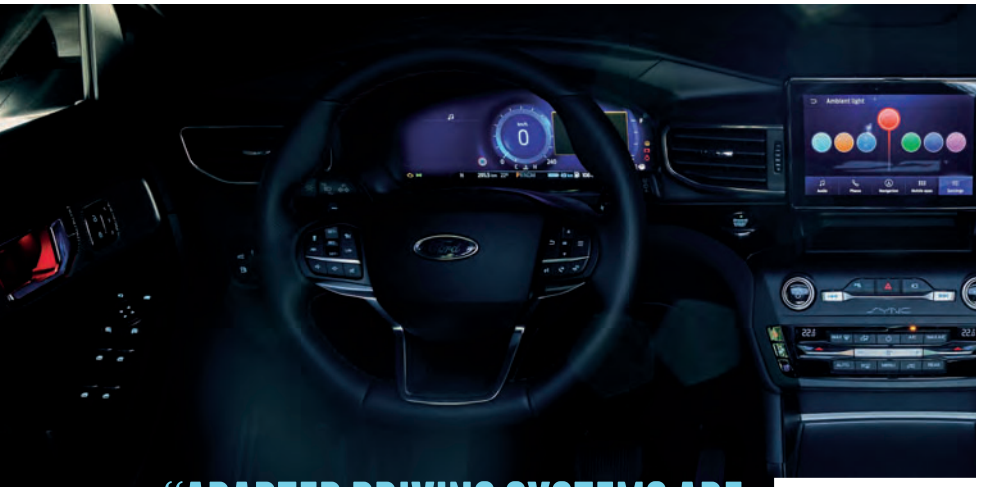
The reverse idea is being looked at in vehicles. Daimler has conducted several studies to investigate the psychological and physiological effects of high blue component lighting on drivers in vehicles, focusing on alertness.

Its team of researchers studied the effects of exposing truck drivers to blue light as they drive in the Arctic Circle’s winter darkness, in an effort to develop systems to combat driver fatigue.

Daimler says a flush-fitting light with special LEDs in the driver’s sun visor shines light with a high blue content at the driver during the day, while the vehicle is moving.

In addition, the same light source can be used to activate a ‘light shower’ and a vitalizing ‘light alarm’ to keep drivers alert.

They say the main advantage of this technology is that the daytime-like light allows the driver to stay fresher, helping reduce the risk of an accident. The system also helps to relieve strain on drivers so that they can devote their full attention to the road ahead.



LEFT
With Ford’s Sync 3 ambient lighting feature drivers can change the color and adjust the brightness of the interior lighting in their vehicle

“ADAPTED DRIVING SYSTEMS ARE NEEDED SO THAT IT’S BRIGHTER IN THE DAY AND DIMMER AT NIGHT”

Michael Koherr, research engineer for advanced lighting, Ford

Photo: Shutterstock

sensors is an evolving space," adds Helms from Celanese.

One area receiving attention is drowsy drivers. "There is value in driver alertness systems that can detect when a driver is about to fall asleep. This is a big area at the moment. You have to alert the driver somehow, and lights can play a role in that," he explains.

WARNING LIGHTS

Connecting external sensors with the lights on the inside of the car creates other opportunities for active safety systems. "Lots of exterior lights now have sensors and cameras. Take a situation where you are driving at night and come across an unexpected situation in front of you, say a deer in the road. You may not be able to see that far in the dark, but the interior lights could give you a warning," says Koherr.

Indeed, many active braking systems work on just such a principal, but Koherr argues that lights could be used as a warning to the driver before it reaches the point where the car needs to react to an emergency situation. There are limitations, however: "I don't think they would replace the warning lamps on a dashboard, though," he says. "A light would just be a sign that something is wrong. The dashboard symbols are much better solutions to provide information," he concedes.

INNOVATIVE SOLUTIONS

Are any technologies going to take over from LEDs, and are there limitations to the technology? "Organic LEDs are something that we have been interested in for 10 years," says Gonçalves.

"The technology is quite different. LEDs are a semiconductor component, so they are quite solid and very resistant to temperature and humidity, but can only emit a single point of light.

"OLEDs are created using a deposit of very thin layers of organic solution. They require a specific environment, but they are a surface emitter, like a sheet of paper, so the light is distributed uniformly in all directions."

OLEDs also have lighter mass and do not require the same levels of cooling as LEDs, and designers can be very creative with light components that are uniform and homogeneous, enabling subtle design elements.

OLEDs can also be fabricated on plastic substrates and bent, but there is a problem. "LEDs are very stable, production volumes are high, and the producers are well known," says Gonçalves. "OLEDs require time to assemble the layers together and need large investments. We have seen a reduction in the number of suppliers in the market." In fact, Gonçalves says that the technology has been all but abandoned by the industry.

ABOVE
The BMW 850i G14 xDrive Steptronic features ambient lighting throughout the interior

"We can mimic LED in some ways," he adds. "We can inject light into another surface to diffuse it and make it look like OLED, but not with the exact same characteristics."

This doesn't mean that innovation in interior lighting is in any way slowing down. "There is an awful lot of work going on in ambient lighting where the onus is on true color," adds Helms. "We have seen light pipes embedded in headliners and lasers used to etch out patterns in materials to create effects."

Light pipes, used for distributing lights from LEDs, are not new. Such fiber optics have been around for a long time, but engineers are now using injection-molded, plastic light pipes to distribute lighting in cars, allowing much larger areas to be illuminated.

"We also see light being better distributed to where we want it, and all this is using existing technology," continues Helms. "There's a lot of innovation in terms of the location of light. We now see brand images projected on the ground, when you open a car door. Customers are requiring all sorts of things. And if we do not have a current solution, we have to figure a way of getting there," he concludes.

SPEAKER SPOTLIGHT

At The Future of Automotive Interiors Conference in Novi, Michigan on October 22, 23, 24, Kimberly Peiler, senior application engineering manager of automotive at Osram Opto Semiconductors in the USA will be speaking about how interior LEDs can make autonomous vehicles a stronger reality. The presentation will discuss how the right lighting can help passengers in semi- and fully autonomous vehicles feel more comfortable by providing a clear understanding of what their vehicle is encountering on the road.

Peiler will look at how peripheral-vision stimuli can be used to alert passengers when their attention has shifted, to warn them of a hard turn or sudden stop. Thousands of tiny, full-color LEDs embedded throughout a vehicle can offer visual cues and critical warnings, as well as functional and welcoming space lighting for passengers. Peiler will also discuss how the design of LED lighting affects human moods.

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THE FUTURE OF AUTOMOTIVE INTERIORS CONFERENCE

A brand-new (pay-to-attend) conference focused on the trends and technologies shaping current and near-future automotive interiors

Automotive Interiors Expo, Novi, Michigan, is about quality, color, texture, touch, feel and innovation. Specialty finishes are around every corner, with some companies offering plastic compounding and masterbatching, metalized plastics and chrome-look plastics, and others presenting hot foil stamping and film insert molding.

You'll find a wide range of fabrics, acoustical materials, shape-forming materials and foams, fasteners and adhesive systems, lighting and more. The show is a must-visit for Tier 1 suppliers and interior design teams from car manufacturers wanting to keep up with the changing world of materials, finishes and technologies that contribute to a vehicle interior's touch and feel.

This year's expo will also host The Future of Automotive Interiors Conference – a brand-new pay-to-attend conference solely focused on the trends and technologies shaping current and near-future automotive interiors. Speakers include: Joseph Simpson, senior design strategist, Volvo Cars; Bruce Mehler, research scientist, MIT; Dr Vyacheslav Birman, an expert from Continental; Dr Wolfgang Stolzmann, lead engineer and consultant ADAS, CMORE Automotive GmbH; and Dr Rose Ryntz, president/Carbon Advisory Board member, Ryntz & Associates LLC.

Your entry badge for Automotive Interiors Expo Novi also provides free access to two sister events taking place at the same time in adjoining halls: Automotive Testing Expo Novi, and Autonomous Vehicle Technology Expo Novi. The three shows combined will host over 500 automotive industry exhibitors – all under one roof!

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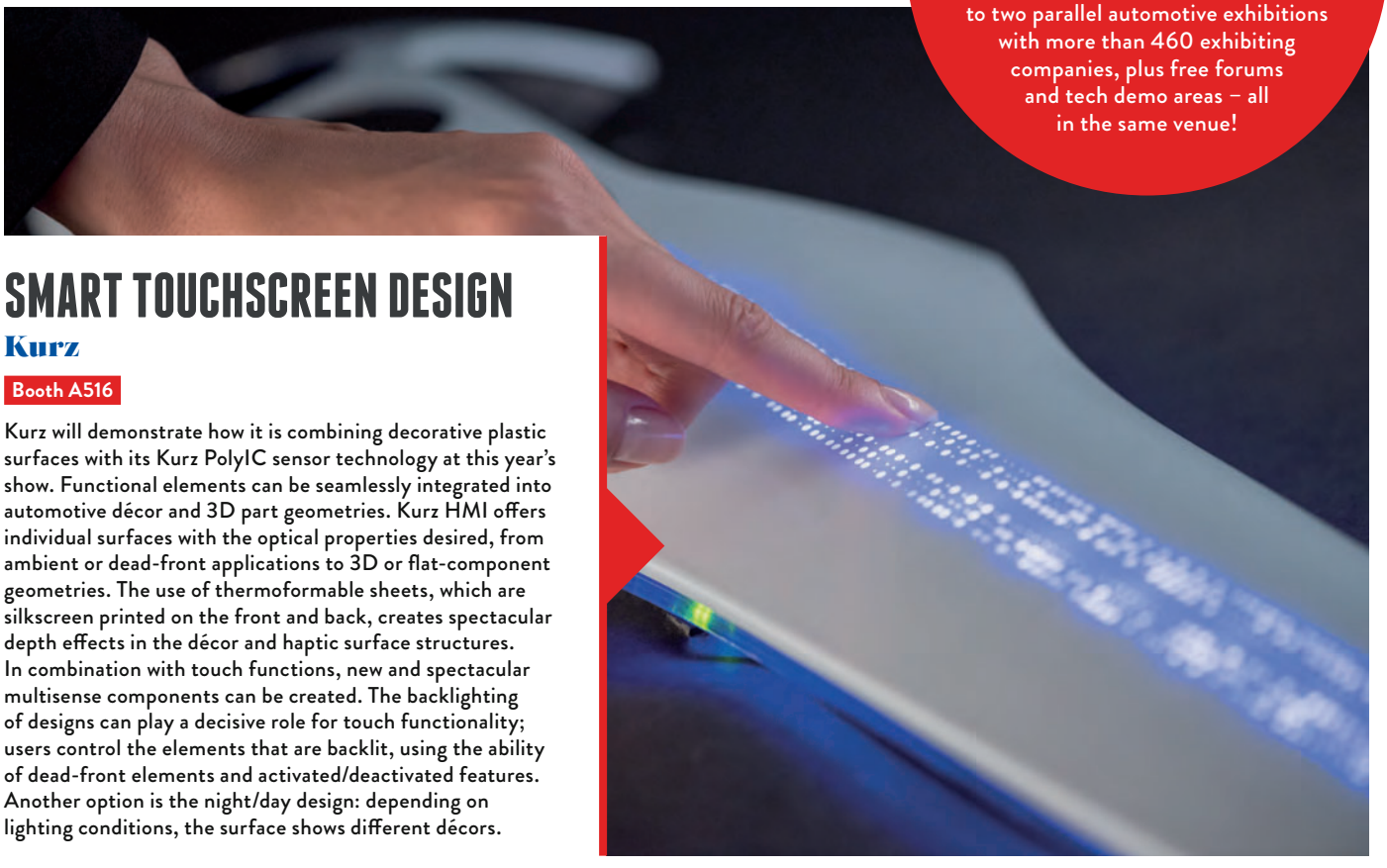


SMART TOUCHSCREEN DESIGN

Kurz

Booth A516

Kurz will demonstrate how it is combining decorative plastic surfaces with its Kurz PolyIC sensor technology at this year's show. Functional elements can be seamlessly integrated into automotive décor and 3D part geometries. Kurz HMI offers individual surfaces with the optical properties desired, from ambient or dead-front applications to 3D or flat-component geometries. The use of thermoformable sheets, which are silkscreen printed on the front and back, creates spectacular depth effects in the décor and haptic surface structures. In combination with touch functions, new and spectacular multisense components can be created. The backlighting of designs can play a decisive role for touch functionality; users control the elements that are backlit, using the ability of dead-front elements and activated/deactivated features. Another option is the night/day design: depending on lighting conditions, the surface shows different décors.

INTERIOR LIGHTING THAT FITS

Lacks Enterprises

Booth A501

Personalized LED lighting enhances the visual and emotional impact of a vehicle's interior and allows a model's aesthetic to truly shine. With Lacks' next-generation backlit selective plating technology, lighting design can set the mood even in tight spaces.

To achieve a breakthrough in design in a streamlined package, trim and lighting elements are molded into a single piece. The slimmer components can exceed structural tolerances and still meet packaging constraints. The lightweight, one-piece construction offers assembly benefits with fewer field issues.

LIGHTWEIGHT CUTTING HEADS

Allfi Robotics

Booth A310

Automotive interior fabricators are constantly looking for innovative products to help increase their plants' productivity. Allfi Robotics (formerly Panwen) is a Swiss/Chinese waterjet robotics cell integrator, and has developed the Allfi Type V 2.0 cutting head. This compact, lightweight cutting head (2.7 lb and 10.2in long; 1.2kg and 26cm), combined with Allfi's state-of-the-art robot cutting cells, results in longer operating hours, improved cycle time and reduced downtime for waterjet trimming cells. The low-mass design helps improve robot reaction time, and the reduced size helps reach tighter locations better than any other cutting head on the market. Customization is available upon request, including mount style, collimation tube length and OD, and orifice type.

NESTING, DIE-CUTTING AND CONVEYING LEATHER HIDES

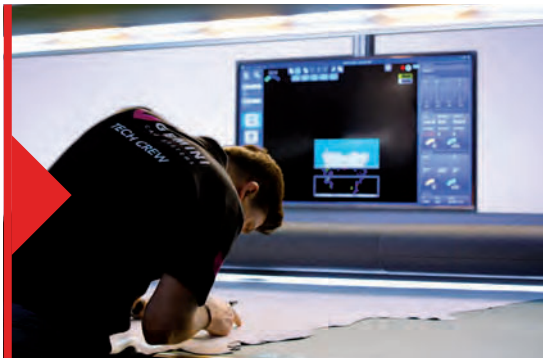
Gemini CAD Systems

Booth A224

Gemini CAD Systems will show its Thagora Leather Scanning Machine, a conveyor for inspection and digitization of leather hides. Thagora Leather Scanning Machine is designed and built with a clear purpose: excellent performance in every step of the scanning process. It features augmented reality, infrared technology, a modular frame and an advanced software system. Thus, the machine leads to higher productivity, accurate marking, faster scanning and stable detection.

Its main benefits include: automation of the leather inspection process through augmented reality; up to seven quality zones; ability to scan hides pre-marked with colors; adjustable lighting system to ensure accurate inspection of hides regardless of color and structure; quick automatic ranking of the hides; stretching system for identification of the fine cuts; clean marking of the hides; and easy correction of mistakes.

The company has also developed a new generation of automatic, multi-hide nesting on GPU technology.



HIGH-PRESSURE THERMOFORMING

Niebling GmbH

Booth A214

Niebling will present 3D formed automotive interior parts produced by Tier 1, 2 and 3 customers with precise high-pressure thermoforming technology. This technology is well known in the industry for the FIM (film insert molding) and IML (in-mold labeling) processes, which are highly accurate and repeatable with less distortion than usual vacuum forming or thermoforming.

Functional integration in decorative parts, named IME (in-mold electronics); high-gloss surfaces with excellent scratch resistance; and great positioning of symbols and graphics are examples of what can be created. Modern interior components, such as radio bezels, display covers, buttons and 3D-shaped touch surfaces with sliders and switches integrated in the film can be produced.

PREPARED FOR THE DEMANDS AND EXPECTATIONS OF CUSTOMERS

BordArte

Booth A605

BordArte and B & C Automotive design and decorate using the latest in cut and sew, embroidery, laser etching, quilting and embossing, as well as combinations of these processes simultaneously, creating unique results. The technology goes from basics to automated sewing. The 3D embossing works on materials such as leather, vinyl or fabric.

Wood and carbon fiber are used in steering wheels, dashboards and doors. Clients often provide a sketch and the companies transform it into a design that realizes the creative vision and is practical.

BordArte and B & C Automotive also have technologically advanced facilities to meet the challenges and demands involved in the sewing of automotive garments, with capacity for any type of component or subassembly that the client requires.

BOND. THERMO BOND.

Necal

Booth A208

Necal provides unique thermo-bond dry film adhesive products that are used widely in the automotive and electronics industries. Thermo-bond dry film adhesive strongly bonds to a wide variety of surfaces, including ABS plastic, aluminum and glass. This distinctive product has a melting point of 150-175°C (300-350°F) depending on its application and the materials used. Necal is actively working to increase the melting point of its films.

Necal also supplies products developed to specific requirements: single and double-side coated transfer tapes, single and double-side coated transfer foams, high-bond and high-heat foams and tapes, membrane switch spacers, and mounting films.

SILENCE BSR WITH INTERNALLY LUBRICATED THERMOPLASTIC COMPOUNDS

Sabic

Booth A118

Buzz, squeak and rattle (BSR): these irritating noises can be a major quality concern, especially as automotive cabins become quieter, particularly in electric and hybrid vehicles. But Sabic's growing portfolio of LNP Lubricomp and LNP Lubriloy internally lubricated thermoplastic compounds can help address the BSR issue and enhance the driving experience by minimizing friction between plastic parts, which generates this unwanted noise.

At Automotive Interiors Expo, Sabic will introduce the newest addition to its automotive interior materials family: a new LNP thermoplastic compound, based on polycarbonate/acrylonitrile butadiene styrene (PC/ABS). The new compound features an innovative internal lubrication chemistry. In addition to minimizing BSR, it delivers an excellent surface finish and can be painted. Applications include interior claddings, trims and bezels.

Sabic will also show other LNP products, including Lubriloy D2000, an alloy-lubricated PC-based compound, and Lubricomp NXCY620, a PC/ABS compound that uses silicone technology. Both offer a low coefficient of friction and excellent dimensional accuracy. Using internally lubricated compounds can simplify production by avoiding secondary BSR mitigation.

DRIVE BETTER WITH NON-WOVENS

Sandler

Booth A112

High-performance absorber non-wovens are required in many areas of a vehicle. Lightweight materials that feature excellent sound absorption are in high demand.

Sandler's sawasorb product lines provide a wide spectrum of efficient absorber non-wovens: from particularly thin materials for narrow installation spaces in the interior, to highly durable and resilient absorbers for use in the engine compartment.

Sandler's product range includes single-polymer polyester non-wovens that are fully recyclable at the end of their operating life and thus support closed material cycles.

LOW-PRESSURE MOLDING WITH FABRIC, SUEDE OR LEATHER

CIE USA

Booth A222

CIE USA will show how it has refined the low-pressure molding (LPM) process, incorporating fabric, suede and leather to bring affordable, luxurious soft-surface technology to hard trim interiors.

OEMs used to be stuck with hard plastic for interior trim such as pillars and garnishes. Suppliers have been moving toward lamination and hand wrapping to incorporate soft surfaces into these types of parts. CIE USA has taken another path, refining the process of incorporating soft surfaces directly into the injection mold. Several OEMs have signed up to have CIE develop and provide these low-pressure molded parts for soft interior trim surfaces that have previously been considered hard trim.

By doing the bonding in the mold, quality issues such as delamination and wrinkles are eliminated. In addition, with unique tooling features, the wrap can be consistent around the parting line, further enhancing craftsmanship in the vehicle.

This process offers cost improvements as well, reducing the equipment and process steps necessary to finish a part compared with traditional lamination and wrapping. CIE continues R&D related to this and other interior hard and soft trim products and processes.

A SHIFT IN LAMINATION FOR CUT AND SEW

3CON

Booth A502

With cut and sew and faux stitching becoming popular, suppliers must provide a repeatable, cost-efficient press lamination process. 3CON has developed its Segmented Cavity Lamination Process, which enables these needs to be met. Usually, IP manufacturing with a cut and sew cover can take between 480 and 700 seconds where pressure is applied in a single axis. This process does not provide true adhesion consistently across a complex surface. Only perpendicular surfaces see the necessary 7-10psi of pressure; angled surfaces see far less.

The 3CON approach attacks the material from many angles without leaving marks on the surface; lamination with 7-10psi of pressure is applied. The seam alignment device remains with the tool during the entire process, mechanically locking the seam in place for correct positioning, and requires only 160-220 seconds with internal prefixing in the tool.

DIGITAL SEWING MACHINES

Dürkopp Adler

Booth A415

Dürkopp Adler is a manufacturer of industrial technology – robotics, software and automated platforms – for sewing and fabric welding applications used in the automotive, leather, upholstery, technical textiles, footwear and apparel industries. The company will be launching Delta, an IoT-based fully digital industrial sewing machine.

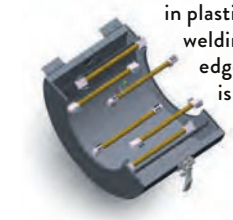
To support this, Dürkopp Adler's QONDAC production optimization system captures performance data from all connected machines to provide real-time data analytics and empower better decision making in sewing room operations. Additionally, QONDAC can control automated settings of workstations, stream work instructions with image and video support, and carry out correctness checks on use of right materials. The result is high productivity and a rapid return on investment.

QUARTZ INFRARED EMITTERS

Hefei Quickly Electric

Booth A410

Hefei Quickly Electric Co Ltd will use the expo to show its quartz infrared emitters, which can be used in plastic processing systems such as welding, forming and laminating, edge-folding, etc. IR heating is targeted to components and has instant heat on/off, meaning lower energy costs.



VISIT TWO FANTASTIC NEIGHBORING SHOWS!

Two sister shows will be held concurrently with Automotive Interiors Expo 2019 at the The Suburban Collection Showplace: Automotive Testing Expo, Novi and Autonomous Vehicle Technology Expo, Novi.

Automotive Testing Expo, Novi is the USA's largest vehicle and component testing and validation technology and services expo, featuring more than 300 exhibitors and attracting over 6,000 attendees.

Visitors can see the latest in ADAS testing, NVH measurement tools, test rigs, simulation packages, durability testing technologies, crash testing equipment, dynamometers, emission measurement systems and dynamic vehicle assessment tools.

Autonomous Vehicle Technology Expo, Novi is the leading expo in North America for advanced technologies for autonomous vehicle development. From Level 2 ADAS to full autonomy, many companies will be in Novi to showcase essential building blocks and systems, including AI learning and virtual environments, deep learning systems, validation of autonomous systems and more!

DISTINCTIVE FILMS AND FINISHES

MacDermid Enthone Industrial Solutions

Booth A218

MacDermid Enthone Industrial Solutions will use Automotive Interiors Expo, Novi to showcase its latest display films and decorative finishes designed to meet the need for sleek, integrated touchscreen film technology with a unique signature.

MacDermid Enthone will promote its XtraForm Antiglare films for displays, specifically designed for deep-draw 3D film insert molding (FIM) applications and automatic processing. This unique coating disperses reflection and is available in various gloss levels, providing different levels of clarity in the display. Also featured will be an array of decorative finishes that provide a distinctive appearance – dark, lustrous, bright or satin – on a range of substrates. These finishes are ideally suited for automotive applications where an aesthetic fashion finish is critical to product differentiation.

CUSTOM FLOOR MATS

U ACE

Booth A508

3D MAXpider Custom Fit Floor Mats are excellent protection for a vehicle's floor. Unlike bulky and smelly rubber floor mats, 3D MAXpider Kagu Series Custom Fit Floor Mats are made with a uniquely designed three-layer structure. A state-of-the-art measuring method ensures 3D MAXpider mats are custom fitted to each vehicle. The patented MAXpider backing keeps the mats in place without damaging carpet, as can happen with the nibs or spikes on other floor mats.

The floor mats are designed to give the vehicle floor protection and are waterproof, meaning all messes and spills stay on the mats, making clean-up easy. The inner semi-hard XPE foam is non-toxic, odorless and eco-friendly. It provides the same cushioning effect as an anti-fatigue mat, and sound deadening for a quieter ride.

SAFE, STYLISH, COMFORTABLE SEATS

Tachi-S

Booth A415

Tachi-S designs, develops, prototypes, tests and manufactures high-quality automotive seats that are functional, safe, stylish and comfortable. It works with automotive OEMs from concept to mass production of seating and seat components such as armrests, headrests and structures.

Each year, Tachi-S delivers over three million complete automotive seats and over four million seat components to the global automotive market. It prides itself on being responsive, flexible and easy to work with to help ensure that every seating program is completed on time, on budget and to a high quality.

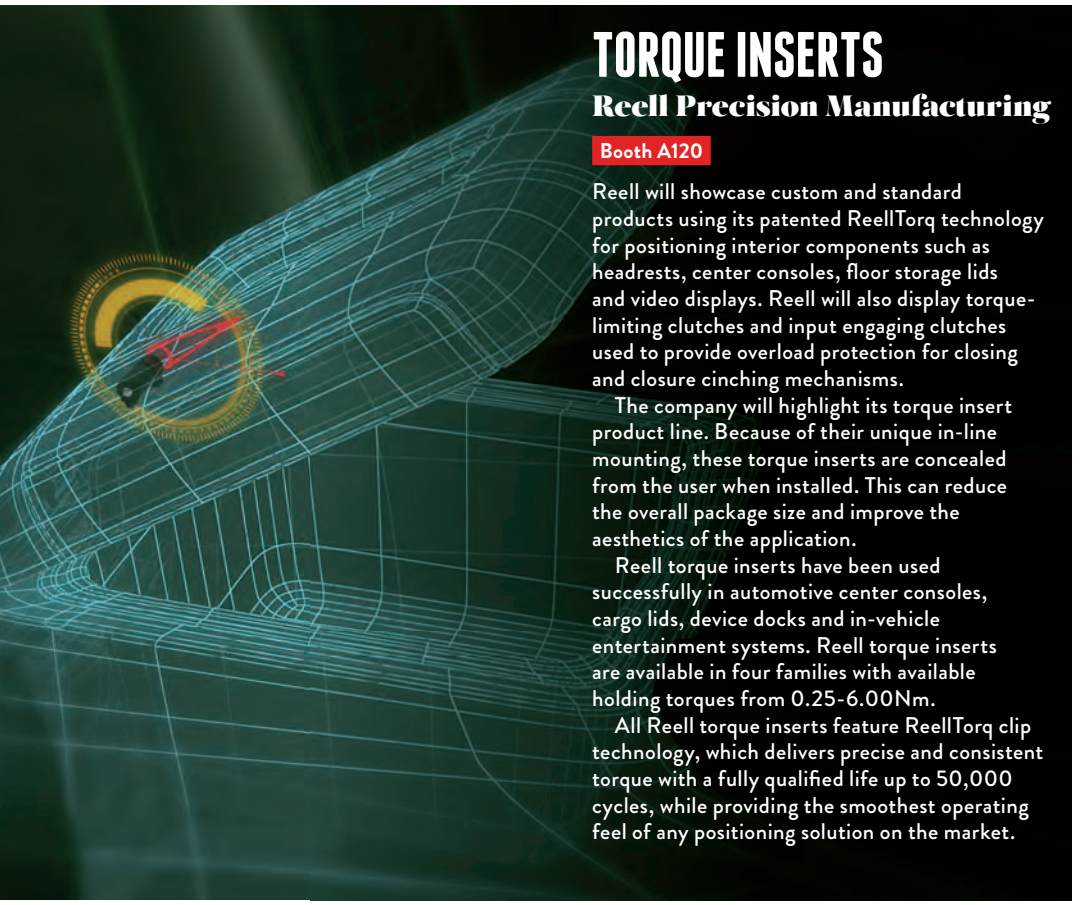
NON-CONDUCTIVE BLACK FOR IMD/FIM TECHNOLOGY

Proell

Booth A116

Noriphan HTR N is a proven, formable, back-moldable and solvent-based one-component screen printing ink for film insert molding technology. A new opaque black color shade – Noriphan HTR N 990 NC – is available for printed electronic applications, and is a carbon-free, non-conductive black.

The color shade can be used for decorative prints but is mainly used for plane multilayer printing or backing of metallic and polymer conductive pastes. Carbon-based pigments, so-called carbon blacks, normally used for black color shades, are electrically conductive and can interfere with functional structures. The Noriphan HTR N 990 NC color shade has been formulated and optimized with regard to interlayer adhesion and shows good adhesion in compound values in the final film/ink/injection material composition.



TORQUE INSERTS

Reell Precision Manufacturing

Booth A120

Reell will showcase custom and standard products using its patented ReellTorq technology for positioning interior components such as headrests, center consoles, floor storage lids and video displays. Reell will also display torque-limiting clutches and input engaging clutches used to provide overload protection for closing and closure cinching mechanisms.

The company will highlight its torque insert product line. Because of their unique in-line mounting, these torque inserts are concealed from the user when installed. This can reduce the overall package size and improve the aesthetics of the application.

Reell torque inserts have been used successfully in automotive center consoles, cargo lids, device docks and in-vehicle entertainment systems. Reell torque inserts are available in four families with available holding torques from 0.25-6.00Nm.

All Reell torque inserts feature ReellTorq clip technology, which delivers precise and consistent torque with a fully qualified life up to 50,000 cycles, while providing the smoothest operating feel of any positioning solution on the market.

FLEXIBLE HIGH-MEMORY FILAMENTS

Felton

Booth A204

MemoryFlex is a multipurpose, flexible polymeric-coated high-memory filament. This coating allows for a variety of design applications and manufacturing processes. It can be formulated to balance softness and feel with abrasion resistance, and some design variations can be used as a strengthener to reinforce different constructions. This high-memory filament can be used in a variety of close-out and sealing applications that have previously used standard thermoplastic products, like nylon or polyester. MemoryFlex can be custom designed for filling gaps between fixed and moving surfaces, making it the perfect fit for a long-lasting, shape-holding protective barrier. Additionally, it can be used for closing gaps where moving parts pass through the gaps, and for guiding, sweeping and keeping taut the movement of material.

STRONG LOAD FLOORS

UFP Technologies

Booth A226

UFP Technologies will show its new load floors. FirmaLite load floors use a patent-pending combination of heat-resistant materials such as polypropylene, glass-fiber composites and natural fibers to create load floors and other components that keep cargo safe.

The load floor design outperforms other commonly used load floors in both short-term and 24-hour load-bearing tests, and is lighter in weight by more than 15%. When subjected to a load of 257kg (570 lb) for two hours, FirmaLite featured less deflection and displayed nearly 0mm of deflection after 24 hours, which is 65% better than some other, heavier floors.

In addition to superior mechanical strength, FirmaLite does not require any urethane sprays, which means greater product consistency and added durability.

UFP Technologies uses its vast array of materials and capabilities to deliver quieter interiors for a more comfortable ride, components to provide a safer vehicle, and patented low-weight composites to increase fuel economy. The Monadnock HPAM non-woven material is a lightweight, high-performance sound absorber made from 100% polypropylene fine fiber with a newly developed acoustic scrim on both surfaces. The acoustic scrim has been upgraded to achieve better sound absorption at the same weight as competitive materials.

GLOSSY TRIMS INSPIRE DESIGN CREATIVITY

BASF

Booth A526

BASF will present its high-gloss and chemical-resistant Ultramid Deep Gloss, an ideal material for decorative trims, panels and inlays. Ultramid Deep Gloss enables designers to incorporate textures or shapes into interior surfaces for new, distinctive designs. The look, feel and functionality of interior spaces will be transformed, especially as the vehicle takes over driving functions. BASF takes concepts from ideas to ideal solutions.

NOT YOUR GRANNY'S SEWING MACHINES

Juki America

Booth A100

Juki will exhibit two new machines at the expo in Novi. First is the AMS-221F-2516, a computer-controlled cycle machine for medium- to heavy-weight materials with a maximum sewing speed of 2,800spm and beautifully finished seams with its new feed control system. This model is best suited for car interior parts, as well as top-stitching and shape-tacking sewn products. The active tension can be changed over with a memory switch between the low-tension side output and the high-tension side output to enable fine adjustment of the thread tension in the actual area of use.

The second new product is the Juki PLC-2760V7, a semi-dry, direct-drive, two-needle post bed, unison feed, lockstitch sewing system with a vertical-axis large hook. Five adjustment values (stitch length, presser foot pressure, alternate vertical movement, use of the walking foot and needle thread tension) are digitized. This machine is best for sewing heavyweight materials for car seats, sofas and sporting goods. The long distance from the machine arm to the needle contributes to improved workability. Maximum sewing speed is 2,500spm and maximum stitch length is 12mm (0.5in).

TEXTURED CHROME PLATING ON PLASTICS

Taiyo Technology of America Ltd

Booth A504

As the industry continues to enhance the passenger experience with new technologies, it is only fitting that aesthetics also continue to evolve. Taiyo Technology, an expert in electroplating on plastics, is excited to show its newest technique for achieving chrome plating on unique surface patterns. This allows more customization and expression for detail while maintaining the touch and feel that only chrome can provide. Together with its newest black chrome color and other surface techniques, Taiyo Technology is capable of luxurious finishes that are cheaper and lighter than pieces made from metals such as aluminum.

FOLDABLE LUGGAGE COMPARTMENT COVER

Macauto

Booth A324

Macauto has made improvements to the luggage compartment cover (LCC) with its new Foldable LCC. Consumers love the security and privacy a LCC provides, but when it comes to large or bulky items, a typical LCC can be difficult to stow. This has led drivers to store the LCC in an awkward spot or outside the vehicle. For manufacturers, size is a problem: it is difficult to design an appropriately large space in which to stow the unit safely, securely and out of the way. Macauto solves this problem with its Foldable LCC. This LCC folds in half down the middle, making it easier for consumers and designers alike. For the consumer the unit folds and unfolds quickly and easily, to be used or stowed in a convenient location. For manufacturers, the Foldable LCC provides more options on where to design an appropriate storage location to maximize cargo space. The other benefit is that the Foldable LCC doesn't sacrifice strength, durability or functionality, and enhances the flexibility of the product.

WEAR-RESISTANT COLOR COATINGS

IHI Ionbond

Booth A326

Ionbond will present its new Decobond series of PVD, CVD and PACVD coatings with a large palette of colors for items that require both aesthetics and a wear-resistant surface. The company recently won a number of contracts for the coating of automotive interior parts.

Ionbond has the ability to coat at very low temperatures. This means it can coat ABS and Zamak substrates that are used extensively for decorative purposes in applications where color and wear resistance are important to ensure a perfect look for a long time and over intense use.

These coatings are environmentally friendly and can be used in many applications. Ionbond coatings meet numerous automotive supplier demands including salt spray, UV, anti-scratch, abrasion, environmental and heat specifications.

THE FUTURE OF AUTOMOTIVE INTERIORS CONFERENCE

Held October 22, 23 and 24 alongside Automotive Interiors Expo, Novi, Michigan, at The Suburban Collection Showplace, the symposium is the place to discuss next-generation interior design trends and issues

The Future of Automotive Interiors is a broad-ranging conference focused on the key trends shaping automotive interiors, as well as the challenges and opportunities presented by autonomous vehicles.

The conference will be exclusively dedicated to the study of future interior design, innovative seating, lighting, ergonomics, instrumentation, control systems, new HMI approaches, in-car entertainment and connectivity, onboard wellness and safety challenges, as well as the opportunities and challenges offered by increased vehicle autonomy and more sophisticated consumers.

The need for a new generation of materials will be explored, in answer to consumer demand for more sustainable and ethical solutions that are allergen-free, antimicrobial and non-toxic. The latest HMI approaches will also be examined, with an emphasis on ease of use and safety, as well as more inclusive design to meet the needs of an aging society.

KEYNOTE PRESENTATIONS

We've highlighted just some of the keynote speakers over the three days to give you a flavor of the topics and technologies being discussed. Full details and speaker line-up can be found on the website.

SPEAKER HIGHLIGHTS

JOSEPH SIMPSON, SENIOR DESIGN STRATEGIST, VOLVO CARS, SWEDEN

Presentation to be confirmed

DRIVER STATE MONITORING TO SUPPORT SAFETY AND WELL-BEING

Bruce Mehler, research scientist, Massachusetts Institute of Technology, USA

This presentation will consider the role of driver state monitoring (situational awareness, cognitive workload, health status, readiness to take control, etc) to support safety and well-being in the context of ADAS and higher-level autonomous vehicle systems.

COMPARISON OF VISUAL APPEARANCE AND CHECKERBOARD CONTRAST RATIO MEASUREMENTS OF HIGH-CONTRAST DISPLAYS

Dr Vyacheslav Birman, expert, Continental, USA

The goal of this study is to estimate the value of noise in the human eye and measuring instrument during observation and measurement of high-contrast-ratio displays with checkerboard image. It will allow the following questions to be answered: What contrast can be appreciated by a human observer? What range of contrast ratio can be measured directly by imaging photometers? A proposal for measurement method improvement will be formulated. An alternative method of crosstalk measurement will be proposed.

THE EVOLVING MATERIAL REQUIREMENTS FOR AUTOMOTIVE INTERIORS

Dr Rose Ryntz, president/Carbon Advisory Board member, Ryntz & Associates LLC, USA

This talk will focus on the changing needs of automotive interior materials as the industry evolves toward autonomy. The need for resiliency, heat tolerance and acoustics will be discussed along with the material requirements that may be affected by HMI solutions.

THE FUTURE OF AUTOMOTIVE INTERIORS

Colin Giles, technical research analyst – interiors and lighting, IHS Markit, USA

This presentation will explore how vehicle interiors, including seating, trim and interior functionality, will be influenced and changed by current automotive trends like electrification and the future that is possible with vehicle autonomy. The information presented will come from primary research from the presenter as well as comments and survey results from supplier and OEM representatives, and will include analyses of the feasibility, launch timing, facilitators and obstacles of these disruptive interior trends.

IN-CABIN VISUOSPATIAL ANALYSIS ENABLED WITH INTERIOR SCENE UNDERSTANDING AI

Modar Alaoui, CEO, Eyeris, USA

This session covers the latest advancements and advantages of holistic in-vehicle visuospatial understanding, using state-of-the-art vision AI neural networks with multiple RGB-IR 2D cameras. It will also cover how visual understanding of the entire in-cabin space is critical to enabling optimized safety, comfort and convenience by synchronizing valuable interior vision data with exterior perception. Finally, this session will highlight how the next generation of automotive-grade AI chips will enable in-vehicle efficient inference that is capable of generating new types of data and monetization models in this third living space.

HUMAN BODY MODELING – A BETTER TOOL, AN ESSENTIAL NEED

John Combest, chair/project manager – Advanced Safety Technology, Global Human Body Models Consortium/ Nissan Technical Center North America, USA

Advancements in science and engineering come when better tools with more precise measurements become available. Human body finite element analysis has matured to a state allowing dynamic simulation of any possible vehicular event from pre-crash braking, using active muscles, to analysis of brain or internal organ injuries in the event of a rapid deceleration event or crash. A few HBMs (human body models) with these advanced human simulation capabilities have been developed, including a detailed and simplified family of models by the Global Human Body Models Consortium. The state of the art in HBM is presented.

SMART DISPLAYS

A look at the seamless integration of high-performance hardcoated films for automotive displays

Smart surface embedded displays with integrated capacitive touchscreen functionality are becoming a requirement for the modern vehicle interior. Where in the past vehicle interiors had an abundance of buttons and toggle switches, recent concept cars reveal elegant sweeping curved surfaces with seamlessly incorporated capacitive touch switches, alongside touchscreens and displays that decipher complex information about the vehicle.

However, with this change comes a number of challenges, and designers need to understand hardcoated film technology to integrate displays that not only deliver on aesthetic appeal and user experience, but are functional, durable, safe and adhere to emerging legislation. Five factors – weight, materials, optics, sparkle and clarity – all support the choice of hardcoated films in interior design.

WEIGHT MANAGEMENT

A recent US Department of Transportation mandate requires all light vehicles (passenger cars, multipurpose passenger vehicles, trucks, buses and low-speed vehicles rated at 10,000 lb or under gross vehicle weight) to be equipped with a rear visibility system. The ruling, which came into effect on May 1, 2018, necessitates the presence of a high-quality display screen with good readability and image clarity. This is something that also needs to be considered with the shift toward electric vehicles. Automotive designers need to not only optimize the functionality of the display, but do so in a way that does not increase vehicle weight to the point of affecting the car's range per charge. As display areas increase in size and number, weight becomes a greater factor for the design engineer.

MATERIAL REQUIREMENTS

Despite its abrasion resistance and optical properties, the use of glass as a first surface for automotive displays presents limitations, particularly considering current aesthetic and lightweighting trends as glass is a high-density material. With growing demand for large, curved, integrated displays with increased functionality, this presents challenges for automotive designers. Given that most light-emitting diode (LED) arrays are flat, a degree of innovation is necessary to seamlessly integrate and harmonize them into a sweeping, curved cockpit design. Glass presents obvious issues for bezel-free integration into the cockpit surface to achieve a harmonious and seamless design.

MacDermid Enthone's XtraForm films are formable and hardcoated with high gloss and antiglare finishes

OPTICAL CHALLENGES

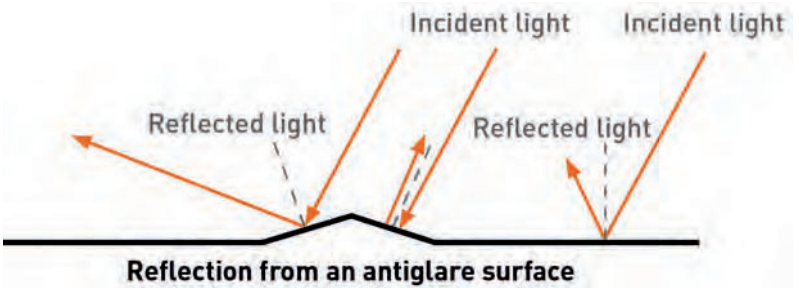
It is essential that cockpit displays are readable at a glance. High-gloss first surfaces provide good readability, but this can be impaired by strong, sharply defined or moving reflections. As the car moves, incident light moves across the cockpit of the vehicle. If the light hits a high-gloss display surface, it will reflect a distinct image – rendering the display unreadable. A delicate balance between glare avoidance and optical functionality must be achieved to ensure that display images can be seen.

A textured antiglare coating is required to diffuse the incident light, breaking up the reflected image and making the display more readable at a glance. The location of the display in the vehicle interior will have an impact on the amount of incident light it is subjected to. At dashboard level there will be a higher level of incident light than at knee level, and subsequently a higher level of antiglare texture in the coating will be required to diffuse the reflected light.

CLARITY AND HAZE

It is important to consider the optical requirements of the display because the presence of the antiglare texture has several associated visual effects, including a loss of clarity and increased haze. Clarity and haze are related to the gloss level of a surface, so where the display requires smaller features to be readable, a glossier, higher clarity surface may be required.

Another key factor associated with clarity is the optical path length between the first surface and the LED. For example, a high-gloss surface will have high clarity, so the optical path length can be longer and the image can still be readable. Antiglare surfaces do cause some scattering of transmitted light, leading to a loss of clarity and resolution. However, because this is proportional to the optical path length, the effect can be managed. If the design requires a greater distance between the display and the first surface, for instance where a flat display is to be integrated into a curved dashboard, it may be necessary to have a higher gloss level first surface for small details in a display to be readable.



SPARKLE

Sparkle is another key consideration in determining the optimal first surface. The variable surface structure of an antiglare coating scatters incident light to improve display visibility. However, the textured features can act as lenses, which cause a transmission artifact called sparkle. Sparkle is caused by the interaction of the antiglare textured features and the display pixels and appears as scintillating colored spots that can be distracting and impact readability. The effect is more noticeable for smaller pixel sizes. Sparkle is an important factor to consider when selecting a first surface for a display, because the periodicity (the tendency to recur at intervals) and size of antiglare features are dependent on the gloss unit of the texture. The first surface antiglare finish can be adapted to minimize sparkle for a given display pixel size.

MEETING FUTURE TRENDS

The current trend to deliver increasing numbers of displays seamlessly into automotive cockpits present considerable challenges for OEMs. These challenges can be overcome using high-performance hardcoated films to address the five decision making criteria of weight, materials, optics, sparkle and clarity.

MacDermid Enthone Industrial Solutions' range of XtraForm films, for example, are formable and hardcoated with deep high-gloss and antiglare finishes. Delivered using a highly advanced variation of FIM, the XtraForm process, the films are designed to be UV cured for maximum formability, while maintaining scratch and chemical resistance. These durable films provide the smooth, high-quality finish that modern consumers demand. In addition, XtraForm films offer a range of textures of different gloss units, which is essential to address the challenges of integrating automotive displays throughout various locations in the vehicle.

Author: Martin Herbert, product development manager, MacDermid Enthone Industrial Solutions

ONLINE READER INQUIRY NUMBER 501

The Future of AUTOMOTIVE INTERIORS CONFERENCE ★ NOVI ★ ★ MICHIGAN ★

OCTOBER 22, 23, 24, 2019

THE SUBURBAN COLLECTION SHOWPLACE, NOVI, MICHIGAN

DISCUSSING AUTOMOTIVE INTERIOR SOLUTIONS FOR THE FUTURE

Headline speakers include:

VOLVO · Continental The Future in Motion · MORE AUTOMOTIVE · NUANCE · MIT Massachusetts Institute of Technology · OSRAM Opto Semiconductors · pillar Part of Accenture Industry X.0 · eyeris · bb7 · IHS Markit

• Next-generation interior design • Improving the occupant environment
• HMI developments • Intelligent UX design • Sustainable and ethical solutions
• Allergen-free, antimicrobial, non-toxic materials • Lightweight fabrics

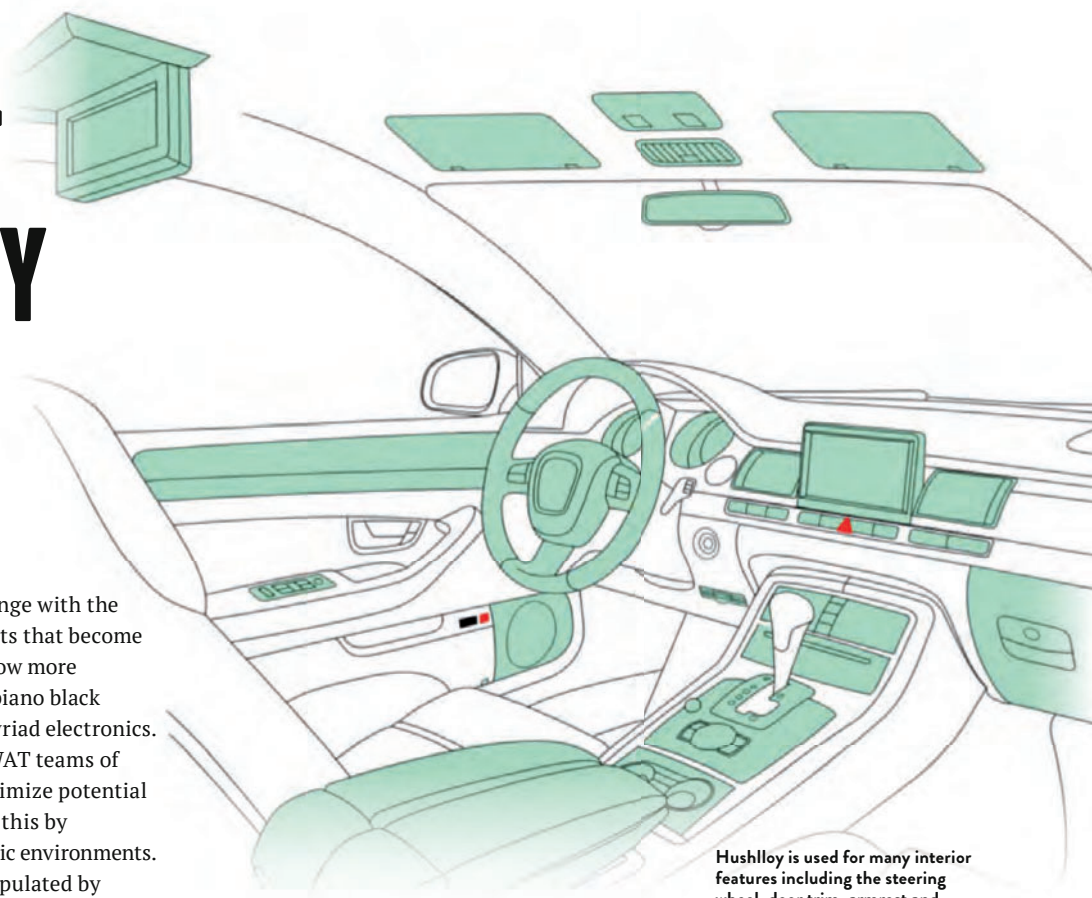
Held alongside: automotive interiors EXPO 2019 ★ NOVI ★ ★ MICHIGAN ★

From the publisher of: AUTOMOTIVE INTERIORS WORLD

www.automotive-interiors-expo.com/detroit

BEING QUIET ISN'T COSTLY

Newly developed thermoplastics provide a cost-effective means of minimizing cabin rattle and stick-slip noises

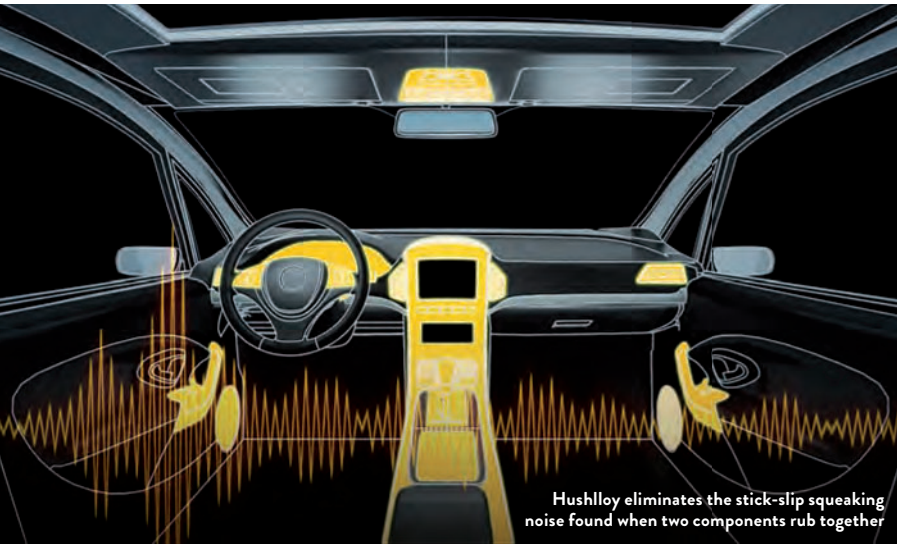


Hushlloy is used for many interior features including the steering wheel, door trim, armrest and instrument cluster

Vehicle interiors continue to change with the times, incorporating components that become evermore complex. There are now more synthetic leather, chrome and piano black finishes to go along with the myriad electronics.

In the midst of it all, design engineers and SWAT teams of buzz, squeak and rattle engineers battle to minimize potential rattle and 'stick-slip' noise in vehicles. They do this by subjecting vehicles to four-post testing in anechoic environments. It's cumbersome, but in a world increasingly populated by quieter electric and hybrid vehicles, it just has to be done.

Much of the noise is rattle, but a good percentage is a stick-slip phenomenon that results in aggravating squeak noises in the vehicle. The stick-slip noise is generated when two adjacent parts or surfaces rub against each other with the slightest force or movement. To guard against this, auto makers and their suppliers use small pieces of tape or felt, along with expensive greases or lubricants between adjacent components, to eliminate or reduce the noise. However, these fixes are temporary, and the associated additional labor is costly and inconsistent.



Hushlloy eliminates the stick-slip squeaking noise found when two components rub together

RESIN POLYMERIZATION

In recent years, Techno-UMG Corporation has provided a different means of eliminating this concern. The 2016 Mustang instrument panel cluster frame went with Hushlloy, a 'quiet' thermoplastic (ABS) resin, in place of a competitive general-purpose ABS, and the results were dramatic. More than 20 pieces of felt and tape, and the associated labor, were removed, along with the potential for interior squeak or stick-slip noise. The total savings were not measured in cents, but dollars.

Other vehicle applications using Hushlloy have followed this change. Chrome-plated interior components are notorious for creating stick-slip or squeak noise. This is where Hushlloy provides the biggest, quietest, bang for the buck. Auto makers and suppliers alike appreciate its ease of use. No injection mold tooling modifications or changes to a part's design are required; it's a drop-in. Hushlloy's physical properties are also equivalent to its general-purpose counterparts.

The characteristics of Hushlloy give its finished molded part surface a lower coefficient of friction, not by silicone or other additives, but through a unique resin polymerization process. So how do the Techno-UMG people and the OEMs know it works? During the development of Hushlloy, Techno-UMG used a Ziegler Machine, which evaluates the potential for noise between two moving surfaces or material components. Now, quiet doesn't have to be costly. AI

ONLINE READER INQUIRY NUMBER 502

SILENCE IS GOLDEN

High-performance lubricants ensure customers get the quiet in-car experience they demand

Special lubricants such as Krytox play a vital part in eliminating BSR, helping to create a quieter cabin for occupants

Since Rolls-Royce claimed in 1957 that 'At 60 miles an hour, the loudest noise in the new Rolls-Royce comes from the electric clock', interior cabin noise has always been a measure of vehicle quality.

Today, quieter interiors and smoother rides are not just the mark of luxury, but a must-have for every vehicle from compact cars to limousines. That's making the job of the automotive engineer evermore demanding – because when quiet is the norm, even the smallest noises, rattles, squeaks and vibrations become noticeable.

In-cabin noise normally occurs when different materials and components, such as leather, metal, plastic and weather-stripping, are used together. This causes friction, rubbing and ultimately noise. It's here that high-performance lubricants such as Krytox have a vital role to play. They are easy to apply, have low volatility, are virtually undetectable and will remain in place over the vehicle's entire lifetime. Most importantly, by reducing friction and rubbing, they cut down or eliminate both NVH and BSR.

It's a combination of these properties that makes high-performance lubricants like Krytox so successful – and why they are being used increasingly to deliver lifetime solutions to noise-quality challenges in interiors.

ONLINE READER INQUIRY NUMBER **503**

INDEX TO ADVERTISERS

Adam EMFIELD

senior manager of user experience at Nuance Automotive, explains why the future of in-car interactions will be multimodal

When we bring up innovation in the automotive industry, most conversations instinctively swing toward connected, autonomous, shared mobility and electrification (CASE) technologies. An important aspect of these developments is the part they'll play in changing the way people interact with their vehicle infotainment and control systems.

In the future, actions will be initiated on more than simply touch and voice: it will almost be a full-body experience, leveraging many of your senses and optimizing your non-verbal communication skills.

We're not suggesting you'll be licking your steering wheel anytime soon, but the subtleties of how we communicate with other people will make their way into the car through mobility assistants. These assistants will be contextually driven, providing users with tailored information to suit the time and place. They will no longer be user-centric, but me-centric, catering to each individual user.

BODY LANGUAGE

Talking to a car today feels a lot like speaking to a person on the phone, with verbal exchanges being passed each way. In the near future, cars will determine where you're looking and what you're doing with your hands. Imagine if you could point or look at something in your environment and ask questions about it? A future where you could just talk to the car without pushing a button or using an activation word.

Today, it is difficult to display information where you need it most. There's a good chance your car is designed so that you look at a display in the center console when interacting with it, or that you have to pick up your phone while driving.

We believe that future vehicles will put the information exactly where you need it. For example, information will be projected onto your windshield, providing an augmented view of the world outside [see page 40 for holographic HUDs].

We may even be able to direct the audio to a single person (say, the driver) when others don't need to hear it. The system will also be able to generate natural phrases and adjust its tone according to the urgency of the situation, rather than repeating monotone instructions.

CONCERNED ABOUT PRIVACY OR DISTRACTION?

Don't worry, so are we. Nuance is researching and designing balanced systems that provide an appropriate level of customization. These personal assistants will learn about you and your habits, but will only be there when you need them.

At Nuance, we understand that not all driving situations are equal, so we're designing multimodal systems that complete every interaction as seamlessly as possible, allowing the driver to keep their eyes firmly on the road.

DON'T MISS

Dr Carie Cunningham,
senior user experience researcher,
Nuance Automotive

The Future of Automotive Interiors Conference 2019

Cunningham will be discussing Emfield's vision in greater detail at The Future of Automotive Interiors Conference 2019 in Novi, Michigan. Be sure to attend Cunningham's presentation 'Don't just see through, but see with: In-vehicle multimodality' to learn more about the future of in-car interaction.

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ABS

HUSHLOY® prevents noise at its source.

A special polymer significantly reduces the "stick-slip" tendency of commonly-used interior plastics. The risk of squeaks and noises caused by friction, contact and movement is minimized. And ***HUSHLOY®*** polymer does not bleed out over time, providing a long-lasting effect.

HUSHLOY® easily replaces current ABS-type material and is compatible with the same molds and processes.

When quiet counts – use *HUSHLOY®*

Techno-UMG