

Fabric Sculpture – Jacob's Ladder

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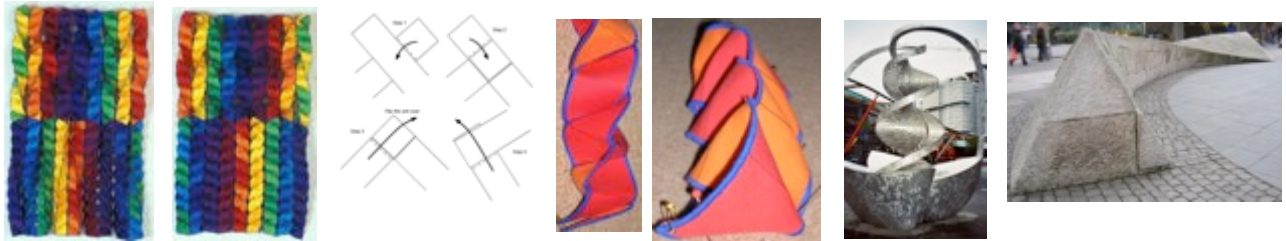
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Abstract

Becoming aware of maths in my work. Translating origami concepts into fabric constructions. How fabric affects form and opportunities it creates. New developments

Designing the Jacobs Ladder

In 2005 I made a fabric Jacob's ladder for my first book *The Quilter's Guide to Twists and Tucks* (Louise Mabbs and Wendy Lowes. Collins & Brown 2006)



Figures 1 & 2: Jacob's Ladder front & back **Figure 3:** Folding sequence in paper

Figures 4 & 5: Fabric version semi & fully stretched

Figure 6; Charles Jencks, architect, by Life Centre, Newcastle built by local craftsman

Figure 7; John Mayne sculpture outside Royal Festival Hall, South Bank, London

I played with origami as a child. Then forgot about it. When I met Wendy, who I invited to be a Co-author, and her fascinating work through quilting circles, she recommended joining the British Origami Society. I dithered for years until the book commission came, when I subsequently attended two of their biannual conferences. Heinz Stobl was the key guest at my first conference, I was riveted by his work and stretched myself to attend even the advanced lessons. At the time I recognised how amazing his constructions were, but it was the techniques he taught in order to construct his interconnected boxes that interested me. He demonstrated a technique for folding that I know as 'Jacob's Ladder'. I promptly forgot about it, until the deadline for my book proposal.

The structure has many names around the world.

"In Holland this is called a "muizentrapje" (mouses' staircase), in Germany a "hexentrappe" (witches' staircase). Sebastian Kirch calls it in English "witches' staircase" and Heinz told me he heard English and American people call it "witches ladder".” [1]

NB I will be add a lot more information and making more sculptures before the conference

[1] <http://home.tiscali.nl/gerard.paula/origami/knotology.html#knippen>

The Mathematics

When I made the piece, I did not initially recognise the mathematical implications of the structure. I had prepared the strips for the first photoshoot and had no idea how to proceed. Several things soon became clear:

- a) Using 2 separate colours on the first strip and two different colours on the second strip of each pair was too chaotic for what I wanted to achieve, which in this case was a sharp rainbow sequence. This was resolved by making two sets in the same colour pairing for each unit.
- b) In terms of the smallest number of colours I could use so they would not come up against themselves (4 colour map theory) Could I change colours every third strip in this structure?.
- c) When the pairs were folded together it was difficult to see how they could be joined together, so I had to alternate clockwise and anticlockwise folding techniques. The piece therefore, involves symmetry.
- d) In order to add more interest I used an odd number of colours, in this case 13. Each colour comes up against two other colours.
- e) When you fold a paper ladder, the structure appears square, end on, because you fold the strips squarely across each other, though they may spiral above one another if badly folded. When I started to manipulate my fabric ladders, I discovered they appeared triangular in cross section, end on, when stretched beyond the 'natural' extended position of the ladder. **Figures 4 & 5**
- f) Fabric ladders have more than one comfortable extended position. Which can be exploited for a variety of effects.
- g) At natural comfort position, the outer corners of the unit lie along a line facing 90 degrees from each other
- h) At maximum stretch, the corners face opposite directions another 90 degrees. In paper this is uncomfortable but not in fabric, where the outer edges of the compartments take on a curved appearance to accommodate the stretch.
- i) When the ladders are extended fully compartments lay flat on the front of the piece, but there are triangular peaks on the reverse (see top of piece).
- j) Folded units can also be sewn with the pyramids on alternate sides:
VVVVVVVVVVVVV V V V V V V ((line needs inverting))

 V V V V V V
- k) The links with DNA structure are obvious, if you imagine DNA as a strip of paper twisted where the edges give 2 helices, The sculpture in Newcastle is a good interpretation **Figure 6**
- l) 3 helices are generated by my folded structure, similar to the sculpture by John Mayne outside National Theatre, London **Figure 7**
- m) Several other questions also arise: Does the number of squares affect the results in terms of rotation? How many strips can be folded into a structure? Or how few? One strip twisted gives two spiralling edges, another interesting structure in itself. Can three strips be successfully plaited? Cords can but how would flat pieces work?