Carl von Ossietzky
Universität
Oldenburg

2023/24 ISSUE
THE UNIVERSITY OF OLDENBURG'S RESEARCH MAGAZINE

EINBLICKE 68

50 YEARS open to new approaches

The 50th anniversary issue – featuring answers to the big questions of our time and glimpses of the future

Dear Reader,

When the University of Oldenburg was founded in the 1970s, Germany's energy supply was a burning political issue: it was a time when arguments raged over the expansion of nuclear power and finite resources, especially oil. Oldenburg researchers began looking for alternative sources of energy – and were ridiculed for their ideas.

Today all nuclear power plants in Germany have been shut down, and the coal phaseout has been rubber stamped, as has carbon neutrality. Yet energy remains a critical issue, both nationwide and at the University. Oldenburg's unique energy research path – from its rocky beginnings to the broad interdisciplinary collaborations today – is one of the themes of this anniversary edition. We take a brief look at the past and then turn our attention to what the future holds.

In many other areas, too, our erstwhile "reform university" continues to be a galvanising force. Not only has it become larger, more diverse and more international, promoting start-ups better than almost any other German universities, but when it comes to research, it always keeps its finger on the pulse. This magazine is dedicated to a number of its key areas of research, such as sustainability, hearing research, marine sciences and teacher training.

This current edition of EINBLICKE, for example, takes a look at the future of schooling in Germany. Education scientist Till-Sebastian Idel accompanies a school experiment in North Rhine-Westphalia and explains the advantages of not changing schools in Year four in contrast to current practice in Germany and how mixed-age classrooms work.

The topic of artificial intelligence (AI) is on everybody's lips these days. Computer scientist Oliver Kramer is an expert in this rapidly developing field. In our interview, he explains the benefits of this new technology and how it can advance digitalisation.

AI is also built into the voice assistants that are found in so many homes today. Communication acoustics expert Bernd T. Meyer, who works with his team in the Cluster of Excellence Hearing4all, takes advantage of these apps to diagnose hearing impairments.

A mysterious group of long-lived organic molecules is the focus of marine geochemist Thorsten Dittmar's and modelling expert Sinikka Lennartz's research alike. Using different approaches, they aim to determine the role played by this vast but largely invisible carbon reservoir in the global climate.

Critical social issues are the focus of a series of articles called Outlooks. The series offers a forum for researchers at the University to paint a vision of the future from the perspective of their particular field. Taking the format of short texts distributed throughout the magazine, they discuss issues such as social inequity, human-machine collaboration and the transformation of the health system.

Other topics in the magazine include: how a new property law could curb the overexploitation of nature and why love is still a hot topic for readers and the editorial team alike. We wish you an inspiring read!

The EINBLICKE editorial team

50 YEARS
University of
Oldenburg

A potpourri of events in the anniversary year

Since 1974, the University of Oldenburg has been teaching and conducting research in innovative fields. With an interdisciplinary, international, and socially responsible approach, the University aims to provide answers to key social issues and scientific questions. "50 years of openness to new approaches" is thus the motto for its anniversary year. The programme of events is as diverse as the University itself. We invite you to embark on a discovery tour – on campus, in the city or online.
www.uol.de/50Jahre

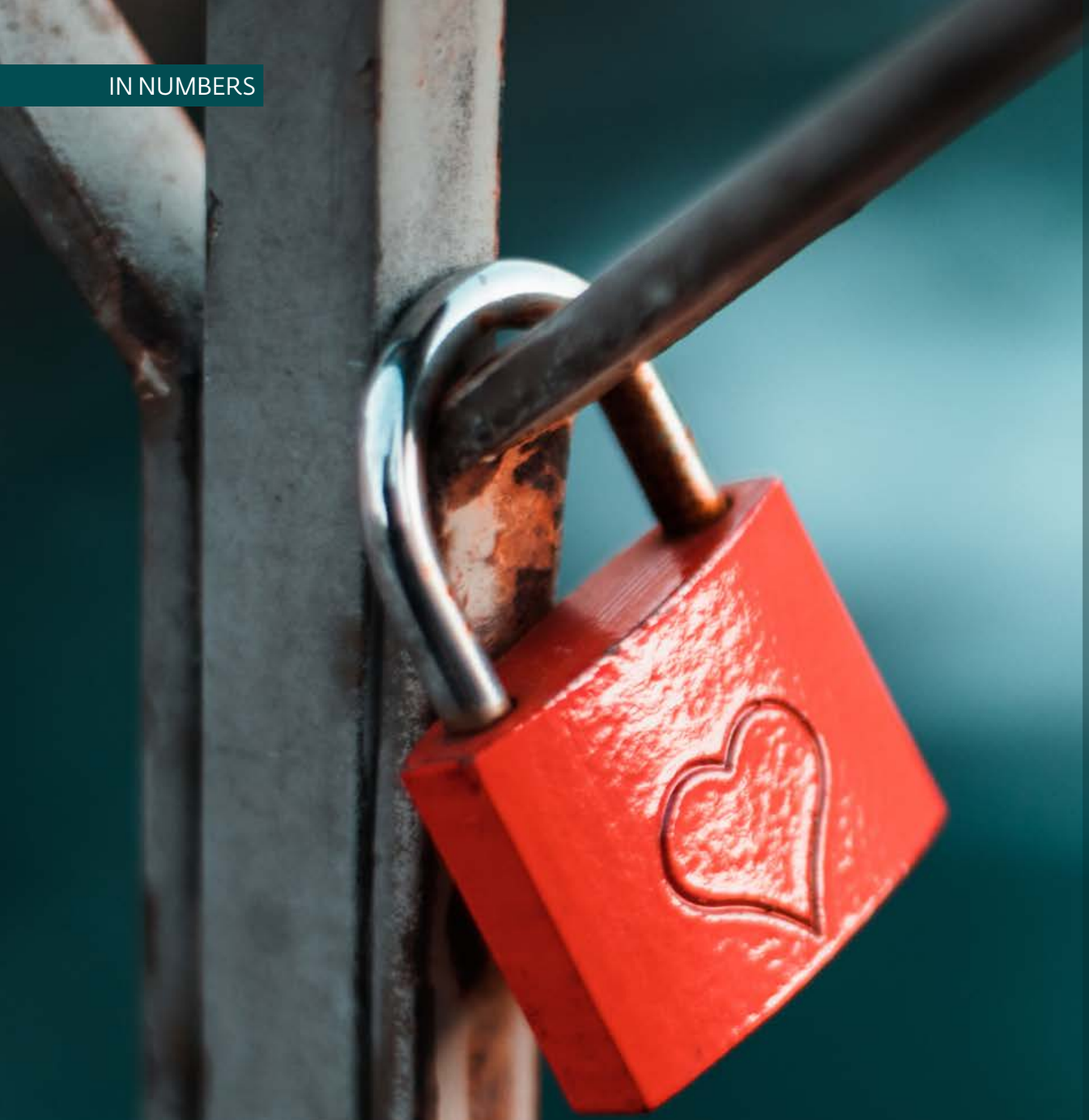
8

ENERGY RESEARCH

The Oldenburg way

Unconventional, interdisciplinary and ahead of the times

CONTENTS



The key to love

14.716

is the number of times the Einblicke article “Love and Being in Love” was viewed online in 2022. The text, which was published in spring 1997, is still surprisingly popular more than 25 years later: the corresponding web page is one of the most frequently visited on the whole University website and if you Google the terms “liebe” (love) and “verliebt” (in love) together, the Einblicke article tops the search results.

What is the reason for its enduring appeal? Its author, Prof. Dr Ulrich Mees, says he’s not surprised his article still attracts so many readers: “Love and being in love play an extremely important role, especially in young people’s everyday reality,” says the former lecturer in general psychology, who is now retired.

Mees’s specialty was the psychology of emotions. In a series of empirical studies, he investigated the thoughts, emotions and actions that are characteristic of love and being in love – and thus refuted, at least to some extent, the popular myth that everything about love is mysterious and unfathomable.

Mees’s Einblicke article neatly summarises the results of his research. He lists the main characteristics of romantic love, explains which of these are more pronounced when we are in love (infatuated) and which are more marked when we love someone. He also goes into some detail about how we expect our partner to express their love – as well as how we fall out of love.

“There is a tacit agreement in our culture about what it means to love and what it means to be in love," says Mees. His studies made – and continue to make – this for the most part unconscious knowledge accessible to people. “I believe the results are still valid,” he says.

The authors of online encyclopedia Wikipedia apparently share this view: the entry for “Verliebtheit” features a link to Mees’s Einblicke article.

481

test subjects took part in four studies by Mees on love, being in love and friendship – most of them were students at the University.

30

key characteristics of loving and being in love were identified. For example, people who are in love think a lot about their partner. With love, absolute trust and the acceptance of weaknesses play a pivotal role. Tenderness and strong affection apply to both.

15

percent of participants in a study on the differences between loving and being in love said they both loved their partner and were still in love with them.

uol.de/einblicke/25/liebe-und-verliebtsein

The Oldenburg way

The University's researchers were among the first to start investigating renewable energies back in the 1970s. Unusual for a university without an engineering faculty, energy research is still one of Oldenburg's flagships. On a tour of various locations on campus and around the city, we follow the unconventional path of the University's energy research from its beginnings to the present day.

By Ute Kehse

The Energy Lab is one of the few architectural testimonies to the early days of the energy transition. The building went into operation in 1982 and was exceptionally energy-efficient for those times. Power was supplied by photovoltaic modules originally manufactured for space travel, which still feed electricity into the grid today, and a wind turbine (not pictured).

It was a pretty crazy idea back then, and people called us crazy, too," recalls Prof. Dr Joachim Luther. "Energy nutcase" was one of the names he and fellow Oldenburg researchers got used to in the 1970s and 80s when people found out they were researching ways to create a national energy system based on renewables. But as he points out: "Our research was a precursor to today's energy transition."

Luther, now 82 and Professor Emeritus of Physics, was one of the first professors appointed to the newly established University of Oldenburg in 1974. And he founded a field of research that still plays a key role today.

The impetus came from the project-based courses offered by the University of Oldenburg as a "reform university" where new methods of higher education were introduced. In these courses, students acquired specialised knowledge by working on socially relevant projects – also in the field of physics. "Those were turbulent times," the researcher recalls. In 1972 the Club of Rome predicted that many raw materials were finite, and the oil crisis of 1973 led to the expansion of nuclear power. "These developments raised the question: Are there alternatives to the current energy system, and to nuclear power in particular?" explains Luther, who had originally specialised in laser physics.

In the study project "Alternative Technologies for the Use of Energy and Raw Materials", which continued into the 1980s, researchers and students soon began to look for answers. "We found the topic so exciting and important that we made it part of our scientific work," Luther explains. The team of physicists, chemists and biologists worked together with the economics department from the outset. "When you move between different faculties, some thing truly innovative can emerge," he says.

In the following decades energy remained a major focus of research at the University – and it still is.

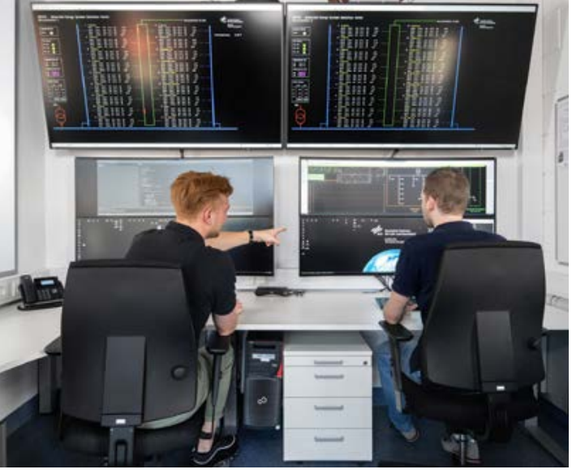
The Energy Lab:
Almost entirely self-powered since 1982

"Luckily, they didn't end up on the scrap metal heap," says Michael Köritz, pointing to three large control cabinets standing in the corridor of building W0, the Energy Lab. The control panels feature an array of electrical symbols, a row of black rotary switches, and analogue current and voltage meters.

For Köritz, who was a research associate at the Energy Lab in the 2010s, these control cabinets dating from the early 1980s are a slice of history. "Today, you could control everything that goes on in here with a smartphone," he notes. But in 1982, when the building was first commissioned, the concept behind it was nothing short of revolutionary. Instead of being connected to the public electricity or gas grids, the octagonal Energy Lab, with its 250 square metres of offices, seminar rooms, laboratories and a light-filled inner courtyard, was designed to be completely self-sufficient energy-wise. The three control cabinets were the linchpin: power came from a 25-metre wind turbine and 336 photovoltaic modules originally manufactured for space travel which still feed electricity into the grid today.

Surplus energy was fed into 104 batteries, and later on into an electrolyser to produce hydrogen for a fuel cell. The building was heated using thermal solar collectors, geothermal probes, a hot water tank and heat exchangers. There was a minor flaw in the system: a backup combined heat and power generator that was supposed to run on biogas had to run on propane gas from bottles instead, because the logistics of ensuring a safe supply of biomass at the University were too complicated. Apart from that, the Energy Lab was completely self-sufficient. "All the technologies we are discussing today already existed back then," says Köritz.

The driving force behind this unique experiment was the research group 'Physics of Renewable Energies'



In the NESTEC Emulation Centre at the DLR's Institute of Networked Energy Systems in Oldenburg, scientists can create accurate simulations of complex power grids.

The 30-metre long wind tunnel, with its 3m x 3m active grid, is the scientific centrepiece of the Oldenburg WindLab.

which formed around Luther in the early 1980s. The researchers wanted to demonstrate the feasibility of their concept in a very practical way. This proved more difficult than expected. "We totally underestimated the problems," Luther admits. "On paper, it all looked easy, but even when the system was up and running we still had a lot of work to do." Sometimes physicists have more faith in feasibility than engineers, the researcher quips dryly.

But despite the experiment's teething problems, the Oldenburg scientists were years ahead of their time: it wasn't until 1992 that the Fraunhofer Institute for Solar Energy Systems in Freiburg (of which Luther later became director) completed a solar house which is now regarded as one of the world's first truly self-sufficient buildings.

However, self-sufficiency was not the Oldenburg team's ultimate objective. Behind the demonstration project was a larger question: Could Germany be reliably powered by energy from non-fossil and non-nuclear sources in the long term? "We collected more and more data and made more and more detailed calculations," Luther recalls. Finally, they arrived at a conclusion: "Technically, physically and systemically, it is possible."

The researchers began to look more closely at energy storage systems and energy converters – specifically, solar cells and wind turbines – with the goal of improving their performance. Another focus was energy meteorology. The aim was to collect accurate data on the fluctuating output of solar and wind energy sources to improve forecasting. The topic was way outside the mainstream back then: at the end of the 1980s, the prevailing opinion was that renewable sources could meet only two to three percent of total energy needs.

Germany now covers about a fifth of its primary energy demand and almost half of its electricity requirements with energy from renewable sources.

Meanwhile the Energy Lab is somewhat past its prime. "You could say it's in a deep slumber," says Köritz, who along with Luther and several others is campaigning for the now vacant building – one of the few architectural testimonies to the early days of the energy transition – to be put back into use.

The WindLab:
A storm in a wind tunnel

The visitors from South Africa are impressed. The delegation from Oldenburg's twin town Buffalo City has just listened to a lecture at the WindLab about the problems of Germany's energy transition. But Princess Faku, Mayor of Buffalo City, sees things rather differently: "Germany is addressing its problems." In South Africa, she explains, blackouts are common and wind energy is rarely used even though there's plenty of it.

In Oldenburg's Research Laboratory for Turbulence and Wind Energy Systems, or WindLab for short, visitors can get an idea of the progress that has been made in harnessing the power of the wind. The scientific centrepiece of the elegant research building is a 30-metre-long wind tunnel through which air is propelled at speeds of up to 150 km/h – as strong as a hurricane, and just as turbulent.

This is made possible by a grid of almost a thousand diamond-shaped metal blades whose configuration can change from one elaborate geometric pattern to another in a matter of moments to generate different degrees of turbulence, similar to what happens in natural wind fields. "It's like cutting a piece out of a storm," is how a team led by turbulence researcher Prof. Dr Joachim Peinke described the process in a well-received paper published in the journal Physical Review Letters.

The ForWind Center for Wind Energy Research of the Universities of Oldenburg, Hanover and Bremen, of which Oldenburg wind research is a member, recently began studying real wind fields and their turbulence dynamics at a large-scale, globally unique research facility: the German Aerospace Center's (DLR) new WiValdi research wind farm offers researchers five measurement masts, each over a hundred metres tall, and two wind turbines fitted with around 1,500 sensors for their experiments.

A third methodological pillar of Oldenburg's wind research, alongside the lab experiments in the wind tunnel and the free field experiments at the wind farm, are the complex simulations carried out on ForWind's two supercomputers. The Energy Meteorology Group – established in the 1990s as a separate research group by Dr Detlev Heinemann – also remains active in the University's wind research.

With these research strategies, the Oldenburg researchers follow in the tradition of the Energy Lab. "We study the wind and its interactions with the turbines not as engineers but from a physics perspective," explains Prof. Dr Martin Kühn, head of the Wind Energy Systems research group and board member of ForWind.

In Kühn's view, the main task now is to increase the "social and ecological value" of wind energy. "As an industry, we have been very successful in recent years in reducing the cost of generating a kilowatt hour of electricity. In future, the focus will be on making wind power more consistently available and ensuring that it maintains the stability of the grid and replaces fossil fuels."

The DLR Institute:
From materials research to systems

The roof terrace of the DLR Institute of Networked Energy Systems provides a fantastic view of the University's sports ground – and of the Energy Lab, whose grey wooden façade dotted with blue solar panels peeks out between the trees. The path joining the two buildings is not a long one, and they have many other things in common. "The Oldenburg site started with energy systems research, then switched its focus to energy-related materials research, and has now gone back to energy systems research," explains Prof. Dr Carsten Agert, Director of the institute.

After Luther left the University in the mid-1990s, his successor, physicist Prof. Dr Jürgen Parisi, focused on the search for new materials that could efficiently convert solar energy into electricity. He was very successful: "The timing was perfect, the photovoltaics research in Wechloy got off to a flying start, expanded and made a name for itself," Agert recounts. This success contributed to the establishment of a new affiliated institute at the University in 2008, the NEXT ENERGY – EWE Research Centre for Energy Technology, which, with its focus on photovoltaics, fuel cells and energy storage, was the forerunner of today's DLR Institute. "Back then, materials and components were a key topic in the discussion about the energy transition, because photovoltaics, fuel cells and batteries were still very expensive," explains Agert, who has headed the Oldenburg DLR Institute since its founding.

In 2017, when NEXT ENERGY found a new home at the German Aerospace Center (DLR), the photovoltaics industry was in crisis and it had become clear that the main challenge would be to find ways to properly integrate renewables, with their fluctuating energy outputs, into the energy grid. "Consequently, the institute focused entirely on systems research," says Agert. Today, its ten research groups investigate topics such as energy management in smart power grids, integration of energy sectors and the modelling of power grids and energy systems.

The Future Laboratory Energy:
Energy systems go digital

Information technology plays a key role in the energy transition, says Prof. Dr Astrid Nieße, head of the Digitalised Energy Systems Group at the University of Oldenburg and Executive Board Member of the R&D Division Energy at the OFFIS Institute for Information Technology, one of the University's affiliated institutes. "New IT-based approaches are a game changer in the transition to a sustainable energy system," she emphasises. With four en-

Energy research has been EINBLICKE's cover story five times since the magazine was launched. The cover of the first issue published in April 1985 shows the hot water collectors on the outside wall of the Energy Lab.

ergy informatics professorships and a junior research group focused on energy, Oldenburg's Department of Computing Science is well positioned in this field, she notes.

As head of the Future Laboratory Energy, a large collaborative project funded by the state of Lower Saxony, Nieße is working hard to advance smart energy management systems, simulation models and energy scenarios, and to streamline collaboration between the various players in energy systems research. The goal is to integrate millions of photovoltaic systems, battery storage units, heat pumps and electric cars as well as thousands of wind turbines without destabilising the power grid. Easier access to data and software is essential, says the IT expert. Under her leadership, the NFDI4Energy consortium works across Germany to make energy systems research more transparent and – thanks to digitalisation – more efficient.

Nieße and her research group at the University study how artificial intelligence (AI) and the principle of so-called controlled self-organisation can be used to stabilise energy systems. "Controlled self-organisation means that the individual components of the system are equipped with autonomous software that controls their operation – but in a safe mode," she explains.

People involved in the Future Laboratory investigate how this and other energy informatics solutions can be put into practice on a small scale in three "smart neighbourhood" pilot projects in in the north German federal states of Lower Saxony and Schleswig-Holstein. "Neighbourhoods are an important part of the transition, but in Germany, for example, citizen-driven energy systems or energy cooperatives are not yet standard practice," Nieße explains. Which is one more reason for the researchers to simulate concepts like electric mobility in the three pilot neighbourhoods. One of these neighbourhoods – Helleheide – is located in Oldenburg.

Helleheide:
A climate-friendly neighbourhood

It's a Tuesday in March 2023. Two members of the ENaQ (Energetic Neighbourhood Fliegerhorst Oldenburg) project group are giving a guided tour of the former Oldenburg Air Base site. The focus of the tour is a section covering around five hectares in the northern part of the site which is currently under construction: the Helleheide neighbourhood. The whole area is still fenced off; the future living lab is still just a large hole in the ground. But it will soon be home to a climate-friendly neighbourhood where as much energy as possible is generated and consumed locally – not yet fully climate-neutral, but certainly very close to what the Oldenburg researchers led by Joachim Luther envisioned almost fifty years ago. In 2025 around 350 people will move into seven buildings on the site and make communal use not only of the energy but many other things, including a launderette and a meadow orchard.

"It's wonderful that people will actually live there and go about their normal lives," says Prof. Dr Sebastian Lehnhoff, head of the project consortium, which includes many of the stakeholders in Oldenburg's energy sector, and Chairman of the Board of the OFFIS Institute. The project is not just about researching technologies but also about the "interface with humans", he emphasises. Oldenburg citizens were invited to express their wishes and requirements for the climate-friendly residential area in a participatory process that was organised and evaluated by a team from the University led by sustainability economist Prof. Dr Bernd Siebenhüner, among others. One idea that emerged was the "energy traffic light", a small lamp that is plugged into a socket and goes green when there is plenty of green electricity in the grid. "Ideally, users will switch on their appliances during that time," explains project worker Maren Wesselow. The traffic light device offers a simple solution to avoid load peaks within the neighbourhood. A preliminary test in Oldenburg showed that many of the participants used larger electrical appliances more conscientiously thanks to this device – although this didn't save them any money because the tariff system still lacks the necessary flexibility.

A digital platform is also in the pipeline to encourage Helleheide's residents to save more energy. Users will be able to track things like how much money their solar panels are currently earning, or consumption levels in their own household, their street, or the neighbourhood as a whole. "Comparing yourself with others can be very effective," says Lehnhoff.

He stresses that the success of the energy transition hinges not only on new technologies, but on people accepting them. This means that the social sciences play a key role in the current phase of the energy transition, and the University has an important contribution to make. "Energy research at the University has always been transdisciplinary," he explains, adding that over the years an intense and unique interdisciplinary collaboration has developed between the University's energy informatics, wind research, social sciences and economics departments and the affiliated OFFIS and DLR Institutes. "We've been doing this for a long time," Lehnhoff underlines, "and we're really good at it."

Outlooks

How will healthcare change in the years to come?

Prof. Dr Hans Gerd Nothwang
Medicine and Health Sciences

"We are facing a major transformation in the healthcare system. Medical services will be concentrated in far fewer locations than at present, and treatments will increasingly take place on an outpatient basis. All current developments and hospital reform plans point in this direction. There is no alternative because medical professionals – already in short supply – will continue to decline in numbers, and this is the only way to meet demands for quality healthcare. What is the point of a hospital that has no staff, or where the procedure that a patient needs is not routine? Centralisation may mean that people have to travel longer distances – especially those in rural areas – but it also has advantages for patients: expertise will be concentrated at those facilities that continue to operate, and the diagnosis and treatment of even rare diseases will become routine there.

The digitalisation of the health industry will also shape this transformation. Tired of having to repeat your medical history to every doctor you go to? That will no longer be necessary once the results of all your medical examinations and information about medications and previous illnesses are stored on your health insurance card or in an app. Having this data at their disposal will give patients a new autonomy. I believe that within the next five years our smartphones will inform us in advance about what we need to bring along when we go to hospital, guide us through all the required examinations during our stay, and receive and store the results afterwards. The expectation here is that medical professionals will know far more about patients in advance, thanks to digital medical records and other innovations – and this will leave more time for actual communication."

Measuring turbulence with greater precision

At the recently launched WiValdi (short for "Wind Validation") research wind farm in the district of Stade on the Elbe, Oldenburg researchers are studying how wind turbines that are positioned close together influence each other. This large-scale research facility run by the German Aerospace Centre (DLR) features two state-of-the-art wind turbines equipped with hundreds of sensors and measuring instruments as well as five meteorological measurement masts. The University of Oldenburg is involved in the project via the Centre for Wind Energy Research (ForWind). Together with the DLR and the Fraunhofer Institute for Wind Energy Systems (IWES), ForWind is a partner in the Research Alliance Wind Energy (FVWE) which is conducting the research at the wind farm. The new facility is funded by the Federal Ministry for Economic Affairs and Climate Action and the Lower Saxony Ministry of Science and Culture.

At the core of this unique testing area – the only one of its kind world wide – are two conventional multi-megawatt wind turbines with rotor blades reaching up to a height of 150 metres. One of the turbines is positioned in the slipstream of the other, in order to address the key question of how turbulence from the front turbine affects the one behind it. Measurements taken from three masts carefully positioned between the two turbines will provide answers. ForWind was responsible for planning the positioning of the masts and their sensors.

The configuration will enable the scientists to measure the turbulent wind conditions between the turbines at a high temporal and spatial resolution. In addition to wind speed, the measuring devices installed on the masts record other variables between the wind turbines such as temperature and humidity. The data thus obtained will enable the researchers to conduct a detailed analysis of the meteorological conditions on a vertical surface between the two turbines. Another measurement mast positioned in front of the foremost wind turbine will measure the inflowing wind field. Measuring systems planned and developed by members of the ForWind team at the Universities of Bremen and Hanover are also attached to the towers and rotor blades of the wind turbines.

On the basis of the data gathered in the project the researchers aim to determine whether it is feasible to position wind turbines closer together than is currently the case on wind farms, for example. They also want to learn how to configure them to achieve maximum efficiency for the power grid.

A large crane was used to assemble the huge wind turbines at the research wind farm. The three measurement masts in the background enable scientists to make high-resolution spatial and temporal measurements of the turbulent wind conditions between the turbines for the first time.

Tracking plastic particles

The analysis of the dispersal pathways of plastic waste in the southern North Sea and the development of strategies for reducing this pollution was the focus of a study by an interdisciplinary team of researchers led by scientists from the University's Institute for Biology and Chemistry of the Marine Environment. Citizens in the focus region of the "Macroplastics" project played an important role. A dedicated website was set up so they could report the beaching locations of wooden drifters deployed by the researchers in the open sea and along the coastline. The study showed that there are no permanent accumulation areas in the North Sea and that most plastic particles larger than five millimetres in diameter are quickly washed ashore. The results were published in the journal Frontiers in Marine Science. By combining its observations with model calculations, the team was able to obtain an overview of the spatial distribution of litter sources as well as the role played by different sectors such as tourism or industry.

Local species loss may often be underestimated

The number of species in an ecosystem is not a reliable measure of its biological stability: seemingly healthy communities with constant or even increasing species numbers may already be on the path to decline and loss of species, according to a new study. Even in long-term data series, these negative developments may only become apparent with a delay that results from a systematic bias towards earlier detection of colonisations than extinctions. The study was conducted by Dr Lucie Kuczynski and Prof. Dr Helmut Hillebrand from the University's Institute for Chemistry and Biology of the Marine Environment together with Dr Vicente Ontiveros from the University of Girona (Spain). The results were published in the journal Nature Ecology & Evolution.

New concept for lithium-air batteries

Lithium-air batteries are candidates for the next generation of high-density energy storage devices as in theory they can store ten times more energy per kilogram than conventional lithium-ion batteries. An inter-institutional project in which a team of researchers led by Oldenburg chemist Prof. Dr Gunther Wittstock is participating in testing a new concept for boosting the stability of these innovative battery cells. The project "Alternative materials and components for aprotic lithium-oxygen batteries: chemistry and stability of inactive components – AMaLiS 2.0" is led by IOLITEC Ionic Liquids Technologies, a company based in Heilbronn. The scientists aim to develop a membrane separating positive and negative electrodes so that different electrolyte fluids can be used on either side. The Oldenburg team is using several methods, including surface spectroscopy and electrochemical scanning microscopy (SECM), to investigate the processes on the surface of the membrane and electrodes.

Long-term impact of the Covid pandemic

The University Medicine Oldenburg is involved in the work of the COVID-19 Research Network Lower Saxony (COFONI) with two projects. Together with psychologist Prof. Dr Andrea Hildebrandt and sociologist Prof. Dr Gundula Zoch, medical informatics expert Prof. Dr Antje Wulff and psychologist Prof. Dr Mandy Roheger are developing models that can estimate how a person's individual health profile influences their risk of suffering long-term effects of COVID-19. Health services researcher Prof. Dr Falk Hoffmann is investigating the development and progression of mental illnesses in children and adolescents during the pandemic. The research projects at the University have been allocated some 670,000 euros in funding.

Digital presentation of cultural heritage

A new research network based in Oldenburg is investigating how digital technologies can be used to preserve humanity's cultural heritage – including historical objects and documents in museum collections and archives. The aim is to enable unbiased interpretation and improve access. The project "Digitisation, Visualisation and Analysis of Collection Items" (DiViAS) has received 2.7 million euros in funding from the state of Lower Saxony and the Volkswagen Foundation for an initial funding period of three years. DiViAS is a collaborative project between the University of Oldenburg's Institute of History, the Prize Papers Project headed by Prof. Dr Dagmar Freist (based at the institute and part of the German Academies Programme), the Institute for Applied Photogrammetry and Geoinformatics at the Jade University of Applied Sciences Wilhelmshaven, Oldenburg, Elsfleth and the State Museum Nature and Human Oldenburg. Other partners are University Hanover's Institute for Cartography and Geoinformatics and the Head Office of the Common Library Network Göttingen (VZG), as well as various associated researchers in Germany and abroad. The project combines novel scientific methods and practices to digitise, analyse and display colonial collections. The resulting procedures will be made widely available in a digital toolbox.

Controlling mosquito populations by targeting their sense of hearing

Together with researchers from University College London (UK), Oldenburg biologist Prof. Dr Jörg Albert has shown that the neurotransmitter octopamine plays a crucial role in temporarily enhancing the hearing of Anopheles mosquitoes. Because the male mosquitoes of this malaria-transmitting species need a good sense of hearing to detect female mosquitoes and reproduce, this finding could result in a novel approach to controlling mosquito populations. The scientists were also able to demonstrate that the octopamine receptors in these insects can be artificially activated using pesticides such as amitraz. Stimulating the receptors outside normal mating times could confuse male mosquitoes, making them unable to detect females in swarms of hundreds of mosquitoes flying together at dusk, when most mating occurs. According to the researchers, there may also be a molecule that can inhibit the octopamine receptors and thus prevent the enhanced hearing that is crucial for the mosquitoes to mate.

How migratory animals navigate

The German Research Foundation has approved further funding for the Collaborative Research Centre "Magnetoreception and Navigation in Vertebrates". Led by Oldenburg biologist Prof. Dr Henrik Mouritsen, the project will receive up to 9.2 million euros in its second phase, which ends in 2026. The central objective is to gain a comprehensive understanding of all aspects of the magnetic sense and navigation abilities in vertebrates – from signal detection and neural processing to the animals' natural behaviour and migration routes. A main focus in the second funding period is the analysis of magnetically sensitive proteins, which the team is now able to produce in cell cultures. The researchers plan to conduct experiments and use computer simulations to gain insights into which parts of the proteins are important for magnetoreception. The research will also focus on the processing of magnetic stimuli and other important information for navigation in the brains of migratory animals. In addition, a new sub-project led by Oldenburg biologist Dr Oliver Lindecke is investigating the migratory behaviour and magnetic orientation of pipistrelle bats, which can cover thousands of kilometres during migration. Another recently launched sub-project is focusing on how the decision to winter in a particular location affects the breeding success of migratory birds.

From gender history to fashion

Four projects at the University of Oldenburg are receiving funding from the regional funding programme Pro*Niedersachsen as of August 2023. A team led by medieval history expert Prof. Dr Almut Höfert is investigating the role of gender in medieval concepts of peoples and communities in the project "Gentes und Nationes". The project "Colportage Literature" focuses on nineteenth-century prints from publications, books and religious tracts distributed at fairs in Oldenburg. A team led by Dr Christian Schmitt, a scholar in German studies, is analysing and digitising these small prints, which were very common at the time and provided readers with a wide range of information. In another project, the Institute of Material Culture is collaborating with the Museum Bückeburg to research fashion trends in traditional costumes from the Schaumburg region in Lower Saxony, a subject that has received little academic attention to date. The University is also working together with the National Park House Wittbülten on the island of Spiekeroog to integrate more information about the research activities on the island into the centre's permanent exhibition.

Outlooks

How can science fulfil its responsibility?

Prof. Dr Katharina Al-Shamery

Physical Chemistry / Nanophotonics and Surface Chemistry

"Our society has reached a turning point: the global population is continuing to grow, resources are limited, and we are already feeling the effects of climate change. If we want to live decent lives on this planet fifty years from now, we need to find solutions. Science bears a responsibility here. And there is also growing pressure from society for research to contribute to achieving the United Nations' Sustainable Development Goals.

In my field, physical chemistry, one of the main objectives now is to make production processes more sustainable and socially equitable. This means, among other things, designing circular processes for the chemical industry and obtaining energy from renewable sources while developing new, efficient materials from chemical elements that are widely available on our planet and are not extracted under inhumane conditions.

To achieve all this, we need more freedom and more courage to embrace unusual ideas. Up to now our German system has mainly promoted incremental progress. New projects are based on the corresponding years of preliminary work. But we should support more projects that might have a high risk of failure, but which, if successful, will produce genuine innovations.

At the same time, we researchers and lecturers must ensure we keep up to date with the latest methods. Artificial intelligence, for example, will become an important tool for research. We cannot afford to stand still. This is the only way we can we react flexibly to developments in society."

An ocean of molecules

Thorsten Dittmar and his team use sophisticated methods to analyse millions of different organic compounds that are dissolved in the world's oceans. These substances bind large amounts of carbon – in some cases for thousands of years. Using a combination of expertise from the fields of geochemistry, microbiology and mathematical modelling, the researchers aim to determine what role these substances play in the global carbon cycle and, by extension, the global climate.

By Constanze Böttcher

Few things last very long in the world of the open oceans, it would seem. In the light-filled surface layer, microscopic algae convert carbon dioxide and water into biomass via photosynthesis. Individual cells vanish in a matter of hours or days, ingested by other tiny creatures or decomposed by microorganisms such as bacteria. Whereas tree trunks might remain standing for centuries and even millennia on land, the tiny inhabitants of the open seas disappear almost without a trace. Far from shore, for most seafarers, the infinite blue of the ocean is all there is to see.

But in reality, life in the sea also leaves lasting traces. Everywhere in the ocean, from the surface to the deep sea, from the polar regions to the tropics, from the tidal flats to the ocean floor, an invisible mixture of molecules accumulates over time: dissolved organic matter, or DOM for short. Every litre of seawater contains on average one milligram of these water-soluble carbon compounds. If this figure is extrapolated to the total volume of the oceans, it means that around 700 billion tonnes of carbon are stored in DOM – more than in all living organisms on land and sea combined, and roughly equivalent to the amount of carbon dioxide (CO_2) in the atmosphere.

Part of this gigantic carbon reservoir is incredibly durable: "The oldest molecules are over 10,000 years old," notes Prof. Dr Thorsten Dittmar. These compounds help prevent part of the organic carbon in the sea from being released straight back into the atmosphere as CO_2. Researchers suspect that this buffer plays an important role in regulating the natural CO_2 content in the atmosphere and therefore in regulating the global climate.

We are surrounded by billions of molecules that we have not yet identified

However, whether or how dissolved organic matter influences our climate on a time scale of centuries to millennia is not precisely known at this stage. "Nor do we know which processes determine the size of this carbon reservoir – or, conversely, how climate change might affect dissolved organic matter," explains Dittmar, head of the Marine Geochemistry bridging group, a collaboration between the Institute for Chemistry and Biology of the Marine Environment (ICBM) and the Max Planck Institute for Marine Microbiology since 2008. For this reason, dissolved organic matter is not factored into current climate models.

Scientists have known of the existence of DOM for more than a century, and they also know that unicellular algae and other microorganisms excrete dissolved organic matter as metabolic products, or when they die. But for a long time, it was unclear what chemical compounds DOM was made of. The analytical methods needed to determine its chemical composition were lacking. "We are surrounded by billions of molecules that we have not yet identified, but which control the habitability of our planet," Dittmar says.

Identifying these molecules is crucial to understanding what happens to them. Only then can researchers generate mathematical models to describe the interactions between the molecules and their environment and thus create the basis for global climate models. Is it due to their structure that some of these compounds survive for millennia? Researchers began finding preliminary answers to this question more than two decades ago. At Florida State University, where Dittmar was an assistant professor, he and a team of researchers performed the first analyses of seawater samples using a new type of tool, ultrahigh-resolution mass spectrometry, and found thousands of different types of organic molecules. "That was my personal eureka moment," says Dittmar. The results revealed the enormous – and hitherto unimagined – molecular diversity of the dissolved organic matter.

This encouraged Dittmar to delve deeper, even though progress was slow at first: evaluating the data provided by the mass spectrometer took months back then. In the meantime, the geochemist has made significant headway: his lab in Oldenburg is home to the world's most powerful ultrahigh-resolution mass spectrometer for marine research. Its analyses of molecular masses are precise enough to enable the assignment of molecular formulae – or put more simply, to determine the number of atoms of elements such as carbon, hydrogen, oxygen and nitrogen that are present in a compound. Thanks to their collaboration with the mathematicians at the ICBM and modern computing power, nowadays the researchers can assess all this data within minutes.

The results show that every litre of seawater contains millions of different substances, although determining the exact quantity is virtually impossible because – as further experiments have indicated – for every molecular formula there are probably many different molecular structures. Another method, nuclear magnetic resonance spectroscopy, has shown how some of the elements in the molecules are linked, thus providing clues about the molecular structure. Dittmar's research group is currently setting up a new laboratory that will house the large instrument required to further this research.

Presumably, the processes in the ocean floor are similar to those in the water column

All these data provide insights into the diverse world of long-lived organic molecules. In this world, microorganisms play a crucial role not only as a source of CO_2, but also in its storage: they ingest organic matter and use their tools, highly specific enzymes, to break down certain molecular bonds and release new substances. Among others, the microbiology research groups in Oldenburg and Bremen also study these organisms and their enzymes. Together, the researchers provide valuabe insights into the world of molecules and microbes from different angles.

For example, a comparatively simple experiment conducted by the researchers of the Oldenburg-based Roseobacter Collaborative Research Centre, which recently concluded its activities, illustrates the complexity of the interactions between microorganisms and molecules: the results showed that a single species of bacteria feeding on a single sugar in a lab culture excretes tens of thousands of largely unknown substances.

On the basis of such experiments and observations the researchers have concluded that the long-lived substances are a molecular waste product of enzymatic degradation processes. "The cells actively excrete these substances because they cannot utilise them," explains Dittmar. According to one hypothesis, some of these substances accumulate because their molecular structure prevents them from being broken down further. However, this hypothesis is called into question by the fact that there are hardly any substances on Earth that microorganisms cannot process.

Consequently, the researchers suspect there is another reason why microorganisms, and especially those in the deep seas, paradoxically do not utilise this abundant food supply. They posit that ingestion, processing and excretion processes produce more and more new compounds in ever lower concentrations. As a result, despite the abundance of molecules, it becomes increasingly difficult for microorganisms to find ones they are able to process.

The work of Prof. Dr Sinikka Lennartz supports this hypothesis. Lennartz, Junior Professor of Biogeochemical Ocean Modelling at the University of Oldenburg, creates network models that describe the interactions – in very simplified terms here –as follows: an organism in the network ingests a certain substance and excretes two new substances. Another organism comes along, selects only one of the two substances, and excretes two more into the water, only one of which is processed by a third organism – and so on. This

Geochemist Thorsten Dittmar wants to understand the composition of organic matter dissolved in the world's oceans and why certain molecules persist for thousands of years.

network model delivers results that are "pretty close to the mean concentration and mean age of the dissolved organic matter in the real ocean", says Lennartz.

So the way organisms and molecules interact in their natural environment is decisive, according to the researchers. Dittmar speaks here of the "ecology of molecules", which has a role beyond the open seas: large quantities of long-lived dissolved organic matter are also found on the seabed in certain places. As part of The Cluster of Excellence "The Ocean Floor" based at the University of Bremen, the geochemist's team investigates the interplay between dissolved matter and carbon-containing substances found in particles.

"Presumably, the processes in the ocean floor are similar to those in the water column," says Dittmar. The latter may actually be even more complex, partly because the sedimentary structure serves as an effective physical barrier separating substances from organisms. Together with the microbiologists, the Oldenburg researchers plan to explore in greater detail the processes in the ocean floor and their role in the carbon cycle, and also merge the geological expertise of the Bremen-based researchers with Oldenburg's ecological and geochemical know-how in a new Cluster of Excellence.

Dittmar's group is also involved in a number of Oldenburg research projects that focus on shallow marine environments. Here, too, Dittmar sees the need for more research – not least regarding the question of whether carefully calibrated ecosystem management could help these environments to store more carbon than they have done up to now.

Findings on processes that take place on a small scale cannot simply be extrapolated to global scales

However, with all these projects, the following challenge remains: findings on processes that take place on a small scale cannot simply be extrapolated to regional, let alone global scales, such as the world's oceans. The interactions in the microbial network are too complex for that. But ultimately, this is the only way to find out what role dissolved organic matter plays in the carbon cycle, and thus for our climate. Given these limitations, modelling expert Sinnika Lennartz takes the findings from detailed studies and identifies the most important processes, then integrates only these simplified findings into her larger models.

This approach helps to shed light on the large-scale distribution patterns of dissolved organic matter in the ocean. The researchers know, for example, that dissolved organic matter accumulates in the nutrient-poor regions of subtropical oceans. Presumably, the microorganisms living in these areas are unable to break down these substances because they lack other nutrients such as nitrogen or phosphorus that are crucial for their growth. "If we factor this into the model, we can reproduce the observed patterns and thus locate large carbon reservoirs in the world's oceans," explains Lennartz.

By combining measurements, experiments and modelling, the researchers thus gradually move closer to their goal of better understanding the molecules and their cycling to be able to integrate this knowledge into global climate models. As the size of the dissolved organic carbon pool is enormous, even small changes could have a major impact on the ocean's ability to store CO_2. Whether this is really the case remains to be seen. For Dittmar, at any rate, the quest to understand the invisible traces of life in the deep blue sea continues.

Outlooks

What is the future of teaching and learning in higher education?

Prof. Dr Olaf Zawacki-Richter

Knowledge Transfer and Learning with new Technologies

"A large proportion of today's students have social or professional commitments. As a result, for more than a decade now there has been a trend towards more flexible degree programmes and even courses that can be done entirely online. Private universities, in particular, are focusing on this type of programme. At the same time, traditional campus-based universities are still in demand because many students find it important to have direct interaction with each other and the teaching staff.

Nonetheless, these universities also face the challenge of making their courses more flexible. This is not an end in itself but can serve strategic goals such as strengthening research-based learning, attracting non-traditional audiences or making teaching more international. There are good opportunities here, such as inviting international guests to attend online meetings. And even large classes with stable course content, such as lectures on statistics, can become much more interactive. In the flipped classroom format, for example, students first watch a video on a topic and can ask questions later in regular classes. This approach adds real additional educational value.

In the science and technology subjects, virtual reality and augmented reality are becoming increasingly popular. There's also a lot of hype about AI applications like ChatGPT. In a project with lecturers from all over the world we are currently researching how to integrate these tools into teaching at the didactic and pedagogic levels. Modern universities should prepare their students for a digital work environment."

"A large part of the world's knowledge is in AI"

Since the launch of the new chatbot ChatGPT, artificial intelligence has become a major topic in the media. Many are excited by the possibilities the platform offers. It gives intelligent answers to all kinds of questions and can write long and informative texts on every conceivable subject. But there are also many critical voices. In this interview, computer scientist Oliver Kramer talks about the opportunities presented by the new technology and to what extent it can advance digitalisation.

Interview: Tim Schröder

Prof. Kramer, will ChatGPT trigger a revolution in artificial intelligence (AI)?
Kramer: The technology is very interesting because it makes AI faster and more powerful. It is the latest of several developmental leaps in AI in the last 20 years. I'm sure it will change our lives and the way we work, but I wouldn't talk of a revolution.

Just to be clear, what exactly do experts mean by the term AI?
Kramer: AIs are computer programmes that can learn. They're used for things like image recognition. These programmes are trained using vast amounts of data so that they learn to recognise certain objects – faces, for instance. This is also known as machine learning. ChatGPT is what is known as a Large Language Model, which has been fed millions of texts on all kinds of subjects. As a result, it contains a large part of the world's knowledge.

And what does it do with it?
Kramer: ChatGPT and other AI systems basically do nothing more than map learned data onto other data. A simple example would be translating a German text into French. We computer scientists call this "sequence to sequence learning" – in this case a sequence of German words is mapped onto a sequence of French words. But the resulting translation is not particularly intelligent. ChatGPT adds a whole new aspect called "attention" or "self-attention" – a concept introduced by a team of computer scientists in 2017 in the seminal paper "Attention Is All You Need". With this approach, an AI is made capable of independently assessing which part of an input is important for the desired response and which isn't. This means that the AI has the capacity to pay attention and take context into consideration, even with longer queries. It's very similar to information processing in humans. Thanks to our ability to pay attention, we also weigh up which information is important before taking the next step.

Can you give an example?
Kramer: Let's say you're chatting to ChatGPT about New York. If you then ask a question like: "Where is the coach station?", ChatGPT will take the context of the conversation into account and tell you the location of the coach station in New York – rather than in another city, for example. A simple voice assistant is not able to do this.

Have you already had experiences with this new type of AI?
Kramer: Yes, we used these new attention mechanisms in a project aimed at developing drugs against coronaviruses. The project was focused on blocking an enzyme – a protease – that cuts certain proteins when the viruses reproduce. The goal was to find a new drug molecule that would paralyse the protease's cleavage mechanism. We worked with different AI methods. First, we used evolutionary algorithms, which have been established for some time now, to modify molecules from chemical databases via an evolutionary process and make them dock onto the protease and deactivate it. Then we used the new AI method to integrate new proposed molecules into the optimisation process. In this way, individual molecules were continually improved in a kind of optimisation loop. We also used mainframe computers for this optimisation process. With these computers it takes two days to calculate a molecule.

Did you find promising drugs against Covid?
Kramer: Yes, we did. We had to take several things into account, ensuring not only that the molecule inhibited the protease, but also that it was well tolerated and that it wasn't too difficult to produce in the lab. This type of complex compound has to be synthesised atom by atom. It takes up to half a year to get a production process like this up and running. The simpler the structure of the drug molecule, the faster this goes. This example shows how versatile AI is today. Many other research groups at the University's Department of Computer Science are also using AI – Astrid Nieße is using it to optimise the operation of charging stations for electric cars, for example, and my colleague Daniel Sonntag is working on making it easier for humans and robots to work together. Many different AI technologies are used in these projects.

But systems like ChatGPT and the "attention principle" seem to be the dominant topic at the moment.
Kramer: Of course. After all, it paves the way for completely new applications. The one-armed industrial robot PaLM-E which was developed by Google and the Technische Universität Berlin is a prime example. Like ChatGPT, this robot is equipped with a Large Language Model which allows it to access the world knowledge contained in the model. Normally, you have to show robots what to do step by step. PaLM-E, by contrast, makes creative use of its knowledge and ability to reason. For example, it opens drawers to look for tools because it knows, thanks to its world knowledge, that tools are often stored in drawers.

In spite of all the enthusiasm, ChatGPT has also prompted warnings about the dangers of AI. How dangerous is it?
Kramer: Critics often say that we computer scientists can no longer explain or keep track of what algorithms actually do – that AI is essentially taking on a life of its own. This is true to the extent that like neural networks, AI methods do indeed operate independently. That's the whole point. They can solve far more complex tasks than we humans can. A human being can perhaps combine three or four different parameters, but beyond that we lose track. A neural network can combine dozens of parameters and identify connections that we humans would never discover. But that doesn't mean we are losing control. After all, we train the AI using specific information to solve specific problems. And generally,

Oliver Kramer is Professor of Computational Intelligence at the Department of Computer Science. The AI expert specialises in methods that use evolutionary algorithms to optimise substances intended for use in pharmaceutical drugs.

AI is only put into use in everyday life once it has been sufficiently tested – as with automated driving, for example.

So you're saying we don't need to worry about the risks of AI?

Kramer: Naturally there are also risks. If systems like ChatGPT are able to write entire essays, then as a university lecturer I have to ask myself how I can make sure that my students don't cheat. Since the launch of ZeroGPT a few months ago, we have a software that can check texts to see if they were written by AI. But such systems can also be tricked. Systems like ChatGPT clearly pose challenges. It's entirely possible that jobs in service centres will be lost because ChatGPT can provide very creative answers to many questions. Such systems will also be able to take over certain types of text work in sectors like the advertising industry. But this can also be an advantage if work processes become more efficient as a result. In the meantime, new jobs like that of "prompter" are emerging. A prompter is responsible for writing particularly apt and effective AI prompts so that these systems generate texts with more substance. Basically, we're having the same discussion as we always do when a new AI technology comes onto the market. And the answer is also always the same: a new technology can have disadvantages, but also great potential.

What potential do you see?

Kramer: What really interests me is combining Large Language Models like the ones ChatGPT is based on with other data sets – image data and videos, or information about diseases or chemical molecules. Perhaps in the future we'll be able to ask questions like: "What is the perfect molecule to inhibit the protease in the coronavirus?". That could save a lot of time. In one of our new projects we're combining a neural network with the new attention mechanism as well as with data from hundreds of wind turbines – with the goal of improving short-term weather forecasts. We want to be able to use the current electricity production data from the many turbines on a wind farm to reliably predict the electricity yield expected from that farm in the next hour. With the expansion of renewables, these short-term forecasts are becoming more and more vital for operating power grids. And this approach can improve short-term forecasts significantly.

The digitalisation of industry and of society as a whole has been high on the political agenda in both Germany and Europe for years. To what extent can the new AI advance digitalisation?

Kramer: For me, these are two separate worlds. When I think of digitalisation I think of authorities and administrations that are still barely digitalised today. The process begins with digitising correspondence – as pdf documents, for example. The electronic patient file, which is to be introduced nationwide in 2024, is also a step towards digitalisation. It will make the exchange of data between doctors, clinics and patients much easier. Up to now, however, many digitalisation activities have failed due to security concerns. Data security is certainly important, but it often becomes a hurdle when it comes to digitalisation. There's still a long way to go before artificial intelligence comes into play here. Yet especially when it comes to electronic patient records, AI could be very helpful. AI programmes could be used to analyse patient data and identify health risks or potential diseases that would otherwise go undetected, for example.

Outlooks

How can we create a successful human-machine dialogue?

Prof. Dr Susanne Boll

Media Informatics and Multimedia Systems

"Overall, I'm optimistic about the future: the new digital technologies have enormous potential to make our lives better, more humane, healthier, and also more democratic and connected. But for this to happen we need science, business, society and politics to create the right framework. In my view, we need to integrate a set of values into the basic design of AI-based systems in order to guarantee respect, correct information, checks and balances and control.

Above all, we must design digitalisation to ensure that humans are active participants. As things stand now, many users simply feel dependent on digital technologies. This is why human interaction with technical systems must be part of the design and development process – right from the start.

More and more often, we are finding ourselves in environments with multiple digital systems. Many of these systems use artificial intelligence and deep neural networks. I might have a smart home system that can identify my "wellness times" and configure itself accordingly, for example. Ensuring that humans are able to sufficiently understand and use these increasingly pervasive digitalised environments despite their complexity is a major challenge.

Nowadays, companies are very keen to tailor their products to the user's requirements. When we look at technological development processes, there is still some way to go before this goal is fully realised. But we'll get there."

A digital twin for your hearing

Voice assistants from various brands are now found in many households and accompany us everywhere on our smartphones. Cluster of Excellence researcher Bernd T. Meyer and his team use the artificial intelligence (AI) on which these apps are based in their hearing research – and make good use of the voice assistants' deficiencies. Because very often these apps encounter the same problems as humans do.

By Sonja Niemann

The human ear picks up acoustic signals, but it is the brain that decodes sounds, noises and speech. Voice assistants also break down sound waves into smaller units and then reconfigure them into words – and sometimes encounter the same difficulties as people with impaired hearing.

The mincemeat for the bolognese is sizzling in the pan, the radio is blaring and the extractor hood is whirring loudly as the spaghetti is removed from its packaging and dropped into the pot with a splash. Now we just have to make sure we don't miss that perfect "al dente moment".

"Computer, set the timer for nine minutes."
"Sorry, I don't know that."
"Computer! Set the timer for nine minutes!"
"The timer has not been set."

There are certain situations in which home voice assistants seem incapable of understanding commands. Despite, or perhaps because of this flaw, these small devices and the AI on which they rely have a special place in hearing research. After all, when it comes to understanding speech amid background noise, they have similar problems as people with impaired hearing. Making use of this similarity is just one of several approaches adopted by the researchers of the Oldenburg Cluster of Excellence Hearing4all in their quest to use speech recognition software to improve human hearing.

Professor Dr Bernd T. Meyer and his team from the Communication Acoustics Division are key players in this endeavour. Together with five PhD students he conducts research at the intersection of speech and hearing research. Meyer has been fascinated by the possibilities of modern speech recognition ever since he did his degree in physics. At the time, Professor Dr Dr Birger Kollmeier, who now leads the Hearing4all Cluster of Excellence, suggested the topic for a presentation. "I was interested in why the software's speech recognition was so much worse than that of people with healthy hearing," says Meyer. He began to develop methods to improve the systems – and also found ways to transfer his findings to hearing research.

One of his research approaches is based on using speech recognition software to diagnose hearing impairments. Thanks to research carried out in Oldenburg, German speaking persons can carry out a preliminary hearing test in the comfort of their own living room using the Alexa Smart Home system. You simply give the specific command and the skill from Oldenburg will start playing short sentences, which you are asked to repeat.

500.000 utterances taught the AI to understand speech

The answers reach the voice assistant in the form of sound waves, which then divides them into short acoustic units. "The AI has been trained to match the acoustic signal units with the smallest units of human speech, phonemes," Meyer explains. But this only solves half of the speech recognition puzzle. In the next step, the AI alculates the most probable sequence of the phonemes it has recognised and then strings them together, ideally forming the word that the test person said.

Whereas the home hearing test uses the Alexa AI, Meyer's team usually uses its own purpose-built AIs to conduct research. For this, the researchers use methods from machine learning, which means they teach a computer to recognise patterns in data and thus learn to transcribe spoken language into text. They train their AI by supplying it with speech samples – most recently, more than 500,000 utterances by more than 1,000 people. An artificial neural network learns from this data and uses it to generate an output (in this case, a written word) from an input (in this case, a sound wave).

Unlike the Alexa hearing test, which provides feedback about possible hearing impairments using a rather limited traffic light system, the researchers want their AI to deliver sufficient accuracy to provide a clinical diagnosis. The team has already come very close to this goal, and the underlying algorithm is well advanced. "We have shown that our neural network can test how well a person hears with a similar degree of accuracy to a test performed by a medical professional," says Meyer.

Despite constant improvements in diagnosis and hearing aids, science is

still not able to restore all facets of hearing for hearing-impaired people. This is because it is not enough to simply amplify the soundscape. In everyday life, the main objective of hearing is to understand speech. And in this respect humans have very similar problems to the voice assistant in the kitchen: the spoken word easily gets lost amid all the background noise.

Meyer's research team is seeking to turn this shared weakness into an advantage using another approach. Instead of programming a neural network to make it particularly proficient in understanding a speaker, as with the hearing test, the physicist and his PhD student Jana Roßbach aim to create a speech recognition system that hears as well or as poorly as a real person. The Oldenburg researchers recently attracted a lot of attention with a study in which they were able to calibrate their neural network to mimic the hearing impairments of test persons with such accuracy that the performance of the humans and the computer in hearing tests was almost identical – like acoustic doppelgangers. "The idea behind this is that if an AI is able to predict that a hearing aid user will not be able to understand a certain word spoken in their presence, it will also be able to optimise the hearing aid settings to ensure that the person can follow the conversation. In this way we turn a disadvantage into an advantage," explains Meyer.
"Up to now we have focused on hearing with one ear, but we know that binaural hearing has positive effects on speech comprehension," he adds. Therefore, they now plan to train the AI to make the same predictions in the test as a human using both ears.

Usable not just in hearing aids, but in all herables

In the experiments conducted so far, the AI was fed speech samples which were overlaid with a strong signal noise that simulated the hearing impairment of the test person. The AI transcribed this speech sample and compared the result with the information about what the speaker had actually said. If the two were identical, the AI knew that the test person would understand the speech sample. "In real life, of course, an AI doesn't know what is actually being said," says Meyer. So he is working with Roßbach to make predictions possible without this information – based on the sound quality of the speech sample.

The benefits of AI applications like this go beyond hearing aids. "They are relevant for the entire spectrum of communication with hearables," says Meyer. In addition to hearing aids this includes smart headphones, which have long been used not just for playing music but also to block out unwanted background (noise-cancelling) or amplify speech in a particular environment. Tailoring these devices to the hearing ability – or preferences – of the wearer could be the next logical step in their development. However, the power supply required for complicated algorithms as well as the limited performance of the built-in processors still pose hurdles at this stage.

But an example from Meyer's department shows that these hurdles are already being overcome in Oldenburg's hearing research. In 2017 Meyer attended a scientific lecture in Baltimore and was very impressed by a demonstration in which an AI was able to separate the acoustic signals of two people speaking into a microphone at the same time. "That really blew me away," he says. But although this seemed to offer a promising approach to a fundamental problem in hearing research – separating desired sounds from unwanted noise – it was initially useless for that purpose. "The app was too resource-heavy and too slow. Hearing aids can only work with a maximum delay of ten milliseconds, otherwise the natural undelayed sounds and the delayed sound from the hearing aid result in distortions," Meyer explains.

Together with PhD student Nils Westhausen he has now found a way to reduce the delay to two milliseconds making it sufficiently fast and resource-efficient for use in hearing aids. This technology could enable people to actively select the acoustic signal they want to listen to – and, for example, block out whirring extractor hoods and sizzling pans. That would be another major breakthrough.

Communication acoustics expert Bernd T. Meyer uses machine learning for speech and hearing research. One of his projects uses voice assistants to perform high-precision hearing tests.

Outlooks

How can we reduce social inequalities?

Prof. Dr Gundula Zoch

Sociology of Social Inequalities

"We are facing enormous social challenges such as the transformation of the labour market and new technologies. To meet these challenges, comprehensive access to education for children and adults is essential. They all need the skills required to seize opportunities and cope with social change.

Education is also key for social cohesion. It plays a role not only in achieving material prosperity and wellbeing, but also in social, political and societal participation. However, in Germany we urgently need reforms to ensure more equal opportunities in the education system.

Research has shown that good education in early childhood is crucial to reducing educational inequalities. It benefits children, including those from disadvantaged groups, throughout their lives. It also helps older generations, because the costs of government benefits will be borne by young people who embrace technological developments in the labour market and use or complement them with their skills.

My vision for the future is that fifty years from now we will have created an education system in Germany which benefits everybody, regardless of their family circumstances and background. And that education is seen as a lifelong process which paves the way for people to participate successfully in society even in times of major change. Investing money and expertise here is worthwhile, because it will enable us to reduce social inequalities across the board."

Rethinking school

School is a static and inflexible institution? Educationalist Till-Sebastian Idel and his team disagree. They have been analysing new concepts for years, including research on a long-format system in which pupils don't change schools between primary and secondary level. For Germany, this would be a whole new type of school.

By Deike Stolz

Till-Sebastian Idel, pictured here in the foyer of the Integrierte Gesamtschule Flötenteich in Oldenburg, has seen more schools from the inside than most people. The educationalist does his research where new concepts evolve, where they are tested and embraced.

Red, blue, orange, green, pink. The schoolyard, pupils, parents and staff of the PRIMUS School in the town of Minden in North Rhine-Westphalia are covered in a multi-coloured cloud of corn-starch powder of the type used during the Indian Holi festival celebrations. At the start of the summer holidays, the German pop song "Auf uns" (To Us) plays on the loudspeakers. The school is celebrating its tenth anniversary, celebrating itself. And above all, celebrating the young people who were the first to take part in an ambitious school experiment that ran from their enrolment in 2013 to the end of Year 10, and who now have their intermediate secondary school-leaving certificates under their belts. In German, the acronym PRIMUS stands for the integration of the – traditionally separated – primary and secondary schools, or, as Oldenburg education scientist Prof. Dr Till-Sebastian Idel likes to put it, for an "all-in-one school". Idel has been monitoring the experiment, which is being conducted at five schools in North Rhine-Westphalia, since it first began.

Since 2013, the participating institutions have been testing "nothing less than a whole new type of school", as Idel and his research associate, Dr Sven Pauling from the Institute of Educational Sciences, described the undertaking in a paper they wrote together. Idel explains that there is an ongoing social debate according to which schools in Germany are too inflexible and static. This does not reflect his own perspective: "We focus on schools that see themselves as highly adaptable. And this is what is so exciting here – to see that schools can perhaps change, after all."

Just like the schools in the PRIMUS project. One of the goals of this school experiment is to make it possible for schoolchildren to have uninterrupted educational trajectories – which in Germany means not having to change school after Year 4 – in educationally innovative, high-performing progressive schools that are also inclusive and provide equal opportunities. What will schools in Germany look like in future? More "all-in-one", like in many other countries? As we see it, the idea of a school that goes all the way from Year 1 to Year 10 has enormous potential," says Idel, who heads the School Pedagogy and General Didactics team at the University of Oldenburg and oversees the research accompanying the PRIMUS experiment together with a colleague from Münster, Prof. Dr Christina Huf.

Idel and his team conduct research on schools and school culture, on lessons, on teacher professionalisation, and on how all these things change – which automatically leads to what he describes as a "wide-angle perspective". This is extremely helpful for monitoring and analysing the school experiment, which touches on several aspects of a current school education reform agenda: one lesson for all in the name of inclusion; the opportunities offered by learning with other pupils of different ages and education levels; the interplay of teachers and other professionals in a Ganztagsschule (all-day school, as opposed to many German schools where the school day ends around 1pm). In essence, schools that offer more than "just" lessons. The accompanying research is still underway, but group discussions and interviews with children, teachers, parents and head teachers, as well as participant observation of everyday school life, already deliver initial findings.

Idel's research is primarily qualitative. In other words, it is not about creating the broadest possible data base, as with PISA, IGLU and other standardised studies. Instead it focuses on gaining specific insights: "We're interested in things like how the teaching staff of a school reflect together on the development of their school, whether in committees, working groups or the like. What problems they identify, and how they talk about them. What solutions they find, and how they implement them," Idel explains. The solutions can be very different at each of the five PRIMUS schools. "We observe, we're there in the background, and at certain intervals we conduct interviews with those involved." Then they supplement this work with quantitative data, numerical material that can be evaluated statistically.

The numbers show, for example, that not having to change schools – one of the key features of the PRIMUS school profile – has quantifiable results. As Idel points out, research on this topic has already indicated "that the transition common after Year 4 is a neuralgic point at which disadvantages and inequalities arise in the education system." This, he continues, is to a certain degree the result of a form of "self-selection" by parents, who tend to shy away from pursuing a higher level of education than their own for their child. Similar considerations also mean that teachers err on the side of caution with their recommendations as to which type of secondary school a child should apply for: a Hauptschule or Realschule that also prepare for vocational trainings after grade 10, or a Gymnasium, which is more academic and focuses on preparing for the Abitur, Germany's higher education entrance qualification. "For all the talk of permeability in the public school system, it is rare for a child to 'upgrade' to a higher level of secondary school than the one recommended."

The PRIMUS schools show that it is easier for pupils to exceed the expectations of school recommendations if they are outside Germany's standard

As a general trend, pupils at Primus schools achieved a school qualification that was one level higher than the one previously recommended by their primary school. Forty-eight percent qualified for upper Gymnasium classes – far more than the anticipated nine percent.

Parents say Primus schools allow their children to experience the joy of learning without the pressures of deadlines and grades and give them the chance to form lasting bonds with other children as well as with teachers.

Individualised learning, with different content and targets for the same subject matter, allows each pupil to learn and differentiate their knowledge at their own pace and level.

multi-tracked school system. This is because in the early years of the experiment three of the five PRIMUS schools enrolled pupils in Year 5 as well as in Year 1. The researchers were thus able to compare the school-type recommendations of 193 pupils who started in Year 5 with the actual secondary school qualifications they went on to actually obtain in 2020. The results: 95 of the students – about half of them – had come to one of the PRIMUS schools with a recommendation for the intermediate school type Realschule, another 60 – so almost one third – for the basic Hauptschule. Only 17 – less than one tenth – were recommended to continue their education at a Gymnasium. However, as a report compiled by the researchers for the Ministry of Education states, the general trend was that these pupils "achieved a school qualification which was one level higher than that which they had been recommended to aim for."

„If I want a good future I have to learn effectively"

This translated to 50 pupils obtaining a basic school-leaving certificate like from a Hauptschule – including special needs pupils, some of whom had been transferred to Year 5 without any recommendation at all. 41 obtained an intermediate school-leaving certificate, and a 93 – almost half of the students – achieved the necessary grades for a place in upper Gymnasium classes where pupils prepare for the university entrance qualification. In other words, the number of pupils who left PRIMUS schools with a school-leaving certificate qualifying them to pursue the Abitur was five times higher than would have been expected based on the recommendations. "We are talking about centralised exams here," Idel emphasises. And in these exams, just as in statewide surveys of learning levels in Years 3 and 8, PRIMUS schools "performed very well in comparison with other schools with similar pupil configurations," he adds.

He reports that parents of PRIMUS school pupils speak of how the schools allow young people to experience the "joy of learning without the pressures of deadlines and grades" and – because they don't have to change schools halfway – enable their children to form lasting bonds with other children as well as with teachers. At the same time, qualitative interviews with more than a hundred pupils from different PRIMUS schools showed that their learning efforts were driven above all by the desire to optimise their own performance – irrespective of grades or the desire to achieve a certain school qualification. According to the interviews, this is because many of these children and young adults have understood how important learning and the learning process is for their future: "My future is ahead of me and I still have everything to experience, and if I want a good future I have to learn effectively," one pupil explained. In another still ongoing study, the researchers are following the subsequent educational paths of PRIMUS graduates.

Change of scene: "Money, money, money…", the voices of the Swedish pop band ABBA ring out in the classroom at the beginning of an English lesson. The rows of desks are filled with Year 8 or 9 pupils. The teacher announces a brainstorming session to see how many words related to money they can come up with in the foreign language. He makes a hand signal and the pupils call out English words in a staccato response – until education scientist Idel presses "pause" on his office computer. He is playing back a video of a lesson similar to many that he and his team, always on the lookout for "an interesting situation", record for their research and for use as visual teaching material. "This is a typical start to a teacher-led lesson," says Idel. "A conversation among the class that is structured by the teacher and in which the teacher assigns tasks and determines who gets to speak."

Idel likes to contrast this example of frontal teaching with footage from a mixed-year learning group in Berlin. Instead of straight rows of desks there are room-dividing elements. The pupils work on exercises individually or in groups, moving around the room freely to share information or ask others for advice, or to join the queue forming in front of the teacher's flipchart and find answers to their questions there. "A typical open lesson," Idel explains. In this classroom, known as a "learning office", there is naturally a lot more "hustle and bustle".

This teaching format is also used at the PRIMUS schools. Individualised learning at a pace and level that suits each pupil and, as Idel emphasises, "with different content and targets for the same subject matter". The learning material is organised into so-called "spiral curricula" which offer pupils access to content on a subject at the various levels of an imaginary rising spiral. With this method, pupils in different years and with different learning levels can all work on a topic simultaneously, without older pupils in the learning group having to repeat the previous year's material. Each pupil can access knowledge according to their own goals and ability. In this type of lesson teachers guide the learning process rather than leading it, shaping the lesson plan together with the pupils and providing individual feedback at regular intervals.

„Successful concepts are easily transferable. However, every school is different"

Lessons like this challenge schools to keep evolving – including the PRIMUS schools in Minden and Münster, where the learning groups up to the end of Year 9 span three different year groups. Here the researchers observe how teachers seek ways to implement the school experiment as effectively as possible. For example, in the Level II learning group where pupils from Years 4 to 6 learn together, teachers who are specialised in different levels of school education – namely primary and secondary school – set aside these differences and work together. The researchers watch how the teachers move away from the standard methods based on different textbooks for each level and develop their own teaching materials.

They also observed that discussions among Level III teachers about the best way to organise study time can get pretty contentious. Opinions diverge on whether subject teachers or class teachers should supervise the daily individual study periods during this level leading up to the final year: What should take priority? The relationship between pupil and class teacher, or knowledge of a specific subject? In the end, the teaching staff decided on a mixed model with a focus on specialised teachers.

It has yet to be decided whether these long-format schools will remain in their current form after the experiment ends in 2027, and whether the future legislation of the state of North Rhine-Westphalia will open up the possibility of establishing more such schools elsewhere in the future. But PRIMUS schools can already serve as a source of inspiration for other schools, Idel says. "Successful concepts are easily transferable – whether they're about assessing performance without using grades or organising the teaching of a subject into 'learning offices'. However, every school is different: the problems are slightly different, the people involved are different, the social environment is different," he emphasises. "There is certainly no one-size-fits-all solution that could be replicated here." So when it comes to the future of schools in Germany, it's probably a bit like with the different colours at the school event in Minden: it's all in the mix.

"No time for utopias"

"Property entails obligations ," according to Article 14 of Germany's Basic Law. Sustainability is one of these obligations, says Oldenburg philosopher Tilo Wesche. He advocates giving property rights to nature to end the excessive exploitation of natural resources.

Interview: Ute Kehse

The Whanganui River in New Zealand owns its own resources. People who live along the river may acquire ownership of some of its natural assets, but are obliged to use them sustainably.

There is a lot of discussion about property at the moment, including proposals for the socialisation or even expropriation of property companies. The Collaborative Research Centre "Structural Change of Property", of which you are a member, also focuses on a new concept of property. What is behind the desire to change the current system?

Wesche: In recent decades our understanding of property has narrowed. Property is increasingly understood to mean solely private property. In our Collaborative Research Centre we want to remind people that there are alternative forms of ownership, such as cooperative ownership or public ownership. These alternative forms are increasingly coming under pressure: in Berlin, for example, a large percentage of housing was publicly owned until the 1960s. Then came several waves of privatisation. Also, public universities are increasingly competing against private universities.

Is private property at the root of problems like social inequality and environmental destruction?

Wesche: I don't think private property per se is the cause. The problem is more the modern property rights, which were introduced at the dawn of the nineteenth century, when the French and American Revolutions ended. A key flaw is that these property rights fail to take account of the fundamental differences between assets and treat all assets as "objects". We lump everything together and treat natural resources in the same way as consumer goods such as clothes, furniture, toothbrushes.

You make the case for seeking alternatives to private property, especially as regards natural assets – you suggest nature itself to be given property rights.

Wesche: Exactly. In their current form, property laws allow me to use and consume natural assets as if they were consumer goods. I believe that natural assets should not be private property. Real estate, for example, should be treated differently from the soil on which it stands, because the soil is a natural asset and provides services such as stability and water storage. If nature belongs to itself, there may be private claims to natural assets, but these assets are always shared property: I can't simply do whatever I want with my land, even though it belongs to me, because it also belongs to nature.

Can you give a concrete example of what this might look like?

Wesche: One example I use for orientation is the Whanganui River in New Zealand. The New Zealand Parliament decided to give this river rights, including property rights. The river also owns its resources – the water, the fish, the plants along its banks, the sand. However, the river is not the sole owner of these resources. Those who live along the river can also acquire ownership of the natural assets, but these rights are limited by the property rights of the river. This results in the obligation to use the river's natural assets sustainably. Property ownership is supposed to protect against the encroachments and interests of others. Nature, as the owner of its resources, also deserves to be protected in this way.

So the idea is that we should give something back to nature when we take something from it – do you have other examples?

Wesche: This idea exists in all cultures and throughout history, whether in Latin America, Africa or Asia. In Christianity there is also the idea that God's creation does not belong to man, but to God. What interests me is how to translate this culturally or religiously informed idea into a secular social order. This is where the philosophical work begins, the search for arguments to justify the creation of such non-human legal entities.

And what was your conclusion?

Wesche: We should look at how we justify our existing property rights. Their normative basis is the rule that those who work to create assets have property claims to those assets. We find this concept in the history of ideas, from antiquity to Thomas Aquinas in the Middle Ages and John Locke in the early modern period. It also crops up in current debates about unpaid care work or unearned wealth. I simply transfer this idea to nature. Because nature contributes to creating assets through ecosystem services – just as humans do through labour. And for that reason, nature should have the same property rights as humans do.

Couldn't the dilemma of overused ecosystems be solved by economic instruments such as taxes?

Wesche: By granting property rights to nature we go one step further and put up hurdles at different levels. The first is that if natural assets are not solely a human privilege, there can be no more

Tilo Wesche is Professor of Practical Philosophy at the University of Oldenburg. His research interests include questions relating to democracy and justice and theories of the good life. His book "Die Rechte der Natur – Vom nachhaltigen Eigentum" (The Rights of Nature – On Sustainable Property) was published by Suhrkamp Verlag in September 2023.

free, unrestricted access to nature. We could no longer just go ahead and mine seams of coal or spray pesticides on fields, for example. The second hurdle is to create a compensation mechanism for our use of natural assets. This means, for example, that if soil is sealed and built over as a city grows, an equivalent amount of land must be unsealed elsewhere. If a forest is cleared, an equal amount of land must be reforested elsewhere. A third hurdle arises at the bioeconomic level: a price tag is put on nature. There's nothing unusual about this. If I use someone else's property, I'm prepared to pay for it – for using public transport, for example. And I believe the same should apply to the use of natural assets – that a fee should be paid for the use of property that doesn't belong to us. This fee should then be invested directly in sustainability goals. If you clear a forest and use the timber, for example, you pay a fee that covers the cost of reforestation.

Which piece of nature – locally or in Germany as a whole – should belong to itself in your opinion?
Wesche: The Wadden Sea, of course, which is under severe threat from resource extraction and rising sea levels. But the green landscapes around Oldenburg are also threatened by global warming and the ensuing droughts. This shows just how urgent it is to provide nature with robust protection that can withstand economic interests. This doesn't mean that we should abandon economic interests altogether, but we need to set limits to the logic of profit maximisation – limits that can really put an end to the excessive exploitation.

Aren't you imagining some sort of utopia?
Wesche: For me, the point is not to present a utopia that is unattainable for us humans, but to start with what already exists. In the face of pressing problems such as climate change, species extinction, global pollution and the depletion of resources, we don't have time to think about utopias that may or may not be achievable at some point. Besides, there are already around 200 rights of nature cases worldwide – in New Zealand, Ecuador, Colombia, as well as in the US, Canada and even the EU. Last year, for example, the Mar Menor lagoon near Murcia in Spain was granted its own rights. Rights of nature, including property rights, are now well established in legal practice.

So this change in property law would open the way for a sustainable society?
Wesche: That's a good way of putting it: it's the path towards a sustainable society. But ultimately, sustainable property rights, or property rights of nature, are not the goal. I would say that the kind of society we really want would not necessarily need property rights at all.

What do we need property for?
Wesche: The primary function of property is the distribution of assets: we need to distribute resources that are scarce in societies based on the division of labour. Property rights are the medium through which assets are distributed. On the other hand, this means that in societies where there is no division of labour and also no shortage of assets, we don't need property. But I think that is really utopian.

Outlooks

How will ageing change in the coming years?

Prof. Dr Tania Zieschang
Geriatrics

"The way we feel about ageing is constantly changing. For World War II widows born in the 1920s, for example, growing old after a lifetime of looking after children and tending to the elderly meant being looked after oneself at long last. The idea of having to exercise to maintain independence in old age generally met with resistance. Today, doing exercise is considered normal for adults, and the positive effects are well known. Many people are doing more and more to stay fit.

This is great, but it can also lead to frustration when people get older and are confronted with declining physical or mental abilities despite their efforts. They also experience this under different circumstances than previous generations: their children are busy with their jobs, or live far away and are not able to care for them. In view of this dilemma, as well as the shortage of healthcare workers, I am convinced that technical support systems will soon find their way into more and more households. Online shopping using voice commands has long been technically possible, but still needs to be adapted to the needs of older people. Homes will be fitted with sensors that detect things like whether they have got out of bed in the morning, or if they have had a fall, and automatically inform relatives.

One challenge for the field of geriatrics is to reach out to less educated population groups, especially when it comes to offering preventive services. Otherwise, the gap between those who are still fighting fit at 80 and those who feel old at 60 will further widen."

Prizes for top research

To mark the 50th anniversary of the university's founding, the Universitätsgesellschaft Oldenburg (UGO) decided to double the number of awards for research and doctoral theses. German philologist Thomas Boyken and musicologist Mario Dunkel share the Award for Excellent Research in the category humanities, social and cultural sciences, while Business Information Systems expert Antje Wulff received the same prize in the category of natural sciences, mathematics and medicine. Both awards are endowed with 5,000 euros. In addition, both biologist Jingjing Xu and chemist Lars Mohrhusen received an Award for Outstanding Doctoral Thesis along with 2,000 euros in prize money.

Award for Outstanding Doctoral Thesis

The chemist Dr Lars Mohrhusen won the award for his doctoral thesis dealing with defects in titanium oxide (photo)catalysts, a topic which is of broader interest for the function of redox-active oxide catalysts. Mohrhusen studied chemistry at the University of Oldenburg, where he completed his bachelor's degree in 2014 and his master's in 2016. He went on to do his doctorate under Prof. Dr Katharina Al-Shamery in the Nanophotonics and Surface Chemistry group.

The biologist Dr Jingjing Xu received the award for her doctoral thesis, which represents a scientific breakthrough. She demonstrated that migratory birds use quantum mechanical effects to navigate across thousands of kilometres. Xu earned her bachelor's degree in 2012 at the Shandong Institute of Physical Education and her master's in 2015 at the University of the Chinese Academy of Sciences in Beijing. She then completed her doctorate in Oldenburg, most recently under Prof. Dr Henrik Mouritsen.

Award for Excellent Research

Prof. Dr Mario Dunkel has been teaching and doing research at the Institute of Music since 2017, initially as a junior professor and since March 2023 as Professor of "Music Education". Dunkel received the award for wide-ranging achievements in various areas of music pedagogy research, which also address diversity and intersectional issues, as well as for his extensive international network. Dunkel studied at Oglethorpe University in Atlanta and the TU Dortmund, where he completed his PhD. He has also undertaken several research trips to the USA.

Prof. Dr Thomas Boyken has been teaching and conducting research at the Institute for German Studies since 2019, initially as a junior professor and since July 2023 as Professor of "Children's and Youth Literature". He received the award for his innovative approach to the academic study of children's and youth literature as well as for his contribution to knowledge transfer in the region, particularly within the framework of the KIBUM Children's Book Fair. Boyken studied German philology and sports science in Oldenburg, where he also earned his PhD. After that he became a junior lecturer at the University of Tübingen.

Dr Antje Wulff was appointed Junior Professor of "Big Data in Medicine" at the Department of Health Services Research in 2022. She receives the award for her nationally and internationally acclaimed work and pioneering approaches in the field of medical data integration and analysis as well as for the development of clinical decision support systems. Wulff studied business informatics at the Baden-Wuerttemberg Cooperative State University in Stuttgart and at the TU Braunschweig, where she also earned her doctorate.

Jörg Albert

Sensory Physiology and Behaviour

Prof. Dr Jörg Albert has been appointed Professor of "Sensory Physiology and Behaviour" at the Department of Neuroscience. Before moving to Oldenburg, he was a professor at University College London (UK). Albert studied chemistry and biology at the University of Bielefeld and the University Erlangen-Nuremberg. He received his PhD from the University of Vienna (Austria) in 2002 and then held teaching and research positions at the Universities of Tübingen and Cologne, among others. In 2008, Albert moved to the UK, where he taught and conducted research at the University College London (UCL) Ear Institute and became Professor of "Sensory Biology and Biophysics" in 2016. From 2019 to 2022, he also led a research group at the Francis Crick Institute in London, which conducts biomedical research and is a partner institution of UCL.
Albert's primary area of research is the mechanosensory world of insects, which includes the sense of hearing. His current research focuses on hearing in mosquitoes and fruit flies (Drosophila), which he is also studying with the goal of attaining key insights for the development of new treatments for deafness and age-related hearing loss in humans.

Sascha Alavi

Marketing and Innovation

Prof. Dr Sascha Alavi has been appointed Professor of "Marketing and Innovation" at the University's Department of Business Administration, Economics, and Law. Before coming to Oldenburg he was Professor of "General Business Administration" with a focus on sales management and held a chair at the Sales Management Department of the University of Bochum. Alavi studied business administration at the University of Mannheim and earned his PhD in Bochum. After completing his habilitation there in 2016, he moved to the University of Lausanne (Switzerland), where he was an assistant professor, before taking up the professorship at the University of Bochum in 2017. Alavi's main area of research is marketing and innovation management with a focus on new technologies and innovation processes in organisations. He deals with questions such as how artificial intelligence (AI) and other new digital technologies are changing the working environment in marketing. He uses historical data and mathematical models to predict future developments. The German business magazine Wirtschaftswoche ranked him among the top German researchers under 40 in the field of business administration in 2020 and 2022.

Kerstin Avila

Fundamentals of Turbulence and Complex Systems

Dr Kerstin Avila has been appointed Professor of the "Fundamentals of Turbulence and Complex Systems" at the Institute of Physics. She is also a new member of the ForWind Center for Wind Energy Research. Prior to joining the University of Oldenburg she was a postdoctoral researcher and project manager at the University of Bremen's Faculty of Production Engineering and at the Leibniz-Institut für Werkstofforientierte Technologien (IWT) in Bremen. Prof. Avila studied meteorology and physics in Kiel. She completed her doctorate in 2013 at the Max Planck Institute for Dynamics and Self-Organization in Göttingen and the University of Göttingen and then held research positions at the University of Erlangen-Nuremberg and the University of Bremen's Center of Applied Space Technology and Microgravity (ZARM). Since 2019 she has led two research projects on turbulent flows at the University of Bremen. Her research focuses on interactions between regions where flow moves uniformly and those where turbulence occurs. Avila is a reviewer for several journals as well as for the German Research Foundation (DFG).

Thomas Boyken

Children's and Youth Literature

Prof. Dr Thomas Boyken has been appointed Professor of "Children's and Youth Literature" at the Institute for German Studies. He was previously a junior professor at the university. Since 2020, he has been director of the Oldenburg Research Unit for Children's and Youth Literature (OlFoKi), where the academic activities of various disciplines on this subject are brought together.

Boyken is a graduate of the University of Oldenburg, where he also earned his PhD in 2012. From 2009 to 2014 he taught at the Institute for German Studies and conducted research at the Herzogin Anna Amalia Bibliothek in Weimar, the German Literature Archive and at the University in Torun (Poland). From 2013 to 2015 he worked with the bibliographical journal "The Year's Work in Modern Language Studies", before taking up a post as a junior lecturer at the University of Tübingen.

His research focuses on literature around the turn of the nineteenth century, post-war and contemporary literature, gender studies, narratology and drama theory. In his current projects he examines mediality in children's and youth novels and children's and youth literature of the post-war period.

Jan Clemens

Auditory Neuroscience

Dr Jan Clemens has been appointed Professor of "Auditory Neuroscience" at the Department of Neuroscience. Before joining the University of Oldenburg, he headed a research group at the European Neuroscience Institute Göttingen (ENI). Clemens studied biology and theoretical biology at the Humboldt-Universität zu Berlin and did his PhD on sensory computation in neural systems at the Bernstein Center for Computational Neuroscience Berlin. From 2012 to 2017 he was a Postdoctoral Fellow at Princeton University in New Jersey (USA), after which he returned to Germany in 2017 and became a group leader at the ENI. Clemens researches how the brain enables successful communication and how it processes acoustic information from our environment and communication partners so that we say the right thing at the right moment. He conducts experiments with insects, which are commonly used as a model for human hearing, and develops innovative machine-learning methods to explore the neural foundations of communication behaviour.

Mario Dunkel

Music Education with a Focus Transcultural Music Education

Prof. Dr Mario Dunkel, previously a junior professor at the Institute of Music, has been appointed Professor of "Music Education with a Focus on Transcultural Music Education". Before coming to Oldenburg, Dunkel was a research associate at the Institute for Music and Musicology at TU Dortmund University.

Dunkel earned a teaching degree in English and music at TU Dortmund. His studies included two extended stays at universities in the USA. In his dissertation in American Studies, completed in 2014, he examined the construction of jazz history between 1917 and 1956. Dunkel's main area of research is cultural and musicological aspects of jazz and popular music as well as the political dimension of music and music education. He is exploring possibilities for diversity-sensitive music teaching and has investigated music diplomacy during the Cold War, the role of jazz musician Charles Mingus in the US civil rights movement and the connection between popular music and populism, among other topics.

Max Ettinger

Orthopaedics

Prof. Dr Max Ettinger is the new Professor of "Orthopaedics" at the Department of Human Medicine. He has also taken over as head of the Orthopaedics department at Pius-Hospital Oldenburg. Before joining the University of Oldenburg, Ettinger taught, researched and practised at the Medizinische Hochschule Hannover (MHH). Ettinger studied and earned his doctorate at the MHH in 2011, after which he also worked there, mainly in the Orthopaedics department. After completing his specialist training three years ago he was appointed consultant. In 2017, he was made head of the Computer-Assisted Surgery section and also took over as director of the Tumour Surgery department the following year. Ettinger is an expert in knee and hip endoprosthetics (surgical interventions designed to secure or restore joint function – either using the body's own materials or artificial joints). His research focuses on the use of digital technologies in orthopaedics and robot-assisted surgical methods.

Sarahi Garcia

Pelagic Microbiology

Prof. Dr Sarahi Garcia has been appointed to the professorship in "Pelagic Microbiology" at the Institute for Chemistry and Biology of the Marine Environment.

Garcia studied biochemical engineering at the Universidad Autónoma de Coahuila (Mexico) and received a master's degree in bioengineering from the University of Georgia (USA). She completed her PhD in microbiology at the University of Jena, Germany. She then became a postdoctoral researcher at the University of Wisconsin-Madison (USA), followed by a period at Uppsala University (Sweden), where she studied the ecology of freshwater bacteria. In 2019, she received a fellowship from the Swedish Science for Life Laboratory (SciLifeLab) and became an assistant professor at Stockholm University, where she focused on environmental genomics of aquatic microorganisms.

Garcia is particularly interested in aquatic bacteria, their interactions and their influence on the global carbon cycle. She uses an integration of cultivation and omics methods, i.e. methods that allow the analysis of all genes present in a sample. One of her aims is to contribute to the fundamental ecological knowledge that can be used to develop microbial-based biotechnological tools that can convert industrial emissions into valuable chemicals.

Yulia Golub

Child and Adolescent Psychiatry and Psychotherapy

PD Dr Yulia Golub has been appointed Professor of "Child and Adolescent Psychiatry and Psychotherapy" at the Department of Human Medicine and has also taken over as director of the University Clinic for Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy at Oldenburg Hospital (Klinikum Oldenburg).

Golub studied human medicine at Samara State Medical University (Russia) and neuroscience at the University of Tübingen. She completed her doctorate at the Max Planck Institute of Psychiatry in Munich in 2009, after which she worked as a resident medical doctor in various clinics and trained as a specialist in child and adolescent psychiatry. In 2017 Golub moved to the University Hospital Carl Gustav Carus in Dresden, where she was an executive senior physician at the Clinic and Polyclinic for Child and Adolescent Psychiatry and Psychotherapy. She earned her habilitation at the University of Erlangen-Nuremberg in 2019. A key focus of Golub's research is neurodevelopmental and behavioral consequences of childhood adversity including trauma and substance exposure. Among other she investigates epigenetic mechanisms transmitting environmental impact into an early behavioural phenotype. Furthermore, she conducts clinical trials on psychotherapeutic group interventions in adolescents with addiction and posttraumatic stress.

Felicitas Macgilchrist

Digital Education and Schooling

Prof. Dr Felicitas Macgilchrist has been appointed Professor of "Digital Education and Schooling" at the Department of Educational Sciences.

Before joining the University of Oldenburg she was head of the Department of Media|Transformation at the Leibniz Institute for Educational Media | Georg Eckert Institute (GEI) in Braunschweig and Professor of "Media Research with a focus on educational media" at the University of Göttingen.

Macgilchrist studied psychology, education and linguistics at the University of Edinburgh and the Open University (both in the UK). She completed her PhD in Cultural Sciences at the European University Viadrina in Frankfurt/Oder, then took up a postdoctoral research position at the GEI, where she led a junior research group from 2012 to 2016 and became head of the "Textbooks as Media" Department in 2015.
In 2016 she received her Habilitation in Educational Science from the TU Braunschweig and took up the professorship at the University of Göttingen. Macgilchrist researches at the interface of education, digital media and society, with a particular focus on the critical study of educational technology.

Martin Maurer

Diagnostic and Interventional Radiology

Prof. Dr Dr Martin Maurer has been appointed Professor of "Diagnostic and Interventional Radiology" at the Department ofHuman Medicine. He also took over as the director of the Institute of Diagnostic and Interventional Radiology at the Klinikum Oldenburg at the same time. Before coming to Oldenburg, Maurer was Senior Consultant at the radiology department of the University Hospital of Bern (Switzerland).
In addition to his medical degree, Maurer completed two Master's degrees, one in Health Business Administration and another in Health Economics, Policy and Management. He earned his Doctor of Medicine degree at the Charité University Hospital in Berlin in 2007 and another doctorate in health sciences in 2014. He also did his habilitation at the Charité in 2012. In 2019 he became an adjunct professor at the University of Bern. During his seven years at the Charité hospital Maurer completed his specialist training as a radiologist, before moving to the University Hospital of Bern in 2014, where from 2015 he led the abdominal and urological radiology team. The use of radiological procedures, particularly in the abdominal cavity, is a key focus of Maurer's research.

Friederike Nastold

Art History with a Focus on Gender Studies

Dr Friederike Nastold is the new Junior Professor for "Art History with a Focus on Gender Studies" at the Institute of Art and Visual Culture. Before joining the University of Oldenburg, she held a substitute professorship at the Karlsruhe University of Education.
Nastold studied fine arts, German language and literature and educational sciences at the University of Mainz and the University of Granada's Faculty of Arts (Spain). After obtaining her Master of Education degree, she completed a master's programme at the Academy of Fine Arts Mainz and went on to earn her PhD at the University of Mainz and the Academy of Fine Arts Mainz. In 2021 she became a research associate at the Burg Giebichenstein Kunsthochschule Halle. In her research and teaching, Nastold links questions from the arts and visual culture with approaches from gender and queer theory. Her research interests also include performance studies, psychoanalytical cultural theory and affect theory. In 2015 she founded TOYTOYTOY, a collective which operates at the intersection of art, mediation and theory from a feminist perspective and organises lectures, workshops and event series.

Peter Rott

Civil Law, Commercial Law and Information Law

Prof. Dr Peter Rott has been appointed Professor of "Civil Law, Commercial Law and Information Law" at the Department of Business Administration, Economics and Law. He had previously held the professorship on an interim basis. Rott studied law with a supplementary degree in economics at the University of Bayreuth and completed his PhD at the University of Erlangen-Nuremberg in 2002. In addition to several posts abroad at the universities of Sheffield (UK), Copenhagen (Denmark) and Ghent (Belgium), he was a junior professor at the University of Bremen and a professor at the University of Kassel. His research focuses on European private law and German and European consumer protection law. The legal challenges posed by a changing world, such as sustainability, globalisation of supply chains and the privatisation of state-run services, are among his main areas of interest. Currently his key focus is on legal issues related to the digitalisation of economy and society, where he concentrates on the consumer and user perspectives.

Marius Sältzer

Digital Social Science

Dr Marius Sältzer has been appointed Junior Professor of "Digital Social Science" at the Institute for Social Sciences. Before moving to Oldenburg, he was a postdoctoral researcher at the GESIS Leibniz Institute for the Social Sciences in Cologne. Sältzer studied economics and political science in Mannheim and Hamburg. His doctoral dissertation, which he completed in 2021 at the University of Mannheim, dealt with methods for analysing the positions and priorities of politicians based on their posts on social media. As a postdoctoral researcher, he first took up a post at the University of Basel (Switzerland) and then moved to the Computational Social Science department at the GESIS Leibniz Institute.
Sältzer's research interests include party politics, political communication, social media and data science. He is particularly interested in how new data sources and machine learning – an AI method – can be employed in the social sciences. He uses these innovative methods among other things to analyse political communication on social media.

Pascale Sandmann

Clinical Audiology

Dr Pascale Sandmann has been appointed Professor of "Clinical Audiology" at the Department of Human Medicine. She also took over as head of the Department of Audiology at the Otorhinolaryngology Department of the Evangelisches Krankenhaus Oldenburg at the same time. Sandmann studied zoology and neuropsychology at the University of Zurich (Switzerland) and completed her doctorate in neuropsychology there in 2009. She then joined the University of Oldenburg's Neuropsychology Lab in 2010. After three years there, she moved to the Medizinische Hochschule Hannover (MHH) to take up the position of Junior Professor of "Audiological Diagnostics" in the Hearing4all Cluster of Excellence. In 2015 she moved to Cologne, where she became an academic audiologist at the university's Department of Otolaryngology and then head of audiology and paediatric audiology as well as audiological head of the Cochlear Implant Centre Cologne. She completed her habilitation in 2021. Sandmann specialises in objective audiometry, which focuses on the measurement of hearing ability beyond subjective hearing tests. She also researches methods for testing the hearing and speech comprehension of cochlear implant users.

Simon T. Schäfer

Anaesthesiology, Intensive Care Medicine, Emergency Medicine and Pain Therapy

Prof. Dr Simon T. Schäfer is the new Professor of "Anaesthesiology, Intensive Care Medicine, Emergency Medicine and Pain Therapy" at the Department of Human Medicine, and was appointed director of the department of the same name at the Klinikum Oldenburg.
Schäfer studied human medicine in Regensburg and at the Technical University of Munich, where he received his doctorate in 2003. He then worked at the university hospitals in Erlangen and Essen and at the same time completed a part-time Master's degree programme in Health Business Administration. He earned his habilitation at Universitätsklinikum Essen and then returned to Munich the following year to work at the department of Anaesthesiology of the Ludwig-Maximilians-Universität-München (LMU), where he was appointed leading anaesthesiologist of the pediatric liver transplant program. Subsequently, he became vice chair of the department of anaesthesiology at LMU Munich and furthermore associate professor at LMU in 2020. Schäfer conducts research in the field of geriatric anaesthesia, which focuses on considerations when using anaesthesia in older persons. He also studies new methods for analysing the coagulation properties of blood and investigates hypoxia tolerance (mechanisms for compensating for oxygen deficiency in organs or tissue).

Lars Schwettmann

Health Economics

Dr Lars Schwettmann has been appointed Professor of "Health Economics" at the Department of Health Services Research. Before coming to Oldenburg, he led several research projects at Helmholtz Zentrum München – German Research Centre for Environmental Health (HMGU) and taught at the University Halle-Wittenberg (MLU). Schwettmann studied economics at the University of Osnabrück and earned a Master's degree in economics at the University of Birmingham (UK). He completed his PhD in Osnabrück in 2008 and earned his habilitation at the University Halle-Wittenberg in 2015. In 2016, he moved to HMGU, where he led the research group Quantitative Methods in Health Economics.
Schwettmann's research examines various aspects of health services, with special attention to regional inequality and vulnerable groups. He also investigates methods for measuring the costs and effects of public health measures. Another research focus is on behavioural economics, prevention, and health behaviour.

Philipp Staudt

Environmental and Sustainable Information Systems

Dr Philipp Staudt has been appointed Junior Professor of „Environmental and Sustainable Information Systems" at the university's Department of Computing Science. Before coming to Oldenburg, he was a postdoctoral researcher at the Massachusetts Institute of Technology (MIT) in Cambridge, USA. Staudt studied Industrial Engineering and Business Mathematics at the Karlsruhe Institute of Technology (KIT), where he also earned his PhD. After heading a research group and serving as an interim professor he moved to the US to take up the position at MIT. Staudt's research interests include digital tools for analysing energy consumption, the use of data to increase corporate sustainability, and the sustainability of the platform economy. He is investigating how digital tools can help individuals to better understand their energy consumption and how organisations can use their data to implement sustainable innovations in decision-making processes. In recent years he has also conducted extensive research on energy markets.

Gesa Wellmann

History of Philosophy

Dr Gesa Wellmann has been appointed Junior Professor of "History of Philosophy" at the Institute of Philosophy. She was previously a research associate at the University of Wuppertal's philosophy department.
Born in Oldenburg, Wellmann studied philosophy at the Freie Universität Berlin and the Katholieke Universiteit Leuven (Belgium). After completing her bachelor's degree in 2011 and master's degrees in 2013 and 2014, she earned her PhD in 2018 in Leuven with a dissertation on the concept of a metaphysical system in the works of Lambert, Kant, Reinhold and Fichte. She then took a position as a research associate at the University of Basel (Switzerland), before moving to the University of Wuppertal in 2019.
Wellmann's main fields of research are German idealism, its impact and its history, philosophy of the Enlightenment and postcolonial theory. Her current research topics include a decolonial critique of the concept of history in the European Enlightenment and German idealism as well as questions regarding the conditions of immanent self-criticism.

Matthias Wendland

Civil Law and Digital Transformation Law

Prof. Dr Matthias Wendland has been appointed Professor of "Civil Law and Digital Transformation Law" at the Department of Business Administration, Economics and Law. He was previously Professor of "Civil Law, Business Law and Information and Data Law" at the University of Graz (Austria).
Wendland studied law at the Humboldt-Universität zu Berlin, the KU Leuven (Belgium) and the Fletcher School of Law and Diplomacy (Massachusetts, USA). He then earned a Master of Laws degree (LL.M.) at Harvard Law School. In 2015 he received a PhD for his award-winning fundamental work on the relationship between mediation and civil procedure from the Ludwig-Maximilians-Universität München, and went on to earn his habilitation there.
His authorisation to teach (Venia Legendi) covers civil law, civil procedural law and private international law, as well as comparative law, legal philosophy and sociology of law. Prof. Wendland's main fields of research are commercial law, civil procedural law, IT law and artificial intelligence laws. He focuses on the question of how laws can react flexibly to the challenges posed by the digital transformation in areas such as data protection, medical law, IT security and the use of algorithmic systems.

IMPRINT

Issue 68, 38th year of publication - ISSN 0930/8253
uol.de/en/einblicke
Press & Communications Office
Ammerländer Heerstraße 136
26129 Oldenburg
Phone: +49/441-798-5446
Fax: -5545 - presse@uol.de

Publisher:
Presidential Chair of the
Carl von Ossietzky University of Oldenburg

Chief Editors:
Dr Corinna Dahm-Brey, Ute Kehse

Editors:
Dr Constanze Böttcher,
Dr Henning Kulbarsch (volunteer), Sonja Niemann,
Volker Sandmann, Deike Stolz

Freelance work:
Tim Schröder

Layout, Design and Grafic:
Inka Schwarze, Per Ruppel

Translations:
Lucy Powell, Alison Waldie

Printed by:
Officina-Druck - Posthalterweg 1b
26129 Oldenburg
Phone: +49/441-36144220
info@officina.de

Photos:
AdobeStock/Antonio: p. 6/7
AdobeStock/meepoohyaphoto: p. 18/19
AdobeStock/Naeblys: p. 5, 26/27
AdobeStock/kovgabor79: p. 34/35
Mohssen Assanimoghaddam: p. 5, 30/31, 32, 32/33, 33
Johannes Bichmann/SOUL Photo: p. 24
DLR, CC BY-NC-ND 3.0: p. 14
Axel Hamprecht: p. 50/51
Daniel Schmidt: p. 4, 5, 8/9, 10 (2x), 20, 28, 36
This image was generated using the online AI image creator Playground AI. The prompt was: "An AI device devours the knowledge of the world in the form of books, movies and photographs": p. 22

Paper: PEFC certified