BOOKS & ARTS

A journey into the impossible

Virtual Worlds: M. C. Escher and Paradox
Portland Art Museum, Portland, Oregon
Until 13 September

Two artists embody the saying that mathematics and art are so far apart, they are practically neighbours — Leonardo da Vinci (1452–1519) and Maurits Cornelius Escher (1898–1972). Whereas Da Vinci searched for the possible, generating functional designs such as his flying machines, Escher searched for the impossible, creating images by distorting nature's rules. Escher's techniques are explored in the retrospective exhibition *Virtual Worlds: Escher and Paradox*, now showing at the Portland Art Museum in Portland, Oregon.

Escher's prints of tessellations form the heart of the show. *Heaven and Hell* (1960) is the most intricate, incorporating patterns that repeat at many size scales, inspired by the tile designs of the **[ok?]** Alhambra palace in Granada, Spain. The print's alternative name, *Circle Limit IV*, reflects the mathematical challenge that the artist undertook to make it.

To achieve visual balance, Escher insisted that the shrinking patterns must converge towards a circular boundary. The patterns emerge "like rockets", in his words, and flow along curved trajectories until they "lose themselves" again at the boundary. Constructing this sequence required help from mathematics. After several attempts, Escher found the solution in an article written a few years previously by the British-born geometer H. S. M. Coxeter. By viewing the early versions of *Heaven and Hell* that are on display, visitors can chart the aesthetic evolution of Escher's tessellations.

Escher's work is often presented as an academic exercise in visual mathematics, but his interest lay in the real world. He declared: "We are not playing a game of imaginings … we are conscious of living in a material, three-dimensional reality." This is emphasized in his tree sketches, which show how the patterns of branches repeat at different scales and distort when reflected in the rippled surface of a pond.

The patterns in *Heaven and Hell* do not replicate those found in nature — they shrink at a different rate. Nature produces fractal structures, as shown in one exhibit that comprises a spherical mirror positioned at the centre of a cube of mirrors. Coloured light rays bounce around the mirrors, their many reflections setting up a fractal pattern when viewed from out-

side. But Escher did not depict this geometry, instead using the hyperbolic one described in Coxeter's article.

Intriguingly, *Heaven and Hell* was created many years before Benoît Mandelbrot's book *The Fractal Geometry of Nature* (W. H. Freeman, 1982), which [ok?] made nature's scaling properties well known. The exhibition thus asks to what extent Escher knew about these natural rules. The artist hints that he was conscious of them and chose alternatives: "The reality around us … is too common, too dull, too ordinary for us. We hanker after the unnatural or supernatural, that which does not exist, a miracle." Perhaps he achieved this miracle in what he referred to as the "deep, deep infinity" of his repeating patterns. ■

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