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Language

Language is perhaps the most universal tool of human beings. It enables us to express ourselves, to communicate and understand, to help and get help, to create and share togetherness.

However, that does not completely capture the value of language. "Language belongs to the character of man," said the English philosopher Sir Francis Bacon. If you believe the poet Johann Gottfried von Herder, a human is "only a human through language". Ultimately, this means that we live in our world not *with*, but *in*, language. We not only describe our reality by means of language, but language is the device through which we open up the world in the first place. It is always there and shapes and influences us and the way we perceive, analyze, describe and ultimately determine everything around us.

Since it is so deeply connected with human nature, it is hardly surprising that our language has always been in the center of academic research – and not only in those fields that bear the name linguistics. Philosophy and media studies, neurology and psychology, computer science and semiotics – all of them are based on linguistic structures and their premises and possibilities.

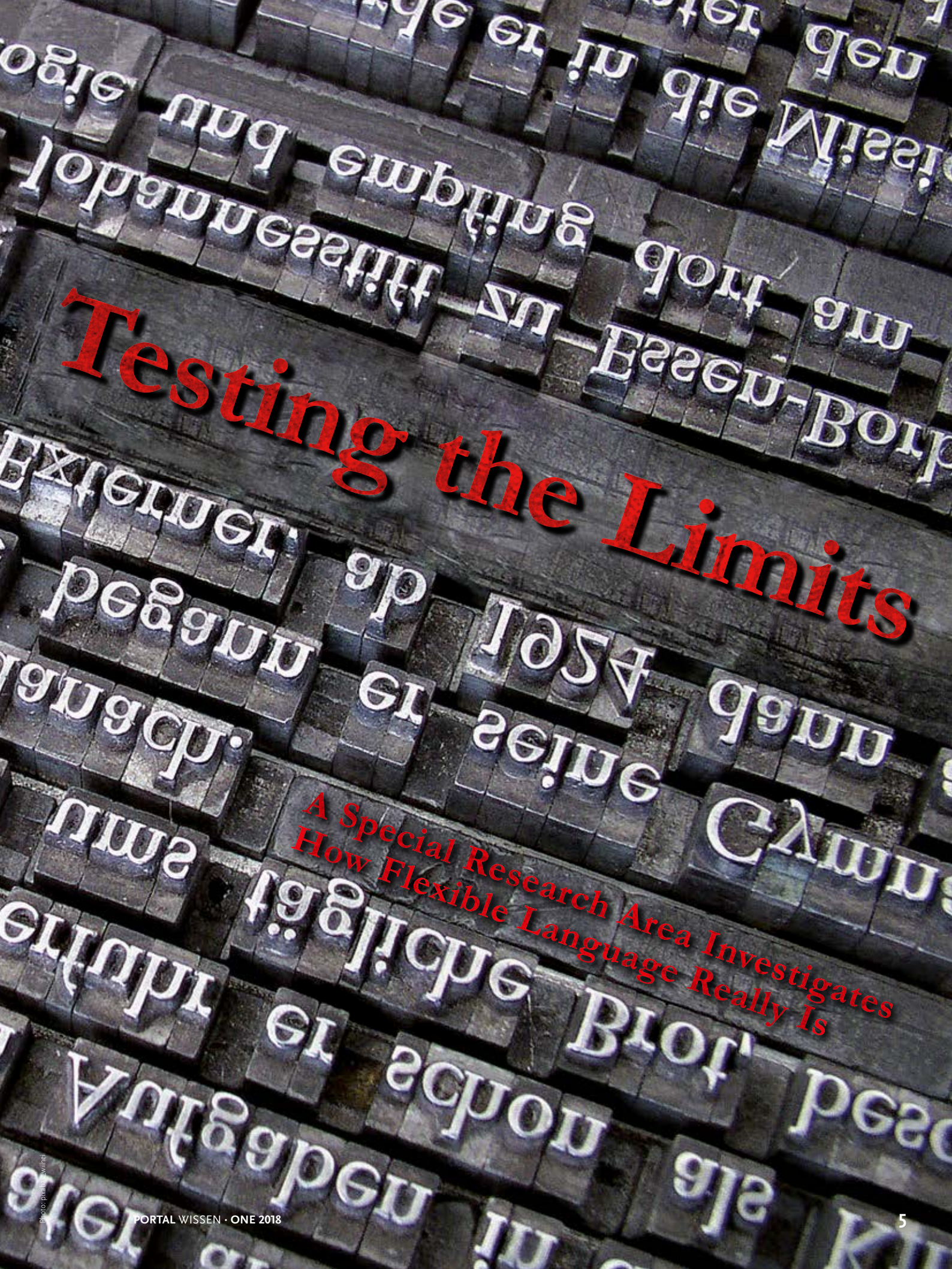
Since July 2017, a scientific network at the University of Potsdam has been working on exactly this interface: the Collaborative Research Center "Limits of Variability in Language" (SFB 1287), funded by the German Research Foundation (DFG). Linguists, computer scientists, psychologists, and neurologists examine where language is or is not flexible. They hope to find out more about individual languages and their connections.

In this issue of Portal Wissen, we asked SFB spokeswoman Isabell Wartenburger and deputy spokesman Malte Zimmermann to talk about language, its variability and limits, and how they investigate these aspects. We also look over the shoulders of two researchers who are working on sub-projects: Germanist Heike Wiese and her team examine whether the pandemonium of the many different languages spoken at a weekly market in Berlin is creating a new language with its own rules. Linguist Doreen Georgi embarks on a typological journey around the world comparing about 30 languages to find out if they have common limits.

We also want to introduce other research projects at the University of Potsdam and the people behind them. We talk to biologists about biodiversity and ecological dynamics, and the founders of the start-up "visionYOU" explain how entrepreneurship can be combined with social responsibility. Other discussions center round the effective production of antibodies and the question of whether the continued use of smartphones will eventually make us speechless. But do not worry: we did not run out of words – the magazine is full of them! Enjoy your reading!

THE EDITORS

Photo: Fotolia/Denys Rudyi



Testing the Limits

A Special Research Area Investigates How Flexible Language Really Is

Photo: photo_ewilhelm

It's Friday morning at a weekly market in Berlin. Those who visit the Maybachufer market in the district of Neukölln are treated to a little journey around the world – or at least that's what it sounds like: Market stalls are a-buzz with languages. And yet people somehow understand each other – most of the time, that is. Among the crowd is a team of Potsdam linguists led by German philologists Heike Wiese and Ulrike Freywald. They are investigating why communication succeeds despite the apparently Babylonian diversity of languages as well as the structures of the utterances used at the weekly market, although there seem to be none at first glance. The research project is part of the new Collaborative Research Cluster (CRC; SFB: Sonderforschungsbereich) 1287 at the University of Potsdam that investigates the "Limits of Variability in Language" from various perspectives. In an interview, spokesperson Prof. Isabell Wartenburger and her deputy Prof. Malte Zimmermann offer insight into the SFB's background and objectives.

Prof. Isabell Wartenburger

The SFB researches the "Limits of Variability in Language". What does that mean?

Wartenburger: What people say in a particular situation depends on many factors. The same is true for how we understand and interpret linguistic utterances. For this to work, language needs variation and this variability exists on all levels: meaning, syntax (sentence formation), and even phonetics. Each sentence is a bit different, depending on who I'm speaking to and about what. I'm not even able to pronounce a sound exactly the same twice. But there are also certain limits. I can't do anything I want. After all, "A" always needs to sound approximately like "A", otherwise it won't be recognized, and I won't be understood. In the SFB, we explore such limits of variability at various levels to see what they have in common – and how they differ. This will enable us to learn more about how language actually works and how it is that we are able to use language so flexibly.

Zimmermann: You have to understand that for a long time theoretical linguistics operated on the false premise that there is something like "the 'one' language" – German, English, French, for instance – and that linguistics is about identifying its rules, its abstract representations. As a result, you get a rather rigid, black-and-white system, in which a sentence is either grammatically correct or isn't. At the same time, theoretical linguists have always known that this is not quite the case, that language use is more flexible. So, this is the SFB's focus. The question is to what extent language can be varied before it becomes incomprehensible. A popular example is the discussion around German youth dialects. Researchers like Heike Wiese and Ulrike Freywald have been able to demonstrate that these dialects are certainly no pidgin. It differs from the German taught at school, but it does follow rules. Also, even if someone says, "I'm going Kudamm", any speaker of standard German would understand.

Why is language variability so important?

Zimmermann: For it to serve its purpose, language needs to be variable. On the one hand, we use language like a tool – with very diverse communication objectives. These can only be achieved if our tool is versatile. On the other hand, though, flexibility contributes to effectiveness. All speakers have their idiosyncracies: voice modulation, pitch, clarity, etc. Such differences need to be tolerable, otherwise we'd always be asking: "What do you mean?" If language were a rigid system, it wouldn't function very well. We have to be able to tolerate deviations from the norm and still understand each other.

Photo: Fritze, Karla

What are the limits of variability?

Zimmermann: Every language has a standard version, like standard German. In many situations – as has been pointed out – deviations from this standard can be tolerated, even if they are systematic. At the same time, there are rules we would consider unbreakable. For instance, when children acquire language and start learning to conjugate verbs, they might add regular endings to irregular verbs. They have realized that there's a rule about the inflection of verbs and apply it to all verbs, so they would say, for instance, "I eated" or "I goed". With enough feedback, they quickly learn that this is incorrect. But the other way around – incorrectly conjugating a regular verb – doesn't happen.

Wartenburger: Exactly. It's similar when we look at the syntax. The German language has many options for word order – but some are ruled out. It's exciting to see whether these limits also exist when the possibilities of variation are regularly exhausted, such as at the weekly market, where people use different languages or a mixture of languages. This is what Heike Wiese and Ulrike Freywald's project in the SFB focuses on. She and her team are investigating: What is said? What is possible? The assumption is that even at the weekly market there are certain rules that aren't broken – automatically, that is, since speakers don't consciously think about it. This would be a limit to variability, a fixed parameter of the language that can't be easily ignored – whether at the weekly market or in the lecture hall.


Prof. Malte Zimmermann

Why are these limits needed?

Zimmermann: Without limits to variability, language systems might never have evolved. Language came into existence to better coordinate larger social interrelations. For this to work, the speakers of a language needed a common framework: a conventionalized system of rules, an unconscious agreement on the use of language that every speaker has internalized, which is not completely arbitrary and is relatively stable. Yet this framework is not as rigid as linguists had long thought. After all, language exists in the interaction between speakers. This is also where it changes, but changes don't happen overnight. There isn't someone who gets up in the morning and says: Hey, from now on, I'm gonna systematically change the position of the subject in the sentence! It does start somehow, and if enough speakers use it, it'll gain acceptance. But there are also other reasons altogether for changes: In Old Icelandic, for instance, there used to be two variable positions for the verb and the object in a sentence: "object before verb" or "verb before object". (By the way, a similar variation in word order also exists in the German language between main and subordinate clauses.) As it happened, many older speakers of Icelandic fell victim to a smallpox epidemic in the early 17th century. At the same time, Danish – with a more rigid "verb before object" word order – became more prevalent in administrative language, so "verb before object" became the norm in the language system in the following generations. So, extralinguistic factors resulted in one variant remaining and becoming the standard.

Wartenburger: This is exactly the type of historical changes the SFB is researching. Ulrike Demske and Claudia Felser are exploring why certain structures of Early Modern High German died out while others are still in use. The most fascinating part is that they are testing out the extinct forms on contemporary speakers to find out whether our brains "accept" them as legitimate or "sort them out" as unnecessarily complicated.

Photo: Fritze, Karla

Thanks to its variability, language helps to build bridges

Was language more variable in the past than it is now?

Wartenburger: Yes and no. Without a doubt, Early Modern High German had linguistic options that disappeared over the centuries. People became increasingly mobile. There was more language contact, which contributed to more variability. Of the many options, some turned out to be more efficient than others and survived. But if speakers of different languages are able to communicate at the weekly market, this again testifies to the flexibility of language. Or take, for example, the language used in completely different channels, like on the internet – in blogs, on Twitter, Facebook, and others, as Tatjana Scheffler and Manfred Stede are researching in their project. Online, linguistic forms and structures that would've been considered impossible and completely ungrammatical 10 years ago are being tested out – and seem to become accepted. It's a sort of feedback loop.

Photo: Fotolia/hurca.com

Zimmermann: In this cycle of change, there will always be phases when two competing variants exist until one of them gains the upper hand. Negation in French is a very good example: According to the standard grammar, it takes two parts, "ne" and "pas" – on either side of the finite verb – to create a negative sentence, but in colloquial French nowadays only the more economical simple "pas" is used. It is predicted that the "ne pas" variant will become extinct and that only "pas" will remain. This actually also happened to the German language. Until Middle High German, a small negative adjective was used in negative clauses in addition to the adverbial "nicht" – analogous to the French "ne". As a matter of fact, new requirements in language contact constantly lead to new variants. For reasons of efficiency and conventionalization, some of these are later dropped. All of this happens unconsciously.

For you as researchers, what is more fascinating, the limits or the variability?

Zimmermann: (Laughing) The limits, absolutely.

Wartenburger: I agree. All the more so because variability has already been heavily researched. What makes our SFB special are the many projects that enable us to look at our research topic from very different angles. Some of us go to the weekly market and study the language used there with sociolinguistic methods; others study what the brain does by analyzing eye movements during reading. Ultimately – and this is very exciting – we will pool our results to find the links, correlations, and common features.

Does that mean that limits are more difficult to establish?

Zimmermann: Yes, because they're not as rigid as theoretical linguistics long thought them to be. Variations are actually easy to establish empirically – and to describe. You take a recording device and find people in village A speaking differently than those in village B. To a certain extent, this is trivial and was even sneered at by theoretical linguists for quite some time. However, it gets really interesting when you combine the two – the empirical study of variability and the theoretically reconstructable structures that limit them.

Wartenburger: Each project in the SFB is trying to establish these limits empirically or experimentally, to push variability as far as possible to see: Okay, it works up to this point but no further.

The research projects of the SFB are divided into three clusters. What are they?

Wartenburger: Cluster A looks at variability in language and its limits in situations of language contact and interaction. What variability do we see in such situations? How has it developed historically? What do contemporary speakers make of structures that are no longer standard? And how much variation is there in how people use language? That is, how does linguistic usage vary in situations like sitting here and giving an interview, writing an email, using Twitter, or doing some shopping at the weekly market ...

Zimmermann: This includes – in the broadest sense – the social function of language. Cluster B covers the biological-cognitive component: how people process language in various situations or based on their cognitive abilities: babies and young children, people with aphasia, people who grow up bilingual, etc. Cluster C focuses on grammar theory. It deals with the intermediary system between the individual speaker and the interpersonal construct of a grammar. Grammar models are not yet well suited to capture linguistic variability. We hope to better understand and describe the mental system of language by combining empirical data and theoretical models. I think this is also one of the things that convinced the reviewers at the German Research Foundation (DFG).

THE RESEARCHERS

Prof. Dr. Isabell Wartenburger studied psychology at the University of Bielefeld and received her doctorate from Charité – Universitätsmedizin Berlin in 2004. Since 2013, she has been Professor of Patholinguistics/Neurocognition of Language at the University of Potsdam.

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Prof. Dr. Malte Zimmermann studied German language and linguistics, English language and literature, and philosophy at the University of Cologne. In 2002, he received his doctorate in general linguistics from the Universiteit van Amsterdam. Since 2011, he has been Professor of Semantics and Grammar Theory at the University of Potsdam.

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Photos: Fritze, Karla (2)

Wartenburger: Combining the various levels is one of our major objectives. Ultimately, any of the projects could just as well have been assigned to another cluster. For instance, Gisbert Fanselow and Reinhold Kliegl are trying to teach people different syntactic structures that are not part of standard German. Of course, they're interested in limits: What structures can I learn, and at what point does the brain say: "No, this is complete nonsense! I refuse to reproduce or accept this." With exactly the same approach or result of this study, you could also go to the weekly market and try to find out: Are any of these unacceptable structures being used here? And how do speakers deal with them when they hear them? What do the brain and the eyes do? The good thing is that the projects can all be combined and benefit from each other. For this reason, it's enormously helpful that almost the entire SFB is at Potsdam. We meet often and talk to each other. This is a big advantage over SFBs in which research projects are distributed all over Germany.

What are you researching in your own projects?

Wartenburger: The project that Sandra Hanne and I are pursuing is at the interface of syntax and prosody:

Speech melody or prosody can play an important role in how we interpret a sentence. For example, in the German sentence, "Die Mutter küsst das Kind" ["The mother kisses the child"], there is subject-object ambiguity, so it could be understood as the mother kissing the child or the child kissing the mother, depending on my intonation. We are interested in how participants of varying ages register such prosodic cues – the intonations or stresses – in various settings, so we would test, for instance, an older person or a child in a noisy environment. Last but not least, we want to find out whether prosody could help people with speech impairments like aphasia to better or more quickly comprehend sentences – for instance, when prosodic cues are enhanced. This could ultimately have a benefit in speech therapy.

Zimmermann: Alexander Koller – who has since gone to Saarland University – and I are researching the limits of variability in semantic interpretation, that is, how we actually understand what's been said. Basically, we want to find out if there are limits to the interpretation of statements imposed by syntactic structure. One example is the interpretation of sentences with two quantifying expressions such as: "Ein umgestürzter Baum blockiert jede Zufahrtsstraße" (literally: "A fallen tree blocks every access road"). English readers can understand this to mean that each road is blocked by a different tree, next to the implausible reading on which there is only one very big tree. In German, however, this is disputable. We want to empirically quantify the actual situations in German, English, and the West African language Akan. If there are differences, they have to be explained by the language system, since we can well imagine the situation described by this particular way of reading the sentence.

In addition to the 13 subprojects …

Wartenburger: … there is an internal PhD program chaired by Tatjana Scheffler to ensure that young researchers receive structured doctoral training so they can network better – including special events, retreats, and guest lectures for which they invite or suggest speakers. There is also the Q project for service and information infrastructure led by Shravan Vasishth and Ralf Engbert. It provides quality assurance and advises the participating projects on, for example, statistical analysis, data collection, data management, and ensuring sound scientific practice.

Zimmermann: The Q project in particular provides excellent methodological training for the doctoral students – probably the best in linguistics in Germany.

Photo: Fritze, Karla

THE PROJECT

SFB 1287 – Limits of Variability in Language: Cognitive, Grammatical, and Social Aspects

Funding: German Research Foundation (DFG)
Head: Prof. Dr. Isabell Wartenburger (spokesperson), Prof. Dr. Malte Zimmermann (deputy spokesperson)
Duration: 2017–2021
www.uni-potsdam.de/de/sfb1287

Looking back, how did the SFB come into being?

Wartenburger: It took many, many years ....

Zimmermann: When the SFB "Information Structure" expired, many here at the University had the idea of starting a new SFB – also in our field, in which a whole generation of students had grown up with this system. So we sat down and collected ideas. The topic had to be broad enough to "encompass" all prospective projects. On the other hand, it couldn't be so vague that it no longer had any meaning. The first linguistics SFB in Constance in the 1970s was simply called "Linguistics". Those days are over...

Wartenburger: Once we found the topic, we needed to draft an outline – a good 100 pages. It was written, revised, critiqued, rewritten, revised, critiqued, and rewritten again... An initial internal examination you might say. The paper was submitted to the DFG before Christmas 2015. After the assessment, we traveled to Bonn to present our outline and answer the examiners' questions. About two months later, it was clear that we were going to be able to continue. That's when the real work began. The final application has to be about 20 pages – for each project. So, it all started again: writing, revising ...

Is it hard to push yourself to the limit for years without knowing whether it will work out in the end?

Zimmermann: The possibility of failure is certainly always present. And it's very real, since there's a lot of competition for research funding, and at the level of SFB's, we're competing with every other discipline. I'm very happy that we were successful in the end.

Wartenburger: Yes, that would've been really frustrating. But I can say that everyone was highly motivated throughout the process. It's been really fun. Even more so once the SFB started in July 2017.

Photo: Fritze, Karla

In an SFB like this, how do you make researchers and projects come together in the end?

Zimmermann: (Laughing) By force! Joking aside, it can't hurt to constantly initiate discussion among the SFB members. You can also try out new formats, in which we all put our heads together and come up with suggestions of what else we could do together. These may well develop into small sub-projects or ideas for a second SFB phase.

And how can the results of 13 sub-projects be brought together?

Wartenburger: We don't expect to end up with one model that explains everything; four years just isn't long enough for that. We're focusing on phenomena, structures, and topics for joint work and joint theoretical approaches, which then could lead to a potential second funding phase.

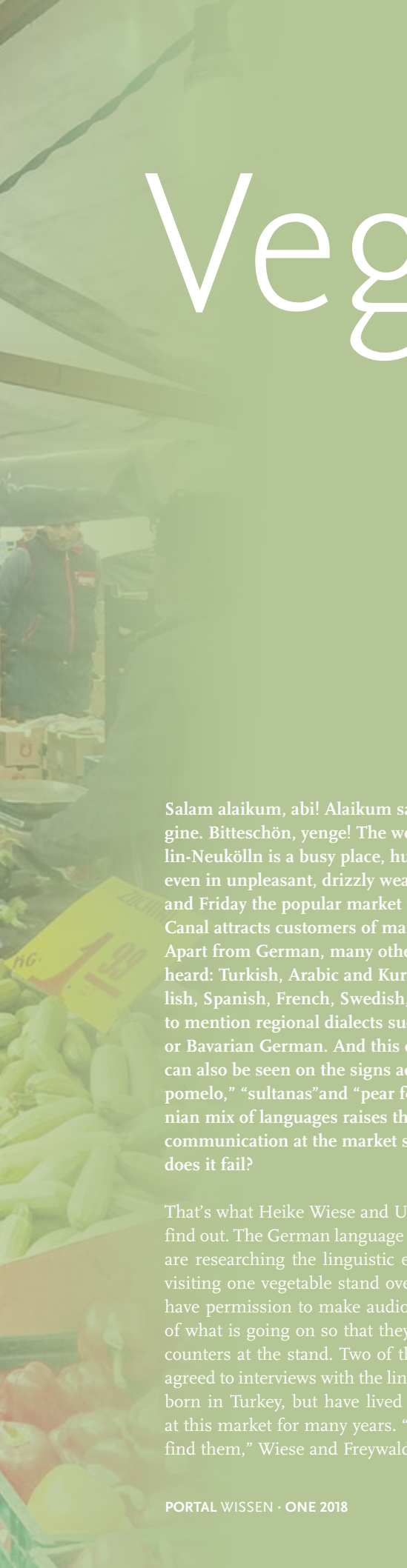
INTERVIEW: MATTHIAS ZIMMERMANN
TRANSLATION: MONIKA WILKE

Market stall at
Maybachufer in Neukölln

Photo: Schulz, Jana

Over the coming four years, the **"Integration of linguistic resources in highly diverse urban settings: Stretching the limits of variability"** project will research variability in language at a weekly market in Berlin. The project is part of Collaborative Research Centre (Sonderforschungsbereich, SFB) 1287, entitled "Limits of Variability in Language: Cognitive, Grammatical, and Social Aspects." In addition to the project's directors, Prof. Dr. Heike Wiese and Dr. Ulrike Freywald, Ph.D. students Kathleen Schumann and Serkan Yüksel are working on the project, as well as student assistants İrem Duman and Henrik Willun.

✍ www.uni-potsdam.de/en/sfb1287/subprojects/cluster-a.html



Vegetables Mixed Style

Linguistic Diversity at a Weekly Market in Berlin

Salam alaikum, abi! Alaikum salam. İki tane Aubergine. Bitteschön, yenge! The weekly market in Berlin-Neukölln is a busy place, humming with people, even in unpleasant, drizzly weather. Every Tuesday and Friday the popular market next to the Landwehr Canal attracts customers of many nationalities. Apart from German, many other languages can be heard: Turkish, Arabic and Kurdish, as well as English, Spanish, French, Swedish, Hindi, Bengali – not to mention regional dialects such as Berlin, Swabian or Bavarian German. And this enormous diversity can also be seen on the signs advertising "honey pomelo," "sultanas"and "pear forelle." This Babylonian mix of languages raises the question: How does communication at the market succeed? And when does it fail?

That's what Heike Wiese and Ulrike Freywald want to find out. The German language experts and their team are researching the linguistic ecology of the market, visiting one vegetable stand over several weeks. They have permission to make audio and video recordings of what is going on so that they can analyze their encounters at the stand. Two of the salesmen have also agreed to interviews with the linguists. Both men were born in Turkey, but have lived in Berlin and worked at this market for many years. "We were very lucky to find them," Wiese and Freywald say.

Although the salesmen say they speak Turkish and German, in practice they use many more languages. Everyday words taken from Arabic, English or Spanish are used in various combinations. Similar phenomena have been found in Asian countries. Here the researchers observed multilingualism at work and came to a remarkable conclusion: Although many of the respondents report that they speak only one or two languages, they actually use many more in their work as fast-food vendors or barbers. It seems that they picked them up unwittingly in everyday life.

People at the market know little about their counterparts' linguistic skills

"Many tourists use other languages than the community in this neighborhood," Freywald says. One American customer bought a zucchini for one euro and paid with a fifty-euro note, recounts student assistant İrem Duman. "I'll give you the change next week," joked the salesman in German. But the American did not get it; he did not speak German. To understand such situations, project participants conduct mini follow-up interviews. They ask people at the market about their language skills and their linguistic biographies. One researcher remains at the stand as a silent observer, taking notes on conversational situations and the

The team collecting data at the weekly market

atmosphere without interacting. Later, this ethnographic fieldwork will be complemented by grammatical analyses.

"Many interactions take place without language," Wiese and Freywald explain. People point at a vegetable, squeeze it to find out how ripe it is, and then hand it to the salesman, who weighs and packs it. But there has to be some verbal communication, at the point of payment at the latest, as there is no register to show the price. Seller and buyer now have to decide on a language. If all else fails, they resort to body language. "Actually, it works quite well," says Kathleen Schumann, a Ph.D. student in the project. "But how and why it works, has not yet been investigated in detail."

Does the market have its own grammar?

The study focuses on grammatical structures. When switching between various languages, many things are combined, but not randomly. One hypothesis the researchers have is that nominal phrases are formulated according to the grammar of one language, even when various languages are used in it. The next nominal phrase – consisting of an article or numeral, a noun and adjectives – can then be expressed in the grammar of another language, as in "iki tane Aubergine, bitte" – literally, "two pieces of eggplant, please". The sentence follows Turkish grammar, which indicates the plural not by adding a suffix to the noun, but by inserting a function word such as "piece" after the numeral, explains Serkan Yüksel, another Ph.D. student. The project is focusing on these kinds of morphological structures.

But lexis, or vocabulary, also plays an important role. One sign says "Çıtır Gurke." It is meant to advertise "crunchy cucumbers," but usually the word "çıtır" is not used in combination with vegetables in Turkish. Is this expression typical of a certain region in Turkey? Or specific to this market? Or is it widely used among speakers of Turkish in Germany? Experts are brough in to answer these types of questions. Two of the project's researchers are native speakers of Turkish. Other linguistic experts will help later in the analysis. Once data collection is completed, the team will also elicit the opinions of several market salespeople on certain linguistic phenomena.

The language experts and their team are especially interested in the question of whether there is a market-specific grammar. Could it be that local ways of speaking develop at the market, a special language belonging to the people who communicate here on a regular basis? "The speakers behave in ways that indicate that they systematically opt for certain structures," Wiese explains. But according to what rules? And what do these rules say about the organization of language in general? "Maybe there are parallels to creole languages," Freywald adds. Such languages develop through intense contact between people of different native languages, and such languages have their own grammar. The Potsdam project is examining whether an explicit "market language" has developed at Berlin's weekly markets.

Years of researching urban linguistic contacts

The researchers are regular shoppers at the market who have also been interested in the topic of multilingualism in neighborhoods for quite some time. In their "Kiezdeutsch" project, they studied the way young people in the Berlin district of Kreuzberg speak. Most of these young people grew up bilingual and speak – in addition to German – Turkish, Arabic, Kurdish, or Slavic languages as their native languag-

Photos: Scholz, Jana (2)

es. The specific focus in the "Kiezdeutsch" project was on how the German language develops in such multilingual contexts, including what new resources young people develop among themselves in terms of everyday language and dialects.

The situation is a bit different at the weekly market because many more languages are spoken. "The people who interact here don't know much about each other," explains Henrik Willun, a student assistant on the project. "So how do they decide which language to use?" After all, shoppers at the market are unaware of the language skills of the salespeople – and the salespeople do not know which languages their customers speak, unless they are regulars. The research team has already made one important observation: Yüksel and Duman explain that, when the sellers assume that their customers speak Turkish, they address them as "abla," "abi," "yenge" or "baba," that is elder sister, elder brother, aunt or father, respectively. Women identified as speakers of German are addressed as "Madame." "It might be that factors such as appearance, sex or age play a role when deciding on a language," Wiese and Freywald suggest. They will only really know whether this is true once their material has been analyzed.

The data obtained in the "Kiezdeutsch" study is also useful for the current research project. It can shed light on the question of whether there are market-specific ways of speaking, and whether the linguistic structures of young people differ from those used at the market. The researchers would like to study another market next, such as the Vietnamese Dong Xuang Center in the Berlin district of Lichtenberg. This would enable them to compare the linguistic peculiarities of the two markets and gain insights into whether distinctive market languages exist. In any case, they plan to collate the results with those of other projects in the Collaborative Research Centre. Wiese and Freywald expect a fruitful exchange with the "Variability in Bilingual Language Processing" project, paying particular attention to German-Turkish speakers.

"In a highly diverse urban setting such as the weekly market in Berlin-Neukölln, people are used to adapting linguistically to the person they are speaking to," Wiese explains. Several people here have an international background and have lived at various places around the world. "Many of them have a very colorful life story," Freywald adds. And you can hear that.

JANA SCHOLZ
TRANSLATION:
MONIKA WILKE

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Photos: Loos, Steffi (top); Müller, Stefan / LingPhot (middle); Scholz, Jana (bottom)

What Languages Tell about Language

Linguist Doreen Georgi researches grammatical structures around the world

Photo: Fotolia/Cybrain

Language is one of the most versatile instruments we possess, thanks to its variability at all levels – from pronunciation to word order. But linguistic flexibility also has its limits, which are of particular interest for linguists. After all, they make sure that we speak more or less the same language. Doreen Georgi is Assistant Professor for Variation and Variability in Grammatical Systems and a member of the Special Research Area "Limits of Variability in Language," known as SFB (Sonderforschungsbereich) 1287. In her sub-project she investigates whether different languages have common limits, and evidence of a universal grammar may be derived from it.

"Language varies a lot. It actually has to, otherwise we could not express all we want to say," Georgi explains. "But it does not vary wildly. There are rules that aren't broken and limits that aren't crossed." Like all projects in the new SFB 1287, the linguist wants to make her contribution to describing these limits more precisely. The special feature of her approach is that she is researching not one, but dozens of languages from all parts of the world. "We already know that, at the abstract level, languages function universally. Some rules are unbreakable."

THE PROJECT

The project **"The Limits of Variability in Extraction Asymmetries"** is part C05 of the SFB "Limits of Variability in Language" (1287).

Funding: German Research Foundation (DFG)
Duration: 2017–2021
https://www.uni-potsdam.de/sfb1287/

These overarching structures are the linguist's research topic. With the aid of selected grammatical phenomena, she intends to identify and describe general rules that apply to various languages. For her, the ultimate objective – the linguistic dream of a universal grammar – is not so much a golden book of rules as it is a set of rules about how various languages interrelate. "All languages have limits, but they are differently weighted. Some may be broken here, others there," Georgi points out. A universal grammar is conceivable as a compilation of existing rules. "For instance: These are my ten rules – and depending on which of them are considered unbreakable in a language, a certain grammar is derived from it."

Prof. Doreen Georgi

Photo: Fritze, Karla

A phenomenon shared by many languages

Among the phenomena Georgi investigates across languages are extraction asymmetries. In most languages, the parts of a sentence may be shifted to various positions. When a part is placed somewhere other than its normal position, linguists call this extraction. If the statement "The man sees the women" is converted into an interrogative clause – "What women does the man see?" – the interrogative word is inserted at the very left. In many languages, this shift is easier to do with some parts of a sentence than it is with others. For instance, it is often more difficult to extract subjects than objects – a phenomenon referred to as extraction asymmetry. Besides, subject extraction is less common, yet in many languages possible, with the help of specific morphological markings only. "It's always the subject that causes problems," Georgi says with a laugh. "Linguists have been wondering why for quite some time. I hope we can find an answer."

Above all, Georgi is fascinated by languages displaying various asymmetries. For instance, in German you can easily ask for a subject, like in "Who sees the man?". But this kind of question does not exist in the Mayan language Kaqchikel. And while the subject can easily shift its position in German, it invariably takes the same position in English. "We want to investigate languages with various asymmetries and find out: Is there something like a rule in a mental grammar that obstructs subject extraction in general?" Georgi says. She set herself the aim of including as many non-related languages as possible into her research, ideally about 30 languages from almost all continents: Berber and Bantu languages from Africa, Mayan languages from America, Turkish, Italian dialects, as well as Asian languages. Only Australia will be left out. Asked if she also speaks these languages herself, she says no and laughs. "One can research languages without speaking them. – Even though I find many of the languages I have researched so far quite exciting."

THE RESEARCHER

Prof. Dr. Doreen Georgi studied linguistics and Romance studies at the University of Leipzig, where she also received her doctorate. Since 2017, she has been Assistant Professor for Variation and Variability in Grammatical Systems at the University of Potsdam and head of the sub-project C05 "The Limits of Variability in Extraction Asymmetries" of SFB 1287.

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Enthusiasm for linguistic plurality

Typology, or the comparison of languages, has been Georgi's favorite topic for a long time, and eventually

Investigating many languages reveals what they have in common

Photos: Fritze, Karla (top); Fotolia/vege (bottom)

earned her a professorship at the University of Potsdam. "I have always been intrigued with the range of linguistic variation in the world. Things we are not used to from our language and would not consider possible," the linguist says enthusiastically. So while the Mayan language Kaqchikel does not have subject questions, it does allow subject and object questions, such as: "Who saw whom?". In other languages, grammatical phenomena are expressed only by the tone of the verb – for instance negation in Igbo, a language spoken in Nigeria. "But what fascinates me even more is that theoretical models, patterns and rules can be identified in this somehow wild mix." This has always been one of Georgi's main research interests. Her appointment as assistant professor came with the task of conceptualizing her own project for the SFB. As soon as she had arrived in Potsdam, she began to flesh out her draft. The allocation of the SFB by the German Research Foundation (DFG) was a defining moment for Georgi, too, and the actual start for her project.

Together with a postdoc and two student assistants, she is now going through the research literature and countless grammars of languages from all over the world. The team will then develop a questionnaire for the empirical research phase. "We are compiling various factors that we know influence extraction in some languages," Georgi explains. The questionnaire will then be sent to a large number of speakers of the selected languages. Their answers will help to prove, and interrelate, the results of the theoretical analysis: In which languages do these phenomena actually occur, and under what conditions? Can parallels be drawn between the languages? The results will then indicate what the identified rules have in common, what divides them, and whether general patterns can be distinguished. In a second step, Georgi plans to investigate whether and to what extent these parameters influence each other. "This would be a further step towards a better description of how language works – everywhere in the world."

MATTHIAS ZIMMERMANN
TRANSLATION: MONIKA WILKE

Photos: Fritze, Karla (2)

ESSENTIAL FOR LIFE

AND YET NOT AVAILABLE EVERYWHERE

Prof. Dr. Axel Bronstert coordinates a sub-project on water resources management

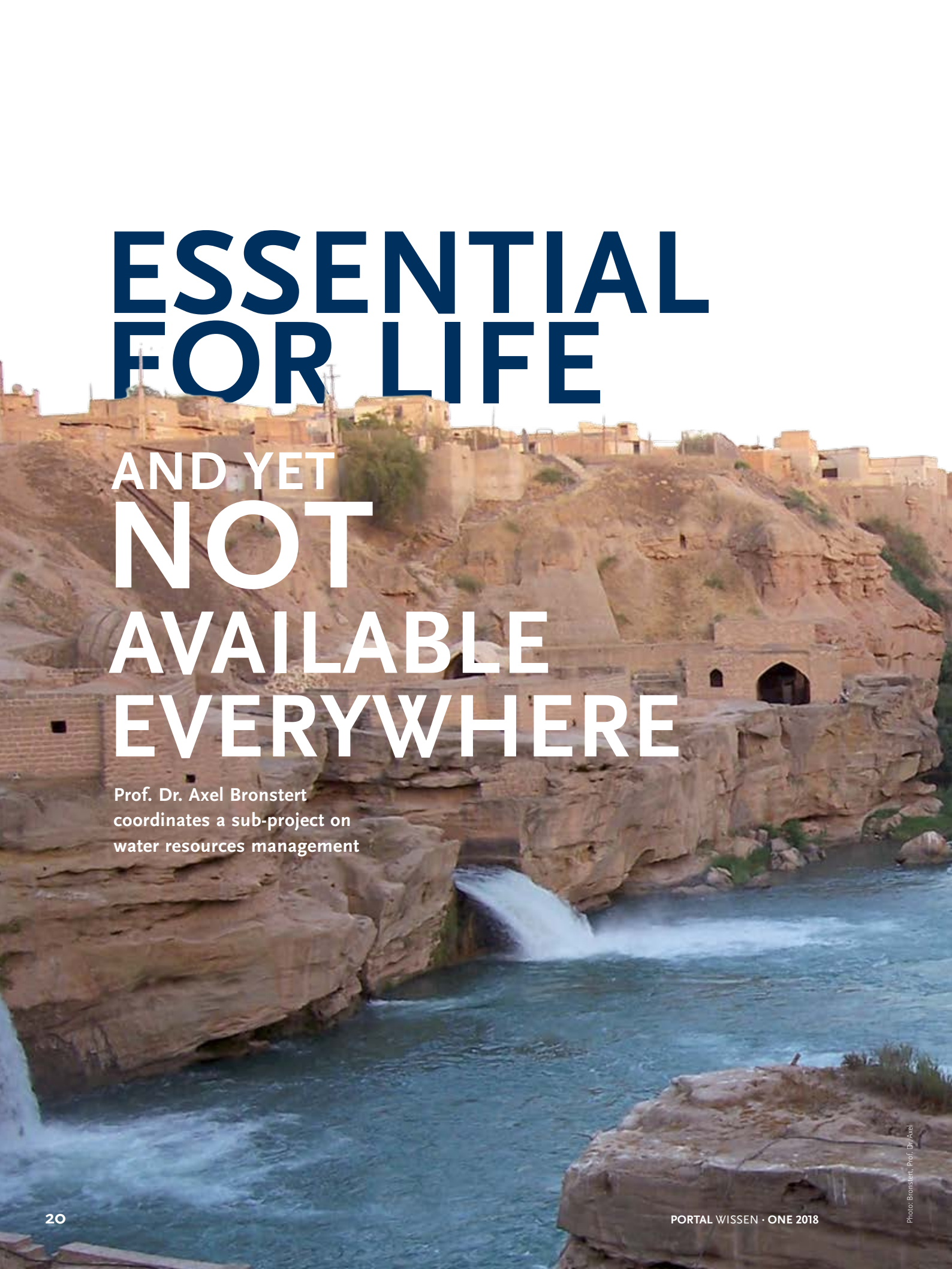
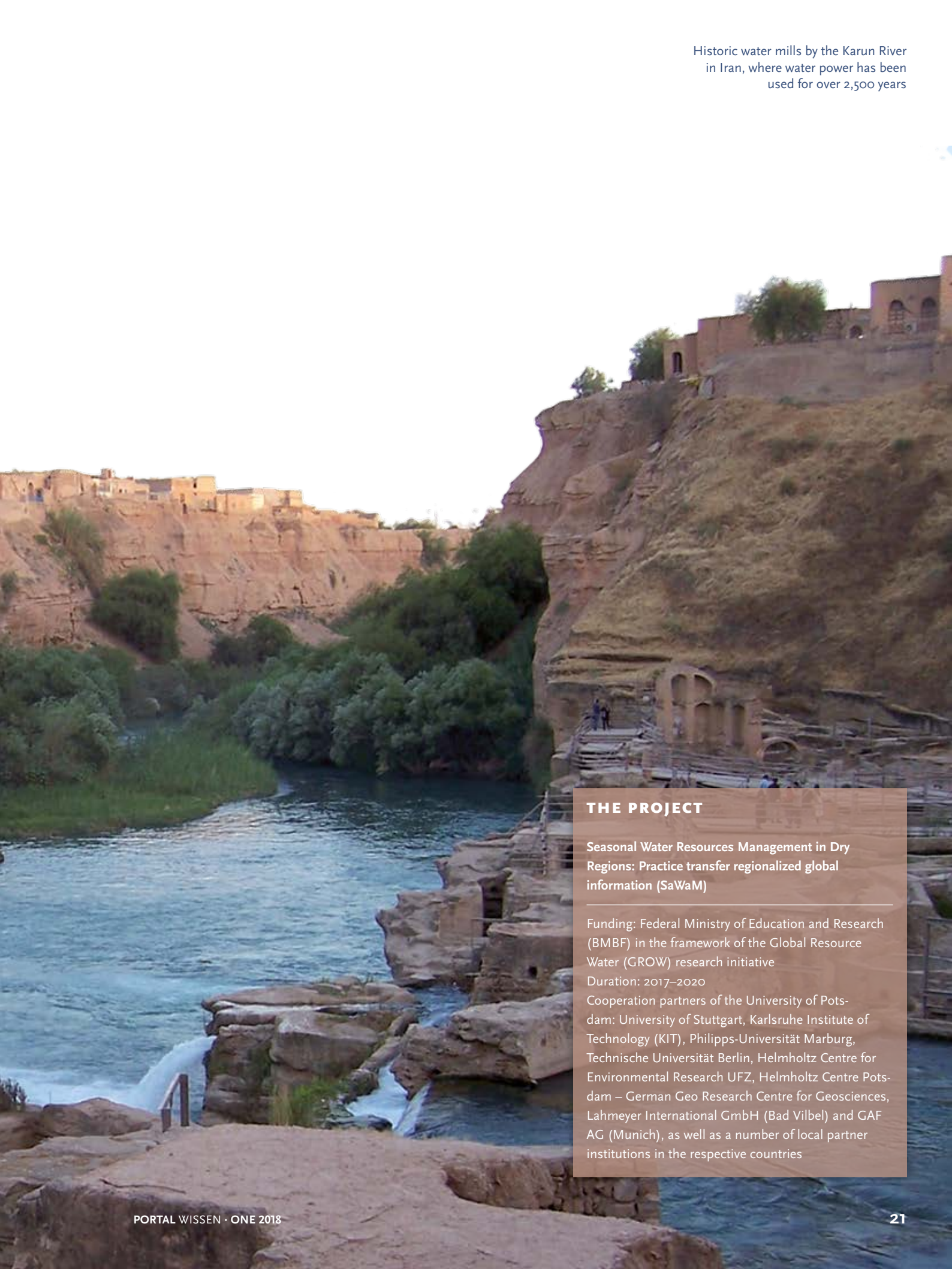


Photo: Bronstert, Prof. Dr. Axel

Historic water mills by the Karun River in Iran, where water power has been used for over 2,500 years



THE PROJECT

Seasonal Water Resources Management in Dry Regions: Practice transfer regionalized global information (SaWaM)

Funding: Federal Ministry of Education and Research (BMBF) in the framework of the Global Resource Water (GROW) research initiative
Duration: 2017–2020
Cooperation partners of the University of Potsdam: University of Stuttgart, Karlsruhe Institute of Technology (KIT), Philipps-Universität Marburg, Technische Universität Berlin, Helmholtz Centre for Environmental Research UFZ, Helmholtz Centre Potsdam – German Geo Research Centre for Geosciences, Lahmeyer International GmbH (Bad Vilbel) and GAF AG (Munich), as well as a number of local partner institutions in the respective countries

Households in Germany consume about 120 liters of water per capita, per day. Furthermore, industry, power plant cooling and agricultural irrigation require significant amounts of water. In many parts of the world, however, water scarcity is the order of the day. That is why forecasts about the amount of water to be expected in dry regions of the earth are of vital importance. No less pressing is the question of how storage reservoirs, hydro power stations and the irrigation of farmland can be controlled and coordinated. In the joint project "Seasonal Water Resources Management in Dry Regions, Regionalized Global Data and Transfer to Practice" (SaWaM), funded by the Federal Ministry of Education and Research (BMBF), more than 20 researchers are looking for answers to these questions. Among them are environmental scientists at the University of Potsdam. Their objective is to tap into global and regional satellite data, as well as simulation models, to facilitate regional water management and seasonal water forecasting.

The vital resource of water is distributed very unevenly between regions of our Earth and over the seasons. According to estimates by the United Nations, water scarcity may impact some 1.8 billion people by 2025. The growth of the world's population, the increase in water consumption by households, in agriculture and industry, as well as climate change in some regions, are the three main reasons for the imminent scarcity. To remedy the situation, we need a clearer picture of hydrological cycles and resources. But in many cases, there are not enough observation data available, or they are insufficient. This is why researchers increasingly depend on satellite data or specific simulation models. However, such data and model results are often quite inaccurate and thus fraught with considerable uncertainties. The objective of the SaWaM project is to investigate the potentials of hydro-meteorological data and simulation models, optimize them with newly developed methods, and thereby help improve regional water management in many places. A total of seven research institutions in the fields of climate, hydrology, and ecosystem research, as well as remote sensing, are involved in the project, plus two private sector companies from Germany.

THE RESEARCHER

Prof. Dr. Axel Bronstert studied hydrology and water resources at the University of Karlsruhe. Since 2000, he has been Professor of Hydrology and Climatology at the University of Potsdam.

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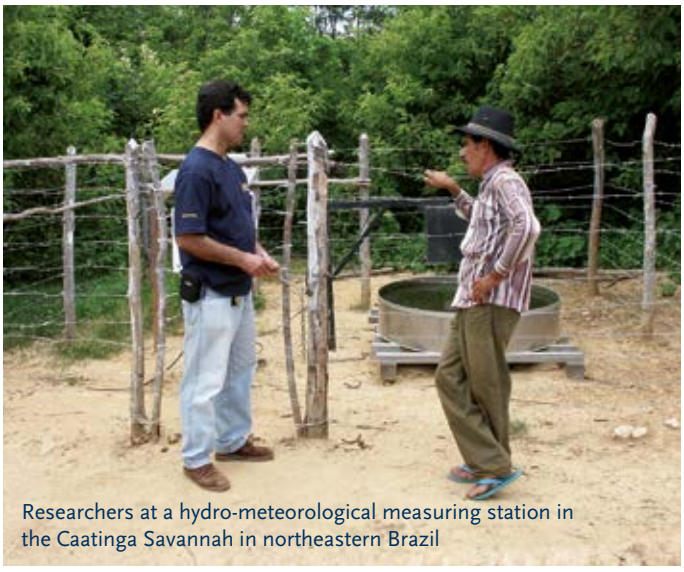
Water management is an imperative to tackling scarcity

Axel Bronstert, Professor of Hydrology and Climatology, coordinates the sub-project "Regional modelling of water management and hydro-sedimentological processes and statistical downscaling for seasonal forecasting" at the University of Potsdam. "We want to contribute our share to the comprehensive simulation of hydrological processes, soil erosion, and the shrinkage of storage reservoir volumes for large catchment areas in dry regions of the world," he explains. "To achieve this, we use specifically developed model systems and new, sometimes globally available information." The combination of specific simulation systems and data analysis methods is expected to facilitate an efficient and sustainable use of scarce water resources in these regions. Regionally valid seasonal forecasts of climatological conditions and the resulting water availability are a particularly innovative instrument used in this connection.



Researchers at a hydro-meteorological measuring station in the Caatinga Savannah in northeastern Brazil

One example of thousands of small local reservoirs in the northeast of Brazil, used to ensure water supply in the dry season

Photos: Fritze, Karla (top); Bronstert, Prof. Dr. Axel (2)

The Karun River in the southwest of Iran in the dry season, upstream the town of Shushtar

The researchers are testing and developing their methods in five regions: Brazil, Ecuador, Iran, Sudan, and western Africa. At the University of Potsdam they are focusing on the catchment areas of two large rivers, the Sao Francisco in Brazil and the Karun in Iran. These are semi-arid regions with only limited water reserves, which means that demand often exceeds the available supply. Besides, these regions are particularly important for countries with growing populations and increasing levels of industrialization. Above all else, agriculture requires water. Demand is rising, while the supply remains constant, at best, or is decreasing. Consequently, the gap between supply and demand is widening here, too. Seasonal water forecasts for these regions would be tremendously important as they would enable sustainable water use.

As a rule, the required data are not collected by the researchers themselves, but made available to them by cooperating universities and local energy and water management authorities. Water scarcity is a problem more regional than global in character. "Nevertheless, there is a host of global data, information, and models that could help in finding solutions. For instance, we use water level measurements for rivers and storage reservoirs obtained by remote sensing from space," Bronstert points out.

From precipitation measurement to forecasting models

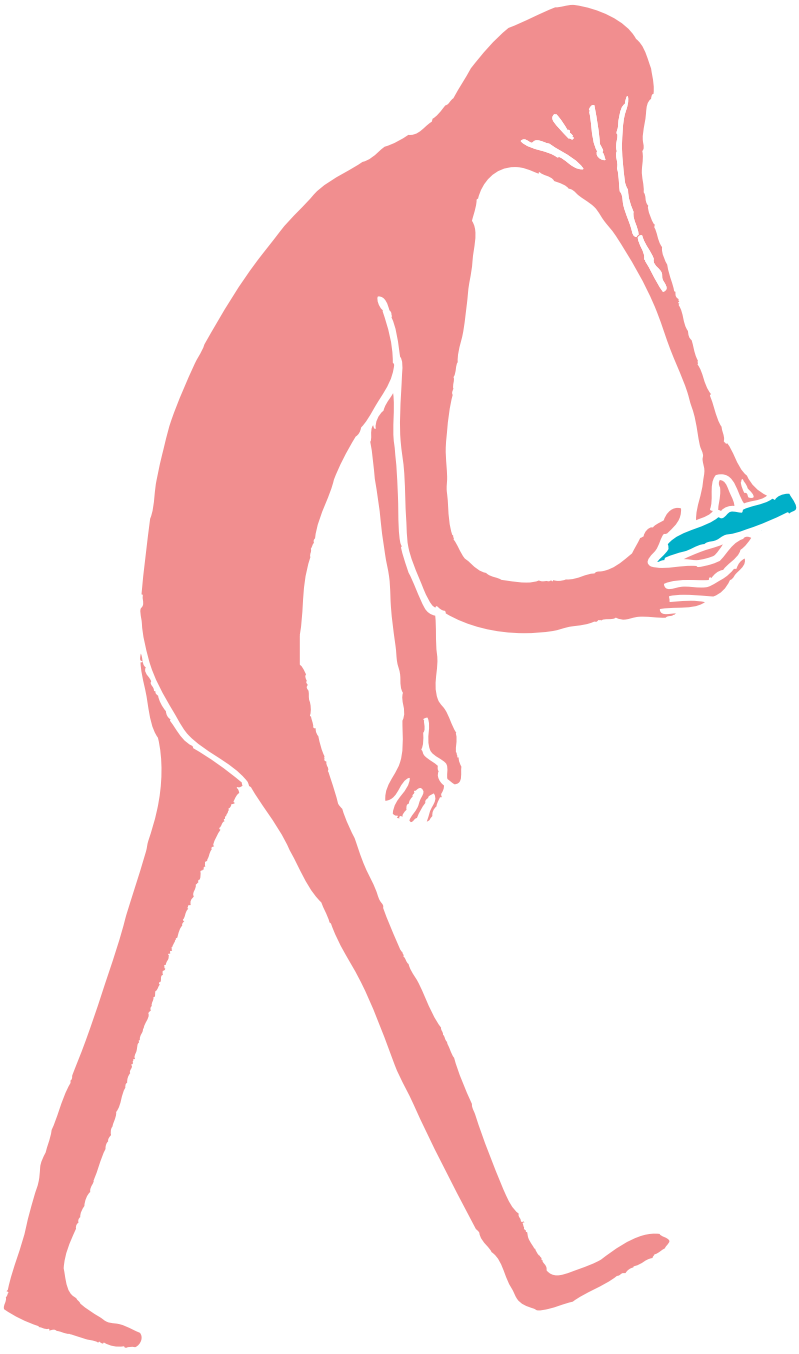
Over the past 15 years, researchers at the University of Potsdam have gained a lot of expertise in this field. They have developed computer models specifically for regional hydrological cycles in dry environments. To do this, they use classical meteorological data such as precipitation and temperature, as well as information on soil and vegetation. To interpret them in a meaningful way, they have to take into account that the accuracy of the data varies depending on local conditions. "A tolerance of plus/minus 20 percent is desirable. Only then can the models provide a reasonably certain result, on the basis of which water resource management becomes plannable," Bronstert explains. Long-term seasonal weather forecasts are another important set of tools for researchers. In dry regions with dry and rainy seasons, it is particularly important for the population to know when the rainy season will start and when particularly wet or dry spells are to be expected. "Our project is testing how reliable this information is." In general, the storage reservoirs in these regions are managed in such a way that they fill up during the rainy season to provide water for irrigation and electricity generation in the dry season. If it were known, for instance, that the upcoming rainy season would bring just a little rain, then existing water reserves could be used sparingly during the dry season.

Prof. Axel Bronstert in northeastern Brazil in the rainy season

Far-sighted water management relies on relevant information and forecasts to facilitate efficient and responsible management of storage reservoirs, also in the dry season. To develop their models, the researchers need extensive data and new weather models preferably looking forward for up to three months. As a result, the project network will provide an online prototype to support water management in dry regions all over the world.

DR. BARBARA ECKARDT
TRANSLATION: MONIKA WILKE

Photos: Bronstert, Prof. Dr. Axel (2)



look! at! me!

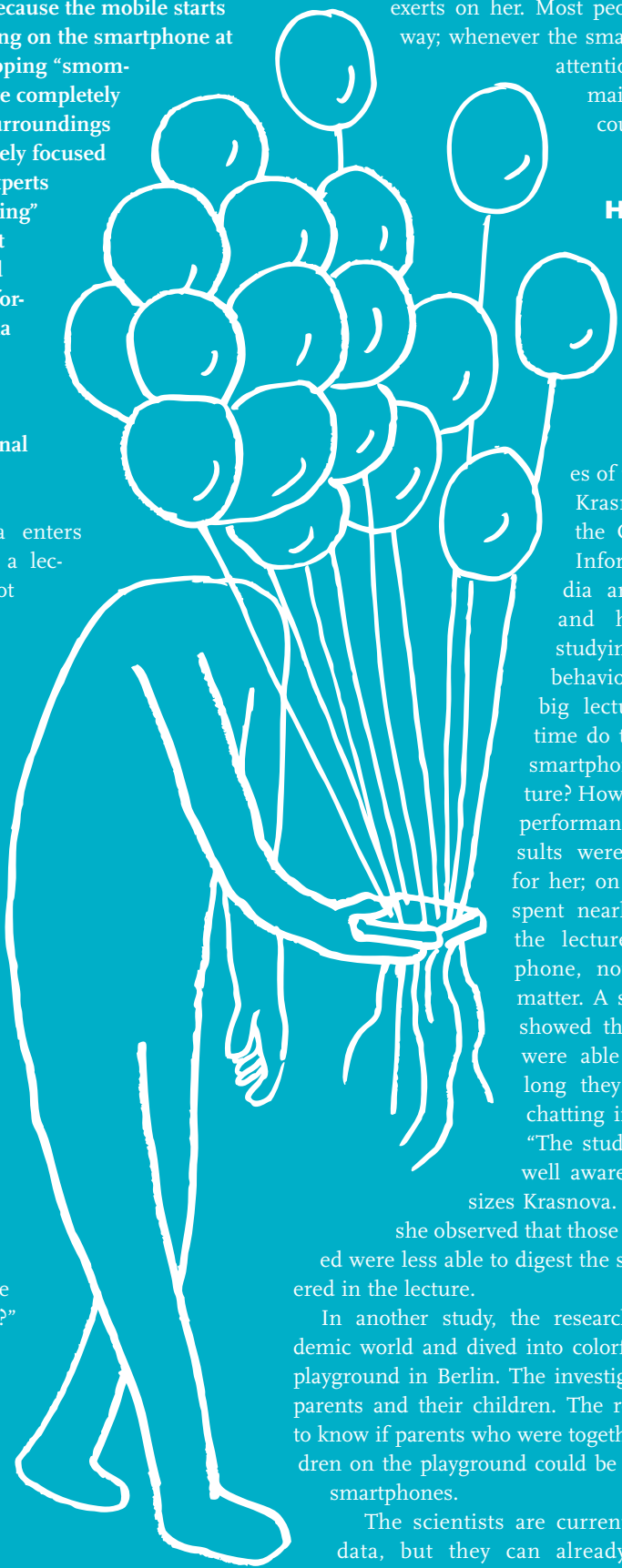
how digital communication affects our lives

Illustration: Töpfer, Andreas

Buzzing, ringing, blinking – the latest news, new e-mails or the latest gossip on social networks compete for our attention. Talking to someone and suddenly turning away because the mobile starts beeping. A child is chatting on the smartphone at the dinner table. Sidestepping "smombies," pedestrians who are completely out of touch with their surroundings because they are completely focused on their smartphones. Experts call this behavior "phubbing" – a neologism created out of the words "phone" and "snubbing." Business informatics expert Prof. Hanna Krasnova examines the consequences of being permanently online in our private and professional lives.

When Hanna Krasnova enters the lecture hall to give a lecture, she knows that not all of her students will follow her attentively. When standing at the lectern and looking at the rows of students, she often sees lowered heads. The students' gaze is directed at displays and monitors, not at her. She has to compete with a strong opponent for the students' attention: the digital world, always available via smartphone, tablet and laptop, in the lecture hall and everywhere else.

"Our daily life is affected by being permanently online," Krasnova explains. "How can we deal with this situation?" She is confronted with this question not only as a professor who sees her students' attention dwindling. As a mother, she faces a dilemma whenever her smartphone rings while she is reading a bedtime story. "I feel the urge to read and answer e-mails immediately," she says about the pressure that the smartphone exerts on her. Most people feel the same way; whenever the smartphone grabs our attention, we rarely remain focused on our counterpart.



Hardly anyone can escape the lure of smartphones

To investigate the extent and consequences of this phenomenon, Krasnova, who heads the Chair of Business Informatics, Social Media and Data Science, and her team began studying the smartphone behavior of students in big lectures. How much time do they spend on the smartphone during the lecture? How does it affect their performance? The study results were surprising even for her; on average, students spent nearly 40 minutes of the lecture on the smartphone, not on the subject matter. A subsequent survey showed that many students were able to estimate how long they were surfing or chatting in the lecture hall. "The students are relatively well aware of this," emphasizes Krasnova. At the same time, she observed that those who were distracted were less able to digest the subject matter covered in the lecture.

In another study, the researchers left the academic world and dived into colorful everyday life: a playground in Berlin. The investigations focused on parents and their children. The researchers wanted to know if parents who were together with small children on the playground could be distracted by their smartphones.

The scientists are currently evaluating the data, but they can already say that many

Illustration: Töpfer, Andreas

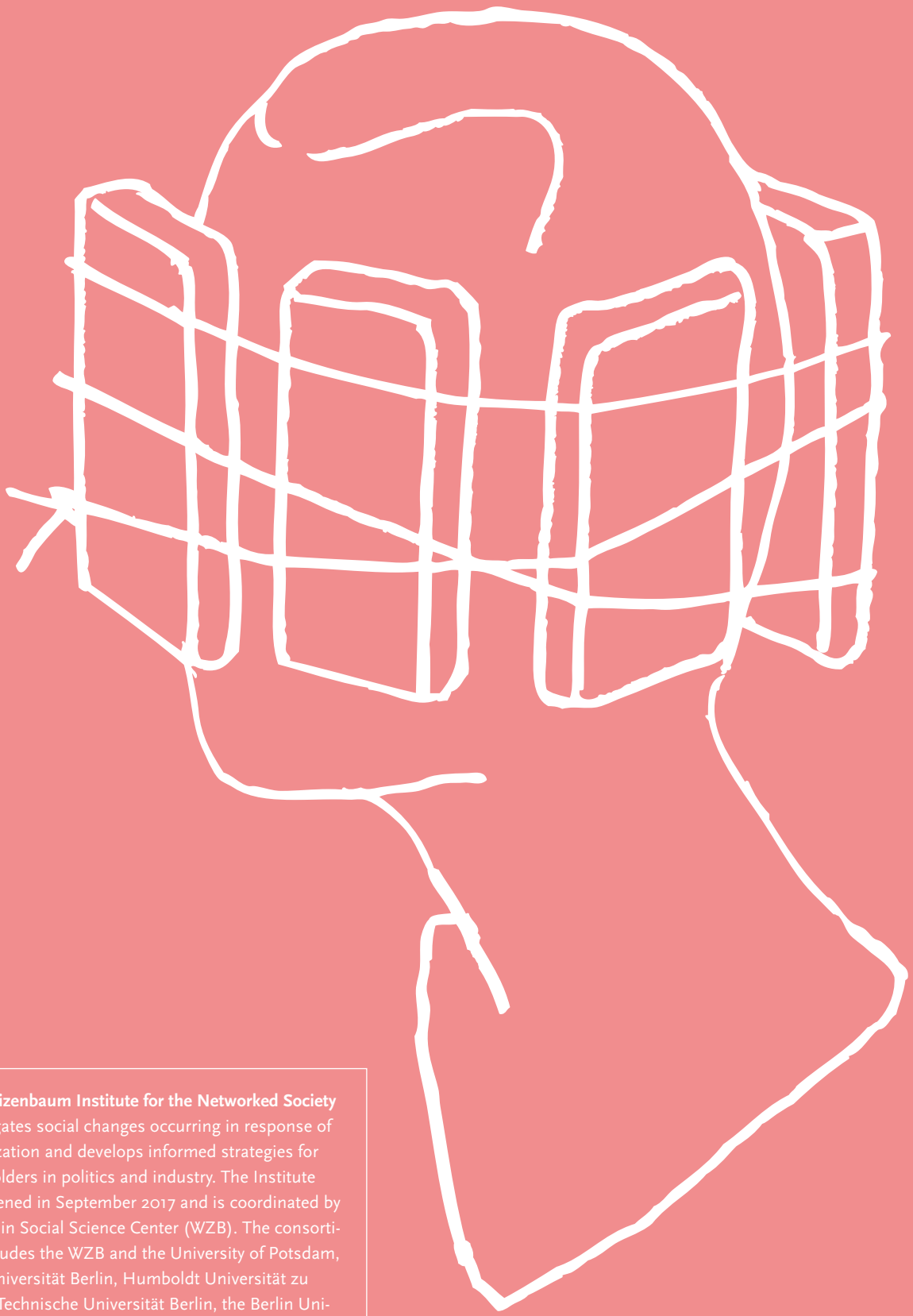
parents spend a lot of time on the playground with their smartphones, while their children are digging in the sand or climbing on jungle gyms. “We're talking about really young children who are two, three or four years old,” Krasnova says. “That can be dangerous.”


Prof. Hanna Krasnova

New communication technologies raise many questions

For Krasnova, current research, which also includes phubbing in relationships, is only the beginning. At the Weizenbaum Institute for the Networked Society, which was recently founded in Berlin, she will focus on further questions about new communication technologies and their impact on society. Here, Krasnova heads up the research group “Digital Technologies and Well-being”. “Of course, smartphones and similar devices also have many positive aspects,” she says. Just one click gives us access to all kinds of information and can connect us with people who are important to us, and with people all over the world. “The smartphone even plays an enormous and very special role in the context of refugees,” explains Krasnova. Refugees stay in contact with their families with the help of these devices, and receive important online information about mandatory appointments with the authorities, or about language and training

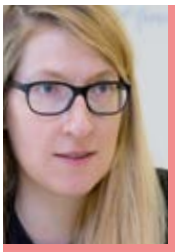
Photos: Fritze, Karla (2)



The **Weizenbaum Institute for the Networked Society** investigates social changes occurring in response of digitalization and develops informed strategies for stakeholders in politics and industry. The Institute was opened in September 2017 and is coordinated by the Berlin Social Science Center (WZB). The consortium includes the WZB and the University of Potsdam, Freie Universität Berlin, Humboldt Universität zu Berlin, Technische Universität Berlin, the Berlin University of the Arts, and the Fraunhofer Institute for Open Communication Systems (FOKUS). The Federal Ministry of Education and Research has funded the Institute with 50 million euros for the first five years.

www.vernetzung-und-gesellschaft.de

Illustration: Töpfer, Andreas



THE RESEARCHER

Prof. Dr. Hanna Krasnova studied Economics and Management Science at Humboldt Universität in Berlin. Since 2015, she has been Professor for Business Informatics, especially Social Media and Data Science at the University of Potsdam. Since 2017, she has been the principal investigator heading "Digital Technologies and Well-being" and "Digital Integration" research groups at the Weizenbaum Institute for the Networked Society.

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courses. In another research project, Krasnova therefore is also looking into how digital technologies affect integration.

"Nevertheless, we cannot forget the negative aspects," Krasnova warns. Many users develop a full-blown smartphone addiction. The day starts and ends with a look at the display. In the time between, many barely last 30 minutes without looking at their device. "We are trying to understand why and how this addiction develops."

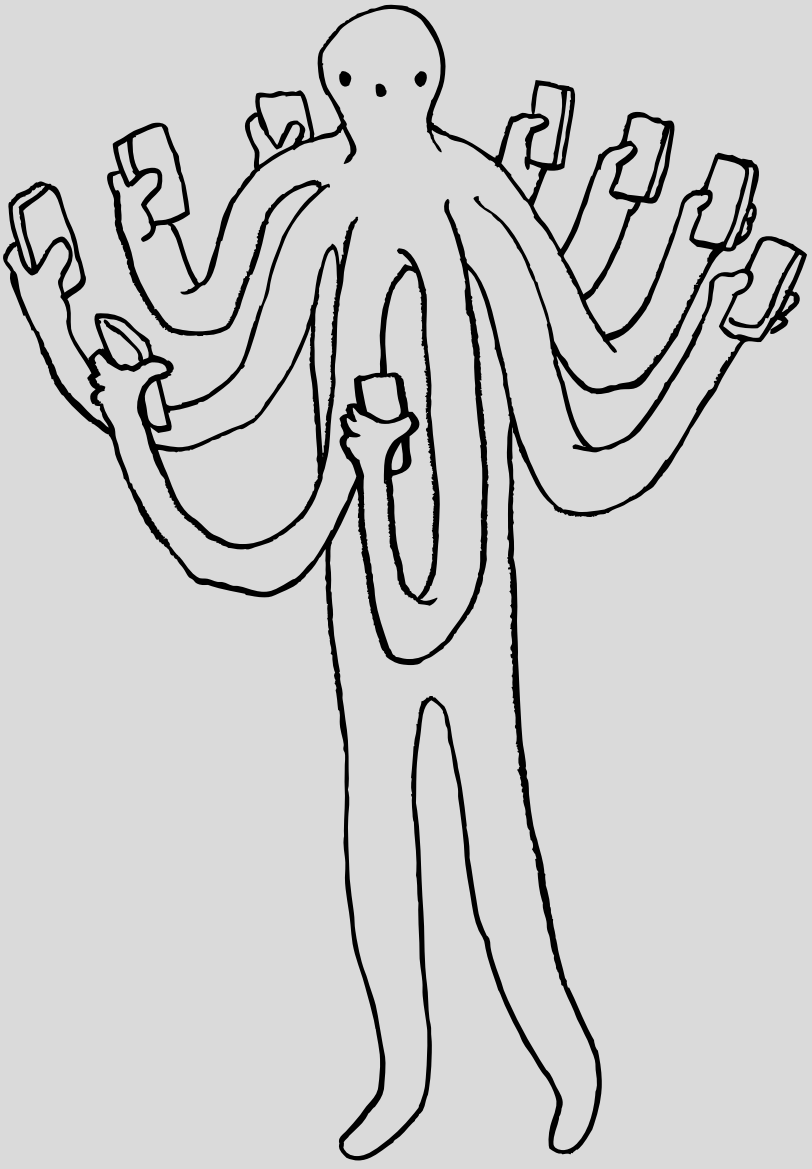
Smartphone addiction involves mechanisms similar to gambling addiction

So why do we accept the snubbing of friends and relatives, missing the subject matter of lectures, and not devoting our full attention to our children? Krasnova describes these processes as follows: When we receive an interesting e-mail or a nice comment on Facebook, we are pleased. At the same time, however, we expect this pleasure to be repeated. Fearing to miss exactly this event, we check the smartphone every few minutes. "You're waiting for the reward, but you do not know when it will come." Similar mechanisms are also at work in gambling addiction.

However, research on digital media, and its social potentials and risks, is still in its infancy. As a matter of fact, digital technologies are changing the way we communicate with long-term effects that remain unpredictable. "Here I see a social mission for our research," says Krasnova. "It is a mass phenomenon that we cannot ignore."

HEIKE KAMPE
TRANSLATION: SUSANNE VOIGT

Illustration / Photo: Töpfer, Andreas (left); Fritze, Karla (right)



permanent online

For our page SKETCHED, we asked graphic designer and illustrator Andreas Töpfer to interpret one of the research topics graphically. In this issue it is the research of Hannah Krasnova, Professor of Business Informatics, about the omnipresence of smartphones in our lives.

Illustration: Töpfer, Andreas

Interplay of Nature

How biodiversity relates to ecological dynamics

THE PROJECT

Flexibility matters: Interplay between trait diversity and ecological dynamics using aquatic communities as model systems (DynaTrait)

Duration: 2014–2021
Funding: German Research Foundation (DFG)
www.dynatrait.de

Photo: AG Ökologie und Ökosystemmodellierung

Biodiversity is rapidly declining worldwide, on land and in the water. In Germany alone, a quarter of all plants and a third of all animal species are considered endangered. The reasons are manifold. They include climate change and a growing world population, which is causing the disappearance of important habitats. It is increasingly difficult for ecological populations and communities to adapt to the changing climatic and environmental conditions. Science, but also politics and society, face the challenge of finding solutions that stop the loss of biodiversity. The DFG-funded Priority Program "DynaTrait" wants to contribute to finding such solutions. Its goal is to investigate the dynamics in aquatic ecosystems and previously neglected feedback loops. The functional traits of animals and plants play a key role in determining how well individuals can respond to new environmental conditions.

The climatic chamber has a temperature of 22°C. It is warm – and obviously just the right temperature for the chemostats inside. PhD student Svenja Schälicke explains what is going on in the glass flasks. She is doing research in one of the DynaTrait subprojects. She explores the effects of food quality on trophic interactions, focusing on the role of essential biochemical nutrients. "In the chemostat experiments, we investigate how populations of different algae species and rotifers are developing over a specific period of time," she explains. The researchers investigate so-called predator-prey cycles, which result from the animals' feeding behavior and growth as well as the growth of the algae. Two factors determine the food and growth of rotifers: quantity and quality of the available algae.

Schälicke and her colleagues can influence both from outside. The quality of food changes, for example, when essential omega-3 fatty acids and phytosterols are added. As a result, the normal predator-prey cycles between algae and rotifers suddenly change. The processes in the chemostats are very complex. To better understand them, additional experiments are performed in the lab. "Using these controlled population growth and feeding experiments, we can examine how the quality of the algae eaten by the rotifers promote or inhibit the rotifers' growth and cause temporal variations in population sizes in the chemostats," says the junior researcher, who had to put a lot of detailed work into the chemostat experiments.

In parallel to these experiments, the project team undertakes a lot of hard theoretical work. What might happen within the food webs is first simulated in mathematical models on the computer. "However," Schälicke says, "we first need the results of the laboratory population experiments, for example the animal growth rates under different algae quantities and nutrient compositions."

A fellow PhD student, Michael Raatz, analyzes these models in more detail. They predict how populations will develop over time. At the moment it seems very likely that diversity in the quality of algae enables the coexistence of several algae species alongside the rotifers.

The theoretical and practical efforts have already paid off. The initial research results show that the population growth of rotifers depends on the algal species available to them. The individual nutrient properties of the algae play a key role. The team also found that different strains or genotypes of the same rotifer species respond differently to the quality of

"DynaTrait" entered its second funding period in January 2018 with 13 sub-projects. Two sub-projects at the University of Potsdam and 18 at other universities were completed during the first funding period (2014–2017). The University of Potsdam takes part with the project "Interplay between trait variation, food web dynamics and maintenance of biodiversity".

Photo: Fritze, Karla

Svenja Schälicke in the lab

food. Obviously, even these microorganisms have different requirements.

The subproject will run until the end of 2018. In the chemostats, the researchers are currently testing two algae of different biochemical qualities and one rotifer species. The predator population will evolve depending on how the developing quantity of the prey species and how their quality will vary. “In the best-case scenario regular predator-prey cycles would develop,” Schälicke says.

PD Dr. Alexander Wacker thinks that the project is on the right track. He leads the team that, apart from ecological modeling, also carries out research in the lab and in the field. “The project goal is to link established food-quality effects to recent concepts of predator and prey trait variations,” he says. The team wants to investigate how food can alter traits in both populations and influences complex interactions between groups. So far, science has not sufficiently understood the feedback loops between the trophic levels. “This is crucial for predicting how populations and food webs respond to changing environmental conditions,” Wacker says.

Eating and being eaten

What is behind the individual subprojects explains by Ursula Gaedke, Professor of Ecology and Ecosystem Modeling and head of the Priority Program in the office next door. “We try to understand the feedback

Photos: Fritze, Karla (2)

Gaedke's working group has five walk-in **climate chambers** and eight climate cabinets. These are enclosures that maintain defined ambient conditions for a specific test setup enabling long-term experiments under precisely defined conditions.

between the diversity of functional traits and biomass dynamics," she says. Nature creates an interplay according to which organisms of a food web adapt under pressure. If for example, the predators' feeding behavior changes, it will impact the prey population. "It is a very complex structure," Gaedke says, and our Priority Program faces the great challenge of sorting it out." She illustrates the complexity of the individual processes with a picture. If there are many small crustaceans such as water fleas in a water body, the number of edible algae will decrease. The algae begin to protect themselves by forming colonies or long threads or by forming small spines. The predator responds by changing its own behavior or growth. "This has a huge impact on the biomass, both in the prey and the predators." The process will not come to an end at this point because if the predator has changed the prey population, the latter will change in turn. Fewer colonies will be formed and the cycle will start again from the beginning.

All of this comes at a price. Developing spines, for example, costs energy. "It is the dilemma of defense and growth. When investing more in defense, the algae grow more slowly – with consequences for the biomass and ecosystem services," explains the experienced biologist. As part of the program, the researchers take a closer look at the organisms on both sides. They examine how different prey and predator species are, what costs they have to take on and how fast they are able to adapt over many generations. Microorganisms are particularly suitable for this purpose. The researchers use them to understand dynamic processes in rapid cycles. In water fleas, for example, changes over generations can already be seen after eight and in rotifers even after three to four days.

In the future complex management models will be necessary

Prof. Gaedke emphasizes the importance of models for such research projects. "Ideally, we first create a

Dr. Alice Boit (left) and Prof. Ursula Gaedke

Photo: Fritze, Karla

THE RESEARCHERS

Prof. Dr. Ursula Gaedke studied biology and mathematics in Oldenburg, Texel, and Oxford. In 1988, she earned her doctorate in ecological modelling in Oldenburg. She gained her habilitation for the analysis and modeling of pelagic food webs at the University of Konstanz in 1995. Since 1999, she has been Professor of Ecology and Ecosystem Modeling at the University of Potsdam.

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Dr. Alice Boit studied biology in Berlin and earned a Master of Science in Digital Media in Bremen. In 2012, she wrote her dissertation about ecosystem modeling at the University of Potsdam. She is scientific coordinator of the DFG Priority Program DynaTrait and postdoctoral researcher in the working group Ecology and Ecosystem Modelling.

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PD Dr. Alexander Wacker studied and obtained his doctorate at the Limnological Institute of the University of Konstanz. After postdoc studies in Basel, he became Junior Professor of Theoretical Aquatic Ecology at the University of Potsdam in 2004. Since December 2014, he has been leader of the DFG-funded Heisenberg Group "Theoretical Aquatic Ecology and Ecophysiology".

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Svenja Schälicke studied biology at Freien Universität Berlin and marine biology at the Universidad de la Laguna (Spain). She received her Master of Science in 'Ecology, Evolution and Conservation' at the University of Potsdam in 2015. Since 2015, she has been a PhD student in the Heisenberg Group „Theoretical Aquatic Ecology and Ecophysiology".

✉ svenja.schaelicke@uni-potsdam.de

model to get a better understanding of the system," she explains. Only after this has been tested in specific conditions are elaborate experiments carried out. This is often done by other research groups in Germany, who have established cultures and experimental setups for those experiments over years.

Gaedke and her team are facing a huge task, which they can neither solve alone nor in the short term. The goal is to develop management models, for example for oceans. "We need models that show how processes work even under changing environmental conditions," says Dr. Alice Boit, who is scientific coordinator of the Priority Program. "This has been the limit of our knowledge so far." We are not yet able to predict what the plankton in the oceans will look like in 100 years. "Political stakeholders, however, need a basis for taking decisions. This requires modular models applicable to a specific system that enable a certain degree of transferability," Boit says. The crucial point is to bring the specific into a general form.

The researchers still have a lot of work to do to accomplish this goal. But they know that time is ticking. "We have to do use the means available to us to help politicians so that they can take decisions that are more important than ever for the preservation of our ecosystems," emphasizes Gaedke. "Because dwindling biodiversity means reclining adaptability, which in turn makes the system more susceptible to variability in the climate. These are two mutually amplifying processes."

PETRA GÖRLICH
TRANSLATION: SUSANNE VOIGT

Female rotifer with egg

Photos: Fritze, Karla (top, middel top, bottom); Photoatelier Pfeil (middel bottom); AG Ökologie und Ökosystemmodellierung (right)

Photo: Roese, Thomas

Markus Grebe looks at an eight-week-old *Arabidopsis thaliana* in the plant room

Everything in Its Right Place

Plant physiologists examine control mechanisms in cell plants

Whether in plants, animals, or human beings, cells are the buildings blocks of life. Their interiors are little organisms in themselves, consisting of membranes, cytoplasm, organelles, little protein factories and metabolic processors. To keep everything running smoothly, each compartment has its specific place. Substances are transported from one organelle to another, from one cell to the neighboring cell. It is this asymmetry, which is determined by genes and performed, maintained and controlled by innumerable molecules, that researchers describe as cell polarity. When it is disrupted, the effects are dramatic.

In most plants, the root grows downwards and the shoot upwards. There are exceptions, however, in Markus Grebe's laboratory. The Professor of Plant Physiology takes a jar from the climate chamber with thale cress seedlings that are only a few days old. The little plants with the scientific name Arabidopsis thaliana, do not seem to know which way is up and which way down. The seedlings grow in all directions – look crooked and sick. Grebe explains why. "They are mutant plants in which a specific gene has been switched off."

Defects in genetic information affect the cell's organization

Plants can orientate their growth by gravity and thus are able to differentiate between upwards and downwards. Plant physiologists call this process gravitropism. It allows plants to anchor their roots deeply in the soil and lets the shoots and leaves grow in the opposite direction. Grebe is particularly interested in those plants in which this mechanism is disrupted – because defects were introduced into their genetic information – leading to changes in the function and the distribution of individual proteins in the plant cell.

Plant physiologists deliberately switch off specific genes in order to subsequently investigate the functions of these genes in the plant. To be able to examine such a plant, Grebe first has to grow it in the laboratory. He treats plant seeds with a chemical reagent, a so-called mutagen, which alters individual DNA building blocks. Other methods are based on ionizing radiation or on bacteria that introduce certain DNA building blocks into the plants' genome.

The plants that develop from these seeds have mutations. After applying a chemical mutagen, a plant may have 300-400 mutations. "Many have no

Photo: Roese, Thomas

Arabidopsis thaliana plants

Grebe explains the advantages of the model plant

effect," Grebe explains. And then the researchers have to find the needle in a haystack to identify the plant with the desired mutation – which was randomly generated.

The process is extremely time-consuming; the researchers scanned about 30,000 plantlets in the Grebe's laboratory to find interesting mutations. "Two colleagues needed three months for it," he says. Under the "giant magnifying glass" as Grebe affectionately calls his microscope, he is able to identify what is going on inside these mutated plants. When enlarged, each individual root cell is visible in the delicate seedling measuring only a few millimeters. While cells of healthy seedlings are evenly spaced and close together, individual cells in the diseased plants look strangely displaced and disorganized due to the maldistribution of an important protein, which regulates their growth.

The proteins and lipids Grebe is interested in are usually located on only one side of the plant cell – at the top, at the bottom, directed towards the middle of the plant or towards its outside. Researchers call this phenomenon cell polarity. Organelles, membranes, and molecules are not evenly distributed in the cell but asymmetrically and in defined places. Only there are they able to fulfill their specific function.

The researchers identify new genes and their functions

In a healthy plant the plant hormone, auxin, regulates amongst many other processes the development of lateral shoots and root hairs. To this end, it is transported in a specific direction – downwards in the stem of the

Photos: Roese, Thomas (2)

shoot and in the inner root cells but upwards in the outer root cells. Therefore, one hormone transporter is always located on the side of the cell from which, for example, hormone transport out of the cell takes place.

For his investigations, Grebe marked this molecule with a fluorescent dye, which emits green light under the microscope showing the researcher its exact location in the cell, i.e. not the place where it is supposed to be in the observed mutant. Unlike in a healthy plant, the hormones in the roots of mutant Arabidopsis seedlings are wrongly distributed. This has serious effects on the entire plant. The transport of auxin and thus the growth of the plant is disturbed. The cause is a gene mutation that alters a component in the cytoskeleton. Threads of this skeleton traverse the entire cell ensuring that everything is transported to the right place. In the observed mutants, this mechanism is severely impaired. The auxin transporter does not reach the side of the cell and the hormone is no longer properly distributed in the plant.

As a consequence, shoots and roots bend without direction; the plant withers away. In nature, it would have hardly a chance to survive. "We identified genes that alter the localization of the auxin transporter," Grebe explains, and this is precisely his research goal. He and his team are identifying more and more genes and the associated proteins responsible for cell polarity and ensuring that a plant cell is healthy, can transport nutrients, and can grow and divide – in a nutshell that it performs all the important functions.

THE RESEARCHER

Prof. Dr. Markus Grebe studied biology at the universities of Gießen and Sussex, Great Britain. He investigates molecular mechanisms that coordinate tissue cell polarity and sterol dynamics in plant cell polarity. Since 2013, Grebe has been Professor of Plant Physiology at the University of Potsdam and has been researching different aspects of plant cell and tissue polarity.

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The results from research on plants also provide insight into other research questions

Like the auxin transporter, a variety of different molecules is produced in the cell and transported to their specific destination, for example proteins that protect plants against pathogenic fungi. They are located on the outer membrane of plant cells. Mutants with such a protein inside but no longer on the outside of the cell are more susceptible to disease. Grebe and his team identified a previously unknown protein that ensures the transport of this protective molecule.

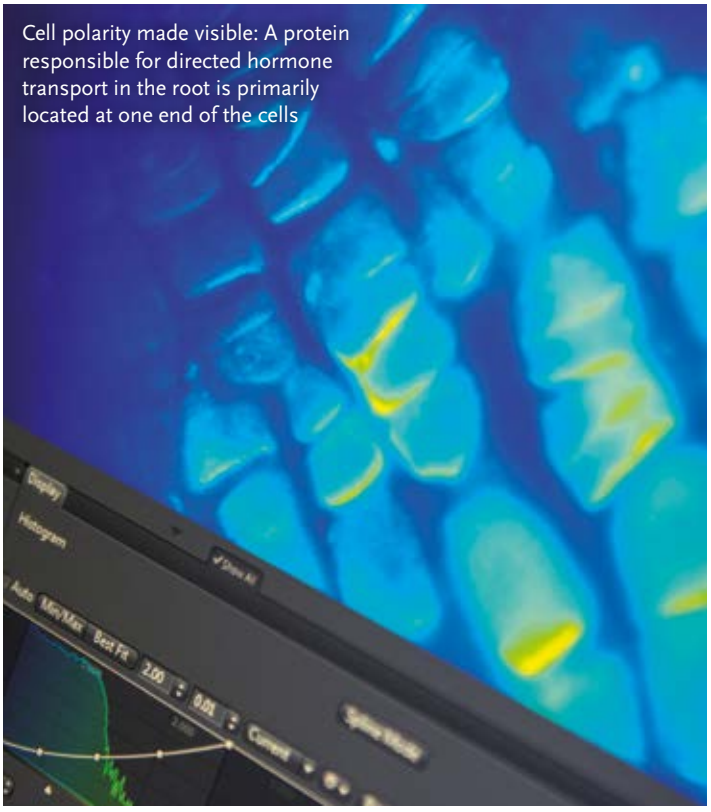
Roots of young Arabidopsis plants under the fluorescence microscope

Photos: Roese, Thomas (2)

Markus Grebe and Michael Sauer are evaluating an experiment

"Cell polarity is extremely important for all living beings," Grebe emphasizes. Human and animal spermatozoa and fertilized egg cells (zygotes) are already polarized, similar to plant pollen and zygotes. A plant cell divides, stretches, and differentiates itself – "with many polarization processes taking place at the same time," says Grebe, who has been fascinated by the underlying mechanisms of this phenomenon for more than 20 years.

In practice, the new findings of plant research will be used in areas that might seem unusual. "We have already identified several new genes, also some that exist in humans," Grebe explains. One of them is particularly active in human cancer cells – but so far nobody knows why. Grebe and his team were able to show that in plants this gene regulates the direction of cell division. "You may think that we are just looking at our root hairs, but we find genes we did not know anything about and that likely also have important functions in other organisms."



Cell polarity made visible: A protein responsible for directed hormone transport in the root is primarily located at one end of the cells

HEIKE KAMPE
TRANSLATION: SUSANNE VOIGT

Photos: Roese, Thomas (2)

Cozy in the Petri Dish

Bioscientists at the University of Potsdam are breaking new ground in antibody production

Photo: Fritze, Karla

Prof. Katja Hanack

They are the weapons of our body against unwanted invading microorganisms. Antibodies bind to the surface of viruses and bacteria. Specialized phagocytes are then able to recognize and eliminate them. Antibodies are also useful outside the body. In the pharmaceutical industry, the business with these tiny molecules is worth billions. They are used in diagnostics and increasingly also in treatments of various diseases. Endowment Professor Katja Hanack and her team are researching new methods for the production of antibodies.

Rheumatoid arthritis, colon cancer, macular degeneration, multiple sclerosis – the list is almost endless. Today, these and many other diseases can be treated with antibodies. The molecules that specifically bind to certain surface structures have become indispensable in medicine and life sciences. They are used to treat and diagnose diseases or to do blood tests for allergies and drug abuse. Even the pregnancy test is based on an antibody reaction. The need for these highly specific binding molecules is huge. However, the production is tedious, and often it does not meet the companies' needs.

Antibodies should be produced faster, more efficiently, while taking into account animal welfare

Katja Hanack, Endowment Professor of Immunotechnology, is researching new methods that may revolutionize antibody production. "We are developing new strategies to simplify and optimize the whole method," Hanack explains. The time factor is a crucial point. So far, it has taken six to eight months to produce an antibody. "We are now able to do it in two," she says.

Another aspect is also important: "In the long run, we want to manage without a mouse." Antibody production is mainly based on immune cells from the spleen or blood of animals – usually mice or rabbits that are killed to get the desired cells.

The team led by Prof. Hanack wants to change this. Mice or rabbits are to be replaced by cell lines in the future. "We are trying to replicate the system in the lab as it is in nature," she says about the project. She takes the basic component of this plan from the air-conditioned culture cabinet in her laboratory. Invisible to the human eye, millions of blood stem cells float in a reddish nutrient solution at a constant temperature of 37°C in a flat culture dish. About 20 of these cultures are in the climate cabinet. The researchers' goal is to build a complete artificial immune system from them. This process is special because it is a completely controlled process. The researchers will be able to verify the respective development stages of the system.

Immune cells have special needs

The complex structure of this system involves numerous cell types. They all need to feel comfortable in the artificial environment of Petri dishes and culture flasks. They all need to grow, divide, and be activated to fulfill their functions and eventually produce antibodies. This is a challenge for researchers and laboratory technicians. "We also test whether the precursors of the respective cells are suitable for our processes. Everything is quite time-consuming," Hanack says. If everything works well, the researchers get the cells they want: highly specific cells in huge numbers that produce the desired antibodies to which they were previously programmed.

The researchers spare no effort towards this goal. "If the cell feels disturbed by anything, it will not work properly," Hanack explains. In order to make the immune cells feel well, it does not only need the right nutrient medium and temperature; a little bit of comfort is also necessary. "We do our best to create a 'home' for them," she says. "Such a cell culture plate is nice, but it is not like in vivo, i.e. in the organism." To recreate the natural environment, the researchers want to model certain lymphatic gland structures that provide particularly good conditions for the growth of immune cells. They use a bioplotter to print two- and three-dimensional protein structures on the culture plates. Will the cells appreciate the architectural effort? "We hope so."

The interests of the companies are central

Hanack does not need to look far for the practical relevance of her research. Her research team works closely with small and medium-sized local companies that develop antibody-based pharmaceutical or

THE RESEARCHER

Prof. Dr. Katja Hanack studied biology in Rostock and Berlin. She earned her doctorate at the University of Potsdam and was head of the InnoProfile junior research group "Antibody Technologies" from 2008 to 2014. Since 2015, she has been an Endowed Professor of Immunotechnology. The endowed chair is co-financed by the Federal Ministry of Education and Research and eight regional biotech companies.

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Photo: Fritze, Karla

In the lab

Photo: Fritze, Karla

THE PROJECT

"Pit goes Next" develops a platform for antibody production based on cell lines. The new technology will be able to produce antibodies faster, with precision tailoring and without animal experiments.

Funding: Federal Ministry of Education and Research within the InnoProfile Initiative
Duration: 2015-2019
www.uni-potsdam.de/ibb-immuntechnologie/startseite.html

biotechnological products. She knows that companies depend on the fast and safe production of the required molecules. "If the antibody is not available, the product cannot be developed."

And something else is important to companies: They want to buy antibodies that are immediately usable, under the given conditions of the laboratory environment. "Many of the mass-produced antibodies are not sufficiently validated," Hanack describes the problem. The buffer solution, the detection system or the nutrient medium – these components must be individually adjusted to make the systems work well.

Hanack knows what she is talking about. In 2014, she and her colleague Pamela Holzlöhner founded the company "new/era/mabs," which the two bioscientists use to transfer their research findings to the business sector. They use their expertise to produce and sell antibodies not only quickly but also precisely tailored for the customers.

HEIKE KAMPE
TRANSLATION: SUSANNE VOIGT

The Thinking Club

Scientific network researches political struggles over new forms of transnationalization

Photo: Fotolia/Denys Rudyi

New political structures
beyond nation-states are
developing all over the world

The world is in flux: money is becoming digital, people are highly mobile, and the economy is global. As a consequence, some say, politics has turned global and must be analyzed on this level. Others argue that those political players and structures that really make a difference are still to be predominantly found at the national level. Neither is true, says Dr. Christian Schmidt-Wellenburg. He has initiated a scientific network of political and social scientists examining what political processes in "transnational fields" look like and who the drivers are.

"We use the term transnational very deliberately," explains Christian Schmidt-Wellenburg, "because we don't believe that everything in the world works only globally. That is, we see the world and all that's happening here as neither one big box nor as many small boxes in a row." Processes are, instead, happening in many places simultaneously and are interrelated – such as the development of a European society, labor migration in all directions, or flows of refugees across continents.

The researchers also refute the widespread notion that politics is becoming less important. They find that interested parties are indeed driving political processes, both in the classical field of politics and in other social fields. Their aim is to establish and develop transnational orders that go beyond nation-states but are not global. Striking examples are the self-contained political and social worlds in Brussels and other places hosting EU institutions, as laid out in European Union treaties. To understand the mechanisms underlying the establishment of such structures, the 18 researchers collaborating in the network "political sociology of transnational fields" are examining very different phenomena.

Transnationality in Europe – from economic to higher education policies

For instance, they are investigating how good economic policy is discussed in the European Union during economic and financial crises. In this context, Lisa Suckert of Max Planck Institute (MPI) for the Study of Societies in Cologne is studying EU members' National Reform Programmes (NRP), in which each state formulates analyses and ideas for its economic policies and determines how to align them with the objectives of the European Union. "Analyzing NRPs offers a fairly accurate description of how member states

Particularly in the EU, numerous transnational political orders are emerging

Photo: Fotolia/Grecaud Paul

Dr. Christian Schmidt-Wellenburg

discuss the future in their communications with the EU," Schmidt-Wellenburg explains. "Here, it becomes evident that this instrument changed the perception of what good economic management is." The crisis in 2008 in particular showed how much the European Union was struggling over how to interpret an insecure economic future – in a completely new setting.

The "Europeanization of higher education" is another transnational phenomenon with its own actors, logics, and structures. Dr. Christian Baier and Vincent Gengnagel of the University of Bamberg are studying the promotion of science in Europe. Specifically, they are investigating how the research landscape changed after the European Research Council (ERC) was founded in 2007. Research in Europe has since ceased being funded only at the national level. After all, the ERC boasts a 13 billion Euro budget between 2014 and 2020 alone. By analyzing which projects have been applied for – and received funding – and in which fields, the two sociologists are looking to determine what a transnational academic field actually is. Are national hierarchies dissolving? And are they being replaced by a European academic capitalism – a pan-European performance comparison characterized by a handful of globally visible winners, brain drain, and a European academic elite?

New policies are made by people, too

In their work, the researchers always put the human actors at the center: "Political scientists tend to speak of systems and organizations doing this or that," Schmidt-Wellenburg says. "We are interested in the people behind the policies." To this end, the members of the network apply French sociologist Pierre Bourdieu's concept of "field", which allows the researchers to determine the mechanisms behind the functioning of various societal fields and to capture who follows these rules and – above all – shapes them. "People are not merely recipients of transnationalization but are also its agents and drivers."

Field is one of the core concepts of French sociologist Pierre Bourdieu. It is based on the assumption that, in a society, individuals act in various, separate fields. Economics, politics, religion, science, and the arts are all seen as independent fields with their own rules. To operate successfully in one field requires following its rules. At the same time, the structures of a field are alterable and, thus, contested. In his theory, Bourdieu described features that all fields share, providing the basis for their comparison.

Photo: Fritze, Karla

Another member of the network is Dr. Sebastian Büttner of the University of Duisburg-Essen. He is investigating the phenomenon of "EU professionalism", that is, the experts and professionals who are directly or indirectly involved in the structures of European policy and who support and drive the project of Europeanization. "They possess a special knowledge, are oriented towards Brussels, where they also try to influence policy," Schmidt-Wellenburg points out. "A unique form of statehood has developed in Brussels as a result."

THE RESEARCHER

Dr. Christian Schmidt-Wellenburg studied sociology, political science, and economics at Philipps Universität Marburg, the University of Manchester, and Humboldt-Universität zu Berlin. After having held positions at HU Berlin and Otto Friedrichs Universität Bamberg, he started working as research associate at the Chair of General Sociology of the University of Potsdam in 2009.

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Of experts who disagree

In most cases, these new forms of policy and political action are not easily recognizable, the sociologist underlines. "These are silent policies that are seldom labelled as such," making their identification and description all the more important. In his own project, Schmidt-Wellenburg focuses on experts and expert commissions set up in the wake of the financial crisis at national, European, and international levels. His interest in the matter was triggered by a 2012 open letter in the Frankfurter Allgemeine Zeitung. After Angela Merkel had spoken out in favor of stricter banking regulation, 274 "economists from German-speaking countries" came forward to sharply criticize the German Chancellor. Just two days later, 221 other economists contradicted this opinion in another open letter – praising the Chancellor's initiative. "My reaction was: 'This is crazy! It needs to be studied,'"

Photos: Fritze, Karla (2)

THE PROJECT

The **scientific network "Political Sociology of Transnational Fields"** comprises 18 young researchers that research transnational processes of societization and accompanying new forms of governing people from a political sociology perspective.

Funding: German Research Foundation (DFG)
Duration: 2016–2019
https://www.uni-potsdam.de/de/allg-soziologie/dfg-wissenschaftlichesnetzwerk.html

Schmidt-Wellenburg says with a laugh. "The sample was already there." So, he began collecting data on the social attributes of those who had signed the letters: What is their scientific reputation, and how was it acquired? What are their connections to politics and academia? And what are their positions in the political economy of German-speaking countries? He also collected statements and publications on the financial crisis by as many of the signatories as possible. "Once coded and statistically analyzed, the data showed a multi-layered picture," he says. On this basis, conclusions could be drawn as to why and how economists tended to be similar to the signatories of "their" letter – and different from those of the other one. However, no causal explanation can be derived from statistical correlation alone, Schmidt-Wellenburg underlines. "I can use the data to reconstruct structural relationships that show why people act the way they do, but these are not forecasts. I still have to go to the people, talk to them, and try to understand."

In his network project, he is now comparing German and French economists. In France, there was a public debate about labor market reforms which he intends to analyze further. He will subsequently be comparing the two cultures involved in the debate – and the transnational exchange in the expert commissions. "I am interested in the problems these commissions specified and the solutions they suggested – depending on who was sitting on them." Once again, he will be combining the qualitative analysis of individual work environments with the statistical analysis of the role economists play in new fields of transnational policy. "All projects in the network are designed to link transnationalization from the bottom and from the top," Schmidt-Wellenburg emphasizes. The long-term objective is to describe fundamental mechanisms of transnationality on the basis of the individual projects.

What he appreciates about working in the network is the thematic proximity: "We are doing all kinds of projects but on the same topic: transnationality. So, our network is like an ongoing colloquium. It feels good to debate with people with whom I don't have to first explain what this is all about." At regular meetings, the researchers exchange views on methods, discuss articles-in-progress or research findings, and network with international guests. "Our network is a kind of thinking club, in which we read each other's texts and support each other – a unique and conducive environment."

MATTHIAS ZIMMERMANN
TRANSLATION: MONIKA WILKE

Photo: Fritze, Karla

The Courage to Take a Risk and a Passion for Innovation

Alexander Kritikos is a researcher and teacher at the German Institute for Economic Research (DIW Berlin) and at the University of Potsdam

Entrepreneurship – is difficult to define cleanly. It comprises not only the whole process of establishing a business, but also subsequent decision-making, leadership, negotiation, renewal, and investment. Economist Alexander Kritikos seeks to understand what characteristics founders need in order to successfully start their business and safely steer it through good times and bad times.

In our series "Peals of Science" we regularly introduce researchers from institutions connected with the University of Potsdam in the "pearls – Potsdam Research Network".

An expert on the Greek crisis, Alexander Kritikos is frequent commentator for newspapers, television, and radio. Although Kritikos was born in Munich, part of his family lives in Greece. He studied economics and political science at the LMU Munich, earned his doctoral degree at Humboldt University Berlin, and completed his Habilitation at European University Viadrina. Currently, he is Research Director for Entrepreneurship Research at the German Institute for Economic Research (DIW Berlin) and Professor of Industrial and Institutional Economics at the University of Potsdam.

His own surveys and evaluations of data collected by the DIW Berlin-based Socio-Economic Panel have produced diverging results: It turns out that those personality traits that are beneficial in the early days can become a problem as firms mature. At first, one needs to be open to new experiences and willing to take risks. Later conscientiousness and low levels of agreeableness are more useful. A higher level of the

Photo: DIW

GERMAN INSTITUTE FOR ECONOMIC RESEARCH

Founded in 1925, **DIW Berlin (the German Institute for Economic Research)** is one of the leading economic research institutes in Germany. The Institute analyzes economic and social aspects of relevant current issues and advises political and economic stakeholders based on its research findings. As part of both the national and international scientific community, DIW Berlin provides global academic research infrastructures and promotes young academics. It is an independent and, as a member of the Leibnitz Association, primarily publicly funded institute.

THE RESEARCHER

Prof. Dr. Alexander Kritikos has been Research Director for Entrepreneurship at the German Institute for Economic Research (DIW Berlin) since 2011. Before, he was Head of the Department "Innovation, Manufacturing, Services" since 2008 and Vice-President from 2010-2011. He is Professor for Industrial and Institutional Economics at the University of Potsdam, Research Fellow of the Institute for the Study of Labor (IZA), Bonn, and of the Institute for Employment Research (IAB), Nuremberg.

willingness to take a risk, and trust in colleagues, business partners, and supporters, two characteristics that help when starting a business, should increasingly give way to a moderate level of risk tolerance and critical attention in daily operations as businesses mature.

Kritikos uses empirical methods and instruments from psychology for his investigations into which personal qualities and motives lead to success and why so many companies quickly fail. Do the motivations that were important when starting the business play a role for the eventual success or failure? Linking theoretical questions with practical applications is also important and Kritikos works to make sure that his results are applied to the real world, helping people interested in starting and running a business.

Alexander Kritikos and Marco Caliendo, also an Economist at the University of Potsdam, are researching what drives companies to continue to grow and hire new staff. How do entrepreneurs develop the indispensable ability to continually innovate, taking the less traveled road, thus giving room to new ideas? They are both interested in the personality traits of entrepreneurs and how economic outcomes are affected by these traits. These research results are the focus of lectures and seminars on entrepreneurship and innovation that Kritikos gives at the Faculty of Economics and Social Sciences.

Kritikos finds teaching rewarding: the students' ideas and unconventional thoughts ultimately enrich his research. Through his teaching, he helps students learn how to recognize and assess causal relationships when analyzing empirical studies. This extends to encouraging students to reflect on how best to use modern methods and instruments when carrying out research projects. Whenever he spots talented young researchers, he encourages them to pursue a career in economics. So far he has supervised several Master's theses and convinced some of his graduate students at Potsdam to pursue a PhD at the DIW Berlin Graduate Center.

Future PhD students will have an abundance of research topics to choose from at DIW Berlin. These days Kritikos launched a new project funded by the German Federal Ministry of Education and Research that will examine and compare the innovative capacity of micro and small companies in Germany and Greece. It is assumed that companies with fewer than 25 employees are less capable of innovation, Kritikos notes. He is confident that empirical analysis will show that this is not true. The project will include cooperation with IOBE, a Greek economics research institute. The partners will investigate whether and how small companies succeed in effectively and innovatively responding to the ongoing economic and financial crisis in Greece. With his cutting edge research, Kritikos will enhance his expertise on Greece and on entrepreneurship.

ANTJE HORN-CONRAD

The **pearls – Potsdam Research Network** connects the University of Potsdam and 21 non-university research institutions in the science region of Potsdam/Berlin. The network focuses on joint research projects, developing young researchers, and joint research marketing of the science region Potsdam.

pearls
Potsdam Research Network

www.pearlsofscience.de

Photo: DIW

SFB 1287: Limits of Variability in Language:
Cognitive, Grammatical, and Social Aspects

Spokesperson: Prof. Isabell Wartenburger

(Structural Unit: Cognitive Sciences)

https://www.uni-potsdam.de/de/sfb1287

Why is it often possible to express the same thing in many different ways in one language? How do such variations evolve or disappear in the course of language change? Why don't we always understand linguistic utterances of people equally well although we speak the same language? Collaborative Research Center 1287 addresses the cognitive, grammatical, and social aspects of these questions.

Collaborative Research Centers are institutions established at universities for a period of 12 years that enable researchers to pursue interdisciplinary collaboration. Long-term funding from the German Research Foundation (DFG) facilitates innovative, scientifically ambitious, complex, and long-term research.

✍ http://www.dfg.de/foerderung/programme/koordinierte_programme/sfb/

2

DFG COLLABORATIVE RESEARCH CENTERS (SFBs)

are currently working at the University of Potsdam. Another 10 SFBs are conducted with UP participation.

✍ https://www.uni-potsdam.de/de/forschung/profile-programme-projekte/sonderforschungsbereiche.html

SFB 1294: Data Assimilation

Spokesperson: Prof. Sebastian Reich

(Institute of Mathematics)

https://www.uni-potsdam.de/sfb1294.html

Collaborative Research Center 1294 focuses on the seamless integration of large data sets into sophisticated computational models in order to better understand underlying processes and to enable more accurate predictions. Data assimilation has been successfully used in meteorology, hydrology and the search for raw materials. New applications will benefit from data assimilation, for example in biology, medicine, cognitive and neurosciences.

FIGURES presents one of the many figures that describe the research work at the University of Potsdam, offering a glimpse of the hustle and bustle behind the scenes.

Photos: pixabay_wilhei (top); Fotolia/James Thew (bottom)

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