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Pooling Expertise for a Stronger Profile

The Herder Building is the home of the new Faculty of Environment and Natural Resources. Photo: Baschi Bender

The University of Freiburg has a new calling card: On 1 January 2013 the Faculty of Forest and Environmental Sciences and the Department of Earth Sciences, previously part of the Faculty of Chemistry, Pharmacy, and Earth Sciences, combined to form the Faculty of Environment and Natural Resources. Research at the new faculty focuses on fundamental processes of natural science and the resulting interplay between environment and society. The University of Freiburg is the only university in Baden-Württemberg to offer a concept for research and instruction in the environmental sciences that combines natural sciences and engineering disciplines.

The scientists are planning particularly close research collaboration in four fields: the sustainable use of natural resources; the conservation of water, soil, air, and biodiversity; adaptation to global change; and natural hazards and natural risks. The faculty will offer four bachelor's programs, each with a broad thematic scope: Environmental Natural Sciences, Forestry and Environment, Geography, and Earth Sciences. The undergraduate programs will be complemented by eight specialized master's programs and seven fields of research in the graduate school "Environment, Society, and Global Change." The faculty is home to around 1700 students and 250 doctoral candidates.

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Contents

A Life on the Road

Cultural studies professor Anna Lipphardt is investigating the consequences of long-term mobility for performing artists

by Thomas Goebel

A month in Priština, Kosovo, for an ongoing art project; a week in Osnabrück to prepare for an upcoming job; two weeks of research in Sofia, Bulgaria; an exhibition in Berlin; project meetings in Stuttgart and Munich; a couple of days visiting friends in Frankfurt; the film festival at the Biennale in Venice, Italy; and then five months on a grant in Singapore: This is what the life of an artist can look like, juggling proposals and contracts, programs, and freelance work. Dr. Anna Lipphardt, junior professor in cultural studies at the University of Freiburg, examines itineraries like this in great detail – mobility as a permanent condition is one of her research interests.

Lipphardt studies people who aren't just trying to get from A to B but whose daily lives consist of being on the road: In two projects she is investigating various kinds of artists and small family-run circuses. Previously, she wrote a dissertation on the migration of Jews from Vilnius, Lithuania, after the Holocaust. "In my new projects I want to study what mobility and being on the road are like when they are not connected with a catastrophe but are part of a regular lifestyle."

At Odds with the Official Narrative

In April 2011 Lipphardt launched the research group "COME – Cultures of Mobility in Europe" at the Institute of European Ethnology of the University of Freiburg. Mobility research is currently in vogue; globalization and transnational networks attract attention. However, Lipphardt considers her group's approach to be at odds with the common, official narrative: Politicians, and also political scientists, tend to associate mobility with progress. "Occasionally you'll hear a discussion on how to remove barriers to mobility, but the financial, social, and emotional costs of this lifestyle are not systematically included in the dialogue." Lipphardt's research group studies traveling street artists, "alternative travelers" that often live in mobile homes and the transatlantic networks of the Roma. The central ques-

Up in the air: On stage, every movement is meticulously rehearsed, but when it comes to organizing their daily lives, performing artists don't have a routine to fall back on.
Photo: Thomas Kunz

"Artists don't usually even talk among themselves about how strenuous it is to move around all the time"

tion is: "How do mobility rhetoric and mobility politics compare to the reality of these people's lives?"

Mobile, cosmopolitan, trendsetting: These are the words typically conjured up in our minds when we talk about musicians, actors, or artists, but it also often corresponds to their own self-image. Lipphardt devoted one of her projects to this topic: "The so-called creative class is characterized as a mobile avant-garde, and this is how they characterize themselves too." Avoiding routines and perpetually calling one's own work into question are important components of creative work, says the junior professor. However, "artists don't usually even talk among themselves about how strenuous it is to move around all the time." She wants to conduct case studies to analyze the tension between the "official narrative" and the "behind-the-scenes narrative" and illustrate the differences between various branches of the arts, artistic practices, and biographical situations.

"A blend of historical and empirical cultural studies" is how she refers to her approach. "We use the tools of field research to study people, also taking into account historical perspectives, and attempt to access the field from as many different avenues as possible." One important avenue for Lipphardt was a research scholarship at the Akademie Schloss Solitude in Stuttgart, a public foundation whose main purpose is to provide accommodations and studio space for young artists. This allowed her to fill her research journal with anonymous accounts of informal conversations in the cafeteria at lunch or over a glass of wine in the evening. In addition, she conducted interviews with the artists over an extended period: "Artists enjoy talking about the official version of their biography and artistic work, but it takes a good while before they start talking about problems and setbacks." Some of them now provide Lipphardt with additional material, like project and travel data or reports on expenses resulting from their mobile lifestyles for their tax returns. In addition, the cultural stud-

Keep on moving: Politics tends to associate mobility with progress. What consequences a life in transit has on the financial status, social life, and emotions of the artists has yet to be studied. Photos: Thomas Kunz

ies professor conducts interviews with other representatives of the art scene and visits archives.

In addition to the opportunities and advantages of life on the road, her research has exposed the enormous organizational and financial difficulties artists are faced with: A sculptor who receives a month-long grant in Priština, for instance, doesn't just have to find a way to get there and a place to stay – he also has to organize the transport of his materials and tools and deal with questions concerning things like health insurance and taxes. And then there are the personal issues, says Lipphardt: "How do I cope with relationships and reach agreements with my partner? Who does the housekeeping and waters the plants if I'm always away from home? And what about my friends – who really even knows me if I'm never around?"

"Germany offers relatively few solutions for professional milieus or social groups that are permanently mobile"

The situation can become really difficult when children enter the picture: In addition to the general strain a child can place on a relationship, artists often have more difficulties than people in other professions finding child care, because theaters and organizations that award art grants with residency requirements usually do not offer such benefits. "There are next to no opportunities for institutional integration for people with a mobile lifestyle," says Lipphardt. Finally, depending on what kind of artistic work a person is engaged in, moving around all the time doesn't just mean inspiration and excitement. The brief stays are often insufficient for planning daily life and finding contract work, and they leave little time to get to know the city and people outside of the art scene or to develop oneself further in an artistic sense.

Traveling is part of the daily lives of musicians, actors, and other artists – they like to see themselves as a mobile avant-garde.

When Lipphardt arrived at the Akademie Schloss Solitude in 2008, her goal was to work on her research project on small traveling circuses. "When I presented the project, a lot of people came to me and told me how closely the topic affected them. I didn't understand that at first," she says. The lives of artists at the academy in Stuttgart initially seemed to her to be too far removed from the world of circus families – until she realized that the actors and painters were able to identify with the perpetual state of flux that characterizes the daily lives of circus performers.

Fascinating and Captivating

For small-scale traveling circuses, which were founded in the late 19th century and make up a large part of the circus companies active today in Germany, mobility is and always has been a basic precondition for their work: "It's the only way they can play the same repertoire in front of a different audience, week in, week out." They are often made up of a single extended family that moves from place to place together and has to adapt to new living circumstances again and again. "The circus lives off a staging of the foreign, the exotic," says Lipphardt. That's what makes it fascinating and at the same time captivating for most people. However, it's getting harder and harder to find sites to set up camp and erect a tent: "It isn't just about being on the road but also about the question: Who is allowed to stay where and when?" It is often uncertain whether water supply and waste disposal will be available – and classical integration policies are not effective, because the circus is constantly on the move. "It's an area in which no one has jurisdiction," says Lipphardt, "Germany offers relatively few solutions for professional milieus or social groups that are permanently mobile." This is particularly evident in the case of education: "Children from circus families have no adequate access to school education, and their chances on the job market are worsening." The only German state with an educational project for circus children is North Rhine-Westphalia. Originally initiated by the Protestant Church, the project combines on-site teaching phases and distance learning coordinated by the same teachers.

Lipphardt is planning a project with an artist friend of hers in which circus children will be asked to photograph their daily lives on the road – as a starting point for interviews: "How do you perceive your world? How does family life function in a limited space and without the benefit of having a circle of friends around? What strategies do you use to settle conflicts in your group or with the people who live where you're staying?" If she can find the time, she would like to accompany a traveling circus – for an entire season.

Anna Lipphardt also has first-hand experience with the charms and pains of a life on the road from her own life as a mobile academic. As an example, she cites the period after she completed her doctoral dissertation: "My official residence was in Berlin, but I had a job in Constance and a scholarship in Stuttgart. It felt like I spent most of my time on the train – and that is nothing unusual for postdocs."

***Dr. Anna Lipphardt** has served as junior professor of cultural studies at the Institute of European Ethnology of the University of Freiburg since 2011. She studied political science, Baltic studies, and Jewish studies in Lithuania, Germany, and the USA and earned her master's in Jewish studies from the University of Chicago, USA, in 1999. In 2006 she completed her dissertation on transnational history of memory of the Jews from Vilnius, Lithuania, after the Holocaust. She then worked at the Centre Marc Bloch in Berlin and the University of Constance. Migration and mobility research is one of her primary research interests. Photo: private*

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Biofuel from Bacteria

The biologist Annegret Wilde is studying how tiny organisms can produce fuel with the help of photosynthesis

by Verena Adt

The cyanobacteria are grown in bioreactors made of plastic film. In order to produce high-quality fuels, the microorganisms only need seawater, carbon dioxide, and energy from sunlight. Photo: Algenol

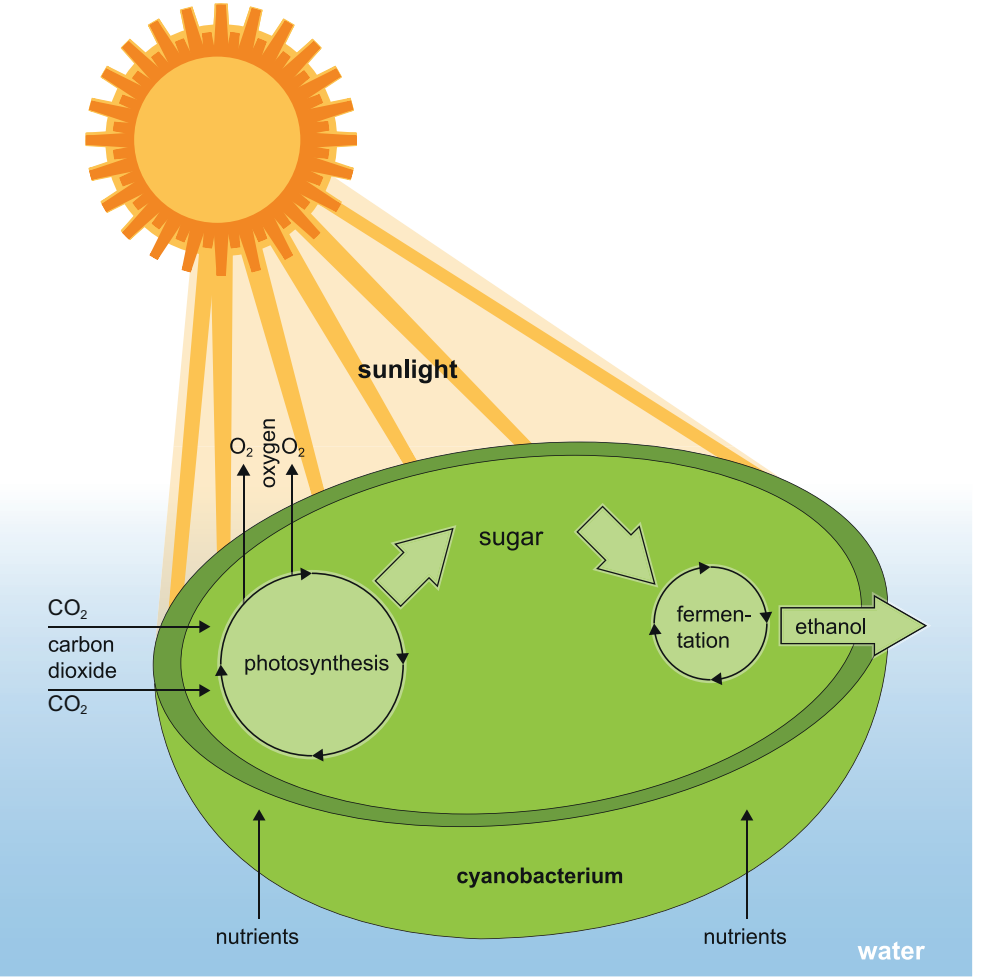
Biofuel doesn't have a particularly good reputation at the moment. Its production takes up land that could otherwise be used to grow food. The intensive cultivation of the soil with a heavy use of fertilizer and pesticides does damage to the environment. Fuel obtained from rapeseed or sugarcane, once hailed as the answer to all of our future energy problems, has fallen into disrepute among the environmentally and socially conscious. It is regarded as a polluter with a lousy carbon footprint and as a cause of increases in food prices. These price hikes hit people in poor countries the hardest.

"Our main goal is to prepare a pilot project on the large-scale industrial production of biofuels obtained from cyanobacteria"

In light of these facts, the idea that there are organisms that require neither arable land nor fertilizers nor pesticides and that break down carbon dioxide (CO_2) while also producing fuel seems like a tree hugger's pipe dream. But these remarkable organisms actually exist. Known as cyanobacteria or blue-green algae, they live in the water and use CO_2 and light to make ethanol, an alcohol that can go right into the gas tank when mixed with gasoline. Scientists at the University of Freiburg are conducting a research project called "Cyanosys – Systems Biology of Cyanobacterial Biofuel Production" in collaboration with several partners in order to determine whether this novel form of obtaining biofuel has the potential to be part of the energy mix of the future.

"Our main goal is to prepare a pilot project on the large-scale industrial production of biofuels obtained from cyanobacteria," says Annegret Wilde, professor in molecular genetics at the Institute of Biology III of the University of Freiburg. Wilde has served as scientific coordinator of the project since its launch in March 2013. The research team also includes Wolfgang Hess, professor in experimental bioinformatics and genetics at the Institute of Biology III. The two professors are collaborating with

> “The key question is whether using cyanobacteria to produce ethanol can be made profitable”



Every cell is a tiny ethanol factory: The diagram shows how cyanobacteria produce biofuel. Source: Algenol, Illustration: Tamara Klaas

experts in bioinformatics, modeling, and metabolism studies from the Humboldt University of Berlin, the University of Rostock, Max Planck Institutes in Potsdam and Magdeburg, and the company Algenol Biofuels Germany GmbH in Berlin.

The researchers are focusing especially on improving the production of enthanol in the carbon metabolism of cyanobacteria. The two liters of ethanol per square meter and year they have managed to achieve so far is already three times higher than the yield of biofuel from sugarcane, when one takes into account the fact that the former can be harvested twice a year. For a series of experiments conducted in Berlin at the test facilities of Algenol Biofuels Germany GmbH, the scientists are using two genetically modified model organisms. The cyanobacteria swim in plastic-film photobioreactors filled with 500 liters of seawater. With the help of sunlight, they can convert CO_2 pumped into the transparent vessels into ethanol as well as several other high-quality hydrocarbons, such as isoprene and ethylene, which can also be used for the production of plastics.

Ensuring Genetic Stability

The alcohols obtained from the bacteria are high-quality fuels. They are less toxic than conventional gasoline or petroleum and have a high octane rating – making them less likely to self-ignite and burn uncontrollably. Moreover, an analysis conducted at the Georgia Institute of Technology, USA, shows that the ethanol production method used in the project leaves a significantly lower carbon footprint than the production of gasoline from crude oil. Ethanol should provide the researchers with an initial example that it is possible to adapt the photosynthetic metabolism of cyanobacteria to the production of biofuels.

Even in the small-scale conditions of the laboratory, ethanol stores around 90 percent of the carbon fixed from CO_2. “However, the process of using organisms that create their energy from light to produce ethanol is far from being a straightforward affair,” emphasizes Annegret Wilde. She is concentrating especially on find-

One-liter reactors in the lab: Researchers are experimenting with bacterial cultures on a small scale in order to increase the ethanol yield. Photo: Annegret Wilde

ing a way to ensure the genetic stability of the bacterial cultures under industrial production conditions. It is still unknown how the microorganisms react to stress, such as when temperatures fluctuate wildly or not enough light penetrates through the dense cultures. Other difficulties include contamination by other organisms and spontaneous mutations that lead to a decrease in production rates. "We want to use artificial evolution to enrich and characterize cells that adapt particularly well to the production conditions and yield the highest possible amount of ethanol, isoprene, or ethylene." In addition, both of the Freiburg research groups are working on identifying so-called regulatory elements, which can improve the performance of the optimized strains. Last but not least, they are also studying factors that limit the yield of the finished product.

"The key question is whether using cyanobacteria to produce ethanol can be made profitable," says Wilde. The amount of ethanol that can be produced with light as an energy source cannot measure up to the alcohol yield from conventional yeast fermentation. All the same, ethanol production could still prove to be a lucrative endeavor: Whereas yeast needs sugar to ferment, cyanobacteria are less demanding, requiring only the carbon from the CO_2. A cost-benefit analysis reveals that the production method used in the project uses up much less resources than those used to produce conventional biofuels. The photobioreactors can be installed on land that is unsuitable for farming. The salt-tolerant bacterial strains are satisfied with seawater and thus use only little fresh water. The greenhouse gas CO_2, which is pumped into the reactors, is available in the atmosphere in larger amounts than are beneficial to the environment. Finally, the light energy necessary for photosynthesis comes for free from the sun.

Will Annegret Wilde and her team achieve a breakthrough in energy production by the end of their three-year project? The microbiologist responds to this question with composure: "We don't know that yet today. All I can say is that if we don't try, we won't find out the answer."

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Prof. Dr. Annegret Wilde *studied microbiology at the University of Saint Petersburg, Russia. She then spent 20 years conducting research in Berlin, first at the Institute of Technical Microbiology in Berlin-Buch, and from 1991 on at the Humboldt University. In 1994 she completed her dissertation on the photosynthesis of cyanobacteria. From 1994 to 1998 she worked in a postdoc position at the Humboldt University, before accepting a two-year scholarship from a German program promoting women in science. In 2001 the researcher accepted a position at the Department of Plant Biochemistry, where she completed her habilitation thesis on the molecular biology of cyanobacteria. In 2008 she accepted a chair in microbiology at the University of Gießen. In 2012 Wilde came to Freiburg as professor of molecular genetics. Her main research interests are the photosynthesis and genetics of cyanobacteria. Photo: private*

Making It through the Gate

Researchers at the Centre for Security and Society are developing a typology for evaluating airport security checkpoints from an ethical perspective

by Nicolas Scherger

Making hidden things visible: At the airport, metal detectors check the passengers, x-ray detectors screen their baggage – with the goal of finding dangerous objects. Photo: Werner Hennies/Flughafen München GmbH

One's own naked body, exposed on a screen for all to see, the staff at the checkpoint and the passengers waiting in line: For many passengers the notion of such a scenario was simply too much. It therefore comes as little surprise that the initial test phase of the so-called full body scanner, a technology designed to make dangerous objects visible and thus increase air safety, gave rise to nationwide protests in 2010. "It was the right debate at the right time," says doctoral candidate Sebastian Volkmann from the Centre for Security and Society, a research institute at the University of Freiburg that conducts interdisciplinary research on security. "The security measures keep getting more rigorous, costs and operating requirements are on the rise, and there is a broad national debate on the increasing violations of the private sphere," says the philosopher of the loss of moderation at airport security checkpoints.

The EU-sponsored research project "Accelerated Checkpoint Design, Integration, Test and Evaluation," or XP-DITE for short, aims to counteract this trend. The goal of the project is to find an approach that enables a balance between security, ethics, and costs at checkpoints. 13 airlines, technology companies, and public research institutions are working together to develop a computer program to analyze the security checkpoints, appraise the consequences of the use of technology at them, and propose alternatives. "Designers can set up a checkpoint with a virtual toolbox," explains Volkmann. "The program then gives them an estimate of how high the security level is, how many passengers can be handled, how much it will cost, and how high the ethical consequences will be." What's new about this approach is that it doesn't just consider the individual measures and devices but takes the entire checkpoint into account. However, it is first necessary to work out the foundations: In cooperation with his supervisor Prof. Dr. Hans-Helmuth Gander, director of the Husserl Archive at the University of Freiburg, Volkmann is conducting ethical research for the project at the Centre for Security and Society and is developing evaluation criteria for use with security technologies.

The focus of XP-DITE is narrowly defined. While the airline collects passenger data at the check-in counter and the border control and customs authorities are in charge of entry requirements and the import of goods, the checkpoint only has two functions, says Volkmann: "On the one hand it is supposed to reveal things that are not openly visible – with the aim of identifying dangerous objects. On the other hand it restricts entry to the gates so that only passengers who do not have such objects can fly." Checkpoints at European airports currently consist of several lines situated next to one another.

"Designers can set up a checkpoint with a virtual toolbox"

Passengers generally have to have their hand luggage, jackets, and any metal objects they are carrying screened by an x-ray detector. They themselves have to walk through a gate-shaped metal detector. If something sets off the alarm on one of these devices, the security personnel conduct further electronic inspections or intervene physically – for instance by opening the bag in question or frisking the passenger. In the coming years these measures could be joined by new technologies, such as devices for detecting explosives. These technologies either screen luggage and bodies or collect particles on their surface for subsequent analysis.

Biometric Data Awaken Desires

The new technologies are designed to increase security, but they will also make the security checks more expensive and perhaps also more time consuming. The researchers from XP-DITE are thus also studying two alternative models for setting up checkpoints that are currently under discussion among politicians and researchers. One of them involves distributing detectors at various stations along the way to the gates. In this way, not every line would have to be equipped with all of the expensive – but in some cases only rarely used – devices. "The sequence of stations would have to be

Too dangerous: Sharp and blunt objects and containers that hold more than 100 milliliters aren't allowed in hand luggage. Photos: WoGi, ratatosk, Anterovium, by-studio (all Fotolia)

designed carefully in order to prevent passengers from handing bags to other people who've already been checked," says Volkmann. It would also be necessary to ensure that the same passenger appears at each of the stations – for example with the help of biometric methods like fingerprints or facial recognition technologies. However, the potential for abuse would be high: "When data like these are stored, they awaken desires." The instruments could be designed in such a way that the biometric data remain with the passenger, for instance on the boarding pass, which can be destroyed after the flight, "but there is always a loss of transparency because the passenger is not entirely certain what happens with the data."

"Checkpoints always invade the private sphere. The question is only how serious this invasion is"

The other model under discussion no longer considers all passengers to be an equal risk, but recommends dividing them up into groups. XP-DITE is not looking at what institution assesses the risk and which data it uses to do so – the project is focusing exclusively on the consequences of this model for the checkpoint. For instance, the airport could set up a tunnel for each group, each with a different level of security. The passengers would walk through with their jackets and bags: no lines, no security personnel, no inconveniences. "However, the approach could lead to a reduction in the level of security," says Volkmann. "A person who finds out how the risk assessment works can easily outwit the system." Since the criteria used to divide up the passengers into risk groups can't be transparent, the danger of discriminating against particular societal groups would be particularly high. It would thus be exceedingly difficult to monitor this classification, as Volkmann emphasizes. Another tricky aspect of this model he sees is that the risk assessment would perhaps need to be limited to the area of terrorism. However, the criminal acts that have been committed on airplanes are much more diverse: People have blackmailed airlines, hijacked airplanes to escape over international borders, and committed fraud on airplanes – there are even cases of people who have bought an expensive life insurance policy, gotten into an airplane, and caused it to crash so their family could benefit from the payout.

Special Groups, Special Risks

In order to be prepared for all types of scenarios, Volkmann developed a typology of ethical problems. He analyzed comments by passengers concerning difficulties they've encountered at checkpoints and took into account values and norms – for instance those listed in the Charter of Fundamental Rights of the European Union. This analysis led him to identify two individual problem fields. The same thing applies to all passengers: "Checkpoints always invade the private sphere. The question is only how serious this invasion is." Other risks emerge when particular groups of persons are affected more than others, such as when the personnel orders a follower of the Sikh religion to remove his turban, or when the body scanner sounds the alarm because it has detected an unidentified structure on the body of a female passenger and it turns out to be a breast implant. In addition to these individual and group risks, there are also two collective problem fields: Do the technologies find enough acceptance in society, and what effect does a checkpoint have on society at large? "Security measures could make passengers so nervous that they compromise their behavior. If I fly to Spain to participate in a demonstration, for example, I might decide to leave a banner at home

New scanners show stick figures instead of realistic naked images of the passengers. This makes the technology less controversial from an ethical perspective. Photo: Marem/Fotolia

because it would reveal the purpose of my trip." This would place restrictions on our freedom.

Volkmann now plans to develop a scale of assessment to determine the severity of various violations of the private sphere. This will involve taking the entire checkpoint into consideration, as he explains: "A technology is not good or bad in and of itself. The important thing is whether the system as a whole keeps the risks inherent in that technology to a minimum." Full-body scanners, for instance, could be used only in the case that another detector sounds the alarm – and then the passenger could be given a chance to choose to be patted down by hand instead. Besides, newly developed full-body scanners no longer show a realistic image but only a stick figure on which any deviations they find are superimposed. A similar method is being developed for luggage: "Familiar objects, such as clothes, will not appear on the screen anymore." From an ethical standpoint, Volkmann also advocates considering carefully whether it wouldn't be better to do without data collection at checkpoints. "Then there wouldn't be any risk of misuse."

When the software is ready, it will be tested in practice: The researchers are setting up demonstration checkpoints at airports in Amsterdam, Netherlands, and Manchester, Great Britain, in order to test the program and evaluate their own work: Is it possible to implement the design recommendations? Are the predictions regarding security, costs, operational procedures, and ethics correct? "We will have volunteer test subjects pass through the checkpoints and then answer questions," says Volkmann. The researchers hope the software will provide an assessment of consequences and show alternatives. Deciding how the security checkpoints of the future will actually look, however, is not within the bounds of the project. "That is a job for politicians, and aspects that aren't governed by political decisions are up to the designers." All the same, Volksmann intends to make his findings available to the public on the internet as a way of contributing to the public debate.

Transferring Methods to Other Contexts

The scope of Volksmann's dissertation project at the Husserl Archive is broader: On the one hand he is using checkpoints as a model to describe how security ethics can assess the consequences of technology and make practical recommendations to decision-makers. The goal is to transfer the methods to other contexts. On the other hand, he aims to give the typology of ethical problems he developed a deeper philosophical dimension by considering it from the perspective of the individual. "XP-DITE is working with abstract concepts like the right to travel and the private sphere. I want to find out what these concepts mean, what role they play for our perception, and why some people are affected more strongly by violations of privacy than others." It's not enough for the philosopher that his typology proves successful when used in the software: "I can build a house and be happy that it's stable, but I want to understand why this is so."

***Sebastian Volkmann** has worked at the Husserl Archive and the Centre for Society and Security of the University of Freiburg since May 2012. Upon completing a degree in Philosophy, English, and Political Science at the University of Freiburg, he served initially as a research assistant in the project "Universality and Acceptance Potential of Societal Knowledge" at the Institute of Sociology. He then studied the ethical assessment of surveillance technologies as a research assistant at the Centre for Security and Society, before joining the project XP-DITE on 1 September 2012. Volkmann is writing a dissertation at the Department of Philosophy under Prof. Dr. Hans-Helmuth Gander. His topic is "Security and the Public Sphere: Principles of an Open Society as Guidelines for Applied Security Ethics." Photo: private*

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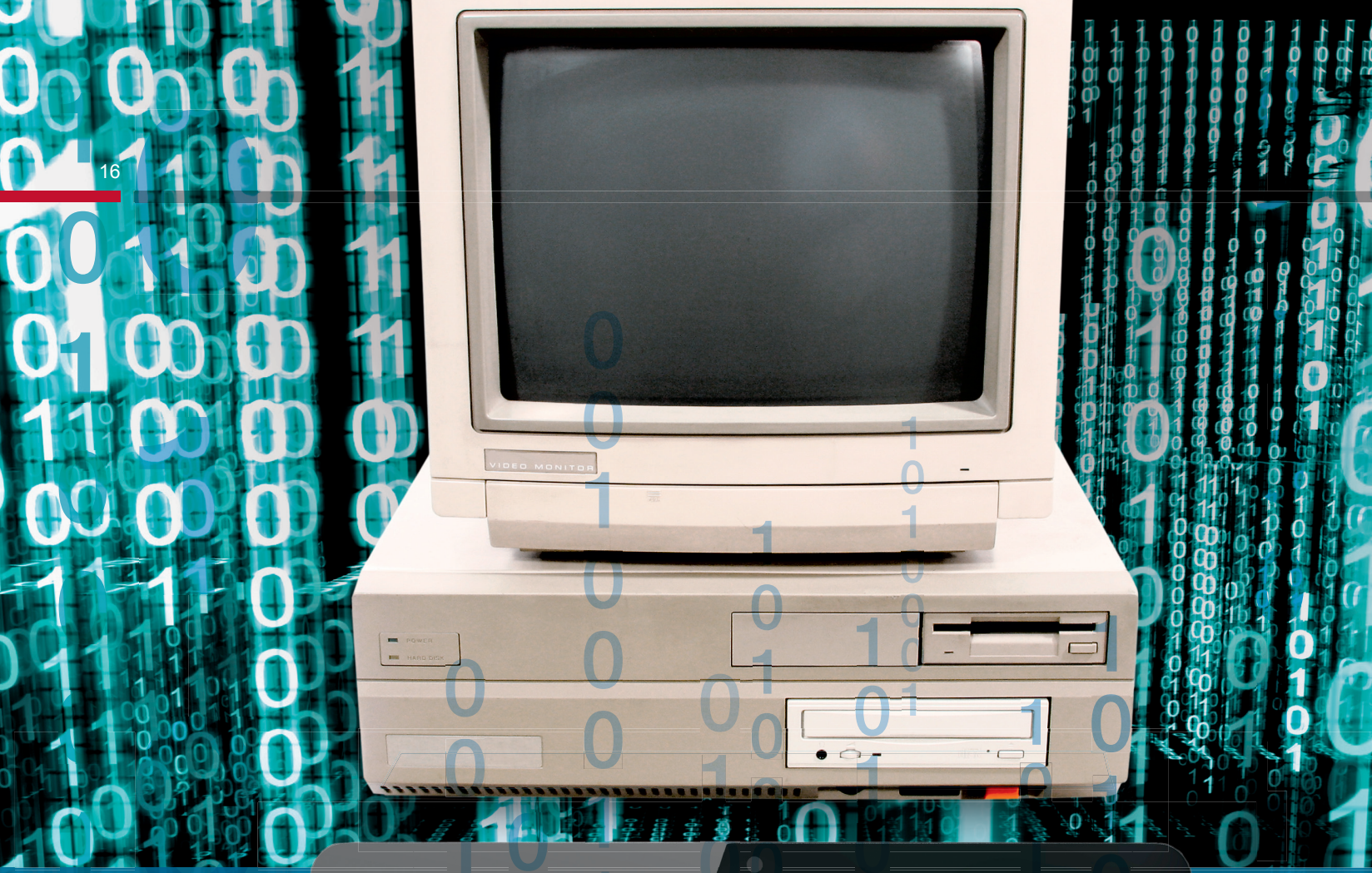

The Data Rescuers

A team at the IT Services Department of the University of Freiburg helps researchers to digitally archive information and keep it available in the long term

by Claudia Füßler

Antiquated technology, useless information: Data stored on outdated computers are often no longer readable by current models. The solution lies in imitating old systems on modern computers by means of emulators. Photos (montage): Carlos Castilla, Maksym Yemelynov, soundsnaps (all Fotolia)

The linguists were at a loss: Their digital database was suddenly unreadable. The problem wasn't the data – they were still there – but the new computer system the department had installed, which was no longer capable of reading the old data formats. The entire local language atlas, the map material, and the transcriptions of audio documents from the years 1974 to 1986 – simply gone. A linguistic treasure trove, assembled in the course of many years of hard work, had suddenly vanished into thin air. Luckily the linguists had the idea of asking for help from the IT Services Department of the University of Freiburg. Director Prof. Dr. Gerhard Schneider and his team succeeded in retrieving the valuable data: by means of emulation.

Emulation refers to the procedure of making the original computing environment on which digital data was stored available again or creating a similar environment on which it can be read. Schneider uses an example to explain what this means: "If I want to open a Word document created on an old version of Word on my computer today, I either won't be able to open it at all, or the program will tell me that the document needs to be converted in some manner." At best, the computer will still be able to read the information contained in the document, but the original form will be gone: the formatting and representation of the data as well as the so-called macros, the preset functions of forms. That might be inconsequential for casual users, but for scientific research it can be a fatal development. After all, what is the value of data that can no longer be read? Consider the case of the linguists, for instance: They had begun filling up their database in 1993 – using hardware that is now obsolete, and modern computers simply refused to read the old data.

The only recourse in situations like these is to "trick" the modern technology into thinking it is actually old. Hardware emulators are special applications that run on current systems and imitate an old system as authentically as possible. This allows the users to access and work with the data originally created on the old system. "Emulators bridge the technological gap between outdated and current environments," explains Klaus Rechert, a research assistant in Schneider's team. This works with all kinds of data, including digital art.

Documenting Processes, Describing Surroundings

The idea of emulation goes even further: Data only retain their true value if the means by which they were created is known. "No one wants to spend millions collecting data only to find out one day that they are no longer comparable," says Schneider. This "comparable" is what he and his team are working on. When generations of PhD students work with the same data, for instance, the procedures and tools they use will change again and again. All it takes is for them to be rearranged, recalculated, or sorted according to new criteria – and hardly anything will be left of the form in which the data were originally created. "It's like with the game of telephone: with each new user, with each refinement to the system, practical knowledge is lost," explains Rechert. The computer scientist thus stresses the importance of also archiving this non-documented knowledge, this work with the data, along with the data itself. Processes need to be documented, environments described as precisely as possible, in order to keep the data available for comparison or general use later on.

"No one wants to spend millions collecting data only to find out one day that they are no longer comparable"

The emulators make it possible to document the metamorphoses the data has undergone. Not only does this enable the data to be reproduced in the future, it also provides a means of determining the origin of dubious data. "If we know the path by which they were created, we can find out more easily whether there is a systematic error that has been carried over through all of the changes to the system or whether it

Fully documented experiments: Computer programs will document the entire research process in detail, ensuring that future researchers will still be able to reconstruct the experiment. Photo: Thomas Kunz

might even be a case of deception," explains Schneider. It is only possible to answer such questions if the data can be converted back to the format in which they were created. This is the real challenge for designers of emulators, says Klaus Rechert: "Data storage and data protection are peanuts; making the data useful is much more exciting." This comes as no surprise when one considers that procedural knowledge is a lot more important for science than pure data.

Filling the Gap in Data Management

Numerous open-source hardware emulation programs are already available. They make it possible to simulate popular computers of the past like Atari, Commodore, and the first PC and Apple systems. The computer scientists at the IT Services Department of the University of Freiburg are currently concentrating on 40 to 50 systems. "Most of them are systems that are relevant for research and research data," says Schneider. This is particularly true with regard to the future, because preparing the emulators for their role as archiving aids is a much more important task for the researchers than merely saving old data. Ideally, an emulator should be designed to archive all processes without requiring the user to explicitly create documents to do so. Schneider illustrates this by means of a typical scenario: "A biologist has prepared an experiment and is looking at his sample under the microscope. The microscope is controlled by computer, as are the cameras he is using, and perhaps even the entire experiment. In complex scenarios like these, scientists often forget to document minor details that might yet be important for understanding and verifying the findings later on." On the one side we have the raw data, on the other the publication – and in between a giant black hole. An emulator and a description of the original environment and the processes can serve to fill this gap in research data management, because they capture the research environment and the process of processing data for posterity: Where exactly was the camera? Did the scientist filter the selection of data?

Research data management is becoming ever more important. The German Research Foundation and other research sponsors are starting to attach more importance to strategies for data management and long-term data access in selecting research proposals. Researchers of all disciplines would thus do well to learn more about the topic, and they are invited to call upon Schneider and his team for help in this endeavor. The team is currently investigating the possibili-

Tips for Archiving Data at Home

- Use open and standardized formats: JPG is a good choice for images, PDF for text documents.
- Make regular backups of your hard drive.
- Keep a copy of your hard drive at a different location.
- Use cloud providers.
- CDs are not a secure archiving option – use a USB stick or flash storage media instead.

Photos: knee0, Romain Quéré (all Fotolia)

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ties for long-term archiving at the university. How simple or complex does an emulator need to be to document current research? What solutions are on the market? What is the best way to completely and authentically document the individual steps of research in various disciplines? “On this point, we are cooperating closely with the users to find out what is important to them,” says Schneider.

“Data storage and data protection are peanuts; making the data useful is much more exciting”

As a rule of thumb, the simpler a computer system is, the less programs need to run on it, the better. A simpler system will be less prone to error if it needs to run in an emulator somewhere down the road. This is the balancing act that research data management needs to perform: collecting a lot of data by simple means, while at the same time steering clear of the errors that have been made in the past. Decades ago people were confident that the technology they were using would work forever, but now digital archivists know that their greatest enemy is time. Equipped with their emulators, however, researchers in Freiburg will be in a good position to outsmart it.

Prof. Dr. Gerhard Schneider *studied mathematics and physics at the universities of Erlangen and Oxford, England. He completed his PhD in 1981 and his habilitation in mathematics in 1989 at the University of Essen. In 1989 he accepted a position at the same institution as head of the newly established Department of Experimental Mathematics. In 1992 Schneider was offered a professorship in decentralized systems at the University of Karlsruhe, where he also served as deputy director of the university computing center. In 1997 he became executive director of the Gesellschaft für Wissenschaftliche Datenverarbeitung (Association for Scientific Data Processing) in Göttingen, and in 1999 he accepted a chair in practical informatics at the University of Göttingen. He has served as director of the IT Services Department of the University of Freiburg since 2002. His current research interests include long-term archiving and research data management. Photos: Patrick Seeger*

Klaus Rechert *studied computer science at the University of Freiburg. In 2010 he was a visiting lecturer at the Malta College of Arts, Science, and Technology. Since 2011 he has served as coordinator of a project launched by the State of Baden-Württemberg to develop a system for the functional digital long-term archiving of state data. Rechert is a research assistant at the IT Services Department of the University of Freiburg and is writing a dissertation on dangers for the private sphere associated with the use of mobile communication.*

Chivalry in a Post-Heroic World

Working together to save lives: Firefighters show democratic togetherness and group-oriented teamwork in action. Photo: fotodrachenei/Fotolia

American studies professor Wolfgang Hochbruck is studying the behavior of firefighters during operations

by Katrin Albaum

A house is ablaze. Flames leap out of the windows, smoke billows into the air. A firefighter charges into the burning house and emerges from it again shortly afterwards: behind him the flames, his face covered in soot, in his arms a rescued child. Scenes like these are familiar to us from countless films, television series, and other media. “They convey the image of a fearless hero,” says Wolfgang Hochbruck, professor of North American studies at the Department of English of the University of Freiburg. “The stereotypical firefighter in American films pays no heed to safety regulations, is selfless and prepared to put his life on the line for others.” However, Hochbruck stresses that firefighters are not heroes in a modern sense. Rather, their behavior corresponds more closely to a medieval image of chivalry. “You don’t see anything more closely resembling swords and plate armor today than the heavy protective equipment and the axes always carried by the Americans.” Hochbruck is conducting research into the various images and cultural backgrounds of firefighters. The cultural studies and literary scholar is studying how the media portrays firefighters, how the public perceives them, what role their profession plays in society, and how the situation in Germany differs from that in the USA. From April to September 2011 he worked on the project as a fellow at the Freiburg Institute for Advanced Studies (FRIAS) of the University of Freiburg.

“There is something of an international firefighter habitus”

He came upon the idea for this research topic because he has been a firefighter himself for around eleven years, currently in the towns of Denzlingen and Waldkirch near Freiburg. He became a volunteer firefighter after 11 September 2001, at the age of 42. “This gives me a completely different appreciation for the topic and for the people I interview,” says Hochbruck. He is especially interested in fire prevention education for children. In 2009 he visited the New York City Fire Department’s (FDNY) renowned elite unit Rescue Company 1. During a research trip to Oregon in 2012, he observed the training company of the professional firefighters of Springfield and Eugene and studied the volunteer fire

Wolfgang Hochbruck visited the New York City Fire Department (FDNY) in 2009 and observed firefighters conducting a training exercise. Their clothing alludes to their culture: The helmets are reminiscent of the leather helmets from the so-called war years, a celebrated era for the FDNY in the 1970s. Photo: Wolfgang Hochbruck

departments of Santa Clara and Brownsville. He even participated in firefighting operations with the unit in Santa Clara. He conducted interviews with the members of all of the units he visited to learn about their motivation and experiences. Hochbruck found similarities between the USA and Germany, particularly in modes of behavior. "There is something of an international firefighter habitus," he remarks. The language of firefighters in these two countries is similar particularly in their use of metaphor, and they also use a similar type of humor to come to grips with stressful situations. A firefighter who had the toughest job in an operation, for instance recovering a dead body, is allowed to make a sarcastic remark. The act of laughing together provides release and protection against a potential trauma.

Fire Departments Are Conservative

The structures and equipment, on the other hand, are very different in the two countries. For example, fire departments in the USA have separate units for fire extinguishing and rescue operations, the engine and ladder companies, respectively. In Germany there is no distinction of this kind. The American organizational principle is largely a result of historical and cultural factors. Another distinctive marker of firefighting culture is clothing. The helmets worn currently by New York firefighters are reminiscent of the leather helmets of previous generations. "They still revere these helmets today because they serve as a reminder of the so-called war years, the celebrated era in the 1970s when the FDNY had to extinguish numerous fires set by homeowners who wanted to collect insurance payouts," explains Hochbruck. Firefighters are generally conservative: "They cling to traditions and are reluctant to introduce new technologies."

The typical, traditional heroic figure is still alive in many parts of the USA. "The most respected fire departments, the ones that shape the public image of firefighters, are those in New York and, to a considerably lesser extent, in Chicago and Boston. There are applicants who give up better paid positions and endure long commutes for the opportunity to work at these departments," says Hochbruck. The image is shaped to this day by the media and individual

A scene from the film Backdraft *with the actor Kurt Russell: The movie still has a great influence on the image of the heroic firefighter today. Photo: DVD Backdraft/Universal Pictures*

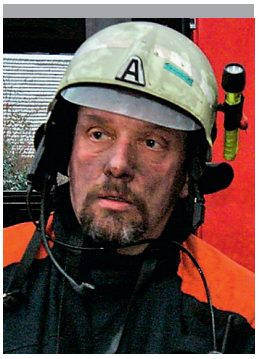
"In a firefighting operation I can't be worried about whom I'm working with and whether I can stand someone personally"

fictional works like television series and novels. The 1991 action film *Backdraft*, which chronicles the exploits of two firefighter brothers in Chicago, still has an enormous influence. All of the recruits interviewed by Hochbruck had seen it, and the members of some firehouses said they watch it together regularly. However, the heroic image is less pronounced in some regions than in others. "In the Northwest, for instance, there are more forest fires than fires in buildings. As a result, firefighting is structured differently there." In the rural South, the researcher adds, the fire departments are worse off and are held in less esteem since they were established later and often struggle to find enough recruits.

Stronger Volunteer Culture in Germany

American volunteer fire departments are currently suffering from an alarming drop in membership: Many of them have been combined with other departments, restructured to form professional fire departments, or dissolved entirely. The concept of "fameworthiness" was originally the foundation of community service: Volunteers enjoy high recognition and esteem but do not expect any financial reward in return for their services. This concept has lost significance, as Hochbruck has found. While volunteer fire departments are still experiencing an influx of new recruits, many of them join in hopes of improving their prospects of being hired later by a professional department. If they don't find a job, they often leave the volunteers soon afterwards. If they do find one, of course, the volunteer fire department also loses them. Germany, by contrast, has a stronger culture of volunteerism. Still, according to Hochbruck the concept of volunteerism has changed here as well and is no longer in line with the reality of modern firefighting. Volunteer rescue personnel must be willing to take on a great burden, for instance the necessity of being on call at all times and unforeseeable working hours. Hochbruck thus recommends distinguishing this kind of volunteering from other kinds and finding a new definition for the concept.

In capitalist societies, the researcher argues, the foundation for social behavior based on unselfishness is eroding. We live in post-heroic societies: There is still heroic behavior, but it is no longer a part of the social contract. Instead, individual profit and personal economic advantage have pushed themselves into the foreground. The fire department thus has a more important role than ever before as a potentially democratizing element in society. Hochbruck sees it as a system in which the leadership role needs to be negotiated. Normally there will be a person who gives the commands, but group leaders must prove their worth to their colleagues in operations. In this regard, there is no absolute hierarchy. Moreover, the fire department is a vivid example of democratic togetherness and group-oriented teamwork in action. This leads to important learning effects: "In a firefighting operation I can't be worried about whom I'm working with and whether I can stand someone personally," explains Hochbruck, "and this attitude is transferable to society as a whole."



Prof. Dr. Wolfgang Hochbruck *studied German, English, and history in Freiburg, Canada, and the USA. In 1990 he earned his PhD at the University of Freiburg, in 2001 his habilitation in Stuttgart. He then accepted a position as a professor at the Braunschweig University of Technology. In 2003 he returned to the University of Freiburg, where he has since served as professor of North American studies at the Department of English. He is academic dean of the Faculty of Philology, director of the master's program in British and North American Cultural Studies, member of the Centre for Security and Society of the University of Freiburg, and deputy chair of the Carl-Schurz-Haus Freiburg (German-American Institute). He has been a volunteer firefighter for eleven years. Photo: Rudi Oswald*

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A Concerted Effort

Diana Panke is analyzing how the United Nations achieves a balance between the formal equality and the real inequality of member states in the General Assembly

by Stephanie Streif

One country, one vote: This is the guiding principle of the United Nations General Assembly, but in reality there are major differences in the relative political strength of the member states – because large states have more resources at their disposal. Photo: Greg Kinch/UN

"Countries like Great Britain or France have budgets at their disposal that are thousands of times higher than those of microstates like Kiribati"

São Tomé and Príncipe is an island nation off the western coast of Africa. It has a population of only 167,000 and a total area hardly larger than the Baltic Sea island of Rügen. It pales into insignificance in comparison to the distant People's Republic of China – a country with 1.34 billion citizens, more than Europe, North America, and Russia combined. All the same, the vote of São Tomé and Príncipe has exactly the same weight as that of China in the United Nations General Assembly. "In no other international organization has the principle of equality been implemented as successfully as in the General Assembly," says Diana Panke, holder of the Chair of Governance in Multilevel Systems at the University of Freiburg. She has been studying in detail how the members of the policy-making organ in New York negotiate and vote for a good three years. While the member states of the United Nations may be equal in a strictly formal sense, they differ greatly with regard to their administration, finances, and the size of their staff – and thus also their relative political strength.

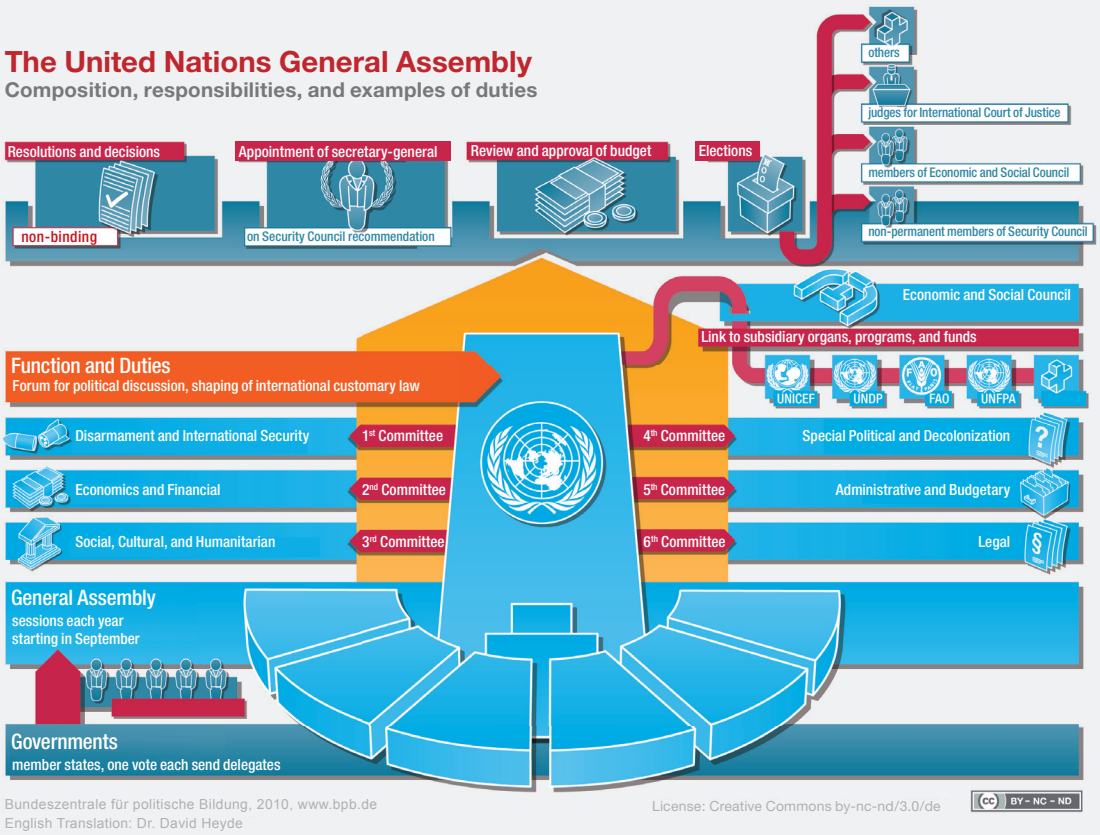
Panke's study is primarily a quantitative analysis. In order to determine how the General Assembly develops, negotiates, and makes decisions on political issues, the political scientist combed through scores of data on the resolutions the organ worked on between 1999/2000 and 2009/2010. The databases contained information on what resolutions were submitted and passed at what time and on how each member state contributed to the political decision-making process: Did the state play an active role in drafting the resolution, did it participate in the negotiations, or did it simply ignore it from the start? Panke focused her efforts on two questions in particular: How strongly do the material resources available to a member state impact its participation in the stages of a cycle of political decision-making, and to what extent does political activity translate into influence? In addition, she also conducted more than 160 interviews with diplomats in New York in order to have more than just statistics as a basis for her analysis. Finally, her research design also included six case studies whose purpose was to demonstrate by way of example how small, medium-sized, and large countries engage – or don't engage – in the multilateral interaction.

Resources Are Crucial

The most important finding of her study should hardly come as a surprise: Large countries tend to participate more actively than small countries because they have a lot more resources at their disposal. The differences are immense. There are countries that are so small that they don't even have their own diplomatic mission in New York, such as the Republic of Kiribati in the central Pacific. Others only send a single diplomat, like Somalia, Guinea-Bissau, and Nauru. These countries enter into negotiations with countries like the USA, whose delegation is over 100 diplomats strong. The representatives of a large embassy can distribute duties and areas of responsibility among their ranks, they can follow positions that are in their national interests on a

broad front, and they can also engage in intensive networking. A single delegate cannot do this. Another reason the participation of small countries lags behind that of large countries is because their budgets are too small to allow them to increase their activities. “Countries like Great Britain or France have budgets at their disposal that are thousands of times higher than those of microstates like Kiribati,” says Panke. However, staff and money are not everything. Another factor that leads to a higher level of participation among large nations is that their foreign ministries take care of the groundwork for their diplomats at the United Nations and call in experts to advise them if necessary. After all, remarks Panke, a diplomat can’t be an expert on everything.

In a word: A lot of participation – whether with regard to political issues, negotiations concerning details in the wording of resolutions, or coordination – requires a lot of resources. And that costs money: “The tension between formal equality and real inequality within the General Assembly is immense,” says Panke. “That surprised even me.” The only thing left for small states and microstates to do is to determine whether there is any way to compensate for their deficiencies. Panke pursued this question as well and came to the conclusion that by no means do small states have their hands tied; in fact, they can even act more quickly and flexibly than larger countries. Panke explains why: “In large countries every decision, every possible



Bundeszentrale für politische Bildung, 2010, www.bpb.de
English Translation: Dr. David Heyde

The United Nations is an international organization with a current membership of 193 member states whose main goals are to work toward world peace, improve international law, protect human rights, and promote international cooperation. It consists of six principle organs: the General Assembly, the Security Council, the Economic and Social Council, the Trusteeship Council, the International Court of Justice, and the Secretariat. In contrast to the Security Council, which includes the five permanent members China, Russia, France, Great Britain, and the USA as well as ten non-permanent members, all member states have equal representation in the General Assembly. It controls the budget and administration and can discuss all issues addressed by the United Nations Charter and make recommendations to states in the form of resolutions. Unlike those made by the Security Council, these resolutions are not binding, but under certain conditions they can contribute to the establishment of binding international customary law. Illustration: Bundeszentrale für politische Bildung, www.bpb.de, License: Creative Commons cc by-nc-nd/3.0/de

Faster, freer, more flexible: Diplomats from small countries like São Tomé and Príncipe can often act more independently than their colleagues from large countries, whose foreign ministries dictate all decisions. Photo: Evan Schneider/UN

compromise, is determined by the foreign ministry. The ministries give their diplomats detailed instructions, tell them exactly how they should decide on a particular issue and what compromises they are allowed to make in the negotiation phase." The representatives cannot make decisions on their own initiative and have to check back with their superiors repeatedly to ensure that they are making the right decision. The diplomats of small countries, on the other hand, are often not bound to follow the orders of their foreign ministries because they are too small to even develop national positions on each and every resolution. They are therefore free to decide for themselves according to what they think is right.

Making Convincing Arguments

Small countries can also improve their bargaining position within the General Assembly by developing effective strategies: first, by setting clear priorities and not even trying to deal with all issues, and second, by teaming up with other countries to rally around the positions that are important to them. "Formal and informal networking and alliances can enable even smaller states to exert influence," explains Panke. The fact is that most countries are not only members of the United Nations but also of regional organizations and groups – such as the European Union, the Association of Southeast Asian Nations (ASEAN), the Mercado Común del Cono Sur (MERCOSUR), or the Group of 77. Although these organizations do not have a vote in the General Assembly, they can develop common positions that their members can then advocate in accordance with their relative strength and bring to a vote. Whereas large groups can use their collective negotiating power, the influence of smaller groups is based on argumentative strategies. The latter might not have even remotely as many votes as the usually rather heterogeneous large groups, but if everything runs as it should, they can win over other nations for their cause. A concerted effort is their key to success.

"Formal and informal networking and alliances can enable even smaller states to exert influence"

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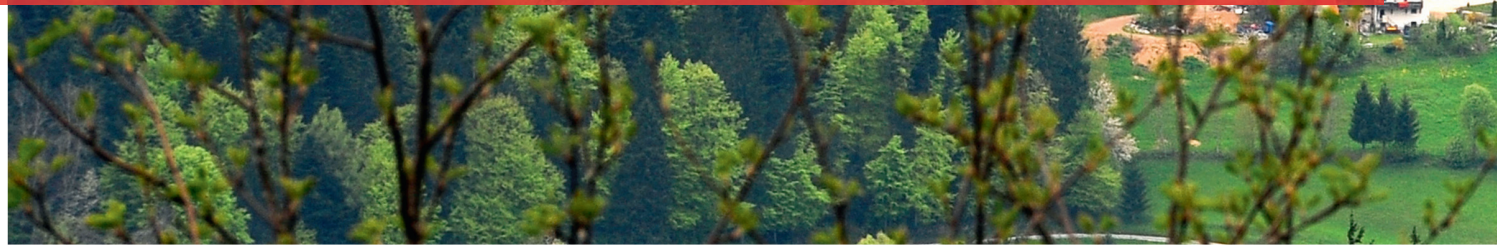
Prof. Dr. Diana Panke *studied political science, public law, and business administration in Mannheim. She then went on to complete a PhD with a study on the judicialization of the European Union and its effects on internal dynamics of interaction. While working on her dissertation, she worked as a lecturer at the Institute of Political Science of the University of Heidelberg and later at the Otto Suhr Institute of Political Science of the Free University of Berlin. After completing her doctorate in 2007, she went to the University College Dublin, Ireland, as lecturer of political science, and in 2011 she was promoted to associate professor of political science. In 2012 she became the first holder of the new Chair of Governance in Multilevel Systems at the University of Freiburg. Photo: Nicolas Scherger*

A Guide to the Energy Transition

A research project coordinated by Freiburg researchers has produced a guide for local governments

by Anita Rüffer



After the nuclear disaster in Fukushima, Japan, CDU Chancellor Angela Merkel called for a transition to renewable energies. The SPD politician Rolf Böhme, former mayor of Freiburg, considers the energy transition to be "one of the most ambitious large-scale projects in post-war Germany." However, he maintains that the actual catalysts of change will be the local governments: The energy transition will usher in a new era for municipal self-government. Indeed, more than 100 municipalities and regions in Germany, representing more than 20 million citizens, are already taking concrete steps to make the switch to renewable energies. But how does this work? What should municipalities watch out for? What obstacles could hinder their progress in this endeavor?

The research project "EE Regions: Social Ecology and Self-Sufficiency," which is receiving two million euros in funding from the Federal Ministry of Education and Research from May 2009 to April 2014, aims to provide them with answers to these questions. The head of the project is the forest and environmental scientist Dr. Chantal Ruppert-Winkel from the Center for Renewable Energy of the University of Freiburg. With the help of her colleagues in Freiburg as well as junior researchers from the Institute for Ecological Economy Research in Berlin and the University of Hohenheim, she has prepared a guide municipalities and their citizens can use to shape the energy transition on a local scale. "It isn't just about energy production in a strict sense but also about how energy can be produced through sustainable means," says the project director. "Only if all of the gears interlock as smoothly as possible can the energy transition be at the same time ecologically sound and socially acceptable."

Several local governments have already learned this lesson, such as the rural districts

Lofty goals: More than 100 municipalities and regions in Germany want to supply themselves with renewable energies. Photo: Thomas Kunz

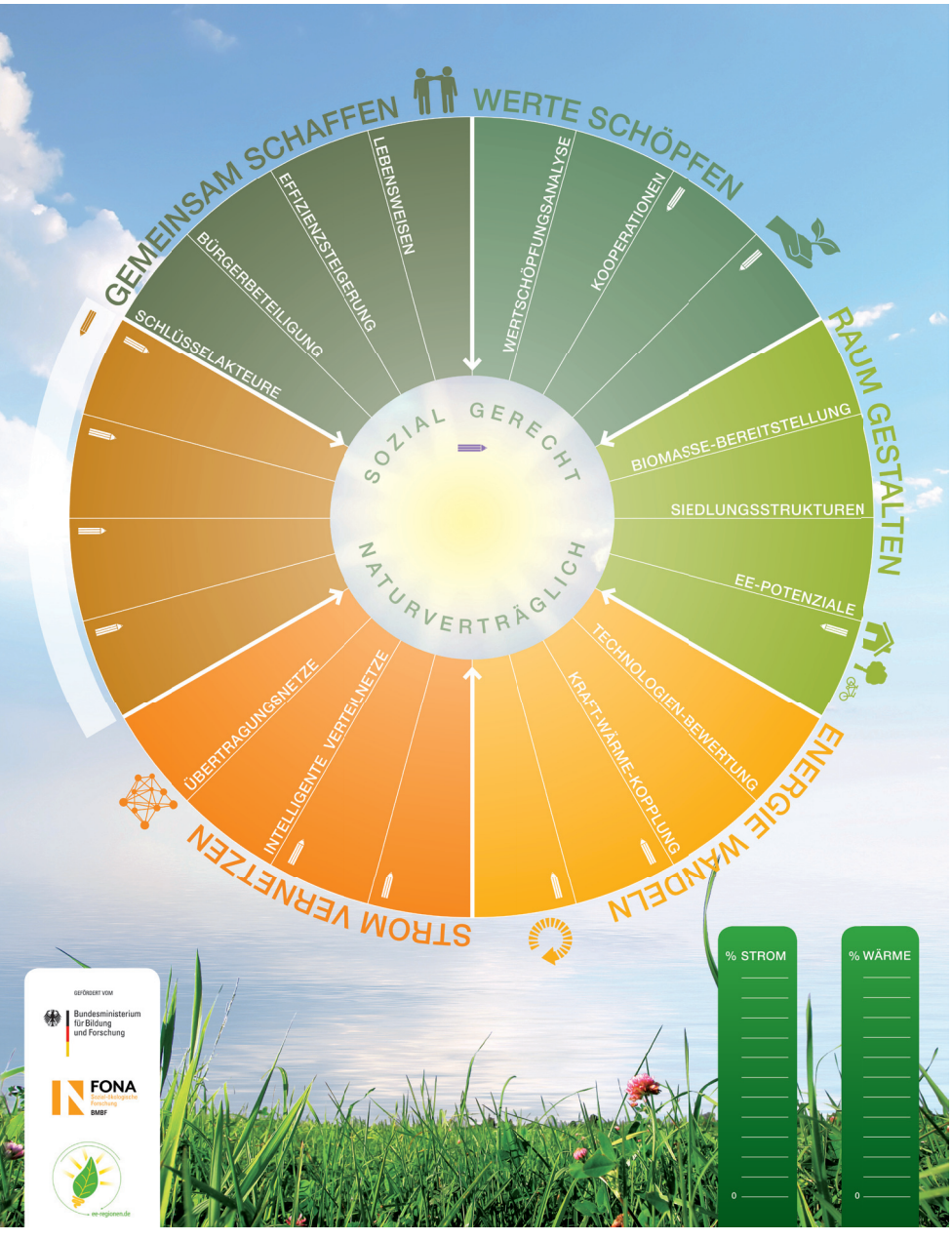
Lüchow-Dannenberg in Lower Saxony and Schwäbisch Hall in Baden-Württemberg and the municipalities Morbach in Rhineland Palatinate and Wolpertshausen in the district of Schwäbisch Hall. They have already begun to make the switch to renewable energy and participated in the research project as partners. The scientists and politicians sat down together and deliberated over the necessary know-how and changes in policy for making the vision a reality.

Fed Up with Nuclear Power

When Germans hear the name Lüchow-Dannenberg, they think of radioactive waste transports. No wonder the rural district has long been fed up with nuclear power and is looking for alternatives. Energy from biomass seems to suggest itself. Many citizens, the scientists have found, have modified their cars and now fill up their tanks at the biogas filling station. However, producing energy from plants eats up vast swaths of cropland. In addition, it can lead to maize monocultures and drain the soil of nutrients. This has a detrimental effect on the skylark, a species of bird that serves as an indicator for biological diversity in agricultural landscapes. This in turn angers conservationists, who suddenly find themselves at loggerheads with farmers. One would think that this situation would not necessarily be conducive to an ecologically sound and socially acceptable energy transition. Nevertheless, the scientists believe that it is possible, particularly if it is realized on a local scale, where people know one another and aren't forced to deal with faceless large-scale institutions.

"There is a great willingness among the various interest groups to search for common solutions"

"There is a great willingness among the various interest groups to search for common solutions," reports Ruppert-Winkel. Indeed, the group has already found such solutions – in the case of Lüchow-Dannenberg, for instance, flower strips for insects and more environmentally friendly seed mixtures are now contributing to the survival of the skylark.



Shaping the energy transition on a local scale: The "energy wheel" shows the various dimensions for the sustainable expansion of renewable energies. Illustration: EE Regions Project

The important thing is to set up a networking center, says Ruppert-Winkel, touching on one of the group's most important findings: "In addition to being run by dedicated individuals, this center should be embedded within a solid institutional framework." As an example, the scientist names the Agenda 21 office of the district Steinfurt in North Rhine-Westphalia, winner of the 2012 German Solar Prize. The office serves as the nerve center for energy policy in the district. It engages in conflict management, calls the protagonists together, delineates their fields of activity – mobility, agriculture, finances, project planning – and organizes public participation as well as a comprehensive system of data collection as a basis for planning.

Integrating Key Protagonists

The researchers emphasize the great importance of identifying the key protagonists in the region and getting them involved. For instance, the "political and technical pioneers" in the district of Schwäbisch-Hall "looked for solutions even before renewable energy legislation was passed and simply began experimenting with biogas plants at their farms," says Ruppert-Winkel. These experiments led to the establishment of a company that now has 200 employees – a success story that also serves as a demonstration of the economic benefits the regional energy transition can have: Capital stays in the region, where it contributes to prosperity rather than disappearing into the hands of global energy corporations. The researchers thus added a section on "regional value creation" to their guide for municipalities. What makes the difference is that the energy center Wolpertshausen, responsible for the entire district of Schwäbisch-Hall, is funded by the local economic development agency. The center organizes lectures and seminars to inform experts and the interested public about the benefits of alternative energy production. More than

"Everyone has to be able to understand what we are saying"

Creating electricity on one's own roof: The regional energy transition is interesting for ecological as well as economical reasons. Photo: LianeM/ Fotolia

90 percent of the district's electricity is produced from renewable sources of energy. The next projects include promoting e-mobility with a quick charge station and making electric cars available for rent as well as expanding the already existing local heating supply over the central Hackschnitzel Heating Plant.

Although an important goal of all of these activities is to reduce energy consumption in order to enable complete energy self-sufficiency, the fact is that they have not yet succeeded in achieving this goal. This gave the researchers the idea of considering people's lifestyle as a further relevant criterion. Instead of buying a new car that runs on biogas, it might be better to ride a bicycle more often. People who live near a store do not need to get into the car every time they want to go shopping. The design of public space, building stock, and infrastructure also influence our energy consumption behavior. As a consequence, the municipality Morbach has drafted a new housing development policy to provide incentives for building in the old center of the town.

Municipalities Set Priorities

The guide, which was developed on the basis of research, does not offer ready-made solutions. An "energy wheel" shows various dimensions for making the switch to renewable energies – such as "designing space" and "creating value." The guide leaves it to the municipalities themselves to weigh possibilities and set priorities. It is thus a versatile tool for helping municipalities to develop a strategy that fits their needs.

The research was conducted by a team of forest and environmental scientists, sociologists, engineers, economists, geographers, and biologists. They divided up the project into five parts. In Freiburg, for example, a group led by Ruppert-Winkel was in charge of investigating the decision-making and communication processes involved in switching to renewable resources on the regional level. The researchers always sought contact with their political partners and coordinated every step with them. This is evident even in the writing style used in the guide. "Everyone has to be able to understand what we are saying," explains Ruppert-Winkel. Her team was rewarded for their efforts with great cooperativeness and interest on the part of the project partners and other municipalities. But their products for practical usage, though "very time-consuming" to create, do not speak the language of scientific publications. "This makes things difficult for career planning, leading to conflicts for the junior researchers, who have to produce both products for practical usage and scientific publications. That was and still is a balancing act of sorts that accompanies our way of working" – a balancing act that, at least in the eyes of many interested municipalities and citizens, was well worth the effort.

***Dr. Chantal Ruppert-Winkel** studied forest science at the University of Freiburg and earned her PhD in 2006. Since 2008 she has served as a junior research group leader at the Center for Renewable Energy of the University of Freiburg. She focuses on socioeconomic and interdisciplinary research on regional development, socio-ecological research, the sustainable and efficient use of resources on the regional level, analysis of organizational structures, networks, and institutions, and bioenergy. She is currently working on her habilitation thesis. In 2012 the Ministry of Science, Research, and the Arts of Baden-Württemberg appointed her to the expert group "Science for Sustainability." Photo: private*

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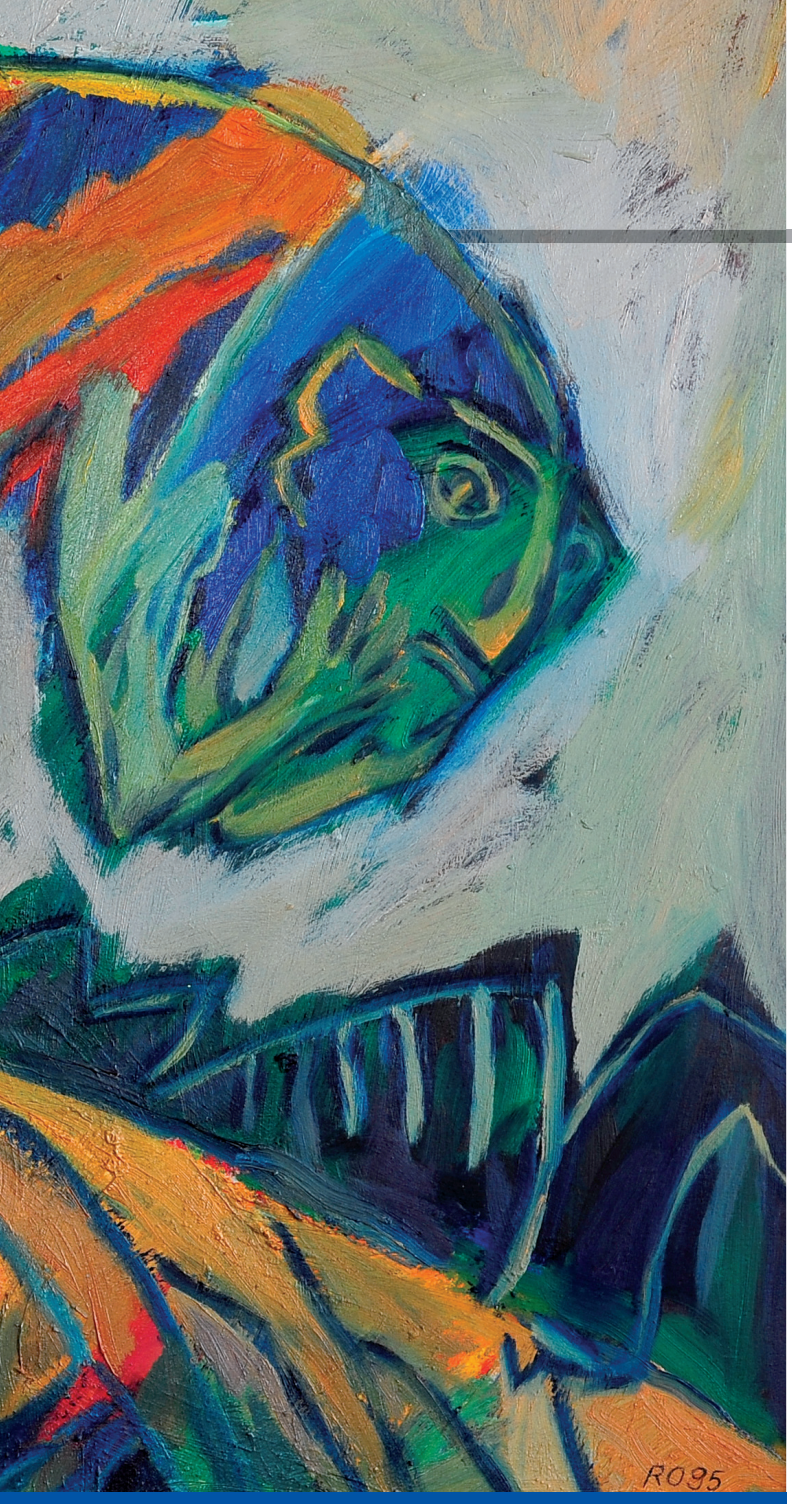
Victim and perpetrator: In classical and late antiquity, Jewish scholars condemned Cain as a brother murderer. In the modern period, poets stylized him into a tragic hero who struggles against a self-righteous god. Painting: Rainer Oberhänsli-Widmer, Photo: Thomas Kunz

Divine Murderers, Human Heroes

Jewish studies professor Gabrielle Oberhänsli-Widmer traced changes in images of evil in the history of Jewish theology, culture, and thought

by Rimma Gerenstein



Sin lies at Cain's door: "And unto thee *shall* be his desire, and thou shalt rule over him," warns God, as the first son of Adam and Eve gets angry with his brother Abel. The rest of the biblical story is well known: Cain, the farmer, attacks and kills his brother Abel, the shepherd, because God prefers the latter. Cain becomes the first murderer in human history, Abel the first victim. The roles seem clearly assigned, but is this really the case? Isn't God the one responsible for causing the jealousy between the siblings and hence for bringing about the tragedy? And doesn't Cain show courage by taking a stand against this arbitrary act?

"The distressing contradiction does not stun the priests, scholars, philosophers, and poets"

The question of who is good and who is evil is all a matter of perspective, finds Gabrielle Oberhänsli-Widmer. The Freiburg Jewish studies professor has conducted research on images of evil in Judaism. The tree of knowledge, the chaos monsters Leviathan and Behemoth, the brother killer Cain, the fallen angels, the evil impulse, the rebellious Esau, the sacrifice of Isaac: On the basis of seven biblical figures, the Jewish studies professor investigated how the notion of evil has changed from century to century in the course of Jewish history. "There has been a 180-degree change in the interpretation of some of them. A figure one era rejects as the epitome of all evil is revered by the next as a tragic hero."

Cain is the best example of such a reversal. While the scholars of classical and late antiquity condemned him as a bloodthirsty murderer, he has been viewed since the early modern period with a more sympathetic eye. "In the course of the Enlightenment, religion and the role of God were increasingly called into question. Humans began to take center stage as rationally acting and self-determined individuals," says Oberhänsli-Widmer. The English Romantic poet Lord Byron, for example, praises Cain in a play in 1821 as a kind of Prometheus who struggles against a self-righteous god in search of truth. In the mid-20th

"Without an evil impulse, the human race would not make any progress"

century, Jewish poets, shocked by the horrors of the Holocaust, gave the figure of Cain a new twist, stylizing him as a henchman of the Nazis, a human monster created by God as the originator of evil.

Absurdity Engenders New Categories

A god who torments, destroys, oppresses – is that the same god children pray to, the same god who is supposed to watch over them? This absurdity is already present in the *Bible*. In Isaiah 45:7, God proclaims: "I form the light, and create darkness: I make peace, and create evil: I the LORD do all these *things*." This *Bible* verse is a theological scandal, stresses Oberhänsli-Widmer: "If the passage weren't so prominently placed in one of the books of the Old Testament prophets, one would be inclined to simply cut it out." The verse was always a thorn in the side for rabbis, says the Jewish studies professor. They twisted it and turned it this way and that, but they never tried to keep it from being known. After all, it enjoys a prominent place in the liturgy: Practicing Jews sing the words in their daily prayer. Perhaps this is why religious teachers took the edge off of the verse during the course of its textual transmission: "The rabbis replaced 'evil' with 'everything.' This may only be a slight change in wording, but it causes a massive change in the content of the sentence," explains Oberhänsli-Widmer. Theological debates of this kind were the starting point for her study. She wanted to find out how Jewish thinkers treat the phenomenon of evil: "The distressing contradiction does not stun the priests, scholars, philosophers, and poets. It drives them on to think in new categories in order to explain the relationship between good and evil in new ways."

The researcher investigated texts representing 3,000 years of Jewish history – from theological sources in Hebrew, Greek, and Aramaic and philosophical writings by Moses Maimonides and Moses Mendelssohn to Sigmund Freud's psychological treatises and contemporary novels, plays, and poems. Her aim is to illustrate the range of Jewish culture, which unites a wide variety of traditions, says the researcher: "Judaism is made up of documents in countless languages from almost every country on Earth." Despite this diversity, she discovered parallels in the ways in which Jewish thinkers have argued against God: "Criticism is allowed, but you first have to situate yourself within the lines of thought in Jewish culture." Even non-religious modern writers cite religious thinkers and teachers before stating their opinions. "What counts in Judaism is the lines of tradition. You can't explain the world out of nowhere like Aphrodite, born from foam."

The Hebrew Bible *introduced images of evil like chaos monsters and fallen angels. These figures have changed from century to century in the course of Jewish history – not just in theological texts. Photo: Marén Wischnewski/Fotolia*

From Plato's Chariot of Souls to Freud's Psychoanalysis

The Jewish scholar found a similar integration of new thought into established lines of tradition in the notion of the "evil impulse," a rabbinical concept from the 1st and 2nd century after the birth of Christ – a time in which the Jewish wise men in Palestine were greatly influenced by

"I form the light, and create darkness": Practicing Jews utter these words from the biblical verse Isaiah 45:7 in their daily prayer. The notion that God does not only create good but also evil drives Jewish priests, scholars, and philosophers to think in new categories. Photo: Rafael Ben-Ari/Fotolia

***Prof. Dr. Gabrielle Oberhänsli-Widmer** studied French and Hebrew in Zurich, Switzerland; Florence, Italy; Avignon, France; and the Swiss towns Lausanne and Lucerne. In 1988 she submitted her dissertation on laments for the dead in the French and Occitanian Middle Ages to the University of Zurich. In 1996 she completed her habilitation thesis on biblical figures in rabbinical literature at the same institution. After a stint in Israel at the Hebrew University of Jerusalem, she worked as a visiting professor in Jena and Bern, Switzerland. Since 2004 Oberhänsli-Widmer has held the Chair of Jewish Studies at the University of Freiburg. Her research interests include the history of the influence of biblical motifs and figures in rabbinical and Jewish literature as well as translations of modern Hebrew and contemporary Israeli literature. Photo: Thomas Kunz*

Greek thought. The model states that the good and evil impulse are both present in every person. Oberhänsli-Widmer traces this idea back to Plato's "chariot of souls": The Greek philosopher saw humans as chariot drivers who need to keep two horses under control – the evil horse of desire and the good horse of prudence. "The rabbis borrowed the allegory from Plato and made it into an astonishingly realistic anthropological model," explains the researcher. They separated evil from God. "According to this concept, it is humans who can conquer the two opposing forces." Nearly a thousand years after the formulation of the rabbinical concept of good and evil impulses, Oberhänsli-Widmer sees an extension of this line of thought in Freud's famous drive theory: In the constellation of the id, ego, and super-ego, humans have to maintain a balance between various forces – a psychological model of the modern age that of course dispenses entirely with allusions to God. "The more secular the age, the less prominent the role of God. What remains from epoch to epoch are the thought patterns, which are then filled with new content as appropriate."

However, the researcher emphasizes that evil is not only a harbinger of chaos and destruction – it also has a positive effect, setting a dynamic process in motion: "Without an evil impulse, the human race would not make any progress." There are even some human achievements the world has the cursed Cain to thank for: After his banishment he founded the city of Enoch, and his family includes the first harp and flute makers as well as the first ore workers and ironsmiths. He is thus a brother murderer who turns his energies to the advancement of civilization.

Her study of evil has also released new energies in Gabrielle Oberhänsli-Widmer. At the moment she is working on a new book on figures of love: from the Song of Solomon, an "erotic effort" the rabbis wrote pious commentaries on with red faces, to the poems of Lea Goldberg, an Israeli writer from the 20th century, whose poems combine images of love with images of the Holocaust. The Jewish studies professor feels right at home moving back and forth between thematic extremes – and into the heart of the history of Jewish theology, culture, and thought.

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Poisoning and Healing

The pharmaceutical and medical researcher Klaus Aktories wants to detoxify bacterial toxins or use them to develop new medicinal agents

by Jürgen Schickinger

Clostridia are a real nuisance: The bacteria can produce a whole arsenal of toxins. Some clostridia carry toxins that lead to tetanus; others produce the botulinum toxin, which can cause food poisoning and – under the trade name Botox – smoothen out wrinkles. Prof. Dr. Dr. Klaus Aktories studies clostridia toxins that are less well-known than these but no less dangerous. Several of them could potentially be used to develop new medicinal agents. The toxin in the gas gangrene pathogen *Clostridium perfringens*, for instance, has what it takes to become a powerful agent against cancer. The Freiburg researcher wants to harness this potential. In the case of *Clostridium difficile*, on the other hand, he wants to deactivate a toxin that can lead to a life-threatening infection of the intestine.

"*C. difficile* is one of the most dangerous hospital germs"

"*C. difficile* is one of the most dangerous hospital germs," says Aktories. Five to ten percent of the victims die from the infection. With the help of his research team, the pharmaceutical and medical researcher from the Institute of Experimental and Clinical Pharmacology and Toxicology recently revealed how the *C. difficile* toxin CDT binds to intestinal cells. Now the team is hunting down the substance that blocks this binding site. "This could help us to make the course of an infection with *C. difficile* considerably milder." The optimal substance for a drug

Hygiene is a top priority at hospitals – but that doesn't stop the bacterium Clostridium difficile *from proliferating and causing life-threatening intestinal infections with a toxin. Klaus Aktories and his team want to develop a drug that alleviates the course of the disease. Photo: Britt Shilling/Freiburg University Medical Center*

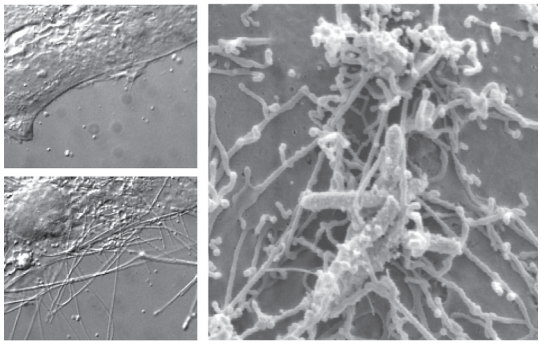
would be an agent that only takes effect in the intestine, where *C. difficile* is present one out of 25 people, in hospitals even in one out of every five patients. Those who actually get sick from the infection are usually older than 65, take antibiotics, and often suffer from other severe illnesses. Antibiotics damage bacteria of the normal intestinal flora, allowing the *C. difficile* bacteria to develop freely. Their toxins cause diarrhea and inflammation of the intestines.

The frequency, severity, and danger of the infections have increased in recent times due to a proliferation of hypervirulent or highly infective strains. Their deadliest weapons are the toxins A and B. "Without them, no one gets sick," explains the scientist. To make matters worse, hypervirulent strains are resistant to certain antibiotics, and they produce CDT. This toxin attacks the cytoskeleton, which stabilizes the cell and keeps its shape intact. "There is a high probability that the toxin aggravates the course of the infection," says Aktories. His colleague Dr. Carsten Schwan shows a microscopic video of the cytoskeleton, in which the microfilaments, forming a framework of fibers made of the protein actin, resemble a spider's web. It becomes thinner and porous when CDT attacks. In addition, tentacle-like structures begin growing out of the cells, forming a network on the cell surface the *C. difficile* bacteria can use to latch on to the cell. "The bacterium creates its own little niche and makes itself right at home," explains Schwan.

In order to penetrate into the cells, CDT binds to the protein LSR on the intestinal cells. In cooperation with the cancer researcher Dr. Thijn Brummelkamp from Amsterdam, Netherlands, Aktories and his team identified the receptor by means of "gene trapping." This method works with haploid cells, which contain only a single set of genes instead of the normal double set. With their help, errors in the genes can be identified immediately, because there are no "copies" that could compensate for defects. Through skillful manipulation, the scientists established haploid cell lines, each of which was missing a different gene, and then infected these cultures with CDT. The only cells that survived were the ones in which the toxin could not take effect because its receptor was missing. The subsequent genome analysis confirmed that LSR was indeed the culprit. This discovery earned the researchers the Phoenix Pharmaceutical Science Award, worth 10,000 euros.

Introducing Toxins into Cancer Cells

Aktories plans to use the same method to find the receptor of the toxin TpeL in *C. perfringens*. The bacterium causes gas gangrene, a wound infection that quickly leads to death if left untreated. TpeL does not act primarily on the cytoskeleton. It deactivates the protein Ras, an important switch for cell proliferation, cell differentiation, and cancer. "Ras is mutated in almost 40 percent of all tumors," says Aktories, "in pancreatic cancer even in nine out of ten cases." All previous attempts to develop a therapy have failed because scientists did not know of any substance that blocks Ras – until now. TpeL has the potential to cure cancer or at least alleviate



Invasion under the microscope: The rod-shaped bacterium Clostridium difficile *(right) attacks the actin fibers in the cytoskeleton, which helps the cell to keep its shape, by means of a toxin. The previously intact skeleton (upper left) becomes thinner and porous (lower left). Photos: Klaus Aktories*

its effects. Aktories and his research group are looking for a way to introduce it into cancer cells without infecting healthy cells. They have decided to enlist the help of immunotoxins, an artificial protein they already have experience with. Immunotoxins identify cancer cells by way of special markings, so-called tumor markers. They can then introduce toxins like TpeL into these cells. “A single molecule per cell could already be sufficient,” says Aktories. TpeL would jump from Ras to Ras and switch them off, one after the other.

“The bacterium creates its own little niche and makes itself right at home”

This is the plan. But first Aktories still has to test whether TpeL knocks out the mutated Ras protein as effectively as its natural counterpart. As for CDT, the question is currently what properties its receptor LSR has and what happens in detail when CDT attacks the cytoskeleton. The researcher also speaks enthusiastically about other bacterial toxins – ones that cause nerves to grow or live in a symbiotic relationship with parasitic worms that derive nourishment from them. “We are studying a whole lot of other toxins,” says Klaus Aktories. “They are so interesting that one could write a whole series of articles about them.”

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Prof. Dr. Dr. Klaus Aktories *studied pharmacy and medicine in Frankfurt and remained there to earn his doctorate in medicine in 1977. He then relocated to the University of Heidelberg, first earning his PhD in natural sciences and then completing his habilitation at the Faculty of Theoretical Medicine in 1983. After several years working at various positions in Mainz, Gießen, and Essen, he accepted a post as professor of pharmacology and toxicology at Saarland University in Homburg in 1991. Aktories has researched and taught at the University of Freiburg since 1995. He is director of Department I at the Institute of Experimental and Clinical Pharmacology and Toxicology and a member of the Freiburg Cluster of Excellence BIOSS Centre for Biological Signalling Studies. His research group is studying the effects of bacterial toxins and the possibilities of using them to develop pharmacological agents. Photo: BIOSS*

Dr. Carsten Schwan *studied biology at the University of Freiburg. In 2007 he completed his studies with a diplom degree and began work on his dissertation in the department led by Prof. Dr. Dr. Klaus Aktories at the Institute of Experimental and Clinical Pharmacology and Toxicology. He submitted his dissertation, titled* The Effect of Bacterial Toxins on the Cytoskeleton*, in 2010. He then accepted a postdoctoral position in Aktories’ research group. His main research interests are the cytoskeleton and inquiry into the role bacterial toxins play in the interaction with their hosts. Photo: private*

Masthead

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