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Maths by plan and chance

I've now been in maths directly for just over five years – I entered it more or less because maths and stats were always part of my courses, and gradually it became clear that maths was at the root of interesting things.

At high school I studied Maths A and Maths B, as well as Physics and Chemistry – and English, of course. I also did graphic communication, which was fun but not something I kept going with. I liked the maths and science subjects: I think that when you can do something well and get on top of it, it's enjoyable. I could see, even in Years 11 and 12, that you could use maths to describe what was going on in the real world and figure out things that were not obvious about how they worked.

I did my undergraduate degree at Melbourne University in mechanical and manufacturing engineering, with plenty of science – maths and physics – in it as well. Then I did a postgraduate course at the same uni. I took on maths subjects in science rather than in engineering because in science the maths itself was the topic, with a lot of detail, and not just a support.

I was inspired by some of the lecturers at university, particularly when I was doing my postgrad course. I thought a couple of them in particular were top notch people in knowing their field, which was not necessarily maths-related. But they used maths to do lots of really interesting things.

I didn't really see maths or stats as a career itself. Initially I was interested in engineering, but as time went on, things changed. I ended up working in this field with some degree of planning and some degree of just happening to find myself there. Planning was taking on more and more maths and statistics as my study went on, and seeing more and more that it was the root of interesting work. Chance was that maths was a key subject that I had to study at university and I liked it a lot, so I kept following as it led me along the path.

CSIRO's work with industry

I did lots of different jobs to get me through university, but my current job at CSIRO is the only full-time, real job I have had since leaving uni. CSIRO is a big organisation that does research in heaps of different areas. The government funds part of the research and industry funds the other part.

We work in all different parts of industry – so far my work has ranged from developing software for planning people's holiday travel to rostering staff in banks, fast food places and hospitals. A lot of the work here is logistics-based, such as scheduling trucks, telling them where to go and deciding what goes on them.

When we do our work here at CSIRO, we sometimes work with small companies and sometimes work with very big companies, like we just started some work with BlueScope Steel. And when we work with those companies we change the way that they do business, usually a change that makes things more efficient, that allows people to concentrate on the interesting part of their jobs or allows companies to do profitably what they couldn't do before. And in that way we're making industry more competitive. But we're also benefiting the environment, with contributions to things like solar energy. So we can make a big difference to the country.

Some challenging projects

I've worked on lots of different projects while I've been here at CSIRO. One of the bigger projects I've been in, and one of the latest ones, is with the wine industry, and looking at when they bring grapes in to a winery, making sure they come in at the right time. And that involves heaps of trucks, and lots of people, and tons and tons of grapes. We've been constructing software and coming up with the maths that goes into that software and new ways for them to do the planning that tells them the best way to bring the grapes into the winery.

I think the most interesting and challenging problem I've worked on at CSIRO has got to do with planning holiday trips for people. People plan their holidays in all sort of different ways. To go somewhere in Australia they might just pick up a map, get brochures and do it all by hand. But to go overseas, especially to somewhere they have never been before, it can be really difficult to bring all the information together, and they would like to have a starting point.

I worked on some software that took a lot of information about aircraft flights and hotels, tours people could do, the cost of things and all that sort of business, and created the maths that planned holiday itineraries that were attractive, that made sense and that people would actually be interested in doing. I managed to make it work, but it was probably between six and nine months worth of modelling using maths, then putting that maths into a computer and seeing what happened.

The software the travel agents have is really good for finding things that you know you already want – minimum costs and direct plane flights – but it simply can't string together plane trips for a complicated itinerary, it can't find things you didn't even know were there. The software we came up with is a new thing that's not out there yet; it sort of bolts on to what already exists in the travel industry.

The variety of work

The sort of work that I do at CSIRO is very varied. Yesterday I was at BlueScope Steel, talking to people there about steel making and about the trains that they run from Port Kembla in Wollongong, across to Perth and up to Brisbane. We were looking at mathematic computations about how that works. Then I came back and worked on computer programming on something completely different.

I also manage a fair few people at CSIRO – talking to them, figuring out where their work's at, helping them look for promotions and figure out what they might do in the next year or two. So it's all in a day's work – from putting a suit on and being all very proper in a business sort of way, to talking to colleagues my age or younger and having a laugh. We often talk about why the work is much harder (or even much easier) than people thought it should have been.

Work's a very creative place. We're creating all the time and one of the harder things about the job is that there's no process to what we do, in that when I used to work in a cheese factory, I'd get there for the start of the shift that was eight hours long. You knew what you were going to do. You were cutting the cheese or you were wrapping it up in plastic and labelling it. The hard part was to keep interested at all in work. Whereas in the maths and stats area, the hard part is being creative all the time. You need to keep yourself motivated, to keep really excited by the work, to be making up what you're going to do next. That suits me fine.

This job is different from what many of the people I did engineering with at uni are doing. Their jobs range from mainstream engineering stuff to working in chemical companies, looking at logistical stuff there – so it's related to what I'm up to – to working for recruitment agencies, making medical equipment, renovating houses. I guess I was the only one from that course who went in this direction. But as I went further on in uni I made friends who I now work with here, at my current job.

Making sense out of chaos

Maths and scientific training is good in the sense that you learn logic and you learn to see what the real problem is behind the chaos. A lot of the maths that we do – of vehicles going all over the place, or people not knowing what they're doing, or grapes getting mature or not getting mature – is making sense out of chaos. So that instils a way of looking at things: you find out what's simple and what's really going on in the system, or you find out what's complicated and start chipping away at understanding and managing it.

We do have to step back occasionally, though, because not everything lends itself to being looked at logically. Sometimes you come up with a view in maths that there's just one right answer, but when you're dealing with people, it doesn't always work that way: there can be multiple answers.

To do maths well, industrial maths well, it's much more than just knowing maths. You've got to really know what's going on, on the mathematical way, in order to actually deliver the results. But in working with people, it's just as important understanding what businesses want. So they're not interested if a solution is beautiful; they're interested if the solution makes a difference.

Learning from those around you

I still count myself as an engineer, as well as an expert in the mathematical side of things. The enjoyable part of it is that you can almost have a different job every month or so, when you get a different project with a different business. I like creating new things. A combination in my job of the maths side, together with the software and computer programming side, the working with people side and the change the world side, is just great. So that's the best part about the job.

The only real down side is that you do have to stay on the ball, you have to make your own way. There's no one who can tell you how to do the job, because if they knew how to do the job, they wouldn't be coming to ask you how it's done !

I have learnt quite a bit from other people, though. I did have a mentor. I looked up to the way that he went about breaking the world down into chunks that you could study and do things with, and that's really an important skill for applying maths in the real world – that you can't model the entire world in one shot. You have to cut it down, cut it down until you get a bit that you can munch on, and then if you munched on that part, maybe you can make it bigger, maybe you can do something about it.

In some ways I'm surrounded by mentors at work, almost like a family of mentors: there's a lot of people here in their 50s and 60s who have done some amazing things in their time and who I look up to. It really helps if you can pick the nice parts, the parts that you like most, about the way they do their work or deal with people, and try to bring that into the way you live and work.

Finding a good balance in life

On the weekends and after work I spend a lot of time working around the house: I built the kitchen and the bathroom and painted everything in the place we live at the moment. I really like that. I potter around in the garage fixing things, working with my hands. I do a lot of tiling – perhaps I'm a bit obsessed with maths, because the tiles I put on parts of the house and on the ground are not just straight but at angles, cut strangely and so on. In fact, sometimes I don't know how people could calculate it all without knowing a bit of trigonometry!

My hobbies include creative things like music and building models. I like to hook up with old high school friends and to ride my bike. I like reading, too. It's all a good counterpoint to my work time.

Maths, maths everywhere

A good word to describe maths would be 'everywhere'. In all jobs there's some maths involved, even if it is just adding up dollar values, and it doesn't take too long in any job before you start getting into some tricky maths.

I see maths and stats in a lot of places. I can go to an industry and say, 'If you had some software that did this sort of maths for you and you used it every day, then things would be different.' And they say, 'How did you ever come up with that?' It's just the way I see the world now. Similarly at home, I use maths to put tiles down or to figure out how long it will take me to drive from one place to another. So I do put a mathematical lens on the world.

But I also put an engineering lens on the world, although occasionally it is almost opposite to the maths lens. The engineering lens is, 'Let's fix things, let's be pragmatic, let's get a result.' I learnt that way of doing things when I was at university, and it certainly influences the way I go about work and life generally.

Following a maths career

My main advice for someone who's thinking about a maths career is, first of all, make sure you get on top of the maths. Maths is the sort of subject that if you're not on top of the work, then it starts getting unpleasant. There's a method to the way you do maths and if you start to slip, then it's no fun anymore. So stay on top – do the homework, do the study for university, stay ahead and then it will stay interesting. You'll actually learn what's there; you won't be playing catch-up.

My other advice is that because maths is in all sorts of things, be interested in maths, but also be interested in some of these things – whether it's finance, engineering or whatever. There are stacks of people who are crazy about the maths in sport. The more you look at these fields, the more maths you'll see – and the more maths you see, the more interesting it is.

For a career in maths and stats – or both, whatever way you want to go about it – it is important to be interested in the area and to let that, in a way, take you to an interesting place. You might end up in finance, or in astrophysics, or dealing in supply chains and logistics and transport. In each of those areas, people have got maths coming out of their ears. People with maths skills, whether they picked them up in a maths course or a different technical course, are using their skills every day and are better at the job than they would be without those skills.

With a career in maths, there's an opportunity to make a difference in the world, to change things on a big scale or a small scale. If you understand how mechanical things or technology or computers work, you know maths is at the heart of it. And with environmental problems, you can make a difference that is equal to and alongside people who work politically or in more social areas.