six of the best

Fractals chosen by Marcus du Sautoy

The writer and mathematician on patterns that repeat

Anyone who went clubbing in the Eighties and Nineties knows what fractals look like; they were those shapes projected on to the walls of clubs. They are patterns that never simplify and they gave you the illusion that you were plunging into a shape that just went on and on. Fractals are a way of touching infinity.

But in essence, a fractal is simply a repeating pattern. They appear in snowflakes, ferns, trees, lightning . . . At first sight the universe looks far too messy to be mathematical but a single, simple rule can give rise to infinite geometrical complexity.

Even if you have all the equations to describe how the universe works — the weather, waves — you still cannot predict what will happen. There are things about the universe we will never know. That is where art, and religion, can come in: to navigate the unknown.

Marcus du Sautoy is speaking on *God of the Gaps* today as part of the Southbank Centre's festival *Belief and Beyond Belief*; southbankcentre.co.uk. *What We Cannot Know: Explorations at the Edge of Knowledge* by du Sautoy is out now, published by 4th Estate

GETTY IMAGES; ALAMY; THE TRUSTEES OF THE BRITISH MUSEUM; ALLSTAR

STARRY NIGHT, VINCENT VAN GOGH (1889) A good example of chaos and fractals is turbulence. Turbulence is something that mathematicians don't understand and one of our greatest problems is the vortices in the sky.

▶ ISLAMIC MUQARNAS, THE ALHAMBRA, GRANADA, SPAIN The Islamic world was obsessed by geometry and symmetry. Here infinite complexity and symmetry meet.

▲ THE GREAT WAVE OFF KANAGAWA BY HOKUSAI C 1830 Waves are an obvious example of fractals. As you zoom into this picture you see the same structure repeated again and again — a larger wave, then a smaller wave, and a smaller wave within that.

▶ UP, PIXAR (2009) Pixar is basically full of mathematicians, not artists, who are using fractal geometry to create these amazing natural backgrounds, of waterfalls tumbling over cliffs and an infinity of leaves in a jungle.

ARCADIA BY TOM STOPPARD (1993) Fractals are a theme in Stoppard's classic play, which has a fractal structure itself. The modern strand of the drama spans a few days and represents a telescopic version of the 19th-century story, which extends over several years.

TWO MEN ON A FOOTBRIDGE OVER A STREAM BY JAN VAN GOYEN (1665) The clouds and the trees have a fractal quality. Van Goyen knows that nature is made up of repeating the same patterns on a smaller scale.