# The Mathematics of Craft

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Using craft to unravel the complexities of maths.

Enjoy craft? Then you probably enjoy mathematics too, you just may not know it. This was the idea behind the recent Maths Craft Festival, a weekend-long festival held at the Auckland Museum, celebrating the many links between mathematics and craft. The Festival was the creation of three mathematicians: Drs Jeanette McLeod and Phil Wilson from the University of Canterbury, and Dr Julia Collins from the University of Edinburgh, and was the first of its kind in New Zealand.

The trio were inspired to start the festival after a serendipitous encounter while Julia was on holiday in Christchurch from Edinburgh. Jeanette and Julia – both avid knitters and crocheters – wanted to find a way to share the beautiful mathematics behind craft with the public. Many people have a mental block when it comes to mathematics, and yet it is all around us and we use it every day. Especially those of us who craft. Mathematics is much more than just fractions and calculus – it is present in the repeats and symmetries of a pattern, the folds of a crocheted or knitted ruffle, and the arrangement of squares in a blanket. The aim of the Festival was to showcase these links, bringing mathematics to those who love crafts, and crafts to those who love mathematics.
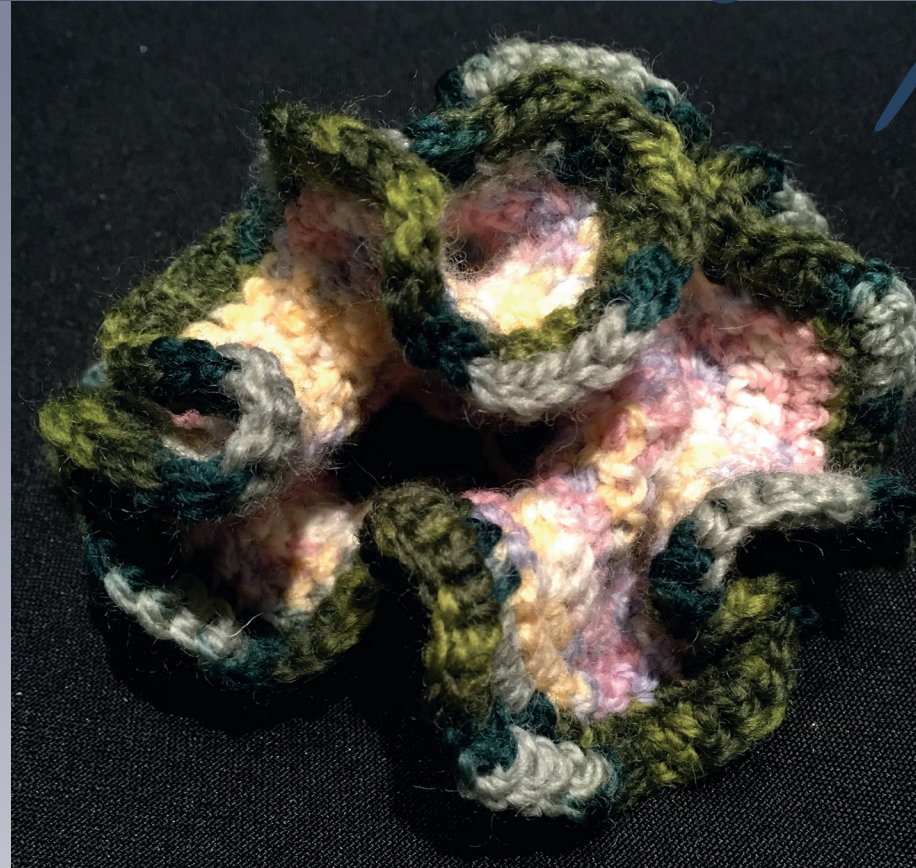
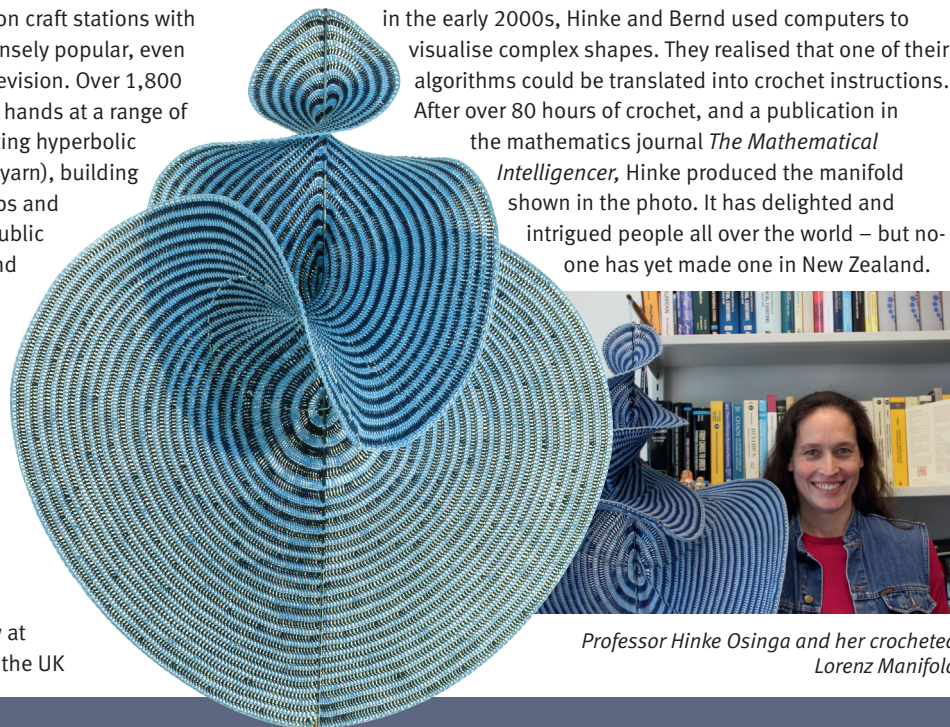*A hyperbolic plane made during the Festival from 8ply Tekapo yarn*

A stellated dodecahedron crocheted by Sarah Mark from 8ply Tekapo yarn

The Festival combined eight hands-on craft stations with a series of public talks, and was immensely popular, even making an appearance on national television. Over 1,800 people visited the Festival, trying their hands at a range of mathematical crafts, including crocheting hyperbolic planes (with beautiful Ashford Tekapo yarn), building fractal sculptures, making Möbius strips and folding origami dodecahedrons. The public talks were given by mathematicians and crafters, and covered topics ranging from the mathematics of knitting, and the Four Colour Theorem, to fractals in art and nature, and chaos and the crocheted Lorenz Manifold.

A star of the Festival was a magnificent crocheted mathematical object of almost 22,000 stitches, the Lorenz Manifold. This beautifully convoluted crocheted surface is the creation of mathematicians Prof Hinke Osinga and Prof Bernd Krauskopf, now at the University of Auckland. Working in the UK in the early 2000s, Hinke and Bernd used computers to visualise complex shapes. They realised that one of their algorithms could be translated into crochet instructions. After over 80 hours of crochet, and a publication in the mathematics journal *The Mathematical Intelligencer,* Hinke produced the manifold shown in the photo. It has delighted and intrigued people all over the world – but no-one has yet made one in New Zealand.

Professor Hinke Osinga and her crocheted Lorenz Manifold

Hinke and Bernd have set a challenge: be the first in New Zealand to crochet a Lorenz Manifold, and they will send you a bottle of champagne! The instructions are available from Hinke's website: www.math.auckland.ac.nz/~hinke/crochet

Hinke and Bernd's manifold is just one of many fascinating mathematical objects we can create from yarn. Sarah Mark (a graduate student from Canterbury University) crocheted a stellated dodecahedron from 8ply Tekapo yarn. A dodecahedron is a solid with 12 identical pentagonal faces. In the crochet version, each of the identical pentagonal faces are stellated, which means that instead of being crocheted flat, increases have been used to create points at the centre of each face. These kinds of solids are not only fun to create and beautiful to behold, but by making them we can experience firsthand the wonderful symmetries present in such highly structured objects.

After a weekend immersed in such crafts, what did people learn from attending the Festival? Aside from experiencing the "fascinating complexity and depth to all of the various constructions", they were "amazed by how much breadth mathematics encompasses", and have come to realise "how wonderful knitting and crochet can be mathematically". And perhaps most heartening of all, that "maths is exciting" and "maths can be fun!"

The popular crochet station at the Maths Craft Festival