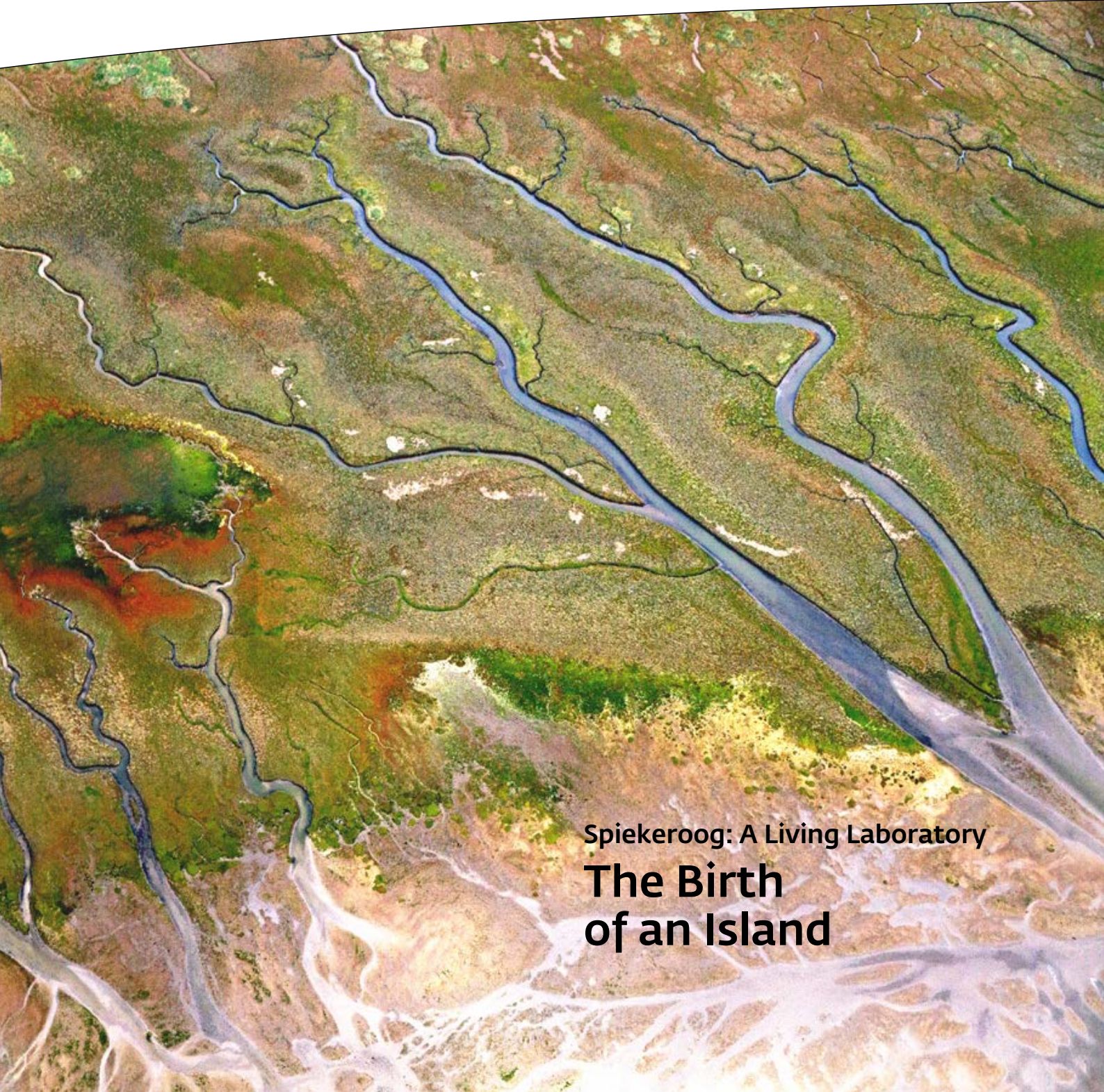


2020/21 Issue

THE UNIVERSITY OF OLDENBURG'S RESEARCH MAGAZINE

EINBLICKE 65



Spiekeroog: A Living Laboratory
**The Birth
of an Island**

ANZEIGE

Dear readers,

“flattening the curve“ was also the goal at the University of Oldenburg when it reduced its operations to a minimum in March due to the coronavirus pandemic. Buildings were closed to the public, courses were held online only, and laboratory activities had to be severely restricted. The implications for our academic staff were enormous: as teachers they had to reorganise their classes, as researchers they had to cope without important infrastructural resources. So when, after a few weeks, a certain normality was restored on campus and laboratories were “rebooted”, everyone breathed a sigh of relief.

COVID-19 is still having a considerable impact on university life. Nonetheless, research, in all its variety, continues. Einblicke shines its spotlight on a number of current projects. An interview with geriatrician Tania Zieschang and medical ethicist Mark Schweda deals with ageing

and old age. Special education expert Andrea Erdélyi, on the other hand, is researching ways to help the young: she and her colleagues are developing new career guidance concepts and materials for young people with intellectual disabilities.

Business informatics scientist Jorge Marx Gómez is connecting big data and pig farming. His team is working on new data science methods that can assist farmers, as well as bike couriers and many other businesses. Hearing researcher Simon Doclo is an expert on signal processing: he is studying the “cocktail party effect” – our ability to filter out background noise during a conversation – with the ultimate goal of improving this effect in hearing aids and mobile phones.

The North Sea island of Spiekeroog may seem like a quiet place, but it’s actually bustling with activity.

Within a relatively short period, sandbanks just a few metres long can turn into wild landscapes. Geoscientists Gudrun Massmann and Luise Giani are studying these transformative processes. Back on the mainland, management expert Jörn Hoppmann is investigating why ecological and economic interests don’t have to be mutually exclusive and how sustainability can be a successful business strategy.

A 1980s stage production was instrumental in creating the image of Wolfgang Amadeus Mozart as the rock star of Viennese classical music. Musicologist Anna Langenbruch is researching this unique form of historiography.

We wish you a stimulating read!

Yours truly,
the EINBLICKE editorial team



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ANZEIGE

In Numbers

10×10^{-18} of a second = 1 attosecond

Scientists from the Institute of Physics are working in a new laboratory and using cutting-edge laser technology to create inconceivably short light pulses lasting less than 150 attoseconds. One attosecond is equal to a billionth of a billionth of a second. With these ultra-fast light flashes, the researchers plan to study and ultimately control the movement of electrons in atoms. The goal is to gain a better understanding of ultra-fast processes such as those involved in the generation of charges in the nanostructured materials of future generations of solar cells.

To turn femtosecond pulses into the even shorter attosecond laser pulses, the researchers focus the laser light with the

help of a beam of noble gas. This creates light waves with an integer multiple of the original frequency in the extreme ultraviolet part of the light spectrum. „The way it works is similar to playing a stringed instrument that, as well as fundamental frequency, also produces higher tones, so-called overtones,“ explains Prof. Dr. Matthias Wollenhaupt. With these light pulses of less than 150 attoseconds, far smaller structures can be captured than would be possible with a light microscope. The construction of the laboratory cost around two million euros and was funded by the German Research Foundation (DFG), the Lower Saxony Ministry of Science and Culture (MWK) and the university's own resources.

Light takes about *one attosecond* to travel a distance that corresponds to the size of a hydrogen atom.



The main discharge of a lightning flash during a thunderstorm lasts about *30 microseconds*, or 0.00003 seconds.



The blink of a human eye lasts a tenth of a second, or about *0.1 seconds* – a long time by comparison.





Having a say in career choices

Straight from the special school to a sheltered workshop: for many young people with intellectual disabilities this career trajectory seems preordained – yet their wishes and ideas are not particularly taken into account. Special education professor Andrea Erdélyi wants to change this with the help of designated toolkits

Years ago, when Prof. Dr. Andrea Erdélyi was still working as a special education teacher at a school, a pupil with a learning disability told her about her career aspirations: she wanted to be a doctor – an impossible goal for a young person who would never obtain a higher education entrance qualification, let alone study at university. Erdélyi discussed

the young woman's motivation and passions with her and it turned out that her main ambition was to care for others in her work – just as she cared for her younger siblings. Together with her pupil, Erdélyi then set out to find her a suitable occupation.

Erdélyi has passed through many stages during her transition from special education teacher at a Bavarian school to her current post as Professor

for Pedagogy and Didactics for Intellectual Disabilities at the University of Oldenburg. But in all the intervening years, her motivation has never changed: “I want people with intellectual disabilities to be listened to, and their ideas, wishes and goals to be taken seriously.”

But how to achieve this with young adults who have difficulties forming complete sentences? In many cases

the concepts and tools to simplify communication are lacking, for example during the transition from school to the workplace. This is where Erdélyi and her team come in: their two projects TiT (“Participation in the Transition Process”) and STABIL (“Self-determination and Participation for All in the Choice of Career and Education and Training”) develop concepts and materials – from work folders to apps – that are designed to help young adults express their own ideas and choices in cases where parents and carers would normally decide for them.

It is by no means standard procedure for young people with intellectual disabilities to be asked what sort of career they might want to pursue: “In many cases their lives are mapped out for them,” says Erdélyi. Even today, many attend a special school right from the beginning. Those who are schooled on an inclusive basis usually switch to a special school after primary education. After that, they complete a two or three-year vocational training programme in a workshop for people with disabilities and then continue working there. According to a 2017 study by the German Economic Institute (“Institut der deutschen Wirtschaft“, IW), only about one percent of all the German companies that provide training offer apprenticeships for people with intellectual disabilities.

Another reason why communication about career goals often fails for these young people is the limitations in their ability to express themselves. Yet under the generic term “Augmentative and Alternative Communication (AAC)“, there is a whole range of tried and tested communication tools that can be used by people with intellectual disabilities to make themselves understood – not only via complicated speech processors, but also using simple systems such as pictograms. More than a quarter of the pupils at special schools in Lower Saxony rely on AAC, according to the results of a state-wide study jointly conducted by Erdélyi and her colleague Prof. Dr. Ingeborg Thüm-

mel. However, only a small proportion of young people receive the help they need – partly because teachers are not sufficiently familiar with the various communication tools.

According to Erdélyi, these tools can be particularly helpful in the critical phase of transition from special school to workplace – for two reasons: firstly, young people often either don't have a clear plan for their career or are unable to articulate it. And secondly, teachers in the new environment are often not informed about whether a young person on their course needs AAC, or which forms of communication they use.

Easing the transition

Erdélyi and Thümmel addressed the issue in a previous project, developing a preliminary concept and work materials called the Oldenburg Box of Tools (OLBoT). Designed to ease the transition from school to workplace, the box contains a Future Folder, a Me Book and a Transition Protocol. The Transition Protocol is already a well-established tool, used by teachers to describe their pupils' skills at the end of their school education. For this project, Erdélyi added the AAC aspect, allowing teachers to indicate whether a young adult relies on signs, pictures or speech generation devices for communication.

The Future Folder contains work materials for teachers to use when discussing career choices in class and to help young people to express their dreams, fears and aspirations. The Me Book is a folder in which young people can present themselves, their social environment, their interests, strengths, weaknesses and goals. When they fill out the work materials, the pupils generally use METACOM, an established AAC symbol system of more than 10,000 symbols, most of which are self-explanatory. The symbols are printed on small cards which pupils stick onto a booklet. They can stick a

picture for “singing“ under the heading “I can do that“, for example.

In TiT, their current research project, which like its predecessor is funded by the Federal Ministry of Labour and Social Affairs (BMAS), Erdélyi, Thümmel and their team have expanded and updated the OLBoT for young people from the 10th grade upwards, based on insights gained from their preliminary studies. It now contains a Transition Protocol and picture-based communication boards, as well as Bobbie – a Career Guidance Book for Educational Institutions.

This is based on the earlier components, which have been revised, but also contains additional components that deal with gaining practical experience and setting objectives. Pupils can use it to explain what their dream job is or to express areas of learning that interest them. This is the second step, however, not the first, because young people are often not aware of what they want and what their dreams are, Erdélyi explains. She refers to this as “acquired helplessness“: “When young people are used to others deciding for them, they don't develop their own goals“. The researchers have therefore added information on a range of occupations so that school leavers can learn more about the typical activities involved in these jobs and assess their suitability.

Bobbie in practice

From the early stages of their research, Erdélyi and her team sought to work closely with the teaching staff at a special school, who tested the materials for the scientists and reported on their experiences. The researchers will continue to rely on this feedback in the future. After all, the main hurdle in the development of new work materials is the transition from development to practice: “A study from 1997 which was fundamental to our work shows that ultimately, about 75 percent of the innovations developed



"Bobbie" helps young people with cognitive disabilities to learn more about themselves and their job options.



In the STABIL project, Andrea Erdélyi develops career orientation apps for young adults.

in research projects are not used in schools. With Bobbie, we want to avoid this at all costs," says Erdélyi. She and her team now plan to test the materials at 50 schools and with around 120 teachers across Germany. The test design splits the teachers into three groups: the first group will be given Bobbie, along with explanations and ideas for designing lessons. A second group will receive additional support via a designated website where teachers can watch tutorials and exchange ideas with colleagues. The third group of teachers will also receive individual support from the researchers. The team plans to use the insights gained in this project to optimize the materials for regular use in schools and, above all, identify effective strategies for implementation.

An app for choosing the right profession

Financed by the Federal Ministry of Education and Research (BMBF), the STABIL project also focuses on developing materials to help with choosing a career. Together with partners from science and industry, Erdélyi focuses on school leavers or young adults working in workshops for disabled people who want to plan the next steps in their career. The emphasis here is therefore on a later stage of

career orientation and training and on the development of digital work materials. Oldenburg software companies are working with Erdélyi and her colleague Prof. Dr. Rudolf Schröder, Oldenburg Professor of Economic Education with a special emphasis on career orientation, to develop three interconnected apps, each with its own particular focus. The apps are designed to help teenagers and young adults – working together with their carers – to provide clear answers to questions about individual qualities and skills that are relevant to the workplace. They can also be used to find suitable training programmes.

To develop a list of appropriate questions for their questionnaire, the researchers in Erdélyi's team analysed competence assessment procedures and curricula, while Schröder's team analysed training schemes for people with intellectual disabilities. They worked out which qualities and skills are most relevant for the individual occupations and formulated simple statements such as "I can take telephone calls" or "I am very tidy", together with a few simple response options. The app aims to provide useful partial results, even if respondents don't manage to answer all the questions. Therefore, questions on the key competences required in a large number of occupations were placed at the beginning of the questionnaire.

The results of the first tests were very promising: many of the young people were highly motivated and focused when working on individual app modules, and were able to fill in the questionnaire independently, Erdélyi reports with satisfaction. This is also because the apps combine different means of communication, she explains: "Every statement is available in writing and in simple language and can be read out loud by the app". A matching picture also appears for each question. At the end, the respondents receive feedback on their self-assessment.

Erdélyi and her colleagues plan to continue testing the apps in workshops and schools in 2021, to the extent that this is possible under the restrictions imposed due to the coronavirus pandemic. With this approach they hope to integrate parents, teachers, career advisers and trainers into the project, so that they, too, can use the app to provide input about the young adults under their supervision. Afterwards, young adults and their carers can discuss the results. "The important thing is to take the different results seriously – not only the assessment of the carers, but also the self-assessment of the young people", Erdélyi emphasizes. "This is a good example of what the projects as a whole stand for: listening to what these young people have to say." (isr)

ANZEIGE

Threshold values under scrutiny

Tipping points have become a relevant concept in environmental research. The idea suggests that an ecosystem tips into a different, often worse state, as soon as a particular stressor crosses a threshold. For example, the tiniest algae can cause reef damage by growing too quickly thereby superseding the corals when the amount of nutrients in the water is too high. This implies that if an ecosystem is to remain stable, environmental stressors such as those resulting from global change should not exceed these thresholds.

Now, however, an international team led by Prof. Dr. Helmut Hillebrand, director of the Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg, has cast doubt on whether environmental policies should be based on the concept of

tipping points. In an extensive analysis published in the scientific journal *Nature Ecology and Evolution*, the researchers indicate that tipping points are almost impossible to identify on the basis of environmental data.

The team studied a total of 36 meta-analyses, which statistically summarize the findings from some 4,600 ecological field experiments on the impact of environmental stressors. The study is thus the most comprehensive analysis of scientific literature on global change to date. The researchers used the data to calculate how strongly a system reacts to a particular stressor. They then tested statistically whether greater stressors induce stronger reactions and whether any indicators of thresholds could be inferred from this. Although the degree of stress caused by a stressor did influence how strongly

an ecosystem reacted, thresholds were detectable in only three of 36 cases, the scientists found. Further simulations showed that even small environmental changes cause a variety of reactions in ecosystems. But existing data often does not reflect these fluctuations – and therefore provides no evidence of thresholds.

The idea that ecosystems remain stable within a clearly defined range must therefore be abandoned, the researchers conclude. The focus on tipping points risks overlooking smaller and more gradual, but no less impactful changes. Scientists and policy makers should therefore pay close attention to the size and duration of random fluctuations and their possible consequences to be able to act according to the precautionary principle in the future.

New method for EEG scans

User-friendly, comfortable and in the future almost invisible: Oldenburg brain researchers have presented a new method for long-term monitoring of the brain's electrical activity. In the *Journal of Neural Engineering* the team led by neuropsychologists Prof. Dr. Stefan Debener and Sarah Blum reported that their fEEGrid (flex-printed forehead EEG) device captured similar brain signals as conventional EEGs yet causes almost no inconvenience to users when worn over periods of eight hours in everyday situations. The new, flexible measuring device would enable future EEG scans to be conducted outside the laboratory – and without the unpleasant side effects often experienced by patients undergoing long-term brain wave measurement. For their study, the team conducted tests with twenty healthy volunteers. The test subjects wore the mobile EEG devices for a total of eight hours as they went about their daily activities.

Looking inside a battery

Oldenburg chemists have developed a new method to allow real-time observation of previously inaccessible activity in batteries on a microscopic level, according to a paper published in the scientific journal *ChemElectroChem* by a team in the Chemistry Department led by Prof. Dr. Gunther Wittstock. The technique they used is known as scanning electrochemical microscopy, or SECM. This involves slowly moving a measuring probe across the surface of a sample to collect chemical data at intervals of just a few micrometres (a few thousandths of a millimetre). The researchers developed a special measuring cell in which they could directly obtain high-resolution information about the surface of metallic lithium electrodes during charging and discharging cycles. The team paid particular attention to the extremely thin layer that forms on the surface of the electrodes. This new technique could help speed up the search for suitable materials for new generations of batteries, the researchers said.

Learning from sea cucumbers

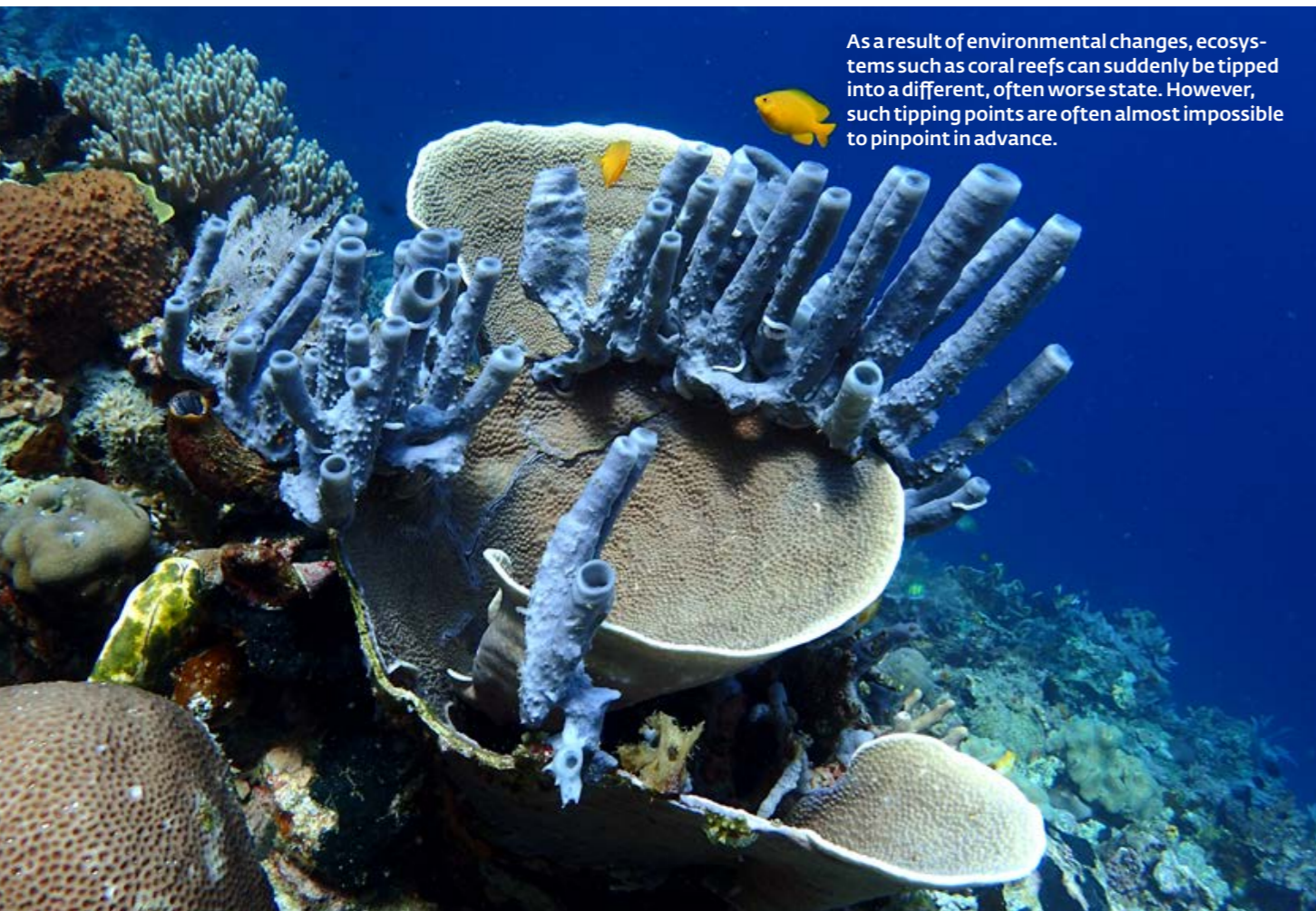
Sea cucumbers possess a natural anti-fouling mechanism, according to paper published in the science journal *Marine Drugs* by a team of researchers led by Prof. Dr. Peter Schupp at the Institute for Chemistry and Biology of the Marine Environment (ICBM). The cylindrical animals can prevent other organisms from growing on them by producing special chemical compounds known as saponins. The researchers studied various species of sea cucumbers off the coast of Indonesia and Guam. They discovered that the anti-fouling effect of the substances varied according to the sea cucumber species, the concentration of the saponins and their molecular structure. The team was able to identify saponins that were particularly effective in terms of anti-fouling. This knowledge could be used to develop environmentally friendly paint that prevents organisms from growing on ships and marine measuring devices, for example. The anti-fouling paints currently in use are mostly not biodegradable and are toxic for aquatic life.

New ideas for rural areas

How to make post-school education available outside urban areas? Researchers at the University of Oldenburg are investigating this question in a sub-project of the research project InDaLE (“Innovative Approaches to Public Services”), which is funded by the Federal Office of Agriculture and Food and coordinated by the University of Hannover. The Oldenburg team led by Prof. Dr. Ingo Mose analyses examples of successful educational programmes in European countries such as Sweden and Scotland. The aim is to find out whether these approaches would also work in Germany.

A boost for digital teaching

Together with partners at the University of Vechta and the Osnabrück University of Applied Sciences, lecturers at the University of Oldenburg are developing “Open Educational Resources” for education management and inclusive education in two new projects. These free and open-access teaching and learning resources will range from individual videos to entire online courses and are aimed at education managers and students in teacher training. Each of the two projects has been awarded a grant from Lower-Saxony's Ministry of Science and Education of around 170,000 euros over a period of eighteen months.



A nanolaser made of gold and zinc oxide

Tiny particles made of metals and semiconducting materials could be used as light sources in the components of future optical computers – thanks to their ability to dramatically concentrate and amplify incident laser light. In the scientific journal *Nature Communications*, a team of researchers from Germany and Sweden led by Oldenburg physicists Prof. Dr. Christoph Lienau and Dr. Jin-Hui Zhong described how the process works.

For the study, the physicists produced nano-materials that combine the optical properties of metals and semiconductors. First, they took sponge-like particles of gold with a diameter of just a few hundred nanometres (one nanometre is equal to one billionth of a metre) and pores approximately ten nanometres in size. The team then developed a procedure for coating the particles with a thin layer of the semiconductor zinc oxide that penetrates the tiny pores of the gold particles.

The resulting coated particles are capable of changing the colour of incident light. If red laser light is directed at them, for example, they emit short-wave blue laser light. The colour of the light depends on the exact properties of the nanomaterial. These nanoparticles could function as tiny light sources – nanolasers so to speak – in future optical computers that compute using photons rather than electrons. Potential sites of application are ultra-fast optical switches and transistors.

Measuring the wind upstream

Wind ramps are strong fluctuations in wind speed and direction that take place within a period of less than thirty minutes. To more accurately forecast their occurrence, scientists at the ForWind Centre for Wind Energy Research and their project partners aim to measure wind speeds several kilometres “upstream” of wind farms using lasers. The team

led by Prof. Dr. Martin Kühn uses the laser-based remote sensing technology lidar (light detection and ranging) to calculate distances and wind speeds. These measurements will be used to develop an “observer-supported wind energy forecast” that can be integrated into existing forecasting methods. Another goal is to improve the range and

resolution of lidar devices. The necessary data is being collected in a two-year measuring campaign at the Nordergründe offshore wind farm northeast of Wangerooge. The “WindRamp” research project is being funded by the German Federal Ministry for Economic Affairs and Energy with 2.75 million euros over three years.

Monitoring ship emissions more effectively

Around 90 percent of global trade takes place along the shipping routes of the world’s oceans. Shipping emissions are not only harmful for the marine environment but also for the health of people living in densely inhabited coastal regions and near ports. To measure and track these emissions more effectively in the future, a German-French team of researchers led by Oldenburg marine chemist Prof. Dr. Oliver Wurl of the Institute for Chemistry and Biology of the Marine Environment (ICBM) is

developing a new monitoring network as part of the EU joint research project MATE (“Maritime Traffic Emissions: A monitoring network”). One aim of the project is to better calculate the precise dimensions of contamination events such as those resulting from shipping collisions, for example. Over the next three years the team will work to develop novel methods of automated, 24-hour tracking of pollutants such as soot, oil, sulphur dioxide and plastic debris on the

sea surface and in the air. Drones and equipment from research ships will be used in conjunction with a network of profiling floats. This measuring network will allow the researchers to meet the demand for new environmental monitoring systems to ensure compliance with international emissions regulations. The German Federal Ministry for Economic Affairs and Energy is providing the German project partners with approximately 1.6 million euros in funding.



Students' research on the coronavirus pandemic

Is social contact as important as we think it is? What new word combinations have emerged since the start of the coronavirus pandemic? Which stress factors and problems have parents had to deal with over the past few months? Around 50 students from five different faculties examined questions like these in independent research projects between June and November. The university provided 100,000 euros in funding for these projects as part of its teaching approach *forschen@studium* (*research@curriculum*). The money was used to cover material costs and also to hire students as student assistants for the duration of the projects. A total of 27 teams applied in response to the call for proposals, of which 19 were selected. Prof. Dr. Verena Pietzner, Vice President for Instruction and International Affairs, acted as patron for the initiative.

The topics of the funded projects were

as varied as the students' prior knowledge and academic backgrounds, which ranged from educational sciences, social sciences, cultural studies, German studies and history to the natural and health sciences. The teams investigated questions such as how the university's energy use changed during lockdown, the potential of digital media for practice-oriented music teaching, and the consequences of pandemic-related restrictions, for international students in particular. Several teams from the international programme “European Master in Migration Studies and Intercultural Relations” (EMMIR) focused on the concept of “home” in their projects, examining how this has changed during the pandemic. Since many of the EMMIR students have already carried out their own research projects in the course of their studies, the call for proposals

offered a good opportunity for them to try out new or more ambitious research methods. All the teams were assisted by one or two members of the teaching staff who provided academic supervision.

“The topics and challenges that the students dealt with in their projects varied greatly. What they all had in common was the desire to link current developments with the knowledge acquired during their studies, and thus understand them better,” explained Dr. Susanne Haberstroh, Research-Based Learning Spokesperson. Promoting the passion for research was one of the main objectives of the call for proposals. The teams presented the results in a virtual poster session on 26 November to mark the annual “Teaching and Learning Day”, which aims at improving knowledge exchange and experiences in higher education teaching and learning approaches.

In the spotlight

History is not only something you read about; it can also be heard and felt. Together with her team, musicologist Anna Langenbruch researches how music history is presented on stage



Wolfgang Amadeus Mozart as the rock star of classical music – many people have this image in their heads. But Mozart’s superstar status is a relatively new phenomenon – stemming primarily from Peter Shaffer’s play “Amadeus” and Miloš Forman’s film of the same name from 1984. “This shows how much theatre productions can influence our perception of historical figures,” Dr. Anna Langenbruch says.

It is this unusual approach to historiography that Langenbruch and her research group “Music History on Stage” are studying at the university’s Music Department. Their research covers everything from plays featuring music to musicals and operas about musicians or events in the history of music. Works such as “Les trois ages de l’opéra”, an opera that dates back to 1778 about the history of French opera, as well as very recent productions such as Marina Abramović’s “7 Deaths of Maria Callas”, which only came out this year (2020).

Langenbruch’s team is the first to conduct comprehensive scholarly research on historiographical music theatre. The team’s objective is to study it as an independent historiographical genre. After all, music history in theatre functions differently to music history in book form. “Our knowledge about personalities or events in music history is often based on contemporary depictions such as in films or on stage. In these formats, historiography becomes something that we can listen to, see and feel,” Langenbruch says. Such “audio-images” are all the more interesting when they relate to music history, she notes.

A cornerstone of her research is an extensive database – the only one in the world that brings together works of historiographical music theatre from the eighteenth to the twenty-first century and makes them accessible for further research. Langenbruch laid the

foundations for the project when she was a research assistant at the Music Department, before becoming a Fellow in the German Research Foundation’s renowned Emmy Noether Programme in 2016. With the funding from the programme she then set up her research group, which currently has seven members.

“Historiography becomes a choir of voices.”

Since then she and her colleagues have continued to work diligently on the database – it now contains information on nearly a thousand productions, gathered from archives, libraries and digital collections. It provides information on themes, authors, genres, dates and locations of productions as well as related sources. Painstaking detective work is often needed to secure this knowledge, because scripts and other original sources can be hard to track down.

Using the data, the researchers can determine, for example, whether and how a musician has been “canonized”, in other words, accepted into the ranks of the “great artists” and idolized. Historiographical music theatre certainly has the power to do this, says Daniel Samaga, a doctoral student in Langenbruch’s research group. The music historian is working on so-called “authentication strategies” in productions about Mozart – in other words, he is studying how historical credibility is communicated to the viewer. His analysis of the productions also shows how much the theatrical portrayal of a historical figure can change over time. “Here we clearly see society’s influence on this form of historiography,” he emphasizes.

Whereas in the nineteenth century Mozart was portrayed as an introverted artist, a musical comedy from 1925 saw him seducing women from all walks

of life. With Sylvester Levay’s 1999 musical “Mozart!” the transformation to rebel was complete: Mozart defies his controlling father and attempts to escape the constrictive corset of his time. The musical uses contemporary rock and pop music for its songs and features only brief recordings of Mozart’s music.

A further focus of the junior research group is to apply ethnographic methods to the study of contemporary productions. One area of research here is how particular gender roles or stereotypes – for example Marlene Dietrich as femme fatale – developed. To gain insights into this process the researchers watch rehearsals and performances and conduct interviews with directors and performers.

A special feature of historiographical music theatre that can be observed in all the research group’s projects is that it makes it possible to study how people interpret history and argue over it. Not only does it shed light on the views and attitudes of those directly involved in the productions, both on and back stage, but also on those of audiences and critics. They, too, discuss historical content and correct, supplement or comment on it accordingly, as Langenbruch’s research has shown. “In this way historiography becomes a choir of voices,” the researcher says. And the music itself becomes an intermediary of history. “Compositions are performed centuries after they were written, and in the process, they are rearranged to cater to shifts in listening habits.”

Thus, the creative, artistic approach of historiographical music theatre has just as powerful an influence on historiography as other forms – and all of these forms should be taken into account, Langenbruch continues. “Because our relationship to history partly determines our self-perception, it influences how we see the world, and this is something we discuss with others. That has a direct impact on our lives today.” (kbo)

A mirror of society

Ageing and old age affect everyone and can be studied from many different perspectives. Geriatrician Tania Zieschang and philosopher Mark Schweda discuss the focus on negative aspects and useful resources, the protection of the elderly in the pandemic, robots in care – and what stays with us



Structured floor panels simulate natural surfaces in the university's Gait Laboratory, which is jointly run by the Institute of Sports Science and the Division of Geriatrics. The panels can be used for motor training or analysis of the movement patterns that people use to compensate for surface irregularities.

Professor Zieschang, like virtually all organisms, humans age. When does this process begin?

Zieschang: In some respects, it begins at birth. By the time we're 20, at the latest, changes can be detected at both the cellular and molecular levels. The telomeres – the ends of our chromosomes – become shorter, cells undergo changes, certain metabolic products accumulate. So we see signs of aging in young people too. It starts pretty early on.

Many disciplines, from biology and psychology to the social sciences, study the phenomenon of old age and aging. How do you – a geriatrician and an ethicist – view old age?

Zieschang: First of all, we have to be clear about how heterogeneous the older generation is – far more so than younger age groups. There are 80-year-olds who are still running

marathons or learning new languages, but at the same time there are 70-year-olds who are completely dependent on care. As a geriatrician, my focus is on people who need a high level of support, whose independence is at risk or already restricted. This is particularly the case among the over-80s, but there are also people in their seventies who are multimorbid – in other words, those who suffer from more than one chronic illness.

So your main criterion is the need for support?

Zieschang: Precisely. Naturally we can all suddenly be confronted with the loss of independence due to an accident or serious illness. However, I'm talking about patients who can be plunged into a downwards spiral by a minor infection or alteration. The reserves – even in an 80-year-old mar-

athon runner – just aren't what they were in youth. It is this vulnerable and highly heterogeneous group that we focus on.

Schweda: Aging is indeed a complex and multidimensional phenomenon. First of all, it's a basic calendar fact: as time goes by the years accumulate, and this changes – quite literally – our standpoint in life. So in addition to the already mentioned functional aspect, aging is also a psychological and mental process: something happens to us, our perception of things changes. And finally, aging is also a social phenomenon. Whether we count as old or not is decided, not least, by others. In modern industrial societies, the threshold to old age is retirement. In the past you were given a golden watch and sent home to sit in your armchair and wait. For what? For death! For a long time, this was the role that older people were given.

A socially defined role.

Schweda: Cultural ideas are key here – the images we have in our minds. Quite often these are very negative and focus only on deficits. Medicine is not entirely blameless here. If you look at an aging person from a medical perspective, the first thing you see are physiological degradation processes, dwindling reserves and declining performance. Yet from other perspectives, aging has much more positive connotations. In the philosophical tradition, for example, aging is often associated with wisdom, with a life experience that gives you a view of the bigger picture and more insight. The fact that nowadays we perceive aging mainly from a medical perspective is on the one hand important, because a lot can now be done about age-related impairments and diseases. On the other, however, there is the risk that aspects of old age

are themselves increasingly perceived as diseases.

Zieschang: In geriatrics and in medicine in general, we are seeing a certain shift away from this purely pathology-oriented deficit model and increased focus on the process of creating and maintaining health, also known as salutogenesis. This is a way of thinking that I happily offer my patients: that it's actually a miracle that our organism regulates itself over decades despite all the disruptive factors. A huge effort that we barely perceive goes into achieving this balanced state known as homeostasis.

So you deliberately focus on the resources.

Zieschang: We have integrated this approach into our work in geriatrics. In team meetings we make a point of describing all the things a patient is still

capable of doing, and the potential that is there. We also look at how the social environment can be used as a resource to help the patient in the future. That changes a lot in people's minds. However, I admit that we geriatricians also tend to relapse into the deficit mode of thinking. Medicine starts from the premise that good health is the normal state, and society from the premise of the perfect face with smooth skin, in which wrinkles are seen as flaws. A study has shown that people whose perception of old age is shaped by negative stereotypes have shrinkage of the hippocampus. This is the region of the brain that first undergoes changes in Alzheimer's disease. Additionally, a longitudinal observation study showed that people with a negative attitude towards old age have a significantly higher risk of dementia. So it seems to be also up to us. One hypothesis: If, as



Prof. Dr. Mark Schweda

Mark Schweda has been teaching and researching medical ethics at the Department of Health Services Research since 2018. He won the 2015 Habilitation Award at the University of Göttingen's medical faculty. Before that, Schweda completed his doctorate at the Department of Philosophy of the Humboldt University in Berlin and worked at the Institute of Ethics and History of Medicine in Tübingen, and other institutions. In addition to the ethical aspects of ageing and old age, his research focuses on the use of assistive technologies and the impact of digitalization in healthcare.

a society, we focus more on the advantages of aging, age-related cognitive decline could be considerably reduced.

What's your view on this, Professor Schweda? You did a research project on the idea of "successful aging" from a normative perspective...

Schweda: The discussion about positive images of aging has been going on for five or six decades. "Successful Aging", by which we mean active, healthy and productive aging, is the buzzword that was used in the gerontological and, later on, political debate. The idea was to overcome the traditional, deficit-oriented images of aging. But ultimately this has led to a new problem, namely that we now have one-sided, positive images of aging that can put us under tremendous pressure. Illness and fragility are perceived as personal failures and a deviation from the standard of the fit and active "silver ager".

"If we were made of stone, we would not need morality."

Mark Schweda

So one-sided concepts of aging are not a solution?

Schweda: The concept of "Successful Aging", which originated in the U.S., reflects social values that have not been properly considered, and that's a problem. The need for critical reflection here is one finding of our research project. We need more nuanced images of old age. We must take into account that aging is a process of individual-

isation, that the older generation is heterogeneous, and a single standard image of old age can't do this. Aging is an ambivalent process with both positive and negative aspects that can have very different outcomes both at the individual and societal level.

Zieschang: All over the world, social structures and attitudes towards aging are changing. It is important not to create pressure by making rules for how everyone should age. What "aging well" means is determined individually and on the basis of one's own history. For patients born in the 1920s, having attained a certain level of security is often sufficient – a roof over one's head, having enough to eat, being well cared for and surrounded by cherished mementos and the knowledge that one's children have made something of themselves. Those born in the 1930s, and certainly those born in the 1940s, are generally less easily satisfied.

Schweda: Ultimately, old age holds up a mirror to society. The baby boomer generation, for whom the ideals of self-realisation, staying active and youthfulness are key to a good life, is now reaching the retirement age. This is likely to have a lasting impact on our perception of aging. However, we may well see a clash when these ideals come up against the inescapable realities of aging. I'm curious to see what happens. In the research project mentioned above, we also worked empirically and asked people who are getting older – it affects us all – what they consider to be a good, successful life in old age. We observed that people's ideas on the subject vary greatly, and that while good health is certainly

considered important, it by no means plays a dominant role – aspects such as participation, education and staying active are in the foreground. We must therefore ask people what they actually think, and not just rely on models formulated by experts.

Professor Zieschang, you mentioned the importance of social resources – but in the coronavirus pandemic social contacts have been considerably reduced. What do you think about the restrictions for residents of care homes, for example?

Zieschang: That's a controversial issue since these people can't make the decision themselves, but are subject to rules made by the care home management and politicians. For older people living at home, weighing up the pros and cons hasn't been and isn't easy either. We are currently examining the impact of the restrictions in a research project conducted with people aged 60 and upwards. In care homes, as in rehabilitation centres and hospitals, extremely restrictive measures were simply put in place without any consultation. Patients perhaps had the option of refusing rehabilitation measures under these conditions, or breaking off this or that treatment – but people in care homes have no other home. Yet they weren't adequately and regularly involved in the discussion. I find this problematic, particularly because when it comes to rolling out a vaccination programme, we're talking about a period of time that may well extend beyond the lifetime of many care home residents. For some of them this means restrictions for the rest of their life.

Prof. Dr. Tania Zieschang

Since the beginning of 2019, Tania Zieschang holds the professorship for geriatrics at the Department of Health Services Research and has been director of the University Clinic for Geriatrics at the Klinikum Oldenburg and of the Clinic for Geriatric Rehabilitation at the Rehasentrum Oldenburg. Before coming to Oldenburg, she completed her doctorate in Bochum and then worked for many years in Heidelberg at the University Hospital and other institutions, and was Acting Medical Director of the Agaplesion Bethanien Hospital. Zieschang is a specialist in internal medicine, clinical geriatrics and palliative care. Her research focuses on promoting physical activity, training and fall prevention in the elderly and dementia patients in particular.



How do you see this from an ethical perspective?

Schweda: In an uncertain situation, it was right to take a cautious approach and put comprehensive protective measures in place. But now we have a better idea of the risks, and it is our duty to examine what measures are really necessary and effective. We must find creative solutions, for example for care homes. This means constantly balancing measures to contain the spread of the virus with fundamental rights and freedoms, quality of life and health.

Zieschang: I think it's good that in Germany a clear decision was made from the outset: we will protect vulnerable groups, including older people, and we are prepared to pay a high social and economic price for this. It is a considerable sacrifice on the part of the community, which I also see as strong protection for us health care providers.

We have yet to see the after-effects in countries like Italy, France and Spain that were struck hard in the first phase of the pandemic – perhaps in the form of post-traumatic stress disorders or in the form of emotional blunting in increasingly streamlined healthcare systems. All these effects will also need to be evaluated in the future.

The term "vulnerability" was just mentioned. This is something you investigated in a research project. You examined the question of our moral obligations vis-à-vis the vulnerability of the older generation. Did you come up with an answer?

Schweda: In moral philosophy there are schools of thought according to which vulnerability is ultimately the root of all morality. If we as human beings were not vulnerable, if we were made of stone, we would not need mo-

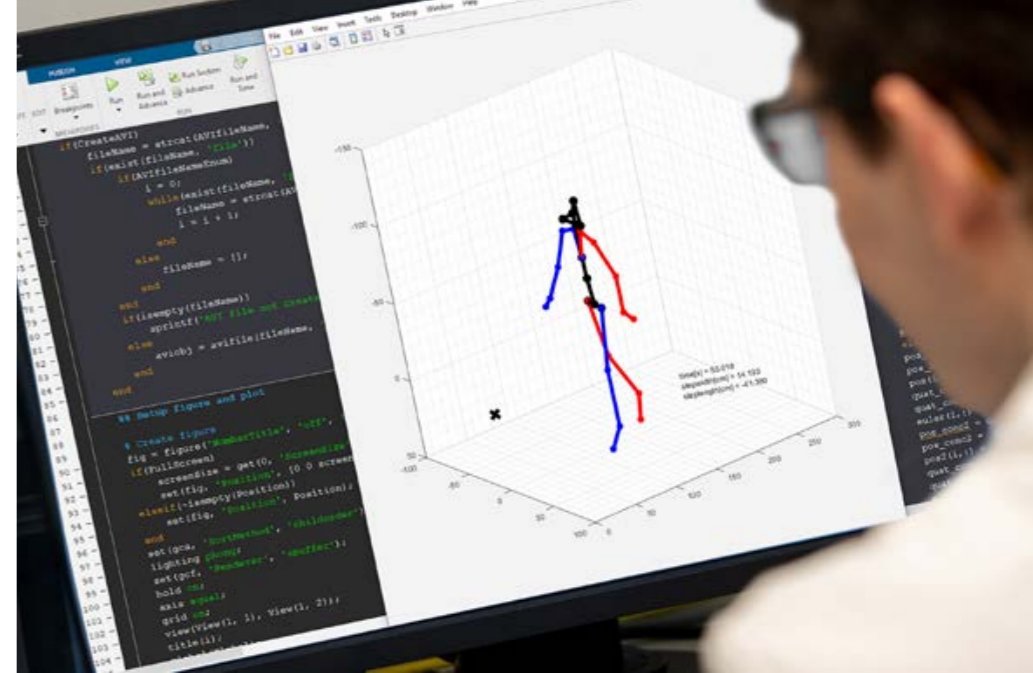
rality. Morality has to do with consideration for others, with sensitivity for each individual's need for protection and help. In this respect, vulnerability is a fundamental characteristic of all human beings. And then there are particularly vulnerable groups, such as those we focus on in research ethics: Do pregnant women need special protection in medical studies? What about children or the elderly, or people with cognitive impairments such as dementia? We have an obligation to take special protective measures with regard to people whose interests are particularly at risk.

You just mentioned a vulnerable group, dementia patients, which you are both researching – potentially working together in the future. What is your focus here?

Zieschang: The risk of developing de-



Aging is also the subject of university teaching: wearing an "ageing suit", medical students at the university's Clinical Training Centre gain first-hand experience of typical symptoms of old age.



Robotic assistance systems for use in nursing care are tested and analysed in the Nursing Laboratory at the Division of Assistance Systems and Medical Device Technology.

How to prevent falls in older persons? The team at the Division of Geriatrics is investigating this and related questions in a research project. A perturbation treadmill that simulates lurching movements (left) like those of a bus in traffic can be used to analyse dynamic balancing. Depth-image cameras record and display reactions to perturbation (right).

mentia has decreased in recent decades. However, due to the increasing older population, the absolute numbers are rising. Since nowadays hospitals perform as many operations as possible as outpatient procedures, the proportion of particularly vulnerable and older patients in hospitals is growing: today, 40 percent of acute care patients aged 65 and over have cognitive impairment. I have been studying the special requirements of this group of patients ever since I started working in healthcare research. As a young doctor I helped set up a special ward for dementia patients at the Bethanien Hospital in Heidelberg. This project was the first of its kind to be published in Germany.

"Many dementia patients nonetheless retain an emotional memory."

Tania Zieschang

You recently launched a research project in which, although you have not set up a new special ward in Oldenburg, you are creating a new system in this branch of care. Have you gained any new insights yet?

Zieschang: In our project we have

so-called key carers – “Bezugspflegerkräfte“ in German – who don't work in shifts and who are only responsible for dementia patients. These patients seem to benefit greatly from this system. In addition, we evaluate how this impacts the rest of the care team on the ward. Although the extra staff on the ward cares for “difficult“ patients, this also requires additional organisation, and it's important to make sure that there is someone who feels responsible for the patient at all hours of the day. The fact that these key carers have more flexible working hours and can focus more intensively on caring for their patients can also provoke feelings of envy.

Are assistive technology systems an alternative in care, Professor Schweda?

Schweda: Smart technologies that assist with care are a growing trend. They are finding their way into the care of older people in general, and the care of people with dementia in particular. This raises a number of ethical questions about the quality of care, questions such as: What impact does interacting with monitoring systems or, for instance, a social robot actually have on a patient? Particularly if I am

cognitively impaired, I may not even be able to understand what is happening. We currently have a project in which we are looking at the effects on patients and their relatives, particularly from the point of view of privacy.

You also plan to talk to this group of potential users of such technologies. Have you started the empirical work?

Schweda: Not yet, due to the pandemic. But my research also contains theoretical components – it's about formulating perspectives, categories and ethical principles, and applying them to a specific problem. And what is already clear is that although privacy is a major topic in the debate about ethics, when it comes to constantly monitoring and controlling certain vital functions, physiological parameters or daily activities in care, in cases of dementia this category seems to fade into the background. There is very little research in this area that deals systematically with the privacy of dementia patients in general, or with their privacy in the context of assistive technologies in particular.

So these patients supposedly don't need privacy?

Schweda: That appears to be a widespread view. Our project, on the other hand, starts from the premise that people with dementia absolutely need privacy, and that we perhaps need to review our understanding of this concept in order to adequately reflect this – even if the individuals in question perhaps no longer realise that their privacy is being violated.

Zieschang: Or forget it immediately.

Schweda: So perhaps we need to revise how we think about privacy. We must consider what it really means for us all to have a private sphere, beyond the protection of personal data. Particularly when it comes to home care, where there is very intimate contact between patient and carer in a familiar environment, something changes when technologies suddenly come into play. This is what we want to explore in our interviews.

Zieschang: What many people probably don't realise is that many patients with impaired short-term memory nonetheless retain an emotional memory of situations. That means that although they may no longer be able to remember an encounter on a cognitive level, certain emotions remain imprinted – whether I felt comfortable or, whether instead I felt misunderstood.

Each positive interaction can help patients, also in the long term.

The emotional dimension remains.

Schweda: And that is a perfect example of what studying dementia can do for us: it reveals certain dimensions of human existence that we often ignore. The American bioethicist Stephen Post says that we live in a “hypercognitive society“ that places inordinate emphasis on people's powers of rational thinking and memory. This means that many other aspects are disregarded: embodiment, emotionality and affectivity. In the process of studying dementia, I personally am learning that we also need to think about ethical questions in a new way.

Zieschang: I have encountered many families in which a case of dementia has added an entirely new emotional depth to the relationships with the patient. This is particularly evident with men born in the 1920s who may have shown very little emotion over the course of their lives, but when suddenly all the cognitive abilities start to fall away, an inner core is revealed. Some families emerge stronger from this experience, with the feeling that they have at last come to know this person properly.

Schweda: Unfortunately, as a society we propagate an image of dementia as the worst thing that could happen. According to this logic some people would prefer to die rather than live with dementia. We need to work on this. We don't want to trivialise dementia and the dramatic changes that accompany it, but this exaggerated doom-mongering that results from a one-dimensional self-image that is also narcissistic ...

Zieschang: For example when celebrities choose to commit suicide after a dementia diagnosis, there appears to be so much vanity in that decision – they can't bear the idea of the façade crumbling.

The loss of control.

Zieschang: Precisely.
Schweda: What we can learn from reflecting on aging and old age in general is to accept that our possibilities and capacities are limited. And to not narcissistically perceive our mortality and limitations as an insult, but to recognise these things as part of our human existence.

Zieschang: And also recognise that we can't determine how our lives end. At some point we have to let go.

Interview: Deike Stolz

In the service of sustainability

The imperatives of ecology and the economy are often seen as contradictory. But for Jörn Hoppmann, Professor of Management at the Department of Business Administration, Economics, and Law, sustainability is a promising business strategy, and the mobility and energy sectors are the focus of his research



Anyone who grew up in the Wendland region in Lower Saxony in the 1980s spent their childhood among anti-nuclear and green activists, and the country's first organic farmers. Born in 1982 in Gifhorn, a town in the east of Lower Saxony, and today Professor of Management at the University of Oldenburg, Jörn Hoppmann was one of them. And even if his academic discipline might suggest otherwise, the topic of sustainability is the red thread that winds through Hoppmann's life. His research focuses on sustainable business strategies, organizational change, and technological innovation.

His childhood was shaped by protest. Hoppmann's parents took part in anti-nuclear demonstrations in the 1990s. His father, a physics and chemistry teacher, and his mother, a biology and physics teacher, were all too aware of the dangers of nuclear waste repositories. Hoppmann's takeaway from this time: "Protest is an effective way to push for change." In the meantime, the Wendland has made a name for itself as a model region for ecological agriculture, wind energy, and sustainable tourism – which is why the management scholar believes contemporary movements like Fridays for Future are key to finding solutions for the climate crisis: "From a scientific perspective, we can say that social change gives rise to new laws and regulations, which in turn promote technological and organizational change." Hoppmann is someone who thinks across disciplines; who strives to combine business strategies, climate change, and sustainability in a profitable way – and who is bringing big business executives and ecologists to the same table and doing the sums to show them that climate protection and profit do not have to be mutually exclusive. "No big company today can afford not to have a sustainability strategy," Hoppmann asserts.

Hoppmann's research at the University of Oldenburg is tripartite, weaving together innovation, strat-

egy, and sustainability. He also tries to be as sustainable as possible in his private life. As a commuter he spends a lot of time on trains: his wife and one-year-old son live in Hamburg. The 38-year old always tries to keep his CO₂ footprint as small as possible without being too preachy about it: "I wouldn't claim that I do everything perfectly. But I do feel I'm in a position of responsibility, to the students, as much as anyone else," he stresses. It would go against his principles to not practice in everyday life what he teaches in the lecture hall.

Tripartite research

In 2002, when Hoppmann graduated from school with the best grades in his year, the subject of sustainability was not something he focused on initially. After his year of compulsory community service, he studied mechanical engineering and business administration in Braunschweig. He was fascinated by how many disciplines it combined: business management, engineering, physics, maths, but also law and politics. But while many of his peers were already planning a career in the automotive industry, Hoppmann had yet to find his focus. He became more and more interested in innovation issues: How can a company develop innovative products and position them on the market? At that time, sustainability was still very much a niche issue in the executive world.

As a student, he worked on projects that dealt with lean product development at Porsche Consulting in Stuttgart and then landed an internship in Frankfurt at Boston Consulting, one of the largest global strategy consulting firms. At this point Hoppmann reached a decision about his future: as attractive as the lucrative jobs and career opportunities in industry were, he opted for academia instead.

A research trip to the renowned Massachusetts Institute of Technology (MIT) in Cambridge, USA, established

the coordinates: Hoppmann completed his Master's thesis on innovation and lean product development: "I had reached the point where I knew how much I loved academic work and that I wanted to do a PhD. However, I wanted to do it on a subject that seemed meaningful and that would combine my interests in the fields of economics, sustainability, and technology."

It was after Hoppmann organized the first sustainability summit ever held at MIT that he realized this was what he really wanted to focus on. He then applied to ETH Zurich to do a PhD in the Group for Sustainability and Technology at the university's Department of Management, Technology, and Economics. The problem was that apart from top grades, the young researcher had little to show other than a deep commitment to sustainability. Yet he somehow convinced the selection committee in Switzerland. From then on, sustainability became the main focus of his work, and he decided to specialize in renewable energy. In 2013, Hoppmann earned his doctorate at ETH's Department of Management, Technology and Economics and was awarded the ETH medal for the best doctoral thesis in the department. In his thesis he investigated the drivers and dynamics of innovation for clean energy technologies, with a focus on the photovoltaic industry. While writing his PhD, he went to Harvard University as a Research Fellow in the Energy Technology Innovation Policy group: "My time there left a big impression on me because the Americans had a very different perspective on the energy sector and a quite limited understanding of the German energy transition."

During his postdoc period in Zurich, Hoppmann looked at how the big electricity suppliers in Switzerland and Germany were reacting to the energy transition: "It was a logical continuation of my PhD research," he explains. Because by this time, the political situation had shifted and renewables had become far more affordable thanks to government support. Established

corporations like electricity suppliers were being forced to change course. They were setting up new departments dedicated to renewables. Hoppmann found it interesting to study how these large companies were discovering sustainability as a strategy and restructuring their organizations accordingly.

Back in northern Germany

Having returned to Germany and to Oldenburg in particular, Hoppmann is now much closer to where he grew up again. "I just love the north!" And he was surprised to see what a powerhouse the Oldenburg "Sustainability Economics and Management" programme is: "A flagship for the university."

Since his appointment to the Chair of Management, he has extended his empirical focus and his working group now researches both the energy sector and the revolution in the mobility sector. "We decided to look more closely at the mobility sector because – like renewables – it plays a significant role in climate change. The dynamics of the two sectors are astoundingly similar," the researcher explains. In mobility, too, political impulses are crucial when it comes to getting new technologies

onto the market. Established firms are being forced to react strategically to political developments by changing their products and business models. "Right now, for example, we are looking at how established carmakers can prepare large numbers of employees for new areas like electric vehicles, autonomous driving, and car sharing – within a very short time."

In this context, one topic that is becoming increasingly important and that is helping to drive change is digitalization. Hoppmann and his team have various projects in which they are researching the role of digital platforms in the mobility revolution and the speed at which businesses that rely on digital solutions have to grow in order to remain competitive in the market. Initial findings show that platform businesses face particular challenges in the mobility sector because they need to coordinate numerous interfaces between the physical and virtual world.

The 38-year-old is also researching how industries can reconfigure value chains to create a circular economy. Scientists define this economic model as a system that relies on life-long products, maintenance, and recycling to keep energy and resources consumption as low as possible and minimize waste and emissions. Ex-

perts agree that the circular economy could contribute significantly to saving resources and lowering carbon emissions. The EU set ambitious targets for this long ago. "But it's not yet clear how to achieve them or how individual companies such as packaging manufacturers, recyclers, or retailers will react to this transition," Hoppmann explains. This is where his team comes in. In one current project Hoppmann is examining factors at the company level that have led to a decline in the use of reusable packaging in the beverage sector, flying in the face of EU targets and leading to an increase in single-use plastics that are more harmful to the environment.

Hoppmann has an excellent reputation with his students: in his first year at the university, he received the 2017/2018 teaching prize in the category "best lecture" for his course "Introduction to Business Administration". Being close to his students is important to Hoppmann: "On the one hand, it's about giving them a solid basic education, but ideally they will go on to become socially and ecologically responsible citizens, employees, and leaders. This is something that I care deeply about." For Hoppmann, lectures are an important opportunity to "anchor sustainability-thinking in the minds of the students." (kl)

ANZEIGE

Profile

Jörn Hoppmann was appointed Professor of Management at the University of Oldenburg's Department of Business Administration, Economics, and Law in April 2019. Prior to that he was the interim head of the Chair of Strategic Management and Sustainability.

Hoppmann earned his habilitation in 2018 at ETH Zurich, where he also completed his PhD. He earned his diploma in mechanical engineering and business administration in 2009 at the Technical University of Braunschweig. Research trips have taken him to

Harvard University and the Massachusetts Institute of Technology (both in Cambridge, USA), the University of Waterloo in Canada, and the IMD Business School in Lausanne (Switzerland). He has received numerous awards for his research.

The birth of an island



With every high tide, the North Sea washes new sediment into the salt marshes of Spiekeroog's Ostplate. The tides, the wind, and the storm surges keep the soil "young".

The North Sea island of Spiekeroog is a huge natural laboratory: over the past century its eastern part, the "Ostplate", has been transformed from a small sand flat into a vast, wild landscape of sand dunes and salt marshes. A team of researchers led by Gudrun Massmann and Luise Giani has studied how groundwater and soil develop on this young stretch of land

The great wilderness begins behind the National Park Centre Wittbülten. The red brick building, where visitors can learn about the flora and fauna of the Wadden Sea, roughly indicates the point where the island of Spiekeroog used to end around 1950. At that time, there was nothing but a few small white heaps of sand – and behind them, a bare, dry sand flat and the sea stretching all the way to the horizon. Nowadays you can walk eastwards from the National Park Centre for hours on solid ground. Behind the building a trail begins that winds its way between a chain of dunes and flat salt marshes crisscrossed by tidal creeks for about seven kilometres, until it reaches the end of the island.

The inconspicuous path, which visitors are only allowed to use during the winter months because of the numerous birds breeding here in spring, leads through one of the most untouched landscapes in Germany – the "Ostplate" or eastern flat of Spiekeroog Island. The new part of the island, like the rest of the East Frisian Islands, has been a protected area since 1971. Since

1986, when the Wadden Sea National Park of Lower Saxony was established, it has been part of the most strictly protected restricted zone. "There are no coastal management measures of any kind, no construction. The landscape is just left to itself – it's the jewel of the national park," enthuses Prof. Dr. Gudrun Massmann, head of the Hydrogeology and Landscape Hydrology working group at the University of Oldenburg. The only forces at work here are the tides, the wind and the weather. Storm tides repeatedly break through the young dunes, depositing new sand and flushing salt water into the gaps between them.

All this makes the Ostplate a unique experimental laboratory: "You can literally watch how the landscape evolves, how the dunes grow higher and higher and the vegetation changes," explains Prof. Dr. Luise Giani, who heads the Soil Science working group at the university. Less visible are the changes below the surface, which are crucial to turning the former sand flat into a piece of new land. Here, various chemical reactions occur, substances redistribute, and rainwater seeps into the dunes, displacing the saline

groundwater and creating contiguous bodies of freshwater.

It was these processes that Massmann, Giani and Dr. Thomas Pollmann, Dr. Tobias Holt and Dr. Stephan Seibert, who were still doing their PhDs at the time, rigorously studied from 2015 to 2019. Their project, funded by the German Research Foundation (DFG), was titled "Chronosequential initial evolution of soils and freshwater resources of a barrier island."

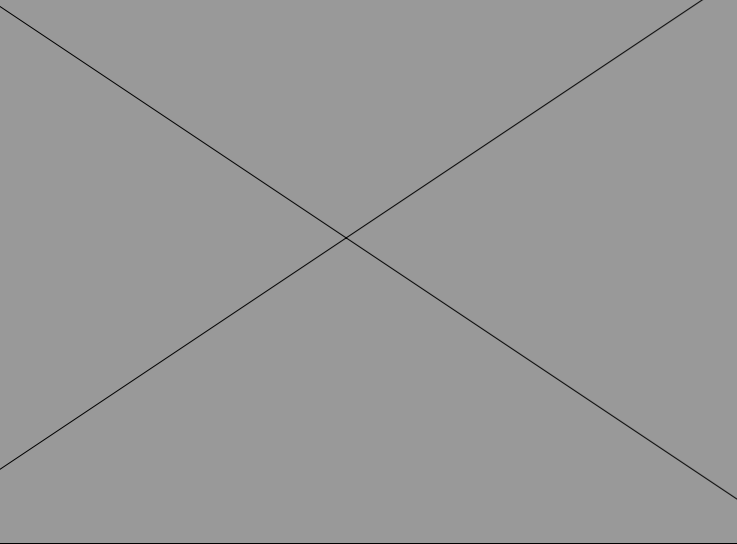
Accelerated growth

The history of the Ostplate began at the end of the nineteenth century when the last remnants of what was once the Harlebucht (Harle Bay) were diked. Originally fifteen kilometres wide, in the sixteenth century the bay stretched about ten kilometres inland, almost all the way to what is now the city of Jever. "The flow patterns in the tidal flats changed so much as a result of the diking that sand accumulated east of Spiekeroog at a breath-taking pace," explains Massmann. Around 1920 a sandflat appeared at the eastern end

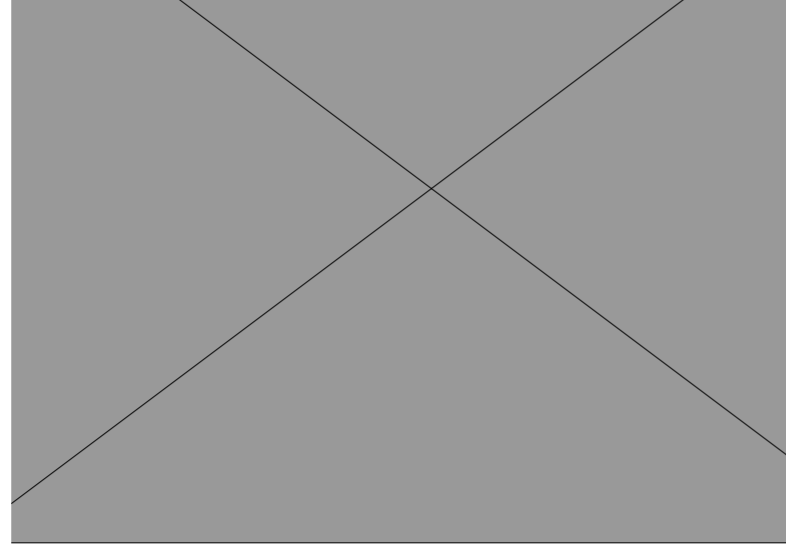
of the island, the first dunes began to grow on it 60 years ago, and 30 years later a seven-kilometre chain of dunes covered with marram grass and a wide strip of flat salt marshes had formed.

The focus of the hydrological project part was freshwater. A special feature of the East Frisian islands is that despite their small size they have their own freshwater reservoirs, so-called freshwater lenses, which are fed by rainwater and float above denser saline groundwater. The lens in the western part of Spiekeroog, for example, is almost 50 metres thick and supplies residents and tourists with drinking water. But until now very little was known about how and at what speed these bodies of water are formed, how large they are, what determines their chemical composition and what role the soil plays in this process. "The Ostplate is the only place where it is possible to study the initial stages of freshwater-lens formation," says Massmann, even if there are no plans to extract water there.

The team had to make regular visits to Spiekeroog to conduct their investigations. The researchers took hundreds of soil and water samples over



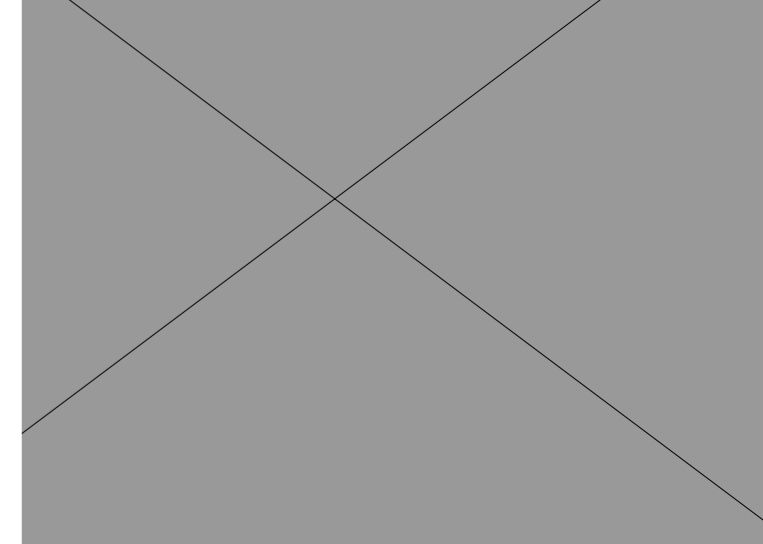
Salt-tolerant plants such as *Salicornia* and common cordgrass are found in the pioneer zone of the salt marshes. In autumn, the shoots turn bright red.



Hard work: Tobias Holt (right) and Stephan Seibert had to rely on their own muscle power to bring the equipment for groundwater sampling to the Ostplate.



Redox potential measurements show whether aerobic or anaerobic conditions prevail in the soil.



Luise Giani, Thomas Pollmann, Gudrun Massmann and geocologist Holger Freund (from left) don't just conduct research on Spiekeroog, they also organize a landscape ecology excursion for students every autumn.

the course of a year, installing fifteen new groundwater measuring points with built-in data loggers. The instruments still continually record water levels and salinity all the way down to a depth of fifteen metres today. "The sampling was of course carried out in close consultation with the National Park administration and the rangers; we had to comply with strict regulations," emphasises Giani.

A transitional area between land and sea

Working in the nature reserve was a unique experience for everyone: "The Ostplate is a world of its own," says Pollmann. The team was under constant time pressure during the long marches to the measuring points because the salt marshes are partially flooded at high tide. The researchers also had to transport their equipment – spades, drilling rigs, cameras, pumps and measuring devices, etc. – on foot, and also carry the samples they had collected in their backpacks. It was not unusual for each of them to be carrying twenty kilograms or more at a time.

The data they collected on the new part of the island (and also on the old part for comparison) revealed that the Ostplate is still a transitional area between land and sea that is shaped by tides and storm surges. Holt's measurements and models showed, for example, that although several sep-

arate freshwater lenses already exist beneath the dunes of the Ostplate, the formation of which probably began around 1975, they differ from the large lens in the western part of the island: "These freshwater lenses are only two to four metres thick, much thinner than the one in the west," Holt explains. His models also predicted that under the current circumstances they are unlikely to expand any time soon. "They have already reached the maximum possible size and are in a kind of equilibrium," the researcher explains. Although precipitation fills up the freshwater lenses, the winter storm tides limit their growth: seawater regularly seeps into the subsoil north and south of the dunes, causing fresh groundwater to become saline and lenses to shrink again. In this way, the lenses grow and shrink in a seasonal rhythm. Only if the dunes of the Ostplate continue to grow, giving rise, for example, to another chain of dunes, could the lenses increase in size.

Using samples from the groundwater measuring points on the Ostplate and from wells in the western part of the island, Seibert studied the chemical processes that occur as the rainwater passes through the dunes, as well as inside the freshwater lenses themselves. His measurements show how the chemical composition of the groundwater changes as it ages. For example, microbes break down organic material with the help of reactive substances such as oxygen, nitrate or sulphate,

creating new compounds such as the iron mineral pyrite. "The oldest water in the main lens in western Spiekeroog is about 50 years old," explains Seibert.

The smaller lenses on the Ostplate proved to be much younger and more dynamic by comparison. The water there was no more than five years old. The team also found that, unlike in textbook illustrations, fresh and salt water are not clearly separated there but that instead there is a broad transition zone: "It is here that oxygen-rich, salty seawater meets freshwater that contains no oxygen or nitrate, but does contain dissolved iron, for example. Some minerals precipitate, others dissolve," Seibert explains.

Chemical reactions also take place in the soil above the groundwater. Pollmann's measurements showed that, contrary to expectations, soils in the new part of the island hardly seem to age at all: the dunes and salt marshes in the western part of the Ostplate were formed earlier than those further to the east, but from a pedological viewpoint they are at the same stage of development. "Tides, wind and storm tides are currently working against soil formation, they keep the soil in a young state", the researcher explains.

As the project results show, the Ostplate is still a dynamic landscape which, in the absence of coastal protection measures, is constantly changing. But how will the East Frisian Islands develop in the future if the sea level continues to rise and heavy storm tides

become more frequent? As part of a newly initiated joint project, the Oldenburg hydrogeology team wants to determine how climate change will affect freshwater lenses – and how these resources, which are so important for the islanders, can be managed sustainably. "Storm tides that break through

protective dunes would be particularly problematic," Gudrun Massmann explains. "If they cause seawater to seep from above into a freshwater lens that is used to supply drinking water, this resource could be rendered useless for decades." The balance between precipitation, water extraction and submarine

groundwater discharge is "unstable and in the worst case irretrievable" – as on Langeoog, where several storm tides in the eighteenth and nineteenth centuries divided the island and its freshwater lens. The lens has not recovered to this day and is still divided into two separate water bodies. (uk)

BACKGROUND

Research in the backyard

For the marine and environmental researchers at Oldenburg University, Spiekeroog is the island "on their doorstep" – their first port of call when researching tidal flats and the North Sea. It all started in 2001 with the research group "BioGeoChemistry of Tidal Flats" at the Institute for Chemistry and Biology of the Marine Environment (ICBM), which was funded for almost ten years by the German Research Foundation (DFG). It aimed to study the influence of tides, weather and microorganisms on the biogeochemistry of tidal flats, with a particular focus on the Janssand sandbank. Since then, Oldenburg research on Spiekeroog has covered topics such as invasive plant species, the spread of plastic waste and submarine groundwater discharge. In an ongoing project on coastal protection, the island serves as a field labo-

ratory for social science and ecological research. In all projects, the university works closely with the National Park Administration as well as the National Park Centre Wittbülten and the Hermann Lietz School. Laboratories and seminar rooms are available at the Wittbülten Research Centre, located next to the National Park Centre. The University runs several permanent monitoring stations on Spiekeroog, including the fifteen groundwater measuring points on the Ostplate (see text), twelve experimental islands in the Wadden Sea and the "Time-Series Station Spiekeroog" – also known as the "Messpfahl" – in the strait between the islands of Spiekeroog and neighbouring Langeoog. Built in 2002, this bright yellow construction protrudes about fifteen metres out of the sea and has since been integrated into

two national networks for long-term environmental measurements. Underwater sensors continuously record the temperature, electrical conductivity and pressure of seawater at various depths, as well as the direction of the current and its nutrient concentrations. A radar measures the height of the waves, while meteorological sensors record weather data and solar radiation. All this makes Spiekeroog one of the most intensively studied German North Sea islands. The various measuring stations in combination with regular teaching and research activities make up the Spiekeroog Coastal Observatory (SCO) at the ICBM. The Oldenburg researchers aim to investigate this turbulent transition zone between land and sea even more comprehensively in the future.

Tracking down speech signals



Background noise, reverberations and acoustic feedback often hamper speech comprehension when technical devices are in use. Hearing researcher Simon Doclo uses mathematical methods to tackle the problem

In the legendary Star Trek series, devices called “communicators” allowed people to communicate directly with each other anywhere in the universe in a fraction of a second. That was in the late 1960s. But although interstellar communication is still a distant dream, technology – mobile phones, teleconferencing and hearing devices – has come to play an increasingly important role in everyday communication.

Yet despite major advances, the technology that helps us communicate with each other still has its shortcomings. If you have ever tried to make a phone call from a noisy train station or listen to a person at the other end of the table in a busy restaurant, you know the problem: background noise and reverberation make it difficult to understand what is being said, even for those with good hearing, not to mention people who depend on a hearing aid. Experts call this the “cocktail party effect”, a term that was coined back in the 1950s.

This is the starting point for the research of Prof. Dr. Simon Doclo, who heads the Signal Processing Group of the Department for Medical Physics and Acoustics at the University of Oldenburg. “Our aim is to improve speech communication in adverse acoustic environments when devices such as mobile phones and hearing aids are being used,” he says. Doclo’s team uses mathematical methods to meet the challenge that the Oldenburg researchers in the Cluster of Excellence “Hearing4all” and the Collaborative Research Centre (SFB) “Hearing Acoustics” approach from a wide range of perspectives: the team develops algorithms – in other words sequences of instructions for calculations – which can be used to cancel or at least suppress effects that reduce speech intelligibility and speech quality during communication.

The Belgian-born scientist has been researching and teaching at the university since 2009 – a time, he stresses, when hearing research in Oldenburg had already established an interna-

tional reputation. Doclo’s research is generally a three-step process, the first step being the design of a new audio signal processing algorithm. “In the next step we implement and optimize the new algorithm and evaluate it using computer simulations to see whether it achieves the desired effect, for instance improving speech quality by a certain percentage,” the electrical engineer explains.

To obtain more than just technical results, in the final step the researchers determine whether the new algorithm actually works in practice by means of listening experiments with test persons – a time-consuming process, which is often carried out in cooperation with other groups in the SFB and the Cluster of Excellence, Doclo emphasizes. But what may sound like a routine task is actually highly complex, because working with mathematical methods to filter out intelligible speech from complex acoustic sound information is often an extremely laborious process. “Only a handful of the algorithms that we develop turn out to be good enough to use in the final stage with test persons,” Doclo says.

In his work, the 46-year-old takes advantage of the fact that most devices, including hearing aids, contain several microphones. This allows the researchers to filter out more than just the so-called spectral components from an audio signal – specific frequencies with more or less background noise, for example. “The different microphone signals also provide information about the positions of the sound sources and how sound propagates within a room,” Doclo explains.

“The ‘holy grail’ of acoustic signal processing.”

To develop what he calls “smart algorithms”, the team takes two different approaches: “On the one hand, we work with classical methods of digital signal processing, utilizing statistical

models of speech and room acoustical properties,” he says. This means that the researchers use statistical methods to describe for instance the frequencies of an acoustic signal, that is the sound’s oscillations, and how these frequencies change over time.

Based on such time-frequency analyses, the optimal parameters of a mathematical objective function are then estimated, for example, aiming at extracting the clean speech signal from noisy and distorted recordings. “One of the main challenges is to design a suitable objective function that it is on the one hand relatively easy to optimize but on the other hand also incorporates psycho-acoustic properties of human hearing,” Doclo says. Furthermore, the algorithms should preferably work in a fully blind way. “In well-defined experiments in the lab the positions of the sound sources or the microphone distances may be assumed to be known. But in real-life situations, these variables are often unknown,” he explains.

With this approach the researchers’ work of the last five years has led to major progress in several areas, most notably how to deal with reverberation. Reverberation is a term used by experts to describe the repeated reflections of an acoustic signal that occur when the sound encounters obstacles such as walls and is reflected back multiple times. “This is the ‘holy grail’ of acoustic signal processing, because it is extremely hard to separate the reflections from the clean acoustic signal,” Doclo says. “We developed a new method which is able to filter out reverberation much more effectively than previously possible.” This work attracted considerable interest among experts, and at the end of 2019 Doclo and his colleague Dr. Ina Kodrasi were awarded the annual publication prize of the Informationstechnische Gesellschaft (ITG).

In addition to statistical model-driven methods, the team works with data-driven methods. These methods are based on “machine learning”, in which the scientists train so-called neural networks using large



amounts of data. "Basically, we feed a huge quantity of audio signals that we have either recorded under controlled conditions in the lab or simulated on the computer into the network," Doclo explains. The researchers can, for example, record speech and background noise separately and thus specify the clean speech signal as the desired result. The network then has to learn how to extract the clean signal from the noisy data.

But Doclo emphasizes that many data-driven methods are often "black boxes" which don't contribute to understanding the underlying processes. Statistical model-driven methods are generally more helpful in this respect, he believes. "This is one reason why we aim at combining the advantages of both approaches by merging statistical model-driven and data-driven methods," he says. In this way, the researcher hopes to achieve the best possible balance between an algorithm's performance and its robustness. By robustness, researchers mean the ability of an algorithm to generalize as much as possible, that is to be applied to many different situations. "After all, our algorithms should also function for unknown acoustic environments and unknown noises," Doclo says.

Another challenge for the team's research is that all their approaches have to work in real time, because speech communication devices such as hearing aids and mobile phones should not noticeably delay the signals for their users. "Therefore, we need to pro-

cess the signals as quickly as possible when they reach the device, extracting a clean signal within milliseconds," Doclo explains. This is another reason why the researchers need to take care that their algorithms don't become too computationally complex.

The team also uses their algorithms in so-called acoustic sensor networks, where information is used from several spatially distributed microphones, for example those in a hearing aid and a mobile phone. In the future, in a noisy restaurant setting for example, hearing-impaired people as well as people with normal hearing could simply place a mobile phone on the table and its microphones would work together with the hearing aid microphones. "All available microphones then analyse the surroundings acoustically," Doclo explains. "And even when the positions of these devices are not exactly known, our algorithms are becoming increasingly effective at extracting the desired speech signal in this type of situation."

But mathematical methods also have their limits: "In many applications, we first analyse the acoustic environment in order to determine all relevant sound sources and their location," Doclo says. Experts call this step computational auditory scene analysis. However, purely based on the acoustical signals it is not possible to decide which sound source the user wants to listen to. For this, an entirely different type of information is needed. By working together with the Oldenburg neu-

ropsychologist Prof. Dr. Stefan Deben-er, one of the researchers' long-term objectives is to use EEG measurements to help determine which sound source a person focuses their attention on, in order to amplify this source.

"We want to make things better."

Another tricky problem that Doclo wants to solve mathematically is acoustic feedback. Anyone who has ever put a microphone too close to a loudspeaker to which it is connected will have heard the typical screech of a feedback loop. This acoustic phenomenon also occurs in so-called "hearables". These ear-worn devices go far beyond simple earphones. They use digital signal processing algorithms to provide individualized hearing support for people with normal hearing to, for

example, better understand a conversation in a noisy situation. A number of research groups at the department and at the Division Hearing, Speech and Audio Technology of the Fraunhofer Institute for Digital Media Technology (IDMT) are currently working on optimising hearables.

"In the Collaborative Research Centre "Hearing Acoustics" we have developed a new hearable, which contains two or three tiny microphones in a small earpiece," Doclo explains. But because these microphones are located very close to one of the loudspeakers, the researchers have often grappled with feedback issues. "We have now developed a comparatively simple method to suppress this feedback," the electrical engineer explains. And it works much better than we could ever have expected. "This came as a surprise and we were thrilled."

Doclo sees plenty of other interesting

challenges for the future. The first item on the list is to further optimize the algorithms by combining statistical model-driven and data-driven methods. "We are engineers," he says, "we want to make things better." In the long-term he can imagine opening up his mathematical methods for further applications - in medicine, for example. "This is another field where sensors are distributed across the body and deliver distorted signals." As in acoustics, the algorithms could help to filter out the desired information.

But his true passion is acoustics, Doclo says - from hearing aids to mobile phones to smart speakers. His dream is to develop algorithms that are truly robust and function seamlessly. "The Star Trek thing," he says, with a smile. "You can run around, talking to everyone, even over huge distances, without any annoying background noise." (cb)



- 1 In their experiments, Doclo and his team use artificial heads designed to simulate the acoustic properties of a human head.
- 2 The researchers play back certain sounds over a loudspeaker. The microphones in the ears of the artificial head record these sounds. The result is a recording that authentically replicates what a person in the same position as the artificial head would hear.
- 3 Using sound cards, the scientists record different microphone signals and then use these signals in further experiments.
- 4 Microphones operating in tandem, known as "microphone arrays", are used in acoustic sensor networks. Scientists use them to analyse the acoustic environment of a room, for example.



Simon Doclo has been at the University of Oldenburg for more than a decade. Among other things he has developed a method for filtering acoustic signals to remove reverberations.

The power of data

Data has become one of the most important economic assets of the 21st century. Jorge Marx Gómez and a team of Oldenburg business informatics researchers are investigating how companies can glean new knowledge from accumulated business figures, measured values, images and text documents

You don't need to travel all the way to Silicon Valley to find out how big data could change the future. Right here in Germany, in Lower Saxony, you can get a glimpse of the fascinating world of data science and the vast possibilities of artificial intelligence (AI), machine learning and neural networks. In Oldenburg, for example, where cargo bike couriers working for a postal company will soon be guided through the city by augmented reality glasses. Or in Wolfsburg, where the Volkswagen Group is developing new methods for data-driven auditing. And also at the Chamber of Agriculture in Lower Saxony's experimental station for pig farming in Wehnen, where tests are about to find out how modern data science methods can optimize livestock management.

Cameras have been installed above the spacious piggpens while sensors measure humidity, ammonia levels in the air, feed consumption and other variables. Veterinarians and agricultural researchers are convinced that pigpen digitalisation can make a significant contribution to animal welfare. In the "DigiSchwein" project coordinated by the Chamber of Agriculture, a team of business informatics researchers from the university and the affiliated OFFIS computer science institute headed by Prof. Dr. Jorge Marx Gómez is developing an automated farm management system that would warn farmers if problems arise in their livestock.

Intelligent use of data

Digischwein, which is funded by the Federal Ministry of Agriculture, is one of a series of projects at the Department of Business Informatics/Very Large Business Applications, all of which focus on the intelligent use of large volumes of data to optimize decision making. In addition to the above-mentioned systems for cargo bike couriers and for the Volkswagen

Group, the team is also working on applications that analyse high-resolution operating data from wind power plants, provide advice and guidance for customers buying glasses online, plan routes, and organize car-sharing. "Data helps companies to find new products, access new markets and optimize internal processes," says Marx Gómez. He and his colleagues cooperate with various companies, from start-ups to large corporations, as well as with several cities and regions in Germany, the Netherlands and the UK, and also with other research institutions. The team's goal is to apply innovative data science procedures in areas where they have rarely been used until now - agriculture, cycling and certain areas of business administration.

"Our area of expertise is applying existing, scientifically-based techniques to new problems and putting the data to optimal use," stresses Marx Gómez. He and his team deal with both "structured data", such as numerical values in tables with hundreds of columns and millions of lines, and "unstructured data" such as texts, images and videos. The quantities are often in the gigabyte range - as in the SmartHelm project, in which the researchers are developing an assistance system for cargo bike couriers delivering packages in congested city centres. Images from an eye-tracking camera that records the courier's eye movements as well as audio recordings and other data will all flow into the system.

The first step in a big data project is usually to determine what information is needed to accomplish the task at hand. In the case of SmartHelm, the data management platform should be able to store data from various internal sources as well as from external portals. All this information is analysed to measure how much of the courier's attention is absorbed by traffic and other environmental stimuli. Then in line with this assessment the smart glasses provide the couriers with information about the route or their current assignment, such as which entrance a parcel should be delivered to. This means

that the courier doesn't need to search for the information on a smartphone, which can be dangerous in traffic. The team is currently focusing on how the different data sources may be combined and analysed to reliably measure attention levels. Furthermore, an important aim is to reduce the number of individual sensors to improve comfort of the drivers and wearability of the helmet.

Laborious preparations

The next step is usually to eliminate errors from data that may have been gathered from various sources, remove superfluous information and convert all the data into a standardized format. This preliminary work often takes up about 70 percent of the time in a project. "During these steps you have to keep asking: How can I get the most out of my data?" explains Jan-Hendrik Witte, a researcher involved in the DigiSchwein project. "So the process is not just laborious, it also requires a lot of creativity and brain power."

In the next step the data is analysed. This is where new knowledge is gleaned. "Computers have become faster and faster in recent years, so they can also process more and more data," says Marx Gómez. "At the same time, new ways to extract more knowledge from data are emerging, most of them involving AI." The term Artificial Intelligence (AI) refers to various methods by which computers solve problems independently and ultimately learn from experience. AI is already in use in numerous everyday applications such as facial recognition and automated text translation.

In the case of DigiSchwein, the project based in Wehnen, one of the team's objectives is to find out whether it is possible to detect tail-biting at an early stage. This is a behavioural disorder that can have many causes and is not fully understood. "Obviously, we're not pig farming experts, so we need to cooperate closely with our partners, in-

cluding veterinarians from the University of Veterinary Medicine Hannover and the University of Göttingen," Witte explains. He and his colleague Johann Gerberding have the task of processing the data from the pigpens in such a way that it brings to light previously unknown correlations in the animals' behaviour.

The two scientists first feed training data, in this case images showing the pens from above, into an image recognition algorithm, which can also be referred to as a "model." The goal is that the model learns to recognize the shapes of pigs – a task which none of the currently available image recognition software can perform. The researchers essentially tell the model which of the shapes that it identifies belong to a pig and which do not. In this way the programme gradually gets better and better at recognising the animals on the images – a procedure known as machine learning and one of the most important subdisciplines of AI. A key challenge in this project is to make the system as robust as possible so that it can cope with problems specific to the pigpen, such as cobwebs on the camera lens or changing light conditions.

In the next step, the researchers combine the unstructured data from the video cameras with the structured columns of numbers from the sensors. With the help of other partners in the project they will then look for clues pointing to situations in which problems such as tail-biting arise, for example elevated ammonia levels in the air, or changes in water consumption accompanied by increased jostling among the pigs. To detect suspicious patterns in the data, the researchers

use deep learning methods – a special form of machine learning based on artificial neural networks. These mathematical models simulate networks of nerve cells in the human brain and learn rules autonomously on the basis of the data fed into them.

The amount of data also plays a critical role here: "The best way to predict an event such as tail-biting, the causes of which are as yet unknown, is to have as much information as possible about this specific problem," says Witte. After all, a model is only as good as the data you put into it, regardless of which AI method you use, he explains. Once completed, the farm management system should be able to alert the farmer via smartphone whenever something happens in the shed that deviates from the norm.

Dark data

Deviations from the norm are also the subject of the DiFA (Data Intelligence for Audit) project, another undertaking in which the University of Oldenburg is involved. In this case the focus is on deviations in business processes. Whereas DigiSchwein evaluates measured values, i.e. numbers, and unstructured image data together, most of the data collected in companies consists of text. "Roughly speaking, about 80 percent of business data is unstructured, and much of it is never used," says Gerrit Schumann, a business informatics researcher from Oldenburg who is also a member of Marx Gómez's team. Experts refer to this as "dark data", unused data that lies dormant within the systems of every company.

In cooperation with the Volkswagen Group, Schumann and his colleague

Jakob Nonnenmacher are currently developing a system that looks for anomalies in structured data such as Excel tables or database exports, as well as in unstructured data such as contracts, protocols, guidelines, and other text documents. "Such anomalies might be ordering processes that are taking longer than usual or indications of fraud," explains Schumann. The system is to be used by employees in the company's internal auditing department. This independent department checks business processes in sub-divisions such as the purchasing or sales departments of the individual Volkswagen brands, looking for anything that could pose a risk to the company. The Volkswagen Group already uses so-called mass data analyses to process the mountains of business data generated by each of its twelve brands. "However, the auditors typically look for anomalies that are already known to them, and so far they have focused exclusively on structured – i.e. tabular – data," Schumann explains.

Nonnenmacher, an external PhD student at the University of Oldenburg working for the Volkswagen Group, is developing a new approach for analysing structured data that doesn't rely on already suspected anomalies. Schumann, on the other hand, focuses on methods for analysing unstructured corporate data. He is currently testing various methods from the field of Natural Language Processing, which deals with the automated processing of text or speech by machines. Words, sentences and entire paragraphs in text documents are converted into machine-readable, mathematical expressions. By analysing the results in a procedure known as "text mining", complex information can be extracted from documents, for example sentiments, contradictions and attempts to conceal information.

To find out which information is actually relevant for their project partners at Volkswagen, Schumann and Nonnenmacher conducted a series of interviews with auditors at the com-

pany. "Expert knowledge plays a key role in all our projects when it comes to interpreting results and validating the respective model," Marx Gómez stresses.

The programmes that emerge from these projects can often do amazing things. In the DiFA project, the final system would work as follows: The auditors upload the data to be checked, either as structured tables or unstructured texts; the system can then choose from around two dozen different algorithms for analysing the data, and decides – depending on the type of data – which of these it will use for each analysis. After analysing the data, the algorithm extracts the data sets in which it has identified anomalies, classifies them using a points system, and provides an explanation of what exactly the anomaly is.

This would take a weight off the auditors' shoulders, as it would substantially reduce the risks posed by dark data and previously undetected irregularities. (uk)

1 Jan-Hendrik Witte (left), Jorge Marx Gómez (second from right) and Johann Gerberding (right) are working with Marc-Alexander Lieboldt from the experimental station (second from left) on the DigiSchwein project.

2 The team is developing AI methods to identify indicators of abnormal behavior such as tail biting in pigs.

3 Cameras positioned above the pig pens provide data for automated image recognition.



No more looking at a mobile phone while driving: the SmartHelm project is developing an assistance system for bike couriers. They receive relevant information via smart glasses – but only when opportune.

Quantum biology and digital freight documents



The University Society of Oldenburg e. V. (UGO) has awarded its 2020 "Award for Excellent Research" and 5,000 euros in prize money to physicist Prof. Dr. Ilia Solov'yov. The "Outstanding Doctoral Thesis Award", endowed with 2,000 euros, went to early career researcher and jurist Dr. David Saive.



UGO Award for Excellent Research

Prof. Dr. Ilia Solov'yov has held a Lichtenberg Professorship for Quantum Biology and Computational Physics at the University of Oldenburg since last autumn. The professorship is sponsored by the Volkswagen Foundation. In his research, Solov'yov uses theoretical methods and computational techniques to investigate the physical foundations of a variety of processes in complex molecules found in living organisms and intelligent nanomaterials. His focus here is on the quantum mechanical principles of biological processes in which energy, for example light, is converted into a chemically useful form. The biophysical principles underlying magnetoreception in birds are a main topic of this research. Solov'yov studied physics in St. Petersburg, Russia, and Frankfurt. He earned his PhD from the University of Frankfurt in 2008 with a thesis on magnetoreception in birds. In 2009, he received a second doctorate for a thesis in theoretical physics at the Ioffe Institute of the Russian Academy of Sciences in St. Petersburg. He then held research posts at the University of

Frankfurt and the University of Illinois at Urbana-Champaign, USA, before moving to the University of Southern Denmark in Odense to take on a position as assistant professor in 2013. In 2014, he was awarded a lifetime professorship there. Solov'yov has published extensively in prestigious science journals and received several scholarships and awards for his research.

UGO Outstanding Doctoral Thesis Award

Dr. David Saive completed his doctorate under the supervision of Prof. Dr. Prof. h.c. Jürgen Taeger at the Department of Business Administration, Economics and Law. In his thesis he examines how freight papers can be replaced by digital documents in international maritime trade. Here he focuses in particular on bills of lading, the most important documents in freight traffic. Although the use of electronic freight documents has been permitted since 2013, due to legal and technical hurdles they are still not widely used. In his

paper Saive analyses the relevant paragraphs in the German Commercial Code and sets out the corresponding requirements for digital bills of lading. He demonstrates that a certain form of block chain technology can fulfill all legal requirements for electronic bills of lading. Saive took his first state examination in law at the University of Hamburg. While writing his doctorate he has been attending the Information Law (LLM) course in Oldenburg and the International Maritime Law (LLM) course at the World Maritime University in Malmö, both of which he will complete in 2021. Saive is currently involved in the Oldenburg consortium project HAPTİK ("Tradability of Physical Goods through Digital Tokens in Consortium Networks"), which is funded by the Federal Ministry of Economics and Technology, and is working with other experts to effectively implement digital bills of lading. He also holds a management position in the financial sector and is a member of an expert group on the worldwide implementation of electronic securities at the UN organization UNCITRAL/ UNCEFACT.



Thomas Boyken
Children's and Youth Literature

Dr. Thomas Boyken has been appointed Junior Professor of Children's and Youth literature at the Institute of German Studies. He was previously a junior lecturer in modern German literature at the Department of German Language and Literatures of the Eberhard Karls University of Tübingen. Boyken studied German language and literature and sports science at the University of Oldenburg, where he passed his First State Examination in 2006 and received his PhD in 2012. From 2009 to 2014, he worked as a lecturer at the Institute of German Studies. Research stays took him to the Duchess Anna Amalia Library in Weimar and the Nicolaus Copernicus University in Torun, Poland. From 2013 to 2015 Boyken worked with the English-language bibliographical journal "The Year's Work in Modern Language Studies". Since October 2018 he has been a member of the scientific advisory board of the Hölderlin Society in Tübingen. Since July 2020 he has been director of the Oldenburg Research Unit for Children's and Youth Literature (OlFoKi). His research centres on children's and youth literature from the 18th to the 21st century, gender studies, narratology and drama theory.



Caterina Cocchi
Theoretical Solid State Physics

Prof. Dr. Caterina Cocchi has been appointed Professor of Theoretical Solid State Physics at the Institute of Physics. She previously held a Junior Professorship for "Theory of excitations in low-dimensional systems" at the Humboldt University of Berlin. Cocchi studied physics at the University of Modena and Reggio Emilia, Italy, where she also received her PhD in 2012 with a thesis on graphene nanostructures. In 2013, she moved to the Humboldt University as post-doctoral researcher. Cocchi's research focuses on light-matter interaction. She studies the electronic and optical properties of complex materials from first principles. These materials could be used in next-generation solar cells, for example. She heads projects in a Collaborative Research Centre and in a Priority Programme both funded by the German Research Foundation (DFG). She is also involved in a competence cluster on battery materials funded by the Federal Ministry of Research (BMBF) and leads a project on digitalization financed by the VolkswagenStiftung.



Anne Frühbis-Krüger
Arithmetic/Algebraic
Geometry and Computer Algebra

Prof. Dr. Anne Frühbis-Krüger has been awarded the Professorship of Mathematics with special focus on arithmetic/algebraic geometry and computer algebra. She teaches and does research at the intersection of pure mathematics and the development of algorithms. Previously, she was an adjunct professor at the University of Hannover's Institute of Algebraic Geometry. Frühbis-Krüger studied mathematics and physics before completing her PhD at the Technische Universität Kaiserslautern in 2000, where she also earned her Habilitation. After several months on a research stay in Paris and a Visiting Professorship at the Freie Universität Berlin, she moved to Leibniz Universität Hannover. A central aspect in Frühbis-Krüger's research are problems of a geometric flavour, in many cases centered around singularities of spaces and maps. She addresses these based on methods of symbolic computation, integrating parallel algorithms and an experimental approach using computational algebra into her work.

New Appointments



Thilo Gross

Biodiversity Theory

Prof. Dr. Thilo Gross has been appointed to the joint Professorship for Biodiversity Theory of the university's Institute for Chemistry and Biology of the Marine Environment (ICBM) and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI). In this capacity he conducts research at the University of Oldenburg's Helmholtz Institute for Functional Marine Biodiversity (HIFMB). Prior to this position he was a professor of computer science at the University of California, Davis (USA). After holding posts in Potsdam and at Princeton University, USA, he headed a research group at the Max Planck Institute for the Physics of Complex Systems in Dresden. From 2011 to 2018 Gross worked at the University of Bristol, England, before taking up the post at the University of California, Davis. Gross applies approaches from network and data science to ecosystem modelling. The aim of his research is to enhance understanding of the relationships between biodiversity and ecosystem functions.



Blanka Hartmann

Pedagogy and Didactics for Emotional and Social Development

Dr. Blanka Hartmann has been appointed Professor of Pedagogy and Didactics for Emotional and Social Development with special focus on inclusive educational processes. The professorship is based at the Department of Special Needs Education and Rehabilitation. Hartmann studied education with a focus on rehabilitation and education for persons with disabilities at the Technical University of Dortmund, where she received her PhD in 2001. From 2001 to 2010 she held posts as a research assistant and research associate at the University of Leipzig, where in 2010 she also earned her Habilitation. Before coming to Oldenburg she was a lecturer at the University of Bremen's Faculty of Pedagogy and Educational Sciences in the area of inclusive education, specialized in emotional-social development and learning. Hartmann's research interests include school development in the context of inclusive education, diagnostics in inclusive settings and the professionalization of teaching staff.



Till-Sebastian Idel

School Education Studies and General Didactics

Prof. Dr. Till-Sebastian Idel has been appointed Professor of Educational Sciences with special focus on school education studies and general didactics at the Department of Educational Sciences. Before coming to Oldenburg he was Professor of School Theory and School Research at the University of Bremen. After completing his degree in education studies at Mainz, Idel studied philosophy and sociology and then earned his doctorate with a thesis on biographical socialization in Waldorf schools in 2004. He continued working at the University of Mainz until he took up the professorial post in Bremen. From 2008 to 2009 he was Deputy Professor of School Educational Studies at the University of Education Heidelberg. Idel's research group at the University of Oldenburg deals with the basic practices and processes of school education studies. He conducts research and lectures in the design, change and reform of lessons and educational professionalism. His focus here is on practical aspects of teaching and learning in the classroom, as well as changes in school and school culture.



Katrin Kleinschmidt-Schinke

German Language Education

Prof. Dr. Katrin Kleinschmidt-Schinke has been made Professor of German Language Education at the Institute of German Studies, where she previously held the position of Junior Professor. Kleinschmidt-Schinke studied German and biology for Gymnasium teaching at Oldenburg University. In 2017, she earned her doctorate at the University of Cologne with an empirical thesis on student directed speech used by teachers. Before coming to Oldenburg, she held a deputy professorship for applied linguistics at the Leuphana University Lüneburg. Kleinschmidt-Schinke's research looks at how teachers can best promote their students' oral and written language skills. For example, in a project funded by the German Research Foundation (DFG) she studies adaptive language behaviour – the phenomenon of teachers adapting their language in the classroom to their students' developmental levels.



Tanja Jungmann

Speech and Communication and its Facilitation through Special Needs Education

Prof. Dr. Tanja Jungmann has been appointed Professor of Speech and Communication and its Facilitation through Special Needs Education with special focus on inclusive educational processes at the Department of Special Needs Education and Rehabilitation. She was previously Professor of Educational Science with a focus on Education for Special Needs Pedagogy ("Learning") at the University of Siegen. Jungmann studied psychology at the University of Bielefeld, where she also completed her PhD in 2003. After working as a research assistant at the Department of Child and Adolescent Psychiatry at the University Hospital of Jena and at the Criminological Research Institute of Lower Saxony in Hannover, in 2006 she was appointed Junior Professor of Special Educational Psychology at the University of Hannover. In 2009 she moved to the University of Rostock and took up the professorship of Speech Impairment Education and Special Needs Early Intervention. Jungmann's research focuses on professionalization training for educators, with speech training and early support.



Djordje Lazovic

Orthopaedics and Trauma Surgery

Prof. Dr. Djordje Lazovic has been made Professor of Orthopaedics and Trauma Surgery at the Department of Human Medicine. Lazovic had held the professorship in an acting capacity since 2013. He studied human medicine at the Hanover Medical School (MHH), where he also received his doctorate in 1983 and completed his specialist training as an orthopaedist in 1987. He went on to earn further qualifications in chiropractic therapy, sports medicine and special orthopaedic surgery, as well as specialist training in orthopaedics and trauma surgery. In 1996, Lazovic earned his Habilitation with a thesis on meniscus transplants. In 2001, he became Director of the Clinic for Orthopaedics at the Pius-Hospital Oldenburg, which is now the University Clinic for Orthopaedics and Trauma Surgery. Professor Lazovic's research focuses on the meniscus and ligaments of the knee as well as with the biomechanics of hip and knee joint endoprostheses. He has received several awards, including the Oldenburg University President's Plaque of Honour for his services to the development of the university's medical faculty.

New Appointments



Ulla Licandro

Heterogeneity and Diversity

Dr. Ulla Licandro has been appointed Junior Professor of Heterogeneity and Diversity with special focus on inclusive educational processes at the Department of Special Needs Education and Rehabilitation. Prior to this appointment she was Acting Professor for Language and Communication and its Special Educational Support. Licandro studied rehabilitation and speech and language therapy at the Technical University of Dortmund, the Eötvös Loránd University (Hungary), and the University of Iowa, USA. In 2010 she has held research and teaching posts at the University of Hanover, where she earned her PhD with a thesis on the narrative skills of multilingual children. She spent three semesters conducting research at the University of Iowa and the University of Ohio (USA) on scholarships from the German Academic Exchange Service (DAAD) and the Robert Bosch Foundation. Licandro's research focuses on the prevention of linguistic-communicative impairments. She also investigates intervention options for language/speech disorders and the importance of peer interaction in language acquisition.



Petra Löffner

Theory and History of Contemporary Media

Dr. Petra Löffler has been appointed Professor of Theory and History of Contemporary Media at the Institute of Art and Visual Culture. Prior to her appointment in Oldenburg she held a teaching position at the Humboldt University of Berlin and was a project leader in the Cluster of Excellence "Matters of Activity". Löffler studied German, art history and Slavic Studies at the University of Cologne, where she received her doctorate in 2003. After her studies she worked as a research assistant in the Collaborative Research Centre "Media and Cultural Communication" at the universities of Cologne, Bonn and Aachen and at the University of Regensburg. In 2008, Löffler became a University Assistant at the University of Vienna, where she obtained her authorization to teach film and media studies in 2012. She has held various guest professorships and was a Senior Fellow in international Collaborative Research Centres at the Universities of Weimar and Lüneburg. Löffler's research interests include contemporary media practices in the sharing and migration of images, digital infrastructures and archives of the future.



Karin Loser

Immunology

Prof. Dr. Karin Loser has been appointed Professor of Immunology at the Department of Human Medicine. She was previously a professor at the University of Münster and headed the Centre for Experimental Dermatology and Immunobiology of the Skin at the University Clinic for Dermatology. Loser studied biology at the University of Münster, where she also earned her PhD. She worked as a postdoctoral researcher at the Institute of Pharmacology and Toxicology, and then from 2001 at the Clinic for Dermatology. In 2005 and 2006 she was a visiting fellow at the Institute of Molecular Biotechnology (IMBA) at the Austrian Academy of Sciences in Vienna. In 2012, she moved back to Münster, where she took over the management of the Centre for Experimental Dermatology and Immunobiology of the Skin. Loser's research focuses on basic cell and molecular biological processes in the skin and their influence on the development and progression of inflammatory diseases. She also studies the impact of environmental factors on diseases of the nervous system.



Bernd T. Meyer

Communication Acoustics

Dr. Bernd T. Meyer has been appointed Professorship of Communication Acoustics at the Department of Medical Physics and Acoustics. He was previously head of a junior research group in the medical physics group and a member of the Hearing4all Cluster of Excellence at the University of Oldenburg. Meyer studied physics at the University of Oldenburg, where he also received his PhD in 2009. A scholarship from the German Academic Exchange Service (DAAD) took him to the International Computer Science Institute (ICSI) in Berkeley, California, as a postdoctoral fellow. From 2016 to 2017 the physicist spent a year conducting research at the Center for Speech and Language Processing at Johns Hopkins University, Baltimore, Maryland (USA). He has also headed a junior research group in Oldenburg since 2011. Meyer's research focuses on the processing and perception of language. He develops voice-controlled automated hearing tests and is investigating how machine listening can continuously improve speech intelligibility in hearing aids.



Astrid Nieße

Digitalized Energy Systems

Prof. Dr. Astrid Nieße has taken the post of Professor of Digitalized Energy Systems at the University of Oldenburg's Department of Computing Science. She was previously Professor of Energy Informatics at the University of Hannover. Nieße is also member of the board of the energy department at the university's affiliated OFFIS Institute for Information Technology, where she was involved in setting up the department over a decade ago. Nieße studied biology and computer science at the University of Oldenburg and the Bremen University of Applied Sciences. After graduating in 2005, she worked with an Oldenburg startup before joining OFFIS in 2007. She earned her PhD from the University of Oldenburg in 2015 with a thesis on the application of distributed algorithms for virtual power plants, and then took up the professorship in Hannover in 2018. Her research focuses on the digitalization of energy systems using self-organizing methods and software agents. At OFFIS, Nieße supervises application-oriented research projects in connection with the energy transition.



Emmanuel Asane-Otoo

Environmental Economics

Dr. Emmanuel Asane-Otoo has been made Junior Professor of Economics with special focus on environmental economics at the Department of Business Administration, Economics and Law. Previously, he was a postdoctoral researcher in the Economic Policy research group. Asane-Otoo studied agricultural sciences at the University of Cape Coast in Ghana. He then took the international Master's degree course "Agricultural, Food and Environmental Policy Analysis" at the University of Bonn and the Swedish University of Agricultural Sciences in Uppsala, graduating with a double Master's in Economics and Food, and Resource Economics. During this period, he was funded by an Erasmus Mundus grant from the European Commission. In 2017, he completed his PhD at the University of Oldenburg with a thesis on energy and climate policy. His research focuses on energy economy and the economics of climate change, using econometric methods and numerical equilibrium models.

New Appointments



Konstantin Pankrashkin
Analysis and its Applications

Prof. Dr. Konstantin Pankrashkin has been appointed Professor of Analysis and its Applications at the Institute of Mathematics. He was previously a lecturer ("Maître de conférences") at the Paris-Sud University, France. Pankrashkin studied applied mathematics at the Mordovian State University in Saransk, Russia. He completed his doctoral project at the Institute for Problems in Mechanics in Moscow and at the Humboldt University of Berlin in 2002. As a postdoctoral fellow, Pankrashkin conducted research at the Humboldt University as well as the Paris-Nord and Paris-Sud universities, and has been a lecturer at the latter since 2008. He completed his research habilitation degree there in 2010. Partial differential equations are one focus of his research. Pankrashkin uses theoretical methods to study various wave processes with external interactions as well as novel mathematical models in order to describe so-called metamaterials with special electronic and magnetic properties.



Kimberley Peters
Marine Governance

Dr. Kimberley Peters has been appointed to a joint professorship in Marine Governance at the Institute for the Chemistry and Biology of the Marine Environment (ICBM) and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven. Peters does research at the Helmholtz Institute for Functional Marine Biodiversity of the University of Oldenburg (HIFMB). Previously, she was a lecturer in human geography at the University of Liverpool, UK. Peters studied geography at Cardiff University and the Royal Holloway College of the University of London, where she completed her PhD in 2011. After working as a Teaching Associate at the University of Sheffield and as a Lecturer at Aberystwyth University she moved to Liverpool. There, in 2019, she became a Reader. Peters is the first social scientist to join the interdisciplinary team of the HIFMB. Her speciality is marine geography. She researches the social, cultural and political meaning of the oceans, in particular rules and governance mechanisms for using and protecting the seas.



Oscar Puebla
Fish Ecology

Prof. Dr. Oscar Puebla has been appointed to a joint professorship for Fish Ecology at the Institute for the Chemistry and Biology of the Marine Environment (ICBM) and the Leibniz Centre for Tropical Marine Research (ZMT) in Bremen. The biologist previously headed a research group as Junior Professor for Marine Ecology at the GEOMAR Helmholtz Centre for Ocean Research Kiel. Puebla studied biology and oceanography in Switzerland and Canada. In 2009 he received his PhD from the McGill University in Montreal (Canada). He then spent seven years at the Smithsonian Institute for Tropical Research in Panama, of which he remains an associate member. As part of his cooperation professorship, he heads the research group "Fish Ecology and Evolution" at the ZMT. Puebla's main research interests include population genetics. He is also interested in ecological and evolutionary processes in the seas and studies the impact of protected areas on Mediterranean fisheries.



Anne Rahn
Health and Care Systems

Dr. Anne Christin Rahn has been made Junior Professor of Health and Care Systems with special focus on international comparison at the Department of Health Services Research. She was previously a postdoctoral researcher at the University Medical Center Hamburg-Eppendorf. After training as a nurse, Rahn worked in nursing at the University Medical Centre Schleswig-Holstein. In 2007, she began studying to become a teacher and completed her studies in 2012 with the first State Examination. Within the same time she earned a Master's degree in Health Sciences at the University of York (England). She then worked as a research assistant at the University of Hamburg, where she also received her PhD. In 2016 she took up a post as a lecturer at the Medical School Hamburg (MSH). In her research Rahn focuses on decision coaching in multiple sclerosis - a special form of counselling aimed at helping MS patients make informed immunotherapy decisions. She is also currently preparing a systematic review of responses to immunotherapies.



Teresa Sansour
Education and Didactics for Intellectual Disability

Dr. Teresa Sansour has been made Professor of Education and Didactics for Intellectual Disability with special focus on inclusive educational processes at the Department of Special Needs Education and Rehabilitation. Sansour studied special education at the Heidelberg University of Education. After completing her teacher training period at the State Seminar for Didactics and Teacher Training Heidelberg, she became a research assistant at the Humboldt University of Berlin. In 2012 she returned to Heidelberg, where she completed her PhD as an academic assistant in 2016 and continued her work as an academic councillor. Prior to her appointment in Oldenburg, she held professorships at the universities of Paderborn and Halle-Wittenberg. Sansour's research interests include pedagogical interactions in the context of intellectual disabilities. She also investigates inclusive education for children with intellectual disabilities and the participation of people with multiple severe disabilities in school and outside school.



Marcel Schlechtweg
English Linguistics, Language Acquisition, Language Processing

Dr. Marcel Schlechtweg has been appointed Junior professor of English Linguistics, Language Acquisition and Language Processing at the Institute of English and American Studies. As a postdoctoral research fellow, he headed the language laboratory at the University of Kassel. Schlechtweg studied English and American Studies, Romance Studies and Educational Science in Kassel. His studies took him to Bordeaux, France, as well as Dartmouth College in New Hampshire, USA. He continued to focus on linguistics in his doctoral project on the acquisition of complex linguistic constructions in German, English and French, which he completed at the University of Kassel in 2017. Among Schlechtweg's research interests is the role and function of fine acoustic and phonetic details in the language system. In the context of the Hearing4all Cluster of Excellence he plans to focus intensively on these aspects and at the same time establish a link to speech perception.

New Appointments



Christian Schneider
Quantum Materials

Dr. Christian Schneider has been appointed Professor of Quantum Materials at the Institute of Physics. He previously headed a research group at the University of Würzburg, for which he received a Starting Grant from the European Research Council (ERC). Schneider studied physics and nanotechnology in Würzburg and at the University of British Columbia in Vancouver, Canada. After completing his PhD in Würzburg in 2012, he headed the spectroscopy group at the Chair of Technical Physics. He completed his Habilitation in 2019. In 2016 Schneider was awarded an ERC Starting Grant of 1.5 million euros for his project "unlimit2D". The project runs until 2022, and Schneider will continue it in Oldenburg. The focus of the research is interaction mechanisms between light and matter in innovative quantum materials just one atomic layer thick. The physicist aims to create novel light sources, quantum conditions and highly efficient lasers.



Ilia Solov'yov
Theoretical Molecular Physics

Prof. Dr. Ilia Solov'yov has been appointed Professor of Theoretical Molecular Physics at the Institute of Physics. The chair is a Lichtenberg Endowed Professorship. His research group "Quantum Biology and Computational Physics", which he set up in 2013 at the University of Southern Denmark, has relocated to the University of Oldenburg. Solov'yov studied physics in St. Petersburg, Russia, and Frankfurt. He earned his PhD from the University of Frankfurt in 2008 with a thesis on magnetoreception in birds. In 2009 he received another doctorate for a thesis in theoretical physics at the Ioffe Institute of the Russian Academy of Sciences in St. Petersburg. He then held research posts at the University of Frankfurt and the University of Illinois at Urbana-Champaign, USA, before moving to the University of Southern Denmark in Odense to take an assistant professor position in 2013. In 2014, he was awarded a lifetime professorship there. Solov'yov's research interests extend from theoretical and computational physics to biophysics.



Jarl Ivar van der Vlugt
Anorganic Chemistry

Prof. Dr. Jarl Ivar van der Vlugt has been appointed Professor of Anorganic Chemistry at the Institute of Chemistry. He was previously an associate professor at the University of Amsterdam, the Netherlands. Van der Vlugt studied chemistry and chemical technology at the Technical University of Eindhoven in the Netherlands, where he also completed his PhD in 2003. He then took a post as a post-doctoral researcher at the University of Illinois at Urbana-Champaign (USA). In 2005, he moved to the University of Göttingen on a scholarship from the Alexander von Humboldt Foundation. Early 2007, van der Vlugt returned to Eindhoven to set up his own research group. Eighteen months later he moved to the University of Amsterdam as an assistant professor. In 2011 he was awarded a European Research Council Starting Grant, and in 2017 he was appointed associate professor with the right to award doctorates. Together with his research group, van der Vlugt studies chemical reactions inspired by biological models. Other focuses include phosphorus chemistry and sustainable chemistry.



Tobias Vogt
Art History: History and Theory of Visual Culture

Dr. Tobias Vogt has taken the post of Professor of Art History: History and Theory of Visual Culture at the Institute for Art and Visual Culture. Before coming to Oldenburg, he held deputy professorships in Bochum, Tübingen, Berlin, Frankfurt am Main and Munich. Vogt studied art history, journalism, literature and theatre studies in Mainz and Berlin, where he received his PhD in 2004. After working as assistant curator at the Staatsgalerie Stuttgart he took a research post at the Free University of Berlin's Institute of Cultural History. During this period, he was awarded a fellowship by the German Forum for Art History in Paris, and went on to complete his habilitation in 2015 in Berlin. Research stays took him to Paris, New York and Washington D.C. (USA). Vogt is especially interested in the relation between word and image as well as works of art and commodities, recently focussing on the authentication of art.



Milena Wrobel
Explicit Methods in Number Theory and Algebra

Dr. Milena Wrobel has been appointed Junior Professor of Mathematics with special focus on explicit methods in number theory and algebra. Wrobel studied mathematics at the University of Tübingen, where she also completed her doctorate in 2018. She then took up postdoctoral research posts at the Max Planck Institute for Mathematics in the Sciences in Leipzig and the Simon Fraser University in Burnaby, Canada. Before moving to the University of Oldenburg, Wrobel was a fellow of the Margarete von Wrangell Habilitation programme in Baden-Württemberg for half a year. Wrobel's research focus is algebraic geometry, i.e. the investigation of geometric objects such as contorted surfaces in space using systems of equations. One way to simplify the description of a complex geometric object is to make use of its symmetries. Wrobel uses this approach to deduce combinatorial methods for describing such objects. Her research is based on Mori theory, which is i.a. used in the context of the "minimal model programme".

ANZEIGE

Doctorates

Fakultät I – Bildungs- und Sozialwissenschaften

FATOSATALI-TIMMER, Thema: „Was ist interkulturell an interkulturellen Trainings? Zur Instrumentalisierung von Differenzlinien in der pädagogischen Praxis“ **Pädagogik**

SVEN BROSCINSKI, Thema: „Dynamiken von Lohnungleichheiten in Europa. Betriebliche und arbeitsmarktpolitische Anpassungen während der Eurokrise“ **Sozialwissenschaften**

ELISA BRUHN, Thema: „Virtual Internationalization in Higher Education“ **Pädagogik**

JENNY BUSCH, Thema: „2+5=6? Basales arithmetisches Faktenwissen, Arbeitsgedächtnis und basale Mengenverarbeitung als Merkmale der Rechenschwäche und Rechenstörung unter Berücksichtigung ausgewählter diagnostischer Kriterien“ **Pädagogik**

VERONIKA KOURABAS, Thema: „Die Anderen gebrauchen. Eine rassismustheoretische Analyse von ‚Gastarbeit‘ im migrationsgesellschaftlichen Deutschland“ **Pädagogik**

REBECCA LEMBKE, Thema: „Professionalisierung von Lehrpersonen zur Weiterentwicklung der Berufs- und Studienorientierung in gymnasialen Schulformen in Niedersachsen“ **Pädagogik**

JOYCELINE NTOH YUH, Thema: „Woman of African descent living with HIV/AIDS in Germany, and their struggle with stigmatization perceived as ‘threat’ in one’s own community, yet wanting to have a normal live amid experience of subtle racism“ **Pädagogik**

JASMIN OVERBERG, Thema: „Divergente Perspektiven auf internes und externes Qualitätsmanagement an Hochschulen – illustriert am Beispiel des finnischen Hochschulwesens“ **Pädagogik**

MICHAEL PAAL, Thema: „Möglichkeiten der Unterstützung und Förderung emotional-sozialer sowie fachlicher Kompetenzen im Rahmen von schulischer Mehrebenen-Prävention im Schulalltag“ **Sonderpädagogik**

ANNIKA RADEMACHER, Thema: „Selbstregulationsfähigkeiten im Kindergartenalter“ **Sonderpädagogik**

JULIANE SCHLESIER, Thema: „Lern- und Leistungsemotionen, Emotionsregulation und Lehrkraft-Schulkind-Interaktion: Ein integratives Modell“ **Pädagogik**

Fakultät II – Informatik, Wirtschafts- und Rechtswissenschaften

COLIN BIEN, Thema: „Conceptualising Sustainability in Higher Education“ **Betriebswirtschaftslehre**

RENATA CURZEL, Thema: „The TRIPS Agreement Balancing Incentives to Research and Access to Medicines – The Participation of the Brazilian National Health Surveillance Agency (ANVISA) in the Patent Grant Proceedings: A Model for Controlling Pharmaceutical Patents?“ **Rechtswissenschaften**

RAPHAEL HOFFMANN, Thema: „Profilbildung unter der DSGVO – Digitale Persönlichkeitsprofile im Spannungsfeld zwischen Unternehmensinteresse und Persönlichkeitsrecht“ **Rechtswissenschaften**

CHRISTINA FELIX KIFUNDA, Thema: „The Role of Gender in Supporting Livelihoods through Urban and Peri-Urban Agriculture: The Case of Kinondoni Municipality in Dar es Salaam City, Tanzania“ **Betriebswirtschaftslehre**

ANELISE RAHMEIER SEYFFARTH, Thema: „Applied Analysis of Economic Trade-Offs in Climate Policy: Four Essays on Land Use and Overlapping Regulation“ **Volkswirtschaftslehre**

OLIVER RICHTERS, Thema: „Between Bounded Rationality and Economic Imperatives: Essays on Out-of-Equilibrium Dynamics“ **Volkswirtschaftslehre**

JOHANNES ROLFS, Thema: „Zulässigkeit der Auswertung von Datenbanken durch Meta-suchmaschinen“ **Rechtswissenschaften**

DAVID SAIVE, Thema: „Das elektronische Konnossement“ **Rechtswissenschaften**

MUSANKUBASHELEMBI, Thema: „Commercial Farming Models, Smallholder Farmers’ Choices and Sustainability in the Highlands Agro-Ecological Zone in Njombe District, Tanzania“ **Betriebswirtschaftslehre**

SOPHIE TSCHORR, Thema: „Der Kampf gegen Computerkriminalität in Europa“ **Rechtswissenschaften**

NINA TSYDENOVA, Thema: „Sustainability Assessment of Waste Management System in Emerging Countries based on Example of Mexico City (Mexico)“ **Betriebswirtschaftslehre**

Fakultät III – Sprach- und Kulturwissenschaften

MARINE CHANTURIDZE, Thema: „Processing of German Prepositions in Adults, Typically Developing Children and Children with Cochlear Implants“ **Niederlandistik**

ALENA CICHOLEWSKI, Thema: „Chronopolitical Interventions in the Afterlife of Slavery: Forms and Functions of Temporal Disruptions in Contemporary Speculative Neo-Slave Narratives“ **Anglistik**

MARCELLA FASSIO, Thema: „Das literarische Weblog als Genre und Subjektivierungspraktik – Verfahren, Poetologie(n), Autorschaft(en)“ **Germanistik**

STEFANIE REINERS, Thema: „Wie stehst du zu Kleist?“ Der Kleist-Preis. Zur Kleist-Rezeption in den Preisreden (1985-2011)“ **Germanistik**

DANIEL ŠÍP, Thema: „Torture in Series: Negotiations of Torture in US-American Television after 9/11“ **Anglistik**

JANKA WAGNER, Thema: „Sachlichkeit ist tödlich für das Wesen der Kunst – Funktionen der Debatte um Nieuwe Zakelijkheid im niederländischen Kunstfeld der Zwischenkriegszeit aus feldtheoretischer Perspektive“ **Niederlandistik**

Fakultät IV – Human- und Gesellschaftswissenschaften

MICHAEL CZOLKOSS, Thema: „Transnationale Möglichkeitsräume: deutsche Diakonissen in London (1946-1918)“ **Geschichte**

ANN KRISTIN HAVERICH, Thema: „Sportlehrer*in-Werden – Fallrekonstruktionen über die Passungsverhältnisse von Sportlehrerstudierenden im universitären Feld der Lehramtsausbildung“ **Sportwissenschaft**

SABINE HOLLEWEDDE, Thema: „Dialektik der Freiheit in der bürgerlichen Gesellschaft. Kritik der Philosophie in der kritischen Theorie“ **Philosophie**

HENNING KULBARSCH, Thema: „(Un-)Verinigtes Königreich? Die britische Politik und der Spanische Bürgerkrieg 1936-1939“ **Geschichte**

KATHRIN STERN, Thema: „Erziehung zur Volksgemeinschaft. Die Rolle und Handlungspraxis von Volksschullehrkräften im Dritten Reich“ **Geschichte**

KNUT VOLKER MAX WORMSTÄDT, Thema: „Versöhnung Erzählen Verstricken. Eine prozesstheologische Untersuchung ökumenischer Versöhnungsbegegnungen mit den Mennonit*innen“ **Evangelische Religion/Religionspädagogik**

Fakultät V – Mathematik und Naturwissenschaften

SEHER ABBAS, Thema: „Molecular switches leading to deactivation of sensory signalling and recovery of the cellular response“ **Biologie/Umweltwissenschaften**

CHRISTIAN ADEN, Thema: „Konzeption und Implementierung eines webbasierten Geo Content Management Systems für die Erfassung und Publikation von Umweltdaten mit Fokus auf die Datenspezifikation Species Distribution (INSPIRE 2007/2/EC)“ **Biologie/Umweltwissenschaften**

ANNA-LENA BARKLEY, Thema: „Lehr- und Lernprozesse zum Verständnis der theoretischen Wahrscheinlichkeit im Mathematikunterricht der Grundschule“ **Mathematik**

ELENA BARYKINA, Thema: „Assessment of the energy yield for thin-film photovoltaic modules using satellite retrieved solar irradiance and weather reanalysis data“ **Physik**

JULIA BASS, Thema: „Biodiversity effects on dune and saltmarsh biogeomorphology – a trait-based approach“ **Biologie/Umweltwissenschaften**

HAUKE BECK, Thema: „Reconstruction of wind turbine wake wind fields with long-range LiDAR measurements“ **Physik**

RALF BECKER, Thema: „Verbreitung, Habitate und Schutz von Characeae (Armleuchteralgen) in Deutschland und auf Sardinien (Italien)“ **Biologie/Umweltwissenschaften**

JÖRG THOMAS BEST, Thema: „Examination of the Closedness of Spaces of Stochastic Integrals“ **Mathematik**

KAI BLIESMER, Thema: „Physik der Küste für außerschulische Lernorte. Eine Didaktische Rekonstruktion“ **Physik**

NIKLAS BUHK, Thema: „Die Effekte genetischer Diversität auf Kolonisierung, Verbreitung und Co-Existenz zweier Cytotypen des Quellers“ **Biologie/Umweltwissenschaften**

MAREIKE BUHL, Thema: „Towards machine learning in audiology: Introducing Common Audiological Functional Parameters (CAFPAs) to support audiological diagnostics“ **Physik**

XIAO YAN CHEW, Thema: „Rotating Wormholes in General Relativity & Scalar-Tensor Theory“ **Physik**

FLORIAN DENK, Thema: "Characterizing and conserving the transmission properties of the external ear with hearing devices“ **Physik**

JANNIK EHRICH, Thema: „Coupled and Hidden Degrees of Freedom in Stochastic Thermodynamics“ **Physik**

ALEXANDRA ERDT, Thema: „Synthese und Charakterisierung von platinbasierten Bimetalnanopartikeln“ **Physik**

MARTEN FISCHER, Thema: „Microplastics Analysis with Pyrolysis-Gas Chromatography-Mass Spectrometry in Environmental Samples“ **Meereswissenschaften**

JANINE FRECKMANN, Thema: „Empirische Untersuchung Tiefenstruktur-orientierter Planung im Fachpraktikum Physik“ **Physik**

KLAAS HAUKE GERDES, Thema: „The characterization and community structure of the deep-sea megafauna at active and inactive hydrothermal vent fields at the southern Central Indian Ridge and South East Indian Ridge“ **Biologie/Umweltwissenschaften**

MIRIAM LIBERTAD GERHARD, Thema: „Phytoplankton community responses to nutrient availability: interactions with temperature and diversity“ **Meereswissenschaften**

ANJA GROHMANN, Thema: „Characterisation of microbial metagenome and metatranscriptome repertoires in anaerobic biogas production systems“ **Meereswissenschaften**

PAUL GUDLADT, Thema: „Inhaltliche Zugänge zu Anteilsvergleichen im Kontext des Prozentbegriffs“ **Mathematik**

HAUKE HÄHNE, Thema: „Propagation of Fluctuations and Detection of Hidden Units in Network Dynamical Systems“ **Physik**

BIRGEN HAEST, Thema: „Climate change and bird migration phenology – New insights using the long-term Helgoland ringing dataset“ **Biologie/Umweltwissenschaften**

CHRISTIAN HOFFMANN, Thema: „Solitons in gravity and non-linear systems: Wormholes and Rogue Waves“ **Physik**

TOBIAS HOLT, Thema: „Evolution and Dynamics of Freshwater Resources below a Young Barrier Island (Ostplate, Spiekeroog)“ **Biologie/Umweltwissenschaften**

SEYED POUYA HOSSEINI YAZDELI, Thema: „Conductive coordination network compounds for microelectronic application“ **Chemie**

DAVID HÜLSMEIER-REINEKE, Thema: „Simulating impaired hearing with the framework for auditory discrimination experiments (FADE): Towards aided patient performance prediction“ **Physik**

JULIA SUSANNE KIRCHNER, Thema: „Reducing CO₂ emissions via accelerated weathering of limestone: Suitable locations, process optimization and environmental“ **Meereswissenschaften**

THOMAS KLINNER, Thema: „What’s the difference? Migration behaviour of long- and medium- distance migratory songbird“ **Biologie/Umweltwissenschaften**

DMITRY KOBLYKOV, Thema: „Navigation-relevant geomagnetic cues and their integration in the brain of migratory birds“ **Biologie/Umweltwissenschaften**

SANDRA KÜNZLER, Thema: „Designing New Silyl Lewis Acids for Synthesis and Catalysis“ **Chemie**

JAN LANDHERR, Thema: „Zur Form- und Funktionsbestimmung von Technik im kapitalistischen Produktionsprozess“ **Physik**

MAIKE LOCKHORN, Thema: „STM study of the adsorption of organic molecules on metal and ternary oxide surfaces“ **Physik**

BJÖRN MAACK, Thema: „Untersuchung des zeitabhängigen Oxidationsverhaltens polykristalliner Kupferschichten als Funktion von Druck, Temperatur, Granularität und chemischer Zusammensetzung des Ausgangsmaterials“ **Physik**

ANGELIKA MADERITSCH, Thema: „Investigation of the deposition method’s influence on the layered structure of organic light-emitting diodes“ **Physik**

JULIAN MERDER, Thema: „Marine dissolved organic matter and its interaction with biotic and abiotic factors: novel insights from advanced statistical analysis and data processing“ **Meereswissenschaften**

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