WE
ARE
WHERE...

# MAKING HAS MEANING

The industrial revolution is powered by global communication, interconnected machines, the internet of things, the cloud, artificial intelligence, big data analysis and machine learning. It can deliver new experiences that are more meaningful and longer-lasting for everyone.

In the last two centuries, the manufacturing industry has imagined, developed and made the useful products that societies and economies have needed, as well as products that we have all dreamed of for ourselves. Manufacturers have also made constant efforts to make products accessible to the largest number of people, as quickly as possible. As the world's population grows, we have become aware that the manufacturing sector plays a vital role in serving the global community and, at the same time, that the Earth's resources are scarce and precious.

The manufacturing sector has always been about balance, but it has not historically paid due attention to human beings or nature. At Dassault Systèmes, we are convinced that the fundamental purpose of the 21st century's Industry Renaissance is to achieve harmony between products, nature and life. The zero-carbon ambition is a key aspect of that revolution.

In the 21st century, industry involves a new way of seeing the world, of inventing, learning, producing and selling, one that combines the virtual and real worlds. It is a horizontally integrated network of creation, production and sharing of experiences. Many companies such as Tesla offer new solutions in new markets and show us that the new economy, which is fundamentally use-based, is creating much more value – use value – than the industries of the last century. The "factory" of tomorrow will not make products but experiences, new uses requiring ecosystems that are very different from the supply chains of the past in terms of their structure and associated business models.

Today's economy is organized around marketplaces that reconcile supply and demand, global and local. Virtual experience platforms are the infrastructure of the 21st century and are already transforming commerce (just look at Amazon!), distribution, transport and tourism. Industry is next. Today's digital realm – with its virtual experiences, augmented reality and realistic simulation capabilities – is what the printing press was to the renaissance in the 15th century. Virtual models – digital twins – will revolutionize our relationship with knowledge and know-how which, when combined with data, distinguishes true innovators from those content to automate existing processes. Manufacturers, including startups and SMEs, will get to grips with usage data from virtual experiences, even before data from real experiences, will be able to develop new offerings that add large amounts of value.

To sum up, the manufacturing industry's virtuous revolution is the key to a sustainable future. It involves what we call harmonizing product, nature and life. The ambition of our **3D**EXPERIENCE platform is to provide a digital collaborative environment – an innovation platform, an operations platform and a marketplace at the same time – that is needed for the networks of the future, based on sustainable values, to emerge and develop.

**Dominique FLORACK**
President,
Chairman of the Manufacturing Industries Board

# INSIGHTS INTO THE REALITY OF PRODUCTION GAINED FROM OBSERVATION AND ANALYSIS

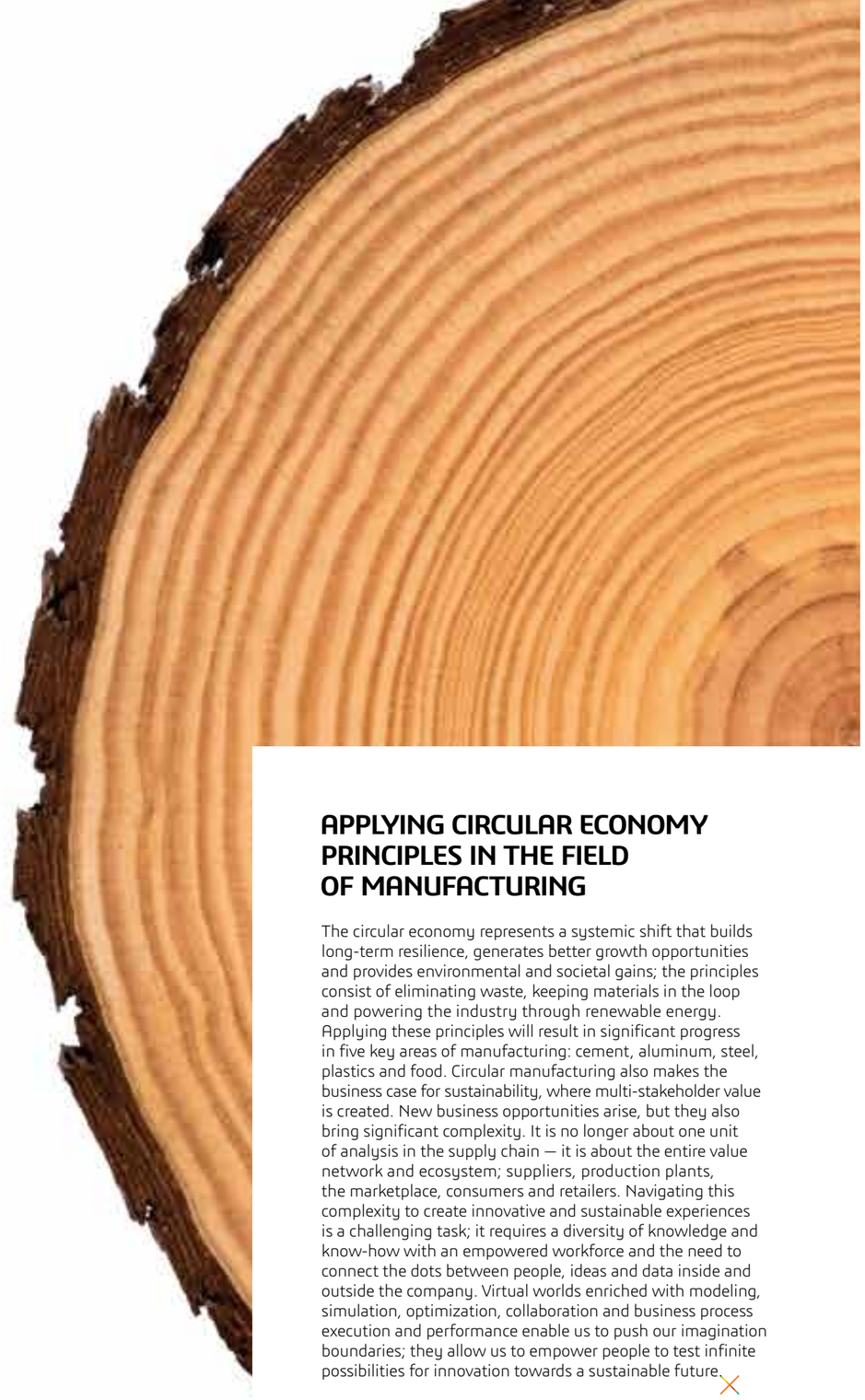
## INTERPRETING AND ORGANIZING TEXT DATA WITH ONTOLOGIES AND AI-DRIVEN SEMANTIC ANALYSIS

In 2020, Dassault Systèmes strengthened its data science capabilities by acquiring French company Proxem, which specializes in advanced (or artificial intelligence (AI)-driven) semantic processing based on natural language processing (NLP) and machine learning. Proxem's solutions and know-how help users turn textual data into ontologies and actionable insights for businesses. By combining AI-powered semantic modeling and data services applications, users of the **3D**EXPERIENCE platform will be able to leverage knowledge buried in requirements, regulations, client and reseller feedback, after-sales service reports, contracts, scientific publications, research reports and clinical trial results, thus enriching their virtual twin experiences. This will provide unprecedented opportunities for collaboration, encouraging innovation and the creation of new products and services, while facilitating planning and execution throughout the extended enterprise.

## PREVENTING MUSCULOSKELETAL DISORDERS **IN THE L'OCCITANE FACTORY**

MyHealth@Work is a Dassault Systèmes service based on the DELMIA solution, developed with L'Occitane en Provence as the pilot client. L'Occitane wanted to prevent the occurrence of musculoskeletal disorders among staff members working on the factory floor. The solution works by capturing the real situations and operational procedures of each workstation, performing an analysis using the workstation's virtual twin, and shows its risk level. This assessment – which method engineers would not have had the time or resources to perform – was carried out very quickly in L'Occitane's factory, analyzing tasks performed in the production and packaging workshop. Method engineers now have access to a MyHealth@Work dashboard based on the Ergonomic Workplace Design solution, which combines two algorithms: Smart Posturing Engine, which automatically positions a virtual manikin, and Ergo4All, which ergonomically assesses the manikin's posture to determine the risk of joint or musculoskeletal problems. Using an objective, mathematical model makes all participants in the occupational health ecosystem more accountable. It changes the work done by method engineers, who are now able to spend more time on prevention: together, the virtual twin of the workstation and the associated virtual manikin represent a powerful educational tool to raise operators' awareness and give them information regarding their own health.

# STREAMLINING MANUFACTURING FOR MORE SUSTAINABLE DEVELOPMENT



## APPLYING CIRCULAR ECONOMY PRINCIPLES IN THE FIELD OF MANUFACTURING

The circular economy represents a systemic shift that builds long-term resilience, generates better growth opportunities and provides environmental and societal gains; the principles consist of eliminating waste, keeping materials in the loop and powering the industry through renewable energy. Applying these principles will result in significant progress in five key areas of manufacturing: cement, aluminum, steel, plastics and food. Circular manufacturing also makes the business case for sustainability, where multi-stakeholder value is created. New business opportunities arise, but they also bring significant complexity. It is no longer about one unit of analysis in the supply chain — it is about the entire value network and ecosystem; suppliers, production plants, the marketplace, consumers and retailers. Navigating this complexity to create innovative and sustainable experiences is a challenging task; it requires a diversity of knowledge and know-how with an empowered workforce and the need to connect the dots between people, ideas and data inside and outside the company. Virtual worlds enriched with modeling, simulation, optimization, collaboration and business process execution and performance enable us to push our imagination boundaries; they allow us to empower people to test infinite possibilities for innovation towards a sustainable future.

## REVOLUTIONIZING AUTO BODY PAINTING **WITH SMART PAINTSHOP**

Italian-Japanese company Geico Taikisha is a world leader in automated body painting systems and has been a partner to carmakers around the world for more than 50 years. It is now about to revolutionize its industry. The company's collaboration with Dassault Systèmes will give carmakers more flexibility in their production, at a time when mass personalization is increasingly important. Modularity is also a focus, as many customers need to manage multi-car platforms and new product introduction. DELMIA's solutions are unleashing the potential of Geico Taikisha's Smart Paintshop, which is designed to be the car paintshop of the future, with smart, connected solutions to improve efficiency, safety, quality and cost – while at the same time working towards ambitious sustainability goals. The **3D**EXPERIENCE platform manages communications between processes and end-user systems, complemented by an IoT system and technologies that facilitate energy and design management.

The Paintshop Execution System is fully adapted to match the requirements of its specific environment, and DELMIA Apriso helps to create deep insights throughout the entire car painting process. The Smart Paintshop system manages, guides and documents each step with pinpoint precision. This innovation allows Geico Taikisha to provide its automotive customers with an end-to-end solution that will help them adapt to increasing demand for high-quality, low-cost products and high levels of customization.

## ENSURING RESILIENT SUPPLY CHAINS

The COVID-19 crisis starkly highlighted the fragility of some supply chains. In many industries, however, securing the upstream supply chain has long been identified as crucial to a company's survival. The **3D**EXPERIENCE platform provides a comprehensive solution for designing, planning, simulating and continuously optimizing overall supply chain processes in a virtual environment. It starts with managing supplier-related costs with ENOVIA solutions. Approving and qualifying each new component before introduction into a product is extremely important to ensure component reuse, introduce parts from preferred suppliers and minimize validation costs. When the supply chains gets disrupted, the first step in the recovery process is to collect and interpret data in order to understand the existing supply network before it can be optimized or redesigned, if necessary. By connecting enterprise, suppliers, customers and market data into the **3D**EXPERIENCE platform, NETVIBES offers supply networks monitoring solutions able to detect and help reduce the impact of disruptions. Should a supplier be at risk, the procurement department can consult PartSupply on the **3D**EXPERIENCE Marketplace to find an alternative supplier of a similar product part. From sourcing to distribution, the **3D**EXPERIENCE platform helps design more efficient supply chains, plan agile production and secure a comprehensive downstream supply chain.

# DESIGN FOR LIFE: MEANINGFUL ACTIONS FOR TODAY'S WORLD

Since 2016, Dassault Systèmes has run a program called Design for Life, focusing on innovative practices and processes for sustainability by design. In 2020 Dassault Systèmes gathered powerful testimonials from forward-looking designers and architects whose work lies at the crossroads of technology, science and nature — for a radically positive impact on today's world. This initiative was led in collaboration with *Dezeen*, the influential design and architecture magazine.





## ANNE ASENSIO

### VICE-PRESIDENT, DESIGN EXPERIENCE, DASSAULT SYSTÈMES

**Using simulation to understand what is possible**

"Designers use technology as a catalyst for thought, particularly as part of a new relationship with nature, our living conditions and our environments. They question the ways the world is changing. Digital technologies such as simulation are more generally used by engineers to understand and reduce the risks inherent to industrial projects, weight management, logistics impact (i.e. to gain control over what could be). For designers, however, the aim is to perform simulations of their creative scenarii as a leap into the unknown, to explore possibilities in an imaginative way, to ponder and judge the relevance their work.

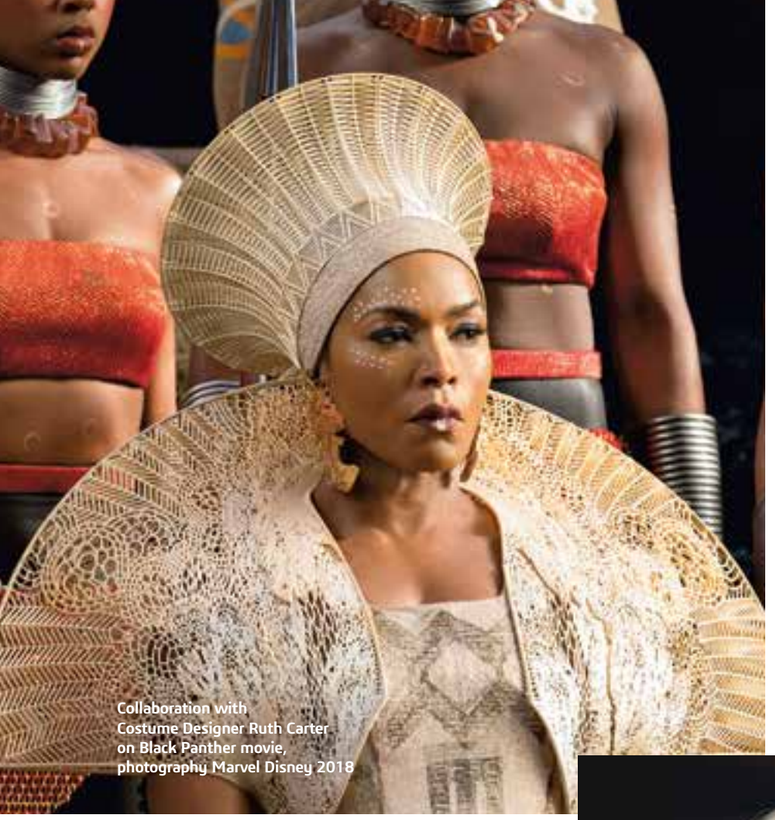
Technology brings objectivity to a design project. And even if it is not used to enhance performance or optimize processes, it allows us to gain a systemic perspective from the sustainability point of view, as a way of measuring design's impact. Technology is becoming a new raw material for designers, allowing them to exercise judgment alongside their subjective sensibilities and intuitions Digital technologies allow us to make projections and representations, and we can use those to make a critical assessment of how industrial design over-relies on consumerism, revealing the true purpose of the design process: design for people's wellbeing.

In the design world, projects are developed in "action-research" mode within vibrant, connected communities. Virtual co-creation spaces, such as those of the **3D**EXPERIENCE platform, give designers the ability to reinvent the way they work and to learn by doing so. The Design for Life initiative shows how we can represent the imaginary as tangible and realizable elements, and how we can be inspired by the structures of living things. Our imaginations become representations of the world."

# ARTHUR MAMOU-MANI

## ARCHITECT

**Sustainable design based on natural processes**
Arthur Mamou-Mani is interested in architecture that is designed and produced digitally. His firm believes in innovation, craftsmanship and the role of architecture in society. In his London office, he creates sustainable designs based on natural processes, and brings his projects to life in an integrated Fab Lab. He works iteratively as part of a conceptual-empirical loop, learning constantly through trial and error. His firm's beliefs regarding the circular economy are illustrated by one installation in particular. Designed using the XGen solution, which allows parametric models to be created within the **3D**EXPERIENCE platform, the installation is made up of a dynamic grid of 3D-printed modules, and cascades through the space as if it was taken by the wind. The modules are 3D-printed on site using a material called polylactic acid (PLA). PLA is a bioplastic made from fermented sugar, and comes in pellet form. The installation also features a crusher, demonstrating how recycling can be done on a very small scale. The crusher breaks down the printed modules into pellets, which can immediately be reused to print new modules. According to Arthur Mamou-Mani, "it's very important that designers start thinking beyond the timeframe of their project. They need to start thinking of where the material came from, where is it going, how can it be reconfigured – the entire lifecycle of a project needs to be taken into consideration."



Collaboration with
Costume Designer Ruth Carter
on Black Panther movie,
photography Marvel Disney 2018

# JULIA KOERNER

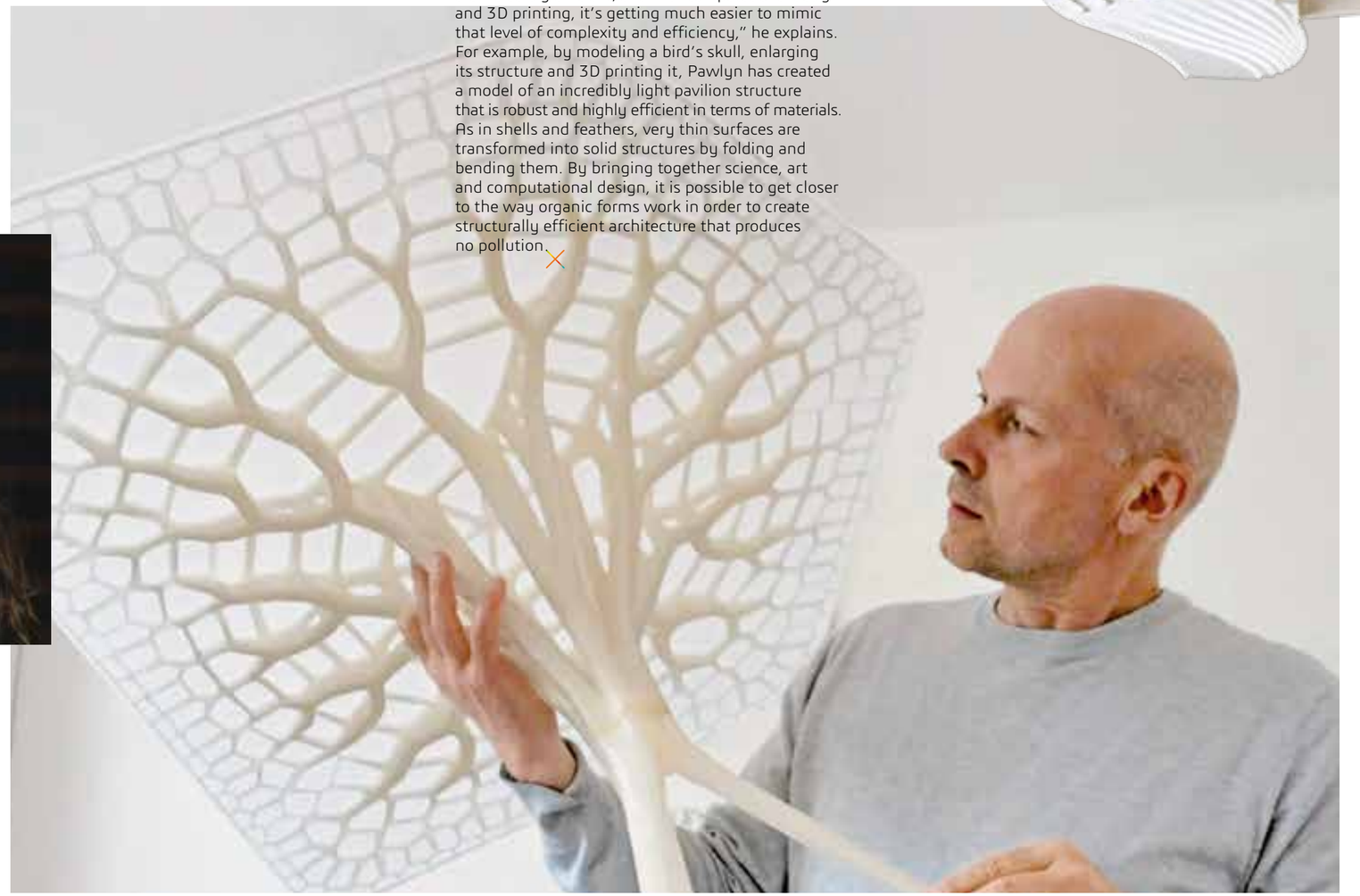
## DESIGNER

**Textiles that draw inspiration from butterfly wings**
The work of Julia Koerner, a designer based in Salzburg and Los Angeles, blurs the boundaries between architecture, fashion and product design. She makes extensive use of 3D printing, and draws inspiration from natural shapes. Her most recent feat was designing the impressive regal attire for the film Black Panther – directed by Ryan Coogler and part of the Marvel Cinematic Universe. Her designs explore the possibilities of biomimicry; for example, using close-up photographs of butterfly wings that she digitized, processed using an algorithm and turned into 3D models. After turning the photographs into thousands of pixels mapping the butterfly's wings and colors, she reproduced the motif using 3D printed bristles on a flexible fabric that moves and flows organically, coming alive with each movement.

# MICHAEL PAWLYN

## ARCHITECT

**Exploring the infinite possibilities of biomimicry**
Michael Pawlyn is a British architect known for his interest in biomimicry and innovation inspired by nature. His firm, Exploration Architecture, uses this approach to rethink construction and develop solutions that use resources in a much more sustainable way. "Complex organic structures, like shells, are incredibly efficient, and with computational design and 3D printing, it's getting much easier to mimic that level of complexity and efficiency," he explains. For example, by modeling a bird's skull, enlarging its structure and 3D printing it, Pawlyn has created a model of an incredibly light pavilion structure that is robust and highly efficient in terms of materials. As in shells and feathers, very thin surfaces are transformed into solid structures by folding and bending them. By bringing together science, art and computational design, it is possible to get closer to the way organic forms work in order to create structurally efficient architecture that produces no pollution.

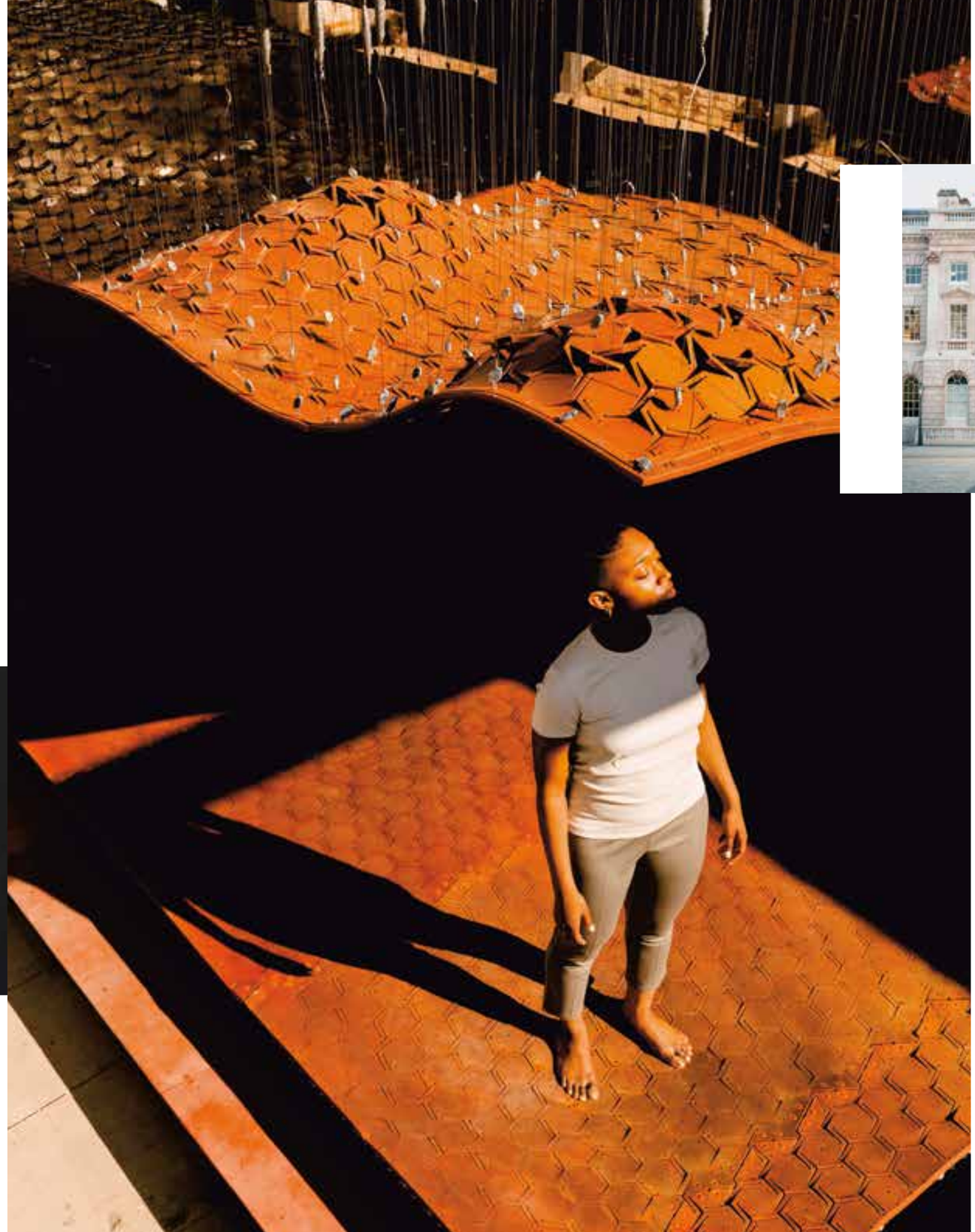


# THIERRY MÉTROZ

## HEAD OF DESIGN, DS AUTOMOBILES

**Reviving a legend with the DS Aero Sport Lounge**
In *Mythologies*, when considering the DS, the legendary car designed in France in 1955, Roland Barthes wrote: "I think that cars today are almost the exact equivalent of the great Gothic cathedrals; I mean the supreme creation of an era, conceived with passion by unknown artists, and consumed in image if not in usage by a whole population which appropriates them as a purely magical object." In 2009, the PSA group revived the DS brand, which symbolizes a combination of French elegance and technological progress, condensed into a very modern form. Thierry Métroz, head of design at DS Automobiles, explains that the DS Aero Sport Lounge concept car was initially inspired by the tradition and avant-garde spirit of the original DS, and features numerous technical innovations, both in the car itself but also its design process. "80% of our design process is digital," he explains. The team of designers uses parametric modeling to create the initial shape of the car, resulting in benefits such as reduced wind resistance. The design is then reviewed and refined using immersive virtual reality software.





# NASSIA INGLESSIS

## DESIGNER, ENGINEER AND ARTIST

**Creating interaction**
Nassia Inglessis is a designer, engineer and plastic artist. She is the founder of experimental design studio Studio INI, which has offices in London and Athens and creates immersive experiential environments. *Urban Imprint* is an installation that reinvents the urban landscape, creating a malleable, flexible environment around its inhabitants: a flexible floor depresses around their feet, causing an equivalent movement in the ceiling. *Disobedience* is a 17-meter kinetic wall that visitors can walk through, with flexible walls that bulge open around them as they pass through the installation. A steel spring flexes open in response to the weight of a person's step, causing the walls – made of recycled plastic – to change shape. The design tools and processes Inglessis uses allow Studio INI to move very quickly from the digital to the physical realm by testing complex designs. "We always have one hand on the computer and one hand on the material," she says.