From the editor

Welcome to Issue 75 of the Secondary Magazine, which is a short issue published just before Christmas, but we have included some activities for the classroom in Christmas Puzzles by Dudeney – just in case you are looking for something different to do in a last lesson of the term! The next issue will include all the usual features.

Both Aaron Sloman, in The Interview, and Professor Sir Christopher Zeeman, in A Christmas lecturer discusses mathematics teaching, raise interesting and important issues about students' experiences of appealing mathematical proofs. We hope their views will provoke fruitful discussion – perhaps not unrelated to concerns raised in the Subject Leadership Diary.

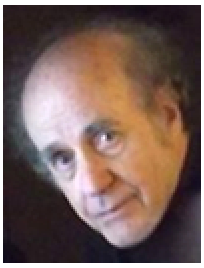
HAPPY CHRISTMAS!

Secondary Magazine
Issue 75

National Centre
for Excellence in the
Teaching of Mathematics

The Interview

Name: Aaron Sloman



About you: Until 2005 I was Professor of Artificial Intelligence and Cognitive Science in the School of Computer Science at the University of Birmingham. I am currently retired, but doing research full time – on a range of topics related to philosophy, cognitive science, artificial intelligence, biology and mathematics – in the School of Computer Science. My first degree was in mathematics and physics in Cape Town (1956), after which I did a DPhil in Philosophy of Mathematics in Oxford (1962), then a few years later discovered that the best way to address many philosophical problems – for example about the nature of minds, and about what mathematics is – is to do Artificial Intelligence, including trying to design and test working fragments of minds.

Do you use mathematics in your work?
I use examples of mathematical ways of thinking, to try to formulate tasks for a designer of intelligent machines, or tasks for someone trying to build a robot that could be a model of mathematical development in young children. For example, how does a child come to understand that it makes no difference whether you count a row of objects from left to right or from right to left? How can a child discover that containment must be transitive? How does a child develop from discovering that some generalisations have no exceptions in our experience to discovering that a subset of those generalisations can be proved to be true in all possible circumstances: for example that three internal angles of a triangle on a plane surface must add up to a straight line?

Why mathematics?
Mathematics was my favourite subject at school and university for various reasons including its power, its depth, and the existence of beautiful short proofs about infinitely varied topics – for instance the ancient proofs that there cannot be a largest prime number, that the square root of 2 cannot be a ratio of two integers, and the purely geometric proofs of Pythagoras' theorem, illustrated in this video and notes about it. When asked my religion on immigration forms etc., I always wrote 'Mathematics'!

Some mathematics that amazed you?
When, many years ago, a school teacher who had been a student at Sussex University 'proved' to me that the internal angles of a triangle add up to a straight line by sliding an arrow, or pencil, round the sides of a triangle, rotating it at each corner through the internal angle, using the five moves labelled "a" to "e", it seemed to me to be a far more memorable proof than the standard one using parallel lines – I was amazed that nobody else had discovered it and used it in the classroom (as far as I knew). Both proofs fail on a curved surface -- but that's also an interesting mathematical fact.

A significant mathematics-related incident in your life?
First learning about transfinite ordinals when I attended lectures given by Hao Wang in Oxford about 50 years ago. These are three examples based on the natural numbers:

'Greater' this way -->

1 2 3 4 .....

.... 4 3 2 1

1 3 5 7 ... 2 4 6 8 ....

It still amazes me that a human mind can think about these infinite structures. I can teach complete non-mathematicians to think about them in about five minutes, so that they can answer some questions about them. Are they discussed in schools? I don't think anyone knows yet how to give machines those human-like abilities to visualise infinite structures and transformations of the structure. We just have not figured out how human brains do it.

The best book you have ever read?
That's impossible to answer. There probably isn't one. But perhaps Bertrand Russell's *History of Western Philosophy* had the biggest impact on me, leading me to switch from mathematics to philosophy as a graduate student, even though I disagreed with Russell's philosophy on many things, including the nature of mathematics.

Who inspired you?
Immanuel Kant – when I started reading his Critique of Pure Reason many years ago I thought he was closer to the truth about mathematics (as I had experienced it) than Russell, or David Hume, or the philosophers I met in Oxford at the time. My DPhil Thesis was an attempt to show why Kant was right.

If you weren't doing this job you would…
be forced to retire properly! Perhaps I would try to find a primary school that would let me help with teaching of mathematics and artificial intelligence. Or maybe I should try to organise the many half-baked discussion notes on my website into a collection of books, all freely available online.

Any regrets?
In 1978, I thought the tremendous promise of computing to revolutionise many sorts of education (including mathematics, philosophy, and the development of scientific and creative thinking) would be obvious to everyone – as I wrote in The Computer Revolution in Philosophy.

But that promise never materialised. That's partly because it was thought by politicians, employers, parents and teachers, that school kids should be taught to use word-processors, databases, spreadsheets, and other tools that would be useful in their jobs – instead of learning to use computers and programming languages as tools to help them design and test working versions of their own ideas! An example might be inventing a way to express unary arithmetic using lists of symbols. I don't know if it is too late to reverse what happened – unfortunately too many computer experts are now products of that disastrous educational mistake, and have no idea what has been lost.