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Weekly Newsletter

DVN-I
Automotive Interior

NEWSLETTER #147

Editorial

Smart Surfaces And Interior Lighting Transform Interiors

'Smart' surfaces—for a wide variety of definitions of 'smart'—are a fast-growing trend integrating multiple technologies. Sensors, switches, and other bits of hardware are integrated into surface materials such as PVC; fabric, and leather. Screens; buttons, and tactile controls with sensors are being considered as a further way to create a better and more intuitive user experience. We take a close look in this week's in-depth article, as a teaser of the smart-surfaces session planned for the upcoming DVN Interior Workshop in Köln on 25-26 April. Exhibition booths and lecture slots are filling up, so please **confirm your participation** before 16 February.

The DVN Workshop on lighting was last week in Paris, with great success and 350 attendees. Part of it presented interior lighting topics, and in this week's DVN-I Newsletter we report on those topics. It shows again how light is important in a cabin, and confirms that on top of light's design and decoration aspects, interior lighting plays an increasingly central role in providing and augmenting safety; comfort, and convenience. The upcoming DVN Interior Workshop has a substantial interior lighting session planned, which will go beyond what we've already presented here, so stay tuned!

Meanwhile, in the Coffee Corner, DVN Interior Designer Athanassios Tubidis picks up where last week's article on eco-friendly interiors left off, with his ideas about leather alternatives.

All of us on the DVN-I team are happy to have you with us!

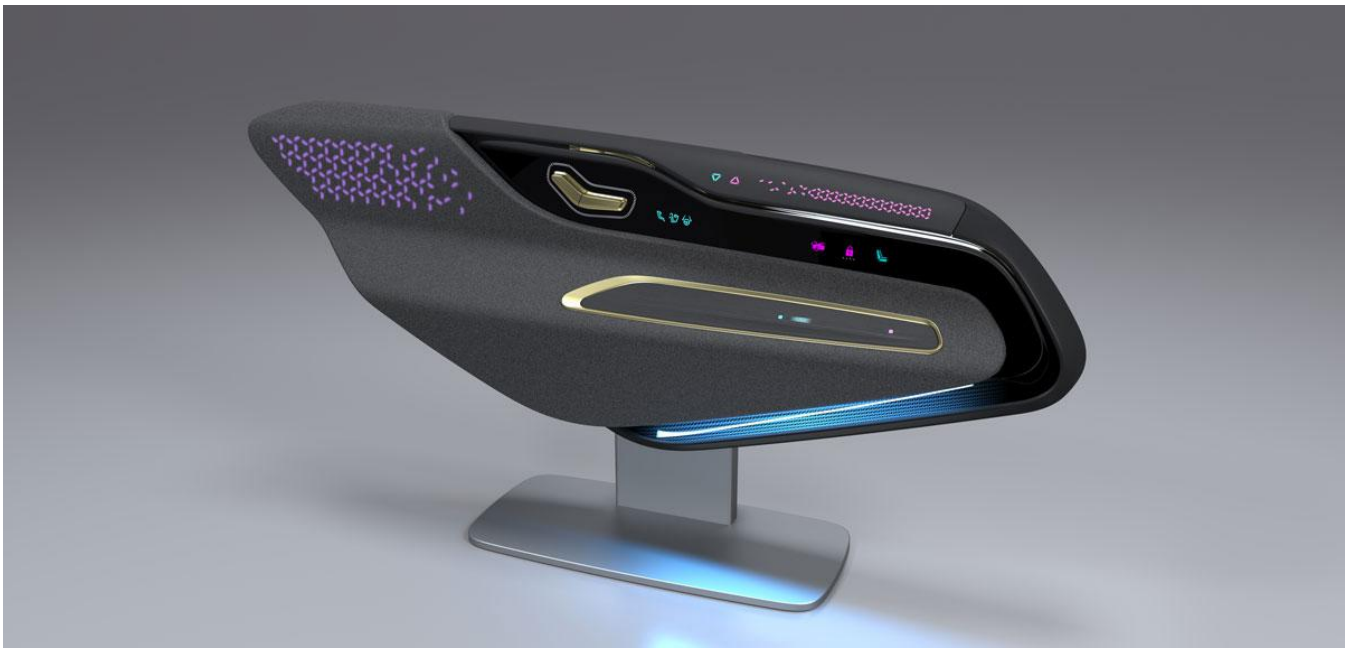
Sincerely yours,

Philippe Aumont
General Editor, DVN-Interior

In Depth Interior Technology

'Smart' Surfaces for Integrated Design, Weight Reduction

By Rob Miller, DVN



YANFENG'S 'SMART SURFACE DOOR' (YANFENG IMAGE)

User experience and HMI are expanding to cover every bit of real estate within the reach of the driver. Morphing screens; buttons, and tactile controls are being considered as a further way to create a better and more intuitive user experience. 'Smart' surfaces, at base, involve combining electronics and surfaces for the sake of design and of cost and weight reduction.

'Smart' surfaces are a fast-growing trend of integrating multiple technologies into one panel—interior trim; door panels; dashboard surfaces; center consoles, and other areas—to provide controls, displays, or lighting. There is a lot of effort in the industry consolidating several technologies into one energy-efficient panel, and a growing focus on energy efficiency and sustainability in developing 'intelligent' panel systems for automotive.

Smart surfaces offer weight reduction by combining multiple technologies into one surface. Using a variety of electronics; materials; and light sources, they broaden interior design freedom and can help differentiate car brands. Application examples include high-gloss trim surfaces; painted and chrome surfaces; leather and leatherlike surfaces.

LEDs in Plastic

Encapsulating LEDs in polycarbonate is typically done to protect the LEDs from environmental moisture; dust; dirt, and impact. But more importantly, it offers clean, integrated styling. The technique typically begins by attaching the LEDs to a metal-core PCB, which serves as the heat sink. The LEDs and PCB are then placed into a mold, and the polycarbonate material is injected around them under high pressure. Finally, the polycarbonate material is cooled and solidified, forming a protective housing around the LEDs. The encapsulation process is essential to ensure the long-term performance and reliability of the LED. Additionally, the polycarbonate material can help to dissipate heat, which is crucial to LED performance and longevity.

CONSOLE PROTOTYPE: LEDS IN POLYCARBONATE WITH HAPTIC TOUCH TO CONTROL THE STAR FIELD. (ROB MILLER IMAGE/DVN)

Ablation

Another trend is illuminating chrome or painted surfaces with laser ablation (also called etching or engraving): a laser is used to create designs or patterns on a surface by precisely and finely removing paint or chrome so light can shine through. Generally, the part has a white diffused plastic substrate under the paint or chrome. The laser beam vaporizes the chrome or paint, while leaving the substrate intact, creating a translucent design or pattern on the surface. The laser can be programmed to create highly intricate patterns, shapes, logos, or text on the surface.

The process of laser ablation is exact, allowing for a high degree of detail and control over the design or pattern created on the surface. This makes it an ideal method for creating intricate designs; patterns, or functional elements—QR codes or other types of identification marks—that would be difficult or impossible to create using traditional methods.

The advantage of illuminating chrome or painted surfaces with laser ablation is that the surface can be customized in various ways, allowing for a unique design look.

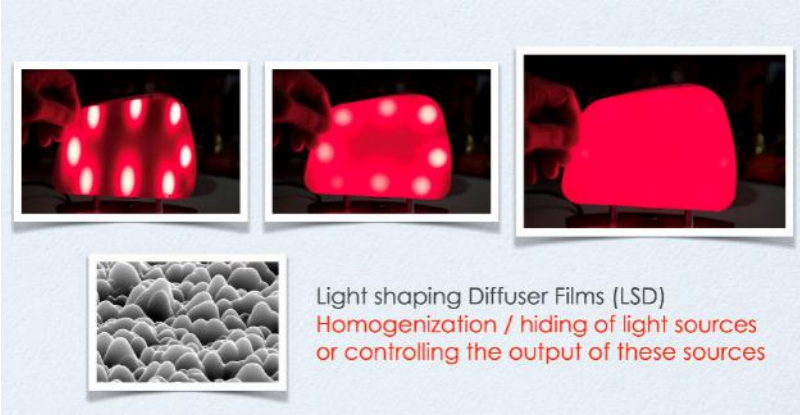
Haptic touch

Haptics refers to tactile feedback for users when they interact with touchscreens or other digital devices. Haptic touch technology uses vibrations and other physical sensations to acknowledge, through touch, a user's input efforts. For example, when a user taps a button on the screen, haptic touch technology can generate a vibration or other physical sensation to confirm that the button has been pressed. It can provide a sense of resistance when a user reaches a list's end, or a boundary within a menu. It can also help to reduce mistaps and other errors that can occur when using a touchscreen, or simulate the clicky-springy-notchy feel of various kinds of physical controls.

HAPTIC TOUCH WITH VISUAL FEEDBACK ON PLASTIC DOOR PANELS (YANFENG IMAGE)

Optical Films in 'Smart' Surfaces

Thin, transparent optical films can be used in 'smart' panels to enhance the display's performance and improve the user experience by reducing glare; increasing contrast, and improving the display's color accuracy. They also can be used to control and bend light.



LIGHT-SHAPING DIFFUSER FILMS CAN CONTROL LIGHT IN 'SMART' PANELS. (ROB MILLER IMAGE/DVN)

By placing optical films between the LED light source and the surface of the panel, the light can be directed; dispersed, and redirected to specific areas of the display. For example, a diffusion film can scatter the light evenly across the panel's surface, creating a uniform, soft light. Or a light-guide film can direct light from the LED source to specific display areas, reducing the number of light sources required and increasing the system's efficiency.

More, optical films can adjust or control the color of the light. A color-conversion film can be used to convert white light into a specific color to improve the display's color accuracy and rendering. And films incorporating phosphor can shift blue light into varying kinds of white light.

All in all, optical films in 'smart' panels with LED lighting can help improve the system's performance, functionality, and efficiency.

Interior News

Interior Lighting at DVN Paris Workshop

INTERIOR NEWS

DVN IMAGE

Last week's DVN Workshop in Paris was more than just an outstanding technical symposium and expo, though it certainly was that. It was also a gala celebration of DVN's 15th anniversary with 350 attendees at the fabulous Paris Hyatt Regency. What a great pleasure to meet again, live and in person, in the City of Lights (as keynote speaker Valeo CEO Christophe Périllat said so well).

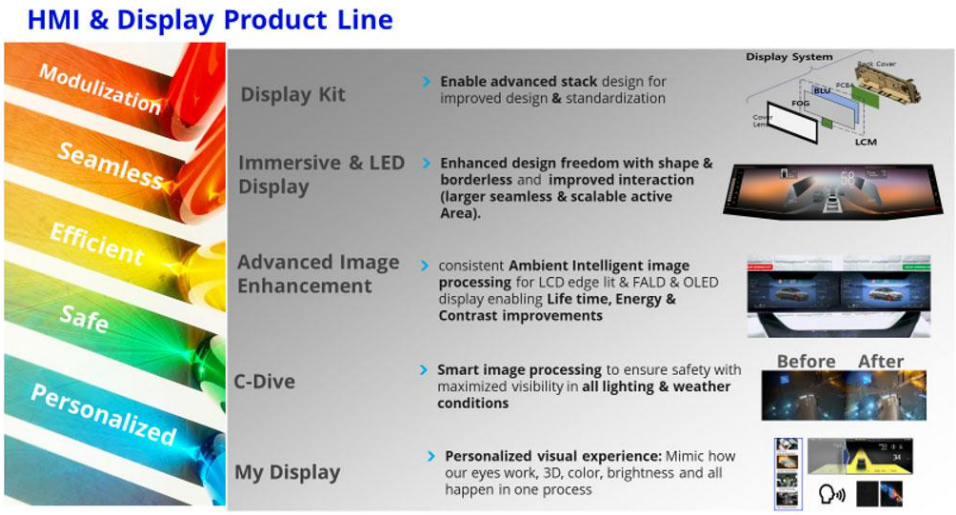
Most of the lectures and exhibitions were dedicated to exterior topics—lighting, digital grilleboards, and other suchlike—some presentations were focused on interior lighting, by companies including Forvia DesignLED and AMS Osram.

Forvia DesignLED: Personalization and Immersive Cockpit

FORVIA IMAGE

DesignLED presented for the first time under the Forvia brand, exhibiting in a booth together with Forvia Hella.

Under the tagline *Mobility Experiences that Matter to People*, Forvia's LED display product manager Tony Allison presented why and how personalization matters to people. He demonstrated how user interaction and light are the ultimate personalization.



FORVIA IMAGE

With a multidisciplinary team of experts working with automakers to explore an immersive experience in displays, Forvia put displays and lighting together to create a blank canvas that can be used to personalize the vehicle interior. On any surface—the IP; the door panels; the headliner, and more—displays and lighting can enhance a more immersive experience.

Touch-sensitive surfaces and gaze selection can simplify HMI interaction, and voice recognition and digital assistants allowing new inputs. They use Forvia Irystec's Smart Dimming software, and low-resolution surface lighting fills the gaps between high-res screens. High-res offers information, while low-res creates design freedom to reinforce brand-specific animations.

Overall, the benefit is to reduce cognitive load by decluttering high-res screens and displaying low-res info over a larger area, at lower cost and power compared to additional screens.

The immersive cockpit looks forward, preparing new use cases with more automated driving and related work; home, and social activities.

AMS Osram: Dynamic Lighting Needs Intelligent LEDs

HERMANN SENNINGER (DVN IMAGE)

AMS Osram senior marketing manager Hermann Senninger gave a talk called "From Dynamic Lighting to Open System Protocol OSP—Why We Need Intelligence Inside the LED".

Dynamic lighting is in between backlighting of displays and high-quality static illumination, meaning that inside cars, light is used for backlighting of displays and/or projections and/or statical illumination of a dedicated area. Now, light is used for decoration; for alerts and warnings; for communication—all to help humans interact with vehicles. All these new user scenarios generate new requirements in the lighting system—slim; thin; curvilinear, etc. From an optical perspective, needs include dimming capabilities; color homogeneity; brightness, and all the others. That means new kinds of LEDs, controllable by microcontroller via a new protocol called OSP (Open System Protocol).

Marquardt: Dynamic and Communicative Lighting

INTERIOR NEWS

MARQUARDT IMAGE

Marquardt is a family-run company founded in 1925 and based in Rietheim-Weilheim, Germany. They manufacture electromechanical and electronic switching components and systems. Marquardt interior lighting systems create atmospheric vehicle interiors in which people feel comfortable on the road. Colors and dynamic effects can be configured in a variety of ways to suit individual needs, ensuring relaxation and a sense of wellbeing.

Marquardt Dynamic Light is more than just ambient lighting. Individually integrated into the vehicle operating concept, it provides visual feedback to inform about incoming calls or warn in dangerous situations. This way, the lighting atmosphere and functional displays combine to create an overall experience.

Dynamic Light comprises Marquardt components including individually-controlled LEDs in combination with light guides and diffusers, to enable homogeneous color rendering; soft light gradients, and high-contrast light edges. The high mechanical flexibility and the optional use of individual 3D shapes ensures the best integration. Marquardt supports the system with special light colors and dynamic animation sequences and becomes an intuitive HMI component as a building block in a vehicle's operating concept. The system visualizes the communication with the voice assistant; displays calls and messages, and supports the use of media. In interaction with the vehicle sensor system, it provides a visual warning when the driver is too close to another vehicle, or other dangerous driving situations arise. And the system is also equipped with various visual feedbacks to support autonomous driving.

Dynamic Light is based on a flexible system architecture that makes it easy to implement individual application scenarios. Solutions for cybersecurity and ASIL classification are also already available. Variable components such as LED spacing; light output; module geometry, and module length mean many flexible product solutions are available.

Tesla Sinks to 7th Place in AD System CR Comparison

INTERIOR NEWS

CADILLAC ESCALADE WITH SUPER CRUISE RUNNING (GM IMAGE)

Consumer Reports evaluated 12 technologies that combine adaptive cruise control (ACC) and lane centering assistance (LCA) to aid with highway driving. The systems, which are becoming increasingly prevalent in the auto industry, keep a vehicle in its lane while slowing down and speeding up with the flow of traffic. The assessment criteria were ease of use; capability and performance; keeping the driver engaged; how they handle an unresponsive driver, and how clearly they indicate when it is safe to use them.

Ford's BlueCruise (called ActiveGlide in Lincolns), which allows drivers to take their hands off the steering wheel on approved highways, was ranked first. General Motors' similar Super Cruise feature came in second, and Mercedes-Benz's system took third. Tesla Autopilot fell to seventh place this year, from second in 2020. That, according to Consumer Reports, is because Elon Musk's automaker hasn't made any significant upgrades to Autopilot's core functionality in years—it still doesn't allow collaborative steering and doesn't have an effective driver monitoring system.

The Ford and GM systems rated highest use DMS (Driver Monitoring Systems) that require drivers to keep their eyes on the road even while the systems are automating steering; acceleration, and braking. Both point infrared cameras at the driver's face and sound an alert if the driver stops paying attention to the road, even if just for a few seconds. If the driver doesn't turn their eyes back to the road, the system slows the car down and takes other safety measures.

Schott: Glass Fiber Technology and Applications

INTERIOR NEWS

SCHOTT IMAGE

Various transparent materials are required in the interior of a vehicle, from antireflective displays for dashboard consoles to touchscreens that detect the smallest touches while repelling fingerprints and dirt. Schott, German-based glass experts for 130 years and counting, are constantly innovating in specialty glass and glass-ceramics; ultra-thin glass, and apposite polymers.

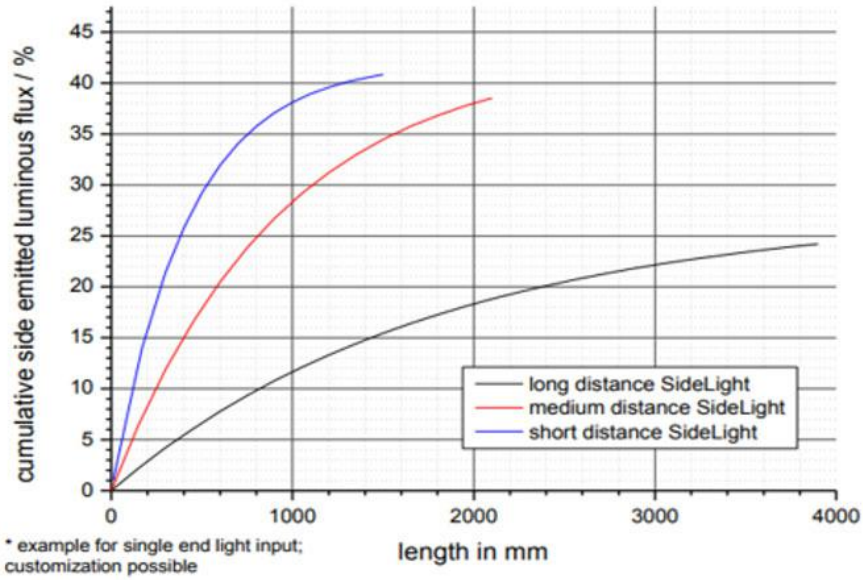
Conturan is one of their new materials. It has a reflection of less than 1 per cent, and displays all information to the driver in all lighting conditions. Borofloat, a specialty Schott borosilicate glass, is robustly impact and scratch resistant, making it ideal for long-term indoor use.

SCHOTT IMAGES

Schott's SideLight; MultiLight, and LuminaLine solutions create bright; clear; colorful, and uniform contour lighting throughout the car's interior, while their MultiLight fibers combine contour lighting with spot lighting from a single light source.

Glass fiber optic lighting offers advantages over plastic fiber solutions. It is highly resistant to degradation from chemicals and ultraviolet light; has a wide operating temperature range, and withstands the damaging effects of mechanical stress and aging. Customizable diameters and superior bending radii facilitate the installation of SideLight and MultiLight systems in vehicle interiors.

Color quality is a reliable constant: With 360° radial illumination, Schott's light-diffusing flexible fibers offer high color stability and homogeneity over lengths of up to 4 m. This results in evenly distributed light and high-quality ambience.



Parameter	LuminaLine	SideLight MultiLight
Light guide material	Toughened glass fiber (customizable)	Glass optical fiber bundle, polymer sheathing (customizable)
Typical diameter vs. flexibility	100µ – 200µ fiber (flexible) 0,5mm – 3mm rod (rigid)	1mm – 5mm cable (flexible)
Typical luminance @350mW LED	1.000cd/m²	100cd/m²
Temperature range	-40°C – 400°C	-40°C – 105°C
Integration in the trim	Directly visible, laminated or over-molded	Directly or indirectly visible, press-fitted, sewn-in or clamped

SCHOTT CHART

Covestro's Automotive Interior of the Future

INTERIOR NEWS

COVESTRO IMAGE

Tomorrow's automobile will be fully networked, says Covestro, and will integrate seamlessly into everyday life as trends of electric connectivity and car sharing start to redefine vehicle utility. In order to meet these demands, Covestro has worked alongside its partners to develop a premium concept with new material solutions.

Highlights of the concept include among others multi-sensory infotainment systems, innovative seating concepts and a sound-insulating dome. High-tech materials from Covestro open up a kaleidoscope of new possibilities for many different components.

As the classic function of the driver's seat will no longer be required, the car interior can be given a new look and design. Not only should the seats be comfortable, they should also offer enough flexibility to expand the interior space.

Covestro's head of textile coating, Thomas Michaelis, says the company's vegan, water-based Insquin technology for textile coating gives the attractive appearance of leather, at a lower cost and with reduced solvent emissions and new capabilities: "What is exciting is the possibility of allowing light to shine through the coated surface, creating an all new kind of ambient lighting".

The new movable Privacy Dome is designed to protect users' privacy. A sound-absorbing acoustic foam made with Covestro's Baynat polyurethane technology provides each passenger with individual peace and quiet, independent of other passengers and the outside world. In addition, passengers can relax to calming sounds such as waves on a beach.

Corvette E-Ray: Performance Data Recorder and More

INTERIOR NEWS

GM IMAGES

For the first-ever electric Corvette, the E-Ray, Chevrolet is offering a fully customizable interior with a range of updates and revisions over the previous model.

New Charge+ and stop-start buttons feature on the console, and the infotainment system and instrument cluster now deliver a more integrated in-cabin appearance. In addition to the E-Ray's standard head-up display, buyers can opt for a Performance Data Recorder to foster better driving. It enables users to record high-definition video, with telemetry overlays, of their driving experiences on and off the track, while also providing an analysis of the run. It includes major components all seamlessly integrated into the vehicle's interior: a 720p high-definition camera mounted in the windshield header trim to record a driver's-eye view through the windshield; a dedicated microphone in the cabin for recording audio, and a self-contained telemetry recorder that uses a dedicated GPS receiver operating at 5 Hz. That is five times faster than the vehicle's in-dash navigation system, allowing more precise positioning and corner traces. The recorder is also hardwired into the vehicle's CAN to access vehicle information ranging from engine speed and transmission-gear selection to braking force and steering wheel angle. There's an SD card slot for recording and transferring video and vehicle data. Recording time depends on the capacity of the memory card, with a 32-gb card storing up to about 800 minutes of drive time.

The E-Ray's infotainment system is compatible with both wireless Apple CarPlay and wireless Android Auto, and a 14-speaker Bose Performance Series sound system is available.

A new driver information screen delivers relevant data on the vehicle's battery power and various other performance parameters. Located on the center screen is the new E-Ray App, which enables occupants to view more performance data, in addition to rear-wheel-drive vs front-wheel-drive power. Chevrolet's global executive design director Phil Zak says "The interiors allow customers to reflect their individual personalities with their choice of color executions that provide a refined or dynamic sport look and feel". Then there's the new Artemis Dipped interior option: deep green tones on most of the E-Ray's interior surfaces. Customers can

The Design Lounge

UnLeather

By Athanassios Tubidis

THE DESIGN LOUNGE

MERCEDES-BENZ VISION EQXX (MERCEDES-BENZ IMAGE)

A trade in leather and tanning work developed during the 12th century around the small canal that runs through the city of Grasse, in the south of France. This is when and where numerous technical developments begun and the city witnessed a great expansion. Once tanned, the leathers were exported through a commercial alliance to Genoa and Pisa. Grasse leather acquired a high-quality reputation producing, among other leather goods, gloves for nobility. The strong and unpleasant odor though, due to the previous treatment, was something that did not appeal to the honorable clients. A serious marketing issue was raised. In the mid-1500s, Galimard, a local tanner, after following an oriental recipe, came up with the idea of creating perfumed leather gloves in rose-water and spices "scented baths". He offered a pair to Catherine de' Medici, and the queen was seduced by the gift. From then on, tanners treated accordingly leather skins and scented gloves spread to the Court and throughout high society. The countryside around the city began to grow fields of flowers, offering new scents. In 1614, the king recognized the new corporation of "glovers' perfumers", and the rest is history.

Grasse became the world perfume capital and, because necessity has always been the mother of invention, leather never stopped its technical progress, developing new properties hand in hand with new technologies all the way to our days. Today's most in-tune CMF designers still use the label 'leather' for products that look and feel just like it, composed from anything but leather. Beyond a natural material, leather became a notion that signifies quality. Intuition, entrepreneurship, continuous investment in research and development are the

drivers that over the years have enabled to approach even the most demanding sectors, automotive interiors, with new advanced methods, options or leather alternatives. After all, we all love the feel and the looks of leather. Pineapple leather is leather made from pineapple leaves and once implemented by fashion companies, designers proved that could virtually do anything that regular leather does. Its low cost and biodegradability are about to make pineapple leather the most popular vegan leather yet. Eco-suede is softer than suede, made from a combination of plant starch and postindustrial recycled polyester, while coco-fiber implemented to the same purpose, proved incredibly versatile to any form or thread due to its long golden-brown fiber that equally constitutes a structural benefit.

Mercedes, in their Vision EQXX concept that aims at a premium car interior experience, worked with Mylo, the company that began the mushroom-leather movement. The vegan leather is used to detail the seat cushions and yet it is not the only plant-based material in the cabin. Pulverized cactus fibers and bamboo strands as well as bioengineered silk take over floor and door panel surfaces of what the constructor claims to be the most efficient car the company ever built, with maximum comfort and style.

It is promising and exciting rendering one single car interior in a variety of products from mushroom leather to vegan silk, creating the best leather alternatives to leather.

Nissan Max Out EV Roadster Concept

THE DESIGN LOUNGE

NISSAN IMAGES

Nissan is holding Nissan Futures, an event showcasing how they are shaping the future of sustainable mobility and innovative design, at their Global Headquarters gallery in Japan from 4 February to 1 March.

As part of the event launch, Nissan unveiled a physical concept model of their Max Out EV convertible. The model was previously shown in virtual form as part of the Nissan Ambition 2030 vision announced in November 2021. The Max Out, on display for the duration of the event, embodies Nissan's ambition to support greater access to both sustainable and innovative mobility.

This Concept is a two-seat, convertible EV show car.

Concepts are often design exercises meant to spur creativity within a company. Sometimes, these concepts provide a glimpse at what design direction an automaker may take, so elements of the Max Out could come to be included on production vehicles.

The wild front and rear lighting are only outdone by the illuminated wheel covers. It's hard to imagine some of this stuff ever coming on production cars, but it wouldn't be a stretch to see a variant of the rear lighting make its way to a future production car.

The interior is futuristic, with a large screen wrapping the entire dashboard and an illuminated rectangular steering wheel inspired by aviation controls. The effect is minimalist, and could inspire new interior designs in production cars. What's more, Nissan says the passenger seat can be folded into the floor to gain even more space.

News Mobility

VW Wanderer: Tiny House on EV Wheels

NEWS MOBILITY

VW IMAGE

In the face of increasingly fierce global competition, vehicle manufacturers are striving to reliably differentiate their products. Volkswagen, for one, is working on a new vehicle concept: a posh tiny house on wheels, called the Wanderer. This EV concept is intended to disruptively modernize RV styling, and VW says it will be produced—but not until 2030 at the earliest.

This futuristically designed vehicle is, in the words of former VW CEO Herbert Diess, "a comfortable yet compact home on wheels that takes you to your most desirable places autonomously, safely, comfortably and in style". Instead of comparatively small rectangular windows for the view outside, VW's mobile home design offers generous glass sections with acute angles. The Wanderer is designed to be as self-sufficient as possible with air conditioning; heating; solar power, and water management. It releases additional square meters of usable space at the touch of a button, and extends its integrated terrace.

Bosch Auto-Park Expands Beyond Airport

NEWS MOBILITY

BOSCH IMAGE

As we've previously reported, Bosch's automated valet parking system has been approved for commercial use at Stuttgart airport. And now, deployment of the system is expanding.

Bosch, together with their connected-parking technology partner Apcoa, are installing the technology in 15 additional parkades in Germany. From Hamburg to Munich, work to expand the infrastructure-based, automated, driverless L^4 parking system is set to start this year. The two companies say their goal is to gradually equip several hundred parkades around the world with automated valet parking.

Their system allows drivers to park a vehicle in a handover zone near the entrance of a parkade and then, using a smartphone app, they can order the automated and driverless parking service. Bosch stereo cameras identify vacant parking spaces and monitor the driving aisle and surroundings, and detect obstacles or people in the aisle. If an unexpected obstacle is detected, the vehicle stops until the way is clear. All the data generated by the cameras is fed into edge computers. Algorithms transmit the driving maneuver to be made and thus enable driverless parking, even when moving between stories on narrow ramps. The system also relies on technology installed in the parking garage, minimizing in-veihcle technical requirements so the valet parking service lends itself to all vehicle classes.

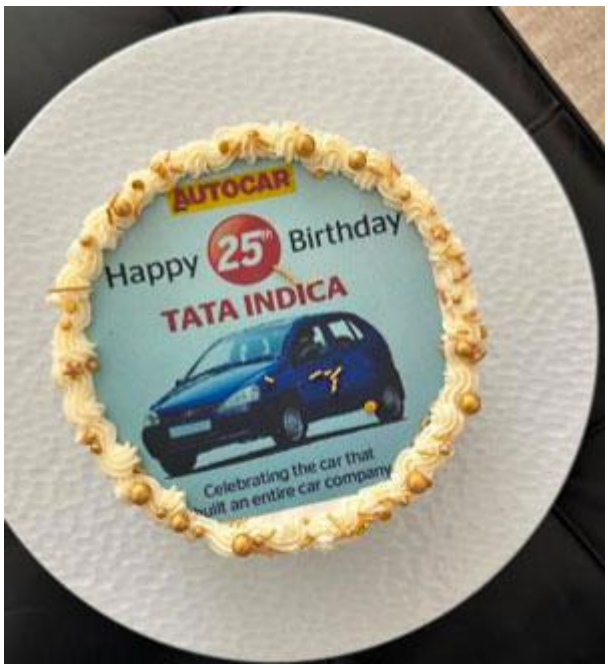
General News

Tata at Auto Expo 2023 in Dehli

GENERAL NEWS

AUTOEXPO IMAGE

Auto Expo—India's biggest auto show, also known as the Delhi Auto Show—happened a few weeks ago at the India Expo Mart near Delhi. It was a refreshing return after last year's show was cancelled on account of Covid. That might help explain this year's record turnout of over 636,000 visitors who came to see 82 global and national vehicle launches.



Tata, one of India's largest automakers, presented their new model range including many EVs, all using the maker's Ziptron technology, an umbrella name for Tata Motors' EV technology: battery; motor, and power

electronics to make cars with zero noise; zero vibration, and zero emissions.

Tata introduced EV models including the Harrier; Sierra, Avinya, and Tiago, and feted the 25th anniversary of the Indica: on 15 January 1998, the Telco (now Tata) pavilion was huge—but not big enough to accommodate the media-executive-politician crowds waiting to see India's first truly indigenous car, which went on to the lay the foundation for Tata Motors's passenger car division. Indica production ended in 2018 after 20 years, but its legacy was evident in some of the Tata cars on display this year at Auto Expo.

Alibaba and the Promise of the EV Market

GENERAL NEWS

ALIBABA IMAGE

Alibaba is one of the largest tech companies in the world. Now they're pushing into the automotive industry with power and almost limitless capital. Alibaba is something like the Amazon of China, but much more. For example, Alibaba also has their own payment system, Alipay. Customers of this financial subsidiary can do online banking or apply for microloans. This company alone is considered the world's most valuable startup, valued at around USD $150bn. Other subsidiaries offer online map services; cloud computing, and online auctions. All in all, Alibaba is one of the most powerful tech giants in the world. They're omnipresent on smartphones in China, where it is almost impossible to escape or operate outside the Alibaba sphere.

And now they want to enter the automotive industry, because the advance of electric cars, increasing digitalization, and connectivity are opening new opportunities for monetization, and Alibaba is banking on traditional automakers not knowing how to exploit them. Enormous investments would be needed for Volkswagen, BMW or Mercedes to be able to compete on equal terms with Alibaba in the software sector.

Both BMW and Volkswagen have Alibaba in the car. At BMW, the focus is on connectivity support. The two companies also jointly operate a technology center in Shanghai, aiming is to discover promising startups to help BMW bring innovative products to market. At Volkswagen, Alibaba is helping with autonomous driving and connectivity.

Some vehicles run Alibaba's YunOS operating system and also are equipped with Alibaba's digital map material. The tech giant has stakes in countless companies, from the software company DeepRoute, which produces artificial intelligence for autonomous driving, to navigation and map providers. And Alibaba has teamed up with SAIC to create the IM Motors brand, a manufacturer of premium electric sedans and SUVs.

McKinsey Center for Future Mobility senior expert Dennis Schwedhelm says, "On the one hand, this is about additional revenue, for example through entertainment or insurance, and on the other hand about cost savings, for example through predictive maintenance of vehicles. Our estimate is that there's a triple-digit billion amount of value in this area by the end of the decade that can be realized by more than just automakers"—assuming software that can be deployed across all model ranges, and computing power that won't be overwhelmed in a few years.