

# HUMBOLDT KOSMOS

Research – Diplomacy – Internationality

DEUTSCHE  
VERSION:  
BITTE  
WENDEN

## GERMAN CYBER VALLEYS

Where the AI hotspots  
are emerging

## THE DESERT IS ALIVE

How arid regions  
help to mitigate  
climate change



## Better connected!

How cooperation  
benefits research



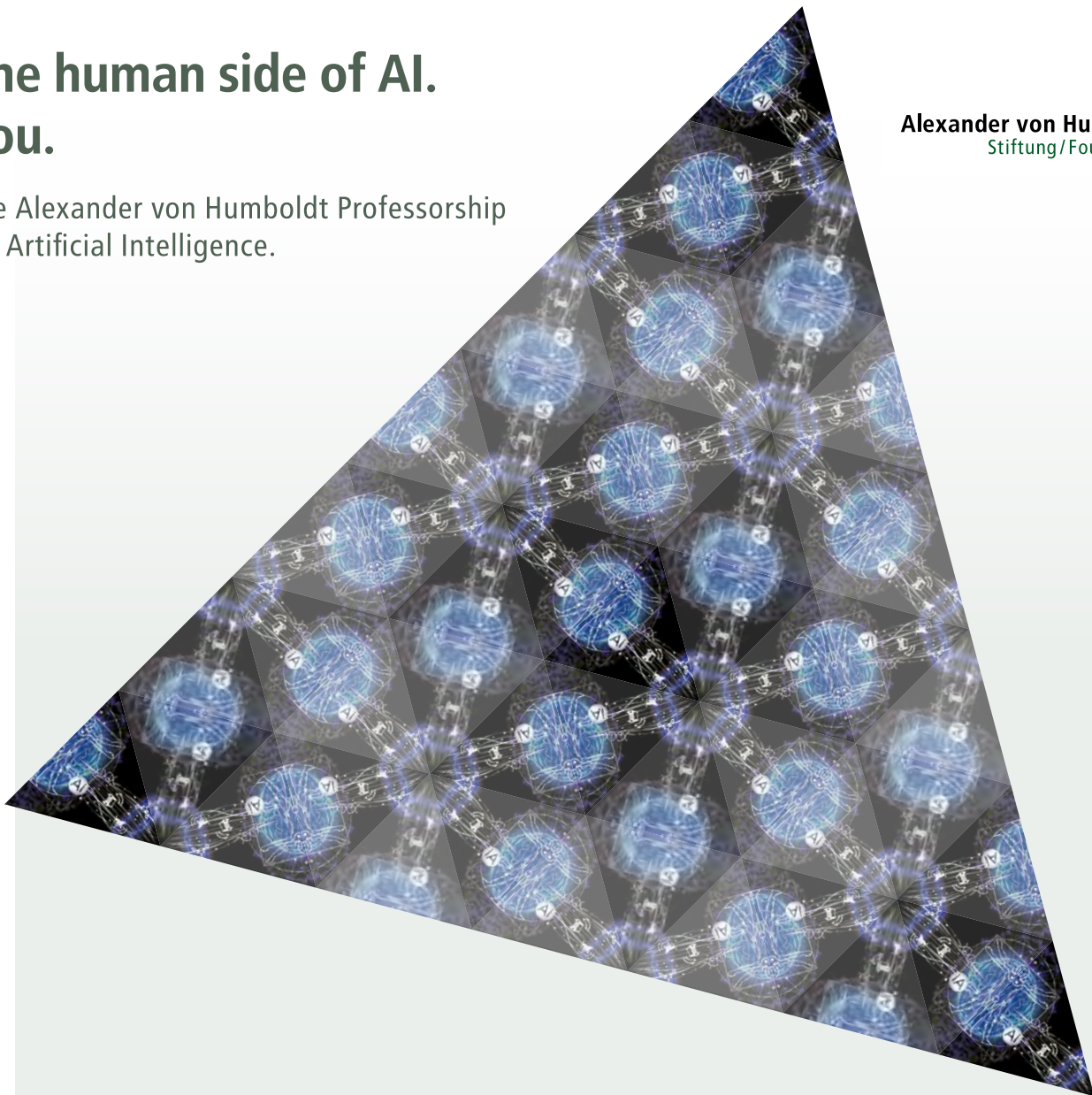
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Freedom for creative ideas and ideal conditions for independent research – these are the opportunities that an Alexander von Humboldt Professorship offers to leading researchers who come to Germany from abroad to pursue research on Artificial Intelligence or its broader implications.

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*We welcome the synergies between Alexander von Humboldt Professorships for Artificial Intelligence and research projects being funded through the German Research Foundation's strategic funding initiative in the field of Artificial Intelligence.*

Think **Humboldt.**

# KWEEN KONG: COMEDY AGAINST RACISM



The photo shows Lynette Mayowa Osinubi in a discussion following a showing of her film, *Acting White*, in Berlin. In the United States, “acting white” is a derogatory term used to refer to people of colour who supposedly betray their own culture by fulfilling the behavioural norms and expectations of white society. In the documentary, Mayowa, as she is known artistically, explores how this negative judgement affects one’s own identity and what consequences it has for the psyche.

Mayowa comes from Atlanta, Georgia. In 2018, she moved to Berlin as a German Chancellor Fellow to make a documentary about the experiences of people of colour in Germany. Mayowa is a film maker, YouTuber, model and event host. In Berlin she discovered stand-up comedy as a form of expression. In general, she is sad to say, the comedy scene is dominated by sexist and racist humour. So, two years ago, she launched ISSA Comedy Show. ISSA is now not only the first, but also the largest event that provides black artists and comedians from the LGBT community with a stage where they do not have to fear encountering hostility or discrimination.

An event like this takes courage. For Mayowa, it is important that her events are held in a safe space. Her first full evening’s programme, *Kween Kong*, attracted some 400 enthusiastic fans. As the host, Mayowa ensured there

was barrier-free access for people in wheelchairs and translators for those who did not speak English. On stage, Mayowa uses stand-up to expose the absurdities of a sexist and racist society and to discover the healing power of laughter together with her audience.

As a black woman living in Berlin, you are sometimes alienated from yourself, she feels, because you represent the “other” in contrast to the majority white population. During the fellowship, Mayowa came to the conclusion that Berlin society is not as tolerant as many believe. She intends to continue speaking out and encouraging people to find a voice for their very own stories – whether as a film maker or a comedy show host. ●

*Recorded by* **MAREIKE ILSEMANN**

**LYNETTE MAYOWA OSINUBI** comes from Atlanta, United States, where she has her own film production company. Her documentary *Acting White* was selected for the 2020 Berlin Feminist Film Week. In 2018, she moved to Berlin as a German Chancellor Fellow and founded the ISSA Comedy Show.

Photo: Humboldt Foundation / David Ausserhofer



Dear readers,

By the time you receive this, the Corona crisis will probably still be dominating the headlines. Due to our editorial deadline, however, you will not read anything about the global pandemic anywhere else in this edition of Kosmos – at least not specifically.

Nevertheless, our cover story addresses the topics of the moment: global challenges like Corona and climate change can only be solved by joint efforts worldwide and by international collaboration – in research as well as in politics.

In our Focus you can read how international research networks function and how they mutate under the impact of new challenges. How can digital tools help? How is researcher mobility changing in the face of flight shame? How, for example, does practical cooperation work within an international network that collects and analyses soil samples in arid regions around the world in order to develop measures to combat climate change?

Particularly in times of crisis like the present, collaboration, trust and solidarity are the qualities that sustain international research networks and send a signal against isolationism and national self-interest. Given the backdrop of the current Corona crisis, that, too, is one of the messages of this magazine.

Happy reading!

**GEORG SCHOLL**  
*Editor in Chief*



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Photos: Humboldt Foundation/Nikolaus Brade, Silvia Steinbach, Illustration: Martin Rümmele/Raufeld Medien

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Photo: Humboldt Foundation / Nick Helderman



## WHAT DOES MARS TEACH US ABOUT EARTH, MR RUESCH?

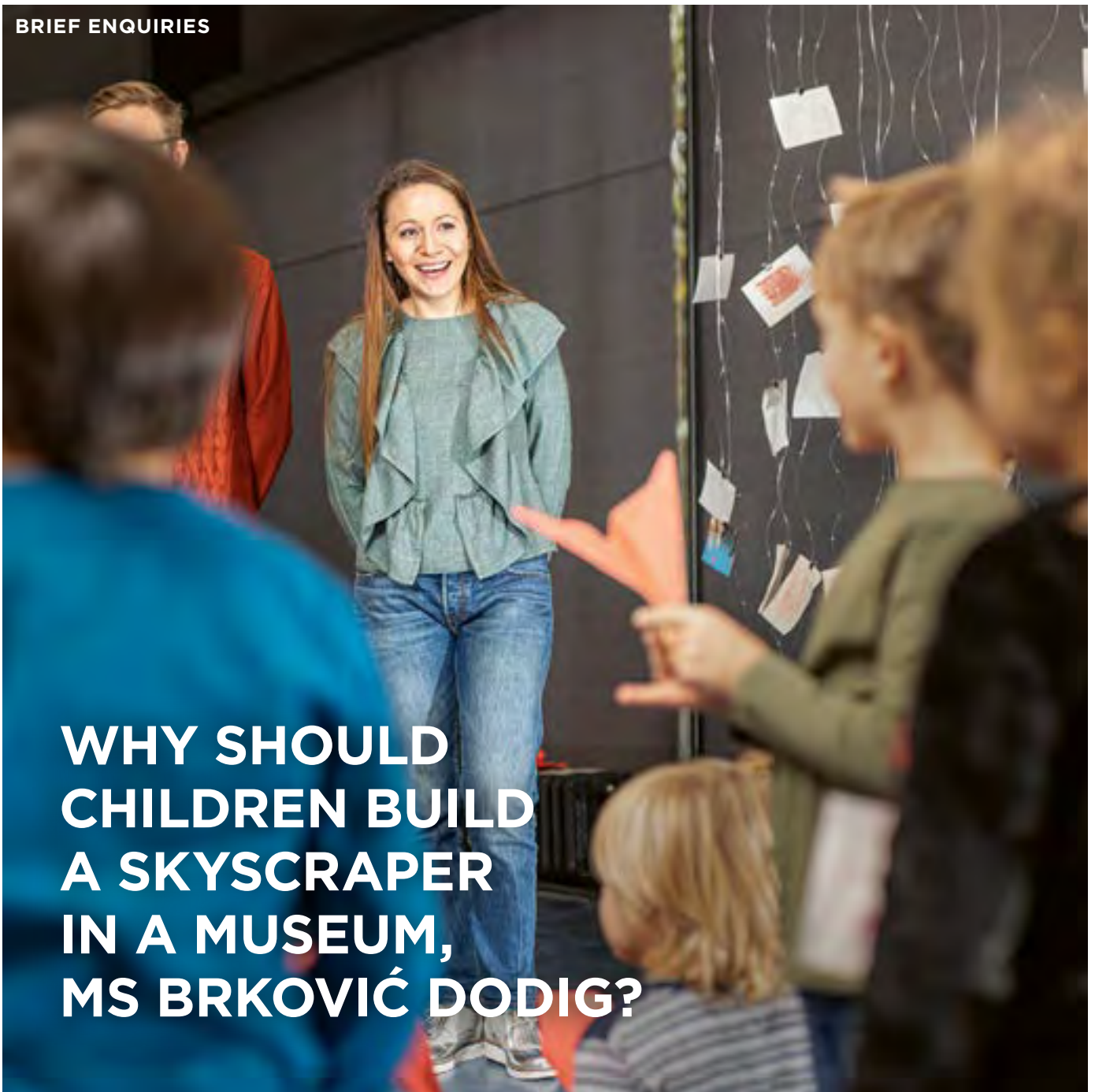
**In the coming years, a European ExoMars Mission's rover is scheduled to collect the first rock samples that will be sent from Mars to Earth. The geologist, Ottaviano Ruesch, will analyse the collected data.**

For decades, scientists have been studying Mars. "The main question is, of course, whether there is life there," says Ruesch, "or, at least, an indication that there was at some time." So far, no clear evidence has been discovered. But even if there never is any, the Red Planet still allows us some insights into the Earth's past, because we don't know exactly how life came about on our planet. Nearly all the evidence from that time has been wiped out. "Mars is effectively the Earth's little brother. But one who hasn't developed since childhood," explains Ruesch. Whilst the Earth developed its own dynamics three and a half to four billion years ago, and its surface in the dense atmosphere was constantly altered by plate tectonics, volcanic activity and the weather kitchen, at some stage, Mars froze over time and the surface rock, in particular, barely changed at all. "For geologists, rocks are like books from the past," says Ruesch. "In the Mars books we may be able to read about the conditions that prevailed when the first protozoa formed on Earth. We want to understand the context in which life evolves from organic material."

The ESA rover will explore the Oxia Planum plain. From its clay, researchers know that it is approximately 3.9 billion years old. "We will analyse everything in the finest detail, from the topography of the surface to the mineralogy and chemistry of the rock," says Ruesch. ●

*Text* **JAN BERNDORFF**

The Swiss geologist, **DR OTTAVIANO RUESCH**, has conducted research for the European Space Agency, ESA, at Noordwijk in the Netherlands and for the American Space Agency, NASA, in Greenbelt. He is now a Sofja Kovalevskaja Award Winner, heading his own research project in the Institute for Planetology at the University of Münster.



## WHY SHOULD CHILDREN BUILD A SKYSCRAPER IN A MUSEUM, MS BRKOVIĆ DODIG?

Photo: Humboldt Foundation/Nikolaus Brade

**When museums present architecture, visitors are often drawn into participatory activities. Marta Brković Dodig has run many such hands-on activities for children and young people. She is employing scientific methods to examine the young research field of Built Environment Education.**

“Blockholm” is a classic example of BEE, Built Environment Education. In the exhibition at the National Centre for Architecture and Design in Sweden, children, young people and adults have recreated the city of Stockholm using the computer game Minecraft. More than 100,000 designs have been produced. A jury selected ten models which were then presented on a scale of 1:5 in a follow-up exhibition. There are, or have been, similar events at museums in Chicago, Munich and Budapest.

Together with her team, Marta Brković Dodig is collecting information on BEE programmes around the world, how they differ, and

how their success can be evaluated. But why should children acquire experience of town planning outside of school? “When it comes to urban planning and urban history, we want children to become informed citizens,” says Brković Dodig. Ultimately, it is all about democracy. “The city is the place where we live together. That’s why it’s important to be connected with it – with buildings and squares, with monuments, but also simply with places that are personally important to people.” ●

*Text* RALF GRÖTKER

**DR MARTA BRKOVIĆ DODIG** is an assistant professor of architecture at Union – Nikola Tesla University in Belgrade, Serbia. She is currently a Humboldt Research Fellow at the Institute of Urban and Regional Planning at TU Berlin.





# WHAT DOES ANTARCTIC ICE TELL US ABOUT CLIMATE CHANGE, MR CASADO?

Photo: Humboldt Foundation/private

**In autumn 2019, he spent two months in the middle of nowhere: Mathieu Casado studies Antarctic ice in order to reconstruct climate change over Earth's history. To this end, researchers use a drill to take samples from the permanent ice – the deeper they penetrate, the older the ice layer.**

Formed over hundreds of thousands of years, the ice stores information from those past ages. Pollen, salts, cosmic dust and trapped air bubbles reveal, for example, which gases were contained in the atmosphere at a given time, what vegetation there was and when massive volcanic eruptions occurred.

Mathieu Casado analyses the composition of the oxygen and hydrogen isotopes in the ice. "The proportion of these in a layer reveals what the air temperature was at the time," says Casado. The ice thus delivers pre-historic temperature recordings. And that's

not all: "I have discovered that the isotopes also tell us something about the structure of the snow back then and its albedo, or potential to reflect solar radiation." The Earth's albedo also plays an important role in climate change today. Casado's research seeks to examine climate history to derive knowledge about changes happening now.

So far, the oldest samples go back some 800,000 years. The newest sample could reveal secrets going back more than 1.5 million years. The Antarctic climate archive is constantly expanding. ●

*Text* **JAN BERNDORFF**

The French Humboldt Research Fellow, **DR MATHIEU CASADO**, is currently working at the Alfred Wegener Institute's research centre in Potsdam.

# HOW DO NEPTUNE, HERCULES AND CO. STILL INFLUENCE CHILDREN AROUND THE WORLD TODAY, MS MARCINIAK?



Photo: Humboldt Foundation/Nikolaus Brade

**From Zeus to the Argonauts: In times past, children and young people learned about ancient gods and heroes from books; today, they watch the battle of Troy on screen. Together with an international research team, the Polish classical scholar, Katarzyna Marciniak, studies how antique stories are adapted and received today.**

The epics of ancient Greece and Rome have long since ceased to be an exclusively European cultural heritage. Take the New Zealand artist, Marian Maguire, who associates the figure of Hercules with Maori traditions in her work. And global popular culture is also steeped in antique myths. In “Beauty and the Beast”, for example, we encounter the story of Eros and Psyche.

It emerges that the narrative patterns of the myth contain universal themes, such as the search for love and inner values in “Beauty and the Beast”. The sagas of gods and heroes capture archetypes of human

feeling and action and thus furnish adolescents, in particular, with identity, meaning and orientation.

“Every new adaptation rekindles the ancient world in our cultural memory; it is universal and embeds us in a local context. The figures and narratives form a communicative code which crosses national and generational borders. Anyone who has learnt to read it has access to the mythical community that is built on the values of humanism,” says Katarzyna Marciniak. ●

*Text* MAREIKE ILSEMANN

The former Humboldt Research Fellow and Humboldt Alumni Award Winner, **PROFESSOR DR KATARZYNA MARCINIAK**, heads the international research project “Our Mythical Childhood” at the University of Warsaw, Poland. She is the Humboldt Foundation’s Ambassador Scientist in Poland.



Photo: Humboldt Foundation / Axel Martens

## HOW DOES A LANGUAGE APP HELP IN COURT, MR ABATE AND MS TACHBELIE?

**More than 80 languages are spoken in Ethiopia. That makes it very difficult and expensive for courts to find experts to transcribe oral witness statements in the various languages. Self-learning computer systems could offer a remedy.**

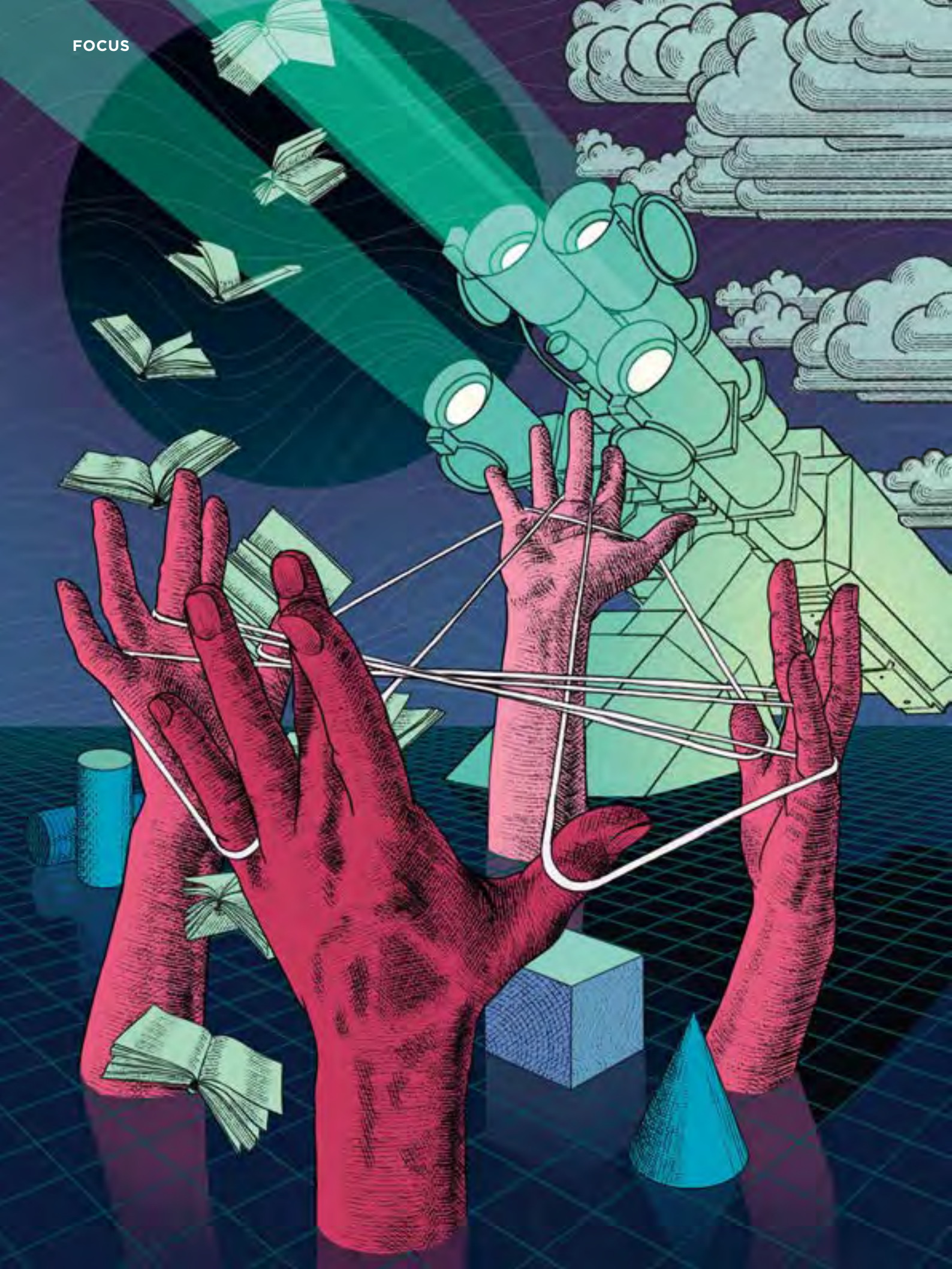
Solomon Teferra Abate and his wife, Martha Yifiru Tachbelie, are developing processes for automatically converting spoken language into written text. “Many people in Ethiopia can’t read or write; not least because written Ethiopian is far more difficult than English, for example,” Solomon Abate explains. An app on your smartphone that translates the spoken word into text could be a big help in many respects.

The structure of the languages poses a challenge. It is extremely difficult for the computer to recognise the various manifestations of a word because grammatical distinctions are essentially achieved by

additions to individual words. Moreover, there are no comprehensive linguistic dictionaries for the Ethiopian languages that could be used as a data base. So, the couple employs a trick: Even though Ethiopian languages use a system of symbols that is fundamentally different from our alphabet, a considerable proportion of the basic sounds are identical to those in German or English. “That’s why we train the model with acoustic data that is available for other languages – including German.” ●

*Text* RALF GRÖTKER

**DR SOLOMON TEFERRA ABATE** and his wife, **DR MARTHA YIFIRU TACHBELIE**, from Addis Ababa University in Ethiopia are Georg Forster Research Fellows at the University of Bremen.





# TOMORROW'S NETWORK

**W**hen Alexander von Humboldt contemplated the view of the Andes from Chimborazo in June 1802, he started to see the world through different eyes. “The Earth seemed to him like a huge organism in which everything was linked with everything else,” is the way in which the Humboldt biographer, Andrea Wulf, describes it. Humboldt’s holistic view of nature revolutionised science; today, we know indisputably that individual cells are connected – they interchange and communicate with one another via subterranean mycelia, creating networks of entire ecosystems.

Since then, the notion of the network has established a unique place for itself. Whether we think of neural networks, the internet or social networks, in the second half of the 20th century, the network became a universal metaphor. According to the cultural scholar, Hartmut Böhme, from Humboldt-Universität of Berlin, this was a result of “the paradigm shift from physics to biology and from sociology to computer science that caused not just living biological systems but, above all, information-based control and communication networks to become the focus of scientific attention.”

Networks can cross borders and break open supposedly hermetically sealed entities. As the Humboldt Foundation’s global academic network shows, they forge connections across disciplines, institutions and nations.

On this point, encounters with people from cultures other than our own are particularly fruitful. At the latest since the publication of the influential essay, “The Strength of Weak Ties”, by the American sociologist and network

The benefits of academic networks and how they need to keep developing

*Text* ANJA REITER and MAREIKE ILSEMANN

*Illustrations* MARTIN RÜMELE

theoretician, Mark Granovetter, in the 1970s, we know that in networks, the especially productive contacts are those that come about between people who previously had little or nothing to do with each other. Whilst proximity means that we tend to share the same information within our inner circle, which leads to uniform ways of thinking, outside influences generate new ideas.

## **WEAK TIES, STRONG IDEAS**

There are plenty of examples of the strength of these “weak ties” in the Humboldt Network, too. Holger Schönherr, for example, professor of physical chemistry at the University of Siegen, got talking to the junior researcher, Nowsheen Goonoo, from Mauritius at a conference in South Korea in 2013. Both researchers discovered that they were using similar classes of materials and methods. “We were both immediately struck by the very promising synergic effects of combining polyesters with polymers on the basis of indigenous renewable raw materials for biomedical applications,” says Professor Schönherr. This personal encounter engendered several research collaborations during >



## ARE NEW TECHNOLOGIES OBVIATING THE NEED FOR CLIMATE-DAMAGING AIR TRAVEL TO CONFERENCES AND RESEARCH VISITS?”

which Nowsheen Goonoo came to Siegen. Whilst the Siegen scientists’ research on biodegradable nanomaterials benefitted from Goonoo’s material expertise on the indigenous Mauritian plants, aloe vera and brown seaweed, the visiting researcher from the small island state in the Indian Ocean was able to acquire experience working with an atomic force microscope.

Another win-win situation is the cooperation between Nicole Wrage-Mönnig from the University of Rostock and the Georg Forster fellow, Chabi Djagoun, from Benin. This contact also came about through the Humboldt Network. Whilst the ecologist from Africa made the Rostock research group rethink what were seemingly self-evident assumptions about photosynthesis, for instance, he himself was able to use the isotope ratio mass spectrometry facilities in the Department of Grassland and Fodder Sciences to investigate which plants feed the common tsessebe, a species threatened with extinction in his own country.

What many members of the Humboldt Family experience for themselves is not only confirmed by the Foundation’s evaluations, but also by work like that of Caroline S. Wagner, professor of international relations at Ohio State University, United States. She explores the relationship between a country’s science system and its politics and society. Together with Koen Jonkers from the University of Cambridge, United Kingdom, she studied 36 countries’ publication and citation data. The outcome was that the strength of a country’s science, calculated according to publication numbers, citation frequency and co-authorship, correlates with its willingness to host international researchers. “The more people travel and exchange ideas, the more a country benefits. The more open a country is through exchange, the more scientifically important and influential it becomes,” Caroline S. Wagner summarises. So, researcher mobility helps networks and countries to meet the challenges posed by the future. But to what extent do researchers in a digitised world really need to be in the same place at the same time in order to work together and benefit from one another? Are new technologies obviating the need for climate-damaging air travel to conferences and research visits?

### DIGITAL NETWORKS ARE MORE OPEN

“Physical and virtual mobility should not stand in binary opposition to one another. The challenge is to discover how both can be practised best in the highly flexible, dynamic meshwork of interlocking networks so that the knowledge we need for the future can be produced. In new, multi-dimensional networks, this knowledge should be understood as a structure, not a personal good. It is up to all of us to create the ‘Humboldt Network 4.0,’” is the appeal voiced by Hans-Christian Pape, President of the Humboldt Foundation.

The American microbiologist, Beronda Montgomery, has addressed the question of how social media and digital platforms can be used to create sustainable, functioning networks. She herself is also active in digital networks:

“Over the past three to four years, I have been actively engaged in a number of groups on Twitter, networks of support, networks of mentoring. Some of those are disciplinary, others are things like #BLACKandSTEM which is a community to support African Americans in the sciences,” Montgomery reports. She thinks the major advantage of digital networks is quite simply how open they are. “So, I

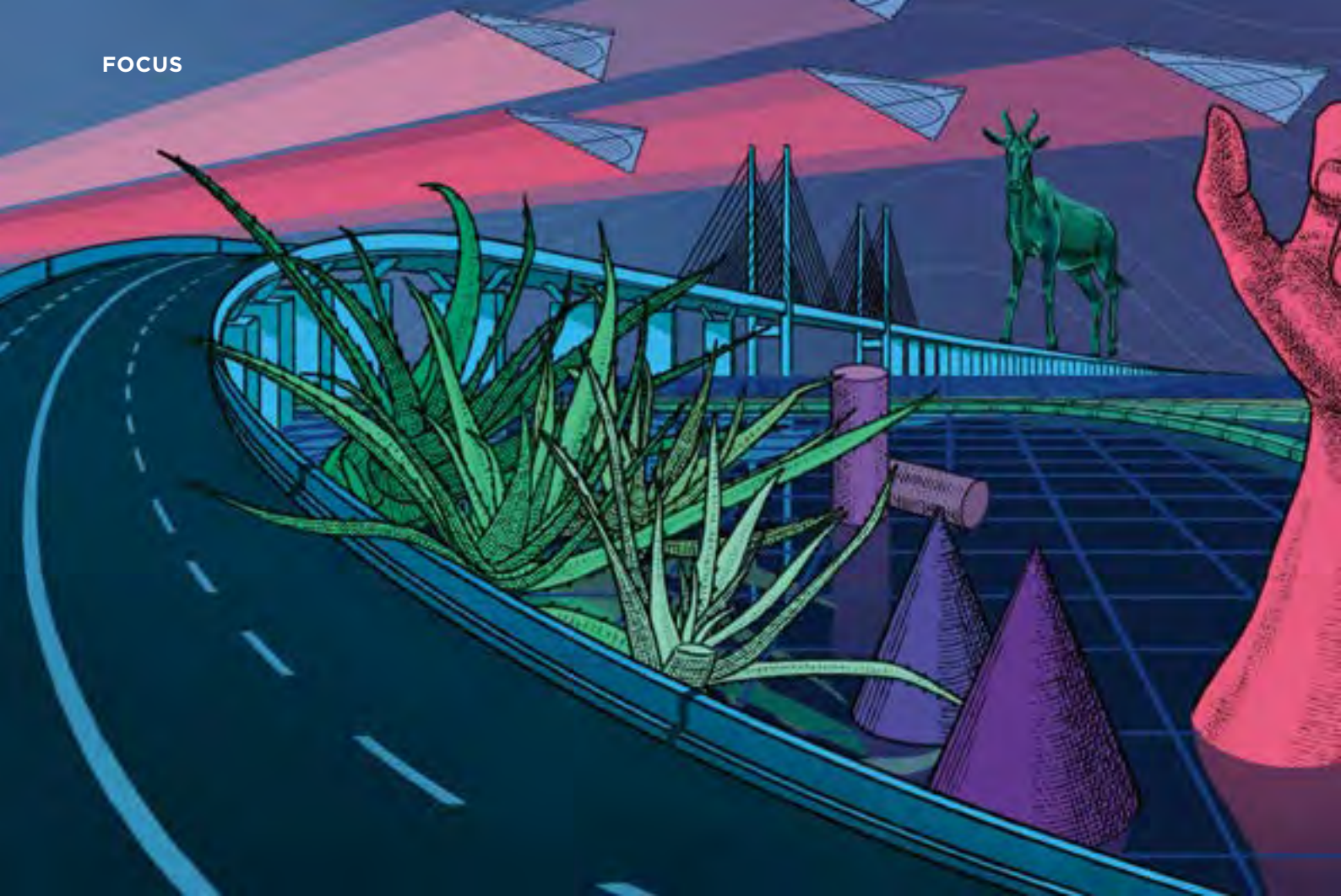


think the public nature of networks is integral to their inclusivity because they allow individuals who are simply scanning for resources to connect with a community that they may not have otherwise found and had access to. But I think as well, it allows people who may not be members of a certain identity group to listen in to topics of interest or perhaps be an advocate for these groups,” says Montgomery.

Looked at historically, novel networks are usually linked to technological developments. This also holds true for the world of science and especially its digital networks. The digital science platforms ResearchGate and Academia.edu, for example, have more than 15 and 108 million registered users respectively. According to ResearchGate, some 10,000 researchers, who are merely required to state to which institution they are affiliated when they register, log on every day. They want to contact each other and gain access to the papers that are available so quickly there because they do not have to go through the protracted editing and redacting processes at a publisher’s. A broad mass of users has >

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easy access to specialist knowledge that it can continue processing. A new framework thus emerges in which knowledge is exchanged and generated. This virtual mobility of knowledge changes the form of the knowledge itself.

Other methods, such as crowdreviewing, which the Humboldt Foundation also embraces, utilise the opportunities offered by digitisation – in this case to unburden the review process and make it more flexible.

#### **FAST KNOWLEDGE TRANSFER**

It would also be good for the climate if not only knowledge, but also researchers were more frequently connected with one another virtually. “I attended a couple of conferences over Twitter this past year to reduce my carbon footprint. Still being able to participate in these spaces is one positive outcome of digital platforms like these, but they are also reaching a wider audience by lowering some of the economic and ecological barriers to engaging in knowledge exchange,” Beronda Montgomery believes. She now feels quite happy about holding seminars online. What gets lost, however, are the informal conversations over cof-





“

Physical and virtual mobility should not stand in binary opposition to one another. The challenge is to discover how both can be practised best in the highly flexible, dynamic mesh-work of interlocking networks so that the knowledge we need for the future can be produced. In new, multidimensional networks, this knowledge should be understood as a structure, not a personal good. It is up to all of us to create the ‘Humboldt Network 4.0’.”



**HANS-CHRISTIAN PAPE,**  
President of the Humboldt Foundation

fee or dinner, the American emphasises. And these are so very productive, Caroline S. Wagner confirms and adds that, in her own research, she found that close to 90 percent of the collaborations began face-to-face in some way.

Last year, more than 1,700 researchers in Germany signed a petition committing to abstaining from air travel on business trips of less than 1,000 kilometres. Whilst organisations can consider sending only some representatives to conferences by air, who can represent their organisations and later act as multipliers, even the experts do not doubt the sense and purpose of research visits – despite climate change. One reason for this is that these offer different ways of accessing explicit and tacit knowledge, a concept attributed to the philosopher, Michael Polanyi.

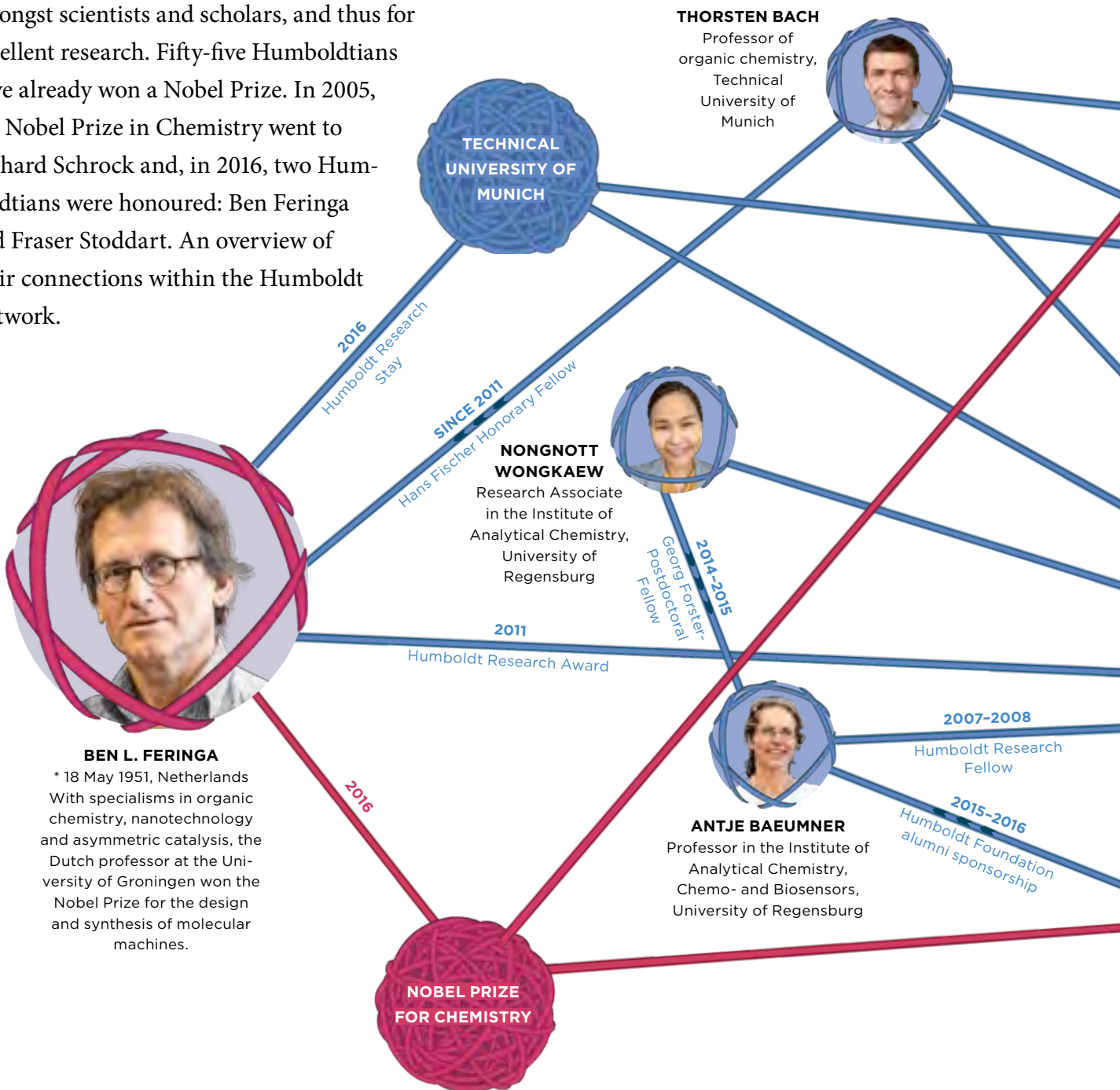
Explicit knowledge denotes knowledge that can be clearly formulated and reproduced; tacit knowledge, on the other hand, always has a personal quality. Explicit knowledge, such as an online presentation at a conference or a webinar at university, can easily be communicated using digital means or, in some cases, via digital platforms. In order to learn and apply tacit knowledge like tried and tested

research practices, it is necessary for individuals to be physically present in a different research environment. Only by experiencing a trusting relationship with senior researchers can young scientists and scholars learn from their way of working, methods and informal practices and thus also form unexpected linkages.

“Networks only ever exist as networks within networks,” Hartmut Böhme has observed. So, today’s researchers have long been involved in many networks at the same time, both analogue and digital. They and their knowledge must be able to circulate, digitally and analogously. Travel, especially by air, will become less frequent, let us venture to predict. But it will not often be possible to find a substitute for personal encounters. ●

# ACHIEVING MORE TOGETHER

The world-spanning Humboldt Network is an important foundation stone for collaboration amongst scientists and scholars, and thus for excellent research. Fifty-five Humboldtians have already won a Nobel Prize. In 2005, the Nobel Prize in Chemistry went to Richard Schrock and, in 2016, two Humboldtians were honoured: Ben Feringa and Fraser Stoddart. An overview of their connections within the Humboldt Network.

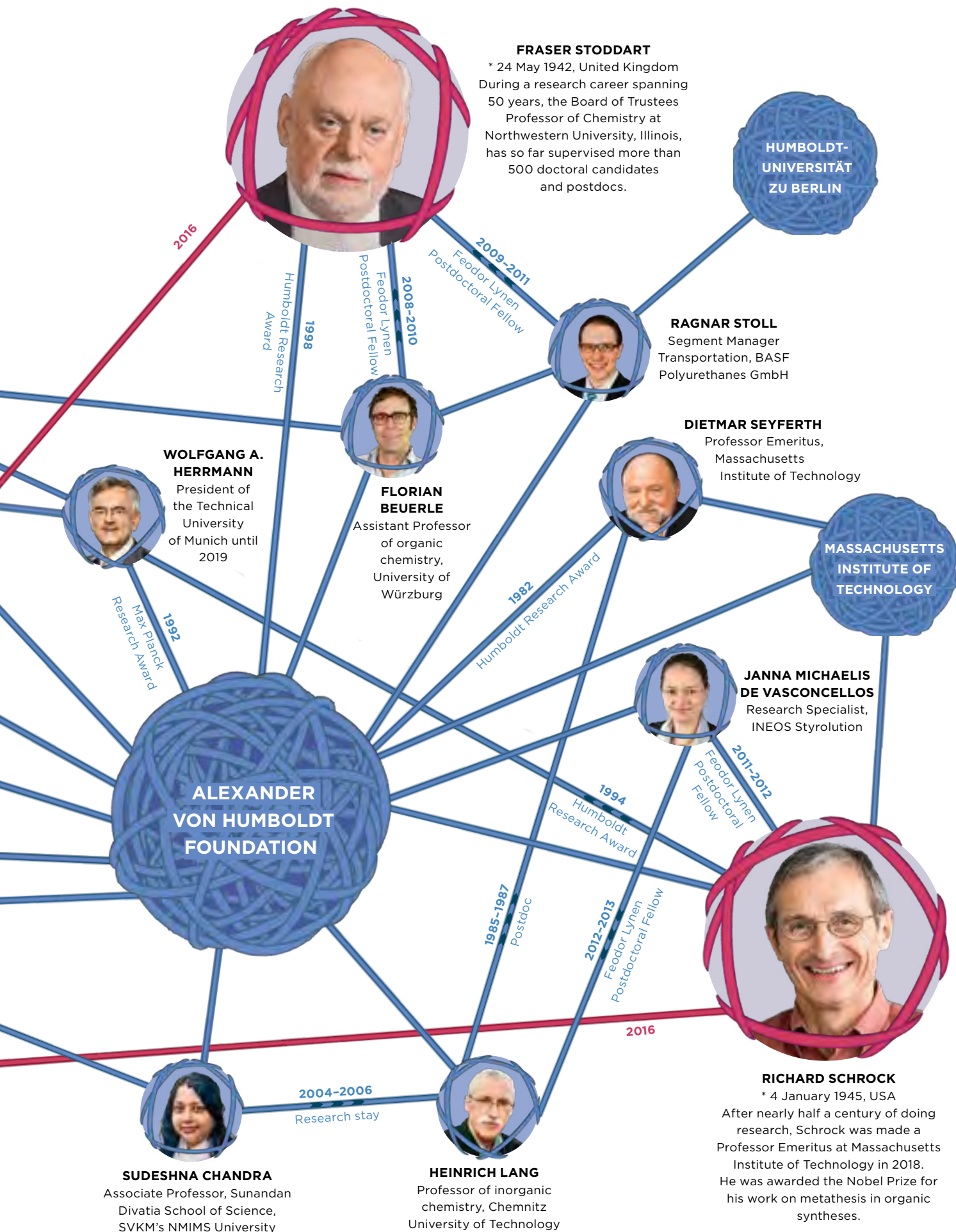


**BEN L. FERINGA**  
 \* 18 May 1951, Netherlands  
 With specialisms in organic chemistry, nanotechnology and asymmetric catalysis, the Dutch professor at the University of Groningen won the Nobel Prize for the design and synthesis of molecular machines.

**THORSTEN BACH**  
 Professor of organic chemistry, Technical University of Munich

**NONGNOTT WONGKAEW**  
 Research Associate in the Institute of Analytical Chemistry, University of Regensburg

**ANTJE BAEUMNER**  
 Professor in the Institute of Analytical Chemistry, Chemo- and Biosensors, University of Regensburg



**FRASER STODDART**

\* 24 May 1942, United Kingdom  
 During a research career spanning 50 years, the Board of Trustees Professor of Chemistry at Northwestern University, Illinois, has so far supervised more than 500 doctoral candidates and postdocs.

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**RAGNAR STOLL**

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Professor Emeritus, Massachusetts Institute of Technology

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

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Assistant Professor of organic chemistry, University of Würzburg

**JANNA MICHAELIS DE VASCONCELLOS**

Research Specialist, INEOS Styrolution

**ALEXANDER VON HUMBOLDT FOUNDATION**

**RICHARD SCHROCK**

\* 4 January 1945, USA  
 After nearly half a century of doing research, Schrock was made a Professor Emeritus at Massachusetts Institute of Technology in 2018. He was awarded the Nobel Prize for his work on metathesis in organic syntheses.

**SUDESHNA CHANDRA**

Associate Professor, Sunandan Divatia School of Science, SVKM's NMIMS University

**HEINRICH LANG**

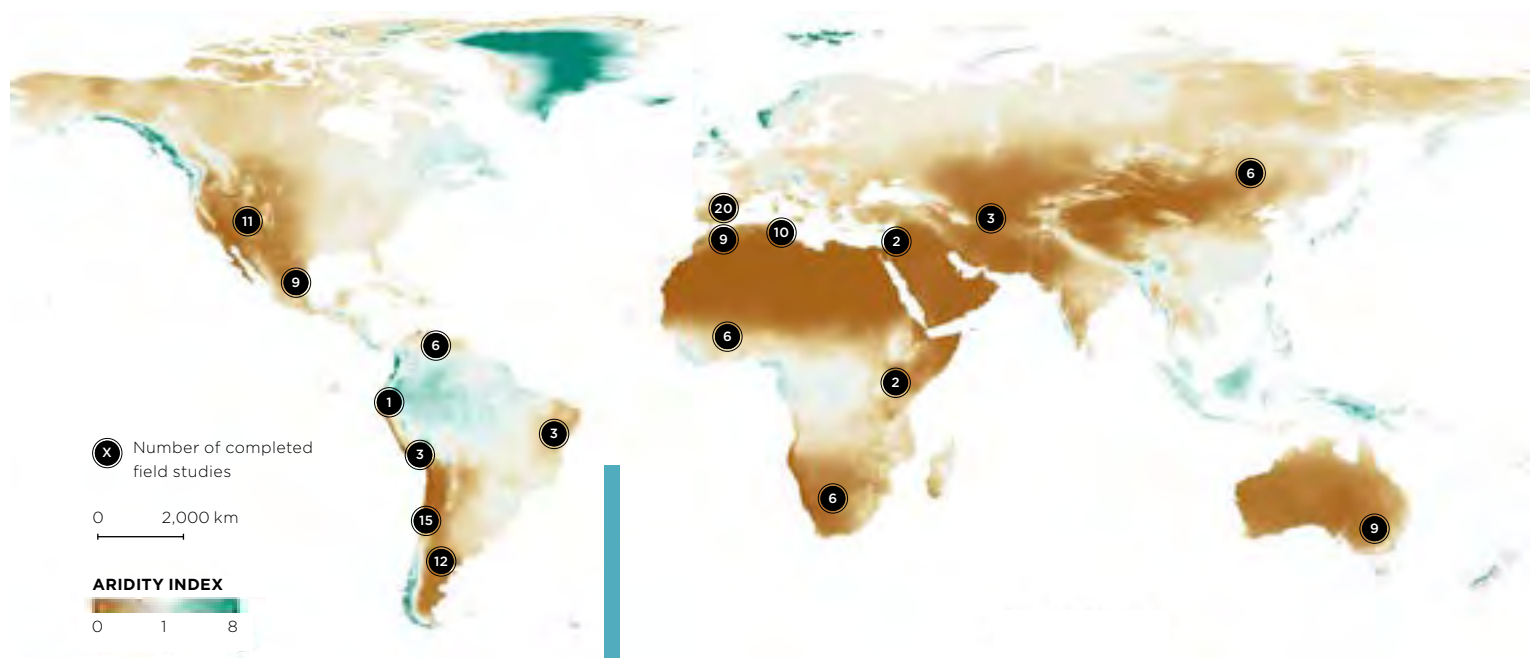
Professor of inorganic chemistry, Chemnitz University of Technology

# THE DESERT IS ALIVE!

The Spanish ecologist Fernando T. Maestre investigates how protecting arid regions can help to mitigate climate change. A conversation on greening drylands and how a small project can turn into a global research network.

*Interview* **GEORG SCHOLL**





**KOSMOS** Mr Maestre, when we talk about climate protection, many people immediately think of the rainforests and reforestation projects. But you explore what arid zones can do for climate protection.

**MAESTRE** That's true. Traditionally, not much attention has been paid to dryland zones, although they account for more than 40 percent of the earth's surface. But they don't produce much biomass compared to other biomes, as there simply isn't enough water to sustain a continuous vegetation cover. Added to which, scientific heavyweights like Germany and the United Kingdom don't have any dryland regions of their own. The United States do have drylands but most studies on climate protection carried out there have been done in ecosystems with more vegetation.

**How did you manage nonetheless to establish a research network that is now active on five continents and funded by the European Research Council (ERC)?**

I had the idea of studying drylands on the global scale when I was still a young PhD student. When I returned to Spain after a post-doc stint in the United States in 2005, the amount of funding I had at the time was so tiny that I could only pursue this idea in Spain. But I already knew that I wanted to make it much bigger.

**What happened?**

The breakthrough came a year later when my team and I got funding from the Ibero-American Program of Science and Technology for Development, an alliance of Spain, Portugal

### THE BIOCUM PROJECT

The black dots on the world map at the top indicate the location and number of experimental sites in the EU-financed BIOCUM project. Headed by Fernando Tomas Maestre and involving colleagues working in 19 countries on five continents, the project is the first to explore the composition of plant and microbial communities and the functioning of ecosystems in the world's arid zones in a systematic way. In drylands such as the Pampa, near the Lanín volcano in Argentina (photo left), mean annual evaporation exceeds mean annual precipitation. Arid zones account for 41 percent of the Earth's surface and are home to more than a third of the world's population. They are of great climate relevance because their soils and vegetation can store crucial amounts of carbon dioxide. One of the findings of the BIOCUM project was that biodiversity in arid zones is a decisive driver of their capacity to provide ecosystem services essential for human life as well as for tackling global warming.

[biocom.maestrelab.com](http://biocom.maestrelab.com)

and Latin American countries. This meant we could build up a network that brought together a diverse assemblage of experienced and emerging research groups. So suddenly we had partners in Argentina, Chile, Venezuela, Brazil, Nicaragua, Peru, Ecuador and Mexico.

**What was cooperation like in such a diverse group?**

I asked all the research teams to do everything exactly as we had already done it in Spain. Our approach in Spain had proved its worth, now we had to test if it could function in a different environment. And it did!

**So well that it convinced the ERC?**

My first application in 2007 was rejected. A year later, I applied again and this time it worked. Suddenly my lab and I had enough funding to recruit the necessary staff, analyse the vast quantities of soil samples obtained and pay for the shipping. We were now able to recruit additional partners from all over the world to join our network. During my stay in Germany as a Humboldt Research Award Winner, multiple German colleagues joined the crew, either by conducting fieldwork themselves in countries like Ghana or Burkina Faso or by analysing soil samples for variables not measured in my lab.

**What were the results of this collaboration?**

We managed to prove that plant and microbial diversity plays a key role in maintaining the capacity of drylands to provide essential ecosystem services linked to soil fertility >

How much carbon dioxide does the soil emit? Professor Maestre measuring soil CO<sub>2</sub> efflux at an experimental site near Alicante, Spain.



“

UNTIL A FEW YEARS AGO, NOBODY KNEW THAT THE SOIL IN DRY REGIONS STORES SO MUCH CARBON.”

and the production of plant biomass, which are fundamental for supporting the livelihood of more than 1 billion people globally. Until a few years ago, nobody imagined that biodiversity could play such an important role in global drylands. Also, in the last 30 or 40 years, we have seen a real greening of drylands worldwide. This indicates that a lot of additional carbon bonding is taking place.

**What has caused the greening?**

The increase in the proportion of carbon in the atmosphere has made plants more efficient in taking up water and thus stimulated their photosynthetic capacity. So, they have been able to grow more. However, in some regions this effect has already reached its peak, especially as climate change is responsible for increased warming and decreasing levels of rainfall.

**But will the additional growth not be able to compensate for the lack of rain caused by climate change?**

We can't make any generally valid statements about future rainfall levels across the world yet. Some areas may receive more rainfall, but others will experience extended droughts and receive less rainfall. But we are confident that global warming is increasing evaporation and associated water losses, and this effect may not be compensated for by the positive effects on plant growth promoted by having more CO<sub>2</sub> in the atmosphere. This is aggravated by the fact that the dry areas in some regions of the world are in a bad state.

**Why is that?**

One reason is that the trees and shrubs have been cut down in many dryland areas, which often have also been overgrazed. Drylands host more than 2 billion people, 90 percent of whom live in developing countries where they rely on what the environment has to offer – from their livestock who graze on existing vegetation to whatever they can cultivate.

**What would have to change?**

We could do a lot by managing grazing. We are getting very revealing data on how livestock grazing affects dryland ecosystems and how much grazing a dryland ecosystem can support before it becomes irreversibly degraded. Measures to help to conserve biodiversity are also key, as our data demonstrate the importance of plant and soil biodiversity in improving plant productivity, preventing soil erosion and delaying the onset of desertification.

**When people are struggling to survive, environmental protection is not a priority. How are your suggestions received?**

In developing countries, we often have a harder job explaining to people that they must change certain behaviours, not just for environmental reasons but because otherwise they are endangering their own livelihoods.

**What kind of contribution are African researchers making here?**

They carry out a large share of the field studies on this continent. In our network we have

researchers from Niger, South Africa, Namibia, Botswana, Algeria, Ghana, Morocco, Tunisia and Kenya. We make sure that they know the methods and how to use them. It is certainly time-consuming, but I personally find it very enriching.

**You were at the heart of this project from the very beginning and determined the methods. But a network is composed of many researchers with their own ideas. Hasn't anyone ever banged their fists on the table and said, "my idea is better"?**

No, never. But other people's ideas have enabled us to hit on approaches that we hadn't come up with ourselves. This has made us able to answer questions I wouldn't have thought of in my wildest dreams.

**Can I tempt you into a prediction: will the arid areas be greener 20 years from now?**

If we want to achieve that, we would have to immediately start on an ambitious conserva-

tion and rescue programme. We work hard to publicise the results of our research; we do radio and television interviews and use social media to disseminate our findings, but the politicians haven't yet shown much interest in our results or asked for advice.

**Not even in your own country, Spain, which is one of the EU countries most threatened by drought?**

Unfortunately, not. But if we don't do anything now, in the future, southern Spain will have a landscape rather like northern Africa and we will likely exhaust the aquifers. I really wish that Spain and other affected countries would finally wake up and declare the protection of drylands and the sustainable management of their water resources a national priority. ●



**PROFESSOR DR FERNANDO**

**T. MAESTRE** is a distinguished

researcher at the University of Alicante, Spain, and a professor of ecology at Universidad Rey Juan Carlos in Móstoles, Spain. After his doctorate in biology at the University of Alicante followed by a post-doc at Duke University, United States, he was awarded a Starting Grant by the European Research Council (ERC) in 2009 for carrying out the global BIOCUM research project. Maestre has spent time working on research in countries such as Australia, Germany, China, the UK and the United States and was granted a Humboldt Research Award in 2014. Since then, he has been cooperating closely with German colleagues in Berlin, Cologne and Leipzig to analyse samples and data collected in arid zones. Also in 2014, the ERC awarded him a Consolidator Grant for the follow-up project BIODESERT. This gave Maestre and his international team of collaborators the possibility to further investigate how global dryland ecosystems are responding to climate change and desertification and to propose measures to mitigate their impacts.



View of the Tabernas Desert in Almería, Spain, the driest area in Europe.



**ANTON ZENSUS**  
in the control room of  
the Radio-Observatory  
at Effelsberg, Eifel.





# SPELLBOUND BY THE BLACK HOLE

Without a world-spanning network, this sensation would never have been possible: radio astronomers managed to take the first picture of a black hole in space. To do so, scientists from 20 countries pooled their expertise. Leader of the alliance: Humboldt Research Award Winner, Anton Zensus, from the Max Planck Institute for Radio Astronomy.

*Text* **THORSTEN DAMBECK** *Photos* **SILVIA STEINBACH**

It is not easy to meet Anton Zensus in autumn 2019. If you want to interview the astrophysicist, you first have to manage to make an appointment with him. Whether he is giving lectures, appearing before a fascinated lay audience or attending award ceremonies: Zensus is in demand. But then it works out, after all – at his own place of work, the Max Planck Institute for Radio Astronomy in Bonn, of which he is the director. On top of this, he heads a consortium of some 200 researchers from 60 institutes – the Event Horizon Telescope (EHT) Collaboration Council. Why is there such huge interest in this radio astronomer? Just six months ago, on 10 April 2019, the EHT team announced an extraordinary breakthrough: after decades of preparation, experts had managed to do what had been considered impossible: to capture an image of a black hole.

Known to millions of cinemagoers in its fictitious form from the space epic, *Interstellar*, the mysterious object can now effectively be viewed in natura. The image was presented to the public around the world at simultaneous press conferences, one of which was in Brussels in the presence of the EU's Commissioner for Science, Carlos Moedas. The Portuguese Commissioner's words were indicative of the significance of the event. He spoke of "a huge breakthrough for humanity." To date, a recording of the press conference has been viewed more than three million times online. And the image of the black hole triggered a flood of headlines in the world >



**COVER STAR** The first image of a black hole went around the world in 2019.

“

SOMETHING LIKE THIS CAN ONLY HAPPEN TO A SCIENTIST ONCE IN A LIFETIME.”

press. Since then, a poster with selected title stories has adorned the wall in Zensus’ office in Bonn. “We were surprised by this tsunami of public interest,” he admits. “Something like this can only happen to a scientist once in a lifetime.”

Even for a sober physicist, black holes are a fascinating phenomenon because they are, literally, attractive: due to their enormous gravitational force, matter is unable to escape their vicinities. Even light and other electromagnetic waves fail to get away, which is precisely why they are “black”. The theoretical concept of black holes had been haunting the universe for more than a century, as they were believed to be a consequence of the General Theory of Relativity. But although the physicist Karl Schwarzschild derived them from Einstein’s equations back in 1916, Ein-

stein himself doubted their existence. While there is very little doubt amongst astrophysicists today that the cosmos is full of such bizarre objects, until spring last year they had only indirect evidence.

But despite this, it had to be possible to visually prove the existence of black holes – this had been Anton Zensus’ creed for much of his scientific career. He had discovered his interest in space while studying physics in Münster – and it never left him. But it was only perseverance and unrelenting work on scientific and technical innovations that finally led to success.

#### A FASCINATING SCIENTIFIC PHENOMENON

It was already well known that visible light is unsuitable for imaging black holes. Only shortwave radiation can travel the cosmic distances between the object of study and the observer on Earth unhindered. So, the required antennae first had to be prepared to receive the millimetre waves and computers had to learn to generate a photo-like image from the measurement data. Nor could the measurements themselves be taken by one single radio observatory. Only by linking eight individual telescopes in Chile, Mexico, Hawaii, Arizona, Spain and the Antarctic was it possible to create a sufficiently large virtual radio telescope with enough magnification to capture the relatively tiny black hole. In the technical jargon used by the experts, this is known as Very Long Baseline Interferometry. In particular, the 66 ALMA antennae (Atacama Large Millimeter Array) in Chile that were integrated in the EHT network were a crucial success factor.

“International cooperation is indispensable for our research,” explains Zensus who has spent 16 years of his career in the United States – at Caltech, California, in New Mexico, and later in Charlottesville, Virginia. Here, at the headquarters of the National Radio Astronomy Observatory, he honed both the technical and organisational skills that were conducive to later becoming the head of the EHT Consortium, since the network of radio anten-



**ANTON ZENSUS** with design engineer, Gino Tuccari, at a data recorder in the Bonn laboratory for Very Long Baseline Interferometry (VLBI).

nae had to have a solid organisational footing. Zensus: “In two years, we had about 50 meetings.” His task as chairman was to elaborate a detailed agreement balancing out the various interests to serve the common objective. Zensus: “That sometimes meant taking the lead.”

Now, everyone can picture what a black hole looks like. The one caught by the EHT researchers is in the Virgo Constellation, right in the middle of the enormous elliptical galaxy M87. In the club of black holes it is a particularly massive member, weighing in at 6.5 billion solar masses. The image shows a central area which is actually black. The actual hole is invisible to the eye, hidden in this dark zone and surrounded by a bright region. Zensus explains: “That is hot, radiating matter that has collected in a ring around the hole.” A considerable part of the shining matter was even behind the black hole. This is because such a massive object bends space and time so strongly that it deflects light. After a certain point, the beams of light then run circles around the object. So, to be precise, the image does not show the

black hole itself, but its shadow and the immediate environment.

### **COOPERATION ACROSS NATIONAL BORDERS**

One of the reasons why black holes are so popular is because they have a mystical, threatening aura. The fictitious example in the film *Interstellar* is called Gargantua, like the father of all grotesque giants in the eponymous Renaissance story by Rabelais. Today, its genuine equivalent in galaxy M87 has also sparked the interest of people who are otherwise indifferent to physics and astronomy. “We are now perceived quite differently,” says Zensus. “I never used to be invited to give lectures to SMEs; now I am.” And young people are showing much more interest, too, which means a boost for scientific and technical subjects. Zensus: “Neither of my sons works in science. Now their friends ask them about the fascinating research their father and his colleagues are doing. That’s a new experience for me.”

»



**RADIOASTRONOMER PROFESSOR DR ANTON ZENSUS**, the Director of the Max Planck Institute for Radio Astronomy in Bonn, was granted the Humboldt Research Award in 1994 and the Max Planck Research Award in 1999. The picture on the left shows him talking to researchers in his research group at the Max Planck Institute for Radio Astronomy. Anton Zensus read physics and astronomy in Cologne and Münster where he completed his doctorate in 1984. In 1985, he relocated to the United States as a postdoc at California Institute of Technology in Pasadena, California, moving to the National Radio Astronomy Observatory in Socorro, New Mexico, and Charlottesville, Virginia, in 1988. Anton Zensus became a scientific member of the Max Planck Society in 1996 and was appointed director of the Bonn institute where he heads the Very Long Baseline Interferometry (VLBI) research department.

There is also more official support for radio astronomy than there used to be. “And that is essential if we are going to retain our leading position in this research,” Zensus emphasises. The network needs additional radio telescopes to improve the quality of future images and help to interpret them scientifically. Radio antennae on satellites in space could also contribute to this, too.

But research into black holes is not just about distant heavenly bodies. It questions the whole basis of modern

physics. Due to their extreme gravitational fields, the General Theory of Relativity has to prove itself under conditions that were never previously considered. So far, Einstein’s thought edifice has withstood the stress test to which the EHT researchers have subjected it.

Currently, the consortium is working on capturing the black hole at the centre of our Milky Way. They already have the measurements and are busy evaluating them. Although it is 2,000 times nearer than the one in M87, it is no easier to catch the image. Zensus explains: “The relatively fast changes in the centre of the Milky Way cause disturbances and make it hard to take a photo. At the moment, we are trying to eliminate this effect.” Zensus takes a careful look at his watch: his next trip is about to start. He is flying to the award ceremony for the 2019 Breakthrough Prize in Fundamental Physics which has been awarded to the entire EHT team. Sometimes referred to as the “Physics Oscar”, it is presented at NASA’s Ames Center in California. And a few days later, he is off to the Falling Walls conference in Berlin where people want to hear more about the breakthrough with black holes. The wave of curiosity and fascination continues unabated. ●

“

IT QUESTIONS  
THE WHOLE BASIS OF  
MODERN PHYSICS.”



**ANTON ZENSUS**  
in the main mirror  
of the Effelsberg  
telescope which  
has a diameter of  
100 metres.



Angela Merkel with the President of the Republic of South Africa, Cyril Ramaphosa

#### GERMAN CHANCELLOR FELLOWSHIPS

## Now open to South Africa, too

The Alexander von Humboldt Foundation will soon be inviting young professionals from South Africa to become German Chancellor Fellows in Germany where they can conduct projects and develop new contacts. The addition of South Africa completes the group of BRICS nations in the German Chancellor Fellowship programme. Until now, candidates from the fast-growing economies of Brazil, Russia, India and China could apply for fellowships as well as talented individuals from the United States. Chancellor Merkel announced the forthcoming expansion when visiting Pretoria in February.

As part of the worldwide Humboldt Network, German Chancellor Fellows – who come from a wide range of fields – act as intermediaries between their native country and Germany after their stay in Germany and develop lasting contacts.

This fellowship programme is under the patronage of Germany's Federal Chancellor and is financed by the Federal Foreign Office. Every year, it offers up to ten university graduates from each country who have already gained some leadership experience the opportunity to come to Germany to expand their international experience and, at the same time, strengthen their intercultural skills. ●

 FURTHER INFORMATION

[www.humboldt-foundation.de/web/german-chancellor-fellowship.html](http://www.humboldt-foundation.de/web/german-chancellor-fellowship.html)

#### REIMAR LÜST AWARD

## Awards go to a philosopher and a legal scholar

The philosopher Hannah Ginsborg and the legal scholar Toshiyuki Kono are the recipients of the 2019 Reimar Lüst Awards. The award is granted to humanities scholars and social scientists from abroad who, through their research, have shaped academic and cultural relations between Germany and their own countries. Each award is endowed with €60,000. Every year, the Alexander von Humboldt Foundation, in collaboration with the Fritz Thyssen Foundation, grants up to two Reimar Lüst Awards.

The philosophy professor Hannah Ginsborg conducts research at the University of California in Berkeley, United States. She has made important contributions not only to the history of philosophy but also to contemporary philosophy of mind, language and art. Her work revolves around the notion of a primitive form of normativity, which she has derived from Kant's theory of aesthetics. She is an important mediator in the exchange between the German and the Anglo-American philosophical tradition. In the past, she has come to Germany a number of times for research purposes.

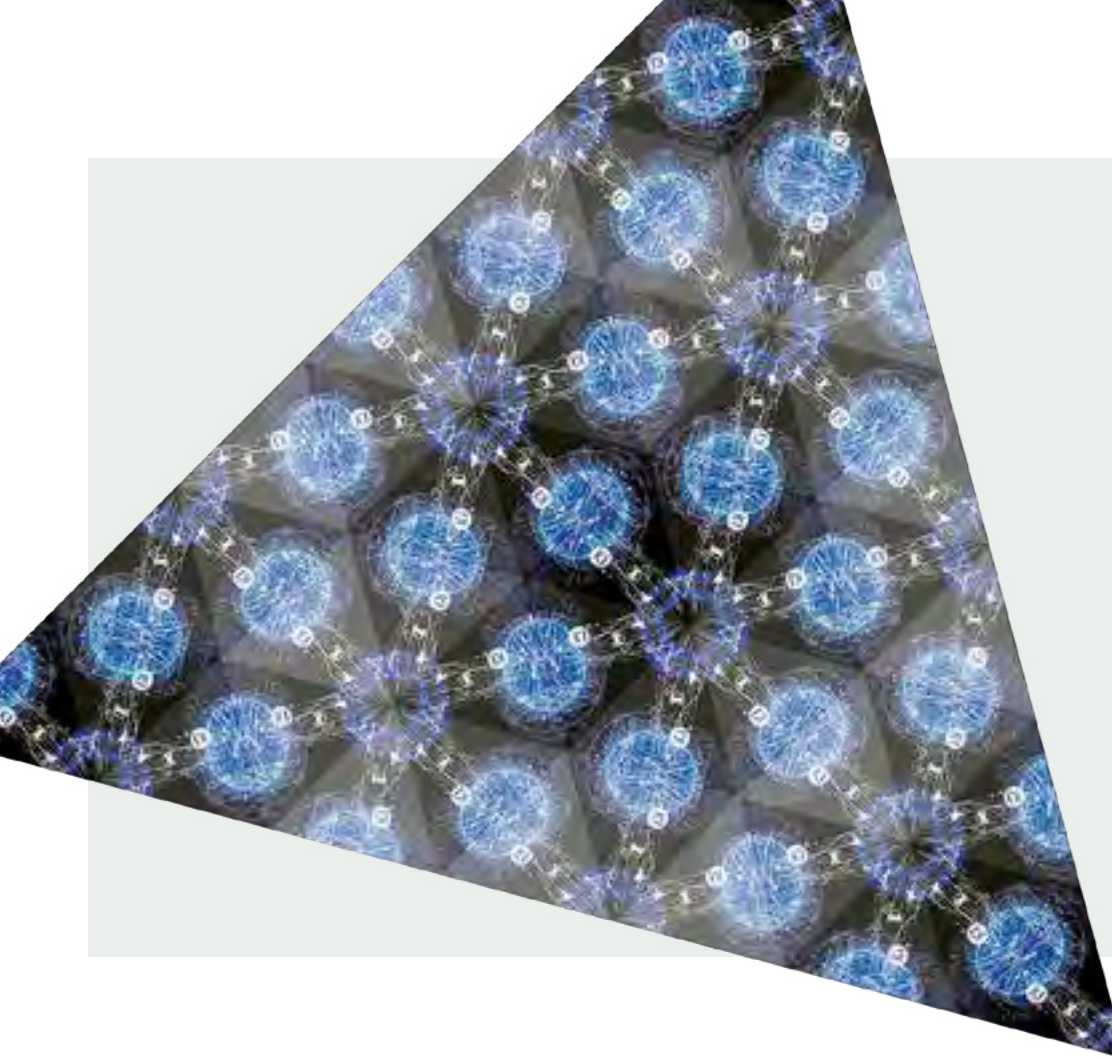
In her capacity as a Reimar Lüst Award Winner, she plans to collaborate with colleagues at Humboldt Universität zu Berlin, particularly on the relationship between her concept of primitive normativity and the connection between 'ought' and 'intention'.

Toshiyuki Kono is a professor of law at Kyushu University in Fukuoka, Japan. In addition to his academic research on private international law and the enforcement of intellectual property rights, Toshiyuki Kono has made valuable contributions in the field of national and international protection of cultural property. In 2018, he was the first Japanese citizen to be elected president of the International Council on Monuments and Sites (ICOMOS International), after having served several years as chairman of the Committee for Cultural Affairs in Japan's National Commission for UNESCO.

As a Reimar Lüst Award Winner, his collaboration with colleagues at the Institute of Information, Telecommunication and Media Law at the University of Münster will examine the connection between cultural heritage protection and trademark law. ●

 FURTHER INFORMATION

[www.humboldt-foundation.de/web/luest-award.html](http://www.humboldt-foundation.de/web/luest-award.html)



The computer scientist, Professor Dr Daniel Rückert (above), and the neuroscientist, Professor Dr Peter Dayan receive the first two Alexander von Humboldt Professorships for Artificial Intelligence

## ALEXANDER VON HUMBOLDT PROFESSORSHIPS

# Up to 30 professorships in Artificial Intelligence to be awarded

Up to 30 additional Alexander von Humboldt Professorships in the field of Artificial Intelligence are to be filled in the years up to 2024. Through these professorships, the Alexander von Humboldt Foundation intends to contribute to the German Government's Artificial Intelligence Strategy which targets the establishment of new AI chairs in Germany.

Alexander von Humboldt Professorships are financed by the Federal Ministry of Education and Research. The award comes with €5 million in funding for individuals conducting experimental research and €3.5 million for researchers working in theoretical fields. The award brings top international researchers from abroad to German universities and offers them long-term prospects for conducting research in Germany. The Humboldt Professorship enables German universities to offer top international researchers competitive conditions for research and to raise their own international profiles

in the global research market at the same time. To date, it has been possible to award up to ten Humboldt Professorships every year. Now, six additional Humboldt Professors specifically for the field of Artificial Intelligence can be recruited to come to Germany annually. Nominations are being accepted with immediate effect.

“The Alexander von Humboldt Professorship will help to thoroughly explore and utilise the opportunities AI offers for our future. And it will also serve to reinforce Germany as an internationally attractive and influential location in this important area,” said Hans-Christian Pape, President of the Humboldt Foundation. Not only researchers in technical disciplines but also those who address the socio-economic, ethical and legal aspects of artificial intelligence are eligible to be nominated. As in the past, up to ten professorships will continue to be open to candidates from any discipline. ●

 FURTHER INFORMATION  
[www.humboldt-professur.de/en](http://www.humboldt-professur.de/en)



Who actually does what at Humboldt headquarters? Who are the people behind the scenes making sure that everything runs smoothly? This page is devoted to the colleagues at the Humboldt Foundation, their lives at work and beyond.

**TODAY: CHRISTINE MAY.**

You can tango anywhere – even in the Foundation’s underground car park. Today, a colleague stepped in as my dance partner; usually, it’s my husband who accompanies me on the tango trail. Once or twice a week, we go to so-called “milongas” – open dance sessions. We are talking about Tango Argentino, mind you, not to be confused with the tango you learn at dance studios, which is more regimented.

Tango Argentino originated in the Rio de la Plata in South America. The music and dance emerged in the poverty-stricken immigrant societies of Buenos Aires and Montevideo at the end of the 19th century. They were influenced by the culture of former African slaves as well as elements of Polish and Bohemian dance. People tangoed in the brothels and bars around the port and in the suburbs. I could go on about the history of the tango for ever.

But there is one cliché I would like to banish. Even if you dance cheek-to-cheek in a tight embrace: Tango

Argentino has nothing to do with eroticism. Above all, tango is about “walking and engaging with the music.” The leader sends a signal to his or her partner who responds to it and transforms it. Tango is an intense conversation between two people.

I once held a tango course at the Foundation after a selection meeting. There are definite analogies between my work and my passion for dancing. In the Organisation and Change Management Department, I am in constant dialogue with staff: I set something in motion, take in what I am told, have to respond. Last year, I supervised modelling the processes for acquiring ISO certification for our quality management system. This involved intensive communication, just like doing a tango.

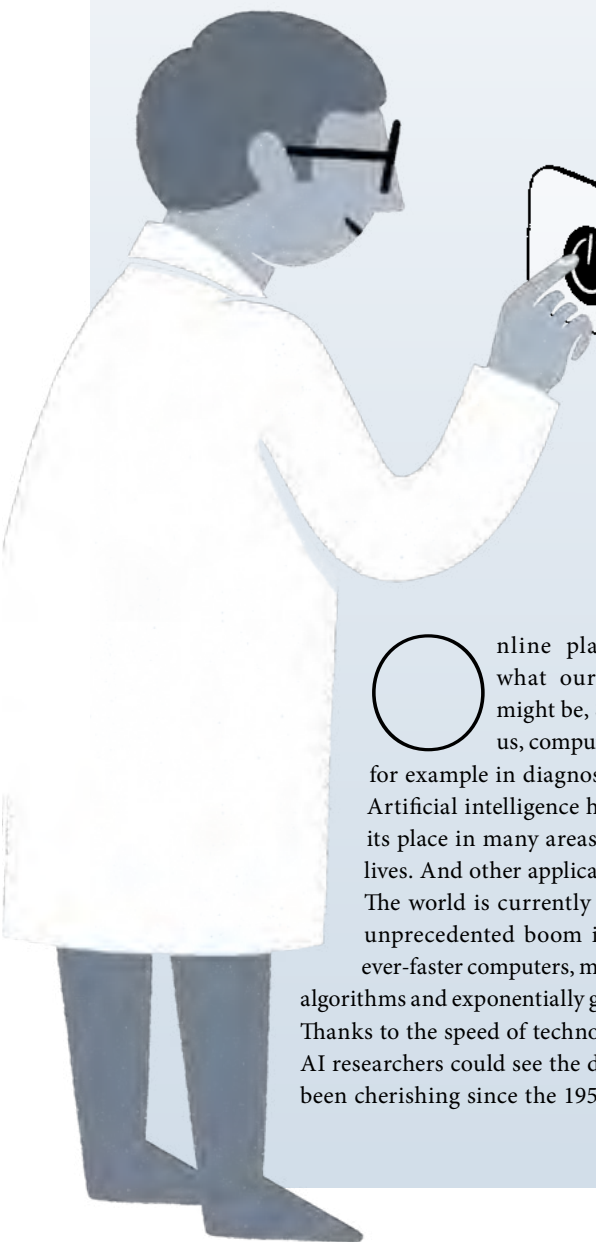
Tango clears my head. I am forced to think about my posture, my partner and the music. Such total concentration is relaxing. ● Recorded by MAREIKE ILSEMANN



# AI IN GERMANY - A FAST-LEARNING SYSTEM

German research has a lot going for it in the field of artificial intelligence. To ensure this continues, the Federal Government has launched a national AI strategy. It includes the establishment of up to thirty Alexander von Humboldt Professorships that will be filled in the next few years.

Text **LILO BERG** Illustrations **KARO RIGAUD**



Online platforms suggest what our next purchase might be, Siri & Co. talk to us, computers help doctors, for example in diagnosing skin cancer. Artificial intelligence has already taken its place in many areas of our everyday lives. And other applications will follow. The world is currently experiencing an unprecedented boom in AI, driven by ever-faster computers, more sophisticated algorithms and exponentially growing data sets. Thanks to the speed of technological progress, AI researchers could see the dreams they have been cherishing since the 1950s come true: to

build machines that solve problems themselves, learn new things automatically and respond flexibly to novel conditions – a development that has long since been taking shape and that will change every aspect of people's future lives around the world. In the global contest, Germany must hold its own in the AI market and ensure that its industrial base is fit for that future. At the same time, every individual's civil liberties, privacy rights and freedom of choice must be protected.

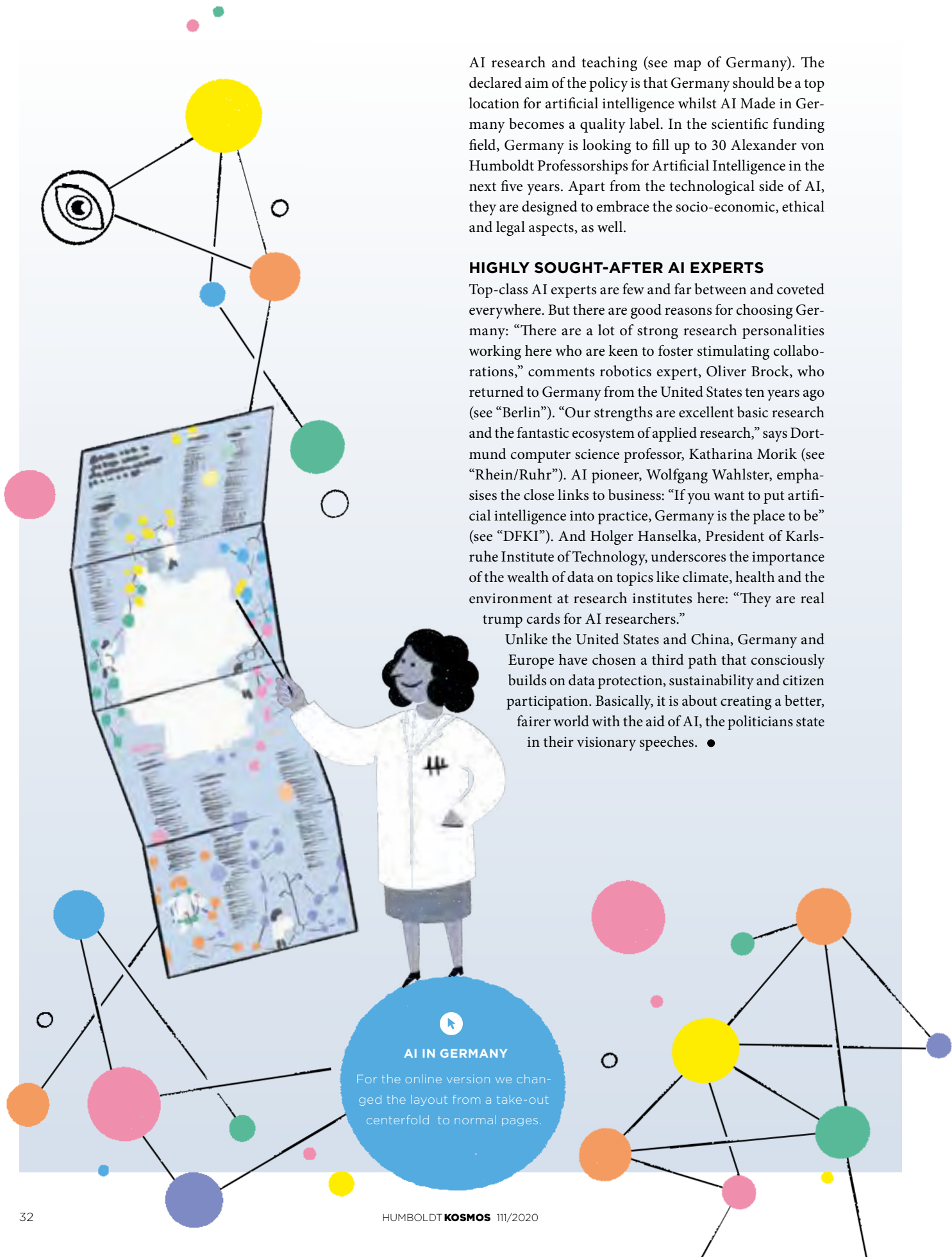
Against this backdrop, the Federal Government published its first national AI strategy in autumn 2018, setting out the general conditions for the technological megatrend and seeking to drive development. It envisages, amongst other things, connecting and expanding the centres of excellence spread around the country that specialise in >

AI research and teaching (see map of Germany). The declared aim of the policy is that Germany should be a top location for artificial intelligence whilst AI Made in Germany becomes a quality label. In the scientific funding field, Germany is looking to fill up to 30 Alexander von Humboldt Professorships for Artificial Intelligence in the next five years. Apart from the technological side of AI, they are designed to embrace the socio-economic, ethical and legal aspects, as well.

### HIGHLY SOUGHT-AFTER AI EXPERTS

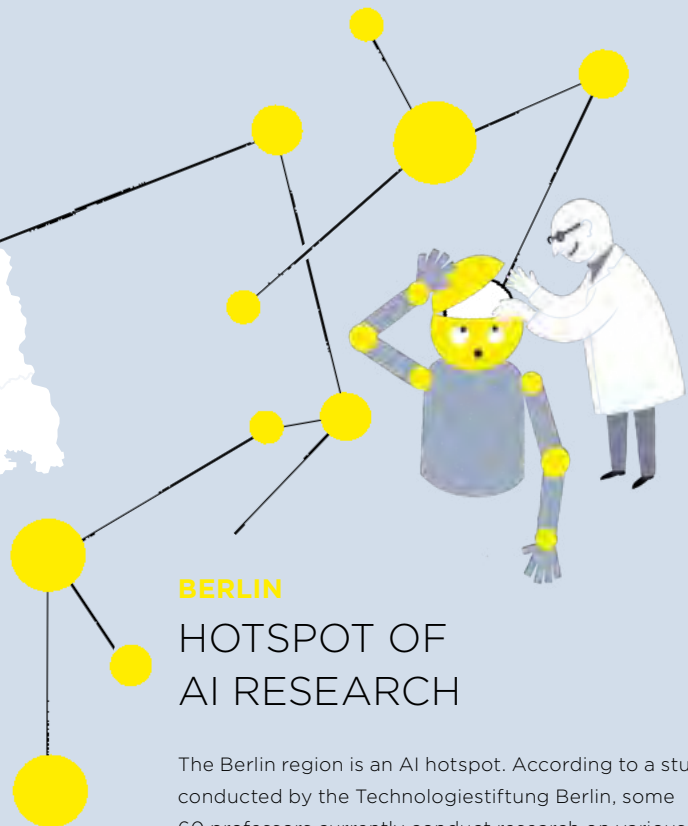
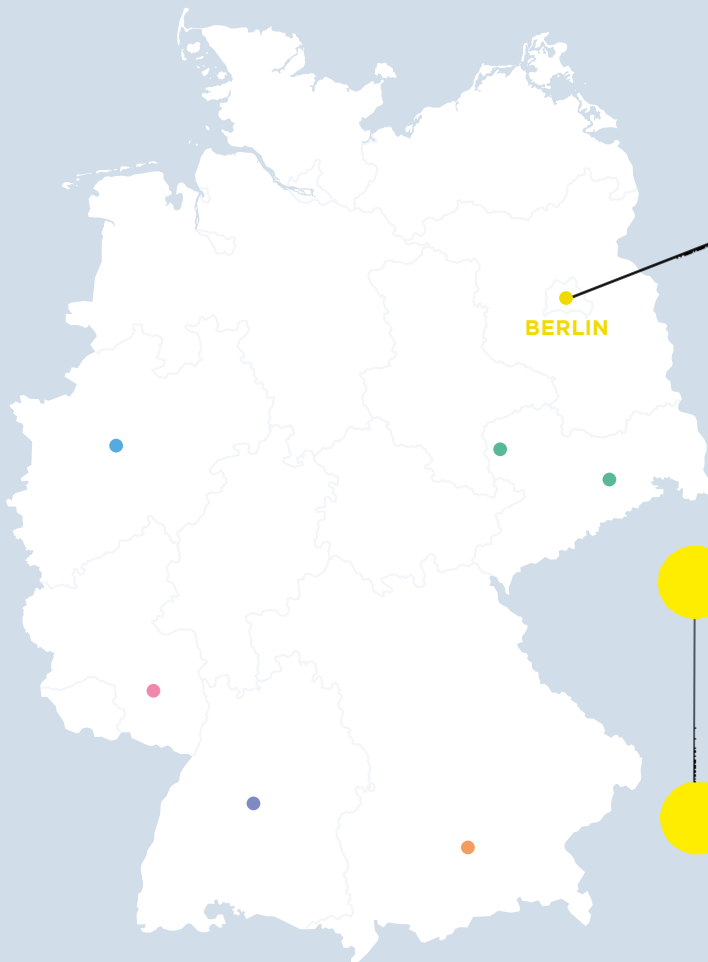
Top-class AI experts are few and far between and coveted everywhere. But there are good reasons for choosing Germany: “There are a lot of strong research personalities working here who are keen to foster stimulating collaborations,” comments robotics expert, Oliver Brock, who returned to Germany from the United States ten years ago (see “Berlin”). “Our strengths are excellent basic research and the fantastic ecosystem of applied research,” says Dortmund computer science professor, Katharina Morik (see “Rhein/Ruhr”). AI pioneer, Wolfgang Wahlster, emphasises the close links to business: “If you want to put artificial intelligence into practice, Germany is the place to be” (see “DFKI”). And Holger Hanselka, President of Karlsruhe Institute of Technology, underscores the importance of the wealth of data on topics like climate, health and the environment at research institutes here: “They are real trump cards for AI researchers.”

Unlike the United States and China, Germany and Europe have chosen a third path that consciously builds on data protection, sustainability and citizen participation. Basically, it is about creating a better, fairer world with the aid of AI, the politicians state in their visionary speeches. ●



**AI IN GERMANY**  
For the online version we changed the layout from a take-out centerfold to normal pages.

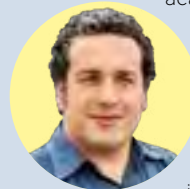
# SELECTED AI-HOTSPOTS IN GERMANY: AN OVERVIEW



## BERLIN

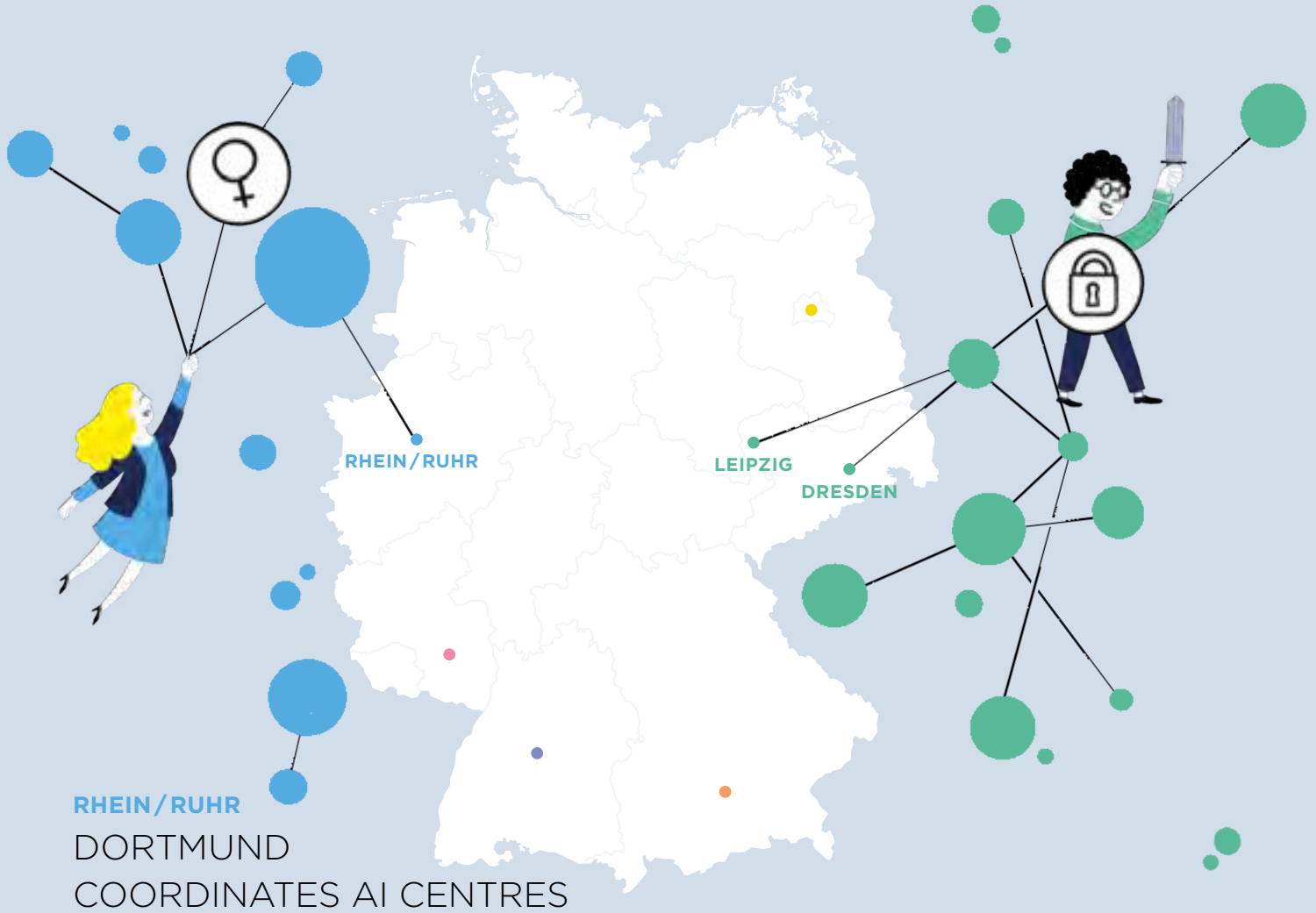
### HOTSPOT OF AI RESEARCH

The Berlin region is an AI hotspot. According to a study conducted by the Technologiestiftung Berlin, some 60 professors currently conduct research on various aspects of artificial intelligence at universities and non-university research institutions. One of the region's academic highlights is the "Science of Intelligence" cluster of excellence. "We come from different disciplines and want to understand what intelligence is," says **Oliver Brock**, professor of robotics at TU Berlin and spokesman for the cluster. The special thing about it is that the insights gained are immediately implemented,



for example in extremely versatile robotic hands based on the human model. "Robots are embodied intelligence and thus a core element of AI," says Brock. Now, many national and international AI companies have also established themselves in the region, including market giants like Google. And fifty percent of German AI start-ups have settled here, according to the Platform #AI-Berlin.

*"Fifty percent of German AI start-ups are based in Berlin."*



**RHEIN/RUHR**  
**DORTMUND**  
**COORDINATES AI CENTRES**

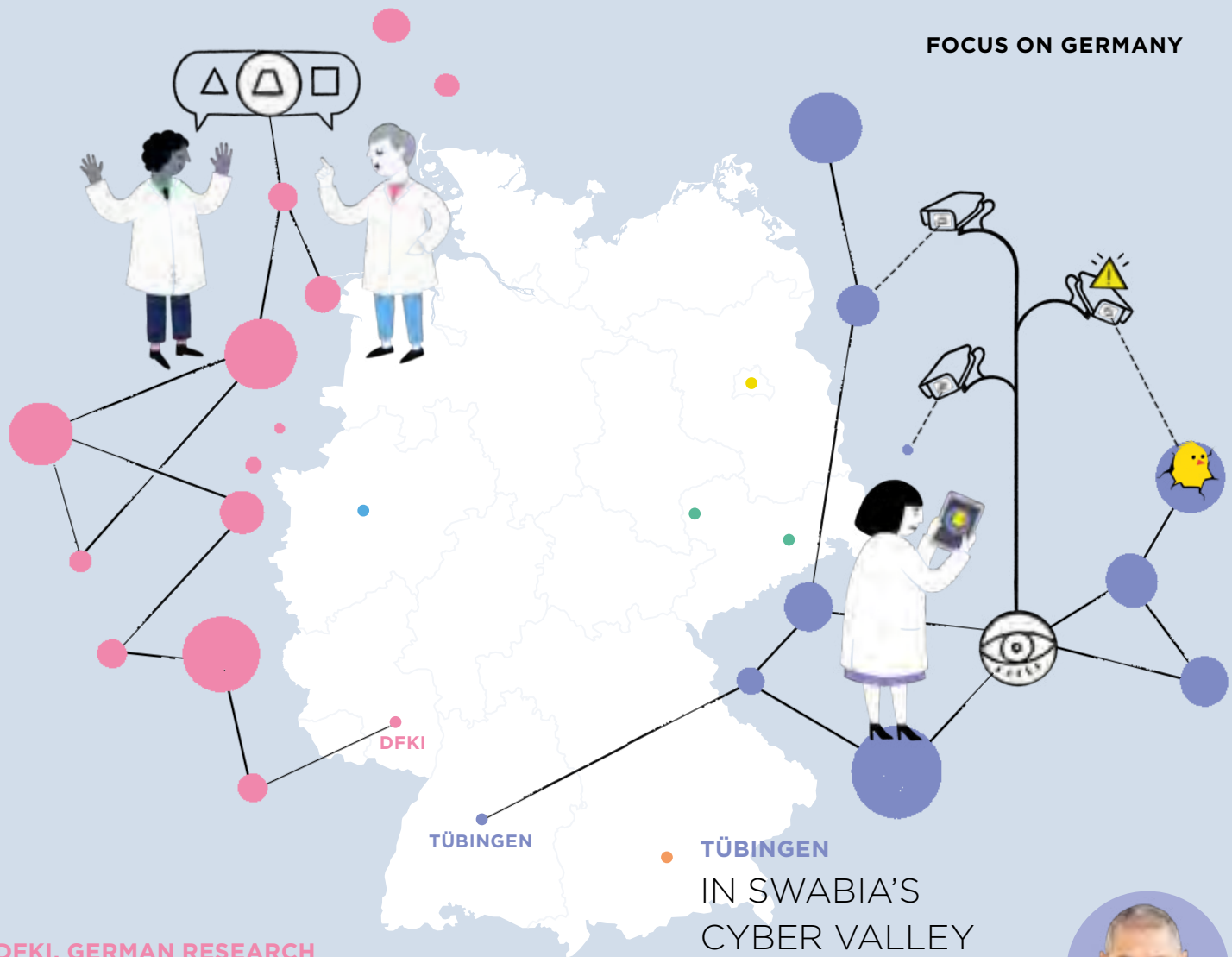
In Dortmund, many of the threads of the German AI scene are woven together. It is from here that the computer scientist, **Katharina Morik**, coordinates the six centres of excellence in artificial intelligence and organises AI cooperation with France. In Dortmund itself, the TU professor is in charge of the Competence Center Machine Learning Rhine-Ruhr that is operated by the universities of Dortmund and Bonn together with two Fraunhofer institutes (the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS, St Augustin, and the Fraunhofer Institute for Material Flow and Logistics IML, Dortmund). In addition to basic research and transfer activities, the pioneer of machine learning feels very strongly about promoting young scientists. She believes, for example, that young women have enormous potential. "At present, only about 20 percent of AI specialists are female, which is a real shame." It is an ideal research area, she notes, for women who are passionate about a better future for humans and nature. Katharina Morik's vision of the future of AI in Germany is permanently funded, strong centres of excellence radiating out and actively pursuing exchange, especially within Europe and with Australia: "There they prefer our third path for dealing with artificial intelligence."



**DRESDEN/LEIPZIG**  
**AI TO COMBAT HACKERS**

"The euphoria about AI in this part of the country is impressive," says **Erhard Rahm**, professor of computer science at the University of Leipzig. Together with colleagues, he founded the Center for Scalable Analytics and Artificial Intelligence (ScaDS.AI Dresden/Leipzig) which focusses on developing machine learning methods for handling Big Data as well as trustworthy AI methods for the fair and protected use of sensitive data. From the very beginning they always consider practical applications, Erhard Rahm explains, looking at improving tumour diagnosis, for instance, or defence against cyber-attacks. A new graduate school with sites in Leipzig and Dresden shall train the young experts, who are so desperately needed both inside and outside academia, as well as building a bridge to business with an AI service centre. "The German AI centres of excellence are the seeds that urgently needed to be sown," says Erhard Rahm and adds, "What we now need is permanent funding and new AI professorships so that great things may grow."





**DFKI, GERMAN RESEARCH CENTER FOR ARTIFICIAL INTELLIGENCE**

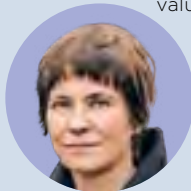
**APPLICATIONS FOR INDUSTRY AND SMES**

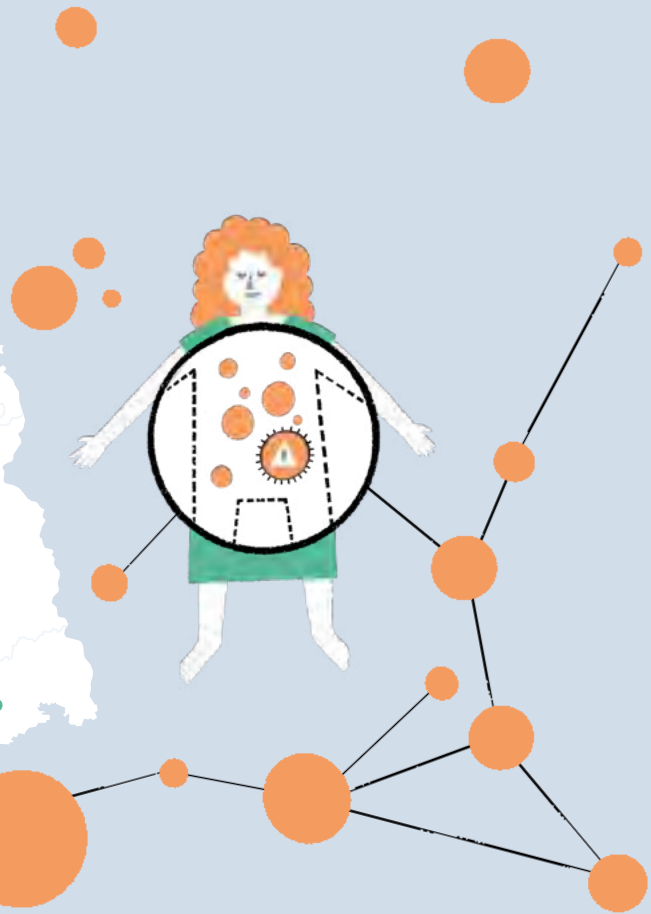
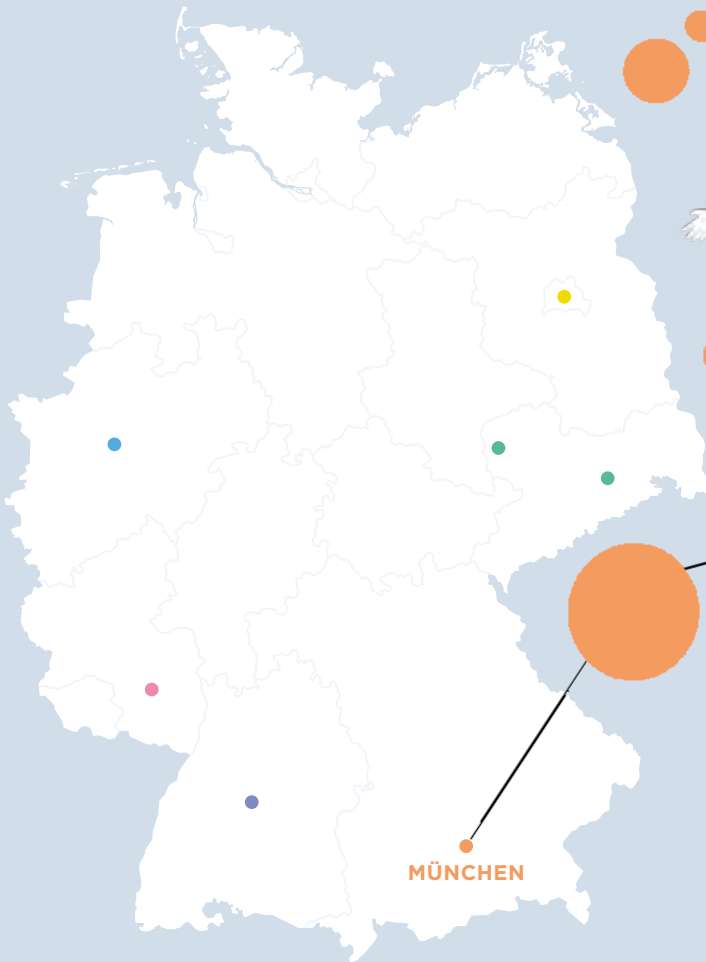
The German Research Center for Artificial Intelligence, founded as a public/private body in Kaiserslautern and Saarbrücken in 1988, brings together large corporations from all over the world, medium-sized enterprises and research institutions. The centre now employs more than a thousand staff who work at five different sites to develop AI solutions for various sectors – from the automotive industry via agriculture and shipping through to trade. “Many innovations have their origins here, such as the principles for the first versions of the globally used translation programme, Google Translate,” says **Wolfgang Wahlster**, professor of computer science and founding director of DFKI. According to Wahlster, AI research in Germany has a 70-year tradition and is still two or three years ahead of other countries when it comes to applications in manufacturing industries. Wahlster: “If that’s what you’re interested in – the keyword here is Industry 4.0 – Germany is the place to be.”



**TÜBINGEN IN SWABIA’S CYBER VALLEY**

In Cyber Valley, between Stuttgart and Tübingen, a major AI research alliance is emerging, combining academia and business. The neuroscience fields, which want to link the new Tübingen AI Center with AI research, are one of the main drivers. “It’s a pulsating research environment,” says **Peter Dayan**, who became the first Humboldt Professor for Artificial Intelligence at the University of Tübingen and director of the Max Planck Institute for Biological Cybernetics at the beginning of 2020. A theoretical neuroscientist, he investigates how people manage to make good decisions in an uncertain world and how these processes can be transferred to artificial systems. **Jessica Heesen**, philosopher at the International Center for Ethics in the Sciences and Humanities (IZEW) at the University of Tübingen, would like ethical reflection to be an integral part of AI projects like this from the word go. The head of the Tübingen Research Focus “Media Ethics and Information Technology” argues for value-based AI development that monitors the origin of data, communicates the goals of algorithms and focusses on the societal significance of its applications. “Integrated research can make this work well, but only if technology and ethics cooperate on a level playing field.”



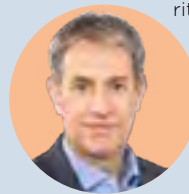


*“AI detects diseases that the human eye simply doesn’t see”*

**MUNICH**

**MACHINE LEARNING:  
TURNING AI INTO  
A HELPER**

Machines that find good solutions of their own accord – this is the common objective of researchers at the AI centre of excellence, Munich Center for Machine Learning (MCML). They all have backgrounds in data science, computer science and statistics and want to propel the practical application of AI, as well as further basic research. Like **Daniel Rückert**. At Imperial College London, the German computer scientist developed algorithms that can crucially improve medical imaging.



Using his calculation rules, tumours and other anomalies in body tissue can be discovered more easily and correlated with a clinical picture, for example. “AI enables us to visualise things that the human eye can’t detect,” says Daniel Rückert who has been awarded a

Humboldt Professorship for Artificial Intelligence and is currently negotiating his appointment at the Technical University of Munich. The fact that Munich is an up-and-coming hotspot for AI is a strong argument in favour of the location, according to Rückert, whose eyes light up at the future prospect of using data from imaging examinations, lab tests and genetic analyses to draw up a complete image of a patient.