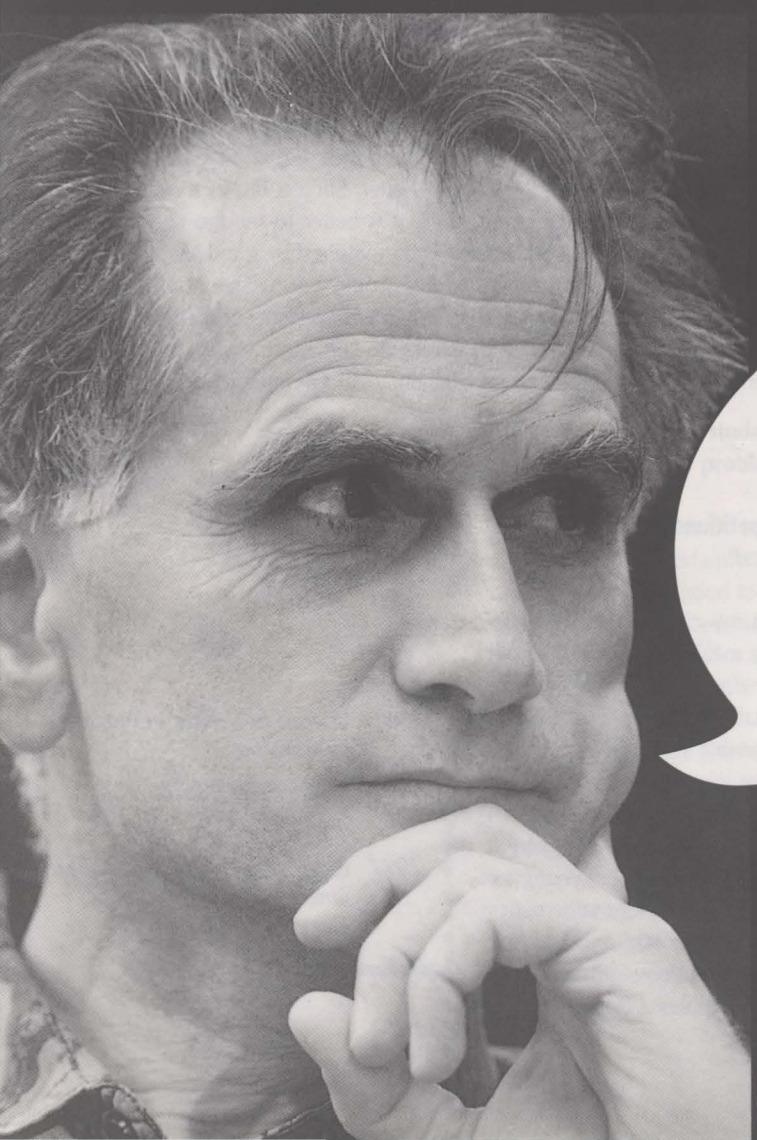
An Interview with

Béla Bollobás

by Pang Yu Hin & Tan Eng Chye

In the afternoon of September 14, 1994, Drs. Tan Eng Chye and Peter Pang of the Singapore Mathematical Society interviewed Professor Béla Bollobás in his office at the NUS where he was a visiting professor, and below is a transcript of the interview. Professor Bollobás had earlier given away the prizes to the winners of the two mathematical olympiads organized by SMS, so the conversation started with his opinion on mathematics competitions. The interviewers are denoted by **SMS** whereas the interviewee is denoted by **BB**.



Oh my God!

It's terrible. It trains you to be more comfortable with numbers to a certain extent, but it has nothing to do with mathematics, it has nothing to do with thinking.

SMS: Do you think that mathematics competitions promote mathematics?

BB: I am a strong supporter of mathematics competitions; I have no doubt whatsoever that, on the whole, competitions serve a very useful purpose: they demonstrate that mathematics is not about getting results by applying well worked out, standard and boring methods, but is full of exciting, beautiful and unusual problems, whose solutions need ingenuity. Competitions should and do awaken the participants to the *beauty* of mathematics and to the role of *ingenuity* and *imagination* in attacking mathematical problems. In my experience, ordinary school mathematics very rarely indicates that one of the greatest assets of a professional mathematician is his *imagination*. Also, competitions enable youngsters to get some idea where they stand compared to their contemporaries, whether they are among the very best in the country at the stage or only better than their school friends.

SMS: So are competitions entirely good?

BB: Not entirely, far from it. The usual competitions have a number of drawbacks. Maybe two of the greatest drawbacks are that they happen only very occasionally and there is a time constraint which makes them too much like exams, which almost nobody likes. Also, it is rather sad, but undeniable, that for some people, competitions may do more harm than good. They think that they are rather good at mathematics and they go along to a competition thinking that they must do well. Then they become very nervous and they don't do well, so they get discouraged.

Personal data:

Born:

3rd August 1943, Budapest, Hungary

Family Status:

Married, one child

Address:

Department of Pure Mathematics and Mathematical Statistics,
16 Mill Lane, Cambridge CB2 1SB, England

Nationality:

British citizen, and permanent resident of the US

Mathematical Competitions:

1957-61 Winner of numerous national competitions in mathematics and physics, including all eight competitions run by the Journal of Mathematics

1959-61 Participated in the first three International Mathematical Olympiads, winning a bronze medal and two gold medals

1965-66 Three-time winner of the National Mathematics Competition (lasting 10 days)

SMS: Do you think that mathematics competitions are just for the elite few?

BB: In some sense this is true, for the people who get the greatest pleasure out of the exam-like competitions are those who do well in them, and they are, by definition, the elite few. For the others the exam-like competitions can even be harmful, by signalling to them that they are not as good as they think, at least not in *that* type of competition, so they may be discouraged. As a matter of fact, this kind of discouragement happens often at Cambridge, and at any other university with outstanding mathematics undergraduates. As a Director of Studies in Trinity College, I have seen many students who are used to being at the top of the school, and upon their arrival in Cambridge, they find two boys on their staircase who are much better. Such a discovery can be devastating. I have to tell them not to be upset, since it is better to see the very best of their contemporaries at close range, so that they know where they stand. As for the competitions, one way to avoid discouraging students would be to have *some* easy problems as well, so that many competitors can go home with a sense of success. But there should also be some genuinely difficult problems, to sort out the very best. For example, the problems at the last International Mathematical Olympiad were far too easy.

SMS: You have, of course, distinguished yourself in mathematical competitions from an early age. When and how did you first become interested in mathematics?

BB: I first noticed that I was quicker and better in mathematics than my classmates at the age of nine and I became interested in the subject. My father gave me his secondary school books to study, but they were not good at all; they were rather dry and didn't encourage thinking. So he found me a tutor who was a senior undergraduate. My tutor was a baron who had lost all his possessions, but just being a baron was a terrible crime in communist Hungary, so he had a very hard time at the university. For the past hundred years Hungary has had a lovely Journal of Mathematics for Secondary Schools, based on points computations for students aged 14-18. In fact, the Journal was founded exactly hundred years ago by a young priest, Dániel Arany, who had the brilliant idea that the competitive instinct of youngster and their fascination with intriguing problems can be used to raise the level of mathematics in the entire country. My tutor introduced me to this journal when I was ten, and I started to solve the problems. For the first four years I could not submit my solutions to the Journal, as I was too young. My tutor also brought me many collections of problems from Hungary, Russia, and other countries.

Sport:

1969 Oxford half-blue in modern pentathlon

1970 Cambridge half-blue in fencing

1971 Represented Great Britain in fencing against France, Germany and Poland

SMS: So did your father encourage you to study mathematics?

BB: Not really, except for giving me his book. My father was a physician, and he very much wanted me to become a physician as well. However, when it became clear that I was totally unwilling to become a doctor, and I had tremendous enthusiasm for mathematics, then he relented and did everything he could to encourage my love of mathematics. He was a great believer in private lessons, so I had more private lessons than official school periods. But my private lessons never had anything to do with schoolwork.

SMS: Was solving the problems in this Journal of Mathematics you mentioned important for your mathematical development, and the development of mathematics in Hungary in general?

BB: Yes, it is difficult to exaggerate the importance of this journal. As I said, the journal is based on points competitions: *every month* eight problems are posed in each category and the readers are invited to submit their solutions to the Journal to be judged. The best solutions are published in a later issue, and the points obtained are totalled up throughout the year. At the end of the year the photographs of the most successful competitors are published, and they are given (rather small) prizes. It is all terribly exciting for a young student!

In order or solve the problems the students are encouraged to *learn* more mathematics and to *read up* various topics on their own. As many students can solve quite a few of the problems, in order to win, the competitors have to give elegant, properly presented solutions, they have to find generalizations and extensions. The upshot of all of this is that the points competition in this journal introduces the students to something resembling proper *mathematics research*, unlike Olympiad-type competitions, which place too much emphasis on speed, and happen only once in a blue moon.

This journal does a great deal to promote mathematics in Hungary. Most mathematics teachers, even those who have rather little talent for mathematics, read the journal and attempt some of the problems. Above all, they use the beautiful problems to motivate their best students.

Professional activities:

Publications

Books:

- *External Graph Theory, Academic Press, 1978*
- *Graph Theory, Springer-Verlag, 1979*
- *Extremal Graph Theory, with Emphasis on Probabilistic Methods, Amer. Math. Soc., 1984*
- *Random Graphs, Academic Press, 1985*
- *Combinatorics, Cambridge University Press, 1986*
- *Linear Analysis, Cambridge University Press, 1992*

SMS: Do you think this environment of mathematical problem-solving can be developed in Singapore?

BB: If it can be done anywhere in the world, it ought to be easily doable in Singapore because here the government is committed to educating the people.

SMS: But here the students have very heavy school work and may not have time to solve mathematics problems.

BB: It is terrible to be too preoccupied with school work. It is harmful not to have enough time to think. Certainly not everyone should spend the same amount of time on mathematics, but it is not good to do school work all the time. Good mathematics standards are important for absolutely everybody, engineers, teachers, economists, and even doctors. If not anything else, mathematics teaches correct *logic* and *a sense of proportion*. It would be terrible if to an economist a thousand and a million are just large numbers.

SMS: The best and the brightest used to go for mathematics at Cambridge. Is this still the case, or have they all gone to business studies?

BB: No, we are still getting the best students. The British education system is rather different from the one you have in Singapore. Unlike in most countries, education in England is *not vocational*. The English have the idea that the role of a university is to train *first class minds;* the subsequent profession of a graduate need not have anything to do with his field of study at the university. Thus, to become a high flyer in commerce, finance or industry, your best bet is to come to Cambridge to do mathematics for three years.

SMS: But you are also faced with the problem of declining standards, as in many other countries?

BB: Yes, the students are weaker, they are trained less in the schools. 'A'-levels are getting easier. We used to get students who knew quite a bit more than was needed for 'A'-levels. Now, because of lack of manpower, Further Maths and 'S'-level Maths have been scrapped in most but the top schools. Most of our double maths students are from Eton, King Edward Birmingham, Winchester, Manchester Grammar, St. Paul's and the like.

SMS: Do you think that the 'A'-level exams have become too routine? Were exams very different during your school days in Hungary?

BB: The philosophy today is that exams must be doable by everybody who has learnt the material, so problems needing imagination are out. I rather regret this: I believe it's wrong to base exams *solely* on bookwork. I much prefer the style I was used to, when we were supposed to come up with additional ideas to solve the questions.

SMS: There have been many Singaporeans reading mathematics at Cambridge. Who do you recall to have been the most outstanding one?

BB: There have been many good Singaporean students, but one stands out among them; Lee Hsien Loong, your Deputy Prime Minister. He graduated at the top of his class, and he really won by a street. The one who came second has now become a world-class mathematician, but it was clear to everyone at the time who was the better one.

Appointments held:

1973-85
Lecturer in Mathematics at Cambridge University

1985-
Reader in Pure Mathematics at Cambridge University

1982-
Professor at Louisiana State University

SMS: Who influenced you most in mathematics?

BB: If it is a single person, then it has to be Paul Erdös, the renowned Hungarian mathematician. He had just returned from the West when, at the age of 14, I won the National Competition, and I was summoned to see him. I was immediately very impressed by him. He was a world famous professor dressed smartly, lived in the best hotel, carried foreign currency, and was a real globe-trotter: he travelled freely in the "Free World". He told me lots of fascinating problems and amazingly, did not talk down to me. From then on we had a lot of contacts, and have quite a few joint papers.

SMS: You have two PhD's in mathematics.

BB: I got my first doctorate in 1967 from Budapest. I wrote my thesis on discrete geometry, related to the spheres-packing, under Fejes-Tóth. During my undergraduate studies, on Erdös' recommendation, I got a scholarship to visit Harold Davenport at Trinity College, Cambridge, for one year. After that, they offered me another scholarship to do a PhD in Cambridge, and I was also offered a scholarship in Paris. But the communist government refused to let me go to either of these places. When after a year in Moscow with Israil Moiseievich Gelfand, I was allowed to take up a scholarship in Oxford in order to learn from Atiyah, I decided not to return to Hungary. I reactivated my Cambridge scholarship and a year later got a Trinity Fellowship. In those days, Cambridge was rather snobbish. It recognized only three doctoral degrees: their own, the DPhil from Oxford, and the PhD from Trinity College, Dublin. So I thought if that's what it takes, I will submit a thesis. I wrote a thesis on Functional Analysis, Banach algebras and numerical range, and got my PhD from Cambridge in 1971.

SMS: A final question. Mental arithmetic(xinsuan) is the rage in Singapore at the moment. What is your opinion of it?

BB: Oh my God! It's terrible! It trains you to be more comfortable with numbers to a certain extent, but it has nothing to do with mathematics, it has nothing to do with thinking. A few days ago, a very clever boy came to see me. While we were talking, I saw that he was spinning his pen around his thumb with amazing skill. I was really impressed. He told me that he had practised for years. Mental arithmetic is a skill like that.

SMS: Is It harmful?

BB: I suppose, like spinning your pen, it is not harmful. But it has *nothing* to do with mathematical education. M²

Dr Tan Eng Chye graduated with an Honours degree in Mathematics from NUS in 1985. He then obtained his PhD in Mathematics from Yale University, USA in 1989. Currently he is a Senior Lecturer at the Department of Mathematics at NUS. He is also Sub-Dean of the Faculty of Science at NUS.