



AWAREness

INTELLIGENT MACHINES ARE AN INTEGRAL PART OF OUR LIVES. DIGITAL REALITY HAS LONG PLAYED A DEFINING ROLE IN OUR THOUGHTS AND ACTIONS. THIS HAS BECOME EVEN MORE APPARENT SINCE COVID-19 REACHED PANDEMIC PROPORTIONS. WE ARE ALSO USING ALGORITHMS AND ARTIFICIAL INTELLIGENCE TO FIGHT THIS VIRUS. CORONA IS INCREASING THE PRESSURE TO REORIENT OURSELVES IN THE WORLD. ESPECIALLY RIGHT NOW WE NEED A NEW TYPE OF AWARENESS – AND ALL OUR SENSES.

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Digitalization takes over a lot for us. We reproduce our senses with technology and artificially augment them. But dealing with Alexa, Siri and modern image recognition software significantly changes our awareness and perception. We are well-advised to remain sensitive despite all the technology. Because the digital helpers can be outsmarted and manipulated.
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sight

Scientists have won five Nobel Prizes for their research of it so far, but it would have deserved this award itself long ago. We are talking about *Drosophila melanogaster*, better known as the fruit fly. This insect, which is only three millimeters in size, is familiar in the household as an annoying first colonizer of overripe fruit. Biologists have their own view of the fly. For them, *Drosophila* is a favorite animal, a model organism. Easy to breed and genetically easy to decipher, it is probably the best studied living being in its entirety. Many biological processes in *Drosophila* are similar to those in mammals, including humans. Thanks to *Drosophila*, for instance, we know that genes are located on chromosomes and that their alteration affects their appearance. For example, its 1,600 compound eyes are usually red in colour, but white when mutated. Successful cross-breeding of the fly genome with the mouse genome, which is responsible for eye formation, also indicate that the varied eye shapes of all creatures have a common origin. In view of such findings, the fruit fly more than deserves to be looked at with admiration by more people. ☒

smell

A close-up photograph of a grey hamster rat, likely a HeroRAT, wearing a harness and a metal detector. The rat is sniffing a small metal object, possibly a mine, in a hole in the ground. The background is a blurred, reddish-brown soil.

Their names are Magawa, Carolina and Shuri and they are HeroRATS. Under this name the Belgian non-profit organization Apopo uses giant hamster rats for humanitarian purposes. With the help of the University of Antwerp, the clever rodents with the fine nose are trained to sniff out explosives in landmines. There have already been successful clearance missions, for example in Tanzania and Mozambique. The HeroRATS have a 50 times higher hit rate than metal detectors because they also detect mines that are mainly made of plastic. They are even superior to dogs: rats learn faster, need less food and can be brought to the search areas in greater numbers and with less effort. And thanks to their low body weight, they rarely set off mines. They are also trained to detect the smell of tuberculosis. A rat can check 100 saliva samples in 20 minutes, a laboratory technician needs four days for this. HeroRATS can thus speed up diagnosis and the start of treatment, particularly in regions where there is a lack of technology and specialist staff. By the way: anyone can adopt a real HeroRAT and support their work for us humans, via www.apopo.org. ☐

taste

Our tongue is a real multi-tool. Nine individual muscles allow it to move freely. So it helps us to kiss, but especially to chew and swallow. It owes its velvety surface to so-called papillae. The visible elevations carry several tactile and about 10,000 taste buds, each with up to one hundred taste receptor cells, which enable us to experience complex and distinct types of tastes. We have receptors for sweet, sour, bitter, salty, spicy and umami – Japanese for meaty, savory. But that's not all: without our tongue, we could hardly make sounds, much less speak, sing or whistle. Mankind is of course working to recreate this miracle of evolution, with a mixture of sensor technology and self-learning data processing. Electrodes simulate the taste receptor cells and collect information about substances in the form of ions. Little by little, a "taste library" is being created that can be used, for example, for the quality analysis of liquids. Once calibrated, the artificial tongue could assess the lubricity of vehicle oils, monitor wastewater from sewage treatment plants and industrial facilities, and in food production, ensure that a lemonade, for example, never deviates from the desired taste. But this technology is not yet mature, even the special applications mentioned are still in their infancy. For the time being, the complexity and performance of the human tongue remains unrivalled. ☑

touch

With six tactile dots, Louis Braille changed the world of visually impaired people forever. In 1825, the then 16-year-old Frenchman, who was blind from childhood, invented the communication system named after him. It enables visually impaired people worldwide to live and write and thus to participate in everyday and professional life. Six raised dots form the basis of braille and represent the letters of the alphabet depending on their number, arrangement and combination. The computer version has two dots more to represent all numbers, punctuation marks and special characters. And digitalization makes communication even easier for the blind. The special braille keyboard for computers is supplemented by a speech input and output function. Audio books and podcasts make knowledge more accessible. Smartphone apps allow braille patterns to be entered via the display. Other apps can use the camera to name the color of things like clothes, for example. With the help of special camera glasses, blind people can have street signs, menus or labels read aloud. According to a study by the University of Heidelberg, braille will remain important even in the digital age. Because for blind and sighted people alike, hearing and reading are two different skills that complement each other and cannot completely replace each other. ☒





Hobson

1919
st 2004 aged 84.

scamstress and Edward William Winter, joiner.
ool and worked at Crawfords biscuit factory.
Alder Hey Hospital.
red Hobson, they had one son, John born 1947.
Darlington Golf Club.
ic was a very practical woman and loved gardening,
singing, pottery and watercolour painting.

hearing

Even if we do not know when our life will end, we can still decide how posterity should perceive us. For some people, a simple gravestone no longer seems sufficient – as new forms of cultural memory show. “Rest in Vinyl”, for example, presses part of the ashes of customers into records. Vinyl color, cover and label can be designed as freely as the recording: should it be a final message to posterity, the ultimate playlist of life or a reading from a favorite novel? Alternatively, there are gravestones with a display that plays nostalgic videos when someone passes by. Companies such as NEST and Foreverence offer individual urns from the 3D printer: those who want to can be put to eternal rest in a model of their dream car or in a mini version of themselves, formed from the data of a 3D body scan made during their lifetime. Celistis is the right choice for those who prefer to escape the earthly in death. For around 5,000 US dollars, the company shoots ampoules containing a few grams of ash into orbit from SpaceX rockets and lets them fall as shooting stars. For half the price one can also have their own urn shot into the night sky on board a large firework rocket. At a height of about 400 meters, this existence comes to a spectacular end – with a big loud bang. ☒



In 1961 the Russian cosmonaut Yuri Gagarin was the first person to travel into outer space. His journey lasted only 108 minutes, but it changed our idea of the limits and possibilities of human existence forever. Since then, another 565 men and women from 41 nations have travelled to where our earthly perception of body, space and time is turned upside down. This is also probably one of the reasons that the beauty, uniqueness and fragility of our home planet is seen differently from space. In 2013, for example, astronaut Luca Parmitano shot this selfie during a “space walk”, in which the International Space Station ISS, the Earth and the Sun are reflected in his helmet visor. Parmitano flew to the ISS again in 2019, as the first Italian commander. He returned safely to Earth on February 6, 2020, after a total of 367 days in space. ☑

Important and really important

ALL AROUND THE GLOBE THE CORONA PANDEMIC HAS TURNED OUR EVERYDAY LIVES UPSIDE DOWN PRACTICALLY OVERNIGHT. WHAT OUR SOCIAL AND ECONOMIC LIFE WILL LOOK LIKE IN THE FUTURE IS NOT YET FORESEEABLE. WE ARE JUST **LEARNING TO ORIENT OURSELVES IN THIS FUNDAMENTALLY CHANGING WORLD**, TO DIFFERENTIATE BETWEEN AND BE AWARE OF WHAT IS IMPORTANT AND WHAT IS REALLY IMPORTANT.


I am writing this text on April 9. Today we stand in line in front of supermarkets and pharmacies as if it were the most natural thing in the world, we practice social distancing, many people wear masks to protect themselves or to protect others. Suddenly we think about whether you can get infected when you touch the shopping cart and we notice how often we touch things that others just had in their hands. This is a level of awareness that we did not have at Christmas. We have always had the ability to distinguish between what is important and what is really important. A crisis always turns focus onto what is really important. Health, family, job – and always in conjunction with safety.

“We worry about safety so that you don't have to worry” used to be an advertising slogan of TÜV Rheinland. Today, while Corona has a firm grip on us, I have the impression that a great many people are wearing TÜV glasses and it's not only the test engineers that see the gaps and faults. And that is a good thing.

We have been doing this professionally for 150 years and also in many areas that are not currently in the spotlight. Production plants, elevators, children's toys, power plants and cars must remain safe. Shopping carts are also TÜV-inspected and even the Robert Koch Institute has its testing equipment monitored by us.

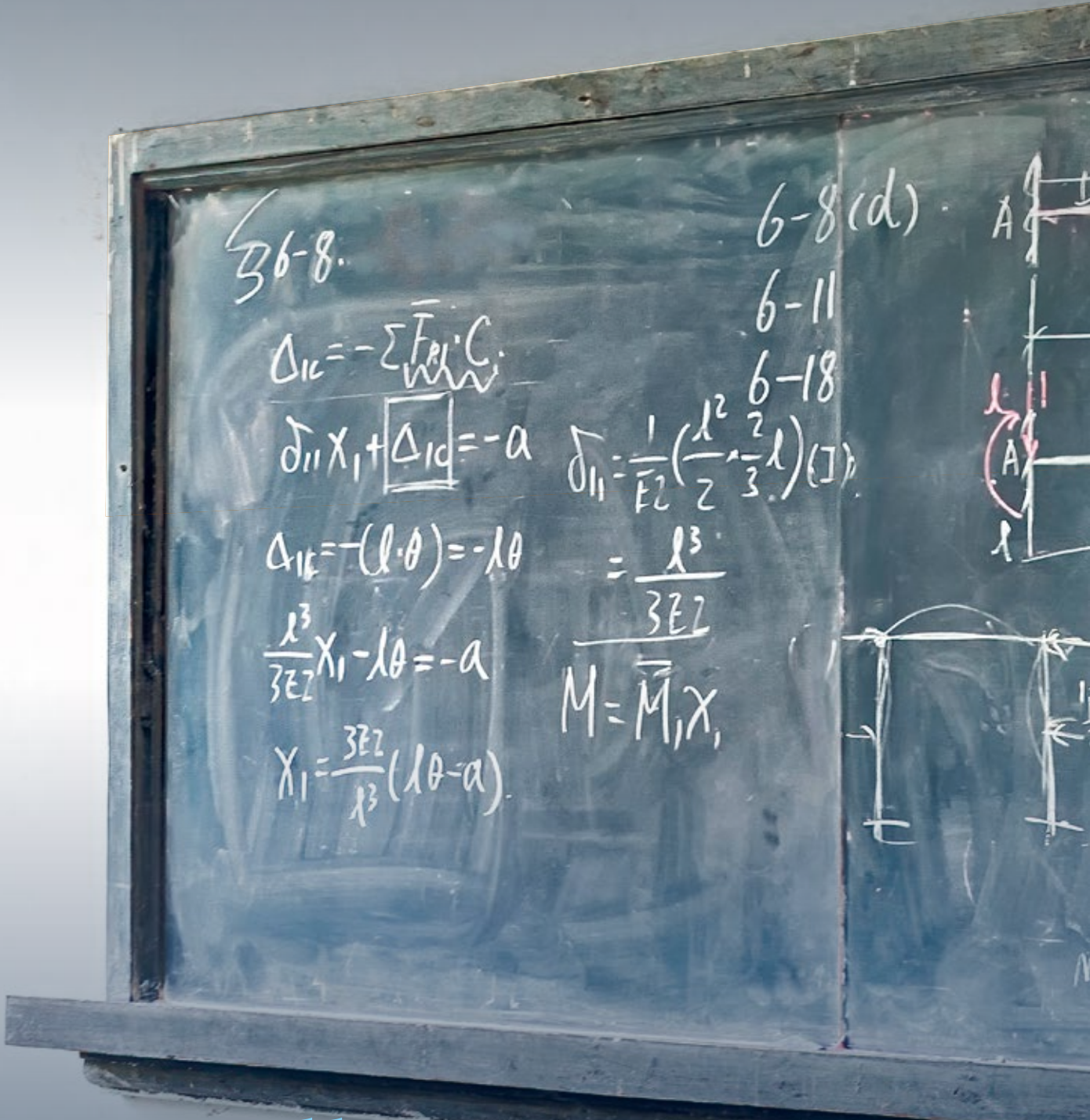
In times of crisis, we recognize more than ever that a strong society needs competent, trustworthy and objective bodies that help to classify complex interrelationships. This does not mean, however, that we should relinquish responsibility for ourselves and others. On the contrary: especially in the field of digitalization, each and every one of us should constantly be aware of technical and ethical developments and seriously contemplate them. What information and sources are relevant and reliable? On what data basis do I make my decision for or against a certain behavior, and what am I prepared to give up in terms of personal – including digital – freedom in order to increase safety for myself and others? These are complex questions that no computer can answer.

Safety is always very high up on our awareness scale, but rarely is it as visible and tangible as today. Certainties have never dissolved as quickly as in the last three months. When we planned this magazine and the title Awareness, Corona had not yet arrived in Europe. Now the topic seems more relevant than ever.

What is your experience and awareness these days? Send your opinions and thoughts to me at Michael.Fuebi@de.tuv.com 

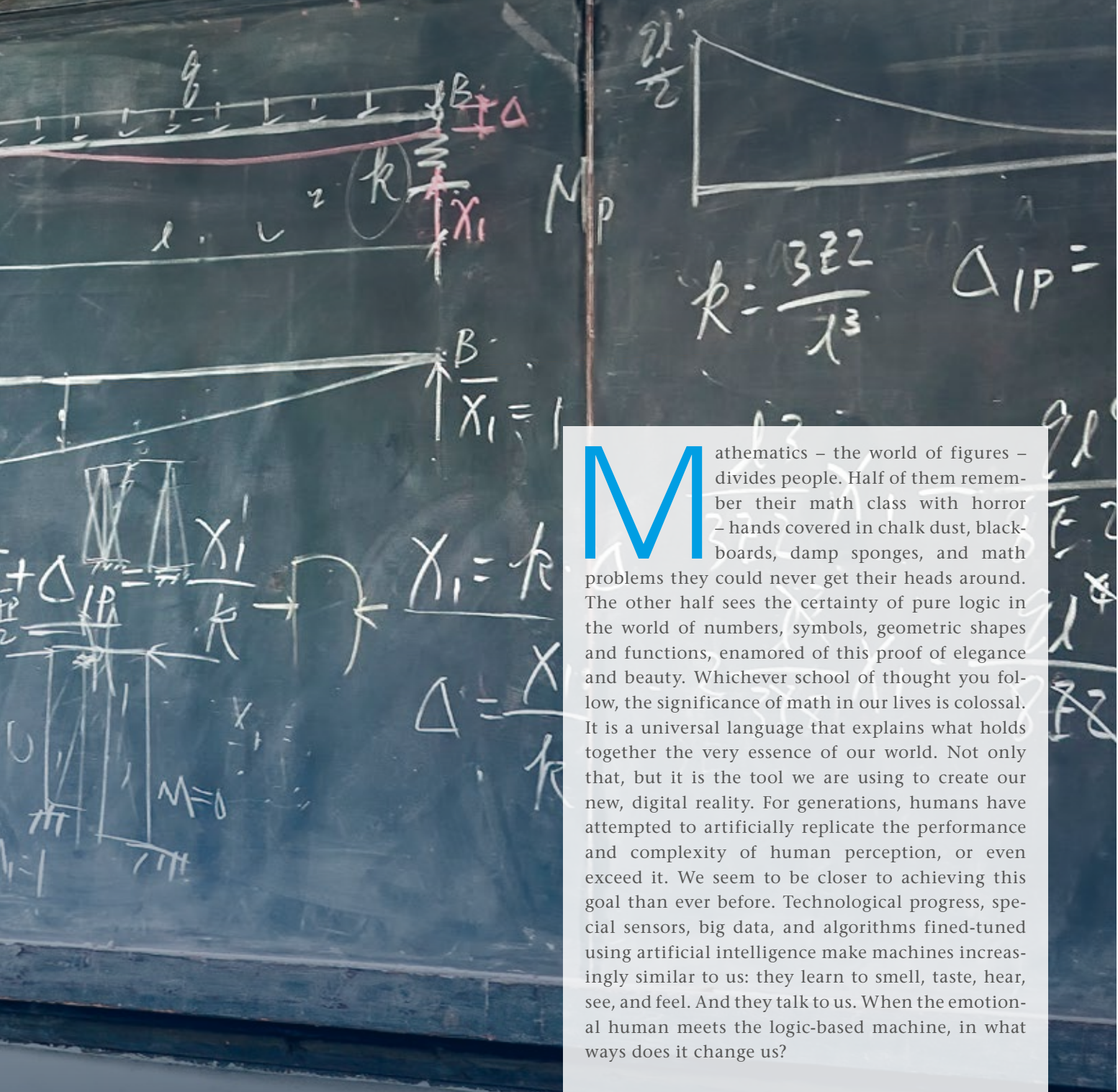


Dr.-Ing. Michael Fübi
Chief Executive Officer TÜV Rheinland



Using all our senses

DIGITALIZATION HAS REVOLUTIONIZED OUR PERCEPTION OF THE WORLD: WE EQUIP OUR HOMES AND BODIES WITH SENSORS, CONNECT TO PROGRAMS, AND CHAT WITH MACHINES. WHAT HAPPENS WHEN EMOTIONS MEET ALGORITHMS?



Mathematics – the world of figures – divides people. Half of them remember their math class with horror – hands covered in chalk dust, blackboards, damp sponges, and math problems they could never get their heads around. The other half sees the certainty of pure logic in the world of numbers, symbols, geometric shapes and functions, enamored of this proof of elegance and beauty. Whichever school of thought you follow, the significance of math in our lives is colossal. It is a universal language that explains what holds together the very essence of our world. Not only that, but it is the tool we are using to create our new, digital reality. For generations, humans have attempted to artificially replicate the performance and complexity of human perception, or even exceed it. We seem to be closer to achieving this goal than ever before. Technological progress, special sensors, big data, and algorithms fined-tuned using artificial intelligence make machines increasingly similar to us: they learn to smell, taste, hear, see, and feel. And they talk to us. When the emotional human meets the logic-based machine, in what ways does it change us?

WITH WHOM AM I SPEAKING? OR WITH WHAT?

Looking to the area of digitalization provides us with an answer in the shape of something that has already become a mainstay of our daily lives: automatic language analysis. The ability to speak, hear, and process information acquired by these means is no longer the reserve of human beings. The first

CAN AI CREATE ART? THE PARIS-BASED TECHART COLLECTIVE OBVIOUS EXPLORES THIS PERTINENT QUESTION. THE PAINTINGS IT PRODUCES USING ALGORITHMS ARE BRINGING OUR CONCEPT OF CREATIVITY INTO THE DIGITAL AGE. IN DOING SO, HUMANS AND ARTIFICIAL INTELLIGENCE ARE PERCEIVED AS ARTISTS ON EQUAL TERMS.

$$\min_{\mathcal{D}} \max_{\mathcal{D}} E_x [\log(\mathcal{D}(x))] + E_y [-\log(1 - \mathcal{D}(y))]$$

speech recognition robots were developed by IBM and the US Department of Defense at the beginning of the 1960s. While these programs could initially only recognize a dozen or so words, by the 1980s they were able to communicate at the same level as a three-year-old child. Since Apple's virtual assistant Siri was first integrated in the iPhone in 2011, chatbots have been a normal feature of everyday communication. About 3.3 billion devices were equipped with a voice assistant in 2019 – this is set to rise to eight billion by 2023. However, the leading corporations in developing this technology – Google, Apple, Amazon, and Microsoft – do not publish precise figures on this. At any rate, the American AI researcher and author



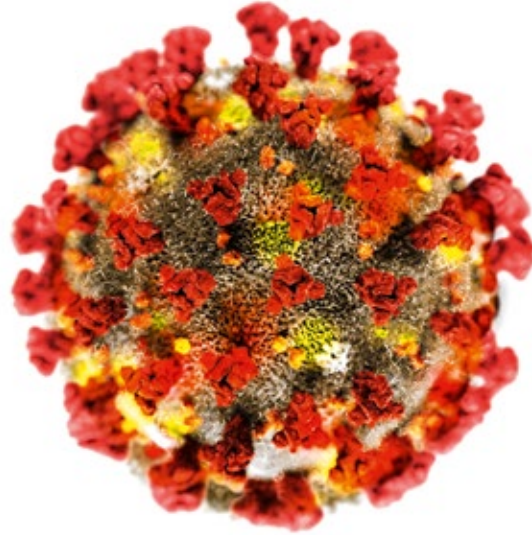
In 2018 Christie's auctioned the image "Edmond de Belamy" for about 380,000 euros. The artist was an AI program conceived by Obvious, which was able to access a dataset of 15,000 portraits spanning six centuries. The work is signed with an algorithm code.

assistants as if they too were living beings. According to a study undertaken by UNESCO, the number of people who have more conversations with voice assistants than with real people is on the rise. A survey carried out at the University of Washington has also shown that children who grow up

James Vlahos sees nothing less than the "turning point in human history" in the rise of language recognition technology. That's because it is fundamentally changing our perception of computers and our relationship to technology. "Voice computing will profoundly reshape the way humans relate to machines," says Vlahos, who programs memory chatbots to preserve the life stories of deceased loved ones together with his company, Hereafter. "We tend to humanize objects as if they can think and feel like we do. We give cars nicknames and swear at computers that won't do what we want. And now they suddenly answer back, have a nice name like Alexa, address us directly, and crack jokes." This means that we increasingly perceive digital

with smart speakers like Alexa view them as a member of the family and find it difficult to distinguish whether they are a living thing or a machine. This has also become harder for adults, as Alexa, Cortana, Siri, and the like sometimes convince us that they're charming, eloquent, and intelligent individuals. The UNESCO study also indicated that children in particular adopt a domineering, commanding tone towards virtual assistants that would be perceived as insulting in a conversation between two humans. As smart speakers tend to have a female voice – by default at least – UNESCO pointed out that this could lead to a discriminative view of women. In any case, most voice assistants now tend to react negatively to insults from their users.

Protection against epidemics – at any cost? Movement data recorded by millions of private smartphones allow the coronavirus’ spread to be understood. An option that many countries have waived – in favour of data protection.



HOW HUMAN SHOULD TECHNOLOGY BE?

In mid-2018, Google sparked much public interest after the company allowed its voice assistant Duplex to ring a hair salon to arrange an appointment. The employee didn’t realize that she was talking to a computer – and also wasn’t told as much. Experts like James Vlahos consider this a danger: “Just because machines are becoming more human, doesn’t mean they should impersonate humans. This could have dire consequences for our society.” This can be seen in the power of social bots that influence opinions on social media with incorrect information as well as deepfake photos and videos. Internet corporations already wield considerable power over information and our perception of the world via their search engines. But we still have to do our own searches, check an entire list of links, and evaluate the quality of information. Which sources should you trust – and which should you not? Voice assistants always give a precise answer; however, these answers could be sponsored in the future. That may be alright for weather forecasts, but when it comes to societal and political questions, there are rarely straightforward answers. In the interest of freedom of speech and diversity of thought, virtual assistants should factor this into their responses. Otherwise, our perception of the world’s complexity could be in jeopardy. A sensible step could be to dehumanize machines once more and develop an emotional distance to them. For example, a neutral voice that



“ONE ONLY SEES WHAT ONE KNOWS” – GOETHE’S WORDS REMAIN RELEVANT IN THE DIGITAL AGE. EDUCATION OPENS OUR EYES AND ALLOWS US TO MOVE SAFELY THROUGH OUR NEW DIGITAL REALITY.

doesn’t clearly indicate gender could be put into operation. However, it could be desirable to make machines even more human in some specific contexts. In light of the skills shortage and ageing of many societies, elder care robots and digital monitoring and care solutions will become standard at hospitals, retirement homes, and in outpatient care in the future. This is where

humanized, emotional perception becomes desirable for technology, because it increases the acceptance rate of such solutions. Digital systems could even replace social contact and help to counter isolation – but whether this is actually wanted should be discussed by every society in terms of its individual cultural context. In technology-friendly Japan, for example, robots are attributed a kind of soul.

MUCH MORE THAN JUST WORDS

Businesses take a positive view of smart assistants – especially for cost reasons. The organizers of “Chatbot Summits” held in cities such as Berlin, Tokyo, and Las Vegas estimate that costs for processing a customer request can be reduced by 80 percent if they are processed by a chatbot instead of a human. They added that Vodafone wants to process 60 percent of its roughly 50 million customer requests per month fully automatically by 2021. This savings potential equates to about 35 million euros each month. Insurance providers have started selling policies and handling simple claim reports via chatbot. This is all possible because customers have

become used to chatting to a program in their private lives. This technology continues to develop as providers are consulting many different specialists, including computer scientists, linguists, sociologists, and even doctors to further improve the quality of bots. That's because a whole range of companies are working on using voice analysis as a diagnostic tool. It has been assumed that many people disclose a lot about their health condition in their voices. This makes it possible to diagnose ADHD, Parkinson's, Alzheimer's, and even heart disease by means of voice analysis with a comparably high degree of certainty. But how do we process the fact that our voice reveals so much about us – regardless of whether we want it

PEOPLE HAVE BECOME USED TO TALKING TO A PROGRAM – SOMETHING THAT'S GREAT FOR COMPANIES.

to or not? At the end of 2018, Amazon submitted a patent for Alexa to recognize its users' illnesses and suggest suitable medication by listening to them. The startup cogito from Boston has also developed a software that can analyze a person's mental state using their voice. Call centers may be able to better appraise the mental state of callers and react accordingly. In a test series carried out with war veterans, the program was able to detect markers for depression, stress, and post-traumatic stress disorders. This can be helpful to psychotherapists, but also seem attractive to employers, for example. The latter could use the program in interviews to comb out candidates with a risk of depression using a voice sample.





Diamonds are a by-word for luxury, but also a symbol of human exploitation. Producers and traders are reacting to this issue and verifying fair supply conditions and trading processes using blockchain technology.

Pulse, sleep quality, water balance: smartwatches allow our bodies to be continuously monitored and pose a risk to data protection. But what they record can also help doctors to detect illnesses early on and treat them.

WE'VE LONG BEEN CYBORGS

The large-scale use of wearables and smartphones has similarly given rise to both welcome developments and dangerous scenarios. It has now become normal for millions of people to monitor the state of their bodies with the aid of mini computers and sensors. Heart-beat, calorie consumption, steps, sleep quality, blood pressure – this is just a small selection of the medical parameters that any layperson can now record using a fitness tracker or sensors on their smartphone. The latter is transforming from a communication device into a personal one-stop-shop for all things health. Health and self-measurement have become fixtures of the digital lifestyle. The “Health” app is pre-installed on every iPhone. This can’t be deleted, but instead connected to dozens of apps and diagnostic tools, from a snore microphone to a body fat scale. What’s not automatically recorded can be manually input by the user – for example, “sexual activity.” Apple provides third parties with this data in anonymized form. This is a blessing for scientists, who can base their research on hundreds of millions of data sets from both healthy and sick people. The large-scale collection, storage, and analysis of our most intimate data is of course to be monitored and viewed critically, but this has been so normal for so long that there’s no going back now. This is because it is consciously being accepted by growing numbers of people. Digital opportunities, networking, and communication on social media have shaken up our old conventions of having a private sphere and intimacy. This also applies to our own perception of our bodies. We are in the process of creating a second digital body, equipped with sensors, made up of information, data, and algorithms, and digitally connected. Perhaps it no longer makes sense to differentiate between humans and machines. We’ve long been one and the same. We are robots and cyborgs, united and at home in the world of numbers. 📱

„If you have a stable view of a subject, then it won't be possible to influence it with aggressive framing.“

Professor Dr. Christian Schemer researches and teaches subjects such as political communication, prejudice against specific societal groups, and the effects of advertising at the Institute for Communication Studies at Johannes Gutenberg University Mainz.

The power of language

WHETHER IT'S THE CLIMATE CRISIS, DIET COLA, OR ASYLUM SHOPPING – WORDS CONVEY MESSAGES AND SENTIMENTS, DEFINING THE INTERPRETIVE FRAMEWORKS IN WHICH WE PERCEIVE SUBJECTS. **PROFESSOR DR. CHRISTIAN SCHEMER**, A RESEARCHER IN COMMUNICATION STUDIES, SAYS THAT THIS “FRAMING” IS AN EVERYDAY ASPECT OF HOW WE COMMUNICATE AND INFLUENCES OUR PERCEPTION OF THE WORLD.

Professor Schemer – what role does language play in terms of how we act?

Language is very important in how we form and convey the ideas, opinions, and values that shape our actions. We depict issues in a certain interpretative framework by means of the words we choose to use. It is through these frames that we communicate our views and interpret the statements of others.

Can you give us an example?

Let's take the debate on abortion in the US, where proponents and opponents consciously use contro-versial terms in their activism. While proponents say the word "fetus" – the medically correct term – opponents use "baby" to stir up emotions. "Baby" makes us think of a newborn with a personality. A "fetus" is much more abstract and featureless. Here, the choice of words alone is an attempt to depict abortion as either murder or a medical procedure. Both camps try to gain the high ground by means of these frames.

Is language really that powerful?

Framing has been researched since the 1970s. And it's been clearly proven that people who exhibit stable attitudes for or against an issue cannot be influenced by aggressive framing. On the contrary, their attitudes consolidate, and fronts become more impenetrable. To stick with this example: the choice of words won't make opponents of abortion into proponents, and vice versa. Framing tends to have an effect on people who do not yet have a clear opinion on an issue, or when an issue is totally new to a society and people have to take a position on it. Frames can take hold where information and interpretations are sorely lacking. Interest groups also attempt to utilize this in pushing forward their ideas and in the language they use. But that only succeeds – if at all – when no strong antagonistic positions are present.

Nevertheless, framing is important in our everyday communication. Why is that?

Generally speaking, framing is a constant in our perception. It makes sense of things. After all, we want to understand what an issue is really about, and what it means for us personally. Each individual forms their own interpretative framework, depending on how an issue relates to their values. Framing allows us to allocate people to

groups, categories, and ideologies. This makes the world easier to understand. This is also necessary because we are not able to understand everything going on around us in its full complexity. Our personal frame – our own worldview – helps us to efficiently make decisions. Companies of course actively use this effect. Advertising specifically depicts products in a certain context. Everything is currently organic, sustainable, and allergen-free, for example – because these are terms to which consumers react positively. The fact that this wording is often far-fetched or inaccurate on closer inspection is of secondary importance when it comes to advertising. Companies just want to touch on specific frames.

Are we able to alter our frames?

We use certain expressions as a matter of course. This isn't an issue until conventions change or societal groups protest at their usage. One example would be gendered pronouns – we have moved on from using purely masculine pronouns, to including the female form, right through to factoring in a range of diverse genders. That means that new linguistic tendencies are constantly being evolved and adopted.

What role does language play on social media?

Generally speaking, social media allows verbal conflicts to be dragged out. A variety of conflicting opinions are disclosed online, and every statement provokes discussion, commentary, and agitation. And words are what hold true on the Internet. Even if you delete a tweet or video, copies will end up doing the rounds later on. That gives words weight. But a lot of these things tend to play out in smaller social media bubbles. Issues reach a boiling point and are then quickly forgotten again. That means that not all that's said and written on the Internet remains relevant to or has an effect on a society – unless influential interest groups and politicians continue to push ahead with an issue. Framing is used time and time again to put issues and interpretations thereof on the societal agenda. That's OK – that's freedom of speech. But it's good that increasing numbers of people are reflecting on their perception and scrutinizing language, asking themselves: "Why exactly have these words been chosen? What is the intention here?". ☐

Incredibly normal

SYNESTHETES HAVE A UNIQUE PERCEPTION OF THE WORLD: FIGURES, LETTERS, SOUNDS, AND SMELLS ARE CONNECTED WITH COLORS AND SHAPES. ABOUT FOUR PERCENT OF PEOPLE HAVE THIS GIFT. DR. CAROLINE BEIER, CHAIR OF THE GERMAN SYNESTHESIA ASSOCIATION, IS HAPPY TO BE ONE OF THEM.

Dr. Beier first realized that she perceived the world differently to most people when she was 17 years old: “I always associated numbers and letters with specific colors. But when I asked my classmates what it was like for them, they stared at me as if I were mad. That’s how I learned I was a synesthete.” Today Dr. Caroline Beier is a family doctor with a practice in Hamburg and Chair of the German Synesthesia Association. “It’s estimated that four percent of the population experiences synesthesia. It’s probably even more than that, because many people don’t even know that they have a special kind of sensory perception,” says Dr. Beier.


A RICH, COLORFUL INNER WORLD

Different sensory stimuli are linked with one another in an unusual way in the brains of synesthetes – for example, when they see something it is accompanied by a noise or taste. Sounds and melodies make colorful, static, and moving shapes appear inside their mind's eye or even outside of their bodies. “Colorful hearing” is also quite common. “Everything I read, hear, and think automatically creates colors in my mind,” explains Caroline Beier. Words and letters have a specific color for many synesthetes, but for Dr. Caroline Beier it’s only vowels. For instance U is kind of green, while E is brown. Her synesthesia also applies to her sense of touch. “I very intensively perceive my patients through their speech and demeanor, but also through my hands. During physical examinations I can quickly tell where the issue lies.” Her gift even helped Dr. Beier during her studies. Like a lot of synesthetes, she is better able to remember formulae, names, and other pieces of data thanks to her extra

layer of sensory perception – mnemonics that others spend hours making up are something that synesthetes automatically put together. Many are also creative. Famous examples include artists like the singer Lady Gaga, the painter Wassily Kandinsky, and the writer Vladimir Nabokov.

Yet research on this neural phenomenon is still in its early stages. One hypothesis claims that all newborns are synesthetes and that we more or less lose this characteristic as our growing brains differentiate. However, it is much more likely that synesthesia is passed down genetically. Brain scans have shown that sensory perception in synesthetes activates more areas of the brain than in non-synesthetes. This doesn’t revolve around the individual subconsciously feeling, but consciously experiencing instead. Synesthetic sensory perception is inseparable from our “usual” sensory impressions, and similarly, it is not possible to fully block them out. Synesthetes tend to view their pronounced sensitivity as a gift, says Dr. Caroline Beier: “This inner colorful world, sensitivity, and an ability to empathize are enriching, not to mention wonderful, indispensable parts of our personalities.”

“Many people don’t even know that they have a special kind of sensory perception.”



Dr. Caroline Beier is a family doctor and Chair of the German Synesthesia Association (www.synaesthesia.org). This association connects people who have synesthesia, follows research on this neurobiological phenomenon, and makes these studies known to the public.

“We don’t just want to protect consumers from toxic substances. It’s also about occupational safety and environmental protection as well as supporting those who are conscientious in their production.”

Professor Andrea Büttner is a food analyst and Chair of Aroma and Smell Research at Friedrich Alexander University Erlangen-Nürnberg. Since 2020, the internationally renowned scientist has also been director of the Fraunhofer Institute for Process Engineering and Packaging in Freising. She is not just passionate about sensory perception, but also about developing new foodstuffs, protecting the environment, and sustainable economic activity in a globalized world.



Always follow your nose

WE TAKE JUST ONE SIP OF MILK, AND WE NOTICE IF IT IS SPOILED. PROFESSOR DR. ANDREA BÜTTNER IS CURRENTLY INVESTIGATING HOW WE CAN TRANSMIT OUR OLFACATORY SENSES OF SMELL AND TASTE TO TECHNICAL SYSTEMS. HER GOAL IS TO TRACK DOWN HAZARDOUS SUBSTANCES IN PRODUCTS AT THE EARLIEST STAGE POSSIBLE.

Professor Büttner – what do you find so fascinating about our senses of smell and taste?

Our chemical senses are our most ancient senses, evolutionarily speaking. Even single-cell organisms make contact with their environment via chemical sensory systems. Our senses of smell and taste provide us with an incredible amount of information about a whole range of different molecules and fulfill several elementary biological roles. They protect us from hazards by enabling us to detect smoke or help us subconsciously in selecting our sexual partners, for example.

Dogs sniff out drugs, rats can detect tuberculosis – how does the human nose compare?

We are not particularly attuned to our sense of smell – we are more fixated on our hearing, and on our sight especially. But our nose is extremely sensitive and can even be trained – take a look at sommeliers, for example. In evolutionary terms, we're omnivores. This explains why we are able to perceive a very wide spectrum of smells and substances. However, it is estimated that about 15 percent of adults have a greatly impaired sense of smell or no sense of smell at all. It's when you can't smell whether food has gone off or not that you have a problem.

If you have poor eyesight, you wear glasses. Hearing aids help the hearing-impaired. Has anything comparable been developed for our sense of smell?

Not yet. That's because molecules that we perceive as having an odor are often present in very low concentrations and are upstaged by other non-odorous substances. This makes direct measurements using machines a challenge. One trick can be to discover a characteristic pattern that doesn't necessarily relate to the odorous substances, but correlates with a sensory impression. However, many interfering influences can pop up. For example, if you want to diagnose an illness like cancer with a breath sample, then the patient's last meal could falsify the result. However, it would help us if we had systems that warned us

about potential risks or illnesses so that we could take a closer look. What's more, we are often better able to reliably detect toxic emissions or contamination because they smell so strong.

What use would this have specifically?

If the smell of a plastic toy seems strange and lingers in our noses, then this serves as a warning signal. Mechanical noses could take on the task of detecting anomalies and sounding the alarm. These would sniff out things that human beings cannot or should not smell to eliminate hazards. Where possible, this would happen before harmful substances and products went into circulation. Sensory quality control should become an integral part of production facilities and logistics centers within networked systems that immediately warn the responsible bodies. This would be a massive step forward for consumer protection as when we look at the globalized market, product safety and monitoring is reaching its limits.

How so?

New and unknown harmful substances are always coming into circulation. These have to be tracked down at the earliest stage possible. We don't just want to protect children from plasticizers in toys. It's also about saving resources, occupational safety, and environmental protection, not to mention protecting the people who have to handle raw materials and products on a daily basis in factories, warehouses, and stores. Sensory diagnostics of harmful substances could help to keep substances that are harmful to human health and the environment off the market. That is why many quality-oriented companies want to collaborate with us.

I suppose that means that until this technology has evolved, we'll simply have to continue relying on our noses?

This ancient sense helps us to detect harmful things in the modern world. But it would be better if we didn't need to completely rely on our noses. Machines have to help us, and making that happen is our job. 🗨️

Global internet coverage – from outer space!

SINCE THE BEGINNING OF 2019, THE COMPANIES SPACEX AND ONEWEB HAVE BEEN SHOOTING SATELLITES INTO THE EARTH'S ORBIT IN ORDER TO PROVIDE EVEN THE MOST FAR-FLUNG CORNERS OF THE [WORLD WITH HIGH-SPEED INTERNET](#). THESE REVOLUTIONARY PROJECTS OFFER A WIDE ARRAY OF OPPORTUNITIES – YET ALSO POSE DIRE CONSEQUENCES.



When satellites provide broadband connections from space, topography and local infrastructure no longer matter.

Back in 2015 the plan sounded like science fiction, but this vision has since become reality. A Falcon 9 rocket launched 60 satellites into orbit on February 17, 2020. It was the fifth space mission of this kind for the company SpaceX. Since then the newcomers have orbited the Earth with 240 other satellites from the company at a height of about 550 kilometers – and many more are set to follow. It plans to have about 1,600 by the end of 2021 and just about 12,000 by 2027. Requests to release a further 30,000 satellites have also been submitted to the International Telecommunication Union (ITU). For comparison, since the launch of the first satellite – Sputnik 1 – in 1957, roughly 8,500 objects of this nature have been blasted into space. SpaceX founder Elon Musk wants to provide high-speed Internet to even the most remote regions of the planet by means of the “Starlink” project. A skeleton service will begin in mid-2020. Transmitting the Internet from space means that service provision no longer depends on topography and local infrastructure, which are the main reasons why about 50 percent of the world’s population doesn’t have reliable access to the Internet. According to Musk, another advantage would be that when Starlink is fully operational, it could surpass the transfer rates of fiber-optic technology. Stock markets in particular would have a major interest in this and would constitute financially strong customers. The proceeds could be used to ensure that this technology becomes available in poorer regions of the world. Whether this principle of solidarity would actually be taken up by companies remains to be seen.

A FATAL CHAIN REACTION

And SpaceX is not alone in its aims – alongside Amazon with Project Kuiper, the company OneWeb has also been working on facilitating Internet provision from space since 2015. While Amazon does not yet have its own satellites in outer space, the OneWeb constellation currently consists of 40 satellites that orbit the Earth at a height of about 1,200 kilometers. According to its current plans, this technology will be deployable by the end of 2020 and will gradually increase to an initial 600 satellites. However, the incredible opportunities offered by this technology are dampened by risks that are difficult to predict. NASA estimates that about 700,000 tons of space debris orbit the Earth, the majority of which lie in the target area of the small satellites. Ultramodern ground monitoring stations already receive thousands of collision warnings each year and avoidance maneuvers have to be frequently enacted. The variety of new objects in this highly contaminated area would increase the likelihood of such collisions. This would in turn create more debris and could trigger a chain reaction – the so-called Kessler syndrome – that would make space travel impossible for many years.

LUMINOUS CHAINS OF SATELLITES


Further criticisms arose after the first 60 SpaceX satellites were launched on May 24, 2019. The issue was that it was possible to clearly recognize the chain of satellites in many parts of the sky because they reflected the sunlight surprisingly strongly. Astronomers fear that this phenomenon could make observing the skies significantly more difficult or even impossible in the future. However, the greatest challenge posed by this technology lies in cybersecurity. If satellite constellations are to one day be responsible for Internet provision across the world, then they must be protected against unauthorized access. That’s because successful attacks of any kind could entail significant societal, economic, and geopolitical consequences. **□**

It's the quantity that counts


ENSURING AN EXTENSIVE AND STABLE INTERNET SERVICE WILL REQUIRE A DENSE NETWORK OF SATELLITES. CONTROLLING THESE MEGA CONSTELLATIONS IS CRUCIAL AND WILL BE TAKEN OVER BY GROUND STATIONS. THESE WILL GUARANTEE THAT **EACH USER RECEIVES THE BEST SIGNAL AT ALL TIMES.**

OFF-THE-SHELF SATELLITES

A radical overhaul in satellite manufacturing has made these mega constellations economically viable in the first place. The respective models from SpaceX and OneWeb are identical and can thus be manufactured using automatic series production. One satellite is currently produced each day in this way. They cost around 3.2 million euros – and are therefore 100 times cheaper than one geostationary satellite.

A satellite view of Earth showing the Americas. A red dot is placed in the central United States, with dashed red lines extending from it to the top and bottom of the frame, suggesting a satellite's orbital path or signal range. White crosshair markers are scattered across the image.

Geostationary satellites were the benchmark until now. From meteorology to TV signals, these custom products – which cost at least 250 million euros – are considered one of the most modern technologies currently available. However, as they orbit the Earth at a height of around 36,000 kilometers, they are unsuitable for ensuring blanket Internet coverage. Data transfer from these satellites to the Earth lags by half a second, but latency is about zero for satellites that fly much closer to the Earth. But as these cover a significantly smaller section of the Earth compared to satellites in geostationary orbit, a correspondingly high number of satellites is needed to facilitate worldwide coverage.

Ground stations around the globe are also crucial for high-speed Internet provision from space. They monitor mega constellations like Starlink, but also coordinate the signals of thousands of satellites. The technology of these ground stations ensures that every user always receives the signal of the satellite closest to them. Because the satellites continuously orbit the Earth, there is always a procession of satellites available to provide Internet to users from the signal nearest to them. 

CONTROLLED BURN-UP

The first generations of these small satellites have a lifecycle of about five years and are fitted with their own drives. These transport them to the desired height after their launch into outer space. Not only that, but they cause them to descend shortly before the five years lapse so that they burn up in the Earth's atmosphere. SpaceX intentionally launched its first satellites at a low enough height for them to autonomously enter the Earth's atmosphere within a short time if they malfunction. Sensors in conjunction with the North American Aerospace Defense Command's database of objects in space will enable satellites to independently avoid debris. The company also reacted to the unexpectedly strong reflections from the satellites, also known as albedo. One of the satellites was sent to space with a darker surface for test purposes to try and reduce this effect.

A short glossary of cyber terms

MALWARE

The generic term for programs that have been developed to cause damage to others.

VIRUS

A file with harmful code that smuggles the virus into a program, making it more or less unusable. The virus then attempts to spread itself.

WORM

In contrast to viruses, worms primarily infect storage media like USB sticks and external hard drives.

PHISHING

Phishing refers to attempts to gain access to an Internet user's personal data via fake websites, e-mails, or text messages and use it to commit identity theft.

TROJAN HORSE

Trojan horses disguise themselves as programs that seem useful. However, they usually smuggle other types of malware into the system during installation.

EXPLOITS

Exploits are programs that systematically exploit vulnerabilities to gain access to software and computer systems.

ZERO-DAY-EXPLOITS

This special type of zero-day exploits targets vulnerabilities that are unknown to the manufacturer or operator of a piece of software. They only come to light after the attacks have been carried out.

PROOF-OF-CONCEPT ATTACKS

These attacks are used to identify potential security gaps. Exploits are also used by IT specialists to test software and systems for corresponding security gaps.

RANSOMWARE

This type of malware locks a part of your system using a piece of software and requests a ransom for its release.

A paradise

FROM THE FACTORY TO THE SMART LAMP – DIGITALIZATION IS MAKING THE ECONOMY MORE EFFICIENT AND OUR PERSONAL LIVES MORE CONVENIENT. THIS IS A RAPIDLY EVOLVING DEVELOPMENT – YET SECURITY TOO OFTEN TENDS TO FALL BY THE WAYSIDE.

The “transparent citizen” – a metaphor for the large-scale collection of personal data by states, organizations, and companies – came into existence in the course of the German Census Act in 1982. Large sections of the population insisted on their right to informational self-determination, meaning that they were not willing to disclose their data to the state as ordered. The German Federal Constitutional Court agreed with these critics and prohibited the planned census procedure in 1983. The census ended up being carried out four years later in accordance with significantly stricter data protection requirements, but resistance to

SMART DEVICES ARE CAPABLE OF FINDING OUT EVERYTHING AND ANYTHING ABOUT THEIR USERS.

Artjom Schmidt, cyber expert at TÜV Rheinland.

it remained widespread. Over one million citizens didn't fill out the data entry form or did so incorrectly. Such large-scale societal resistance to disclosing one's own address almost seems amusing from today's perspective. After all, in the era of online shopping and social media, this and much more information is voluntarily and constantly divulged. Convenience and functionality often take top priority in digitalization. The protection of data and personal information often falls much too short or is completely ignored. This means that we now have transparent companies and states alongside transparent citizens. ☐





for spies

1. The economy

The outbreak of the coronavirus has proven that disruptions to supply chains can have serious consequences for the world's economy. Thousands of production facilities are at a standstill not only in China. From industrial goods to medication – a huge array of products are in short supply. Economic losses in the first quarter of 2020 have already been enormous. Global supply chains are becoming more efficient and dynamic thanks to digitalization, but also more complex. It's this dynamic and closely coordinated processes in particular that makes them so attractive to cybercriminals. If attackers succeed in disrupting any point in the chain, then those affected will usually take a hit immediately. Criminals tend to capitalize on this fact by using ransomware. This type of malware encrypts all data of the cybercriminal's mark and demands a ransom for its decryption. As the potential losses suffered by the companies affected quickly exceed the ransom, the methods used by extortionists are usually crowned by success – which in turn finances new methods of attack. "Financial pressure is high when it comes to digitalization. Companies find themselves forced to quickly implement solutions to survive the attack and remain competitive. Security gaps are pre-programmed by slap-bang processes,"

says Wolfgang Kiener, expert in cybersecurity at TÜV Rheinland. The characteristics of systems and means of transportation tend to feed into this issue. Ports and ships are often not designed according to digital security aspects from the ground up – rather, existing technology is modernized. This means that criminals often achieve the goal of undermining familiar vulnerabilities using tried-and-tested methods to circumvent more modern security mechanisms. "All too often, companies selectively deal with recognized threats and vulnerabilities are eliminated using a patch. This isn't sustainable, as most threats target a range of vulnerabilities," warns Kiener.

TEN DAYS OF ANALOG OPERATION

The logistics giant Maersk is the most famous victim of a ransomware attack to date. An attack of this nature paralyzed the company's entire IT system back in 2017. The Danish company did not pay a ransom, but needed ten days to reinstall about 45,000 computers and 4,000 servers as well as reset around 2,500 programs. These ten days of analog operation cost Maersk at least 250 million euros according to conservative estimates. **C**



Cyberattacks on ships and ports have been on the rise over the last few years. The combination of outdated technology and modern digitalization plays into the hands of attackers.



2. States


Exploits are specialized, digital tools for breaking into systems. These programs systematically exploit vulnerabilities and usually make it possible to gain control of a computer system. They are particularly detrimental if they are designed for vulnerabilities that don't yet have a security patch. In this case, they are known as zero-day exploits. As manufacturers also use different malware-like software to detect security gaps in their own developments, many of the former are freely available for purchase on the Internet. It's frequently states and non-IT companies that take up on this offer. "Exploits are sometimes extremely valuable – and this tends to drive the purchase price up," says Artjom Schmidt, expert in cybersecurity at TÜV Rheinland. Yet in contrast to Schmidt and his colleagues, individual states and their intelligence services often show no interest in securing vulnerabilities. They purchase exploits to make the most of them for as long as possible. Edward Snowden's revelations to the public in 2013 demonstrated the additional power that states have over their citizens thanks to digitalization. "Espionage, sabotage, and manipulating societies are also a key aspect of secret services' core business in the analog world. This entire scenario has now been enhanced with a digital layer," says Schmidt.

A NEW ERA

In an increasingly networked world, it is generally possible to cover one's tracks. This means that speculations about potential hackers are common, but hardly any proof exists. This is the case to this very day for the computer worm Stuxnet. This highly elaborate malware ushered

in a new era of digital issues in 2010. Stuxnet was specially developed to manipulate certain control systems, such as the Iranian uranium enrichment plant it was used on. Experts estimate that the cyberattack set back the country's nuclear program by at least two years. Not only that, but it had been proven possible that physical machines could be manipulated via digital channels for the first time in history.

DANGEROUS COMPONENTS

Seven years later, similar attack occurred in Saudi Arabia using much more dangerous components. This is because the cyberattack was designed to manipulate the emergency shutdown system in an oil factory in order to destroy it. "This attack had one aim and one aim only: to put human lives at risk and cause a catastrophe. This constitutes a totally new dimension of cyberattacks," explains Schmidt. While such examples still cause people to sit up and take notice, campaigns to influence politics and groups in societies tend to fall under the radar. Around the globe, political rivals at home and abroad can be discredited by a flood of false reports, influencing the outcome of elections, for example. 

The computer worm Stuxnet infected control devices in the Iranian uranium enrichment plant in Natanz.



3. Citizens

Since the Internet entered private homes, the majority of users have been overwhelmed. Even in the year 2020, passwords like “123456” and “password123” are still among the most common around the world. This can prove disastrous when it comes to security. Many people seem to bury their heads in the sand when faced with potential risks, while others seem to hazard the consequences. This makes it easy for cybercriminals to find out almost anything about an individual. They are helped along by countless smart devices that have flooded the world market over the years. From the television, to the vacuum cleaner, right through to the wall socket – many digital products collect all sorts of data and systematically spy on their users. “IoT devices are capable of finding out anything and everything about their owners. That’s why you should only buy trustworthy products. However, it’s often the price that counts. Thinking they’ve gotten their hands on a bargain, people bring home devices with-

out knowing that they collect data or where it’s stored and analyzed,” says expert Artjom Schmidt.

TAKING RESPONSIBILITY

While many people think of fraud and financial losses when they think about cybercrime, a lot of the truly hair-raising risks actually lie elsewhere. If cybercriminals are able to find out virtually everything about an individual, then it will also be possible for them to steal a person’s identity. This means, for example, that they commit crimes in the victim’s name, and in some cases even put them under pressure and extort them with these crimes. “Identity theft is a terrible thing. People need to radically rethink this issue and think about how they can protect themselves and their families. This is where everyone is responsible for themselves and should not merely rely on the state,” highlights Schmidt. While the General Data Pro-



Health-related information is data that requires special protection. If it is manipulated, it can have grave consequences for the person affected.

tection Regulation (GDPR) constitutes a major step in increasing protection for citizens and making manufacturers take more responsibility, in many cases it remains a toothless paper tiger. Online shopping, for example, is rife with dubious retailers. If an investigation regarding data protection is carried out against a retailer of this nature, it often turns out that the company doesn’t actually exist. “The data collected disappears with it and the GDPR becomes ineffectual,” explains Schmidt. ☑

Wolfgang Kiener is one of the authors responsible for TÜV Rheinland's annual Cybersecurity Trends report, in which the international testing services provider regularly addresses relevant issues related to digital transformation and cyberthreats.

A culture of looking away

WOLFGANG KIENER IS A RENOWNED EXPERT AND KEYNOTE SPEAKER ON CYBERSECURITY AT TÜV RHEINLAND. HE HAS FREQUENTLY STATED THAT MANY COMPANIES PREFER TO LOOK AWAY THAN TO EFFECTIVELY AND SUSTAINABLY PROTECT AGAINST CYBERATTACKS.



Mr. Kiener – the risks posed by cyber criminality have been pointed to for years. And yet companies appear to be reluctant to enact security precautions – if they do at all. Why is that?

Many companies have been putting comprehensive cybersecurity management in place. But overall, I would say that too little is being done. They could say let's tackle this issue head on – but many seem to recoil from this step. Companies often suspect that their digital structures have vulnerabilities. Yet if they have them detected, it means that they'll also have to take action – which means making investments. So they prefer to look away rather than to take on potential problems. They say to themselves "It'll be fine."

So something needs to happen before any action is taken?

That seems to be the case a great deal of the time. Maersk is the best example of this. They have since implemented a highly effective cybersecurity system. But they had to first lose over 250 million euros before they made this step. If they had used this budget early on to build up their cybersecurity, then the attack in 2017 wouldn't have been such a major blow or it could have even been prevented. The company wouldn't have had to invest as much as the financial damage caused by the cyberattack ended up costing them.

How can companies properly protect themselves?

Cybersecurity shouldn't just be a task that is allocated to the IT department. This task should be anchored at the highest management level on a par with the CEO. A combination of internal

and external experts is key. External specialists are rare, but are usually indispensable in bringing the necessary expertise to the company. Technical security solutions come into play in the second step. The typical vulnerabilities at most companies tend to be much more banal.

What would those be?

Employees are frequently the weakest link in the security system. Social engineering campaigns, which target everyday workers, are often very successful. This includes phishing, for example. Even the most sophisticated technology is of little use when cybercriminals are able to access the system via an employee's computer because it was protected with a weak password. Companies that do a good job of extensively educating their employees are already one step ahead

when it comes to cybersecurity. By doing so, companies give their employees the tools to support the implementation of all-encompassing cybersecurity management.

What do you do if you identify a vulnerability in your software or hardware?

We have a team that is specialized in detecting vulnerabilities in digital structures – not just for our customers. If we come across these vulnerabilities – whether they are known or unknown – we act according to the

THEY COULD TACKLE THE ISSUE HEAD ON – BUT MANY COMPANIES PROCRASTINATE WHEN IT COMES TO THIS STEP. THEY ARE PUT OFF BY THE POTENTIAL RAMIFICATIONS AND HAVING TO MAKE INVESTMENTS IN THIS AREA.

principle of responsible disclosure. We notify the company or manufacturer and give them some time to resolve the issue. If they don't respond or engage in delay tactics, then we ramp up the pressure. Specialist media outlets are briefed initially before the general public are notified in the final step. Most organizations that campaign for modern and all-encompassing cybersecurity act according to this framework. ☑

A myth wavers

MANKIND NEEDS THE FOREST. IT IS OF IMMENSE VALUE, BOTH AS AN ECONOMIC FACTOR AND VITAL BASIS FOR LIFE AND LIVELIHOODS. ITS INFLUENCE ON THE ENVIRONMENT, THE CLIMATE AND NOT LEAST ON MANKIND IS UNDISPUTED. BUT THE STATE OF THE WORLD'S FORESTS IS NOT GOOD.

It is more than the sum of all trees. The forest is a place full of life for animals, plants, fungi and lichens, which are interconnected in multi-layered relationships. "Trees communicate with each other, care for their young, nurse their sick and have a memory." This is how the German forester Peter Wohlleben explains the forest in his book "The Hidden Life of Trees" to millions of readers. A forester as a bestselling author whose books have sold millions of copies worldwide and are being made into movies? Apparently people are rediscovering the forest, the place of longing in German romanticism, the source of peace and inspiration. They jog and walk in the forest, hug and crochet around trees, meet for forest yoga

and go forest bathing according to the Japanese model.

FOREST MUST GIVE WAY TO FAST-GROWING PLANTS

Bad timing, you might say. Because at the same time, hectares of trees are disappearing, drying up and burning all over the world. They are attacked by bark beetles, felled by storms and, last but not least, still cut down by human hands. Every year, some 26 million hectares of forest are cleared worldwide – that is roughly the surface area of Great Britain and Northern Ireland combined. Yet the world needs the forest. It is of fundamental importance for the global hydrological cycle, for biodiversity and, last but not least, for the world

economy. Wood is one of the most crucial renewable resources. It is traded worldwide to produce furniture, flooring, houses, fuel and paper. The animals, fruits and medicinal plants in the forest are also an important basis for nutrition and health in many regions of the world.

In most cases, however, economic reasons also lead to forest depletion – to make way for more lucrative, fast-growing plants. In Brazil alone, more than 9,000 square kilometers of rainforest were destroyed last year to create fields for growing soybeans, for example. The clearing of the Amazon rainforest is particularly precarious in these times of climate change, as the rainforest is regarded as a gigantic storage facility for CO₂: the trees produce bio-

Global forest area (2018)

33

percent of the earth's surface is forested. Half of the total of around four billion hectares of forest worldwide is distributed among only five countries: Russia, Brazil, Canada, USA and China.

Economic factor forest (Germany)

1.1 million employees

128 thousand companies

180 billion Euro turnover

The forestry and timber industry is one of the leading sectors in Germany. It employs more workers than the automotive industry and generates a higher turnover than the electrical industry or the mechanical engineering and plant construction sectors.

Small beetle, big danger: Drought in the forests leads to a mass reproduction of bark beetles. The pests find ideal conditions especially in spruces weakened by the drought. The trees die off en masse.



mass and oxygen from CO₂ and sunlight and permanently bind the greenhouse gas. According to calculations by the Potsdam Institute for Climate Impact Research (PIK), the Amazon absorbs around five percent of the CO₂ emissions caused by humans – but these are released again when the forest is cleared and place an additional burden on the atmosphere.

FORESTATION BEST SOLUTION AGAINST CLIMATE CHANGE

In this context, forests could help to stop global climate change. British scientist Thomas Crowther from ETH Zurich has calculated this precisely: before man began to clear the forest for agriculture about 12,000 years ago, approximately 6.6 trillion trees grew on the earth. Today

there are just over three trillion left. According to Crowther's calculations, these three trillion trees on earth have stored around 400 gigatons of CO₂. One trillion more trees could remove around 133 gigatons of the greenhouse gas from the atmosphere. For comparison: in 2019, global CO₂ emissions amounted to 37 gigatons. According to Crowther, massive reforestation could completely offset the CO₂ emissions for several years. "Our study clearly shows that reforestation is currently the best available solution to climate change. However, we have to act quickly, because it will take decades for forests to mature and their potential as a natural CO₂ reservoir to be fully exploited," the scientist says. The scientists have already identified the areas for this: they are located in Russia, USA, Canada, Australia, Brazil and China. ☐



Growing envelopes accelerate height growth and facilitate crop protection.



Mr. Kaltenmorgen, how is the forest doing?

The forests, for example the rain forests, are actually doing well as long as modern man keeps away. There are about four billion hectares of forest in the world. Almost nine million hectares of it are destroyed every year, mostly through depletion for economic reasons – because the cultivation of soya is more economically interesting. When you then see that an additional 13 million hectares have been destroyed by bush fires in Australia in recent months alone, it is very frightening. By way of comparison: in Germany we have a total of 11.4 million hectares of forest.

... of which about 245,000 hectares must be reforested after massive damage, as the Federal Ministry of Agriculture announced in spring. What are the biggest problems in German forests?

There have also been devastating storms and forest fires in Germany, which have destroyed a lot. Added to this are extremely dry summers. The climate changes are apparent in the forests. In Germany, the rapidly growing spruce dominates the picture, which also has historical reasons: after the war, timber was needed for reconstruction. The spruce is an alpine tree, a flat-root tree. It is especially vulnerable to drought and, when weakened, is an easy prey for the bark beetle, which in turn can reproduce particularly quickly in warm weather.

Do native tree species cope better with the new climate conditions?

No, not necessarily. Beech, for example, literally suffers from sunburn in hot weather: the bark flakes off. To close the wounds, it needs water and nutrients. However, as the soil water reservoirs are empty in many places, even the deep-rooted beech does

RAIMUND KALTENMORGEN

is a forestry scientist at TÜV Rheinland and is responsible for the certification of sustainable forest management. The forestry expert mainly travels through the forests of Germany, Austria and Switzerland to grant the PEFC and FSC seals.



„No quick fix“

EXTREME DROUGHT, STORMS, FIRE AND PEST DAMAGE: THE EXTENT OF FOREST DAMAGE IS A CONSTANT SOURCE OF CONCERN EVEN TO FOREST EXPERTS LIKE **RAIMUND KALTENMORGEN**. THE FOREST ECOSYSTEM ADAPTS TO NEW CLIMATIC CONDITIONS. AND THE ONE THING THAT HELPS IS NOT MANKIND – IT IS TIME.

not get enough of it to heal itself. Fungi and other harmful organisms penetrate the tree and a beech that was just green with leaves dies within six weeks.

Which trees will grow in Central European forests in the future?

Unfortunately this question cannot be answered satisfactorily. At present, spruce, pine, oak and beech are our main tree species. In the future we will definitely see fewer spruces. At the moment, oak seems to cope well with the conditions. However, it grows very slowly and we must not forget: our forests are purely commercial forests. In Europe there are almost no primeval forests – apart from minimal areas in Romania and Poland. The current damage to our forests has immense, sometimes life-threatening financial consequences for the forest owners, who make the services of the forest available to every forest visitor free of charge.

Can economic interests and a near-natural forest be reconciled at all?

The key is “sustainable forest management”. The aim is to manage and use the forest in such a way that productivity and vitality are maintained. This means safeguarding the diverse functions and values of the forest now and in the future without endangering other ecosystems. For the forest owner, for example, this means he may only remove as much as he can regrow, usually less. The task now is to reforest the damage of the past few years through controlled planting of various tree species or natural regeneration. In future we will have fewer monocultures and more mixed forests. This will lead to a more balanced distribution of forest owners’ economic risks. But we have a long road ahead of us, because the forest grows slowly. ☐

BAR



MISTER FUTURE

After carving out a successful career as a journalist and publicist, Matthias Horx is quickly becoming one of the most influential trend forecasters and future researchers in the German-speaking world. He has published 20 books – including a number of bestsellers. Horx also founded Germany's most important future-oriented think tank – the Zukunftsinstitut – which is based in Frankfurt, Germany, and Vienna, Austria.

Back from the future

HOW WILL OUR LIVES LOOK AFTER THE CORONAVIRUS HAS PASSED? THE FUTURE RESEARCHER MATTHIAS HORX TRIES TO ANSWER THIS QUESTION BY MEANS OF A “RE-GNOSIS” AND EXPLAINS WHAT ATTITUDES WILL BEST HELP US TO OVERCOME THE CRISIS.

Mr. Horx – you are a future researcher, or “futurist.” Are you able to predict when the coronavirus crisis will end?

Yes – in that it will never end. The change that is happening right now will one day give rise to a new normality. And this is simply something we will have to get used to. This is when the crisis – in terms of us experiencing it as a crisis – will be over, but our world and society will have transformed.

The coronavirus crisis has turned all of our lives upside down. When will we be able to return to our old lives?

Is that something we really want? Many people I have been speaking to have told me that they wouldn't give back the experiences they've been having during this period of lockdown. Even if our fear has gotten out of hand at times, we have suddenly been feeling much closer to other people. Some have even said that they have really enjoyed how life has slowed down considerably, and that it isn't as hectic or chaotic as it was before. I think that this shift in mindset could truly change us. We are now confronted with ourselves and the question “How do I actually want to live my life?”

Do we simply have to wait and see how things will turn out, or are we able to independently determine our futures?

Weren't we able to do that before? I suppose that the crisis has shown us that we've been missing out on a lot of opportunities to change that we might have had in the past. We always complained about the world

around us and “those at the top”. But at the end of the day we all know that you have to start small – with yourself – to make big changes. And that's something we can all do.

Existential fears, money worries, loneliness – the onset of the crisis has triggered much anxiety and uncertainty in many people. How can we conquer our fear of the crisis?

You can't exactly “conquer” fear per se – it's an important emotion for human survival. If our ancestors hadn't had fear, then humans wouldn't exist today. But it is possible for us to gain new impulses by pushing through our fear. Perhaps the point of crises is to uncover our creativity and vitality, and to make it clear to us that we are not alone. Our friends, family, and even the state can help us out in emergencies. Not everyone experiences things this way, but countless people do. That makes us stronger.

You mentioned that we will experience a “new normality” after the coronavirus. Do you really believe that we won't be able to return to how things were “before”?

The world as we know it is in the process of disappearing. But a new world will piece itself together and take its place. We can only guess what shape it will take. There is an exercise that we use for vision processes at companies which has produced positive results. We call it a “RE-gnosis”. A prognosis is usually always about fearfully looking ahead to the future with all of its problems and risks. But if you mentally put yourself in

the future, in a time when the crisis has subsided, then you will possibly see that not everything was bad – and that you even managed to overcome some difficulties. That imbues us with confidence and helps us to better handle the challenges of today. This is how we connect ourselves with a somewhat more advanced version of our future selves and pull ourselves out of our hopelessness. We reinvent ourselves in the process, so to speak.

Are you perhaps downplaying the extent of the crisis? Some people would like to maintain the current level of deceleration, but for others it's about surviving or keeping their jobs.

I don't think I am. We're all learning, whether we're rich or poor, aren't we?

Who are the winners and losers of this crisis?

It depends on what we make of it. But those who previously worked behind the scenes – the nurses, drivers, grocery store clerks – are now held in reverence and appreciated, and I think that is something that will stick. Those who have been grumbling are the ones who will lose.

The climate crisis was a major issue before the coronavirus crisis. Do you think the earth and climate have been recovering due to the shutdown that has been imposed across the world?

At the very least, we have managed to figure out that the world can slow down without it being the end of the world. We used to believe that the climate crisis couldn't be solved because any change would damage

the economy. But if we resolve the coronavirus crisis, then perhaps we can also reduce our CO2 emissions. That would at the very least be something worth considering.

What can we learn from this crisis when taking on other issues, like the fight against climate change, for example?

We are learning that we can handle crises and that a slowdown of our industrialized society doesn't necessarily have to lead to its demise. Moreover, we now know that we can achieve a whole lot with innovation and a community behind us.

Do you think that we will learn how to be more careful with resources in the future because we have to do without at present, or will we fall back into old patterns?

Some people will revert to how they did things before. But maybe the Corona will lead to a slowdown of sorts. Perhaps we won't race around the world as much as we used to, and maybe we won't congregate in massive soccer stadiums to cheer on our favorite teams as often. That in itself could be something that becomes contagious in the future. We may have to look for new ways of relaxing and blowing off steam that aren't cool après-ski parties in Ischgl. And perhaps having to do this will benefit us in the long run.



What does history tell us? What have major crises left behind in their wake?

They often result in learning processes. Hygiene rules had been invented by the end of the Middle Ages to make diseases more controllable. The AIDS crisis didn't result in the exclusion of homosexuals, but to greater tolerance. The Cuban Missile Crisis didn't lead to the Third World War, but to disarmament negotiations. Chernobyl ushered in the beginning of renewable energies. It is sometimes quite surprising to see what crises make of us – in the end, crises mean that we have to learn so we can better handle the future.

Technology, AI, and self-learning algorithms have played an increasingly important role over the last few decades – but all of a sudden solidarity and human fellowship are what's most essential. What opportunities do humans have in this crisis?

The opportunity to become a “doer”, to experience a feeling of community, and to face external threats with humanity and confidence, is something wonderful that

will stick with us. It isn't much different to how we handle crises in our personal lives. In a crisis, things become difficult when you get wrapped up in denial, just like in your love life. Then you become bitter and really unhappy. But once you overcome this hurdle, you can rediscover love again.

We have one last question for you, our expert – how do you think the world will look after the coronavirus crisis has passed?

We will only be able to shape this new world together. I don't want to give people any ideas about how it will look. We should all feel responsible for contributing to the future to come. ☐

„CHERNOBYL INITIATED THE END OF THE SOVIET UNION AND THE BEGINNING OF RENEWABLE ENERGIES. WE TOO WILL LEARN WHAT WE CAN DO BETTER IN THE FUTURE FROM THE CURRENT CRISIS.“

Matthias Horx at his second home, Bad Gastein, Austria



*“It is absolutely possible that beyond
the perception of our senses
unexpected worlds are hidden.”*

Albert Einstein, Physicist

ABO

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