

Cover: H. Schulze Eißing, XENON-Collaboration  
*XENON1T experiment in the Italian Gran Sasso underground laboratory with a water tank for radiation shielding (left) and the technical building (right).*

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## Statement by the Executive Committee

# AI, ChatGPT and the Sciences

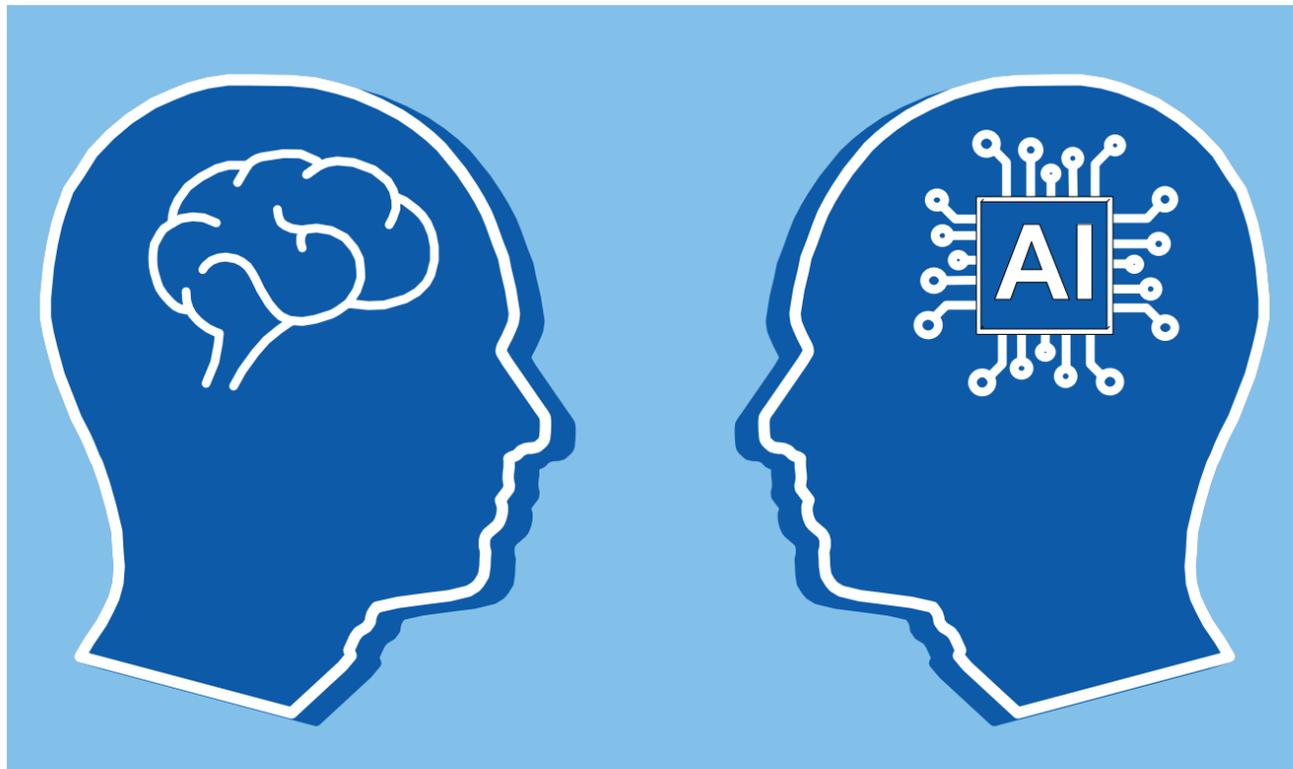
*Generative models for text and image creation are already changing the entire scientific work process in a whole range of different ways. In view of the great opportunities and development potential they offer, their use should by no means be ruled out, but binding framework conditions are needed so as to ensure good research practice and the quality of research results.*

The DFG has formulated initial guidelines for dealing with generative models for text and image creation. A statement now published by the Executive Committee of the largest research funding organisation and central self-governing organisation for science and the humanities in Germany sheds light on the influence of ChatGPT and other generative AI models on science and the humanities and on the DFG's funding activities. As a starting point for continuous monitoring and support, the paper seeks to provide guidance for researchers in their work as well as for applicants to the DFG

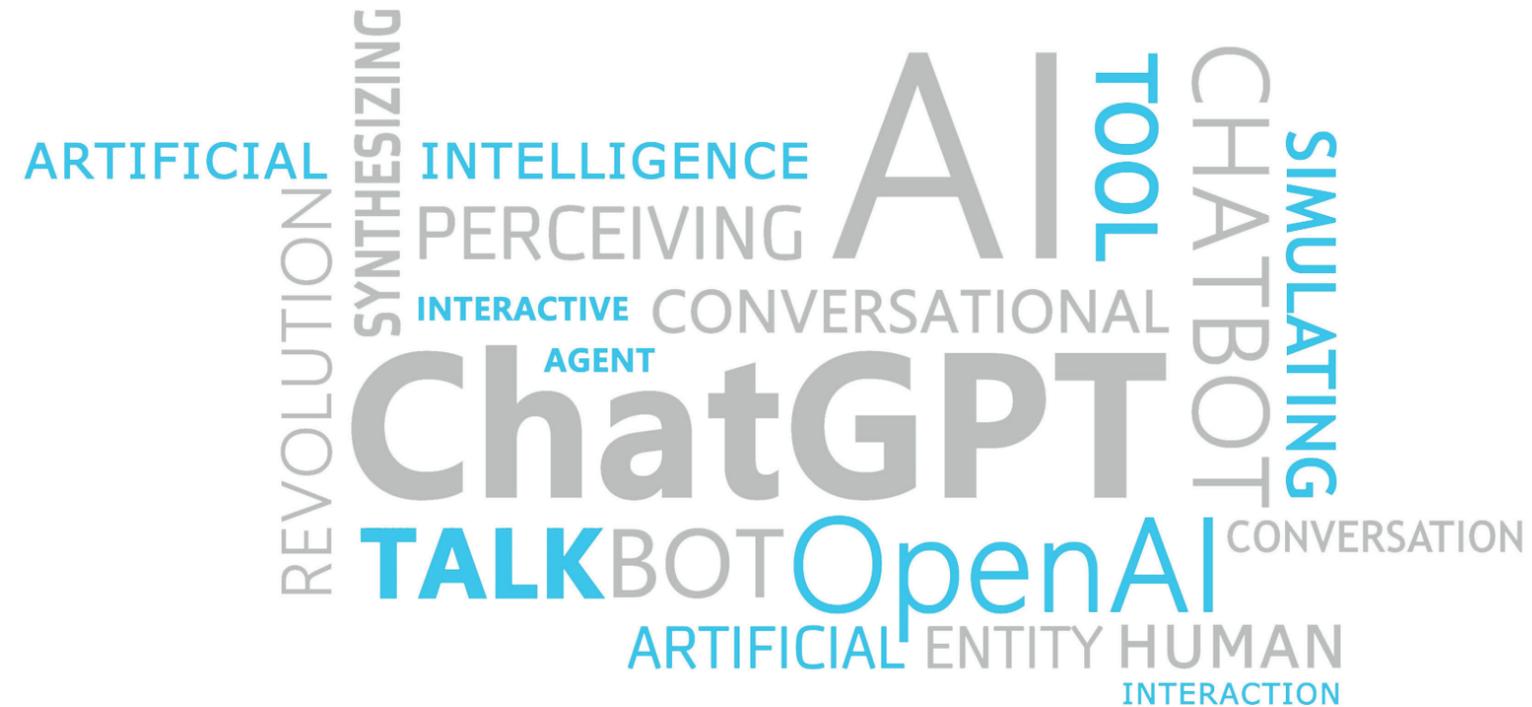
and those involved in the review, evaluation and decision-making process.

In the view of the DFG Executive Committee, AI technologies are already changing the entire work process in science and the humanities, knowledge production and creativity to a significant degree and are being used in various ways in the different research disciplines, albeit for differing purposes. In terms of generative models for text and image creation, this development is still very much in its infancy.

"In view of its considerable opportunities and development potential, the use of generative models in



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the context of research work should by no means be ruled out", says the paper: "However, certain binding framework conditions will be required in order to ensure good research practice and the quality of research results." Here, too, the standards of good research practice generally established in science and the humanities are fundamental.

In terms of concrete guidelines, the DFG Executive Committee says that when making their results publicly available, researchers should disclose whether or not they have used generative models and if so, which ones, for what purpose and to what extent. This also includes funding proposals submitted to the DFG. The use of such models does not relieve researchers of their own content-related and formal responsibility to adhere to the basic principles of research integrity.

Only the natural persons responsible may appear as authors in research publications, states the paper. "They must ensure that the use of generative models does not infringe anyone else's intellectual property and does not result in scientific misconduct, for example in the form of plagiarism", the paper goes on.

The use of generative models based on these principles is to be permissible when submitting proposals to the DFG. In the preparation of reviews, on the other

hand, their use is inadmissible due to the confidentiality of assessment process, states the paper, adding: "Documents provided for review are confidential and in particular may not be used as input for generative models."

Instructions to applicants and to those involved in the evaluation process are currently being added to the relevant documents and technical systems at the DFG Head Office.

Following on from these initial guidelines, the DFG intends to analyse and assess the opportunities and potential risks of using generative models in science and the humanities and in its own funding activities on an ongoing basis. A Senate Working Group on the Digital Turn is to address overarching epistemic and subject-specific issues in this context. Any possible impact in connection with acts of scientific misconduct are to be addressed by the DFG Commission on the Revision of the Rules of Procedure for Dealing with Scientific Misconduct. The DFG will also be issuing further statements in an effort to contribute to a "discursive and science-based process" in the use of generative models.



Illustration: DFG/Bildschön

## Another Four Years at the Helm

*DFG President Katja Becker elected for a second term with an impressive vote*

**K**atja Becker will continue as President of the DFG for another four years. At the DFG annual meeting in Saarbrücken on 28 June, the 58-year-old biochemist and physician from Gießen was elected by an overwhelming majority to retain office for a second term, starting on 1 January 2024.

The impressive vote was a sign of both recognition and respect for the work done to date by the DFG President, who has held this office since January 2020 – the first female researcher to do so. Together with her organisation, she has taken on a whole series of previously unforeseen challenges of global proportions over the past three and a half years: whether the coronavirus pandemic that broke out only a few weeks after

she took office or the Russian attack on Ukraine two years later – Becker has always demonstrated close personal involvement in the DFG's activities aimed at tackling these crises.

As chair of the Governing Board of the Global Research Council, she was also very active internationally, while at the same time providing numerous impulses to the outside world and to the DFG to boost exploitation of the research potential of universities of applied sciences, for example, and on the issues of diversity and sustainability; she also supported closer dialogue on a more equal footing between all stakeholders within the DFG and in the research system in general, as well as with policymakers and with the public at large.

In addition to current issues, Becker considers a number of other topics to be important for the coming years, as she explained in Saarbrücken: she said these included the second round of the Excellence Strategy of the federal and state governments, in which the DFG is responsible for the Clusters of Excellence competition, as well as securing funding for the DFG and for research in Germany as a whole in the face of dwindling resources. Becker also believes that important discussions lie ahead regarding issues of research quality and the research process. What is more, she firmly believes that the internationalisation of the German research system will continue to be of great importance.

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## Strengthening Transatlantic Partnerships

North American trip by the DFG President / Expansion of bilateral funding opportunities / Signing of the first Memorandum of Understanding with Canadian SSHRC

**W**ith the aim of deepening transatlantic cooperation in science and research, not least in the face of major geopolitical challenges, DFG President Professor Dr. Katja Becker took a trip to Canada and the USA at the end of August that lasted several days. In Ottawa she visited the Canadian Institutes of Health Research (CIHR) and the Natural Sciences and Engineering Research Council of Canada (NSERC). Becker signed a Memorandum of Understanding with the Social Sciences and Humanities Research Council (SSHRC) in Ottawa. As the DFG's first comprehensive agreement with the SSHRC, this seeks to facilitate collaborations in the humanities and social sciences in particular. On the following day, the DFG delegation travelled on to Washington DC for consultations with US partner organisations.

In the US capital, the DFG President held talks at the Howard Hughes Medical Institute (HHMI) as well as meeting the new Ambassador of the Federal Republic of Germany to the United States of America, Andreas Michaelis. This meeting also involved discussion of cooperation with the German consulates general and embassies in the

US, which work closely with the DFG's three locations in North America: in addition to its offices in Washington DC and New York, the DFG opened a branch at the German Centre for Research and Innovation (DWIH) in San Francisco just a year ago.

[www.dfg.de/en/service/press/press\\_releases/2023/press\\_release\\_no\\_36](http://www.dfg.de/en/service/press/press_releases/2023/press_release_no_36)

*DFG President Katja Becker and SSHRC President Ted Hewitt at the signing of the MoU.*



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**Network conference is held face-to-face once again:** *Approximately 500 participants, including 230 postdocs, met in Boston at the invitation of the German Academic International Network (GAIN) from 25 to 27 August. At the 2023 GAIN annual conference, the aim was once again to bring researchers in the postdoc phase into contact and dialogue with representatives of the German scientific community, politics and business. At the traditional "Talent Fair", 60 institutions provided information on career opportunities and vacancies, including the DFG, the DAAD and the AvH, while on the evening of 26 August, the DFG welcomed around 110 postdocs who are currently in the USA on a DFG fellowship.*



Illustration: DFG



Illustration: Shutterstock / Markus Pfaff

# Dealing with Risks in International Research Cooperation

The DFG presents recommendations for greater certainty in the proposal submission and review process / Meaningful assessment and reflection rather than “red lines”

The potential risks involved in international research cooperation projects funded by the DFG shall henceforth be subjected to a more thorough and systematic reflection. To this end, the DFG has put forward recommendations that

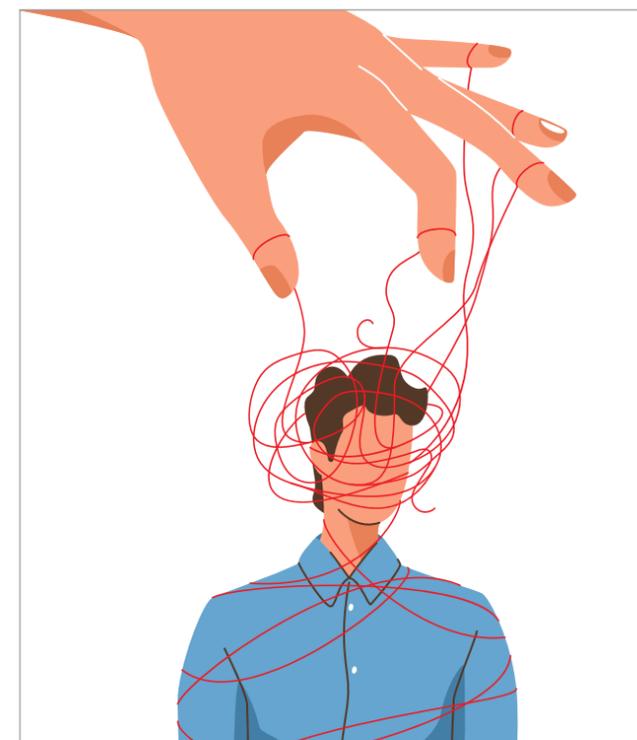
have recently been approved by its Joint Committee. These recommendations, which apply particularly to the cooperation with researchers in authoritarian countries, aim to enable researchers to realistically assess the risks of misuse of research re-

sults, on the basis of which carefully balanced decisions can be reached. While primarily aimed at individual and institutional applicants, the recommendations can also be drawn on in the DFG’s review and decision-making process.

“The exchange of data, experience and skills between people, which is integral to research cooperation, can always entail risks. These not only depend on the research subject, but also on the cooperation partners as well as the political objectives and powers of the authorities within the cooperation country”, said DFG President Professor Dr. Katja Becker when presenting the recommendations. “The DFG therefore considers it necessary to obtain a balanced view of all international collaborations within DFG funded projects. We are deliberately refraining from drawing general ‘red lines’ with regard to specific countries, partner institutions or research topics, because freedom of research is of high and constitutionally protected value. We have instead compiled a list of assessment and reflection steps that are intended to point out potential risks and give our applicants greater clarity and safety. This will enable us to react jointly and in a timely manner to geopolitical shifts, and to promote a reflective approach to the benefits and risks associated with research activities.”

According to the recommendations now published, applicants wishing to cooperate with international partners are tasked to be as specific as possible in explaining the risks that could arise. This should include a review of aspects such as whether the respective partner institution conducts research for military or comparable purposes

and whether systematic diversion of research data is conceivable or even likely. The research subject should also be reviewed in terms of critical application or exploitation opportunities. The reflection



Graphic: Shutterstock / Zaie

should also consider any restrictions on the freedom of research in the cooperation country, for instance with respect to the publication of project results.

The basic principle behind all recommended assessment and reflection steps is that the greater the risks or the appearance of risks are, the more precise and detailed the justification for the research project must be. Conversely, a brief explanation is sufficient if there are no discernible risks relating to a proposed project.

Researchers should also be able to rely on their higher education institutions and non-university research institutes, which bear the legal responsibility for such coop-

erations and can actively shape the framework conditions of research. In addition to assistance with adherence to legal obligations, this includes the ongoing support via the Committees for Ethics in Security-Relevant Research (Kommissionen für Ethik sicherheitsrelevanter Forschung, KEF). Researchers are also encouraged to closely exchange relevant information in their research communities and seek the cooperation of the committees and commissioners already established at many research institutions when weighing up the risks and benefits of specific collaborations.

The corresponding information for applicants on dealing with risks in international research cooperation and for those involved in the evaluation process are currently being added to the relevant documents and technical systems at the DFG Head Office.

The new risk assessments will supplement the existing provisions, such as the Recommendations for Handling Security-Relevant Research and its Challenges (Dual Use) published in 2015 by a joint scientific commission established by the DFG and Leopoldina, which also addressed the international dimension of research and was last updated in November 2022. The recommendations now published are also to be regularly adapted to new developments.



Andrea Flack

# Lifetime Monitoring

Tracking technologies can be used to record the movement patterns and migration behaviour of white storks. Ornithologists want to utilise them to decipher which knowledge is innate and which is learned from other conspecifics or is environmentally dependent.



*Elegant and enduring: a white stork in flight. It is well known that storks migrate south in winter. Their flight routes take them either east or west around the Mediterranean – mostly, but not just to regions south of the Sahara.*

A colloquial saying suggests that “with age comes wisdom”, but have you ever wondered whether this proverb also applies to animals? To migratory birds, for example? Some people consider migratory birds to be particularly wise, because they fly south before our grey winter to enjoy more pleasant climate and living conditions during the cold season. Migratory birds of all ages undertake these journeys and they often begin to do so shortly after they leave the nest for the first time. How do they know which way they need to fly? There are species that “simply know”. Their innate migratory behaviour tells them when, how far and in which direction they need

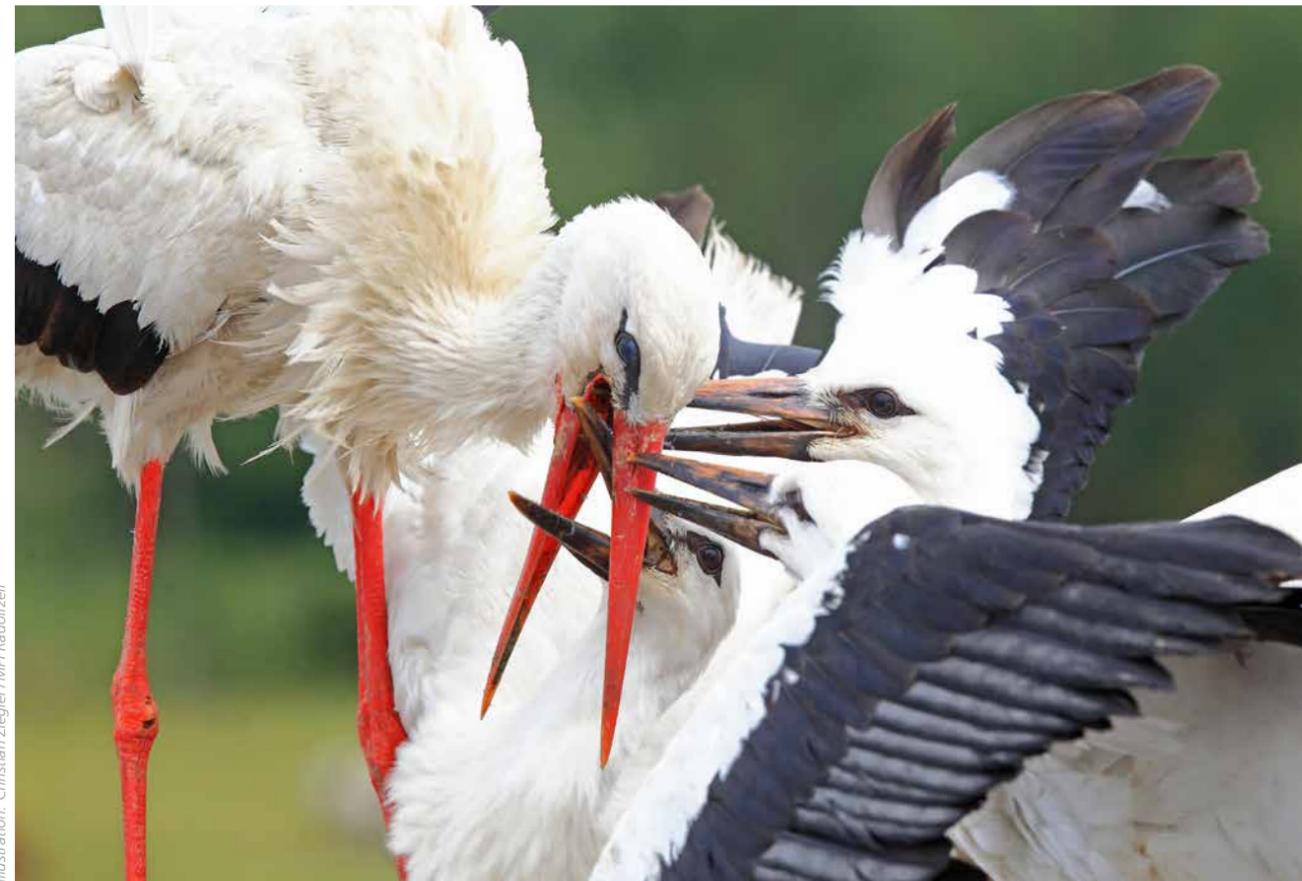
to fly. The cuckoo is a well-known example of this.

Yet there are also species in which inexperienced young birds follow their parents or other experienced conspecifics to reach suitable winter quarters. We can often observe geese families flying in formation during autumn. Regardless of where this “first knowledge” comes from, it is known that in many bird species the migratory behaviour of adult birds differs from that of young birds. The flight routes and flight times of experienced birds are often shorter, meaning that migratory behaviour is not fixed, but develops over the course of life, especially in long-lived species. The question therefore arises: do migratory birds

actually become more efficient (or wiser) in old age, or is it only those animals that have been wise since birth that survive? And if there is an observable individual development in migratory behaviour – biologists speak of “ontogeny” – what are the individual, social and environmental factors that play a role in this?

My working group focuses on how and why the migratory behaviour of long-distance migrants changes over the course of their lives. Which abilities are innate and which change during life? The role of social interactions is also of great interest. The subject of all our studies is the white stork (*Ciconia ciconia*), a migratory bird that is common in Europe. White storks

*Feeding is on the agenda – the offspring is already waiting. The white stork (*Ciconia ciconia*) is a breeding and migratory bird that is common in Europe. As a cultivator, it has adapted to people and their lifestyles in towns and cities as well as in the countryside.*



*Photographed through the wire mesh fence: young storks in an aviary. The behavioural study involves the start of their southerly migration being delayed somewhat – the animals are thus exposed to different starting and environmental conditions for research purposes.*

are probably among the most well-known and best studied migratory birds. Much is known about the phenomenon of stork migration after almost 150 years of research.

This extensive knowledge is also available because the size of white storks means that they can be easily researched by attaching small telemetry transmitters to their backs. These so-called tracking devices can record the positions, movements and behaviour of the animals in high resolution over the span of their entire lives. The GPS recordings in combination with acceleration sensors can for instance reveal their detailed movement patterns during the migration flight. This makes it possible to estimate how costly these movements are in terms of energy. What is crucial is that the information from the solar-powered

transmitters is regularly received via the mobile network – regardless of whether the storks are standing on a roof in their home territory, foraging on a landfill in Spain or striding through the savannah in Africa. In other words: they record the complete life paths of storks – from their first to their last flight.

This path begins with their first southerly migration four to six weeks after leaving the birth nest. Contrary to what is often assumed, young storks do not undertake this journey with their parents, but fly in flocks with many other young storks. But who stipulates the direction taken by these groups? Do the storks interact with one another? Our team discovered in an earlier study that there are two different types of birds in these groups: so-

called followers and a few leading storks. Leading storks fly a little further ahead and have to find the optimal, most energy-efficient flight path, while the followers fly behind and benefit from the decisions taken by the leading storks.

Yet their better flying skills mean that the leading storks are so fast that the followers have difficulty in keeping up with them, so they frequently have to switch from gliding to active flapping – a highly energy-consuming form of motion for such large birds! These differing abilities also affect how far south the storks can fly: leading storks from Lake Constance migrate all the way to West Africa, while the followers often end their migration in Spain. The study also revealed that storks benefit from social interactions during their mi-

gration, since they use each other as a source of information.

Mere observational studies are insufficient if we want to examine the level of influence that this social component has upon the learning of migratory behaviour. That is why the team is combining the transmitter studies with field-based behavioural experiments. What does that mean? The underlying conditions that could be relevant to the development of migratory behaviour (such as social environment) are altered to then record in detail how the animals react to it. The start of young storks' migration

period was for example postponed by holding them in aviaries for a short time. This forced them not only to fly under different environmental conditions (in late summer rather than mid-summer), but also in a changed social environment comprising older animals. Older storks that have flown south multiple times already usually only migrate at the end of summer.

The experiment documents that the young white storks' delayed migration time influences both the immediate "flight costs" and their long-term migration decisions. The acceleration sensors indicated that

the manipulated young storks flew faster than their conspecifics who started earlier and flapped their wings more often. The delayed animals flew less far in the first and the following year. They overwintered with the old storks – not in Africa, but in Spain. This suggests that the timing of migration is crucial in terms of both environmental and social conditions and for learning migratory behaviour.

**F**urther factors are to be considered over the coming years. What happens, for example, if you move experienced storks who have

*View into a stork's nest with four young white storks. The research team attaches transmitters to the young animals when they are six to seven weeks old. A good time: they are fully grown at this age, but do not yet fly away.*



*Documentation: a stork equipped with a transmitter is weighed using a spring scale before it is released again (right). Other physical characteristics, such as beak height, are also measured and recorded (left).*

already learned their migration route to regions where the local storks choose a different migration route? Will they follow their conspecifics, even if this means they arrive at unknown overwintering areas? Or what happens if young storks don't even have the opportunity to migrate because they are transferred directly to their overwintering area? Will they return to their birth region, even if they never made the journey themselves and thus had no opportunity to learn about migration? Using the latest tracking technologies enables us to record their movements and behaviour. We can thus decipher which knowledge is innate to them and which is learned from other conspecifics – and also how this knowledge changes over the course of their lives.

In addition to these experiments, the research team is also conducting long-term observations of storks in south west Germany. Transmitters have been regularly attached to young storks for ten years. Interested observers can incidentally follow

the journeys of these "transmitting storks" live in the Animal Tracker app ([www.icarus.mpg.de/29143/animal-tracker-app](http://www.icarus.mpg.de/29143/animal-tracker-app)). These long-term records provide information on the individual life paths of storks and their development. Young storks, for example, have longer migration routes and try to minimise their "flight costs". Older storks shorten their journey, because time savings are more important for a breeding bird. The long-term study also provides information on the migratory behaviour of the entire population and how this alters due to human influence.

**A**n increasing number of storks no longer make the long journey across the Sahara, but rather overwinter in Spain or Morocco. The temperatures there are moderate even in winter, and there is sufficient food available at landfill sites. The studies also indicate that this strategy is paying off, since storks die less frequently when they overwinter north of the Sahara.

Whether this behaviour is actually wise and will therefore prevail among the population is an exciting question for the coming years. The answer will certainly depend not only on whether and when the last landfills in Spain are to be closed, but also on whether the storks can adapt to climate change. Our long-term study of the transmitting storks will reveal it.



**Dr. Andrea Flack**

has led the Emmy Noether Group "Understanding the Elements that Influence the Ontogeny of Migration in White Storks" at the Max Planck Institute of Animal Behavior since 2022.

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Rolf Wachter, Katrin Wasser and Klaus Gröschel



Illustration: iStock

## In Pursuit of Atrial Fibrillation

Cardiac arrhythmias after a stroke are particularly dangerous because they can easily trigger another attack. A nationwide clinical trial involving more than 5,000 patients now aims to reduce the number of secondary strokes based on an evidence-based approach.

Which illness do you fear the most? – this is a question a German health insurance company asks every year in a survey. The responses leave no doubt whatsoever: strokes are regularly cited as being one of the ailments people are most afraid of. Only cancer, dementia and accidents are feared more. A stroke is a sudden circulatory disorder of the brain that often has far-reaching consequences such as persistent disability or even death. About 270,000 people in Germany suffer a stroke each year.

One frequent cause of a stroke, especially in older patients, is the heart rhythm disorder known as

atrial fibrillation, which is easy to detect using an electrocardiogram (ECG). Atrial fibrillation can cause blood clots to form in the heart, which can be carried by the bloodstream to the head where they can block arteries, thereby causing a stroke. Atrial fibrillation increases the risk of a stroke by a factor of five, but blood-thinning medications called anticoagulants can reduce this risk by up to 70 percent.

There is one major problem with atrial fibrillation, however: in many of those in need of treatment, the cardiac arrhythmias do not necessarily occur permanently but only

occasionally. These so-called intermittent cardiac arrhythmias may last only a few minutes, but also several hours or days. The critical aspect here is that people often do not even notice it. It often goes unnoticed until they are admitted to hospital having suffered a stroke.

The search for intermittent atrial fibrillation begins immediately when they are in hospital, usually in a stroke unit specialised for this purpose. Recent studies indicate that the longer the search for such arrhythmias, the more frequently they are found. Studies have even included continuous rhythm monitoring

Left: Atrial fibrillation significantly increases the risk of suffering a stroke. Improved monitoring should provide help.

over three years. It is still an unresolved and controversial issue as to whether blood-thinning medication should be used to treat atrial fibrillation of very short duration occurring within a long period examination in patients who have previously suffered a stroke. Here it is important to weigh the benefits against the risks of the medication, as blood-thinning drugs can cause bleeding.

Neurologists at Mainz University Hospital and cardiologists at Leipzig University Hospital have been attempting to answer this ques-

tion for 14 years. They now believe they are only three and a half years away from the definitive answer – thanks to a long-standing research project that goes by the apt name of “Finding Atrial Fibrillation”, or “Find-AF” for short.

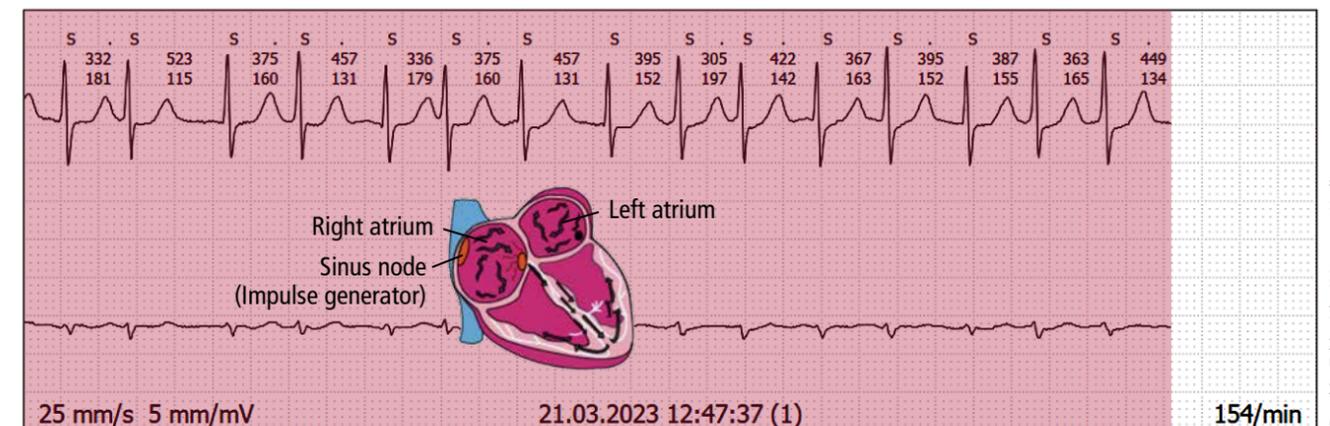
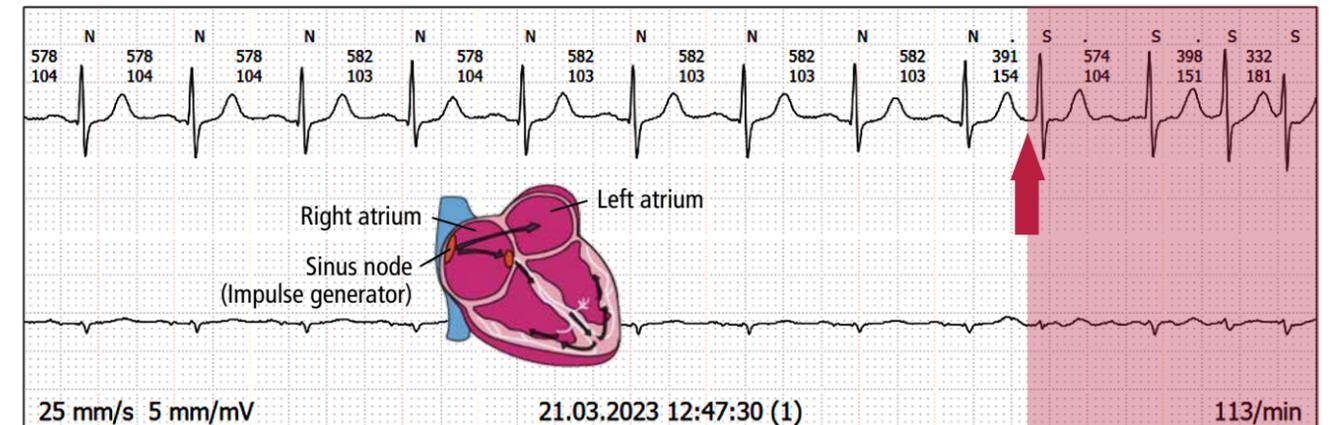
What led up to the current Find-AF 2 trial? It all started in 2009–2010 with an observational trial aimed at defining the measurable size of the clinical problem. For this purpose, all patients at University Medical Center Göttingen who had suffered a stroke were examined for the presence of atrial fibrillation based on a long-term ECG over a period of seven days. The surprising thing, also in retrospect, is that this question had never been pursued in such detail

before. One key outcome was that it was possible to detect atrial fibrillation in one out of eight individuals who had suffered a stroke.

In 2011, a randomised trial involving more than 2,500 patients was applied for under the DFG “Clinical Trials” programme, but it failed to gain the approval of the reviewers at the time. There were quite a few people who assumed that patients with short episodes of atrial fibrillation also needed to be treated with anticoagulants.

The next step involved another trial conducted in 2013 and 2014 which was called “Find-AF<sub>RANDOMISED</sub>”. This was a kind of dose-finding trial linked to the key question “How much heart rhythm monitoring is

Transition from regular heartbeat (sinus rhythm, white background) to atrial fibrillation (arrow). The pulse rate increases significantly (shorter intervals between two heartbeats).



Graphic: Tobias Uher/Montage: Herling

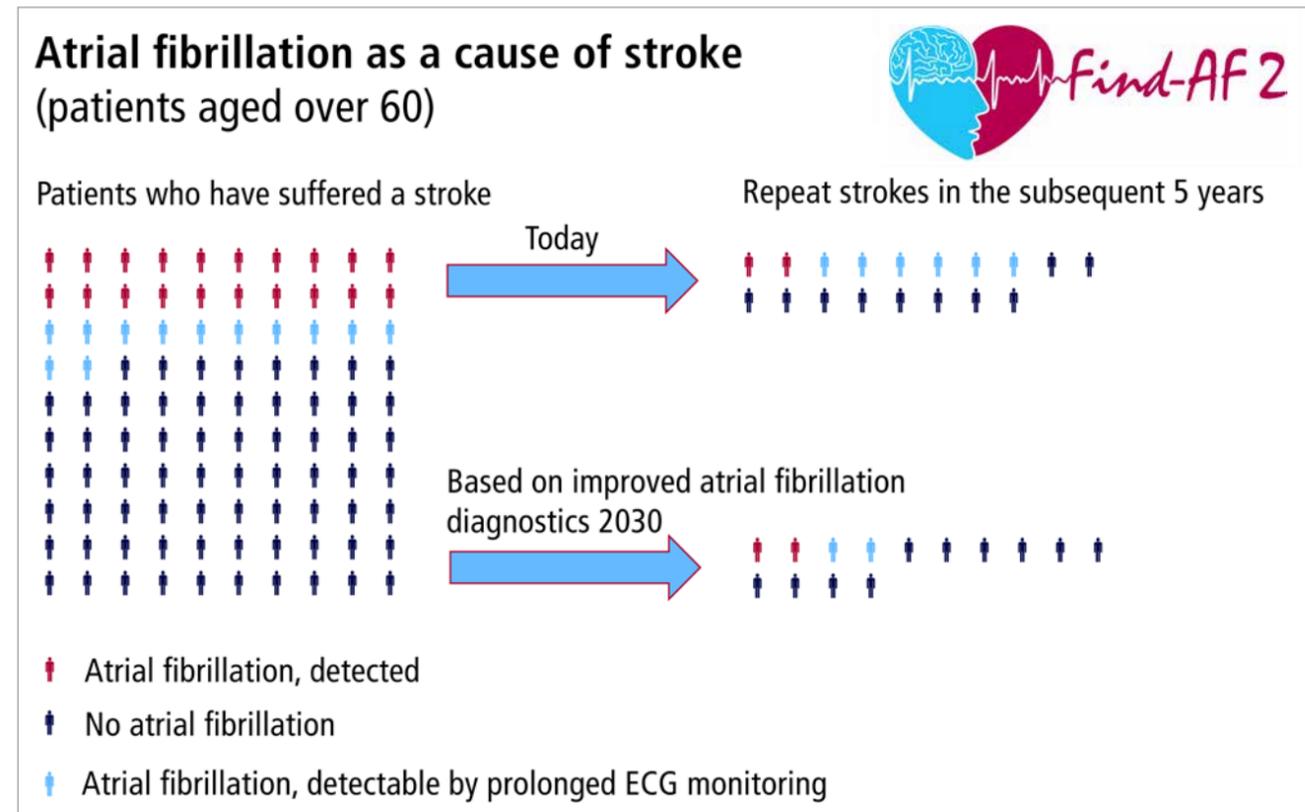
necessary to detect atrial fibrillation?" With research funding provided by the company Boehringer Ingelheim, this involved randomly allocating 398 people with atrial fibrillation to either heart rhythm monitoring for ten days on three occasions (immediately after the stroke, three months later and after six months later) or to the usual standard diagnostic procedure (usually 72 hours of heart rhythm monitoring). The result: heart rhythm monitoring detected atrial fibrillation three times more often after six months (13.5 percent to 4.5 percent). There was also a trend towards fewer recurrences of stroke and fewer deaths within three years. This was an indication that anticoagulation could prevent recurrent strokes during short episodes of atrial fibrillation.

The analysed data showed that a large and randomised trial would be useful and necessary. The Find-AF 2 trial was accepted for funding by the DFG as a clinical trial in 2019. Randomised trials with clinically relevant endpoints (e.g. stroke, heart attack, death) are considered the supreme discipline in clinical research. Trial participants are assigned to one or the other diagnosis or therapy by drawing lots. This is the only method that permits an independent comparison of two different methods or therapy procedures; it is called randomisation. The Find-AF 2 trial aims to answer the key question: can prolonged heart rhythm monitoring prevent strokes by starting therapy with blood-thinning drugs (anticoagulants) as soon as atrial fibrillation is detected?

Find-AF 2 benefited from interdisciplinary collaboration between cardiology and neurology right from the outset. By the end of the trial, 5,200 people will have participated who suffered a stroke within the preceding 30 days and are at least 60 years of age. Patients first receive a long-term ECG over a period of 24 hours. If they have no atrial fibrillation, they are assigned to the trial group or the control group by lots (i.e. on a randomised basis). In the control group, they then receive the usual follow-up examinations and therapies as they would in a stroke unit after suffering a stroke and are questioned regularly by the trial centre – at least every six months – as to whether new strokes have occurred.

In the trial group, patients also receive repeated long-term ECGs

5,200 stroke patients are to take part in the nationwide trial. The objective: fewer subsequent strokes through better diagnosis of atrial fibrillation.



For the purpose of heart monitoring, the patient has a so-called event recorder implanted under their skin. The data is transmitted by means of a long-term ECG device (enlarged, top left).

over a period of seven days at least once a year. If they are at high risk of developing atrial fibrillation, they receive a so-called event recorder: this is implanted under the skin and is able to record the heart rhythm for up to three years. Special devices are used to monitor heart rhythm which are the size of two matchsticks. The ECG data are regularly transmitted remotely for analysis by means of a transmission device that is placed on the bedside cabinet, for example.

Implementing the Find-AF 2 trial presents the team with a variety of challenges, including organisational ones. These are tackled by means of a clear trial design and defined procedures. Even the basic details of the trial indicate the demands involved: 5,200 patients who have suffered an

ischaemic stroke are to take part in the trial at 51 trial centres throughout the whole of Germany. Three years after the start of the trial, more than two thirds of the required subjects have already been recruited, despite the coronavirus pandemic. All 5,200 patients are to have been found for the trial by mid-2024. These will then be followed up for another two years up until mid-2026, so results can be expected in late 2026/early 2027.

One difficulty of randomised trials that is well-known because it is structural to the nature of such undertakings is that a network of partners and collaborations has to be established. In other words, patients have to be found at large and small sites and treated according to the trial protocol. In practice, it is very important to

ensure good accessibility of both the trial staff and the trial management, for example. In addition, support is needed from the university hospitals in Leipzig and Mainz.

Trial research is not only top-down work: all trial centres involved have the opportunity to develop their own clinical questions that can be answered based on the data generated by Find-AF 2. A transparent arrangement was agreed on in advance for shared participation in the results in the form of co-authorship. The trial team expects to be able to provide an evidence-based answer to the core question by the end of 2026. The hope is that the trial results will help prevent more patients from having another stroke. This has been a source of motivation for large numbers of participants over the course of 18 years – knowing that new evidence-based answers will also trigger or suggest further research questions in the future.



**Professor Dr. med. Rolf Wächter** is Professor of Clinical and Interventional Cardiology at the Leipzig University and leader of the Find-AF 2 trial.

**Private Lecturer Dr. med. Katrin Wasser**, neurologist at University Medical Center Göttingen, is the coordinator of the Find-AF 2 trial.

**Professor Dr. med. Klaus Gröschel**, University Hospital Mainz, is co-leader of the Find AF-2 trial.

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[www.find-af2.com/en](http://www.find-af2.com/en)



Monica Dunford and Tilman Plehn

# Abundantly Accelerated

The discovery of the Higgs particle was a spectacular success for the fundamental quantum field theory of elementary particles. Particle physicists are now attempting to discover further basic building blocks in the universe by means of elaborate experiments and measurements.

If young particle physicists are asked about their motivation to study or work in this field, the enthusiastic answer is often: “We currently understand less than 15 percent of the mass in the universe, and I want to know what constitutes the remaining 85 percent.” So what are these basic building blocks or elementary particles in the universe? And how do they exert forces upon each other, in other words, how do they interact with each other?

The first major question of particle physics concerns dark matter. Its existence is well known from a variety of cosmological observations. Yet, we don’t know what kind of particles are involved, how heavy they are and how they interact with visible matter. This interaction is interesting because the formation of the universe depends upon it. A second equally significant question is why the universe contains almost only matter and hardly any antimatter. The so-called Standard Model of particle physics – such a name for the fundamental quantum field theory of elementary particles is a PR disaster! – provides no explanation. And thirdly, the Higgs boson

may well have been discovered, but it is not yet understood how it interacts with other elementary particles. This interaction is linked to the universe’s ubiquitous Higgs field and the mass of particles. But how does this vacuum property actually arise and does it really only affect the Higgs particle?

Theoretical physics can formulate these questions in precise mathematical terms. This involves physicists using fundamental and universal laws. There is for instance no attempt to understand a particular system or to measure a certain quantity, but rather to examine whether this theory actually describes all of nature’s observed fundamental structures. The researchers involved are using quantum field theory, the extension of quantum mechanics to systems with antiparticles and vacuum effects such as the Higgs field.

Assuming that there must still be unknown elementary particles, the experimental questions

*XENON1T experiment in the Italian Gran Sasso underground laboratory with a water tank for radiation shielding (left) and the technical building (right).*

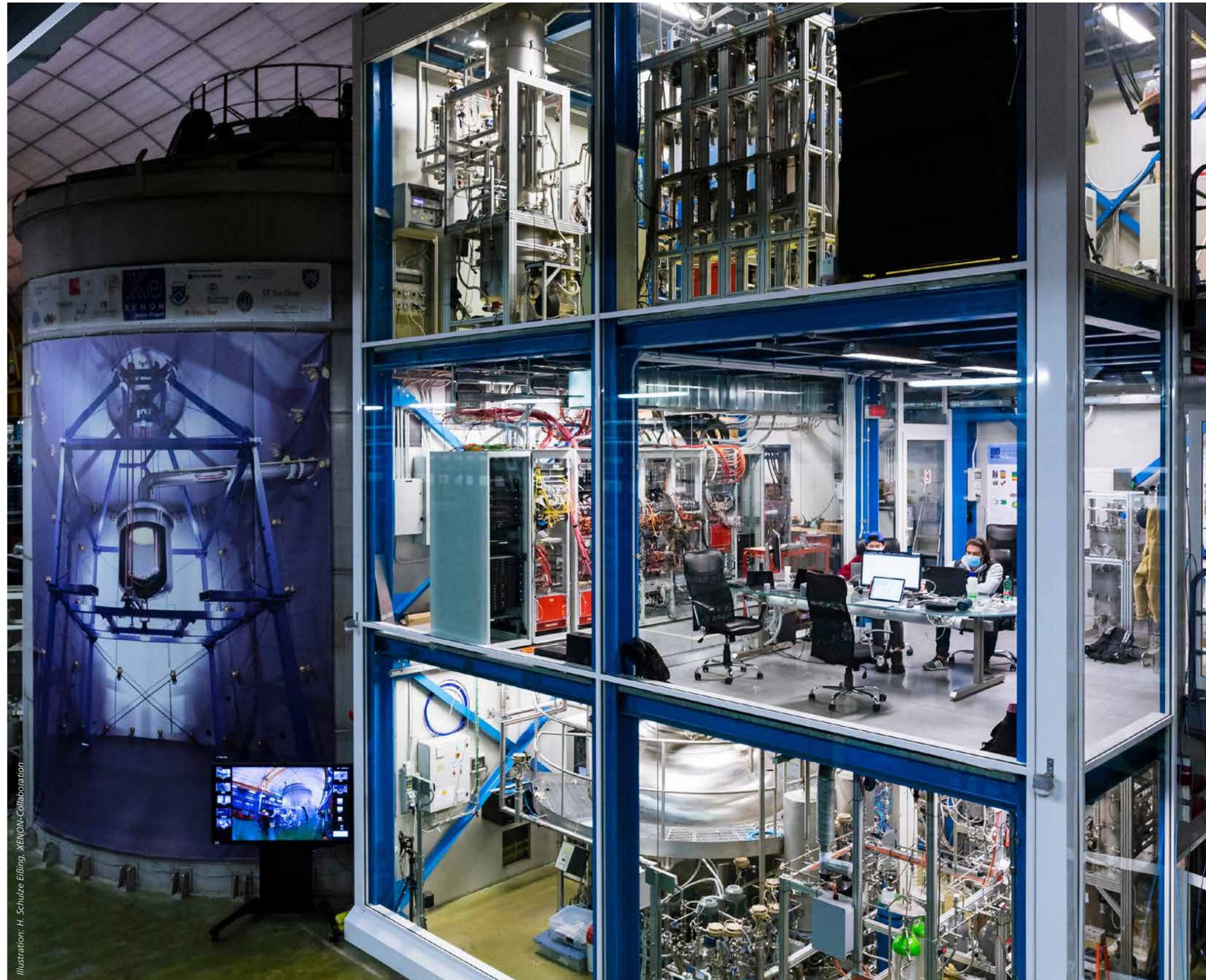


Illustration: H. Schulze Eibing, XENON-Collaboration



Illustration: Laurent Thion, ecliptique.com

The SuperSUN source of ultracold neutrons can for instance be used to measure dipole moments at Institut Laue-Langevin in Grenoble.

are whether they would be light enough to be produced in an experiment; and whether they would interact strongly enough with a detector to enable their observation. There is also a degree of inequality among particles. The Large Hadron Collider (LHC), a particle accelerator at the CERN European Nuclear Research Center near Geneva, has discovered more than 60 new particles, yet only the Higgs boson was

greeted with such acclaim and attracted huge media attention. It is unfortunate, but all these other particles reveal little about fundamental interactions. The core topic of particle physics is therefore to learn fundamental physics from the combination of simulations, theoretical calculations and measurements. Fundamental theories or models can always be used to describe data. The researchers are therefore inter-

ested in a fundamental theory, however this theory cannot be expected to be able to adequately describe systems beyond a certain level of complexity.

Major discoveries need an experimental lever, be it huge distances in space and time, high energies, vast amounts of data or extreme accuracy. Particle physics experiments are a balance between

is the world's first precision proton accelerator, in experimental and theoretical terms. This specifically means that interactions among elementary particles have never been understood so precisely as with the help of the LHC.

An example of some smaller experiments at CERN is the FASER experiment – just as international as the large LHC experiments, but with smaller groups, a smaller budget and greater individual design freedom. FASER, ForwArD Search Experiment, was one of the eight particle physics experiments conducted at the LHC in 2022. It intends to search for new light and weakly coupled elementary particles, and to detect interactions among high-energy neutrinos. Other specialised experiments measure the properties of bottom quarks or charm quarks, or search for electric dipole moments or new light particles. Experiments in traditional atomic physics can search for new interactions or very light particles within spectral lines. Many of these specialised experiments depend upon their precision and the measurement of rare events. The search for dark matter poses many challenges, since it involves bringing together various experiments from the direct searches for cosmic dark matter, to indirect searches for the production of dark matter in the universe, and to accelerator experiments.

The length of time required for development and construction makes it vital that all particle physics experiments repeatedly find unplanned, new applications. An example of this is the XENON experiment, which involves a collaboration among several universities and laboratories in the Gran Sasso underground laboratory. It was built

to search for heavy dark matter particles in scattering on xenon atoms and is now successfully searching for light dark matter particles in scattering on electrons.

Looking back a few years, the LHCb experiment (LHCb stands for Large Hadron Collider beauty) had already discovered most of the 60-plus new above-mentioned particles, yet it was not built for this, nor for its measurements of the particles which propagate the weak force. In many cases, therefore, the boundaries between the search for dark matter on the one hand and neutrino physics on the other are currently blurred. All these aspects create dynamics within particle physics. The era of the LHC and its associated possibilities has only just begun. The first objective was the discovery of the Higgs boson. But LHC methodology has fundamentally altered since then, away from searching for specific new particles and toward a comprehensive understanding of the LHC data either via the Standard Model or preferably via new particles. A new set of experiments is therefore to be used until 2040 to analyse 25 times more data than previously.

From a data science perspective, the LHC produces one of the largest and most interesting datasets in the world. The data volumes are comparable to commercial datasets, but are investigated under fully controlled experimental conditions with corresponding precise simulations. LHC analyses combine fundamental issues with precision analysis of a massive dataset. Can these data be understood in all aspects by means of fundamental quantum field theory or do they disclose something about new

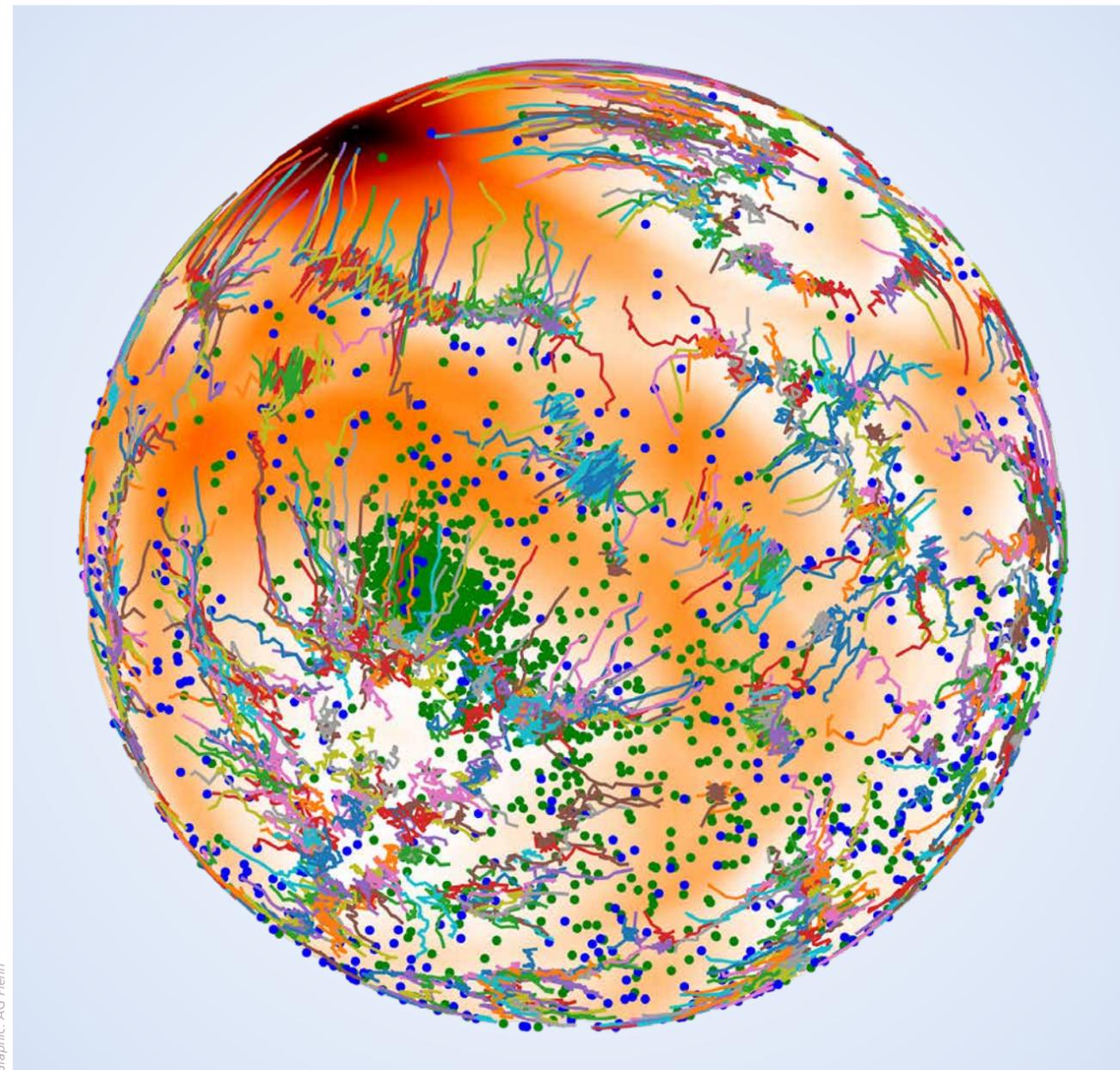
elementary particles? The amount of data alone is a challenge if we consider LHC physics from a data science perspective. A single LHC experiment generates around one petabyte of data per second, of which only around 300 megabytes can be stored. The previous focus of the chips and algorithms that filter

out the interesting collisions from the data flow was on hypothetical new particles and interesting analyses. Data compression has nowadays become crucial at this point and should, if possible, be as low-loss like when streaming videos.

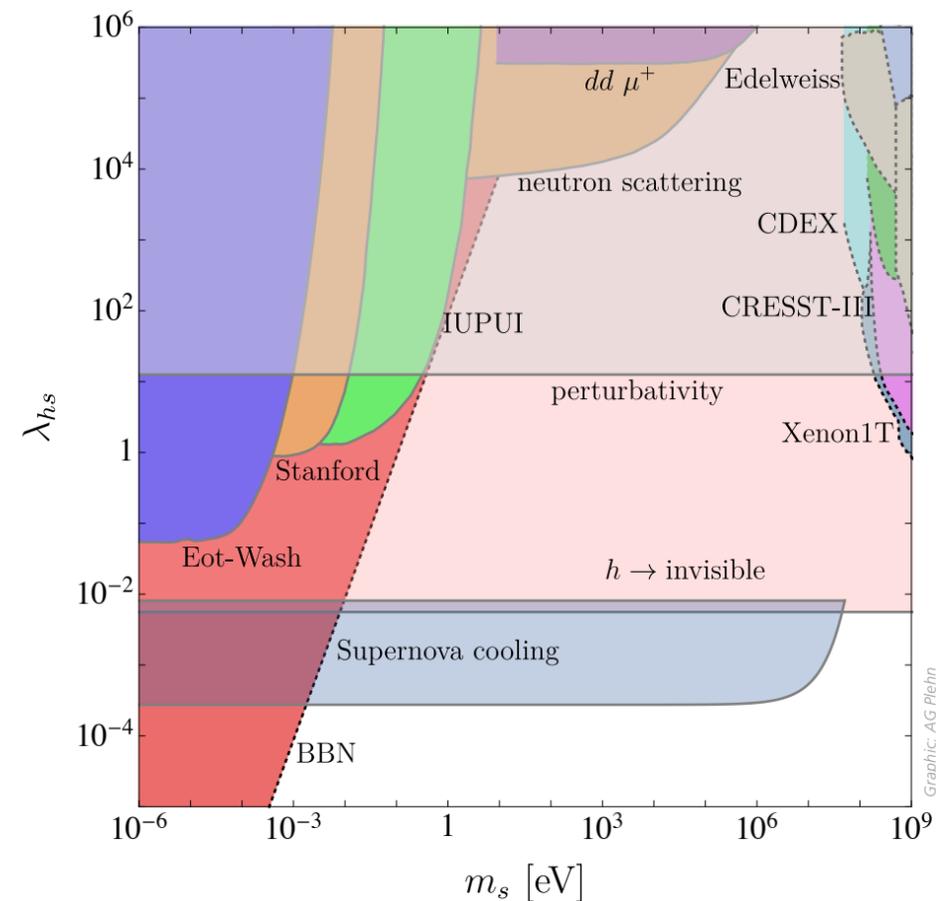
A related and constant question is how we can discover interesting

pattern deviations or anomalies in LHC data if we don't know exactly what we're looking for. Data science calls this situation as unsupervised learning, examples of which include uncovering abnormal network traffic in hacked computer networks or blocking credit cards given travel to unknown regions of

Latent space of a so-called autoencoder (artificial neural network) applied to simulated LHC data with hadronic decays of top quarks (green dots = QCD; blue dots = top).



Graphic: AG Plehn



Graphic: AG Plehn

Interplay of various experiments and observations in the search for light dark matter.

National Accelerator Laboratory) near Chicago or the DESY (German Electron Synchrotron) in Hamburg. These researchers espouse the vision of a modern globalised society based on open international cooperation and the values of the Enlightenment, which is renewed at universities with every new generation of students. We accordingly train researchers not just for particle physics, but also for industry and society. The best COVID simulations in England, for example, were developed by an LHC theory group. Rather than proton-proton collisions, they simulated how humans move and carry a virus – perhaps the most complex system we've been able to understand so far using particle physics methodology.

the world. Such anomaly searches are new territory for the LHC, but these applications could perhaps even enable researchers to conceptually benefit from the strengths of the LHC dataset.

The question arises when designing each LHC analysis of how to optimize the measurement to deliver the best result. An example of this is the self-interaction of the Higgs particle, which firstly reflects the potential of the Higgs field and could secondly be responsible for the universe's particle-antiparticle asymmetry. An optimal measurement is a challenge, especially where AI methods are involved, because it requires a change in approach from visualisation of the event itself to a complete view of the event with all uncertainties, which includes how

much information the AI method has actually learned.

It is ultimately important to ensure that new ideas and theories are incorporated and compared with LHC data. Analysis results need to be prepared in such a way that interested researchers can use public simulation tools to process them. In this case the latest analyses calculate detector effects from the data, again using modern AI methods. These are just a few of the many examples that reveal how particle physics contributes to relevant developments beyond basic research.

Particle physics is above all an international field of research. People from over 100 countries collaborate in large laboratories such as CERN, the Fermilab (Fermi



**Professor Dr. Monica Dunford**

worked in Chicago and at CERN before teaching experimental particle physics at Heidelberg University where she also conducts research within Research Training Group 1940 "Particle Physics Beyond The Standard Model".

**Professor Dr. Tilman Plehn**

worked in Madison/Wisconsin, at CERN, in Munich and Edinburgh, and is now a Professor of Theoretical Particle Physics in Heidelberg. He is the spokesperson for RTG 1940.

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F. Scherbaum, M. Müller, N. Mzhavanadze and S. Rosenzweig

# Scales Beyond Major and Minor

Musicology meets seismology – and opens up new possibilities for computer-assisted recording and analysis of polyphonic singing. Researchers use throat microphones to study traditional Georgian vocal music, which is included in the UNESCO World Heritage list.

Located in the South Caucasus on the border between Europe and Asia, Georgia has a remarkably diverse and highly respected musical tradition. In particular, this includes a type of polyphonic singing that presumably dates back to pre-Christian times. The songs do not remain the same, however: passed down from generation to generation, they constantly change. In 2001, this traditional Georgian singing was included in the UNESCO list of “Human Masterpieces of Oral and Intangible Heritage”.

Another point of interest is that documentation and research into the songs of Georgia can be traced back more than a hundred years in Germany and Austria. For example, phonographic recordings of Georgian songs in German and Austrian prisoner-of-war camps during the First World War formed the basis for a series of seminal articles on Georgian vocal music.

To Western ears, the music often sounds unfamiliar, as the scales used do not fit into the familiar major and minor scheme. In particular,

the similarity of traditional Georgian singing to the late medieval music of Western Europe gave rise to speculation as to potential links between the two musical traditions.

The songs are usually for three voices, and these are combined differently depending on region and context. It is still predominantly the men who perform the songs in public, although this is just beginning to change. Traditional singers tend to match their intonation to each other during the course of a song so as to produce certain harmonic intervals with particular purity, for example, or achieve certain timbres within the ensemble, while often performing in close physical contact. In the past, this caused an unsolvable technical dilemma for ethnomusicological field recordings. Clean acoustic separation of the individual voices – a prerequisite for a precise acoustic analysis of the singers’ interaction – was not possible using conventional microphones due to the virtually unavoidable acoustic cross-talk. When the singers sang their parts individually in a (portable) studio, they could no longer relate to each other, so a characteristic feature

*Ethnomusicological fieldwork in Ajara, Western Georgia.*





In order to record throat muscle vibrations that occur during traditional Georgian singing, the singers are equipped with throat microphones. Frank Scherbaum (left) fits them on site.

of singing, namely the interaction between the singers, disappeared completely. The authentic sound was lost.

In order to record individual voices while maintaining interaction between the singers at the same time, however, there is an amazingly simple solution if the problem is approached from a “seismological perspective”, i.e. focusing on the body vibrations generated during singing. In concrete terms, this means recording not just the airborne sound signal of a voice, but also the elastic muscle vibrations of the throat muscle near the larynx using throat microphones. These signals contain the essential information about a singer’s voice in terms of pitch, intonation and vocal intensity, but they

are virtually unaffected by neighbouring singers, even when the latter are in close physical contact.

Using throat microphones, it is possible to extract the time-dependent frequency information contained in the recorded signals for each singer on a more or less automated basis. This information then provides the basis for the likewise largely automated determination of the pitch trajectories (melodies) and the pitch inventory of the individual singers. This gives rise to a whole new approach of using computer-assisted methods for the documentation and analysis of orally transmitted vocal music.

The DFG research project “Computational Analysis of Traditional Georgian Vocal Music GVM” was preceded by a three-month ethno-

musicological field expedition in summer 2016. The objective was to record and document traditional Georgian chants, prayers and laments. The regional focus of the expedition was on the high-altitude mountain villages of Upper Svaneti where very old (presumably pre-Christian) traditions and songs are still maintained as part of daily life, as these villages were previously difficult to access.

Every performance was recorded in the form of multi-channel multimedia recordings, combining a high-definition (4K) video channel with one conventional headset microphone and one throat microphone per voice group, as well as a conventional stereo recording. In addition, each recording session was accompanied by extensive in-

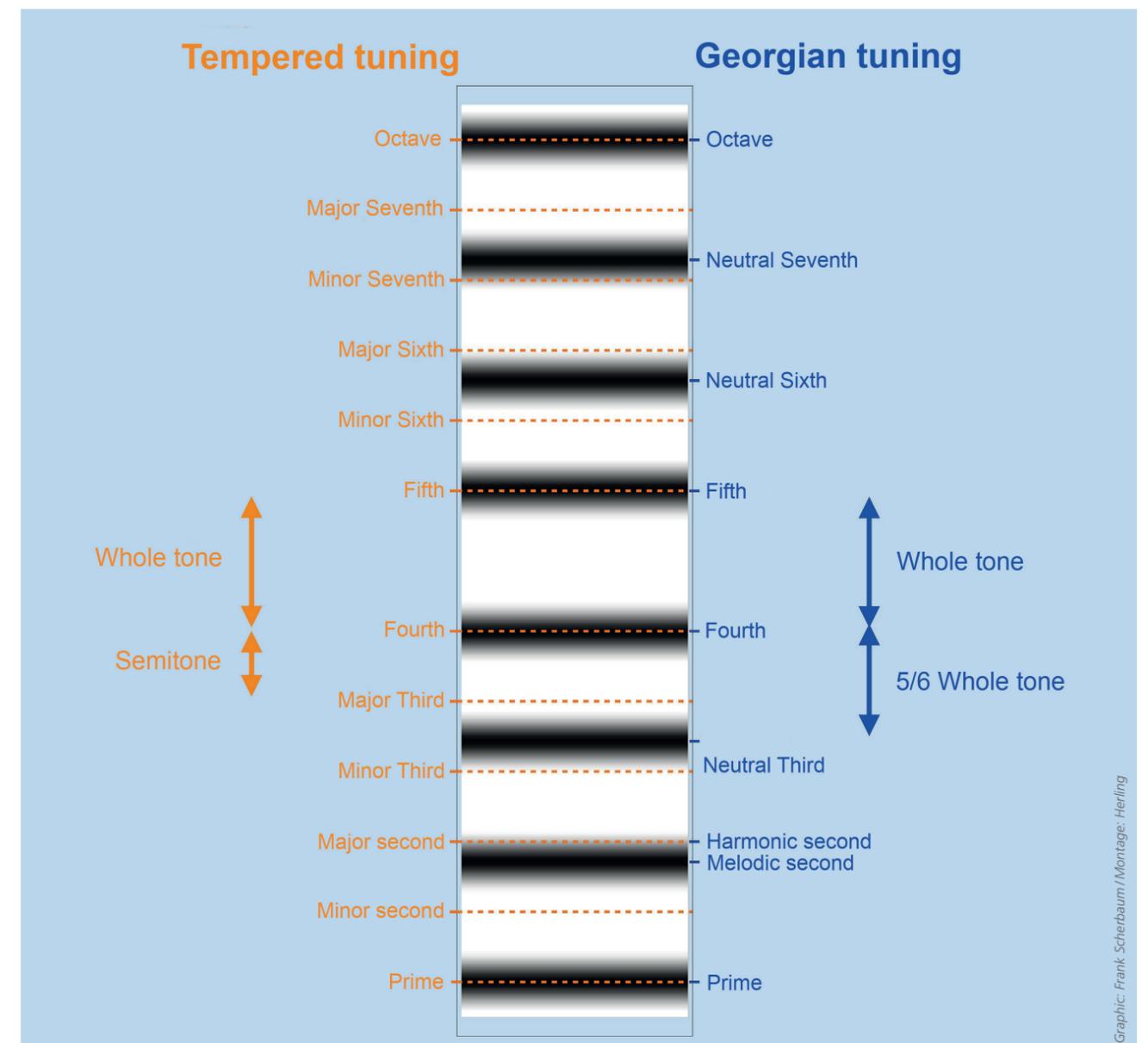
terviews with the musicians. This so-called GVM dataset, consisting of approximately 250 new recordings, together with the newly prepared approximately 100 historical recordings by the master singer Artem Erkomaishvili (1887–1967) dating from 1966 in which he sang all three parts separately, provides

an excellent data basis for computer-assisted analyses of traditional Georgian vocal music.

The new and elaborately created datasets are to be used to gain a better understanding of Georgian tonal systems. For decades now, there has been much controversy

over the question of whether there is or was a characteristic traditional Georgian tonal system, and if so, how it is structured. This is not just of academic interest: among other things, the answer to these questions will determine in what form this music will be considered authentic, performed and passed on in the future.

*Schematic representation of the pitch inventory for comparison purposes: in terms of pitch, the intervals used in Georgian tuning (blue) are mostly in between the small and large intervals used in Western tuning (orange). This explains why traditional Georgian songs do not fit into the major and minor scheme of Western music.*



In order to conduct this discourse in an evidence-based manner based on a large dataset of objectively verifiable pitch measurements, the interdisciplinary research project involved carrying out a computer-assisted analysis of the entire pitch and interval inventory of both datasets. In concrete terms, this meant evaluating something like more than one million pitch and interval samples. The result so far: the melodic scales used are significantly different from those that occur in music that is based on the major and minor systems, in which the melodic scales are made up of intervals the size of half or whole steps.

Based on an initial approximation, the melodic scales of traditional Georgian music are constructed from more or less equally spaced intervals of the size of 5/6 of a whole tone, though the distance between the fourth and fifth steps above the last bass note of a song often corresponds to a whole tone step. The size of the melodic second as the most frequent tone step of the songs varies significantly around a mean value of 5/6 of a whole tone step, whereas the harmonic second is

*The team developed a broadband recording device specifically designed for singing that is able to record vibrations of the lateral neck muscle from the heartbeat frequency up to frequencies of several kilohertz. Created using a 3D printer, the neck brackets are individually adapted.*

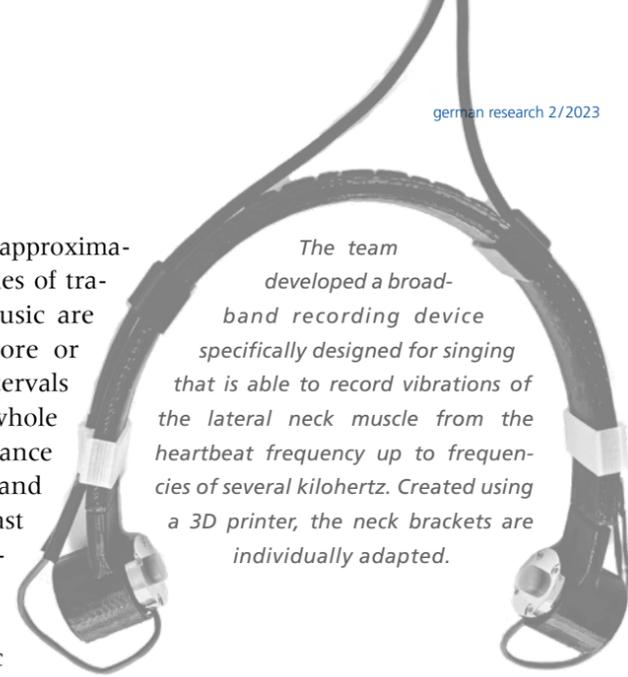
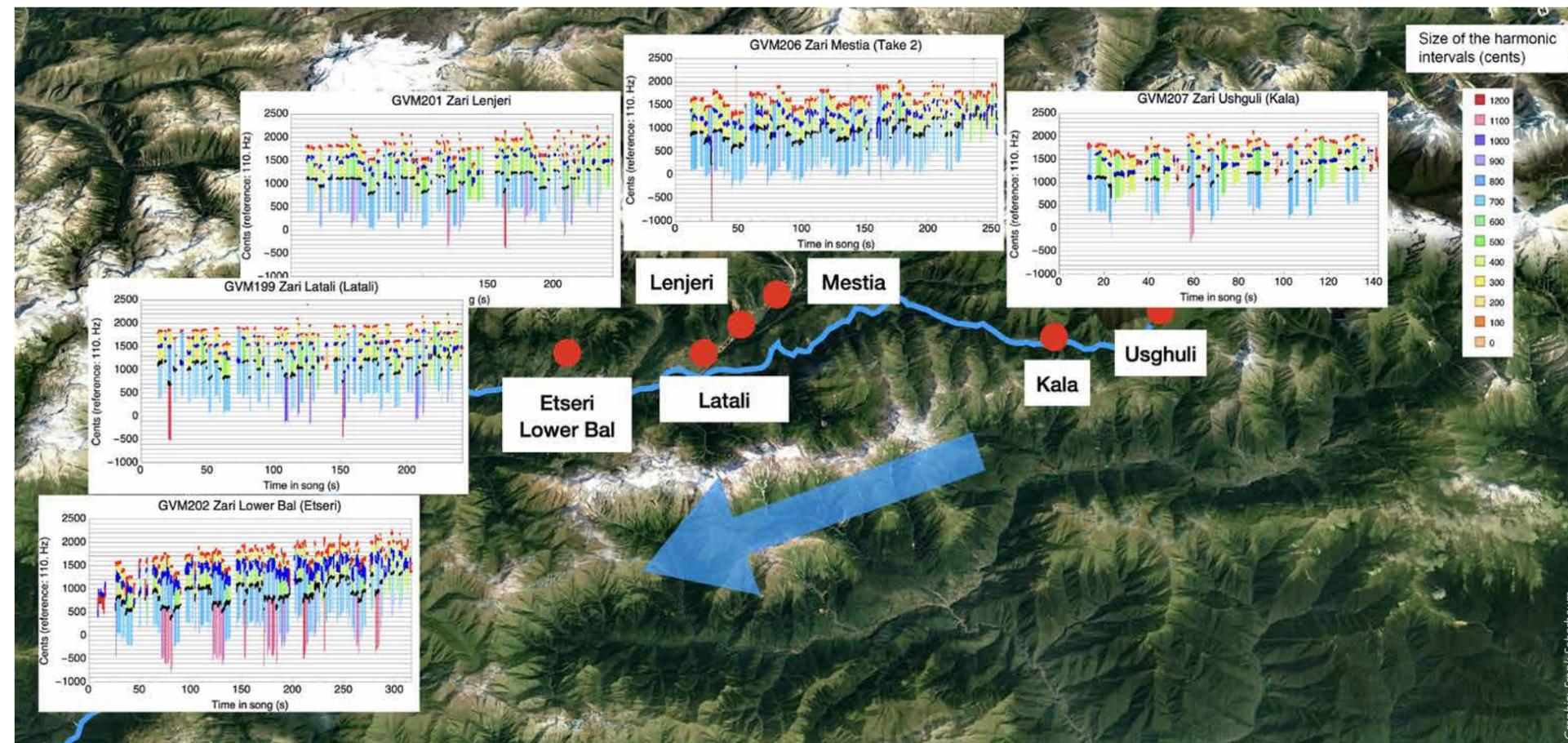


Illustration: Frank Scherbaum

significantly larger. This can be accounted for among other things as a consequence of the 1-4-5 chord that is very popular in Georgian music:

*The range, duration and complexity of the melodic and harmonic structures of the so-called zār dirges increase systematically in the direction of the flow of the Enguri river (arrow). This correlates with the fact that the non-Svan influence from the Samegrelo lowlands increases, the further the settlements are located from the high-altitude mountain areas.*



Graphic: Frank Scherbaum

this involves a fourth and a fifth being sounded simultaneously as pure intervals above a root.

Of particular importance in terms of both research and the cultural history of Georgia are eleven recordings of dirges from Svaneti in the north of the country. Known as zār in Svan language and zari in Georgian, this chant for three voices consists solely of vowel-rich sounds and is sung by men on the day of the funeral before the body of the deceased is placed in the grave. This musical expression of collectively expressed pain provides a glimpse into one of the oldest layers of Georgian vocal polyphony. The eleven recordings included in our dataset represent five out of a total of eleven still known variants of zār, all

of whose origins can be attributed to localities in the Enguri Valley in Upper Svaneti.

The pitch and harmonic interval analyses show remarkable results. For the most part, the bass and top voice of the zār chants move in parallel fifths: acoustically, this results in a very marked overlapping of their overtone spectra, resulting in an intense “merging”, i.e. fusion, of the two outer voices. In addition, the average pitch of the singing is continuously raised in the course of the song, giving rise to the impression of a permanent increase in the intensity of the sound.

This requires the singers to have an extremely well developed sense of harmony and engage in a very high level of vocal coordination. The intensity of the acoustic impression is further enhanced by the fact that, as phonetic analysis shows, some of the singers “detune” certain resonance frequencies of their vocal tract (formants) in such a way that the fundamental frequency appears amplified. This technique, known in Western singing styles as “formant tuning”, is apparently used unconsciously by the zār singers and results in penetrating tones that spread far into the landscape. Given the fact that after the death of a village member, zār is the only song that may be sung for 40 days, one can appreciate how much the mourning for a deceased person imprints itself onto the day-to-day soundscape of a village over a certain period of time, thereby blending everyday life and singing in a distinctive manner.

Furthermore, the acoustic analysis of the zār recordings shows that both the range and the complexity of the songs’ melodic and har-

monic structures increase systematically from the upper reaches of the Enguri River in Ushguli – the highest permanently populated place in Georgia – in the direction of the river. This correlates with the increasing exposure of settlements to non-Svan influences from the lowlands. Based on the example of Georgian vocal music, these and other analysis results clearly show the enormous and as yet unexploited potential inherent in the measurement of muscle vibrations. This will benefit the recording and detailed analysis of polyphonic singing in the future, too.



**Professor Dr. Dr. h.c. Frank Scherbaum** is Professor Emeritus of Geophysics at the University of Potsdam; he led the research project together with Prof. Dr. Meinard Müller.

**Professor Dr. Meinhard Müller**, Chair of Semantic Signal Audio Analysis at the International Audio Laboratories Erlangen, was co-leader of the research project.

**Dr. Nana Mzhavanadze**, Potsdam, and

**Dr. Sebastian Rosenzweig**, Erlangen, were project collaborators.

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[www.uni-potsdam.de/de/sound-scapelab](http://www.uni-potsdam.de/de/sound-scapelab)

[www.audiolabs-erlangen.de/fau/professor/mueller/projects/gvm](http://www.audiolabs-erlangen.de/fau/professor/mueller/projects/gvm)



## Rembert Unterstell



Illustration: dpa/Mary Evans Picture Library

## “Sometimes the Full Horror Appears in a Single Detail”

For 17 years, the DFG funded the most comprehensive edition of sources on the Holocaust to date: this monumental collection is now available, including documentary evidence from all over Europe. After the final conference of this once-in-a-century project, we talked to project leader Susanne Heim about perpetrator, victim and bystander documents, and about future perspectives for Holocaust research.

The transcript of the meeting between the Litzmannstadt ghetto administration and the Gestapo on 16 October 1941 appears alongside the manuscript of the speech by Roland Freisler, the notorious president of the People’s Court, lecturing on the forthcoming special criminal law for Poles and Jews. In a handwritten postcard of March 1942, Roza and Luisa Gips tell their parents in the Warsaw Ghetto of their impending murder. Alongside this there is an inflammatory article from the “Litzmannstädter Zeitung”, which holds forth about cases of alleged ritual murders carried out by Jews in Poland and Russia. It was important to the editors of the Holocaust Edition to compile a

broad spectrum of contemporary historical sources. This ranges geographically from Norway to North Africa, from the Netherlands to the Caucasus, and historically from the “seizure of power” in 1933 to the end of the Second World War in 1945. The territorially structured volumes contain reproductions of public and private documents, each arranged chronologically: official letters and anti-Jewish decrees, court judgements, personal letters, diary entries, notes and poems from ghettos and concentration camps, petitions, secret messages, and newspaper articles that appeared in German and international media. The aim is to piece together an overall picture that is multi-layered and multi-faceted.

Left: At the ramp – Jewish men, women, children and old people from Hungary at Auschwitz-Birkenau extermination camp, June 1944.

“forschung”: Ms. Heim, we’re talking to you here at the Berlin Research Department of the Institute of Contemporary History. This is where the work on “Verfolgung und Ermordung der europäischen Juden” (“Persecution and Murder of the European Jews”) was focused: 16 volumes, 5,280 documents, more than 13,000 printed source pages and 18 years of editorial work – did you accomplish your mission?

Heim: Yes, I think we did. The Edition provides a very broad foundation of sources for further research, but also for university teaching and secondary school history teaching. We succeeded in compiling a representative selection of documents so as to provide an overview of the persecution and extermination of the Jews in all European countries in which the Holocaust took place.

“The Holocaust as a European Event” – this was the title of the international conference in May 2023 which was held to conclude the Edition project. What does this title highlight?

On the one hand, it emphasises that the persecution of the Jews as a crime was not limited to Germany and did not only concern the Germans but also affected other countries – whether they were occupied or allied with Germany. The Holocaust had a powerful impact on these countries, too, which to some extent can still be felt to this day. The relationship between Jews and non-Jews in Poland remains severely strained to this day, for example. On the other hand, the choice of this title expresses the fact that without the assistance of allies and their bureaucracies on the ground, it would probably not have been possible for the Germans to murder so many people.

In addition to its European scale, the Edition is characterised by its multiple points of view: perpetrator, victim and bystander perspectives deliberately appear side by side ...

This was certainly influenced in conceptual terms by discussions surrounding the books by Saul Friedländer [editor’s note: an Israeli historian and publicist born in Prague in 1932], who called for

an “integrated historiography” with regard to the Holocaust. For good reason, German Holocaust research has focused on the perpetrators for a very long time, but it has tended to neglect the perspectives of the persecuted. From the beginning, it was important to us to bring these together: both the voices of the perpetrators and those of the persecuted; in addition, those not directly involved were to be taken into account as well – whom we refer to as “third parties”.

Why did work on the Holocaust Edition start so late?

After the Second World War, it took many years for the realisation to take hold that the murder of the Jews was an unprecedented crime. Scientific documentaries were focused on the perpetrators, on a particular region or a specific time period. For a long time, German research was dominated by the idea that the documents of the persecuted only reflected their subjective views but could not contribute anything in terms of reconstructing the decision-making processes involved, so it took years for people to admit that they are impor-



Illustration: Rembert Unterstell

### The Project Manager

Private lecturer Dr. Susanne Heim, political scientist and historian with research interests in National Socialism and the Holocaust, was the research coordinator of the Edition project from 2005 to 2020. After graduating in political science, she was a research assistant at the Hamburg Institute for Social Research. She obtained her doctorate at the Otto Suhr Institute in Berlin in 1991 with a dissertation

on “Economic rationalisation and extermination policy in occupied Poland 1939 to 1945” before going to gain a postdoctoral lecturing qualification at FU Berlin in 2002. From 1999 to 2005, she worked in the Max Planck Society’s research programme on the “History of the Kaiser Wilhelm Society under National Socialism” before taking over as director of the Holocaust Edition.



had a quite different impact on you. Sometimes you had to simply put a document down – you can't read material like this for eight hours.

*Can you give us an example?*

In one of the Soviet volumes, a German soldier describes how he witnesses a mass shooting. Trucks drive up, Jews are dragged off the back of the truck and then driven to a shooting trench. He mentions a man, a butcher, who still has his apron on when he is shot. The idea that they took this man out of his butcher's shop, not even giving him time to take off his apron, then crammed him onto the cart and drove him to the execution – that's something I couldn't get out of my head. Sometimes the full horror appears in a single detail – such as here in the butcher's apron.



*In June 2021, Federal President Frank-Walter Steinmeier received the editors, including Susanne Heim, in Bellevue Palace.*

Illustration: www.bundespraesident.de/Guido Bergmann

*At the symbolic handover of the Holocaust Edition at Bellevue Palace in 2021, Federal President Frank-Walter Steinmeier spoke of the Edition's dual function of research and commemoration. How important was it to the project team to give the victims a name and an identity?*

We tried to compile a brief biography of each person involved. Tracing the lives of the persecuted was not

only important to us in terms of our editorial work. There's no escaping the consequences of remembrance work of this nature. It was something that was frequently present in our day-to-day routine as well: we were dealing with people who had survived the Holocaust themselves or with relatives who provided us with documents.

*What do you think of the fact that media reports have spoken of a "written monument to the European Jews"?*

I find this term rather problematic. Some have criticised us saying we were out to create the ultimate, conclusive monument. That actually wasn't what we were trying to do. I prefer to talk about an aspiration to achieve "comprehensive documentation": after all, there'll be other researchers after us. In 30 years from now, this Edition would probably be done in a different way and with a different focus.

*"In a different way" – here we are in the digital age: would a digital or at least a hybrid Edition be conceivable today?*

I suppose so! We started in the conventional way with Word files. None of those involved were digital natives. And there were no models for digital editions at that time, such as how to create a suitable database

for this purpose. It took a long time to set up one that suited our needs.

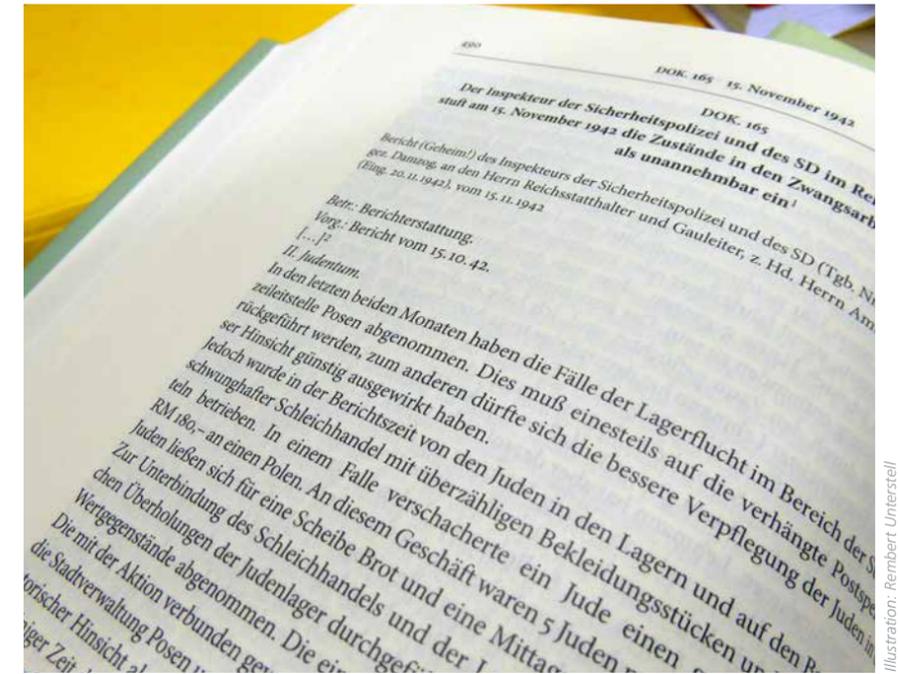
*Back to Holocaust research. What is there in the Edition that future research might pick up on?*

The first thing that occurs to me here is international comparison. A lot of open questions have arisen that need to be explored further: why did the Germans do things one way in one country and quite differently in another? How did they coordinate this? How did the Jewish aid organisations act and respond? And what deceptive manoeuvres did the National Socialists use in the individual countries in relation to the crimes they committed?

*What expectations are attached to the international, English-language Holocaust Edition, which is also to be compiled here at the Institute in cooperation with the Yad Vashem memorial site by 2027?*

This has the potential to give fresh impetus to international Holocaust research. Much of the research is taking place in the USA and Israel; research debate in other countries such as Greece and Bulgaria didn't get off the ground until much later. A collection of English-language documents is of huge benefit when it comes to international dialogue. And books don't attract much attention internationally if they're only available in German – even if they're important for research. This would be even more true of a documentation of this kind.

*The DFG has supported the German Edition with almost 8 million euros of funding over 17 years and is now also funding the Edition that is being compiled in English. How important was it to receive funding as a long-term DFG project in terms of the editing work?*



*Extract from a volume of the Edition: on 15 November 1942, an inspector of the security police submitted a report summarising the daily misery at the forced labour camps.*

Illustration: Rembert Unterstell

## The "Documentary Audio Edition"

Since 2013, Bavarian state broadcaster BR, in cooperation with the Institute of Contemporary History in Munich, has produced a series of radio and internet broadcasts

entitled *Die Quellen sprechen* ("The sources speak"). It is based on the Edition and its volumes. The letters, diary entries, decrees, orders, etc. are read aloud by contemporary

witnesses and by actors; there are also interviews with the contemporary witnesses about their own life stories. The programmes and materials are permanently available in the

ARD audio library

[www.ardaudiothek.de/suche/quellen%20sprechen](http://www.ardaudiothek.de/suche/quellen%20sprechen)

or at

<https://die-quellen-sprechen.de>.



We probably wouldn't have been able to finance the project without this funding. It was very helpful that the DFG and the responsible programme directors were supportive of the overall project and its objectives – and that the reviewers approved the approach adopted for the Edition, in spite of all the delays. This was of enormous value to the project team. I don't know of any other institution that would have facilitated such a project in its entirety.

*The last survivors and contemporary witnesses of the Holocaust will soon be silent. Does this make the Edition even more important – and potentially give its documents greater visibility, too?*

I hope so. Like all editors, we hope that this pool of sources will be used in research and theory of course – and that it will stimulate new research, too. But historical sources don't belong solely in archives. They

can be used for readings and seminars, for political adult education or in remembrance work – or for an audio edition, as the Bavarian state broadcaster BR has done with *Die Quellen sprechen*. I'd like to see the sources being used by more people in general, in addition to libraries and archives – for example secondary school students. In order to enable this, the sources would have to be prepared by subject specialists for use in teaching units. The documents transport the reader into the details of day-to-day life – they vividly convey what exclusion, terror and deportations meant in concrete terms. And perhaps they can prevent us from limiting our discourse about the Nazi era to the meta level.

*Thank you very much, Ms. Heim, for the interview!*

**Interview: Dr. Rembert Unterstell,**  
Publishing Executive Editor of "german research".

## The Deutsche Forschungsgemeinschaft

The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation), a registered association, is the largest research funding organisation and the central self-governing organisation for research in Germany. Its mission, as defined in its statutes, is to promote “all branches of science and the humanities”.

With an annual budget of around €3.9 billion, the DFG funds and coordinates more than 31,000 research projects in its various programmes. These projects are carried out by both individual researchers and groups of researchers based at universities and non-university research institutions. The focus in all disciplines is on basic research.

Researchers at universities and research institutions in Germany are eligible to apply for DFG funding. Research proposals are evaluated by reviewers in line with the criteria of scientific quality and originality, and then assessed by review boards, which are elected for a four-year period by the German research community.

For more information, visit [www.dfg.de/en](http://www.dfg.de/en)

The DFG places special emphasis on early career support, gender equality and scientific relations with other countries. It also funds and initiates measures to develop and expand scientific library services, data centres and the use of major instrumentation in research. Another of the DFG’s core tasks is to advise parliaments and public interest institutions on scientific matters. Together with the German Council of Science and Humanities, the DFG is also responsible for implementing the Excellence Strategy to promote top-level research at German universities.

The DFG currently has 99 member organisations, primarily comprised of universities, non-university research organisations such as the Max Planck Society, the Leibniz Association and the Fraunhofer-Gesellschaft, the Helmholtz Association of German Research Centres, and academies of sciences and humanities. The majority of the DFG’s budget is provided by the federal and state governments, and it also receives funds from the Stifterverband.

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More than perhaps any other organisation in Germany, the DFG stands for scientific self-governance, and this defining quality is perhaps nowhere more evident than in the DFG review boards. Elected for a fixed term by the researchers in the respective subject, these form the central link between the initial review and the final decision in the three-stage processing of the many thousands of funding proposals submitted to the DFG each year. The next round of elections to the DFG review boards starts on 23 October. For a period of one month, some 150,000 researchers will have the opportunity to choose their representatives from among 1,631 candidates to fill 649 places on 49 review boards. As has been the case since 2007, this election will take place online, too. Incidentally, dear readers, you can find out selected results of the review boards’ work in every issue of *german research* – in the articles by researchers who have just been voted to serve on the review boards. Elsewhere in this issue, you can read about two fundamental issues that the DFG – as an organisation of scientific self-governance – is currently addressing and will continue to address: how to deal with risks in international research cooperation, and the impact of ChatGPT and other models of generative text and image creation on research and funding activities. As always, the editors wish you an informative read.

