SCAN THIS IMAGE –
how to use the augmented reality options

Augmented reality makes the fascination of Porsche an even more intense experience. Simply download the Porsche Newsroom app from the App Store or Google Play, select the augmented reality function in the menu and look out for the labels SCAN THIS IMAGE and SCAN THIS PAGE. View the labelled images and pages on the screen of your smartphone or tablet – and bring the content to life.

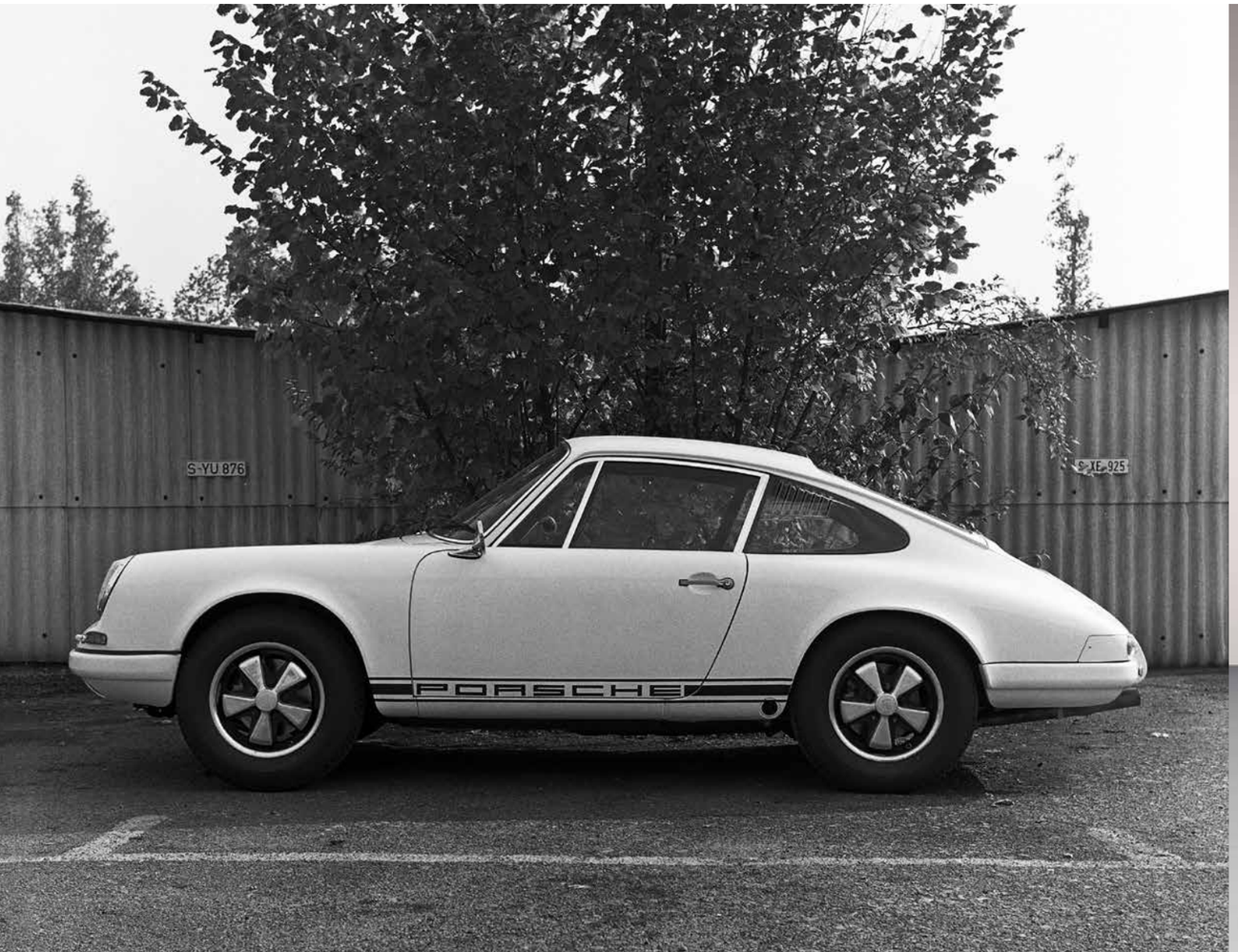
Perspective.

Annual and Sustainability Report of Porsche AG 2016

PORSCHE

Unmistakable.
A refusal to conform.
The future is the destination.
Closer every day.

Tradition.
Innovation. It started with a great idea.
The past tells us how it became a reality.



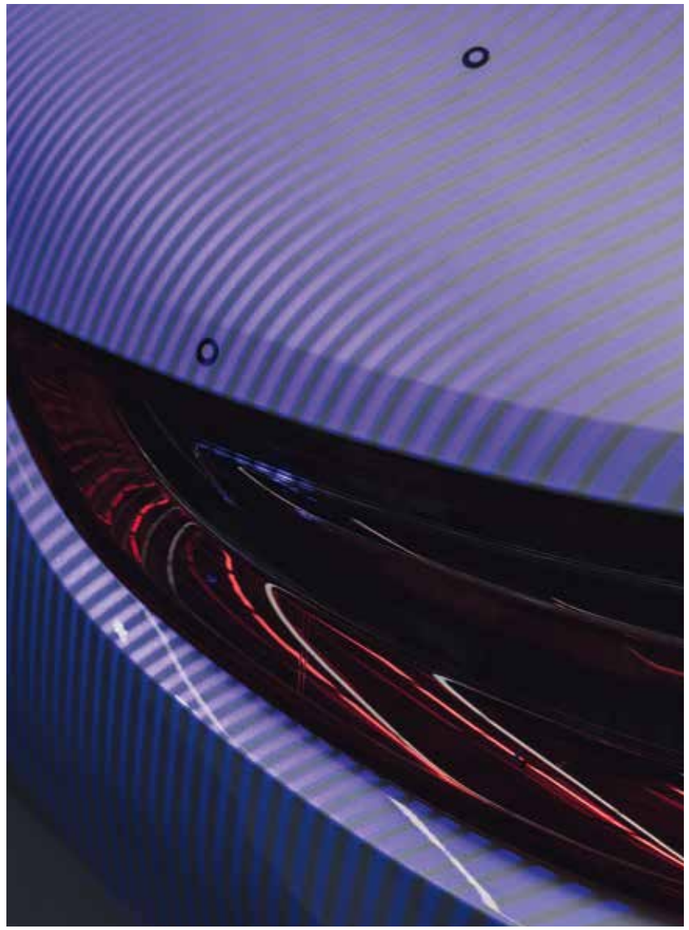
911 R: Fuel consumption combined 13.3 l/100 km; CO_2-emissions 308 g/km

Dynamics.
Power. Perfection.
Search for the ultimate.
The synthesis of
sport and series.

Performance.
For night and day.
Passion and intellect.
Feel the pulse.
Reason is alive.

SCAN
THIS IMAGE

Courage.
Inspiration. Movement.
Courage changes everything.
Without courage, tomorrow
would be no more than yesterday.



SCAN
THIS IMAGE

Panamera 4 E-Hybrid combined fuel consumption 2.5 l/100 km; CO_2 emissions 56 g/km; combined energy consumption 15.9 kWh/100 km

Reflection.
Never forget. Look back.
So you can move forward.

Cities grow.
Everything is connected.
The need for individual
mobility remains.

Motorsport.
Project. Passion. Desire.
Endurance test for the road. Always.
Victory for the customer.

People.
Us. Working together
breeds success.
Staying together
is the future.

Form as a language.
Design as a function.
Conceptual harmony.

Perspective.

Sustainability in practice is an overall strategic objective for Porsche. Economic success, environmental awareness and social responsibility are not opposing concepts for the company. On the contrary, they are combined to form an overall idea that defines the company's attitude.

Economic success is one of Porsche's distinctive features, as is social compatibility. As a manufacturer of exclusive, powerful sportscars, Porsche is committed to achieving greater acceptance of its company and products around the world through socially and environmentally responsible conduct. Responsible actions that benefit not only the company, but also the environment and society, are not only what is expected by customers, business partners and investors – they are also crucial for ensuring competitiveness.

For the first time, Porsche has published a combined Annual and Sustainability Report. It wishes to consciously demonstrate that these two subjects are inseparable. Economic strength, innovative vehicles, customer focus, environmental protection and employee responsibility: Porsche sets the highest standards in all areas and wishes to undergo continuous, long-term improvement.

You have two volumes in front of you: "Perspective" is intended to inspire, motivate and encourage you, to confront, challenge and familiarise you with the topics and theories that an automotive company such as Porsche faces in times of great change in the industrial system. What significance do origins have for the future? What about the spirit of enterprise? How much empathy do leaders need? Where do the benefits of digitalisation begin and when the control of people? Does "failure culture" mean allowing failure to happen or making new ideas possible?

Inspiration is complemented by information regarding the Porsche philosophy within the triangle of electrification, digitalisation and networking, or consider our innovations in vehicle production, or how Porsche is helping to develop a region.

The second volume is called "Performance" and contains all events from the 2016 financial year. It contains trends, summaries, explanations, key performance indicators and documentation regarding Porsche's overall commitment to sustainability in all facets of the company.

The two volumes may be different, but they have one thing in common: communication on different levels. That is why some of the articles offer you the opportunity to experience "augmented reality". Information regarding this can be found on the relevant pages – where surprises await you.

Self-motion is individuality plus freedom. That is the origin of the automobile, and even more so of the special and exceptional automobile that expresses the idea of personality, behind which technology is the means to achieve freedom.

We are emphasising our tradition and shaping the sportscar of the future

Interview with Oliver Blume

What does value-creating growth mean? How sustainable is the Porsche business model? And how is digitalisation changing the working environment and staff structure? Chairman of the Executive Board Oliver Blume discusses the 2016 financial year, Strategy 2025 and combining tradition with innovation.

Oliver Blume, since becoming Chairman of the Executive Board at Porsche AG, you have always stressed that the most important thing for you is not necessarily how many cars you sell. Are you a sceptic when it comes to growth?
If you want to measure success in terms of sales alone, then I would actually say I'm very sceptical.

Why?
Size alone is misleading. And for me, growth is not a matter of size. I associate growth with quality and actions that take a long-term view. What's the point of being successful in the short term if your company is not competitive over time?

You sold 238,000 vehicles last year – that's only 6 per cent more than in the record year of 2015. Is this enough for you?
It's extremely satisfying, particularly because we were able to substantially increase our profits and our returns again at the same time. Our return currently stands at more than 17 per cent. Delighted customers, solid returns and secure and attractive jobs are more important to Porsche than unit sales.

In macroeconomics, there have long been debates about the importance of growth for company success. Is growth alone of no merit?
Growth alone is not an indicator of company success. Growth must create value.

Value for whom?
For Porsche, for our shareholders, for customers and partners, and ultimately for our employees.

Can you clarify exactly what you mean by the term "value-creating growth"?
Value-creating growth is the hub of our Porsche Strategy 2025. It focuses on four overarching goals. Firstly, customer delight achieved through a unique product and brand experience. Secondly, excellent profitability. Thirdly, innovation and sustainable actions. And fourthly, to be an attractive employer and business partner. Buyers want inspiring vehicles. We need capital for investment and innovation. The success of our company depends on whether we can retain talent to a sufficient degree. If you want to create sustainable value in the long term, it's not just about understanding the relationship between financial earnings and value creation for people and the environment. You also have to justify this aim to a society that's becoming increasingly environmentally and socially minded.

How surprising is it for an executive in the automotive sector who earns his money from high-performance sportscars to acknowledge this?
Not surprising at all – the two are absolutely consistent. Value-creating growth is not a marketing slogan. It is primarily underpinned by one thing: working systematically. I mean strength of innovation, I mean competitive productivity, I mean being able to respond to customer requests quickly and appropriately, and I mean having clear organisation with efficient processes that work well. In all modesty, Porsche has shown itself to be very well positioned in this regard – when it comes to technology, product range and profitability in equal measure.

How do your figures look for 2016?
Our final results are very positive. We've successfully completed three major model changes with the 718 Boxster, the 718 Cayman and the new Panamera. We've also invested heavily in future products, electromobility and digitalisation. At the same time, deliveries rose by 6 per cent from 225,000 to 238,000 vehicles. The operating result even increased by 14 per cent, from EUR 3.4 billion to 3.9 billion. We led the pack in customer satisfaction surveys, such as J. D. Power. We've also created more than 3,000

718 Boxster/718 Cayman: combined fuel consumption 7.4 – 6.9 l/100 km; CO_2 emissions 168 – 158 g/km

new jobs. And we've become world champion in motorsport and won the most famous race in the world, Le Mans.

Even by Porsche standards, 2015 was an extraordinary year, the best year to date in the company's almost 70-year history…
…and the fact that we managed to add to this in 2016 just makes it even better. We are picking up pace – moderately but continuously. The trend in earnings is exactly where we predicted. To achieve the operating result, we concentrated on consistent cost management and improving our mix in the markets and product lines. Changes in exchange rates were another positive factor. In view of the extensive investment and development expenditure for the future of the company, ending the year 14 per cent above the record value of the year before is even more of an accomplishment.

Where is the limit? Is it 250,000 vehicles a year? 300,000? More?
Unit sales are not what we're working towards. They would be the outcome. I can only assure you of one thing: A Porsche will always be a brand promise. What we need to do now is adjust our organisation, structures and processes to our growth level and to make the company robust for the future.

What importance does Porsche as a company put on sustainability?
Cars have a considerable impact on people, the environment and society. They use up resources when they're being made and when they're being used. They emit pollutants, make noise, take up space. They have to be repaired and somewhere along the line they have to be recycled. What's clear against this background is that we shoulder a very particular corporate social responsibility.

Of the company's own volition or because you have no choice?
Because of our own conviction! Porsche has always understood that financial success has to be combined with social responsibility. This stems in part from being a family company. There's no contradiction there. It's part of the Porsche philosophy that we embrace.

And that's true for sportscars and the environment?
Put it this way: There are times when we could make it easy for ourselves. Porsche currently has a global market share of 0.3 per cent. In other words, we make three out of every 1,000 cars. The impact that our sportscars have, let's say, on changes to the global climate, therefore falls far short of being significant by anyone's estimation. So we could say, "No problem, then." But it's not that easy.

Why not?
Firstly, apart from the increasingly rigorous legal limits that are being imposed on emissions, our responsibility is not something that can simply be shaken off – regardless of what we do, regardless of how we do it, regardless of how much we do. Either sustainability runs through the very heart of a company's social responsibility, or it doesn't. Secondly, the demands of internal and external stakeholders regarding corporate transparency have increased sharply. People – our employees, customers, suppliers – self-evidently want to know how we are addressing financial, ecological and social challenges and how we are tackling megatrends such as climate change, scarcity of resources and future mobility. And our response to this and resulting actions have to be just as self-evident and credible.

What does sustainability mean for you personally?
Acting responsibly – without jeopardising the opportunities of future generations.

And what does it mean for Porsche?
That sustainability has been grounded in our Porsche Strategy 2025 as a cross-sectoral issue for the first time. That Porsche has become a member of B.A.U.M., the corporate network for sustainable business. That we were one of the first companies in Baden-Württemberg to introduce an environmental management system at our Zuffenhausen site back in 1996, and that in 2016 we rolled out this system to all external sites and audited them. And that we are constantly driving forward many different measures: reducing the use of resources in production, mobility concepts for employees, and launching an integration year for refugees, to name just a few.

You have also set up a sustainability advisory committee – with prominent figures such as former Environment Minister Klaus Töpfer and government advisor Lucia A. Reisch. What is the committee's role?
To be a source of inspiration and ideas, and to support the Executive Board. This includes monitoring trends and identifying key issues.

How hard is it to communicate, in a credible way, that high-performance vehicles with up to 900 hp can have fuel consumption values of comfortable run-of-the-mill cars?
Let's put it this way: it's not always easy. There are many preconceptions. People can't always grasp, or don't want to grasp, the fact that huge steps forward have been made in the automotive sector. It's easy to demonise our industry. But at Porsche, we never stop trying to find the perfect combination of sustainability and sportiness. A Porsche 911 has always been the most sustainable car in its class. Where others use ten cylinders, we limit ourselves to six, and we're faster on any race track. This way of thinking is deeply rooted at Porsche.

Is that one of the reasons why Porsche is combining the Annual Report and the Sustainability Report for the first time this year?
It's an indication that what belongs together goes together. We also want to make it clear that sustainability underpins the way we lead the company. Previously, if you were a shareholder, journalist or analyst, it was only a company's Annual Report that was compulsory reading. The Sustainability Report was simply a nice little magazine to read on the side. Since then, the importance of each has clearly shifted. Sustainability plays a part in competition and is a key distinguishing factor.

The motto of the Porsche Strategy is "The future of the sportscar". What do you mean by that?
In summary: The sportscar of the future will blend the history and values of Porsche with innovative technologies, while at the same time ensuring sustainability. Electromobility, digitalisation and connectivity play a key role in this regard. Recent months have seen us launch a whole host of new products. And that's something that's set to continue over the coming years. As we've already demonstrated with the new Panamera, going forward we'll place a greater emphasis on combining digital innovations and state-of-the-art drive concepts with sporty driving dynamics. And at the same time, we'll continue to delight fans of the brand by delivering classic, particularly purist sportscars.

What does that mean exactly?
It means that as part of our plan for the future, we're thinking hard about the drive mix that makes the most sense in each model line. What suits the Panamera or the Cayenne is not necessarily right for a two-door Porsche sportscar.

As Ferry Porsche predicted many years ago, the last car ever made will be a sportscar. Will Porsche also be the last car that is fully electric?
In 2019, the Mission E will be the first purely battery-powered sportscar, as only Porsche could make.

Other manufacturers have been quicker to electrify, including at the premium end of the market.
Porsche stands for driving dynamics, drive and design. On the race track, we're constantly learning more about storage technology, energy recovery and system control. This is incorporated directly into series production; we're always ahead of the pack in this respect. When it comes to issues like autonomous driving or connectivity, we don't necessarily have to be the first. Instead, we have to offer solutions that perfectly meet our customers' needs.

Nevertheless …
… Porsche was the first car-maker back in 2014 to be represented in three premium segments at the same time with innovative plug-in hybrid models. In motorsport, we've demonstrated that you can win even the most demanding long-distance races with innovative hybrid systems. And please don't forget that Porsche invented the hybrid drive! I think that puts the issue of being a technology leader to rest. We fully champion the hybrid – as transitional technology. As the purely electric range that can be achieved increases, so too does its appeal. In the new Panamera, this range is approximately 50 kilometres.

… would you prefer to launch the Mission E earlier?
2019 is exactly the right time.

How much Tesla is there in the Mission E?
Nothing at all – apart from the fact that both cars have purely electric drives. I think what Tesla is doing is innovative and bold. It's generated huge traction and I have great respect for them.

Even more so than electromobility, the issues of digitalisation and connectivity will change business in the sector – right through to the self-driving car.
Both the technological possibilities and the social demands on mobility will change, and quite considerably. This is what we call "mobility of the future". It's characterised by digital connectivity, emission-free drives, an understanding of mobility that is new yet still typical of Porsche, and by fresh new thinking. We are working hard to prepare ourselves for this. And we're already starting today by developing innovative services for the mobility of tomorrow. Offering services of this kind will become increasingly important going forward. The same is true of autonomous driving.

What do you think of autonomous driving?
I don't believe in a Porsche that is defined by autonomous driving.

No?
Essentially, you always want to drive a Porsche yourself. No question. But Porsche and autonomous driving are not contradictions. Our aim is to define the autonomous driving functions that suit each model across the model lines – and the functions that don't. There will obviously be fewer in the 911 than in the Panamera, for example. What matters is to do one thing without neglecting the other. One thing is clear to me: Even if a Porsche can drive automatically, the experience of driving it yourself must still be an emotional one.

How do you envisage that exactly?
Imagine you've arranged to meet up for dinner in town one evening. You can't find anywhere to park. You're short on time so you pull up outside the restaurant, get out and then the car looks for somewhere to park itself. When you leave the restaurant, the car is there to pick you up, with a full tank of fuel and sparkling clean. Or let's imagine you're on your way to work in heavy traffic and want to take a look at the newspaper – and the car chauffeurs you through the congestion. But I can also imagine exciting solutions on the race track. You could use automated driving functions to practise taking the racing line in sporty driving. There are absolutely no creative limits.

So the assumption is that the digital transformation will impose huge structural change on the industry. It will be a complete break with the previous system, and existing value creation chains will be blown out of the water. Do you agree with that assessment?
In principle, yes.

Is there anything about it that isn't true?
It sounds a little over-dramatic. One thing is clear: Digitalisation is bringing about a huge shift in the automotive industry. Our products, production, processes – everything is being scrutinised. But we won't see everything change overnight. Digitalisation is a huge challenge. But at the same time, it is also a great opportunity to combine decades of experience in making sportscars with fresh ideas and new approaches. It's more important than ever to take the history of our company into the future.

Is digitalisation the solution to everything?
Digitalisation cannot be an end in itself. But we'll use it in all areas where it enhances customer functions or makes processes easier. In doing so, we'll concentrate on three core areas: firstly, on our products and services; secondly, on our customers and trade, and thirdly on the company itself. People are always at the heart of what we do – whether it's customers, business partners or employees. So we won't just guide people towards digitalisation without first considering how appropriate this is. In my view, success hinges to a considerable extent on whether digital technologies and processes are simple and intuitive to operate and use and whether they bring clear, recognisable benefits. Customers are the driver of change.

In one sentence, how will Porsche change?
Tradition will meet innovation.

Innovation plays a large role in your Porsche Strategy 2025. Is Porsche not innovative enough already?
Porsche has always been innovative and will remain so. But we're approaching the issues in a more systematic and structured way. We're concentrating on areas in which Porsche is particularly strong and where we can lead the competition in future, for example in design, drives and vehicle architecture, but also associated materials and production processes – in a nutshell, Porsche Production 4.0. We're working in a more networked manner, speeding up our processes and using resources more flexibly.

Is that why you founded Porsche Digital GmbH?
It's one of the reasons.

What's the thinking behind it?
In short, Porsche Digital GmbH is our competence centre, where vision is turned into reality. We identify digital customer experiences, products, areas of business and processes and develop them further. We look for suitable partners and get involved in funds and start-ups. We test and implement new value creation models and innovative products. We investigate what brings real value to customers and what improves our processes in the company. The skill is in combining Porsche's automotive expertise with digital expertise. The goal is to develop Porsche into a leading provider of digital mobility solutions in the premium automotive segment.

The Porsche Development Centre in Weissach has been your ideas factory to date. Will the future of Porsche now be determined elsewhere?
Weissach is and will remain our innovation centre for new products. But new ideas are just as likely to emerge in other areas, such as in procurement, production or sales. And that will remain the case in the future. Working closely with the divisions, the new subsidiary focuses particularly on the entire spectrum of digital topics.

In Berlin, you have founded the Porsche Lab, also something of an ideas factory.
You could put it like that. Porsche Digital GmbH and Porsche Lab work hand in hand. While Digital GmbH concentrates on the development of products and services for customers, the focus in Berlin is on trialling and applying digital technologies to company processes.

Digitalisation and a new innovation management structure will also change the corporate culture. Is it possible to impose an ideas culture?
No. It's not like switching on a light bulb.

Can you teach people how to be innovative?
That's difficult too. The desire to be innovative comes from each individual. But you can impart knowledge. You can improve skills. You can create an organisational framework in which people develop better.

How do you plan to go about establishing an innovation culture akin to the philosophy of Apple or Google – companies rumoured to have considerable ambition in the automotive sector?
We don't want to be a clone of Apple or Google. Porsche is Porsche. And Porsche will remain Porsche. But we can create an atmosphere that encourages even more creativity. People are at the heart of it. If creativity is to lead somewhere, I have to understand what makes people come up with ideas or what might stop them from doing so. What creative freedom do they need? How do we handle mistakes? An innovation programme does not invest in patents, it invests in people.

What kind of people do you need?
There are people who enjoy entering uncharted territory, who are passionate about digital topics, who relish the idea of solving problems and who don't shy away from making mistakes. They have to be prepared to challenge established processes, to experiment, take calculable risks and break new ground. It's a question of creating space for new ideas and re-assessing entrenched structures.

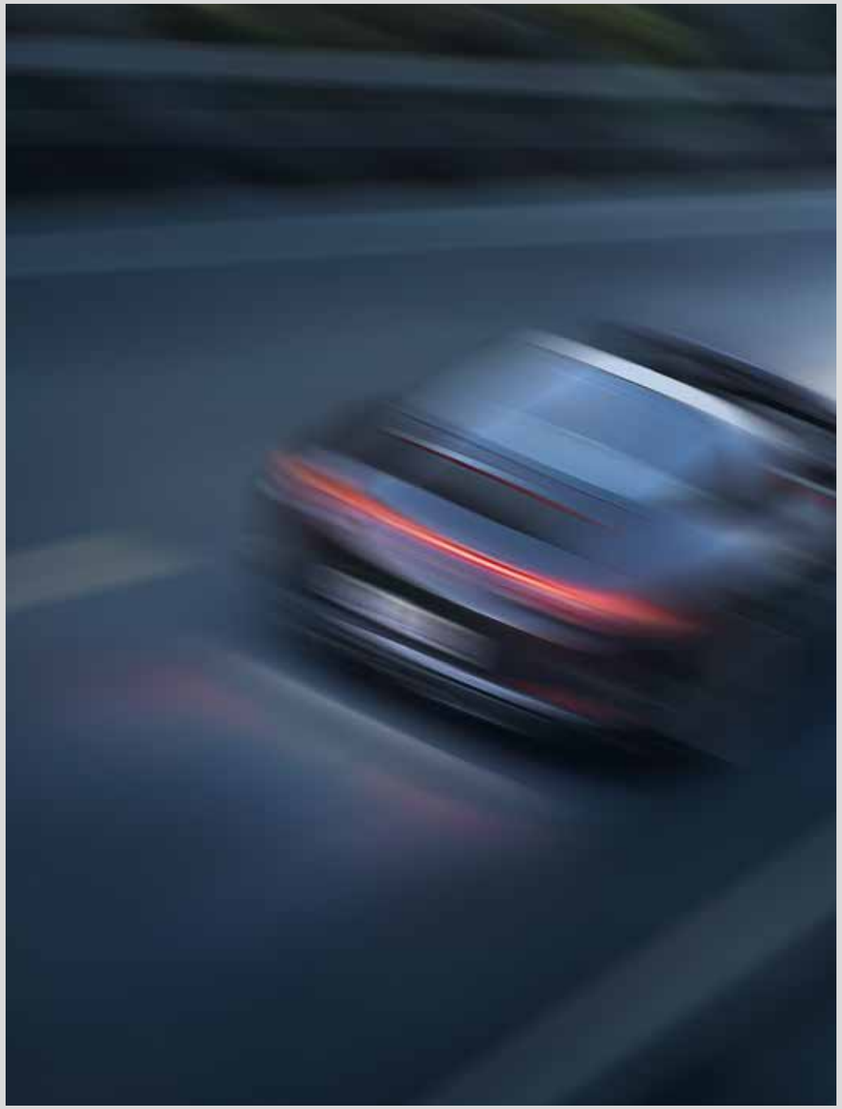
Does more employees with an IT background mean there will be fewer from a conventional engineering background?
Yes, the structure of the workforce will definitely change. We're planning to boost the number of employees in the area of digitalisation from just under 600 today to about 900 by 2019. And not just at Porsche AG, but also at subsidiaries such as Digital GmbH. The percentage of employees with a degree in IT will rise.

Will Porsche become a different company?
Our aim is not to change our character. What we're aiming for is to systematically generate ideas across all divisions, and for these to be put into practice quickly and flexibly. We want rapid responses to urgent questions, without being blinkered in our approach. What we don't want is a culture of avoidance, but an enterprise culture in the truest sense of the word. We don't want to be any different, we want to be better.

What's the biggest obstacle?
Thinking that a continuous improvement process is already innovative enough! If we make everything a little quicker, easier and cheaper, then everything will be fine. That's true, of course, but only to a certain extent. For a truly innovative company, success in itself can put you at risk if you only rely on what you've always been good at and are always able to do it a bit better. Truly innovative companies also have the courage to challenge the fundamental things.

Where do you see Porsche in 2025?
No-one knows exactly what 2025 has in store. What matters more between now and then is having a clear vision with specific goals, and being ready to learn and adapt to changes in a flexible and open way. This is the approach that we've set down in our Porsche Strategy 2025. No matter what, Porsche will remain Porsche. The leading provider of exclusive and sporty mobility.

Self-motion



YESTERDAY, TODAY, TOMORROW

If you know where you come from, then you can move forward in a logical way. On the relationship between the past and the future.

Wolf Lotter

EVERYTHING IS IN MOTION

This phrase has long been used by people to describe change in society, culture, technology and their personal lives. *Everything is in motion* is a sentence that each generation has spoken and thought. And they will continue to do so. There is no such thing as inertia. Sometimes it seems to exist.

But this is actually due to the measuring instruments that we use. They make us believe that the world is a static and calm place in which everything is just the way it has always been – and in which the concept of change is not a factor. A world that believes everything is motionless is a world that looks downwards for orientation. We see that our two feet are standing firmly on the ground. We are at peace. All is well. But look up and you will see that the world is turning. Should you look up or down? It sounds as if we have a choice, but that is not true – not even for those who believe that everything can be left the way it is. After all, things are fine that way.

In his novel "The Leopard", the Italian writer Giuseppe Tomasi di Lampedusa wrote the central maxim for change in all successful systems, a transformation formula for all those who enjoy success but, through their wisdom and insight, are still prepared to make a break with the past in order to take on the new: "Everything must change so that everything can stay the same".

The fact that everything must change does not mean that you should wreak havoc on everything that is important to you. On the contrary: If you want to effect a positive change, then you must sharpen your perception not just of what is to come, but of what you are. If change is around the corner, then self-awareness can come to your aid.

But the future makes us uncertain and anxious. Perhaps surprisingly, this is a particularly widespread phenomenon in societies that enjoy a high degree of prosperity. If those with material wealth are not prepared to initiate change, then who should? Does acceptance of the new require you to be under increased pressure? Or would it not be enough to curb indecision and hesitation by seeing the world from a new perspective? Let us try to look at change from a new and different vantage point.

The best place to do this is on the road, where life plays out before us. Let's take a drive.

In a vehicle, you have three possible angles of view. Naturally, it's best to look straight ahead – after all, this is the direction in which you are travelling. Looking ahead allows you to make all the relevant decisions. We might say that it is also the direction of change. When the road is straight, then you can see everything. But behind the bends lies the unknown. So you drive with caution, using your knowledge, skill and personal and organisational expertise – all attributes that you have acquired over many years of practice. Perfect roadholding is the sum of our experience.

But you can also look back and make sure of what is behind you by checking your mirrors. Every learner driver knows how important it is to check their mirrors if they want to drive safely. If a person is confused by motion and change, then in our example, instead of looking primarily forwards and occasionally back, they would spend virtually the whole time staring out of the side window, struck by panic. What would they see? If the vehicle is moving quickly, then almost nothing, as the landscape and other objects lose their contours. The view out of the side window is the view of the present. This is where motion becomes compressed. It falls in on itself at a narrow point and within a narrow timeframe. What we perceive there confuses us, makes us uncertain.

If you want to understand your role in a transformation, and in the continuity of change, then you must become aware of this phenomenon. The view from the side window of history shows us too much, and at the same time, not enough. Your current viewpoint is overlaid with countless details, making it much less clear than your view of your own history and of the malleability of the future.

If you want a transformation to succeed, you must therefore be ready to turn your head. Look forwards and occasionally look back. Once you have achieved this interplay, once it is fluent and proceeds without interruption, then the correct orientation will be possible, giving you a good perspective on the phrase *everything is in motion.* Then everything will exist in a "systematic or logical connection" – that is how Merriam-Webster defines the term "coherence".

The word "coherence" comes from the Latin "cohaerentia", meaning "cohesion". It is a key term in the field of change. The view from the side window towards the present day, and the lack of awareness of change and the future, form the basis of disorientation. If you do not know that you are in motion, or how that motion is taking place, and if you can no longer see the contours – just like when you look out of the side window – and the information you obtain makes no sense, then it is here that transformation, something that has gripped so many facets of life today, becomes a completely insurmountable task. Of course, the transformation happens anyway. But those suffering from "future shock" – as the writer and futurist Alvin Toffler called it in the late 1960s – because they believe that everything today is already overwhelming and moving much too quickly, are unable to make decisions and take action. They fail to keep pace. At best, they lose valuable time. The change is made in any case – after all, the world does not stand still.

Coherence is so important because it gives us context that shows where we come from, who we really are and what part we play in the change. Coherence is not born out of a momentary snapshot. Coherence is like a photo album, a family tree that helps us to understand the present and the future.

This understanding is reflected in a quotation from the German philosopher Odo Marquard: *The future needs the past.* He also explained why it is so important to think of the two together: the past and the future. Since the Enlightenment and the Industrial Revolution, the sciences have changed our lives. The field of science is known to be objective and sober, building on facts and figures. And that is a good thing. But sometimes, it might be possible to lose or conceal something. Like history, for example. This may be history in the sense of an historical analysis, like looking in the rearview mirror: Where do I come from and who am I? And it may be history in the form of a tale, describing a shared heritage that binds us as we move towards the future. Marquard

was a proponent of modernity. He called on humanities scholars, of which he was one, to understand their field of study as being the "narrative sciences". If you understand history, then you can retell it, and learn from it for the future. Out of tradition comes innovation. Slowly, from the innumerable trials and errors of the past, something new is born. But it is not the result of coincidence. Luck plays little part. It is built on conscious experience.

Conscious experience – this is the key to the philosopher Marquard's assertion that the future needs the past. If you know who you are and what you have done, then you also know that you are capable of taking on new challenges. If you want to succeed, then you need to adopt these points of view: The future needs the past – this means being able to identify the turning point of the change and to define the torque yourself. In this scenario, technology becomes the tool for achieving the idea. It turns creative thought into something tangible, and helps us understand who we are. Who among us understands our own history? And where is it taking us?

We live in the age of digital transformation. In the production industry, this is known as Industry 4.0. Looking far back in our car's rearview mirror, we see the beginnings of the Industrial Revolution, of the age when machinery was driven by steam and water, and when automation first began. Later, this initial period of industrialisation that had started over two hundred years earlier was dubbed a "revolution" – a term that is always used to describe an enormous, inevitable and radical change. If you look closely, you can see the connection between the development of that era and one of mankind's oldest dreams, which countless generations have worked towards achieving.

The Industrial Revolution was not an end in itself. It gave the masses a share in material wealth like never before in human history. During the first decades, which have since been termed Industry 1.0, the focus was on the essentials – extracting and processing raw materials like coal and ore, building rail networks and promoting science and technology in education. In this period of radical change, everyone was looking ahead, and everything was in motion. It was a mass movement.

Even today, the term "mass" is closely associated with industrialisation, and that is no accident. The primary goal, the next logical step that was already the subject of discussion in the first few decades of this new world, was to manufacture products in quantities large enough to provide the masses with goods that until then had been the preserve of the rich and powerful. Mass production and mass culture encompassed everything and everyone, providing for strict standardisation. This soon came to epitomise industrialisation, even more so than steam engines and locomotives, which initially defined the vision behind this new form of production. Towards the end of the 19th century, the focus was no longer on the basics of the new world. Instead, it was on goods and products manufactured in large quantities – for everyone.

This was the dawn of the mass production era – Industry 2.0 – driven by new forms of energy, fossil fuels and electrical power. From the beginning of the 20th century, factories increasingly came to be defined by conveyor belts. The concept of "scientific management" developed by the American management consultant Frederick Winslow Taylor became a part of the production process. Every movement was standardised, with everything following industrial norms. This was highly efficient, making it possible to provide a great many things to a great many people. Today, in an age that likes to discuss the notion of excess, this is something that we should take into account. We consider it normal that we have a great amount of choice available to us. But it is not normal at all. We must not overlook the fact that wherever mass production and basic provision are normal, the need for individuality and differentiation grows. People do not want to choose between one thing or another – they want it all: mass supply and diversity and maximum self-actualisation. Is that a contradiction? Or is it a de facto law of nature? There are more arguments in favour of the latter than you may think at first glance.

The American social psychologist Abraham Maslow recorded this fact most effectively in his famous theory of the human "hierarchy of needs" over 70 years ago. At the very bottom, at the first levels of human and cultural development, humans and all other living things are concerned with survival, financial security, food, water and physical integrity. These are followed by social needs and relationships with others. This level includes love, our sense of belonging, and the capacity to understand when it is better to cooperate with others, and when we might benefit from not doing so. All of these needs, which describe approximately the first three levels of Maslow's hierarchy of needs, are familiar to us and determine our cultural and social existence. Organisations and the economy are based on these notions. But what else is there?

These basic needs at the first three levels are merely a foundation. The uppermost levels of the hierarchy of needs take everything personally: According to Maslow, the fourth level is all about the recognition we receive from others for who we are and what we have achieved. It is about respect – a frequent subject of social and political debate today. People want to be different from others. They long to be seen as human beings, as people and individuals. This is a powerful force and a basic need. At the very top of the hierarchy is the desire for self-actualisation, or the opportunity to live one's life. The signpost in this development and evolution is always pointing in the same direction: towards individuality and personality, towards something unique. There is no force that is more powerful. Everything we do boils down to this. Throughout history, there have been countless attempts to suppress individuality, to eliminate and castrate it. Ultimately, they have all failed. As soon as it is possible for them to do so, human beings will search for themselves and their freedoms.

This defines the transformation of today, but it is a long-established idea. Wherever it was possible throughout history, times of good and reliable basic provision have been followed by periods of significant individualisation. The self is the goal that everyone – without exception – strives to achieve.

This became clear at the juncture between Industry 1.0 and 2.0; or in other words, at the turn of the 20th century. The world of technology and progress came to be defined by a new word: *automobile*. It is a term coined from the Greek word "autos", meaning "self", and the Latin word "mobile", meaning "motion". Self-motion. It is not about advancing en masse, swimming with the tide or being driven by others.

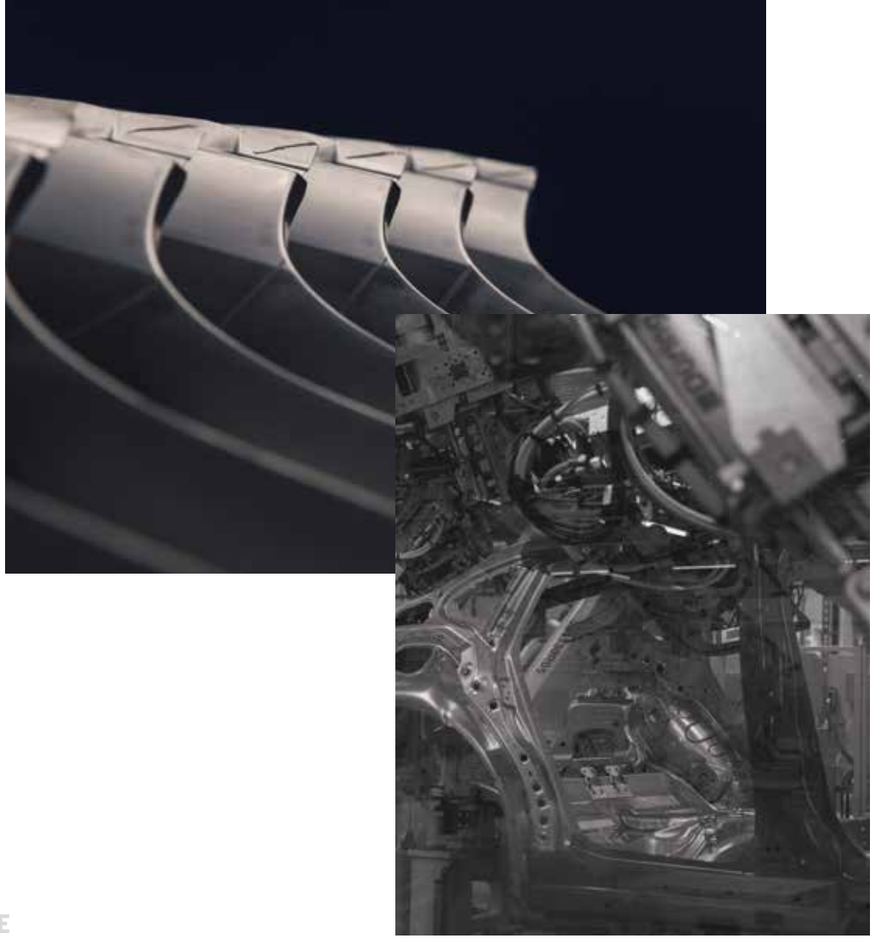
Self-motion is a very self-aware word for a technology that lets an individual go wherever they please – by their own free will, as the situation demands.

Practical freedom always means having space in which to make your own choices. The desire for space and individual motion is much older than the car. This need is part of our evolution. Restricting it comes at a high cost – the loss of personal freedom. A society based on division of labour, which grew up around industry, no longer offers everything in one place. Specialisation virtually always means physical separation, and this requires movement, exchange and availability. This is still the case in the age of digital networking.

On the face of it, digital technology seems capable of overcoming physical boundaries. But the less you need to move – through the power of digital networks – the more you want to move. Only at first glance is this a contradiction and a paradox. Research shows that in older, pre-industrial societies, mobility was in most cases caused only by external forces, perhaps because of the need to escape enemy soldiers in wars, or because natural disasters made it impossible to stay in one's ancestral home. Without these external factors, the stationary society was generally immobile.

Today, this circumstance is romanticised and glorified, as if people would have voluntarily stayed put. This is a fallacy that overlooks the fact that the everyday immobility of the majority came not from free will but from need and constraint. Inertia was the result of deprivation, poverty, hardship and dependence. Look in the rearview mirror and this becomes clear. Some people could not leave because their right of free movement was taken away by rulers and feudal lords. This was a trend that continued well into the 20th century in the form of travel bans imposed by various dictatorships. Many also lacked the ways and means to move according to their own free will. The major migrations of the 19th century, in which sometimes whole towns and districts moved from Europe to the USA, provide evidence of the link between mobility and the biggest social and personal hopes of the day, just as today's migratory movements do. People who set out on such a journey are searching for a very personal happiness, not that of an anonymous mass. Human beings move by themselves and for themselves.

It is no accident that the age of modernity was ultimately always perceived as an era of movement. Inertia is not an idyll – it is an illusion of calm. One variant of inertia is routine, in which there is movement but also monotony, a lack of variety and, above all, no way for people to choose their own course. This is exemplified by the story of Sisyphus in Greek mythology, who



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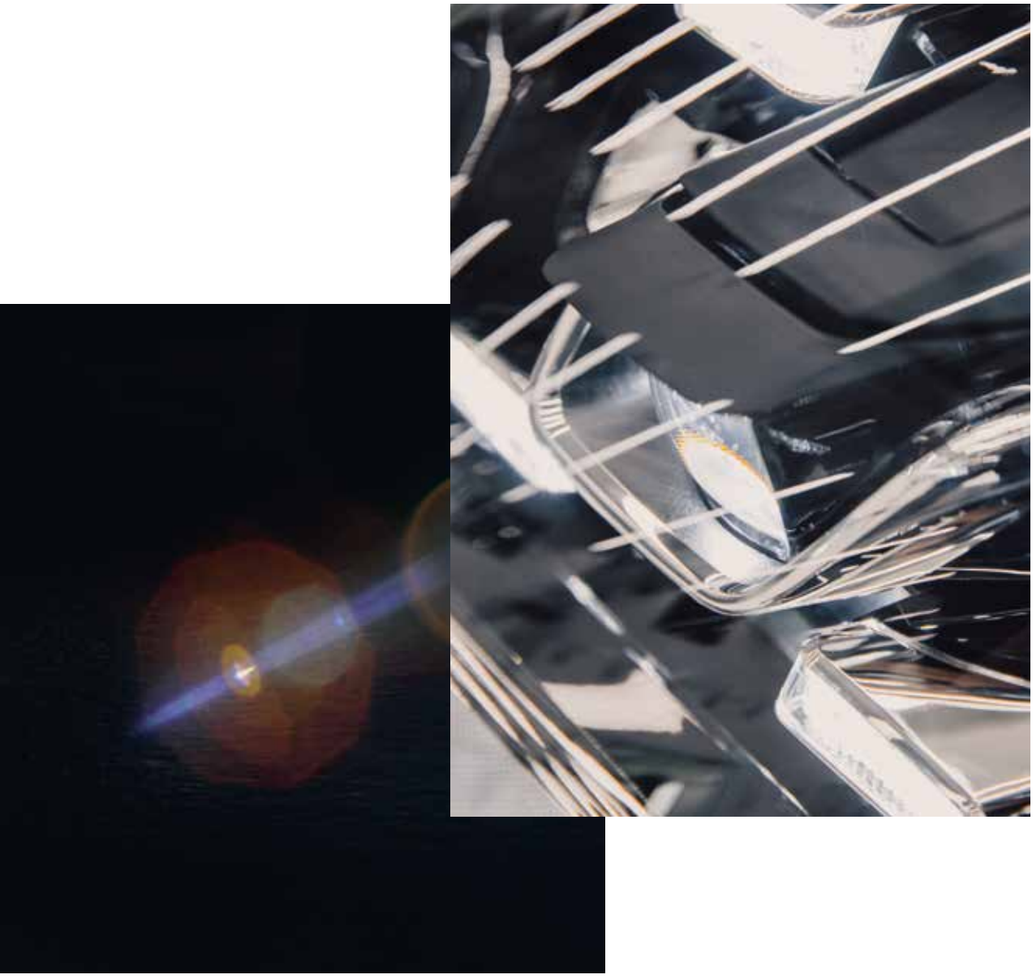
Culture plays the same role in communities, and by extension in companies, as identity does for individuals: It is the capacity to make a difference.



fell out with the gods of his age and faced the most terrible punishment: To spend all of eternity rolling a boulder up a hill, and then, just before reaching the summit, see it roll back down into the valley. Behind this is the horror of things forever being the same – of being in an endless loop. This is perhaps the most severe punishment that could be imposed on an intelligent being that was created to seek self-determination. To force people into inertia and mindless repetition is inhumane.

It is no coincidence that the right of self-determined movement has played such an important role in the history of liberation movements. Free movement is an opportunity to find happiness – to live your life.

This is why movement and mobility came to epitomise modernity, in which human beings moved from the world of the fateful towards self-determination. Self-motion is individuality plus freedom. That is the origin of the automobile, and even more so of the special and exceptional automobile that expresses the idea of personality, behind which technology is the means to achieve freedom.

The idea of freedom and independence is anything but obsolete. Today, even more than our ancestors, we seek self-determination and self-actualisation. For decades, it has been clear that the need for differentiation is increasing all the time. The more effectively and efficiently people are supplied with mass-produced consumer goods, the more pronounced their need for differentiation becomes, and the more they wish to set themselves apart from the crowd and from the idea of conformity. Behind the best product, there is an even better idea. Behind the car is the idea of self-determination and freedom. This has long been used as the measure of human happiness, and it will continue to be used in this way. It is what drives people.

Let us look back again so that this becomes clear.

The consumer society that grew up after the Second World War was one of mass production and mass consumption, but it also represented a turning point. Where basic provision is secured, personal needs take greater precedence. Issues like individuality have been on the agenda since the 1960s, but so has the issue of developing a new understanding of how to treat the environment and our resources. And such issues will not go away. There is a connection between all these discussions and the search by many in society for greater differentiation. The so-called Fourth Industrial Revolution – Industry 4.0 – follows precisely this line of thought. Digital networks are entering the world of production, and this means that an unprecedented degree of personalisation can now be achieved in this area. It is possible to meet an individual's demands with ever greater precision.

This strengthens brand identities. These are good times for anyone who is able to make a difference with their products and ideas, but who is also challenging boundaries. This is the essence of true originals, of all those companies and their protagonists who see two unmistakable objects in the rearview mirror: identity and a strong culture.

What impact does a strong culture have? It provides orientation. In other words, it takes the complex issues that have long shaped the world and turns them into something understandable. This is the central accomplishment of a culture. At the same time, a strong culture is also able to inspire – one of the most important prerequisites for our ability to imagine new things, as neuroscientists have found. Learning is the way we process new things. It is how we deal with innovations and change. There is a clear link between what exists in our consciousness from the past and from tradition, and what we are capable of creating.

Culture plays the same role in communities, and by extension in companies, as identity does for individuals: It is the capacity to make a difference.

People have long bestowed great value on the idea of differentiation. This is no accident, because differences are what give the world order and make it possible to understand. Differentiation is a central resource of the knowledge society – perhaps even its most important. Culture and identity provide orientation. As the world becomes more and more complex, differentiation takes on ever greater significance – and differentiation is inseparable from identity.

We are reminded of the notion that behind the best product is an even better idea. This is what actually drives people's personalities – people who accept the product and the idea behind it and give it life.

The automobile, the tool that enables self-motion, becomes a movement in its own right. Cars are no substitute for individuality – that much is clear. But they are an expression of individuality. They are a tool, a technology that conveys the link between what we are and what we could be. This brings us back to the idea behind the *future needs the past*. The Latin word "vehiculum" establishes this link: In its original meaning, a "vehicle" is not simply a means of transportation – it is a medium, a carriage, an instrument. Or in other words: a tool, a means to an end. It moves our personality. It takes us from familiar and trusted surroundings towards new horizons.

The key to the future can be found in this relationship. Ultimately, what moves us is ourselves.

Wolf Lotter is an economic essayist who focuses on transformation. He is a founding editor of the German economics magazine brand eins.

What we think about when we think about tomorrow

Type number 356, chassis number 356-001, small, light, efficient: It is the sportscar that Ferdinand Anton Ernst Porsche – also known as Ferry – could not find. So he built it himself. It was his dream of the perfect sportscar. Even after almost 70 years, it is both a guiding example and a mission statement: To make the very most of every opportunity, to shape the future out of tradition, to develop techniques for passion and intellect through technology. It embodies the Porsche principle.

They are all legends: 356, 911, 930, 959, 928, 917, 986, 918, 919, 718. The numbers are like declarations of love. But what exactly defines a sportscar? What makes Porsche unique? Is it the exclusive performance? The aesthetic, the harmony of the design concept? The mythology that runs from the race track into series production? It is not one thing alone, but all of them together. With the Cayenne, the Panamera and the Macan, the brand that takes its vehicles to the limits is redefining society's fascination with sportscars.

What do we think about today, when we think about tomorrow? We think about sportscars, but also about sustainable mobility, digitalisation and urbanisation. The Mission E concept study represents our vision of pure e-mobility in the form of a fully electric, four-seater sportscar. When people ask about the sportscar of the future, it has the answers. And it shows that purely electric drives also fulfil our commitment to intelligent performance. The name of this concept says it all: Porsche E-Performance.

Mission E shows how our vision of electric driving will look. What makes us so confident? The answer is simple: We never forget who we are or where we come from.

A Porsche is defined by its innovative technology, functionality and the aesthetics of its design concept. This is true of every model, but especially the iconic 911 sportscar and the Mission E concept study – the first purely electric Porsche.

911 Targa 4 GTS: combined fuel consumption 9.7 – 8.7 l/100 km; CO_2-emissions 220 – 196 g/km

**It is not sustainability that plays a part in digitalisation.
On the contrary: As a technological process, digitalisation may contribute towards the achievement of sustainability.**

Turning thoughts into actions

Dr Sonja Peterson is a member of the Porsche sustainability advisory committee, which provides inspiration and ideas for the company. Here we take a closer look at the internationally renowned environmental economist – and the question of how we can tackle climate change as a central problem for humanity.

Author: Dr Alexandra Hildebrandt

WANTED: A NEW AWARENESS OF COMPLEXITY

The far-reaching social transformation processes that we are currently experiencing are having a profound impact on our existence. Today's challenges are demanding entirely new approaches and solutions for how companies and organisations are managed as well as how societies are configured. If we want to be well prepared for an unknown future, we require new political instruments and management practices, new problem-solving skills and the development of a new way of thinking that encompasses multidisciplinarity, collaboration and an awareness of cycles.

We can only understand and shape a new society if we recognise complexity management as one of our most important resources. This requires experts in complexity.

Experts like environmental economist Sonja Peterson. She bases her actions on what she has learned and internalised: conceptual expertise and a precise, structural approach to thinking and planning. She faces specific situations in a forward-looking way, and is able to examine phenomena and developments from a range of perspectives and develop appropriate scenarios – all as a means of understanding the big picture and grasping complex relationships.

She possesses what the climate researcher Hans Joachim Schellnhuber refers to as "system intuition": This internal compass allows people such as Sonja Peterson to easily transcend specialist disciplines and departmental competencies as well as to make abstract findings comprehensible and methodically applicable. It helps to turn thoughts into actions.

THE INTERDISCIPLINARY VIEW

Dr Sonja Peterson is not just a trained mathematical economist, as well as an environmental and resource economist, but is also very well practised in interdisciplinary thinking and working. As a young doctoral candidate in Kiel, she worked with legal experts, natural scientists and economists in the area of "integrative environmental assessment".

Today, her professional interests lie particularly in the modelling of relationships and interactions between climate change, climate policy and economics. Her fields of expertise include international and European climate and energy policy, bio-energy and land use as well as instruments of environmental policy. In her work, she embraces a broad concept of prosperity that encompasses as many people as possible.

NO SOLUTION WITHOUT DIALOGUE

One of the core questions facing her as an environmental and resource economist is: How can excessive environmental pollution be prevented using instruments of a market economy? And how do we make best use of our ever dwindling natural resources? With regard to ecological sustainability, this is not a matter of restrictions and limitations, but of a better quality of life that is based on integrated, sustainable actions and economic activity.

For Dr Peterson, responsible use of natural resources and transparent access regulations in the producing countries are fundamental prerequisites of a sustainable economic policy. She is convinced that the complex strategies required for sustainable use can only be established in a shared dialogue between the industrial countries and the emerging and developing countries. To be properly equipped for the future, what is needed is a firm political will to proceed down this path, even if this carries short-term costs: "Stringent politics also offer investment incentives – that is, the incentive to invest in new technologies".

Economist Sonja Peterson is convinced of the importance of such incentive systems – not least because greenhouse gas emissions are closely linked to our economic process, particularly with regard to pricing mechanisms (carbon pricing, i.e. emissions trading and taxes), which are increasing the world over. More than 13% of greenhouse gas emissions are already covered by such mechanisms. Dr Peterson believes that these systems not only need to be expanded and interlinked, but also reformed so that they work better. In the EU, for example, this means stricter targets, more sectors, minimum prices and networking with other systems.

According to Peterson, environmental problems can only be properly solved when the economic system is regulated accordingly. One problem with the energy, for instance, is that many countries release emissions into the atmosphere without anyone bearing responsibility or having to pay for them. Economists speak of "negative externalities", which are not integrated in the decision-making process but are damaging to the population at large – in the combustion of fossil energy, climate change is one such negative externality.

However, the field of economics also offers potential solutions that take account of these externalities – for example, by requiring a certificate for the release of CO_2 emissions, as in the case of the European Emissions Trading System: "If you do not have enough certificates, you can either avoid emissions or purchase additional certificates. This ensures that emissions are avoided in the areas where this is most favourable".

CLIMATE PROTECTION: AN OPPORTUNITY, NOT A DISRUPTIVE FACTOR

Global energy use must move away from fossil fuels, with the countries that supply oil, gas and coal suffering most from this development. Sonja Peterson believes that attention must now turn to the question of how best to compensate the relevant parties.

The fact that decarbonisation was discussed at the most recent climate conferences can be considered real progress, she says. However, credible negotiations and decisions regarding possible compensation – such as through emissions rights, technology transfer or development aid – are only possible if the aim of these discussions is to leave fossil fuels in the ground and truly decarbonise global energy use.

According to Peterson, the sustainable energy system of the future will be based on a range of renewable energy sources that will be used according to their availability. These include geothermal, wind and water energy as well as bio-energy – primarily from residual or waste materials – and, of course, solar energy. The latter is the only renewable energy source with "virtually unlimited potential". In the long term, it will have to serve as the fundamental basis of our energy system. From a short-term perspective, "energy conservation" is the most important sustainable energy source.

Sonja Peterson wishes to contribute to the effort to solve the climate issue as a central problem for humanity, where the first step must be to consider the matter as an opportunity rather than a disruptive factor. One thing is clear: To avoid drastic (and expensive) climate impact, a great deal of effort is required on a local, national and international level. Since prosperity in industrial nations has, until now, been very closely linked with greenhouse gas emissions, the core question for Peterson is: How can we achieve sustainable and fair prosperity without emissions? And what can technology achieve in this regard? What are the limits of prosperity? In what way do lifestyles need to change? How do we achieve this in a democratic way?

THE TIME HAS COME

The time to make the necessary changes is running out. It is not enough to wait for the politicians to act. "In Europe, we have a range of options available to make a conscious contribution to sustainability and environmental protection, be it in our private or professional lives", says Sonja Peterson. In her opinion, the first step towards sustainability begins at home, in the private sphere, by examining and altering your lifestyle. She is convinced that every single person can be part of the solution to the climate problem.

What is needed is for us all to turn our thoughts into actions.

Photography: Gerhardt Kellermann

How can we achieve sustainable and fair prosperity without emissions? And what can technology achieve in this regard? What are the limits of prosperity? In what way do lifestyles need to change? How do we achieve this in a democratic way?

Dr Sonja Peterson studied mathematical economics at the University of Hamburg from 1993 to 1999 and graduated with a diploma. From 1997 and 1998, she studied economics at the University of Colorado at Boulder supported by a Fulbright scholarship and received her M.A. in Economics. In 1999, Sonja Peterson began working on her doctorate as part of the interdisciplinary DFG research training group on "integrative environmental assessment" at the Faculty of Agricultural and Nutritional Sciences of Kiel University, graduating in 2002.

She then became a research assistant at the Kiel Institute for the World Economy (IfW) and was made head of the "Environment and Natural Resources" research unit in 2005. In 2006, she became a member and principal investigator of the excellence cluster "Ocean of the Future" at Kiel University. Since 2010, she has been management coordinator of the IfW and became scientific director in 2012.

In November 2016, Dr Sonja Peterson joined Prof. Dr Lucia A. Reisch, Prof. Dr Maximilian Gege, Prof. Dr Ortwin Renn and Prof. Dr Dr Klaus Töpfer on the Porsche sustainability advisory committee.

The Kiel Institute for the World Economy (IfW) is a centre for global economic research, economic policy consulting and economic education that is dedicated to the subject of sustainability with all its facets. The research conducted by the IfW is based on the motto of "fair and sustainable prosperity for humanity". The institute has set itself the task of researching innovative solutions to urgent problems affecting the global economy.

Dr Alexandra Hildebrandt is a publicist, blogger and sustainability expert. She was in charge of social policy at Arcandor and was a member of the Sustainability Committee at the German Football Association (DFB). At the SpringerGabler publishing house, she publishes the regular German-language journals "CSR und Sportmanagement" ("CSR and sport management") (2014), "CSR und Energiewirtschaft" ("CSR and the energy industry") (2015) and "CSR und Digitalisierung" ("CSR and digitalisation") (2017).

The role of sustainability management in digitalisation

Digitalisation and sustainability are two key "mega trends" of our age. But how does each of these trends impact upon the other?

By Prof. Dr Stefan Schaltegger and Dr Holger Petersen

Considering the sheer volume of publications and events on the topics of digitalisation, Industry 4.0 and the Internet of Things, you could be forgiven for thinking that sustainability – a major focus in modern society – is losing ground to this tough new competitor as they vie for the scarce commodity of public attention. This interpretation of the current discourse suggests that the issue of sustainability should be coupled with and tackled alongside digitalisation, its potentially superior challenger, in an attempt to head off its decline into insignificance. However, a closer examination of the issues at play reveals that sustainability and digitalisation are an unevenly matched pair. In fact, rather than grappling for prime position, these two aspects are complementary – with each building on and contributing to the development of the other.

Sustainability is a visionary objective that many companies and individuals are gradually and persistently working towards. Conversely, digitalisation is a technological process, defined neither as good nor bad, viewed as neither desirable nor to be prevented; digitalisation is simply a tool and approach used to achieve a wide range of different objectives that can be shared or rejected.

TECHNOLOGIES NEED TO BE EMBRACED

In this respect, the title of this piece could be construed as slightly misleading for it is not sustainability that plays a part in digitalisation. On the contrary: As a technological process, digitalisation may, or indeed may not, contribute towards the achievement of sustainability. After all, technologies need to be embraced if they are to develop to their full potential – if they are to contribute towards the achievement of sustainability objectives, for example. This is exactly where sustainability management comes into play. Approaches to sustainability management are diverse and can be observed most clearly in production environments. Following the ages of steam, electrical assembly lines and computers, “Industry 4.0” signifies a new revolution with the dawn of the “smart factory”. These intelligent facilities will combine the advantages of mass manufacture with the demands of flexible custom production. If the plans of its proponents become reality, the smart factory will enable customers and business partners to be virtually integrated into the value-creation processes of a production facility. The linchpin on which this vision rests is the Internet of Things, which merges virtual and real production spaces in cyber-physical systems (CPS). In these systems, robots complete virtually all of the mechanical labour, allowing their human counterparts to concentrate fully on their roles as designers, using touchscreens to manage and control the advanced automation processes at play. As industry becomes increasingly willing to invest in the technology, cyber-physical systems will develop the capability to measure and map operational material and energy flows in real time. Their remit will extend to building facility management and monitoring vehicle fleet usage. Digitalisation therefore not only enables rapid customisation in production, but also improves resource efficiency by streamlining production processes and preventing rejects, material wastage and overproduction. A predictive control system based on sensor technology helps to ensure that the production systems consume only the energy and materials actually required to meet customer demand. Information on the availability of secondary raw materials can be fed into the system to meet the requirements of a circular economy designed to protect primary raw materials.

THE SUSTAINABILITY MANAGER’S STAMP ON THE SPECIFICATION

For sustainability managers, these developments in digitalisation are a call to get involved in the planning of construction and modernisation projects at an early stage so as to ensure that no opportunity to map energy and resource use or control operational processes is missed. Sustainability managers must strive to put their stamp on the final order specification for newly ordered software and hardware. In order to do this, they require knowledge of the technologies on offer for the specific investment plans that are on the table. Today, sustainability managers are required to have a more in-depth technical understanding and an ability to assert their views; IT managers, too, must recognise the relevance of their decisions to sustainability.

These requirements are limited not only to production design, but also encompass the advance assessment of potential and risks arising from the development and use of digitalised products. 3D printers render the transition from digital to physical in a tangible plastic object. 3D printing gives greater scope for development in lightweight digital construction. Unlike conventional technologies, 3D printing – used, for example, to produce components for aircraft – has been known to help to reduce waste. The technology allows replacement parts to be produced quickly and cost-effectively for objects that previously would have had to be replaced completely if even the most minor of defects arose, hereby opening up new business opportunities for repair services.

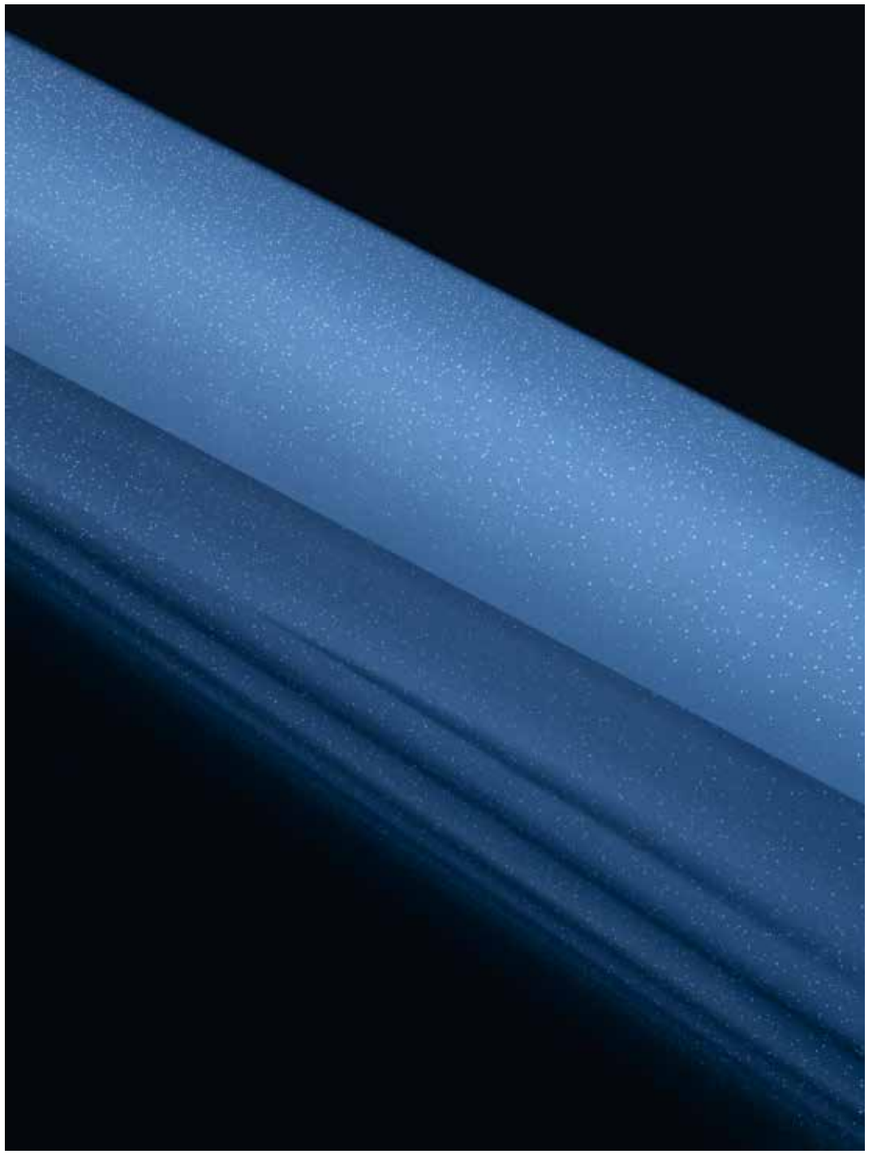
ENVIRONMENTAL PERFORMANCE VARIES ON A CASE-BY-CASE BASIS

Together with other digital technologies, 3D printers can help to drive a process of decentralisation: Simple products like toys no longer need to be manufactured en masse in centrally located Far Eastern factories, but can instead be printed cost-effectively on demand at local printing centres or using the customer’s own printer. This approach reduces global transport and frees up vast amounts of warehouse capacity.

The custom-made photo books that are commonplace today are produced based on a business model that could conceivably be expanded to hologram portraits and many other products with ease using 3D printing technology. But the expansion of this concept highlights the drawback to the technology: No-one really needs a plastic bust depicting a much-loved family member, yet these kinds of gifts would inevitably start appearing under Christmas trees in huge numbers. With this in mind, it is easy to understand the concern that the aforementioned advantages of 3D printing could be offset by the disadvantage of increased production of new objects. 3D printing shows the greatest efficiency potential in the design phase, enabling prototypes to be developed and tested without significant expense. However, this approach further shortens the product life and trend cycle whilst 3D printers in a domestic setting generate a huge amount of wasted misprints as their users try to learn from their mistakes and print novelty objects for fun. With such a vast range of potential uses and applications for the technology, it is not easy to say whether 3D printing helps to protect s or, conversely, is just another source of waste; the environmental performance will vary depending on the product,

Digital technology cannot replace human common sense and conscience.

Sustainability managers must seize the opportunity that digitalisation brings and engage in the process at an early stage. This is the only way to safeguard its positive effects for mankind and the environment.



the material used, the degree of utilisation of the machine and the actions by the user. This point further serves to highlight the importance of sustainability management in the case-by-case assessment of new manufacturing technologies and in their selection and use. Sustainability managers must possess an in-depth knowledge of 3D printing – in particular, they must be capable of making an ecological assessment based on the properties of and recycling options for the materials used for the printing process, comparing these with what would have been used previously.

SUSTAINABILITY MANAGERS IN ALL DEPARTMENTS

The popular concepts of the “smart home”, “smart mobility” and “smart health” all open up a wealth of new opportunities – but they also come coupled with risks to sustainable development, all of which must be determined, controlled and avoided. The mere presence of digital production and building technology alone does not automatically guarantee success in terms of sustainability; such technologies can be sustainable only when their in-built environmental features are activated, properly configured and subject to regular checks.

Digital technology cannot replace human common sense and conscience. Instead, it focuses on the pre-configuration of the hardware and software used in specific processes by a small number of users and programmers. Information in material flow diagrams appearing in real time on a touch-screen can only help the user if he understands the information, recognises opportunities to optimise the process and is motivated to implement such changes even if a trade-off needs to be made, for example, between throughput time and energy consumption. The processes for evaluating environmental data and its associated potential are completely different to the processes applied when evaluating statements, SAP lists and data protocols in a silent office once a particular action has already been completed.

“Implicit sustainability managers” – who, as plant managers, supervisors, purchasers or facility managers, are often required to make ad-hoc decisions on how best to optimise sustainability – are taking on an increasingly important role. This is particularly true in the technical procurement processes mentioned previously; in future as well, it is likely to remain the case that specifically appointed sustainability managers will be rarely involved in plans, or will be consulted at too late a stage. In this context, the task of the specifically appointed sustainability expert in the company becomes all the more crucial: This person must build the competence of the implicit sustainability managers and encourage them to keep thinking about optimising sustainability performance in their management decisions.
In the digital working environment, social interaction is characterised by acting on your own initiative, constantly working to optimise your own performance and being able to rapidly integrate into networks that may not have their own clear hierarchy. The skilled interplay between laterally connected colleagues, intra-company networking, education and social assertiveness will become increasingly relevant as key qualities in sustainability management as digitalisation moves forward.

With all of these challenges at play, one thing is clear above all else: Digitalisation will not replace sustainability management. The responsibilities and professional competencies of the sustainability manager cannot be input and fulfilled by a digital entity. However, the roles of both explicit and implicit sustainability managers alike will become more demanding and widen in scope as the process of digitalisation unfolds.

Photography: Studio Amos Fricke

Prof. Dr Stefan Schaltegger is Professor in Sustainability Management and Head of the Centre for Sustainability Management at the Leuphana University of Lüneburg. He also manages the MBA Sustainability Management study programme. Together with the German Environmental Management Association (B.A.U.M.), he regularly organises the Sustainability Leadership Forum – a platform for companies aiming to achieve exceptional standards in sustainability management.

Dr Holger Petersen, a qualified banker, has been lecturing in Sustainability Management at the Nordakademie University Elmshorn since January 2017. Prior to taking up this post, he worked as a lecturer and author at the Centre for Sustainability Management in Lüneburg and coordinated knowledge transfer programs with companies, particularly by means of involvement in the Sustainability Leadership Forum.

It's time for a new "we"

In today's world, we face a great paradox: The trend towards individualisation has taken hold, yet we are more reliant on cooperation than ever before. How do we reconcile these apparent opposites?

Text: Tobias Hürter

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Sometimes all you need are a few figures to encapsulate an era. For example, 3 and 300 would characterise the time in which we are living now. By the end of the century, three billion more people will join the middle classes worldwide – the current figure is two billion. Altogether, this makes a total of five billion people with high expectations in terms of living standards. Many want to drive a car, own their own home, take holidays. Over the last hundred years, some 300 cities with over one million inhabitants have sprung up worldwide. In the 1910s, there were just twelve. This simple statistic alone shows that humans need to drastically reorganise how they live. And whatever form this readjustment takes, it will be accompanied by new types of cooperation. As we get closer and closer, we need to find better ways of living and working together.

That means collectively, instead of every man for himself. At first, this sounds like a paradox. Life-long partnerships, family ties, clans and village communities are ways of life that are apparently consigned to the past. We live in an era of individualisation. Having the freedom to shape your own existence has become perhaps the most important value of all. We have become accustomed to regarding other people as competitors, not as allies. We squabble over food, partners, jobs, parking spaces and places to live. Our economic system is based on healthy competition. The theory of evolution states that people have only become the highly developed creatures they are because of survival of the fittest. Evolution is war – that is the popular perception. Charles Darwin himself spoke of the "struggle for existence".

But something is missing from this picture. Our elbows are not the most dominant part of our body. We are designed to cooperate. Our faces are points of contact and the diversity of our facial expressions is unique in the animal kingdom. Our brains are highly specialised in reading these expressions. Psychiatrist Thomas Fuchs refers to the human brain as a "relationship organ". Behavioural studies conducted by anthropologists among children show time and again that from a very early age, people are ready to help.

How did we become the grand masters of cooperation? Most researchers believe it was a gradual development – from lone warriors to couples, and then on to clans and larger communities. It's now time for the next stage of development. Some of the challenges that we face today – from the design of our cities through to our use of natural resources and climate management – can only be addressed through cooperation, and in some cases this cooperation has to be on a global scale.

People are born cooperators. For some old-school economists, this is still an inconvenient novelty, with humans traditionally being perceived as homo economicus. Such a rigid framework provides almost no room for any cooperative instinct. In truth, people do not cooperate in all circumstances. They have an egotistical and a cooperative side, and sometimes one and then the other manifests itself in different life situations. If your stomach is rumbling, you will be less willing to share your food. In an atmosphere of trust, cooperation is easier than in an environment that is dogged by mistrust. If you want people to cooperate, the circumstances in which they live must be right.

What are the right circumstances? The primary ingredient is clear from the famous "prisoner's dilemma", a game theory experiment. The game involves two prisoners who are accused of committing a crime together. They are questioned separately and cannot communicate with each other directly. If they both deny any involvement in the crime, they will both serve a year in prison. If both confess and therefore incriminate each other, they will both get two years. If only one of the prisoners confesses, he will be acquitted as a chief witness and the other will serve three years. So how does it play out? If both prisoners follow their individual interests, they have to betray the other – and spend two years in prison. If they close ranks and both keep quiet, they would get away with one year. That is the penalty for their egotism.

The outcome of an "iterated game", where it is repeated multiple times, is even more fascinating. This allows the two players to sound out the possibilities for cooperation by keeping quiet in one round to test the waters and seeing whether the other player does the same in the next round. Gradually, the two can develop an understanding of the other's intentions and behavioural patterns. Perhaps they recognise their common interest, perhaps they build up trust between them, and perhaps after a few rounds opponents ultimately become team mates who together pursue the lowest penalty overall of one year each.

People are born cooperators. For some old-school economists, this is still an inconvenient novelty.

Common goals are not simply the point at which individual goals intersect; shared plans are not just a combination of individual plans.

The prisoner's dilemma is a classic game from the field of economics. It has countless variations and is applied to any number of situations in economic life. It shows how cooperation can fail and the circumstances in which it can succeed. Clearly, a minimum degree of interrelationship, consistency and trust is required. Aligned interests alone are not enough. In a nutshell: Two or more people cooperate when they are in a relationship that helps them to realise their objectives and plans. Cooperation means more than just doing the same thing. A relationship is an essential part of it.

To cooperate, you must therefore interrelate. To interrelate, you must communicate with one another. Language is a prerequisite for any cooperation. The story of the Tower of Babel from the Old Testament provides a perfect analogy in this context. In their enthusiasm for working together through a shared language, an ancient community decides to build a tower to heaven. God is concerned that man is becoming an overly powerful force and decides to thwart the building of the tower by giving the people different languages. The moral of the story is that one language provides divine strength.

But language alone is not enough, as it is only a medium. Those involved must be able to do more than communicate information to one another. They must understand one another; they need a "theory of mind". Empathy – communication – cooperation: It is within this three-point framework that people act. Cooperation is based on language, and language is based on empathy – and conversely, language itself is an important case of cooperation, and language is a condition for empathy. Everything is interdependent. From this, we derive the core of any cooperative relationship: "we" intentionality.

Intentionality is akin to directionality. Many philosophers see this as the key to all conscious content and linguistic meaning. Human brains have intentional states: If you think about a certain person, your brain is in a state that is precisely directed at this person. This ability for individual intentionality is amazing enough in itself. Even more amazing is the ability for shared intentionality. People can share thoughts, pursue common goals and develop shared plans. This "we" intentionality cannot be boiled down to individual intentionality, argues American philosopher John Searle. Common goals are not simply the point at which individual goals intersect; shared plans are not just a combination of individual plans. "we" intentionality is a basic human capability, says Searle. It provides the foundation for our ability to cooperate.

"We" intentionality does not come about in isolation. It needs trust, understanding and consistency. Readiness to take shared responsibility is also part of it. When a team or a consortium of companies acts in a cooperative manner, it is often impossible to assign responsibility for these acts to one individual. The actor as a whole, i.e. the team or consortium, must take responsibility for and justify these acts. It is specifically in this respect that cooperation often fails. When something goes wrong, many people switch back from the "we" to the "I" and point the finger at each other, with the risk of creating deadlock. In a marriage, you would say that they're a bit short on domestic bliss. It's not until those involved overcome their differences, jointly take things in hand, focus on common goals and assume shared responsibility that the impasse starts to free up. But just like in a marriage, it must be possible for all those involved to maintain their autonomy. If a relationship of cooperation is only rescued by one party adjusting their behaviour to the other, it won't last long. The best cooperation – like the best marriage – is one in which each party respects the individuality of the other. Cooperation and individualisation are not polar opposites.

To cooperate, you need a relationship. But not every relationship is suitable as a foundation for cooperation. For example, just because two people are in love does not mean that they can start working together to master everyday life, plan a holiday or look after the children. The abstract common desire to live together must first be converted into concrete common action. This is also often the point at which young companies get into trouble. The founders are convinced that they have common goals, are guided by similar values and trust each other. Nevertheless, a certain friction develops. Perhaps they are speaking different languages, perhaps they are used to going it alone, perhaps they are at different stages of life. There is the risk that they will alienate each other or fall out. But they might also learn to communicate better and to nurture their relationships. Perhaps they will go out for a meal regularly or use online team communication tools. They are learning the art of cooperation.

As the world becomes increasingly complex, the ability to cooperate becomes even more important. A hundred years ago, when a farmer prepared his breakfast, he really had made the meal himself: water from his well, milk from his cows, vegetables and cereal from his fields, fuel collected from his own wood. When his great-grandson prepares a meal today, the water comes from the municipal water supply, the electricity comes from the power station, the coffee from Costa Rica and the cereal from a packet of cornflakes. Even if he does not have to cooperate directly in this respect, the products that he consumes are produced through cooperation. And when he has finished his breakfast, he won't be able to avoid cooperation for long: with his neighbours in the machinery ring, or with colleagues in the milk cooperative.

From daily life right through to global issues, working together is becoming a necessity. The financial markets cannot be tamed by taking a narrow, national view; climate change cannot be curtailed single-handedly. Bertrand Russell knew this a hundred years ago: "The only thing that will redeem mankind is cooperation". As technology becomes more and more sophisticated and networks in society become increasingly complex and interlinked, our ability to cooperate is needed even more.

To cooperate, you need a relationship. But not every relationship is suitable as a foundation for cooperation. For example, just because two people are in love does not mean that they can start working together to master everyday life.

Companies develop sustainability strategies to give their business a stable basis in changeable times. They want to ensure, for example, that their supply chains are characterised by fair working conditions or that their energy needs are met from renewable sources. This cannot be done single-handedly. Strategies of this kind rely on collaboration between hundreds, sometimes thousands of other companies. It is often a laborious development that gets little attention but it shows how large, overarching goals can be realised in today's confusing world.

In many respects, it is apparent that the ability to embrace "we" intentionality is gaining in importance against old virtues such as assertiveness and an instinct for power. It has long been the convention to "squeeze" suppliers, putting significant pressure on prices. When a supplier is unable to keep up, they are replaced by another. Now, another approach is starting to take hold: treating suppliers as partners rather than servants, sharing technical expertise with them and paying fair prices. Not only is this the nice thing to do, it is also clever – it improves quality and punctuality. Acting humanely and applying an economic rationale are in no way opposites. In a very fundamental sense, predatory competition is "inhumane". People are cooperative, yet built to compete at the same time.

And in a broader sense, this is good news. This new, more confusing world that lends itself to cooperation could be one that particularly suits the abilities of women. Some years ago, Dutch psychologists compared the cooperation behaviour of men and women in a large meta-study and found that the sexes differ considerably in this respect. Although men cooperate among themselves better than women, women cooperate much better than men in groups containing both sexes. In a world where cooperation is gaining in importance, female strengths are therefore in greater demand.

Illustrator: Silke Weißbach

Tobias Hürter studied philosophy and mathematics in Munich and Berkeley. He edited the weekly German newspaper Die Zeit and co-founded the philosophy magazine Hohe Luft. He lives with his family in Munich.

Silke Weißbach is an artist and illustrator. She studied illustration in Hamburg and Copenhagen and is now continuing her education at the Hochschule für Bildende Künste Hamburg (University of Fine Arts Hamburg), studying painting. She currently lives and works in Hamburg.

Nardò,
or the principle of sustainability

Porsche Engineering has operated the Nardò Technical Center since 2012. Located in the Apulia region of southern Italy, it makes a major contribution towards optimising new developments from Porsche and other manufacturers until they are ready for series production. But that's not all.

The Nardò Technical Center is home to over 20 test tracks and facilities spread over an area of 700 hectares. It is the ideal place to explore the complex principle of sustainability and all its facets in true-to-life conditions. Alongside a forward-thinking local economic policy, the Technical Center has helped to return the region to the strengths it enjoyed in the past, and to make it ready to face the future.

After Porsche Engineering acquired the testing facility, it carefully and respectfully restored the masseria – an historic farm house – and saved it from certain ruin. The company is now using this protected monument as an office and administrative building in a sustainable design.

Porsche Engineering has also refurbished the workshops, resulting in benefits like significantly reduced energy consumption. In addition, the entire vehicle fleet has been replaced in order to achieve a better environmental performance.

The modern works fire department established at the site has an important role to play when it comes to protection and preservation, as there is a permanent risk of forest fires in the region during the hot summer months. And they can be devastating. Porsche has known this since at least 2013, when the last major forest fire broke out in Nardò. Ever since, the fire protection concept at the site has included thermal imaging cameras on the control tower. They monitor the facility and are able to detect a fire at an early stage.

The people working in the masseria or elsewhere on-site are a focal point for the sustainability work in Nardò. It is not simply about hiring people – it is also a matter of taking care of them in a responsible and forward-looking way. The employees primarily come from the surrounding region, and the company uses talent identification, individual training courses and other forms of professional development to provide jobs that they are likely to identify with and that offer perspectives for the future. This long-term approach also encompasses partnerships with universities in the region, including through internships.

If you look beyond the facility itself, it is clear that the Nardò Technical Center is having a far-reaching impact. It is not just the local trade businesses and dealers who are benefiting – there are also genuine, sustainable opportunities opening up for the hotels and restaurants in the region. That's because the Technical Center and the 12.6-km high-speed circular track are also available to other companies in the industry, meaning they generally bring between 300 and 400 visitors to the region every day.

Photography: Robert Fischer

Light on the horizon: The economy in Apulia is now the jewel in the crown of southern Italy. And when it comes to renewable energy, the region is leading the way for the whole country.

The masseria. An historic farm house that was saved from certain ruin through careful restoration.

A new purpose: The masseria is a protected monument that is now used as an office and administrative building in a sustainable design.

Preservation and protection: There is a serious risk of forest fires during the hot summer months. The fire protection concept in Nardò includes thermal imaging cameras that detect fires at an early stage.

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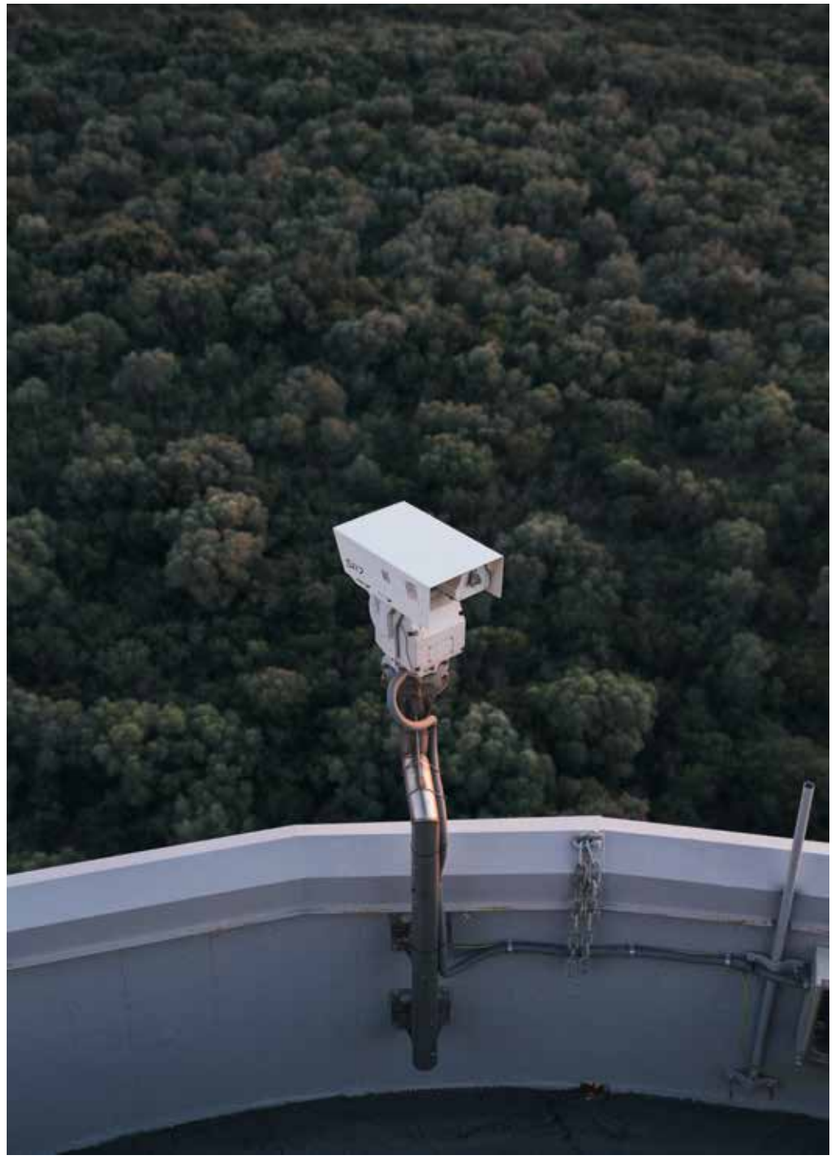


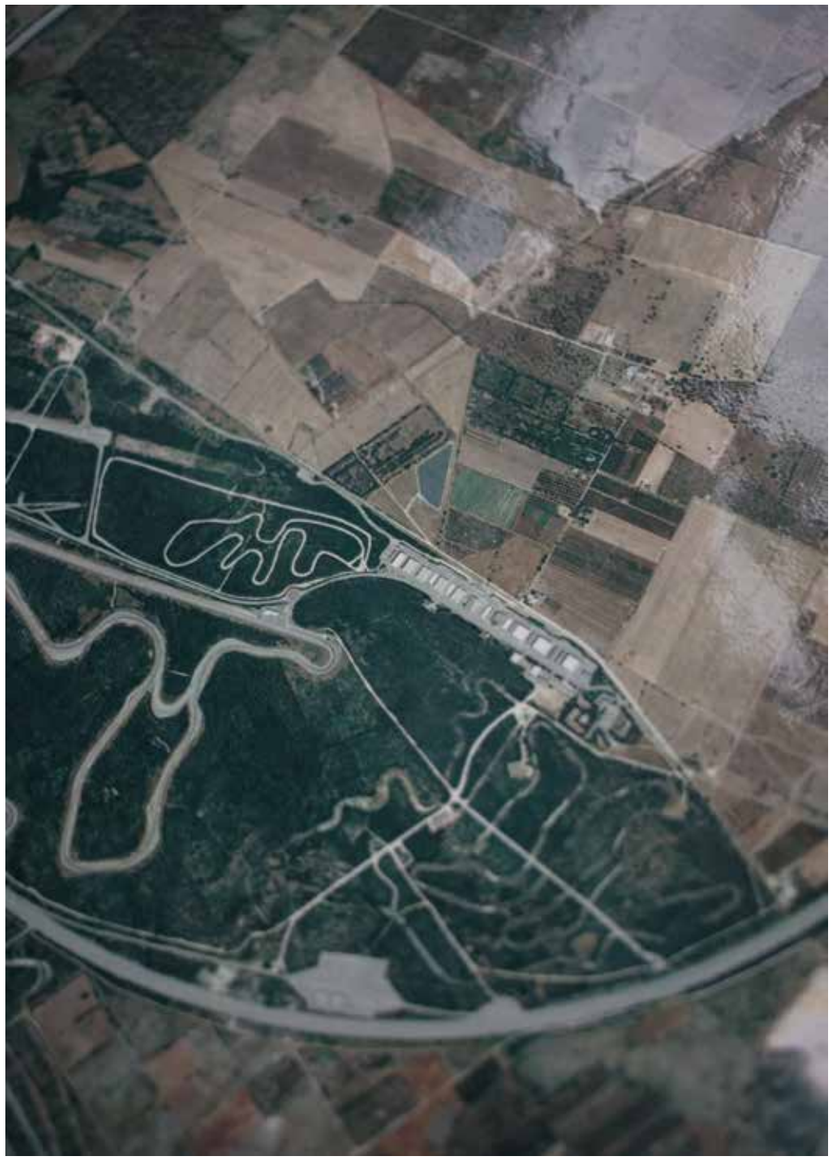
The Nardò Technical Center makes a major contribution towards optimising new developments until they are ready for series production.

Nardò provides jobs that employees identify with and that offer perspectives for the future. Talent identification, individual training courses and other forms of professional development are all part of this approach.

Nardò is in the province of Lecce and covers 190 square kilometres. It is a small, picturesque town that's attracting a lot of attention.

The Technical Center is also available to other manufacturers. It now brings between 300 and 400 visitors to the region every day.

Nardò attracts visitors from all over the world. Good news for the local restaurants and hotels.

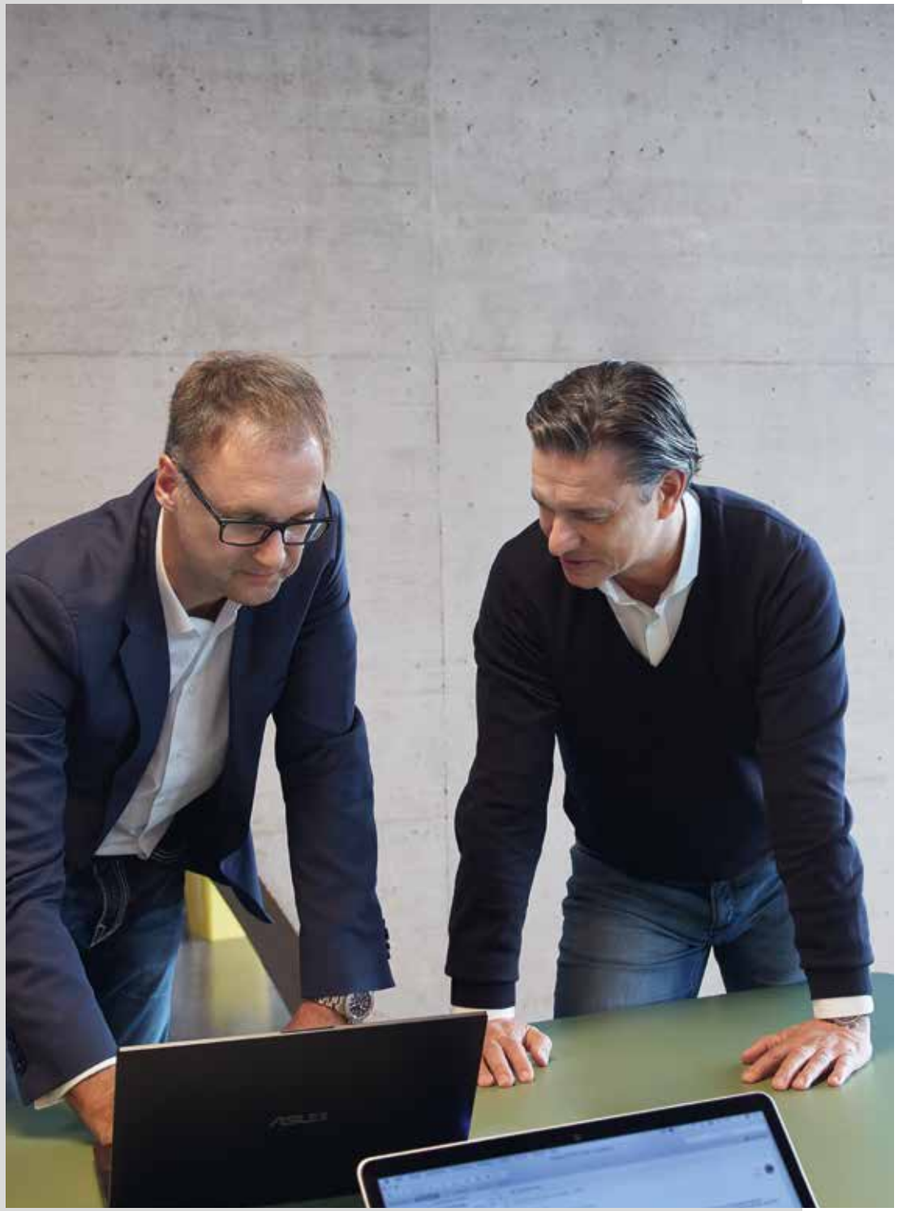


Room for development – and not just
for sportscars. A bird's eye view of
the Nardò Technical Center.

We need to become something akin to an Internet company ourselves.

DIGITALISATION

Space for digital inspiration



Lutz Meschke (right) and Dr Sven Lorenz (left) in conversation at the Digital Lab

In the new Digital Lab on the banks of the River Spree in Berlin, a team from Porsche lives and breathes digitalisation. Lutz Meschke, Deputy Chairman of the Executive Board of Porsche AG and Member of the Executive Board with responsibility for Finance and IT, and Sven Lorenz, Vice President of Porsche Information Systems, discuss the creative power of Berlin, new ways of working, and perfection in the digital age.

Text: Dr Jakob Vicari

A cold, harsh wind blows along the banks of the Spree. In Berlin's East Harbour in the district of Friedrichshain, the backdrop of graffiti provides an ever-evolving social commentary. A glance down to the floor reveals a clear message to US President Donald Trump – so fresh that the paint is not yet dry. Beside these political messages, a group of young people have constructed a skateboard ramp from car tyres. The building with the striking green concrete façade looks almost other-worldly; its futuristic architecture is punctuated with curves, wrapping around the building with a mathematical precision. The ground floor was originally intended as a showroom for a fashion company – but it now houses the Porsche Digital Lab, founded in 2016 in partnership with Porsche subsidiary MHP. Brightly coloured Post-Its are stuck across the insides of the windows. Outside the main entrance, there's a cargo bike and a car emblazoned with the logo of a car-sharing company. The place doesn't look like it belongs to Porsche.

The door to the lab is ajar. Lutz Meschke, Deputy Chairman of the Executive Board of Porsche AG and Member of the Executive Board with responsibility for Finance and IT, enters the space – crossing a threshold into a new reality.

MESCHKE: "The individual mobility requirements of our customers are evolving massively. Technological progress in the automotive sector – electrification, digitalisation and connectivity – is requiring us to think in a whole new way. The digital transformation is making its mark on every part of the company – from internal processes and customer interaction through to our products and services. No aspect of our business is unaffected. Vehicle connectivity, a new understanding of mobility and a changed competitive environment are driving a revolution in the automotive industry. The lab is a symbol of this shift."

This is not Porsche's first foray into the new automotive world. The Porsche Digital Lab followed hot on the heels of Porsche Digital GmbH, which was recently established in Ludwigsburg. In the Lab, several teams are focusing on the question of how Porsche can take innovations from the fields of big data and machine learning, micro services and cloud technologies, Industry 4.0 and the Internet of Things, and turn them into practical solutions for Porsche. In contrast, Porsche Digital GmbH focuses on products and services for customers. It collects and evaluates information on trends and ideas, identifies digital customer experiences, products and business areas, seeks out suitable partners and engages in funds and start-ups. The company trials and develops ideas that hold high promise in terms of customer benefit, or that will improve processes within the company. Networked mobility, intuitive control concepts and the vehicle architectures of tomorrow are the key elements of a digital ecosystem in which a host of new services and business models are developed. The Digital Lab and Digital GmbH work hand-in-hand on projects. The skill is in combining Porsche's automotive expertise with digital expertise.

LORENZ: "The Lab acts as a testing ground for the digital transformation of the company. We identify and trial innovative information technologies. We essentially provide a platform for collaborating with technology companies, start-ups and the scientific community. The Digital Lab is a satellite; it is a place that works differently and where people think differently as they search for new technologies, new business models and new partnerships for Porsche."

The architecture of the Lab is dominated by rough concrete arcs. The ventilation system in the ceiling is exposed; folded-up deck chairs rest casually against a wall. Pallets have been fashioned into tables and benches by a carpenter in the Black Forest region. All of this sends a clear signal: When Porsche talks about digitalisation, it does so without clichéd phrases and overused jargon.

MESCHKE: "It is impossible to innovate on your own. We need and want to open up and be inspired. Digital GmbH and the Lab in Berlin are just the first steps in this process."

In the Lab, the green refrigerator is packed full to bursting with energy drinks. Mixed teams from across the company – including Porsche Design, Porsche Digital, Volkswagen and MHP – value the laid-back atmosphere. The communal kitchen serves as a gathering place for the employees. Twelve of the Lab team members work directly for Porsche. Lab Manager Boris Behringer has been with the company for 16 years, and knows it like the back of his hand.

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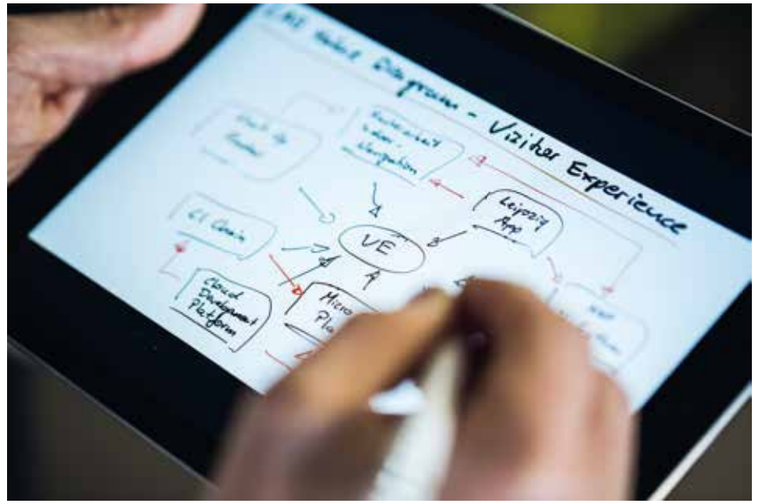

Others, like Roman Siejek, are new: The 32-year-old Relations Manager is responsible for establishing good links with start-ups that interest the company, building the relationships that fledgling companies often find lacking when they partner with industry giants. He works with colleagues with job titles such as Lab Scientists and Solution Managers – all of whom are specialists in their fields, from the Internet of Things and micro services to machine learning and big data. There are no fixed teams; the employees work flexibly using the Scrum approach, splitting projects up into individual user stories, which are then tackled in sprints lasting one to two weeks. One of the concepts developed using this methodology is a prototype smartphone app to support idea generation in the Porsche innovation process. The app enables users to submit an idea and an accompanying video in minutes, and the submission can then be evaluated by employees – providing a virtual space for the creatives of Porsche to collaborate.

LORENZ: “Berlin is home to one of Europe’s leading start-up scenes. It is a place where we want to spark interest in our company among prospective employees. Of course, we have computers and intelligent assistants, algorithms and robots. But it is people who shape our future. Here, we give them the space to think differently. In the digital realm, we need a whole different set of processes, because the conditions surrounding our work can change extremely rapidly, so we need to respond much more dynamically.”

In the Lab, collaborations usually start with the development of ideas for digital business models. The guiding principle in this process is Design Thinking. The new approaches are then firmed up in the form of Minimal Viable Products (MVPs), and subsequently turned into prototypes. The end result of the process is a solution – anything from an app to an IT application – that can be used on an industrial scale.

How can we communicate to young people that they don’t necessarily need to work for Google or Hewlett Packard to put their talents to good use?

MESCHKE: “In the past, the automotive industry only sought out true petrolheads. But now we also need people who can contribute different interests and values, who view cars primarily as digital end devices. These are the people whose attention we need to attract and who we need to get interested in our company. The decisive factor will be our ability to offer a working environment that delivers everything that this group of people is looking for right now.”

For the “First Tuesday” event, held on the first Tuesday of every month, the Lab opens its doors to Berlin’s start-up scene. The event attracts technical talent from across the world to the city – including people working on gestures to open cars, artificial intelligence researchers and others developing solar-powered cars, financed by crowdfunding. Porsche enters this ecosystem with almost 70 years of history and tradition, combined with the will to transport the Porsche mystique into this new era. The company’s approach is one of confidence: Half of the Lab’s capacity is dedicated to free research, trials and experimentation, or to “fuelling Porsche with laughing gas”, as they put it here.

LORENZ: “Freedom is essential; it is a crucial factor in the generation of new ideas. However, the Lab also takes on specific development projects from Stuttgart. Future Porsche cars will all contain technology developed in Berlin.”

A new openness

The ongoing search for new technological innovations has long been an established part of Porsche – but the openness of the Lab to the outside world is a much more recent development. The view into the building from the outside is the perfect metaphor for this new transparency: With glass fronts on three sides of the Lab, any passing stranger can see what is happening inside. Seven iPhones straight out of the box lie on a table. Two employees are playing with the first Porsche Lab app, which showcases the work of the Digital Lab in a virtual partnership between Zuffenhausen and Berlin. The app is at ‘Minimum Viable Product’ stage. Only the absolutely essential basic functions work – and yet the app is already in use, in a form that previously would not have been considered ready for Porsche engineers to present to the Executive Board.

“We need to become something akin to an Internet company ourselves.”

Lutz Meschke

MESCHKE: “We need to speed up our processes, and we’re learning how to do that here. We still spend 42 months on developing a vehicle, with an engineering quality standard of 120 per cent. For safety features, this amount of time is completely justified and we won’t be speeding up this aspect of our process. Digital services, on the other hand, only remain current for three months before an update is released.”

LORENZ: “We used to think in terms of years, based on the model lifecycle of our cars. In the digital age, we need to think in terms of months, or sometimes even weeks. It is crucial that we learn how to do this successfully.”

Will the customer forgive the fact that a Porsche service might not be completely perfect?

MESCHKE: “Customers will expect perfection. But they will also expect us to offer the most up-to-date features, far beyond infotainment and services: These developments also encompass new vehicle characteristics. Against this backdrop, Porsche is seeking to become the most innovative brand in terms of exclusive and sporty mobility.”

So features such as increasing engine power online are a definite possibility?

MESCHKE: “Many of the features in a vehicle are delivered by a combination of hardware and software, whether it’s heated seats or a new headlight function. Or, indeed, using software to increase engine power. These kinds of things enable the vehicle to become a car for life – something that grows and develops with you. As a customer, I can choose between a full up-front service package valid for an entire year, or just for a three-week holiday. Regardless of the customer’s choice, the digital Porsche will adapt to the driver in a way that has never been possible before.”

So, in the digital age, it will be perfectly feasible for a driver to buy a car with the basic specification, and simply add the features and services that he needs over time, one by one. It will also be possible to rectify faults without a trip to the garage, via an over-the-air update. The car will ultimately become a component of a digital ecosystem; a citizen in a networked city. The driver communicates with the car, and the car, in turn, communicates with its environment. It becomes a ‘connected car’, avoiding traffic, locating parking spaces and transporting its passengers to their destination more safely, more quickly and more elegantly. The car can be included in the family schedule or used to update the diary. For Porsche, digitalisation is also an opportunity to restore the vehicle to its position at the centre of the driver’s life. It becomes a living space that its owners enter as comfortably as their living room at home.

LORENZ: “If you need to access information quickly and directly, where better to get it than behind the wheel, where you need the information immediately? Now is the time to transfer the digital progress we have made in mobile technology and the web to our platform: the car.”

“Porsche will become a platform provider, which will enable us to branch out beyond the boundaries of the automotive sector.”

Lutz Meschke

Learning from tech companies
For many years, the automotive industry has been a closed shop – but now its doors are wide open. Suddenly, the industry has been turned on its head; the competitive environment is seeing dramatic change. Google is working on driverless cars, Apple is developing software for autonomous vehicles, Uber is shaking up the service sector and Tesla is a completely new market player aiming to redefine luxury and sportiness in the automotive sector. Tech companies are not concerned with making cars, but are looking for solutions to society’s problems. Does this shift present a threat to car manufacturers?

MESCHKE: “In principle, all future Porsche cars must possess the same characteristics as the Porsche cars of the past and present. We cannot compromise on the driving characteristics of a 911. But we do, of course, need to keep up with the times – and we have already established a leading position in the premium segment with our plug-in drives. A Porsche cannot be compared to a device like a smartphone. You feel safe in a Panamera, even when it is moving autonomously in heavy traffic. In spite of our leading position, we must respond to new developments – not with panic, but with courage. The Mission E, which will be available in 2019, will be the first fully electric Porsche and also the most digital Porsche to date.”

What can car manufacturers learn from tech companies?

MESCHKE: “We need to become something akin to an Internet company ourselves. The more data we give away, the less opportunity we have to steer our company in this direction. We do not only need to know our customers, we need to protect their data and develop new business models for the future.”

But data-based business models can be challenging from a data protection perspective.

LORENZ: “Porsche firmly believes that ultimate data sovereignty lies with the customer. We handle data responsibly, as we have done for decades.”

In the Mission E, the curved OLED display integrates seamlessly into the cockpit as though the space it occupies has never been used for anything else. In the concept study, the five driver displays are controlled using eye tracking technology. The system uses a camera to detect which instrument the driver is looking at. The exterior mirrors reflect camera images into the driver’s line of vision in the bottom corners of the windscreen. But how is digitalisation affecting the Porsche business model? Digital transformation is a core element of the Porsche Strategy 2025 – not as an enthusiastically pursued end in itself, but as an essential challenge.

MESCHKE: “In the medium term, we are aiming to generate a double-digit percentage of our revenue from digital services. We are developing from a car manufacturer into a provider of mobility. The automotive sector is increasingly converging with the consumer goods industry, and we are responding to that trend. Porsche will become a platform provider, which will enable us to branch out beyond the boundaries of the automotive sector. That is the major challenge we face: to not lose sight of Porsche customers when they shut the car door, but to accompany them in the rest of their life too. Porsche continues to stand for its promise of freedom, even outside of the car.”

Porsche Digital GmbH has invested a seven-figure sum in start-up Evopark, a Cologne-based company aiming to replace paper car parking tickets with free parking cards. Card holders are now using the company's cards to access parking spaces in 21 German cities and 59 car parks and underground car parks. It is precisely these kinds of futuristic services, which make day-to-day life significantly more convenient for customers, that the Porsche management is keen to focus on.

LORENZ: “Around 80 per cent of Porsche customers are iPhone users. They are attracted to the concept of a smart home and see themselves as first movers when it comes to adopting new technologies. This is what we want to build on.”

Networked production
Before long, the last person to touch a new Porsche on the production line could be wearing a networked glove – a glove that knows the required assembly steps and alerts the employee in the event of a problem or if something is

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missing. In spite of this, the assembly engineer will retain ultimate decision-making authority, even in the world of networked assistants. But as technology continues to gain in intelligence, the collaboration between man and robot on the assembly line will become ever more fluid and ergonomic. This all-encompassing integration allows production to be adjusted to new requirements almost in real time. Does this progress close the door on conventional automotive technology?

MESCHKE: “Definitely not. People will always be fascinated by the mechanics of cars, and sportscars will always hold a special appeal as they have the ability to captivate their audience, whether on the race track or on the road. In twenty years’ time, this model will still exist, even if it is only a part of our business.”

Porsche as a digital and smart company
On the banks of the Spree, an employee is perched on a table taking a phone call and looking out over the river. By her side is a copy of the start-up magazine “Berlin Valley” – a publication that focuses on business models and digital services, barely making any mention of physical ‘things’. Seeing the magazine in this precise location raises a question: Is it conceivable that, in the future, people will no longer own a Porsche, but instead will share it with others?

MESCHKE: “An exciting model that we could explore would be one whereby people no longer buy a car, but a car package. This would allow me, as a customer, to have a cabriolet in the summer and an SUV in the winter. And if I go to California on holiday, a 911 cabriolet would be waiting for me at the airport. I would be able to go to a Porsche dealer and buy a vehicle package tailored to my personal interests. And I’d still be a Porsche driver without owning a single vehicle.”

Is that a utopian vision?

MESCHKE: “It’s actually not far off at all. We are creating digital and intelligent customer experiences that fascinate customers and bear a clear Porsche signature. This is one of the reasons why we have the Lab in Berlin.”

Remaining unmistakable
All cars that leave the Porsche production line now contain up to 90 computation modules – but there is potential for a few hundred more. This technology changes the very essence of the car. Author and Porsche enthusiast Ulf Poschardt once said that “the Porsche 911, the brand’s iconic model, awakens all of the senses”. But how can the brand protect the assuredness surrounding its products in the future?

LORENZ: “Even though we are thinking digitally, we will always retain our unmistakable identity.”

MESCHKE: “With hybrid plug-in and electric models, it does become more difficult to recognise a Porsche from the sound of its engine. But as soon as the car moves off, the driver will realise that the experience of driving a Porsche remains unique, irrespective of the drive technology or digital features. Even in the future, you will want to drive a Porsche yourself – just not in a traffic jam”.

A graduate in business administration, Lutz Meschke left Hugo Boss to join Porsche in 2001. In 2009, he became the Member of the Executive Board with responsibility for Finance and IT, and in 2015, he assumed the role of Deputy Chairman of the Executive Board.

Dr Sven Lorenz wrote his doctorate on knowledge-based processing of natural language. After working at IBM, A. T. Kearney Management Consultants and Deutsche Post, he joined Porsche in 2002 as the Vice President of Porsche Information Systems and CIO.

Empathy in the Age of Digitalisation

Empathy is the latest buzzword. It's had a breathtaking career path. Just ten years ago, it was exclusive to scientists. Now everyone is using it: managers, politicians, teachers and marketing experts.

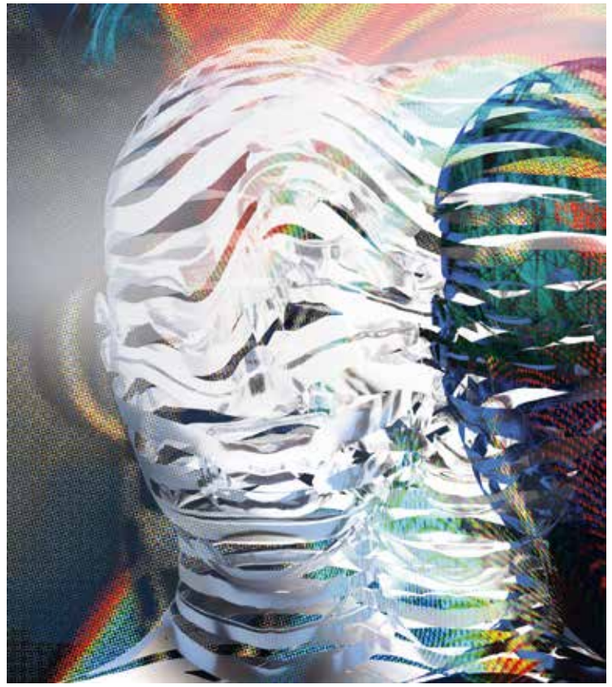
Text: Prof. Dr Ute Frevert

Empathy is the ability to understand and share the feelings of another. The capacity to feel and show empathy is something that people today expect of themselves and of others. Where there's a lack of empathy, whether in an individual person or in entire groups or societies, there's a problem. And the criticism comes from the very top: Even before he became president, the young US Senator Barack Obama complained about the rampant "empathy deficit" in American society. Too many Americans were thoughtlessly overlooking fellow citizens who urgently needed active compassion: Children and young people growing up in poverty and without prospects; the unemployed and people without health insurance, who have no access to medical aid even in emergencies. Without empathy, according to Obama, people would not be able to live together, and societies would not work.

I.
The politician could have cribbed this sentence, often repeated during his eight-year term in office as President, from Adam Smith. The Scot is considered to be the founder of scientific economics; his book "The Wealth of Nations", published in 1776, is the bible of modern capitalism. But Smith had been contemplating its moral and philosophical principles for a long time. According to the main hypothesis of his "Theory of Moral Sentiments" from 1759, people are defined by more than just self-love. In addition to the *self-love* that drives them to define and assert their own interests, each and every person feels another basic emotion: *sympathy*, the ability to sense and understand the feelings of others.

For Smith, the ability and willingness to empathise were an important means of socially embedding and absorbing the communication and cooperation processes determined by self-love. Even if we did not have the butcher, baker or brewer's benevolence to thank for our dinner, but their regard for their own interest, we could rely on them empathising with our feelings and, under certain circumstances, actively helping us out.

These circumstances, as Smith observed, included social and spatial proximity. It was easier to feel *sympathy* for a family member or neighbour than for a stranger. The further removed the stranger, the harder it was to consider and treat him as a "neighbour". In addition, *sympathy* often hit against moral boundaries.



Neuroscientific research confirms that the ability to empathise can be blocked by moral considerations.

For example, you could easily identify with "innocent" children, who had been made to suffer, and feel their suffering as your own. But the same did not apply to the people who had caused pain to others and were held to account as a result. When criminals were publicly executed – which was still common practice in Europe in Smith's time – only very few spectators showed compassion because the person being executed did not "deserve" it.

II.
Neuroscientific research confirms that the ability to empathise can be blocked by moral considerations. If a player, who has consistently behaved unfairly, is given a pain impulse as punishment, the neuronal pain matrix of his team mates remains mute and passive. If the same thing happens to a fair player, the pain matrix of the other players is activated: They feel the other's pain. In the first case, the lack of empathy can also be attributed to the activation of the section of the brain responsible for reward processing: When unfair players are punished, the subjects feel satisfaction.

Laboratory studies investigating the interaction between empathy and group membership have drawn similar conclusions. When pain was inflicted on a member of their own football club, the subjects empathised with their pain and were even willing to shoulder it themselves, in order to help the other person. On the other hand, when members of the opposing fan club were mistreated, the spectators showed neither pain perception nor altruistic behavioural signals; on the contrary, the familiar reward signal flared up in their brain, and they experienced "Schadenfreude".

The current empathy debate, with all its moral overtones, is also cultural: Empathy is good and does good.

The researchers also discovered that women reacted differently to men. They empathised even when unfair players were punished. Does this make women "better", more caring people? Or are there situations in which they too deny empathy and are bent on revenge? Cultural history features plenty of vengeful women: One example is Kriemhild, who took cruel revenge on her husband Siegfried's murderers in Etzel's castle. Or Medea, who killed her own children and her love rival in order to avenge her husband Jason's betrayal.

In recent times, however, women have predominantly been described as being especially caring and empathetic. Around 1820, it was thought that "women alone" were the source of all "moderate and gentle natural feelings" and that their "vivid compassion" allowed them to "partake in every misfortune". But even "natural feelings" had to be trained, maintained and cultivated. Parents and educators placed great emphasis on raising girls in such a way that they complied with their notion of "female character". This notion proved to be extremely powerful. Despite all the processes of social transformation, the stereotype that women are guided by compassion while men are governed by the postulate of justice lives on to this day. No wonder then that neuroscientists observe corresponding feelings in their female and male subjects – though these feelings are less natural than cultural.

III.

The current empathy debate, with all its moral overtones, is also cultural: Empathy is good and does good. Even Adam Smith was able to see the ability to empathise with the feelings of others as a necessary ingredient in human coexistence. The principle applied to all feelings, but the focus was on compassion for the pain of strangers. The poet Gotthold Ephraim Lessing found "the most compassionate person is the best person", or the most virtuous. The philosopher Arthur Schopenhauer saw compassion as the source of "all true human love" and moral actions. Wherever he looked – as was written in 1840 – he saw evidence of active compassion: in the active anti-slavery movement, predominantly in the United Kingdom, as well as the active animal welfare organisations in many places. Compassionate impulses stimulated social reform initiatives, from improving conditions in prisons and workhouses to fighting against child labour.

Sensitivity to violence and suffering increased significantly in the 19th century. Executions disappeared behind prison walls and floggings were no longer carried out in public. Such practices, it was now said, violated human dignity and injured the feelings of those who attended and watched, whether voluntarily or otherwise.

With their theoretically formulated and practically reaffirmed culture of compassion and

Empathy is required even in business life. More so than in politics, it is instrumental in business.

empathy, the "good" Europeans broke away from those they perceived to exhibit excessive cruelty. Initially, this meant the men and women in the bottom ranks of their own society, but it increasingly came to mean members of foreign nations. Wherever they appeared as colonisers, Europeans were outraged by what they perceived as a blatant lack of compassion. But in most cases they adapted to local customs in no time at all, and established a regime that elevated violence to a principle. After all, the locals were used to it and it was the only language they understood. Empathy was felt only in Europe and among Europeans. The rest of the world remained excluded.

But something was changing in Europe too. Nationalist and racist movements, which could be found across almost the entire continent by the late 19th century, drew the boundaries of empathy ever closer. If compassion required "an awareness of a certain likeness between us ourselves and the alien being", the negation of any likeness must inevitably lead to a denial of empathy. With this in mind, National Socialism only allowed compassion for "community comrades". The suffering inflicted on those who did not belong to the community or had been excluded from it was merciless.

But the men who tortured prisoners in the Gestapo basements and concentration camps were not callous monsters, but normal German citizens, often family men. Most were very well able to empathise with their victims. It's precisely for that reason that they knew exactly where the torture would be most effective in breaking their prisoners and extracting the desired information. As this example shows, empathy is no guarantee for prosocial behaviour. It can also be used to pursue entirely immoral objectives and commit crimes against humanity.

IV.

Another form of strategic use can be observed today. Politicians need to show empathy to prevent voters from penalising them as robotic members of an elite establishment intent on retaining power. When Hillary Clinton called Donald Trump's supporters *deplorables*, her approval ratings plummeted. Even Angela Merkel received a bad press when she was unable to comfort a crying refugee girl in summer 2015. She learnt from her mistake.

Empathy is required even in business life. More so than in politics, it is instrumental in business. Empathy training, as offered by many agencies and firms, primarily focuses on teaching a technique. Empathy is a means to an end: If you understand your customers' feelings, you can successfully persuade them to buy a product or service. If you are able to read your colleagues' feelings, it is easier to motivate them to achieve more.

Empathy academies, which are popping up everywhere now, are not usually targeted at nurses or doctors. In these professions, after all, too much empathy with patients can interfere with the necessary professional distance, to the extent that the job suffers. Instead, empathy canvassers have in their sights set on company managers, for whom an empathetic relationship with and attitude towards their employees can help them achieve better work results.

Empathy here is just another, nicer way of saying emotional intelligence. This term took hold in occupational, industrial and organisational psychology in the 1990s. A person who could decode (and control) his own emotions as well as those of others, so that he had the upper hand in every situation, was considered emotionally intelligent. The masters of emotional intelligence were masters of emotional manipulation.

But "manipulation" has negative connotations. The idea of using people's feelings in a strategic way sounds bad. Any suspicion of manipulation or instrumentalisation provokes unease, defence and resistance. But it's different with "empathy": This feel-good word immediately awakens positive emotions and sympathy. The strategic calculation behind it is usually concealed. Empathy can become a magic word, the elixir of good, attentive and responsible social and political behaviour.

The term's triumph has not been limited to Europe and the USA. Frans de Waal's "The Age of Empathy" and Jeremy Rifkin's "The Empathic Civilization" were global bestsellers. The wave of empathy has even reached China. When a young girl in Guangdong was run over by two vehicles in 2011 without passers-by taking any notice or assisting the dying child, the Chinese public spent weeks discussing the meaning behind this striking lack of empathy and what it said about the country's sense of community. Some commentators explained that this thoughtlessness resulted from the fear of being held liable for the costs of hospital treatment. Others referred to the traditional attitude of only feeling

The facelessness of the Internet gives antisocial feelings and behaviour a significant boost.

responsible for your own family members. Outside China, people were quick to hark back to the old stereotype of an uncivilised lack of consideration for others, and expressed doubt about whether Chinese culture allowed society to feel any moral sensitivity at all.

V.

But have societies in Europe and North America actually reached a higher, "empathetic" state of development? Or is the digital revolution cancelling out many civilising achievements? What role does empathy play in the age of social media platforms full of hate messages? Has the Internet really made our world more fundamentally democratic, interactive and friendly?

The overall assessment is mixed. The promise of limitless connectivity was no lie; almost every second German is registered on Facebook and, in this way, feels connected with friends, colleagues and acquaintances and shares news, photos and feelings with them. Young people in particular enjoy finding like-minded people not only in their circle of friends, but also at a distance, and communicating with them. In comparison with their offline reality, the world of virtual encounters seems smaller, warmer, more familiar, friendlier. They demonstrate this through a specific communication style that is full of *likes* and emoticons.

Another asset of digitalisation is the increased willingness to make charitable donations. Such donations have filled the coffers of humanitarian aid and non-profit organisations. Many people now donate online, and not only when disasters occur. Platforms like "Schulengel", "Bildungsspender" or "Betterplace", which support charitable projects and associations, benefit from online fundraising. This willingness to donate, online and offline, is a clear indicator of an empathy that resolutely crosses national borders. It has been booming since the second half of the 20th century, strengthened by the ubiquitous media presence and visualisation of global suffering.

But there are also drawbacks. How empathetic, sustainable and resilient are relationships made through social media? Even teenagers should now be aware that online friends are often not reliable friends offline. When a New Yorker journalist invited his 534 Facebook friends to a bar to celebrate his birthday (without picking up the tab), a whole six people came. Clicking the *like button* is an entirely different thing to empathising with the feelings of another person and behaving prosocially.

Social psychologists have observed that people who find it difficult to feel and show empathy are those who tend to use digital communication. They don't have to show their face, can hide behind pseudonyms and can assume a different identity. In the *virtual reality* of a *second life*, they can do and say things that nobody will hold them accountable for and that they would never dream of saying in their real lives.

The facelessness of the Internet gives antisocial feelings and behaviour a significant boost. Insulting other people via your smartphone, shaming them publicly or bombarding them with hate mails is much, much easier than confronting them directly and personally with your own anger. Victims of shaming or hate campaigns cannot defend themselves. The communication remains one-sided, anonymous and without consequences. Attacks are not punishable. On the Internet, people can act out their "Schadenfreude" unchecked. To share in and empathise with a lust for violence, you just need to publish a *happy slapping* or rape video online and click it. Here too, empathy is at work – empathy with the perpetrators, not with the victims.

VI.

How can we minimise or prevent these negative effects? What can social actors do to reinforce the positive side of empathy and to make social coexistence more considerate and acceptable, if not conflict-free? Singing the praises of empathy is not enough. Instead, we must establish incentives and better conditions, so that people can mobilise and implement their prosocial skills. This includes curricula that, right from primary school age, teach children about mutual regard, friendliness and willingness to help. It also includes clear rules on the sanctioning of negative empathy in order to curb the brutalisation of social manners in both the analogue and digital world.

And it includes a corporate culture that values empathy and uses it as a resource without overusing it strategically. In this type of culture, treating colleagues and employees with respect is a matter of course. And it can't do any harm to talk to them about their feelings and to understand why they are upset, dissatisfied, angry, depressed or sad. Young employees, familiar with a digital *mindset* since their childhood, wear their hearts on their sleeves and adorn their *messages* with countless emoticons. These emotional messages are intended to be noticed. Furthermore, recent studies show that younger people give negative feelings greater attention than positive feelings, while the older generation does exactly the opposite. We have to adapt to this too.

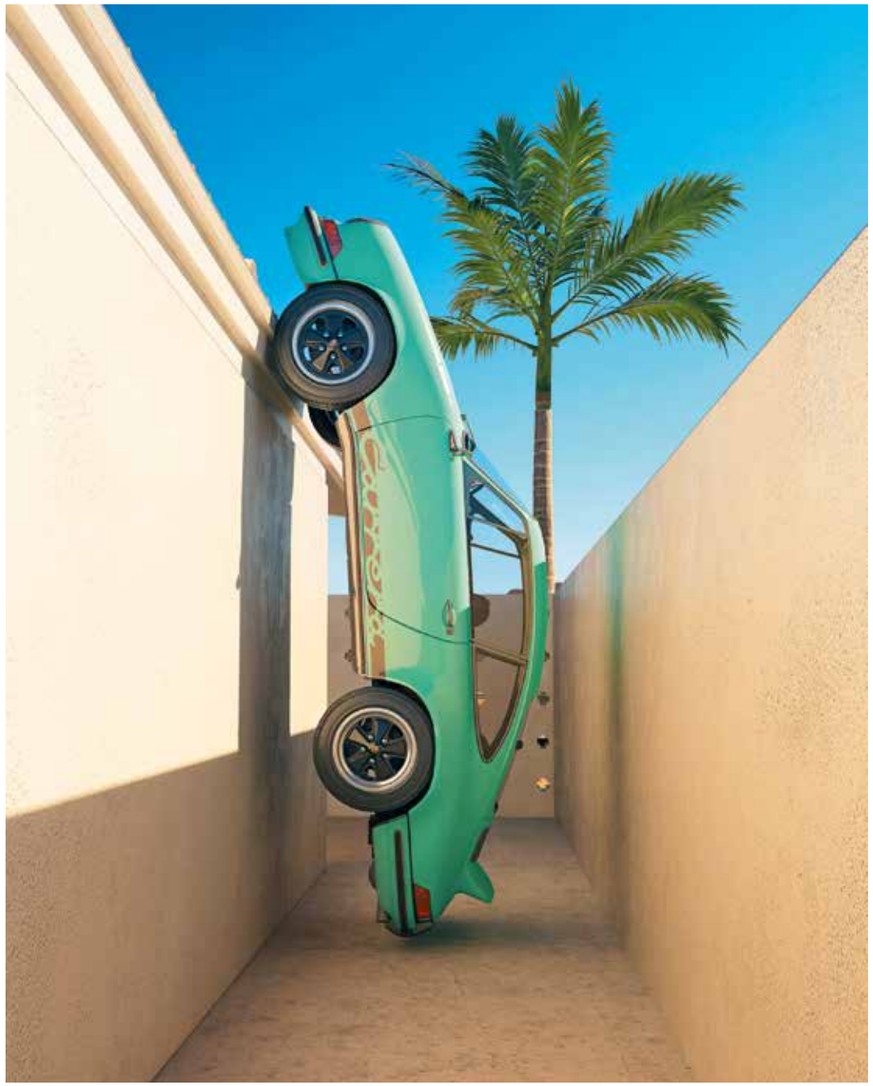
But at the same time, we should avoid anything that smacks of instrumental interest. And that goes for our dealings with customers too. Advertising cars as "empathetic companions", along the lines of the robots "sensitive to emotions" that are currently all the rage in Japan, can be counter-productive. With *affective computing*, it is now possible to equip vehicles with the ability to recognise their user's voice and adapt to it. But who wants to have their feelings continuously scanned and addressed by a computer program? If we start to besiege people instead of simply caring about them, then we're better off without it.

Illustration: James Dawe

Prof. Dr Ute Frevert is a German historian. After professorships in Berlin, Constance, Bielefeld and at Yale University (USA), since 2008 she has been the Director of the Center for the History of Emotions at the Max Planck Institute for Human Development in Berlin.

James Dawe stands out as an illustrator for his work with photo-collages and digital manipulation. His work is ever unexpected, often abstract and also dramatic. Some of his clients include Red Bull, Warp Records, GQ Style, Sky Sports and Network Rail. Since graduating from Brighton University in 2006 he has been working as a freelance illustrator in London.

The reality of simulation



SCAN THIS IMAGE

Virtual brand experiences are nothing new for the automotive industry. The racing game genre is deeply rooted in digital culture and has provided a platform for digital brand and product experiences since the 1980s. However, one thing about computer-generated images has changed: their realism.

Chris LaBrooy lives with his wife Jessica and son Chase on the outskirts of the tranquil Scottish town of Ellon. His studio is a small room on the ground floor of a narrow brick house. A bookcase, three chairs, a desk, an enormous monitor and a graphics tablet – these are the only things that the artist and product designer needs to bring his fantastic ideas to life.

His hand moves a millimetre at a time: up, around, to the right, to the left, and up again. In a matter of seconds, he's painted a car. As he changes the position of the virtual sun, the rendering of the gloss on the vehicle's paintwork also changes from one moment to the next. LaBrooy works in silent contemplation, appearing to almost disappear into the fantasy world that is taking shape on the screen. A turquoise Porsche 911 Carrera RS hovers in an upright position with the ducktail on its rear end pointing downwards, wedged between two concrete walls. The car is undamaged, its nose slightly folded, as if it wants to peer over the frame of the prison from which it is unable to escape.

3D computer graphics have long been an integral part of our visual culture, appearing online as well as in advertising, films and video games. By now, computer-generated images and films have achieved a degree of perfection that makes it increasingly impossible for the observer to distinguish between what is "real" and "artificial". *Renderings*, for example, appear to show reality but are in fact deceptive transfer images that are not grounded in reality at all. Thanks to these renderings, there are virtually no limits when it comes to creating hyperreal 3D worlds.

This topic is becoming particularly relevant as system performance improves. Equipped with virtual reality (VR for short) headsets such as the Oculus Rift or the HTC Vive, private users can immerse themselves in a real-time representation of an interactive virtual reality for the first time ever – a place where they can move, experience and feel. VR environments with extreme depths of immersion provide a completely authentic adventure and enable emotive experiences that have the power to evoke the full range of feelings. This technology is still in its infancy, but all the signs suggest that VR will trigger a revolution as big as the smartphone. Investment bankers at Goldman Sachs estimate that the VR market will be worth 80 billion US dollars by 2025.

The video game industry is one of the driving forces behind the development of new spaces and worlds. This is reflected in the evolution of racing games, which have been an important part of digital gaming culture since their inception. *Gran Trak 10*, released by Atari in 1974, signalled the dawn of a new era. In the world's first arcade racing game, the cars were still large white pixel blocks that could be driven along highly abstract lanes using a steering wheel, accelerator and brake on a monochrome computer monitor.

The progress made since then has been epochal, as today's racing games such as *Forza Motorsport*, *iRacing* and *Assetto Corsa* offer breath-taking visuals while the first VR versions of these games have already started delivering impressive experiences. Driving and product experiences are becomingly increasingly realistic, provided these experiences are actually related to real products.

In the automotive industry, the virtualisation of brands and products is becoming more important than ever. Reaching out directly to digital target groups around the world has resulted in a significant increase in brand awareness and has made it possible to hone the profile of a brand across multiple dimensions. The virtualisation of products facilitates individual interaction by combining driving experiences with customisation options. When looking at the future of VR, the importance of securing brand loyalty through emotive and interactive brand and product experiences cannot be stressed enough. This applies not only to the transfer of experiences from our normal world to the virtual realm, but also to brand-specific yet potentially completely new experiences.

Chris LaBrooy learnt two things early on. Firstly, that he was extremely talented at using special techniques to portray animated renderings as reality and could even transcend this reality on a frequent basis. And secondly: how powerful the lure of images is. An A2 printout lies in a tray under Labrooy's bookcase. It depicts a modern villa with a swimming pool. Twelve light-blue 911s bathe side by side in the pool, gently bobbing in the water as if they belong there.

Left: Under the Palm Springs sky, British 3D computer artist Chris LaBrooy renders the iconic Porsche 911 Carrera RS in a patio walkway. His image compositions are as fascinating as they are vexing: What is real? What is fake?

Top: Full throttle under an artificial sun – the complex weather simulations in *Forza Motorsport 6* enable you to drive in all types of lighting and weather.

Left: The racing simulation *Assetto Corsa* offers a visual experience with highly detailed driving physics.

Right: The digitally compressed world of motorsport: With over 450 virtual vehicles and 26 race tracks, the racing game *Forza Motorsport 6* offers virtually limitless combinations.

SCAN
THIS IMAGE

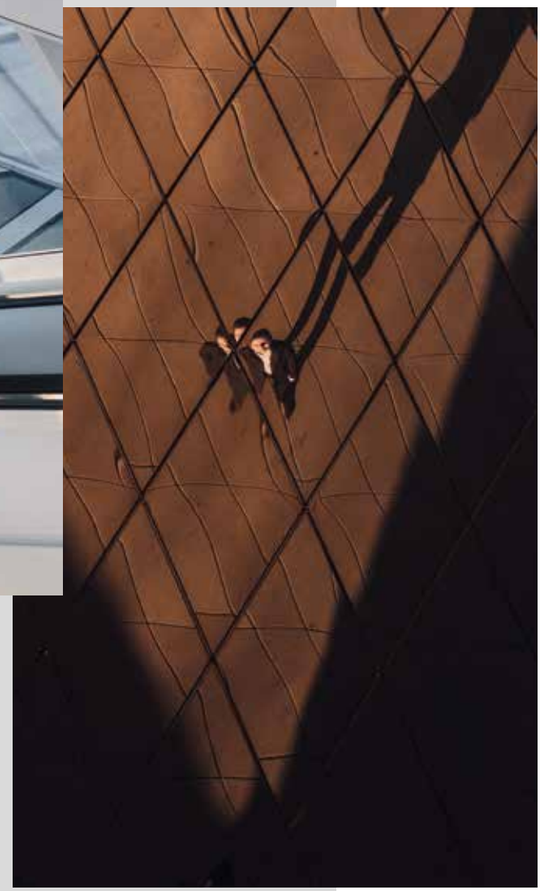
Top: In a hyperreal sculpture by Chris LaBrooy, four Porsche 911 Carrera RS cars drift skywards like balloons in a net

Right: The Porsche Expansion for *Forza Motorsport 6* brings legendary Porsche cars and motorsport moments into virtual life with over 20 models.

The future
is already here.

INNOVATION

The future is already here



While many will be busy celebrating Porsche's 70th birthday next year, others are already living the next two decades – albeit in their extremely creative heads. How is our industry changing? Are cars becoming a new living space? What is Google up to? And how will digitalisation change the working and management culture of traditional, long-established companies? Holger Endt and Frank Weberbauer, pioneers of smart mobility at Porsche, discuss the dream of Ferry Porsche – and what may become of it.

Interview: Rolf Antrecht

What about the future?

ENDT: *The future is already here – it's just not very evenly distributed.* William Gibson, the American science fiction author and co-creator of cyberspace, once said this. It's a wonderful quote. The future consists of thousands of elements, some of which we can't even see yet. But they are all here, even it is only in labs or in the creative heads of developers. We may not know their precise application for mankind, but the next 20 years are here. Very much so.

WEBERBAUER: If we compare the past 20 years to the next decade, developments in the automotive industry will be much more disruptive than we can currently imagine. The car will soon integrate seamlessly into the entire ecosystem surrounding the driver. He will be able to tailor the vehicle to suit his own individual requirements. Autonomous driving will be well established by then. This idea of getting into the car and occupying yourself with other things is already conceivable today. We can already make assumptions about what comes next, but we don't have a clear picture – yet.

ENDT: To be honest, since we made the switch from the horse to the car, very little has actually changed when it comes to the actual *doing* involved in driving. We still just sit there, pushing, pulling and steering while something else pulls and moves us along. In that respect, autonomous driving will be something of a "disruption" – at least for those people who are not used to being driven around by a chauffeur, in the broader sense. What is much more easily perceivable, is that we are creating a new living space. The difference between my living room and an autonomously driving car is becoming ever smaller. Going through the same door might not always take you into the kitchen, but perhaps into a restaurant. That is, the place where I get out is different to where I got in. And, just like in my living room, I don't want to be bothered by the road when I'm in my car. I might want to hang a picture, or put a sofa or TV in my car, just like how I design my living room today.

WEBERBAUER: We often speak of the "third place"…

ENDT: Exactly. My living space is always with me. The most exciting change will be when I no longer have to concern myself with such matters as how and where I arrive – I just arrive. This will once again alter the sense of "personal freedom". For me, it is not even so much about the car at the moment, but instead, for example, about making a connection at a well-functioning airport. This is something that will really revolutionise the automotive industry.

WEBERBAUER: There will always be a sense of excitement and passion associated with a very special car; and not forgetting the pleasure that comes with it. There are more horses today then before – not as means of transport, but because they serve as an expression of a person's lifestyle. After all, you don't buy a horse today so you can ride it to work tomorrow, but so that you can have fun with it at the weekend. Sports-cars, and the fascinating experience they deliver, will be around for as long as there are cars on the road. In 15 years' time, however, urban mobility will be much more modular in nature, and much more interlinked.

Evolution, disruption?

ENDT: It'll be some time yet before we can beam people up like on Star Trek. Now that would be a real disruption. I consider everything else to be evolution.

WEBERBAUER: The next ten years will be marked by extreme networking of all manner of things, such as personal calendars with information about traffic, parking spaces and timetables for various means of transport. This is clearly an evolution. Google and Apple have already created their ecosystems. We as car manufacturers still have to follow suit. Autonomous driving will be much more disruptive. It offers whole now opportunities in terms of individual mobility. Many studies predict that urban mobility will be enhanced by driverless robot taxis, which are intelligently operated by a central control centre. We are already seeing signs of this development today, as highlighted by initial tests conducted by ride-haling services such as UBER or Lyft with driverless taxis. We are currently investigating the implications that this may have for Porsche.

ENDT: It may be difficult to grasp, but software already plays a huge part in the shaping of our world. And digitalisation will only enhance this effect. This also applies to areas where you would not have thought such developments possible. Tesla is one particular example. These people came from the software world and decided to build a car, just as you would "build" a piece of software. And the machine really drives. It's all quite incredible. And things can go even further: we will have people who can write code and therefore have a very clear idea of what *holds the world together at its very core*. By way of example: With 20 likes, Facebook understands you better than your colleague. With 300 likes, this algorithm can describe you better than your partner. After 450 likes, the cloud knows more about you than you care to know about yourself. If you can't write code, it may become difficult to understand the processes in our world. Software is a very abstract beast. Unlike in the traditional industry, where I can see and touch everything, software isn't tangible. Once it's done, there isn't really anything to see. After that, I can only perceive things if I understand the language of the software and the data – if I can put myself in the mind of my computer, as it were. This is one of the greatest challenges facing our society. And it is our task to take our colleagues with us on this journey.

WEBERBAUER: It doesn't matter whether you're in the kitchen, on the production line or in the office, whether you're a developer or a strategist: The data analysis you mention is always equally important. Not least because this intelligent analysis gives rise to new ideas. If we just say: "We've always done it like this", we will never make this important step as a company or as a society. The great challenge facing a company like Porsche is how best to straddle the divide between tradition and innovation, between the continuation of a successful model and our duty to consistently re-invent it. This is a fundamental part of our strategy, and for good reason. Our customers rightly expect continuity when it comes to our products. Yet the world in which we live is undergoing rigorous and rapid change in the face of digitalisation: we have new technologies, new competition and a new understanding of mobility. Plus it's all happening at the same time.

Holger Endt

Dr Frank Weberbauer

ENDT: I'm from Bavaria. People there have been rather successful in making the switch from agriculture to high technology. The combination of laptop and lederhosen seems to work. You may now work for a high-tech company, but you still have "weisswurst" for breakfast every Friday. What I mean is that you can't equate tradition to some inflexible view of the past. That's the crux of the matter. As long as you view tradition as an identity, you can continue to embrace it while still doing things differently.

Wish? Dream?

WEBERBAUER: We build fascinating products. We used to have the advertising slogan "Nobody needs a Porsche, but everybody wants one" – this must still apply today. But we can't simply rest on our laurels. Success is extremely fragile in such times of sweeping change. History is littered with examples of companies that wasted their future because they couldn't take their eyes off the past. Others changed their business model entirely and enjoyed great success. We at Porsche have an unwavering commitment to our tradition, but we must do everything in our power to allow it to co-exist with this new period of upheaval.

ENDT: This might be a little abstract, but if we could entertain the thought then I'm not all that sure whether people in general consider Porsche to be synonymous with sportscars in the literal sense, but rather with a dream or a promise that only we can fulfil. Porsche will continue to build sportscars for a long time and it is very likely that the last car ever to be built will be a sportscar. But whether it is the sportscar specifically that must be our tradition or whether it can also be this feeling of "I had a dream"– I'm not so sure. For me personally, Porsche has never been just about sportscars, but rather about this notion of "having something" that you can't get anywhere else.

WEBERBAUER: A new interpretation, perhaps. But for people who own a Porsche, it's not just about making a dream come true. They are fulfilling a wish that is all about fascination. We have many customers who have been driving our cars for a long time, and there are many repeat offenders. One particular feature offered by Porsche is exclusivity. Everyday usability is the other. There's no contradiction there. You can be seen in a Porsche every day and at every opportunity and still have the feeling of sitting in something very special indeed.

ENDT: I would love to ask Ferry Porsche why he dreamed of a sportscar. Because he wanted to drive down the Italian coast in an amazing car, enjoying the wind in his hair on a warm summer's evening before settling down to a nice glass of red wine? Or did he dream of a very specific vehicle? Did he dream of something exploding and moving inside the engine or did he simply dream of driving? It is clear that skilled engineering, precision and quality play an important part in this regard. But for me personally, it is this feeling of Italy, the Amalfi Coast and the smell that goes with it. The overall experience, that is the dream. The car completes it – it is the icing on the cake.

What is luxury?

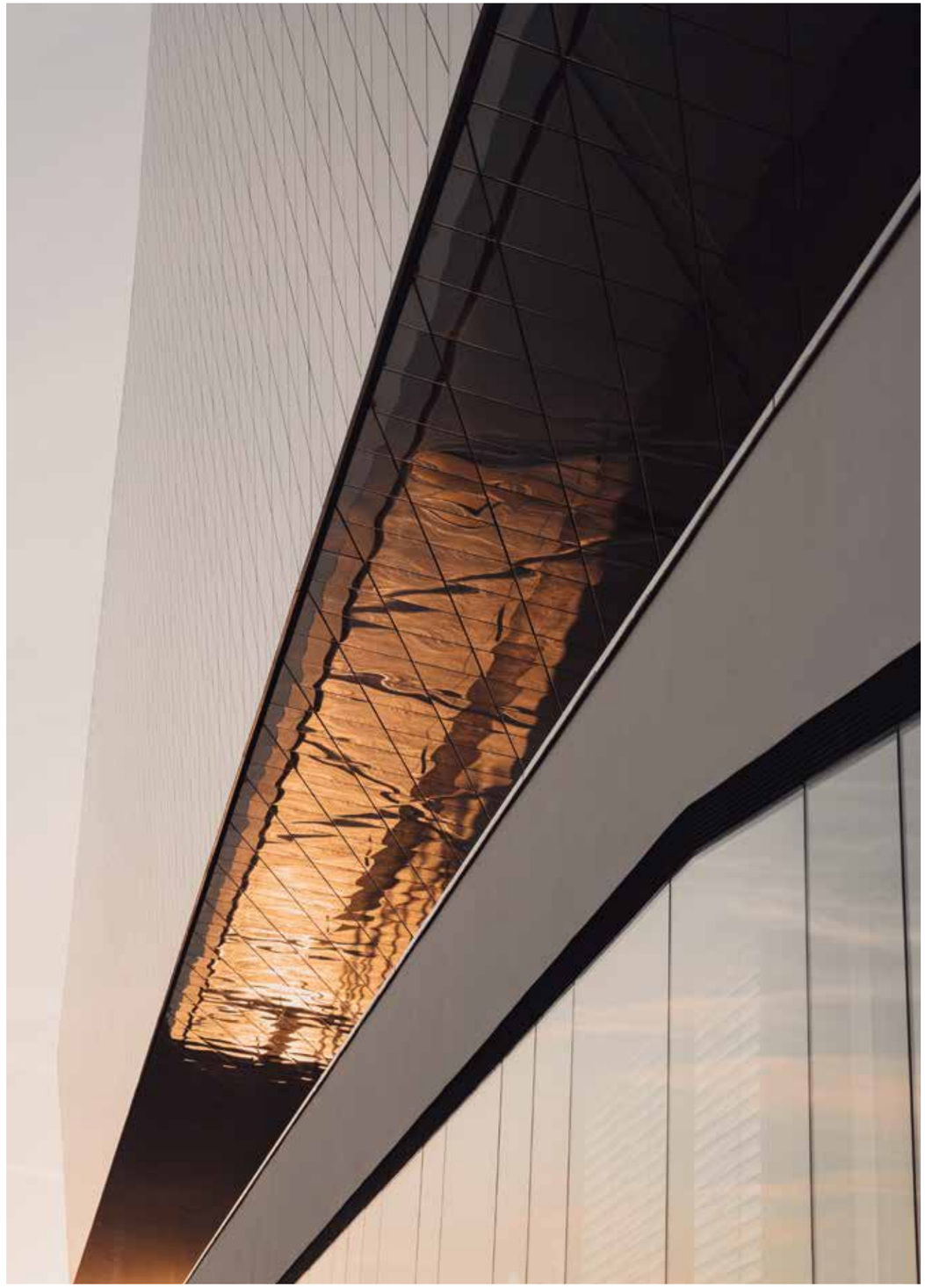
WEBERBAUER: To have the mobility that I require at any time and in any place. To have access to the type of mobility that I desire, wherever I may be at the time. To be able to enjoy a sportscar when I'm on the move and perhaps have an hour of free time. Or to have access to the most rapid means of transport, such as a train or plane, whenever I'm in a hurry. It is also important that I can swap seamlessly between the various modes of transport. And that I can use the time to do all those things that are important to me. This may be work, relaxation or even just driving myself along a particularly enjoyable stretch of road.

ENDT: For me, there are two types of mobility. Firstly, I simply don't want to move; the luxury is just being there. That is, the ability to have my own living space, inside my car. I can set it up and furnish it just the way I want. And secondly: "The journey is the reward". I would like to be in a specific place while on the move. Take sailing for example. I enjoy being on the water and surrounded by nature. Mobility as a means of relaxation. The ability to just switch off. That for me is the joy of sailing and the open expanse of the water, while others prefer cruising along in an open-topped sportscar.

What drives us?

ENDT: I once read the following in a children's book: "I can't say what my favourite food is; I always say what my second favourite is since I don't know yet whether there might be something better." What this means is, if I don't allow myself to compare what I am doing just now with something new or different, then I have no way of knowing whether what I am doing now is good or not. If I try something new, it may be better or worse than what I did previously. The main thing is that I learn something from the experience. And if the new thing is better, than I'll carry on doing just that. That's what drives me. I want things to be better.

WEBERBAUER: I'm excited by adapting a tried-and-tested system to new conditions, to contribute to this process of carrying tradition into the digital age. Theoretically, we could carry over all new mobility services, such as car sharing. But that would be too easy. We have to transfer our brand identity to this new age.



"What I mean is that a different kind of idea requires a different kind of idea management. In Silicon Valley, managers have adopted a philosophy in which you can openly say that what you are currently working on may be complete rubbish."

Holger Endt

What makes us fail?

WEBERBAUER: The difficult thing is to turn your back on something that is currently working – to hold onto something for too long. This is certainly understandable, since large companies in particular have considerable social responsibility. The trick is to let go at an early stage, without endangering the old and established. This doesn't mean that we have to immediately jump onto every bandwagon. Not every company that made smartphones was successful.

ENDT: Companies are thwarted by the ego of the employees and managers. That is my belief. If you make your fortune in a system that promotes a fixed way of thinking, this gives rise to a culture that enforces the status quo, where there is little room for new ideas. Within such a culture, innovation management is frequently misunderstood, with an absence of innovation being attributed to a lack of ideas at the start of the process. But in actual fact, the entire process chain may be the problem. What I mean is that a different kind of idea perhaps requires a different kind of idea management. In Silicon Valley, managers have adopted a philosophy in which you can openly say that what you are currently working on may be complete rubbish. To find out whether or not what you are doing is better than something else requires a great deal of skill and confidence. And this can result in some bruised egos.

WEBERBAUER: We can already see many companies adopting something of a "start-up mentality", which runs in parallel with their old philosophy, rather than replacing it. This parallel existence is chosen not only due to the prospect of leaner processes, but also because of the company's healthy respect for the possibility of failure. After all, the company has a great social responsibility.

Is failure a culture?

ENDT: People in companies are not paid for failure. They are paid to try new things, and then compare these with the way things are currently done. If I try something new, then it may turn out to be worse, in which case I simply stop doing it. That is not failure. I simply carry on as before. If the new way is better, then I adopt that instead. The term "failure culture" is a false description of what is happening here. It is a question of attitude, a matter of habit. But where does this come from? Taking the example of Silicon Valley again: Here children start to answer big questions when they are only in primary school: "Write down how you will make the world a better place in the future." My little sister is currently at school, and she has never been posed such questions. There is a whole different approach to free thought and action in the Valley. Children are taught to think big from a very young age. And they are told just to try things; perhaps they will be better.

WEBERBAUER: If we venture into new directions, the risk of failure is higher than if we simply remain on the same path. But failure is an important way of learning. The findings gained from failed projects are both valuable and necessary. That is what makes this so challenging. When new issues arise, we are permanently looking for analogies from familiar, successful projects. But there are things for which no analogies exist yet. We have to allow ourselves to fail sometimes.

ENDT: Instead of searching for analogies to new things "in the old world" – that is, in your own environment – it would perhaps be better to notice the differences between your own world and that of others. Then we would perhaps understand that the people at Google aren't trying to attack us by building an autonomous car. They are simply trying to solve the problems of humanity. Therefore, we shouldn't question whether Google's actions are befitting of the company. They are approaching something from a different angle and finding a solution that is in all our interests. We should be asking why!

WEBERBAUER: The challenge lies in integrating such a philosophy into a traditional zero error culture. We can't afford to make mistakes when building a car. The customer expects a perfect vehicle. But that is not the issue here. It is about something different: the ability to recognise opportunities, to pursue them but also to abandon them in the case of failure. This may be a matter of course in an IT company, or in a lab. But it is not so simple in an industrial culture that has developed over a number of decades, and in which products have been continuously enhanced to the point of perfection. This represents a coming together of a number of extremely different cultures within the company. In my opinion, the big challenge lies in integrating the whole team into the new subject matter as early as possible. Enrichment rather than segregation. This is a very big challenge indeed. But it is also essential to our success.

ENDT: But can we change the philosophy? Do we even have to? And what if it doesn't work? Every existing organisation will encounter problems in adapting to the new working environment. And if we then attempt to bring in new people who do things differently, then two things could happen: The existing team becomes frustrated, or the new guys do. We have to consider very carefully how to handle this, who we hire, and how best to involve the whole company in the process. By the way, Google has the very same problem – albeit it in a different order of magnitude. They set up a whole new company for their various "moonshots", as things would otherwise have become quite messy within the existing enterprise. That is not to say that this is also the right approach for Porsche. But it is important that we tackle the issue head on and don't just let nature take its course.

"But we also want to appeal to customers who do not own a Porsche but would still like to afford themselves a touch of premium mobility from time to time."

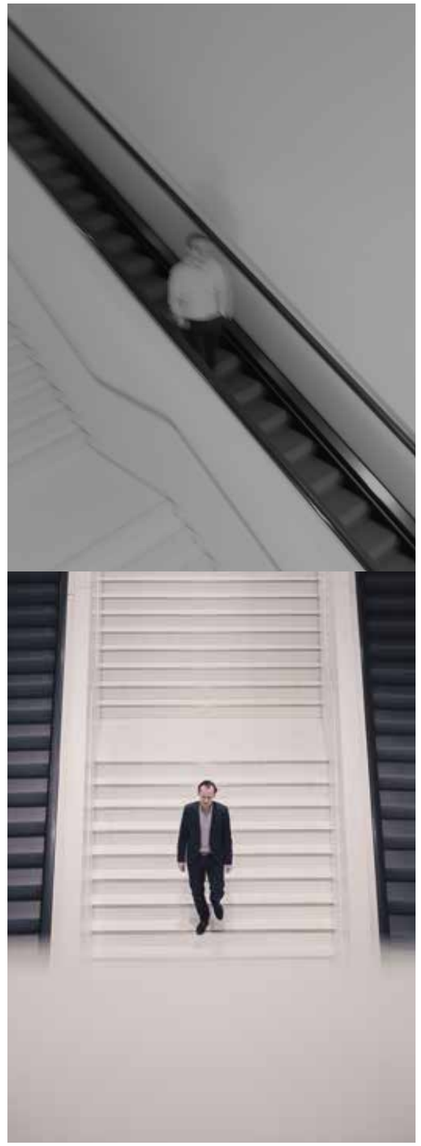
Dr Frank Weberbauer

A different way to drive a Porsche.

WEBERBAUER: There is this trend towards sharing. You no longer have to own a vehicle, but instead just order and use one when you need it. This does not match the existing user profile of a Porsche customer. Many want to own a Porsche. But we also want to appeal to customers who do not own a Porsche but would still like to afford themselves a touch of premium mobility from time to time. We could offer them a ticket into the exclusive world of Porsche. However, Porsche mobility will not just be restricted to driving a Porsche, but will also incorporate other means of transport in the future.

ENDT: We have to move away from this concept of movement and transport being something special. We will certainly continue to enjoy sporty driving, and the pleasure this entails, at the weekend. And this will remain something special. But when it comes to normal and autonomous transport, the driving experience may become less important. Maybe it'll be more about having time to yourself. Suddenly other things are much more important. And then we will know that we have arrived in the future.

Photography: Ramon Haindl



Dr Frank Weberbauer
After completing his doctorate on the subject of "Thermodynamic analysis of petrol DI engines", he worked as group manager for diesel research at Bosch before assuming responsibility for the development area of complete vehicle functions at Porsche AG. Today he is Director of Mobility Concepts and Infrastructure at Porsche. For Frank Weberbauer, 45, the next two decades in the automotive industry will deliver "what we can't possibly imagine today". But of one thing he is certain: The fascination with the sportscar will outlive any disruption – even if the pleasure of driving changes and the car becomes a living space.

Holger Endt
Holger Endt, 35, is the project manager for Connected Car and "Digital Transformation – Products and Services" at Porsche. Endt is an engineering graduate who studied electrical engineering and information technology at the Technical University of Munich and was awarded a scholarship in the Manage&More development programme of UnternehmerTUM GmbH. He started programming at the age of six and, during his studies, worked with the European Space Agency (ESA) on a feasibility study for a student mission to the moon. He later started his own technical consulting company, conducted research for BMW in Munich and China before finally joining Porsche in 2015. In his current capacity, he is actively shaping the company's strategy for Connected Car and Smart Mobility.

Trial and error
Why failure is part of (good) business

The two inventors of bubble wrap, Alfred Fielding and Marc Chavannes

If they want to make the impossible possible, entrepreneurs need to put up with all kinds of things. That might also mean coping with the possibility that they will repeatedly fail.

Author: Harald Willenbrock

It was a work of art in miniature – made from aluminium and plastic, developed by one of the most popular designers of his time, and featuring an ingenious technical trick. “Hot Bertaa” was produced by an Italian cult brand, famous for its lemon squeezers that look like rockets and kettles with colourful whistling birds on the spout. Both were bestsellers – in the hundreds of thousands. Now came a joint project between Philippe Starck and Alessi to develop a new type of kettle, and everything was in place for “Hot Bertaa” to become the next global success.

In fact, the appliance turned out to be a spectacular flop. The mechanism that was designed to restrict the outflow of steam and had worked on the prototypes failed in practice. Many customers were put off by the kettle’s futuristic shape, others by its high price. After just 25,000 units had been produced, Philippe Starck’s innovative kettle disappeared forever into the depths of the Alessi company archive.

For Alberto Alessi, it was a defeat that cost millions – but a reassuring sign at the same time. “We are proud of our flops”, explains Alessi, head of the family business based in Crusinallo on Lake Orta, who estimates that he has already sunk millions of euros into failed products. If his product launches did not fail every two or three years, Alessi would take this as a sure sign that his company was in great danger. “Fiascos are essential to our survival because they show us that we are on the right track. As a design brand, we have no choice but to sail as close as possible to the limit of what is feasible”. While his company has lost millions on failed innovations, it has profited many times over from bold ideas that have prevailed and gone on to become successful models. Take Alessandro Mendini’s “Anna G.”, a corkscrew that at first glance looks like a novelty item and at second glance is reminiscent of a female silhouette. This has become a long-standing bestseller that has been generating revenue for Alessi for more than 20 years.

In adopting this approach, Alberto Alessi is embracing a fundamental insight attributed to Winston Churchill. According to the British statesman, “success consists of going from failure to failure without loss of enthusiasm”. This is because it is impossible to calculate whether ideas will take hold, and one cannot compel them to do so. The only option open to true entrepreneurs is therefore to keep experimenting with new ideas. To fail. To try again in a different way. And perhaps to be unsuccessful again. By its very nature, experimenting is an open-ended game. You will only know if you try. And the outcome may well be bankruptcy.

Statistically, of the six million companies registered in the US, some 600,000 vanish each year. And even size is no guard against failure. Anyone who follows the list of America’s 100 richest companies will see that in ten years’ time about 20 will have gone. Too big to fail is an illusion (unless you have the backing of a government that can keep a dying company alive as a zombie business). Some years ago, an apparently unshakeable company with 22,000 employees was caught out – a company that until its collapse had flattered itself with the boast of being “The world’s greatest company”. Its name? Enron.

“It’s true that organisations can be successful for a very long time”, says British economist Paul Ormerod, who has written an entire book on the underestimated yet widespread phenomenon of business failure*. “But it’s also true that they all fail in one unforeseeable moment. Failure is everywhere”. According to Ormerod, companies that are doing well are particularly susceptible to collapse because when you are successful, you lose your ability to scrutinise yourself and the basis of your success.

Failure is commonly treated as a tragic workplace accident in a world full of success stories. In reality, it is an integral part of business. And that is just the way it should be.

It is only through experimenting, irrespective of the result, and a readiness to fail that you can find out where the “borderline” is, as Alberto Alessi calls it – that ever-changing, unseen line that separates the grand failed attempts from the unexpected bestsellers.

Max Levchin, for example, looks back on his first company as something that imploded “with a great bang”. His second and third companies took a similar nosedive. The fourth survived, at least: “It still didn’t really feel great, but it did okay”, says the IT specialist and serial entrepreneur. His fifth company was PayPal – the idea that took Levchin over the borderline and into the realm of successful innovations. Two years after setting up PayPal, Levchin and co-founders Peter Thiel and Elon Musk sold their payment service to eBay for 1.5 billion dollars.

Crazy? No doubt. But only by trying things that seem to be crazy can you find out which ones really are crazy and which are true strokes of genius. Or – as often happens – you can find out which ideas do not work as you imagined at the start of the experiment, and discover another, better application instead.

This was exactly the experience of a research team at DuPont, the US chemical group, who were looking for a new refrigerant to use in

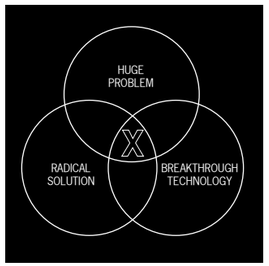
Talking about failure: FuckUp Night in New York

When it comes to the accuracy of our view of the future, we are like snipers firing at extremely mobile targets with a gun set in concrete – and we keep wondering why we so rarely hit the bull's eye.

fridges back in the 1930s. During their experiments, the researchers noticed that, in certain conditions, their precursor material tetrafluoroethylene (TEF) polymerised to form a material that did not react with any other substance. This finding was completely useless for the actual objective of DuPont's research, but the material was, and still is, perfect for providing a long-lasting protective coating on any number of products, from spacesuits to frying pans. And because of these properties, Teflon – as the accidental invention was christened by DuPont – became a veritable billion-dollar business.

Alfred Fielding and Marc Chavannes also came upon wealth and fame in a similarly roundabout manner. In 1957, the two US inventors were trying to create a 3D plastic wall covering in their garage by sticking shower curtains together, producing a bubble effect between the material. Unfortunately, no one was interested in their invention. They also tried to sell their bubble idea as an insulating film for greenhouses – with little success. But instead of giving up, Fielding and Chavannes hit on the idea of marketing their product as packaging material to protect fragile goods during transport. Bingo. Today, "Sealed Air", the company that Fielding and Chavannes set up to make their bubble wrap, employs around 25,000 people in 175 countries around the globe.

Fielding and Chavannes succeeded in achieving something that many find extremely difficult: Not to regard mistakes as a setback or lack of success as a failure. Failure is the unloved sister of innovation, often hidden away like an embarrassing relative. Interestingly, failure can hit particularly hard when we are actually sure about what we are doing. In his book "Stumbling on Happiness", Harvard psychologist Daniel Gilbert outlines why things turn out differently in life and not in the way you expect.



The moonshot thinking approach at Google X and Astro Teller, Director of Google X

The main reason is that "we tend to imagine the future as the present with a twist, thus our imagined tomorrows inevitably look like slightly twisted versions of today".

Unfortunately, the future does not meet our expectations. When it comes to the accuracy of our view of the future, we are like snipers firing at extremely mobile targets with a gun set in concrete – and we keep wondering why we so rarely hit the bull's eye.

Unavoidable failed attempts may give rise to completely contrasting reactions. Either you retreat into your "we've always done it this way" comfort zone where there is no risk and no failure but also no possibility of change and progress, or you accept failure as the inevitable price of experimentation. It is even better if you can learn to regard failed attempts as the impetus behind progress that spurs us on to find better, more resilient and more successful solutions. "We must learn to fail", asserts Birgit Thoben, Innovation Manager at technology giant Bosch, with good reason. "We need a hundred ideas for one to take hold".

But what happens to the other 99 ideas that don't make it? And what about the people who have developed and championed them, then ultimately have to let them go? "Our media-based culture is a culture of winners that makes it harder for any of us to lose graciously", explains psychoanalyst Wolfgang Schmidbauer. "In the media-driven world, small players are of no interest and mediocre success is boring". A culture of winners therefore inevitably produces people who feel like losers, even though they lead a completely regular life with its unavoidable peaks and troughs.

But as long as perfection is regarded as a positive attribute and failure is hushed up because it might kill a person's career, it is impossible for a genuine risk-taking culture to become established. It is even more disastrous to sidestep every risk for fear of failure. But this is exactly the strategy that appears to be the most widespread, at least in Germany, as Andreas Kuckertz discovered. As Professor of Entrepreneurship at Hohenheim University, he surveyed 2000 Germans on their attitude to company formation, risk and failure. He found that causes of financial difficulty such as unemployment or a weak economy, for which those affected were not responsible, were largely accepted by the respondents. In contrast, causes that company founders had brought on themselves were stigmatised ("I just wanted to try

The true skill in this regard is to be able keep falling down without breaking every bone in your body. "Fail fast, fail cheap" is the motto in Silicon Valley, the engine of innovation on America's west coast.

something out"). More than 40 per cent of those surveyed said that they would prefer not to found a company at all if there was a risk of failure. But this is akin to avoiding swimming for the sake of safety because the risk of getting wet seems too great.

Thankfully, alongside those who shy away from risk are people like Max Levchin or Alfred Fielding who are happy to embrace it and do not misinterpret a bump in the road as an indication that there is no point forging ahead. For them, a mistake is not the worst thing imaginable but a valuable signpost. It is a blip along the way that highlights factors that have been overlooked or interpreted wrongly. The true skill in this regard is to be able keep falling down without breaking every bone in your body. "Fail fast, fail cheap" is the motto in Silicon Valley, the engine of innovation on America's west coast.

One thing is clear: Even in Silicon Valley, making a mess of things does not go down well, and failure is not a happy prospect for any developer. Nobody knows this better than Astro Teller. "It is disheartening to hear that what you have been working on is not working", says the CEO of X. Based in Mountain View, California,the company is the think tank of Google's parent company Alphabet Inc. Its goal is to find pioneering solutions for mega missions such as combating global hunger and providing worldwide access to the Internet – tasks that appear as insurmountable as it did to get to the moon in the early 1960s. Which is precisely why this method of innovation has been dubbed "moonshot management". "Here is the surprising truth: It's often easier to make something ten times better than it is to make it ten per cent better", explains Teller. When people are only working towards negligible optimisation, they mostly take the usual routes and use tried and tested tools. "But when you aim for a 10x gain, you lean instead on bravery and creativity – the kind that, literally and metaphorically, can put a man on the moon".

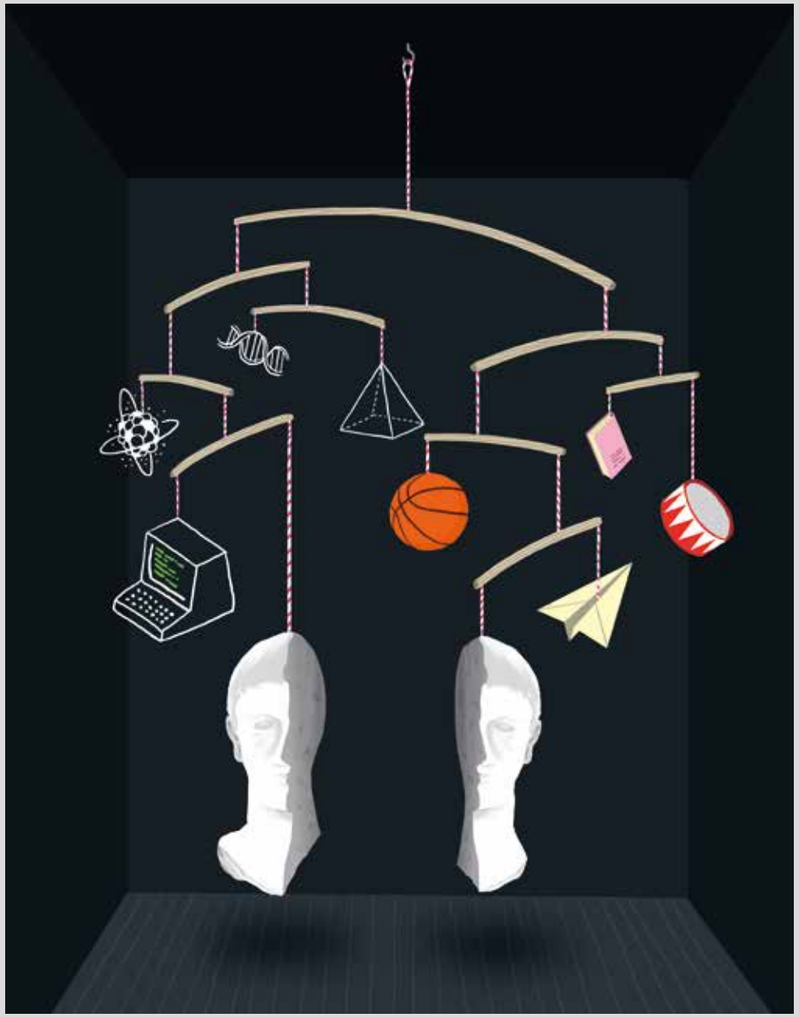
Following this approach, Teller's colleagues have developed break-through innovations such as Google Glass, Google's self-driving car and Project Loon, a network of hot-air balloons that the search engine giant hopes will provide Internet access to some of the most remote regions on earth. In the process, countless ideas have therefore had to fail and innumerable projects buried at X – and that is how it should be. If you want to win, you have to be able to fail (and vice versa). "If you don't fail in the beginning, then your goal simply wasn't ambitious enough", says Teller, who explains his trial-and-error approach in a highly recommended TED talk. "You make a ton of progress by making a ton of mistakes".

The X researchers are following in the footsteps of a famous compatriot who introduced a whole host of innovations more than 200 years ago. As well as the United States Declaration of Independence, Benjamin Franklin was also responsible for useful items like the lightning conductor, the glass harmonica, an early form of swim fins, bifocal glasses and the flexible urinary catheter. The skilled printer and inventor also experienced a large number of expensive and failed attempts along the way. The "Pennsylvania fireplace", a wood stove he developed that was supposed to be particularly efficient, mainly generated significant financial losses rather than heat. But it didn't matter. Nobody's perfect.

Franklin put it like this: "I haven't failed", explained the inventor and entrepreneur. "I've just found 10,000 ways that won't work".

*Paul Ormerod: Why Most Things Fail, John Wiley & Sons 2007

Harald Willenbrock writes for the business magazine *brand eins* and recently failed to establish a bee hive on his roof.



The processes of creating new things, implementing innovations and managing daily business are tasks that each demand a different type of usage of the brain. We talk of intuition, will/instinct and reason. Today, people often attempt to push forward innovations simply by using the powers of reason from their daily business. But that won't work!

By Prof. Dr Gunter Dueck

A long time ago now, my children were considering what subjects they should study. A wise professor said something along these lines: "Your best path is to choose the area of work that is dictating the crucial ideas of the age. At one time that was nuclear physics, then management; today it is probably biotechnology or Industry 2.0." That is what they both did, but many relatives advised them to focus instead on something with secure employment prospects. Each had particular conceptions of this solid security; today, however, when my children have graduated, these have become highly questionable.

Thus, there are people who love new beginnings and discoveries, and others who even as children take out a mortgage savings plan, who dream of finding a partner for life "from the same village" and who apply for a secure position at a larger firm. The latter are in the vast majority, but the digital revolution is bringing up new questions: How much is secure consistency worth? How much innovation do we need to aim for? The priorities are shifting.

The discussion of such opposite poles has been going on within the field of psychology for a long time. In his acclaimed book, Basic Forms of Anxiety (1961), Fritz Riemann contrasts various pairs of anxieties or fears. For example, compulsive personality has a fear of change, while the hysterical personality longs for change, becoming bored with consistency and moving on with irritation if nothing new ever happens. Compulsive people are neat, perfectionist, traditional, clean, hard-working, solid, conservative, careful and thrifty. Hysterical people need excitement, enterprise and variety. They always want to be meeting new people, having adventures and having fun. Taking risks? No problem. In this sense, the unsteadiness of "disruptive" digitalisation is uncomfortable for all those people whose personalities lie closer to the compulsive end of the spectrum. People who tend towards the hysterical side, on the other hand, find the ongoing transformation great: Things are cooking!

When it comes to innovation, we almost automatically look across the pond. Where Germans tend to struggle with major changes, the Americans in Silicon Valley, for instance, are already cheerfully trying everything out in a way we find too unselfconscious and naive in terms of consequences. Americans, you could therefore claim, are more hysterical than us Germans. A glance at old school reports is almost enough to confirm this. Top marks require effort, organisation, co-operation and good behaviour – not humour, creativity, courage, energy, initiative or entrepreneurial spirit. Do we really want things to stay this way? The compulsives prevalent in today's society are amazed at the young people of "Gen Y", the millennials or digital natives with their conception of meaningful work, flexibility, mobility, personal responsibility and independence, of achievement and happiness, internationality and multiculturalism. "They are a totally different kind of people," we hear it said. At the same time, it is more the hysterical replacement of the old by the young that gives us hope.

The current situation can be explained using a model for humans with a mathematical touch: Sigmund Freud sees in us a super-ego (the rules of our lives including from our parents or the

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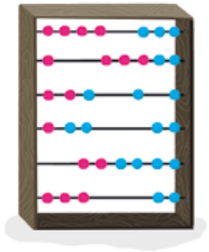
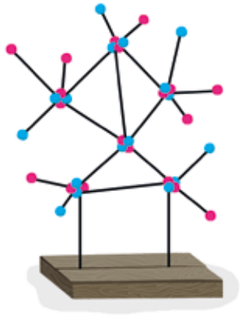




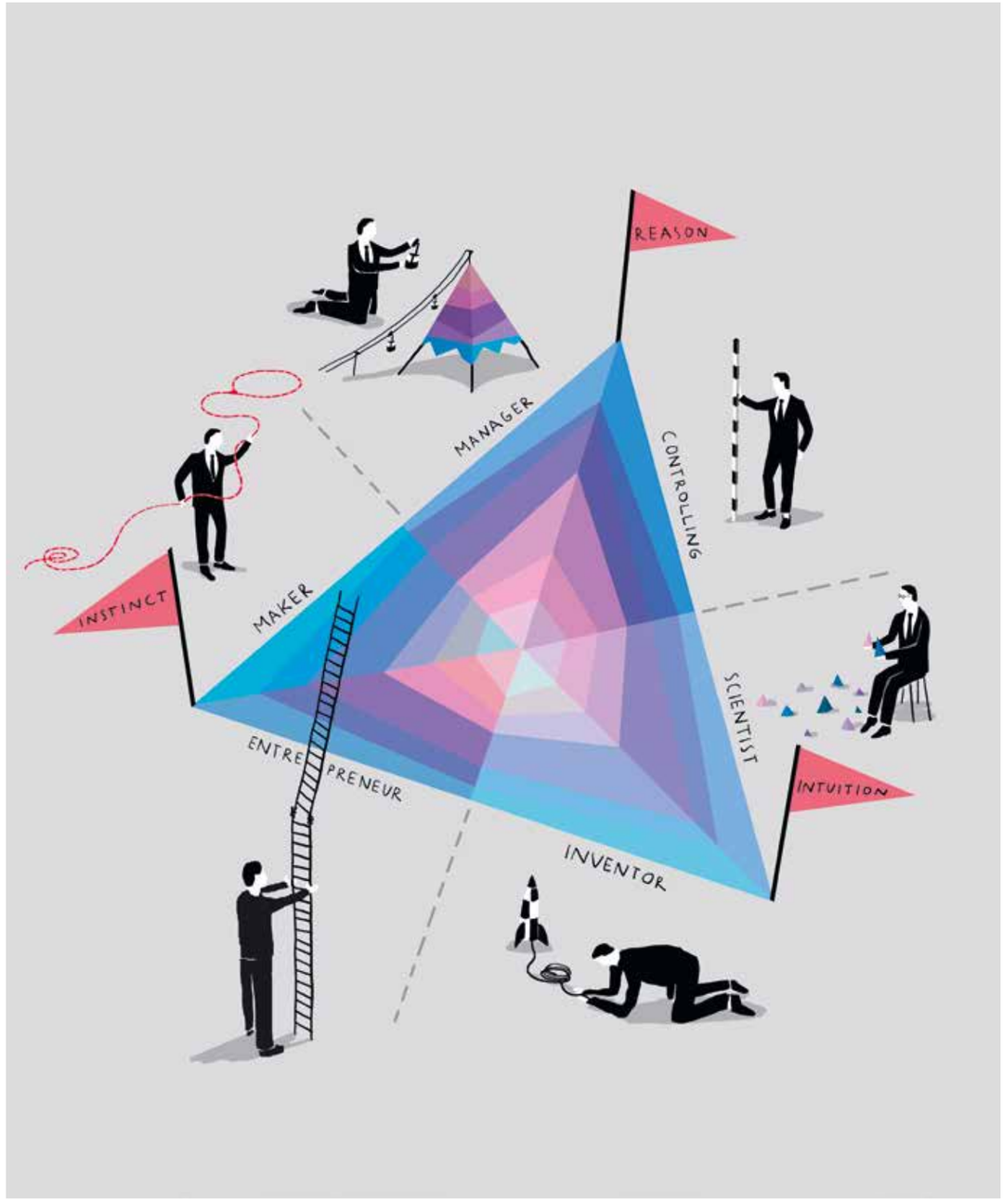
education system), the ego and the id, which denotes the drives that want to or have to be lived out and enjoyed. The Bible recognises belief in God and sin in the body (like the id). The teachings of the Buddha distinguish between manas – keen, often self-seeking, analytical understanding – and buddhi – a holistic intuition, which is able to detach itself from ego and see the world as it truly is, rather than through the filter of the self and the fetters of culturally imposed rules. C.G. Jung differentiates between the perceptive functions of directly absorbing individual facts (nowadays, for example, numbers management) and intuitive perception (picturing the whole before you intuitively). For some time – since Jung – it has been fashionable to situate these two kinds of perception in the two halves of the brain. We talk about left-brain and right-brain functions. According to this, the left is where we find the more black-and-white world of logic, while the right houses the more colourful world of ideas, principles and images from the imagination. Pure left-brainers act as controllers in head office or consistently reliable line managers. Right-brainers lean towards research and development or become pioneers if they have sufficient volition to make something of their discoveries. The makers, doers and entrepreneurs of start-ups are the ones who can turn discoveries into innovations.

There are – disputed – tests which suggest that in most companies a good 80 per cent of managers are "left". They only ask about thinking, not about action, not about gut decisions, responses when faced with danger or uncertainty. This promotes the idea of a third half of the brain, perhaps the nerve cells in the spinal cord and in the stomach? That is where we find instinct, which sends us lightning-flash warnings! Is this where we find the soul of entrepreneurs and athletes? It is not the sin and the id, like the instinct condemned by Christianity as animal and described by Freud as drives. No, we find in it a valuable entity representing the will, the energy to act, the instinctive judgement of the captain in a storm. From all this you could argue:

– Efficiency innovations reside at the top – reason
– Improvement innovations reside at the bottom right – intuition
– Disruptive change has more to do with willpower in uncertainty and requires a fine business instinct

Business economics is seated in the left camp and only knows the "homo economicus" who makes cold, rational decisions. The management of large businesses is dominated by the left-brain thinking of numbers management; will and vision are applied for the purpose of reaching numerical targets, but lack the necessary strength for radical digitalisation. This deficit is expressed in the management literature of the day. The purely left-brained attitude of the kind of process thinking that was almost celebrated in the past, is today increasingly criticised as being excessive: "That is how managers think, and definitely not leaders!" This phrase expresses the belief that the classic "white collar manager" of the old American school or the classic German executive should be replaced by a more proactive model. "Management" is associated with planning, organisation, co-ordination and oversight (the daily business of a large company), while "leadership" is connected with persuasive communication, vision, cross-cultural

The management of large businesses is dominated by the left-brain thinking of numbers management; will and vision are applied for the purpose of reaching numerical targets, but lack the necessary strength for radical digitalisation.



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In essence, all companies are noticing that they must more or less reinvent, reanimate or create a new their entrepreneurial and creative sides in order to overcome the disruptive revolution.

integration, employee coaching and talent development, networking and active encouragement of innovation.

How does the management model mutate from the left to the opposite side? That requires a very fundamental shift in the psyche of a business. It needs to transform as a whole;its heart must beat differently, its soul mutate. This fundamental set of problems is rarely discussed from the ground up – the whole is hardly a topic for general discussion, not in the least! Instead, it is possible to observe the transition from one model to the other drop by drop in many places.

The good old brainstorming technique is currently being energetically dusted off and upgraded to design thinking. It has become more than about just coming up with ideas for improvement within your own department. The current method is to discuss ideas in general, including with future customers, and to have them tested as early as possible with initial prototypes of an idea. The classic approaches of ideas and innovation management with their notions of stages and funnelling are losing ground to more active alternatives. The word “agile” is being bandied about almost like a magic word. Everything must now be agile – many large companies are converting the classic organisation with stages of development (“waterfall model”) to agile cycles, in which after each phase (“sprint”), the current status is repeatedly discussed with the subsequent customer, who is always able to contribute new ideas and improvements.

More and more, high-ranking company directors as well as politicians report back from visits to Silicon Valley. They generally return deeply impressed by the entrepreneurial “agile” ways of the mostly young people. They think about how they can turn their employees into entrepreneurs, how their managers can become leaders, how everyone in the company can work as willing and loyal followers towards a vision for the future. For about three years, the Gartner Group has been pushing the idea of “bimodal IT”, IT which has one branch managing the day-to-day IT and the other branch engaged in constant agile innovation in IT. These ideas are now being transferred to the whole company, not just to IT.

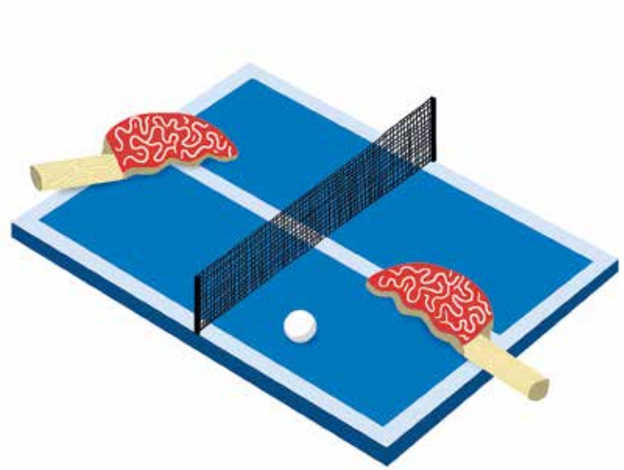
In essence, all companies are noticing that they must more or less reinvent, reanimate or create anew their entrepreneurial and creative sides in order to overcome the disruptive revolution. What they do not yet understand, however, is that to do so, their psychology is fundamentally changing, that this squabbling around the question of “Is the new a blessing or a curse?” is not an objective discussion but dissent in the face of the “brain preferences of a company”.

But how does one go about transforming the soul of a company? How do dutiful employees of large organisations learn to feel “passion for the business”? How do “responsible administrators” become “customer advisers”? How can perfectionist planners in an error-free environment be encouraged to start something when it is not 1000 per cent certain that everything will work as it always does? How do companies behave under conditions of absolute insecurity in the markets – in view of all the crises that now erupt almost on a yearly basis and, time and again, snatch away successes that were believed secure?

A good start might be to take a critical look at models of thinking and processes in a company, but not from the perspective of efficiency or cost cutting this time! Instead, the question to ask is whether the company has a great passion for innovation or simply responds to changes? Does it want to get going of its own accord or does it wait until there is no choice? Does it struggle with changes or is it confident that it will benefit from them? Is the company ship robust in the face of the approaching storm? Can is also prosper in unfamiliar circumstances (“resilience”)?

The rigidity that hyper-efficiency has given us must be softened in favour of a new flexibility. Often this means that we must take something that we celebrated as an accomplishment (of efficiency) only a few years ago, and give it up again. And we are not allowed to be hurt by it! But it does hurt! We must simply listen much more to the young employees of Generation Y, who change everything with the necessary joy and intrepidness. Anyone who has successfully steeled themselves in today’s internship generation is resilient and entrepreneurial, makes the required decisions and lives with the consequences. The “new ones” can speak more languages, are more international, have lived through more crises, are happier experimenting and are more flexible regarding location than any other generation on Earth has ever been. They will help us. Because: The spirit of enterprise must return! Look forward to an exciting future!

Illustrator: Alexander Glandien



Prof. Dr Gunter Dueck, mathematics professor and former Chief Technology Officer at IBM Germany, is today a freelance writer, philosopher and satirist – with a second home on the Internet.

Alexander Glandien works as an artist and illustrator in Vienna. Since 2009, he has lectured at the University of Art and Design Linz. He regularly works for the New York Times, the Neue Zürcher Zeitung and Brand Eins. His artworks are held in Federal collections, as well as at the Albertina in Vienna and elsewhere.

The factory of the future is already here

The factory of the future is already a reality at the Porsche sites in Leipzig and Zuffenhausen. This is particularly evident in the new engine plant in Zuffenhausen in which Porsche has invested 80 million euro. Up to 200 engines can be assembled here per day and some 100 technical innovations are deployed in the production department alone. The foyer – brightly lit with modern LED lamps – is more reminiscent of a technology centre. The functions of the precision machines are overseen by monitors. With its white floors and state-of-the-art technology, it is a futuristic-looking factory that sets benchmarks and leads the way into the future.

"Porsche Production 4.0" is a natural evolution of the current production system – a continuous improvement using new technologies and methods. Applications from the digital world are connected with the physical world. To this end, Porsche has defined six areas that continue to be developed on an ongoing basis: production system, resource efficiency, work organisation, new technologies, digitalisation and communication.

The modern one-line concept – a typical Porsche manufacturing philosophy – places the person at the centre. The idea is for every employee to perform as many work steps as possible so that, in principle, any employee could be deployed anywhere in the plant. Porsche embraces the factory concept and uses robots to perform specific tasks where absolute repeatability is required. And in the ergonomically optimised assembly line of the engine plant, all tools and processes are tailored towards supporting the employees in their work. In addition, the employees use wireless EC screwdrivers that know the exact torque curves defined – even if they are taken to a different work station.

Smart does not just mean computer-based or robot-controlled, however: A quality control loop, involving employees from all areas relevant to production, ensures that prompt action can be taken if abnormalities are identified during the assembly process, thereby preventing a high error rate.

Furthermore, Porsche Production 4.0 is not only innovative, but also sustainable. Thanks to the careful use of resources in production – such as switching to standby mode and environmentally friendly logistics – the company managed to save around one million euro in 2016, while also reducing carbon dioxide emissions by 2,254 tonnes.

Photographs:
Ramon Haindl

Augmented reality:
In the Porsche quality centre, detailed experiments are being conducted into augmented reality to find out if it is possible to obtain more precise information about individual components even more quickly. What this means is that work steps or production details can be displayed directly on a tablet with added computer-generated information. Even minor deviations from the standard are identified straight away and it is possible to see clearly where body parts fit together perfectly or do not quite sit right.

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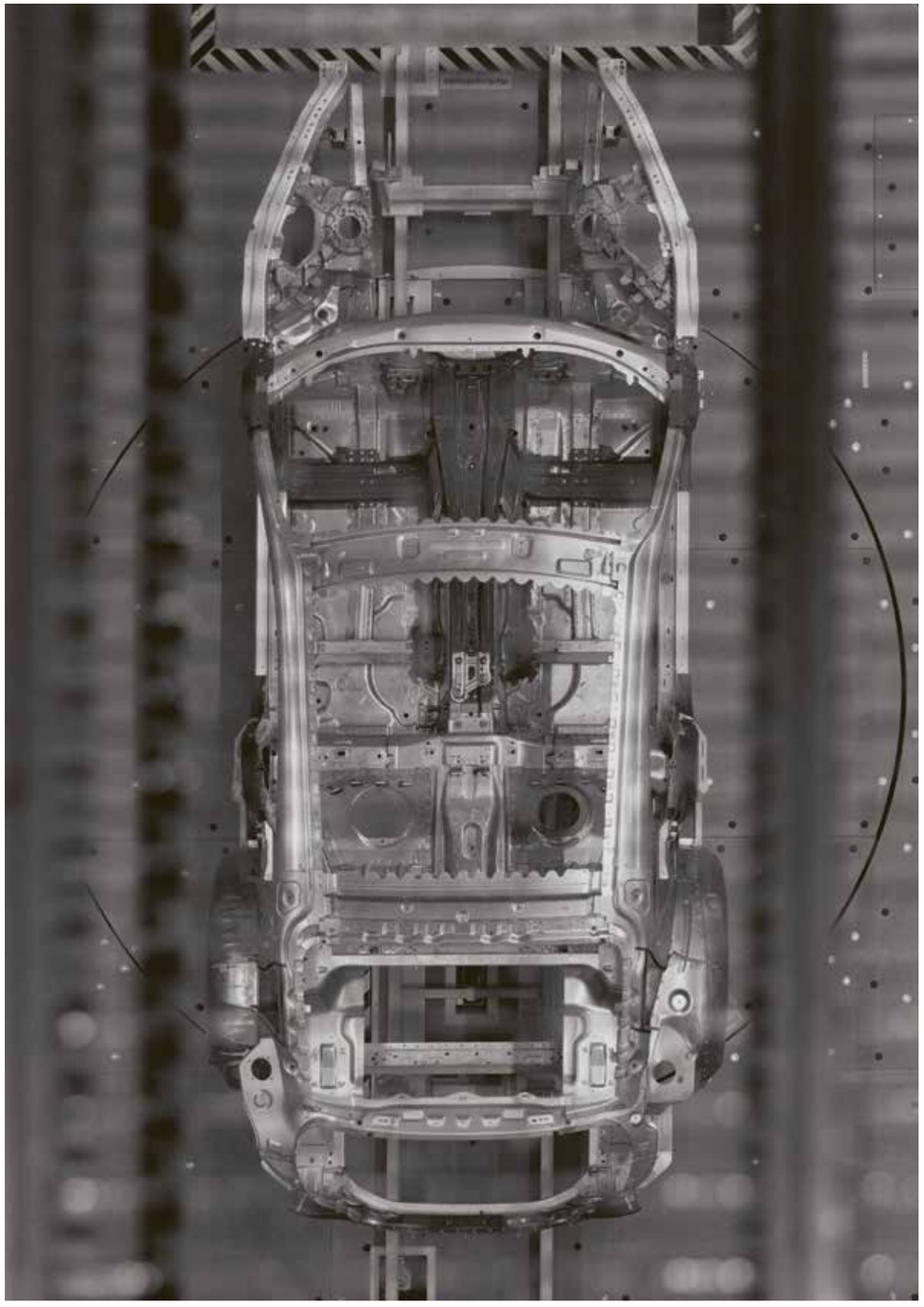
Optical digitalisation:
The quality of body parts is checked quickly and precisely using special optical technology. Every component is fully digitalised and measured in three dimensions. Up to 16 million points are recorded per scan, enabling the entire component geometry to be extensively plotted in a high-resolution point cloud. In the quality assurance process, deviations between each individual body point and the CAD data can be determined in the minimum amount of time. Using the digitalised measurement data, the deviations are also visualised precisely in an all-over 3D representation.

Extensive options: There is a lot that can be done digitally, but not everything. In order to perform a final check and assessment of the properties of a vehicle and individual components, actual vehicle models will continue to be needed even in the future. They alone can provide complete, realistic impressions. The cubing method uses models that are true to the original and provide extensive options for testing and analysis.

All production parts are represented, assembled, tested and harmonised in their original dimensions. The model is fully electronic, meaning, for example, that the wing mirrors can be folded, the windows opened and closed, and the lights and the position of the rear wing tested.

Using robots to optimum effect: Porsche uses industrial robots, for example, for sealing oil pans. As the seal depends on the material being free from grease and dirt, a robot first moves along the surfaces with a cleaning tape. All particles cling to this microfibre cloth that is wetted with primer. A second robot then applies the fluid sealant and a camera monitors the process.

Rethinking efficiency: This V8 bi-turbo engine block was manufactured in the new Porsche engine plant, in which over 100 technical innovations were deployed. One such innovation is the hot test that the engines have to pass. The energy generated during the test is used for heating and provides up to 80 per cent of the heating energy required by the entire plant building.



Lightweight guaranteed:
One of the characteristic innovations in the body shop is that the new Panamera is manufactured using a fully galvanised hybrid lightweight body in a mixed construction of aluminium and steel. The body is made from hot-formed steel sheet as well as extruded profiles, sheet metal and cast parts made from aluminium. The purpose of employing this combination of materials is to use the material with the best properties in each case, which results in the Panamera being extremely lightweight. 475 robots and around 190 specially qualified employees are responsible for building the bodies, which are made up of 430 individual parts manufactured using innovative thermal and mechanical joining methods – such as bonding.

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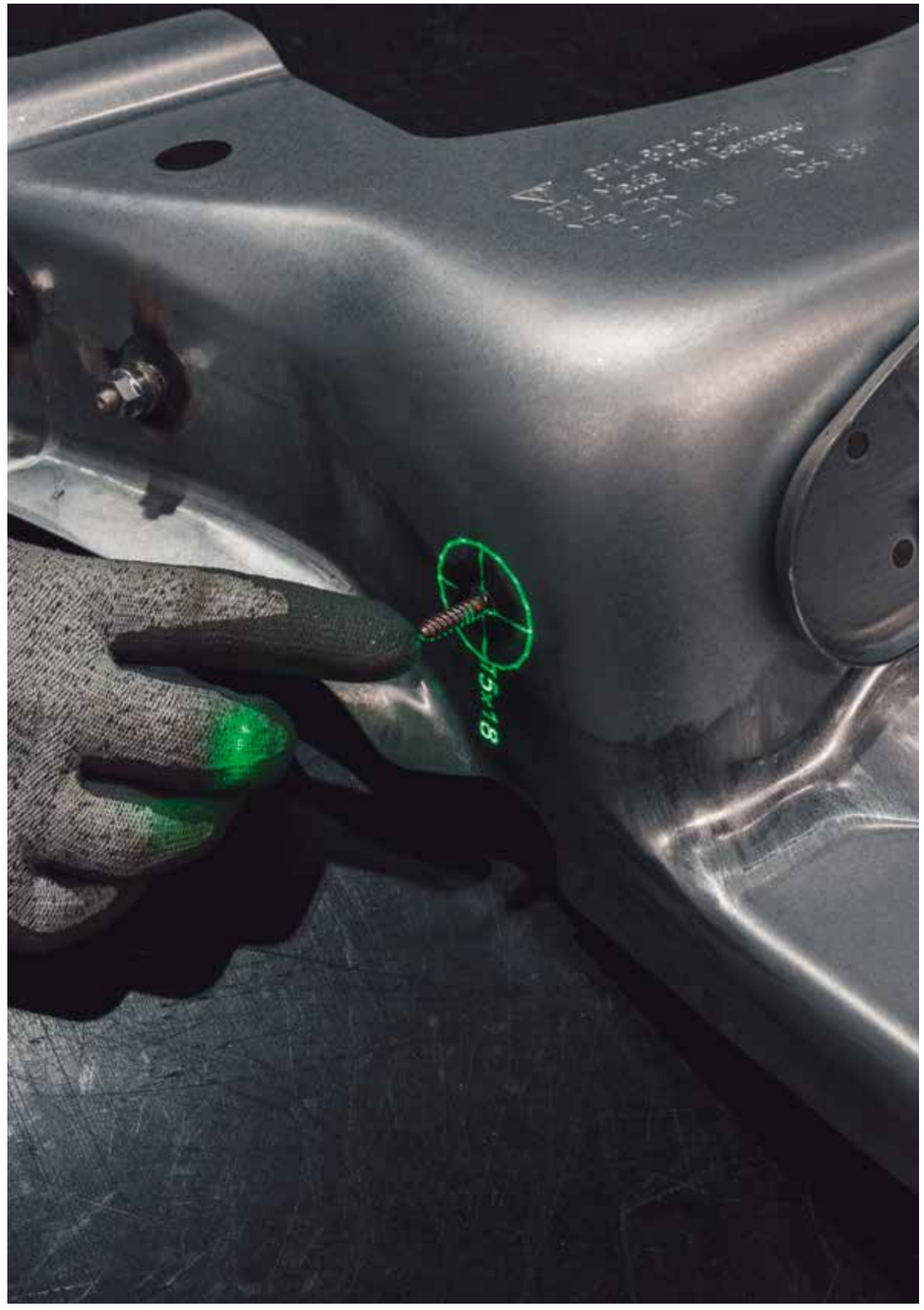
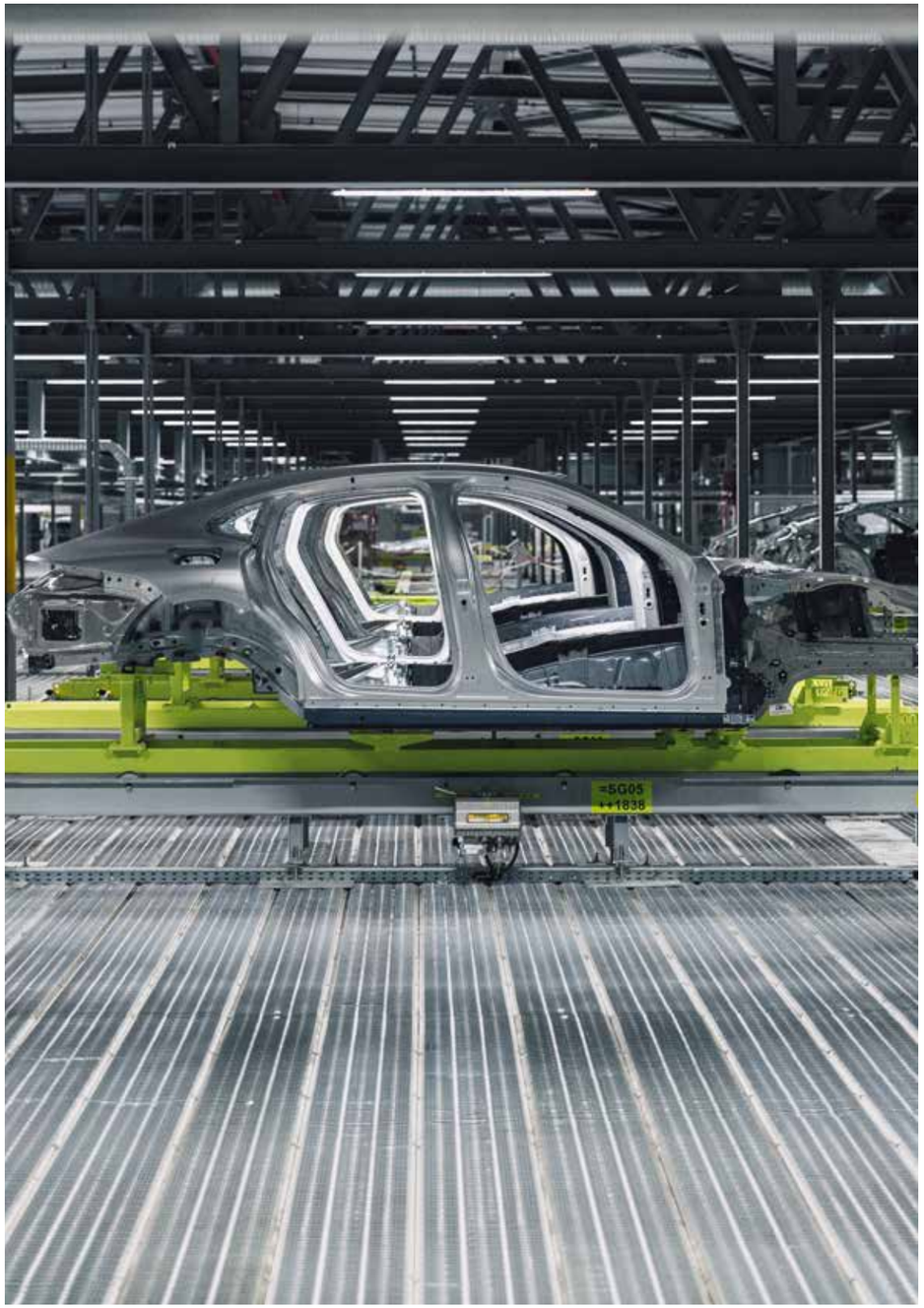


Flexibility 4.0:
Thanks to a new kind of laser visualisation system, conventional templates are no longer required for positioning bolts. The laser points can simply be corrected using code, enabling the positions of the bolts to be altered quickly and flexibly. This dispenses with the time- and cost-intensive production of new bolt templates.



Secure connection: Two innovations play a crucial role when mounting the outer side sections of the Panamera to the side panel reinforcements: The side-panel frame is now made from aluminium rather than steel. And using a new roll hemming method, Porsche has succeeded in combining the soft aluminium alloy with hot-formed steel to optimum effect.

The Panamera body shop in Leipzig is also one of the most efficient in the world. The large photovoltaic system on the roof produces 800,000 kWh of electricity per year. By way of comparison, this could provide energy to 150 four-person households for one year.

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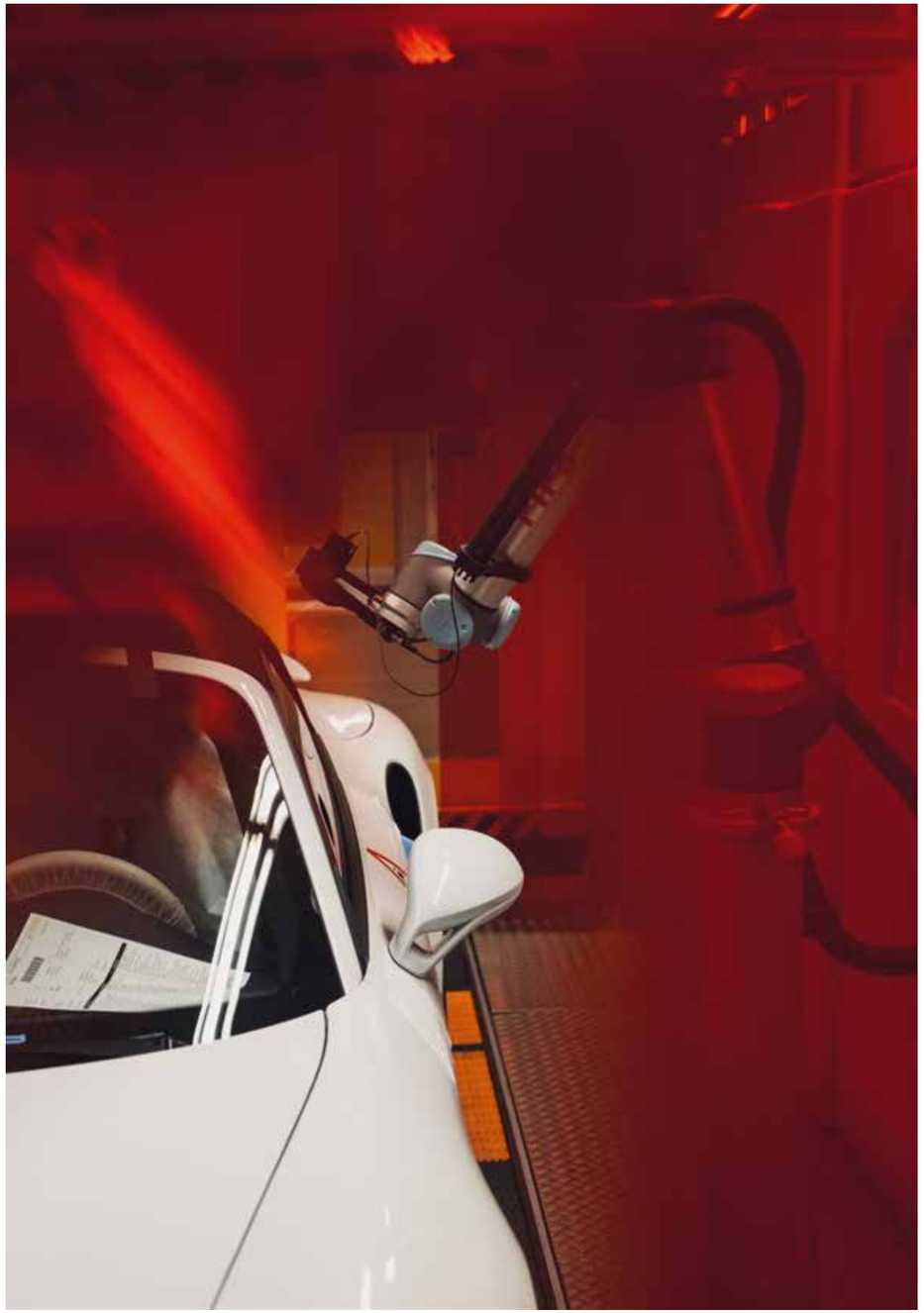
Sealed to perfection: Every Porsche has to pass an extremely thorough rain check in an irrigation system. This is the ultimate check to make sure that the vehicle is perfectly sealed. To prevent any water from actually getting into the vehicle during the test, Porsche experiments in the Zuffenhausen plant using an intelligent pre-test. The vehicle's sound system is used to produce a specific tone. A robotic arm checks at defined points whether the vehicle remains sound-proof or whether the sound penetrates outside. If this is the case, it is ensured that the vehicle is perfectly sealed at the critical points before it is released for the actual rain check.



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