

# Travels in hyperbolic reality

Amy Karafin

**As with life on earth**, the Hyperbolic Crochet Coral Reef project began with a single-celled organism. The ‘mother cell’ was an unusual woollen flared-circle shape that was the first known real-life model of an obscure form of theoretical geometry once considered the domain of maths-world outcasts and dreamers. More crocheters became involved. They mixed up stitches, varying the size of their crochet hooks and taking apart sweaters and garbage to create strange new yarns. The little flared circles began to mutate, branching out into endless paths of speciation. From these single cells emerged curly, woolly sea slugs and rust-red grooved brain coral, turquoise sparkly sea rod corals and kelps in recycled green acrylic. Soft, squishy sponges competed with silky polyps of fingerling or white pillar corals, while long-spined black sea urchins watched on. And, as with life on earth, some of the reefs were soon covered with milk-bottle lids, straws and the planet’s unofficial flower, the plastic bag.

Comprising some 40,000 creatures created by forty crocheters from around the world, *The hyperbolic crochet coral reef*, 2006–, is the brainchild of Brisbane-born physicist and science writer Margaret Wertheim and her twin sister, Christine, a lecturer at the California Institute of the Arts. Together the Wertheim sisters head up the Institute For Figuring (IFF), a non-profit organisation in Los Angeles dedicated to promoting ‘the poetic and aesthetic dimensions’ of mathematics and science. Inspired by the concept of hyperbolic space, their reef project now straddles both the worlds of science and art, to grace such contemporary art spaces as Pittsburgh’s Andy Warhol Museum and, most recently, London’s Hayward Gallery.<sup>1</sup> Here, art audiences have become bedazzled by immersive environments of Technicolor brilliance, as well as being subjected to scenes of environmental devastation. What the IFF calls the reef’s ‘satanic sibling’, the Rubbish Vortex is a tornado-like mass of woven plastic bags. As real reefs once did, so *The hyperbolic*

*crochet coral reef* keeps expanding, adapting, and evolving – to the point where it has become, in itself, a force of nature.

When hyperbolic space was discovered in the nineteenth century, it was considered ‘the most useless piece of mathematics that anyone had ever come upon’, Margaret Wertheim has said.<sup>2</sup> Unlike the standard, flat Euclidean plane, the hyperbolic plane is in a state of constant curvature, with the surface seeming to multiply on itself. It is difficult to imagine let alone picture or represent. According to Wertheim, western mathematicians in the past had ‘an important philosophical prejudice’: they saw the world as perfectly Euclidean. And so, even though objects in nature have a hyperbolic form – think of the frilly edges of kelps, kale or lettuce – no-one thought to put the two together until now.

Daina Taimina, a mathematician at New York’s Cornell University and creator of the Reef’s original organism, was among the first to construct a physical hyperbolic form. By increasing the number of stitches in each crocheted row – resulting in a form whose edges curl like the hem of a flamenco dress, or a sea slug – Taimina found that she could crochet something that very closely represents a hyperbolic shape. It was a discovery noted with interest by mathematicians around the world, and also by Margaret and Christine Wertheim, who invited Taimina to share her discoveries in a lecture at the IFF in 2004.

Intrigued by these worldly representations of the hyperbolic realm, the sisters began crocheting a number of frilled woollen hyperbolic shapes themselves. The forms began simply as curly circles and spiralling rectangles. But Christine Wertheim soon tired of abiding strictly by the rules of hyperbolic crocheting algorithms, vowing ‘to buy some hairy yarn and deviate’. While her sister initially resisted, what they both eventually found was that the more they diverged from mathematical formulae, the more organic the pieces appeared. Several of them were lying on the Wertheims’ Los Angeles coffee table when their resemblance to coral became



opposite (detail)  
**Crochet coral and anemone garden, 2007,**  
 with sea slug by Marianne Midelburg, courtesy  
 the artists and the Institute For Figuring,  
 Los Angeles. Photograph Alyssa Gorelick.

noticeable. The next step was inevitable, as Christine Wertheim recalls of their creative epiphany in 2005: 'We should crochet a coral reef.'

Hailing from Queensland, home to the world's largest coral-reef system, the Wertheims were all too aware of the environmental dangers facing this and other coral atolls around the world. These 'rainforests of the ocean', Margaret Wertheim has written, may by some projections be decimated by the end of the twenty-first century. The Hyperbolic Crochet Coral Reef project was therefore founded with a sense of urgency and premised on both aesthetic and educational grounds. 'It's pretty, it's got this amazing ecological dimension, and it will bring public attention to the plight of coral reefs', Margaret Wertheim explains.

The Wertheims posted an invitation to participate on the IFF website in 2006, and a flood of positive responses came from all corners of the globe – including the art world. As it happened, Pittsburgh's Andy Warhol Museum was about to mount an exhibition on global warming and invited the IFF to show their budding reef in 2007.<sup>3</sup> Crocheters and other fibre artists began sending in pieces and innovating new forms. Among their most inventive contributors were Helen Bernasconi, a former computer scientist who now runs a sheep property at Bonnie Doon in country Victoria, and the Rubbish Vortex's creator, Sydney horticulturalist Helle Jorgensen. Crocheters went off on their own hyperbolic tangents, and their diversions brought forth new organisms. From simple kelps and coral polyps, the crocheters began inventing new reef members, including sea urchins (which are not, technically, hyperbolic) and new species of sea slugs, sponges and corals. The more experimental the crocheters became, the more real – and *natural* – the reef became.

If Taimina's hyperbolic technique and the iterative process of crocheting made forms resemble those found in nature, the crocheting deviations gave them life. In nature, Margaret Wertheim explains: 'there's an algorithm at the heart of everything. Life forms start with a simple code, and the DNA

gets more diverse as time goes on.' Life never leads, however, to perfection: 'You don't ever see a perfect sphere in nature. You don't see perfect hyperbolic spheres, either.' Even the reef is not perfectly hyperbolic – as Margaret Wertheim properly acknowledges on the IFF website: 'If you want to be a purist, you could call it the Almost Hyperbolic Reef – or as Christine often remarks, you can just relax and go with the evolutionary flow, wherever it leads.'

And so the reef seems to have sprung organically, each alga and polyp filling up space opportunistically and assuming harmonious palettes in the way that organisms do. While the visual effect is undeniably – and at times overwhelmingly – beautiful, the extent of the reef's art-world embrace has come as something of a surprise to the Wertheims. 'It was conceived as a natural history project inspired by mathematics and global warming', Margaret Wertheim explains. 'We didn't expect to exhibit it in the art world.' In early 2009 the reef will be shown at Track 16 Gallery in Los Angeles before travelling to Arizona's Scottsdale Civic Center in April, with other mooted venues to follow.

Indeed, the reef has come to dominate the profile of the Wertheims' IFF, which over time has also hosted talks on subjects as diverse as the physics of snowflakes, the art and science of child's play, and the engineering behind how flies fly. It could also provide the model for other planned IFF projects to do with knot theory, algorithm-based origami and an even more difficult-to-imagine geometric plane whose nickname is the 'twisted sphere' and whose edges join up at infinity. As Margaret Wertheim wryly notes: 'We've been doing the hyperbolic plane for years.'

<sup>1</sup> 'Hyperbolic Crochet Coral Reef', The Hayward Project Space, London, 11 June – 17 August 2008.

<sup>2</sup> All quotes are taken from interviews with the author, 30 July 2008.

<sup>3</sup> '6 Billion Perps Held Hostage! Artists Address Global Warming', The Andy Warhol Museum, Pittsburgh, 11 March – 17 June 2007.