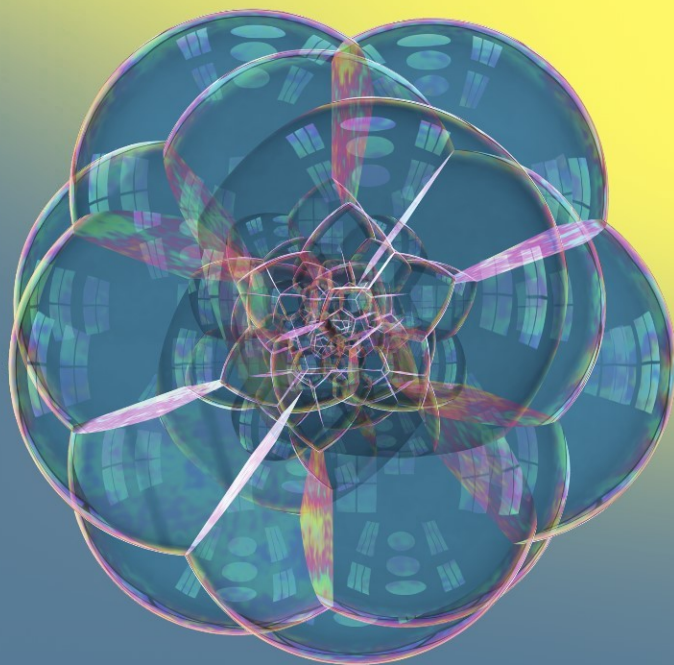


Ehrhard Behrends

Nuno Crato

José Francisco Rodrigues *Editors*

# Raising Public Awareness of Mathematics



Springer

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Ehrhard Behrends • Nuno Crato •  
José Francisco Rodrigues  
Editors

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*Editors*

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# Preface

This book arose from the presentations given at the international workshop held in Óbidos, 26–29 September 2010, as a result of a joint initiative of the Centro Internacional de Matemática and the Raising Public Awareness (RPA) committee of the European Mathematical Society (EMS). The objective was to provide a forum for general reflection with an international mix of experts on building the image of mathematics, ten years after the World Mathematical Year 2000 (WMY 2000). Óbidos, a charming town situated one hour by car to the north of Lisbon, Portugal, was also the site of the re-creation in the year 2000 of the international mathematics exhibition “Beyond the Third Dimension” (<http://alem3d.obidos.org/en/>) and a meeting of the EMS WMY2000 Committee.

The opening of the workshop was also a public “mathematical afternoon” organised by the Portuguese Mathematical Society (SPM) in cooperation with the town of Óbidos. At this event mathematical films and lectures to the general public were presented. The first lecture was given by H. Leitão, from the University of Lisbon, on mathematics in the “Age of Discoveries”, and the second one by G.-M. Greuel, the current president of ERCOM (the EMS committee of the European Research Centres on Mathematics), on the topic “Mathematics between Research, Application and Communication”, which text is included in this book.

During the Óbidos public awareness event, the website [www.mathematics-in-europe.eu](http://www.mathematics-in-europe.eu) of the EMS was officially launched and an itinerant mathematical exhibition, *Medir o Tempo, o Mundo, o Mar*, on the use of geometry to measure the universe and help astronomical navigation, jointly organised by the SPM and the Museum of Science of the University of Lisbon, took place at a local art gallery. This book aims to encourage and inspire action to raise the public awareness of the importance of mathematical sciences for contemporary society through a cultural and historical perspective, and to provide mathematical societies, in Europe and in the world, with ideas and details of concerted actions with other national or international organisations and societies with regards to raising the public awareness of science and technology and other important areas of society that have a strong mathematical component. The book is divided into four parts:

- National Experiences
- Exhibitions and Mathematical Museums
- Popularisation Activities
- Popularisation: Why and How?

**National Experiences** During and after the World Mathematical Year 2000 several European countries started extensive RPA projects in mathematics. In this part of our book activities in the following countries are described: the UK (John D. Barrow and Robin Wilson), France (Jean-Pierre Bourguignon), Germany (an article about the German website [www.mathematik.de](http://www.mathematik.de) by Wolfram Koepf and another about the German Mathematical Year 2008 by Günter M. Ziegler and Thomas Vogt), the United States (Reinhard Laubenbacher), Portugal (Renata Ramalho and Nuno Crato) and Spain (Raúl Ibáñez Torres).

**Exhibitions and Mathematical Museums** Over the last few years there have been a number of (temporary or permanent) mathematical exhibitions. The experiences of the organisers are given: How can one present mathematics successfully? Ehrhard Behrends (the exhibition “Mathema—Is Mathematics the Language of Nature?” during the German Mathematical Year 2008), Albrecht Beutelspacher (the “Mathematikum” in Gießen), Manuel Arala Chaves (“Atractor”), Ana Eiró, Suzana Nápoles, Jorge Nuno Silva and José Francisco Rodrigues (exhibitions in collaboration with the Museum of Science in Lisbon), Enrico Giusti (“Il Giardino di Archimede” in Florence) and Andreas Daniel Matt (“IMAGINARY”).

**Popularisation Activities** The large variety of RPA projects that happened in various countries was really impressive: films, popular websites, RPA using computer games or the history of mathematics. Surprisingly most of these activities were unknown to the majority of participants until this workshop. A number of them are described in more detail here: Ehrhard Behrends describing the international mathematical popular website [www.mathematics-in-europe.eu](http://www.mathematics-in-europe.eu); Franka Brueckler on the problem of how to organise RPA projects with a low budget; Mireille Chaleyat-Maurel on her experiences during the World Mathematical Year, 2000; Krzysztof Ciesielski on how to explain “strange” geometries to an audience of non-mathematicians; João Fernandes, Carlos Fiolhais and Carlota Simões on various projects at the University of Coimbra; Steen Markvorsen on his experiences of an event that had a large impact on raising the public awareness of mathematics; Yasser Omar on RPA projects in developing countries; and John M. Sullivan on the role of pictures in mathematics, art and RPA activities.

**Popularisation: Why and How?** A number of talks were of a more “fundamental” character. This part of the book starts with an article by F. Thomas Bruss, who explains why it is of fundamental importance to improve the image of mathematics. Then Jorge Buescu and José Francisco Rodrigues stress that it is necessary to present “useful” mathematics to convince people that it is important. Barry Cipra asks what advice Martin Gardner would have given us for creating successful popularisation

projects. Maria Dedó also starts her contribution with a question: “How important is rigour in communicating maths?” In Gert-Martin Greuel’s article the focus is whether it is possible or necessary to impart an understanding of mathematics to the general public. Vagn Lundsgaard Hansen advises us to keep mathematical awareness alive, and in the last article António Machiavelo explains why the question of what mathematics really is and what it exactly deals with can only be satisfactorily understood within an evolutionary perspective.

The editors and organisers of the workshop wish to express their gratitude to the Centro Internacional de Matemática (CIM), the Portuguese Mathematical Society (SPM), the town of Óbidos, the Portuguese Fundação para a Ciência e Tecnologia, the Fundação Calouste Gulbenkian, the Munchen RE and the Portuguese mathematics research centres, CMAF/U Lisbon and CEMAPRE/TU Lisbon for their support.

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**Part I**  
**National Experiences**

# Raising Public Awareness in the UK —Some Snapshots

John D. Barrow and Robin Wilson

**Abstract** The United Kingdom has a track record of events to raise the public awareness of mathematics, although mathematics still remains a closed book to the vast majority of UK citizens, and prominent figures are quite happy to admit to their lack of knowledge of mathematics in situations where they would never dream of admitting they knew nothing of Shakespeare or music. In the UK there is a two-pronged approach to mathematics outreach—outreach to the general public, and finding ways to encourage students to pursue mathematics in schools and universities. Below are some of the attempts that have been made in these two directions to improve the situation.

## Gresham College, London

Gresham College was founded in London in 1596 for the purpose of providing free public lectures in a range of subjects for anyone who wished to attend—and 400 years later, this remains its purpose. The wealthy financier Sir Thomas Gresham left money to the City of London and the Mercers' Company to provide for professorships in geometry, astronomy, physic, rhetoric, music, divinity and law. Early Geometry professors included Henry Briggs (the co-inventor of logarithms) and Robert Hooke. In the 1890s Karl Pearson's lectures on statistics introduced the terms 'histogram' and 'standard deviation' for the first time. For a brief history of Gresham College, see Robin Wilson's article in the June 2007 issue of the European Mathematical Society's *Newsletter*.

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The original professors were appointed for life and were required to live in the College (within the City of London), to remain unmarried, and to lecture in both Latin (for visiting foreign scholars) and English (for the general public). Nowadays, professors are appointed for three or four years and recent appointments have included Sir Christopher Zeeman, Ian Stewart, Sir Roger Penrose and Robin Wilson. The current geometry professor is John Barrow, a previous Gresham professor of astronomy.

Each professor gives six public lectures per year, and recent lectures have ranged from Greek geometry to the Riemann hypothesis, from Hilbert's problems to continued fractions, and from the mechanics of a superball to Einstein's theory of relativity. In addition, there are one-off lectures by such figures as Tim Gowers and Simon Singh, and also annual joint lectures with the London Mathematical Society and the British Society for the History of Mathematics. The funding of the lectures is provided (as 400 years ago) by the City of London and the Mercers' Company, and now amounts to about £700,000 per year for about 150 events.

When the second author first held the Geometry Chair in 2004, the total face-to-face audience for the year (for all the lectures) was about 4000. By 2009, this had risen to around 17,000 and continues to rise, with live attendances greatly boosted by online views through the web site. All lectures are now webcast, and from an initial 1000 downloads per month there are now over one million downloads per year worldwide. In particular, all recent Gresham maths lectures can be viewed online on [www.gresham.ac.uk](http://www.gresham.ac.uk).

## The Open University

One particularly effective means for raising the public awareness of mathematics (especially when maths programmes are broadcast on television) has been through the Open University (OU), a major distance-learning institution, which was founded in the UK in the 1960s and initially presented courses in four subjects (mathematics, arts, science and the social sciences) to 16,000 adult UK students. There are now some 260,000 students studying a wide range of topics, including 40,000 students outside the UK, and the number of OU graduates already exceeds two-and-a-half million.

Teaching is by a range of methods, of which the main vehicle has traditionally been the printed correspondence text, prepared by a course team of academics over a period of time. In addition there have been radio and television programmes (over the national BBC network), cassette tapes and videos, home experiment science kits, CDs and DVDs. At one stage, some of our mathematics TV programmes, though designed for 4000 students, were watched by up to 400,000 viewers. There is an increasing use of online teaching methods, including much use of conferencing and iTunes.

Face-to-face teaching is given by over 7000 part-time tutors around the UK who mark the students' written work and give tutorial classes at venues around the coun-



try, as well as communicating with students via e-mail and electronic course conferences. For many years, there were also week-long summer schools that students were required to attend (in one summer over 40,000 students attended summer schools in 15 venues over an eight-week period) or residential weekend courses. Virtual summer schools are now increasingly used.

The assessment of most courses (or modules) is by regular assignments throughout the year (tutor-marked by hand or online, or computer-marked), followed by a three-hour written examination at the end—over many years of studying for a BA degree in Humanities with Music, the second author sent about 60 assignments to his tutors and sat 20 hours of written exams.

Open University students now have a wide range of choices of courses to study, ending with many possible degrees and diplomas, including a range of taught and research higher degrees (MSc and PhD). Most MBA students in Eastern Europe study with the OU, and one-third of the UK's master's students in mathematics take the OU's taught MSc courses (about 600 students per year). Current courses in mathematics include a range of foundation-level courses (about 5000 students per presentation), introductory courses in pure and applied mathematics (800), and higher-level courses in complex analysis (350), groups and geometry (350) and fluid mechanics (250). There are also courses in mathematics education for teachers, and MSc courses in such areas as analytic number theory, fractal geometry, applied complex variables, functional analysis and coding theory.

An early example of a course that the second author originated was a 30-point course on *Graphs, Networks and Design*, written by a team of about a dozen mathematicians and technologists (including a BBC producer). Over a three-year period this involved the production of 1600 pages of printed text, sixteen 25-minute television programmes, and several audio-tapes; this course was studied by more than 5000 students over a 14-year period. More recently, he has written a 10-point history of mathematics course to accompany the BBC TV series *The Story of Maths*, produced jointly by the BBC and the OU and presented by Marcus du Sautoy, Simonyi Professor for the Public Understanding of Science at Oxford University; this course regularly attracts about 300 students per year.

## Broadcasting Mathematics

Much public awareness of mathematics in the UK has been through BBC radio and television programmes—not only the hundreds of OU programmes mentioned above, but also various series and one-off programmes. In his teenage years, the second author used to watch Jacob Bronowski's television programmes (including a memorable one on perfect numbers) which appeared before Bronowski presented his well-known series on *The Ascent of Man*. More recently, there were the four one-hour documentary programmes, mentioned above, entitled *The Story of Maths*; these were watched by up to half-a-million viewers in the UK, were broadcast by BBC World to two million homes worldwide in January 2009, and won first prize

for the best BBC World documentary series of 2009. Other TV programmes have included Simon Singh's *Fermat's Last Theorem* and a series on *Codes*, and Marcus du Sautoy's *Music of the Primes*.

BBC Radio features a weekly series entitled *In Our Time*, chaired by Lord Melvyn Bragg, in which three experts discuss a topic of interest (the telescope, Attila the Hun, humour in Greek plays, etc.). Over the years these broadcasts have included several mathematical topics, including *Archimedes*, *Mathematics and music*, *Prime numbers*, *Newton's 'Principia'*, *Negative numbers*, *Gödel's theorem* and *Henri Poincaré*. They regularly attract audiences of about two million listeners, and all remain available online.

The Royal Society also features all its public and prize-winning lectures on its TV website; these can be found online at <http://royalsociety.org/royalsociety.tv/?from=footer>. Here you will find the Faraday prize lectures of Marcus du Sautoy and John Barrow, as well as earlier popular maths lectures: these lectures attract very large audiences and are webcast live. The Royal Society also has an advisory committee, ACME, on mathematics education.

Every September there is a major public outreach effort at the time of the annual British Science Festival of the British Science Association, formerly named the British Association for the Advancement of Science (see <http://www.britishscienceassociation.org/web/BritishScienceFestival/>). This week-long programme of talks and outreach activities is always hosted by a UK university (it will be in Aberdeen in 2012). It is one of the largest science festivals in Europe, and the week of the Festival is one of the few occasions when science is front-page news in the quality national newspapers. There is a separate mathematics section, and a new president for the section is elected each year. Supported by the mathematics sectional committee, the president is responsible for giving a presidential lecture and organising a stimulating series of talks during the Festival week. Other sections, particularly physics, astronomy and engineering, also regularly feature talks that are of mathematical interest.

The Royal Institution (RI) is another famous institution dedicated to the public promulgation of science and dialogue about its role in society. Although it is best known for its annual series of televised Christmas Lectures, it is also active throughout the year running popular lectures on mathematics and mathematics master classes for keen and able school students (see [www.rigb.org](http://www.rigb.org)).

## The Millennium Mathematics Project

The *Millennium Mathematics Project* (MMP) is an extensive education and public outreach initiative begun by the mathematics and education departments of the University of Cambridge in 1999. The first author directs the project from the Centre for Mathematical Sciences in Cambridge and its principal webpage is to be found at [www.mmp.maths.org](http://www.mmp.maths.org).

The MMP aims to improve the understanding and appreciation of mathematics amongst school students (ages 5–19), teachers and members of the general public. It was set up in response to a perceived drop in the standards of teaching and learning of mathematics in the UK and a perceived lack of appreciation of the role that mathematics plays in science, business and everyday life. From its inception it has been active both nationally and internationally. It combines web-based activity with face-to-face activities in schools, professional development for teachers, video-conferencing to schools, placing students in local schools to support teachers, visits to schools with talks, articles, podcasts and videos about mathematics and its applications for the general public. It is divided into sub-projects that have different audience focuses and different styles of delivery.

The MMP comprises about 17 members, some part-time. They have a range of expertise, spanning research in mathematics and its applications, mathematics teaching, public understanding, editing, fund-raising, administration, and technical aspects of video, web and other modes of presentation. All of the MMP's outputs are free to individual users. The project is supported by grants, donations from benefactors, and some of the science and mathematics departments within the University of Cambridge contribute to the project. In 2006 the MMP was awarded the Queen's Anniversary Prize, the highest award for educational achievement in the UK, and its sub-project PLUS won the Webby Award for the best science education site on the web. In the academic year 2009–2010 the MMP's web-based mathematical resources attracted more than 4.3 million visitors worldwide, while over 39,000 pupils and more than 3500 teachers were involved in its face-to-face activities and events.

The project consists of a family of complementary programmes, each of which has a particular focus:

- The *NRICH website* provides thousands of free resources, designed to develop problem-solving skills and subject knowledge. High-school students send in solutions to problems (only those solutions are published—if a problem is unsolved, it remains so), and there is an Ask NRICH discussion board staffed by Cambridge team members and students who give help and hints to students and participate in discussion threads. All of these threads are archived and indexed: they can be seen and searched at <http://nrich.maths.org/discus/messages/board-topics.html>. Recently, NRICH has been extended to include maths for science and technology (STEM) under the acronym stemNRICH, with dedicated fast-developing web-pages at <http://nrich.maths.org/stemNRICH>: stemNRICH provides free post-16 resources that explore the mathematics underlying biology, physics, chemistry and engineering, to support the school-to-university transition.
- The *Plus website* is an online magazine opening a door to the world of mathematics, and including a careers library of interviews with people who use mathematics in interesting ways in a variety of careers. It focuses on the applications of mathematics and provides articles and interviews with leading mathematicians (see [www.plus.maths.org](http://www.plus.maths.org)). Plus also runs a 'Plus maths news' for registered participants, giving regular updates on what is happening in the world of mathematics, together with updates on mathematical aspects of the news, as well as a blog. The first author has a regular column in Plus called *Outer Space*.

- *Motivate* is a videoconferencing scheme that links mathematicians to schools in the UK and other countries (time zones permitting). It provides bespoke mathematics enrichment sessions for schools by live video-conference, and online multimedia enrichment resource packs. Recently, the project work by schools who participated in this project was published as a research paper in the *Proceedings of the Royal Society B* (see <http://rspb.royalsocietypublishing.org/content/early/2010/10/28/rspb.2010.1807.full>).
- The *Hands-On Maths Roadshow*, *Enigma Project*, and *Risk and Probability Show*: staff visit schools all over the UK and abroad to run hands-on mathematics enrichment activities and workshops; the Risk and Enigma Projects also provide shows for the general public. The Enigma Roadshow is about the mathematics of codes and codebreaking and features a real WWII Enigma machine, as well as an electronic simulation on CD for the participants to keep. The Risk and Probability Show is about many aspects of probability, uncertainty and risk: it is closely linked to the programme for the public understanding of risk, which is run by David Spiegelhalter, the Winton Professor for the Public Understanding of Risk in the Department of Pure Mathematics and Mathematical Statistics at Cambridge, who works very closely with the MMP. The website of his programme, *Understanding Uncertainty*, can be found at <http://understandinguncertainty.org/>.
- A programme of mathematics lectures and events for schools, families and the general public, held in Cambridge. Each year in the UK there is a National Science and Engineering Week to showcase the achievements of science and mathematics: all universities take part in this. At Cambridge, for example, there is a very extensive programme that runs over two weeks in order to accommodate everything on offer. The mathematics departments offer a programme of talks, exhibitions and interactivities for all ages. The Isaac Newton Institute also participates in these activities, and last year it housed a major display of mathematical art.

The MMP has recently developed resources on maths and sport, with a special focus on the London 2012 Olympic and Paralympic Games. This activity, with a new accompanying roadshow, was launched in early 2011. The MMP was chosen as the official Olympic education provider in this subject area by the Local Organising Committee of the London 2012 Games (see [www.sport.maths.org](http://www.sport.maths.org)).

The MMP also maintains close links with other mathematics outreach activities in the UK. These include the series *Maths in the City* by Marcus Du Sautoy and sponsored by the Engineering and Physical Sciences Research Council, of guided mathematical walks in Oxford and East London, (see <http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/H047158/1>), which one of the Plus editors (Rachel Thomas) helps to organise, and Rob Eastaway's *Maths Inspiration Project* (<http://www.mathsinspiration.com/jsp/index.jsp?lnk=200>), which runs at major public venues around the UK. Several other outreach projects exist that aim to enthuse young people about mathematics, see (for example) the FunMaths Roadshow, ([www.maths.liv.ac.uk/lms/funmaths](http://www.maths.liv.ac.uk/lms/funmaths)) of the Liverpool Mathematical Society.

In 2004, the British Government's Department for Education and Skills (now the DCSF), led by the Secretary of State Charles Clarke, gave financial support for the

creation of the National Centre for Excellence in the Teaching of Mathematics (see <https://www.ncetm.org.uk/>). Its present director is Professor Celia Hoyles, and its role is to encourage mathematics teachers to develop their mathematical knowledge and pedagogical skills. Its webpages and local centres act as sources of information and activity in these areas, with the aim of sharing and promoting best practice. They also provide all sorts of stimulating material to help teachers enliven and enrich the teaching of mathematics, for example *the Early Years, Primary, Secondary* and *FE* electronic *Magazines*.

## The Future

We have provided a few snapshots of the maths outreach programmes in the UK in which we participate. They can be followed up in more detail by looking at the web links we have provided in the text. Over the past ten years the profile of mathematics has steadily risen within the UK, but there is more still to be done. This is something that has also been recognised by the national agencies that fund university research in science, engineering and mathematics. Researchers are encouraged to include outreach activities in their research programme and are asked to report on the impact that they have made on society. In the future this evaluation of research impact will play a significant role in the nationwide evaluation of university departments and their research groups. As a result, the profile of public outreach in mathematics is likely to continue to rise and more young mathematicians will be encouraged to participate in this exciting mission. The possibilities of collaborating with European colleagues will add significantly to what can be achieved by sharing best practice and exchanging new ideas.

# Raising the Public Awareness of Math: Discussing Recent Initiatives in France

Jean-Pierre Bourguignon

**Abstract** The article presents some initiatives taken by the Institut des Hautes Études Scientifiques (IHÉS) and a few other French organisations to raise the public awareness of mathematics. They are organised in categories, some rather standard, some more original corresponding to opportunities that have been seized. They all address a public wider than the public of scientists and have involved contributors coming from different backgrounds.

A possible sub-title for this lecture is: *A tour of some initiatives taken by the Institut des Hautes Études Scientifiques (IHÉS) and a few other French organisations to raise the public awareness of mathematics.*

The types of initiatives that will be discussed here are diverse, and they represent only a sample of the actions undertaken to raise the public awareness of mathematics and science in general in France. Here are some typical categories:

1. *Open days* at the Institute
2. Conferences in *unusual* locations
3. A *special lecture series* organised by the Bibliothèque Nationale de France and the Société Mathématique de France
4. Events involving *artists*
5. A *very special adventure* with pictures of scientists, who contributed short texts, and a photographic exhibition that has travelled the world.

This lecture is an opportunity to try and identify:

- Conditions for the success of events whose objective is to raise public awareness,
- Conclusions that can be drawn from these experiences,
- Networks that need to be mobilised.

These initiatives were all addressing a public wider than the public of scientists, and some of them have attracted high school students, and also the general public. This was often made possible thanks to the help of those organisations of teachers

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Fig. 1 Open Days at IHÉS

and mathematicians whose purpose is to create networks. As far as reaching out to high school students is concerned, involving their teachers is clearly critical. The purpose of these events was mainly to create opportunities to meet scientists and get a better understanding of what research is about, and also of how it functions.

## Open Days at IHÉS

Almost every year IHÉS opens its doors to the public, most of the time on the occasion of the Science Week, see Fig. 1, and proposes a variety of activities all centered on the researchers at the Institute and their appearances in different media.

This is of course not very original. Nevertheless each time, the event has been successful bringing a few hundred people to the Institute. It is in particular a very good basis for further contacts and mixing the generations.

## Conferences in Unusual Locations

Over the years IHÉS has organised conferences in *unusual* locations, see Fig. 2. These events were almost all of the same format, namely 20 minute lectures followed by 10 minutes of questions for a sequence of typically eight such lectures. The audiences attending the events were mixed with always a large component of young students.

Another common feature of these events is that they took place in *unusual* places: two of them were held at the Centre Pompidou, the epoch-making building by Renzo Piano and collaborators in downtown Paris. The first event, entitled *Voyage dans l'imaginaire mathématique*, organised in 2000 in the framework of the *World Mathematical Year*, was the first ever mathematical event held there. The 2004 event was called *La face cachée des mathématiques*. In 2008 the event *à la rencontre des*





Fig. 2 Conferences in unusual locations

*déchiffreurs* was held at the Musée des Arts Premiers, a brand new museum in Paris in an impressive building designed by the architect Jean Nouvel.

The science magazine *Pour la Science*, the French edition of Scientific American, was the partner of IHÉS for all these events. The first one was also sponsored by the CNRS who provided the means to record it very professionally. The second one was organised jointly with the Société Mathématique de France (SMF) and the Société de Mathématiques Appliquées et Industrielles (SMAI). For the 2008 event, several foundations helped cover the cost of renting the facilities. It was the major public event in the programme to celebrate the 50th anniversary of IHÉS. Each time these events attracted hundreds of people and generated interesting reactions.

Some of them were held abroad: one took place in Tokyo as part of a week-long series of events organised jointly with the University of Tokyo and Keio University, again during the celebration of the 50th anniversary of IHÉS. In 2010 the Institute took advantage of the special interest raised by the Shanghai World Expo to hold another edition of the *à la rencontre des déchiffreurs* conference at the *Pavillon France* there, partly in French and partly in Chinese, see Figs. 3 and 4, as the Tokyo event had been partly in English and partly in Japanese, with simultaneous translation. In both cases young high school students were involved and could meet prominent mathematicians. In Tokyo, the help of Professor Heisuke Hironaka and of colleagues from the Mathematical Society of Japan was instrumental in the success of the enterprise.

## A Special Lecture Series

Since 2005, the *Bibliothèque Nationale de France* (BNF), in association with the SMF, *France-Culture*, the national cultural radio channel, and the mathematical magazine *Tangente*, has been hosting a special lecture series, entitled *Un texte, un mathématicien*, see Fig. 5. In recent years, the general science magazine *La Recherche* has also been a partner. The purpose is to take a historic text produced



**Philippe LAGAYETTE**  
法国高等科学研究院董事会主席



**Jean-Pierre BOURGUIGNON**  
法国高等科学研究院院长

恭请您参加法国高等科学研究院于2010年10月12日  
在上海世博会的法国展馆举办的“会见解码者”会议。

时间为下午2点30分至7点,会议之后将于法国展馆的餐厅6SENS举行鸡尾酒会。

由于位置有限,请有意参加者用以下方式注册:

- 会议注册方式: 法国高等科学研究院的网站 ([www.ihes.fr](http://www.ihes.fr))
- 鸡尾酒会注册方式: 请于2010年9月27日前发电子邮件至 [touchant-landais@ihes.fr](mailto:touchant-landais@ihes.fr)

注册会议参加者将获得一张当日的世博会入场卷。



**Fig. 3** Invitation for *à la rencontre des déchiffreurs* in Shanghai

#### 演讲名单

**Jean-Pierre BOURGUIGNON** (CNRS-IHÉS), 数学家,  
Flexaedrons不冒烟

**Josselin GARNIER** (Université Paris 7), 数学家,  
噪声生成图像

**HU Sen** (中国科学技术大学), 数学家,  
寻找宇宙的几何

**LIU Kefeng** (浙江大学), 数学家,  
物理对数学的启示

**LONG Yiming** (陈省身数学研究厅, 南开大学), 数学家,  
数学家眼中的太阳系

**George PAPANICOLAOU** (Stanford University), 数学家,  
金融中的数学问题

**LI Ta-Tsien** (Institut Sino-Français de Mathématiques Appliquées, 复旦大学), 数学家,  
暂时未定

**Cédric VILLANI** (Institut Henri Poincaré, Université de Lyon), 数学家,  
星系会休息吗?

**Fig. 4** Programme for *à la rencontre des déchiffreurs* in Shanghai

by a mathematician and to show the way it changed the course of mathematics and discuss its descendance and its most recent consequences.

The series has mostly taken place in the BNF main auditorium, which can hold several hundred people, although some lectures have been given in Grenoble, Avignon and Lens. For each conference, about half of the auditorium is occupied by high school students, who come with their teachers after some preparatory lectures



Fig. 5 *Un texte, un mathématicien*

organised through the extensive network of the association *Animath*, which coordinates the work of several special initiatives in schools lead by teachers. On many occasions, because of overbooking, some people have to watch the lecture on TV sets outside the auditorium. This has become a reference event in terms of reaching out to a wide public. The lectures are now videotaped in a good format and are watched by many people.

### Events Connected with Artists

Connections between mathematicians and artists have been developed in different contexts:

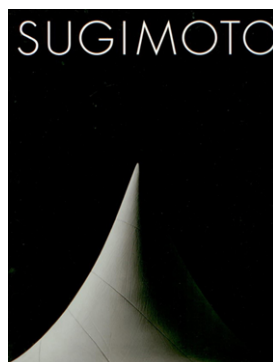
- Some artists are asked to take part in a project involving mathematics;
- Some artists have, on their own, an interest in mathematics, and want to be associated with mathematicians;
- Some mathematicians have been in contact or have inspired artists.

In the first category, there is the sculpture *Lump Bumps and Windy Figures* by the American artist Jessica Stockholder, see Fig. 6. The piece was commissioned by primary school pupils from Longjumeau, near Paris, who explored, during the World Mathematical Year 2000, a combinatorial problem introduced by the Norwegian mathematician Skolem: given a number  $n$ , find sequences of the  $2n$  numbers  $1, 2, \dots, n$  repeated twice, so that the distance between the two occurrences of any number  $k$  is exactly  $k$ . One can represent such a sequence by putting  $n$  two-legged structures, the knights, whose legs are apart by  $1, 2, \dots, n$  units on a board, in such a way that no two knights step on each other's toes. Jessica Stockholder produced a piece, located in the Bois-Marie domain of IHÉS, in two parts: one, merely esthetical, shows the arrangement of 8 objects of sizes 1 to 8 on a chessboard so that one object begins or ends on each line of the board, producing a Skolem sequence in

**Fig. 6** *Lump Bumps and Windy Figures* by Jessica Stockholder, the knights in the foreground



**Fig. 7** Catalogue of the Hiroshi Sugimoto Exhibit

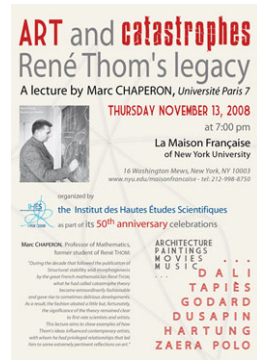


each direction; the other fulfils a request of the children, namely to be able to playfully look for Skolem sequences by moving 8 metallic knights on an 8-line board.

In the second category, there is for example the work of the Japanese photographer Hiroshi Sugimoto, who made magnificent pictures of the collection of geometric surfaces from the nineteenth century kept at the Mathematical Department of the University of Tokyo. The pictures were exhibited for the first time in 2004 at the *Fondation Cartier pour l'art contemporain* in another beautiful building by Jean Nouvel in Paris. I was charged with the task of explaining in the catalogue why these surfaces are mathematically significant, see Fig. 7.

In the third category, one finds René Thom, a former Permanent Professor at IHÉS who passed away in 2002. During his life he interacted with a number of artists: Salvador Dali, who dedicated to him his last series of paintings, among which is the *Topological abduction of Europe* inspired by Thom's work on catastrophes; Jean-Luc Godard, the Swiss film director who produced a movie called *A René*, showing Thom in a provocative way; Pascal Dusapin, a French composer of modern music, whose piece *Loop* is again inspired by Thom's work on catastrophes;

**Fig. 8** Poster for a lecture on René Thom



the Spanish architect Zaera-Polo, who designed the ferry terminal in Yokohama according to a *Thomian* perspective; the German painter Hans Hartung, and the Catalan painter Antoni Tàpies can be added to the list. A lecture on these interactions was given by Marc Chaperon (Université Paris-Diderot) at the Maison française of New York University during the US celebration of the 50th anniversary of IHÉS, see Fig. 8.

### A Very Special Adventure

The following is a most improbable story:

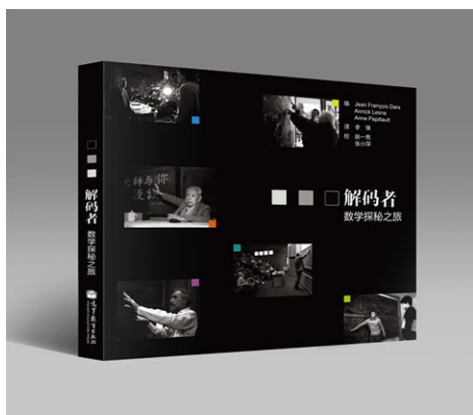
- A couple of film makers employed by CNRS, Anne Papillault and Jean-François Dars, had to find a place to install their equipment after the CNRS decided to stop paying the rent on their professional studio;
- I knew them because we made two movies together, a rather long one on Jacques Tits on the occasion of his retirement and a shorter one on Henri Cartan in connection with the Bourbaki seminar, and they found refuge at IHÉS where they spent four years;
- Jean-François Dars, also a photographer, took thousands of pictures of researchers at work in many instances of the life at the Institute;
- Alain Connes suggested making a book containing the best pictures, accompanied by short texts written by those whose picture was selected. Early in 2008, *Les déchiffreurs* was produced by the French publisher Belin, and is now in its third printing (see Fig. 9); shortly after, an English version was published by A.K. Peters, Boston; a Japanese version was produced later in 2008 by Springer Japan, and a Chinese version in 2010 by Higher Education Press (see Fig. 10); a Korean edition is being prepared.

Some pictures in the book are the result of the exceptional patience of the photographer, like the one in Fig. 11 showing Étienne Ghys lecturing on the Lorenz attractor and the butterfly effect at the École polytechnique (on the occasion of my 60th birthday). A historic text in the book was written in 2007 by Ngô Bao Châu,

**Fig. 9** The French edition of *Les Déchiffreurs*



**Fig. 10** The Chinese edition



**Fig. 11** Étienne Ghys



shown on Fig. 12, who describes his personal experience when he foresaw that he had put his hands on a very simple but very powerful idea while being a CNRS visitor at IHÉS. The conclusion of his article is prescient because, in 2010, he received the Fields Medal for the completion of this work. He wrote: “*Je pense maintenant*

**Fig. 12** Ngô Bao Châu**Fig. 13** Sir Michael Atiyah

*que... cet après-midi-là j'avais vécu l'un des moments les plus décisifs de ma carrière*". Some other pictures show historic figures, such as Sir Michael Atiyah, see Fig. 13, or Eugenio Calabi and Shing Tung Yau, one of the very few pictures where they appear together, Fig. 14, an embodiment of *Calabi-Yau* of a sort.

The very best pictures from the book, about 30 of them, were printed in large format on canvas for a photographic exhibition, which has been touring the world. It has been shown in high schools (such as in Rochefort, France, see Fig. 15), in bookshops in downtown Paris, see Fig. 16, but also in universities and institutes in the US (Chicago, New York, the Institute for Advanced Study), in Japan (Tokyo University and Keio University), and in Thailand (Mahidol University in Bangkok). It is presently touring China thanks to the network of the Alliances Françaises in the country, and will be doing a Tour de France later in 2011–2012.

The exhibition was also presented at the International Congress 2010 in Hyderabad, see Fig. 17, with a few additional pictures such as the one of Shiing Shen Chern shown in Fig. 18 with, standing in front, his daughter May Chu and Louis Nirenberg, the first recipient of the Chern Medal awarded on this occasion.