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Signalling success

A young researcher riding the wave of success wants to share his passion for mathematics and electrical engineering.

Professor Jonathan Manton proves that maths can be an exciting field for young people.

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Jonathan Manton bounds down the stairs to the reception area. He is smartly dressed in a grey suit, white shirt and tie. He explains, almost apologetically, that the formal look accompanies his new position as Executive Director of Mathematics, Information and Communication Sciences at the Australian Research Council (ARC). He's taken up the three-year secondment with the national body only recently, so his corporate attire is slightly at odds with the relaxed atmosphere of his usual workplace at the ANU Department of Information Engineering.

It says a lot about a young man's abilities when he is picked to hold a senior position at the ARC, where he will help to determine how federal funding is distributed to Australian researchers. But Manton has a history of early achievement. In 2005, aged 31, he was employed as a Professor, making him the youngest person to hold the title at ANU at that time. Professor John Richards, Director of the ANU College of Engineering and Computer Science, said Manton was chosen for his ability to be a knowledge leader well into the future.

"We're lucky to have a young age profile at the College, but we also need to recruit leaders for the future," Richards says. "Jonathan came to our attention as a bright young scholar at the University of Melbourne. We asked him to throw his hat in the ring for the professorship, which he won. He's been very active in pulling a lot of different people in from around campus into multidisciplinary projects. He's shown a lot of promise, and we look forward to seeing the contributions he'll make when he returns from the ARC."

When asked why he thinks he was promoted at such a relatively young age, Manton suggests it's a result of vicissitudes in the fields of mathematics and computer science, whose fates fluctuate depending on their uptake by successive generations. But a dispassionate observer would say it's got plenty to do with Manton's ability and his drive to grapple with some of the biggest problems facing a wireless world.

"I was about five years old when I knew that I wanted to do mathematics and be an academic," Manton says, indicating that his academic dad was a major role model.

"My father had a library of maths books which I used to read. I have always enjoyed teaching myself. I was lucky enough to be able to use one of the first desktop computers. The floppy discs were eight inches wide and it programmed in Fortran. Later, my father built his own computer from a kit. Seeing how such a system was put together really boosted my interest in electronics, computer science and, ultimately, in mathematics."

These interests led Manton to gain a double degree in science and engineering from the University of Melbourne, where he also completed his PhD. He was then awarded a Postdoctoral Research Fellowship, followed by a Queen Elizabeth II Fellowship, both from the ARC. Despite his early experience with building electronic circuits, Manton says his interests moved on to more abstract problems.

"I've ended up preferring abstractions, but I'm always very supportive of people who do applications as I think you need a wide range of skills. It's easier for me to write a computer program or think in abstract mathematics than to physically build something. Many of us like to see a creation – whatever we do. In one sense you're always creating, and I guess that people end up enjoying what they are most comfortable with. For some people it's building a fine piece of furniture. Since I can't build furniture, I build mathematics.

"Mathematicians come up with theorems, which can be used by others to solve problems or used as building blocks to create even bigger and hopefully even more useful theorems. By capturing all of your thinking below a certain level into a few big theorems, you enable the next generation of people to start with those theorems and not have to go to the lower level. This is how you can build up something very sophisticated.

"It's not only a succession but also a continual refinement. Just like software libraries are often revised to make them more powerful and easier to use, so too are areas of mathematics. Algebraic geometry – the study of shapes defined by the solutions of a set of polynomial equations – is over 1,000 years old, yet the foundations were recast just recently in the 1950s and 1960s by the pioneering work of Grothendieck and Serre. In other words, mathematics is alive. Unfortunately, people often don't have the chance to see this, so they think that maths is set in stone. They're missing out on some of the excitement."

"If you go to the newspapers, you see the government worried about how to create more innovation in Australia. You see articles about the lack of students in science and mathematics. The only way to try and change this is to be active – to make students interested and passionate

It's one of Manton's missions to convey his sense of excitement about the possibilities of mathematics to young people. He helped shape the curriculum for the ANU Secondary College, a new program where secondary students from the ACT will be able to study courses at ANU, experiencing learning at the tertiary level and gaining credit towards a university degree at the same time.

A key area of Manton's research has involved the field of signal processing, which he says could involve everything from mobile phones to radar systems.

"When signal processing is used in the context of the community to which I belong, you're looking at designing algorithms to solve common

about learning."

problems, such as determining the location of an aircraft based on radar returns.

"Signal processing for wireless communications is very popular now. When the signal leaves one antenna, it doesn't necessarily travel in just a straight line. Often it will also bounce off walls, so that what you receive is a very distorted signal. It's like trying to watch television but getting severe ghosting. Our job is to design how you transmit and receive data so that you can recover from these corruptions.

"We model the problem mathematically and say, 'This is what's being sent, this is what's being received'. We try to come up with algorithms that cover the results that we want. The challenge is not always finding the optimal way to do things, because that would require you carry a supercomputer around in your pocket. By taking into account physical limitations, we come up with suboptimal but satisfactory practical approaches. That's where you depart from pure mathematics, where you can do whatever you want, and move to the engineering world where you might have constraints."

Manton says abstract thinking is often many years ahead of any industry application. He says such mathematicians are like future builders, chiselling away at problems that could shape things to come.

For the time being, Manton has shifted away from his pure research focus to tackle the applied problems of research funding at the ARC. Professor Peter Høj, Chief Executive Officer of the ARC, says that Manton's age will be a real benefit to the organisation.

"I'm very pleased that Professor Manton has decided to join the ARC at an early stage in his career in order to contribute to the building of a globally competitive research base in Australia. The ARC will benefit greatly from his perspective as a young researcher and from his knowledge in the areas of mathematics, information and communication sciences. I'm sure his colleagues throughout the research sector will appreciate the time he has taken off from his full-time research to devote to the work of the ARC, particularly in his area of discipline expertise," Professor Høj says.

Manton says that after receiving funding support from the ARC earlier in his career, he felt it was his duty and privilege to take on the job. But he's also finding that it's stimulating his research too.

"I'm reading articles and having discussions that I normally wouldn't have had because of restraints on time," Manton says, adding that his own mind is constantly working at mathematical problems. He continues to conduct his own research while working at the ARC. Despite his taste for the abstract, it's the real problems facing mathematics, engineering and Australia which challenge him most.

"If you go to the newspapers, you see the government worried about how to create more innovation in Australia. You see articles about the lack of students in science and mathematics. The only way to try and change this is to be active – to make students interested and passionate about learning."

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