



Maths matters

The German Year of Mathematics

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The year 2008 was officially declared 'Mathematics Year' in Germany. This created an unprecedented opportunity to work on the public's view of the subject, and the main goal of the year was to bring a new, fresh, multi-faceted image of mathematics to the general public. Although the Maths Year 2008 was primarily 'a German affair', I believe that a number of the lessons we learned in preparing the Year and in promoting it to the media may be of interest for the readership of the *Gazette*. There certainly has been a great amount of international interest, with Italy, France and India considering running their own Maths Year.

Started in 2000, the Science Years are part of a great PUSH (public understanding of science and humanities) initiative in Germany. Each year the German Federal Ministry of Science and Education has dedicated the year to one particular science, beginning with Physics in 2000, years for the natural sciences of biology, chemistry and geology, a year of computer science, and special years for celebrating Einstein in 2005 and the humanities in 2007.

By now the science years in Germany have acquired a number of well-tested and successful components that happen every science year, such as:

- big events, for instance the opening and closing gala and the week-long 'Science Summer', which took place in Leipzig in 2008;
- exhibitions, including a large exhibition on the 'Science Ship' that travelled on the Rhine, Danube and Elbe rivers all summer, and last year attracted 118 000 visitors during its four-month run; and
- a major media and PR campaign.

We knew from the outset that it was important to reach not only the general public, but also teachers and parents, in order to influence the way that mathematics is viewed in the schools. Therefore a fourth component was new for 2008:

- much more than in previous science years, we worked to reach the schools (teachers, parents, and thus students).

In an effort to attract gifted high-school students, we created the German Mathematical Society 'Abiturpreis Mathematik'. Each high school in Germany can

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The author acknowledges the kind assistance with this article of Thomas Vogt from the Mathematics Year Contents Office, now DMV Media Office, situated at Technische Universität Berlin.

award the prize to their best mathematics graduate. It includes a book prize, published and donated by Springer, and a one-year membership to the German Mathematical Society. This prize, while initiated in the Maths Year, will be available every year from now.

The motto for the Mathematics Year 2008 was ‘Mathematics. Everything that counts!’. The posters and activities for the schools declare ‘You’re better at maths than you think!’.

Four partners supported the Mathematics Year 2008: the Federal Ministry of Science and the ‘Science in Dialogue’ agency (which represents the German Science Foundation and major research organisations such as the Max Planck Society), the Deutsche Telekom Foundation and the German Mathematical Society (DMV). I was acting as the DMV president — it’s important to have an official position when dealing with politics. We had a budget of roughly 7.5 million Euro for the year: that sounds like a lot of money, but the money is soon gone once you get into professional PR, organise big events, and so on.

A professional advertising agency in Berlin designed logo, print and web appearance for the Year, organised the major events, and ran the editorial (and campaign) office. However, in contrast to the approach of previous years, we insisted on having an additional ‘content’ office for the media work. This is where we bundled expertise from the community, taking care that it was represented in the Year, and ensuring that there was ‘maths inside’ (and that most of the maths was correct) in the publications. Now the year is over, the mathematics content office will continue as a ‘DMV Media Office’, which provides an active platform for promoting maths to the public.

The four major partners that ran the Year had identified several aims, but our main aim was to communicate that mathematics is multi-faceted. It does include learning to calculate, but also much more: mathematics is high-tech, it is art, it is puzzles, and more. Our main message for the year was: There is lots to discover! People who think they don’t like maths haven’t seen much of it. Therefore we tried to show people sides of maths they have not seen yet — or show them aspects that they had not identified as being connected to maths.

In general the public has viewed mathematics as a dull subject, and practically any journalist or other person you talk to refers to miserable experiences from high-school times. Such a bad image cannot be simply changed by a Maths Year, but I think we have made a start. Since ‘anyone who defends himself is a loser’ in public perception, our strategy was not to complain about any bad attitude, but to actively and positively promote new ideas, views, and approaches to mathematics.

To improve the perception is crucial: we need more gifted students of mathematics, and all the sciences and engineering in Germany. This is true now, and will be more dramatic in coming years. When teenagers make up their minds about whether to study maths (or sciences, or engineering), their view of what the subject is about, and what mathematicians are like, is crucial. If mathematicians are bearded, white, 50-year-old males, without private lives, and if mathematics

is about long formulas on chalkboards, why would a gifted 18-year-old girl then want to be a mathematician, and why would she want to study mathematics?

About one hundred bigger and smaller exhibitions all over Germany presented different aspects of mathematics. Maths institutes showed historic objects and science centers developed hands-on objects for children of different age groups. Some exhibitions focused on numbers — where they come from, what they are good for, numbers in nature, numbers in everyday life, lucky numbers and so on. The Mathematical Research Institute Oberwolfach developed and promoted the exposition ‘Imaginary’, showing singularities of algebraic surfaces and other visually-striking geometric objects, mostly in three dimensions and partly rendered as colourful plots on plexi-glass. With the software (which is free to download) every visitor could create objects by themselves. A major German weekly newspaper (DIE ZEIT) had a competition for the most beautiful object being created on its website using the Imaginary software.

One of the most popular activities was the ‘Mathematics Ship’, travelling with a 700 square metre mathematics exhibition along the Rhine and Elbe rivers. The ship stopped at various places for two to four days, and had 118 000 visitors in the four months from May to August. As well as being popular with the public, the course of the ship led to an amazing number of press reports in local newspapers and radio.



Children playing in the Mathematics Ship in summer 2008. The maths-expo was underway on Germany’s rivers for about four months as one of the public attractions of the ‘Jahr der Mathematik’ (photo: Ilja C. Hendel).

We frankly and actively admitted that doing mathematics is difficult. Don’t try to say it’s all easy — this is not true, and people will not believe you. We rather argued that maths is difficult but you need it. Since maths is difficult, it is interesting for the brightest. It is relevant, but also fun. We stated that maths is everywhere — one often just doesn’t notice it. This has turned out to be an aspect that the media were very interested in. There were various columns in newspapers and magazines that focussed on maths in everyday life. One point we stressed is that every one of us uses maths daily without thinking: comparing prices of goods, handing over the right amounts of cash to salespersons, counting how long

to park or to travel here or there. The other point we made is that maths is hidden in many objects of daily use like in iPods (compression techniques), automobiles (aerodynamics, navigation, optimisation of electronics), communication, medicine, drug design and even sports (tactical manoeuvres, scoring systems).

We also thought it important to show that not only doing maths, but also watching maths can be fun — for instance as part of film plots. An active group of mathematicians around my colleague Konrad Polthier from Free University of Berlin organised a Math Film Festival with international help. They created a database with maths films ranging from famous blockbusters to local low-budget productions at universities. They negotiated contracts with film distribution companies under which some major movies became available for free public viewing occasions. Some 50 individuals and institutions in Germany registered on the database, and announced local film festivals consisting of maths films from this database.



Another photo of children playing in the Mathematics ship (photo: Ilja C. Hendel).

There are several lessons that we have learned already:

- (1) Don't try to teach. There's no hope that people will know more maths at the end of the Year. If many people think of maths as something interesting at the end of the Year, we will have been very successful.
- (2) Images, colours, graphics, photographs are important. Several maths calendars were produced for the year, with great images — they immediately sold out!
- (3) Faces are important. A subject is 'abstract' for the media as long as they don't have people to talk to, individuals to write about. For all the press materials, we are presenting or portraying mathematicians as people to talk to.
- (4) Talk to the press. Press releases are one thing to do. But you also have to talk to the key editors about topics that you can present especially for them. My experience is: they are interested!
- (5) Use professionals. For us, the year is an opportunity to get help and learn from the advertising agency, but also from all the other major players. For example, the Deutsche Telekom Foundation has been funding maths education projects for years, and they are also sponsoring new programs for maths teacher education and development.

- (6) Make it a community effort. We worked hard to get hundreds of people from all over Germany involved, inviting people to become ‘maths makers’ for the year. This is the only way to have activities all over the country. A top down campaign cannot have a broad effect. Seven hundred and twenty seven people had registered as ‘maths makers’ by the end of September.
- (7) Use the opportunities. The physics community (represented by the German Physics Society) profited a lot from the Year of Physics 2000 and used it to build infrastructure, enlarge their membership base, and professionalise their web, print and media appearance. Mathematicians all over Germany are working hard to grab the opportunities.

This is my personal, preliminary collection of lessons learned. This was an ambitious project, but our feeling is that with the overwhelming press reactions, and with a huge activity level due to many hundreds of local actors and actions, we succeeded admirably. Of course such a year, which primarily amounts to a PR initiative, cannot solve the great, and interlinked, problems — but it can serve as a jump-start for initiatives and activities that over the years really make a difference.

The year had from the beginning been carried by the community: we were awarded the Maths Year because we, the mathematicians, wanted it. I had a mandate from all the German Maths Societies (including the science teachers association MNU) to start and coordinate it. In the framework of the Years we invited everyone to become a ‘maths maker’ for the Maths Year. So many of the more than 700 maths makers are teachers.

All the larger projects of the Maths Year were designed to last, and stay active after the Maths Year as well. In particular, we hope that all the ‘activists’ feel encouraged by the success of the Maths Year, and will keep on going.

The physicists managed to make their own Physics Society very strong as a consequence of the Year of Physics 2000. I think we are on track to achieve something similar. We are currently making plans for a Mathematics Network Office which would support the Content Office, now DMV Media Office, which would continue our media work, but also support the continuing activities all across the country, and which would for example take care of the maths makers after 2008. Currently we are at the planning stage, and talking to sponsors, in order to realise these ambitious goals.

There will not be another formal Maths Year: the Federal Ministry of Science will in the years to come run years about trans-disciplinary topics, not devoted to a single science any more. However, it seems to me that we’ll make the next few years into Maths Years in Germany as well — we are well-prepared to do so.

A huge campaign like the German Maths Year of course takes a lot of effort, but it definitely seems to be worth the effort. I would like to encourage mathematicians in Australasia to start similar projects. If such opportunities arise for greater, national visibility for mathematics projects, grab them. We’ve made a major try, got some major aspects right, but we are also eager to learn in the process. Thus also, your comments are very welcome!

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 Deutsche Mathematiker-Vereinigung: <http://dmv.mathematik.de>
 Imaginary exhibition: <http://www.imaginary2008.de>
 Film fest website: <http://www.mathfilm2008.de>
 DIE ZEIT mathematics page: <http://www.zeit.de/mathematik>



Photograph: Ulrich Dahl/TU Berlin

Günter M. Ziegler was born in München, Germany, in 1963. He studied mathematics and physics at Munich University, and got his Ph.D. at M.I.T. with Anders Björner in 1987. He held postdoc positions at Augsburg University, at the Mittag-Leffler Institute, and at ZIB Berlin. He is a Professor of Mathematics at TU Berlin since 1995, and a member of the DFG Research Center MATHEON.

His interests connect discrete and computational geometry (especially polytopes), algebraic and topological methods in combinatorics, discrete mathematics and the theory of linear and integer programming. He is the author of *Lectures on Polytopes* (Springer-Verlag 1995) and of *Proofs from THE BOOK* (with Martin Aigner, Springer-Verlag 1998). He served as the editor of the *Notices (Mitteilungen)* of the German Mathematical Society 1997–2000.

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