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Anniversary Special
Celebrating 50 Years of CRCs

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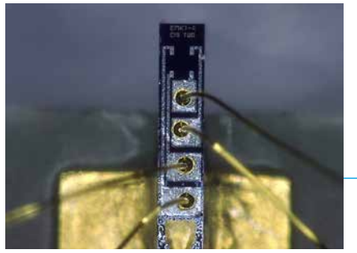
Cover: AG Krämer

***Arabidopsis halleri* in the Giebelwald in the Siegerland region. Understanding the plant's ability to store high amounts of heavy metals leads researchers to modern-day applications.**



Katja Becker

Leading the Way, Setting the Pace

DFG Collaborative Research Centres are celebrating their 50th anniversary. How have they stimulated new directions in the German research system, and how will they continue to do so? A look back at the future

Illustration: DFG/Schepp

In German, Collaborative Research Centres go by the rather unwieldy name of Sonderforschungsbereiche ("special research areas") – the meaning of which perhaps isn't immediately obvious. To understand why this name was chosen, you need to know something about the turbulent phase that science policy went through in the late 1960s and appreciate something of the mood of those years. The emphasis then was on emancipation and enlightenment, rejecting everything with even the slightest whiff of elitism left over from a legacy of tradition. Clusters of Excellence – as a concept and a reality – were still a long way off, and the prestigious Gottfried Wilhelm Leibniz Prize had not yet been established as a means of recognising outstanding researchers. It would be another 40 years before the European Research Council and its much sought-after grants saw the light of day.

Over the years, these and other programmes have given rise to an extremely diverse research funding landscape. But when the first Collaborative Research Centres were set up by the DFG 50 years ago, they were largely isolated features in that landscape. In this, their anniversary year – a key topic in this issue of the DFG magazine and the focus of this editorial – we can see how they have grown from a small seedling to a huge, widely branching tree. They have earned researchers in Germany the envy of colleagues abroad. To continue with the same metaphor, what role does this tree play in an ecosystem characterised by constant change? Does it still have an important contribution to make, or is it losing its ecological niche as a result of competition? And what are its future prospects?

Collaborative Research Centres offer highly qualified researchers a chance to carry out research on a joint, interdisciplinary basis at the highest international level. At the same time, they help establish and refine clearly defined core research areas at the host universities. In this way, they provide a vital impetus for ongoing structural development, for example in structured early career support or more equal opportunities with respect to career options. At a time when universities are obligated to finance a growing proportion of their research through third-party funding, it is especially important to have a clearly defined profile and a healthy competitive position. Preparing, establishing, and coordinating a Collaborative Research Centre is perfect "training" for universities as they seek to structurally adapt and carve out a unique profile for the future.

The conditions are certainly right for Collaborative Research Centres to continue fulfilling their role and function in the research landscape in the years ahead. Indeed, in retrospect it is clear what a lasting impact they have had – and continue to have – on a diversified research system.

In 1997, for example, the DFG introduced CRC independent junior research groups to enable early career researchers to gain leadership experience and prove their abilities at an early stage in their careers. The Emmy Noether Programme, launched in 1999, into which the CRC independent junior research groups were later integrated, pursued the same goal.

But a look back over the past 50 years also reveals many more achievements, including a better balance between family and research career, an area in which Collaborative Research Centres set the bar high from an early stage. Many CRC also make research-generated knowledge available to industry and society. Since 1996, for example, researchers have had the option of proposing transfer projects together with an application partner. Collaborative Research Centres also request and make good use of additional funding for exhibitions, schools labs, and other forms of science communication. Funding is also available to establish an efficient, professional infrastructure for managing scientific data as an individual project within the CRC – an option introduced over a decade ago, long before the importance of networked research data management became obvious. Finally, the transition in 2015 from local concentration to concentration at the applicant university or universities facilitated the participation of external partners, which has also had a positive effect.

These examples illustrate how, over the course of their history, Collaborative Research Centres have served as sensors for change, leading the way and setting the pace. Part of the reason for the programme's success is the fact that it maintains characteristic features that today are taken for granted but are just as important as they were 50 years ago if not more: the concentration of expertise in different disciplines in one location, resulting in regular personal dialogue across all qualification levels – both planned and spontaneous. Particularly in a time of web-based communication, this kind of dialogue often provides an important, even decisive, impetus for innovative research activities and approaches.

Finally, it's important to note that the funding period of up to twelve years, used flexibly and with the right focus, enables researchers to engage with research questions and problems from a longer-term and quality-focussed perspective. Given the ever-increasing pace of basic research, many applicants regard this as an important benefit. The programme has never specified particular topics; researchers are free to design their own research programmes and the number of individual projects within a CRC is more variable than is often supposed.

As to the question of what future standards will be set by CRC and how they will position themselves in relation to other programmes such as Clusters of Excellence and international programmes, only time will tell. But it is clear that the challenges involved will not decrease. Recognising these and other future issues early on will help ensure success and maintain the diversity of the German university landscape.

Prof. Dr. Katja Becker
is a Professor of Biochemistry and Molecular Biology at Justus Liebig University Giessen and Vice President of the DFG.

*"**Collaborative Research Centres** (CRCs, Sonderforschungsbereiche) are joint interdisciplinary research centres based at universities and other doctorate- granting higher education institutions. They promote research cooperation within the framework of interdisciplinary research programmes. Collaborative Research Centres enable researchers to pursue ambitious, elaborate and long-term projects by focusing and coordinating the resources of universities." (From: "Guidelines Collaborative Research Centres Programme", DFG form 50.06 – 07/18)*

Stimulus for Research, Food for Thought

50 years of Collaborative Research Centres – a special celebration for a unique success story

Well-chosen words are an important part of any celebration, but more than that is needed to make an event successful and ensure it is remembered for a long time afterwards. The special event to mark the 50th anniversary of the Collaborative Research Centres programme, held on 22 November 2018 at La Redoute – a beautiful 18th-century ballroom venue in Bad Godesberg in Bonn – delighted the 220 guests by combining celebration and appropriate words with the showing of a specially produced short film and lively entertainment from a cabaret artist.

DFG President Prof. Dr. Peter Strohschneider (top right page) explained the role of the CRC programme, established in 1968, in Germany's funding landscape and praised its proven capacity for productivity and flexibility from a structural perspective. This success story, said Strohschneider, is due firstly to intelligent "adaptation to research structure needs" and secondly to the complex "inherent dynamics of the programme".

He noted that the 1,000 CRCs approved since the programme began have created, supported or leveraged disciplinary and interdisciplinary research dynamics, with lasting impact. In this way, they have become indispensable "agents for major research at universities".

The insider perspective was followed by an outsider's viewpoint from Prof. Dr. Klement Tockner, president of the Austrian Science Fund. Making reference to Austria's Special Research Programmes, he praised the achievements of the research groups in both Germany and Austria as the "backbone of European basic research".

Another insider perspective, this time from a decision-maker, was provided by Prof. Dr. Wolfgang Leininger, a long-serving member of the Senate and Grants Committee for CRCs. He reminded his audience of how combining expertise in directly and indirectly relevant disciplines has contributed to the "success model" of the CRC programme.

The guests were then treated to an 11-minute film illustrating the importance of CRCs from the perspective of science policy, research administration and researchers themselves. He summed up by saying: "50 years of CRCs have given the country an unequalled stimulus."

Finally, there was food for thought from cabaret artist and physics graduate Vince Ebert (below). As well as sharing some insightful thoughts on big data, data overload and AI, he expressed his conviction that human creativity, based as it is on imagination and empathy, cannot be surpassed by machine intelligence. "That's why I'm a fan of science and research," said Ebert. What more needed to be said? **RU**

Illustrations: DFG/Danetzki

In their own words …

PROF. DR. CHRISTOPH PETERS, SPOKESPERSON FOR CRC 850, FREIBURG

I've been working in Collaborative Research Centres almost continuously since 1978, that's 40 years – and I'm still inspired by the possibilities it offers you as a researcher.

PROF. DR. CLAUDIA VEIGEL, PROJECT LEADER IN CRC 863 IN MUNICH, WHO WORKED IN THE UK FROM 1995 UNTIL 2002

Working abroad, you can only envy colleagues and early career researchers based in Germany, because in a CRC they have the opportunity to collaborate on interdisciplinary research at the highest level and with easy, effective communication within the group.

PROF. DR. BARBARA BRÖKER, REVIEWER, GREIFSWALD

The painstaking process of reviewing a proposal for a Collaborative Research Centre, which demands a lot from everyone involved, is itself a form of recognition of the hard work put in by the participating researchers. Both applicants and reviewers value these on-site evaluations, which often serve as a forum for in-depth scientific discussion. This gives added value to the review process.

PROF. DR. BIRGIT MENG, FEDERAL INSTITUTE FOR MATERIALS RESEARCH AND TESTING, MEMBER OF THE CRC GRANTS COMMITTEE

I am approaching my new role as "reporter" with a degree of awe. The different expectations of the various parties involved (from applicants to DFG bodies) entails a great deal of responsibility, combined with an equal amount of trust, because objectively evaluating and balancing all interests is no small challenge.

DR. ANNEROSE BECK, STATE REPRESENTATIVE FOR SAXONY, GRANTS COMMITTEE ON COLLABORATIVE RESEARCH CENTRES

The decision of the Grants Committee on Collaborative Research Centres comes right at the end of the application process for a CRC. Serving as a state representative on such a committee is enjoyable and interesting, but also difficult. Enjoyable because you can see how efficiently the self-administration of the German research system works, what exciting, innovative and relevant ideas are coming out of our universities and research institutions, but difficult because not every proposal can be approved.

PROF. DR. KLAUS GERWERT, SPOKESPERSON FOR CRC 642, BOCHUM

CRC 642 is a striking example of how the DFG enables excellent research at universities by establishing and supporting Collaborative Research Centres and thus contributes to structural change within universities and their international visibility.

PROF. DR. ERNST SCHMACHTENBERG, FORMER RECTOR OF RWTH AACHEN UNIVERSITY

CRCs are perhaps the most important format for developing dialogue in research.

PROF. DR.-ING. KARL-ERNST WIRTH, REVIEWER, ERLANGEN

The CRC programme is the only (or at least the best) environment that offers the complex and long-term framework required for real, in-depth basic research.

1968

Where it all began: Collaborative Research Centres are introduced on the recommendation of the German Council of Science and Humanities. The DFG-administered programme gets underway with 17 research groups.

1972

A new statutory body: the DFG Joint Committee appoints a Grants Committee for CRC funding.

1973

The first CRC to be led by a woman is approved (CRC 115).

1982

Long-term but not perpetual support: in line with a recommendation by the German Council of Science and Humanities, the Grants Committee limits the funding duration to a maximum of 15 years.

1992

After unification: the DFG gives the green light to four CRCs in the former East Germany (two in Jena, one in Halle and one in Greifswald).

1996

Knowledge transfer: researchers can now propose applied research projects with partners in industry.

"More Important than Any Other Funding Instrument"

Having served as the spokesperson for the CRC "Ritual Dynamics" for many years, Indologist Axel Michaels is well acquainted with the special characteristics of these groups – including CRC visits as a form of ritual in themselves. An interview

german research: For many years, you headed the Cultural and Religious History department here at the South Asia Institute in Heidelberg. How important is the institute to you and your work?
Michaels: For me it's the ideal institute in a unique environment, because it brings together classical Indology and other research groups focusing on Asia – covering ethnology, geography, history and modern Indology. This permits an amazing exchange of ideas.
Presumably the CRC "Ritual Dynamics", for which you were the spokesperson for 11 years, benefited greatly from that. How would you sum up the achievements of the research?
Over time, we've been able to show and communicate that rituals aren't what people tend to think they are, which is rigid stereotypes. They are dynamic events that continuously change and evolve. These dynamics are found in various domains – there is a social, a historical and a psychological dynamic. Scholars in many fields are now thinking in terms of dynamics like this.
It sounds as though a new research paradigm has emerged?
Yes, absolutely. This was actually the hypothesis we first started with – over a large span of time, from the first evidence and documentation of rituals to the present day, and over a large geographical area, from Europe to Asia and beyond. We've found confirmation of our assumption throughout the centuries and across different regions.


Illustration: DFG/Lichtenscheidt

What is surprising to read in publications of the CRC is the fact that there are more rituals in modern times than there were in the past. Why is that?
Yes, indeed. When you hear the word "ritual", you tend to think of religious rituals and you think of other cultures, especially those in the past. But when you take a closer look and define "ritual" more broadly, you find that there are also phenomena "here in the west" that can be interpreted as rituals even if we aren't aware of it. I'm not talking about Christmas, but things like Sunday breakfast, for example.
In 2010 you wrote a much-discussed article for the [German daily newspaper] FAZ in which you presented the thesis that a CRC visit has all the hallmarks of a ritual: a formalised procedure, a tendency to exaggerate, ritualised subtle demonstrations of power by the reviewers and DFG representatives, and, if an application is successful, the transformation of applicant to funding recipient. Was this based on your own experience?
Yes, these visits do tend to have the character of ritualised meetings of sovereigns. There is perhaps room to consider whether the current DFG arrangements, associated with this highly structured procedure, need to be that way.
You finished your article by saying: Competition – yes, incentive systems – yes; but please, not too many evaluations. What is the situation like today?
There have been attempts to improve things, but unfortunately not very successfully. Today, we spend a lot of our time on evaluations and reviews. We still aren't really extended that extra measure of trust. The same goes for the review of publications that are somewhat unconventional or don't follow the mainstream. And it also applies to CRCs and their funding.
Quality, interdisciplinarity and international cooperation are all part of any CRC. But what about early career support and the success of measures in this area?
I'm especially pleased about that side of things. We kept statistics and found that nearly everyone who earned their doctorate or worked as a postdoc in the CRC moved on to a very good job, with some of them becoming professors. That's extremely satisfactory.
If you regard early career support as a particular sign of success, what other aspects of a CRC would you say are especially valuable?
What is valuable is that we move away from thinking within the narrow limits of a single discipline. This leads us to different research questions, questions that cross disciplines, that might not have arisen within an individual subject area. It also results in collaboration between larger and smaller disciplines with their respective methodologies. Bringing these together ultimately adds tremendous value for everyone involved.
And the downside?
Sometimes the individual has to make an extra effort to make themselves clearly understood. Occasionally this can be to the detriment of scholarly precision.
Heidelberg is home to the Cluster of Excellence "Asia and Europe in a Global Context". Is this the natural continuation of a CRC with other resources?
The CRC certainly wasn't a direct precursor of the Cluster of Excellence, but it's true that many of the participating researchers are involved in it. The key factor may be the fact that they learned to work as part of an interdisciplinary group. Heidelberg has never had anything like that in this scope in the humanities before. The experience gained and the trust that was built were helpful in approaching an initiative like this with energy and confidence.
The CRC programme is now 50 years old. What do you think will be the future importance of the funding line?
Putting on my visionary glasses and thinking ahead to the next 50 years, I think it will remain more important than any other funding instrument. CRCs were created as a counterpoint to a high degree of specialisation in individual disciplines. This goes hand in hand with returning to key questions of prime importance to scholarship, basic questions that are crucial to humanity and the way we perceive ourselves and our place in the world.
If you could write a congratulatory message to the CRC programme, what would it be?
First of all, congratulations! Collaborative Research Centres are wonderful institutions which I have always publicly advocated for. I wish the CRCs a long and successful future – and for the DFG I wish that the open form of self-administered scholarship that it embodies will continue to thrive and have an impact for a long time to come, including dynamics of change.

Interview by **Dr. Rembert Unterstell** in Heidelberg.

Axel Michaels

Born in 1949, Axel Michaels is a senior professor at Heidelberg University and Vice President of the Heidelberg Academy of Sciences and Humanities. Until 2016, he held the Chair of Classical Indology at the South Asia Institute. He was the director of the Cluster of Excellence "Asia and Europe in a Global Context" and the


Illustration: Philipp Benjamin

spokesperson for Collaborative Research Centre 619, "Ritual Dynamics" (2002–2013), which attracted considerable attention beyond academic circles; for many years he also served on the DFG review board for ethnology, religious studies and non-European cultures. His main interests are the cultural history of Nepal, ritual research, the social and legal history of Hinduism, and ethno-indological studies.

1997
New CRC independent junior research groups allow early career researchers working independently to receive employment and project funding for up to five years.

1999
Introduction of the CRC/Transregio variation: the DFG paves the way for joint CRC proposals by multiple universities.

2002
The funding period for Collaborative Research Centres is extended from three to four years.

2003
Financial resources: CRC 638 "Dynamics of Macromolecular Complexes in Biosynthetic Transport" becomes the first CRC to be awarded €10 million in funding.

2005
Bringing science to the public: the first individual project is approved – an exhibition on "Ritual[s] in Ancient Europe".

2006
Integrated Research Training Groups are introduced, drawing on a wealth of experience from the Research Training Groups funding programme.

CRC funding in facts and figures

Did you know …?

Assumptions and uncertain facts are everywhere, often passed on from one person to another without much thought. Sometimes they bear little relation to a complex reality. This can also be true of CRC funding, in some scientific communities more than others, with often more assumptions than actual facts. The editors invite you to put your knowledge of CRC funding to the test with a fun quiz. Can you tell fact from fiction? You'll find the answers and further information on page 36.

1 Is it true that some CRCs have more than 40 project leaders?

2 Is it true that all draft proposals given an "A" rating in the consultation are later established as a CRC or TRR?

3 Is it correct that there are also CRCs with less than 10 individual projects?

4 Is it correct that the total number of publications by all members of a group is an important criterion for success in the review process?

5 Is it the case that CRCs decided on by the Grants Committee at its May meeting have better chances of being approved than those discussed at the November meeting?

6 Is it true that every CRC requires an integrated Research Training Group?

7 Is it true that the annual budget of a CRC, excluding the programme allowance for indirect project costs, must be between €2 million and €2.5 million?

8 Is it correct that more than 1,000 CRCs have been established since 1968?

9 Is it correct that there are more funded CRCs in the life sciences than in any other discipline?

10 Do statistics confirm that at least one CRC is currently (2018) being funded in all 16 of Germany's federal states?

2007

Introduction of a programme allowance for indirect project costs, initially 20 percent and now 22 percent for all CRCs.

2008

Approval of an equal opportunity allowance: CRCs can request a fixed allowance of €30,000 per year.

2009

Structural sustainability: the first CRC to include an information infrastructure project.

2011

The move to make DFG funding programmes modular is implemented for Collaborative Research Centres.

2015

The requirement of local concentration is replaced by a requirement of bundling expertise at the applicant university/universities.

Barbara Stollberg-Rilinger

The Throw of the Dice

In early modern Europe, many things were decided by casting lots – from the distribution of assets to punishments and even elections to public office. When understood as a communicative process and a symbolic practice of a particular time, this method of decision-making also forms part of the mosaic of political cultural history.

Tally stick (manina) and election balls (ballotte), Venice, 1789.

Illustration: Heeke / "Spectacles of Power" exhibition catalogue, Darmstadt, 2008, p. 81

When the trial of the suspects in the NSU murders case began in Munich in May 2013, the limited spaces for journalists were allocated by lottery – with the result that the major newspapers *Frankfurter Allgemeine Zeitung* and *Süddeutsche Zeitung* lost out, while women's magazine *Brigitte* and Munich's weekly local *Hallo München!* secured some of the sought-after places. The use of a random selection process treated all candidates equally, which was considered scandalous given that the different media competing for spaces in court were clearly unequally qualified for the task. The result was a public outcry: was it right to allow such an important decision to be decided at random?

The reasons for such objections are obvious. Generally speaking, we assume that decisions should be based on rational deliberation, weighing up reasons and establishing what is true, good and right. We prefer to plan and manage things rationally, and have a degree of certainty about our expectations. Deciding things by lot, however, means placing matters in the hands of chance. It relieves us of the burdens of deliberation, consultation, negotiation and compromise, but also of personal influence and constellations of power. When the dice decide the outcome, all options are equal; the dice are completely impartial. The act of casting lots epitomises that which we cannot control.

But as irrational as the principle of randomness might appear at first glance, in some situations it can in fact be a rational choice – namely when the available options are in fact completely equal or, conversely, are not comparable. Alternatively, it may be appropriate when there is an unmanageable number of competing criteria as to the "right" decision, when there is insufficient time available, or when the costs of establishing the best option are disproportionately high – in short, when it is more important to reach a decision quickly than it is to reach the "right" one. The use of lots also creates equality between competing parties or options, and may therefore serve as an instrument of democratic participation. In recent times, some political theorists have therefore been calling for the establishment of bodies made up of randomly selected citizens who would be directly involved in the political decision-making process, in a bid to counter the loss of legitimacy of parliamentary processes and political elites. Even research funding organisations have recently been contemplating the inclusion of random elements in their decision processes – although the German Research Foundation is not currently considering such an option. Proposals to place decisions of great importance on a random basis are generally rejected as being frivolous and not intended seriously. But this raises the question of why this should be so – because it has not always been the case. In earlier times, people made use of the throw of the dice much more often than they do today. Does a willingness to cast lots say something about the society in question? And if so, what?

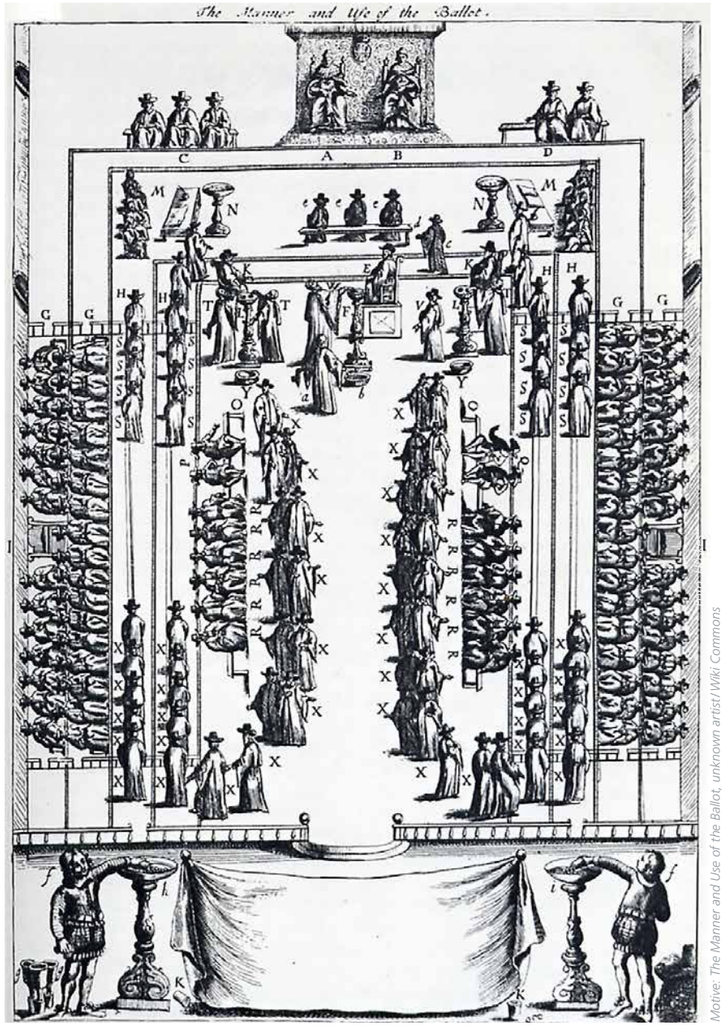
Two soldiers, on the right below the gallows, dice for their lives; Jacques Callot, "La pendaison / The Hanging", Paris, 1633.

Motive: La pendaison, Jacques Callot / Wiki Commons

The art of decision-making has a history of its own. If we understand decision-making not simply as an internal mental process but as a communicative, social occurrence, then it becomes possible to describe historic "cultures of decision-making", according to what a particular society considers capable of and in need of being decided, and how decisions are reached – or indeed avoided. It is by no means always the case that social action is framed, modelled, perceived and represented as an action of decision-making. Making a decision means explicitly distilling a limited number of possible actions from an endless sea of possibilities and, again explicitly, opting for just one of them.

At various times, people have dealt with this specific form of action in very different ways. In our research project, we are investigating exactly how. Historically, making a decision has, if anything, been the less likely scenario because it always represents an imposition. After all, one could always arrive at a different decision instead, and the correctness of the choice made is never guaranteed at the point when the decision is made. This raises questions of legitimacy, gives rise to responsibilities, and brings the possibility of loss of face. For these reasons, people have shown a preference for avoiding decisions.

Casting lots provides a possible answer to these impositions by locating the decision at a level which is inaccessible to the participants, who thereby cede their own capacity for action – albeit only within the framework allowed to chance. In the words of B. Goodwin, casting lots is an instance of "organised chance". Much depends on the question that random chance is intended to resolve and at which point in a process the element of chance is used.



Motive: The Manner and Use of the Ballot, unknown artist / Wiki Commons

Election by lot in James Harrington's utopian "Commonwealth of Oceana", 1656.

In early modern Europe, the process of casting lots was used for a whole array of purposes and with different procedures. In most cases, contrary to what one might assume, it was not about determining the divine will in order to reach the one correct decision. In fact, the *sortilegium*, the process of divination by lots, had been expressly prohibited under Roman church law since the 13th century. It was regarded as a sinful, indeed magical practice, an attempt to compel God to reveal something that he had not of himself chosen to reveal to human reason. Casting lots was only permitted in the context of purely

Motive: Crucifixion, Lucas Cranach der Ältere/Wiki Commons/Saiko

At Calvary outside the gates of Jerusalem: soldiers cast lots for Jesus' garment (detail lower right); Lucas Cranach the Elder, "Crucifixion", 1538.

pragmatic human agreement and when it left God out of things. Of course, this does not mean that people did not still believe in some kind of supernatural involvement when lots were cast, but this was not the primary focus of the process.

Lots were cast, for example, to decide the distribution of assets or unpleasant duties. Which of multiple heirs with equally valid claims should inherit which piece of land? Which doctor should be sent to minister to the sick during an outbreak of plague? Which soldier should be executed *pars pro toto* when the whole troop had refused to obey orders? Most commonly, casting lots formed part of the procedure for choosing who should hold public office. Ancient Athens and the medieval city-states of Venice and Florence are the most famous, but by no means the only, examples of places where this happened. The method was also used in Osnabrück, Münster, Minden and Unna in Germany; in Utrecht, Rotterdam and Deventer in the Netherlands; in Bern, Basel and Geneva in Switzerland; and in the larger German cities of Bremen, Hamburg and Frankfurt am Main. But casting lots was not, as Aristotle once supposed, a sign of democratic equality. The deliberate use of randomness did not mean that the process was entirely free from the influence and control of the elite. Everything depended on the specific framing of the event, which determined the degree to which the process could be controlled.

The annual elections of mayors and councillors in premodern cities were, essentially, nearly always based on rotation and co-option within a defined circle of council families, not free elections

Illustration: Heeke/"Spectacles of Power" exhibition catalogue, Darmstadt, 2008, p. 81

Election instruments from Basel, used to fill public offices by lot, 17th/18th century.

where lots were cast equally between all citizens. There were numerous variations on the process, sometimes of bewildering complexity. Typically, electors were chosen from an existing body by casting lots and these individuals then nominated candidates among whom lots were again cast. For example, the election regulations in the city of Münster in 1721 required councillors to choose, by lot, five *Quartiervorsteher* from among them. Each of these men chose eight electors, known as *Kurgenossen*; these 40 men drew lots to choose ten from among them; these ten chose another 20 *Kurgenossen*; these 20 men chose by lot another ten, and these ten finally elected the new council. Why such a complicated procedure?

It is notable that such random elements were normally introduced during times of crisis, when a city's elite was torn by internal partisanship and its legitimacy called into question by the common citizenry. The randomness principle was intended to eliminate the influence of internal partisanship and patronage structures and combat corruption. It was hoped that this would restore political stability – from which the old established elites stood to benefit the most. The use of lots was intended to achieve this because it had at least three effects. Firstly, it made it impossible to work out who would ultimately be entitled to vote, thus frustrating any attempts at collusion or vote purchasing. Secondly, it involved more people in the process as potential electors, thus enhancing the legitimacy of the outcome. After all, a person involved in the process would be less likely to contest the outcome later. Finally, casting lots protected the participants from losing face and preserved their honour – in those times one of the most valued assets and one of those most likely to generate conflict. Conflicts could escalate easily, because early modern cities possessed only a small amount of executive power. As a result, there were continual strenuous efforts to achieve an impression of harmony and consensus. In a situation like this, the imposition involved in decision-making was especially marked, as decisions expose dissent clearly to view. The fact that early modern cities so often made use of lotteries in their complex election procedures would therefore appear to be characteristic of their specific culture of decision-making.

However, during the course of the 18th century the use of chance as an aid to decision-making was regarded with growing unease. One noted jurist remarked that it was "a kind of ignominy and indignity when such an aid is made necessary by the laws and constitution of a state". After all, how encrusted and corrupt must a society be if it rejected rational deliberation and instead resorted to the caprices of blind chance? Casting lots now seemed like a declaration of bankruptcy on the part of rational decision-making. The greater the confidence in the rationality of human action, the more frivolous the use of a lottery appeared. It is therefore no coincidence that today, when this confidence is increasingly being shaken, it is once again being so much discussed.

Illustration: WWU Münster/Grewer

Prof. Dr. Barbara Stollberg-Rilinger
has held the chair of Early Modern History at the University of Münster since 1997, received the DFG's Gottfried Wilhelm Leibniz Prize in 2005, and became rector of the Wissenschaftskolleg – Berlin Institute for Advanced Study in September 2018.

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www.uni-muenster.de/SFB1150/en

Ute Krämer

The Plants that Suck Up Metal

Contamination with heavy metals can threaten entire ecosystems. The plant *Arabidopsis halleri* has developed an amazing survival strategy. Scientists are now examining how the insights gained through this research can be applied in the biological remediation of soil and water.

Dark spruces, lush green beeches, and a forest path lined with ferns, foxgloves and mosses. For nature lovers, a walk through the woods in summer is a delight. The vast natural diversity of the plants around us always offers new things to discover. But what is less apparent, at least at first glance, is the wide variety of internal, physiological skills of plants that constitute powerful adaptations to the environment. One impressive example of this is plants which, over the course of evolution, have adapted to extremely hostile conditions. Areas affected by such conditions can be recognised through a noticeable sparseness of vegetation. Those few plants which do manage to survive deserve a closer look – because their abilities are extraordinary.

For example, how do plants survive in soils containing high levels of pollutant heavy metals? By studying the thale cress *(Arabidopsis thaliana)* in the Brassicaceae family, which is regarded as the perfect model plant for genetic research, researchers can understand relationships between the genetic information and the plant's capabilities at the molecular level and thus contribute to our general understanding of processes of evolutionary adaptation. However, because the model plant thale cress cannot survive in this type of hostile environment, it makes sense to study a closely related species, *Arabidopsis halleri*, which grows naturally on heavy metal-contaminated soils. Plants like this, with tolerance to heavy metals, could one day help in the re-vegetation or even the clean-up of polluted soil – a growing discipline of applied research over the past 30 years. The ability of some of these plants to accumulate particularly high levels of heavy metals in their leaves could also potentially serve in the extraction of useful metals from the earth, a technique known as phytomining.

All organisms require small amounts of some heavy metals as essential nutrients, including zinc, copper and nickel. By contrast,

Doesn't mind wet feet in nature – Arabidopsis halleri *in a small stream in the Giebelwald near Niederfischbach (Siegerland).*

Photo: AG Krämer

Illustration: AG Krämer

Illustrations: Hagemann

Top: Arabidopsis halleri *in the greenhouse. Second from top: Pollinating a plant. Below: Taking samples for RNA analysis.*

several chemically similar heavy metals, such as cadmium, lead and mercury, have no general nutrient function. All these metals are closely associated with advancements in technology. Since the dawn of the industrial age, soil and water have been polluted with these and other metals at an accelerating rate through mining, smelting, processing and waste disposal. Acutely toxic concentrations of bioavailable heavy metals can be life-threatening to plants, animals and humans. Even far lower concentrations, however, cause long-term damage to ecosystems and human health. In the organs of humans, who are long-living organisms at the end of the food chain, heavy metals can accumulate gradually over time to reach harmful concentrations. This can cause cancer and has been shown to increase the risk of other diseases such as osteoporosis and kidney disorders in the European population (in the case of cadmium).

The toxicity of soils with severe heavy metal pollution, usually in proximity to mining waste or slag heaps, kills off most life. But in a few organisms, processes of random mutation and high selective pressure have given rise to genetically based adaptations that enable plants to survive. We expect to find that the genomes of these plants contain very specific information, a kind of construction manual, for how to tweak a complex molecular machinery to enable each individual plant cell to survive, and the whole plant to reproduce, under these exceptionally challenging conditions.

In the 1960s and 1970s, the vegetation growing at heavy metal-polluted sites was catalogued in detail. At the same time, the plants' tolerance to heavy metals and their ability to pass on this trait to the next generation was tested experimentally. To do this, researchers compared plants with heavy metal tolerance and their close relatives that lacked such tolerance. They analysed what amounts of heavy metals were stored and where in the plant tissue. This research laid the groundwork for the models we have today of heavy metal tolerance in plants. Over the past 20 years, some of the molecular functions responsible for heavy

Illustration: Hagemann

In the lab, metal concentrations are measured using inductively coupled optical emission spectrometry (ICP-OES).

metal tolerance at the biochemical level have been identified and linked to the causal alterations in the genetic information.

One important finding was that all plants – indeed all organisms – have a small tolerance, known as basal tolerance, to heavy metals. This enables them to acclimate dynamically to small amounts of heavy metals in the environment. Researchers achieved groundbreaking new insights into molecular genetics by studying the classic model plant thale cress. In a similar way, promising experimental approaches then began by studying close relatives of this plant. The Brassicaceae plant family, which includes the oil and vegetable plants rapeseed, cauliflower and rocket, comprises a number of heavy metal-tolerant plants. A rare and, at first glance, astonishing strategy of heavy metal tolerance occurs particularly frequently in this family: the strategy known as heavy metal hyperaccumulation.

Metal hyperaccumulators are plant species that store very high amounts of heavy metals, such as nickel, zinc or cadmium, in their above-ground organs. The concentrations reached in the leaves are two or more orders of magnitude higher than the concentrations in "normal" plants, which makes them startlingly high. Current data suggest that approximately one in 200 plant species is a heavy metal hyperaccumulator. Compared with the avoidance strategy of excluding metals from above-ground plant tissues, hyperaccumulation is a very rare tolerance strategy. It is likely that hyperaccumulation helps plants to defend themselves against biological enemies, for example plant-eating insects.

There is enormous scientific interest in these plants, because hyperaccumulation requires tolerance to heavy metals inside the organism – an extremely demanding biological capability. As luck would have it, there are several heavy metal hyperaccumulators among the close relatives of thale cress. Because this makes the molecular

Illustration: Hagemann

Arabidopsis halleri *in a culture vessel.*

Illustration: AG Krämer

Fieldwork against an Alpine backdrop: Arabidopsis halleri *growing in meadows at Poschiavo in the Swiss canton of Grisons.*

and genetic study of heavy metal hyperaccumulation far easier, these plants have given rise to almost all our current knowledge on this remarkable and rare behaviour of plants.

At present, we can say that the rare extreme heavy metal tolerance found in hyperaccumulator plants is based on a sequence of controlled and regulated processes of protein-mediated transport of metal cations across biological membranes in combination with metal binding to specialised molecules inside plant cells. This operates in a manner similar to basal metal tolerance observed in all plants. But heavy metal-tolerant plants differ in that they have much larger amounts of some membrane transport proteins, which has the effect of increasing transport capacity for specific heavy metals. Added to this is a larger amount of the proteins that catalyse the biosynthesis of the organic molecules acting as binding partners for heavy metals inside the plants. The latter results in higher synthesis rates and ultimately larger amounts of heavy metal-binding molecules.

But how do heavy metal-tolerant plants manage to produce increased amounts of these proteins? At the moment, we have only a tentative answer. The number of copies of the corresponding genes in the genetic information is conspicuously enhanced. There are also mutations in the immediately adjacent regions of these genes, which cause each gene copy individually to be read more frequently. Further studies will help us to understand the underlying molecular processes in more detail. In addition, future research will provide a fuller picture of all the functional changes acting together in extreme heavy metal tolerance. This could have long-term benefits for plant breeding, the biological clean-up of polluted soils and phytomining.

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www.ruhr-uni-bochum.de/mgpp/Seiten_en/index_e.html

Christian Hatzfeld, Nataliya Koev, Roland Werthschützky

From Hand to Heart

A cardiac catheterization may be a routine procedure, but it is still associated with a degree of risk. Engineers have now developed an assistance system that allows the guide wire to be navigated more easily and accurately thanks to a miniaturised force sensor and that provides haptic feedback to the cardiologist.

Illustration: dpa /Klaus Rose

Consider this familiar scenario. On the way to work, you stop off for a quick bite at the bakery or grab a coffee to drink on the bus or train. In the evening, instead of getting some exercise in the garden or at the gym, you relax on the sofa and watch TV – or while away the evening surfing the web with your tablet or smartphone. In today's stressful world, this is increasingly typical. But when stress and lack of physical activity are the norm over an extended period, deposits can build up in the blood vessels – with potentially serious results. Combined with other medical risk factors, the result can be a heart attack. When a patient is experiencing warning signals such as a feeling of tightness or chest pain, it is often necessary to perform a cardiac catheterization. In many cases, the problem is a narrowed blood vessel that needs to be widened to reduce the risk of serious consequences.

Left: Cardiac catheterization being performed at a hospital in Iserlohn. Right: The newly developed assistance system with control unit, user interface, control monitor, and model of a blood vessel. The monitor is not required during the procedure. Below: Schematic diagram of the guide wire.

Illustration: Carsten Neupert

Catheterizations of this type are now a standard intervention: according to Deutsche Herzstiftung (the German Heart Foundation), over 1.1 million such procedures are carried out in Germany every year. A thin guide wire is inserted into a blood vessel in the groin or wrist and passed up to the heart. As a guide, the cardiologist uses X-ray images on which the guide wire and blood vessels can be seen using a contrast agent. The wire is navigated to the narrowed area by rotating and pushing using a special handheld tool known as a torquer. Once the required location is reached, the catheter itself can be threaded over the guide wire to treat the narrowed blood vessel. The constriction is frequently widened with a balloon and then mechanically stabilised with a supporting wire-mesh tube called a stent.

Navigating the guide wire to the narrowed point is by no means straightforward: it takes considerable practice to follow the complex, three-dimensional blood vessel pathways in the two-dimensional X-ray images. Friction can easily cause the cardiologist to lose the feel for the force with which the wire is being guided through the vascular system. In rare cases, this can even result in perforation of the vessel wall by the wire.

To reduce this risk there are special training programmes for interventional cardiologists, for example at the Interdisciplinary Training and Simulation Centre (intus) at the university hospital in Würzburg. Here, cardiologists can carry out practice procedures on simulators and models and get a feel for the catheterization process. During a real intervention, they can then draw on experience.

The project "Haptic Assistance System for Cardiac Catheterizations" (HapCath) adopts a new approach in response to the question: How can the cardiologist be provided with additional information during the procedure and a feel for what is going on at the tip of the guide wire? This information could help prevent dangerous situations such as perforation of the blood vessel wall. It also allows the cardiologist to navigate more easily, because branching vessels and deposits can be sensed. This could shorten treatment times as well as reducing radiation exposure for both patient and cardiologist. The same applies to the contrast agent which the patient is given during the procedure for imaging purposes.

To construct such a system, the contact forces between the guide

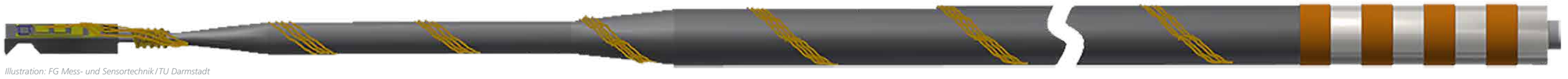

Illustration: FG Mess- und Sensortechnik / TU Darmstadt

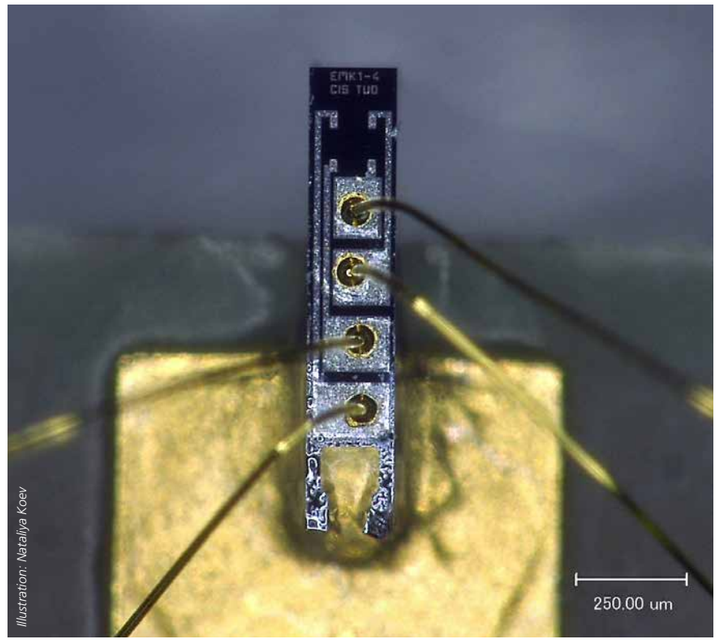

Illustration: Nataliya Koev

wire and vascular system inside the patient's body must be measured and this information made available to the cardiologist. The associated technical challenges are immense. The system needs to be integrated as seamlessly and flexibly as possible into the treatment process. This means that all new functions must be incorporated in existing components, which poses a major challenge in miniaturisation. A guide wire is typically just 360 µm in diameter and up to 2 metres long. This makes it difficult to use established manufacturing techniques, which are not designed for such a difference in dimensions. For several years, the DFG has been funding the development of just such a system, which is now culminating in a transfer project.

The system consists of three components: the guide wire, a force sensor at the tip of the wire, and a control unit. To measure the forces in the vascular system, the team has developed a miniaturised force sensor which is integrated in the tip of the guide wire. The sensor comprises a piece of silicon with areas that change their electrical resistance when the sensor encounters mechanical load. The change in resistance is evaluated to calculate the force being experienced by the sensor. The sensor is designed to compensate as far as possible for undesired effects, for example caused by changes in the ambient temperature. With the aid of special manufacturing technologies as used in the production of microchips, it is possible to construct a sensor measuring just 200×200×800 µm³, making this sensor currently the smallest force sensor in the world.

It is connected to four wires that provide power and signal transmission. As these need to be housed inside the guide wire, coated copper wires with a diameter of 25 µm are used – about half the thickness of a human hair. To attach the sensor the wires are soldered, a manual step that requires not just a small soldering iron but also a very steady hand. Now equipped with an electrical contact, the sensor is integrated into the guide wire.

Illustration: Carsten Neupert

Top: Force sensor for the guide wire tip, shown here on a test board. Right: The handheld tool, known as a torquer, with integrated force sensor, shown with a conventional model for comparison.

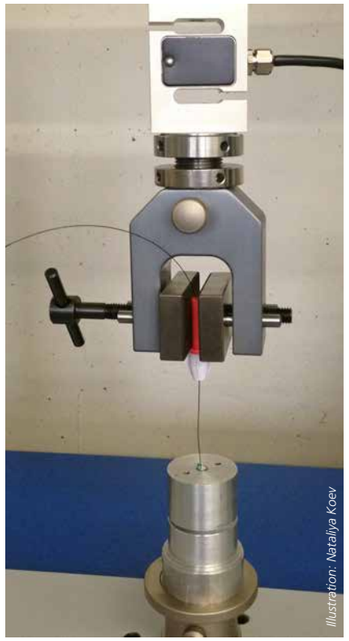

Illustration: Nataliya Koev

Unwavering: measuring the rigidity of a guide wire tip.

The guide wire must have high torsional rigidity and be able to transfer rotational motion at the end as directly as possible to the tip. The wire tip must bend easily so it can be guided through tight bends in a blood vessel, but also stable enough that it will not break.

The design of the HapCath guide wire takes all these requirements into account. For safety and stability it has a high-strength elastic stainless steel core. Around this are wrapped the copper wires of the sensor, which are protected at the rear end of the wire by an additional tube. At the front end, a biocompatible coating protects the wires and sensor and reduces friction inside the blood vessel.

At the tip of the guide wire is a tungsten spring which is opaque to X-rays, making it easily visible in the X-ray image. Standardised tests have shown that this wire has similar dimensions and mechanical properties to the kind of wires typically used in cardiology.

To process and display the measured forces, the control unit filters and amplifies them and feeds them back to the wire via the user interface. This consists of a motor which transmits the signals as feedback force to the guide wire, clamped in a roller system. The guide wire transmits the forces via the torquer to the cardiologist's fingertips. For safety reasons, the roller system is designed to allow only a certain maximum force to be applied and minimal influence on the rotation of the torquer.

Also for reasons of safety, the HapCath system uses a special torquer with extra sensors: an additional force sensor monitors whether the cardiologist is shown the force actually required. An integrated contact sensor ensures that haptic feedback is only active when the torquer is securely gripped in the hand.

To test the system, TU Darmstadt is collaborating with clinical partners who are assessing its usability and integrability in everyday practice in the cardiac catheterization lab. Other applications using individual components are also being investigated. For example, Prof. Dr. Wolfram Voelker, head of the intus training centre at the University of Würzburg, sees new possibilities in simulation training for cardiologists.

The assistance system therefore offers opportunities at multiple levels to make catheter interventions safer for patients and cardiologists alike. Easy integration in treatment routines allows the technology to be used in response to requirements in complex interventions, thus helping to ensure the success of the procedure. But of course, healthy outcomes could also be achieved without the need for surgery – with a healthy diet, regular exercise and a better life-work balance.

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www.emk.tu-darmstadt.de/must/forschung/projekte/hapcath-haptisches-katheter

Péter Maitz and other authors*

Rediscovering a German Creole

„Unserdeutsch“, a creole spoken in a former German South Pacific colony, and what is now Papua New Guinea, is being extensively documented and studied by linguists for the first time. There is no time to lose, because after a chequered history the world's only German-based creole – long ignored – is facing extinction.

Learning about the language was a matter of pure chance. In the late 1970s, a young high school teacher, Craig Volker, was teaching German on the Queensland Gold Coast, in Australia. In his class, there was a Melanesian student whose family had come from Papua New Guinea. She seemed to speak a strange-sounding kind of German. His curiosity was piqued and steadily grew. He travelled to Rabaul in the Bismarck Archipelago to discover the language spoken by its people.

His interviews there formed the basis for his master's dissertation, as yet unpublished. They described for the first time the main features of the newly discovered language. But for thirty years, Germanists showed virtually no interest in this linguistic heritage of the German colonial era.

Briefly, its history is as follows. Unserdeutsch, also known as Rabaul Creole German, developed around a Catholic mission at Vunapope, today part of the town of Kokopo, near Rabaul in the north-eastern part of New Britain. This island, which in the German era between 1884 and 1914 was known as Neupommern (“New Pomerania”), is the largest in the Bismarck

Unserdeutsch speakers in Brisbane, Australia, 2016.

Illustration: Péter Maitz

Archipelago and is now part of Papua New Guinea. The Missionaries of the Sacred Heart of Jesus in Vunapope came from Hiltrup, near Münster in Westphalia.

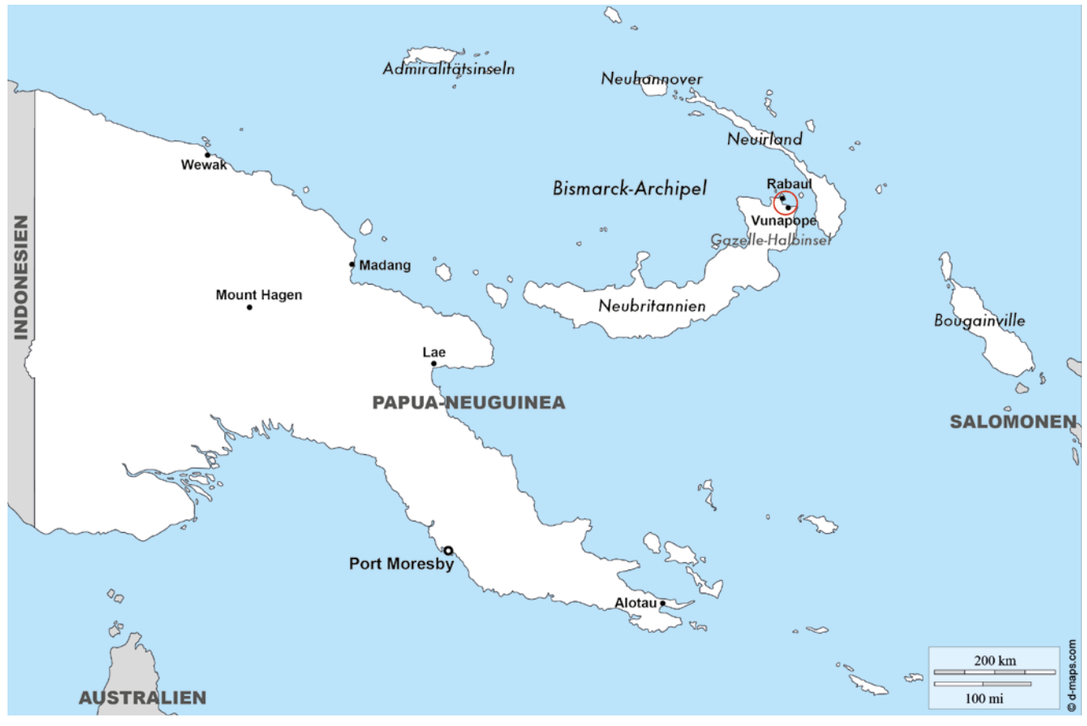
The missionaries' efforts to Christianise the local population were largely unsuccessful and at times, bloody violence even broke out. Louis Couppé, the French bishop at Vunapope from 1889, therefore adopted a new strategy: to form a new young "Christian core" at the mission in order to, as one historian puts it, "let Christianity work through the old society like yeast in dough".

Mixed-race children born to European colonists or Asian immigrants and indigenous women were gathered at the mission. They were brought to the orphanage, founded in 1897, at as young an age as possible. At a later age, as Missionary Arnold Janssen (1869–1938) lamented, in a manner typical of the racist attitudes of the colonial era, "they bring with them evil habits which are difficult to eradicate; moreover, the learning of a European language becomes more arduous the older they are". In the orphanage and the boarding school that was associated with it, children received German lessons and German was also the everyday language of the mission.

The linguistic diversity of Papua New Guinea is globally unique: no less than 840 different languages are spoken here by a population of just 7.6 million people. As a result, the children brought to Vunapope had different linguistic backgrounds. The only thing they had in common was Tok Pisin, an English-based pidgin, which they spoke with differing degrees of fluency according to age. However, the children were forbidden to use the lingua franca of Tok Pisin, which was denigrated at the mission as the language of the indigenous *Kanaken*. The only option that remained was German.

The young people developed their own language which had the advantage of expressing their separate identity while distancing them from the language of the missionaries. This language was Unserdeutsch ("Our German"). As well as its communicative function, it fulfilled an important social function in the community, marking and stabilising group awareness in the uprooted, small and socially isolated mixed-race community. Because Unserdeutsch functioned from the beginning as an "in-group" language within an isolated community with a dense social network, it evolved quickly.

Map of Papua New Guinea. Unserdeutsch developed at the Catholic mission in Vunapope on the Gazelle Peninsula.



Graphic: AG Maitz / Template: d-maps.com)

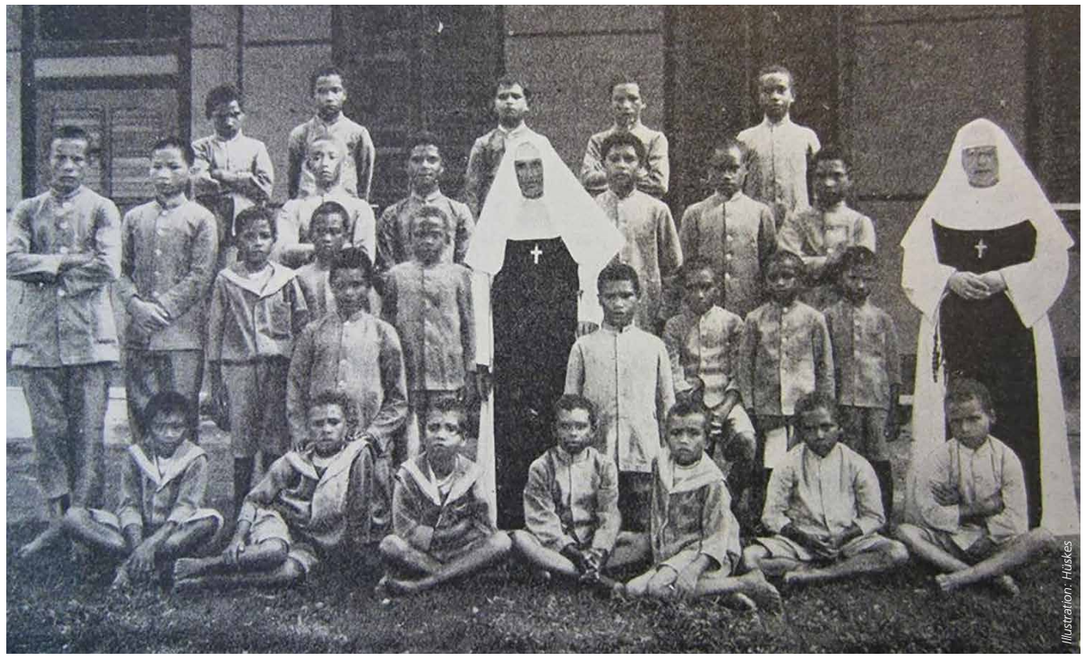


Illustration: Huskes

A historical document from 1932: children at the Vunapope boys' school in East New Britain.

What are the characteristics of Unserdeutsch? While the vocabulary is identical to the Standard German of the time, with traces of Tok Pisin (e.g. *kakaruk*, "chicken") and English (e.g. *schtor*, "shop"), the pronunciation and grammar show clear influences from Tok Pisin. Vowels are usually short (hence Standard German *geht* is pronounced *gätt*) and fully articulated even in unstressed syllables (thus *kochen* becomes *kohän*). Some sounds are replaced, for example ü and ö (*Frühstück/frihstick*, *größere/gresere*) and the complex sounds *pf* and *ts* are simplified (*Pflanzung/flansung*). Consonant clusters are normally simplified and often omitted completely at the end of a word, as in *am aben*, "am Abend" or *i nu sa*, "ich sag nur".

In terms of grammar, nouns are not declined. There is only one definite article, which always remains the same: *de knabe* (der Knabe, boy), *de mädhen* (das Mädchen, girl), *de kokonuss* (die Kokosnuss, coconut). The plural of nouns is formed by preceding the word with *alle*: *s(ch)westä*, "(one) missionary sister" versus *alle s(ch)westä*, "missionary sisters". This corresponds to the pattern of plural formation in Tok Pisin. Both languages have few inflected endings. Unserdeutsch typically makes no formal distinction between main and subordinate clauses, so unlike Standard German, even a subordinate clause follows the order subject–predicate–object. This also applies in imperative sentences (*du komm sitzen in mein office!* – "Come and sit in my office") and in questions, where the interrogative can occur at the end of a sentence: *i hat gemahen was?* – "What did I do?". This phenomenon is also observed in Tok Pisin.

So how was Unserdeutsch able to survive until the present day? On completion of their schooling, the young people stayed on at the mission and learned a trade or domestic skills. Many of them spent

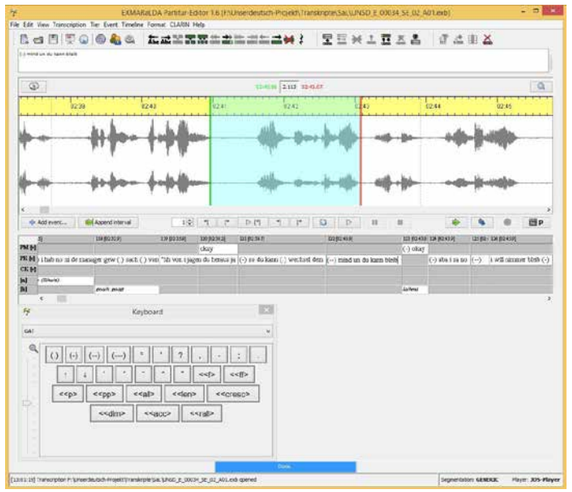


Illustration & Screenshot: Péter Maitz

Left: Recording speech and video with an Unserdeutsch speaker in Brisbane, 2016. Right: The recordings are transcribed with the help of the EXMARaLDA software. Below: A cloud of Unserdeutsch words and phrases.

the rest of their lives working in the mission's workshops or on its plantations. The missionaries also arranged marriages between them. As a result, Unserdeutsch became a shared language in the home and within families, and children of the first generation of speakers grew up with Unserdeutsch as their mother tongue. The language thus became a creole, a grammatically simplified contact language that develops a native-language function.

The next generation was also educated at the mission school. After the start of the Australian occupation of New Britain in 1914, the influence of English increased, but at the mission German remained the dominant language because the German missionaries were not obliged to leave. It was only following the Japanese invasion in 1942 that German was consistently removed from school life. From this point on, Unserdeutsch was only spoken at home, between friends and at work.

The independence of Papua New Guinea in 1975 marked the next major change for its speakers. Following the introduction of the government's localisation policy, which promoted indigenous workers and businesses, the mixed-race community of Vunapope feared denigration and discrimination. Even at the mission, they lost their jobs. Many emigrated to Australia in the hope of finding a better life for themselves and their children. Today, most of the remaining 100 or so speakers are scattered throughout the states of Queensland and New South Wales in eastern Australia. This was what brought Craig Volker into contact with Unserdeutsch and its unique linguistic features.

The surviving speakers of Unserdeutsch are nearly all over 65 years old. They have not passed the language on to their children. Unless it undergoes a revival, Unserdeutsch will die out in 20 or 30 years' time.

In the project "Unserdeutsch – Documentation of an endangered creole language in Papua New Guinea", linguists are building up a corpus of the language. Thanks to multiple field research trips between 2014 and 2017, over 50 hours of recordings have been made of Unserdeutsch speakers. The purpose of the project is the systematic documentation of the language. Fieldwork has revealed that time is of the essence: two of the speakers interviewed in the early stages have already passed away. The language data collected at various locations in Australia and Papua New Guinea is now being transcribed and analysed. Later, it will be made accessible to international researchers through the Database of Spoken German at the Institute for the German Language (IDS) in Mannheim.

The database complies with current international standards. In addition to sound recordings and transcripts, it includes biographical metadata on the speakers. It is designed to allow language data to be searched efficiently for grammatical phenomena. A follow-up project will involve the detailed linguistic description, primarily in the form of a grammar, of what is possibly the last Germanic language to be described.

Graphic: Herling

In parallel to the corpus work, research is being carried out to reconstruct the history of the development of Unserdeutsch. Here, researchers are presented with the rare situation of being able to trace the emergence and evolution of a language through to its death. What is possibly also unique is the fact that, thanks to the mission school archive, the names of all the individuals who once created this language are known.

The fact that virtually all of the surviving speakers have been located during the course of the project is partly thanks to Facebook. In a closed group set up by the project team, the Unserdeutsch speakers, separated by long distances since their exodus from the island, have joined together in a large network. The group shares news relating to the project and the language community. The project also has its own website which, in addition to information about the project, offers sample recordings to listen to.

The project team perceives a positive change in the speakers' attitude towards their mother tongue and heritage, partly due to the interest and attention of outsiders. Before the researchers arrived, they saw their language through the lens of the widespread, standard colonial-era ideology. They most often described their own language as bad German, incorrect German, or broken German. Now they are developing an awareness of being speakers of a unique language and thus "culture-bearers". This is associated with a desire to use the language more, and with greater awareness.

The old community spirit that permeates the history of Unserdeutsch speakers also appears to be regaining its strength. The project has attracted much international media coverage, being reported in newspapers, on the radio and on television. This also gives grounds for optimism as to the perception, documentation and perhaps even revival of the world's only German-based creole.

Illustration: Zentrale Fotostelle U Augsburg

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www.philhist.uni-augsburg.de/en/lehrstuehle/germanistik/sprachwissenschaft/rabaul_creole_german

Illustrations: Websites of the prizewinners

Leibniz Prizes 2019

DFG to honour 10 researchers with Germany's most important research award

The latest recipients of Germany's most prestigious research prize were announced following a decision by the DFG's Joint Committee in early December 2018 in Bonn. The committee selected ten researchers, four women and six men, to receive the 2019 Gottfried Wilhelm Leibniz Prize. The recipients of the prize were chosen by the selection committee from 122 nominees. Three of the ten prizewinners are from the humanities and social sciences, three from the life sciences, two from the natural sciences and two from the engineering sciences. Each will receive prize money of €2.5 million. The recipients can use these funds for their research work in any way they wish, without bureaucratic obstacles, for up to seven years. The awards ceremony will be held on 13 March in Berlin.

The recipients of the DFG's 2019 "Funding Prize in the Gottfried Wilhelm Leibniz Programme" are (from top left to bottom right):

- Prof. Dr.-Ing. Sami Haddadin, Robotics, Technical University of Munich
- Prof. Dr. Rupert Huber, Experimental Physics, University of Regensburg
- Prof. Dr. Andreas Reckwitz, Sociology, European University Viadrina, Frankfurt (Oder)
- Prof. Dr. Hans-Reimer Rodewald, Immunology, German Cancer Research Centre (DKFZ), Heidelberg
- Dr. Melina Schuh, Cell Biology, Max Planck Institute for Biophysical Chemistry (Karl Friedrich Bonhoeffer Institute), Göttingen
- Prof. Dr. Brenda Schulman, Biochemistry, Max Planck Institute of Biochemistry (MPIB), Martinsried
- Prof. Dr. Ayelet Shachar, Law and Political Science, Max Planck Institute for the Study of Religious and Ethnic Diversity, Göttingen
- Prof. Dr. Michèle Tertilt, Economics, University of Mannheim
- Prof. Dr. Wolfgang Wernsdorfer, Experimental Solid-State Physics, Karlsruhe Institute of Technology (KIT)
- Prof. Dr.-Ing. Matthias Wessling, Chemical Engineering, RWTH Aachen University and Leibniz Institute for Interactive Materials (DWI), Aachen

The Gottfried Wilhelm Leibniz Prize has been awarded annually by the DFG since 1986. Each year, a maximum of ten prizes can be awarded, each with prize money of €2.5 million. With the ten prizes for 2019, a total of 368 Leibniz Prizes have been awarded to date. Of these, 120 were bestowed on researchers in the natural sciences, 106 in the life sciences, 85 in the humanities and social sciences, and 57 in the engineering sciences. The number of award recipients is higher than the number of awarded prizes because, in exceptional cases, the prizes and money can be shared. Accordingly, a total of 395 researchers have received the prize, including 339 men and 56 women.

The Leibniz Prize is the most significant research prize in Germany. Seven past prizewinners have subsequently received the Nobel Prize: 1988 Prof. Dr. Hartmut Michel (Chemistry), 1991 Prof. Dr. Erwin Neher and Prof. Dr. Bert Sakmann (Medicine), 1995 Prof. Dr. Christiane Nüsslein-Volhard (Medicine), 2005 Prof. Dr. Theodor W. Hänsch (Physics), 2007 Prof. Dr. Gerhard Ertl (Chemistry) and in 2014 Prof. Dr. Stefan W. Hell (Chemistry).

www.dfg.de/en/service/press/press_releases/2018/press_release_no_55

National Research Data Infrastructure

DFG to coordinate selection and evaluation of consortia

The DFG will play a key role in creating a national research data infrastructure (NFDI). At its meeting in early December 2018 in Bonn, the Joint Committee agreed to take on new responsibilities following a decision of the Joint Science Conference (GWK) on 16 November to set up a national research data infrastructure in Germany. The DFG will conduct the initial selection process, regularly evaluate the established consortia and manage their funds.

Initial funding of approximately €85 million per year will be available to the consortia for the next ten years. This is expected to fund around 30 consortia, which will be selected in three rounds of calls. The consortia will be evaluated at regular intervals by the DFG. The German Council of Science and Humanities will be responsible for evaluating the overall structure of the national research data infrastructure. The first funding decisions are expected to be made by the GWK in June 2020.

"Research data are a constitutive and complex element of research processes. Creating an infrastructure for research data management is important for the entire research system, as this supports scienceled research practices and access to and handling of data, thereby stimulating and driving knowledge processes", said DFG President Prof. Dr. Peter Strohschneider during the discussions of the Joint Committee. "Therefore, it is good that the research-policy and financial conditions for a national research data infrastructure have been created. It is gratifying to see that this important new funding measure will be built on proven and recognised research-driven principles. The DFG and all members of the Alliance of Science Organisations in Germany have strongly advocated for this result."

Graphic: TIB Blog/www.tib.eu/de

Although the final funding decisions will be made by the GWK alone, Strohschneider was pleased that the Federal-State Agreement is precise on this point: Only consortia with a clear funding recommendation based on the review and evaluation process can receive funding. "This guarantees that, for the NDFI, the selection and evaluation of consortia will be made according to strict research principles," said the DFG President.

An NFDI expert committee comprising researchers and representatives of infrastructure facilities will take on a central role in the next stage of the process. It will conduct the initial selection process and decide which funding proposals will be put forward to the GWK for consideration. The members of this committee were selected by the Joint Committee of the DFG.

The Deutsche Forschungsgemeinschaft

The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) 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 €3.2 billion, the DFG funds and coordinates approximately 32,000 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.

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 96 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.

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

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Answers to the "Did you know …?" questions from pages 10 and 11:

1 – true / **2** – false / **3** – true / **4** – false / **5** – false / **6** – false / **7** – false / **8** – true / **9** – true / **10** – true

List of current Collaborative Research Centres: www.dfg.de/en/funded_projects/current_projects_programmes/list/index.jsp?id=SFB
More information on Collaborative Research Centres : www.dfg.de/sfb/en

GERiT

German Research Institutions

The German research landscape is large and varied. The new information portal GERiT – German Research Institutions – provides an overview of approximately 25,000 institutes at German universities and non-university research institutions, organised by subject area as well as by geographical and structural criteria. Provided by the DFG in partnership with the German Rectors' Conference (HRK) and the German Academic Exchange Service (DAAD), GERiT replaces the well-known Research Explorer. It allows users to search for institutes in a particular field with the aid of a finely structured classification system. The system identifies more than 650 different subject areas. GERiT gives an overview of German research institutions in both English and German. This includes information about the disciplines represented at a particular institution, contact details, location maps and links to each institute's own website. For many universities GERiT also provides a link to the institution's own careers portal. GERiT is linked to the HRK's Higher Education Compass, giving access to information about doctoral programmes at each institution. Information about DFG-funded research projects listed in the DFG's own information system GEPRIS can also be accessed. GERiT is therefore a useful tool for international research marketing, promoting Germany as a research destination.

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