

Five questions for the new ETH Rector 39 A wooden dome made solely from waste 40  
ETH alumna Paulina Grnarova wants to revolutionise the legal industry 45

# GLOBE

NR.  
1/2022

## (Un)known threats

How we deal with  
risks 14



+GF+

**Level up. Your ambition  
deserves it.**

Achieving Excellence Together  
[georgfischer.com/career](https://georgfischer.com/career)



+GF+

## EDITORIAL

# SAFETY AND RISK



Images: Tina Sturzenegger (cover page); Oriana Fenwick (editorial)

GLOBE – the magazine for ETH Zurich  
and ETH Alumni

Just as the editorial team was putting the final touches on this issue of *Globe*, something unimaginable happened: Russia invaded Ukraine, throwing the security of Europe into disarray. Our interview in this issue attempts to take stock of the war against Ukraine and its unforeseeable consequences.

Modern societies increasingly rely on complex infrastructure in both the real and digital world, which makes us more vulnerable. At the same time, we face an extraordinary array of challenges on environmental, economic and geopolitical fronts. The COVID-19 pandemic has shown us what a global health crisis looks like. And now, just as we are emerging from the pandemic, we suddenly find ourselves gripped by the uncertain developments of a military conflict close to home. Crisis appears to have become the normal order of things in our modern world.

Risk research at ETH Zurich delves into many different areas. Our researchers are busy exploring which factors are the key to tackling risks, which solutions could help us achieve at least some degree of risk management – and what we need to put in place on a personal, political, societal and economic level to make sure those solutions are effective.

This issue of *Globe* presents a selection of topics from current risk research, and our photo series continues the theme by asking researchers from a wide range of disciplines which risks we tend to underestimate. Their responses guide us back to aspects of our lives outside the realm of military conflict.

I hope you enjoy reading this issue of *Globe*.

Joël Mesot,  
President of ETH Zurich

# Get the student job of your dreams

Earn 5'000 CHF testing the Yuh multi-currency card abroad this summer.\*



Apply here

\*See offer conditions.



**yuh**  
3-in-1  
finance app

**"I consider it my responsibility to give back."**

**Christian Buess, entrepreneur  
ETH alumnus and ETH Foundation donor**

ETH has shaped his life. That's why Christian Buess is naming the ETH Foundation in his will. Discover more and order our information brochure about legacies:

[www.ethz-foundation.ch/en/nachlass](http://www.ethz-foundation.ch/en/nachlass)



## NEW + NOTED

- 6 News from ETH Zurich
- 8 Free rein for creativity
- 10 **ZUKUNFTSBLOG**  
COVID-19 and mental health

## FOCUS

- 14 **UNDERESTIMATED RISKS**  
A photo series
- 17 **“WE WON’T SEE A SECOND COLD WAR”**  
The Russian attack on Ukraine and its consequences for international and Swiss security policy
- 21 **VIRTUAL WORLD, REAL THREATS**  
Digitalisation offers a wealth of new opportunities – and plenty of risks
- 25 **THE SOCIAL IMPACT OF DISASTERS**  
The scale of disasters is often determined more by societal decisions than by the natural hazards themselves
- 29 **HOW SAFE IS OUR MONEY?** Many of the West’s industrial nations are once again facing higher inflation



Images: Daniel Winkler (2)

## COMMUNITY

- 32 Connections to ETH
- 34 **SCIENTIFIC INTEGRITY** The ETH Executive Board has issued new guidelines on the importance of integrity in scientific practice
- 37 **TRANSFER** Sensor system for heart pumps
- 39 **IN PERSON** Günther Dissertori bases his teaching on enthusiasm, empathy and expectation management

## REPORT

- 40 **A WOODEN DOME MADE SOLELY FROM WASTE**  
A shift towards a more circular economy

## PROFILE

- 45 **A SMART USE OF AI** Alumna Paulina Grnarova is revolutionising the way the legal industry works
- 48 **AGENDA**
- 50 **OUT OF FOCUS**

# NEW + NOTED



Image: Xu Chen

Leveraging the power of AI: algorithms automatically create avatars capable of performing complex moves.

## The advent of lifelike avatars

Talk to big tech players, and the message is clear: get ready for the dawn of the metaverse. As early as next year, we could all be meeting up in virtual reality, generated by special computer software. Wearing VR goggles, we will be welcomed into this world by avatars – computer-generated figures rendered in dynamic graphics. They will be key to creating a natural user experience – and the more lifelike they are, the more it will feel like a genuine social interaction.

Led by Otmar Hilliges, Professor of Computer Science at ETH Zurich, a research team has now devised smart algorithms that greatly simplify the process of creating lifelike avatars. Instead of modeling every last detail, the team uses 3D scans of people in just a few basic poses to train the algorithms until they are able to automatically render animated full-body avatars in every conceivable pose.

Starting from one of these basic poses, the AI algorithms are able to calculate the path to a pose expressive of movement. Since the calculations always depart from the same basic pose, the algorithms become better and better at generalising such movements. This is the first time ever that such a computer model has been able to render entirely new patterns of movement. Indeed, its capabilities even extend to acrobatic moves such as somersaults and back bridges.

Because these full-body avatars are generated on the basis of 3D scans of a specific person, it is not yet possible to personalise them. The next step will be to develop a computer model that can create new identities at will. ○

# Massive violation of planetary boundaries

Researchers at ETH Zurich have developed a test that provides absolute figures on the environmental impact of the chemical industry worldwide. The new method measures the industry's consumption of chemicals against the planet's overall environmental budget. The standard practice in today's chemical industry is to calculate sustainability solely on the basis of a given product's carbon footprint.

By contrast, the research team led by ETH professors Gonzalo Guillén Gosálbez and Javier Pérez-Ramírez base their sustainability audit on the concept of planetary boundaries. These describe the anthropogenic impact on seven key planetary life-support systems such as biodiversity loss and change in land use. Of the 492 chemicals investigated, 99 percent violated at least one of the planetary boundaries. Only three of the chemicals were classified by the new method as ecologically sustainable.

That practically all of the chemicals proved harmful to the environment came as little surprise. After all, over 85 percent of the carbon base of chemicals is still derived from fossil fuels. Yet researchers were still startled to discover that some chemicals exceed planetary boundaries by over 100 times.

In discussions with Professor Guillén Gosálbez, virtually every chemical company has indicated a willingness to manufacture their products in a more environmentally friendly way, not least for economic reasons. "Sustainability is now a global issue that more and more customers are concerned about," he explains. ○



Image: Adobe Stock

# Influencing tree growth

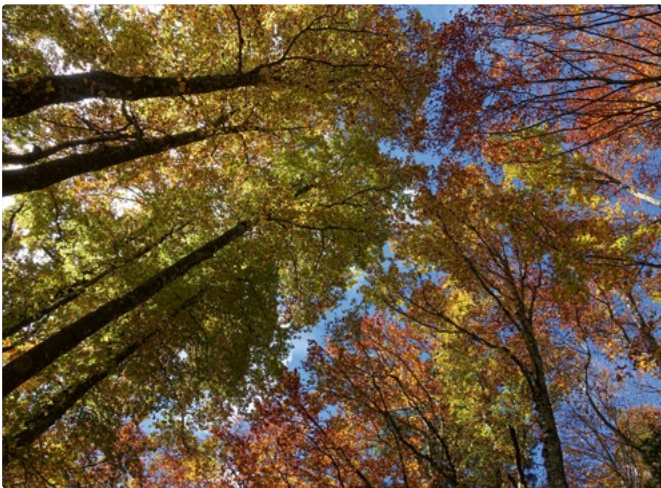


Image: Peter Rüegg

Ectomycorrhizal fungal communities in the soil help regulate how quickly trees grow.

It is only recently that scientists have gained a proper understanding of the extent to which ectomycorrhizal fungi influence the growth of mature trees and forests. A research group led by Tom Crowther, Professor of Global Ecosystem Ecology at ETH Zurich, has shown that differences in these fungal communities have an even greater impact on tree growth than do local climate conditions and anthropogenic nitrogen inputs.

Trees grow fastest where ectomycorrhizal fungal communities are highly adapted to extract inorganic nitrogen in the form of ammonium and nitrates from the soil and make these available to the trees. Conversely, growth is slower where ectomycorrhizal fungal communities supply trees with nitrogen from organic sources. To release this organic nitrogen, the fungi must first generate special enzymes.

This study could help the forestry sector to introduce specific fungal communities into woodland ecosystems and thereby influence the rate of tree growth. ○







## Free rein for creativity

PERCENT FOR ART ○ Green, pink, orange and blue are bold, vivid colours – but in Maya Rochat’s work they flow together to form a harmonious whole. As of February, two carpets printed with images by the young artist are on display in the first-floor lounge of the newly opened Student Project House, not far from the ETH main building. This percent-for-art project fits nicely with the think-tank atmosphere of the Student Project House. In her series entitled “Living in a painting”, she experiments with different ways in which art can be integrated into everyday life. Art shouldn’t be locked away in a showcase, says Rochat; we should be able to touch it, wear it, inhabit it. Her two carpets introduce splashes of colour into the raw concrete building of the Student Project House, a decommissioned district heating plant. Rochat hopes that these will create radiant islands where students can find time to dream and give free rein to their creativity. ○

→ [sph.ethz.ch](https://sph.ethz.ch)

## COVID-19 and mental health

Many people have struggled psychologically during the pandemic – yet some have coped better than others. ETH researcher José Pérez Escobar explains why.



**JOSÉ ANTONIO PÉREZ ESCOBAR** is a researcher and lecturer at the Chair of History and Philosophy of Mathematical Sciences at ETH Zurich. He studied psychology, neuroscience and philosophy.

Over the past two years, the COVID-19 pandemic has plunged the majority of the world's population into a situation unlike any other in living memory. Most people have endured lengthy and severe restrictions on their freedom of movement, and some have been forced into social isolation. At the same time, many have been more anxious than usual about their own health, about the well-being of their loved ones and about the economic impact of the pandemic. All this has affected people's mental health. Yet the restrictions, the misery and the anguish are all an integral part of pandemic life. Avoiding them is impossible – so it's important that people are able to deal with them.

To find out how people have coped with the pandemic and its restrictions over the past year, we carried out a study of over 12,000 volunteers from 30 countries. Our findings show that people who have a system of values and long-term goals – and are committed to pursuing them – are better at processing negative affect. During the pandemic, this group suffered less from stress, depression and anxiety. These were people who agreed with



Social isolation during a pandemic can affect people's mental health.

statements such as “I will come out of this situation stronger than I was before”, “I do something productive every day”, “I am using this situation to get closer to my loved ones” and “I am grateful for my life as it is”. These individuals have a higher degree of what we call “inner harmony”, a state of mind that enables them to accept both positive and negative aspects of their situation and integrate these into their lives.

In recent decades, psychology has neglected the study of how we integrate negative emotions in our lives – yet it turns out this is fundamental to our ability to develop psychological resilience. To achieve inner harmony, we need to embrace both

the negative and the positive aspects of life, instead of repressing the former. This is particularly important in a pandemic, where negative emotions are commonplace and difficult to avoid, though it is also vital in other contexts.

**REFRAMING DIFFICULT SITUATIONS** So how do we adopt this approach? The key lies in a technique called reframing, which essentially means changing how we perceive a problem in order to find practical ways of resolving it. Reframing is based on the idea that the way in which we formulate and define a problem can sometimes constrain how we address it.

Difficult events can be perceived either as a threat or as a challenge. For example, we might view social distancing as a challenge that gives us the opportunity to focus more diligently on our goals, strengthen emotional bonds and enhance our appreciation of the value of relationships. Reframing difficult events and the negative emotions they produce is an alternative to repressing them. And when difficult events cannot be avoided – as has been the case throughout the COVID-19 pandemic – it becomes even more important to adopt healthy strategies for managing stress.

Framing difficult events as opportunities is not an innate ability, but with suitable training, commitment and professional support, it is a skill that anyone can learn.

Reframing skills are especially important for at-risk groups. Our results suggest that the groups most likely to experience stress, anxiety and depression during the pandemic are women, young people, students, low-income workers and, in particular, individuals with a pre-existing mental or physical health condition. It is therefore essential to put the learning of healthy reframing skills on the political agenda and to incorporate it in guidelines issued by official bodies such as the World Health Organization. ○

Read more blog posts at:

→ [ethz.ch/zukunftsblog-en](https://ethz.ch/zukunftsblog-en)

## Having confidence in our decisions



Doughnut or apple?  
It's a tough choice.

Some decisions just feel right – others leave us feeling doubtful or even regretful about the choice we made. But what exactly is it that tells us we've made the 'right' decision? For the first time, a team of researchers at ETH Zurich and the University of Zurich, led by ETH Professor Rafael Polanía, has attempted to answer this question systematically. Using experimental data, the authors of the research study developed a computer model that can predict how an individual will choose between different options and why they might feel confident or doubtful about their decision.

The researcher's model shows that decisions are most likely to feel right if we have paid significant attention to weighing up the different options and, what's more, are conscious of having done so.

Consequently, our inclination to question and revise poor decisions relies on our own judgement of whether we weighed up the options thoroughly or were distracted during the decision-making process. This capacity for self-awareness, which experts refer to as introspection, is an essential prerequisite for self-control. ○

## How robots learn to hike

The path up the 1,098-metre-high Mount Etzel at the southern end of Lake Zurich is steep and slippery in places and features plenty of obstacles, including rocks, exposed roots and big steps. Yet ANYmal, the quadrupedal robot from Marco Hutter's Robotic Systems Lab at ETH Zurich, com-



Image: Takahiro Miki

The four-legged robot ANYmal climbs the rocky trail to the summit of 1,098-metre-high Mount Etzel.

pleted the hike in just 31 minutes, effortlessly overcoming a 120-metre elevation gain in the process. That's 4 minutes faster than a human hiker would normally take – and with no falls or missteps.

This was made possible by a new controller based on a neural network. "The robot has learned to combine its visual perception of the environment with its sense of touch based on direct foot contact. This enables it to tackle rough terrain faster, more efficiently and, above all, more robustly," says robotics professor Marco Hutter. ANYmal is now ready to be deployed on any terrain that is too dangerous for humans or too impassable for other robots.

Before testing the robot's capabilities in the real world, the scientists put the system through its paces in a virtual training camp featuring numerous obstacles and sources of error. In this way, the neural network was able to learn the best ways for the robot to overcome obstacles. It also worked out when the robot should rely on environmental data – and when it would do better to ignore it. ○

## Earth's interior is cooling faster

ETH professor Motohiko Murakami and fellow researchers from the Carnegie Institution for Science have developed a sophisticated measuring system that can be used in the lab to measure the thermal conductivity of bridgmanite under the pressure and temperature conditions that prevail in Earth's interior. Bridgmanite is the most abundant mineral in the boundary layer between Earth's core and mantle.

To perform their measurements, the researchers made use of a recently developed optical absorption measurement system in a diamond unit heated with a pulsed laser. Their findings revealed that the thermal conductivity of bridgmanite is approximately 1.5 times higher than scientists had assumed. This suggests that the heat flow from the core into the mantle is also higher than previously thought. As a result, Earth's interior is cooling faster than expected. ○



Earth's core loses heat to the mantle (orange to dark red), which contributes to Earth's gradual cooling.

Image: iStock / Rost-9D

# GLENCORE

## You prevent waste.



## So do we.



When you buy used electronics, you put less strain on the planet's resources. As one of the world's largest recyclers of discarded electronics, we give the copper and precious metals in old devices a new life in the circular economy. See what else connects us at [glencore.ch](https://www.glencore.ch)

# Safety



# and

**SAFE LEARNING** Autonomous systems such as robots, vehicles and production facilities can learn how to improve themselves. We envision a system that is capable of interacting with its environment and learning to perform a task. Yet with so many options available, actions based purely on experience can lead to mistakes – with potentially devastating consequences. Our methods use modelling, analysis and an in-depth understanding of the system to assess the risk of a proposed action and modify it if necessary. This ensures that learning takes place within a safe framework.

Melanie Zeilinger, Professor of Dynamic Systems and Control → [idsc.ethz.ch](http://idsc.ethz.ch)

# risk



**FOCUS** | Our lives have become safer in many respects. Yet certain areas pose new dangers – and we seem incapable of fully grasping some of the risks that we face. Read on to find out how ETH researchers measure risk and what solutions they are developing to keep it at bay.

**INFRASTRUCTURE FAILURE** A main driver of engineering design is the mitigation of structural failure. The risk of failure, as structures start to age or when new construction methods are put to the test of time, has been underestimated in recent years. In our group, we develop data-driven algorithms that exploit sensing to assess and protect the health of monitored assets. We use data-processing, machine learning and computing to merge data from real operating structures, and we deploy advanced lab tests to gain new understanding of the operation and protection of structures and infrastructures.  
Eleni Chatzi, Professor of Structural Mechanics and Monitoring → [chatzi.ibk.ethz.ch](http://chatzi.ibk.ethz.ch)





**Professor Wenger, does the Russian attack on Ukraine mark the end of an era that began with the collapse of the Soviet Union?**

**ANDREAS WENGER:** It certainly looks like it. The war in Ukraine is forcing European societies to abandon their vision of a liberal and integrative European security order. And that's because this vision cannot be squared with Russian thinking and Russian behaviour. War as the continuation of politics by other means has, sadly, not yet been erased from the history books.

**Does the war also mark a watershed for Russia?**

From the Russian perspective, the post-Cold War era evidently came to an end somewhat earlier. The war in Georgia in 2008 was Putin's way of showing the world that Russia was not about to tolerate any further expansion of NATO. And his intention behind the annexation of the Crimea in 2014, itself followed by the "covert" intervention in eastern Ukraine, was to stymie Ukraine's accession to the EU. It's been obvious for quite some time that Russia and the West have irreconcilable conceptions of political order. The West has neglected to seriously engage with this realignment of the European security order. A vital question here would have →

# “We won't see a second Cold War”

The outbreak of war in Europe marks the return of what was long regarded as unthinkable. ETH Professor Andreas Wenger analyses the medium- and long-term consequences for international and Swiss security policy.

INTERVIEW Christoph Elhardt

been to think about what role Russia and the countries that lie between Russia and NATO might play within this new order.

### **Could the West have avoided war by taking more decisive action?**

That's the subject of intense debate among experts in the US. President Biden has been criticised for his early announcement that NATO would not be sending troops to Ukraine. The argument is that the massive build-up of Russian troops should have been met much earlier by a countervailing military force. In my view, these charges fall short of the mark. They are too narrowly military in their thinking and overlook the fact that the Europeans would not have fallen into line with such a policy.

### **Can we already foresee the medium- and long-term consequences of the war for international relations?**

A lot depends on how it progresses. As ever, the medium- and long-term consequences will become visible only once the "fog of war" has lifted from the conflict zone and domestic political debates have calmed down somewhat. We've still some way to go before that.

### **Could the war mark the beginning of the end for Putin?**

Right now, very different outcomes of the war are possible, each with different consequences for Russia. In the long run, it may indeed turn out that the war heralded the end of Putin's regime. And then it might well become possible to launch a dialogue on the future of the European security order and a new chapter in Russo-European relations. At present, however, it looks more likely that Putin will hold onto power, with Russia internationally isolated and Ukraine facing years of insurgency. In this scenario, relations between the West and Russia would be governed by the logic of deterrence for the foreseeable future. In turn, Russia would move even further eastwards, and the strategic partnership with China would probably deepen.

### **Will there be a new Cold War?**

No, the world won't see another Cold War like the one in the 20th century. The international situation has shifted. Europe is no longer the linchpin of a bipolar system: the centre of gravity in world politics has shifted to Asia and the Pacific. Relations between China and the United States form the main axis in a multipolar system of great powers, which Europe and Russia then group around. Given the complex economic and institutional interdependencies of such a system, states will find themselves having to cooperate in certain areas in order to be able to compete in others.

### **How much of a role did the rivalry between the US and China play in the outbreak of war?**

Both the outbreak of the war and its cessation can be understood only by factoring in the roles of the US and China. One of the reasons why China intensified its strategic partnership with Russia in the period leading up to the war was to form a counterweight to the defence partnership between the US, the UK, Australia and India. This reinforced Putin's position. At the same time, the US has relinquished political leadership to Europe in the Ukraine crisis so as to be able to focus more on hotspots in the Pacific. Washington has no desire at all to get drawn into a war on two fronts.

### **In the past, China has consistently championed the principles of territorial integrity and non-interference. Are we witnessing a shift in Chinese foreign policy?**

The longer the war continues and the more intense it becomes, the more difficult it will be for China to paper over the contradictions in its position: first, the need not to criticise Russia, although the war cannot be in China's interest; second, to repudiate Western sanctions without becoming a target itself of those sanctions; and third, to fully uphold the principles of unconditional sovereignty and territorial integrity, which must then apply to Ukraine as well. The outcome of the war will also have an impact on the partnership between Russia and China. Should this relationship deepen, Russia is likely to increasingly become the junior partner.

**“Russia and the EU will need to learn how to combine geopolitics with rule-based politics.”**

Andreas Wenger

### **Turning to the question of European security, can Russia and Europe find their way back to a stable architecture?**

The relationship between Russia and Europe is highly asymmetric: Russia has a strong military, but is not a global player economically; conversely, the EU is strong economically but still depends on the US for military support. In a conflict between the two, military firepower comes up against regulatory commercial power. That said, Russia will have to think carefully in the future about whether to use its military superiority in a similar way against a NATO member, given that the risks of nuclear escalation

are high. If, in the long term, Russia and the EU are to rebuild stable relations, they will need to learn how to combine geopolitics with “rule-based” politics.

**In response to the outbreak of war, the EU has remained remarkably united and has agreed to an unprecedented package of sanctions. Will we now see the EU playing a more dominant role in world politics?**

It's crucial that Europe reflect critically on its improvised strategic decisions of recent weeks. Alongside the US, the EU has been able to use its regulatory power as a broad instrument of coercion. In so doing, it has placed Russia under huge economic pressure. At the same time, however, it has become clear that the threat of sanctions has only limited force. If sanctions are applied only in the midst of a crisis, there's a risk they will isolate an entire society and lead to a spiralling politicisation of the economy.

**In response to the Russian attack, Germany plans to spend 100 billion euros on its armed forces. Is Europe about to assume greater responsibility for its own defence?**

If implemented, Germany's shift towards higher defence spending could reinforce Europe's conventional military capabilities and bring about a certain convergence of strategy among EU member states. But for the foreseeable future, Europe remains dependent on the security guarantees provided by the US nuclear deterrent.

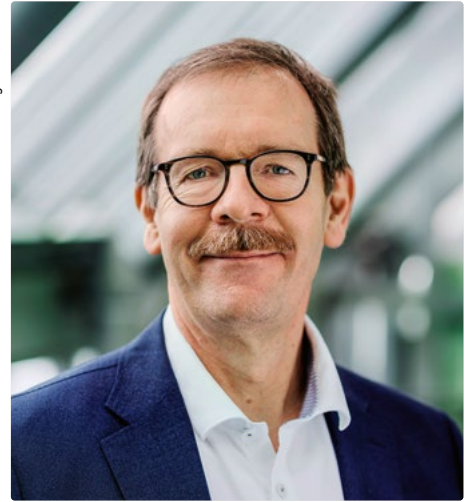
**What impact has the conflict had on NATO?**

Putin has conjured up the very thing he wanted to avoid: NATO's focus has now shifted back to the principle of collective defence; solidarity among member states is higher than it has been for a long time, at least for now; and military deterrence capabilities in Eastern Europe are stronger than ever before. Coordination with the EU has also improved, as have relations with Finland and Sweden. On the other hand, the political balance between NATO's political and military functions remains fragile.

**Let's finish by turning to Switzerland. What are the longer-term consequences for Swiss security and defence policy?**

Again, that depends very much on how the war develops. For Switzerland, the crucial issue will be how the great powers react to the outcome of the crisis, and how the European security order evolves. For example, the scope for Switzerland to continue its policy of neutrality will also depend on whether the very far-reaching package of sanctions against Russia remains an isolated example or whether the recourse to sanctions as a European instrument of coercion is likely to become the norm.

Image: ETH Zurich



**ANDREAS WENGER** is Professor of Swiss and International Security Politics and Director of the Center for Security Studies at ETH Zurich. —> [css.ethz.ch/en](https://css.ethz.ch/en)

**More and more people in Switzerland are calling for increased military investment. What do you think about that?**

We must avoid making any hasty decisions. We need to take a careful look at the military means that have enabled the Ukrainian forces to stave off, for a surprisingly long time, a mechanised enemy with substantially superior firepower. Switzerland must then draw the appropriate conclusions for its own purposes. ○

This is an abridged version of the interview that took place on 8 March 2022. You can find the full version here: —> [www.ethz.ch/globe](https://www.ethz.ch/globe)

**A LACK OF TRANSPARENCY** In Switzerland, as many as 25 percent of all ballots cast are declared void. Similarly, the contracts between vaccine manufacturers and the Federal Office of Public Health remain secret. Reports like this can undermine our faith in democracy and lead to legitimate questions about whether our votes are properly counted and how our taxes are spent. In the age of blockchains, there is no reason for such secrecy. Digitalisation is ushering in an urgently needed paradigm shift towards transparent government. That's the focus of our research.

Roger Wattenhofer, Computer Engineering and Networks Laboratory → [disco.ethz.ch](https://disco.ethz.ch)



# Virtual world, real threats

Digitalisation offers a wealth of new opportunities – and criminals and hostile states are only too happy to exploit them. Protecting against such attacks requires a broad range of measures.

TEXT Felix Würsten

Targeted hacker attacks on governments and companies, a critical data leak affecting holders of Swiss Federal Railway's SwissPass, and a cyberattack that compromised data held by the International Committee of the Red Cross (ICRC) in Geneva: these are all examples of the complex risks that abound in cyberspace. The question of how to make the digital world safer is a highly charged issue – and one that occupies ETH researchers in many different ways.

One of the biggest risk factors in today's world is the internet. To us, it appears to be a smooth-running machine that connects the world in unprecedented ways – yet it also allows malicious actors to interact with innocent users and fosters long-distance conflicts. What's more, the outdated architecture of the internet itself causes a steady stream of serious problems.

**SPEEDY, SECURE AND EFFICIENT** Everyone knows that the modern internet has some major shortcomings, but Adrian Perrig, a professor in the ETH Zurich Network Security Group, is confident they can be fixed. Perrig is the originator of an ingenious concept to make the internet systematically more secure without interrupting its

operations. He describes his approach as “scalability, control and isolation on next-generation networks”, or “Scion” for short. At its core is the notion of dividing up the internet into separate zones and transmitting data packets along pre-defined paths, thereby preventing information from passing through points where it might fall into the wrong hands.

Numerous people are now attempting to put Perrig's concept into practice, and he enjoys the support of various colleagues, including Peter Müller and David Basin, two ETH professors whose groups are engaged in verifying Scion and validating the program code. His work so far has been remarkably successful. Last autumn, for example, the Swiss National Bank teamed up with SIX Group, ETH spin-off Anapaya and other partners to launch the Secure Swiss Finance Network, which is based on Scion technology. His concept has also been adopted by the Swiss Federal Department of Foreign Affairs, which uses Scion connections to communicate with embassies. →

**FUNDING PARTNERS** Research into information security at ETH Zurich is supported by a number of industry partners, including Armasuisse, Swiss Post, NEC, Open Systems, SIX Group, Swisscom, Zurich Insurance Company and Zürcher Kantonalbank. The Werner Siemens Foundation is helping to finance the Centre for Digital Trust, a joint research project run by ETH Zurich and the University of Bonn.

And it's not just a question of better security, says Perrig: Scion is also faster and more energy-efficient. By providing more paths to transmit data, Scion makes optimum use of the infrastructure. And with the option to select which path data packets should take, it's easy to choose the one with the lowest CO<sub>2</sub> emissions.

Perrig initially thought that this faster, more secure and more environmentally friendly approach would be a sure-fire hit – so he has been surprised by the tremendous effort required to spur adoption. Radically new approaches often struggle to achieve mainstream acceptance, but Scion has also been hampered by a web of market dependencies. No customers will use Scion technology if none of the internet providers offer it – and with no users, there is no need to standardise the protocols. That, in turn, makes providers hesitant to invest in the technology.

But Perrig's persistence is finally paying off. Various providers have now started offering a Scion internet service, including Swiss telecom companies Swisscom, Sunrise and Switch. Providers in other countries are also beginning to show an interest in the new concept, and Perrig is confident it is now on track: "Scion is the first inter-domain routing infrastructure that has been deployed in practice since the Border Gateway Protocol over 30 years ago." He also argues that switching to a new internet architecture is inevitable in the medium term: "Today's internet is simply far too insecure given the critical nature of the systems relying on it."

**SMALL AND FRAGILE** But in addition to the risks posed by networks, dangerous vulnerabilities also lurk within computers themselves. As chips become more complex and the capacitors and transistors that make them become smaller, they become more vulnerable to sophisticated attacks. For example, hackers can launch what are known as side-channel and Rowhammer attacks, which compromise the integrity of data in the dynamic memory of computers, tablets and smartphones. Experts have long been familiar with how these attacks are mounted, but chip manufacturers have not yet taken sufficiently robust countermeasures, as Kaveh Razavi, Assistant Professor of Secure Systems Engineering, recently demonstrated.

**“The question of who has access rights to certain data is a political decision that engineers like me can't be expected to make.”**

Kaveh Razavi

This is all the more worrying since vulnerabilities in hardware are much more difficult to fix than software bugs. Right now, these classes of attacks are not a major problem because there are easier ways for hackers to infiltrate people's computers. But the more we improve our defences against other attacks, the more tempting these new hardware attacks become.

Razavi's research focuses on the security of the entire computer system, including both software and hardware, and he is currently working on projects with several of the big chipmakers. "In some of these projects, we're going deep into the system and developing new methods of chip design. In others, we're more concerned with the impact that programs have on the hardware," he explains.

Ultimately, everyone is interested in improving security – yet this poses something of a dilemma for computer manufacturers. Additional security comes at a price, but few consumers are willing to pay more or sacrifice performance in return for more security. Razavi also faces a dilemma: as a scientist, he needs to publish his findings as soon as possible in order to gain an edge in the cut-and-thrust world of academia – but his industry partners have other ideas. "We follow the principle of responsible disclosure," he says. "In other words, we give companies time to fix flaws before we publish them." Razavi has also enlisted the support of Swiss federal authorities: for example, his discovery of the vulnerability in dynamic memory led to a joint publication with the National Cyber Security Centre. As of last September, this is the agency responsible for registering critical vulnerabilities in Switzerland.

Yet technical measures alone are not enough to make cyberspace safer, says Razavi. "We also need input from policymakers, because questions about how we share data and who has access rights to certain types of information are political decisions that engineers shouldn't be expected to make," he says.

**NEUTRAL AND TRANSPARENT** Such policy issues fall within the remit of Jakob Bund, who heads up the cyberdefense project in the Risk and Resilience Team at the ETH Zurich Center for Security Studies. One of his tasks is to examine how governments and organisations protect themselves against risks in cyberspace. “We provide policy-makers with the scientific principles they need to make decisions,” he says. To do this, Bund maintains regular contact with the Swiss Department of Defence and the Armed Forces Command Support Organisation, which is to be transformed into a military cyber command by early 2024.

As a political scientist, his job is to place the technological risks in a political context. “We’re concerned with possible impacts,” he says. “For example, how are these technologies being deployed? What can they be used for? And how do they differ from conventional methods?”

## “Cyberspace spans the globe and has numerous fault lines.”

Jakob Bund

Today’s governments face competition and conflicts on many different levels in cyberspace: disseminating false information in social networks, using cyber espionage to obtain secret information and deliberately seeking to cripple their opponents’ critical infrastructure. Yet individual actions can only be properly understood within a broader strategic framework, says Bund – and by continuously reassessing what actors hope to achieve, and what impact their activities may have. Experts are currently engaged in heated debate about the possibility of establishing rules for governments in cyberspace. “It’s a complex process,” says Bund. “As well as defining what it means for a state to behave responsibly in cyberspace, we also need to figure out how we want to ensure that those norms are followed in the future.”

The US presidential election in 2016 was a wake-up call for how sophisticated state-sponsored cyber conflict has become. “The fact that the national headquarters of both major parties in the US were targeted by cyber espionage operations came as little surprise,” says Bund. “But the way in which some stolen information was used in the election campaign in the attempt to manipulate voting decisions was a new combination of existing tactics and tools.” This illustrates how modern governments

now have completely new methods at their disposal to interfere in another country’s affairs. According to Bund, Europe still tends to underestimate the significance of this point: “One possible explanation is that it’s harder to see the influence on election campaigns here because many continental European countries have a broader range of political parties.”

One aspect of particular interest to Switzerland is the law of neutrality. This has been amended on multiple occasions to reflect the emergence of new technologies such as telegraphy and radio – but the question now is how far the concept of neutrality can be extended to cyberspace. “Cyberspace spans the globe and has numerous fault lines,” says Bund. “Yet it is also connected to infrastructure in the real world. Switzerland and other countries need to consider under which circumstances these digital entanglements might bring them into touch with otherwise geographically distant conflicts.”

And that’s not the only reason Switzerland should be having this conversation: it also needs to consider its duty to protect international organisations based on Swiss territory. “These organisations are an attractive target for cyber espionage,” says Bund. “And that makes it more likely that Switzerland will be caught in the cross hairs of threat actors operating through cyberspace.” Learning how other countries are protecting themselves against cyber risks should therefore be a top priority, he argues. “And independent scientists like us can help share that kind of knowledge,” he adds. ○

**ADRIAN PERRIG**, Professor of Network Security in the Department of Computer Science  
→ [netsec.ethz.ch](https://netsec.ethz.ch)

**KAVEH RAZAVI**, Assistant Professor of Secure Systems Engineering in the Department of Information Technology and Electrical Engineering  
→ [comsec.ethz.ch](https://comsec.ethz.ch)

**JAKOB BUND**, Cyberdefense Project Lead at the Center for Security Studies  
→ [css.ethz.ch/en](https://css.ethz.ch/en)



**IRON AND THE IMMUNE SYSTEM** Over half of the children in developing countries suffer from anaemia due to iron deficiency. Moreover, childhood vaccines in these countries are less effective. Until recently, it was unclear why this should be so. The latest studies show that white blood cells need large amounts of iron to produce antibodies after vaccination. Children with an iron deficiency have a higher risk of reduced vaccine protection because they have fewer antibodies – and those they do have are less potent. Administering iron improves the effectiveness of vaccines against childhood diseases.  
Dr. Nicole Stoffel, Laboratory of Human Nutrition → [humannutrition.ethz.ch](http://humannutrition.ethz.ch)



Christine Eriksen spent 13 years living and working in Australia before taking up her post at ETH Zurich in August 2020. “One of the reasons I decided to move to Switzerland was to escape the growing number of catastrophic bushfires,” she says. The “Black Summer” fires blazed across Australia between June 2019 and May 2020, burning more than 18 million hectares of land and causing damage estimated at CHF 70 billion.

Eriksen was living in Wollongong at the time, 90 kilometres south of Sydney. Fires raged in the hinterland for months, eventually reaching the coast. Smoke drifted into lower-lying urban areas. “I would wake at night in a panic, gasping for breath because the room was full of smoke,” says Eriksen. “Yet my home was a good 60 kilometres from the nearest fire!”

Millions of people were exposed to persistent smoke, and it exacerbated Eriksen’s struggle to separate her personal life from her research work on the social dimensions of disasters.

#### THE RISK OF WILDLAND-URBAN INTERFACES

As a human geographer, Eriksen has been fascinated by forest fires ever since her time as a doctoral student. Her research explores the challenges of rebuilding after forest fires, the role played by social and cultural norms in disaster resilience, and the way in which policy decisions can increase risk in certain contexts.

As part of her field research, Eriksen spent several years in fire-prone areas of south-eastern Australia and California, interviewing residents, public officials and firefighters, and observing →

# The social impact of disasters

Human geographer Christine Eriksen and physicist David Bresch conduct research into weather and climate risks. Their methods may be different, but they agree that the scale of a disaster is often determined more by societal decisions than by the natural hazard itself.

changes in socio-economic factors. Her findings showed that people were increasingly moving away from cities in search of nature, affordable housing and a better work-life balance. "This steady expansion of the wildland-urban interface has greatly increased the risk of forest fires turning into social disasters," says Eriksen. "And that's something we're seeing in many parts of the world, including California and the Mediterranean."

Climate change has increased the frequency and intensity of major forest fires along with heat-waves and dry summers. "When I began my research in the 2000s, Australia could typically expect a major fire once every 5 to 10 years. Now they're happening once every 2 to 3 years," says Eriksen. Yet she still shudders every time she hears the term "natural disaster". "Disasters are not 'natural'," she says. "The biggest risks are primarily a result of social and cultural processes."

"Indigenous people in Australia and North America saw periodic fires as a necessary part of natural regeneration," she says by way of example. "It was only the settlers from Europe who tried to prevent fires at any cost." Over time, this has resulted

in the accumulation of many cubic tonnes of combustible material in forests, which burn more intensely and uncontrollably due to global warming.

Disasters also cast a spotlight on social power relations and inequalities. Eriksen has studied reports on the social impact of Hurricane Katrina, which struck New Orleans in 2005. An estimated 80 percent of the city was flooded, with some areas submerged in up to 4 metres of water. More than a million people were forced to leave their homes and some 1,500 lost their lives.

Those who stayed in the city despite the warnings – and even after the flooding started – were far more likely to be from poorer households. With less access to private or public transport, it was more difficult for them to evacuate. Of the approximately 30 percent of households who did not own a vehicle, most were African-American families in low-income brackets. These families were also more likely to live in low-lying areas that are particularly exposed to hurricanes – precisely the areas that suffered the most devastating consequences when the flood defences failed. "Class, ethnicity, gender, sexual orientation, disabilities, education and religion were all key factors in determining how vulnerable people were to Katrina's effects," says Eriksen.

**MODELLING HELPS DECISION-MAKERS** David Bresch also conducts research into disasters. Unlike Eriksen, however, he deliberately reduces social complexity and assesses risk on the basis of mathematical models. His Weather and Climate Risks Group seeks to apply the principles of mathematics to the practical needs of companies, public bodies and local councils and co-develops tools with stakeholders to help them better prepare for increasing weather and climate risks. Aside from talking to stakeholders, the most important instrument in Bresch's research is CLIMADA, an event-based modelling platform designed to calculate the socio-economic impact of weather and climate events. Decision-makers can use this tool to weigh up the different options and perform a multi-criteria analysis of risk-reduction measures.

During our Zoom call, Bresch shares his screen and launches a global risk simulation generated by CLIMADA. As we watch, fine lines and small circles appear on the image of a globe and steadily make their way from the ocean towards



#### OVERCONFIDENCE IN SCIENCE

Risk assessment and decision-making under uncertain conditions should make the best use of scientific knowledge. One of the main dangers, however, is being overconfident in such knowledge. Climate change, for example, may generate catastrophic scenarios either unforeseen or only envisaged by a minority of scientists. In our research, we explore how to make optimal decisions when experts provide conflicting information. We question the role of experts in decision-making and emphasise the value of research institutions that encourage the creation of original, possibly disruptive, knowledge.

Antoine Bommier, Professor of Integrative Risk Management and Economics

→ [irme.ethz.ch](http://irme.ethz.ch)

land. These represent the path of every recorded tropical cyclone between 1987 and 2016. Wherever one of these cyclones makes landfall, it glows yellow, green or blue, depending on the amount of damage it inflicted on people, buildings and infrastructure. The areas that light up the most include coastal areas of Japan, the Philippines, southern China and Vietnam.

So far, the team has produced CLIMADA models for tropical and extratropical cyclones, floods, forest fires, heatwaves and droughts worldwide. In this way, scientists can model the impact not only of historical events, but also of possible future ones – in other words, they can compute extreme weather scenarios that have never taken place but that are physically plausible. They can estimate the impact of such events with a resolution of just 4 kilometres, anywhere on the globe.

**BUILDING TRUST** With the support of the Asian Development Bank and Germany's international development agency GIZ, Bresch is currently providing expert advice to the Vietnamese city of Hue, which lies on the coast of the South China Sea and is highly exposed to tropical cyclones. After countless Zoom calls with stakeholders and two years of building trust, Bresch's group was able to model and evaluate the city's future climate risks, draw up a series of scenarios and outline possible courses of action. Instead of meteorological parameters such as high wind speeds, the team of researchers provided the authorities with a warning of their impact along with concrete actions to take in response to specific questions: for example, how many people should we evacuate over the coming days, and when and where should the evacuations take place?

The CLIMADA software is open-source and free to use; that means local authorities anywhere in the world can run the weather risk model for their region whenever they wish and tailor it to their needs. "All you need is a laptop and some basic knowledge of the Python programming language," says Bresch. Tutorials are available on his group's website, but they are not used as much as he would like: "It's not an issue of technical impediments. Most of the obstacles are simply in people's minds."

To help researchers from different parts of the world share their local experiences of climate risk adaptation, Bresch co-founded the Economics of Climate Adaptation (ECA) Working Group in 2009. The ECA website offers examples of how public authorities can use CLIMADA to develop strategies for dealing with weather and climate risks. These include insights gained by the City of New York in the devastating aftermath of Hurricane Sandy.

Having examined more than 30 case studies, Bresch has concluded that the biggest risk factor for disasters is social development. To illustrate his

point, he explains how an increase in construction activities in a particular area is much more likely to raise the risk of catastrophic flooding than an increase in extreme weather itself.

**A TRANSDISCIPLINARY APPROACH TO HAIL** The socio-economic dimensions of disasters are so important that Bresch often chooses to work with experts from other disciplines. When it came to modelling the risks Switzerland faces from hail under changing climate conditions, for example, he called on the assistance of computer scientists, climate physicists, agricultural scientists, meteorologists and economists.

Hail is responsible for around 50 percent of damage to buildings in Switzerland, and it also poses serious risks to agriculture. It was therefore important to get stakeholders involved right from the start, including building insurers, Agroscope and the Federal Office for Civil Protection.

Christine Eriksen also favours a transdisciplinary approach to research. "We gain much richer insights into socio-economic issues in certain risk contexts when we combine that knowledge with scientific findings," she says. "In contrast, mathematical models alone might reveal patterns of natural risks, but they don't tell us much about how those risks actually affect people in specific locations." ○

**CHRISTINE ERIKSEN** has been Senior Researcher in the Risk and Resilience team at the ETH Zurich Center for Security Studies (CSS) since 2020. Before joining ETH, she worked as a social scientist at University of Wollongong, Australia. She has published numerous case studies on the social dimensions of disasters in Australia, the USA, Europe and Africa.  
→ [css.ethz.ch/en](https://css.ethz.ch/en)

**DAVID BRESCH** has been Professor of Weather and Climate Risks at the Department of Environmental Systems Science and at MeteoSwiss since 2016. He previously held various positions at reinsurer Swiss Re, including chief modeller for natural catastrophe risk assessment.  
→ [wcr.ethz.ch](https://wcr.ethz.ch)

# How safe is our money?

The war in Ukraine has fanned the flames of inflation. Is this merely a temporary shock – or the start of a new normal?

TEXT Christoph Elhardt

Be it cash in our pockets, bank deposits, or digital credit on a card or smartphone – money is woven into the fabric of everyday life. These days, we tend to assume that our money will still buy us the same amount of goods or services two months, or even two years, from now. Yet this was not always so. “History tells us that high inflation not only causes huge economic harm but can also inflict immense social and political damage,” explains Professor Hans Gersbach, who holds the Chair of Macroeconomics: Innovation and Policy at ETH Zurich and is also a member of the Board of Academic Advisors to Germany’s Federal Ministry for Economic Affairs and Climate Action.

For the first time since the 1980s, Western industrial nations find themselves once again facing the spectre of higher inflation. The war in Ukraine and the resulting fallout are now likely to fan the flames. In the eurozone, the rate of inflation is currently 5.1 percent (March 2022), more than three percentage points above the benchmark of 2 percent. In the US, it now stands at 7.2 percent. One of the few countries to buck this trend is Switzerland, where prices have risen by a mere 2.2 percent during the last year. Given such drastic developments in the eurozone, how safe is our money? Is it merely a temporary shock, exacerbated

This text reflects the situation in the first week of March 2022.

by the Russian invasion? Or should we expect higher inflation in the longer run? And, if so, how can we best protect ourselves against this risk?

**TEMPORARY OR PERMANENT?** When it comes to inflation, ETH professor Jan-Egbert Sturm tends to focus on short- and medium-term movements in prices, wages and interest rates. Sturm is also Director of the KOF Swiss Economic Institute, an organisation whose forecasts carry significant weight. He has regular meetings with members of the Swiss Federal Council and the Swiss National Bank (SNB).

Sturm is an empirically-oriented economist. Rather than relying solely on abstract theoretical models, he favours the use of statistics, time series and indices. "Inflation is essentially being fuelled by the rapid economic recovery following last year's lockdowns and the resulting supply-chain problems," he explains. The outbreak of the pandemic in spring 2020 was a wake-up call for companies. It taught them that without adequate reserves of essential goods, production can rapidly grind to a halt. "Now we have lots of companies all trying to restock at the same time, which leads to supply bottlenecks and rising prices," Sturm explains. "But this situation should improve once inventories are replenished."

Sturm and his colleagues also focus on the basket of goods used to measure inflation. This tracks price changes across a range of consumer goods and services. It turns out that much of the current inflation is down to increased prices for energy, raw materials, and goods that have been in high demand during the pandemic. "People have been prepared to spend more money on computers and TVs, but these are mainly one-off effects that we would expect to normalise over the medium term," says Sturm.

In normal circumstances, this would indicate that the currently high rate of inflation is likely to be temporary. However, the invasion of Ukraine and the resulting sanctions imposed on Russia are also driving inflation. "Russia is one of the world's

largest suppliers of oil and gas, which means that energy prices have risen even further," Sturm explains. Moreover, Russia and Ukraine are among the largest exporters of wheat. Following the outbreak of war, prices not only for wheat but also for other crops such as maize and soya have gone through the roof. Sturm says it is still difficult to tell just how quickly and heavily this will impact food prices. But one thing is clear: rising oil and gas prices will further fuel inflation.

**A SIGN OF UNCERTAINTY** So, where will inflation come to rest in the longer term? This will depend not only on price trends but also on inflation expectations. "When more and more people believe things are going to get more expensive, they start demanding higher wages, which in turn has an impact on prices," Gersbach explains.

Inflation expectations are measured by canvassing analysts, companies and consumers about future price trends. KOF is among the bodies that publish such surveys. In addition, the expectations of financial market actors can be gauged on the basis of certain market transactions. According to Gersbach, the data is increasingly clear: "For a long time, the financial markets appeared to regard future inflation as relatively low and stable. But surveys have been showing a significant rise in average inflation expectations and a greater spread of opinion for quite some time now." Moreover, in many European countries, the majority now expects inflation to continue rising – and the current conflict will only reinforce this trend.

Whether this pessimistic outlook further hardens will depend to a large extent, Gersbach and Sturm say, on the monetary policy of the central banks. In response to high inflation in the 1970s and 1980s, most central banks in industrialised countries have become relatively independent of government policy and now focus on maintaining price stability. "The lesson of past inflationary crises is that currency stability is better left in the hands of independent experts," says Gersbach.

If higher inflation becomes entrenched and inflation expectations move higher, central banks will need to raise interest rates and cut back their generous bond-buying programmes and other interventions in the financial markets. Both economists agree that this would entail substantial risks, especially for the eurozone. "A premature rise in interest rates would threaten the →

fragile economic recovery,” says Sturm. “And countries with a high level of debt could run into difficulties refinancing those loans.” It could also lead to serious upheaval in the financial markets.

The war in Ukraine and the attendant economic fallout have further exacerbated the dilemma facing central banks. “The coming slowdown in economic growth could well persuade them not to raise interest rates as planned, which would further fuel inflation,” Sturm explains. In a worst-case scenario, there is even the threat of stagflation, an economic phenomenon not seen since the 1970s, which combines high inflation with falling growth and rising unemployment. The extent to which the economic picture further deteriorates and the level at which energy prices finally stabilise will depend on how the Ukraine conflict plays out.

So far, the UK and US central banks have signalled a willingness to countenance reduced growth and greater financial market volatility in return for lower inflation. By contrast, the European Central Bank (ECB) remains cautious. Gersbach and Sturm say this is primarily because the ECB is responsible for monetary policy in the entire eurozone and therefore factors in the economic situation of 19 countries. “Yet, if higher inflation proves to be ‘sticky’, the ECB will also have to raise interest rates to protect the value of money,” says Gersbach.

As guardian of one of the world’s oldest and most stable currencies, the SNB has a somewhat easier task than the ECB. “Swiss companies and consumers tend to assume almost zero inflation,” says Sturm. The favourable exchange rate is another factor in the country’s comparatively low rate of inflation: “The strong Swiss franc makes imports cheaper, thereby curbing price increases. Should imported goods become more expensive, the SNB can allow the currency to appreciate slightly to counter inflationary pressures.” What’s more, Switzerland is not especially dependent on heavy industry. For this reason, oil and gas prices have less impact on the cost of industrial goods.

**A NEW MONETARY SYSTEM** “In the long run, however, Swiss monetary policy will also face a big unknown,” says Gersbach. He explains that a new monetary system has emerged in the wake of the 2008 financial crisis: “Before the financial crisis, commercial banks only held small reserves with the central bank. But in order to stabilise the

banking system and, with it, the economy, central banks have undertaken large-scale purchases of securities from commercial banks and of foreign exchange reserves, as in the case of Switzerland. Over the past 14 years, this has massively increased the level of reserves that commercial banks hold with central banks.”

Using these reserves, the banks could greatly expand their lending or the buying of securities, thereby creating new bank deposits and thus increasing the money supply, but without risking liquidity problems. To what extent this will happen and whether this newly created money will lead to higher inflation or even another financial crisis is a matter of debate, says Gersbach. With money, there’s always uncertainty, and therefore risk. ○

**HANS GERSBACH** is Professor of Macroeconomics: Innovation and Policy at ETH Zurich and a founding member of the ETH Risk Center.

—> [mip.ethz.ch](http://mip.ethz.ch)

**JAN-EGBERT STURM** is Professor of Applied Macroeconomics and Director of the KOF Swiss Economic Institute at ETH Zurich.

—> [kof.ethz.ch/en](http://kof.ethz.ch/en)

**ETH RISK CENTER** The ETH Risk Center comprises 21 professorships from nine departments. By avoiding the pitfalls of a piecemeal approach, the Center is able to address the systemic nature of risk. Research focuses on concepts from the fields of integrated risk management and resilience. The ETH Risk Center also acts as a hub between science, industry and government agencies. It was funded through donations to the ETH Foundation by Alpiq, AXA Research Fund, Axpo, BKW, CKW, Credit Suisse, Swiss Re and Zurich Insurance Company.

—> [riskcenter.ethz.ch](http://riskcenter.ethz.ch)



**RESILIENCE OF ORGANISATIONS** Resilience describes the ability of a system to absorb internal or external shocks, as exemplified by an earthquake-resistant building or a healthy immune system. But how do we gauge the resilience of socio-economic systems, such as companies or organisations? One approach is to build models and devise data-based indicators. These tell us when a process of dynamic adaptation threatens a system's inner stability with the risk of failure rather than the hoped-for improvement. This in turn reveals the unintended consequences that decisions may have.

Frank Schweitzer, Professor of Systems Design → [www.sg.ethz.ch](http://www.sg.ethz.ch)

# COMMUNITY



Start-up rreefs is tackling the problem of coral degradation by building artificial reefs.

Image: Leila Tazi

## Battling climate change and the pandemic

With 25 new spin-offs and some 390 million Swiss francs of new capital raised, 2021 was a good year for entrepreneurship at ETH. Many of the start-ups founded last year specialise in the field of medical diagnostics. Hemetron, for example, has developed a hand-held device that can perform rapid and reliable blood tests to predict heart attacks or detect a COVID-19 infection. Another start-up, Diaxxo, also set the pandemic virus in its sights with a reliable PCR test that delivers results in just 10 minutes. Meanwhile, ETH spin-off CustomSurg is working in an entirely different field of medicine, fabricating custom 3D-printed bone plates that make life easier for fracture patients and surgeons alike.

Other spin-offs are employing state-of-the-art methods to help tackle climate change. Start-up rreefs, for example, specialises in the construction of artificial coral reefs. The first of these 3D-printed

reefs was installed several months ago off the coast of a Caribbean island, where it is already attracting plenty of local marine life. Meanwhile, Restor Eco is harnessing the power of data to advance reforestation projects and link them in a global network. And the founders of SmartBreed have found a way to automate the breeding of insect species used as animal feed. This should help make livestock farming more economic and environmentally friendly.

### **QUARTER OF SPIN-OFFS FOUNDED BY WOMEN**

Six of last year's spin-offs were founded by women – a much higher proportion than in previous years. "We're heading in the right direction," says Vanessa Wood, Vice President for Knowledge Transfer and Corporate Relations. "I'm delighted to see more and more women taking the plunge into entrepreneurship – the benefits ripple through the whole Swiss economy." One of these start-ups, DigitSoil, was founded by two female ETH graduates. They



received targeted support in the form of an ETH Pioneer Fellowship, which helped them put their ideas into practice.

**ESTABLISHED SPIN-OFFS MAKE AN IMPACT** And it's not just new spin-offs that are creating a buzz. Some of their more established counterparts have also taken big strides over the past year. Two spin-offs in the field of climate technology achieved key milestones on their growth journey: Synhelion built a pilot plant for the industrial production of solar fuels in Germany, while Climeworks constructed the world's largest direct-air carbon capture facility in Iceland. Last year's most successful financing round was held by Bright Peak Therapeutics, which raised more than 96 million Swiss francs to continue development of its innovative immunotherapy. At the final tally, ETH spin-offs collectively raised more than 390 million Swiss francs in 2021. ○

## Joël Mesot reelected president of ETH Zurich

At the request of the ETH Board, the Federal Council also confirmed Joël Mesot in his position as President of ETH Zurich for a further four-year term, running from 1 January 2023. This reflects the Federal Council's appreciation of Professor Mesot's excellent achievements as President of ETH Zurich and the numerous important initiatives that he has launched. One of the most prominent examples of this is the new ETH Center for the Origin and Prevalence of Life, which will carry out multidisciplinary research in collaboration with the University of Cambridge under the supervision of Swiss Nobel laureate in physics, Didier Queloz. ○



Image: Future Learning

New technologies are transforming teaching.

## First joint doctoral programme

ETH Zurich and EPFL have launched a joint doctoral programme in the learning sciences. The course, which will be offered for the first time this spring, aims to equip graduates with the academic and technical skills required to advance research and teaching in this field.

How might research findings in human cognition and learning help us teach and learn more effectively? How can data science and artificial intelligence be used to support personalised learning? And how can we systematically evaluate the interaction between learners and physical spaces in different environments? These are just some of the questions participants will be tackling in the new four-year doctoral programme, which is supported by the Jacobs Foundation. ○

# A new framework for scientific integrity

Integrity is key to building trust in science. The ETH Executive Board recently issued new guidelines on the importance of integrity in scientific practice.

TEXT Florian Meyer

Scientific integrity and good scientific practice are essential in every aspect of scientific endeavour. Researchers, the business community and society as a whole need reassurance that scientific findings have been generated in an honest, transparent, understandable and reproducible way.

First published in 2008, ETH Zurich's guidelines on scientific integrity were completely overhauled last year. The new version was approved by the ETH Executive Board in early December and came into force on 1 January 2022. This update of the Integrity Guidelines draws heavily on the new Code of Conduct for Scientific Integrity, which was published by the Swiss Academies of Arts and Sciences in May 2021. This code stipulates reliability, honesty, respect and responsibility as the four fundamental principles of scientific integrity.

**CLEAR RECOMMENDATIONS** "With the Integrity Guidelines, we as the ETH scientific community have laid down the standards that should govern our teaching and research activities; by doing so, we aim to strengthen confidence in our scientific work and results," says Nicolas Gruber, Professor of Environmental Physics. Gruber is President of the ETH Zurich Commission for Good Scientific Practice (GSP Commission), which undertook the comprehensive revision of the Integrity Guidelines and the internal consultation process. The resulting guidelines focus on the basics and take an empowerment approach by describing desirable behaviours rather than listing those that should be avoided. "The Integrity Guidelines offer recommendations rather than regulations. They aim to prevent poor practice by offering practical guidance for everyday

The Integrity Guidelines apply to all ETH members engaged in scientific activities in the fields of research or teaching.

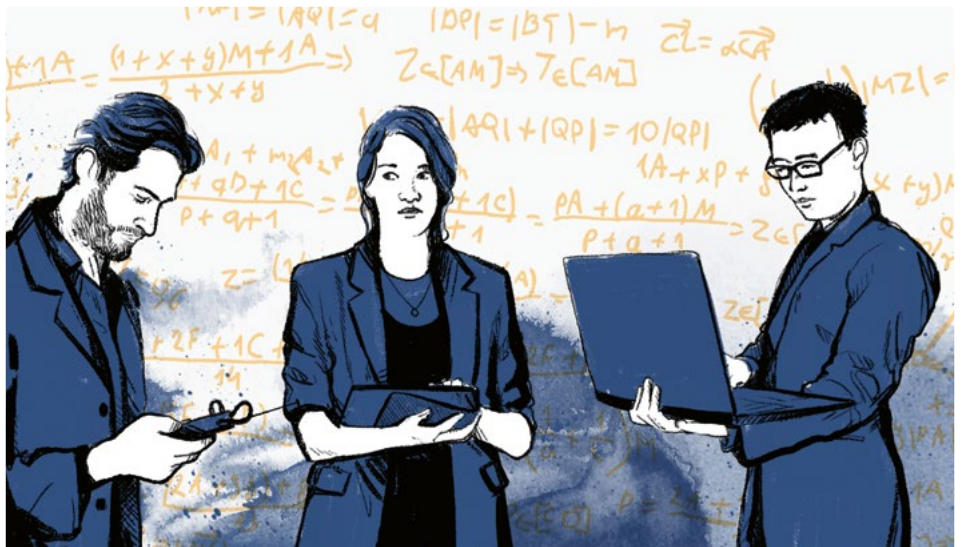


Illustration: Silvio Bohrer

situations,” Gruber explains. “Although they clearly define what constitutes scientific integrity, they refrain from stipulating exactly what people ought or ought not to do.”

**WEIGHING UP CONFLICTS OF INTEREST** The new guidelines provide more information than before on how to deal with potential conflicts of interest, not only in research projects and committee work but also within the general context of decision-making, assessments and evaluations. “The guidelines rely on the principle of transparency,” says Gruber. “It’s vital that researchers declare a potential conflict of interest – only then can a decision be made on how serious it is and whether the person concerned should withdraw from the committee or an evaluation.” Nevertheless, the guidelines steer clear of defining overly rigid, formal criteria, since experience has shown that such criteria are too unwieldy for internal ETH committees and can lead to individuals being excluded for no good reason. For example, major research projects in the field of nuclear physics may occasionally produce publications with as many as 200 authors; in such cases, it is highly debatable whether co-authorship really represents a conflict of interest.

**PUBLISHING PRINCIPLES** The new Integrity Guidelines also take a clearer stance on the authorship of scientific publications. The three criteria for determining authorship remain unchanged – namely that the person concerned has made a significant scientific contribution to a piece of research, was involved in the preparation of the manuscript, and has endorsed the final version of that manuscript. However, the updated guidelines now specify that everyone involved in the scientific side of a project should hold a constructive dialogue on potential authors as early in the process as possible. Also new is the requirement for a clear breakdown of the individual contributions made by each author.

**TRAINING AND AWARENESS-RAISING** To ensure the Integrity Guidelines are applied consistently in everyday practice, ETH is taking steps to raise people’s awareness and periodically remind them of the guidelines’ importance. Moreover, all students who enrol as doctoral candidates at ETH Zurich from 1 January 2022 will be required to earn at least one credit in ethics and good scientific practice during their doctoral studies. Starting this Spring Semester, a new course in Ethics and Scientific Integrity for Doctoral Students will be offered with support from the Innovedum Fund. ○

## PHILANTHROPY

BY  
Donald Tillman



### The gift of flexibility

The ETH Foundation got the chance to say “thank you” no fewer than 3,218 times in 2021. Generous donations came from many quarters, including support for the learning sciences from the Jacobs Foundation, funding for catalysis innovation from Clariant, and backing for Professor Tom Crowther’s ecosystem research from alumnus Eric Winkler. So why are such philanthropic gifts so important to ETH? After all, donations make up only 5 or 10 percent of the overall budget that ETH receives from the Swiss government. The difference, however, is that the lion’s share of this federal funding is earmarked for fixed costs such as infrastructure and personnel, so ETH has little flexibility in choosing how it is spent. The importance of philanthropic donations therefore lies in the margin of freedom they give to ETH. By providing an extra source of income on top of federal funding, donors boost the university’s efforts to nurture talent and to embark on research into topics that will affect our future. As a result, even the smallest contributions help make a big impact. We particularly appreciate the broad support we receive from former ETH staff members, especially professors, as well as from alumni and alumnae: togETHER, we are shaping the future!

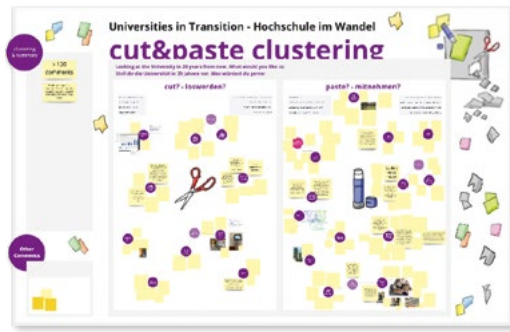
—> [ethz-foundation.ch/en](https://ethz-foundation.ch/en)

# Even more visions for the future

How do we envision creating a sustainable future for the university? Which new avenues should we explore? And what is best left behind? In the last issue of *Globe*, we invited readers to contribute their ideas to a Miro board. This prompted over 120 contributions, each of which has now been reviewed by the team at the ETH Zurich Strategic Foresight Hub and assigned to a thematic cluster. Now it's time for a second round of brainstorming – and this time the team is particularly interested in visions that take the form of photos and images. The Foresight team welcomes any contributions that fit one of the following four thematic clusters: study and working spaces, teaching and teaching methods, lunch and snacks, fun and encounters. So if you are part of the ETH community or a keen follower, please share your pictures, photos and comments on these topics by posting them to our Miro board. ○



The board will be open for new contributions until 15 May 2022.  
→ [bit.ly/3D2nFY5](https://bit.ly/3D2nFY5)



## How might this look?



The Miro board is back in business and ready for your ideas.

Image: Strategic Foresight Hub, ETH Zurich

## Suva to support Rehab Initiative

Swiss health insurer Suva is donating 1 million Swiss francs to the ETH Foundation to fund a series of research projects by the ETH Zurich Competence Centre for Rehabilitation Engineering and Science (RESC) over a five-year period. The projects will focus on the fields of accident and occupational health rehabilitation under the umbrella of the Rehab Initiative. Support from Suva will come in the form of funding as well as through collaboration with its Bellikon Rehabilitation Clinic. The Rehab Initiative, which ETH Zurich launched in 2019, encourages ETH researchers to partner with clinics, foundations, public authorities and other bodies to improve the quality of life and inclusion of people with physical disabilities. ○

## New: Quantum Engineering Alumni

The ETH Alumni Association has a new affiliate organisation for quantum engineering alumni. The president of the recently founded organisation is ETH alumna Anja Ulrich, who was among the first cohort to graduate from the ETH Master of Science in Quantum Engineering. As a top-tier university in the field of quantum technologies, ETH is a springboard for the quantum engineering leaders of the future.

Although current cohorts are small enough to form a manageable network, many of the students have an international background and are likely to follow diverging paths after graduation, both in terms of location and career choice. The Quantum Engineering Alumni organisation aims to keep students connected to each other and maintain their ties to ETH. ○

## Integrated sensor system for heart pumps

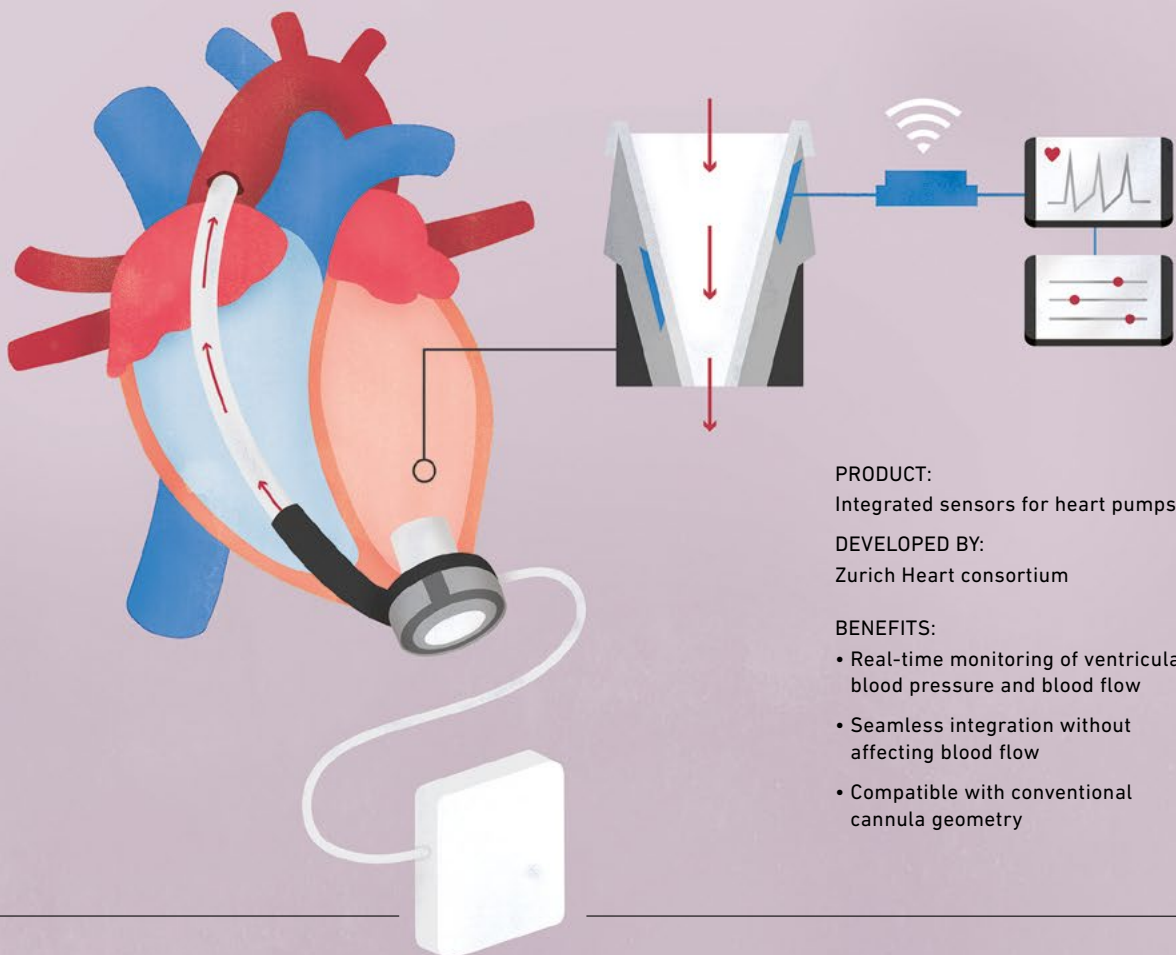
A ventricular assist device (VAD) is a surgically implanted pump used to support patients with advanced heart failure. It works by drawing oxygen-rich blood from the left ventricle and pumping it into the aorta.

VADs operate at a constant speed regardless of whether the patient is active or sleeping. This causes imbalances between blood supply and demand that lead to life-threatening complications

in the long term. To tackle this problem, the Zurich Heart consortium developed algorithms and an integrated sensor system that in combination adapt pump performance to the patient's needs.

The Zurich Heart team seamlessly incorporated two pressure sensors in small cavities in the wall of the inflow cannula, one of the tubes the pump uses to carry blood. The sensors are covered by a polymer coating on the inside of the cannula. This membrane serves as a sensing interface without interrupting the flow of blood through the cannula. The sensors are positioned in different sections of the tube, allowing them to measure pressure and calculate blood flow. ○

→ [hochschulmedizin.uzh.ch/en/projekte/zurichheart](https://hochschulmedizin.uzh.ch/en/projekte/zurichheart)



### PRODUCT:

Integrated sensors for heart pumps

### DEVELOPED BY:

Zurich Heart consortium

### BENEFITS:

- Real-time monitoring of ventricular blood pressure and blood flow
- Seamless integration without affecting blood flow
- Compatible with conventional cannula geometry

# Inspired by the best

Continuing education for specialists and managers with academic backgrounds

MAS, DAS, CAS and short courses  
on [www.sce.ethz.ch](http://www.sce.ethz.ch)



## Study leadership where inventions are born.

As a hotbed for technological innovation, ETH Zurich provides an ideal setting for a postgraduate management programme which integrates novel technologies at its core.

With the MAS MTEC degree you acquire the skills to leverage these technologies in a goal-driven and effective manner and confidently lead your team into the future.



[mas-mtec.ethz.ch](http://mas-mtec.ethz.ch)

**Apply now for the class starting in September 2022!**  
Last day of application: 30 April

## IN PERSON



**GÜNTHER DISSERTORI**  
bases his teaching  
on the three Es:  
enthusiasm, empathy  
and expectation  
management.

TEXT Karin Köchle

**GÜNTHER DISSERTORI** is a professor at the Institute for Particle Physics and Astrophysics. He was appointed Rector of ETH Zurich in February 2022.  
→ [ipa.phys.ethz.ch](http://ipa.phys.ethz.ch)

**You've done a hugely successful job as Professor of Particle Physics. Will you still have time for research now that you've been appointed Rector?**

My passion for research won't just evaporate from one day to the next! What matters most is ensuring that the amazing people in my research group continue to thrive and prosper. I want to continue investing time in them, but it will certainly be a challenge to combine that with my responsibilities as Rector.

**During your time at CERN, you were deputy spokesperson for a scientific collaboration involving 4,000 researchers and students from more than 40 countries. Do you think that experience will benefit you in your role as Rector?**

Absolutely. Organisations like ETH and CERN operate on the same principle – namely, that we can achieve shared goals by working with highly motivated, talented individuals. The only way to tackle most of the challenges we face today is through outstanding teamwork – just as the only way to develop the highly complex experiments at CERN is through broad-based international collaboration.

**If you had to name one key insight you've gained during your 20 years at ETH, what would it be?**

Learning to appreciate the incredible diversity and quality of ETH teaching and research and seeing such a wide variety of truly amazing people all working in one place – from students, researchers and lecturers right through to staff in the academic departments and central services. That's what makes it such a joy to go to work each morning!

**You've already received several awards for your teaching work at ETH. What advice would you give to someone looking to improve their teaching?**

I base my teaching on the three Es of enthusiasm, empathy and expectation management. That means teaching with enthusiasm and cultivating the kind of presence that captures and holds people's attention; putting yourself in the learners' shoes and constantly asking yourself whether you're explaining things clearly enough; and giving clear guidance and objectives that you can actually stick to.

**You were born and raised in South Tyrol. What do the mountains mean to you?**

I feel a close connection to them. I get an extraordinary feeling of inner peace when I'm in the mountains – and I think they can teach us respect and humility. ○

# A WOODEN DOME MADE SOLELY FROM WASTE

TEXT Rahel Künzler  
IMAGES Daniel Winkler





1  
The dome is made entirely from reused building materials.

2  
The team cuts the struts to size after removing any nails and other foreign objects from the wood.



## REPORT | Catherine De Wolf firmly believes that digitalisation can help shift the construction industry towards a more circular economy. The assistant professor and her research group recently completed a hands-on project to illustrate how this could work.

Strolling into the carpentry shop on the Höggerberg campus on this January morning, you could be forgiven for thinking you've stumbled into a beginners' woodworking course. Huddled around a bandsaw, six people are getting a quick tutorial on how to cut timber beams into rectangular struts. Once they've received their instructions, some get straight down to work, deftly guiding the timber past the saw blade. Others – clearly less confident – call on the instructor's help to make sure they're putting their hands in the right place.

Today's team of woodworkers are part of the research group led by Catherine De Wolf, assistant professor in the Department of Civil, Environmental and Geomatic Engineering at ETH Zurich. This is the first time some of them have tried their hand at carpentry, but this crash course is essentially just a means to an end. The Circular Engineering for Architecture (CEA) lab members' real goal over the next four weeks is to construct a building from nothing but demolition waste. The end result will be

a geodesic dome, and the first step is to cut the reused beams into the struts that will form the basic framework. "It's fun working on a project together!" says doctoral student Deepika Raghu, explaining that she never had the opportunity to construct a building on such a large scale during her architecture degree programme. The team began their work last October in an old car depot in Geneva that was scheduled for demolition. The ETH researchers had been given permission to salvage any materials they liked before the bulldozers moved in. Aided by deconstruction specialists, De Wolf and her three doctoral students dismantled an entire floor of the building. This yielded a rich haul of OSB panels, wooden beams, steel girders and some plastic piping, which they loaded into their minivan before heading back to Zurich.

**AIMING FOR SUSTAINABILITY** Assistant Professor De Wolf was part of that deconstruction crew, and she's also on hand today to help with the →

carpentry. Right now, she's moving a metal detector over a wooden beam to find any nails or other foreign objects that need to be removed before sawing. Material reuse and the principles of the circular economy lie at the heart of the 32-year-old Belgian's work at ETH. But her decision to get involved in sustainable construction goes all the way back to her degree programme in architecture and civil engineering.

In one of her first classes, says De Wolf, the lecturer revealed that the construction industry is the world's biggest emitter of greenhouse gases. As a nature-lover, she found this shocking: "But then I decided I could play a big part in helping to change that." Now, more than a decade later, De Wolf firmly believes that achieving greater sustainability in the construction industry depends on exploring digital tools and technologies. Showing how and where digitalisation can add value is therefore one of the key goals of the dome project.

De Wolf wants all the members of her group to go through the whole lifecycle of use and reuse – from the deconstruction of the old to the design and construction of the new. "By carrying out every step in the process ourselves, we can build a clearer picture of where the challenges lie and identify the best solutions," she says.

**MISSING BEAM** "Do we have enough beams?" At the back of the carpentry shop, De Wolf is studying the construction plans with doctoral student Matthew Gordon. Their decision to build a geodesic dome was a calculated one. With a basic structure composed of nothing but triangles, it's one of the most space- and energy-efficient constructions they could have chosen, and it's also extremely stable. But what's special about this particular dome is that it uses wooden struts of varying lengths to form the sides of the triangles, thereby making the most efficient use of the reused materials.

Gordon, who has a degree in digital fabrication, programmed an algorithm to calculate the optimum geometry and dimensions based on the available timber. "The aim was to create a programme that would avoid sawing the biggest beams into small pieces and that would use up as much of the wood as possible," he says. Right now, he's rechecking that the computer data on the wooden beams corresponds to the reality on the ground.

During their initial preparations, he noticed that some beams were missing. These had already been incorporated in the construction plans – so it was time for chief designer Gordon to put his computer programme's flexibility to the test. He redid the calculations earlier this morning, and while the rest of the group was busy sawing up the beams,





3  
Matthew Gordon and Catherine De Wolf check the digital construction plans and discuss computational design optimisation.

4  
The ring-shaped hubs for the wooden struts are also made from reused material; in this case, salvaged plastic water pipes.



he labelled the new parts with the corresponding numbers from the plans. So far things seem to be back on track – another hurdle overcome.

**PLATFORM FOR REUSED MATERIALS** “That whole episode was a good example of how challenging it can be to work with reused materials,” says De Wolf wryly. The only space left to store the wooden beams had been outside the workshop, so someone had probably disposed of them by mistake. Similar problems abound in the construction industry, she says. Although more and more companies are trading in second-hand materials, getting hold of these can be costly and time-consuming, and storage space is often limited. “The ideal thing would be to tell companies about demolition projects well in advance, because then they could start hunting for buyers for the materials right away,” says De Wolf. In reality, however, they often get this information at short notice.

But what if all the information on the materials in an existing building were available on a digital platform? That would mean architects could check the upcoming availability of materials from demolition projects and incorporate them in their plans for new buildings. “During the pandemic, numerous construction projects were delayed by disruptions to global supply chains. That’s made the case for the circular economy even stronger,” says doctoral student Brandon Byers, who has a degree in civil engineering.

His tasks in the dome project included the creation of an online platform for building materials. Using the example of the timber components, he gives us a quick demonstration of how information can be stored across multiple building cycles and updated as required. For this project, the doctoral student has created a table covering every stage of the timber’s life, including up-to-date information on its quality and dimensions, and the date and place each item was installed.

**QR CODE ON EVERY PIECE OF MATERIAL** But the advantages of a digital material passport encompass more than just the practical side of →

construction, says Byers: “By making the information on a building’s materials freely accessible, we actually help people learn more about that building’s history.” To complete the loop, the ETH doctoral student has marked each piece with a clearly visible QR code that links directly to the corresponding material passport on the internet.

Right now, Byers is using a laser cutter to engrave the last of the QR codes into the wood. Meanwhile, in the construction hall, the rest of the group is starting to build the dome. Working in pairs, the researchers screw the ends of the wooden struts onto the ring-shaped connections, which are made of sections from an old plastic water sewage pipe, also salvaged from the building in Geneva. Two hours later, the bottom layer of geodesic triangles is already finished. All in all, it takes them just three days to assemble the entire dome – but then they encounter another obstacle.

5

Every piece of material is provided with a QR code and logged in a database.



The wooden struts are putting so much strain on the plastic hubs that they have begun to warp – another illustration of how challenging it is to plan a building when you have almost no information about the reused materials you’re working with. But this is another hurdle that can be overcome thanks to digital fabrication. Using a computer-numerical-controlled (CNC) milling machine, the researchers cut the salvaged chipboard into discs that fit perfectly into the plastic rings. “As well as improving the dome’s stability, the pieces of chipboard actually make the construction more aesthetically pleasing,” says Raghu, who is leading this part of the project.

**SUMMER COURSE FOR STUDENTS** “I’m really proud that my research group managed to build something so beautiful in such a short space of time,” says De Wolf at an informal gathering to mark the building’s completion. In the private sector, very few buildings are currently built according to circular economy principles. “Projects like this one can only succeed if all the stakeholders are on the same page,” says De Wolf.

By bringing together architects, engineers and computer scientists, she hopes to create the right conditions to achieve this – at least within her own research group. Perhaps even more important, she says, is the ability to combine environmental sensitivity with an affinity for the digital world. But that can be a tough call. “On one side you have people who are fighting for the environment like Greta Thunberg, and on the other tech geeks like Elon Musk,” says De Wolf. What she’s looking for are digital natives who are willing to dedicate their skills to protecting the environment.

One of De Wolf’s primary goals is to raise awareness of her field of research. Her course at this year’s summer school will bring together students from different departments to build another dome from reused materials. This dome will remain on the Höggerberg campus over the summer to showcase her work. She is also planning an exhibition on the circular economy in construction as well as a number of smaller events. ○

Watch the video about this story:



→ [youtu.be/vpKAFfsNo7M](https://youtu.be/vpKAFfsNo7M)

# A SMART USE OF AI

TEXT Jeannine Hegelbach  
PHOTOGRAPHY Daniel Winkler



## PROFILE | ETH alumna Paulina Grnarova wants to use artificial intelligence to revolutionise the way the legal industry works. Her recent appearance on the Forbes 30 Under 30 list has catapulted her into the spotlight.

Paulina Grnarova strolls through the garishly bright rooms of the WOW Museum in Zurich, fascinated by the optical illusions around her. They remind the 30-year-old CEO of her childhood, when her fondness for geometrical complexity first developed. Her father, a computer science professor and entrepreneur, nurtured her interest in technology and mathematics from an early age and came up with fun ways to bring the material to life. “As a kid, I saw maths problems as puzzles to be solved. By the time I was seven, I was already entering maths competitions in North Macedonia, where I grew up,” says Grnarova. A place to study computer science at ETH followed in due course, and she eventually went on to found a software company based around artificial intelligence, or AI.

Grnarova loves the way the WOW Museum plunges visitors headlong into a world of mathematical and optical conundrums. She’s also a big fan of gamification in apps such as Duolingo, which she’s been using for years to improve her German.

“I’m a classic overachiever, not just at work but also in my personal life,” says Grnarova. She makes time for body combat, fitness training or dance lessons on an almost daily basis. But she admits it can be hard to switch off from work, and she often spends her free time reading books or listening to podcasts by other successful female

entrepreneurs. Grnarova has always been driven to succeed: having graduated at the top of her class from the University of Skopje, she received a prestigious prize from the president of what is now North Macedonia, which gave her the opportunity to study abroad. She initially attended EPFL in Lausanne, before moving to ETH Zurich for her doctoral studies.

**ARTIFICIAL INTELLIGENCE FOR LAWYERS** Just over a year ago, Grnarova founded the company DeepJudge together with three other doctoral students from the Data Analytics Lab, which is led by Professor Thomas Hofmann. “Our platform is designed to revolutionise the way lawyers and other legal professionals work,” she says. AI-powered software takes over manual and other time-consuming tasks by automatically searching through thousands of documents and compiling the relevant information. “That gives lawyers more time to concentrate on the strategic side of their work,” says Grnarova. Most of today’s legal software focuses on one specific job without exploiting the parallels and synergies that exist between different tasks. In contrast, DeepJudge operates as a kind of all-round virtual assistant that supports lawyers with a wide range of tasks.

And that’s not the only thing that puts DeepJudge in a class of its own. Trained using millions of publicly available legal documents, the DeepJudge AI understands the semantic content of source documents and processes this in a context-sensitive way. Among other things, this enables the software to compare different contracts and automatically produce a template for a new contract. The platform can also “smartify” existing legal documents automatically by augmenting them with paragraphs from relevant laws and court rulings and adding references to existing registries of commerce. And it allows users to redact sensitive information with just one click.

**UNDERSTANDING LANGUAGE AND CONTEXT** By drawing on a combination of deep learning and natural language processing, DeepJudge has made a quantum leap in semantic understanding and

**PAULINA GRNAROVA** The company founder and CEO studied computer science at EPFL and completed her doctorate in artificial intelligence at ETH Zurich. She lives and works in Zurich. Her pastimes include body combat, cardio workouts and dance lessons.

context awareness. “In 2017, I joined the Google Assistant research team at Google AI Language and stayed for two-and-a-half years. The experience I gained there has been invaluable,” says Grnarova. While working on the text-to-speech version of Google Assistant, she taught the artificial intelligence to condense a lengthy text and summarise the key points in just a few sentences. This required the AI to understand the content on the semantic level. Grnarova’s work on DeepJudge was also inspired by her internship in core machine learning at Google Brain, where she gained important insights into how models learn and what they look at to make decisions.

“I was incredibly fortunate to be working on my doctorate just as researchers were starting to develop deep learning and neural networks. The artificial intelligence revolution was in full swing and it was becoming clear that computers could perform certain tasks to a superhuman degree,” she says. DeepJudge is one of the first generation of ETH spin-offs to be supported by the AI Center.



Grnarova’s inspiration for bringing AI to the legal profession came from her former ETH professor Thomas Hofmann, who had previously launched a successful start-up in this field.

**NEW ROLE AS CEO** Prior to becoming CEO at DeepJudge, Grnarova had always helped write the code for every project and had primarily been in charge of the technical aspects. Now, however, she has an entirely new set of responsibilities, working at the interface between clients, investors and her employees. Her pitches and presentations no longer focus on technical issues; instead, they highlight the problems her software can solve and explain why customers should buy it. Grnarova has faced a steep learning curve as CEO – and her rapid success speaks volumes for her adaptability.

“I do miss programming sometimes, though the truth is that it gets a bit lonely writing your own code year after year, as I did for my doctoral thesis. That’s why it’s such a nice change to be working with a team as CEO,” she says. One year after founding DeepJudge, Grnarova already employs 14 people; during that time, she and her team have won awards and prizes worth over half a million Swiss francs. The philanthropic initiative Venture Kick has just injected another 150,000 Swiss francs into the company, and Grnarova recently gained a place on the prestigious Forbes 30 Under 30 list.

The Forbes accolade triggered a media storm that even reached her home country of North Macedonia, where her story was featured on national TV. Asked what she misses most about her country of birth, she can’t help smiling. “Family, friends and the social life that is such a big part of Macedonian culture – much more than it is here,” she says. She clearly believes in lifelong friendships built on solid foundations, and she thinks entrepreneurs need to be equally discerning in choosing the best people to collaborate with. “When you set up a company together, you inevitably have bad times as well as good, so it’s crucial to have a team of founders who support each other and have the same goals. That’s the secret to success; but, even more importantly, it’s what defines the kind of journey you share along the way,” she says before disappearing into the WOW Museum’s maze of mirrors. ○

Due to COVID-19, events may be cancelled or postponed at short notice. Please check the organiser's website.

## AGENDA

### DISCOVER



Image: Julia Ecker

○ 3 May 2022, 6.15 – 7.15 p.m.

#### A colourful history

It was a chance event and a fuchsia-red pigment that launched Switzerland's chemical and pharmaceutical industry on its path of success. The Chemical and Pharmacognostic Collection tells the colourful story of a fuchsia mystery – and a pair of Levi's jeans.

ETH Zurich, Hönggerberg campus

Sign up for this and other tours:

—> [tours.ethz.ch](https://tours.ethz.ch)

○ 17 June 2022

#### Night of Physics

At the Night of Physics, visitors can navigate the exciting world of physics – via quantum computers and materials science to astrophysics and particle physics – in hands-on experiments, lectures and laboratory visits.

ETH Zurich, Hönggerberg Campus

Find more information at:

—> [night-of-physics.ethz.ch](https://night-of-physics.ethz.ch)

○ 11 – 20 October 2022

## ETH Zurich alumni tour of the Basque Country

The latest alumni trip takes us to the north of Spain, which has overcome the decline of its steel industry to enter a new and vibrant era. The cities of Bilbao, San Sebastián and Pamplona testify to the indefatigable will of the Basque people to reshape their homeland as a melting pot of ideas with a rich mix of spectacular museums, cultural centres and contemporary art.

Thanks to our tour guide's local contacts, we will be able to access cultural spaces that are normally closed to the general public. We will also have the opportunity to sample some of the culinary delights of the Basque Country.

Find out more and book your place:

—> [alumni.ethz.ch/events](https://alumni.ethz.ch/events)



Image: rhz Reisehochschule

Marqués de Riscal is the oldest winery in the Basque province of Alava.



○ Until 26 June 2022

## Blue Links. Cyanotypes.



Image: Grafische Sammlung ETH Zurich

Blue is a pigment that is extremely difficult to produce synthetically. It is also the colour of cyanotypes – blue-tinted photographic images, created here by the renowned Swiss artist Daniela Keiser. This exhibition features works on subjects such as landscape formations, settlement structures, globalisation and agriculture.

ETH Zurich, Zentrum campus, Grafische Sammlung

→ [gs.ethz.ch/en](https://gs.ethz.ch/en)

## AUDIO

○ ETH Alumni Podcast

### We Are ETH

This new podcast focuses on the alumni of ETH Zurich. The initial episodes will feature members of the ETH Circle – a community of ambassadors working together to raise ETH's international profile.

Available on all major platforms. It can also be found, along with other podcasts, at:

→ [ethz.ch/podcast](https://ethz.ch/podcast) (in English)



## BOOKS

### Integrate

Architecture Under the Influence of Climate Change

This work features selected projects by students from the Department of Architecture at ETH Zurich. Together, they demonstrate various ways of incorporating energy considerations, carbon emissions and related principles within the design process. In recent decades, the discussion of environmental sustainability in construction has been polarised into low-tech and high-tech approaches. Sometimes touted as little more than a buzzword, it is often perceived as a hindrance to development.



Image: vdf Hochschulverlag

The projects presented in this book show that we must abandon overly simplistic approaches in favour of systemic ways of thinking that address the entire building life cycle. The mix of projects demonstrates that sustainable buildings can be designed on the basis of many different approaches, ranging from a focus on more efficient technology to a reassessment of construction materials and geometries.

vdf Hochschulverlag AG  
ISBN: 978-3-7281-4099-9

# OUT OF FOCUS

Illustration: Michael Meister



Safety and risk, as seen through the eyes of Michael Meister

**IMPRINT Publisher:** ETH Alumni / ETH Zurich, ISSN 2235-7289 **Editorial team:** Martina Märki (head), Christoph Elhardt, Corinne Johannssen, Nicol Klenk, Karin Köchle, Rahel Künzler, Florian Meyer, Anna Samoylenko, Felix Würsten  
**Contributors:** Jeannine Hegelbach, Samuel Schläefli

**Advertising administration:** ETH Alumni, [globe@alumni.ethz.ch](mailto:globe@alumni.ethz.ch), +41 44 632 51 24 **Advertising management:** Fachmedien, Zürichsee Werbe AG, Stäfa, [info@fachmedien.ch](mailto:info@fachmedien.ch), +41 44 928 56 53 **Design:** Crafft AG, Zurich **Printing and proofreading:** Neidhart + Schön AG, Zurich **Translation:** trawo-Übersetzungen; Stefan Pooth; Klein Wolf Peters GmbH; Clare Bourne, Gena Olson **Circulation:** 37,000 (German), 11,000 (English), published quarterly **Subscriptions:** CHF 20.- annually (four issues); included in full membership of the ETH Alumni association **Newsletter:** [ethz.ch/news-signup](http://ethz.ch/news-signup) **Orders and change of address:** [globe@hk.ethz.ch](mailto:globe@hk.ethz.ch) and for ETH Alumni [alumni.ethz.ch/myalumni](mailto:alumni.ethz.ch/myalumni) **Contact info:** [ethz.ch/globe](mailto:ethz.ch/globe), [globe@hk.ethz.ch](mailto:globe@hk.ethz.ch), +41 44 632 42 52



ClimatePartner®  
climate neutral

Print | ID: 53232-1502-1013

Your motivation is what

*drives*

our CPU.

Adrian Bucher,  
Electrical Engineer



#FeelFreeToSpeedUp

Are you passionate about tearing down barriers and breaking new ground? What about transforming intelligent ideas into valuable solutions through creativity and skill? Then you're in the right place. As an international service provider specialising in technology-driven innovation, we'll offer you the right challenges – and plenty of professional freedom to face them.

Feel free to Innovate. [zuehlke.com/careers](https://zuehlke.com/careers)



# Discover our Young Engineers Program

maxon's Young Engineers Program (YEP) supports innovative projects with discounted drive systems and technical advice. Find out more: [www.drive.tech](http://www.drive.tech)