



**NORWICH**  
UNIVERSITY  
OF THE ARTS

# **LES BICKNELL**

unfolding thinking (2017)

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Output Reference: NUA-LB-01

Output Date: 2017

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**CONTEXTUAL INFORMATION**

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## 2. RESEARCH PROCESS

The initial contact to develop a relationship between Art and Science was from Jeremy Baumberg, Professor of Nanoscience in the Cavendish Laboratory at the University of Cambridge and Director of the NanoPhotonics Centre.

The research process for this project began with a series of meetings with stakeholders and interested parties which set out to establish the specific areas the project would address and identify sources of support. The next step was to explore the large number of starting points that emerged from meetings and initial work within the labs, interviews and notes to form specific lines of enquiry. To understand the new landscape Bicknell researched a number of areas of scientific and technical enquiry, including DNA origami, crystallography, fluidics, electron microscopy, Nanofabrication, Nanoscale building blocks and mechanics, self-assembly, and lab practicalities.'

Bicknell was also interested in addressing the research question: what does science look like? Electron microscopy in combination with the imaging software create a science aesthetic which exudes trust in knowledge, reinforced by the materiality of the spaces in which science is enacted and the attire worn in those spaces: the lab, clean rooms, glove boxes, protective suits and gloves. Working with software more familiar to the art practice Bicknell developed a number of images and films that mine this science aesthetic creating a dialogue around what information looks like.

Specific research sources for this project included texts such as: Skinner, Q. Meaning and Understanding in the History of Ideas in History and Theory, vol 8 No 1(1969) and Pecharsky, V. & Zavalij, P. Fundamentals of Powder Diffraction and Structural Characterization of Materials (2003).

Bicknell documented his research and the development of this work in a number of sketchbooks and on a dedicated blog.

<https://unfoldingthinking.blogspot.com/>

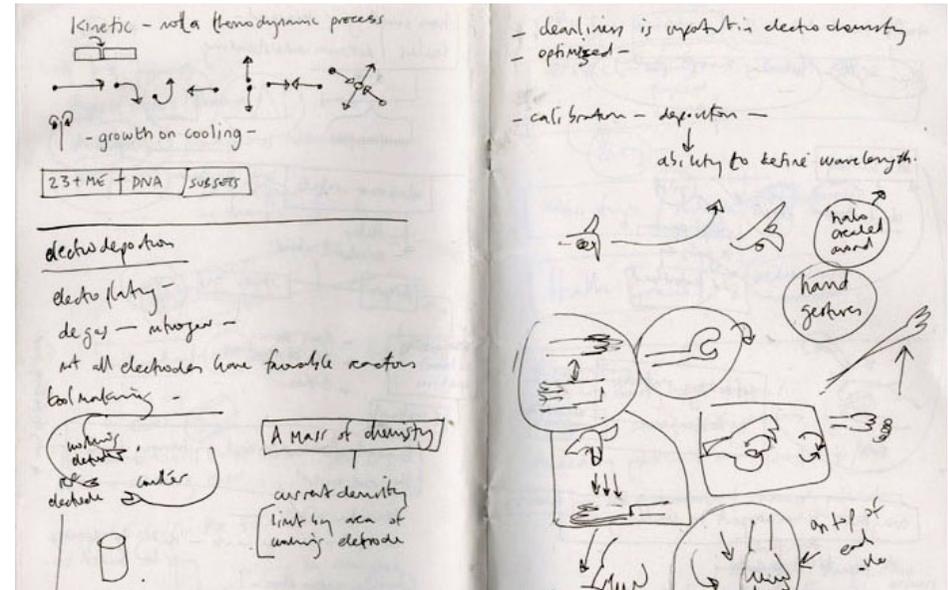


Fig.2 Sketchbook Pages

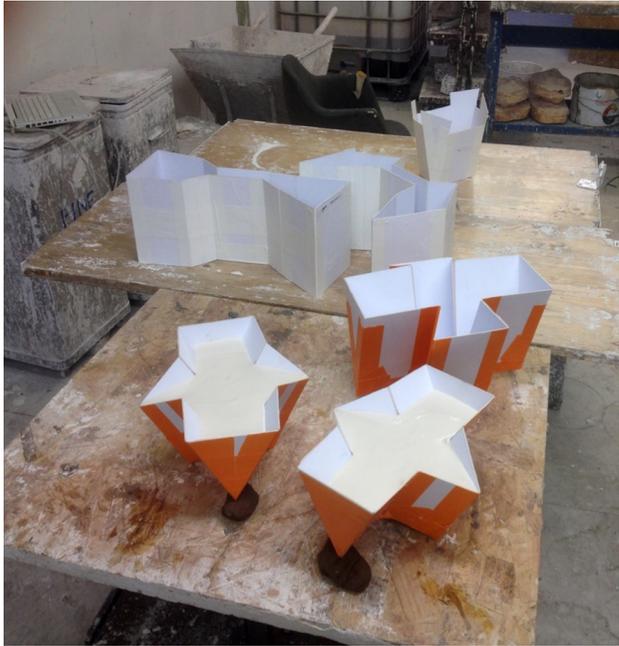


Fig.3 Mould work in studio.



Fig.4 Photo document working in lab

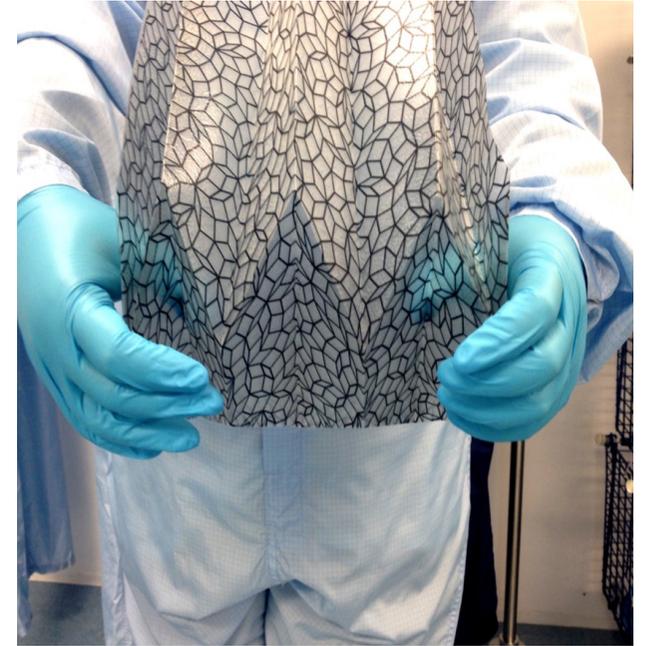


Fig.5 Image of Bicknell lab intervention

# unfolding thinking

As part of a residency with the Nano Doctorial Training Centre I have been exploring concepts of structure in materials down to the atomic scale and creating artwork inspired by the practicalities of revealing nanoscale structure using electron microscopy.

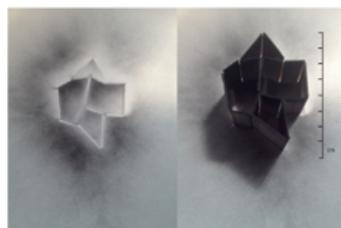
I encountered the idea of using the scattering electrons to obtain evidence of nanoscale structure in a material within an introductory practical held for first year NanoDTC students looking at the interpretation of electron diffraction patterns and images, acquired using a transmission electron microscope.

Initially, I was interested in the use of symmetry within crystallography as a tool for defining, for creating a taxonomy for atomic structure. But the mapping of a structure to a measurable signal, a diffraction pattern or image, captured my interest with the idea that physical laws provide a route to determine an unknown structure by obtaining evidence of its existence in these signals. It is a system which attempts to reveal an unknown from a series of knowns. I have taken this idea and turned it on its head by using a known to make unknowns.

I developed a series of articulated handheld hinged structures. These are derived from what I call 'laboratory choreography'. Whilst attending practical demonstrations I had the sensation of my mind slightly drifting as yet another truly extraordinary piece of information was imparted but one which I was unable to fully comprehend. In an attempt to grasp an understanding I started to watch the hands of the demonstrator, there was an urgency as they used every facility they had to communicate. This space of not knowing appeared to enable a thought, to explore how whilst in the lab scientific concepts and lab processes are communicated through subconscious hand gestures. I have been mapping the hand gestures within the lab that are created whilst explaining scientific processes and creating structures that represented these movements. These structures represent the knowns, something tangible that I grasped as an entry to understanding.

With spray paint standing in for electrons I have used these known forms as a masking tool to make fragmented images that are now unknown but have a sense of having to be remade or reconstructed in the mind. This is the essence of the challenge addressed in tomographic reconstruction where a 3D object is remade from a series of 2D images or projections, the ambiguity in the structure that produces each individual projection creating a "projection problem".

I see these images and the process I have created as an entry point into understanding the challenges in relating a structure to the signal created by probing it and how translation can be used to make the invisible visible and the complex understandable.



An example of a structure created in response to hand movements juxtaposed with the resulting spray print.



working in the studio



Les Bicknell

<https://unfoldingthinking.blogspot.co.uk/>



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and skills

## 3. RESEARCH INSIGHTS

The research developed Bicknell's long-standing enquiry into the bookwork as a hybrid of book and sculpture, alongside an exploration of squeeze, fold and bend structures to control movement so that folding and unfolding and images of folds create their own narrative which are unfolded through thought. The research provided insights into the nature of communication and creative thinking in science and their correlate in creative arts practice, including the processes of mapping shapes and structures in nanoscience and visualising these in a series of artworks and bookworks. Bicknell's works explore how a 'science aesthetic', including ways that science visualises data, can be interrogated to create a dialogue between science and art about what information looks like. The research also developed a model of embedding an artist in a research science community.

Bicknell created over 400 individual outcomes including site specific interventions within labs and communal spaces at The Maxwell Centre. These include poster sessions, works shown in a number of exhibitions as well as presentations and workshops. Over twenty films were created that have been shown in a number of locations including internal information screens in the Department of Materials Science and Metallurgy and the NanoPhotonics Centre .

Fig.6 Poster 1

## 4. DISSEMINATION

### Exhibitions

Permanent installation within the Department of Materials Science and Metallurgy, University of Cambridge. 100 prints exploring a range of approaches to crystallography from symmetry, stereographic projection to direct phase. From June 2017- present

Two six-month long exhibitions in Cavendish Museum, (Department of Physics, University of Cambridge) Display cases with over 200 objects. July 2017 – January 2018

What does Science look like? Exhibition Level 3 of The Maxwell Centre. July – September 2017

Selections from the series of work have been exhibited in group shows at the following locations:  
Art Language Location, Cambridge, 2016

paperscissorsbook, a Northern craft touring show, 2016

Intersections 2017, Loughborough University, Sept 2017

<https://www.lboro.ac.uk/departments/aed/staff-research/intersections/> (accessed 12 March 2021)

Constellation: Inspiration and the Artist Book, Laramie County Library, Cheyenne, Wyoming, December 2016-February 2017

<https://lclsonline.org/constellation-inspiration-and-the-artist-book/> (accessed 12 March 2021)

<https://www.wyofile.com/a-constellation-of-artists-books-challenges-viewers/> 7 June-7 August 2019 (accessed 12 March 2021)

Site Specific, on-line group exhibition at The Cut Arts Centre in Halesworth, Norfolk, August - October 2020

### Films online

electron manipulation - unfoldingthinking <https://youtu.be/mlcJXle8bCY>

2 panel blue folded object - unfoldingthinking <https://youtu.be/XCizd3eRR3w>

2 panel blue triangle object - unfoldingthinking <https://youtu.be/hxJAPirlac8>

2 panel over and under - unfoldingthinking [https://youtu.be/P\\_IFjSO7pvw](https://youtu.be/P_IFjSO7pvw)

2 panels dark circle lots - unfoldingthinking <https://youtu.be/gibw8NbXFEw>

2 panels diff photo layers - unfoldingthinking [https://youtu.be/9ny0Azq\\_xRA](https://youtu.be/9ny0Azq_xRA)

room clean actions in dialogue with object - unfoldingthinking <https://youtu.be/vrgvk7JphMA>

double box <https://www.youtube.com/watch?v=uZv2j0ifjqQ&feature=youtu.be>

## Publications

Bicknell, L: 'Unfolding Thinking - NanoArt-Science Exhibitions in the Cavendish Laboratory', CavMag 19 February 2018, pp16-17 <https://www.phy.cam.ac.uk/alumni/files/cavmag19.pdf/view> (accessed 12 March 2021)

Bicknell, L: 'unfoldingthinking: making book art with scientists' Artists Book Yearbook 2018-19 ISBN 978-1-906501-12-9

## Talks/Presentations

MakeShift, Manchester, Crafts Council 10-11 November 2016 <https://www.theculturediary.com/events/makeshift-innovation-conference-2016> (accessed 12 March 2021)

Making Materials Matter Teachers Conference. The Ironmongers Hall London 19 May 2017. <https://www.materials.ox.ac.uk/files/makingmaterialsmatter20teachersconferenceprogrammedraftv3pdf> (accessed 12 March 2021)

Online workshop presentation for the Leicester Print Workshop, January 2021

Online presentation for the Communicating Science module at Kings College London, March 2021

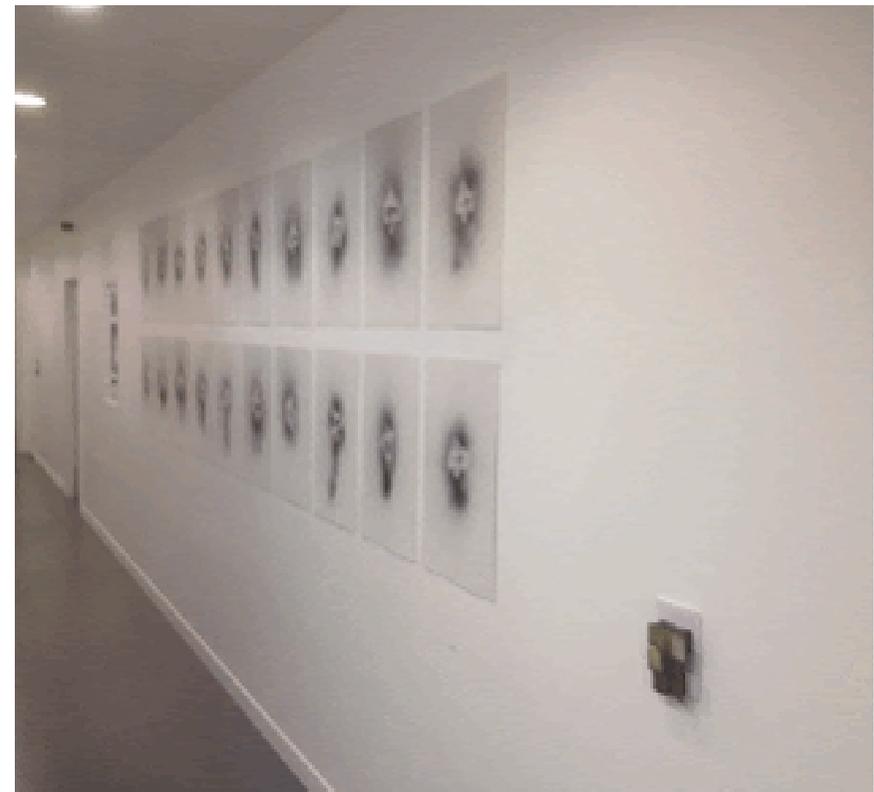


Fig.7 Permanent installation within the Department of Materials Science and Metallurgy ([embedded mp4 file](#))



Fig.8 Maxwell exhibition area with artefacts from Maxwell's time juxtaposed with Bicknell's three-dimensional bookworks and structures reflecting perception of the nano world



Fig.9 Close up of the display ([embedded mp4 file](#))



Fig.10 Exhibition in Cavendish Museum display cases



Fig.11 Exhibition in Cavendish Museum display cases



Fig.12 Close up of Exhibition in Cavendish Museum display cases  
([embedded mp4 file](#))



Fig.13 Exhibition: What does science look like?

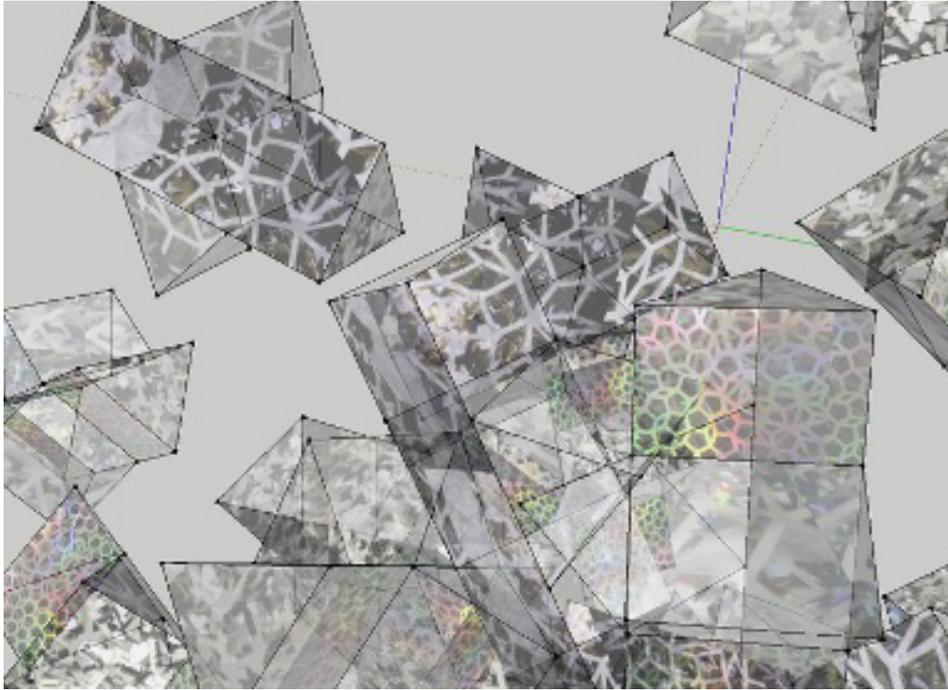


Fig.14 Film still

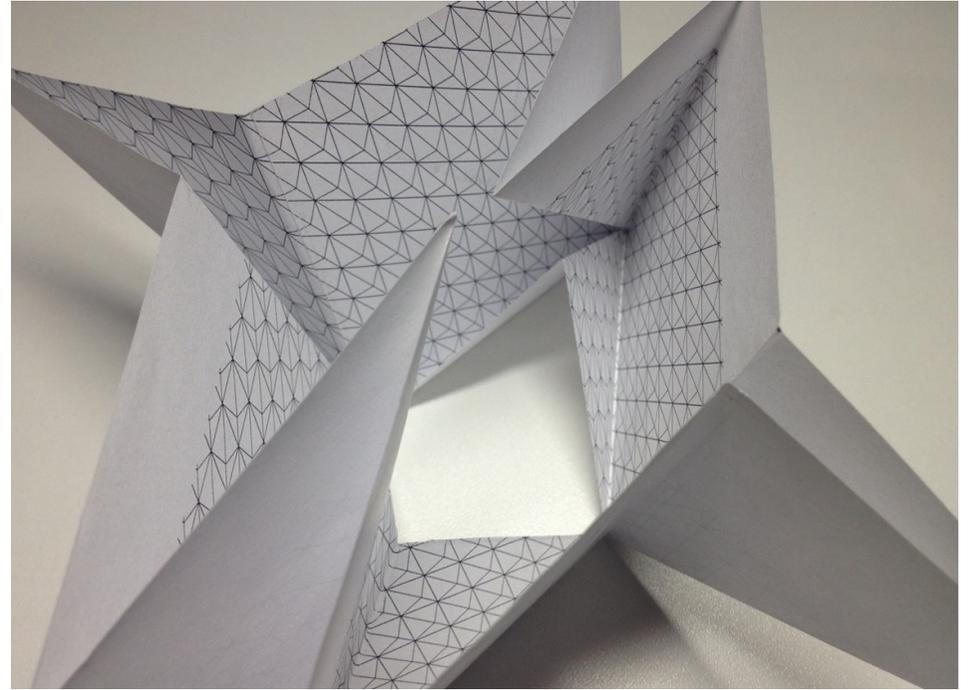


Fig.15 Prototype switch

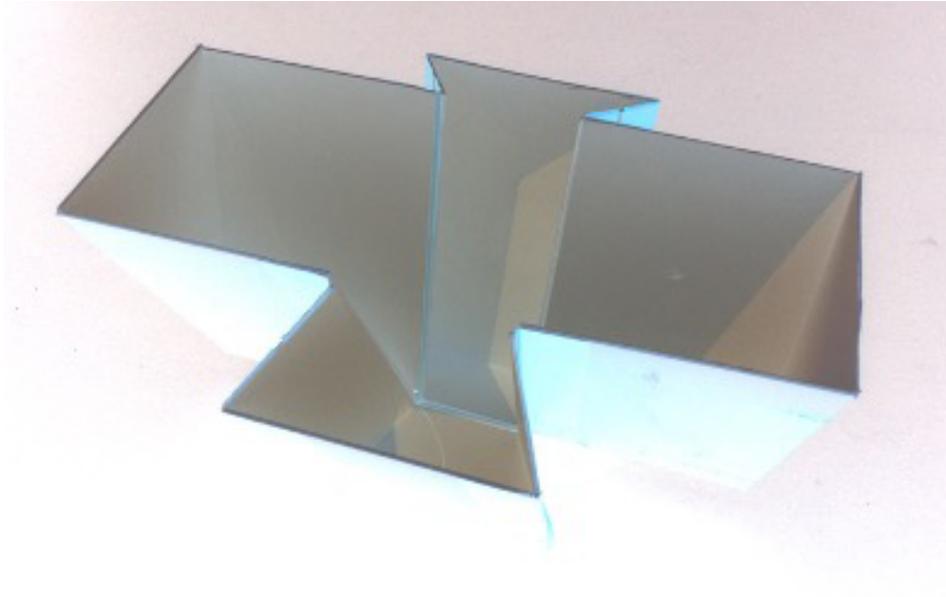


Fig.16 Object 02

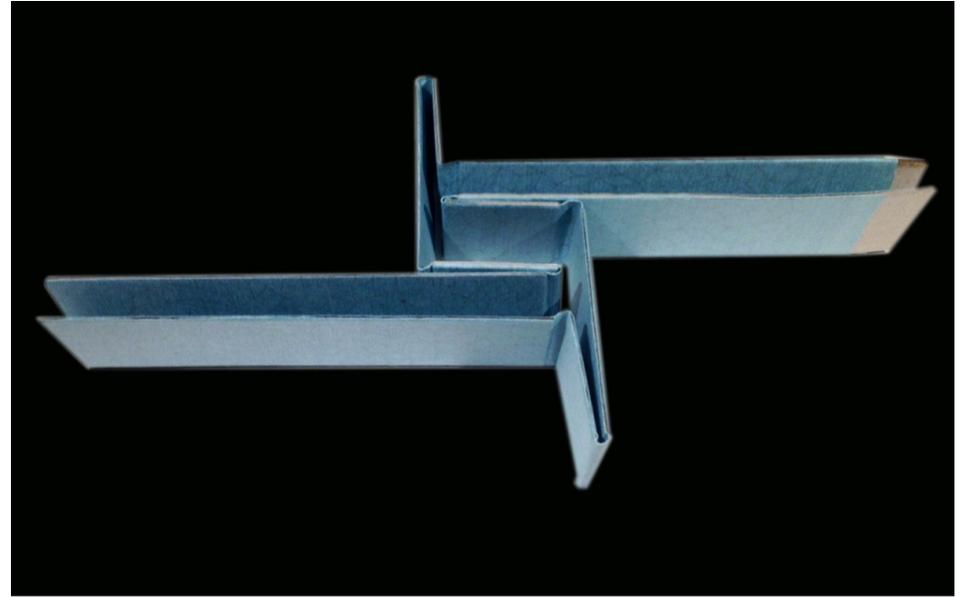


Fig.17 Object 06



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