

Cover: Brüder Grimm-Gesellschaft

The Brothers Grimm often combined both research and politics: Jacob Grimm, a member of the St. Paul's Church Parliament, wrote a compelling proposal for Article 1 of the constitution in 1848.



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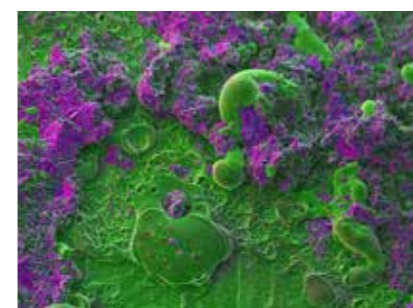
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Peter Strohschneider

A Very Special Prize

For three decades, it has been the most important award for researchers in Germany: the DFG's Leibniz Programme has shaped science and humanities in this country in a number of ways. This anniversary is a reason to celebrate and also to reflect on the next 30 years.

This edition of our magazine is dedicated in large part to a special anniversary. This year the DFG and the research community in Germany is celebrating the 30th anniversary of Gottfried Wilhelm Leibniz Programme.

The festivities began in the early part of the year: at the beginning of March at this year's Leibniz Prize award ceremony and then three weeks later at a colloquium and an event in Bonn dedicated to the Leibniz Programme.

This issue includes reports on all three occasions. In addition, we will introduce the first of a series of articles in which Leibniz prizewinners write about their work. This series will be continued in future issues of "german research". In the course of this year, the DFG will take various other opportunities to revisit the anniversary of the Leibniz Prize and the funding programme associated with it in a number of different ways.

But is that too much celebration? – I think not. The combination of recognition and research funding, coupled with the exceptional quality of the recipients, makes the prize awarded in the DFG's Gottfried Wilhelm Leibniz Programme very unusual and worthy of further elaboration.

At the end of 1983 Eugen Seibold, who was the DFG President at the time, put forward an idea which led to the establishment of the Leibniz Programme in 1985 by the federal government and the states. The idea was to grant a few top-level researchers a significant sum of money, "possibly in the form of a prize", without the need to submit funding proposals. Since then, its impact has been felt in various ways which were probably hoped for, but not actually expected.

This outstanding award has been shaped primarily and mainly by the research and the findings of the 354 researchers to whom it has been awarded. And vice

versa: in many respects, the prize and the research that it has made possible have influenced the development of research areas and disciplines and of working groups and methods as much as they have the reputation of universities and research institutions, and indeed the awareness and appreciation of science and the humanities. Research in Germany would be different, maybe even worse off, without the Leibniz Programme.

This extraordinary effect is due to a number of pioneering decisions which the founders of the programme made when it was established and which in retrospect have proven to be particularly clever. The most important of these was undoubtedly the decision not to set up the DFG's Gottfried Wilhelm Leibniz Prize solely as an award, but at the same time as a funding programme for excellent research.

The most important and most visible honour awarded to individual researchers in German-speaking countries, the Leibniz Prize honours researchers who have already distinguished themselves with extraordinary achievements – and only if they can be expected to produce similarly outstanding work in the future. Science of the highest calibre is the only criterion in the process through which the former is evaluated and the latter anticipated. Furthermore, it is applied as an absolute and is not related to research area, age, gender or any other variables or to an established financial framework, which is the case with project funding. It is therefore not possible to apply for the prize; one must be nominated.

In order to fulfil the expectations associated with the award, Leibniz prizewinners receive a generous sum of money. They are free to use these funds over a certain period exactly as they wish to. Not only are they not required to submit a proposal, they are also completely free of any administrative constraints – as long as it is only used to serve the purposes and further the progress of research.



Illustration: DFG/Schumacher

This freedom, it cannot be stressed often enough, is without parallel in the use of public funding. It is the "idyllic freedom" of which Hubert Markl, the DFG President who had inherited the prize, as it were, from his predecessor, spoke at the first awards ceremony in 1986. We are saddened that Hubert Markl, who passed away at the beginning of this year, cannot celebrate the Leibniz anniversary with us; we pay tribute to him in this issue of "german research", and will remember him with great respect and deep gratitude.

Both the achievements of the winners and its special nature have made the Leibniz Prize the most prominent of all the research prizes in Germany over the last three decades. This extraordinary, undisputed importance will likely remain in times to come. Nevertheless, we should not avoid critical consideration of this award and its future. This anniversary year offers an opportunity for this as do new developments in the area of research funding, for example at the European

level, and also the special attention which the conferral of the Leibniz Prize has attracted in this anniversary year. In this respect, the discussions held at the colloquium dedicated to the Gottfried Wilhelm Leibniz Programme have provided stimulus and will certainly be continued in the statutory bodies of the DFG.

It goes without saying that the Leibniz Prize is not an end in itself, nor is it about those who award it. Rather, the curiosity-driven research which has been funded to such good effect with the Leibniz Prize over the last three decades is cause for celebration and will continue to be so in the future.

Professor Dr. Peter Strohschneider
is the President of the DFG.

Marco Finetti and Rembert Unterstell

The Hour Belongs to the Prizewinners ...

The highest level of scientific achievement, individual degrees of freedom and repayment of the first instalments: the award ceremony for this year's Leibniz Prizes at the beginning of March in Berlin.



Illustration: DFG/Ausserhofer

It was, of course, the actual beginning of the Leibniz anniversary, the start of a series of events and offerings with which the DFG intends to celebrate 30 years of its Gottfried Wilhelm Leibniz Programme and the Leibniz Prize that is awarded as part of it. However, when the DFG presented this prize for 2015 during a ceremony held on 3 March in the now traditional venue, the Leibniz Room in the Berlin-Brandenburg Academy of Sciences and Humanities, the hour really belonged to this year's prizewinners.

The focus was less on the anniversary and the history than on the moment. The circumstances surrounding the award in this anniversary year – that this year not all the

prizes have been awarded and the dearth of female winners – which have attracted particular attention were not completely ignored, but referred to only in fragmented sentences, by the DFG and by the politicians. This having been noted and understood, it was a politician – Cornelia Quennet-Thielen, State Secretary in the Federal Ministry of Education and Research – who assured the prize winners that this particular attention had “nothing to do with them nor with their achievements”.

Full attention on the prizewinners, then, and quite rightly so: they are the people who represent that “highest level of individual scientific achievement” honoured by the

DFG with the Leibniz Prize, which has only one single category and one single criterion, which in turn highlights the importance of this award.

DFG President Professor Dr. Peter Strohschneider addressed both of these issues in his speech to welcome the prizewinning researchers and their families, friends and colleagues as well as guests from the worlds of science and the humanities, politics and society: “Today we are honouring and celebrating eight researchers who have shifted the boundaries of scientific discovery, who have conceived and developed new and groundbreaking ideas, who have brought change to their research areas with their insight and therefore

Left: The eight prizewinners with DFG President Peter Strohschneider (back row on the right), State Secretary in the Federal Ministry of Education and Research, Cornelia Quennet-Thielen (to his left), and Minister for Science for Brandenburg, Sabine Kunst (front row, centre). Bottom: The eight certificates are kept safe in their folders before being presented to the prizewinners in the Leibniz Room of the Berlin-Brandenburg Academy of Sciences and Humanities.

have been able to be entrusted with substantial public funding with full confidence which they will use so that they can conduct outstanding research going forward.”

Thus praised and introduced individually with the now traditional photo montages of their laboratories, institutes and libraries and laudations by the DFG President, these are the recipients of the Leibniz Prize:

Henry N. Chapman, Biological Physics / X-Ray Physics (Hamburg); Hendrik Dietz, Biochemistry / Biophysics (Munich); Stefan Grimme, Theoretical Chemistry (Bonn); Christian Hertweck, Biomolecular Chemistry (Jena); Friedrich Lenger, Modern and Contemporary History (Gießen); Hartmut Leppin, Ancient Christian History (Frankfurt/Main); Steffen Martus, Modern German Literature (Berlin); and Tobias Moser, Auditory Neuroscience / Otolaryngology (Göttingen).



Illustrations: DFG/Ausserhofer

Turning again to the prizewinners, the DFG President said that the prize – and the prize money of €2.5 million each – would allow them scope for their research and ensure that they enjoy individual levels of freedom. He then added: “It is this freedom which imposes an obligation on the researchers and which challenges them to new heights of achievement, and it is this which has set the Leibniz Prize apart from other scientific prizes since its inauguration.”

The politicians also expressed their hopes for and expectations surrounding the prizewinners and the prize and related this to the issues and problems of science policy that are currently under discussion. Cornelia Quennet-Thielen emphasised the responsibility that established researchers, especially those who have won awards, bear towards early career researchers and appealed to the eight award win-

ners: “Use the prize to fulfil this responsibility.” Minister for Science for Brandenburg, Sabine Kunst, speaking on behalf of the federal states, sees the Leibniz Prize as one of the instruments that would “open doors for female researchers and careers in research” and “actively shape diversity” through science and the humanities but also through the substantial contributions from the federal government and the federal states.

Literary scholar Steffen Martus, speaking on behalf of all the prizewinners, drew on Seneca's thoughts on dealing with kind deeds and charity (“De Beneficiis”) to express succinctly their determination to use their prizes in these diverse ways: “He who receives a benefit with gratitude, repays the first instalment of it. You can rest assured that we prizewinners are repaying our first instalment today.”

There was a celebration after the ceremony and, for those who were so inclined, an opportunity to look forward to the festivities on the occasion of the anniversary of the Leibniz Programme and the Leibniz Prize in Bonn in three weeks' time.



... The Day Belongs to the Prize

A colloquium offering more than just food for serious thought and a celebration that was more than just merrymaking – impressions of the DFG's Leibniz Day at the end of March in Bonn

As is so often the case, it was perhaps the small moments which will be remembered from the 25 March this year, when the DFG celebrated the 30th anniversary of its Gottfried Wilhelm Leibniz Programme and the associated Leibniz Prize with a special colloquium and festivities in Bonn. For example, Hannah Monyer, the Heidelberg-based neurobiologist who won the prize in 2004, recalled the Rector of

her university presenting her with flowers to mark the great honour and inviting her to take a walk with him, a telling indication of the visibility conferred by the most important research funding prize in Germany – but by and large only by this one. Peter Hegemann, biophysicist in Berlin and winner in 2013, noticed an inscription chiselled in stone in the laboratory of his fellow researcher Robert Deisenhofer

(winner of a Nobel, rather than a Leibniz Prize) in Dallas, Texas: "Der Wind der Freiheit weht" (The wind of freedom is blowing): a particularly appealing variation on what was probably the most used phrase of the day.

Maybe it was also the various interlinking connections from the Leibniz Programme and the Leibniz Prize to current topics and issues in science policy which would con-

tinue to provide material for discussion, even after a thorough airing throughout the day. And then there was Klaus Fiedler, the Heidelberg-based social psychologist and prizewinner in 2000 who in his short opening presentation contrasted the Leibniz Prize and its "very effective individual research funding" with the Excellence Initiative and its, in his view, "large volume financing".

Or Thomas Carell, the organic chemist from Munich who was awarded the prize in 2004: he might well have wanted to confirm that the Leibniz Prize attracts early career researchers, but also noted that for them in particular (but not only them), in the face of constant evaluation, growing pressure to compete and unfavourable career paths and

job opportunities, research was becoming an increasingly "repressive system". Or Barbara Stollberg-Rilinger, the early modern period historian from Münster and 2005 prizewinner who at a discussion group in the evening entitled "Is Top-Level Research a Male Preserve?" (available only in German) examined the same structures and established that the German research system, in any case not an accommodating one in this respect, even now and despite all the efforts to the contrary "still tended to be anti-women and anti-family."

Perhaps the declarations of love for their profession and for their research as expressed by the prizewinners who had travelled to Bonn for the day had particular resonance.

Possibly the most poetic came from Hannah Monyer, who spoke of "love" and of "being driven", of "really losing oneself in the subject" and of the "short moments of immortality" that research, like music, could bring. Or the lingering impression during the evening's celebrations of the portraits of more than 300 Leibniz prizewinners being brought together into the iconic shape of a double helix in an animation on the giant screen on the stage in the Bundeskunsthalle in Bonn: the DNA of top-level research.

There were in any event many such remarkable moments framed by this intertwining of celebration and reflection, reflection and celebration so typical of the DFG. At the beginning of the colloquium,

Between the lectures and discussions, guests were invited to gain some insight into the world of top-level research at an exhibition at the DFG Head Office with photos of the prizewinners' laboratories and institutes, accompanied by music from the jazz duo Oliver Leue and Gunnar Plümer.



Stimulating discussion at the colloquium: Klaus Fiedler initially took an empirical approach to the "Leibniz Prize effect" (photo left); Dirk Raabe (2nd left), Hannah Monyer (centre) and Oliver Primavesi (4th from left), with moderators Isabell Lisberg-Haag and Uschi Heidel, described what the award meant to them as researchers and on a personal level; early career researchers in the audience.





The visibility and the future of the Leibniz Prize – topics for more panel discussions with Rainer Forst, Christine Silberhorn and Holger Wormer (photo left) and Peter Strohschneider, Friedrich Wilhelm Graf, Amélie Mummendey and Thomas Carell (photo right with chairperson Jeanne Rubner); Dorothee Dzwonnek, Annette Schmidtman and Christoph Markschies (centre) also clearly enjoyed the discussion.

DFG President Peter Strohschneider invited the 150 or so prizewinners attending the event, the other delegates selected from the DFG programmes for early career researchers and the representatives from science policy, research funding and society to an “optimistic discussion about a prize which through its research-friendly nature is itself optimistic”.

It was indeed an optimistic – and largely positive – view that then unfolded, not just due to the positive impact of the Leibniz Prize in the past 30 years, but also, and primarily, due the most important reason for its existence and its most important merit. In the interviews and panel discussions, and even in incidental remarks, there was hardly

any contribution that did not praise the “legendary freedom” which the former DFG President Hubert Markl spoke about in 1986 when the prize was awarded for the first time.

It was not the honour of the prize that they found its most valuable asset, the prizewinners said, nor the prize money, which, some were heard to remark openly, they could have acquired by other means, but the freedom to do and not do what they wanted, provided the interests of research were served. For example, it allows “the business to be more autonomous and run with fewer constraints” (Dierk Raabe, materials scientist and 2002 prizewinner); “innovation at the highest level, by slowing everything down” (Christoph Markschies, theologian

and 2001 prizewinner); room for “failure that can become the basis for success” (Michael Famulok, biochemist and prizewinner in 2002).

There were other more critical and also controversial topics for discussion, such as the question of whether there should be funding directly “after” the Leibniz Prize, from the DFG or at another, possibly European, level – to which the responses were “yes” and “no” delivered with equal vehemence. Opinions also diverged on how visible the prize is outside of Germany and on whether and how this could be improved. So there were no conclusions, but plenty of material for discussion about the future of the Leibniz Prize.

And then there was the Leibniz celebration in the Bundeskunsthalle

At the party: moderator Angela Elis welcomes the guests to the Bundeskunsthalle (photo left); the Minister for Science for Rhineland-Palatinate and Chairperson of the Joint Science Conference, Vera Reiß, offers congratulations on behalf of the government (centre); the Nicolas Simion Quartet plays “Transylvanian Wood”.



The entertainer Vince Ebert (left) made the audience laugh yet provided plenty of food for thought; analysis and anecdotes from panel members Tobias Moser, Barbara Stollberg-Rilinger, Ferdi Schüth and Marion Merklein (centre, from left with moderator Ingolf Baur) on “Is Top-Level Research a Male Preserve?”; Peter Strohschneider, Dorothee Dzwonnek and Bonn Mayor Jürgen Nimptsch give the discussion their full attention.

– and in the same way as the day had not been entirely given over to serious thought, this was not entirely all about merrymaking.

“Thinking is a worthwhile occupation,” explained Vince Ebert, the entertainer with an unusual penchant for science, to more than 350 guests. However he did this not only with satire and snappy remarks, but combined it with a very serious appeal to those who have made a career of thinking and who even get as far as the Leibniz Prize, to take the results of their thinking out to the public, to make a contribution, to get involved where necessary.

Relatively few women have won the Leibniz Prize (42 compared to 312 men). The panel discussion “Is Top-Level Research a Male Pre-

serve?” was partly a response to that fact and again combined views that only initially appeared anecdotal (“The new paper written by a female member of my group cost me three calls to the editor, but daycare for her son cost four to the nursery.”) with crystal-clear analysis of disadvantageous career paths and a lack of planning certainty for women in research, of obstacles and also self-imposed obstacles.

Two Leibniz prizewinners, Christoph Markschies and Günter M. Ziegler, one a theologian, the other a mathematician and both with an astonishing talent for stand-up comedy, devised their own “Study of Leibniz Prizewinners” in accordance with all the rules for quantitative and qualitative investiga-

tion and analysis especially for this evening. It yielded some amusing results and also pertinent comments on the typology, productivity and fulsome praise of the Leibniz Prize and of those who have been awarded it. There was enthusiastic applause from the audience who were invited to participate with a card vote.

And even then, it was not yet over: the foyer of the Bundeskunsthalle was opened for a reception held under futuristic lighting, with excellent food, drink and music and undoubtedly a great deal of discussion stimulated by what had been seen and heard from the morning to the late evening – a fitting end to a special day to celebrate a special programme and a special prize.

“What you always wanted to know about Leibniz prizewinners”: during the presentation of their “Study of Leibniz Prizewinners”, Christoph Markschies and Günter M. Ziegler (left) encouraged audience participation with a vote. Right: the day draws to an end in the Bundeskunsthalle.

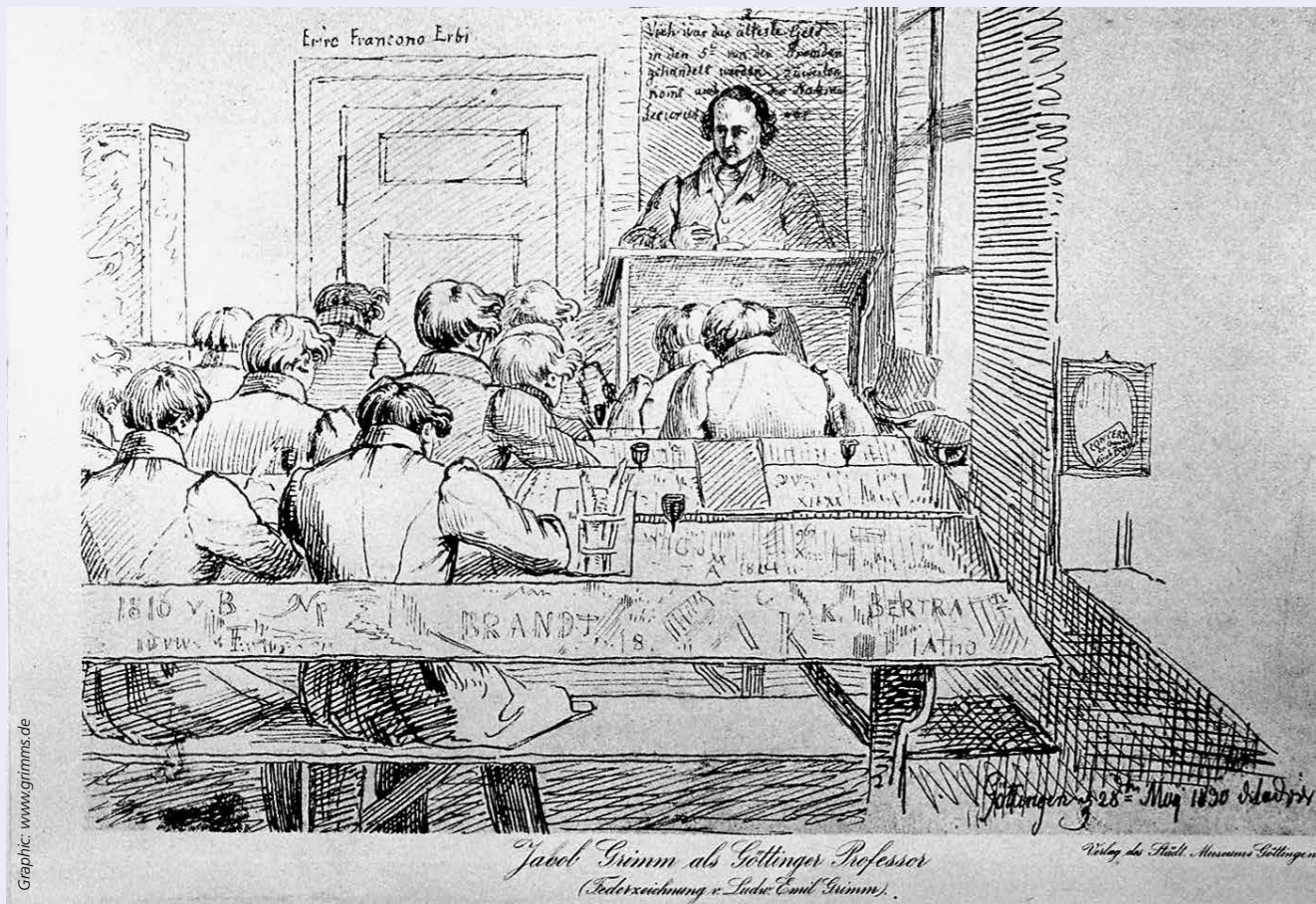


Steffen Martus



Steffen Martus, a 2015 Leibniz Prizewinner, has been teaching since 2010 at the Institute for German Philology at the Humboldt University of Berlin. He is considered a pioneering scholar of modern German literature. His output is prolific and wide-ranging in terms of period and subject matter and is characterised by an original research profile which extends from studies of Friedrich von Hagedorn as an example of the Enlighten-

ment to his postdoctoral thesis "Werkpolitik", to Klopstock, Tieck, Goethe and Stephan George and monographs about Ernst Jünger and the Brothers Grimm. In addition to his research and teaching responsibilities, he is actively involved in academic self-governance, for example serving on the DFG review board for literary studies, and contributes to the public promotion of literature through the media and articles on the Internet.



"What Appeals to the Students from My Odds and Ends of Knowledge"

Jacob and Wilhelm Grimm saw science and the humanities as practised in research and teaching as a way of life which could also be highly political. As a result, in 1837 the brothers and five other professors joined together in protest as the "Göttingen Seven", risking dismissal from their positions and banishment.

In mid-November 1837, the Brothers Grimm and five of their fellow professors at the University of Göttingen protested vehemently against the abolition of the Hanover Constitution of 1833. The response was rapid and uncompromising: on 11 December Ernest Augustus, the King of Hanover, signed dismissal notices for the "Göttingen Seven". It was a particularly hard blow for Jacob Grimm and the historians Georg Gottfried Gervinus and Friedrich Christoph Dahlmann who as the ringleaders were ordered to leave the kingdom within three days. Ernest Augustus declared "in accordance with the holy duties invested in Us by divine providence," he could not allow such men to continue to occupy a "very influential teaching position". Otherwise there would be cause to be concerned that "the fundamental basis of the state would be gradually undermined".

In this respect at least, the King agreed with his professors who had brought their "protest campaign" to a remarkable end. They placed political loyalty to the prevailing regime and their academic work in a mutually supporting relationship: "They know that in faithfully practising their official profession, they always warned their students against political extremes and as much as they could, reinforced their attachment to the government of their kingdom. Their full effectiveness is less firmly founded on the academic value of their teaching than on their

Jacob Grimm gives his first lecture in Göttingen in 1830. From the start, he complained about the tribulations of university teaching. Right: The Brothers Grimm in their later years. Photographs of Jacob (top) and Wilhelm Grimm (bottom).

personal integrity. Once they stand before their students as men who have failed to take their oaths seriously, that is when the blessing of their effectiveness will be lost."

Thus Ernest Augustus accused the "Göttingen Seven" of subverting the civic and public service mentality of the students. The protesting professors levelled the same allegation at the King. Both sides were however in agreement that science and the humanities were founded on political and social order.

The uncompromising protest on the part of the Brothers Grimm is notable, because they had not sworn their oath of office on the 1833 constitution; when they were appointed professors in 1830/31, the old constitution, which Ernest Augustus wanted to reinstate, still applied. The Grimms also emphasised repeatedly that that legal text in particular was of no concern to them. Their response to the constitution movement was one of other-worldly incomprehension saying that the constitution would be "like all modern legislation on closer inspection", and that that, for them, was a mistake. So why did the Brothers Grimm risk dismissal and even banishment?

The problem for the Grimms was the symbolic power of the royal assault, which swept away an obligation based on mutual agreement with the representatives of the community. Ernest Augustus's political coup not only concerned the Grimms' deepest political convictions, but also the political basis of their scholarship and therefore of their lives. The "loyalty" that they had sworn frequently was therefore of particular political significance because they had dedicated themselves to creating a new way of life



in Göttingen: that of university professors with duties in research and teaching.

Jacob and Wilhelm Grimm were librarians when they moved from Kassel to Göttingen in 1829/30. From the start they complained about the situation in Göttingen, particularly about the tribulations of university teaching. In the approximately 20 years before they moved, the brothers had produced an almost unbelievable body of work writing an abundance of recensions, essays, editions and monographs to attain the position of eminent scholars.

This astonishing achievement was accomplished in Kassel, the Electoral Library and in various circles of friends and acquaintances. Their complaints about life in a university town therefore stemmed from the inability to continue the way of life that had become second nature to them, from the associated work ethic, their conception of

themselves, and from the conflicts prompted by the new routines.

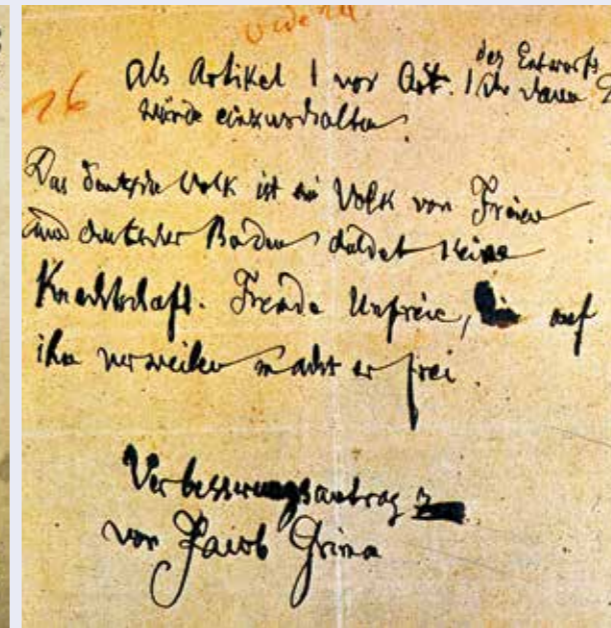
The difference in mental, physical and social habits was of all the more consequence because the university maintained the old statist view of itself. Above all, however, academic life within and outside of the institution was conducted in accordance with unwritten rules and conventions. The whole university operation, from social relationships between the professors to book lending, appeared therefore to the Grimms as an institutionalised disruption to a well-established way of life – even academic work is shaped by certain routines, takes place in certain time rhythms, defines a physical and mental attitude or singles out specific social relationships for privilege. As early as 1823, Jacob Grimm had said of himself and his brother: “It seems that neither of us are suited to be professors.” In February 1831, he said again: “People say that to be a professor, one must prepare and educate oneself from

a doctor onwards, later than that it really does not appeal.”

The lecture was one of the forms of academic practice completely unfamiliar to the Grimms. Their discomfiture with life as professors was particularly strongly expressed in connection with this academic format. In 1829 when negotiating their conditions of appointment, Jacob Grimm said on his own and his brother’s behalf: “Lectures, to which he is not averse either, must be experimented on, as we are both unpractised and unprepared in this respect.” As a “newcomer”, he said in August 1830, even the one lecture he had to give was “enough for him to manage”.

The requirements of their new role were brought home to the Grimms particularly when they stood before the students because this practice required a specific academic performance. Jacob Grimm again clothed this view in a complaint: “Appearing at a certain time at the lectern” smacked of “the theatrical” to which he was “averse”. The lectern demanded that the Grimms’ whole attitude conform to the culture of the university and that they adapt to a specific social situation. They had to adjust their bodies to the lecture situation, modulate their tone, slow their speech rhythms and accentuate in a certain way to fulfil the requirements of the audience; they were obliged to package their knowledge in a certain way, to transform their research interests into teachable topics and nevertheless find ways to convey aspects of their researcher mentality under these conditions.

In the lecture theatre, Jacob Grimm was confronted with the expectation that he concentrates



Illustrations: Brüder Grimm-Gesellschaft

Jacob Grimm wrote “About his Dismissal” in retrospect. As a member of the Frankfurt (St. Paul’s Church) Parliament in 1848, he wrote a proposal for Article 1 of the constitution which, although it was rejected at the time, has lost none of its relevance today.

on presenting established knowledge that the students could record in their notes – “it seems to me that the audience only likes what they also hear from others, and are indifferent to what I think better.” However, it did not suit him: “I just do not like to provide the audience with a compendium of information that I myself would like to explore in some depth.” At least in some respects he had to prepare his knowledge in a non-relevant way as if for a “sermon” and “think about what appeals to the students about my odds and ends of knowledge and order and arrange it for them.”

Organising interaction in the lecture theatre was one challenge: Jacob Grimm spoke so slowly that his audience was almost able to take verbatim notes. However, he was also concerned that the students took an interest in how he had developed his thoughts as they wrote. In his view, they should not expect

“dictation”. Although Jacob Grimm was in principle in favour of new forms of teaching which did away with face-to-face structures and provided an opportunity for “more interaction”, he doubted that the teachers would have the necessary “tact” and “authority” to use them.

He thought an unintentional consequence of the greater “interaction” would be that the lecturer would not have enough confidence in the students’ self-interest. But on the other hand, if one tried too hard to encourage the involvement of the students, which one should be able to take for granted, then this would threaten “the quiet of an inner awakening and learning”.

Jacob Grimm’s examination methods are further testament to the brothers’ inclusion of their lecturing practice in an integrated concept of education: he found comprehensive subject knowledge less important

and was more concerned about the ability to learn. Students did well in his examinations if they succeeded in “stimulating investigations” and asking the right questions: a matter of research potential, therefore. Jacob Grimm arranged his examinations in the form of a wager on the future of the student and not as the documentation of a performance which consisted primarily of acquiring blocks of knowledge.

Teaching, which was so important to the Grimms that it formed the reason for their protest in the “Göttingen Seven” affair, was for them a sizeable collection of practices which formed a way of life. Even a small adjustment to university policies affected the cogs and wheels of scholarship. And because scholarship for the Grimms was part of a complex form of life, research and therefore also teaching had political implications for them, although they saw no call to openly politicise their lectures. The Grimm brothers therefore took part in the “Göttinger Seven” protest emphatically as “professors” and made the “success of their effectiveness” as university teachers and researchers dependent on a constitution of which they in principle thought little.

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www.literatur.hu-berlin.de

A watercolour of Jacob Grimm’s study in Berlin painted in 1860 by Moritz Hoffmann.



Illustration: Brüder Grimm-Gesellschaft

Reimer Gronemeyer and Michaela Fink



Slowed by Hunger

In southern Africa there are over 15 million AIDS orphans. In Namibia, as elsewhere, most are cared for by their extended families. But as traditional structures break down, new initiatives are emerging in civil society in an attempt to relieve hardship.

We are visiting a school in the northern Namibian bush. Seven-year-old Samuel is standing in front of us wearing an orange T-shirt. It's 38 degrees. School is over, it's 2pm and Samuel hasn't eaten yet today. It's October 2013 and the northern part of Namibia,

near the Angolan border, is experiencing its worst drought in 30 years. 780 000 people – a third of the country's population – are dependent on the government's food relief programme. But the sacks of maize flour delivered by lorry don't reach everyone, and what does

arrive is nowhere near enough. More than 100 000 children under the age of five are at risk of undernourishment and malnutrition. In 2013 almost all the harvest failed. Emaciated cattle tear at plastic bags and cardboard, chewing it slowly. Goats and donkeys search in vain

for stalks on the parched ground. Images like these are not easily forgotten.

Northern Namibia is in the grip of drought. In normal circumstances the staple food in rural areas is millet, *mahangu*, or to be more precise the porridge made from it, *oshifima*. The millet is grown in fields next to the *egumbo*, a group of round straw-roofed huts surrounded by a picket fence. As well as being a rural dwelling, the *egumbo* is an important social form in which the entire family traditionally lives, works, cooks, tells stories and celebrates together. In addition to *mahangu* there are normally spinach, gourds, beans and tree fruits (*marula*, *embe*). There are also chickens, goats and occasionally cattle. The millet grains

Left: Children at an after-school support centre in Onambiya, Oshikoto region in northern Namibia. Below: The egumbo – round straw-roofed huts surrounded by a picket fence – are at the centre of social life.

are stored in large woven baskets (*eshisha*), but almost everywhere they are empty.

Thousands of children in rural areas, who often have a one- to two-hour walk to school, arrive with an empty stomach, hoping to get something from the school feeding programme. Samuel hasn't eaten anything today; there wasn't any porridge for him or the other children because the cooks didn't turn up. Grandmothers and mothers come to the school on a voluntary basis to prepare food, but today they haven't come. Maybe the journey was too long, maybe they are ill, or maybe they are too weak.

At Epinga school, further north and even deeper into the bush, the sacks of maize flour haven't come in weeks. If they're lucky, the children will get some *oshifima* at home in the evening, but in times of drought most cannot expect more than one meal a day. The head of the school in Epinga says that fewer and fewer children

have been coming to school since school meals stopped.

This year hunger has become an everyday phenomenon; in most *egumbos* there isn't enough to eat. According to a government report, 6000 children died of malnutrition last year – when there was a normal harvest. How many will it be this year?

In field research you are often confronted with unusual situations, but this drought is the kind of thing that cannot be predicted in a research plan. We carry out interviews sitting in the sand, talking to grandmothers, mothers, aunts and children – and our subject has acquired an unexpected drama. In our research project we are trying to find out about orphans and vulnerable children, or OVCs.

The HIV/AIDS epidemic has left many children orphans or half-orphans, but since the fathers are usually absent, a child without a mother is effectively an orphan. Yet not entirely, because all the moth-



er's sisters are also *meme*, mothers. In this sense there is no such thing as an orphan, because almost every child belongs to a family in some way. But the large extended family is disintegrating, which is why OVCs exist, as well as *egumbos* run solely by children, referred to as child-headed households.

All over northern Namibia, grandmothers and mothers sit in the *egumbos* with a flock of children. Countless rural *egumbo* families live on the pension of €42 (600 Namibian dollars) paid to the grandmothers by the state. During our interviews we meet hardly any men. When we do see one, he looks in a bad way. He has returned because of "the disease": weakened by AIDS, he

will soon need care and wants to die at home.

You cannot recognise the ubiquitous hunger just by looking at the people, but you can see how it slows them down. Sitting in the sand, 15-year-old Anna speaks to us in a clear, strong voice, but leans against the wall of the hut, plainly exhausted. The teachers tell us of children who fall asleep at school because they have had nothing to eat.

So what is the state doing about it? There are grants of 200 Namibian dollars (about €14) a month for orphans, but the money often goes to fathers, mothers or guardians who do not care for the children and live far away. Other chil-

dren do not get the grant because they have no death certificates for their parents or birth certificates of their own. And if the money does actually reach the child, it often leads to conflict along the lines of "It's my money!" within the band of kids. There are also reports of grants being misused, with some caregivers drinking it away at *she-beens*. In any case, as everyone confirms, 200 Namibian dollars is not enough to provide for a child, especially in the towns.

Namibia, which gained its independence in 1990, is experiencing dramatic social change – as confirmed by our interviews and by schoolchildren's essays. The war of independence, the AIDS epidemic and a modern culture that has begun to replace the traditional ways have all brought about social upheaval. Above all, the family with its provision of nourishment, shelter and life orientation is breaking up.

The situation of OVCs demonstrates something of the severe social crisis. Today Namibia is among the countries with the greatest disparity between rich and poor. In the capital Windhoek, the property market is booming and people throng the new shopping malls, while in rural areas and the poor district of Katutura, which is now home to hundreds of thousands of people, the situation is getting worse.

There is growing anger at increasing bureaucracy and the self-enrichment of the elite. Meanwhile, in Katutura, the number of abandoned, abused and orphaned children is growing. Disease, alcoholism and disorientation appear to be on the rise. As the old rural orientations disintegrate they are being replaced by a consumption-

also distributes food to families in the local community. A former member of parliament, Rosa Namises, takes children into her home, the Dolam Children's Home in Katutura. She laments the fact that European and American donors often, in the old style, mistrust black initiatives and want to supervise them or preferably run things themselves. The former MP, who was involved in the civil war which brought an end to the apartheid regime, believes that this is not the right way to do things.

Rauna Jairus, who set up the Pashukeni kindergarten in Katutura and personally took in twelve orphans, feeds 40 children mainly from a large garden where she grows gourds, spinach, beans and cabbages. But the drought and rising water prices are making it difficult to keep the garden going. Like many, Rauna gets by on spontaneous donations, living from hand to mouth.



Corrugated metal shacks in Katutura, formerly a township, now a suburb of Windhoek.

oriented modern culture, whose wares remain out of reach for many.

Meanwhile, amid the collapse of the old traditions – perhaps authoritarian, sometimes patriarchal, but nearly always effective at providing – a new culture is emerging where everyone is obliged to take care of themselves. Previously, the place of provision was the *egumbo* family, but now new initiatives are appearing in civil society, forms of assistance based on neighbour relationships and friendships. Certainly, the concept of neighbourly help is not new: help would always be given, if possible, to the neighbour who had no more seed or an empty *eshisha*. But now unusual new forms of provision for children are emerging, particularly in urban environments.

A large number of OVC initiatives can be found in Katutura and the areas around the northern towns. There are now many places of refuge for OVCs, mainly orphanages, soup kitchens and kindergartens offering free places to OVCs. These saving initiatives are usually run by women. Frieda Kemuiko Geises, for example, runs a soup kitchen in Havana, a particularly deprived area of Katutura, where more than 40 children are fed and receive some basic education.

Oonte OVC is a non-governmental organisation (NGO) in Ondangwa in the north of the country. Nearly 400 children come here every day after school to eat, play and sing before going back to their huts, where there is little to eat. Director Petrina Shiimi

Telling expressions on children's faces outside the soup kitchen at Sam Nujoma Multipurpose Center, Ongwediva.



Prof. Dr. Dr. Reimer Gronemeyer lectured in sociology at the University of Gießen before becoming professor emeritus.

Dr. Michaela Fink is a sociologist and research assistant on the DFG project.

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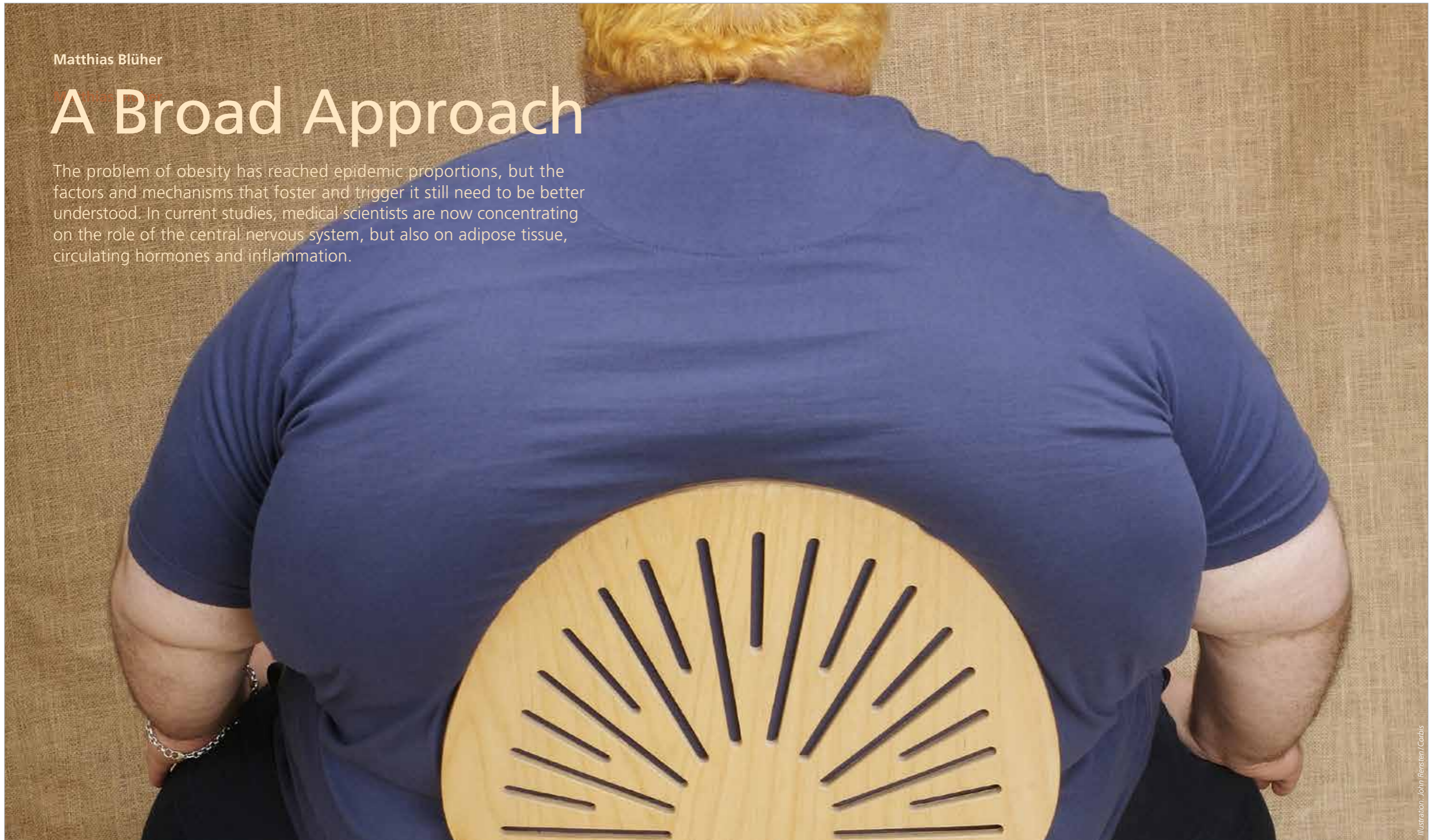
M. Fink und R. Gronemeyer (eds.): "Who takes care? Children of Crisis. Essays by Namibian Learners." Windhoek, Namibia Publishing House, 2013. (Downloadable from www.reimergronemeyer.de)



Matthias Blüher

A Broad Approach

The problem of obesity has reached epidemic proportions, but the factors and mechanisms that foster and trigger it still need to be better understood. In current studies, medical scientists are now concentrating on the role of the central nervous system, but also on adipose tissue, circulating hormones and inflammation.

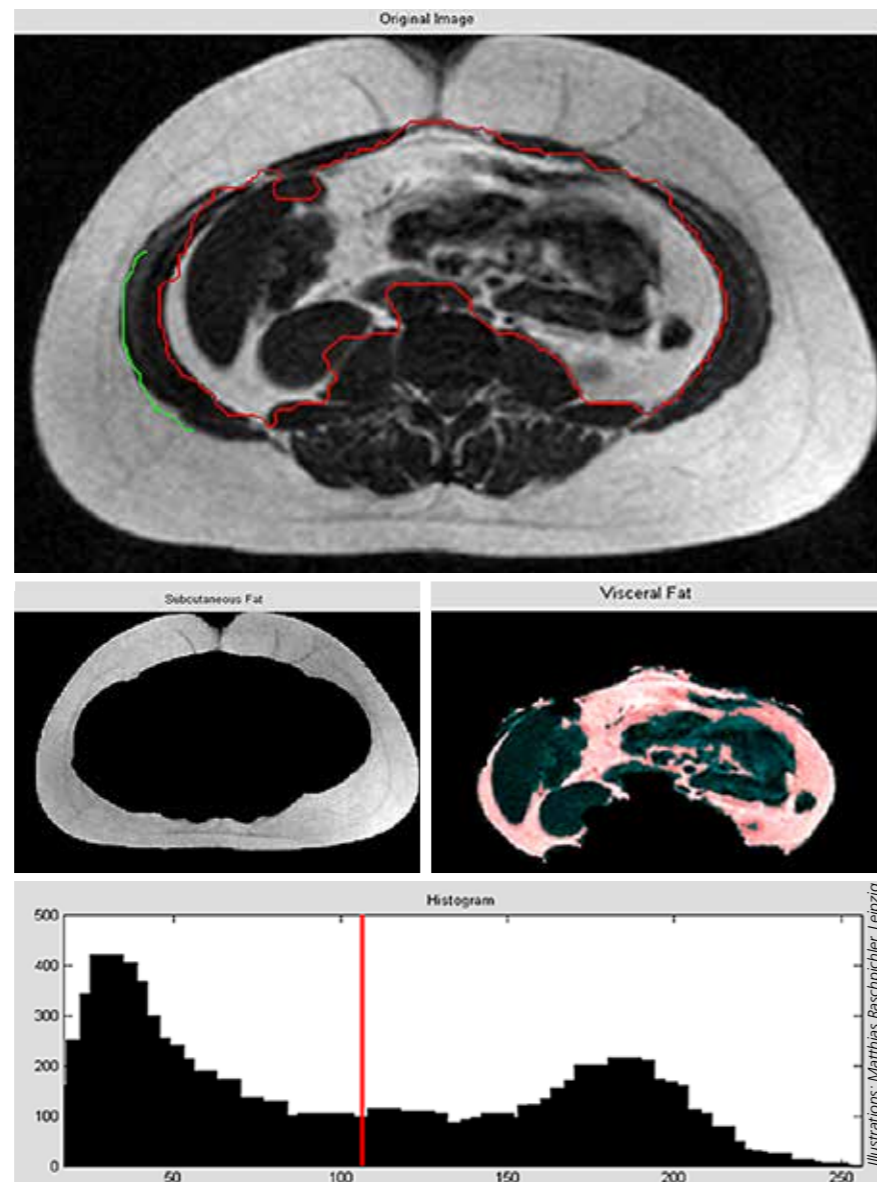


An obese person goes through life with a belly, double chin and “love handles”. Obesity may have a whole range of consequences for the individual – physical, emotional and social. Large people are often the target of both subtle and less subtle derision, as well as self-reproach. Young or old, obesity can be a burden in both a literal and a figurative sense.

Yet obesity is an extremely widespread problem – which makes it all the more important in basic medical research to understand the mechanisms that cause it. One key question is whether obesity constitutes a disease or a conscious “decision”. In medical terms, obesity is characterised by increased body fat and is the visible sign of a chronic energy surplus. Genetic, environmental and behavioural factors all contribute to obesity, with lifestyle playing a major role: the constant oversupply of food, the fact that we are much more sedentary than we were 100 years ago, and continuous stress and overstimulation.

Obesity is one of the virulent health risks affecting modern societies and a very common condition, affecting around 20 percent of the general population in Germany. The increase in obesity worldwide will result in reduced life expectancy because excess weight is associated with serious conditions such as type 2 diabetes, high blood pressure, coronary heart disease, heart attacks and malignant tumours.

This makes the basic questions in obesity research extremely important. What are the central mechanisms that lead to increased and surplus energy intake? Why does surplus energy intake lead in



Studying fat tissue: magnetic resonance tomography reveals the distribution of subcutaneous fat (under the skin) and visceral fat (around the internal organs).

some overweight people to dangerous fat distribution (for example visceral fat or liver fat) and the malfunction of adipose tissue? And what signals from fat increase the longer-term risk of metabolic and heart diseases in overweight people?

In practice, most physicians stop at a description of behaviour (“The patient eats too much and

doesn’t exercise enough.”) without carrying out a structured medical history and diagnosis to identify the causes of the obesity-causing behaviour (“Why does my patient eat too much?”). The decisive factors that affect energy intake, metabolism and energy expenditure are not fully understood and difficult to establish in individual cases.

This is probably why the traditional approach to treating obesity, which relies on increasing physical activity and reducing calorie intake, is rarely successful in the long term. Around two thirds of patients who lost weight with this type of treatment regained weight after a year, and almost all of them returned to their starting weight or even put on more within five years. In other words, we do not yet have a successful way of treating the actual causes of a positive energy balance. This was the starting point for the Collaborative Research Centre 1052 “Obesity Mechanisms”.

To better understand obesity, we need to systematically identify factors that influence the intake and expenditure of energy. Energy expenditure can be divided into resting heat generation (the resting metabolic rate plus food-dependent heat generation) and active heat generation (resting activity plus physical activity). In simplified terms, we can think of the three elements involved: food, metabolism and activity. Changing one of these factors inevitably alters the net balance of energy, resulting in either weight increase or weight loss.

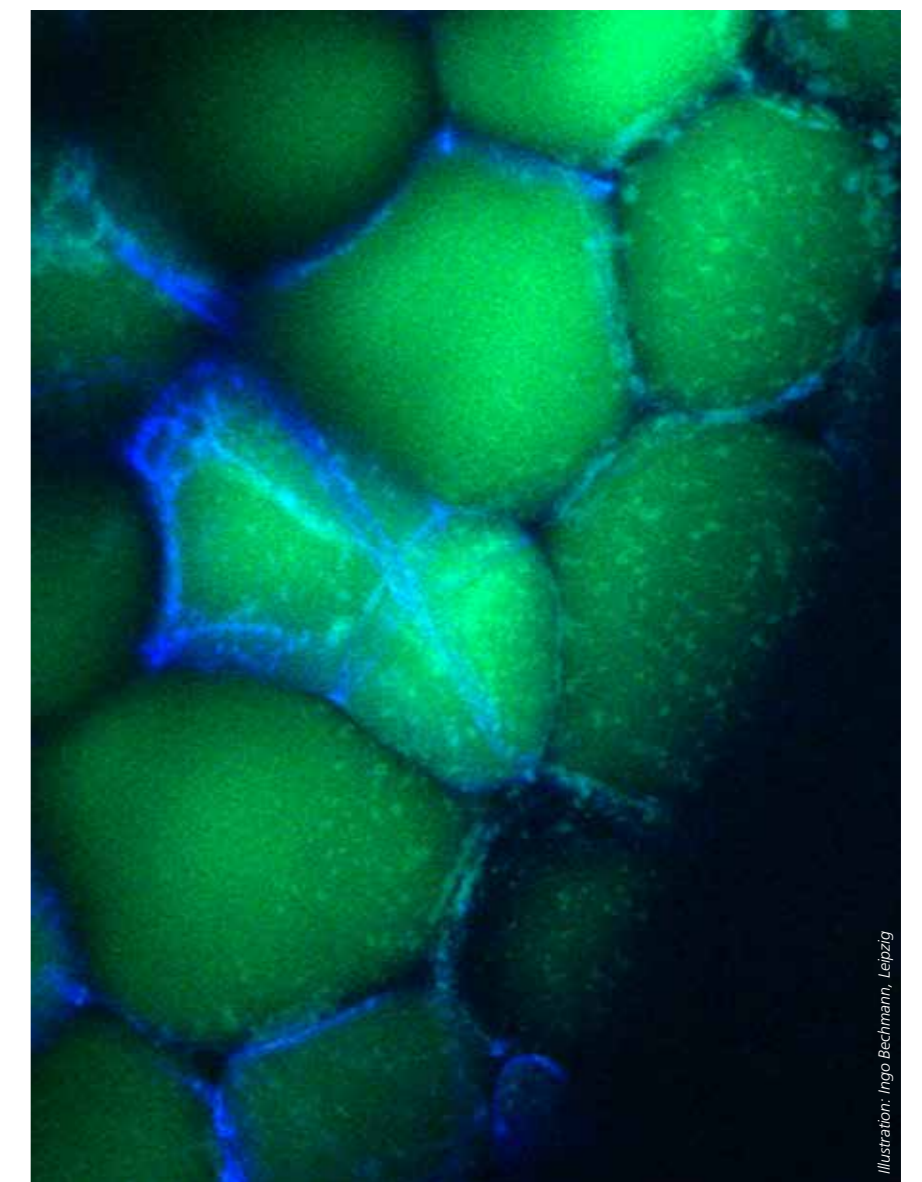
Any analysis of the cause of obesity should start with an estimation of the energy requirement. If a person gains weight but has not changed their diet or activity levels, the weight increase is probably due to metabolic changes. Even a small but long-term reduction in energy expenditure (e.g. basal metabolic rate), if not accompanied by a reduction in energy intake or an increase in physical activity, can lead over time to a significant calorie restriction. The basal metabolic rate is affected by many different

things including genetic and epigenetic factors, age, sex, muscle mass, neuroendocrine factors, metabolically active fat tissue, medication and diet.

Although genetic disposition can play a significant role in the development of obesity, the important genetic changes are not yet understood. Hereditary factors appear to account for 45–75 percent of an individual’s body mass index

(BMI). Although many genes have been shown to affect basal metabolic rate, their role in the development of obesity in humans is still unclear. Monogenetic obesity, or obesity with a single cause, is rare and usually occurs in childhood. Mutations in the melanocortin receptor 4 (MC4R) gene are the most common cause of early childhood obesity, with a morbidity of up to 5 percent.

An interesting structure: the anatomy of white fat tissue.



Recently, studies of 13 different cohorts consisting of more than 38 000 participants revealed a variant in the so-called FTO gene, which is closely associated with a higher BMI in both children and adults. FTO, which is mainly secreted in the central nervous system, appears to be involved in the regulation of risk behaviour. However, the functional importance of this and other genetic variants in

relation to obesity remains unclear.

Human beings obtain 100 percent of the energy they use from food. In contrast to energy expenditure, energy intake may vary between zero (absolute fasting) and many times the actual energy requirement (for example through binge eating). Because it is so easy to “overindulge”, it is not surprising that overeating is an impor-

tant determinant for weight gain. Any analysis of the causes of obesity must therefore take account of eating behaviour. If it becomes clear that an individual overeats, the clinician should try to work out why. It is helpful, in this context, to see overeating as a symptom of a problem related to eating behaviour rather than a conscious behavioural alternative or simply a lack of willpower. Although the socio-psycho-neurobiological factors involved in eating appear more complex all the time, it is convenient to distinguish between four aspects: sociocultural factors, biomedical or physiological factors, psychological factors, and medication.

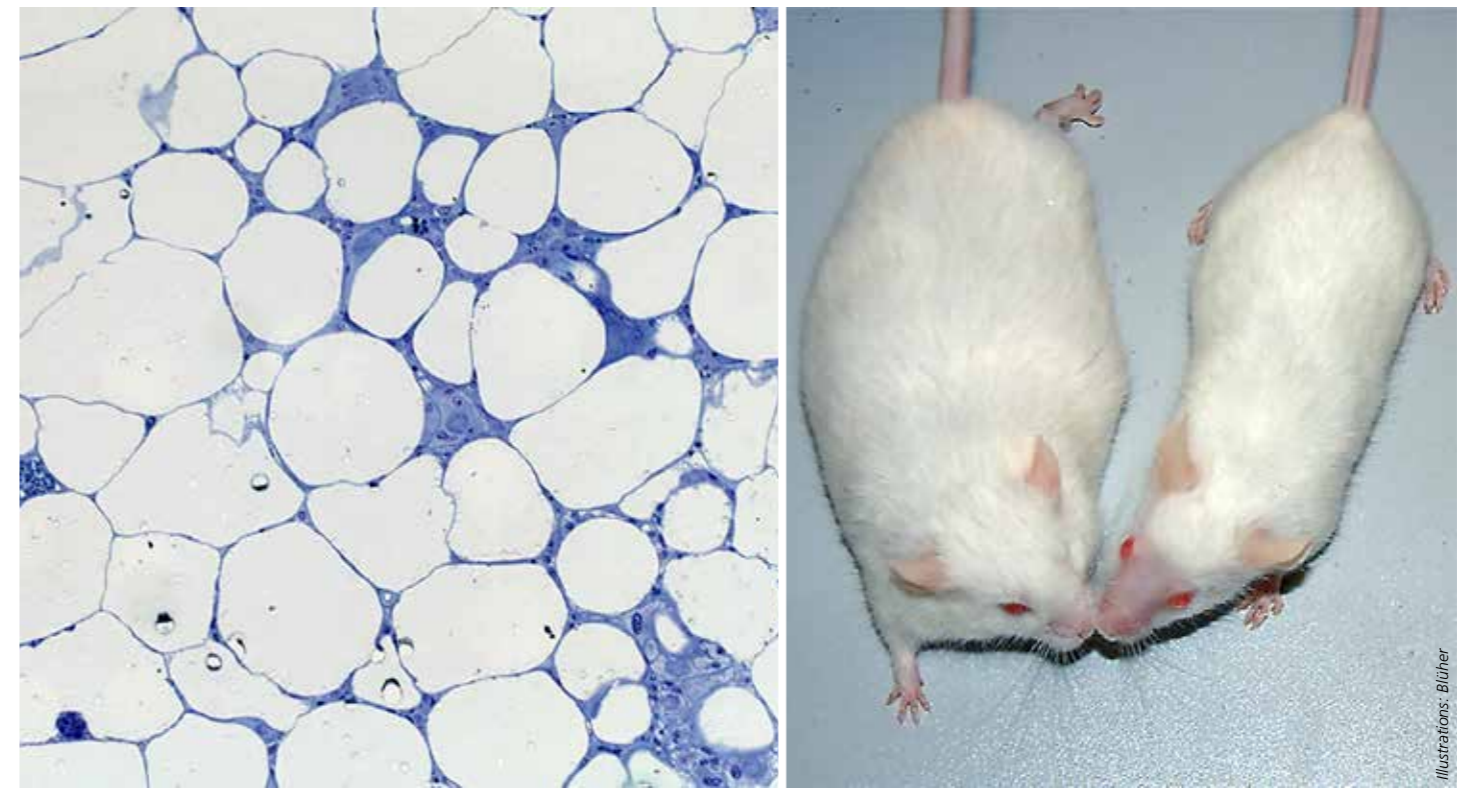
In an obesity patient these factors may be interlinked and indeed overlap. In practice, however, it is often possible to identify the primary factor that triggers an eating disorder, and it is this factor which must be the main focus of psychological and behavioural intervention.

But a surplus energy intake does not always cause an overweight person to develop long-term metabolic problems or heart disease. In most obese patients, the increase in fat tissue interferes with the normal function of this tissue. This malfunction and an unhealthy distribution of fat (for example visceral and liver fat) are some of the primary defects associated with obesity and are probably responsible for associated and secondary conditions. For a long time fat tissue was considered to be an inert organ whose only job was to store energy. With the discovery of hormones produced specifically in fat tissue it became clear that this tissue is in fact a complex, highly

Extra burden: only regular exercise will decrease the pounds.



Illustration: i3/Ocean/Corbis



Illustrations: Blüher

Left: “Inflamed” fat tissue. Contrary to what scientists long believed, fat tissue is a highly active endocrine organ. Right: Protection against obesity – a laboratory mouse without disruption of the insulin receptor in fat tissue (left) and one with this disruption (right).

active endocrine organ. Today we know that fat tissue secretes numerous bioactive peptides known as adipokines, which have effects both locally and on the hormone system as a whole. Fat cells, their precursor cells, stromal cells, blood vessel cells, nerve fibres and immune system cells form a functional unit in fat tissue. The Collaborative Research Centre is therefore investigating the hypothesis that the malfunction of fat tissue is a decisive contributing factor to obesity.

Obesity is often associated with chronic inflammation, and changes in the endocrine function of fat tissue may play an important role in this. It has been shown that adipocytes and other cells found in fat tissue promote inflamma-

tion. A higher “saturation” of visceral fat with immune system cells such as macrophages probably increases the risk of disease. Fat cells themselves also change their activity patterns. The secretion and activity of various stress mediators as well as programmed cell death (apoptosis), particularly of fat cells in visceral fat, also appear to increase.

In short, obesity can be seen as a symptom of a chronic oversupply of calories. The disease requires a careful and systematic evaluation of the factors affecting metabolism, eating behaviour and energy expenditure. The identification and individual weighting of these factors, part of an extremely complex set of factors, is the subject

of intense research that promises new insights into the causes of an epidemic with far-reaching consequences.



Professor Dr. med. Matthias Blüher researches in the Department of Internal Medicine at Leipzig University Hospital and is the spokesperson for the Collaborative Research Centre “Obesity Mechanisms”.

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www.sfb1052.de/index.php/en/



Rembert Unterstell



The Determined Navigator

Medical information scientist Lena Maier-Hein, a Heinz Maier-Leibnitz prizewinner, seeks to optimise assistance systems for minimally invasive procedures in cancer diagnosis and treatment. But the biggest challenge is transferring the technology to clinical practice.

In sports, Lena Maier-Hein has always been a team player. In 2009 she was a member of Germany's champion beach basketball team. And when it comes to her specialist field of medical informatics, the 34-year-old is also an achiever: ambitious, full of ideas and extremely successful. Her greatest success was winning the 2013 Heinz Maier-Leibnitz Prize, the most important award for early-career researchers in Germany, presented by the DFG, and a 2015 ERC Starting Grant.

Team spirit and personal ambition – which many would have difficulty reconciling – are perfectly united in Dr.-Ing. Lena Maier-Hein. The leader of the junior research group “Computer-Assisted Interventions” at the German Cancer Research Center (DKFZ) in Heidelberg, has been held up on the way to our interview due

to the cancellation of her flight from London, where she was visiting a collaboration partner. So it's up to the other members of her 10-strong group to talk about their projects.

We finally meet up with Maier-Hein later in the foyer café at the DKFZ: a young woman bursting with energy, with the look of an athlete, sporting a red pullover, black jeans and red ankle boots. She expresses herself clearly and precisely, but modestly and without frills. You can't help wondering whether she uses her bright red smartphone to make those top-level calls. You can certainly imagine it, but also that she knows how to motivate her team and get the best from them. “I believe in working as a team and the value of collaboration,” she says succinctly.

Lena Maier-Hein works at the interface between informatics, medical technology and surgery. The basic question she addresses is: How can patient data be consolidated and made available so as to provide the surgeon with meaningful support and benefit the patient? She develops new techniques, methods and algorithms to enable surgeons to better plan and perform minimally invasive procedures, for example in the diagnosis of cancer (punctures) and its treatment (ablation).

She began by working with conventional assistance systems based on preoperative images (for example an MRT scan of the cranium). Now she has her sights set on intraoperative images of internal organs taken, which are taken during a procedure. Navigating with a needle in soft tissue pre-

In front of the DKFZ: Lena Maier-Hein (centre) with members of her junior research group “Computer-Assisted Interventions”. New computer-based assistance systems (below) could help surgeons plan and carry out minimally invasive procedures more effectively.

sents particular challenges to surgeons because organs can change shape or move, for example due to breathing.

This is the focus of Lena Maier-Hein's work. As a doctoral researcher she was a DFG fellow in the Research Training Group “Intelligent Surgery”, whose purpose was to develop new computer-based methods for soft tissue surgery. As part of a project entitled “Planning and Navigated Use of Thermal Therapy Methods”, she developed a new computer-based needle control system described by experts as being both precise and effective.

Looking back, she praises the tandem system whereby information

scientists worked alongside medical scientists, which meant that “the technology was developed alongside surgical considerations”. This practical focus cannot be taken for granted; all too often, innovative software concepts fail to make the jump to clinical practice “because they aren't simple enough or they don't save enough time or money”. For this reason, she regards the transfer to practice as the greatest challenge.

In another DFG project, she collaborated with colleagues in Erlangen to utilise time-of-flight (ToF) camera technology in open and minimally invasive surgery. The key outcome was the discovery that a ToF camera can be used to measure a three-dimensional surface quickly, accurately and without contact. Using a combination of high-resolution 2D colour images and corresponding 3D distance data, a new data layer can be generated during the operation.

Maier-Hein first came into contact with informatics in her final years at school, and was inspired by its numerous applications. She studied the “dynamic subject” in Karlsruhe and at Imperial College London. As a doctoral researcher and fellow in the Research Training Group “Intelligent Surgery”, she moved to Heidelberg and the DKFZ, where Professor Hans-Peter Meinzer, head of biological and medical informatics, became her mentor. In 2009 she obtained her doctorate from TH Karlsruhe and was awarded the DKFZ's Waltraud Lewenz Prize. In 2012 she became the leader of the new junior research group on “Computer-Assisted Interventions”. Just three years later, at the age of 33, she completed her habilitation.

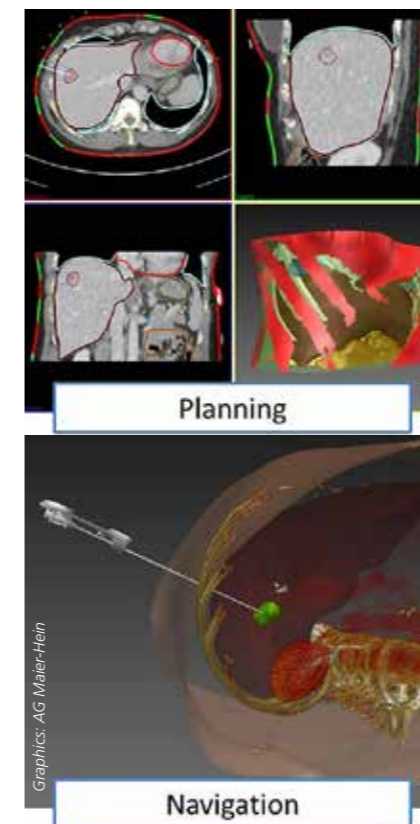
In spite of this rapid climb up the career ladder, she describes the job situation for young researchers

in Germany as simply dire and extremely difficult for the individual. Herself the mother of a two-year-old daughter and married to medical information scientist Dr. Klaus Maier-Hein, she doesn't mince her words: the demands of an academic career, parenthood and family – and in her case a dual career – are all but impossible to balance. Without the certainty that enables people to plan their futures, careers can simply fizzle out. She believes that a proper tenure track model as in the English-speaking world could help.

In terms of her work, Maier-Hein's vision is that “computer assistance will cover and support the entire medical process from the choice of treatment strategy through the planning and implementation of the intervention to clinical follow-up”. She believes that this can be best achieved through cooperation. She invests a lot of time and energy in networking (“She's a master of cooperation,” says one colleague) and cooperates with institutions of excellence such as Imperial College London, Vanderbilt University and University College London. “To come up with outstanding solutions you need complementary expertise,” she says. Full stop.

You don't need to be a technical expert to understand the value of innovations, she argues: the technology that helps motorists to navigate should be cheaply available to surgeons in the operating theatre. She for one believes that assistance systems will be part of the future in minimally invasive surgery – and through her research, she wants to help make this happen.

Dr. Rembert Unterstell
is Publishing Executive Editor of *german research*.



Max Gath and Otthein Herzog

Intelligent Logistics 2.0

From letters and books to medicines, express and courier delivery services have become an integral part of urban life. Managing these services presents new logistical challenges. A transfer project has revealed that self-management and local optimisation deliver greater flexibility.



What do you do when you need a last-minute birthday gift? How can a chain store quickly transfer goods to another branch which has sold out? Easy: just go online and a courier service will deliver within the next 90 minutes. The same idea occurred to Michael Löhr, founder and CEO of tiramizoo GmbH, which is set-

ting new standards in same-day delivery from retailers and wholesalers to customers. Private individuals can order products online and have them delivered in a matter of hours. And for transactions between businesses, intelligent logistics also ensures optimum delivery within the supply chain. But to keep the service cost-effective, transport processes need to be as efficient as possible.

Challenges to the planning and management of urban logistics include highly variable volumes, the sheer number of different services available, and the capabilities of the various vehicles used. The need to process incoming orders immediately adds to the dynamic nature of the processes and makes planning more difficult. In the DFG transfer project "Autonomous Courier and Express Services", researchers developed an intelligent scheduling system that responds to these logistical challenges. It is based on the results of the working group "Artificial Intelligence" at the University of Bremen, part of the Collaborative Research Centre 637 "Autonomous Cooperating Logistic Processes", the aim of which was to develop concepts and systems for self-managing logistics.

While previous research generally focussed on planning and optimisation methods with static specifications, the researchers on the transfer project succeeded in automating the management of courier and express delivery services,

Courier and express delivery services deliver goods – increasingly ordered online – to the customer's address, whether by bicycle or by car. In logistics, speed and flexibility are of the essence.

enabling highly efficient yet flexible transport processes. Drivers receive new jobs by smartphone based on their current position. If a driver is temporarily unavailable or stuck in traffic, the system automatically rearranges the schedule. Shorter delivery times and improved reliability result in a higher quality of service. Different courier companies can link into the new platform, allowing them to swap jobs and thus make the most efficient use of available resources and urban infrastructures.

To solve the complex logistical challenges the research team split the problem into a number of smaller problems involving less complex computations, which can be solved in real time. The management of sub-processes is passed on to local decision-makers, so-called "agents", which communicate with each other. These agents act as digital representatives of logistic objects, pursuing the goals of the objects they represent through autonomous decision-making. Let's look at an example. A package needs to be delivered, so an agent is automatically created for the job. This "job agent" automatically enters into negotiations with suitable available "vehicle agents". These negotiations are similar to an auction in which the vehicle agents "bid" for the new job by calculating how much it would cost them to carry it out. The job agent then works out which transport option is the cheapest.

Because the quality of the transport solution is highly dependent on the sequence in which the jobs are auctioned, vehicle agents can continue to negotiate over jobs between themselves. This further increases the potential for optimisation and gives the

system more flexibility in the face of unforeseen events. In addition, the agents can react immediately to these events by themselves. For example, if a problem occurs during a trip only the affected vehicle agent needs to replan its route, while all other routes taking place at the same time can continue to be carried out unchanged. The breakdown of the problem into smaller local problems results in an effective procedure with flexible system behaviour that increases the robustness and integrity of logistic processes.

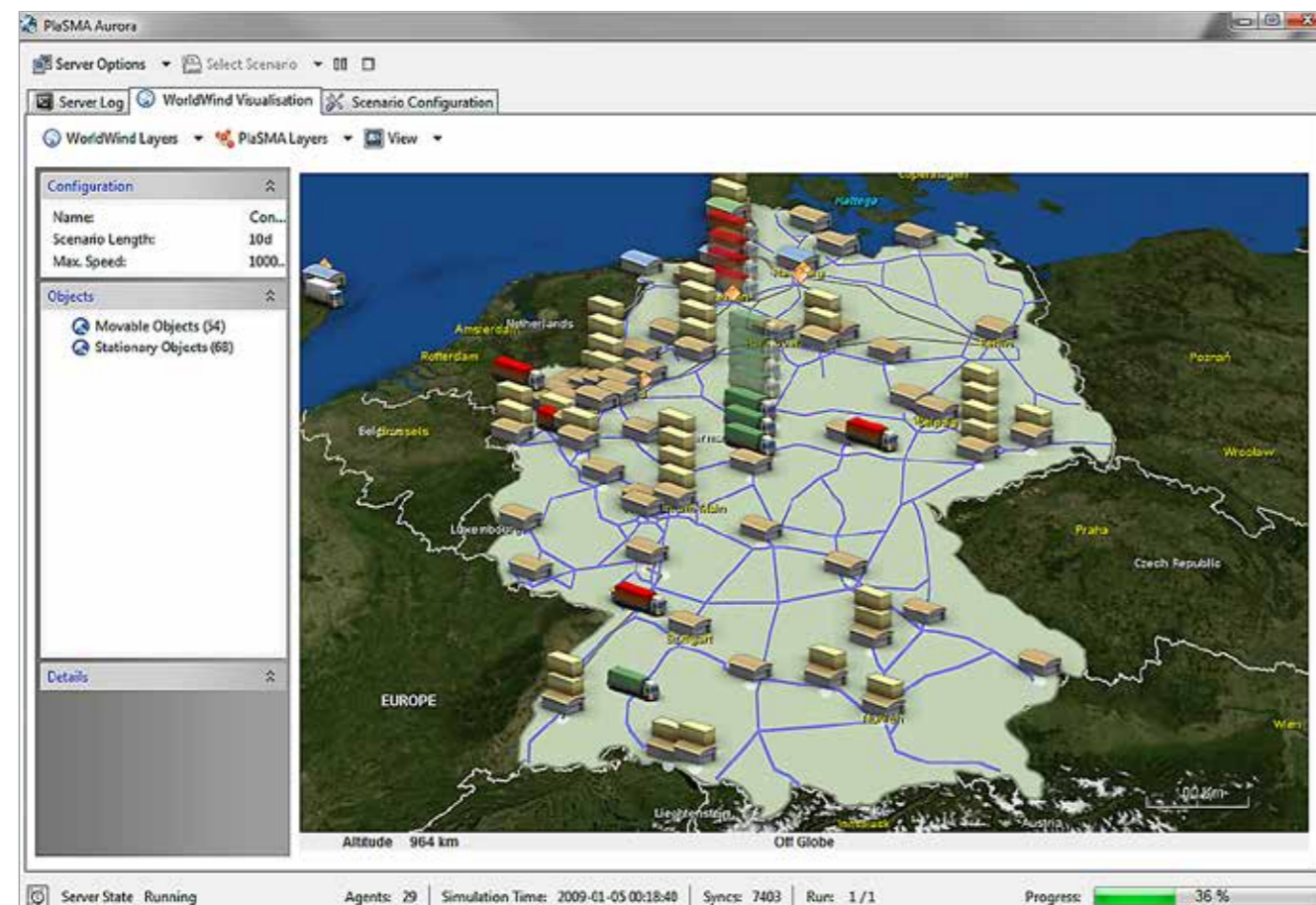
One major challenge this presents is working out the most efficient routes (sometimes referred to as the “travelling salesman prob-

lem”), which forms the basis of the agents’ decision-making process. The individual end functions of the couriers and the capabilities and limitations of different means of transport must all be considered in a very short time. Depending on the scenario, the number of decisions made by software agents can easily exceed 100 000 per working day, with online calculations being made in real-time. For example, in order to take account of current traffic conditions and delays at any given time, alternative routes and requests for shortest routes must be continually recalculated. A distance matrix to calculate the ideal route for just 20 jobs (40 collection and delivery stops) contains

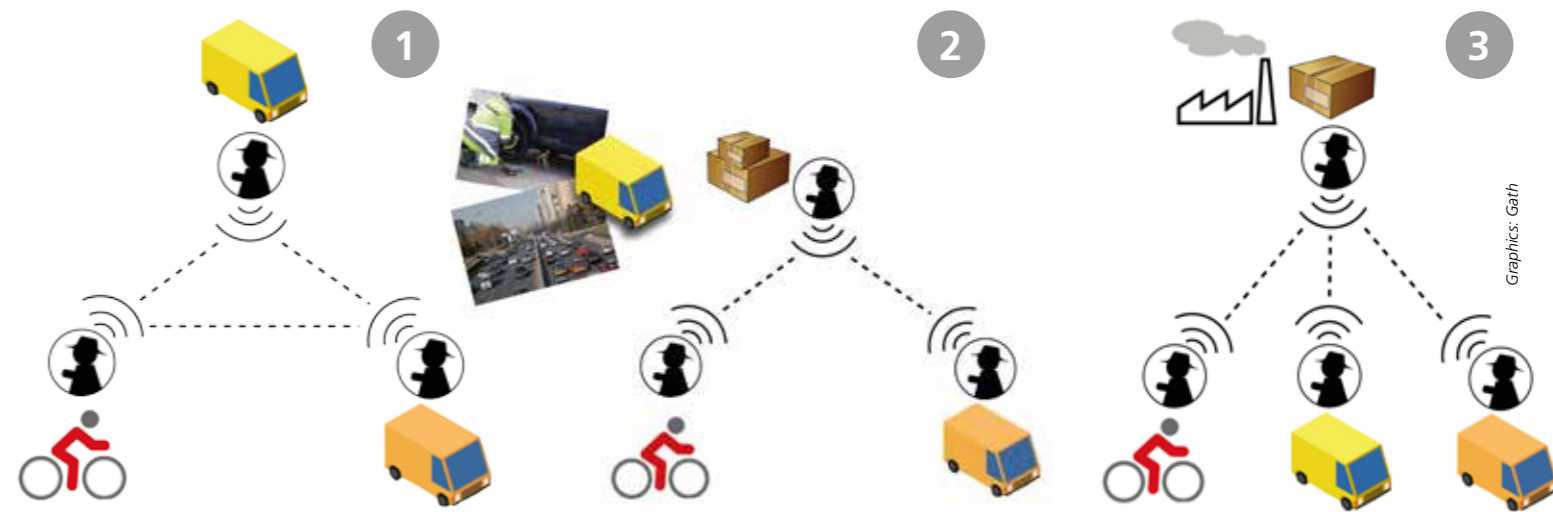
$40 \times 40 = 1600$ entries, so with over 100 000 route calculations per day, requests for up-to-date shortest routes can quickly become a critical time factor.

To allow these complex and time-critical calculations to be performed, the researchers at the University of Bremen developed powerful algorithms specifically designed for the requirements of courier and express delivery services. To simulate the processes they used the highly scalable, agent-based execution and simulation platform “Aimpulse Spectrum”, which generates detailed simulations of logistics processes as a basis on which to design lo-

Improving the self-management of courier and express delivery services requires flexible processes.



Screenshot: Gath



Graphics: Gath

Model scenarios that anticipate and deal with unpredictable situations from everyday experience:

- (1) dynamic optimisation through job swapping, even when a job is live;
- (2) robust planning and quick reactions in unplanned situations;
- (3) flexible integration of new jobs in existing routes.

gistics strategies. The platform was developed by Aimpulse Intelligent Systems GmbH, which specialises in analysis and management technologies for logistics. Aimpulse Spectrum was expanded as part of the transfer project in order to combine it with the PlASMA simulation environment developed by the Artificial Intelligence group at the Collaborative Research Centre in Bremen. PlASMA was designed especially for the analysis and optimisation of agent-based autonomous processes and is freely available. In addition to the modelling and simulation of autonomous processes, PlASMA provides a detailed infrastructure model of real road networks based on data from OpenStreetMap. Real process data

and scenario-specific data can easily be integrated in the simulation.

tiramizoo GmbH evaluated the new breed of courier and express delivery services by simulating various scenarios with real data and comparing the results with those generated by other route and job planning programmes. Factors such as the time needed to travel the distance, including loading and unloading, and the total distance covered were taken into account.

The results show that the new agent-based algorithms are more effective than established planning and optimisation methods, which rely on central management and static specifications. The new reactive behaviour in dynamic environments is more accurate and the quality and speed of the proposed solutions is the same or better. Combining jobs at one location in the simulation also reduced carriers’ working hours and the improved reliability of transport processes increased customer satisfaction. This outcome prompted tiramizoo to further develop the prototype even before the transfer

project was complete in order to integrate the software in the company’s operational processes.



Prof. Dr. Otthein Herzog

was Professor of Artificial Intelligence at TZI – Center for Computing and Communication Technologies at the University of Bremen before becoming professor emeritus in 2009. He is still active in this AI Group and since 2010 he has also held the Chair of Visual Information Technologies at the School of Humanities and Social Sciences at Jacobs University Bremen.

Max Gath

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<http://plasma.informatik.uni-bremen.de>

www.ai.uni-bremen.de



Thomas Kenkmann, Michael Poelchau, Alex Deutsch and Klaus Thoma

Cosmic Collisions in the Experimental Chamber

Shedding new light on fundamental evolutionary processes in the solar system: from the beginnings of our planet to the present day, asteroids and comets have shaped the geological development of planetary bodies. The high-speed processes that occur during impact events are now being modelled by a group of researchers in the laboratory.

Remarkable structures seen with a scanning electron microscope: the steel projectile has melted on to the rock following a collision experiment. The iron-rich material (green) has mixed with the quartzitic sandstone (purple).

The date is 15 February 2013. Planetary scientists and astronomers have been looking forward to this day with anticipation, because the 50-metre asteroid 367943 (also known as 2012 DA14), discovered just a year before, will come within 27 000 kilometres of Earth – closer than weather or television satellites. But then another cosmic event puts this spectacular fly-by in the shade. In the morning, quite unexpectedly, near the Russian city of Chelyabinsk, a 19-metre asteroid fragment enters the Earth's atmosphere with a cosmic speed of over 18 kilometres per second (equivalent to 65 000 kilometres per hour).

To nearby observers, the fireball of the superbolide appears brighter than the sun. Several shock waves finally tear the meteor into thousands of fragments. The resulting blast wave injures 1 500 people and the "Chelyabinsk meteor" causes widespread damage to buildings and roads. Initially, scientists speculate that there may be a connection between the Chelyabinsk

event and the passage of asteroid 2012 DA14. But this assumption quickly proves to be wrong, owing to the different orbits of the two objects.

The events of 15 February 2013 are illuminating in more ways than one. Firstly, asteroid 2012 DA14 is one example of more than 11 000 near-Earth asteroids (NEAs) now known to scientists, detected by systematic search campaigns. Because their orbits are accurately measured, near fly-bys can be predicted in advance, which also makes it possible to plan defence strategies. Secondly, the Chelyabinsk superbolide is representative of a far larger number of so far undiscovered cosmic objects orbiting in the inner solar system, which could collide with the Earth without warning. These objects are often faint and difficult to observe with a telescope due to their small diameter.

The events in Chelyabinsk also showed that the atmosphere presents an effective shield against impacts by smaller objects, which statistically are the objects that ap-

proach Earth most frequently. As they pass through the atmosphere, meteoroids break up. They lose surface material through melting and mass through evaporation and are finally slowed down to terminal velocity. Fragmentation begins as soon as the tension produced by friction exceeds the meteoroid's own strength. The Chelyabinsk bolide began to fragment at around 30 kilometres before bursting at an altitude of 22 kilometres; the subsequent shock wave caused the reported damage. The intensity of the shock wave and the brightness of the Chelyabinsk bolide indicate that the amount of energy released in the atmosphere was approximately 30 times the energy released from the atomic bomb detonated at Hiroshima.

For bigger asteroids, the braking effect of the atmosphere becomes weaker and the spatial distribution of the fragments in relation to their size diminishes, so that the resulting impacts merge to produce a single crater. Iron meteoroids with a diameter of less than 10–20 metres are pervasively fragmented; in the case

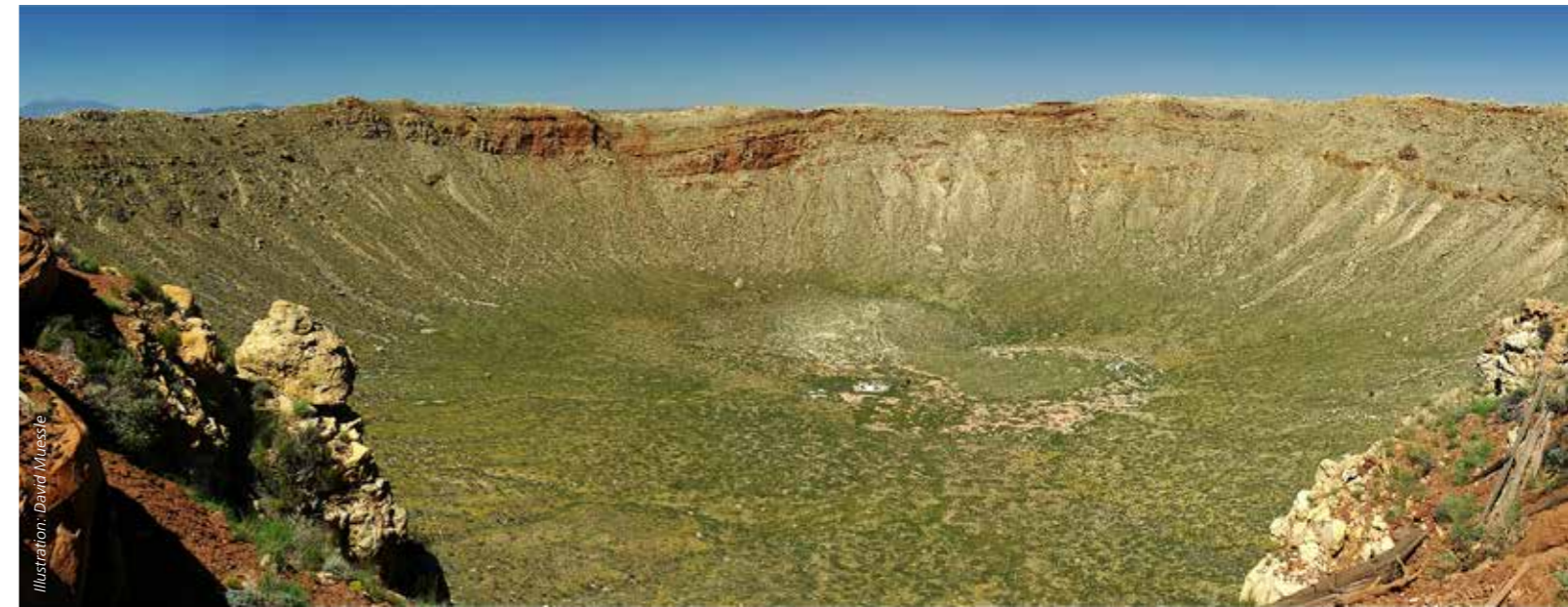


Illustration: David Muesle

Interior of the 1.2 kilometre-wide Barringer Crater in Arizona, USA, formed 50 000 years ago by an iron asteroid.

of brittle rock meteoroids, like the Chelyabinsk meteoroid, projectiles up to 50 metres across are slowed by fragmentation. Larger bodies like asteroids or comets impact the Earth at almost cosmic velocity; the most common entry angle of projectiles is around 45 degrees.

Since 2009 the DFG has been funding a Research Unit known as MEMIN (Multidisciplinary Experimental and Modelling Impact

Research Network), whose task is to understand and model the geological and physicochemical processes involved in cosmic collisions. This interdisciplinary project involves geologists, geophysicists, engineers, mineralogists and physicists from institutes in Freiburg, Berlin, Hamburg, Jena, Munich and Münster.

The MEMIN project concentrates on technically complex cratering experiments which are be-

ing carried out at the Fraunhofer Institute for High-Speed Dynamics (Ernst-Mach-Institut) in Freiburg using two-stage light-gas accelerators. In these experiments, centimetre-sized spherical projectiles made of steel or material from the iron meteorite Campo del Cielo are accelerated towards blocks of rock with an edge length of up to 1 metre. In the laboratory these small bolides reach speeds of up to 7.8 kilometres per second (equivalent

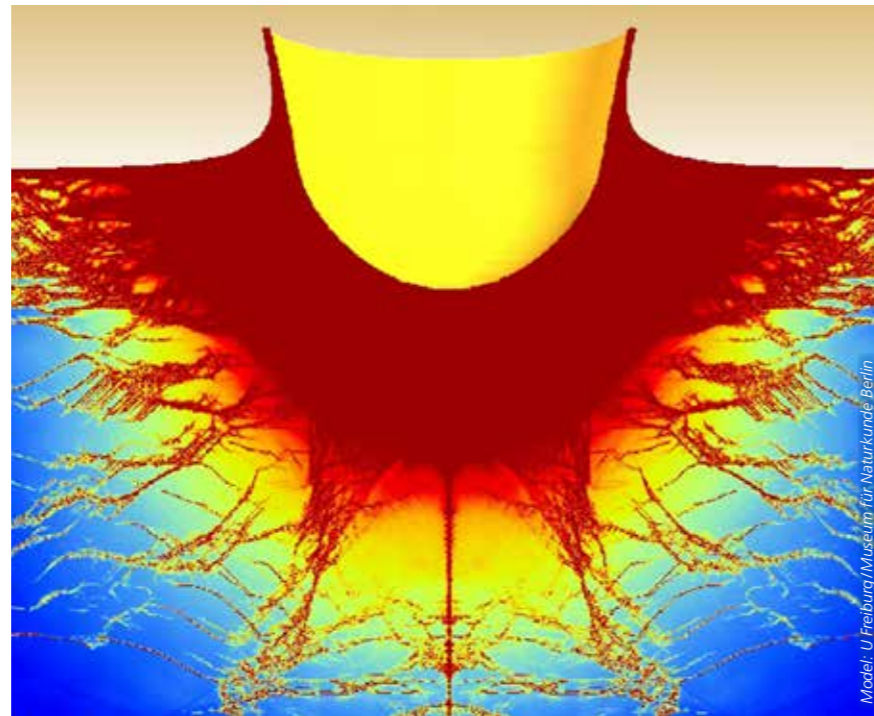
Incredible forces at work: video sequence of an impact experiment in quartzite. The energy released upon impact is so immense that it is capable of partially melting and even vaporising the rock.



Numerical modelling helps geologists to understand the processes of crater formation following an impact.

to 28 000 kilometres per hour). Upon impact, pressures of up to 80 gigapascals (GPa), equivalent to 800 000 bar, are produced in the projectile and the sandstone block. The pressure pulse, which lasts only a few microseconds, propagates into the projectile and target as a supersonic shock wave, leading to extreme compression of the crystal lattice structures, which is associated with an abrupt rise in temperature. The shock wave is registered in real time by ultrasound sensors at various points inside the target block.

After the pressure is released the heat cannot dissipate fast enough, with the result that the projectile and target partially melt or even vaporise and an intensive geochemical exchange of



elements takes place between the two bodies. The propagation of the shock wave in the target causes part of the rock to be pressed into the subsurface and another to be

ejected, producing a crater-shaped cavity. This process is filmed by high-speed cameras at rates of up to 1 000 000 images per second. The ejected material is collected by newly developed capture systems. This allows researchers to study the formation of the crater in minute detail and to calculate the speed and ejection angle of the ejected debris. The plasma cloud produced in the first few nanoseconds is studied using spectroscopic techniques. The craters in the rock targets are measured electronically and the damage to the rock is quantified using electron microscope technology.

Left: Set-up of a crater experiment – a fully instrumented sandstone block equipped with pressure and ultrasound sensors. Right: Ejected material collected on acrylic glass tiles coated with petroleum jelly; the rock was marked before the experiment with fluorescent paint.



These “fully instrumented” crater experiments, which are performed at different scales, are unrivalled in the scientific community. The craters produced during the experiments are large enough to be evaluated with specially adapted geophysical measuring techniques – the same techniques used in a modified form to study natural craters.

Experimental results so far indicate that there are clear, quantifiable dependencies between crater size and the types of rock used. Pore space plays an important role in crater formation, influencing the shape and volume of the crater and the characteristic ejecta. If the pores are saturated with water, all other experimental conditions being the same, the impact craters in sandstone are four times larger than in dry rock. Because water is often abundant in porous, fissured rock on Earth in the form of groundwater, this pro-

vides a new basis for modelling the damage caused by impact events. This is also an important insight for other planetary surfaces. Our neighbouring planet Mars, for example, is believed to have large reservoirs of water ice near the surface in porous rock.

The aim of the MEMIN project is to better understand the mechanics of naturally occurring craters. To do this, researchers must apply the experimental findings to natural craters, which in scientific terms means scaling up by several orders of magnitude. The experimental data is combined with natural observations on Earth and the surfaces of other celestial bodies using numerical modelling. Experiments allow numerical models to be tested, improved and validated that take complex material parameters such as porosity and water content into account. These models are used to

extrapolate the results to natural craters, of which 185 have now been discovered on Earth.

In addition to illuminating the fundamental processes involved in a meteorite impact, the MEMIN studies enable scientists to estimate more accurately what effect potentially threatening asteroids could have if they impacted on the Earth. This provides us with new insights into fundamental, recurring processes in our solar system.



Prof. Dr. Thomas Kenkmann holds the Chair of General Geology, Structural Geology and Impact in Freiburg and is the spokesperson for Research Unit 887.

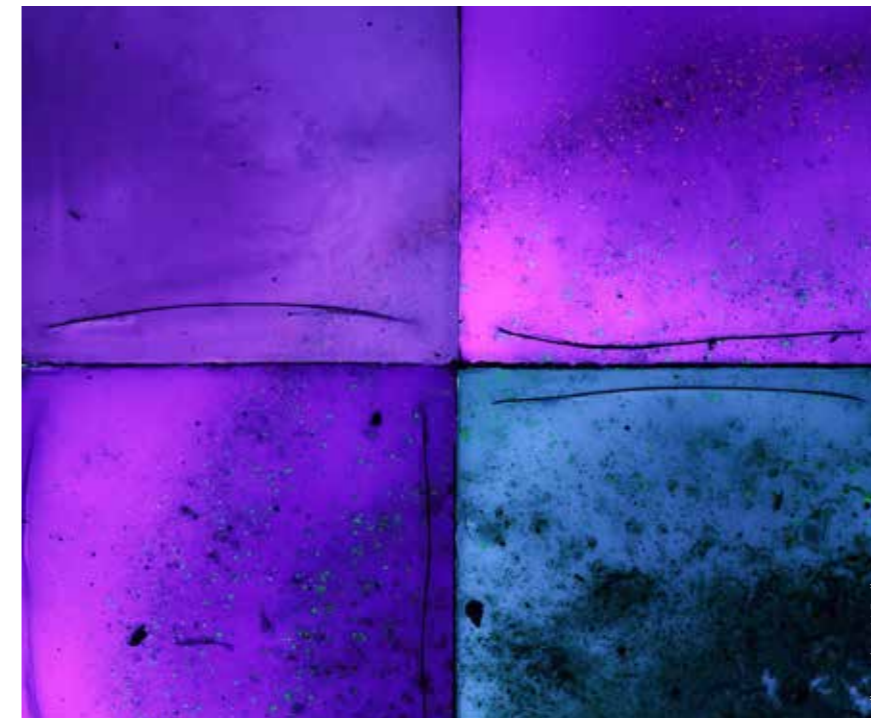
Dr. Michael Poelchau is a researcher in and coordinator of the Research Unit, in the working group of Prof. Kenkmann.

Prof. Dr. Alex Deutsch from the Institute of Planetary Science at the University of Münster is co-spokesperson for the Research Unit.

Prof. Dr. Klaus Thoma is director of the Fraunhofer Institute for High-Speed Dynamics in Freiburg (Ernst-Mach-Institut) and also co-spokesperson for the Research Unit.

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www.memini.de/home-page.html



The Deutsche Forschungsgemeinschaft

The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) is the central self-governing organisation responsible for promoting research in Germany. According to its statutes, the DFG serves all branches of science and the humanities. The DFG supports and coordinates research projects in all scientific disciplines, in particular in the areas of basic and applied research. Particular attention is paid to promoting young researchers. Researchers who work at a university or research institution in Germany are eligible to apply for DFG funding. Proposals will be peer reviewed. The final assessment will be carried out by review boards, the members of which are elected by researchers in Germany in their individual subject areas every four years.

The DFG distinguishes between the following programmes for research funding: In the *Individual Grants Programme*, any researcher can apply for financial assistance for an individual research project. *Priority Programmes* allow researchers from various research institutions and laboratories to cooperate within the framework of a set topic or project for a defined period of time, each working at his/her respective research institution. A *Research Unit* is a longer-term collaboration between several researchers who generally work together on a research topic at a single location. In *Central Research Facilities* there is a particular concentration of personnel and equipment that is required to provide scientific and technical services.

Collaborative Research Centres are long-term university research centres in which scientists and academics pursue ambitious joint interdisciplinary research undertakings. They are generally established for a period of twelve years. In addition to the classic Collaborative Research Centres, which are concentrated at one location and open to all subject areas, the DFG also offers several programme variations. *CRC/Transregios* allow various locations to cooperate on one topical focus. *Cultural Studies Research Centres* are designed to support the transition in the humanities to an integrated cultural studies paradigm. *Transfer Units* serve to transfer the findings of basic research produced by Collaborative Research Centres into the realm of practical application by promoting cooperation between research institutes and users.

DFG Research Centres are an important strategic funding instrument. They concentrate scientific research competence in particularly innovative fields and create temporary, internationally visible research priorities at research universities.

Research Training Groups are university training programmes established for a specific time period to support young researchers by actively involving them in research work. This focusses on a coherent, topically defined, research and study programme. Research Training Groups are designed to promote the early independence of doctoral students and intensify international exchange. They are open to international participants. In *International Research Training Groups*, a jointly structured doctoral programme is offered by German and foreign universities. Other funding opportunities for qualified young researchers are offered by the *Heisenberg Programme* and the *Emmy Noether Programme*. In so called *Reinhard Koselleck Projects*, the DFG supports especially innovative research undertakings by outstanding scientists and academics.

The *Excellence Initiative* aims to promote top-level research and improve the quality of German universities and research institutions in the long term. Funding is provided for graduate schools, clusters of excellence and institutional strategies.

The DFG also funds and initiates measures to promote scientific libraries, equips computer centres with computing hardware, provides instrumentation for research purposes and conducts peer reviews on proposals for scientific instrumentation. On an international level, the DFG has assumed the role of Scientific Representative to international organisations, coordinates and funds the German contribution towards large-scale international research programmes, and supports international scientific relations.

Another important role of the DFG is to provide policy advice to parliaments and public authorities on scientific issues. A large number of expert commissions and committees provide the scientific background for the passing of new legislation, primarily in the areas of environmental protection and health care.

The legal status of the DFG is that of an association under private law. Its member organisations include research universities, major non-university research institutions, such as the Max Planck Society, the Fraunhofer Society and the Leibniz Association, the Academies of Sciences and Humanities and a number of scientific associations. In order to meet its responsibilities, the DFG receives funding from the German federal government and the federal states, as well as an annual contribution from the Donors' Association for the Promotion of Sciences and Humanities in Germany.



The DFG Head Office has a new staff car which has already attracted considerable interest and attention in and around Bonn and at the region's universities and research institutes. It is not only the striking logo on the bodywork that deserves attention however, but also the engine under the bonnet. In keeping with the theme "For science and the environment", trips taken by DFG staff and visitors are now powered by electricity. "We want to support initiatives to encourage electromobility, even though this is just a start. Given the climate scenarios that research is presenting to us, it is important to begin at home and quite literally at our own front door," said Secretary General Dorothee Dzwonnek. Claudio de Maria from the motor pool team (see photo, left) likes the manoeuvrability and soundlessness of the DFG e-Golf and corporate designer Tim Wübben (right) its visibility. Germany's largest research funding organisation has been actively addressing the subject of environmental awareness and environmental protection for some time now: since 2009 it has operated a photovoltaic system on the roof of the Head Office with 144 panels to feed power into the building's network.

Impressum

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