



Exploring mathematics: maths in nature and art

The power of computers

V/O Francesca Hunt

Henri Poincaré was able to discover chaos because of his unique ability to visualise extremely complex and evolving mathematical problems.

Prof. Ian Stewart, University of Warwick

This is the kind of thing that Poincaré would be faced with, some mathematical rule that you have to keep repeating over and over again. For example here 'x' might be the position of a planet at a given instant of time. Of course Poincaré's equations are going to be much more difficult than this one, and what you have to do is say well suppose we start with some value of 'x', let's say one point five, then what happens when you calculate the formula, well in this case we actually get three point five, and then take the three point five, plug that in at the front, do the calculation again, and carry on repeating that - this is a process called iteration - and get the whole sequence of movements of the planet. The problem is you need tens of thousands, hundreds of thousands, maybe millions of these calculations and with pencil and paper, or with a blackboard, there just is not time to do it, so the obvious way is to do it on a computer instead. What I'm going to do here is look at a more complicated set of equations, and firstly let's assume you're an old fashioned mathematician who can only do a hundred calculations before he runs out of steam, so what he would see is this. He would see a curve, and it stops, and it doesn't seem to go anywhere. But suppose we had the computing power to do ten thousand. Now the full glory of the thing becomes clear. Now this particular attractor, as it's called, was discovered only in the 1960's, and it was only discovered then because that was when the computing power first arose for doing this kind of thing.