

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

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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)
- 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

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:

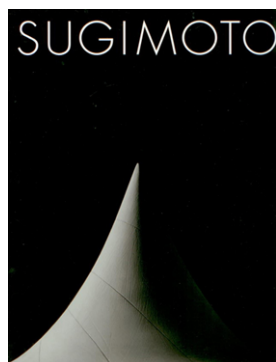
- Some artists are asked to take part in a project involving mathematics;
- Some artists have, on their own, an interest in mathematics, and want to be associated with mathematicians;
- Some mathematicians have been in contact or have inspired artists.

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

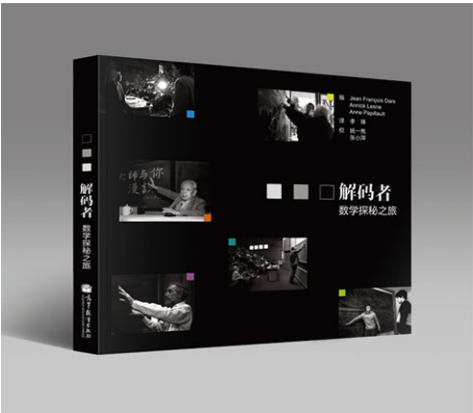


Fig. 11 Étienne Ghys



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.

Fig. 14 Eugenio Calabi and Shing Tung Yau



Fig. 15 High school, Rochefort



Fig. 16 A bookshop in downtown Paris



A Few Concluding Words

From these diverse situations, one can see that a variety of approaches were used in order to reach a mix of people but the most important has been:

Fig. 17 Joanna Jammes (IHÉS) in Hyderabad



Fig. 18 Louis Nirenberg (left), May Chu (right) and a photograph of Shiing Shen Chern (center)



- to seize chances and passing opportunities,
- to do with minimal budgets, while looking for appropriate sponsors ...

Some ongoing projects will rely on the use of much bigger resources and aim for more international visibility in the media but it is too early to say more.

The task to be achieved is immense, due to the very rapid growth of the discipline during the last century, which continues unabated, and its continued sophistication. Mathematicians need to make an in depth transmission of the heart of their discipline. This of course cannot be carried out through the usual channels of school training, which can barely touch recent developments. It is therefore necessary to find appropriate shortcuts, which may have nothing to do with the technical development of the discipline. This is a task that mathematicians need to understand properly. They also need to estimate all the effort that has to go into such an endeavour, give it the appropriate recognition, and they must do so quickly.

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