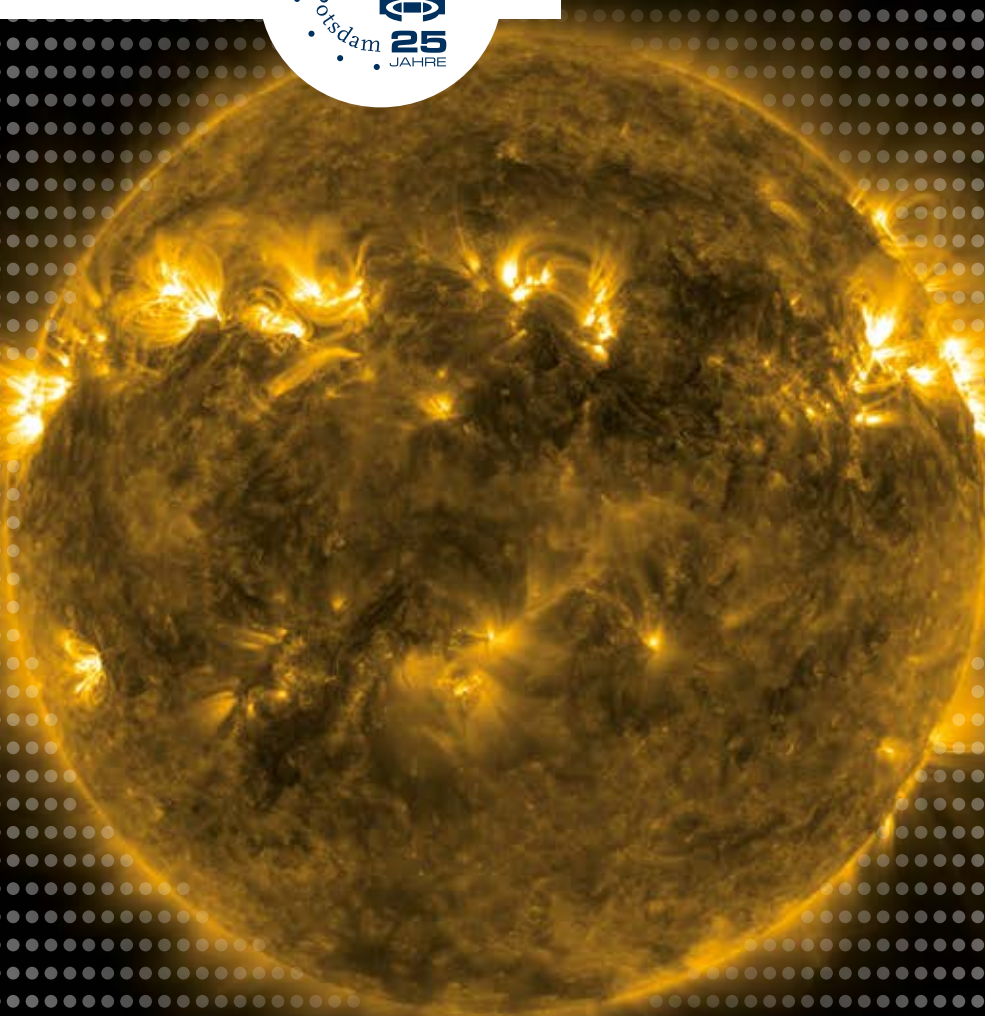


Portal Wissen

The Research Magazine of the University of Potsdam

One 2016





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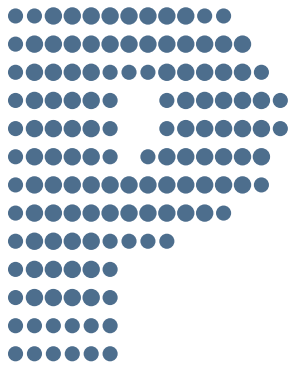
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A point is more than meets the eye. In geometry, a point is an object with zero dimensions – it is there but takes up little space. You may assume that something so small is easily overlooked. A closer look reveals that points are everywhere and play a significant role in many areas. In physics, for example, a mass point is the highest possible idealization of a body, which is the theoretical notion that the entire mass of a body is concentrated in a point, its “center of mass”.

Points are at the beginning (starting points), at intersections (pivot points), and at the end (final points).

A point symbolizes great precision. There is a reason we “get to the point”. In writing, a point abbreviates, structures, and finalizes what is said. Physicians puncture, and athletes collect points on playing fields, courses, and on tables.

It’s no wonder that researchers are “surrounded” by points and work with them every day: Points bring order to chaos, structure the unexplained, and name the nameless. A point is often the beginning, an entry to worlds, findings, or problems.

Points are for everyone, though. German mathematician Oskar Perron wrote, “A point is exactly what the intelligent yet innocent, uncorrupted reader imagines it to be.” We want to follow up on this quotation: The latest edition of *Portal Wissen* offers exciting starting points, analyzes points of view, and gets right to the point.

We follow a physicist to the sun – the center point of our solar system – to ponder the origin of solar

eruptions. We talked to a marketing professor about turning contentious points into successful deals during negotiation. Business information experts present leverage points that prepare both humans and machines for factories in the age of Industry 4.0. Enthusiastic entrepreneurs show us how their research became the starting point of a successful business idea – and also make the world a bit better. Geoscientists explain why the weather phenomenon El Niño causes – wet and dry – flashpoints. Just to name a few of many points ...

We hope our magazine scores points with you and wish you an inspiring read!

THE EDITORIAL TEAM



Weather in Space

Physicist Bernhard Kliem researches solar eruptions

Photo: Courtesy of NASA/SDO and the AIA, EVE, and HMI science teams

They regularly appear and disappear on the Sun's surface – sunspots indicate how active the star is. The 11-year solar cycle of the Sun includes periods known as solar maxima – during which many sunspots are visible – and solar minima – with few sunspots. Large sunspots indicate spectacular events that can be connected with enormous coronal mass ejections. Researchers are trying to more accurately predict such activity because it influences space weather, which also affects Earth. Bernhard Kliem researches the physical processes triggered by solar eruptions at the Institute of Physics and Astronomy. The Sun's magnetic field plays a decisive role.

Non-experts may see only white and black spots unevenly distributed on a grey background, but Bernhard Kliem recognizes patterns in these spots, which reveal something about solar activity and impending solar storms. On his monitor is the star's surface, a map of the magnetic field the researcher is studying. The spots that particularly interest the physicist look rather un-spectacular. In reality, these spots indicate that dramatic processes are taking place on and in the Sun: immense electromagnetic forces that sometimes discharge in solar eruptions. Kliem researches their formation.

The researcher uses images that are mainly taken by the NASA Solar Dynamics Observatory (SDO). The space probe has been measuring the Sun's radiation, magnetic field, and vibration in geostationary orbit since 2010. These freely accessible data enable various examinations of solar processes worldwide that are important for our "living with a star".

"The Sun is in a so-called plasma state, the fourth state of aggregation," Kliem explains. Its core has an unbelievable temperature of unbelievable 15.6 million degrees Kelvin and a pressure corresponding to the weight of the Cheops Pyramid on a pinhead. This is where the nuclear fusion of hydrogen nuclei into helium occurs, which releases gigantic quantities of energy. Electrons are separated from the nucleus due to the enormous heat. "The electrical forces between positive and negative particles produce a gas that behaves like a highly conductive electrical liquid," Kliem explains the specifics of the plasma state.

The energy initially created internally is emitted in the form of light particles and is then radiated out into space from the Sun's surface, which is relatively cold at approximately 6,000 degrees. In the in-between convection zone (the Sun's outer third), however, so-called convective energy transport dominates, in which energy is transported through flux. "The principle is the same as in a kettle," Kliem explains. The plasma heated from below rises, cools, and sinks back towards the core, where it is reheated and rises again. "Since the plasma is electrically conductive, these fluxes lead to a dynamo effect that creates the solar magnetic field," the scientist continues. This is the basis of his research because the magnetic field and the motion of plasma matter are coupled.

The magnetic fields primarily in the Sun's interior sometimes expand to the surface and become visible as sunspots, usually as a pair with opposite polarity. Strong magnetic fields suppress convective energy transport. The surface temperature is a few hundred degrees lower in these areas than in the surrounding area, as evidenced by the characteristic dark spots. In contrast, it is especially hot in the corona above sunspots – i.e. in the solar atmosphere. Researchers call this phenomenon coronal heating, which ensures that the temperatures above the Sun's surface rise again, to over a million degrees – so high that the corona expands. The resulting solar wind – the outflowing of plasma and the magnetic field – fills the interplanetary space. "How exactly coronal heating works is still a mystery," explains the physicist. Researchers know that the magnetic field and its oscillation seem to spur this process. It forms a kind of tunnel system that channels internal energy outward into the corona.

“How exactly coronal heating works is still a mystery.”

Powered by the convection inside the Sun, the magnetic field is subject to constant change. Sunspots, for example, expand to become several times greater than the diameter of Earth and then disintegrate into increasingly smaller fragments; this may take anywhere from several days to several months. Also changing are the magnetic arches that connect positively and negatively polarized sunspots and form an "active region" in the corona. The arches act as magnetic bottles. The trapped hot plasma becomes visible in UV and X-ray images. They can, however, also capture cooler plasma of "only" 10,000 degrees Kelvin, which then floats majestically as a solar prominence in the red light over the solar limb, against the immense gravity and held together by electromagnetism.

A changing magnetic field induces electric currents in plasma. These currents contribute to the energy stored in the active regions. If this exceeds a critical value, the balance of forces becomes unstable. Any small disturbance then results in the accumulation of dramatic electromagnetic forces – which convert the stored magnetic energy like in an explosion into kinetic energy – as well as the conversion of heat of up to 100 million degrees and radiation ranging from radio waves to gamma rays. The magnetic compounds in the active region are virtually

THE PROJECT

The research project **"Triggering Solar Eruptions"** investigates the physical processes that lead to solar eruptions.

Participating: University of Potsdam, Institute of Physics and Astronomy

Funding: German Research Association (DFG)

Duration: 2014–2017



torn apart by the eruption. Such solar prominences and their surrounding hot plasma are often ejected into interplanetary space at 300–3,000 km/second. There they expand into plasma clouds, many times larger than the Sun and spread throughout the solar system, temporarily intensifying solar wind. This can cause serious disturbances when they hit Earth between one and three days later.

Kliem uses a method with the complicated name of magnetohydrodynamics to analyze the Sun's plasma, magnetic, and energy flows. A computer-based model displays the development of the magnetic field in complex calculations and allows him to draw conclusions on the ongoing plasma movement and electricity flows. Kliem investigates the interaction of hot plasma and the magnetic field using numeric simulations.

"This region might be able to trigger powerful eruptions," Kliem explains, pointing to the magnetic field map on his monitor. It shows SDO pictures from October 2014. At this time, the Sun was at a peak of activity. The Sun's surface begins to appear in slow motion – the short film shows one image per hour. The characteristic spots are visible on the left margin of the Sun, an entire sunspot group that seems like it is slowly moving to the right margin due to the Sun's rotation. "Solar flares can occur near strong magnetic fields," explains Kliem. The motions of individual sunspots – whether rotating or moving past each other – provide the researcher with information on the stored energy and probability of an eruption.

“Solar flares can occur near strong magnetic fields.”

Active solar region, image taken by Solar Dynamics Observatory. Plasma particles make magnetic field lines visible.

Kliem's computer model simulates what happens to individual magnetic field lines in a solar magnetic field. The researcher is especially interested in a phenomenon he calls "torsion" (or "twisting"). Through the Sun's Coriolis force, ascending and descending plasma rotates – like low and high pressure areas on Earth. This rotation twists the embedded field lines. This becomes even stronger when sunspots rotate around their own center or around each other. "This means strong electric currents," says Kliem. He determines the threshold value for the instability of magnetic domains in his simulations, which is at about one and a half revolutions of the field lines around the axis of the bundle. If a solar prominence becomes trapped in the magnetic field, its delicate filament structures trace the path of a few field lines and, in some cases, allow for an estimate of the torsion. This often approximates the calculated threshold before an eruption. The smaller the remaining distance, the smaller the impetus – a disturbance from inside the Sun or an adjacent active region – required to trigger the eruption.

The torsion rate is not always high. Another instability must be at play in such a case, and this is what Kliem is currently researching. It is based on the force between the current through a solar prominence and the current passing between its base points inside the Sun, closing the circuit. Forces here mimic those of an electric motor. Solar prominences can lead to solar eruptions if they have risen high enough and the surrounding magnetic field can no longer hold them in the corona. There is, again, a threshold value that Kliem wants to determine exactly.

“Activity on the Sun ultimately determines space weather.”

The physicist “builds” the eruptions mathematically with models, gaining insight into their development – under what conditions they reach high speeds or move in a particular direction. These properties determine the strength of the geomagnetic disturbance if the mass ejection ends up hitting Earth. These models allow the researchers to better understand the necessary conditions for the so-called solar storms of space weather. Kliem tempers expectations for a reliable prediction model, similar to the daily weather report, because the triggering disturbances from the solar interior remain unpredictable. Nobody can see into the Sun’s interior. “In the coming years, we will have to sharpen our ‘ears’ for the Sun using helioseismology, which uses earthquake research methods,” explains Kliem.

The events that the researcher simulates with the model are 150 million km away from Earth. His research, however, has a very practical aspect for our existence. Activity on the Sun ultimately determines space weather. There is an increasing interest in improving forecasting because strong solar eruptions interfere with radio communication and satellite navigation on Earth, affecting civil and military aviation and maritime transportation. They can damage satellites and, in extreme cases, even destroy transformers in extensive power grids, especially ones at high latitudes.

The plasma clouds rushing towards Earth create the alluring phenomenon of the aurora borealis. Earth’s mag-

netic field first acts as a protective shield, guiding the plasma around Earth. On the “night side” of Earth, the compression of the magnetotail accelerates the charged particles moving along the magnetosphere’s field lines towards Earth. Wherever the magnetotail’s flux lines penetrate the atmosphere – near the North and South Poles – the accelerated particles collide with nitrogen and oxygen molecules in the atmosphere, which ionize and trigger glowing. These energetic interactions brighten the night sky with an impressive play of colors – a very special greeting of the Sun.

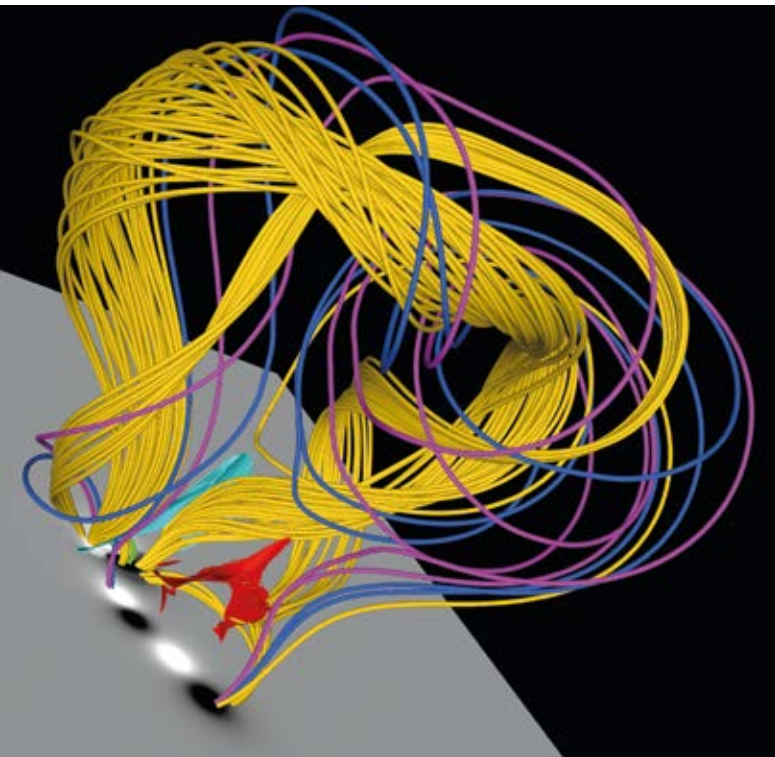
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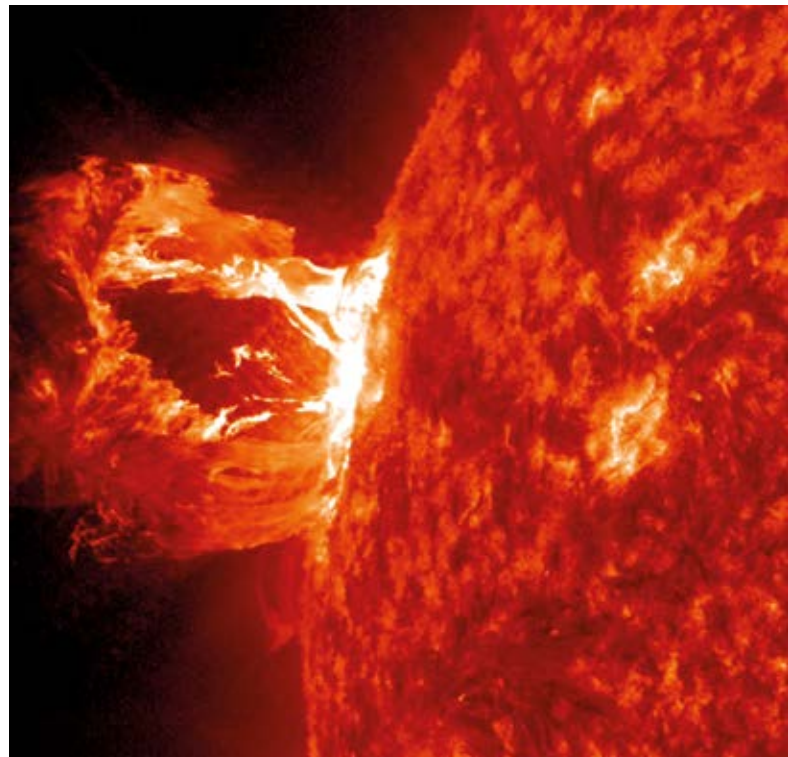
THE RESEARCHER

Dr. Bernhard Kliem studied physics at Humboldt-Universität zu Berlin and has conducted research at the University of Potsdam since 2010. His research interests focus on solar activities and the principles of plasma physics.

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Researchers simulate solar eruptions with computer models and calculate the acting forces.



Prominence eruption, huge amounts of plasma burst into space, taken by Solar Dynamics Observatory.

No Lame Compromises

Negotiation expert Uta Herbst researches and teaches at the Negotiation Academy at the University of Potsdam

“Negotiating is like playing the piano,” Uta Herbst says with a laugh. “If you practice long enough, you will get good at it.” Her laughter is contagious, convincing. Herbst knows what she is talking about. She is Professor of Marketing at the University of Potsdam. Negotiation management, a subject that used to receive very little attention in Germany, is one of her main topics. Herbst has made negotiating into a management issue – and an object of research. After becoming a professor at the University of Potsdam she was able to make a dream come true. In 2013, she founded the Negotiation Academy Potsdam (NEP), which has since become an ideal platform for negotiation research – and for the publication of its results.





The person who starts negotiating has often a decisive advantage.

“You can learn how to negotiate, but you also have to practice it.”

“You can learn how to negotiate,” Herbst says. “If you want to negotiate successfully, you should be well prepared. It is said that 80% of the effort should go into preparation and only 20% into the actual negotiation itself. You also have to keep your interests in mind at all times – and be open to alternate ways of reaching them. Those who stubbornly insist on their position may miss out on a better deal. Be an active negotiator, since the person who puts things on the table steers how things develop.” There are, however, ultimately no hard and fast rules for successful negotiation, the researcher adds. “You can learn how to negotiate, but you also have to practice it.” She practiced what she preached. After all, she found her current research in-

terest somewhat by coincidence, as she mentions confidently. She was neither a natural-born negotiator, nor did she find negotiating easy at first. “Originally, I was a communication scientist and for quite some time toyed with the idea of becoming a journalist,” she says. “But then I realized that I am more drawn to shaping events than to reporting on them. So I turned to marketing.” During her doctorate in industrial marketing she researched how business clients, two firms for instance, negotiate. “I noticed that in business administration – and in practice, too – negotiations were considered a management-free zone,” the researcher explains. “The perception was ‘Negotiations happen between two people; this cannot be managed anyway.’ So it was left to the negotiating skills of the individual.” Studies point out that companies miss out on up to 30% of revenue opportunities as a result. But we have seen a paradigm shift over the last five years or so: Companies have begun training their staff to become better negotiators.

While Herbst very quickly found out that she wanted to stay in negotiation management after finishing her doctoral thesis, she ended up taking a position in a company: “After I received my doctorate, I was hired by BASF to work in procurement. They may have thought that someone who had researched negotiation management was a good negotiator, too,” she says with a laugh. “From my current perspective, I would say I could have done better. But I was always well prepared – and thus no worse off than anyone else.”

In the end, her passion for research won out, and she returned to academia when the opportunity arose. She held junior professorships at the European Business



THE RESEARCHER

Prof. Dr. Uta Herbst studied communication sciences at the University of Hohenheim, where she also did her doctorate on preference measurement in industrial negotiations. She has been Professor of Marketing at the University of Potsdam since 2012, Director of the Negotiation Academy Potsdam since 2013, and Director of Potsdam Transfer since 2014.

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School Oestrich-Winkel and at the University of Tübingen, and was offered the Marketing Chair at the University of Potsdam in 2012. Within a very short time, negotiation management became the focus of her research and part of her lectures.

But how can negotiating be taught – and learned? “Ideally through coaching, in group seminars, where you not only learn approaches and techniques, but can also practice,” Herbst says. Classes focus on various negotiation situations and how to react to them. For instance, is the negotiation only a matter of money, or is the deal more complex? Is a person negotiating or a group? Do you meet at eye level, or is the negotiation power distributed unevenly? Even reading studies on the subject can help to improve negotiation performance, and the learning curve is steep: “You learn quickly at the beginning,” the researcher says. “The results of a trained newcomer do not necessarily differ much from those of an old pro.”

The students she has introduced to the world of negotiating prove the point. In the nationwide negotiating competition “Battle of Universities”, which Herbst helped establish in 2008, Potsdam student teams unsurprisingly took the top two positions in 2013. In early 2015, she launched a competition – open to anyone from Berlin and Brandenburg – to test and demonstrate their negotiating skills. Here, too, a University of Potsdam student climbed the winners’ podium, shoulder-to-shoulder with experienced company founders, doubly confirming that negotiating can be learned. “In general, men feel more comfortable negotiating than women – and also do better on average,” Herbst says. The reasons might be explained by the so-called “five factor model” of personality psychology, which classifies everyone into five dimensions: neuroticism, extraversion, openness to experience, conscientiousness, and agreeableness. “On average worldwide, women are less extroverted than men, more neurotic, and more willing to compromise. That is why they negotiate less frequently and perform more poorly.”

Not least of all, Herbst wants to use the new competition to demonstrate that this is not inevitable, and negotiating skills are not a question of character. She never misses an opportunity to reinforce her point: “You have to understand what negotiating is all about – conflict resolution. Striking a deal that works for both sides does not mean rushing and meeting in the middle,” the researcher says. “This would bypass the actual task and too often result in a lame compromise.” She seems completely in her element when saying this. The challenge is instead to tease out the interests of the other side and make your own interests clear without laying all of your cards on the table. “Many are too quiet in negotiations, ask too few questions, and wait too long. But the anchoring theory, for instance, suggests that the person who makes the first offer in negotiations is at a clear advantage because the negotiation will develop from this offer.”



Because Herbst is a researcher, she wants not only to teach, but above all to research and develop the field of negotiation management. Role-play scenarios, like the competition mentioned above, offer experiment-like conditions for its development. Better yet is looking at what is going on in the business world, since it more closely reflects reality and is very similar to field studies. “Sales documentations of companies offer the best possible data sets for our research projects,” she says. “We, all the while, support companies in effectively improving their negotiation results. Companies we cooperate with increase their profits by up to 10%.”

At the moment, Herbst and her team are studying individual negotiating styles. They focus on how authentically people act in negotiations – and what needs to be done to succeed. “Our findings indicate that you can be as inauthentic as you want,” the researcher says with a laugh. “All that matters is that you are perceived to be authentic.” A second project focuses on concession management, i.e. the way people make concessions and demands. Another core theme of the Chair is researching negotiation objectives and how certain objectives affect negotiations. “It is like in professional sports,” Herbst states. “A long jumper who can jump 8 meters should also set his sights as high as possible and not be satisfied with 7.5 meters. In practice, this is often not yet the case. Because companies often work with reservation values, or minimum margins, they end up staying around their lower limit. We research which objectives are most expedient.”

“ In general, men feel more comfortable negotiating than women – and also do better on average. ”



A particularly interesting point in negotiation management is the issue of outsourcing. Of course, knowing your interests and objectives very well is important in being able to assert them in negotiations, but when you

“As early as at the age of six, children possess a sophisticated arsenal of negotiating strategies.”

are too closely involved, you are probably not good at negotiating, Herbst knows. “Often the general manager, for instance, is too involved, also emotionally, and should leave the actual negotiations to others, for instance a business consultancy or a trustworthy business partner.” Incidentally, this can also create a situation, in which women negoti-

ate better than men – when negotiating about something they are actually not much interested in: buying a car, for instance. “An experience I have had in my own family,” she adds with a laugh.

Herbst is a very curious person, so she never switches off her interest in negotiation research, even at home. As a mother of three, knowing about the secrets of successful negotiation sometimes helps her to cope with her daily life, too. “My oldest son is six and does a lot of haggling with me,” she says with a smile, “but as a matter of principle we do not negotiate pedagogical issues. I always say: ‘Here the negotiating power is clearly with mummy and daddy!’” Nevertheless, she is sure that children are also very interesting subjects for negotiation research. For instance, two year olds “negotiate” in only two apparently primitive ways: batting their large eyes or screaming. Both methods are also very common among “grown-up” negotiators, where they are referred to as push and pull strategies: threatening and flattering. As early as at the age of six, children possess a sophisticated arsenal of negotiating strategies. “In one of my next projects I want to have a closer look at them!”

There are many more issues Herbst would like to explore; negotiation research has many unexplored niches. This is why in 2013 she founded the Negotiation Academy Potsdam (NAP), Germany’s first institution focusing on negotiation research. It brings together research and business in the field of negotiation management and communicates its topics to the public. NAP rests on three pillars: research, executive education, and academia and practice. The first pillar bundles the results of negotiation research at the University of Potsdam and beyond. The majority of German-language publications on negotiation research appear in the NAP’s new monograph series. Successful papers and conference contributions indicate that the NAP is already firing on all cylinders. The transfer of the results into practical negotiation work forms the second pillar of the Academy. In addition to seminars at the University of Potsdam, Herbst and her team organize numerous other seminars for students in MBA programs, members of the Academy, and individual companies. Herbst also takes the liberty of holding annually two seminars, in which she focuses on gender aspects of negotiation management – her “personal interest”, as she says. Under the third pillar, the NAP initiates the exchange between academia, business, and politics as well as interested citizens regarding the theory and practice of negotiation. For instance, on the occasion of the opening of the NAP, Federal Minister of Finance Wolfgang Schäuble recalled the negotiations of the 1990 Unification Treaty, and in the autumn of 2015, chairman of the train engineers’ union GDL, Klaus Weselsky offered insight into the wage conflict with Deutsche Bahn. Starting in 2016, the NAP will award its Negotiation Medal biannually to superior negotiation experts.

“By doing this, we hope to promote negotiation research – and showcase what we are working on here in Potsdam,” Herbst says. “Our learning curve has been extremely steep; we have established contacts to many researchers and companies and pushed many things forward, but I think we will have to work very hard for another two years. After all, we want to make NAP the top place to do negotiation research in Germany.” Again, she is setting her sights as high as possible.

MATTHIAS ZIMMERMANN

The **Negotiation Academy Potsdam** was founded in 2013 by Prof. Dr. Uta Herbst, Professor of Marketing at the University of Potsdam. The objective of the Academy is to put the latest results from negotiation research into practice. In its activities, the Academy promotes a holistic understanding of negotiation as a management process. In addition to negotiating, it also focuses on upstream and downstream management tasks.

✉ <http://negotiation-academy-potsdam.de>

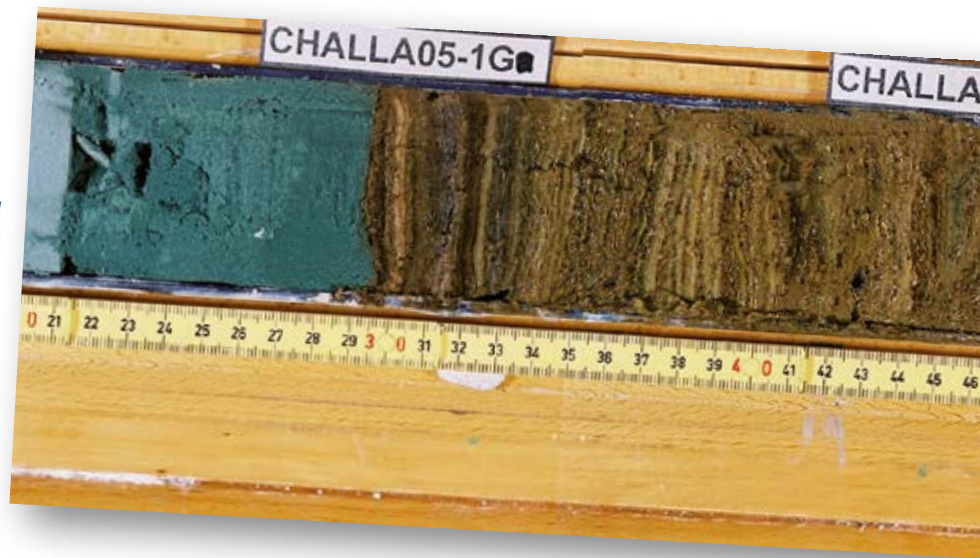
Here It Comes Again

A strong El Niño is wreaking havoc on the world climate. Potsdam researchers have been studying the phenomenon for some time now.



El Niño causes floods as well as droughts.

Heat, drought, flooding, record rainfall, and wildfires – the weather phenomenon El Niño affects various regions of the world in different ways. Climate models forecast a particularly strong El Niño this winter. While heat and drought are expected to afflict mainly the northern part of Australia and Indonesia, South America will face flooding and landslides. At the University of Potsdam, several working groups are researching the weather anomaly, which will likely increase in intensity and frequency in the coming years.



Pale and dark lines alternate, forming irregular patterns resembling the striped fur of an animal or the grain of wood, but in fact are the result of sedimentation. Over thousands of years, dead organic matter and chemical compounds trickle down through the water column to the bottom of a lake, where they form a thick layer. For climatologists and geoscientists, this sediment layer is a treasure trove.

Much like ice cores or tree rings, sediment at the bottom of a lake contains information about past climate events. Researchers can read these climate archives like books and learn about extreme droughts, rising temperatures, and exceptional precipitation events. The El Niño phenomenon regularly leaves its mark here as well. El Niño occurs every two to eight years – not more than the blink of an eye to

climatologists and geoscientists. “To analyze the data, we need climate archives with a very high resolution,” says Christian Wolff, a geoscientist at the Institute of Earth and Environmental Sciences, who is intensively studying the phenomenon.

Researchers in Kenya found a climate archive of this quality at the foot of Mount Kilimanjaro. Lake Chala is a crater lake with sediment layers displaying every single El Niño event, since its impact is enormous here, too. In southern Kenya, most of the around 500 millimeters of average annual rainfall occurs in November and December. In El Niño years, the amount of rainfall in these months sometimes triples, with extreme consequences for the population.

“ In El Niño years, the amount of rainfall in these months sometimes triples.”

Potsdam researchers at Lake Challa.



Photo: Opatz, Stephan (2)



Cross section of a drill core.

In 2005, researchers obtained a drill core from the bottom of Lake Chala. Drilling at depths of up to 25 meters, they collected two 2-meter long sediment cores, sealed them, and transported them to Germany. They are now being kept shrink-wrapped at 4°C in the cold store of the German Research Center for Geosciences (GFZ) in Potsdam. The bottom layers of the core are about 25,000 years old. Many researchers use this archive to study various issues. Wolff uses it to study the history of El Niño.

Under a microscope, the researcher measures the thickness of the dark and pale layers. Centimeter by centimeter, he examines the sediment layers of the past 25,000 years, a time-consuming task requiring great diligence and days of microscope work. “It takes about four hours to examine 100 years,” Wolff says. He evaluates the collected data statistically and looks for correlations between layer thickness and surface temperature of the Pacific Ocean, which the data confirm.

One darker layer and a paler one make up a so-called seasonal year. “The dark stripes in the sediment result from the depositing of calcite during the months with higher precipitation, whereas the paler layers were formed during the dry months – from the remains of dead diatoms,” Wolff explains. The thickness of the layers indicates how wet or dry a year was. Broader stripes were formed in dry years, when strong winds raised nutrients from the bottom of the lake and the water was hardly diluted by rainfall. Due to the abundance of food, strong seasonal algal bloom occurred. Once

dead, the algae sank to the bottom of the lake, where they formed thicker, pale sediment layers over time. In contrast, El Niño years starve the algae out, since a lot of rainfall dilutes the lake water, diminishing the algae bloom and leaving behind a much narrower, pale layer in the sediment.

“Centimeter by centimeter, he examines the sediment layers of the past 25,000 years.”

Photos: Wichura, Henry (top right); Hanf, Franziska (center right); Fer, Istem



THE RESEARCHERS

Dr. Christian Wolff studied geosciences in Trier and earned his doctorate in Potsdam. At the Institute of Earth and Environmental Sciences, he researches climate change over the past 25,000 years using geoscientific methods.

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Franziska Hanf studied meteorology at Berlin’s Free University and is currently doing her doctorate at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research and at the University of Potsdam. Her focus is on the variability of the South Asian summer monsoon and humid-dynamic processes of monsoon interruption phases as well as the effects of atmospheric aerosols on the climate in Southeast Asia.

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Istem Fer studied molecular biology, genetics, and computer science in Istanbul. In her doctoral thesis she is researching changes in the vegetation of East Africa over the past millennia in relation to climatic factors.

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In a next step, the researchers examine the isotope distribution of oxygen in the calcite. They found that the composition of the calcite in Lake Chala correlates with the surface temperature of the Pacific Ocean – on the other side of the earth – and enables researchers to reconstruct historical temperatures and El Niño events.

The analysis of these lake sediments sheds light not only on when El Niño events occurred, but also on their intensity. It has become clear that over the past 3,000 years – considered warm years in terms of climate history – El

“ It can, therefore, be expected that global warming will contribute to a larger number of strong El Niño and La Niña occurrences. ”

Niño has not only appeared more often, but has also been stronger than during the last glacial period, some 18,500-21,000 years ago. An overall relatively warm world climate seems to facilitate particularly severe effects of the weather anomaly, such as extreme flooding or sustained drought, whereas a comparatively cool world climate seems to curb them. The same holds for the opposite

of El Niño, the La Niña phenomenon, which often immediately follows an El Niño, with the opposite effects. It can, therefore, be expected that global warming will contribute to a larger number of strong El Niño and La Niña occurrences, Wolff points out.

Other researchers are using the knowledge gained from looking back into the climatic past to make forecasts and concrete recommendations for action, which is known as climate modeling. To generate meaningful climate models for various scenarios, researchers rely on data produced by specialists like Wolff.

Doctoral student Franziska Hanf is researching precipitation in collaboration with researchers at the University of Potsdam and the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research. Her simulations explore the Indian subcontinent and the adjacent Indian Ocean. The meteorological data Hanf feeds into her model are provided by the European Centre for Medium-Range Weather Forecasts (ECMWF). These global weather data – such as temperature, humidity, wind, and air pressure – result from analyses of ECMWF calculation models based on observation data. In this way, meteorological data not accounted for – because of the limitations of the global



Lake Challa.

Photo: Verschueren, Dirk

measuring network in the region – can be computed and made available. Hanf’s regional climate model runs on these data.

A key input variable is the surface temperature of the Pacific and Indian Ocean. Here is where El Niño comes into play. “The temperature of the Pacific Ocean influences the Indian Ocean and vice versa,” the researcher says. This affects the amount of precipitation in the Indian subcontinent. Below-average summer monsoon rainfall tends to lead an El Niño event. Analyses show further, that extended droughts over India tend to occur more frequently during El Niño years. With the help of her model, Hanf can calculate the volume of rainfall for various regions of India – based on the surface temperatures of the Oceans and other weather data. Although her simulations do not allow for making projections, since they use current and past meteorological data, they are an important milestone in better understanding the complex interrelationship of ocean and atmosphere in the South Asian monsoon system and its variability over time.

At the Institute of Biology and Biochemistry, Istem Fer is studying El Niño from a third perspective. As a member of its working group on vegetation ecology and nature preservation, the doctoral student is researching how a changing climate and El Niño affect the East African vegetation. She also uses a computer model, which shows how the vegetation develops depending on the climatic conditions. “East Africa is quite arid, since the mountain chains in the east prevent the humid air from the Atlantic Ocean from coming in,” Fer explains. Forests cannot grow under such conditions. The region is instead characterized by savannas, i.e. grassland scattered with shrubs and isolated trees.

Based on pollen data and up-to-date vegetation maps, Fer can verify whether the results produced by her model match reality, both in the past and present. Once she has calibrated her model to carry out correct simulations, she will be able to test various future scenarios. For instance, what will happen if more frequent El Niño occurrences cool and humidify the East African climate? Which plant species will benefit and which ones will be pushed aside?

The answers Fer hopes to find with her model are vital for the people living there. Farming in the region has primarily consisted of animal husbandry, since the savanna provides ample grazing for cattle. Should the grassland turn into shrub land, farmers will also have to adapt.

“The aim is to build up an early warning system,” Wolff says of the overall objective of the research projects. “Once we understand the entire system and can put the pieces together, such a warning system will be within reach.”

HEIKE KAMPE



ENSO (El Niño/Southern Oscillation)

The pattern repeats every two to eight years: The southeast trade winds in the Pacific Ocean that normally push warm surface water towards Southeast Asia and Australia, thus facilitating the influx of cold, nutrient-rich deep water off the west coast of South America, die down or decrease. The pool of warm water that has built up near Indonesia swashes back to the South American coast, and the cold Humboldt Current weakens or ceases. This phenomenon is referred to as El Niño – the Child Jesus. It is a phase of the **El Niño Southern Oscillation (ENSO)**, a coupled circulation system between the ocean and the atmosphere. El Niño is generally followed by La Niña, when particularly strong trade winds push the warm surface water back to the west coast of South America. The consequences of the change of sea currents are also felt onshore: Instead of abundant monsoon rain, El Niño brings aridity to Southeast Asia, while South America may experience extreme precipitation with flooding and landslides. La Niña, on the contrary, causes flooding in Southeast Asia and droughts in South America. Weather patterns in other parts of the world are also shifting. The causes of the El Niño weather anomaly are not yet completely understood.

“The aim is to build up an early warning system.”



CULTURES OF INTELLIGENCE

How nations see their intelligence agencies

The first spy novel was published in 1903. "The Riddle of the Sands" by Irish author Robert Erskine Childers is the story of a young Englishman who thinks he is being invited to go duck hunting at the German Baltic Sea. He and a former classmate are instead supposed to map the terrain for the United Kingdom, given that the Germans seem to be planning a war against the British. The novel's initial publication excited more than just literature enthusiasts; the British Admiralty supposedly established three naval bases, and the German Empire removed a stone wall near Norddeich to prevent the British from taking cover behind it in case of war.

The research project “Cultures of Intelligence” analyzes the connections between pop culture representations of intelligence agencies, and their actual practices. “We focus on the cultural-historical discourse in literature, film, and mass media,” says military historian Prof. Sönke Neitzel. The project also offers insight into the unique features of intelligence cultures in Germany, the UK and the US. Since 2012, the research group has been investigating the development of military intelligence agencies from 1880/90 to 1947. Three PhD students are using cultural records to compile the specific national characteristics of this time. The Gerda Henkel Foundation has extended the research project’s funding for another year.

“Secret service is the world’s second oldest profession,” says Neitzel. Although secret coded information was communicated as far back as antiquity, knowledge was limited before globalization. Until the 19th century, individual experts gathered specific information for emperors and chancellors. According to Neitzel, modern intelligence agencies resulted from the profound changes brought about by industrialization. “Modern intelligence structures came into being as the steamship, telegraph, and mass media began making the world tangible at the end of the 19th century.” Intelligence agencies had to technologize and to professionalize to keep pace with the explosion of knowledge and were thus tasked with collecting, analyzing, and exploiting information.

Research has shown that there are indeed nationally specific intelligence cultures. The US clearly lagged behind in the initial development stage; only during the Second World War did it begin concentrating on it. “American intelligence really only took off upon entering the war in 1941,” Neitzel says. After the war, the US actually founded central agencies like the National Security Agency (NSA) and the Central Intelligence Agency (CIA) as non-military, civil institutions. At the same time, dozens of secret service agencies were being established, albeit with a weak central command. As a result, the various intelligence agencies still sometimes compete with each other rather than collaborating.

T.E. Lawrence was not only a British officer but also a secret agent.

The British, on the other hand, were secret service pioneers and Neitzel sustains the view that “nowhere else is espionage as popular as in Great Britain”. A former head of MI6 (Secret Intelligence Service) once referred to his Cold War espionage activities as “great fun”. The British, according to Neitzel, developed their own form of showmanship regarding intelligence; espionage was – and remains – elegant and “cool”.

Germany, however, has a “non-intelligence” culture. “Spies are un-German” is a topos in public discourse. The German intelligence agency is considered technically excellent abroad, but the British have repeatedly circulated rumors that Germans are incapable of keeping secrets. “Consequently, spy novels are virtually irrelevant in Germany,” Neitzel explains. The few that were written are considered trashy novels. “Spy Today – Die Tomorrow” starring Lex Barker – the only film about the German Federal Intelligence Service (BND) from the 1960s – flopped. “Germans prefer watching James Bond.” A popular espionage culture failed to take off in Germany during the German Empire and between the world wars. Neitzel speculates that pop culture probably only discovered the topic of “secret service” during the Cold War. “Further research on post-1947 would be necessary to confirm this thesis,” says Neitzel. In this respect, continuing the research project would make a lot of sense.

“British intelligence is embedded in a broader culture,” says the historian. Espionage literature is read in colleges, and intelligence is part of general cultural education. In Germany, however, novels like Ernst Jünger’s *In Stahlgewittern* (Storm of Steel) are among the canon on war, but there is certainly nothing on intelligence. Neitzel deduces various military-cultural “footprints” from this: German warfare sought out decisive battles like against France at Sedan in 1870. It was about the probation of “man” in combat. The British, on the other hand, traditionally waged long wars and favored blockades in their many confrontations with the French. “Great Britain used indirect warfare. In Germany, you received military recognition for lying in the trenches.” Germany’s obses-

“Secret service is the world’s second oldest profession.”

THE PROJECT

Cultures of Intelligence: Research Project on Military Intelligence Services in Germany, Great Britain, and the USA, 1900–1947

Supervised by: Prof. Sönke Neitzel, University of Potsdam; Prof. Philipp Gassert, University of Mannheim, Prof. Andreas Gestrich, German Historical Institute London

Funding: Gerda Henkel Stiftung

Duration: 2012–2016

sion with the perfect battle actually continued until the Cold War. A successful career in the German military required the commanding of forces, whereas in Britain, this could also be achieved in intelligence. “The British thought of wars as more complex than the Germans did,” so Neitzel. This also reflects the organization of the general staff: British military culture prioritized logistics (the distribution of material and human resources), followed by intelligence and operation (i.e. the leadership of the frontline troops). German generals, however, rated these areas completely differently, prioritizing operations, then logistics, and finally intelligence. Neitzel and his fellow researchers assume that military traditions developed both within the military as well as externally. Explaining this relationship methodologically, however, is difficult. “While we are able to describe the discourse, proving an interaction between society and the military is extremely difficult.”

“ *The British thought of wars as more complex than the Germans did.* ”

Whereas British spies and agents diligently write memoirs, this is uncommon in Germany. Although Reinhard Gehlen, founding president of the BND, published his memories in the book *Der Dienst*, his work did not have widespread impact. Germans learned that they had been wiretapped long after the end of the First World War from memoirs of British spies. With the information



THE RESEARCHER

Prof. Dr. Sönke Neitzel studied Medieval and Modern History, Journalism, and Political Sciences at Johannes Gutenberg University Mainz. He taught and researched at the universities of Mainz, Glasgow, Karlsruhe, Bern, Saarbrücken and the London School of Economics and Political Science (LSE). Since October 2015, he has been Professor of Military History/Cultural History of Violence at the University of Potsdam.

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explosion of the 19th century, the targeted collection and production of knowledge became increasingly important for national policy. The handling of collected information remains problematic, as shown by the wiretapping techniques of the NSA and other intelligence agencies. “The research project is, therefore, more topical than we initially thought.”

Whether an intelligence agency only collects information or also uses this information to write reports representing the interests of state institutions varies from country to country. “The British are mainly col-

Headquarters of the Bundesnachrichtendienst in Berlin.



Prof. Sönke Neitzel.

German military personnel. In the eyes of Professor Neitzel, the “British were extremely successful in making the Germans ‘sing’”. This raised the question of why the Germans were unable to do the same. The Germans even bugged their own interrogators – and not the interrogated. The historian asked British colleagues how they see this discrepancy. The British said that it was clear to them that Germany’s intelligence apparatus was not a shining beacon, citing the 1917 “Zimmermann Telegram”. This carelessly sent message was easily intercepted by British intelligence and contained “juicy” details of a proposed military alliance with Mexico, should the US enter the war. Speaking with his British colleagues led Neitzel to ask whether there is proof of a less pronounced culture of intelligence in Germany than there is in the UK. The Professor retains high hopes for the project: “Historians can contribute to recognizing problems in intelligence, which can have profound implications for politics.”

JANA SCHOLZ

lectors; the BND both collects and evaluates.” Which reports Chancellor Angela Merkel ultimately reads is, of course, unknown. Being a “knowledge taker” does not mean you have to be interested in every single intercepted radio message. Stalin initially did not believe intelligence information about a German attack that did indeed happen in 1941. Policymakers ultimately believe what they wish to, choosing certain information and disregarding other. Thus Neitzel emphasizes that no intelligence agency can predict the future

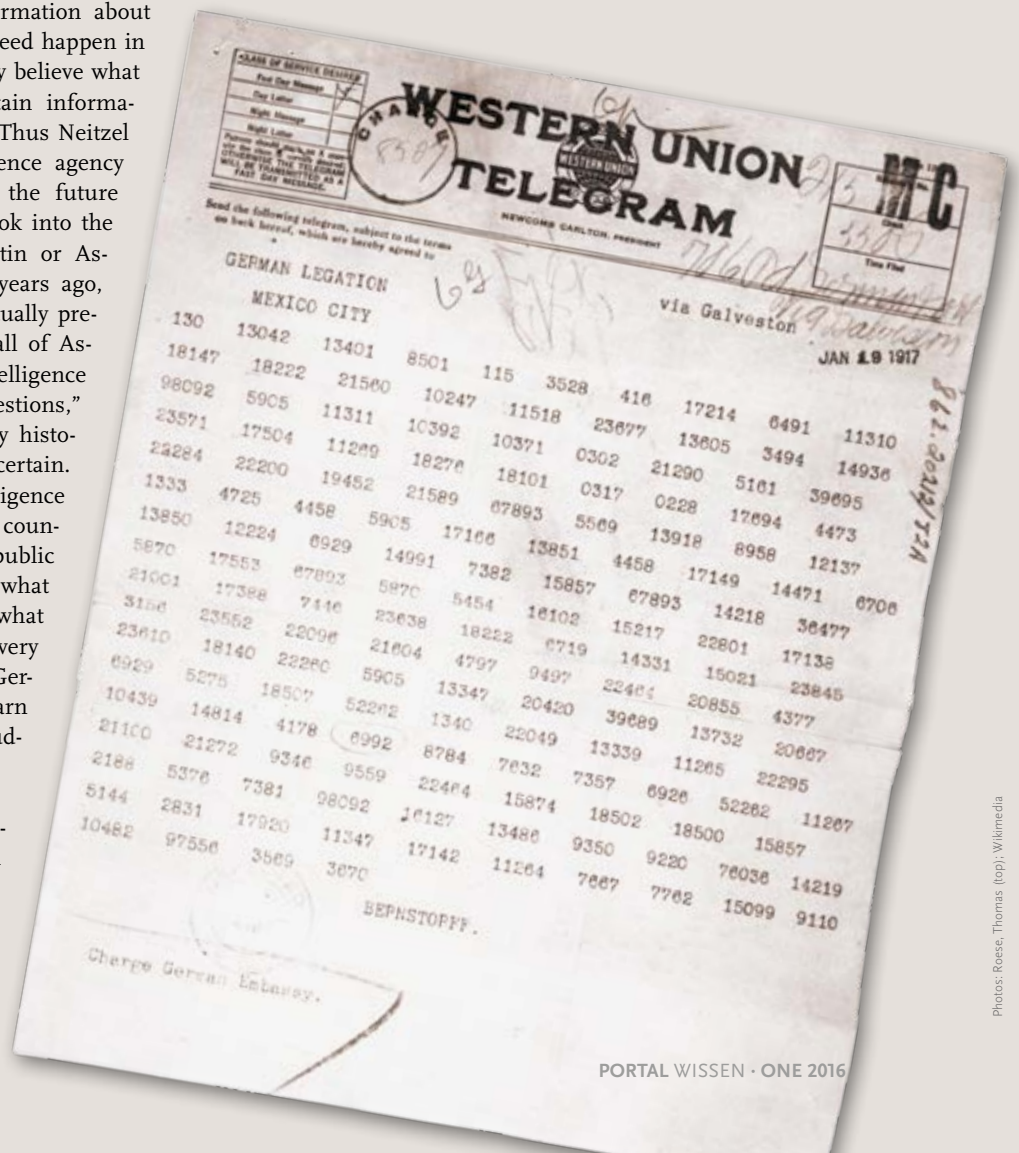
“The British are mainly collectors; the BND both collects and evaluates.”

or is able look into the mind of Putin or Assad. A few years ago, the BND actually predicted the fall of Assad. “No intelligence

agency can answer such questions,” says Neitzel. For the military historian, though, one thing is certain. “How policy translates intelligence into action also depends on a country’s culture.” The German public is “glaringly ignorant” about what an intelligence agency is and what it does. As a result, there are very few intelligence experts in Germany. In contrast, you can earn a degree in “Intelligence Studies” in the UK and the US.

Neitzel’s project on intelligence services resulted from his research on POW (prisoners of war) interrogations; studying transcripts of secret British and American wiretappings of captured

The encrypted “Zimmermann Telegram”, intercepted by the Americans on 19 January 1917.



Photos: Reese, Thomas (top); Wikimedia

The Transformation of the Factory

How Industry 4.0 brings human
and machine into dialogue

*The "Application Center
Industry 4.0".*

“Up to now, a workpiece in a factory has been ignorant. It does not know what it is, where it comes from, and whether it is important,” Norbert Gronau says. “This will change, and the factories of the future need to be prepared for it – above all the people working in them.” Norbert Gronau is Professor of Business Information Systems and Electronic Government at the University of Potsdam and is one of the pioneers in the digitalization of the economy, also known as “Industry 4.0”. He and his team are developing tools to prepare the employees of the factory of tomorrow for this future.

“In factories, more and more intelligent systems have knowledge of the production process and make decisions,” Gronau explains. “This transformation is at the heart of our project ‘Metamorphosis of the Factory’, ‘MetamoFAB’ for short.” The objective of “MetamoFAB”

“ The objective is quite simple: to facilitate human and machine to work hand in hand.”

is quite simple: to facilitate human and machine to work hand in hand or, in technical terms, “enabling individual entities to interact in a networked factory of cyber-physical systems”. Machines and robots have, to date, communicated mainly among themselves and not with humans, Gronau comments.

If they are able to make their own decisions in the future – say, a workpiece is to take precedence over other ones because it is more important or urgent – they will have to communicate this decision to those controlling the entire process: the staff. “A classical machine never has



THE RESEARCHER

Prof. Dr.-Ing. Norbert Gronau studied mechanical engineering and business administration at the Technical University of Berlin. Since April 2004 he has been a professor at the University of Potsdam. His main research interests

are business knowledge management and adaptable ERP systems.

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to explain anything. We have to enable robots to communicate and explain their actions,” Gronau says.

The “MetamoFAB” project, funded by the Federal Ministry of Education and Research (BMBF), unites several research institutions – including the universities of Potsdam and Stuttgart and the Fraunhofer Institute for Production Systems and Design Technology IPK in Berlin – with industrial partners – be they giants like Siemens, Infineon, or Festo or mid-sized companies like Pickert and Partner or budatec.



Simulated production line.

Prof. Norbert Gronau.



The human being is the focus of the Potsdam sub-project – operators and their role in Industry 4.0. In a factory with increasingly intelligent technical systems, the role of employees also changes. They no longer merely push buttons or insert workpieces, but have to control, repair, and decide. They become “flexibly acting troubleshooters,” Gronau says. “We have to meet operators where they are and prepare them for their new tasks.”

The first step is gaining acceptance, since not every staff member welcomes these new “colleagues” with open arms. “We have to avoid a situation where operators think: ‘Oh no, this robot is going to make me redundant!’ – because this will simply not be the case,” the researcher explains. “Many things will still have to be done by operators.” In a study on “acceptance of and adaptability to Industry 4.0”, Gronau and his team researched how firms can introduce digital transformation in such a way that their staff will embrace it. The results indicate that “a well thought-out and clearly communicated transformation concept is indispensable”. This means that the sooner and better the staff learn about their new roles, the higher the likelihood they will accept them – and acquire the necessary skills.

The Potsdam MetamoFAB project focuses on developing transformation concepts and the steps necessary to train staff. Researching knowledge-intensive business processes has turned out to be very helpful. “We have developed a method to quantify the share of theoretical knowledge in business processes,” Gronau says. Process models can be used to calculate what share of the knowledge – for instance in production processes

– comes from the staff and what share from machines as well as how they interact. MetamoFAB researchers are investigating how this ratio changes under the conditions of digitalization and what employees have to learn in order to fulfill their new roles. This will ideally be established for every staff member, since some will be operating robots while others will have to program them.

In a second step, the researchers are developing concrete training and qualification models for the established “requirement profiles”. “How can the staff best be trained? Certainly not by handing over 300-page manuals,” Gronau says with a smile. “There are at least two much better options: in a playful way with serious games or through ‘learning factories’, where they are trained and tested.” One such learning factory has been set up on the premises of Gronau’s chair on the Griebnitzsee campus: “Application Center Industry 4.0”. “Here we are now able to

“Employees become flexibly acting troubleshooters.”

Thanks to its versatility, “Application Center Industry 4.0” certainly has additional applications in store. While it has been used by the LUPO project as a simulation platform for new factory models and by MetamoFAB as a learning factory, Norbert Gronau has recently converted it into a laboratory for a new project: The German Research Foundation’s priority program “Intentional Forgetting in Organizations”, for which Gronau is a co-spokesperson, performs its experiments here.



The "Application Center Industry 4.0" can simulate production lines but also complete factories; it allows developing, testing, and, ideally, training work processes.

simulate what a factory will look like in five years and test various scenarios, from malfunctions and program changeovers to changing order situations," Gronau proudly states.

But the Application Center is more than the technical key component of the MetamoFAB research project. It was created in 2010 as part of the project LUPO ("Assessment of the performance of independent production objects") as a virtual production environment for the simulation of any number of production processes. The Application Center is still being used for this but is now also being used for additional purposes. Gronau and his MetamoFAB team have converted it into a universal interactive learning factory. The advantage is that it can be adapted to the specific needs of various industrial partners. "While some are focusing on an ever-deeper specialization, others are more diversified and thus interested in universally applicable automation solutions. We can simulate this in our model, down to the workplace level," Gronau says. Thanks to close collaboration with industrial partners, scenarios and qualification models are being developed "on the living object", so to speak. This allows researchers to test scientific methods under practical conditions while determining if and how they are applicable – and needed.

"Here we are now able to simulate what a factory will look like in five years."

"In fact, we are planning to commercialize these training units," Gronau says. "Perhaps through a spinoff. There is undoubtedly a huge demand for them. After all, companies can use learning factories to test future production scenarios and to train their staff accordingly."

MATTHIAS ZIMMERMANN

PORTAL WISSEN · ONE 2016

Rapid Bloomers of Evolution

Humboldt Research Fellow Dr. Luis Valente
Researches Biodiversity on Islands



*Small cactus finch, Pinta Island,
one of the Galapagos Islands.*

Darwin's finches – whose discoverer and namesake Charles Darwin founded evolutionary theory – are among the best-known animals in the world. They live on the Galapagos Islands, an archipelago in the Pacific Ocean, about 1,000 kilometers off the coast of Ecuador. The islands' location makes them particularly interesting for biologists, since such remote islands are considered excellent natural laboratories for studying evolution. As relatively secluded ecosystems, they form valuable model systems to study biodiversity in greater detail. A team headed by the Portuguese evolutionary biologist Dr. Luis Valente, who is currently conducting research at the University of Potsdam, has tested a model using the example of Darwin's finches that offers surprising insight into the mechanisms of biodiversity development.

On the Galapagos Islands, the birthplace of Darwin's theory of evolution, species evolve at varying rates. While many bird families are still producing new species, Darwin's finches seem to have reached a certain type of equilibrium. "Our results show that the famous Darwin's finches, at least in terms of the number of species, have already reached an evolutionary endpoint," says Valente, "albeit a productive one: New species are still being added but only when others die out. The reason for this may be their 'rapid evolution' with fast speciation and extinction rates, which continue up until today."

The number of other bird species – and, thus, diversity – on the Galapagos Islands as a whole is still increasing. This suggests that classic island theory does not apply here. The prevailing theory about evolution on islands since the 1960s predicts a dynamic balance between immigration and extinction of species.

"Until now, it has been impossible to empirically verify this hypothesis, because the statistical tools suitable for examining millions of years of biodiversity develop-



THE RESEARCHERS

Prof. Dr. Ralph Tiedemann studied biology, computer science and Icelandic at the universities of Kiel and Reykjavík. After working as a visiting scholar at the Free University of Brussels (ULB), he received his habilitation in zoology with genetic studies on speciation as well as avian and mammalian population structures. Since 2002, he has been Professor of Evolutionary Biology/ Systematic Zoology at the Institute of Biochemistry and Biology of the University of Potsdam.

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As an evolutionary biologist, **Dr. Luis Valente** studied biology and ecology in London. Valente is currently a Guest Researcher at the Institute of Biochemistry and Biology of the University of Potsdam. He received the 2015 Brandenburg Postdoc Award for his research on diversification on islands.

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ment were not available," Valente says. Together with Prof. Rampal Etienne from the University of Groningen and Dr. Albert Phillimore from Edinburgh University, Valente developed a mathematical model that allowed the computer program DAISIE ("the Dynamic Assem-



Fernandina Island, one of the Galapagos Islands.



Dr. Luis Valente examining birds on Lifou Island, the biggest Galapagos Island.



bly of Islands by Speciation, Immigration and Extinction”) to reconstruct island biogeography. DAISIE has enabled the researchers to analyze the evolution of bird species on the archipelago. The researchers published the results of their study – the first-ever analysis of evolutionary dynamics over very long periods – in the high-impact journal *Ecological Letters*. The authors have made the DAISIE model available to other researchers as a software package in the free and widely used R environment.

“DAISIE processes molecular data we have collected on the species on the islands, and provides us insights regarding colonization and extinction rates as well as differentiation,” says Valente. The

“ DAISIE processes molecular data we have collected on the species on the islands.”

researchers collected information on particular genes of representative specimens of many bird species on islands. Related mainland species serve as a comparative foil. The corresponding data are fed into the DAISIE database.

Once the data is as complete as possible, the program simulates thousands of potential scenarios of how the species on the islands have developed over millions of years – compared to the mainland populations – and identifies the most likely one.

“DAISIE offers a useful, innovative approach,” says Prof. Ralph Tiedemann, with whom Valente has been researching as a Humboldt Research Fellow since the end of 2014. “The program is able to analyze speciation mechanisms and identify patterns – for various species and islands.”

Even if the results on the Galapagos Islands are spectacular, they are still only the first step for Valente. His next steps will take him from Potsdam to around the



Large Lifou white-eye (Zosterops inornatus).

globe. DAISIE has long been able to “check out” remote archipelagos around the world. “Together with Ralph Tiedemann, we now want to examine very different types of archipelagos and their particularities: large and small ones, those with high elevations and very flat ones, very remote ones and those nearer continents,” Valente says enthusiastically. With the help of DAISIE, they will be studying about 20 archipelagos and their bird species. The “eligibility criteria” are very strict: The archipelagos must be sufficiently far

“ With the help of DAISIE, we will be studying about 20 archipelagos and their bird species.”



Valente and his host at the University of Potsdam: Prof. Ralph Tiedemann.



Dr. Valente in the lab.

apart from other landmasses – and have always been. This, in fact, only applies to volcanic islands. The requisite data on the species living there should either be available or at least accessible. This is a real challenge, Valente explains. “Much is available on existing databases,” the researcher explains. “Other times, finding data is very difficult.”

Take, for example, the island of São Tomé. About 240 kilometers off the African coast in the Gulf of Guinea, it is a part of the country of São Tomé and Príncipe. About 50 species of birds live on the island, but DNA

“Routine laboratory work often turns into a forensic investigation.”

sequences are not yet available. Valente is now in contact with an ornithologist who has long studied the birds on the island – and who also has the sample material the Potsdam biologist covets.

“It is absolutely essential to be well networked,” says Valente. “We talk to many ornithologists and have to do a lot of negotiating, because not everybody is willing to collaborate and make his or her results available.” Valente also finds information in museums. He evaluates old samples, some of which are centuries old. Because of their old age, these samples are often very degraded, and as a result routine laboratory work often turns into a “forensic investigation”. Student assistants carry out the laboratory tests. “It is great for our students to be able to research at an early stage,” adds Tiedemann. “They work on material from some of the most extraordinary places in the world. In summer 2014, one student, for example, sequenced the DNA of birds on the Canary Islands, off the west coast of Africa.”

Valente’s current workplace is mostly at his computer. He has to enter the results of sample analyses into the database and then model the scenarios with DAISIE. This is not to say that he does not miss working in nature. Valente worked in the botanical gardens of London and Madrid and wrote his doctoral thesis on the evolution of plants in South Africa. This always involved fieldwork. He soon realized, though, that research, especially as an evolutionary biologist, also implied mathematical modeling. “We need to reconstruct connections that may have existed millions of years ago, for which we have no field data,” says Valente. “This is only possible with theoretical models.” In fact, the modeling of scenarios has become indispensable to evolutionary biology, adds Tiedemann. “Many data can only be used to describe connections in terms of probabilities.”

If the registration of samples progresses well, DAISIE will soon be able to calculate models for the first ten archipelagos. This will show whether the results for the Galapagos Islands were a fluke – or a peculiarity that can be applied to other species elsewhere. “This study could help answer a fundamental question of evolutionary biology: Does biodiversity tend towards equilibrium or does it not?” Tiedemann says, “We can model the general development of an ecosystem, one influenced by humans, for example. This provides an important source of information for environmental protection. Preserving biodiversity is the key to successful nature conservation.”

MATTHIAS ZIMMERMANN

PORTAL WISSEN · ONE 2016

A Matter of Trust

Political scientists at the University of Potsdam research the concept of expert authority

The World Bank does it; NATO and the Food and Agriculture Organization of the United Nations do, too. International organizations give concrete policy advice to their member states. How this advice is received and followed says a lot about how the organizations are seen and whether they are deemed experts. In their current project, political scientists are researching how this impacts national and international politics.



Photo: FAO/Giorgio Costulich de Piccini

Dr. Per-Olof Busch.



THE PROJECT

The research project **“Consideration of Expert Knowledge – International Public Administrations as Policy Experts”** is embedded in the research group “International Public Administrations. Emergence and Development of Administrative Patterns and their Effects on International Policy-Making”.

Participating research institutions: the University of Potsdam, the University of Konstanz, Technische Universität Darmstadt, Freie Universität Berlin, Ludwig-Maximilians-Universität München, and the German University of Administrative Sciences Speyer.

Funding: German Research Foundation

Duration: 2014–2017

www.ipa-research.com

It came like a thunderbolt: On October 26, 2015, the World Health Organization (WHO) declared in one of its reports processed and red meat carcinogenic and recommended curbing its consumption. “When I came home that day and told my wife about it, her first reaction was: ‘Oh, we have to reduce our meat consumption,’” says Dr. Per-Olof Busch, post-doctoral researcher at the Chair of International Organizations and Public Policy. For the political scientist, this initial, spontaneous announcement encapsulated a phenomenon in his current research, one transferable to global politics: expert authority.

But what is expert authority? “It is a fairly complex concept,” Busch admits. The project “Consideration of Expert Knowledge – International Public Administrations as Policy Experts” examines how international public administrations such as the World Bank, the Organization for Economic Cooperation and Development (OECD), and the Food and Agriculture Organization of the United Nations (FAO) use their expert authority to make policy. The project’s research team consists of chairholder Professor Andrea Liese, researchers and Ph.D. students Jana Herold and Hauke Feil, and Dr. Busch.

“Nobody has really measured expert authority.”

The World Bank, the International Monetary Fund, and the FAO all have large staffs at their disposal. “The United Nations employs around 12,000 people,” Busch says. Specialists refer to the pools of experts with distinct thematic focuses as “public administrations”. They are the source and basis of expert authority; they generate, evaluate, and analyze knowledge as well as offer concrete advice that is then disseminated to their member countries. How this advice is received – whether questioned, verified, assessed, or adopted without resistance – has to do with expert authority.

The common perception of international governmental organization work is that “member states decide what is done and how,” Busch says. “We do not necessarily as-

sume this.” The researchers are testing their hypothesis of whether it is the expert authority of the organizations themselves that makes them political players, an aspect hardly studied to date. “Nobody has really measured expert authority.” Consequently, little is known about when, how, and why expert authority is relevant to national and international politics, what its potential is, and what its limits are. To find out more, the researchers are examining the role of the public administration on a global scale at the World Bank and other international institutions.

This project is also new territory for researchers Hauke Feil and Jana Herold, who have had to do a lot of research to get the ball rolling. Which policy fields should be addressed? Which organizations are suitable? How do you get in touch with the relevant actors? How do you develop a statistically evaluable questionnaire? These and many more questions had to be answered by the research team before the actual research could start.

“ Having a global perspective enables international public administrations to gain an expertise beyond that of national institutions.”

Agricultural and financial policy seemed to be particularly suitable for their studies. “These themes exist in industrialized and developing countries,” Jana Herold explains. “We wanted organizations’ policy fields and themes to be identical to ensure a direct comparison.” The selected organizations also need to be globally active and give policy advice, since this is what the project is all about.

The team ultimately selected six agricultural and 15 financial policy organizations. Their influence will be examined with the hope of making representative statements about them.

The research focuses on the perception of the policy advice disseminated regularly by international governmental organizations to their member states. This advice touches both on broad fundamental problems of humanity and on specifics. In 2011, for example, the FAO recommended

FAO experts advise people worldwide.



Photos: FAO/J. Belgrave (top); FAO/Veronika D'Anna (2)

introducing financial incentives for small farmers to sustainably increase production. The OECD recommended Colombia implement a comprehensive tax reform to boost its economy. In 2014, the IMF argued in favor of a green tax on carbon dioxide. Such advice is research-based. “The staff researches certain issues, monitors global developments, and draws conclusions. For instance, they compare their member states’ approaches of dealing with various issues: Which were successful? Which were particularly cost-efficient?” says Busch. Having a global perspective enables international public administrations to gain an expertise beyond that of national institutions.

Policy advice is published in the form of research papers and reports. Sometimes it is disseminated by the media and thus available to the general public. International governmental organizations, however, also invite representatives of national ministries to meetings or workshops to present the results and conclusions of their studies. “Informal channels play a major role here,” Busch says.

Establishing whether the experts’ policy advice falls on fertile soil requires diligence. The political scientists from Potsdam first had to randomly determine to which 120 countries to send their 20-point questionnaires in

“The challenge in designing the questionnaire was that we have to beat around the bush a bit.”

German, English, French, and Spanish. Numerous phone calls followed, hours of online searching, and hundreds of emails to identify the relevant contacts for each topic at national authorities and ministries. This sometimes demanded a great deal of patience: “Some states do not have a functioning web-

site, or its information is outdated,” Herold describes the challenges. Ultimately, 960 questionnaires have been mailed to the appropriate people all over the world, the first of them in December 2015.

“The challenge in designing the questionnaire was that we have to beat around the bush a bit,” Busch says. Of course, you cannot ask: “Do you unreflectively adopt policy advice?” The answer would surely be “No”, even though things may look different in reality. “We avoid this by asking about individual elements that give us the right clues.”

In this way, the researchers ask whether policy advice is heeded at all, the extent to which it influences political decision-making, and whether international public administrations are actually perceived as experts. A strong statistical correlation between expert status and the adoption of policy advice indicates “expert authority” to the researchers. “The stronger the correlation, the greater the expert authority,” Busch says.

Now everything depends on how many questionnaires will be returned to Potsdam. Some questionnaires will have had quite a journey. “Some letters will take a month to get to their destination – one way,” Feil estimates. “In all likelihood, we will be waiting three to six months.”

For the statistical evaluation of the project, the researchers will need a minimum number of replies. “It would be nice if at least 50% of the questionnaires are returned to us,” Feil says. “It won’t be easy, since crisis-stricken countries such as Syria and Libya are among them,” Busch points out. “There is the risk that we possibly don’t reach all of our project aims.”

HEIKE KAMPE



THE RESEARCHERS

Prof. Dr. Andrea Liese studied political science, law, sociology, and German literature in Frankfurt (Main). She has held the chair of International Organizations and Policies at the University of Potsdam since 2010.

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World Models

Graduate Research School GeoSim
Bridges Mathematics with Earth and
Environmental Sciences

The “**Helmholtz Research School for Explorative Simulation in Earth Sciences**”, or **GeoSim**, is funded by the Helmholtz Association as well as grants from the participating institutions – GFZ German Research Center for Geosciences, Freie Universität Berlin, and the University of Potsdam. Earth and environmental scientists as well as mathematicians from these institutions have joined forces to provide training and conduct research in the field of exploratory earth science simulation. Currently 39 PhD students from 10 countries are researching there.
<http://www.geo-x.net/geosim/home.html>

The earth is complex. What happens on it and in it is difficult to explain and can only be partially predicted. Yet, this would be important, especially in light of the increasing number of natural disasters that occur worldwide due to e.g. climate change. Devastating earthquakes, severe droughts, or massive flooding resulting from thawing – earth and environmental scientists want to better understand all of these phenomena. Important data, however, are often missing, either because they cannot be collected or their interplay can only be inadequately reconstructed. This is why more and more geoscientists are resorting to computer simulations. They can be used to check data, to map developments, and to understand, reconstruct, and verify relationships. It has become clear that scientific studies have to consider existing uncertainties in order to track down “uncertain reality” – from imprecise and missing data via indirectly determinable parameters, like soil properties in an area under review, to possible inaccuracies in mathematical equations of a computer model. This is exactly the goal of the Helmholtz Research School GeoSim, where young researchers bridge mathematics with earth and environmental sciences.

One such person is Sanjay Bora. The young Indian researcher has developed a model that can reconstruct and simulate ground motion for future earthquakes. Based on the results, seismic safety standards for buildings can be established, which can help in preventing the catastrophic destruction of critical or sensitive public facilities like dams and power stations. Many regions have not enough observed data that can be used to calibrate such models. “We simply often lack the respective data,” Bora says. “Here is where my model can help. In simple words, we transfer a model from one region for which we have sufficient data to another with incomplete data.” This is possible because it is a so-called filter (transfer function) based model. While the basic pattern remains the same, with this model one can easily adjust different segments of the model to different region specific seismological environments – “like the attenuation of seismic wave amplitudes with distance in California can be adjusted to that in the Lower Rhine Basin,” Bora explains. The researchers have been extremely successful: Their work has already received awards in international scientific conferences and “arrived” in practical applications. The model framework has already been used and validated in a recent seismic hazard assessment project carried out in a French earthquake region. For Bora, this is both, a jumping-off point and an incentive to continue his research. “Others use my model and give me feedback on its functionality, which in turn helps me to refine it. It has been mainly used in Europe but will be used globally in the future, for example in the US and Japan.”

Annabel Händel also studies ground motion. Like Bora, her studies are supervised by Frank Scherbaum, Professor of Geophysics and Seismology at the Institute of Earth and Environmental Sciences of the University of Potsdam. Händel addresses attenuation phenomena close to the earth surface, i.e. how much seismic energy

is absorbed by the uppermost layers and how this happens. Attenuation parameters help to determine the amount of high-frequency energy reaching the surface during an earthquake. The parameter can provide information on the requisite concrete wall thickness of a dam or safety standards for piping systems in chemical plants. “The attenuation parameter is very important when you want to adapt a more general ground motion model to a certain region,” Händel explains. Unfortunately, we often lack the data necessary to determine a region’s attenuation. Händel tries to extract the desired parameter from ground noise data recorded by any seismometer

“Others use my model and give me feedback on its functionality, which in turn helps me to refine it.”

THE RESEARCHERS



Prof. Dr. Frank Scherbaum studied physics, geology, (and musicology) at the University of Tübingen. After a doctorate and habilitation in geophysics at the University of Stuttgart as well as spending several years in the US and Japan, he was appointed Professor of Seismology at Ludwig Maximilians Universität in Munich in 1989. Since 1997, he has been Professor of General Geophysics at the University of Potsdam.

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Dr. Sanjay Bora studied physics at Kumaun University (India) and computational seismology at the Indian Institute of Technology Kharagpur. He successfully defended his doctoral thesis at the University of Potsdam in early 2016. Bora is currently working as a postdoc at the GFZ German Research Center for Geosciences.

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Katrin Hannemann and Agostiny M. Lontsi, PhD students at the University of Potsdam, are checking signals of a seismometer in Greece; these data are also used by Annabel Händel.



“Computer simulation has established itself in applied natural sciences alongside experimentation and theory.”

together with seismic signals as a kind of “data garbage”. Ground noise also consists of seismic waves that travel through the ground and, thus, necessarily contain attenuation information – a suitable collection method, though, is not yet available. Händel is currently developing such a method and is working on the recordings from several sensors in Greece, a region whose attenuation properties are well known. Her aim is to find a method that can be easily used worldwide to unproblematically apply information about high-frequency attenuation when adjusting ground motion models.

For Scherbaum, this is just another chapter in the success story of the graduate research school. Yet another is the “arrival” of simulation as a research instrument. “Computer simulation has established itself in applied natural sciences alongside experimentation and theory. The research school has taken this into account, training a new generation of researchers who are experts at mathematics as well as environmental science and geoscience.”

It has become apparent that simulations can specifically help with very difficult and complex problems. “Data are often imprecise or inaccurate, so we need different approaches,” says Scherbaum. Earthquakes, for example, still cannot be predicted. “But you can approach the problem with the help of approximating models – by determining parameters or ground motion – and ultimately better understand the underlying patterns. You can then improve, for example, building regulations in affected areas.”

A few years ago researchers at Freie Universität Berlin, the GFZ German Research Center for Geosciences, and the University of Potsdam joined forces to bring mathematics and geosciences closer. The result is a graduate research school, where a geoscientist and a mathematician supervise each PhD student. One of the supervisors is the Potsdam Professor of Hydrology and Climatology Axel Bronstert. “Exploratory simulation helps us answer questions regarding our understanding of the system and simulating processes lacking data due to geographic inaccessibility or because it is simply too expensive.” Computer models cannot replace fieldwork, though. “Those who believe you can simulate everything are wrong,” says Bronstert. “The models actually reflect the current state of knowledge. We are hoping to collect the best possible empirical data for the individual processes and combine them mathematically in the model. Ideally, the simulation depicts the question – and is able to calculate a probable scenario based on this. The better the empirical data, the better the model.”

The PhD students supervised by Bronstert also work on hydrological topics. While Klaus Vormoor studies the impact of climate change on flooding resulting from thawing in Norway, Filipina Catherine Abon examines if and how so-called flash floods in the tropics can be predicted with the help of rain radar data. Tobias Pilz focuses on regional water cycles, a highly complex topic. Water cycles are difficult to measure empirically because the factors determining how water seeps, for example, may differ significantly only a few meters apart. Regional hydrological models are accordingly difficult, especially for large territories – like in Tobias Pilz’s PhD project. He

examines the Jaguaribe region in northeastern Brazil, a region twice the size of Brandenburg. Bronstert has been conducting research there for decades, collaborating with Brazilian partners. The local climate has long dry periods and a short, often intensive rainy season that may also fail, sometimes even for years at a time. Thousands of water reservoirs have thus been built in the region. Some of them are very large, like those for the water supply of Fortaleza, a city with millions of inhabitants, but the majority of these reservoirs are rather small. In “wet” years there is extensive flooding, with often devastating consequences due to uncontrolled, informal housing developments, also in flood areas. A flood forecast system is not available. “We want to help change this,” Pilz says. “We are, therefore, closely collaborating with the local hydro-metrological institute.”

“The better the empirical data, the better the model.”

The hydrological model that Pilz is developing will allow for the forecasting of how and where water is allocated to a river, particularly when there is a dangerous abundance of it during the rainy season. The problem is that the processes cannot be determined to such a level of precision that they are able to capture the complete hydrological cycle and certainly not for the entire area. This is where mathematical modelling comes in. “Infiltration, retention, and runoff of water can be calculated with the help of equations,” Bronstert explains. “In the model, we combine them with additional information like soil properties, ground water, and precipitation.”

Simplifying complex processes through mathematical simulations is advantageous for two reasons: “Models are not as precise as measured values and never exactly reflect reality but only in this way are we able to approach it in its entirety and describe it, because we are unable to exactly determine the processes. It would be



THE RESEARCHERS

Prof. Dr. Axel Bronstert studied civil engineering with focus on hydrology and water management and earned his doctorate in Karlsruhe. From 1995-1999 he worked in water research at the Potsdam Institute for Climate Impact Research (PIK). Since 2000, he has been Professor of Hydrology and Climatology at the University of Potsdam.

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much too complicated.” On the other hand, models can consider and comprise existing gaps, errors, and uncertainty. “You can, of course, try to minimize the uncertainty with better data,” Bronstert says, “but you can also ‘recognize’ it, integrate it into the model, and assess it statistically. This has been done in weather forecasting for a long time.”

Water reservoirs in the Jaguaribe region, northeastern Brazil.



Photos: Fritze, Kaita (top, center); PIK, Tobias



Tobias Pilz and Prof. Axel Bronstert.

This is exactly what Pilz does. “We feed all the data on hydrological cycles in the Jaguaribe region into the model,” he says. “For some parameters we have no empirical data, for example how much water is actually in the reservoirs.” The simulation calculates how much water flows in, but only to a certain degree of accuracy. “We try to close these gaps with other data like satellite images. This still involves uncertainty – and my model intends to consider, compare, and weigh it.”

The more uncertainty he is able to take into account, the more he approximates reality, even if it is only a probable one. Models can be “updated” as soon as more precise data are available for individual parameters. For

“Communication between the disciplines was not always easy at first.”

Pilz and many other PhD students at GeoSim, “research” takes place in front of the computer screen. This is not a problem for Pilz. “It is a good mix of theory and application.” There is no need to jettison “fieldwork”. When the project started, he and Axel Bronstert visited Brazil to get acquainted with his research field first-hand. He is sure that this was not his last trip to Brazil and is now learning Portuguese in his free time. “English doesn’t get you very far there.”

Finding a common language was also a specific challenge at GeoSim, as Bronstert says with a smile. “All supervisors are enthusiastic about the GeoSim project, be-

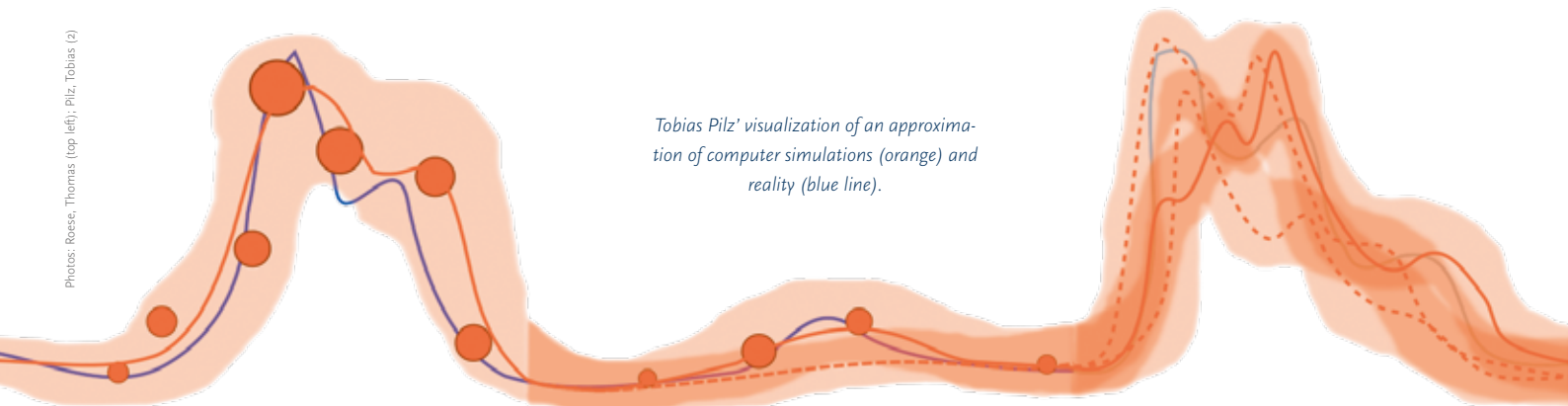


cause the methodological combination of mathematics, earth science, and environmental science has resulted in new research approaches. Communication between the disciplines was not always easy at first. It took six months until the one knew what the other thought or what the problem was.” They have since come to understand each other.

Scherbaum sees GeoSim as “an absolute success. I wish this model would be transferred to the academic curriculum. We should start training the next generation of researchers who are working at the interface of mathematics and geosciences before the PhD phase.”

MATTHIAS ZIMMERMANN

Photos: Roesse, Thomas (top left); Pilz, Tobias (2)



Tobias Pilz' visualization of an approximation of computer simulations (orange) and reality (blue line).

Dose Matters

Sports psychologists are looking for ways to curb the rising consumption of nutritional supplements for athletes

They are available as capsules, lozenges, tablets, and liquids: nutritional supplements are sold by every drugstore and gym these days and from many online stores. And yet, these products that are supposed to supplement our diets are not without controversy. Certain groups may even be harmed by their unregulated use – such as athletes, particularly in professional and competitive youth sports. Organizations like the International Olympic Committee, the World Anti-Doping Agency, and the National Anti Doping Agency Germany, therefore, advise against taking unnecessary substances, which are suspected of being a gateway to doping. All too often, though, these appeals go unheard. Consumption figures are spiking. In their current project, sports psychologists at the University of Potsdam are looking at how to curb supplement consumption. At the conclusion of the project, the researchers will be presenting evidence-based proposals on how to prevent misuse.

A study participant, who is about 14 years old, sits in front of a computer. He focuses on the screen – but there is hardly anything to see. Only if you watch very carefully will you catch anything. An assistant of project head Prof. Dr. Ralf Brand presents visual stimuli:

words like “performance” or “health”. They appear only for seven milliseconds, which falls below the human perception threshold, so he is not able to read them, let alone contextualize them. Nevertheless, what the test subject is not even really able to see significantly influences how quickly he reacts to words displayed for slightly longer, namely two seconds. It happens automatically. For example, he decides very quickly that “creatine” is a popular sports supplement after having been shown the word “performance”. The overall results of the test series indicate that it would have taken fractions of a second longer had the word “health” been presented to him. To a layperson, this experiment may seem unusual, but this is a standard cognitive scientific method of investigating how the human brain processes information.

The test series has since been completed, and Brand and his fellow researchers are now able to answer one of the project’s central questions: Why do athletes so often resort to nutritional supplements? What drives them, and what objectives are associated with taking them?



THE PROJECT

Nutritional supplements for athletes: An experimental approach to explaining, predicting, and preventing the consumption of critical substances by young athletes in competitive sports based on goal systems theory („Nahrungsergänzungsmittel im Sport. Ein experimenteller Zugang zur Erklärung, Vorhersage und Prävention des Konsums von kritischen Substanzen im Nachwuchsleistungssport mit Hilfe der Theorie der Zielsysteme“)

Head: Prof. Dr. Ralf Brand

Duration: January 2015–December 2016

Funding: Federal Institute of Sports Science (BiSp)
(Grant ID: ZMV I 11-070301/15-16)

The project team ruled out conventional interview techniques as its research method. "Athletes are aware that they should not be taking nutritional supplements," Brand explains, "so interviews will produce biased results; they will say what is expected."

The researchers instead opted for an implicit, reaction-time-based method in order to get conclusive results. This decision turned out to be a good one, since they

“ Protein shakes, vitamin and mineral preparations, but also substances like creatine are very popular.”

were able to find out more about the role of the unconscious in human thinking. They based their research on what psychologists refer to as goal systems theory. According to this theory, behavior is largely goal-driven whenever goals are automatically associated with evaluations, product presentation, and action patterns. "In our project, we

assumed that athletes unconsciously and automatically have certain associations when it comes to nutritional supplements," the Professor explains, "and the strength of these associations may influence their actions."

The laboratory experiments have so far corroborated this. Their outcome has been both unambiguous and surprising: The approximately 80 participating athletes linked nutritional supplements with the goal of performance enhancement, which is cognitively distinguishable and very strongly represented mentally. You can tell this from the reactions of the athletes who revealed – under immense time pressure and completely subconsciously – their associations with the respective stimuli. Health was much less associated with nutritional supplements, which contradicts earlier studies by psychologists who evaluated completed questionnaires.

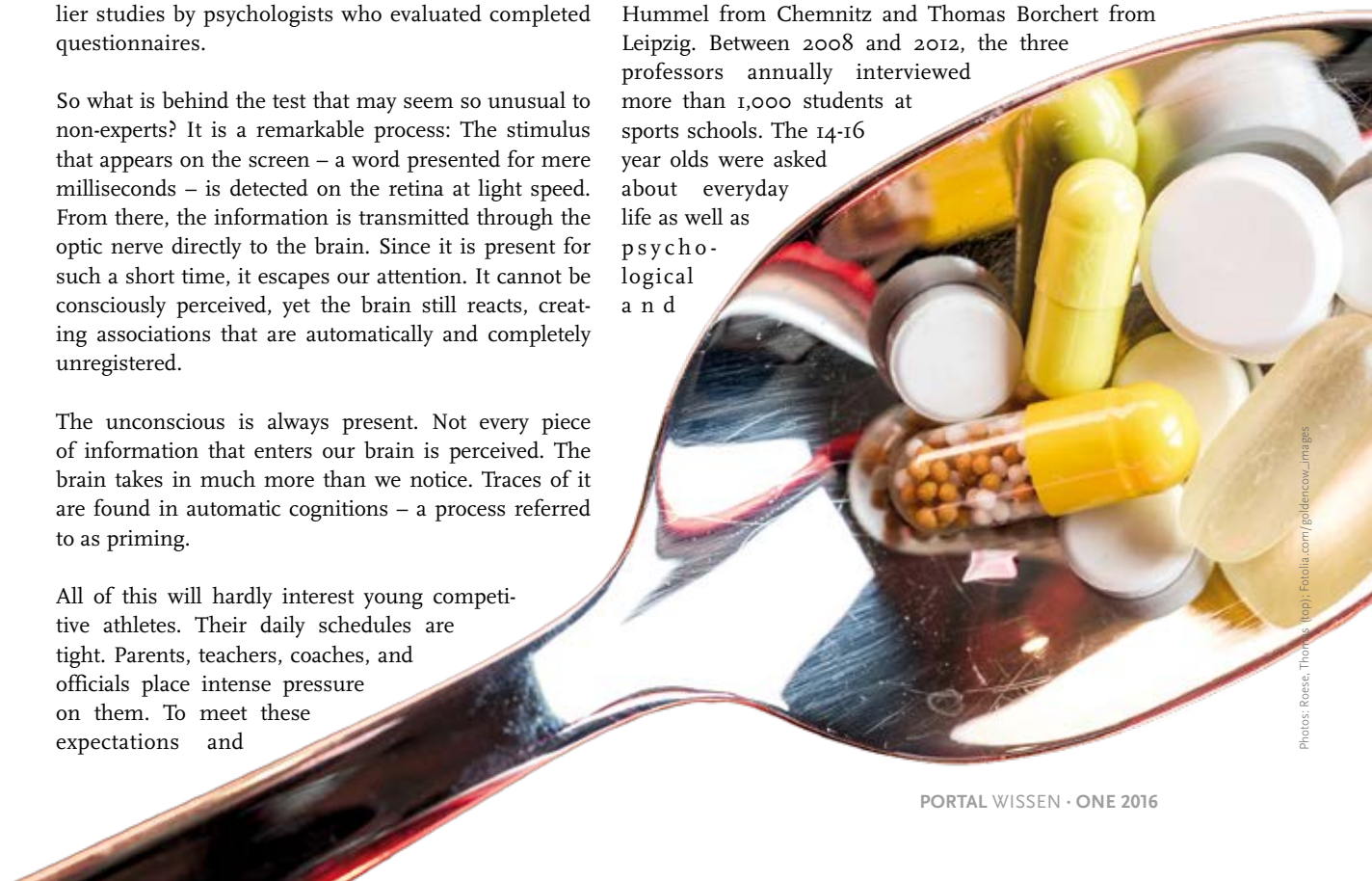
So what is behind the test that may seem so unusual to non-experts? It is a remarkable process: The stimulus that appears on the screen – a word presented for mere milliseconds – is detected on the retina at light speed. From there, the information is transmitted through the optic nerve directly to the brain. Since it is present for such a short time, it escapes our attention. It cannot be consciously perceived, yet the brain still reacts, creating associations that are automatically and completely unregistered.

The unconscious is always present. Not every piece of information that enters our brain is perceived. The brain takes in much more than we notice. Traces of it are found in automatic cognitions – a process referred to as priming.

All of this will hardly interest young competitive athletes. Their daily schedules are tight. Parents, teachers, coaches, and officials place intense pressure on them. To meet these expectations and



enhance their performance, many take nutritional supplements specifically made for athletes. According to a 2012 nationwide survey from the Federal Institute of Sports Science, 90% of the 1,138 athletes on the German Olympic Sports Confederation roster took nutritional supplements at least once a month; nearly 27% did so on a daily basis, and 76% of these athletes took two or more products at the same time. "Protein shakes, vitamin and mineral preparations, but also substances like creatine are very popular," Brand says. This could be problematic, if not dangerous, for competitive athletes, since overdosing poses health risks. Experts find that incorrect dosing of creatine can lead to cramps, too much magnesium to considerable digestive disorders, and large amounts of zinc to an increased risk of developing cancer. Specially trained nutritionists have been visiting Brandenburg's elite sports schools since 2009 to inform 7th-10th graders about these and other facts, yet with little success, as shown in a study by Brand and his colleagues Albrecht Hummel from Chemnitz and Thomas Borchert from Leipzig. Between 2008 and 2012, the three professors annually interviewed more than 1,000 students at sports schools. The 14-16 year olds were asked about everyday life as well as psychological and



Photos: Reese, Thomas (top); Fotolia.com/goldencow_images



“A very hot topic linked with nutritional supplements for athletes is doping.”

educational experiences. It turned out that in some disciplines (triathlon, weightlifting), more than half of the respondents regularly consumed nutritional supplements, whereas in most other sports (including soccer, canoe racing, swimming) it was 33%. “Here social norms play a major role,” the sports psychologist underlines. They suggest that success can be more easily achieved with the help of nutritional supplements, and “practically everyone” in competitive sports is using them. The fact that many everyday norms go unspoken – including those guiding our behavior – may explain their prevalence. “This was one of the reasons why our implicit approach was so important.”

There are not enough role models yet to counteract the trend of haphazardly taking nutritional supplements for athletes. After all, their reasonable consumption under proper supervision may well be healthy. “This, however, is not true for all nutritional supplements, and the effect differs from athlete to athlete and from situation to situation,” Brand says. “So advertising for such products should not focus on performance enhancement, but on health aspects. Ideally, this would one day lead to more prudent use.”

A very hot topic linked with nutritional supplements for athletes is doping: There have been cases of German athletes unintentionally taking nutritional supplements containing substances banned by the World Anti-Doping Agency. Such incidents were avoidable. The Centre for Preventive Doping Research at the German Sport University Cologne publishes an online list (“Kölner Liste”) of uncontaminated products, which have been tested for anabolic and androgenic steroids (prohormones) and stimulants. This is very helpful, especially for young athletes who prefer buying nutritional supplements online, where cheap, contaminated products constantly surface, according to research in England. “Of course, not everybody who regularly uses nutritional supplements graduates to banned substances,” Brand concedes. “On the other hand, we know of no athlete who has doped

that did not take nutritional supplements.” There is, however, no empirical evidence that taking nutritional supplements in fact leads to using banned substances.

In his work on the increased consumption of nutritional supplements by young athletes, Brand relies on goal systems theory and implicit measuring. This fits seamlessly into the research program of cognitive scientists at universities exploring fundamental cognitive processes. The central question is how our brain processes information consciously and subconsciously. “Our latest research on nutritional supplements in competitive sports,” Brand concludes, “has yet again demonstrated how complex, yet examinable these processes are.”

PETRA GÖRLICH



Photos: Reese, Thomas (4)



THE RESEARCHERS

Prof. Dr. Ralf Brand holds a degree in psychology and is a certified teacher of physical education and English. He completed his Ph.D. in Konstanz in 2001 and habilitated in Stuttgart in 2006. He has been Professor of Sport

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From Idea to Product.

Biotech startup “diamond inventics”
develops rapid water test system

THE PROJECT

“diamond inventics” is a startup developing a rapid detection test for microorganisms in water samples. Since June 2015, three of the four participating researchers have been supported through a one-year EXIST Business Startup Grant. They also receive funding for coaching and material expenses.

www.diamondinventics.de



Core element of the miniature lab for water tests.

The drinking water that comes from our faucets free of pathogens like *Enterococcus*, *Legionella*, and *Escherichia coli* must be checked regularly before it is delivered to us. Until now, samples have had to be taken at sampling points, transported to a laboratory, and dispensed onto a culture medium. Then you wait. It takes 2-14 days until the bacterial cultures start growing; only then can they be detected. A research team at the University of Potsdam, headed by Prof. Carsten Beta, has developed a rapid test that will shorten this to 30 minutes. The researchers are now setting up their own business around this idea – supported by the program EXIST – University-Based Business Startups.

Robert Niedl is holding a piece of brown paper with white lines and circles. What the biotechnologist is showing is more spectacular than it looks. The resin-cast filter paper is the key component of a miniaturized analysis lab developed by Niedl at his startup “diamond inventics”.

“Detecting microorganisms in drinking water is what we do,” Niedl explains the principle of his business idea that he and three fellow researchers at the University of Potsdam are developing. The team is funded through an EXIST Business Startup Grant, which allows the researchers to promote their business idea and outline it in a fully developed business plan. This funding program was established by the German Federal Ministry for Economic Affairs and Energy and provides targeted funding for university-based business startups.

“Our testing system provides on-site results in 30 minutes and determines whether there is an infestation,” Niedl explains the aim of diamond inventics. Capture, mark, and detect bacteria – these are the steps of the rapid test using simple filter paper, says Niedl, as he connects a black prism-shaped plastic case to the faucet in the lab. “This is our prototype,” the biotechnologist explains. When he turns the faucet on, water runs out of the other side of the prism. A microporous filter inside the case catches every bacterial cell. Up to 3 liters of water must run through the filter for a standardized drinking water test.

“ Our testing system provides on-site results in 30 minutes and determines whether there is an infestation.”

Once sampling is complete, the filter cartridge is then pushed into a reader that detects bacteria. The detection is based on a mechanism Niedl calls microfluidics. The resin on the filter paper forms small channels and reservoirs, where the analytical equipment applies specific reaction fluids. What makes this special is that the resin coating creates spatial separation that allows several steps to be performed consecutively. First, liquid is added, pushing the antibodies already in a reservoir on the filter to the center, where they can bind with bacterial cells that might already be there. Excess antibodies are then rinsed off, and a dye solution is added. The testing



Dr. Robert Niedl developed the idea for the water test from his PhD thesis.

Photo: René Thomás



system requires only a few microliters of each liquid, applied through a magnetic globe valve. The actual detection of bacteria is based on a chemical reaction that emits measurable light.

Niedl and his team are refining the rapid test. The color reaction still has to be optimized and the case of the testing device still has to be tailored to the needs of water-testing institutions, for example large water suppliers and environmental laboratories. To better understand these needs, “diamond inventics” brought in the Potsdam Water and Environmental Laboratory as a project partner. The Laboratory regularly analyzes water samples for bacterial infestation and will be examining the test’s practical applicability.

“ Apart from the funding, the team also has to be right.”

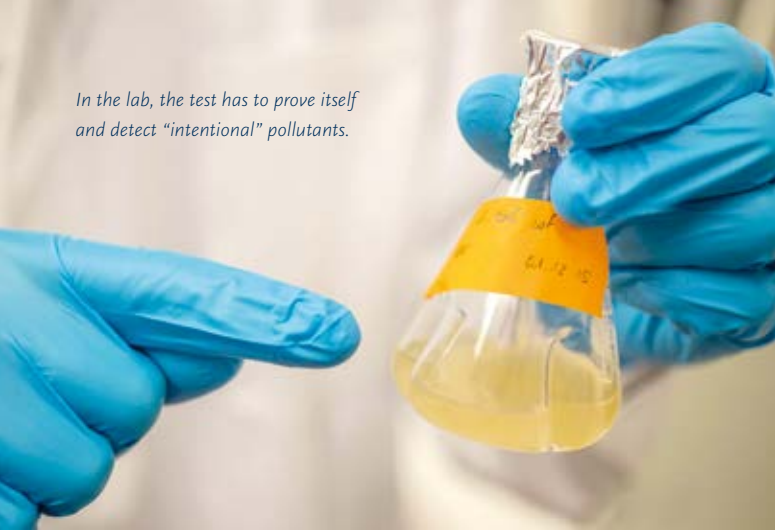
Niedl initially conceived the idea for the water test while working on his PhD thesis, which focused on microfluidics and the detection of substances on very small areas. “Since the basic concept had already shown a lot of promise, we thought it would be a pity to just let the thesis collect dust on the shelf,” Niedl says. So he started looking for suitable partners together with Potsdam Transfer, because a company could hardly be established alone. Apart from the funding, the team also has to be right. The researcher knows that the startup’s success will depend on the system’s practicality and user-friendliness. While Niedl is busy optimizing the biochemical processes, three other team members are in charge of developing the product idea into a marketable solution.

Physicist Alexander Anielski ensures the accuracy of the biochemical reactions, which are the basis of the water test, by developing the measuring device’s electronics and sensor technology. Business graduate Katja Richter is keeping a close eye on the finances, while Nicole von Lipinski makes sure that the test is easy-to-use and that the design meets customers’ needs.



Top: The rapid water test takes only a few minutes and can be performed anywhere. **Bottom:** Nicole von Lipinski is developing the product design for the minilab.

In the lab, the test has to prove itself and detect “intentional” pollutants.



“For me, it is all about manageability,” explains product designer von Lipinski. She considers not only the material and the appearance of the final product, but also the user. To understand the issues important to those using the test, she accompanies employees of the project partner during their daily work to see how water samples are being taken and processed. “What do the sampling sites and sampling bottles look like? What about the car’s interior? How much time does the employee spend in the vehicle? All these details have to be considered during product development,” explains von Lipinski.

The founders’ workdays are long and sometimes riddled with pitfalls. “We are doing pioneering work,” says Richter. In biotechnology, many structures have to be created,

“ Production, packaging, delivery, an ordering system – each of these process steps have to be established.”

since the current selection does not suffice. To develop their product, the researchers need laboratories, clean rooms, and very expensive materials. Patent law presents another hurdle. Precious time is also spent on administration. This all makes the support provided by the university infrastructure, which is bolstered by Brandenburg’s well thought-out funding catalog, even more important. “Without the mentorship of Prof. Carsten Beta and the support provided by Dr. Patrick Bröker from Potsdam Transfer, many things would have been a lot more difficult,” says Richter.

The schedule is tight. The final product should be available in six months. “Production, packaging, delivery, an ordering system – each of these process steps have to be established,” Richter describes the challenges. While the price for the new testing system will be higher than for conventional testing, its advantages are obvious. Besides saving time, the test also includes networking options with digital communication systems, which are to attract more potential users to the test. “The device can be connected to a communication unit – a smartphone or laptop – making the results immediately available to customers, who can then take any necessary measures,” Niedl describes the concept. “The demand for our rapid water test is there,” the team is convinced.

HEIKE KAMPE

THE RESEARCHERS



Dr. Robert Niedl studied biology in Mainz and earned his doctorate in biotechnology in Potsdam. He is responsible for scientific development at “diamond inventics”.

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Dipl.-Phys. Alexander Anielski studied physics at the University of Potsdam and develops the measurement technology of the rapid test.



Nicole von Lipinski studied industrial design at the University of Applied Sciences (HTW Berlin) and makes sure that the final product is user-friendly, robust, and easy-to-use.

A Commuter between Cultures

2015 Max Planck Research Award recipient
Prof. Bryan S. Turner to research in Potsdam

On a proposal of the University of Potsdam, the 2015 Max Planck Research Award, one of the most highly endowed and prestigious academic prizes in Germany, has been awarded to internationally renowned social scientist Bryan S. Turner from the City University of New York. Turner intends to use the prize money of € 750,000 to raise the level of cooperation with the University of Potsdam to an institutional one. A "Centre for Citizenship, Social Pluralism and Religious Diversity" will be set up to involve more young academics.

"When I was researching the significance of Islam in the work of Max Weber in the 1970s, I was considered exotic. Students were also not interested in the topic. But this all changed abruptly after 9/11." The 71-year-old New Yorker, thus, felt particularly gratified to receive this award, also as an acknowledgement of his perseverance as a researcher.

His books and essays now fill bookstore shelves, and new ones are constantly being published – on the relationship between religion and modernity as well as medical sociology, economics, and philosophy. Turner's main research interest is secularization in pluralistic societies. He has worked on this topic not only in the US and Germany, but also in Singapore, Australia, and the Netherlands. "I have also been

The **Max Planck Research Award** is funded by the Federal Ministry of Education and Research and is awarded annually by the Alexander von Humboldt Foundation and the Max Planck Society to one researcher working in Germany and one working abroad. In 2015, the second award went to Hans Joas of Humboldt-Universität zu Berlin.

[www.humboldt-foundation.de/web/
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Prof. Bryan S. Turner.



Bryan S. Turner und Prof. Jürgen Mackert (right).

able to accumulate cultural experiences in everyday life,” says the ever-curious researcher.

“This is another highlight in my international research cooperation with the University of Potsdam,” Turner said at the award ceremony held in Berlin in early December 2015. “It comes at an ideal time given the refugee crisis and all the challenges facing modern pluralistic societies ever since religious issues regained prominence in public debate.”

Jürgen Mackert, Professor of Sociological Theory at the University of Potsdam, nominated Turner for the Max Planck Award. Mackert first encountered the issue of civil rights while working with refugees in the 1980s. As a sociologist, he wanted to find out why refugees were being treated differently. “Some are permitted to work; others aren’t. Some are granted a status that allows them to bring their families; others aren’t. I then developed an interest in discussing civil rights mainly as an instrument of social closure,” the researcher explains. He found an open ear in Turner, who also likens civil rights based on national sovereignty to “some sort of exclusive club membership”. Those who already belong have little interest in increasing the membership. Mackert received fruitful insight for his Ph.D. thesis from Turner. A lively exchange between the two researchers continues to this day.

The Potsdam sociologist is very happy that “as a result of this 20-year cooperation, a new institutional level will be established at the University of Potsdam”. It will also allow him more face-to-face discussions with the CUNY social scientist on religious, social, and cultural pluralism in modern societies.

In the years to come, Mackert and Turner, together with both young international social scientists and young researchers from Potsdam, will be exploring the relationship between civil and human rights to determine

the extent to which they contribute to current conflicts. The focus of last year’s Max Planck Research Award was “Religion and Modernity – Secularization, Social and Religious Plurality”. There could not have been a better link to Turner’s research interest. What is the significance of religion today? How can the universal validity of human rights be justified? What ensures cohesion in multicultural societies? Turner has been addressing such questions for decades.

“After all, we want to link our research activities with existing centers worldwide from the get-go.”

The research of Turner and his team at the University of Potsdam will focus on comparative analyses of Islamic law as well as right-wing populist movements like Pegida to shine a light on their social repercussions. Turner will be working in Potsdam predominantly in the early summer, since he will be keeping his position as Presidential Professor of Sociology and Director for the Study of Religion at the City University of New York.

“I am a commuter between cultures,” he says cheerfully. “After all, we want to link our research activities with existing centers worldwide from the get-go. The US remains an interesting society to compare with, due to its heterogeneity.” Turner also does not want to be separated for too long from his wife and their newborn child.

SILKE ENGEL



THE RESEARCHERS

British-born **Prof. Bryan S. Turner** holds the position of Presidential Professor of Sociology and Director for the Study of Religion at the City University of New York (CUNY). His career path has taken him to the University of Essex and the University of Cambridge in the UK, Utrecht University in the Netherlands, Deakin University in Melbourne, Australia, the National University Singapore and to the renowned Wellesley College and then CUNY in the US.



Prof. Dr. Jürgen Mackert studied sociology at the universities of Heidelberg, Berlin (FU), and Frankfurt on the Main. He has been Professor of Sociological Theory at the Faculty of Economics and Social Sciences of the University of Potsdam since 2009.

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The Forgotten Ones

Sina Rauschenbach focuses on the history of Sephardic Jews

"Wait a minute, there are still Sephardim!" Sina Rauschenbach never tires of saying this, because so little attention has been dedicated to the history of Iberian Jews. Rauschenbach wants to change this; the Professor of Religious Studies (specializing in Jewish Thought) focuses on Sephardic history and culture. Over 500 years ago, Spanish and Portuguese kings expelled Sephardim unwilling to convert to Christianity from the Iberian Peninsula.

The historian wants to bring more than just a fresh breeze to the German academic landscape. Rauschenbach consciously addresses a wider public. She recently initiated a musical project on the life and death of Luis de Carvajal the younger. Carvajal came from a family who had converted to Christianity yet continued adhering to their Jewish faith in secret. His family was threatened by the Inquisition while living in Mexico and was eventually sentenced to be burned at the stake. Numerous testimonials of Carvajal survived, because he kept a written record of his thoughts and experiences.

Touched by Carvajal's story, Rauschenbach came across composer Osias Wilenski, whose oeuvre includes an opera about Carvajal. She managed to convince the Argentinian to compose a song cycle about the life of Mexican Sephardim. Wilenski integrated Carvajal's numerous poems and writings into his work *Poemas y Cartas de Carvajal*. "These are valuable writings that get under your skin," Rauschenbach says. Such sources are rare because converted Jews had to keep their religion top secret. Together with historian Héctor Pérez-Brignoli, Rauschenbach worked for two years on staging a musical interpretation of Carvajal's life. She also appreciated her personal encounters with Wilenski, whom she called "a friendly, open-minded, and enthusiastic gentleman." She conceived of the idea during a research semester at the Institute for Advanced Studies at the University of Konstanz. When Rauschenbach received a professorship in Potsdam two years ago, she brought the project with her. The song cycle premiered at Schinkelhalle Potsdam in fall 2015. "We were all deeply touched by the piece," she says. It was important to her that the concert went beyond academia. "I also want to reach those people who don't attend my lectures."

Rauschenbach has been studying the history of Sephardic Jews in the Middle Ages and early modern period since her PhD studies. She realized then that the Sephardim had influenced important discourses of modernity. "Their history is not a specialized topic. It provides some indication of the development of global networks, economic and colonial history, secularization, and the emergence of hybrid cultures." Since April 2014, Rauschenbach has been a professor at the University of Potsdam and has ambitious plans. "I consider it my mission to bring this topic to a German university and attract students from various disciplines to it." She already offers her introductory lectures on Sephardic history and culture to historians and scholars of Romance and English



Emanuel de Witte: interior view of the Portuguese Synagogue in Amsterdam, 1680.

studies. This new research field in Germany has been positively received by students and has generated a great deal of interest, Rauschenbach reports. "I have a great team at my chair that is very supportive." Rauschenbach is also personally happy to "be back home". After years of teaching and researching in the Saarland, Wolfenbüttel, Halle, and Konstanz and working as a visiting professor in Bern and Potsdam, the Berlin-born researcher is living again in her hometown.

At the University of Potsdam, Rauschenbach is venturing out into novel territory within the current German academic landscape. She wants to connect the perspectives of Ashkenazim with those of Sephardim. While scholars on Sephardic history also teach at universities in the United States, Israel, France, Italy, and Spain, Jewish studies in Germany focuses on Ashkenazi Judaism. She, therefore, invited specialists from around the world to Potsdam to attend her conference "Colonial History – Sephardic Perspectives". "We believe that the role of Sephardim in European colonialism is too important to be excluded from the general discussion on colonial history and that, conversely, Jewish studies can benefit from a critical discussion of new research approaches and concepts from colonial history."

"I also want to reach those people who don't attend my lectures."

"There are two major groups: Jews of Iberian descent and those of 'German' descent," explains Rauschenbach. Sephardim spoke Spanish or Portuguese, whereas the Ashkenazim generally communicated in Yiddish until the 18th century. In the Ottoman Empire, many Sephardim also spoke "Ladino", a special Jewish language based on Spanish. While Ashkenazi originally lived in the north of France, Germany, and Eastern Europe,

Sephardim lived in the Iberian Peninsula. They also started settling in Italy and the Ottoman Empire in the 16th century and in Hamburg, the Netherlands, England, and the Dutch, English, and Danish colonies in the Caribbean and the Americas in the 17th century. Descendants of Iberian Jews who had converted yet secretly retained their Judaism lived in the countries of the Spanish and Portuguese Crown, in southern France, and the French colonies.

The “Alhambra Decree” of 1492 expelled Sephardic Jews from the Iberian Peninsula. Since the 8th century, Muslims, Christians, and Jews had coexisted peacefully under Islamic rule in southern Spain – in “Al-Andalus.” This exemplary model was later praised as *Convivencia*, Rauschenbach explains – without stumbling over the pronunciation because she speaks accent-free Spanish. Since large parts of the Iberian Peninsula had been recaptured in the 11th and 12th centuries, Christian rulers constantly relied on their Jewish subjects and benefited from them. The toleration of Jews ended with the fall of the last Muslim dynasty in 1492 and the attempt to also religiously unify the new Spanish Kingdom. Sephardim had to either convert to Christianity or be exiled. The Ottoman sultan offered all persecuted Jews the opportunity to live in the Ottoman Empire as so-called *dhimmi*, foreigners whose lives and property were protected because they paid taxes. “The sultan thought it was foolish of the Spanish kings to expel their best people,” says Rauschenbach.

After the outbreak of the Eighty Years’ War in 1568, the northern Netherlands did something similar, offering refuge to many Sephardic merchants and traders. The United Provinces had made itself independent from the giant Iberian kingdom and needed every supporter it could get. “War-related and economic pragmatism prevailed in the Netherlands in the decision to admit rich

and useful people.” The trading port of Amsterdam was especially a place of refuge for secret Jews persecuted by the Inquisition in the Iberian Peninsula in the 17th century; in Amsterdam they could live openly as Jews. Strong Sephardic communities formed. Rauschenbach has often visited Amsterdam to do archival research and is planning trips there with her students. A visit to the Sephardic synagogue, which now belongs to the Jewish Museum of Amsterdam, is particularly impressive. “The synagogue is evidence of a type of architecture particular to Sephardim, which has since been reproduced in many western places,” says Rauschenbach. It also reflects the role of Sephardim in European colonialism; the precious wood used in the Torah shrine, lecterns, and benches originates from the colony of Dutch Brazil.

“I started researching this topic due to my personal relationship with Spain,” says the historian. After finishing high school, she lived in Spain for a few weeks in the 1990s. “I realized that everything can function quite differently than what I had known.” Rauschenbach then studied mathematics and philosophy at Freie Universität Berlin. After graduating, she spent some time in Spain and Israel. It became clear that she would continue doing research but definitely not in mathematics. She was initially uncertain about what to write her thesis on. One of her philosophy professors made a suggestion: “Since you speak Spanish and know the country so well, you could do research on Rabbi Joseph Albo.” She followed her professor’s advice – and even earned her PhD under him. “My supervisor was a wonderful scholar,” Rauschenbach remembers. Studying the Spanish philosopher of religion Albo led her directly to Sephardim.

“The role of Sephardim in European colonialism is too important to be excluded from the general discussion on colonial history.”

Pierre Jacques Benoit: Jodensavanne, 1830. Jodensavanne was an agricultural community in Suriname, South America established by Jews fleeing persecution in Spain.



Rauschenbach is particularly interested in the specific culture that developed in Amsterdam in the early modern period, because many Sephardic converts, the Conversos, accepted the Netherlands' invitation. Several generations of Sephardim had been living as Christians in the Iberian Peninsula, only secretly practicing their Jewish beliefs. They were no longer familiar with Judaism in the rabbinical sense but did know Christian practices. A "community of new Jews" – as Yosef Kaplan, an important scholar in this field has called them – emerged in Amsterdam; people who felt like Jews but, in the eyes of the rabbis, had to learn what it meant to be a Jew. "Conversos are interesting to us, because they had a mixed form of religious knowledge," Rauschenbach explains. "This created 'multiple personalities' with hybrid cultures."

Rauschenbach deduces important aspects from the history of Sephardic Jews in the early modern period that extend well beyond the epoch. The intermediary position of many Sephardim is particularly important. "They were able to navigate between worlds very well."

Researchers investigate, for example, which merchant networks emerged in the early modern period. Trade was, after all, an important impetus for increasing globalization. Since many Sephardim in Amsterdam still had relations to the Iberian world, smuggling became possible despite trade embargoes. Moreover, Sephardic scholars knew Christianity particularly well due to their contacts and their own Christian past. This enabled them to act as cultural "translators" between the two worlds and to explain aspects of

Judaism to Christians and vice versa. Rauschenbach has researched this field very intensively. Such ruptures in identity could have conveyed special ways of thinking that have been identified as an early onset of secularization in recent research. "Some Sephardim said, 'I have believed in Moses, Christ, and Mohammed and can find bliss in

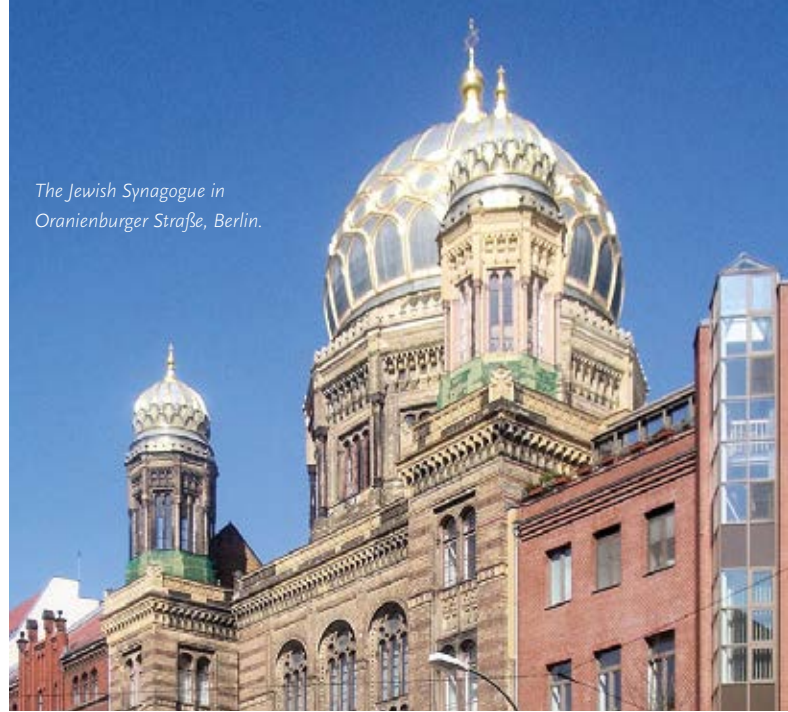
“Some Sephardim said to themselves, 'I have believed in Moses, Christ, and Mohammed and can find bliss in any of them.'”



THE RESEARCHER

Prof. Dr. Sina Rauschenbach studied mathematics and philosophy at the Freie Universität Berlin, where she also earned a doctoral degree in philosophy. She was a research associate at Saarland University, Martin Luther University Halle-Wittenberg and the University of Konstanz, where she habilitated. After holding temporary professorships in Bern und Potsdam, she came to the University of Potsdam in April 2014.

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The Jewish Synagogue in Oranienburger Straße, Berlin.

any of them,' or 'I believe that your religion is the best for you, while mine is the best for me'," says Rauschenbach. She calls this tendency to accept the multiplicity of religions "religious relativism." Rauschenbach assumes that this left traces in the European scholarly exchange in early modern times.

The Jewish Enlightenment and Jewish scholarship later followed the history of Sephardic Jews as a role model of successful integration – despite the unfortunate fate of many Sephardim. "The Jewish Synagogue in Oranienburger Straße in Berlin harkens back to Sephardim, a reminder of the hope that integration can work," says the Berliner.

Since October 2015, Rauschenbach has also been the spokesperson for the "Zentrum Jüdische Studien Berlin-Brandenburg (ZJS)", an important center for Jewish Studies. At the next annual meeting, the 45 year old wants to discuss the history, culture, and literature of Ashkenazi and Sephardic Jews. She also wants to ask in how far Ashkenazi and Sephardic identities are ultimately only cultural constructs. As the center's spokesperson, she is responsible for the center's prime goals to promote and support the PhD students, postdocs, and junior professors funded by the German government, and to connect scholars in Berlin and Brandenburg researching in related disciplines.

Rauschenbach's enthusiasm for the Iberian culture is hardly waning. She regularly visits friends in Spain. "And I'm married to a Chilean." A recent Spanish government law shows how politically charged her research topic is. Over 500 years later, Spain has offered citizenship to Sephardim as reparation.

“The Jewish Synagogue in Oranienburger Straße in Berlin harkens back to Sephardim, a reminder of the hope that integration can work.”

JANA SCHOLZ

Die Tageszeitung der Landeshauptstadt als praktisches E-Paper.



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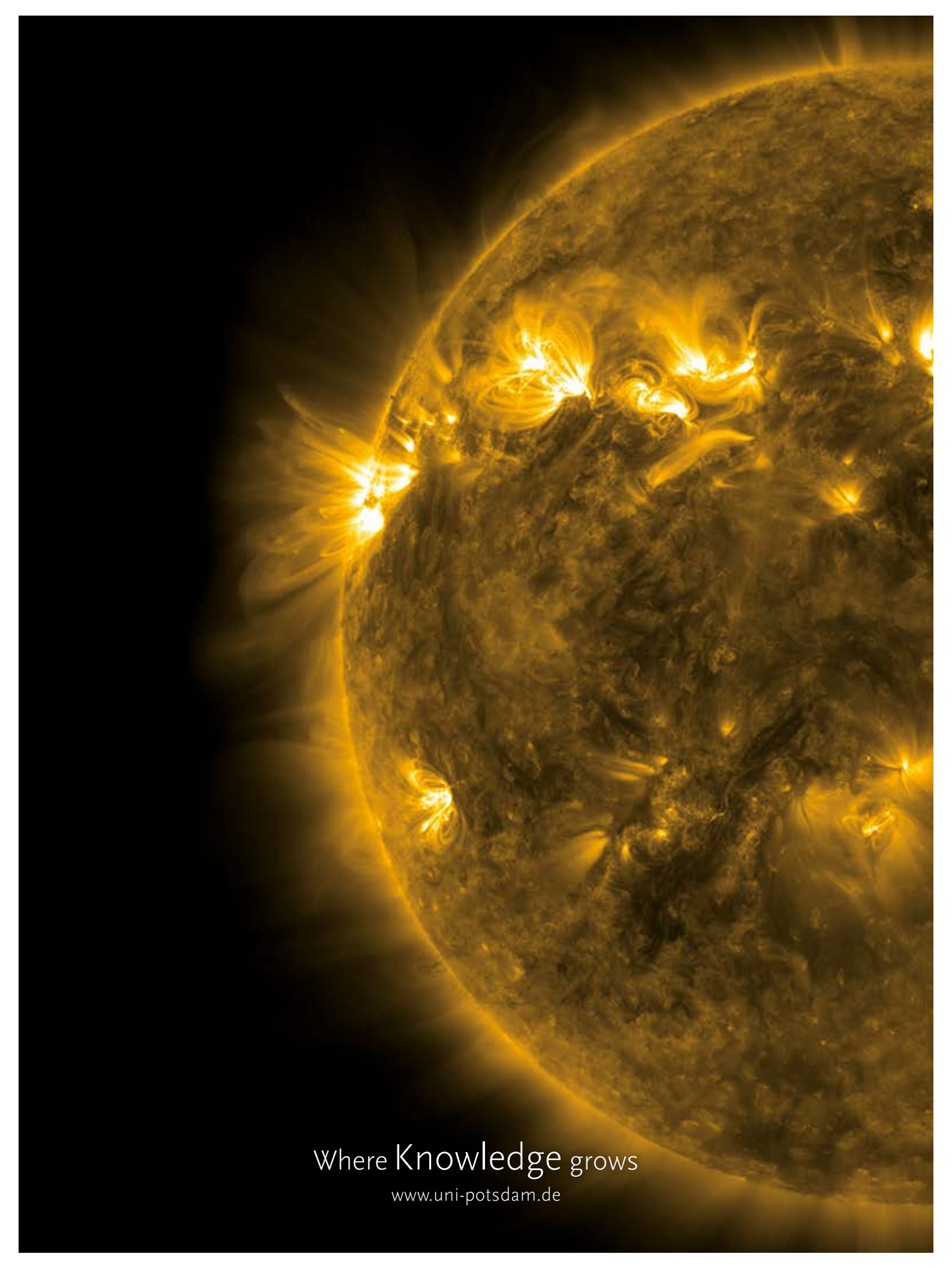
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