



Mathematical minds

Terence Tao*

Gazette: Could you tell us a bit about yourself?

Tao: I was born here, in Australia, in 1975, in Adelaide. I grew up and stayed here in Adelaide for 16 years. When I was a kid, I was accelerated. I skipped five grades in primary school. This meant that I started high school at age 8. But I was already taking more advanced maths classes (Year 11), even when I was in primary school I took some high-school maths classes. And when I was at high school I took some maths classes at uni. My mother and father had to arrange this with the headmaster and the head of department, so it was very complicated. But it all worked out. When I got my Bachelor degree at Flinders University, Garth Gaudry, my advisor, recommended very strongly that I study abroad, so I went to Princeton and completed a PhD. My advisor in Princeton recommended I stay in the States. I've been with UCLA ever since, pretty much. Except I've spent a few summers in Australia, at ANU and UNSW.

Gazette: When you skipped all these grades, did you skip them in all disciplines or just maths?

Tao: It was staggered. At age 8 I was in Year 8 for things like English, PhysEd, etcetera. But for maths I was in Year 11 or 12.

Gazette: Did your parents encourage you to become a mathematician?

Tao: I think initially they were at a loss. They didn't know what it was that you do as a mathematician. Once they realised that I liked maths more than physics, they were happy to let me do what I liked and I'm very grateful for that. They didn't push me into something. In Asian cultures, there's always a big pressure to do something prestigious like medicine or law, but for some people this is not the best career. I'm happy that they didn't mind that I liked maths.

Gazette: Are your parents still in Adelaide?

Tao: Yes. I'm staying with them while I'm here. It's good to be back. Adelaide hasn't changed much, and my parents haven't changed much.

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This interview took place during the 2009 AustMS conference at the University of South Australia in Adelaide.

Gazette: Have you got any brothers and sisters?

Tao: I have two brothers, both younger than me. One is still in Adelaide and works for the Defence Science and Technology Organisation, and the other is in Sydney and works for Google. It was his dream job. He lobbied quite hard. He even had a web page at one stage explaining why he should be hired by Google, with his resume etcetera. It probably helped him getting the job. Google likes that kind of thing.

Gazette: Have you ever considered working for Google yourself?

Tao: Not really. I like academic maths too much. They do some interesting problem-solving but most of it is programming. I can program, but I'm not as good at that as I am at maths.

Gazette: What do you like most about academia?

Tao: I like academic freedom. You can work on your research, and it doesn't have to be directed. It doesn't have to be what your boss is telling you to do. It is very flexible. And I like teaching, when you get the students to learn something that they couldn't see before. Their eyes light up: 'Ah, I get it now'. And this makes you feel like you're doing something very useful. I like the culture: talking to other mathematicians. Everyone who does mathematics does it because they like mathematics. They are not doing it for the money.

Gazette: Do you do much teaching?

Tao: Nowadays I mostly teach graduate courses. I also have my own graduate students, six graduate PhD students. They are quite mature. I've been gone all month now, and they've been looking after themselves. So they've just sent me an email with feedback for the last three weeks of what they have done. That's great. In my students I look for someone who is independent and mature and hard-working. As long as they have some sense of mathematics, they don't have to be amazing. They can always pick this stuff up later.

Gazette: Did you always like maths?

Tao: Yes, ever since I can remember. My parents tell me that at age 2 I was trying to teach other kids how to count using number blocks. Although as a kid I had a different idea of what mathematics was than I do now. I thought it was always puzzles and games. I didn't really understand why we do mathematics until a lot later. I certainly enjoyed doing the abstract. I also enjoyed doing arithmetic.

Gazette: Do you still like doing puzzles?

Tao: Not so much. I think I get enough of it at work.

Gazette: What made you choose to study maths at school or uni?

Tao: It was what I enjoyed doing. As I said before, I really liked solving puzzles. I really liked it when the rules were very clear: what was right and what was wrong. So I had a lot of trouble with English. English was the subject I couldn't get the point of. 'Write whatever you feel like?' – what does that mean?

Gazette: Have you ever considered doing anything else?

Tao: When I was a kid I didn't know what maths research was. I thought there was someone who gave you problems to do and you do them, like a giant homework project. When I was told you have to come up with your own research problems, I had no idea. How does anyone do that? I remember thinking I'd be a shopkeeper. This was something I understood. You could have inventory, and you'd buy things and keep a record. That seems to make sense. I've done a little bit of consulting for government agencies. This was nice, but I do like the academic environment much better.

Gazette: Why do you do mathematics?

Tao: It is rewarding. When you discover something and it makes sense, you can explain it to other people. You get this good feeling, like when you solve a crossword puzzle. You didn't understand it before, now you do. You feel smarter. You've really made some achievement. I really like the fact that you can always build on what you did before and on what other mathematicians did before. It's not like fashion for example, where each year you do something very different from the previous year. I've only been doing research mathematics for 15 years, but I can see how much the fields I've been working in have advanced and how our tools are getting better. It's great to be part of this progress.

Gazette: You've contributed quite a bit!

Tao: Not just me. There are a lot of really good mathematicians out there. Every time there's a breakthrough it's great to hear about. I'm talking at the plenary lecture here about Perelman's work on the Poincare Conjecture. It's a really great achievement, and I had nothing to do with it!

Gazette: Is it difficult to combine the life of a Fields Medal winner with family life with your son and wife?

Tao: The Fields Medal doesn't impress them. It is a big deal in mathematics and right after I got it there was some media attention. But 99% of people in the world have not heard of the Fields Medal. And even if they did, Los Angeles has so many celebrities, I think it wouldn't be a big deal. This is one reason why I like living in LA, I can be anonymous — no-one cares. I wouldn't want to be a celebrity anyway. I give a public lectures, say 500 people show up, and I sometimes wonder if they show up because they want to learn some maths or if a lot of them just come because they've heard that's this famous person. A little bit of this is

good, but being a celebrity shouldn't be the main aspect of yourself. You should focus on the content.

Gazette: Has the medal changed your life in any way? Are you busier than ever?

Tao: I was already busy, and I'm still busy. I'm just busy in slightly different ways. It means that I get invited to more events. And I do feel I have more of a responsibility of being a spokesperson or role model for mathematics. I've noticed sometimes when I talk to other mathematicians, and I say something I didn't really think carefully about and people take what I say off-hand much more seriously. 'Oh, this is very deep', if I'm making some simple observation. Sometimes you have to watch what you say a bit more.

Gazette: You have developed into a spokesperson for mathematics in Australia.

Tao: Yes. I got a lot out of my education in Australia. I do feel like I want to give something back.

Gazette: What was the best career advice you have ever received?

Tao: Mostly people have led by example other than explicitly giving advice. I do remember one thing my advisor told me once, which was very useful. I was writing my first paper, and I put a little joke in it. I thought I was being smart. He took a look at me and said: 'When you write a paper, this is something that will stay in the record for ever. Thirty years from now people will still read it. What you think is funny now, may not be funny thirty years from now'. He told me not to put jokes in my papers. Looking back, that was actually pretty good advice: don't be a smart Alec when you write. And it wasn't a very good joke anyway.

Gazette: You've worked across so many areas. Is there a specific area you enjoy the most?

Tao: I find myself doing different things in different years. My work grows organically. If I find something interesting and I can make some progress, I follow that. At some point, I can't proceed any further and something else is interesting instead. It depends a lot on who I talk to. Most of my work is joint with other people, from other fields and through them I learn what the interesting problems are. For example, right now I'm focusing more on number theory and combinatorics and random matrices, but five years from now I'd be doing something very different. If there are problems that look like they are within reach of doing, and something that I really know may be useful, I really need someone in that area to talk to.

Gazette: Who are your main collaborators?

Tao: That keeps changing. Nowadays I work a lot with three people: Ben Green, a number theorist who works at Cambridge, Tamar Ziegler who is an ergodic

theorist in Israel, and Van Vu who is a probabilist at Rutgers. When I worked in Australia, I worked with people at UNSW and ANU.

Gazette: What achievement are you most proud of?

Tao: I don't really look back. I always have many things on my plate. You can solve one problem and feel great, and there are these other fourteen problems and you still can't solve them.

Gazette: What did the Fields Medal mean to you?

Tao: My first reaction was 'Wow'! There were some rumours that I would get it, but I didn't think I would actually get it in 2006. I had talked to a friend of mine, another Fields Medalist, and he said he was notified in April. The meeting when they announce the winner is in July. April went past and they never called me. Then I got the call in May. The president of the IMU called and asked, 'Is this Terence Tao?'. I said, 'Yes'. He said, 'Congratulations. You have won the Fields Medal'. I don't remember what I said, but I was quite stunned. I wasn't expecting it. I feel I have to live up to the standard of all the other Fields medalists. You become a representative of mathematics.

Gazette: Do you see a broader involvement in the Australian mathematical community as an important part of your role?

Tao: I try to help out where I can. I live in LA. A lot of what I know about the situation in Australia is second-hand. I have a lot of friends and contacts here [in Australia] of course. One good thing about coming here is that I can see it first-hand. I'm on the scientific advisory board of AMSI. I did meet with the Australian Olympiad team in Bremen this year. I'm an expat, and would much prefer if Australians based here [Australia] took a lead. But I'd help out where I can.

Gazette: Is there any advice you could give to early career mathematicians?

Tao: Doing mathematics is a long-term thing. I've had grad students who said, 'OK, I'm doing my PhD, and at the end of the four years, I'll have learnt everything I need to know, and I'll be a leader in the field'. It doesn't work that way! You have to work through undergraduate, and through graduate, and even after you finish, there is still a lot more to learn. Mathematics is huge. You have to keep pushing yourself and not be content with doing just one or two things and sit in this niche of mathematics and never venture out of it, if you want to really progress. I'd describe it as like running a marathon. You can't just sprint right through it. You have to keep learning, and really enjoy doing mathematics. If you don't enjoy it, you won't have the stamina to keep at it. But it is very rewarding if you keep at it.

Gazette: What are the differences between the situations of mathematics in the US and in Australia?

Tao: There are a lot of differences. I think the Australian high-school level is still a little bit better. It has its own problems, but the US system has been struggling a lot longer with the issues of not enough qualified maths teachers, which I guess is just beginning to happen now in Australia. I've taught both in Australia and the US and the Australian students are better prepared. In Australia, universities are mostly funded through the Government and they have to comply with Government directives. Their priorities are set by Government policies, for instance to increase enrolments. In the US, there are public and private universities. Even in the public universities, where the Government provides some funding to support student tuition, the running of it is left to the administration at university level. And much of the administration comes from academia. A lot of very good academics have decided to move into administration, so there are people there who really understand the value of research. There's a bit less bureaucracy in the US. Universities don't compete to get a certain level of students or of publications, they compete for general prestige. They want a good name to attract students. For this reason they value research more, and outreach and service. They don't focus just on numbers, which unfortunately is the focus in Australia.

Gazette: What direction would you like the AustMS go into?

Tao: They do a good job with the resources that they have. I'm very impressed with this meeting, it seems to be well organised. [I'd like to see] more outreach to high-school teachers or students. There are other organisations that do that, of course. But that's one thing we need – high-school students have no idea what mathematics really is. There's the education afternoon at this conference, which is good, but maybe a bit more in that direction.

Gazette: Have you got any hobbies?

Tao: I used to. But since I've had a child, all my free time has gone away. First I had a wife, and certain hobbies started to become less and less important, and then the kid!

Gazette: Can you tell us something about your blog?

Tao: This is something I started two years ago. I used to just have a web page to keep updates on my papers. But then I decided to make it 21st century and make a blog. I'm really happy with the way it's gone. I get a lot of comments. For example, all the talks I gave in Australia I put on the blog weeks before, and I've been getting feedback and corrections. It's forced me to change my culture a little bit. I was always inclined to keep everything secret until it's all published. It's good for me, and a lot of people follow. It's also a good way to tell people some news.

Gazette: You've published a book about your blog.

Tao: Actually, two books now. Every year, the idea is to take the mathematical content of the blog (<http://terrytao.wordpress.com/>) and turn it into a book. I put my lecture notes for the classes I teach on the blog, and they get corrected and proofread. I get to publish a book a year!

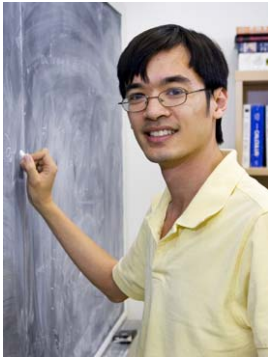


Photo: Reed Hutchinson, UCLA

Terence Tao was born in Adelaide, Australia in 1975. He has been a professor of mathematics at UCLA since 1999, having completed his PhD under Elias Stein at Princeton in 1996. Tao's areas of research include harmonic analysis, PDE, combinatorics, and number theory. He has received a number of awards, including the Salem Prize in 2000, the Bochner Prize in 2002, the Fields Medal and SASTRA Ramanujan Prize in 2006, the MacArthur Fellowship and Ostrowski Prize in 2007, and the Waterman Award in 2008. Terence Tao also currently holds the James and Carol Collins chair in mathematics at UCLA, and is a Fellow of the Royal Society, the Australian Academy of Sciences (Corresponding Member), and the National Academy of Sciences (Foreign member).