JULIE BROOKE: VICE-CHANCELLOR'S COLLEGE VISITING ARTIST FELLOWSHIP

Catalogue Essay

Collaborators

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Statement

Talking to mathematicians can be a disconcerting experience. We start on common ground, then within a few minutes I'm nodding my head in agreement, but my brain is spinning. I feel I'm hovering on the edge of understanding, but can't quite take the next step. I think this correlates with my inability to visualise the abstract systems and structures under discussion.

Working with Dr Vanessa Robins and Professor Stephen Hyde, I aimed to find out how they visualise abstract concepts, and whether developing my own way of picturing these would help me to understand their research. Vanessa and Stephen work in the area of topology, a branch of mathematics "concerned with the intrinsic properties of [the] shapes of spaces."[1] I've focussed specifically on the topology of 'cubic membranes,' known also as 'entangled labyrinths,' three-dimensional Euclidean structures formed from two-dimensional non-Euclidean hyperbolic surfaces.[2] My collaborators are patient, and use physical models – handmade cardboard lattices painted red and blue, tessellating plastic puzzle pieces – to explain their ideas.

This has helped me to visualise the form in the following way. Imagine you're walking through a maze of tunnels, branching left and right, up and down, creating a regular network of interconnecting corridors. Beyond the walls are identical labyrinths, intricately entwined with yours, but entirely separate. Other wanderers tread their own entangled paths, walking beside, above and below you, but your paths will never cross. These topological forms are not only an abstract concept, but have been found in nature where they appear to provide a soft template for the formation of structures inside the wing scales of a butterfly during metamorphosis.[3] I'm intrigued by the metaphorical as well as the mathematical implications of a form that bridges the abstract and the concrete, and negotiates two incompatible systems of geometry.

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[1] "Topology," http://www.math.columbia.edu/research/topology/ (accessed 10 December 2014)

[2] S. J. Ramsden, V. Robins, and S. T. Hyde, "Three-Dimensional Euclidean Nets from Two-Dimensional Hyperbolic Tilings: Kaleidoscopic Examples." *Acta Cryst. A* 65 (2009): 81–108

[3] Schröder-Turk, G. E. *et al*., "The Chiral Structure of Porous Chitin within the Wing-Scales of *Callophrys Rubi*." *Journal of Structural Biology* 174 (2011): 290–295

I wanted to depict this structure in two-dimensions, but without the distortions that occur when hyperbolic planes are mapped onto a flat surface. In the late 19th century, the mathematician Charles Howard Hinton suggested that to understand such complexities,

> … we must form the habit of mental painting… putting definite colours in definite positions… with our minds in thought, so that we can recall, alter, and view complicated arrangements of colour existing in thought with the same ease with which we can paint on canvas.[4]

Setting aside the idea that painting is easy (it's not), Hinton's idea of using colour not as an attribute of a physical object, but as a means of encoding form and space, was key to the development of my work.

In the paintings overleaf the lattice is flattened into a two-dimensional grid, and I represent the separate, interconnected strands of the entangled labyrinths using colour. For example, while the yellow triangles in these paintings are physically separated, they map a single continuous pathway. Ultramarine blue and cadmium orange pass through the yellow in separate but similarly continuous waves, without the colours mixing. I wanted also to evoke a sense of movement through these entangled spaces, so faded and brightened the colours to create a sense of dynamic flow.

In this way I aim not only to map space and movement, but also to evoke the shimmer of the butterfly's wing through the use of complementary colours and simultaneous contrast. However, this is also a material investigation. Perhaps paradoxically, my direct engagement with another discipline has refocused my attention on the manipulation of colour and materials, and the exploration of the picture plane, that is particular to painting.

Acknowledgements
I am very grateful to Dr Vanessa Robins and Professor Stephen Hyde for guiding me through the intricacies of their research with such patience, and to Head of Department Professor Tim Senden for his enthusiastic support of this project.

Bio
Julie Brooke graduated with first class Honours and a University Medal from the ANU School of Art Painting Workshop in 2008, and completed a practice-led visual arts PhD in 2013 for which she was awarded the J. G. Crawford Medal. A former research scientist, she investigates parallels between research in science and in the visual arts, and exhibits nationally. She holds a Research Fellowship at the ANU School of Art.

[4] Charles Howard Hinton, *A New Era in Thought*. London: Swan, Sonnenschein & Co. (1888): 87