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How students predicted the results of a regional election



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Discover New Universes: The Research Portal “Surprising Science”

The University of Freiburg has launched a multimedia portal to showcase new developments in science and research: How is Web 2.0 changing the English language? What are the university’s robots capable of? How can moss help children with kidney diseases? The online research portal “Surprising Science” has the answers in words, sounds, and images.

Many researchers in Freiburg are already contributing to Surprising Science. The portal is a great way to present complex fields of research like neurobiology or economics in an attractive journalistic format and make them accessible to the general public. In addition to reports on selected individual research projects from all disciplines, the portal features information packages that explore a common theme from a variety of perspectives. These special features illustrate the great diversity of research being conducted at the University of Freiburg on topics that are important for our society.

If you would like to be informed as soon as new media is posted on the portal, you can follow Surprising Science on Twitter, subscribe to our RSS feed, or request to be placed on our mailing list. Journalists can use all texts, interviews, audio clips, and videos free of charge. In this way, Surprising Science is helping to disseminate research findings from Freiburg beyond the borders of the region.

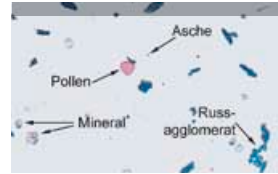


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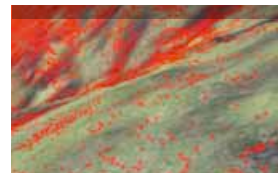
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A satellite photograph showing the Mediterranean Sea, the Iberian Peninsula to the west, and the Balkan Peninsula to the east. The sea is a deep blue, and the land is a mix of brown, tan, and green. The sky is a pale blue with some white clouds.

Attack on the Lungs

Researchers at the University of Freiburg are Testing the Long-Term Consequences of Microscopic Airborne Particles for Our Health

by Annette Kollefrath-Persch

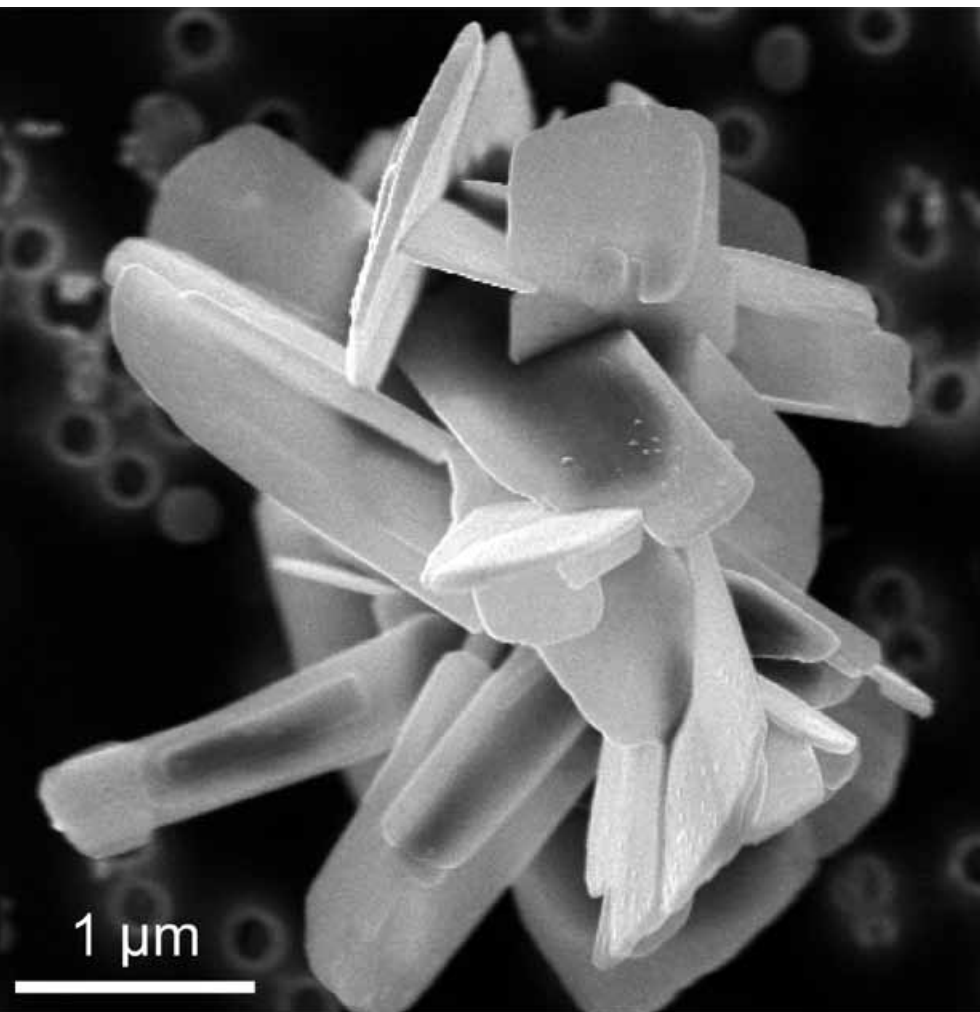


Satellite image of a storm that carried large amounts of desert dust from the Sahara to Europe on 18 July 2000. The dust plumes are easy to see, particularly over the central Mediterranean Sea and Sicily. Dust plumes like these can even deposit particles in Freiburg.
Photo: NASA

On the street we inhale exhaust from cars, in the office particles released from ink cartridges, in the bathroom nanoparticles from hair spray and in the spring dust blown north from the Sahara. Each day we breathe in millions of different particles floating around in the air. It is known that they can be harmful to our health, but how dangerous are they really? Not enough research has been done so far to say for certain. Thanks to a new research approach by Prof. Dr. Reto Gieré from the Department of Earth Sciences of the University of Freiburg, it is now possible to determine what long-term consequences such airborne particles have on our health.

Gieré is collaborating with a team of scientists from the fields of mineralogy, environmental medicine, and pharmacy, as well as from the German weather service. The team is systematically characterizing individual dust particles that fly through the air every day and determining their mineralogical and chemical makeup with the help of microscopes and x-ray devices. Only then will it be possible to analyze with more precision the type of particles we breathe in. "Our goal is to find out what the air we inhale in Freiburg and the Rhine Valley is composed of," explains Gieré, "and to determine where all of these particles are blown in from." Once the re-

“Astoundingly, we still only know little about their impact on our health”



Hard-edged particle under a scanning electron microscope: This particle of calcium sulfate crystals was captured in the air in Strasbourg, France. It was released through industrial combustion processes.

searchers know the mineralogical composition of the dust particles, they can establish whether the dust particles are, for instance, from automobile exhaust fumes, street dust, or smoke from coal-fired power plants. Most people would be shocked about all of the occasions on which humans are exposed to dust particles: “Christmas is the worst time of all,” says Gieré. “Burning candles in the living room let off an unbelievably high amount of particulate matter.” Other particles have a long journey behind them: Even dust from the Sahara reaches Freiburg.

Lung Cells and Dust Particles in Test Tubes

However, the team is not only interested in what the particles are composed of. They are also studying what influence dust particles have on human health. “Astoundingly,” says the mineralogist, “we still know only little about their impact on our health.” But this question is becoming more and more important, because industrialized countries produce and release many different kinds of particles every day and everyone who lives there breathes them in. The research project is focusing initially on synthetic particles, such as those from paint, automobile tires, and deodorant, because we have a certain amount of influence over the extent to which we expose ourselves to these kinds of dust. The influence of natural particles, on the other hand, is difficult to minimize: Wearing a face mask while riding a bicycle or staying at home when dust from the Sahara reaches Freiburg might be prudent precautionary measures, but it is impossible to avoid the natural particles completely. Gieré is thus also planning on studying the impact of these particles on human health in the future.

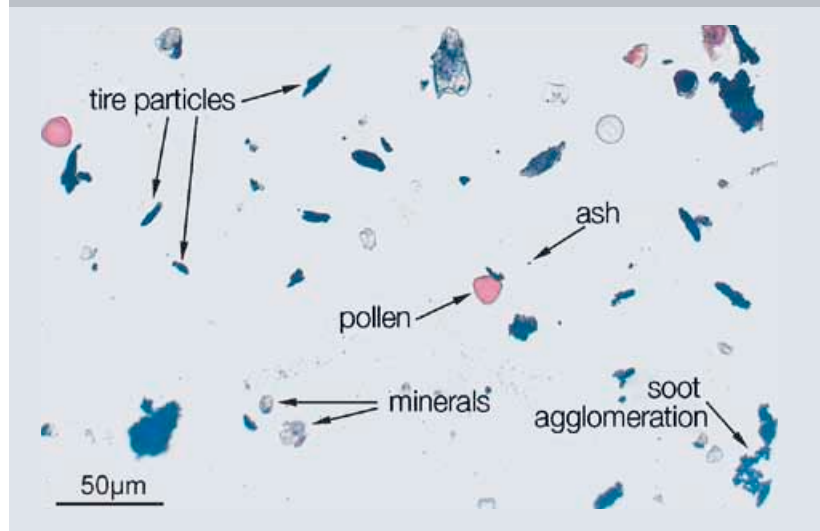
In order to determine to what extent the particles found in Freiburg’s air are detrimental to our health, the researchers produce individual types of particles in the laboratory in various sizes and concentrations. They then expose cultures from the human lung to them in test tubes. “We don’t want to expose the lung cells to all kinds of particles at once, because we are trying to find out what effect particular particles have on the human lung,” explains Gieré. Various tests reveal how the lung cells react: Do the dust particles have an effect on the cells or even on the genes? The researchers are using an electron micro-

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Microscopic image of a sample of atmospheric dust collected in Mainz. A dust analysis can differentiate between various types of particles on the basis of their optical characteristics, allowing scientists to determine their origins. Graphic: German Weather Service/Dietze



scope to ascertain whether the particles have penetrated into the cell, and if so what part of it. The foreign matter can reach the cytoplasm or the nucleus, and in the worst case they can cause damage there. When this happens, the lung sends out antibodies so the cells can defend themselves against the foreign matter. The scientists can then measure the signals created during this process.

The Smaller, the More Persistent

The size of the dust particles is an important factor, and the differentiation between coarse and fine particles has sparked much controversy: “Politicians and the media often speak of fine particles in general,” complains Gieré, “without knowing how fine a particle actually has to be to earn this name.” All dust particles larger than 2.5 micrometers (0.0025 millimeters) are classified as coarse particles, while particles with a size of 2.5 micrometers or less are characterized as fine particles, and those that are smaller than 100 nanometers (0.0001 millimeters) are categorized as nanoparticles or ultrafine particles. The smaller a particle is, the more of that particle a fleck of dust will contain. Moreover, fine particles float around in the atmosphere longer than coarse particles. Only when it rains is the air washed free of fine particles. But it is not only their persistence that makes the smaller particles a greater threat for human health; they can also inflict more damage due to their small size. Dust particles that are smaller than 2.5 micrometers can accumulate in the alveoli in our lungs and once they make it there, we can’t get them back out of our bodies. Coarse particles, on the

other hand, can’t make it that far into our respiratory tract because they irritate our throats, inducing us to cough them out.

The team led by Gieré and Prof. Dr. Volker Mersch-Sundermann from the Freiburg University Medical Center has already published the first sobering results: The researchers’ in vitro tests demonstrated that particles from black ink cartridges inflict changes in the cell nucleus and thus have a genotoxic, i.e., gene-changing, effect on the human lung. This could lead to mutations or cancer, but the research team cannot yet say for sure. Gieré and his colleagues still need to conduct more experiments to analyze all of the effects of the various types of dust. In order to be successful, these experiments must transcend the boundaries of traditional scientific disciplines. Freiburg provides ideal conditions for this multidisciplinary research, says the mineralogist. By no means does he intend to spread panic: “However, it is important to point out concrete dangers, because only so can we react to them.”



Prof. Dr. Reto Gieré has worked at the Section for Mineralogy-Geochemistry at the Department of Earth Sciences since 2004. Other stations of his career include Purdue University in Indiana, USA, the University of Basel, Switzerland, the University of British Columbia in Vancouver, Canada, and the Carnegie Institution in Washington, USA. He is also a fellow at the Geological Society of London and the Mineralogical Society of America. His research interests include atmospheric dust particles, environmental contaminations, and the storage of highly radioactive waste.

auch angemessen berücksichtigen zu können

• Oder der charmantere Weg: Gerade Sie mit Ihrer Lebenserfahrung sind natürlich sehr interessant für unsere Umfrage

8

• Zu alt gibt es bei uns nicht, die Meinung jedes Bürgers ist wichtig, egal aus welcher Altersgruppe er kommt.

Expert knowledge from professionals: Sandra Schlagmann from Infratest/Infratel Berlin trains the students on finding the right strategies for telephone interviews.

Photo: Kunz

Right on Target

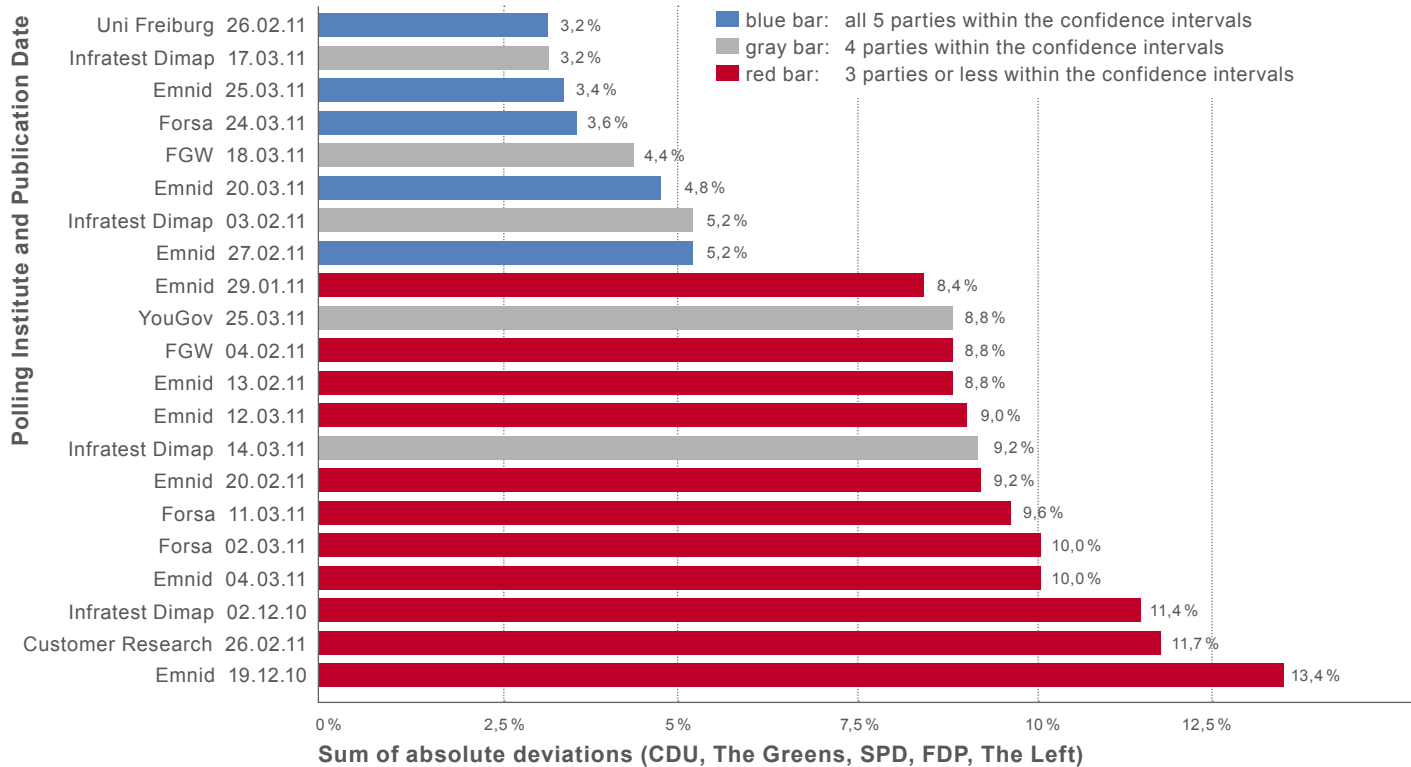
Political Scientist Uwe Wagschal and His Students Analyzed Public Opinion before the Regional Elections in Baden-Württemberg

by Nicolas Scherger

Opinion polls, projections, and trends: The findings of election research are an inseparable part of modern political discourse in the media, in parties and ministries, among voters. What is less well known is how the researchers arrive at these findings. For example: How is it possible to infer the opinions of 7.6 million eligible voters before the regional elections in Baden-Württemberg from interviews with a group of just under 1,400 of them? Uwe Wagschal, professor of comparative political science at the University of Freiburg, answered this question together with his students in an undergraduate seminar: At the end of February 2011, he and his young election researchers published an opinion poll that predicted the actual results

of the election more accurately than any other poll conducted between December 2010 and the regional elections on 27 March 2011.

“My goal was to give the students an idea of what election research involves from A to Z,” says Wagschal. In order to prepare the students for the empirical work, he invited electoral researchers from the polling and public opinion institutes Infratest dimap, Forschungsgruppe Wahlen, and SIGMA as speakers. The students also received training in statistics, interviewing techniques, and the computer programs they would later use to collect and analyze the data. Project partners like the local newspaper Badische Zeitung and the State Agency for Civic



The University of Freiburg tops the charts: The graph shows the amount of percentage points by which the results of opinion polls deviated from the actual results of the 2011 regional election in Baden-Württemberg. It also shows how many parties the polls remained within the bounds of statistically tolerated deviations for the so-called confidence intervals.

Graph: qu-int

Education of Baden-Württemberg helped them present the results of the opinion poll to the public with a podium discussion, several newspaper articles, and a project homepage.

The first challenge for the students was to develop the questionnaire. The trick was to find relevant questions and formulate them as precisely and impartially as possible. "The quality of the questionnaire is the pivotal factor. We thus discussed every question many times over," says Wagschal. The students studied opinion polls conducted by the polling institute Forschungs-

"The students saw how heterogeneous the state is. Freiburg is not the world"

gruppe Wahlen from the 1960s to the present, evaluated and improved their own list of questions in over 25 rounds with test subjects, and had the list analyzed by professional pollsters. The poll collected data on more than 100 variables: What do you consider to be the most important problem currently facing Baden-Württemberg? Who would you like to see as the state's minister president? And, particularly important for the media and the public, the traditional question of the weekly political opinion

polls released each Sunday in Germany: What party would you vote for if elections were to take place next Sunday?

Chance as a Statistical Principle

The participants were selected randomly, thus ensuring that the poll would reach a representative cross-section of society. The basis for selection was a so-called "mother sample" of 7,000 telephone numbers. An electronic random number generator varied the last digit of the numbers to ensure that numbers not included in the telephone book were also represented. The member of each household who had most recently celebrated his or her birthday was chosen to participate in the poll. "If we had just chosen the person who answered the phone, we would have interviewed the daughter of the house too often," explains Wagschal. The students called 31,000 numbers and reached a total of 11,000 citizens; 1,361 of the persons called ended up participating. For the 25 young researchers who conducted the poll, this meant up to 120 attempts per day over a period of three weeks starting in late January. An average of only six to seven of these attempts were successful. Many of the people who answered the phone hung up immediately, some vented their anger about the state of politics, and others agreed to participate. The researchers were forced to react to these situations, sometimes with appeals to reason, sometimes with appeals to the emotions. Wagschal believes that this communication process was the most important experience for the students: "The students saw how heterogeneous the state is. Freiburg is not the world."

The Trade Secret of Opinion Researchers

The data was made anonymous and weighted for the analysis. This means that not all of the responses were treated equally. Along with the development of the questionnaire, this is one of the most important factors in a scientifically sound analysis, says Wagschal and it is also a source of possible criticism: Many opinion research institutes have a reputation for being biased toward a particular party or for slanting results to satisfy their clients. "Opinion researchers never reveal their weighting methods; that's their big trade secret." The students experimented with various values and watched how they changed the results. "We put a lot of thought into how to best weight the data. That was the key to our success."



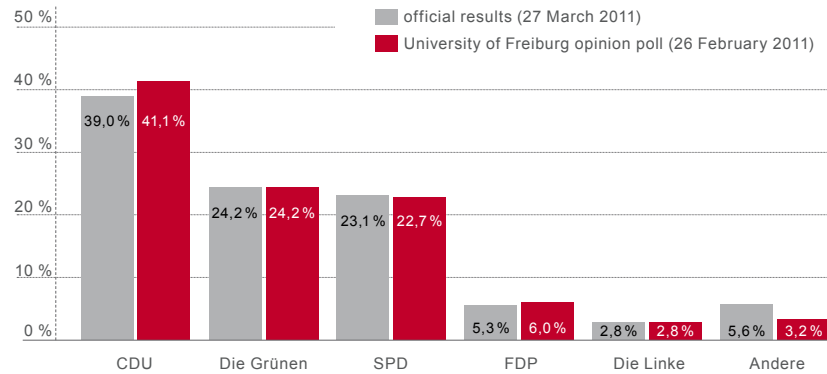
Data collection is hard work: Conducting the telephone interviews was the most important experience for the students.

Photo: Kunz

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Documentation of the project on the Internet: <http://www.landtagswahl-umfrage.de>



Neck and neck: the results of the Freiburg opinion poll in comparison to the official results of the regional election on 27 March 2011.

Source: State Statistics Office of Baden-Württemberg/University of Freiburg

Graph: qu-int

What turned out to be decisive was above all social-structural factors. Although chance delivers good results, the composition of the sample did not accurately reflect the population structure of the state. To compare the two, the election researchers studied data from the State Statistics Office of Baden-Württemberg on factors like the distribution of age, sex, level of education, income, and household size. If they found that a certain age group was not sufficiently represented in the sample, they weighted the data from this age group more strongly in the analysis. However, the researchers would have had to weight a few respondents who belonged to several underrepresented groups 20 times more strongly to accurately reflect their representation in the state. They thus decided to limit the weighting factor to 2.5.

They also decided against a so-called political weighting, which would have affected the typical Sunday poll question in particular. "Election researchers typically reason that voters' old preferences become stronger as the election draws nearer," explains Wagschal. They assume that people who supported a certain party in the previous election, particularly those who supported the currently ruling party, will be less likely to change their minds and support the other party in the last weeks and days before the election and that opinion polls conducted shortly before an election thus often tend to overestimate support for the opposition parties. In order to counter this tendency, pollsters often give more weight in the analysis to respondents who claim to support the ruling party. Since the students did not employ political weighting, they stated in their presentation of the results at the end of February that they thought the ruling CDU/FDP coalition would improve its approval ratings in

the final weeks before the election and attract enough votes to continue governing, while the Greens were rated too highly. Then came the earthquake and the nuclear catastrophe in Japan. "That cost the CDU a couple of percentage points and put our poll right on target with its prognoses for the Greens and the Left."

This example also demonstrates why Wagschal believes that election research will become more difficult in the future: Traditional allegiances to political parties are becoming less common, and social milieus are disintegrating; many voters are more willing to change their vote and make their decision more spontaneously. In addition, it is becoming more difficult to conduct representative polls over landline telephone connections because young people often only have a mobile phone number. "All of the polling institutes are looking for ways to reach people over the Internet," says Wagschal. He predicts that social scientists with training in sociology, psychology, statistics, and market research will soon enjoy excellent career opportunities in the area of election research, a claim that he also backs up with evidence: The tutor who helped supervise his election research project recently landed a job in the strategy department of the national executive committee of the German Green Party.



Prof. Dr. Uwe Wagschal studied political science and economics at the University of Heidelberg. After completing his doctorate in 1996 he served as a research assistant at the University of Bremen. From 2001 to 2003 he worked as a political advisor at the think tank "Avenir Suisse," before accepting a chair in empirical political research at the University in Munich. In 2005 Wagschal was appointed as professor for comparative political science at the University of Heidelberg, and since 2009 he has served as professor in the same area of specialization at the University of Freiburg. His research interests include comparative public policy research, direct democracy, government budgets, and conflict research.

First Aid for Emotional Wounds

Freiburg Psychologists Aim to Improve Care for Victims of Traumatic Events

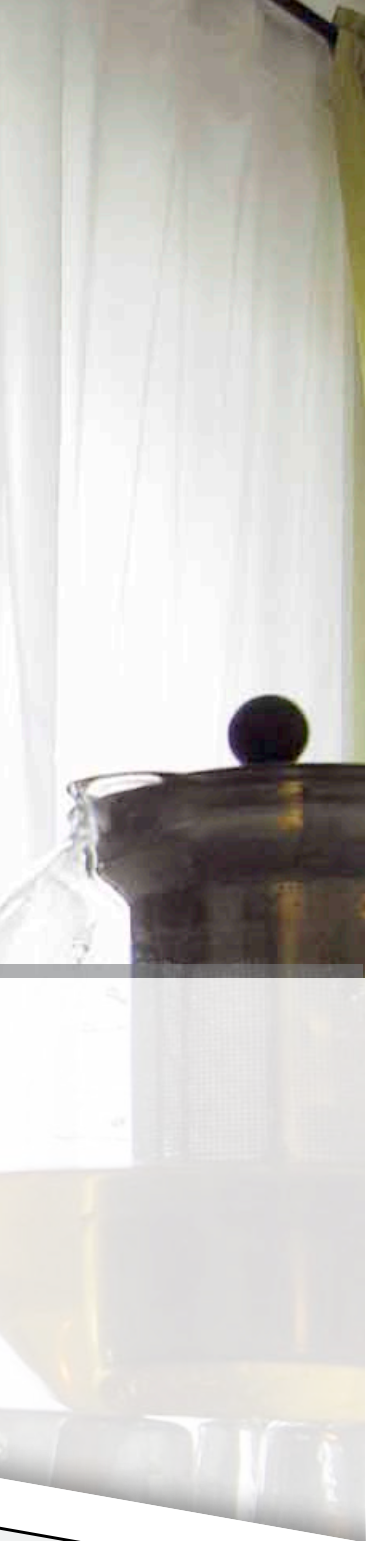
by Holger Lühmann

The researchers are developing a questionnaire to distribute to victims of traumatic events to determine whether they are in danger of suffering from psychological disorders in the long term.

Photos: Lühmann

Questions 32–48 are about
THE FIRST HOURS AFTER

32. I felt intense fear, helplessness,
the event.
33. I thought I could die during the event.
34. I thought I would be severely injured.
35. I lost control of my feelings during the event.
36. My body reacted with perspiration, tremor,
heart palpitations.
37. I was physically exhausted.



The derailed train, the smashed-up wagons strewn across the tracks, the corpses laid out in rows: Catastrophes like the high-speed train disaster near Eschede, Germany, in the summer of 1998, which killed over 100 passengers and railroad employees, often leave survivors with posttraumatic stress disorders and other aftereffects. Memories of the event and its aftermath can rapidly transform the initial shock into a long-term emotional burden. Prof. Dr. Dr. Jürgen Bengel from the Institute of Psychology and his colleague Katharina Becker are studying ways to prevent psychological disorders caused by such events from taking root. They want to optimize the early diagnosis of symptoms and develop methods for preventing posttraumatic stress and providing suitable and immediate support for victims.

Whether train wrecks, fires, or massacres the psychologists want to offer their help to survivors of all incidents in which there are a lot of casualties and injuries. They are analyzing data from a wide range of sources to determine how survivors cope with states of anxiety. "Previous studies have focused primarily on psychological disorders in victims and rescue teams after traumatic events," explains Bengel. "They usually start very late, whereas we are focusing on early intervention. We want to study the victims' experiences directly after the event." They also want to integrate people into the study whose success in coping with the event usually remains undocumented. "Following major incidents there

is always a large number of victims with long-term psychological aftereffects who do not seek help," reports Becker. "Potential victims do not always visit a psychologist, whether out of embarrassment or a lack of knowledge. There thus aren't any reliable studies on who suffers from posttraumatic stress disorders or other conditions, why, and to what extent."

Analyzing Protective and Risk Factors

However, the researchers warn against overestimating the amount of cases. Although a large amount of victims show symptoms of depression and stress shortly after a traumatic event, many of them recover again without experiencing any long-term emotional problems. It is thus a great challenge for psychologists treating victims of traumatic incidents to make a clear distinction: They must differentiate patients with a temporary stress from those with an increased risk of developing a long-term psychological disorder. "It is always difficult to make the right prognosis after large-scale accidents," says Becker. "For one thing, it is easy to misinterpret some symptoms, and for the other, it takes a great deal of organizational and personal effort to detect everyone who is potentially at risk."

In order to determine how people cope with traumatic events, Becker is studying the psychosocial condition of people afflicted with posttraumatic stress for her dissertation. She distributes questionnaires to victims of severe car crashes

at the period **DURING THE TRAUMATIC EVENT** and **BEFORE THE EVENT.**

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
or horror during	0	1	2	3	4
ent.	0	1	2	3	4
ed during the event.	0	1	2	3	4
he event.	0	1	2	3	4
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“Following major incidents there is always a large number of victims with long-term psychological aftereffects”

and other accidents as well as to firefighters and paramedics at public safety answering points, psychosocial counseling services, and hospitals in order to find people who are potentially traumatized. The questionnaire includes 122 questions in which the respondents provide information on the significance of the accident for their lives and on their life situation before and after the event: What fears and anxieties do they have? How close are they to family and friends? Do they feel well regarded and understood by others?

The aim of the study is to determine what influence factors like a person's overall life situation and thoughts can have on how well he or she copes with traumatic experiences, explains Bengel: "We are studying a person's so-called protective and risk factors. Once we know what helps a person to overcome a traumatic experience and what prevents them from overcoming it, we will be able to establish a reliable instrument for diagnosis and psychological care." The risk factors include, for instance, the particular gravity of the event, a history of emotional instability, or a sustained feeling of being threatened following the event. The protective factors, on the other hand, are things that make it easier for a person to overcome a traumatic event such as emotional support from family and friends or optimistic prospects for the future.

“If our approach works, we could have the questionnaire distributed directly by rescue teams at the scene of the accident or by doctors at the hospital”

The researchers knew that it would be difficult to find people who have been victims of a traumatic event for their study. For one thing, it is not mandatory to fill out the questionnaire at the cooperating institutions and organizations. In addition, people who have “other worries” after experiencing an event of this kind are less willing to participate. Nevertheless, Becker is convinced that they will succeed in finding more than enough test subjects: “All of the questionnaires will be filed anonymously, so nothing



speaks against taking part in our study. Besides, the survey will help improve therapeutic care for the patients.” The main priority of the study is to improve psychological practice, and the point of the questionnaire is to find people who will later suffer from posttraumatic stress disorder or other aftereffects and whose fate would not be discovered without a detailed survey.

A Questionnaire for Reliable Prognoses

The psychologists will begin by testing an initial version of the questionnaire, explains Bengel: “We want to find out which questions are most effective and reliable for predicting potential long-term psychological aftereffects.” In the end, they hope to have a short, standardized list of questions that also allows for reliable prognoses. “If our approach works, we could have the questionnaire distributed directly by rescue teams at the scene of the accident or by doctors at the hospital,” says Becker. “This would give us the opportunity to greatly reduce the amount of people afflicted by psychological aftereffects in the long term.”



A severe accident can change lives not only those of the victims, but also those of the rescue teams.

Photo: Soehngen/Fotolia

Becker is studying the answers to the questionnaires for conspicuous features and conducting structured interviews with all of the participants. She meets with everyone who sends back the questionnaire to the Institute of Psychology around three months after the accident and contacts respondents who don't live in the region by telephone. "These meetings can help us find out whether the questionnaire is a reliable way to detect potential cases of posttraumatic stress disorder or other psychological disorders." She can also bring practical experience to bear in these meetings: As a volunteer for the emergency follow-up treatment service of the German Red Cross, she has the necessary sensitivity to deal with traumatized patients.



Prof. Dr. Dr. Jürgen Bengel studied psychology and medicine in Hamburg, Mannheim, and Freiburg. In 1986 and 1987 he earned his doctorate in these two fields and assumed a position as research assistant at the Institute of Psychology. After completing his habilitation, he spent a time conducting research with a Heisenberg Scholarship. Afterwards he worked at the University Medical Center in Hamburg-Eppendorf and at the Humboldt University in Berlin. In October 1994 Bengel was appointed as professor at the Institute of Psychology of the University of Freiburg, where he heads the Department of Rehabilitation Psychology and Psychotherapy. His research focuses on the psychology of chronic illness, psychotraumatology, adjustment and stress disorders, and evaluation and quality assurance.
Photos: Lühmann



Katharina Becker studied psychology at the University of Freiburg from 2000 to 2006 and completed her diplom degree with a thesis on the psychotherapeutic skills of psychology students. After graduation she accepted a position as research assistant at the Institute of Psychology, where she is currently working on her dissertation on early interventions after traumatic events under Prof. Dr. Dr. Jürgen Bengel. In addition to her research activities, she serves as a volunteer for the emergency follow-up treatment service of the German Red Cross in Freiburg.

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A cloud of red dots that's all the image reveals. Scientists have to interpret the data with the help of algorithms to determine where trees and terrain are.

Trees under a Laser Scanner

Freiburg Forest Scientists Create Three-Dimensional Forest Models Using Remote Sensing Techniques

by Stephanie Heyl

If you wanted to survey enemy territory in the nineteenth century, you would launch yourself up into the air in a moored balloon and record what you saw with pen and paper. Later on, this process was simplified through the invention of airplanes and the camera but the fact remained that the aerial images were subject to interpretation. Remote sensing was developed primarily for military reasons, experiencing its first boom in the Second World War. Civilian use of this technology was at first a mere byproduct. The British used it after the war to document the destruction of large portions of Europe.

Today we are bombarded with information gleaned from remote sensing data every day on television. "Thanks to optimized models, remote

sensing can even be trusted for things like weather forecasts most of the time," says Prof. Dr. Barbara Koch, head of the Department of Remote Sensing and Landscape Information Systems (FeLis) at the Faculty of Forest and Environmental Sciences of the University of Freiburg, and grins. Geography and forest science in particular have profited from technological developments in remote sensing, which is capable of collecting information on the earth's surface as a whole as well as on buildings and vegetation. With the help of satellites or airplanes, researchers can investigate the state of forests or analyze land use without needing to come into direct contact with their objects of research. They receive their information from electromagnetic radiation reflected from the objects or emitted by

them. By measuring this radiation, the scientists can draw inferences on the state of the objects. Passive sensors use sunlight reflected from the surface of the earth or the objects. Aerial images created with film and digital cameras are the best example of this method. However, most passive systems only work during the day. The production of night images with a passive sensor requires the use of thermal scanners that measure infrared radiation.

Laser Beams from an Airplane

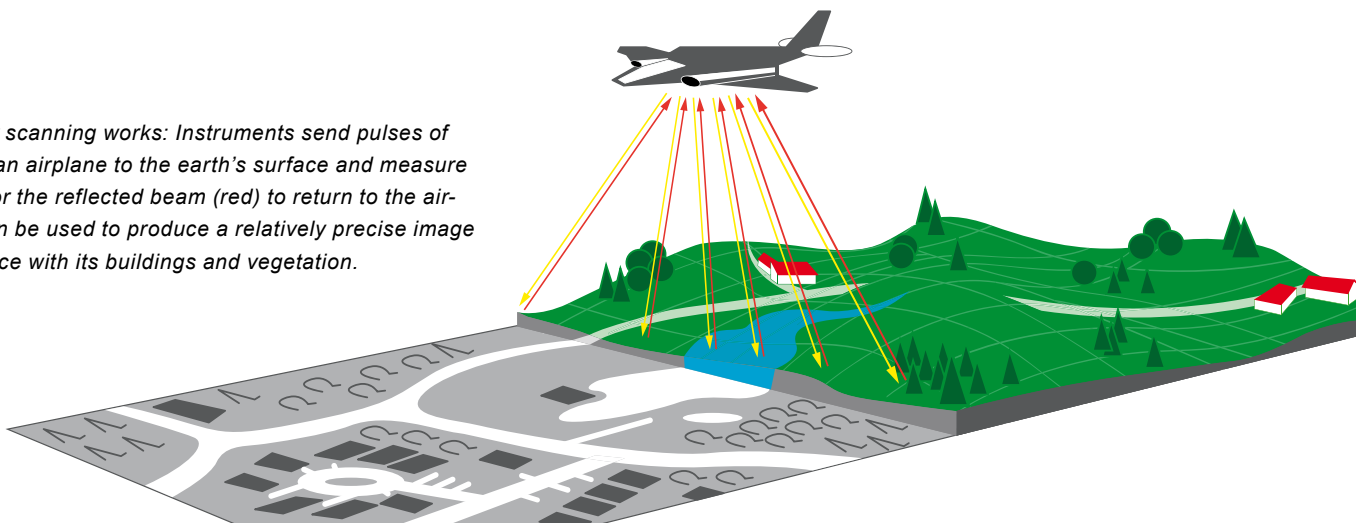
Forest scientist Barbara Koch and her team, on the other hand, are specialized in a form of active remote sensing: airborne laser scanning. With this method, devices send pulses of light from an airplane to the earth's surface and measure how long it takes for the reflected beam to return to the airplane. This interval, the so-called time of flight, is then converted into distance. Measuring systems inside the airplane calculate its position in space and use the time of flight to locate the precise position of the reflection in a system of spatial coordinates. Thus, individual spatial information is collected for each pulse of light. Since the laser systems send out up to 400,000 signals per second, the researchers receive spatial information on up to ten points per square meter enabling them to produce a relatively precise image of the earth's surface with its buildings and vegetation. "The advantage of this method is that the laser can be used day and night," says Koch. The only drawback is that it is not weather-proof like a radar, which can break through the clouds with its long radio waves. "I can't see through a thick layer of clouds with a laser."

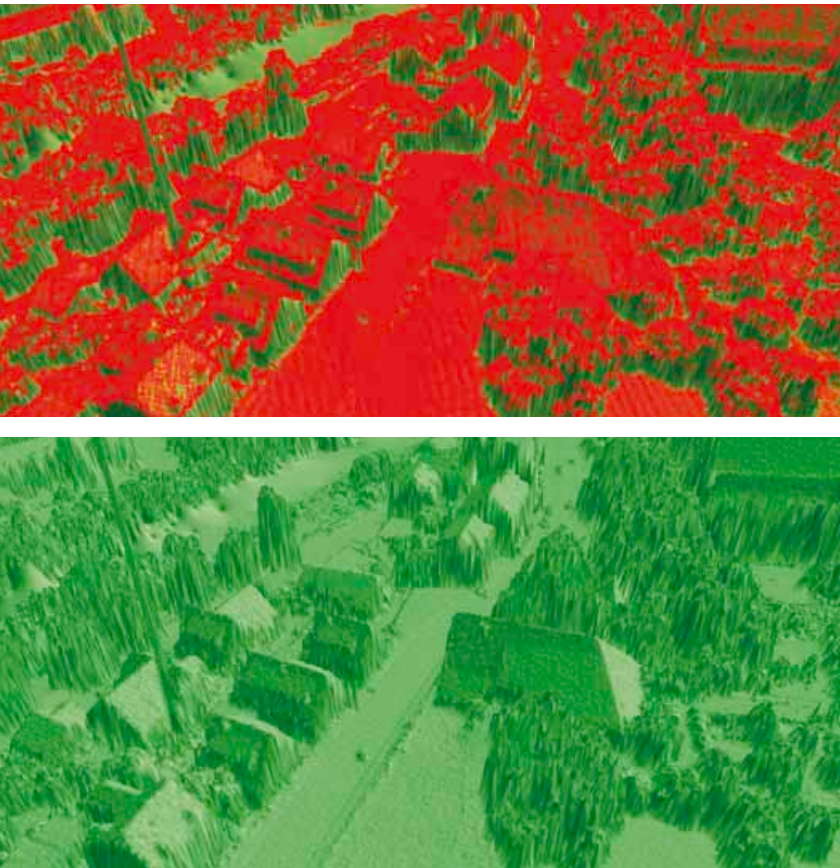
The scientists can use this method to quickly gain comprehensive information on areas which would be too time-consuming and expensive to explore from the ground. This explains why airborne laser scanning has become an increasingly popular method for taking inventory of forests, since the images capture data that is of great importance for forest science. The data is used primarily to make topographical images of the earth's surface. If the laser pulse sent out from the airplane reaches the ground there is only a single reflection, but if it hits vegetation it sends back many echoes: from the treetops, from the branches, from the trunk, and from the ground. Due to holes in the forest canopy, the ground echoes are usually still so numerous that it is possible to collect detailed information on the form of the terrain under the trees, including trenches and gorges.

However, extracting information from the images is no simple matter. Barbara Koch illustrates this by presenting an image with many red dots divided into two clouds. "The dots hanging in the air are reflections from trees, the others are from the ground," she explains. "On an aerial photograph I can always locate forests, streets, and paths intuitively. With a laser image I don't see much at first glance." To interpret this data, Koch and her team developed algorithms that classify the clouds of dots automatically. This saves time and money. In this way, the system can provide data on several layers of vegetation at once, allowing the scientists to make inferences on the biodiversity of the area. "Forest stands consisting of several levels will generally accommodate more plant and animal species than single-level stands." It is not yet possible to

How airborne laser scanning works: Instruments send pulses of light (yellow) from an airplane to the earth's surface and measure how long it takes for the reflected beam (red) to return to the airplane. The data can be used to produce a relatively precise image of the earth's surface with its buildings and vegetation.

Diagram: Klaas





use the data to analyze aspects of genetic diversity, such as the presence of several types of trees, but the researchers are working on it: "To identify tree species we need more than just the geometric data. It's also necessary to analyze physical information such as the intensity and the amplitude of the radiation, and the method

“On an aerial photograph I can always locate forests, streets, and paths intuitively. With a laser image I don't see much at first glance”

for doing this is not yet ready to be put into practice.” At present, it is only possible to differentiate reliably between deciduous and evergreen trees.

This limitation notwithstanding, remote sensing offers an abundance of possibilities even at the current state of technology. It can be used to identify differences in elevation of less than a decimeter in meadows, fields, and paths. It can automatically capture and model individual trees, tree heights, and the degree of canopy cover in wooded areas. It even allows researchers to cal-

culate the stock of available wood and biomass in a forest stand on the basis of the height and density of the trees. "All of this data can be used to develop plans for the sustainable and nature-friendly management of forests. These plans regulate the amount of wood that can be taken from a mature stand and the measures that need to be taken to ensure the stability and natural diversity of the forests," explains Koch. "We can then check at regular intervals whether the regulations are being adhered to."

Cities Want Laser Data Too

One significant factor is the ability of plants to bind carbon dioxide (CO₂) from the air. Once one knows the biomass of a forest, one can use it to calculate the amount of gas it can bind. This is the key quantity for the efforts of nations to improve their carbon footprint. "Before politicians deliberate about pumping carbon dioxide underground, they should determine how much CO₂ can be bound by increasing the amount of forested areas," says Koch. According to the Copenhagen Accord on climate change, countries that increase the size of their forests will receive financial compensation for their efforts. "We could provide evidence of this with the help of remote sensing. Then the rich countries could pay the poor countries for preserving and expanding their forests."

Meanwhile, cities, energy corporations, and nature conservation organizations have been calling up the department to ask whether they can use its information and algorithms. Three-dimensional city models made on the basis of laser data can form the foundation for further environmental models to determine the development of warmth in a city, the houses that would be struck first by a flood, or the optimal location for a solar collector. "Remote sensing with lasers is currently experiencing a real boom," says Koch. "Rightly so because it can deliver a lot of information."

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Prof. Dr. Barbara Koch studied forest science at the University of Munich and was a research assistant for the chair in land-use planning and nature conservation at the Technical University of Munich from 1982 to 1994. She was then appointed as professor and head of the Department of Remote Sensing and Landscape Information Systems at the University of Freiburg,

where she performs research on remote sensing, geomatics, and environmental modeling. She also heads the Steinbeis Research Center for Remote Sensing and Landscape Information Systems, which she founded in 2005 with the goal of transferring knowledge acquired from research and development to business partners.

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*Female and soccer player that alone
can be enough to break a taboo.
Photo: Seeger*

A Level Playing Field?

Class, Body, Ethnicity, Gender:
Sociologist Nina Degele is Charting the Bounds
of Inequality and Discrimination in Soccer

by Claudia Füller



Does it matter whether a soccer player is black or white if he helps his club win the championship with his goals? Do women who play soccer still have to struggle as hard for recognition as they did ten or twenty years ago? And is a star player on the national team more likely to be forgiven for being gay than an average player in the regional leagues? These are just a few of the questions Nina Degele is interested in answering in her latest research project, funded by the Friedrich Ebert Foundation. The professor of sociology and gender studies at the University of Freiburg has – figuratively speaking – taken to the field in an effort to chart the bounds of racism, sexism, and homophobia in the world of soccer. When various forms of inequality and discrimination interrelate, sociologists speak of intersectionality. This research paradigm allows the individual dimensions of inequality and their significance to be examined in more detail.

Gay, but Star Player

The sociologist focuses on the conditions of societal interaction: How is money distributed? What role does a person's gender or position in society play? How do age, physical fitness, ethnicity, and generational affiliation affect who we are? The sociologist's natural enemy is thus the generalization. "When I hear things like 'men are more aggressive,' I see red," says Degele. "That's such a wholesale statement that it has to be false." Claims like "women are disadvantaged" are also inadequate. "When one examines individual cases more closely, such as differences between discrimination against a black female manager and a white female employee, the dimension of gender is compounded by those of ethnicity and class," Degele explains. These are the 'big three' factors class, ethnicity, gender that form the core of intersectionality.

Just keeping track of these three variables alone in a broad sociological analysis would seem to be complex enough, but Degele and her colleague Prof. Dr. Gabriele Winkler from the Technical University of Hamburg-Harburg have also included a fourth dimension in their project: the body. This makes intersectionality into a much more nuanced and, as Degele says, "quite complicated" affair. After all, sociology is not only interested in the absolute amount of influence various factors have, but also how they shift in relation to one another or even displace each other completely. For instance: Can a young man who is discriminated against due to his class affiliation compensate for this deficit by way of physical fitness? Nowhere can such questions be examined so readily as in the microcosm of soccer. Soccer is in the public eye, it's popular, and in many respects it's a reflection of society at large: "Female soccer players are breaking a taboo just by engaging in a sport that's so strongly associated with masculinity, while homosexual male soccer players are the very epitome of taboo." Is it possible to compensate the social stigma of homosexuality through status? In order to answer this question, Degele and her research team conducted discussions with various groups that have little in common besides their love of soccer: a lesbian soccer team, an anti-racist fan club, a Catholic church choir that plays occasionally for fun, regular amateur soccer players, children, immigrants, and older men.

The sociologists visited the soccer players on their own turf in their clubhouse, at their local bar, and even in their locker rooms. "Those discussions were unbelievably fascinating," says Degele. "We just played the part of moderators and got people talking. They really got into the discussions, often even forgetting that we were there." One interesting thing the researchers

noted was a strong tendency toward political correctness on the topic of gay soccer players. No one wants to be branded as an anti-gay traditionalist.

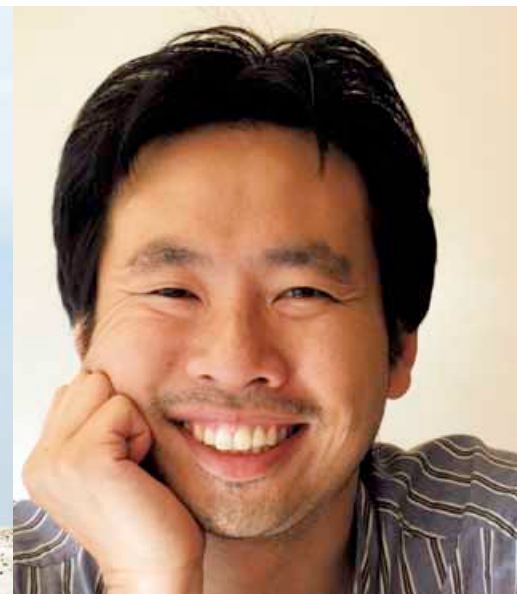
The researchers were astounded at the strategy people use to avoid coming across as being homophobic: “They talk a lot about how fans and the media stir up resentment against gays which is in fact not the case, as may be seen by

While homophobia and sexism in soccer have become more visible in the past years, racism has changed its outward appearance and become more subtle. Racially motivated violence among fans in the professional leagues has become more uncommon. “Some people have taken this to mean that the issue has lost its relevance,” says Degele. “That’s not exactly true. Of course there has been progress in the past years, but the lower leagues in particular are still struggling with xenophobia and racism. Fans of higher-league clubs have become more careful.”

“Recent studies show that more attractive people earn more money and also enjoy certain advantages in everyday life”

the example of well-known gay politicians like Foreign Minister Guido Westerwelle and Mayor of Berlin Klaus Wowereit.” Again and again, a deep-seated aversion to homosexuals reared its head under the politically correct surface of their statements. To the team’s surprise, this disposition often emerged in connection with the ever-ominous topic of showering: “‘I don’t have anything against homosexuals, but I wouldn’t shower with them,’ was a sentence we often heard.”

The dimensions of intersectionality are flexible. This may be seen clearly through the example of soccer, the sociologist explains: “The historical perspective is very important. If you only consider the currently existing dimensions, you might fail to identify important developments.” Gender and ethnicity, for instance, are modern inventions. “When soccer began to become popular a hundred years ago, they were not central dimensions. What was most important back then was class.” As the dimension of gender in soccer developed, it absorbed a lot of the original lower-class associations of the sport, and this makes it interesting to determine what shifts in this relationships are currently taking place or will take place in the future.



All inequality is not created equal: Intersectionality research studies the relationships between the four dimensions class, body, ethnicity, and gender. Photos: konradbak, Liu, Deklofenak, Kovalev (all from Fotalia)

Soccer is an object of research that is always changing, with factors whose relative importance is continually waxing and waning like religion, which seemed to have almost lost its significance and has now become relevant again due to immigration. But it isn't just a matter of the old dimensions shifting in importance. There are also always new dimensions to consider. An example of a relatively new dimension is physical attractiveness, explains Degele: "Recent studies show that more attractive people earn more money and also enjoy certain advantages in everyday life. Someone with the looks of Helmut Kohl would no longer be a viable candidate for chancellor today."



Prof. Dr. Nina Degele has served since 2000 as professor for sociology and gender studies at the Institute of Sociology of the University of Freiburg. Since 2002 she has served as director of the institute. Degele studied sociology, sinology, political science, philosophy, and psychology in Munich and Frankfurt. She earned her doctorate from the Faculty of Social Sciences of the University of

Munich in 1993 with a dissertation on the sociology of human and artificial intelligence. In 1998 she completed her habilitation with a study on the sociology of knowledge in computerized society. Degele has served as visiting professor at the University of Minnesota, USA. Her research interests include societal theory, the sociology of gender relations, and the body, sports, and everyday life.

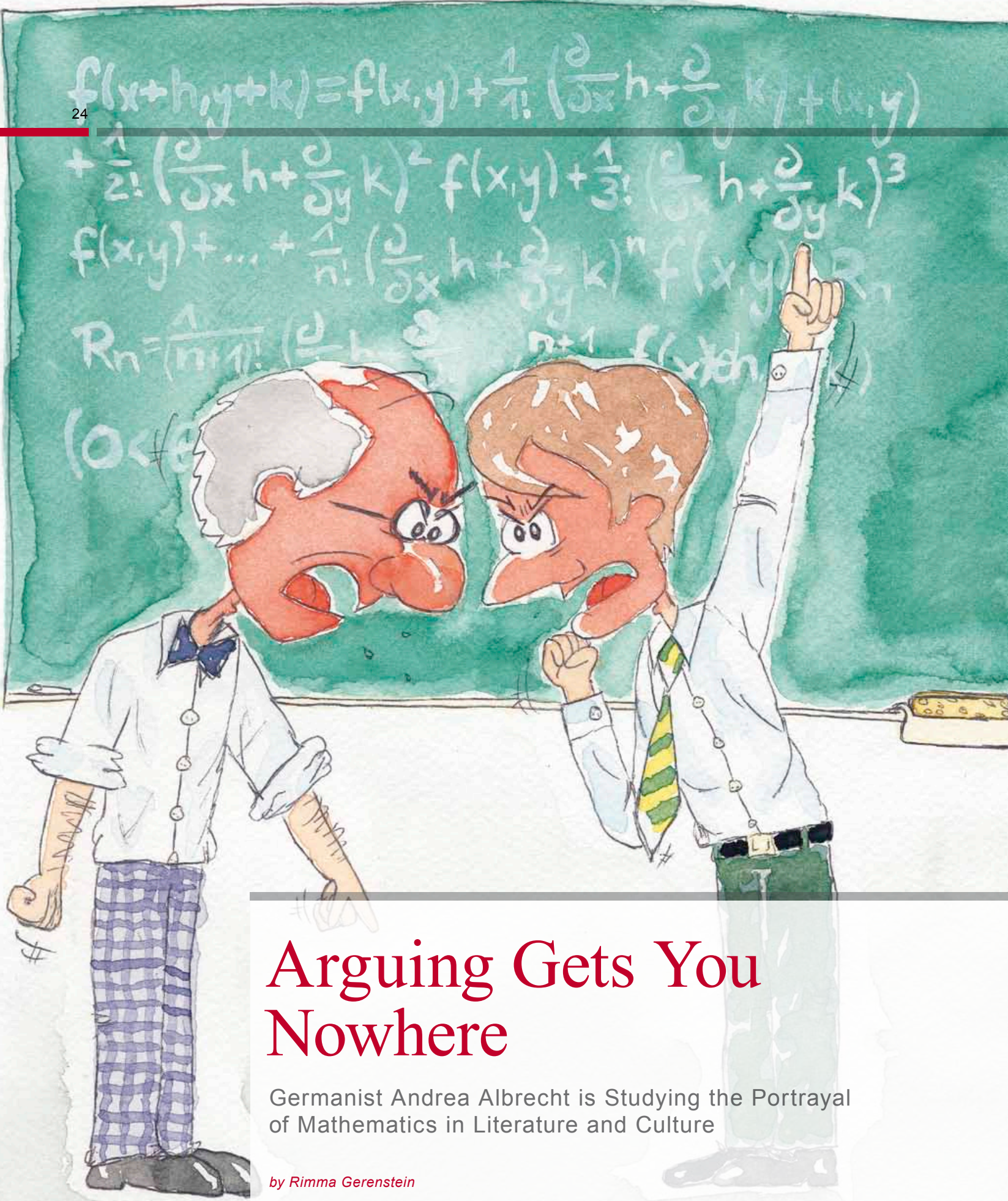


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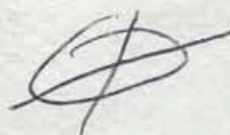
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Arguing Gets You Nowhere

Germanist Andrea Albrecht is Studying the Portrayal of Mathematics in Literature and Culture

by Rimma Gerenstein



*Look who's arguing now:
For centuries mathematicians were thought of as civilized academics who conducted their discussions in a peaceful manner but that had more to do with self-promotion than reality.*

Picture: Becker

From time to time it's amusing to think back about what one's math teacher was like the prototype to end all prototypes. A prototype that doesn't seem to have changed much in the past century: "Blue glasses, a good dose of absent-mindedness, dry as a bone, the necessary consequence of representing the driest subject of them all." Writing in 1904, Moritz Cantor already knew all of the clichés that have been associated with mathematics teachers for centuries. The professor for the history of mathematics wrote

an essay against the misconception that mathematicians are incapable of creativity and fantasy and contributed to a hotly debated topic in the early 20th century. In plays, letters, magazines, and philosophical tracts, humanists and natural scientists were disputing questions like: What makes a good mathematician? And what does he have in common with a creative spirit, a poet, or a writer?

High in Empiricism, Low in Creativity

This discussion would not have been possible in the early modern period. People back then believed in the virtues of mathematics. Not only did it teach pupils valuable skills in arithmetic and logical reasoning, it also built character, shaped the homo mathematicus, regarded back then as the king of exact science and logic, a noble seeker of truth. With these credentials, who would want to blemish their reputation with creativity, the dubious weapon of the philosopher?

But beginning in the 19th century, people began to criticize this traditional dichotomy. "Wit, art, fantasy, and life on the one side, and calculation, rules, monotony, and pedantry on the other these fronts began to crumble," says the Germanist Dr. Andrea Albrecht. In her habilitation thesis, which combines literature and cultural studies with the history of mathematics and philosophy, she is investigating how mathematics and mathematicians are portrayed in literary and cultural texts. "My main emphasis is on discourse about mathematics, so the topic is not mathematical in and of itself." When a mathematician attempts to explain his field to a non-expert, that doesn't have anything to do with formulas, square roots, or compound fractions: "When mathematicians talk and write about mathematics, this communication is a constant attempt to develop a self-image and establish it in cultural



Emmy Noether was the founder of modern mathematics but in the Third Reich she was branded as a representative of "Jewish mathematics," which the Nazis derided as being too abstract and theoretical.

Source: University Archive, Göttingen

“Wit, art, fantasy, and life on the one side, and calculation, rules, monotony, and pedantry on the other these fronts began to crumble”



Thomas Hobbes argued in his philosophical tract *Leviathan* that people would engage in a “war of all against all” if there weren’t a strong state to keep them in check a hypothesis that stands in contrast to the purportedly peaceful nature of a mathematician. Source: Wikimedia Commons

perception and the general public.” It is thus a kind of image building, a centuries-old PR campaign advocating the discipline of numbers, symbols, and figures.

However, not only mathematicians are engaged in the discourse on mathematics: “When a mathematician appears in a school play and exhibits features like cold-heartedness or stubbornness, that says something about the image of mathematics the author wants to construct,” explains Albrecht. Satirical school plays and novels in particular draw on common stereotypes of mathematicians to launch their social criticism.

Harmonic Men of Numbers and Symbols

Andrea Albrecht studied German literature, philosophy, and mathematics, and she didn’t succeed in reconciling these disparate disciplines until after completing her dissertation: “They were like two separate parts of my personality.” She came up with the idea of combining them while studying 19th-century cultural and natural history journals as part of a research project at the University of Göttingen. In many issues she discovered articles that pointed to interrelationships between the humanities and the natural sciences. When Picasso inspired artists throughout Europe with his sculptures and paintings, for instance, architects, art historians, and painters were discussing the term abstraction. At the same time, mathematicians began a debate on the merits of concrete versus abstract thinking for their research. These journals reveal that there was a great need for a dialogue between the sciences,” says Albrecht. “The parties were talking to each other, publishing texts in which they stated their own positions and responded to those of the other party.”

In addition to journals from around the year 1900 and novels and plays from the early 20th century, Albrecht also studies non-literary texts from as early as the 17th century. For instance, mathematicians addressed their colleagues from philosophy in the prefaces to scholarly tracts. In the 18th and 19th centuries, representatives of different disciplines often encountered one another when university administrators gave speeches on the occasion of their installment in office and engaged in self-promotion for their discipline, without, however, always sparking a controversy. Even seminal intellectual figures like Immanuel Kant and Moses Mendelssohn expressed their admiration for the peaceful nature of mathematicians while deriding their fellow philosophers for their ill temper. “These two opposing poles do not accurately reflect the reality of the times,” explains Albrecht. “If you examine the history of mathematics more closely, you’ll find that mathematicians were not harmonious at all. They engaged in heated debates. But the history books gloss over these incidents. Mathematicians who argue, like Thomas Hobbes, aren’t regarded as ‘real mathematicians’ and are later excluded.” To this day, Hobbes is known primarily as a political theorist and philosopher, not for his mathematical ambitions.

Mathematicians: The Best Soldiers

Aggressive, heroic, tough: The public image of mathematicians changed in the 1920s and the 1930s. Germany was preparing for war, looking for the best and most able soldiers: “Here, again, it was thought that science strengthens one’s character,” says Albrecht. “Young academics were expected to develop a national consciousness, an ethos.” Mathematicians had a reputation for being particularly strong-willed and dependable the “soldierly nature” became an educational and political ideal.

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Dr. Andrea Albrecht studied German, philosophy, and mathematics in Bremen, Hamburg, and Göttingen. In 2003 she earned her PhD at the University of Göttingen with a dissertation on discourses of the global citizen in philosophy, literature, and journalism. From 2002 to 2003 she worked as research assistant at the Göttingen Academy of Sciences. She then spent two and a half years as a visiting scholar at the University of California, Berkeley, USA. Albrecht has served as research assistant and post-graduate research group leader (Emmy Noether Program of the German Research Foundation) at the Department of German II of the University of Freiburg since 2007, and she has conducted research at the School of Language and Literature at FRIAS since 2008. Her research interests include the relationship between exact science (particularly mathematics), literature, and cultural theory.

At the turn of the 20th century mathematics had been regarded as a science with little or no relevance for daily life, but now it was suddenly in great demand: The Third Reich needed statisticians for casualties, insurance, or investigations of firearms. National Socialist academics were also suffusing the academic world with their ideology. “The 1930s saw the founding of ‘German mathematics,’ with all of the anti-Semitic connotations the term implies.” The goal was to banish all Jews from the field of mathematics and shape a racist ideal of the German scientist. Jewish mathematicians like Emmy Noether were accused of being too abstract and theoretical in contrast to German mathematicians, who were purported to be clear and intuitive. In practice, of course, they worked in quite the same way, but what mattered was how they presented themselves. “Modern mathematics would not have been possible without Emmy Noether, and the Germans knew that. But instead of citing Noether they cited their own henchmen. They were aware that, from a scientific perspective, their ‘German mathematics’ had lost.”

Cylinders for Cells

A Research Team at the University of Freiburg Has Developed Microscopic Coils for Magnetic Resonance Imaging

by Eva Opitz

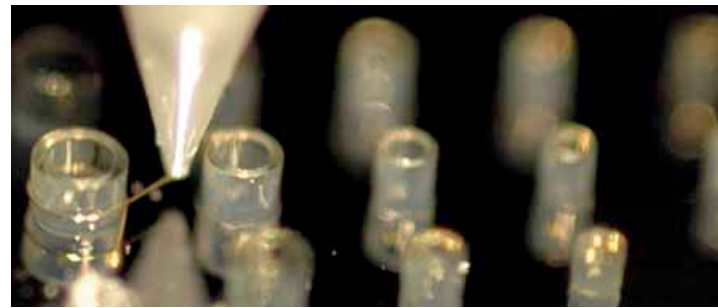
Like tin soldiers on a plate of glass: Coils with a diameter of less than one millimeter enable MRI scanners to visualize microscopic objects. Photos: Doden

When doctors need pictures of a broken bone or a dislocated cervical vertebra, x-ray apparatuses deliver precise images. If they need to examine muscles or other soft internal structures, they turn to a magnetic resonance imaging scanner. The radiation exposure from magnetic resonance imaging is much less dangerous for the body than that from x-rays. A large coil inside its tube creates a constant magnetic field that acts on hydrogen nuclei and their so-called nuclear spin in soft tissue and moves them in a certain direction. The various gray scales of magnetic resonance images reveal the density of water in the various types of tissue. Abnormalities are visible immediately when the pattern reveals conspicuous differences. Tumors, for example, have a different water content than healthy tissue.

The Magnetic Answer

The constant magnetic field in the tube is overlaid with a high-frequency field that makes the nuclear spins resonate, thus producing clear images of the region of the body being scanned. Another coil measures the resonance of the interaction between the magnetic fields, the so-called magnetic answer. "This measuring coil, which takes the images, should be as close as possible to the object," says Prof. Dr. Ulrike Wallrabe, who conducts research on small-scale magnetic systems in the Laboratory for Microactuators at the Department of Microsystems Engineering (IMTEK). "Areas like the stomach, for instance, can be represented with ease. The head is more difficult, because it's farther from the coil." On the other hand, the stomach and the head are not relevant for fundamental research in biology. The objects that biologists want in the tube for this purpose are quite a bit smaller: clusters of cells, individual cells, or tiny life forms. However, current MRI scanners are not suited to

High-tech sewing machine: Gold wire is coiled around the cylinders with the help of a wire bonding technique.



imaging such objects, explains Wallrabe: "When we place cells in the big tube with the enormous measuring coil, there is too much space between them and the coil. The entire signal is destroyed."

In order to scale down the technology to meet the size of the objects of research, Prof. Dr. Jürgen Hennig, Head of the Department of X-Ray Diagnostics at the Freiburg University Medical Center, has launched a joint project with microsystems engineers Ulrike Wallrabe and Prof. Dr. Jan Korvink. "The first step," says Hennig, "is to reduce the size of the measuring coil, not that of the tube." The size of the coil is reduced to meet that of the cell clusters, which are about 0.1 millimeters in diameter. The microsystems engineers have begun testing the new coils with large algae cells. "We want to find out how we can tease out signals that are as useful as possible from the probes," says Wallrabe. The project on micro-magnetic resonance (MICRO MR) receives funding from the European Union. The advantage of MR over optical microscopy in biological research lies in the fact that the cells do not have to be marked with fluorescent dyes and placed in a petri dish or on a piece of glass but can be analyzed in a healthy three-dimensional environment while still living.

The three-dimensional test arrangement includes approximately 25 tiny golden coils per

Big and small: The measuring coils of conventional MRI scanners are designed to scan human body parts, like the head, arms, or legs (left).

The Freiburg research team produced coils so small they can be used to scan individual cells (right).

Photos: Spiegelhalter/Freiburg University Medical Center, Badilita



square centimeter arranged like tin soldiers on a plate of glass. With the help of lithographic methods from electrical engineering, in which structures are applied to semiconductor chips, microsystems engineers can now also construct mechanical or optical structures. Photolithography is a technique for casting shadows. Everything that can be drawn on a sheet of paper can be copied with the help of this technique. For instance, when one transfers a circle to a thin, light-sensitive layer a so-called resist it is copied as such. When one transfers it to a thick layer, it casts a cylindrical shadow. “If we want to create thick structures that are also three-dimensional,

chine takes thin gold wire and coils it around the cylinder with a wire bonding technique. The size and thickness of the coil depend on what it is to be used for. The coils are between 0.2 and 1 millimeters in diameter. The coiling process takes half a second, after which the machine is ready for the next coil. This allows large amounts of the tiny structures to be produced in a short amount of time and at low costs. “If we hadn’t come up with this method, it would have been extremely expensive,” says Korvink. There was previously no standardized production process for three-dimensional microcoils. Once developed, the coil technology can be used for other projects.

“If the cells are living, they can also divide and biologists can observe the process”

we produce one layer after the other,” explains Wallrabe. In this way, the researchers can stack up several layers and vary their thickness or the materials they are made of.

Wrapped around the Cylinder

The researchers use lithography to create a cylinder of resist and use it as a mount for a gold wire coil that starts at the bottom and moves up the cylinder. “The coil accomplishes something that is not possible with lithographic methods alone. It twists upward into the third dimension,” says Wallrabe. The basis for this method was Jan Korvink’s idea of converting a machine from microelectronics. “You might say we misused it to create the coils,” says the micro-electrical engineer. Like a high-tech sewing machine, the ma-

Four to five coils are enough to conduct biological research on cells using magnetic resonance imaging. The cells enter the resist cylinder, which thus has a dual function: On the one hand, it holds the coil in place, and on the other hand, it replaces the petri dish. The necessary magnetic field is created by a magnet in Jürgen Hennig’s laboratory with a strength of 9.4 tesla (the unit for magnetic flux density). The strength of standard tubes in medical MRI scanners is only 1.5 tesla. The tiny cylinders with the gold coils are placed in this big machine and subjected to a constant magnetic field. “At first we only miniaturized the measuring coil; all of the other coils were still the same size,” says Wallrabe. This gives the scientists enough signals to observe the cells living in water or in a nutrient solution, but not to look inside of the cells themselves. “If the cells are living, they can also divide and biologists can observe the process,” says Hennig. This gives the scientists completely new insight into the processes of life.



Prof. Dr. Jürgen Hennig studied chemistry in Stuttgart, London, Munich, and Freiburg. After earning his doctorate in Freiburg and working for several years at the University of Zurich, he accepted a post at the University Radiological Clinic in Freiburg in 1984. He was appointed as professor at the Department of X-Ray Diagnostics in 1993 and has served as director of research at the department since 2004. His research activities range from fundamental research on methods for magnetic resonance imaging and related topics to product development involving the optimization and testing of the basic technologies for existing applications.



Prof. Dr. Ulrike Wallrabe studied physics at the University of Karlsruhe. From 1989 to 2003 she researched on micro-actuators and optical microelectronic systems at the Karlsruhe Institute of Technology, Institute of Microstructure Technology. She has served as professor for microactuator technology at the Department of Microsystems Engineering of the University of Freiburg since 2003. In addition to microcoils and magnetic microstructures, her research interests include adaptive microoptics, such as elastic lenses and mirrors, as a supplementary method for magnetic resonance imaging.



Prof. Dr. Jan Korvink studied in Johannesburg and Cape Town, South Africa. He earned his doctorate at the ETH Zurich, Switzerland, where he subsequently led a research group on microsystems modeling at the Physical Electronics Laboratory (PEL). He has served as professor for simulation at the Department of Microsystems Engineering of the University of Freiburg since 1997. He conducts research on methods for the inexpensive production of three-dimensional microstructures, applications for microsystems in magnetic resonance imaging, and simulation tools for improving the efficiency of computer-based design methods.

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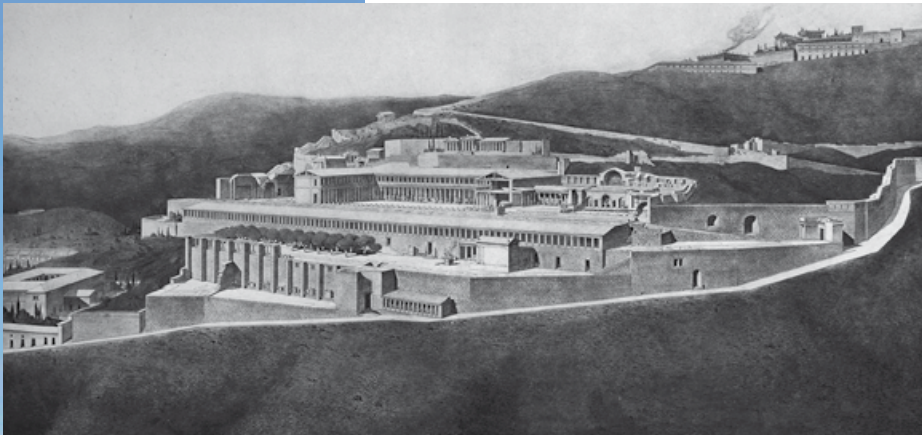
Digging for Stories

How Freiburg Archaeologists are Using Fragments to Reconstruct Life in the Ancient City of Pergamon

by *Thomas Goebel*

Ruins and reconstruction: The Gymnasium in the ancient city of Pergamon was not just a place to engage in sports, but also a central space for culture and communication.

Photo: Stappmanns, Zeichnung: Schazmann (1923)



What can a few pieces of marble ruins, the naked foot of an ancient statue, or a piece of a stone coat say about people who lived over 2,000 years ago? How they saw themselves and their society? A whole lot, says Ralf von den Hoff, professor for classical archaeology at the University of Freiburg: When the finds are not just treated as isolated fragments but are placed in their historical context, they begin to speak. Von den Hoff is studying the Gymnasium of the ancient city of Pergamon in a large-scale project supported by the German Research Foundation. From 2004 to 2009 he conducted excavations on location, in the modern Turkish city of Bergama.

A gymnasium was not just a place for athletes to practice, but also an important public space for the entire Greek city, a central space for culture and communication, full of sculptures of gods, kings, and citizens. And that made it a full-fledged educational institution particularly for youths, says von den Hoff: "In the gymnasium one learned all one needed to know as a citizen."

The Gymnasium in Pergamon was built in the early 2nd century before Christ. It is the largest known structure of its kind. German archaeologists who dug there in the early 20th century found many fragments of sculptures: hands, feet, and parts of clothing, as well as foundations and pedestals. Finds from Pergamon can be found on location as well as in museums, for instance in Berlin or in Izmir, Turkey. But despite earlier excavations, we still have relatively little knowledge of the function of the Gymnasium's architecture and the many sculptures inside of it for

the citizenry of the ancient city and of the changes made to it as a result of political upheaval. Social and cultural references are what von den Hoff is particularly interested in.

Images Create Identity

Pergamon was a royal residence during the Hellenistic period. In the year 133 BC, however, Attalus III bequeathed the whole kingdom to Rome, which was then integrated into the administrative structures of the empire as a province. Earlier excavations have already revealed details on some of the building activities during Roman rule, such as the addition of a thermal bath complex to the Gymnasium. Von den Hoff and his colleagues thus concentrated on the deeper layers from the Hellenistic period and on the transition between the two political epochs.

One of the goals of their excavations was to learn more about the architecture and use of the Gymnasium: as a training and sports complex, as a place of personal hygiene, as a place for ritualistic acts. In addition, the archaeologists were interested in aspects of visual representation, such as the decoration of the rooms with sculptures. They documented the layers of the various phases of construction with sketches and photographs and dated fragments whenever possible, entering them into a database.

The findings from these excavations now serve as the basis for the next big research project. Ralf von den Hoff sees the field of classical archaeology as founded on two equally strong



Only the pedestal remains: While most of the statues from the Hellenistic period were of kings, they were joined later by statues of affluent citizens.

pillars: Field research produces the finds, and historical and cultural interpretation places them in their context. Whereas classical archaeology used to see itself primarily as a form of art history, today its role is often in danger of being reduced to the execution of excavation work. But von den Hoff finds that these two activities fall short of describing the true breadth of the field: “Archaeology also involves the study of images. We ask ourselves: How do images and their perception function in the context of culture?” In societies without mass media, like those of the ancient Greeks and Romans, images played an

“In the gymnasium one learned all one needed to know as a citizen”

immensely important role in the construction of identity. Von den Hoff views the archaeological finds not just as works of art, but first and foremost as evidence of the daily lives of people, of society, of life in Pergamon.

Clothed Citizens, Naked Athletes

“A piece of stone coat, for instance, indicates a clothed statue, and a clothed statue a citizen whereas athletes were portrayed without clothing,” says von den Hoff. Artistic production in these times was not completely free; it followed certain rules, and the statues had certain functions. By determining when the finds were made and where they stood, the archaeologists succeeded in piecing together the history of the Gymnasium’s image

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program bit by bit. One of their main findings is that while the public space was dominated by the kings during the Hellenistic period, it was redesigned by the citizens after the kingdom’s collapse. And they invested it with new splendor: “The citizens began to install marble floors in rooms that had previously only had simple clay floors.” A host of new statues was erected: “There are scores of sculptures portraying citizens in coats.” Most of the statues in the elegant rooms portray patrons and benefactors. They represent the civic ideals of the polis and were thus intended as a model for public behavior.

But the statues of kings were not removed from the Gymnasium. In fact, a close examination of the finds indicates that they were even maintained and restored during the period of Roman rule: “The statues served to remind the citizenry of their own history as a kind of memory repository for civil society,” says von den Hoff. The statues of self-confident and affluent citizens were simply placed alongside those of kings. Later on, a separate room was reserved for sculptures representing Roman emperors.

The Gymnasium as a space for images and civic education: Even if this wasn’t the explicit function of the edifice, it is legitimate to interpret its history as an expression of the formation of identity in an urban civil society, says von den Hoff. And these insights can be integrated into other historical and archaeological findings: The work of Ralf von den Hoff and his colleagues is part of a large-scale Pergamon project coordinated by the German Archaeological Institute (DAI) in Istanbul,



A pile of junk? Archaeologists are studying these fragments to gain insight into the daily lives of the citizens of Pergamon.

Turkey, which in turn is part of the DAI research cluster “Political Spaces.” The Pergamon researchers wish to gain “an overall picture of an ancient city we know relatively little about.” One of the goals of the project is to create a 3D model of Pergamon to illustrate the spaces and images unearthed by the findings in their original context. “This isn’t just a matter of creating an interactive display for museums it also has scientific value.”

Von den Hoff is also supervising two dissertations within the context of the project. One is about the building history of the Gymnasium. The other is a study on euergetism, a Hellenistic social practice in which affluent citizens donated money to finance buildings and works of art and were themselves honored with statues in the Gymnasium. And the general public can also participate in the Freiburg Pergamon project: Von den Hoff and his students have organized an exhibition with objects from the Gymnasium on loan from Berlin

Pergamon in Freiburg

The exhibition “Sculptures in Pergamon. Gymnasium, Sanctuary, Palace” was organized in cooperation with the Antiquities Collection of the State Museums of Berlin/ Prussian Cultural Heritage Foundation. It is being held from 6 May to 31 July 2011 in the Herderbau, Tennenbacher Straße 4 (entrance on Habsburgerstraße).

Opening Hours

Tuesday–Friday: 2–6 p.m.
Sunday: 11 a.m.–5 p.m.
and by appointment.

Admission is free.



Ralf von den Hoff studied classical archaeology, ancient history, and prehistory and early history in Bonn and Munich. He wrote his dissertation on philosopher portraits of the early and high Hellenistic period, served as a visiting assistant professor at the Johns Hopkins University in Baltimore, USA, and earned his habilitation with a study on transformations in the public perception of Theseus in Athens in the 6th and 5th century. He has served as professor for classical archaeology at the University of Freiburg since 2006. His research interests include ancient sculptures and portraits as well as space and interior design in Hellenistic cities. Photo: Nielsen

“The statues served to remind the citizenry of their own history as a kind of memory repository for civil society”

Young, caring, affectionate: The Catholic welfare studies research project is focusing on the parenting skills of teenagers. Photo: Mother-Child Living Community Muggensturm

All Grown Up

A Catholic Welfare Studies Research Group in Freiburg Finds Out What Teenage Parents Really Need

by Stephanie Streif

Laurenz is 19, and will soon be a father. He isn't happy about it, because he doesn't even know yet what he wants to do with his own life. He broke off one apprenticeship and has just started another, but he doesn't really like it. His mother is pressuring him to continue it anyway, because a child costs a lot of money. His father doesn't say anything. He hasn't played a role in Laurenz' life at all. And then there are his girlfriend Nora's parents, who accuse him of one thing after the other: how irresponsible it is to have a child with a seventeen-year-old girl and why he, the older one, wasn't more careful. There is talk of abortion and breaking up. What isn't being talked about is what Laurenz and Nora want. At that age, say the adults, people don't know what they want yet.

The fact is that youth is a time when we have to make a lot of far reaching decisions about our lives. If we suddenly find out that a child is on its

way, the difficulty of developing our own potential is compounded by the need to care for another human being. In addition, many teenage parents have difficult family backgrounds and hope that the world they create with their own child will be a better one than that from which they come. But this usually is not the case. "Teenage parents have to master a dual developmental task," says Klaus Baumann, professor for Catholic welfare studies and Christian social work at the Faculty of Theology of the University of Freiburg. With funding from the Stifterverband, a foundation for German science and research, Baumann is conducting a qualitative and quantitative study to find out how teenage parents deal with this situation and what forms of psychosocial support they need. What's new about the study is that it also takes the fathers into account: "We still know far too little about the skills of teenage fathers. Existing fundamental research tells us next to nothing about them."

Although much research on teenage parenthood has been conducted in recent years, hardly any of these studies go beyond simply providing a snapshot of the current situation and pointing out shortcomings and risk factors.

But not only have young fathers been ignored by the research community, they have also been abandoned by social organizations: There are a lot of hotlines for pregnant teens, and there are advice centers, training programs, and housing concepts for underage mothers. And the fathers? "There is often no place for them in these services. Instead of integrating young fathers, they often regard them as a source of disturbance from the outset," says the sociologist and psychologist Dr. Dieter Fuchs, who is jointly responsible for the project as a freelance researcher at the Section for Catholic Welfare Studies of the Faculty of Theology. Instead of concentrating exclusively on the mother and child, the two researchers are focusing on the entire relationship structure in their project: "What we're interested in is not just the binary relationship between mother and child." The research design of the project is correspondingly complex: Parallel to conducting a quantitative questionnaire among teenage parents in the districts of Lörrach, Rastatt, and Ortenau, the researchers are examining the life stories of the young fathers and mothers as well as the emotional bond between the parents and their child in qualitative case studies.

Playing Together

The questionnaires were distributed by the social services departments of the district administrative offices and by support organizations for mothers and children. The researchers always attempted to get both parents to participate. Nevertheless, the response rate for teenage fathers is only at 29 percent so far. The questionnaire included biographical data on family, relationships, and social networks as well as more involved questions such as what role models the young parents have, what conflicts they are involved in, what expectations they place on themselves, and what they want for themselves as parents and for their children, both at the present time and for the future. In order to identify differences between teenage parents and other youths, the researchers also asked childless teenagers from the same region and the same schools to participate in the ques-



Prof. Dr. Klaus Baumann had himself ordained as a priest in 1989 after completing his studies in theology in Freiburg and Rome. He then studied psychology at the Pontificia Università Gregoriana in Rome and received training as a psychotherapist. In 1996 he earned his doctorate in theology. Afterwards, he worked in the area of pastoral care and opened a psychotherapeutic practice in Freiburg. When Germany passed the Psychotherapist Law in 1999, he applied for a license as a psychological psychotherapist. In 2002 he was appointed as professor for applied human sciences at the Faculty of Theology in Paderborn. Since 2004 he has served as professor for Catholic welfare studies and Christian social work at the University of Freiburg, and in 2010 he was selected as dean of the Faculty of Theology.



Dr. Dieter Fuchs is a freelance researcher at the Section for Catholic Welfare Studies of the Faculty of Theology of the University of Freiburg, where he has taught methodology seminars and courses for the master program in street children education since 2001. He studied psychology (diplom in 1967) and social sciences (PhD in 1988). After completing his studies he did various forms of freelance work, such as at the SOS Children's Village in Sulzburg and as an adjunct lecturer for communication studies at the Department of Architecture of the University of Stuttgart. During this time Dieter Fuchs also completed expert's reports on the topic "Citizen Involvement in Planning [for Municipal Construction Projects]" for the Ministry of the Interior. Between 1972 and 1991 he was departmental director of the day care centers run by the Youth Office of the City of Stuttgart and also taught classes part time at the Stuttgart Academy for Cooperative Education. He then concentrated on biography research.

*Teenage fathers have been ignored by research. The Freiburg research team aims to fill this research gap.
Photo: eyezoom1000/
Fotolia*



tionnaire. 15 schools of various kinds in the districts of Lörrach, Waldhüt, and Ortenau participated in the study. 778 questionnaires were returned by March 2009. The response rate among teenage parents, on the other hand, is still relatively low at 41 questionnaires. “We’re still waiting for questionnaires and will also distribute more of them.”

In addition to this quantitative study, the researchers are also conducting case studies to learn more about qualitative aspects of teenage parenthood: In three support organizations for mothers and children, they documented nine sets of parents with their child. In order to understand the relationships between them, the researchers recorded videos of the parents taking turns playing with their child/mother and child, father and child, all three together. The camera documented the eye movements, gestures, and facial expressions of all three, and their verbal communication was also recorded. Since the scientists are interested in the development of par-

“Instead of integrating young fathers, they often regard them as a source of disturbance from the outset”

ent-child relationships, they are staging every playing session twice whenever possible: once when the child is between three and six months old, and again when he or she is nine months old. The researchers also ask the underage mothers and young fathers to tell their life stories on camera and conduct guided interviews with them. The counselors at the organizations are also asked to comment on the parent-child relationships. For this reason, the researchers selected

parents who are in regular contact with each other and are making an effort to raise their child together. This is extremely difficult, says Fuchs. “We’re just now watching and analyzing the synchronized films.” One of the initial findings of the analysis is that the young fathers are as interested as the mothers in forming a relationship with their babies, and that they succeed in doing so: “We have experienced them as very conscientious, very sensitive despite the great pressure they are under.” It will be two years before all of the results are in. The Stifterverband has indicated that it would be willing to extend funding for the project.

And why is Catholic welfare studies the right discipline to fill this research gap? Klaus Baumann speaks of the theological value of the project, its ultimate goal of promoting social skills: “Ultimately, our project is about supporting young people in need.” The most important thing for the researchers is to help the youths do what they can do, not to point out what they can’t do. “Other studies have focused primarily on pointing out the shortcomings of teenage parents and determining how they can be overcome by way of external help. We, on the other hand, are interested in the skills of young people and how we can promote them both in the context of parenthood and in that of growing up, which is accelerated when one has children.”

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