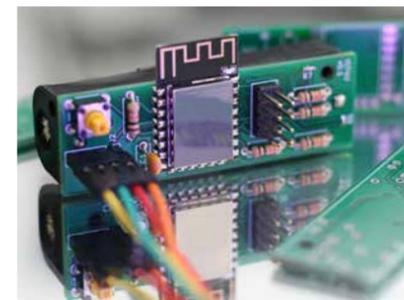


Cover: Jürgen Richter-Gebert
Not only can a computer-generated flow simulation be aesthetically pleasing, it is frequently also useful for mathematicians doing basic research work.



Models and Visualisations: Mathematics for the Senses | Science System: The Value of Togetherness | Pandemic and Economics: Allowing the Economy to Breathe Even During the Crisis | Agricultural and Development Economics: Global Food – Benefits and Drawbacks | Computer Architecture: Designing New Processes | Cultural History: The Romantic Model

Editorial

Katja Becker

The Value of Togetherness

The importance of cooperation within the research system

2

In Focus

Science is Essential if We Want to Address Global Humanity

UN speech by Katja Becker on realising the UN Sustainable Development Goals

4

The Pandemic and its Consequences

The Pandemic – Consequences and Opportunities for Science and the Humanities

Recent report of DFG’s Senate Working Group draws conclusions

6

Interview

Rembert Unterstell

Allowing the Economy to Breathe Even During the Crisis

Pandemic and the economy – interview with tax expert Caren Sureth-Sloane

8

Life Sciences

Matin Qaim

Global Food – Benefits and Drawbacks

About Fairtrade, smallholder farmers and the African supermarket revolution

12

Engineering Sciences

Rolf Drechsler

Designing New Processes

How digital circuits must be checked and ensured more elaborately

18

Natural Sciences

Jürgen Richter-Gebert

Mathematics for the Senses

How mathematical models and visualisations become means of research

22

Humanities and Social Sciences

Stefan Matuschek

The Romantic Model

Why it is worth to engage in a cultural-historical epoch

28

Katja Becker

The Value of Togetherness

Cooperation within the research system and among research organisations often proves its great effectiveness when it comes to making the voice of research heard within political and social discourse. Praise of an all too apparent matter of course

The research system also has principles that seem to be so self-evident that they are sometimes taken for granted and treated as such. This can have quite unintended consequences – to the point that their actual value is no longer recognised and appreciated as it deserves to be. It is therefore useful to remind ourselves and each other of these seemingly self-evident aspects from time to time.

This is precisely what I was recently able to do in a greeting address at the Leibniz Association Spring Reception. This was in itself a great opportunity to reflect on the principle of cooperation within the research system, which may often seem all too self-evident to many within and outside the system, especially in everyday life. It firstly enabled us to take a look at the long, deep and trusting cooperation between our two organisations, which was and remains evident on many levels – starting with the Leibniz Association’s long-standing eligibility in terms of DFG funding instruments and also the transfer of personnel between our two organisations, which extended all the way to the presidency.

Secondly, and beyond this, we were also able to direct our view towards cross-organisational cooperation within the research system as a whole. Two examples may now also particularly illustrate this point: the Pact for Research and Innovation (Pakt für Forschung und Innovation – PFI) and the Alliance of Science Organisations in Germany.

The Pact for Research and Innovation alone shows what cooperation can achieve. Realising the agreed objectives involves the pact organisations entering into partnerships with each other or with stakeholders from research, business and/or society. The added value of this large-scale cooperation is clearly manifested in further development of the research system. It requires comprehensive cross-

organisational cooperation; precisely because it concerns the whole system – in other words how we conduct research – and also because objectives of this magnitude can often only be achieved together with others, even if the partners occasionally change depending on the topic.

Beyond the objectives of the pact itself, the participating organisations also collaborate on joint projects that beneficially contribute to the further development of Germany as a research hub. These include initiatives that help increase society’s understanding of the need for and prerequisites of research, which contributes to improving the underlying conditions for research and keeping bureaucracy in check – in the interests of everyone involved. The pact has thereby successfully contributed to making the research system less rigid.

Just as the planning certainty of the pact makes such initiatives possible in the first place, these activities are usually preceded by extensive consultations – repeatedly also within the Alliance of Science Organisations in Germany. The particular strength of this cooperation in the context of the Alliance lies in the elaboration and negotiation of common positions and standpoints. These provide significant impetus to current issues relating to research policy, research funding and structural improvements in the German research system.

Regular exchange among the Alliance organisations strengthens common interests and eases potential lines of conflict in the distribution of tasks. This common, egalitarian mode of working is also structurally expressed in annual rotation of the spokesperson’s office.

And such joint expression – well coordinated beforehand and a strong signal in itself – also frequently gives research a voice in political and social discourse. It permits some leeway, especially in dialogue with donors, which would otherwise probably remain ex-



Illustration: DFG/Ausserhofer

cluded. This level of cooperation is therefore just as important to Germany as a research hub, and its continued dynamic development, as is the specific interdisciplinary cooperation among researchers.

The multiple recent crises have also made it abundantly clear that certain tasks can quite simply only be solved together, especially when it comes to successfully advancing pressing issues of research policy and research funding in times of crisis.

The added value of such regular exchange was very directly demonstrated in the aftermath of Russia’s invasion of Ukraine. The Alliance quickly decided to freeze its institutional relations with Russia. In solidarity with Ukraine, the Alliance organisations – and the entirety of German research – provided support to refugees. Aid programmes were established in record time and non-bureaucratic assistance was provided to enable Ukrainian researchers to work at German institutions and to support the retention of research operations in Ukraine.

This close cooperation among the Alliance organisations has also repeatedly proven to be a driving force. The energy crisis has posed almost existential questions in terms of the increased costs of ongoing teaching and research activities or the implementation of energy-intensive research. Regular dialogue with the BMBF (Federal Ministry of Education and Research), the Federal Ministry for Economic Affairs and Climate Action, the Bundesnetzagentur (Federal Network Agency) and other political stakeholders enabled the Alliance to work towards ensuring that the research organisations have been ranked as priority institutions. The burden of funding energy costs has consequently been moderated by emergency assistance and the gas price cap, which effectively averted the most severe impacts of the energy crisis on German research. We are still grateful today for this dialogue.

Yet the added value of cooperation among research organisations is also evidenced by various

other aspects, such as the reform of research evaluation at EU level, animal welfare or the participation of citizens in research activities. The united stand or rather “outcry” of the research organisations in light of the looming budget cuts at the DAAD (German Academic Exchange Service) and the Alexander von Humboldt Foundation also sends a strong signal for international scientific exchange, especially in times of crisis.

It is also worth mentioning against this background that the nucleus of what German research collectively advances and implements on a large scale often lies in the particular cooperation of individual member organisations. The close attach-

ment between the Leibniz Association and the DFG recently also came to fruition in this context. Both have jointly elaborated a concept for an advisory centre providing information on legally compliant use of the Nagoya Protocol. Its intended establishment as an Alliance platform is exemplary in terms of the innovative power of cross-organisational cooperation.

As is the case here, it therefore requires exchange and collaboration on all levels – and also among all levels – not least because they all interlock in a very complex manner. And the more we depart from our familiar Ger-

man territory, the more complex the situation becomes, which in turn makes cross-organisational coordination processes even more indispensable. It is precisely these coordination processes that occasionally necessitate a review of outdated structures. This repeatedly requires goodwill – both in our own country and in the international context –, always a little leap of faith and perhaps even a little relinquishment here and there. By the way, this is equally applicable to research as it is to politics.

Cooperation among the research organisations that is designed and fulfilled in this way then also makes a significant contribution to overcoming our current societal challenges. It is nothing less than

the prerequisite for making the common voice of research heard in political and social discourse, and thus also for enabling advocacy of the transfer of sound scientific findings.

Professor Dr. Katja Becker
is the President of the DFG.

Edited version of the DFG President's greeting address at the Leibniz Association Spring Reception on 17 March 2023 in Berlin.

“Science is Essential if We Want to Address Global Humanity”

Speech by Katja Becker at the United Nations on the significance of basic research in realising the UN Sustainable Development Goals / Two-day Multi-stakeholder Forum in New York

The President of the DFG and Chair of the Governing Board of the Global Research Council (GRC), Professor Dr. Katja Becker, used an extremely prominent location to stress the pivotal importance of science and research in relation to addressing global humanity questions and realising the UN Sustainable Development Goals.

Becker spoke on 4 May 2023 in the UN's New York headquarters at the “Multi-stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals (STI for SDG)”. She had been invited by the “Ten Mem-

ber Group”, an advisory body consisting of personalities from the fields of science, technology and innovation appointed by UN Secretary General António Guterres.

“If we want to reach the Sustainable Development Goals in a meaningful time, science has to play a more active role than before. One could even think of a more ambitious idea: defining and establishing an additional Sustainable Development Goal for science. A new SDG that puts global research cooperation at centre stage – not only but also because searching for the truth is a fundamental part

of human nature. However, as long as such an additional SDG is not within our grasp, everything else needs to be done that contributes to integrating research and research findings into the SDG agenda. Because I'm convinced that science is essential if we want to address global humanity questions”, said Becker before representatives of the United Nations and non-governmental organisations from around the world.

Becker, who as GRC Chair spoke on behalf of the informal organisation comprising around 130 research funding organisations worldwide, went on to



Screenshot: UN Web TV/video in full length: media.un.org/en/asset/k1tk1tsj0r0v

emphasise: “In the current ‘polycrisis’, science empowers us with profound expertise, innovative tools and creative solutions to fight climate change and the loss of biological diversity, to eradicate poverty, reduce inequality, to promote justice – and to uncover the logic of global peace.” Although only research that is truly free can make these con-

tributions. “Unrestricted choice of research topics combined with free multilateral cooperation fosters fundamental research at the highest level.”

Becker therefore suggested forming a partnership between the GRC as a global council of research funding organisations and the United Nations STI for SDG process.

“This partnership has the potential to be powerful and efficient – because it will be based on the latest scientific findings and it can build on a strong and dedicated global community of researchers.”

The DFG jointly with the GRC took the opportunity the day before to organise a side event to the STI for SDG Forum in the German House in New York.

Becker together with the leaders of the DFG partner organisations from Brazil, Japan, Canada, South Africa and the USA, Germany's Deputy Permanent Representative to the UN, Ambassador Thomas Zahneisen, and Carlos Henrique de Brito Cruz, representing the “Ten Member Group”, discussed how specific research could be generated in relation to the respective sustainability goals.

www.dfg.de/en/dfg_profile/international_cooperation/news/reports/2023/230504_becker_un

The Pandemic – Consequences and Opportunities for Science and the Humanities

Report by the DFG's Senate Working Group on the challenges related to research activities, individual career paths and funding activities

As was the case in all areas of society, the coronavirus pandemic had a significant impact on science and the humanities from the very outset, affecting both individual researchers and the research system as a whole. In addition to subject-specific issues, this concerned numerous problems relating to the organisation and processes involved in research work, not least the basic functioning and capabilities of projects and institutions.

In view of this, the DFG Senate established a Senate Working Group in 2021 to identify and assess these and other pandemic-related changes affecting the research system. In addition to the adverse effects, the focus was also on any opportunities and benefits that arose or were developed in the course of the pandemic.

Chaired by the two DFG Vice Presidents Professor Dr. Britta Siegmund and Professor Dr. Julika Griem, the Senate Working Group was made up of twelve representatives of the Senate and other DFG statutory bodies, and also four researchers in early career phases in order to explicitly ensure that the perspective of the younger generation was included in the debate.

The Working Group's final report now published sheds light on various areas of research and funding activity and, based on members' observations, identifies measures and needs for action on the part of the DFG and other protagonists in the research system.

According to the Working Group's observations, certain areas and

groups of people were particularly sensitive to the adverse effects of the pandemic. For example, projects that were in their planning phase or just getting under way were particularly affected by contact and travel restrictions imposed as a result of decisions made by policymakers and authorities. The situation made it difficult to establish new research contacts and collaborations and set up research environments as a whole.

Pandemic-related restrictions on research work varied from subject to subject: they included laboratory closures, restricted or selective access to archives, collections and libraries and obstacles to or cancellations of field investigations. This is where a whole series of DFG emergency support measures came into

An empty auditorium at the University of Freiburg in March 2020: all classroom-based courses were cancelled due to the coronavirus.



Illustration: dpa/Rothemel



Illustration: dpa/Roesler

An empty destination board for flights at terminal 2 of Frankfurt Airport. It was closed in April 2020 since passenger numbers had dropped dramatically due to the worldwide coronavirus pandemic.

play as early as spring 2020 which aimed to cushion the impact of these adverse effects on a subject-specific basis so as to enable the continuation and completion of funded research work. In addition to these measures, which included extensions of project funding, cost-neutral project or deadline extensions and a more flexible use of funds, it proved effective to ensure that reviews of research proposals (and renewal proposals) took into account the impact of the pandemic.

In addition to suffering the adverse effects typical of their specific subject area, researchers in early career phases were often not just prevented from changing locations – as would normally be the case in the early stage of an academic career – they also lacked opportunities for networking and establishing new contacts in the community. School and kindergarten closures resulting from the pandemic protection measures particularly affected researchers in early career phases due to the fact that they generally found themselves having to take

on increased care and welfare responsibilities during the family phase. According to the Working Group, it will take several years at least to quantify the extent to which these adverse effects and additional burdens might have led to an increased number of people abandoning their career.

The most far-reaching and lasting change caused by the pandemic to the research system as a whole was the push towards digitisation, leading to more widespread use of digitised research methods and in particular the use of digital communication. Digital exchange formats have proven suitable for day-to-day use and now also significantly reduce the overall cost and travel involved in enabling dialogue among researchers. Providing the appropriate infrastructure is in place, digital channels also have a positive impact in terms of increasing participation in research dialogue. The Working Group sees this as a positive opportunity, especially with regard to combating climate change. Nevertheless, face-to-face meetings continue to be vital to research work and the exchange

of information, especially when it comes to building new collaborations, engaging in creative processes and developing ideas collaboratively.

Here, the DFG Senate Working Group advocates being open-minded about the new digital possibilities and also improving the technical infrastructure. At the same time, however, clear ideas and decision-making aids are to be developed so as to be able to determine which types of event require face-to-face contact and which can be carried out digitally or in hybrid form without compromising the substance or research subject matter.

Finally, the Working Group concludes that the DFG's continuous funding activities during the pandemic had a stabilising effect on the research system. It is now vital for the DFG to learn from the experience of the pandemic and continue to monitor its longer-lasting effects so as to increase resilience to future crises.

The report of the Senate Working Group in full: www.dfg.de/download/pdf/foerderung/corona_infos/bericht_senats_ag_pandemiefolgen_en.pdf

Rembert Unterstell



Illustration: U Paderborn

“Allowing the Economy to Breathe Even During the Crisis”

Pandemic and the economy: zombie companies as a result of the crisis, the potential of tax loss compensation, and the bright and dark side of transparency regulations within our tax system. A conversation with Paderborn economist Caren Sureth-Sloane, a member of the DFG's Pandemic Commission

“german research”: Professor Sureth-Sloane, a three-year pandemic also means that large and small companies in Germany have experienced three years of crisis. What is the current state of the economy?

Sureth-Sloane: The economy in Germany is doing reasonably well after these years of crisis. Overall, we ob-

serve a positive trend after and despite the crisis, although firms are still exposed to uncertainties. The German economy turned out to be quite resilient. As of today, the economy has recovered to a considerable extent. This development might also indicate that government support measures, on average, effectively helped com-

panies. However, this does not apply to every individual case.

The pandemic's impact on the economic system has been as diverse as it was dramatic – which sectors of the economy have suffered the most?

We know so-called coronavirus crisis industries, which include hospi-

talities, catering, artistic activities, film distribution, and specific services in the private sector, such as hairdressers or beauty salons. They were all massively affected within a short period. Many of these sectors have recovered, and even catering is gradually emerging from its nadir. Other sectors, including cinemas and film distribution, are still struggling. Albeit, this is also due to changes in media behaviour.

There was much talk in the media of waves of bankruptcies. Yet the results of the “Accounting for Transparency” Collaborative Research Centre (CRC/TRR 266), whose spokesperson you are, report that a nationwide wave of bankruptcy has not occurred, even mentioning an “insolvency paradox”.

The phenomenon described as an “insolvency paradox” results from suspending the obligation to file for insolvency during the pandemic. This was intended to support companies in financial distress due to the pandemic, even if the formal legal conditions for opening insolvency proceedings were met, for example, due to the strained liquidity situation. But what we now observe was unintended: not only were fundamentally healthy companies supported, but also many distressed and over-indebted companies, which had been in trouble already before the pandemic. The consequence: insolvency filings that would have been appropriate were not filed. The result: fewer insolvency filings despite challenging economic conditions. Recently, we have observed that the number of insolvency cases is increasing. Whether this implies that the so-called zombie companies, artificially kept afloat, are now insolvent remains to be seen.

What is the data basis for such findings? One of our CRC's projects systematically records the insolvency notices issued and published by German bankruptcy courts into our “insol” database. This ensures they are available for different purposes, including research. We can exploit these data to identify patterns and enable further analysis. This is important since insolvency proceedings are a fundamental mechanism of the economic system. The removal of non-functioning companies provides room for innovations. We also use the German Business Panel to assess default probabilities. Analysing both the development and expectations of insolvencies is crucial for economic policy decisions.

Let's look at the research policy decisions and the advisory expertise of researchers from business administration: as early as spring 2020, your CRC submitted a dossier pointedly titled “Research Insights – Addressing the economic challenges caused by COVID-19”. What was its purpose?

We're a group of researchers who study the transparency of firms from the perspectives of financial and non-financial reporting of companies, managerial accounting, and taxation. We also study regulatory

transparency. With our research, we can contribute to pressing issues at various levels. The dossier was therefore published to provide analyses and diagnoses that can help develop effective regulation, thereby contributing to the solution of pressing problems. At that time, for example, we launched a call for specific reforms in the tax law based on theoretical considerations and empirical evidence. We called for extending the possibilities to offset losses for tax purposes, especially the so-called loss carryback, in order to reduce the discrimination against loss-making companies in the tax system.

What was the point of this tax loss carryback in the crisis?

An enhanced tax loss carryback allows companies with crisis-related losses to offset these losses against the taxed profits of previous years. This induces an immediate tax refund that provides liquidity to the companies. The crucial feature of an enhanced tax loss carryback is that it quickly provides additional liquidity through refunding overpaid taxes and is thus a powerful tool during a crisis. An enhanced tax loss carryback is also beneficial for the government because it is cheap. It

Professor Dr. Dr. h.c. Dr. h.c. Caren Sureth-Sloane ...

... holds the Chair of Business Administration, especially Business Taxation, at Paderborn University since 2004. She investigates the effects of taxation on entrepreneurial decisions, especially those involving risky investment decisions. She also works on international corporate taxation and the causes and effects of tax complexity and

transparency. She is the spokesperson for the first purely business administration-based CRC/TRR 266 “Accounting for Transparency” and has been a member of the DFG Senate since 2021.

wiwi.uni-paderborn.de/
en/dep2/stuern/team/11/
prof-dr-caren-sureth-
sloane/academic-career



only speeds up the repayments that would largely accrue in the medium term anyway.

Has the tax loss carryback convinced economic and financial policymakers?

The proposal, which we were able to put forward before the first lockdown and which has also been put forward by other institutions, has been taken up by policymakers quickly. The enhanced tax loss carryback was implemented along the lines suggested. Early in the pandemic, in the summer of 2020, the possibility of loss carryback was expanded, then prolonged in March 2021 and further expanded. This is a positive example of a very valuable and constructive exchange between research, business, and politics.

How can the liquidity support be assessed from today's perspective?

So far, we're only able to observe the short-term effects. We still have to examine the long-term effects of the liquidity support programme.

However, studies of other countries during various prior crises help us understand the impact of specific measures in a crisis. These studies suggest that, for example, investment incentives are particularly crucial in times of crisis but only successfully incentivize if, at the same time, trust in government is strong and application and filing procedures are transparent and easy to handle. In our cross-country studies, we see that high compliance costs and impaired trust in governments considerably attenuate the effectiveness of investment incentives and put avoidable additional burdens on businesses and public administrations.

"Transparency" is an important reference point in your research, not only with respect to pandemic issues. How can the tension between the opportunities and limitations of transparency regulation in the tax system be described? There are many calls for more transparency. Often transparency entails

providing more information and, thus, more documentation. In that case, we need to figure out: what is the quality of this information, who can actually absorb and understand it, and how much does its provision cost? Greater transparency can have an enlightening effect but can also result in misunderstandings. The apodictic demand for greater transparency can paralyse entire organisations or violate incentives to behave in the socially desired manner. Therefore, the costs and benefits of transparency must be carefully assessed on a scientifically sound basis.

Here and in general, you choose international comparison for your studies. Why is this the case?

International comparison is an important instrument for research. We deal with phenomena that arise and rules that are implemented in a global economic environment. In fact, however, the economy responds to national and supranational developments and regulations

– by the OECD, the EU, and countries with different legal systems, political environments, and accounting systems. Given such diversity, regulations are always context-specific and not tailored to every country and every person or entity. We collect and analyse this regulatory and environmental diversity and exploit it to learn which instruments – including investment incentives – best contribute to achieving the politically set aims of regulation and under which conditions.

Back to the pandemic and the pandemic measures: what do you see as the most urgent research need from a business administration perspective?

It is vital to evaluate the pandemic measures and to look deep into the companies and their processes to better understand which conditions and measures are conducive or inhibiting for which types of companies and which stakeholders – managers, employees, customers, suppliers, etc. Who benefits, who suffers – and under what conditions? Which measures were costly but achieved little? Which measures are sufficiently flexible to function well in a rapidly changing environment? A thorough theory- and evidence-based analysis is crucial to enhance the toolbox further and make it even more helpful in the next crisis.

The next pandemic is always just around the corner. What can the "economic view" contribute to our much-discussed preparedness?

It is essential to understand that there are no simple answers. Economic expertise is required to understand the processes within companies and the interactions between companies, public administrations, and all other stakeholders. Sound



Illustration: iStock/Andrey Popov

Many aspects of economic life belong together and interact with each other. This was also revealed by the pandemic. Both large and small companies were prone to domino effects.

knowledge of institutional details is required – concerning the law, soft law, and other regulatory aspects. It's equally important to collect granular data about companies and the perceptions of decision-makers within companies. Coordinated research programmes such as our CRC can significantly contribute to coping with these mammoth tasks. They offer unique opportunities to collect data and make existing data usable and understandable in exchange with business and public administration. In the future, we should make even more targeted use of business administration skills and also collaborate with other disciplines to fuel evidence-based crisis analysis and management.

Resilience is now a big issue throughout the economy, governments, and society. What factors can contribute to long-term resilience in the tax system?

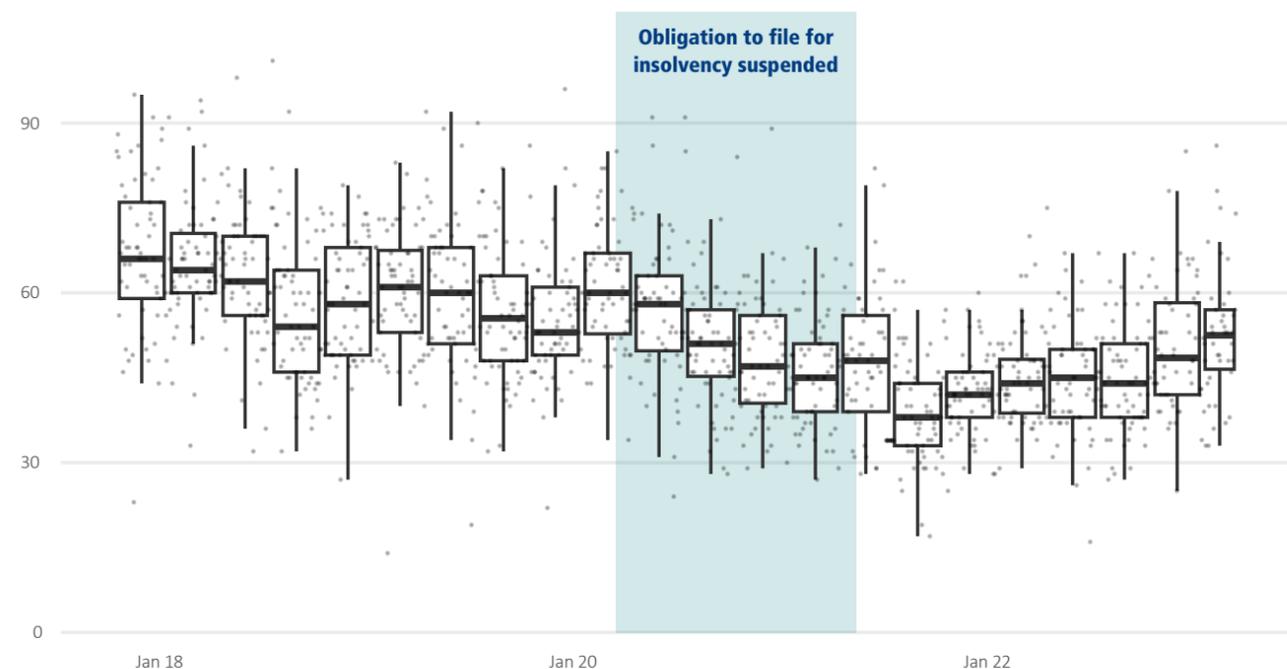
Let me use the example of the tax loss carryback: this is an instrument that provides room to breathe in crises and protects healthy compa-

nies – in other words, those that are doing well but face crisis-induced liquidity challenges from interrupted business models and decreases in sales and services – and that does not generate zombie companies. Further, we're constantly confronted with the fact that many tax reforms are negotiated at the supranational level and, thus, not solely in the hands of a national legislator. So, it is important to identify those areas that national regulators can shape. Our studies also reveal how burdensome many national structures and tax procedures are for companies, especially for companies affected by the crisis. Reducing the inherent compliance costs is a vital starting point for targeted relief, strengthening resilience, and increasing trust in the government. In-depth analysis and identification of suitable measures can substantially help achieve greater resilience.

Thank you very much for talking to us.

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

Overview of corporate bankruptcies per working day and their progression since 2018. The suspension of insolvency obligations during the pandemic resulted in a significant decrease in bankruptcies. Data compiled based on published bankruptcy applications.



Graphic: Subproject of the TRR 266, Joachim Gassen (HU Berlin) and Urska Kosi (U Paderborn)

Matin Qaim

Global Food – Benefits and Drawbacks

Fairtrade, smallholder farmers and the African supermarket revolution: how changing markets, supply and trade chains and globalizing dietary patterns are impacting on economic and social change in developing countries



Before a smallholder farmer can deliver harvested vegetables to the supermarkets, the produce has to be cleaned and bundled by hand.

Hunger, malnutrition and absolute poverty continue to shape the lives and day-to-day routine of much of the world's population. Most of these people live in rural regions of Africa and Asia, where they depend directly or indirectly on agriculture, either as smallholder farmers or as agricultural labourers. In order to fight hunger and poverty, it is important to understand how these people live, what measures can be taken to help them and how markets and political constellations affect their situation.

One measure that probably springs to mind for many consumers in Europe in connection with this topic is the purchase of Fairtrade products. The Fairtrade label pursues the goal of improving the

social situation of people in the producing countries based on fair prices and appropriate working conditions. In Germany and other European countries, the share of Fairtrade in coffee, tea, cocoa and bananas has increased significantly in recent years. Many consumers in rich countries are willing to pay a little more if it means supporting poor people in developing countries.

But does Fairtrade really help small farmers in Africa? This is one of the questions that the Research Training Group (RTG) "GlobalFood" has addressed from various perspectives. And the answer is: yes, it does, at least with regard to those farmers who were the subject of the study, namely coffee farmers in Uganda

and cocoa farmers in the Republic of Côte d'Ivoire. Smallholders organised in Fairtrade-certified cooperatives benefit from higher prices and better access to training and technology. This also allows yields and income to grow. The data collected from over 1,500 households shows that Fairtrade reduces local poverty and improves lives in the smallholder sector.

Fairtrade does not help all poor people in rural areas, however. For example, no impact was seen on the wages and incomes of farm workers – even those working in the fields of farmers who themselves benefited from higher Fairtrade prices. This indicates that the Fairtrade rules need re-assessing and refining. But not all farmers benefit either, since

In most African countries, traditional markets still dominate food retailing – the picture shows an urban market in Kenya. This pattern is currently undergoing rapid change, however.



Illustration: Matin Qaim

Fairtrade currently only works for export products and not where food is grown for the domestic African market. Hence, Fairtrade can certainly have a positive impact at selective points, but it is not enough to fight hunger and poverty across the board.

The projects carried out by the Research Training Group have investigated many other aspects relating to agriculture and poverty in developing countries: for example, how different agricultural technologies and cultivation practices influence nutrition and the role of women in smallholder households, and how cultivation and marketing contracts with agribusiness companies impact on rural poverty and employment. Another aspect

of interest was the role that mobile phones might play in accessing markets and information in remote rural regions. All these studies build on detailed household data collected by the RTG doctoral students themselves in countries such as Ethiopia, Kenya, Uganda, Ghana, Ecuador, India and Indonesia.

A recurring question that arose in the RTG studies was that of the impact of modern supermarkets in Africa. While in Europe most food has been bought in supermarkets for decades, traditional markets still dominate food retailing in most African countries. This pattern is currently undergoing rapid change, however. Modern supermarkets are also mushrooming in many African

countries, and there is even talk of a "supermarket revolution" in Africa.

In some cases, European or US supermarket chains such as Tesco and Walmart are surging into the African market, while to some extent indigenous African chains such as Shoprite and Boxer are emerging and expanding. The growing role of supermarkets is changing agricultural supply chains and food environments, which in turn can have far-reaching implications for both rural and urban households.

Based on data collected over several years, it was possible to study the impact of the supermarket revolution in Kenya and Zambia. Small farmers benefit from the supply of fresh fruit and vegetables to modern supermarkets, because higher

Modern supermarkets are mushrooming in African countries, and there is even talk of a "supermarket revolution" in Africa. The photograph shows a supermarket of the Woolworth chain in Johannesburg, South Africa.

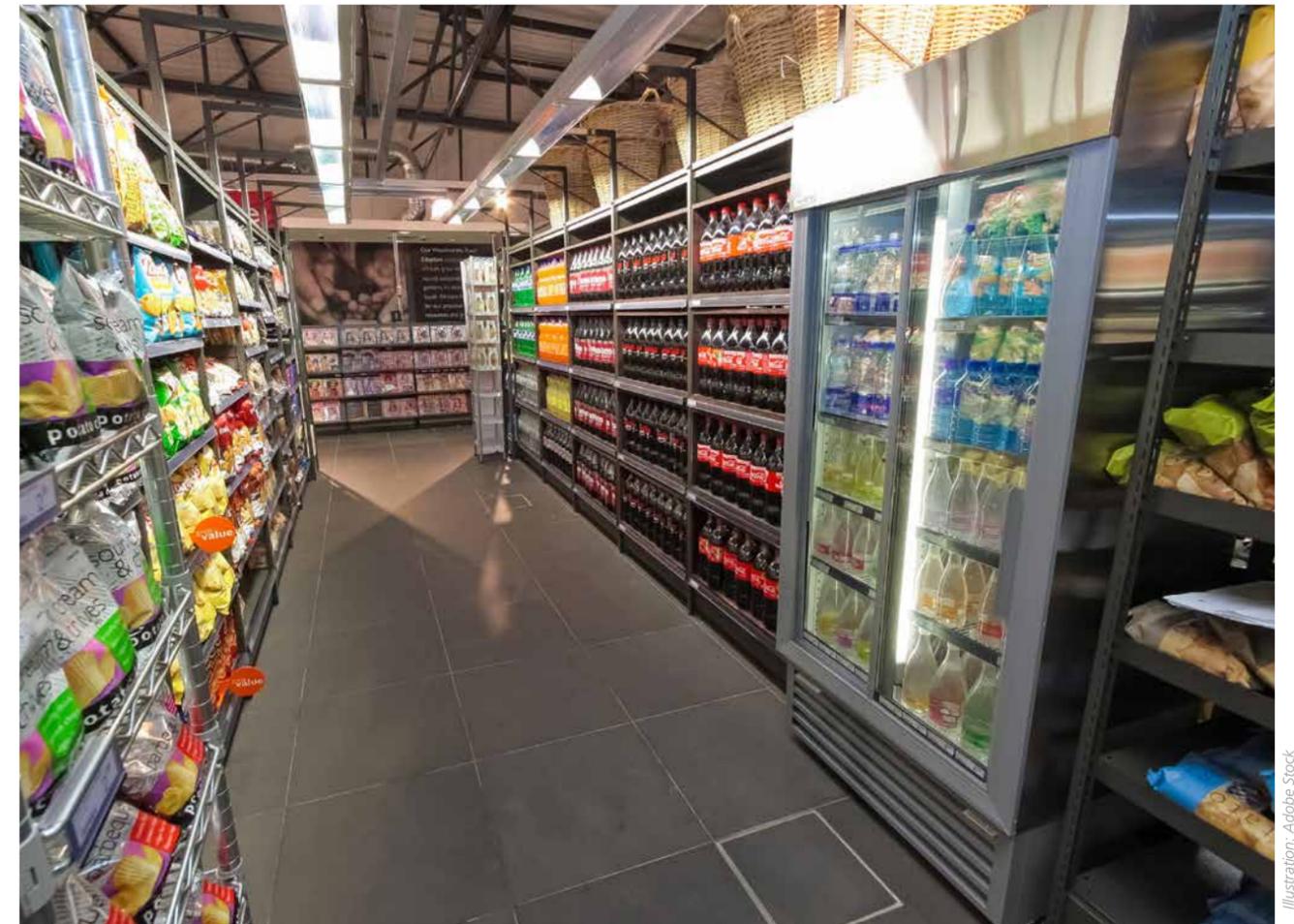


Illustration: Adobe Stock

prices are fetched on average when selling to these new outlets than when selling in traditional markets. These higher prices result from the fact that farmers can sell directly to supermarkets without middle men, but to some extent the increased rates also result from higher quality requirements. Price incentives also increase productivity and employment in the smallholder sector.

For farmers in modern supply chains, there are income benefits of up to 50 percent. The data shows that poverty is declining and nutrition and living conditions in smallholder households are improving. Because of the quality requirements, however, not all smallholders make it into the supermarket

supply chains. Access to credit, training and transport are key prerequisites that are unfortunately not sufficiently guaranteed for all families. Here, policymakers should provide the appropriate support to counteract growing inequality.

In addition to the impact on farmers, it was also possible to look at the impact of supermarkets on urban households. Supermarkets are to be found not only in African metropolitan areas but now also in smaller towns and communities. In small towns in particular, the supermarkets primarily sell processed food and relatively little fresh produce.

In fact, the research data shows that urban households using su-

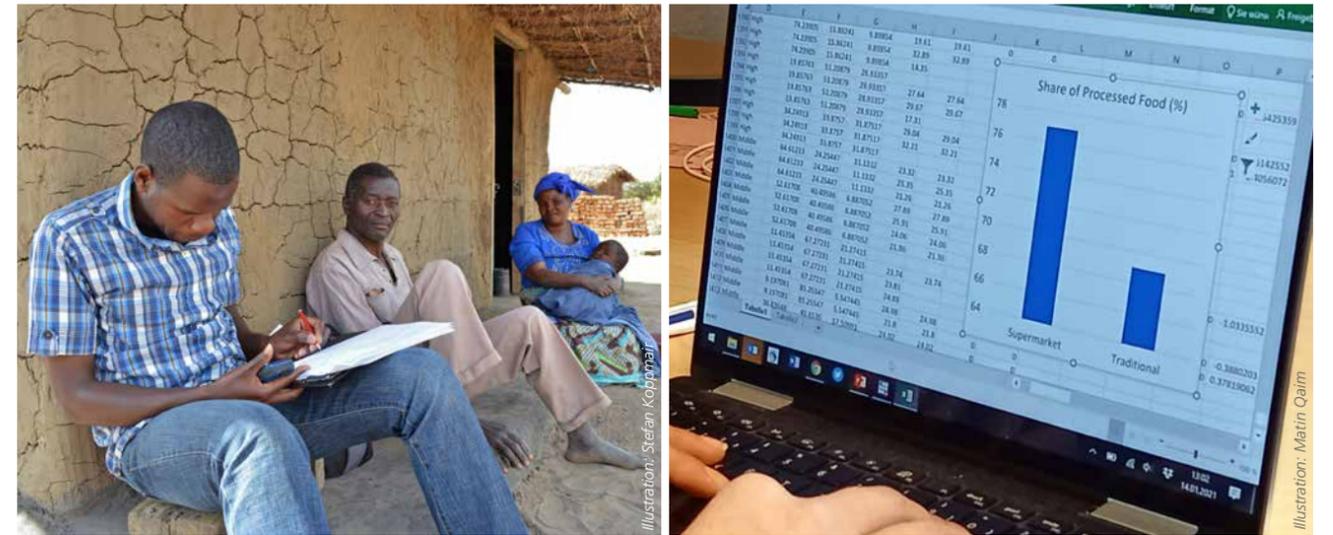
permarkets consume significantly more processed products than households in which food is purchased exclusively from traditional markets. In addition, supermarkets can influence consumption habits and dietary patterns through differing prices, packaging sizes, opening hours and product advertising as compared to traditional markets.

Data from some 2,000 randomly selected women and men in different cities in Kenya and Zambia show that regular use of supermarkets leads to higher (calorie) consumption. At the same time, supermarket users are significantly more likely to suffer from obesity and diet-related chronic disease such as

Information and practical guidance are needed: agricultural training with a group of smallholder farmers in Kenya.



Illustration: Matin Qaim



Left: Detailed research data is collected through time-consuming surveys conducted in the countries under review. Right: The compiled household data provides structural data that enables analyses and insights to be drawn up on a statistical basis.

diabetes. Problems of overweight and obesity are increasing significantly in Africa, not only among the wealthy but also in middle and poor income groups. This means that many countries in Africa are faced with a two-sided problem of malnutrition: undernourishment and obesity. Obesity is caused by different factors of course, but the growing importance of supermarkets seems to be a contributing cause in Africa to at least some extent.

Interestingly, a causal relationship between supermarkets and obesity was only found in adults, not in children. In children, it is noticeable that supermarket purchases actually improve nutritional quality to some extent, reducing problems of micronutrient deficiency and child stunting. All in all, supermarkets seem to improve the overall supply of nutrients in both children and adults. The reason for this is more regular consumption of fruit, vegetables and animal products, often in processed form. These products can be purchased relatively cheaply from supermarkets at any

time. Although processed products are sometimes less healthy than fresh products, poor households in particular otherwise consume mainly staple foods, with fresh fruit, vegetables and animal products less frequently on the menu.

The results underline how important it is to differentiate in this context. The growing importance of supermarkets clearly has a positive impact in many ways, but there are some negative effects for certain population groups in Africa. This must be taken into account in overall policy development. Sensible regulation and support can reinforce desirable trends and reduce or avoid the undesirable effects. One of the aims of our Research Training Group was to improve the knowledge base to inform sound, helpful policy.

In the RTG "GlobalFood", a total of 60 researchers in early career phases from 27 different countries were awarded doctorates, including many from Africa, Asia and Latin America. Most of them focused on

agricultural and/or development economics, though there were also some working in areas such as nutritional sciences, consumer research and marketing. Most of the research data was collected through surveys and experiments conducted together with local partners in the countries in question. Interdisciplinary and cross-border collaboration was an important aspect.



Professor Dr. Matin Qaim

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Rolf Drechsler

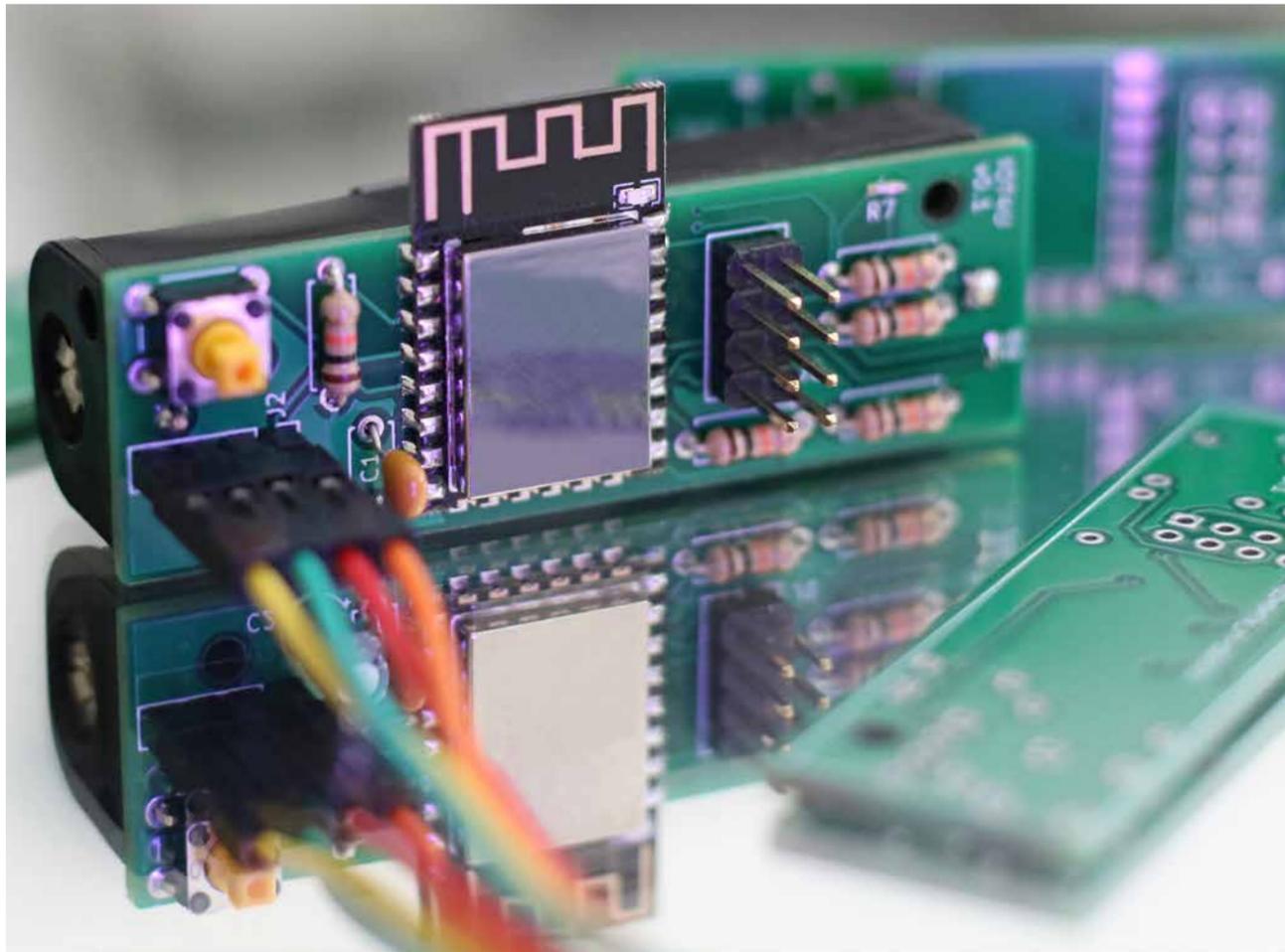


Illustration: Lisa Jungmann / U Bremen

Designing New Processes

Computer architecture: digital circuits are becoming ever more complex. Their functional correctness must also be checked and ensured on an increasingly time-consuming basis for them to work flawlessly. This requires new methods – but also a fundamental rethink

Digitisation has become increasingly popular since the micro-processor was invented in the 1970s and digital technologies are now an integral part of our lives – both in our private and work spheres. Computers used to almost only ever exist in data centres and as research objects, but they have now found their way into nearly every home and pocket. We encounter them not

only as traditional desktop computers or laptops, but also in the form of mobile phones or game consoles, whose performance far exceeds what decades ago was considered to be that of a “mainframe computer”. Tiny microchips are now also installed in many everyday objects and we aren’t even aware of them. The number of processors found in modern vehicles is also hard to

imagine: there can be more than 250 of them generating more than one terabyte of data in an hour.

The first processors consisted of a few thousand components and were still designed by hand. The invention of the transistor in the 1950s, however, resulted in an exponential increase in the complexity and performance of computers. Continuous miniaturisation over time

Left: Modern computer chips can now consist of more than 50 billion components.

meant that more and more transistors could be interconnected to individual integrated components. This growth, also known as Moore's Law, is named after Gordon Moore, one of the Intel founders, who predicted in the 1960s that the peak would see a doubling of hardware complexity every 18 months. Even if such growth has significantly slowed, there are processors today that contain more than 50 billion components.

A jigsaw puzzle can reveal how complex such systems are: a 1000-piece puzzle generally takes people at least ten hours to complete. The number of components in modern processors is roughly equivalent to that of 50 million of these puzzles. It goes without saying that such complex circuits can no longer be manually designed. Construction of these circuits requires automatic procedures and computer support, as well as extremely powerful algorithms and data structures to enable efficient management of the numerous components. The computer programs that support hardware developers in their work must also be continuously improved.

Everybody expects these digital everyday helpers to work reliably and safely. Correctness is of major significance here, since the systems are often used in safety-related areas and life sometimes even depends on them – think, for example, of electronic support when applying the brakes in a car. An obvious approach in ensuring that a designed system meets all requirements would be to test all behavioural possibilities in the form of simulations to see if the

circuit exhibits the desired behaviour in all cases – yet this is barely possible given the complexity.

Considering an addition circuit, in other words a circuit that can add as is common in pocket calculators, enables us to determine the significant role played by a circuit's bit width, which indicates how many signals can be processed simultaneously. Starting with 8 bits in the early 1970s, today's processors already operate at 64 bits, whereby the development usually takes place in powers of two. This is accompanied by a sharp increase in performance and thus in the complexity of these processors.

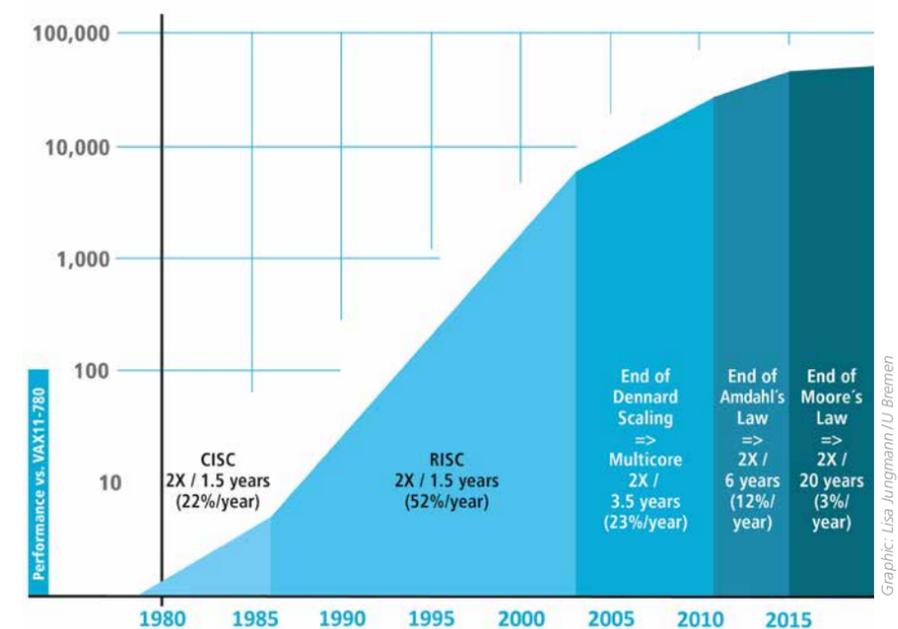
Should it be assumed that a single value can be calculated in a nano-second (overly optimistic), it would take a still justifiable four seconds for a 16-bit computational device to verify all possible switching behaviour in the simulation.

This procedure would however take a 32-bit computational device more than 500 years. It is therefore indisputable that complete verification by pure testing cannot be the method of choice.

Formal methods are an alternative to simulation. The basic principle here is to use mathematical procedures and the application of symbolic calculations (rather than using discrete values) to fully traverse search areas without the need to explicitly evaluate all existing combinations. Logical linkages represent the basic operations of all digital circuits: these are AND, OR and NOT. This procedure can be easily illustrated by the logical AND linkage, which we also encounter in normal use of language: if “Anna AND Hans AND Peter do something”, we only have to remember this one combination (and not the

The performance of computers has increased exponentially as predicted by Gordon Moore (1929–2023) back in the 1960s. Roughly what this means for transistors and their components can be illustrated in a comic book (following page).

40 years of increased processor performance



Graphic: Lisa Jungmann / U Bremen

alternative seven, where at least one person may not be present).

This involves the use of simple decision diagrams with which information can be displayed in a much more compact form, unlike complete enumeration in the form of a table. Very powerful automated evidence methods have been developed over the past 50 years and implemented in computer programs based on the concept of diagrams

and the fulfilment formulas. This is where areas of theoretical, practical and technical computer science coincide, all of which are required to efficiently develop, implement and apply algorithms within technical systems.

The objective of current research within the Reinhart Koselleck project “PolyVer: Polynomial Verification of Electronic Circuits” is

to use detailed analysis to discover how circuit functions need to be designed to enable efficient verification of their formal correctness and how the underlying circuit needs to be structured for this purpose. The development process is mostly design-centric in current practice: a circuit is initially designed according to various optimisation criteria, such as surface area, speed or power consumption. Only then is the so-

“Noerdman – a web comic about technology, nerds and the north” not only deals with AI issues (below) or the screen-based intertwining of our professional and leisure world (right). A particular feature is that the sequel comic is produced by AI expert Rolf Drechsler, our author, and Jannis Stoppe from the German Aerospace Center in Bremerhaven, who are jointly seeking access to the digital world of today and tomorrow.

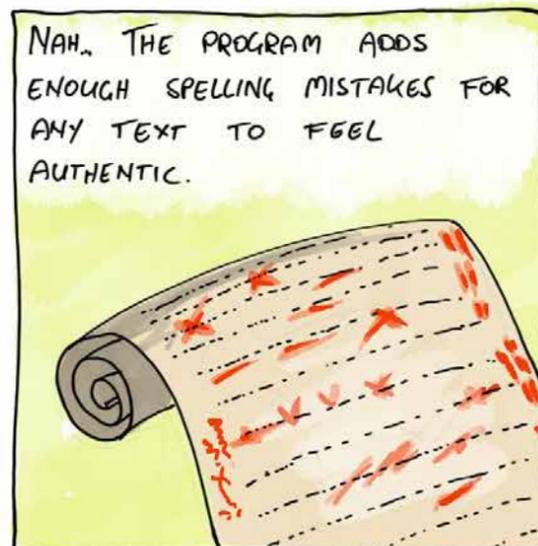
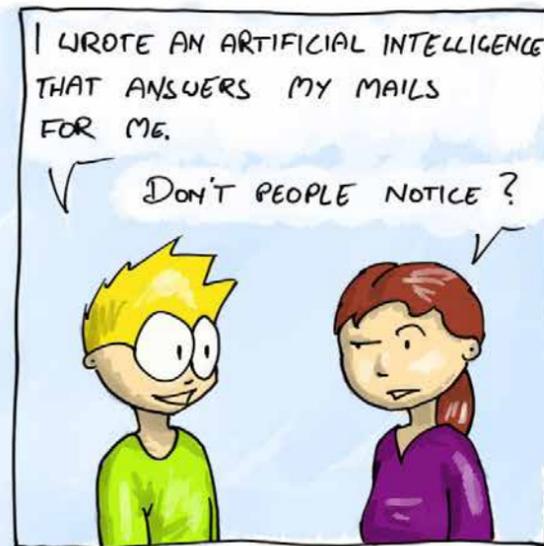


Illustration: www.noerdman.de/index.php?lang=en

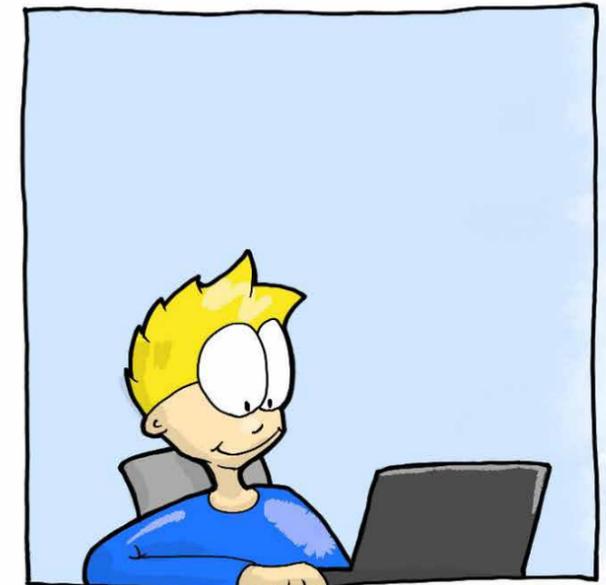


Illustration: www.noerdman.de/index.php?lang=en

called verification performed, which uses formal methods to review the circuit for its correctness.

Yet previous studies indicate that the nature of design implementation has a major impact on whether subsequent full verification based on formal methods can be successfully applied. Different evidence methods can be used in this context depending on circuit type. Experimental studies reveal the possibility of verifying computational devices with multiple 1000 bits as fully correct within seconds. Beyond these empirical observations, it can also be guaranteed on a theoretical level that the calculated runtimes cannot be exceeded.

The test results can also be transferred to other arithmetic circuits that form the basis of complex processors. These findings can also be used to derive rules on the form in which circuits must be designed so that their correctness can be guaranteed to 100 percent. The intention is that the previously design-centric process is thereby to be transformed into a verification-centric process,

which at the outset considers the efficient formal verifiability of digital circuits. It is important to question in this context whether such rules are contrary to the traditional objectives regarding efficient designs, since high requirements relating to circuit performance naturally continue to apply. Further studies are required in this regard.

The approaches to formal modeling of computer systems are often limited to purely logical behaviour: the systems are modelled using 0 and 1. The requirements become significantly more complex when physical variables such as the runtime behaviour of signals within the circuit or its power consumption are also to be considered. Taking these variables into account enables more precise statements regarding the correctness of the resulting overall system – most digital systems do ultimately operate within an analogue environment after all – yet at the same time it also creates another level of complexity that must be included.

The work undertaken so far in the “PolyVer” project indicates that evidencing functional correctness can be successful even given highly complex systems. This does however require a rethink of the design process: the aspect of efficient verifiability must be taken into account at the outset to be able to design and construct reliable and secure systems in the future.



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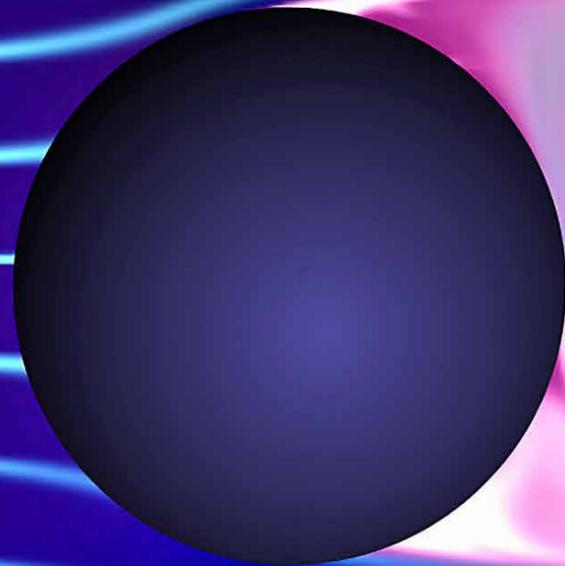
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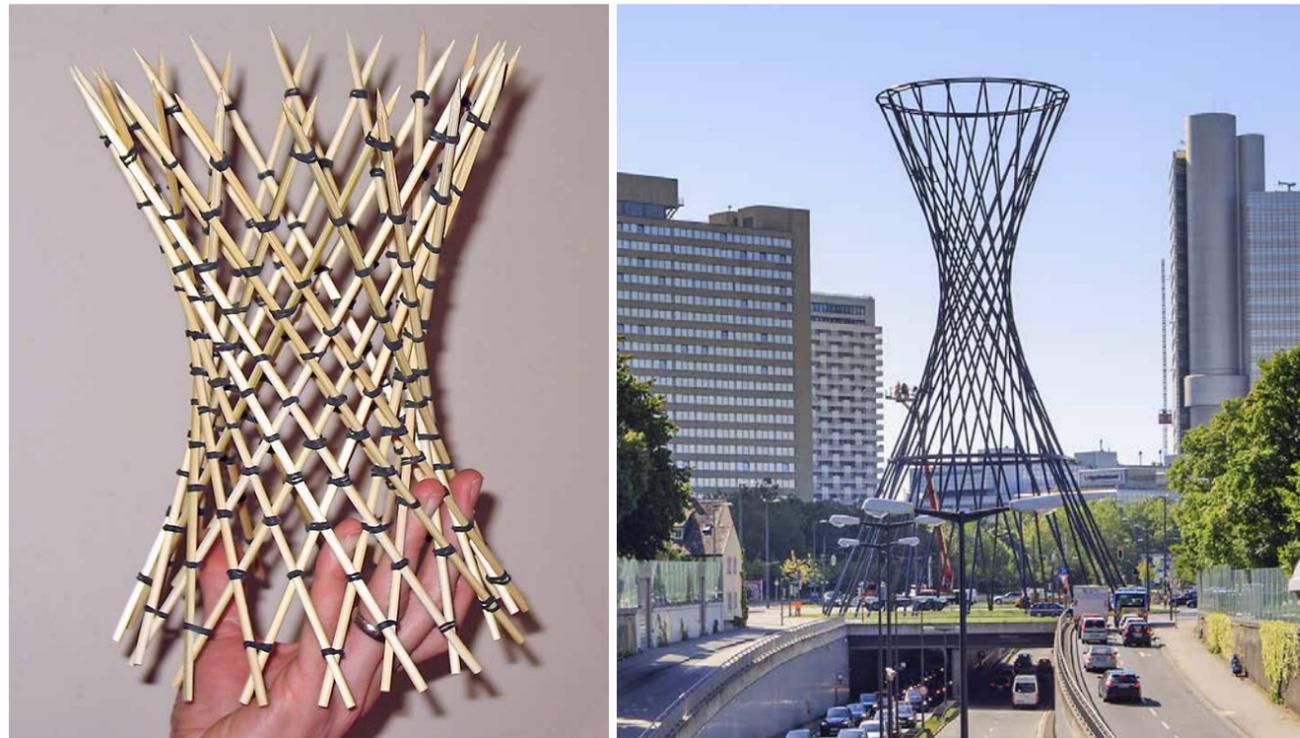
Jürgen Richter-Gebert

Mathematics for the Senses

From black box to white box – how mathematical models and visualisations become groundbreaking means of research and communication in the natural and engineering sciences



Beautifully shaped and meaningful: a computer-generated flow simulation. Such simulations offer huge didactic potential – for researchers and science communicators alike.



A wooden model of a single-sheeted hyperboloid constructed from simple shish kebab sticks illustrates that there are surfaces that are entirely curved but which still have an infinite number of straight lines on their surface. Right: Mae West sculpture in Munich-Bogenhausen.

Mathematics is the science of formal structures. As soon as formal aspects are involved, every other science or engineering discipline is forced to draw on mathematical language and often on deeper mathematical concepts, too. This is one of the reasons why practically all students of a natural science or engineering have to take several semesters of mathematics at the beginning of their studies.

Unfortunately, mathematics is often not simple to take in – precisely because it ultimately has to measure up to strictly formal standards, and these can only be imparted to our intellect through quite extensive training. Even mathematicians do not find it easy to produce a formally strictly correct proof. Formal structures often defy our usual habits of perception, where we combine our thoughts with sensory percep-

tions so as to get a holistic grasp of overall contexts.

Nevertheless, for many mathematicians, mathematics has a distinctly sensory component. In their world, there are concrete objects in sometimes high-dimensional spaces, formulas that are noted down as diagrams, and differential equations that capture vivid physical phenomena. Many mathematicians think in images, and the art of doing mathematics then ultimately consists of translating these images into equations and formulas – making the knowledge gained formally “watertight”.

In this case, mathematical models or visualisations are a bridge between the abstract world and holistic day-to-day experience – and they have a centuries-old tradition in mathematics. Models are concrete objects that represent parts

of mathematical reality and make them tangible to the senses. To draw on Plato’s Allegory of the Cave: they are shadows cast from an ideal world accepted as true, which, despite all their imperfection and simplification, carry a spark of truth, allowing insights to be gained from their contemplation and alteration.

Felix Klein (1849–1925), one of the great mathematicians of the 19th century, was a passionate advocate of mathematical visualisation. This was how he summed up his position in his book *Entwicklung der Mathematik im 19. Jahrhundert*, published in 1925: “As today [~1925], so then too [1840–1880] the purpose of the model was not to compensate for the weakness of the imagination but to develop an imagination of vivid clarity – a goal that was best achieved primarily by making models oneself.” In other words:

models serve to gain knowledge, and this happens most effectively when you build them yourself.

This insight – which has lost none of its relevance today – has consequences for research and teaching as well as for science communication. It’s just that in our day and age, the possibilities go far beyond those of the 19th century. Whereas plaster, paper, threads and wires were the predominant materials for visualisation back then, today we have 3D printing, computer simulations and augmented reality. There are many ways to create models and visualisations; the following is a foray into some facets and options that also reveal some important categories of reasoning.

Art or model

The boundaries are fluid. Entering the realm of the object-like sculptural, many mathematical models

have enormous aesthetic appeal, which stems precisely from the fact that they put an abstract structure into concrete visual space. Conversely, some abstract artworks have a formal core idea, such as the works of Swiss architect and artistic multi-talented Max Bill who died in 1994. Nevertheless, a minimum requirement for a mathematical model is that it must represent a part of the mathematical universe of ideas. As long as it does this, it doesn’t matter how much it oversimplifies. Often, looking at a mathematical model requires an eye-opener – a clear signal as to what to look out for.

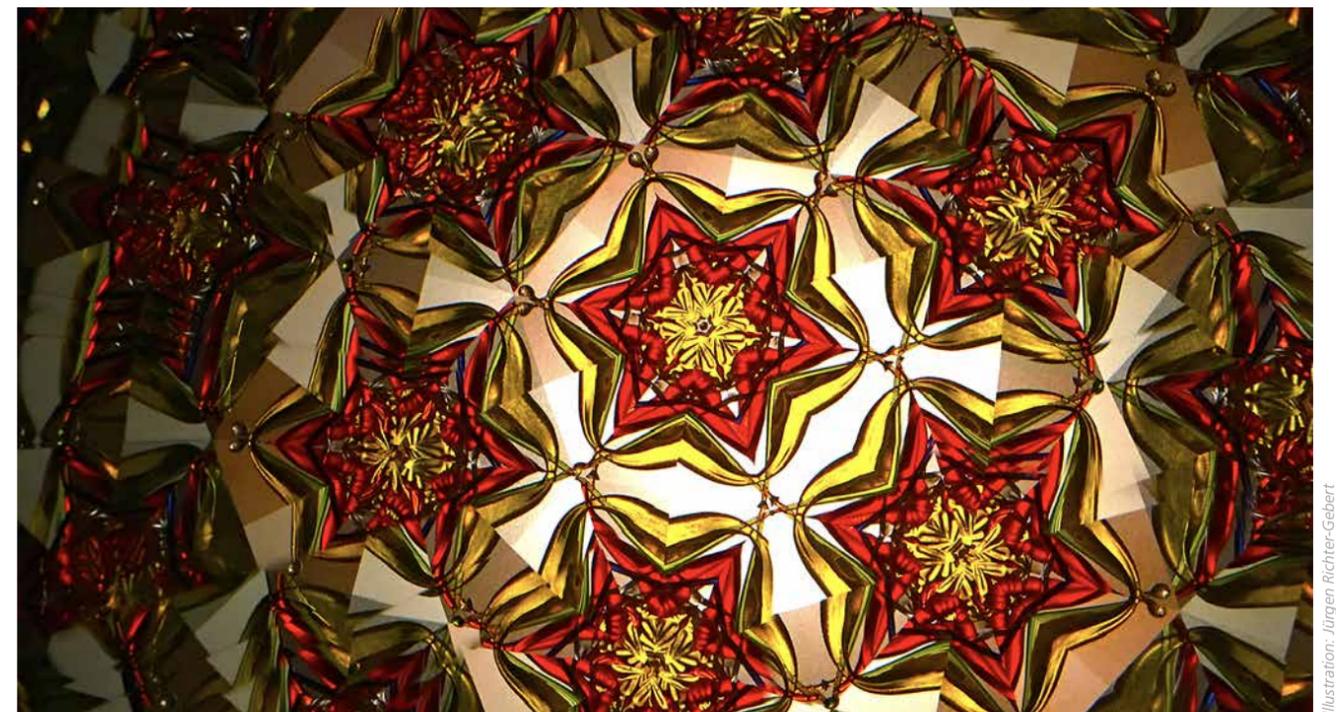
For example, the wooden model of a single-shell hyperboloid (shown above left), constructed from simple shish kebab sticks, illustrates that there are surfaces which are entirely curved but which still have an infinite number of straight lines on their surface. Once you have made such a model and held it in your hands for

the first time, you will be surprised to discover that it is not rigid at all, but allows a very satisfying kinematic range of movement. It is as if it were sending a message from the Platonic universe of ideas to the model maker that there is much more to it that needs to be understood.

Phenomenon vs. model

If you visit a hands-on mathematical exhibition such as the mathematics department at Deutsches Museum in Munich, you will encounter at least two types of artefact: phenomena and models. Here, too, the boundaries are fluid. A mathematical phenomenon is often based on a physical circumstance that makes a certain mathematical aspect particularly obvious. A well-known example of this is the double pendulum: its unpredictable oscillation behaviour provides an initial understanding of chaos theory.

A kaleidoscope composed of mirrors. Physical laws ensure that a harmonious image is created.



Another vivid example are the so-called Chladnian sound figures: these are created when a metal plate that has previously been sprinkled with sand is made to vibrate by brushing it with a violin bow. The sand collects in wave nodes, making the latter's symmetry take on a concrete form.

By contrast, there are models that represent a certain mathematical entity and place it in a comprehensible space that is otherwise difficult to imagine. One classic example here are the plaster models of algebraic surfaces made in the 19th century. The famous Clebsch diagonal surface, for example, shows

that even on a surface that is the solution of a third-degree equation, there can still be up to 27 straight lines. Below is a 3D print showing only the 27 straight lines.

Here, too, the boundaries are fluid. On the one hand, a kaleidoscope built of mirrors can be seen as a phenomenon: physical laws force an aesthetic image to be produced. On the other hand, such kaleidoscopes can be seen as models of reflection groups – one of the most important subfields of group theory.

Animation vs. simulation

Computers now allow us to go far beyond the possibilities of the real world. In particular, they can be used to create scenarios in which the viewer is able to change parameters and even engage in research like exploration of effects in a virtual environment. Here there are as many opportunities as there are didactic pitfalls. Ultimately, a computer can represent and suggest any scenario. The programme that generates arbitrary images based on user input is ultimately a black box as far as the user is concerned. Here, pure animations where certain image sequences are shown quasi at the push of a button can even be counterproductive.

One solution is provided by simulations, i.e. computer programmes that reconstruct a certain mathematical context from basic principles, for example the computer-aided execution of geometric operations and the simulation of physical conditions, to name just two. The great challenge here is to make the rules of the game underlying a simulation as clear and transparent as possible so that the black box becomes a white box in which the user can place their trust

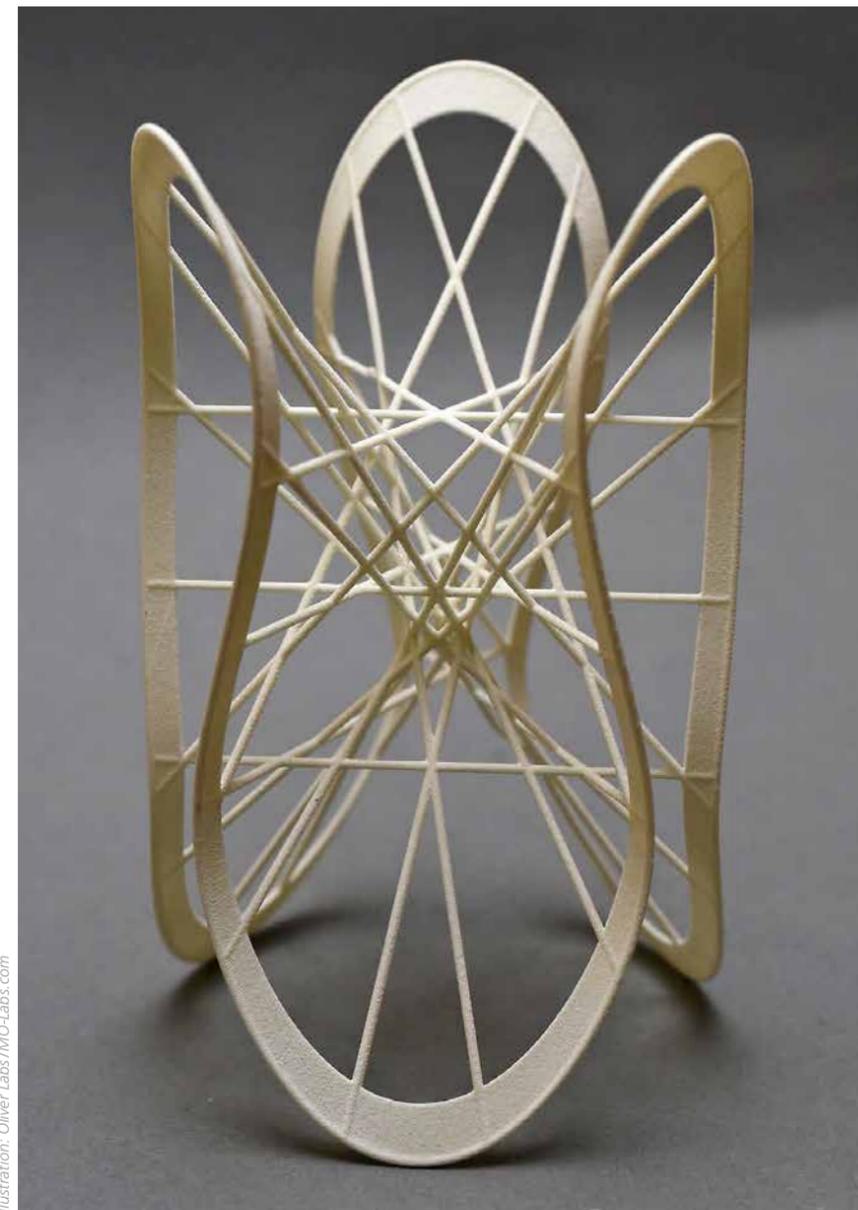


Illustration: Oliver Labs/MD-Labs.com

The Clebsch diagonal surface: even on a surface that is the solution of a third-degree equation, there can still be up to 27 straight lines. Here is a 3D print showing only the 27 straight lines.

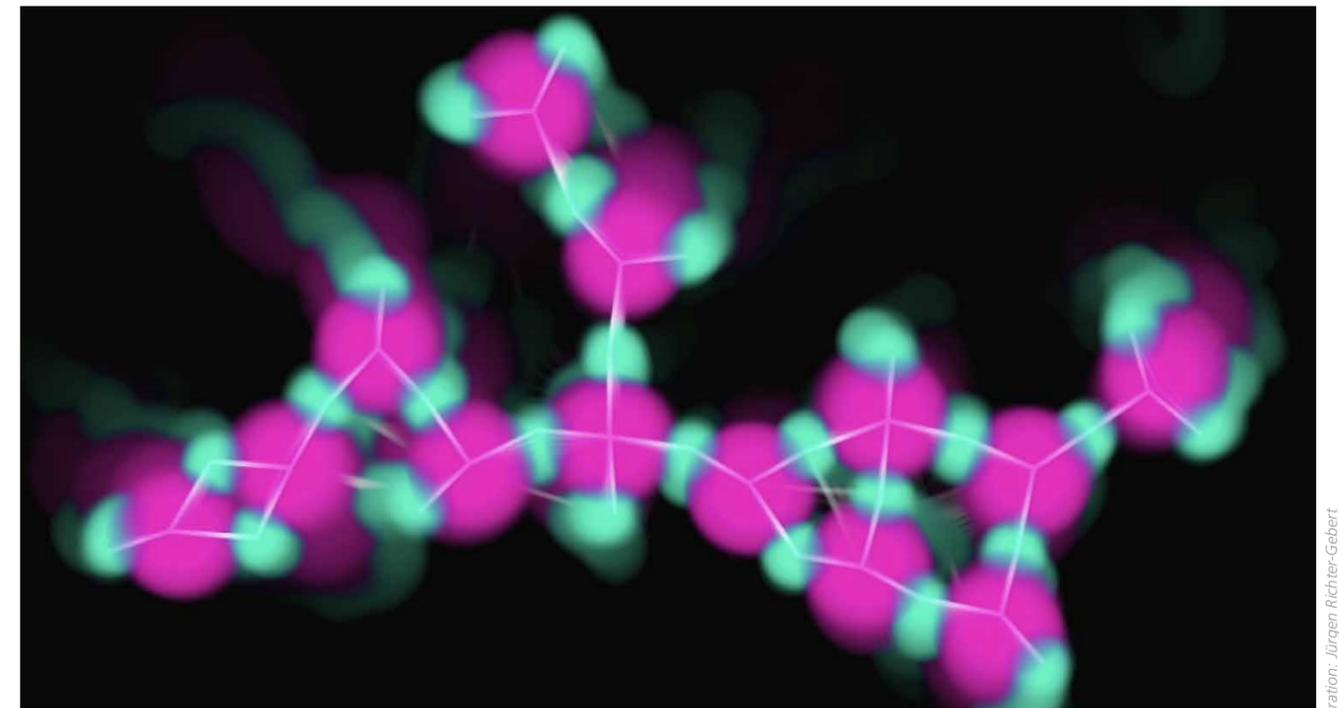


Illustration: Jürgen Richter-Gebert

Added value of visualisation: even highly simplified simulations of charged particles moving in a mutual force field can help to experimentally reproduce effects such as crystallisation and phase transition at the particle level.

in the same way as in the kinematics of a wooden model.

It turns out that simulations offer huge didactic potential. If the parameters to be changed are chosen appropriately, users can become experimenters, exploring the interconnections within an environment for themselves. Often there will be the satisfying feeling of discovering new connections through self-created software that you were not aware of before (here we may call to mind the above quote by Felix Klein).

Another example is Kármán's vortex street, a phenomenon in fluid mechanics in which vortices form behind a body that is placed inside a stream of liquid. Similarly, even highly simplified simulations of charged particles moving in a mutual force field are helpful in experimentally reproducing effects such as crystallisation and phase transition at the particle level.

Why is it worthwhile to reflect on the facets and varieties of models, visualisations and simulations and to develop an awareness of them? They are means of communication of science and as such should convey a reliable picture of an abstract reality. Purposefully interactive design can help create a reliable level of communication and explanation. This process of critical engagement can take place at many different levels: it is possible to look at the assumptions underlying a mathematical model, assess the quantitative and qualitative significance of a simulation, or focus on the clarity of the so-called user interface design of a software. If visualisations are to be created which offer a high level of didactic quality, all these aspects are important.

Even if this brief outline is only able to illuminate the topic very superficially, it may be an eye-opener

in a time when we are used to computers being able to make us believe in arbitrary illusory worlds. The aim is to support and advance our understanding of the essence and value of scientific visualisations, enabling them to be put in perspective.



Illustration: Astrid Eckert/TUM

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Stefan Matuschek

The Romantic Model

Romanticism cultivates the imagination. As an epoch in cultural history, a style and a way of thinking, it was the second impulse of European modernity after the Enlightenment, shaping literature, art and interpretations of life and the world – and it continues to have an impact to this day. An assessment by an interdisciplinary DFG-funded Research Training Group

The definition of “romantic” is both very simple and highly complex: in day-to-day parlance, it is simply the mood in which fantasy elevates us pleurably above reality; yet things become much more difficult when we attempt to determine the characteristics that make up the cultural-historical phenomenon of Romanticism from a scholarly point of view to define what “Romantic” means when applied to a style and a philosophy. The Research Training Group “The Romantic Model: Variation – Reach – Relevance” at the University of Jena adopts a fresh approach in tackling this difficulty.

As an epoch, Romanticism encompasses the (approximately) four decades that followed the French Revolution. This event impacted not only on politics but also intellectual and cultural life as a whole. It abruptly boosted key tendencies already nascent in the Enlightenment: the authority of the classes, the church, the royal court and academia was lost, while journalism and writing gained power. Indeed, writing and reading acquired a whole new function and relevance, creating a sphere of publicity that was independent of the age-old institutions (church, court, universities and academies) and offering both mass entertainment and at the same time their own ideological orientation, which became individualised through private reading.

The prose novel became the new leading genre of literature and, in an explosive increase and expansion of authorship and readership, gave birth to the modern book market, ultimately laying the foundations for literature’s modern-day status as an independent domain of society. It is the term “Romanticism” that precisely marks this process: this is clearly reflected in the German word for novel – *Roman*. In Germany this word emerged from the novel boom at the end of the 18th century as a tribute to the genre, previously scorned as lowbrow “reading fodder” and now taking on a whole new significance as a forward-looking force in society. From literature, the concept spread to painting and music, then to the sciences, politics and to people’s entire outlook on life and mindset.

This quantitative boost was accompanied by an increase in quality, too. Romantic literature brought innovations that can be described as revolutionary in the same way as an epoch-making political event. To name only the most striking features, it created a new style of addressing issues that speculatively transcend the rationality of the academic disciplines: issues concerning the possible significance of a universal entirety, the link between the individual and this entirety, and in general pursuing perspectives that went beyond experience and verifiability. Those

who doubted the denominational religious answers to them were driven – as the common metaphor goes – into “metaphysical homelessness”.

Romanticism is the art of remedying this deficiency by engaging in imaginary construction. It produces metaphysical castles in the air, which we know are nothing but castles in the air, i.e. sheer fantasy. In other words: Romanticism cultivates the imagination as a self-conscious guide in all that goes beyond the realms of our rationality. It’s a good thing not to confuse imagination with knowledge, and Romantic literature developed its own original methods to prevent this confusion. We can see this exemplified in the most famous German-language poem of the Romantic period, Eichendorff’s *Mondnacht*: it formulates the immortality of the soul not as a certainty of faith, but, in the subjunctive, as a mere idea. This gives rise to a subjectivised form of religiosity, based on aesthetic rather than dogmatic persuasion.

In this way, Romanticism (not only in Germany, but also in Britain, France and Italy) created an enlight-

Right: Caspar David Friedrich, a master of Romantic paintings and moods: Man and Woman Contemplating the Moon, c. around 1824. During a nocturnal walk through a mountain forest, a couple pause on a hill next to an uprooted oak tree.



ened relationship with the vitality of the imagination. This is not a general characteristic of Romanticism, but it is certainly one that it can only be a disadvantage to do without. It is what makes Romanticism the second impulse of European modernity after the Enlightenment.

The popularity of Eichendorff's stanza about the flight of the soul in modern-day German obituaries shows just how deeply we are still influenced by it. Its comforting power is able to cast an aesthetic spell both on the enlightened empiricist who is fully aware that we cannot know anything about the hereafter, and on somebody who does not share any religious convictions on this matter. This not only helps get over the death of loved ones, it also offers an invigorating bonus beyond what is verifiable in a wide variety of situations.

Romanticism – this is how we might call one of the key inventions of this era – is the stylistic evidence

that we live beyond the means of our reason. It is a good thing to be aware of this, and not deceive ourselves as to the status of this other domain we construct for ourselves. Singling out this characteristic of Romanticism does not give us the general key to understanding it: but it does reveal how this literature of the past can still work against any kind of fundamentalism today. It invented a model of representation that creates a whole new understanding of transcendence, thereby acting as a source of inspiration for literature, the arts and individual attitudes to life right up to the present day.

For a long time, research was faced with the task of abstracting the contradictory diversity of all that is associated with the term “Romantic” into a single strand. If we look closely enough, this is clearly impossible: different actors engaged in vastly differing conflicts meant different

things by the term. The early German Romantics, for example, used it to oppose the common-sense philosophy of the late Enlightenment, developing an academic-esoteric aphorism from Kant's transcendental philosophy; by contrast, the French and Italian Romantics were fighting for an anti-academic popular culture. As such, it was only the various researchers themselves who were able to discover a “unity of Romanticism” by placing their own accentuations. This was (in Germany) initially the ideology-critical view of the reactionary and nationalistic elements of late Romanticism, and subsequently the rediscovery of early Romantic irony through postmodernism.

The Jena RTG seems to explicitly trace the inevitability of this selection and accentuation and derives its method in this way. We are not looking for a “unity” of Romanticism, nor are we merely registering all the different things that we encounter

Willow Bushes under a Setting Sun, c. 1830–1835, a lesser known but expressive painting by the painter, graphic artist and illustrator Caspar David Friedrich.



Illustration: Wiki Commons



Illustration: Wiki Commons

Setting forth and arriving – gladly by sea: On the Sailing Boat, c. 1818, detail view. Self-portrait of Caspar David Friedrich with his wife Caroline Bommer.

under this term. Instead, we ask at an intermediate level which selections and accentuations have become effective and formative. Between the imaginary single Romanticism and the infinite range of different Romanticisms, we believe, lie a manageable number of models of Romanticism that have emerged in specific contexts for specific intentions.

The aforementioned new representational model of transcendence is one of these. It is transmitted from literature to painting, it is also effective in poetry classified as “realistic” (for example in Theodor Storm), it inspires French surrealism and continues on into contemporary literature, for example in Wolfgang Hilbig, Felicitas Hoppe and Wolfgang Herrndorf – and through subjectification and aestheticisation it has produced the form of art-spirituality that is dominant in many milieus today.

Along with such models of representation in literature and painting, we also pursue models of interpretation and action, i.e. Romantic patterns of thought and ex-

planation on the one hand and of cultural practice on the other. This is an analytical distinction between elements that often merge in phenomena: in galvanism research around 1800, for example, in the lifestyle and self-dramatisation of aristocrats in the 19th century, in contemporary love relationships, and in the drop-out existence of the American writer and philosopher Henry David Thoreau (1817–1862), which has seen a new, almost absurdly commercialised boom in recent years. Equally exemplary is a project devoted to the nation-building of Cameroon, which was partly inspired by the Romantic national discourse in Germany via the *Négritude* movement and the beliefs held by ethnologist Leo Frobenius (1873–1938).

Named and enumerated in this way, this collection of topics seems heterogeneous and haphazard. Yet the large number of rigorous individual studies – some 50 in total – and the shared model-theory approach make it possible to draw on multidisciplinary knowledge that shows how artistic styles originating from

the Romantic era as well as new forms of thought, interpretation and action continue to shape our culture worldwide to this day. This multi-layered search involves various types of literary study and comparative literature, art history and musicology, theology, sociology, history, history of science and, in order to test new research and analysis techniques, language and image-related developers working in the field of the digital humanities.



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The Deutsche Forschungsgemeinschaft

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

With an annual budget of around €3.65 billion, the DFG funds and coordinates more than 31,000 research projects in its various programmes. These projects are carried out by both individual researchers and groups of researchers based at universities and non-university research institutions. The focus in all disciplines is on basic research.

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

For more information, visit www.dfg.de/en

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

The DFG currently has 97 member organisations, primarily comprised of universities, non-university research organisations such as the Max Planck Society, the Leibniz Association and the Fraunhofer-Gesellschaft, the Helmholtz Association of German Research Centres, and academies of sciences and humanities. The majority of the DFG's budget is provided by the federal and state governments, and it also receives funds from the Stifterverband.

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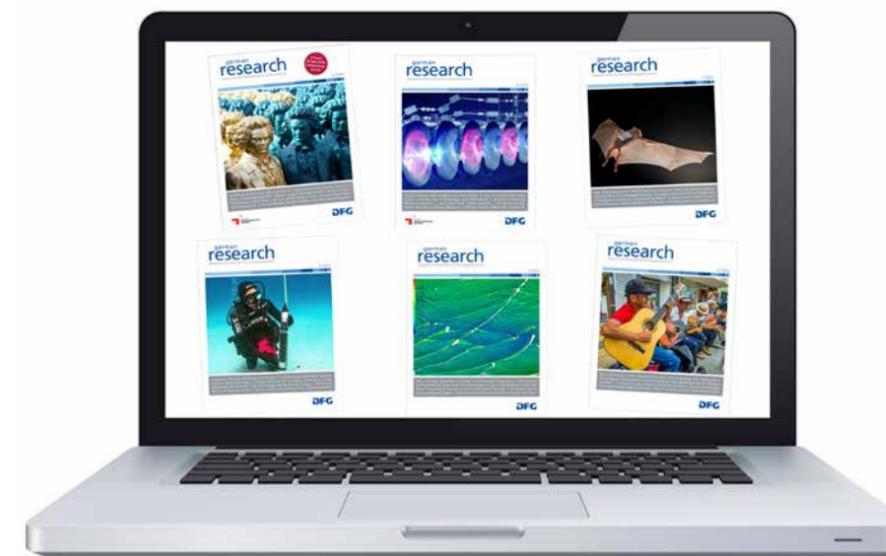


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Newspapers and magazines thrive on change, too – whether in terms of their own content and presentation or when it comes to users and their habits. When *german research* was founded more than four decades ago by then DFG President Heinz Maier-Leibnitz as an international edition of our magazine *forschung*, it quickly received a warm reception. In our key partner countries and organisations in particular, there was great interest in this showcase of fundamental research “made in Germany”, so the freshly printed booklets from Bonn were soon being sent out in their thousands to centres of international research the world over. Today, readers are not only more widely distributed globally, they also increasingly prefer to read online on their own screens. In recent times, the editorial team has been increasingly confronted with a question which has come up internally, too: how can printing and global shipping be reconciled with issues of sustainability and the concern for natural resources? Bearing all of this in mind, this issue of *german research* is now the last to be produced and distributed in the traditional way. From now on, our magazine will be published exclusively in digital form and, based on the idea of offering a more streamlined publication, it will appear in two issues per year rather than three: at the beginning of May and the beginning of November. We would like to thank all readers who have remained loyal to our magazine in printed form, in many cases for a very long time, and we cordially invite them and anyone else interested in the DFG and the research it funds to read the magazine digitally at www.dfg.de/en/dfg_profile/publications/german_research. And to echo the words of Giuseppe Tomasi di Lampedusa, we hope you join us in our belief that some things have to change if we want them to stay the way they are. Stay connected to *german research*.

