

Research scientist, AI



Karen Petrie is a research scientist at the Cork Constraint Computation Centre (4C), which is a research centre linked to University College Cork (UCC) and funded by Science Foundation Ireland. She is a PhD candidate in the field of artificial intelligence.

Most girl's parents try to embarrass them by showing prospective boyfriends pictures of their daughter aged two in which she is both naked and in a compromising position. My parents go for a slightly different approach; in such situations they produce my primary school report cards. When I was ten, my teacher's comment was: 'Karen has absolutely no grasp of mathematical concepts'. As much as I hate to admit it, she was right! So I left primary school without a knowledge of basic arithmetic such as multiplication tables, and with a hatred of all things even slightly related to the topic of mathematics.

The early years

When I made it to high school that all seemed to change. Mathematics stopped being about specific numbers and started being about letters, which could stand for any number. This caused a switch to click in my head, and all of a sudden maths was just about solving puzzles. In short it was fun. I remember one lesson in particular - Pythagoras's theorem was introduced and

we spent many lessons feeding numbers into the equation to prove we could all apply it. A number of questions struck me. Why does this equation actually work? Will it always work? How was it discovered? From that point on I didn't stop asking questions, I was hooked on science.

Qualifications

In 1997 I entered the University of St Andrews, Scotland, to embark on an honours degree in mathematics. In our first year we had to choose a number of science subjects other than our major to undertake courses in, I decided to take two courses in computer science. I had very little idea what computer science actually was; having had a Commodore 64 from the age of eight, for me computers were something to play games on, and perhaps draw the odd picture or write the odd essay. Very quickly I learned that computers were both the tool as I had experienced them, and something that could be studied in their own right. In fact computers and the related disciplines

2001

Graduated
BSc (Hons) in computer science
University of St Andrews, Scotland

2001

Graduate researcher
University of St Andrews
Scotland

were (and still are) fascinating, the mix of logic and mathematics required to undertake a computer science degree fitted in with the skills I had, and so I quickly changed my major to computer science. In 2001, I graduated with an honours degree.

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First steps in research

My interest in research began in 2000, when as an undergraduate I won a scholarship to undertake research during the summer vacation. During this time I designed a random generator for groups, algorithms, and programming (GAP - a system for computational group theory). The subsequent summer I was employed as a graduate researcher on a project relating to automated theorem proving. Having completed my time on both these projects, I really was hooked on research. The challenge of investigating concepts which have never been investigated before and the joy of solving a problem which has troubled you for weeks is still what keeps me going to work each day.

PhD

I very quickly realised that the route to becoming a research scientist, involved undertaking a PhD. This actually seemed like the next logical step to me, anyway. I had finished my degree with a feeling that there was still more to do and more to learn, I knew I was not finished with education. The only problem was deciding what branch of computer science I wanted to focus on. My undergraduate degree was a mix of computer science and pure maths, so the obvious choice was cryptography and I sent applications to many universities with that goal in mind.

While waiting for the replies I had a conversation with Dr Ian Gent, who had taught me artificial intelligence as an undergraduate, and was by now a good friend. He told me that a friend of his from Huddersfield University was looking for a student to undertake a PhD in a branch of AI that would need a strong mathematical background. I told him I was interested and he put me in touch with his friend, Professor Barbara Smith. Barbara and I met a few months later, and she told me about the project, it sounded both challenging and interesting, but most of all I really liked her, she seemed like the sort of person that would be stimulating and fun to work with. So on 28 September 2001, I moved to Huddersfield to commence a PhD in a branch of AI, called constraint programming (CP).

2001

Commenced PhD
University of Huddersfield

2003

Research internship
NASA

Constraint programming

Difficult problems such as those in scheduling and timetabling consist of choices, some of these choices may be incompatible and few are optimal. CP provides automation for deciding on the best choice and hence creates good solutions to such problems. A CP instance consists of a set of variables, a set of possible values, one for each variable and a set of constraints. For example, the problem might be to fit components (values) to circuit boards (variables), subject to the constraint that no two components can be overlapping. A solution to a CP is an allocation of values to variables such that none of the constraints are violated. My PhD concentrated on symmetry within CP, eg if two components are the same, which one should you choose first? During this time I learned the value of collaborating with other people both within the field of CP and related fields. I think in research it is important to realise that you can not know everything, and only by working with other people can you really achieve interesting results.

NASA

In the summer of 2003, I took a three-month break from my PhD studies to undertake a research internship at NASA. Whilst there I worked on applying my research to the terrestrial observation and

prediction system (TOPS). TOPS is a system to process the terabytes of data received each day from earth-observing satellites in a timely and effective measure. It aims to answer questions such as: 'are the conditions in California likely to induce a forest fire?'¹ so that appropriate warnings can be offered to the people living in such areas. I won the British Computer Society young IT practitioner of the year award for this research. This project was the first time I had done research that was so applied. I really enjoyed working with such real-life data, and decided that after my PhD I would try to continue in this vein.

Currently

I am now a research scientist with a research centre that, although linked to a university, works closely with industry. This is the perfect setting for me, as it allows me both to publish as an academic and retain my links with that community, but also to work on real-world problems. My career path has been relatively haphazard, I have always had an idea of where I wanted to end up, but have been willing to take the opportunities that arose along the way. I do not earn as much as I might in industry, but I really like my job which for me is far more important. My role also allows me to travel a lot which is definitely one of the bonuses!

2004

Won BCS young IT practitioner
of the year award

2005

Research scientist
Cork Constraint Computation Centre