Outsider Cosmologies and Studio Practice



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Part I

A studio research project submitted in partial fulfilment of the requirements

for the degree of Doctor of Philosophy.

Trinity 2016

For learned nonsense has a deeper sound

Than easy sense and goes for more profound.

(Samuel Butler)

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Project Abstract

Outsider Cosmologies and Studio Practice

Charles Ogilvie, St. Edmund Hall

D.Phil in Fine Art

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This D.Phil constitutes an investigation led by studio practice and supported by archival and desk-based research into knowledge production through the building of complex cosmologies; specifically those created *de novo* in visual art practice and 'outsider science' oeuvres. It considers how these cosmologies relate to mainstream science, definitions of outsider art, and other complex cultural systems such as alchemy. Through a more detailed analysis of the work of the British artist John Latham and American outsider cosmologist James Carter, the thesis undertakes this investigation through discussions on the development of these systems and a consideration of the epistemologies these cosmologies reveal. The studio practice elements drive this investigation forward by interrogating themes including the relationship between culture and complex systems, alchemical epistemology, and the struggle to relate to unintuitive science.

NOTE: This D.Phil submission contains two bound volumes and a digital portfolio (which also contains copies of all the texts).

Acknowledgements

I am grateful to the AHRC who have funded this research and made it possible for me to spend such focused time in the studio and in the library. Likewise, the Ruskin School has been a supportive home for the last four years and I have benefitted from the leadership of Professors Jason Gaiger and Hanneke Grootenboer who have created a stimulating but unintrusive community of artists and scholars. I am also indebted to both for their direct engagement with this project, as personal tutor and confirmation examiner respectively. Paul Bonaventura and Keith Wilson are both responsible for encouraging my original proposal, and I am glad for their confidence in me.

Dr Anthony Garner, Dr Elizabeth Price and Professor Brandon Taylor have each shared some of the duties of examination and supervision over the project. Without their occasionally firm interventions in refining the early parameters of the project the latter half of the process would have been considerably more arduous.

I am grateful to the institutions and curators with whom I've worked to make the shows documented here, particularly the Max Planck Institute in Dresden, the Society for the Humanities at Cornell University, and the Museum of the History of Science in Oxford, where the (then) acting director Dr Stephen Johnston facilitated not only the show but also much of the relevant research.

Several works over the past four years have been developed in close collaboration, and the involvement both intellectually AND creatively of these collaborators has been substantial. Dr Toby Young, Dr Daniel Crow, Dr Vid Simoniti, Dr Matthieu Chavent and Dr Steve Potter are all owed authorship to some degree for this submission. Julia Mintzer and Sebastian Winnett have reliably provided their insights and ideas as well as their graft. Through their knowledge and professionalism Jane Cairns, Begonia Fernandez, Phil Levy and Carolyn Nicoll have also been instrumental in the finish of the work. Matthew and Nichole Wood at Second Floor Studios & Arts have created a community of studios at Woolwich which has been a welcome home.

The archival research at Flat Time House which underpins much of the thesis was encouraged early on by Elisa Kay and supported in the latter stages by Katharine Jackson, to whom I am also very grateful for her ideas and input on the text.

In addition to his many comments on the text, Dr Vid Simoniti has provided a sounding board for the development of the intellectual scaffolding of the project as a whole. I am also grateful to Dr Toby Young, Julia Mintzer and Professor Mackie Ogilvie for their help with the writing and proofing.

My supervisors: Prof Brian Catling handed me a licence to experiment when I was an undergraduate and has endorsed it whenever called upon. Richard Grayson has followed every twist and turn of the project with patience and enthusiasm and I am forever indebted to his intelligence, insight and kindness.

I have had welcome company along the way, all of who have been supportive and interested and have added to the pleasure of the process: my parents, brother and sister; Paul Scriven; Professor David Fisk; Matt Galpin; Natalie Sanderson; Olivia Thacher; Andrew Shortis; and Senghin Kong.

Finally, I am grateful for Anna and Eiger who never need to concern themselves with outsider cosmology, but who have witnessed more of this process than any creature but me.

Introduction to the Project and Submission

> "...in the course of the aforementioned Age of the Feuilleton, men came to enjoy an incredible degree of intellectual freedom, more than they could stand.... Amongst the favourite subjects of such essays were anecdotes taken from the lives or correspondence of famous men and women. They bore such titles as "Friedrich Nietzche and women's fashions of 1870," or "The Composer Rossini's Favourite Dishes," or "The Role of the lapdog in the lives of Great Courtesans" and so on."(Hesse 1943)

When journalists wrote about the discovery of the Higgs Boson, they used metaphors to explain the science, and with it to explore the profundity of what had been discovered. These attempts were as varied as buckets of ball bearings in engine grease and ping pong balls on a tray of sugar. For many non-expert readers, these images would have left them feeling that they had gained a genuine insight into this discovery, but such is the unintuitive complexity of the underlying physics and the mathematics required to describe it, that these real world simplifications offer practically nothing in terms of representing the actual science behind the discovery of this particle and its operation. For most of us this isn't a problem; we are reassured that progress is being made, and stimulated by the idea that there are things we can glimpse but perhaps will never understand. After all, we live in a world where no single person understands the complete operation of a mobile phone or a motor car; so what hope do any of us really have of understanding what goes on at the vast CERN laboratories where the Higgs was discovered?

We all delude ourselves to some degree. These buckets of ball bearings and trays full of ping pong balls become substantial in the imagination, appealing to our susceptibility to the readily intuitive and the easily visualised. We do not need to be experts or even believe that we have a comprehensive knowledge of a subject to feel as though on some level we understand it - a phenomenon increasingly discussed outside the narrow constraints of complex science. Political movements and religion have long operated through the reduction of complexities to simple visual or narrative renditions. My practice is engaged with this grey area of partial-comprehension and the challenges of knowledge production within the uncertainties of contemporary intellectual and cultural life.

This project was catalysed by some work I did in 2011 at the archive in Flat Time House, the former home of the British artist John Latham. Latham died in 2006 and his art historical legacy had just begun to be re-examined. New versions of his life and work were being spun out of his extensive archives and oeuvre by researchers and institutions. However, of the many histories being proposed, few directly addressed his cosmology; the complex and confusing Event Structure that he related to nearly every single one of his works and actions over his six-decade long career. Even if his cosmology is profoundly idiosyncratic, and at times incomprehensible, it is a response to or struggle to explore something, and I wanted to understand it better. This research question dovetailed with my own practice's enquiry into complex systems, culture and knowledge and formed the basis of my initial research proposal.

In the studio I have developed new work exploring this space whilst using the opportunity of the D.Phil to review archival material and relevant theory to address my specific curiosity about Latham, and by extension the outsider cosmologist James Carter, who became an important counterpoint to Latham over the course of this project. The academic research has been fruitful both in fuelling the development of work in the studio and in answering its own questions: what drives these outsider cosmological projects? How do they operate and what are their claims to knowledge production?

Practice-led research

The fact that two bound volumes make up this D.Phil rather than one illustrates a central challenge of the project. – the dichotomy between on the one hand what is described as 'desk based research', and on the other 'research by practice'. Over the last four years, much time has been spent wrangling with this dichotomy and how it can coherently be reconciled in the practice-led D.Phil; so before I explain the submission in detail I'd like briefly to outline my approach.

As an artist who typically engages with academic subject matter, my practice has always drawn in part from traditional models of research, be it the exploration of archival material or the contextualising of my subject matter through dialogue with other fields. The practice *led* nature of the project is often emphasised but I see the two halves as mutually sustaining. While certain types of activity such as *reading* or *making* might seem to typify one half or another, they often overlap, providing routes to advance the project and solutions to problems or questions encountered along the way.

Hence, the real challenge is a presentational one: the institution asks for an academic thesis and a separate presentation of work. So how do I elaborate the project's entirety, whilst accepting the strictures and conventions of the academic submission? As is common in humanities research, the argument and conclusions in the thesis are often arrived at late in the project when the research material covered can be considered as a whole: research detours and early experiments in writing are jettisoned to produce a consistent and coherent argument supported by a neat marshalling of the relevant evidence. In the studio however, early experiments and failures can be the best documentation of the progress of the research. In this project the two have progressed hand in hand: hence a dilemma - how much to jettison from the thesis to make it academically polished at the cost of stranding important elements in the portfolio, and vice versa: how much to contort the thesis through the inevitably convoluted development of studio work?

My approach, on which I will elaborate in the following sections, has been to try as best I can to shape the thesis around the overall project's progress, whilst making allowances for the necessary focus and coherency of academic writing. The portfolio is an edited account of the research process; like the thesis, it is intended to offer a coherent account in and of itself, whilst illustrating plenty of moments where the two halves have overlapped.

Returning to the Hesse quote from Magister Ludi which opened this chapter; a detailed, standalone study of the cosmologies of Carter or Latham might have been an appropriate endeavour for the age of the Feuilleton. I hope that through the development of ideas and motifs in the studio and desk research, as they weave through the thesis and back into the finished works, the operation of this project is closer to the Glass Bead Game, which supersedes the Feuilleton in Hesse's novel. In this playful endeavour, an idea or form is explored through the perspective of a number of fields and creative expressions.

The submission:

The **Portfolio** included with this submission is a digital documentation of finished studio work. I have selected five key works or groups of work, most of which have been exhibited. Whilst this criterion was not essential, it demonstrates the work achieved a certain degree of resolution. Much of this work is also viewable at lower resolution on my website: www.charlesogilvie.co.uk

The Portfolio is not a comprehensive record of all the work I have made in the last four years. Some of the work presented was made whilst explicitly engaging with the research themes, and some was not, or at least did not start off that way, but later seemed to be pertinent to the subject being explored. Some works that were made prior to the inception of this project are included for reference; for clarity, these are included in the 'other referenced work' folder.

The **Portfolio Listing** gives the basic information about the work in the portfolio. It should be used as an index to the digital portfolio. It also has some notes as to reproduction for the video.

PLEASE NOTE: any/ all of the work in the portfolio is available to view in person through arrangement with my supervisors.

The **Portfolio Text** is intended to put the submitted works into context within the studio practice. They are journalistic rather than academic which is reflected in the style, formatting, and referencing. Whilst they follow the rough trajectory of the research, they are structured along the line of the portfolio rather than strictly chronologically. I have not sought to exhaustively unpick the process of developing new work, or to provide a detailed critique or analysis of finished work or its relationship to the thesis. My aim is that the links and developing ideas should become apparent as you read through the thesis and explore the portfolio, however, I have bolded some sections where themes emerge that explicitly reflect on the overarching structure of the project.

The **Thesis** is offered in the accompanying volume (Part II). Whilst I note in its introduction that it relates to the wider project, this is the sole mention as it is my intention that it stands alone as a piece of writing. Despite this, it is integral to the project as a whole and much of the development of ideas and exploration of material that underpins the portfolio is as well documented through the academic writing in the thesis as it is in the documentation and discussion of the portfolio. If this project comes to explicit conclusions, they are to be found in the thesis.

The **Epilogue** rather, is a continuation of this introduction and the studio texts. Its aim is not to draw grand conclusions as to the value of the whole project, but to reflect on the ground covered, the conclusion of the thesis and developments in the studio and to make some final comments about practice-led research.

I have included at the end of this volume a **Project Bibliography.** This is a survey of the material that I have explored in the development of the project as a whole. In addition to the bibliographic material and cited works within the thesis it evidences various detours and excised but relevant endeavours which, whilst not making it into the thesis itself, have been formative to the project as a whole.

The project can be digested in any order but I suggest leaving the Epilogue until both the Thesis and the Portfolio have been explored.

Portfolio listing

The following works are submitted as a digital portfolio, representing the studio research undertaken.

The work is divided into five main works/ bodies of work, and a supplementary folder with other works referred to in the portfolio text. The following listing mirrors the file structure on the digital portfolio submitted with this text:

A. Taxonomic Cyanotypes:

a. *Plant Species Exhibiting Touch Sensitivity, 2012*
Plants Designated as National Emblems of the Nuclear States, 2012
Plant Species Yielding Blue Dyes, 2012
Cyanotype prints
3 x 910mm x 680mm
***Sustainability*, Oxford Botanic Garden, 2012**

b. *Geodesy Tryptic, 2013*
Cyanotype prints with Indian ink
3 x 1040mm x 580mm
***Three Fields*, NoFormat Gallery, 2013**

c. *Native/ Non-Native Tree Species of New York City*, 2016
Cyanotype print
2 x 665mm x 849mm

B. Map Works:

a. *Nantucket – Cetus Pod,* 2012
Nautical markers on chart
1.2m x .9m

b. *Right Angle Triangle: Nantucket Towers*
Cyanotypes and map with construction lines
3x (1000mm x 1500mm) and 1000mm x 900mm
***The Beautiful is Present*, Hanmi Gallery, 2013**

C. Dreams of Homunculi

Dreams of Homunculi, 2015
Digital animation and sound (11 minutes)
Museum of the History of Science, Oxford, 2015
note: sound should be quiet but audible from the start.

D. Circling the Square

Circling the Square, 2015
Glycee prints and frames, Bronze bust of Max Planck (in situ)
3m x 3m x .3m
Max Planck Institute for the Physics of Complex systems, 2015
note: I have included hi-res copies of the eight prints in case you feel like trying to solve the puzzle.

E. The Principles of Collision

The Principles of Collision
Stop frame animation and sound (10 minutes)
The Society for the Humanities, Cornell University, 2016

F. Other referenced work

a. *Reliquary Bracket for the Jawbone of a Sperm Whale*, 2012
Aluminium, steel, felt
4.5m x 2m x 1.2m
***Open West*, Gloucester Cathedral, 2012**

b. 2D/3D/4D – Klein Blue Bottle, 2016
Woodcuts,
795mm x 573mm
***Anonymous*, Noformat Gallery, 2016**

c. Pi Vessel, 2013
Gas fired and oak chip smoked handbuilt local clay and raku glaze
450mm x 450mm x 700mm
***Modern Makers*, Old Royal Naval College, 2014**

d. *The Renormalized 4-Vertex at one-loop and drawing of The Renormalized 4-Vertex at one-loop by the artist (see reverse)*, 2011
Chalkboard, paint, chalk
1800x1800x400mm
Blyth Gallery, 2011

e. *A Reflection on the Higgs Boson*, 2015
Etching and aquatint
361mm x 418mm

Portfolio text

This text describes the development of the key works in the main portfolio. Where it makes reference to other works they are documented separately in the portfolio as 'Other referenced work'. Whilst the following are presented in chronological order much of the development of the work in the studio and research overlapped.

I have bolded some sections where I allude to specific links with the thesis.

This is not intended as academic writing and so referencing etc. is limited.

Taxonomic Cyanotypes

Plant Species Exhibiting Touch Sensitivity, 2012
Plants Designated as National Emblems of the Nuclear States, 2012
Plant Species Yielding Blue Dyes, 2012
Cyanotype prints,
3 x 910mm x 680mm
***Sustainability*, Oxford Botanic Garden, 2012**

I produced the first three cyanotype works for a small show at the Oxford Botanic Gardens, a site both historically and spatially aligned with the development of botanic taxonomy. The layout of the paths and beds accommodates and mirrors the divisions into which early classifications had divided the plants. I had seen a show in Oxford in 2005 of paintings by the artist Alison Turnbull, who had explicated these divisions in neatly colour coded canvasses and a small almanac, so the idea of the gardens as an embodiment of taxonomy and the classical episteme was live in my mind as I started working on this project. But the Gardens predate both Linnaeus and the euphoria of Victorian classification. At work behind the neatly ordered beds is an apothecary's garden where alchemical reasoning would have made links between the form of a plant's roots and the shape of an afflicted body part, or the seasons of fruiting and the balance of humours.



Figure 1: The Family beds (detail from almanac), Alison Turnbull, 2005



Figure 2: Cystoseira granulata in Photographs of British Algae, Anna Atkins, 1843

The work developed out the discovery of the large body of botanical cyanotypes created by early botanists, specifically Anna Atkins (1799 – 1871), a pioneering English botanist. Atkins used the cyanotype process to catalogue English flora [Figure 2]. The process was invented by her father's friend John Herschel (1792 – 1871) the English astronomer, to reproduce his notes and diagrams.

As I researched the cyanotype process further, its links to the Victorian taxonomic project became more explicit. Atkin's trips around the UK recording plant species were part of the exhaustive cataloguing of the natural world that is a cornerstone of the classical episteme, as I would discover through my later research.

I decided to use a taxonomy as the underlying structure for the work, and started iterating different groupings of objects, ideas and individuals. Building on previous work, and the clear read across to the contemporary sense of the blueprint, I had hoped my cyanotypes might have found an incarnation elaborating upon an engineering subject or piece of architectural infrastructure. Using a spreadsheet to capture the process, I explored lists of power stations made redundant (extinct) through various pieces of legislation and groupings by formal similarities of pylons, lamp posts and television aerials (numbers of branches, degrees of branching). Some of these resulted in some early trials, photographing the subject matter myself and exposing the negatives in studio (see fig. 2)



Figure 3: Kingsnorth powerstation. The Cyanotype techique provides rich midtone variations but detail is quickly lost towards the darker and lighter extremes.

A rare colour in nature and a difficult pigment to manufacture, many renaissance painters were paid in proportion to the area of blue they were being asked to paint. Prussian Blue was the first of the synthetic pigments that from its invention in 1706 had gradually filled the world of the non-elite population with colour. The cyanotype process, although invented nearly 150 years later, produces precisely the complex of ions originally described as Prussian Blue, dying the paper fibres themselves rather than just leaving pigment on the surface.

My lists and groupings evolved through their own kind of natural selection: aesthetic or practical criteria pitted against sophistication of relation or drive for the poetic. The first group of the final three that I settled upon was the plants designated as the emblems of nuclear states. I had been looking at lists of plant emblems, where they appear in heraldry or other insignia (initially responding to the lilies in the crest of Magdalen College, which overlooks the garden). My previous work had been heavily engaged with the British nuclear power programme; reading about the early development of nuclear power stations, I realised that this programme was one aspect of a larger history, closely intertwined with that of the atomic bomb. The oak leaf, for the United Kingdom, led me to other, occasionally surprising plant emblems. France was problematic as it doesn't have a plant emblem per se, so I adopted the heraldic fleurs-de-lils to the purpose. Of course Israel is missing. Its national plant is the Cyclamen, ironically also the name of its nuclear programme.

I made the connection to the Cyanotype when reading about the silhouettes of people and animals etched into concrete by the intensity of the UV emissions from the bomb blasts.



Figure 4: Showing online plant archive image reduced to a negative. The font is from the original 1648 catalogue for the Garden

The other sets then started to fall into place. The Latin names of the blue-dying plants give a clue as to the plants' purpose: 'indigofera' and 'tinctura'. The implicit challenge of handling and placing

the touch sensitive plants onto the coated paper gives a vivid sense of the delicate and deeply tactile element of the work's production.

The specimens for the finalised taxa were collected first from the botanic garden itself, then from photographs of their specimens and finally, failing that, from images from online botanic libraries. [Figure 4]. The final prints were printed from a mixture of real and reproduced specimen.

The medical origins of the medieval botanic gardens were the cultivation and improvement of medicinal plants. The cyanotypes sit at home in this early pharmaceutical preserve too: after its invention Prussian Blue was used as a tonic for heavy metals poisoning and the cyanotypes themselves are therefore, if ingested, a cure.

The three families of plants reflect upon the three essential actions in the creation of the print: the laying of the plant samples on the coated paper (the touch-sensitive group), the UV blast of the exposure (the emblems of nuclear states) and the subsequent dying of the paper (blue-dying plants).

The space allocated for the work is a gallery facing the oldest 'Family Beds' in the garden and they are hung of the back wall of the space, the listed wall of the original garden. The material sensibilities of the images needed to reflect the loaded site they would inhabit. This applied to the framing and hanging of the works, which each faces a sash window and hang in dark oak frames which echo the specimen case and the mannered, scholastic aesthetics of Oxford itself.

The work is not immediately decipherable. The Latin names and sometimes obscure species make 'solving' the taxonomy a challenge of lateral thinking, requiring general and botanical knowledge. This degree and type of riddling implicit in some artistic works started me thinking about the functioning of such puzzles in art, and catalysed a strand of research within the project.

Geodesy Tryptic, 2013
Cyanotype prints with Indian ink
3 x 1040mm x 580mm
***Three Fields*, NoFormat Gallery, 2013**

Whilst researching the history of the blueprint I discovered the work of the French engineer and photographer Georges Poulet. During a long trip to Argentina from 1890 to 1894 as director of a French railway project, he had exposed, on the cyanotype paper, the glass photographic plates he used to record the progress of the project. He would have had the paper in plentiful supply to reproduce technical schematics - blueprints. The resultant images are a mixture of the composed and the informal: great landscapes bisected by the advancing railway, and workmen lounging around small settlements. All are realised in the subtle mid-tones of the cyanotype and annotated in his scrawling hand in red indian ink, literally rubric [Figure 5].

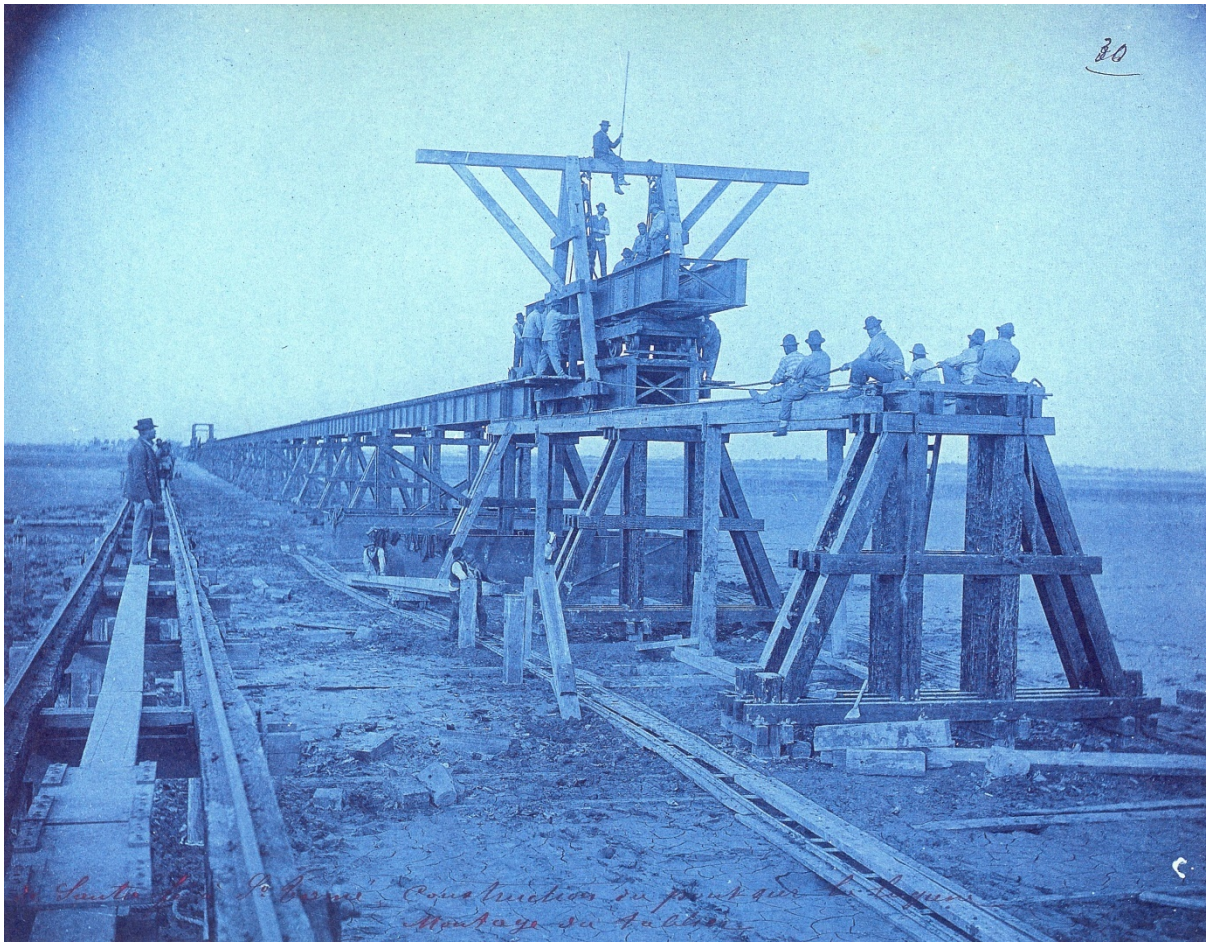


Figure 5 Construction du pont sur la lagune, Poulet, 1894, Cyanotype, 219 x 279 mm

Blueprint and Rubric are both now defunct processes. They have only survived as linguistic relics in modern English, denoting their utility: the robust template and the vital annotation (Rubrication being a separate stage in the production of a medieval manuscript where important names, phrases or and capital letters were added in a red pigment for emphasis [Figure 6]).



Figure 6: Example of Rubrication

The next cyanotype work uses these techniques to describes three early cosmological measurements. It is a triptych of cyanotypes which illustrates three possible approaches to measuring the size of the earth – Geodesy – dependent only on measurements attainable at human scale; these approaches demonstrate an extraordinary imaginative and intellectual leap for the ancient Greeks who proposed them. They extrapolate from the personal scale to the cosmological through the construction of simple geometries writ large. Unlike most early science, these early measurements and calculations were surprisingly accurate. My work formed part of a larger show, which used the site-specific geology of the gallery as the basis for the 'discovery' of other related kinds of geological, historical and cosmological information [Figure 7].



Figure 8: Installation shot from Three Fields at the NoFormat Gallery, 2013

When I conceived of this work it was really designed as a sort of conceptual clue as to the functioning of the other works in a show, T*hree Fields*. The other works operated in a similar way: extrapolating the locally observable to the universal.

Looking back, having undertaken the research and writing for chapter two of the thesis, where alchemical logic and 'renaissance' epistemological thinking is explored, the *Geodesy* work seems an important hinge between the roots of early empirical science and the same instincts which led instead to two millennia of alchemy. The red Indian ink records the 'thought process' through the construction of the geometry and presages the 'diagrammatic logic' of alchemy.

This work predated my detailed research into the manuscripts of alchemy as part of my subsequent project with the Museum of the History of Science, but I was pleased to find plenty of rubric used for emphasis in these texts as well [Figure 8].

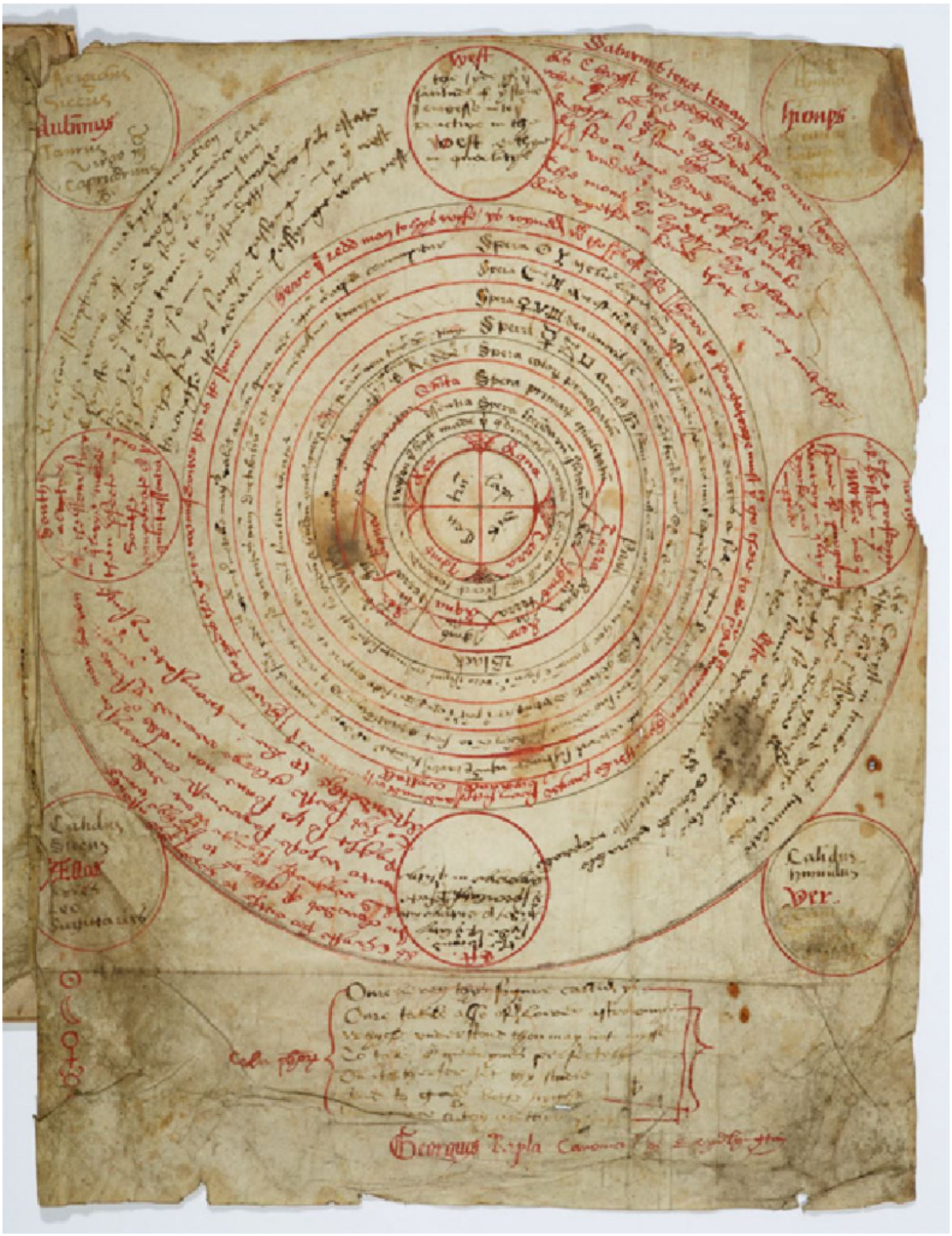


Figure 9: Thomas Knyvet's wheel, rubric and geometric extrapolation at work in cosmology building

Native/ Non-Native Tree Species of New York City, 2016
Cyanotype print
2 x 665mm x 849mm

The original *Taxonomic Cyanotypes* are site-specific to the Botanic Gardens. Such is the aesthetic appeal of the Prussian blue works (which, with hindsight rather overpowers the conceptual context in the *Nantucket Towers* piece which follows) I was a bit wary of developing this approach further. A trip to New York however provided a catalyst for me to make a further cyanotype work.

I was intrigued by the tree species which line the avenues of the city. Ginko, Balm of Gilead and strange oak-like but unfamiliarly shaped leaves which carpeted the concrete slabs of the pavement, interspersed with familiar friends: hawthorns and European maples. This added to the sense of the city as European, but reinvented on steroids. The exotic species mingling with the familiar seemed to match the extremes of individual I encountered, as a tourist freed from the blinkered experience of my own city.

Maybe I had been reading too much Situationist texts on flaneurism, or perhaps I just wanted to keep something of the city with me when I left, but I collected leaves from the trees, pressing them in the pages of The Beach Beneath the Street, which I was ploughing through at the time. Further research revealed that more than 160 species of tree line the streets of the city, split roughly 50:50 between native and non-native varieties.

Towards the end of this project I revisited the leaves I had collected, which became the basis for a diptych work. I think the long detour into alchemical thinking I had enjoyed, and the subsequent exploration of the difficulties of contemporary epistemology meant the construction of a simple distinction, a simple taxonomy was just a pleasurable diversion. Of course the political resonances of a Native/ Non-Native distinction have also shifted since 2013, especially in the US, and printing these works a week before the EU referendum, and against the backdrop of a Trump candidacy gave the work a different weighting. I'm sure Foucault would somehow equate the classical episteme's fascination with taxonomies with the growth of the myth of the nation state, and the binaries of identity these distinctions imply.

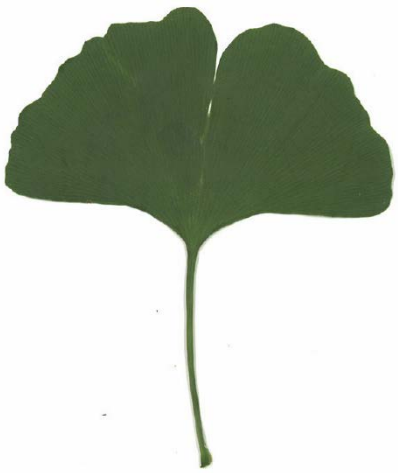


Figure 10: Missing trees from my original leaf collection were filled by friends collecting specimens and flat bed scanning them to me from their offices.

Map Works

Nantucket – Cetus Pod, 2012
Nautical markers on chart
1.2m x .9m

Right Angle Triangle: Nantucket Towers, 2013
Cyanotypes and map with construction lines,
3x (1000mm x 1500mm) and 1000mm x 900mm
***The Beautiful is Present*, Hanmi Gallery, 2013**

I have a long standing interest in the history of whaling, and in the summer preceding the start of the research I had produced an installed sculptural work for Gloucester Cathedral.



Figure 11: Reliquary hanging in Gloucester Cathedral, 2012

Reliquary Bracket for the Jawbone of a Sperm Whale, 2012
Aluminium, steel, felt
4.5m x 2m x 1.2m
***Open West*, Gloucester Cathedral, 2012**

The work was not just a formal response to the Gothicism of the building, it was an empty bracket, constructed from measurements and scale drawings taken from a sperm whale jawbone. The absence of the jawbone from the finished work echoed the purpose of the Cathedral itself, representing through an absence (its vast ornate emptiness) its intended occupant (god). The cathedral is also full of receptacles and brackets; both symbolically (reliquaries and ornate tombs), and literally (unfilled braziers and candle stands, the wrought iron clips and stands for processional crosses or civic and military banners, and indeed the pews and the Cathedra themselves, usually empty but representing or implying the worshippers and Bishop respectively).

The delicate oil found in the sperm whale's head (most likely used as part of its extraordinary sonic navigation and communication apparatus) also links the Cathedral and the whale. At the coronation of King Henry III at Gloucester Cathedral, the last English coronation outside of Westminster Abbey, a key ingredient of the oil with which the monarch was anointed, was spermaceti.

Through this work I had been asked to make a small piece for *Moby Dick Big Read,* a web-based project commissioned by Peninsular Arts at Plymouth University, which paired artists with chapters in Moby Dick.

I spent some time re-reading the novel and contextualising works as well as a variety of accounts of the industry and its culture.

The North American whaling boom coincided with the dissemination of many reasonably new scientific ideas that had arisen in the previous century and were only now being widely discussed. A notable court case, Maurice vs. Judd, enthralled New York in 1818 when the state inspector argued that whale oil was fish oil and therefore subject to his purview. Samuel Judd the oil merchant disagreed, and despite the categorisation of Linneaus back in 1758 that a whale was a mammal (in the 10th edition of *Systema Naturae*), Judd was defeated with such evidence presented to the court as the Bible, and many anecdotes from old whalemen (a taxonomic wrangle that came to mind as I put together the Native/Non-Native cyanotype works). The taxonomy of Linneaus was successfully challenged by the wisdom of a previous episteme.

The work for the Moby Dick Big Read drew from earlier work I had made tracing constellations onto other datasets: a searching for knowledge through geometrical rationales. It informed much of the research into diagrammatic reasoning and the layering of the cosmological onto the earthly that underpinned the *Dreams of Homunculi* video.

The work *Nantucket – Cetus Pod* was the result. It traced the constellation Cetus – the Whale, or sea serpent, through the sounding measurements on a nautical chart. The constellation's meaning has shifted from the classical sea serpent Cetus to mean the Whale (the serpent also gave its name to their taxonomic family: Cetacean).



Figure 12: Nantucket - Cetus Pod

Nantucket – Cetus Pod, 2012
Nautical markers on chart
1.2m x .9m

The whale constellations are 'found' where patterns of same depth soundings can be linked to approximate the star's configuration. They were then plotted using a nautical set square and chart marker pen. There is one Cetus plotted for each whale species, picking up on taxonomic themes in the research.

This work led to a trip to Nantucket to develop a subsequent work, more focussed on the use of geometric extrapolation.

Right Angle Triangle: Nantucket Towers
Cyanotypes and map with construction lines
3x (1000mm x 1500mm) and 1000mm x 900mm
***The Beautiful is Present*, Hanmi Gallery, 2013**

Right Angle Triangle: Nantucket Towers uses a similar starting point, but documents the search for a right angle triangle amongst the landmarks off Cape Cod as 'sighted' from the Island.

Lines of sight are plotted on the nautical chart of the Island from tower structures overlooking the surrounding coastline until a perfect right angle triangle is found with other visible structures or landmarks.

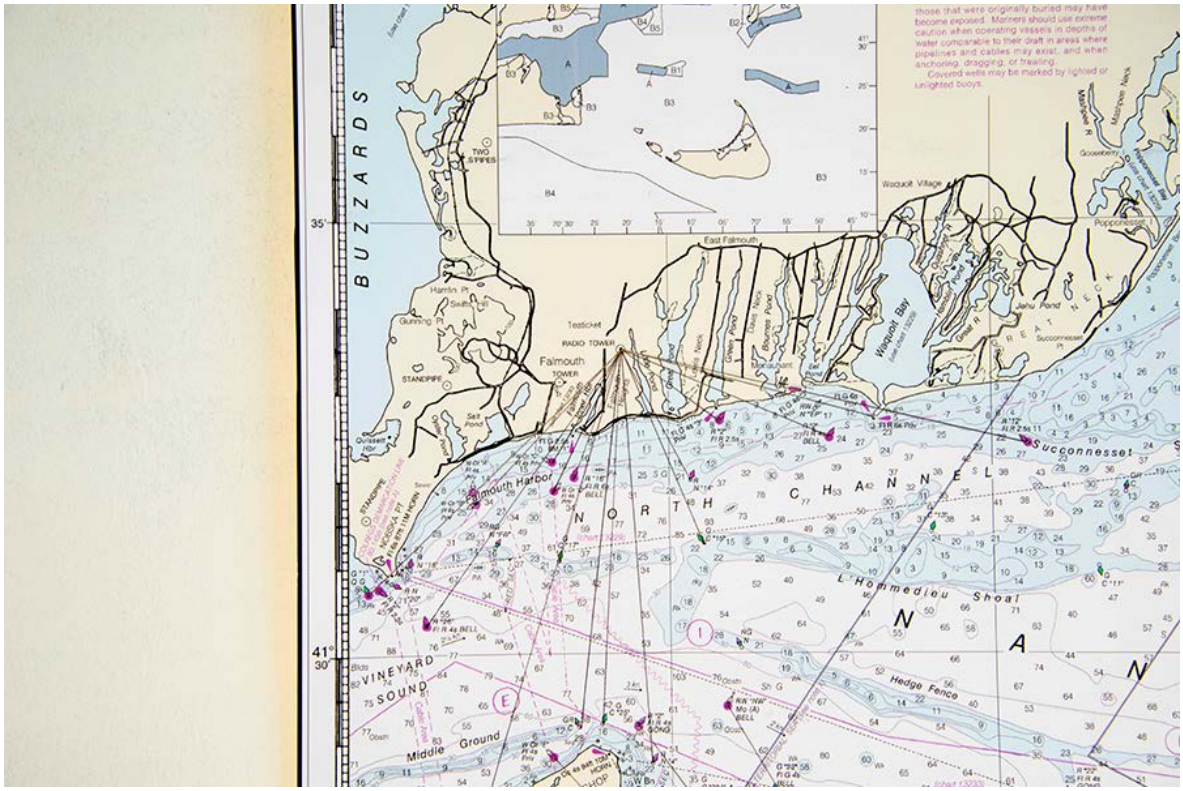


Figure 13: Detail from Right angle triangle Nantucket Towers, showing the landmarks and buoys visible from a point on the mainland plotted in nautical marker

The only true right angle triangle found happened to be three striking towers on the island which were photographed and reproduced for the show in large format Cyanotype, reflecting back to the *Taxonomic Cyanotype* works. The map was installed with the three large cyanotypes.

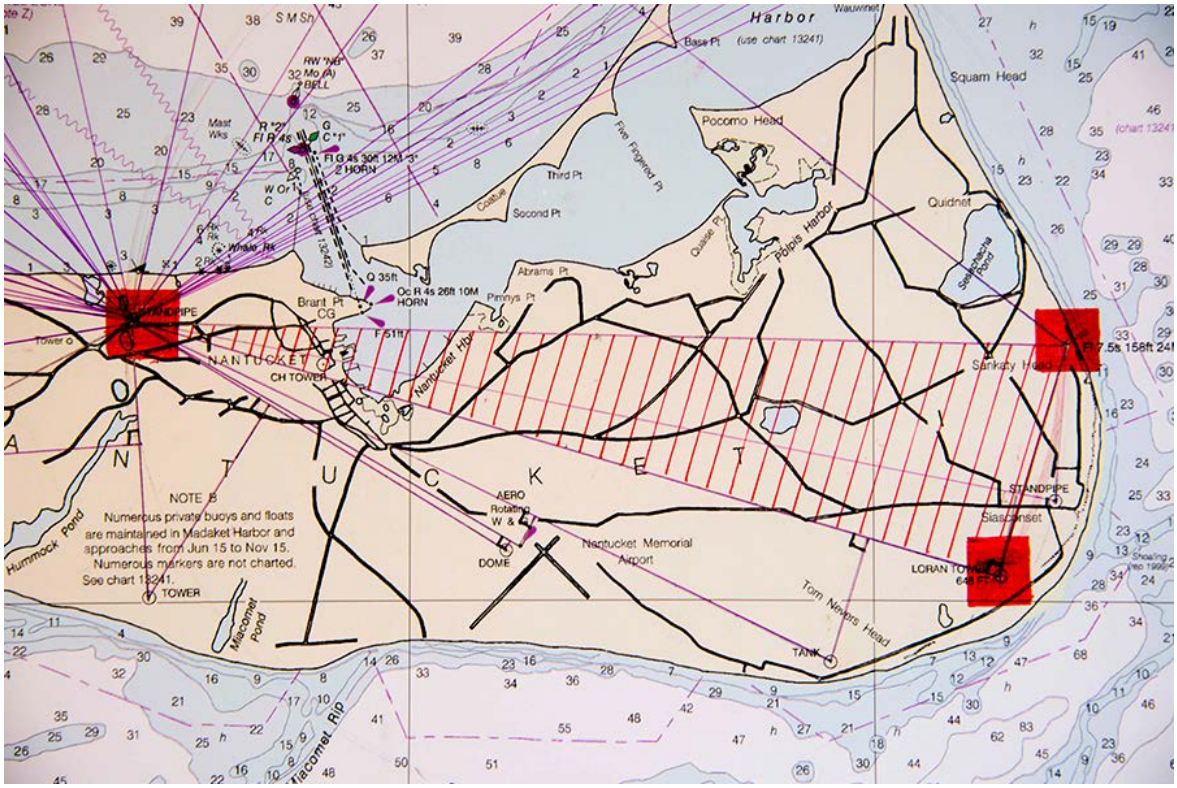


Figure 14: The right angle triangle is found between three towers on the main island

Dreams of Homunculi

Dreams of Homunculi, 2015
HD video and sound (11 minutes)
Museum of the History of Science, Oxford, 2015

Curator Vid Simoniti and I had been talking to the Museum of the History of Science in Oxford about collaborating on a project for the winter of 2014/15.

We wanted to make something that related to their collection of alchemical and early modern glassware and ceramic laboratory equipment. Developing various ideas, I started reconstructing different alembics and cucurbits, the day to day stuff of the medieval alchemist's bench.

This exploration started in drawings and etchings, and through coiling and slab building basic alembic shapes in clay and firing them in a gas kiln.

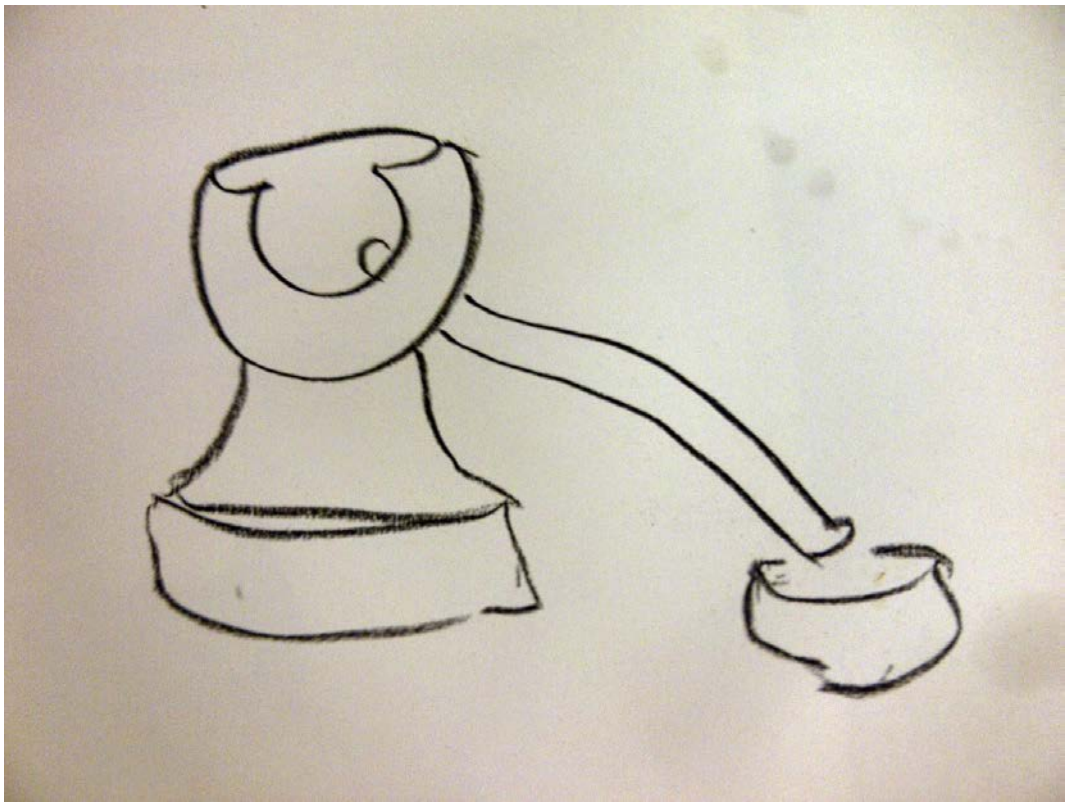


Figure 15: Some apparatus, compressed charcoal on paper, 150mm x 200mm

Back surgery then kept me out of the studio for some months so I began experimenting with various computer software packages, looking for something that might parallel the immediate explorations of form that had been available to me through working with clay.



Figure 16: Freshly fired alembic, earthenware and glaze, 150mm x 100mm x 100mm





Figure 17: Various alchemical vessels, earthenware

Rhinoceros (Rhino), a NURBS (non linear CGI) platform, seemed promising. I developed my first crude images of simple rotated pots- a kind of virtual throwing on the wheel- into more sophisticated forms: extruding curves and blending edges.

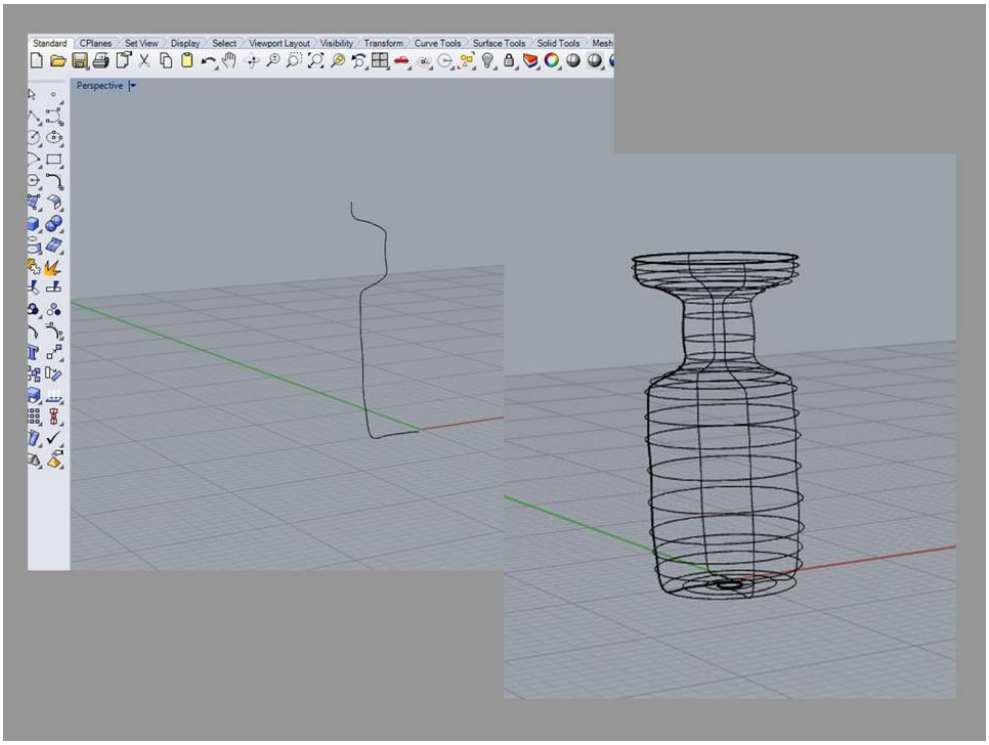


Figure 18: Showing the construction of a simple pot shape in Rhino

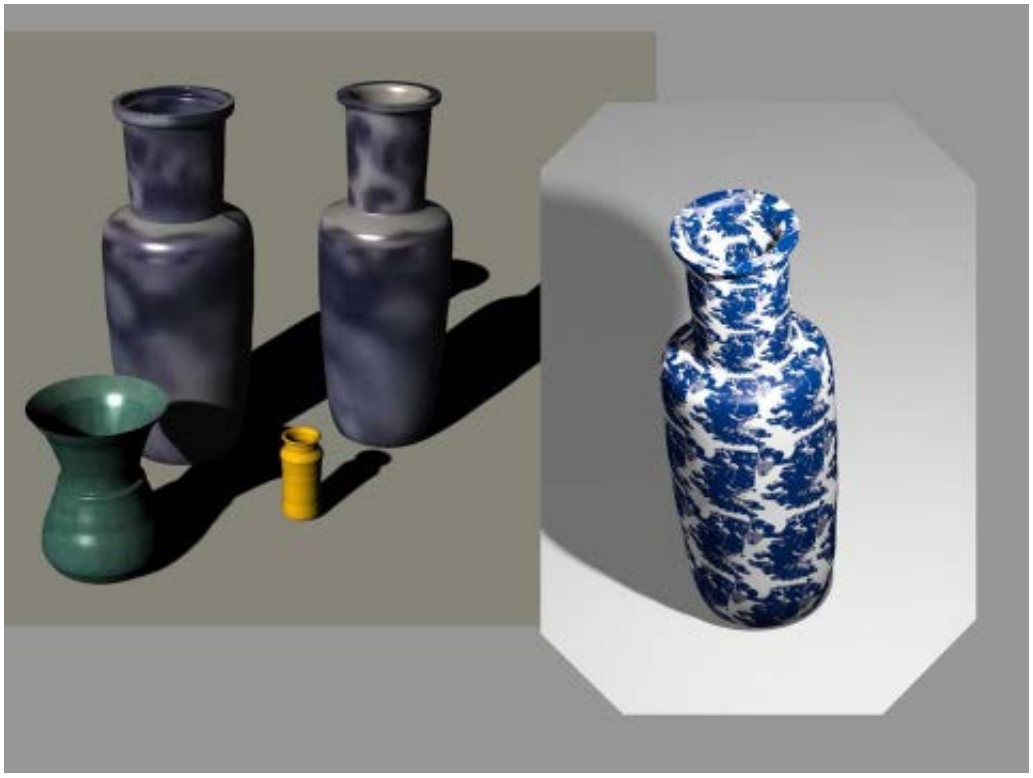
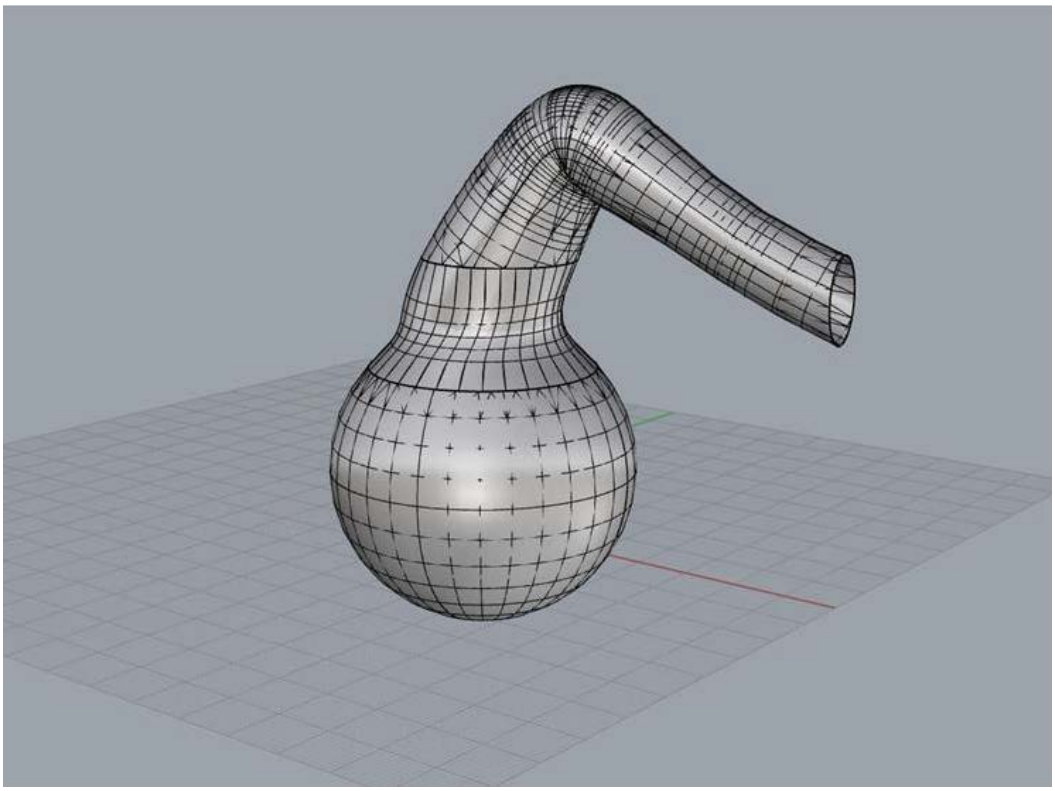


Figure 19: Screenshots of rendered pots

We were looking for a suitable focus for the work at the MHS collection. As my exploration of outsider science had been peppered with references to alchemy the MHS suggested they commission a new work based on an expansion of this research to accompany an upcoming display on Alchemy.



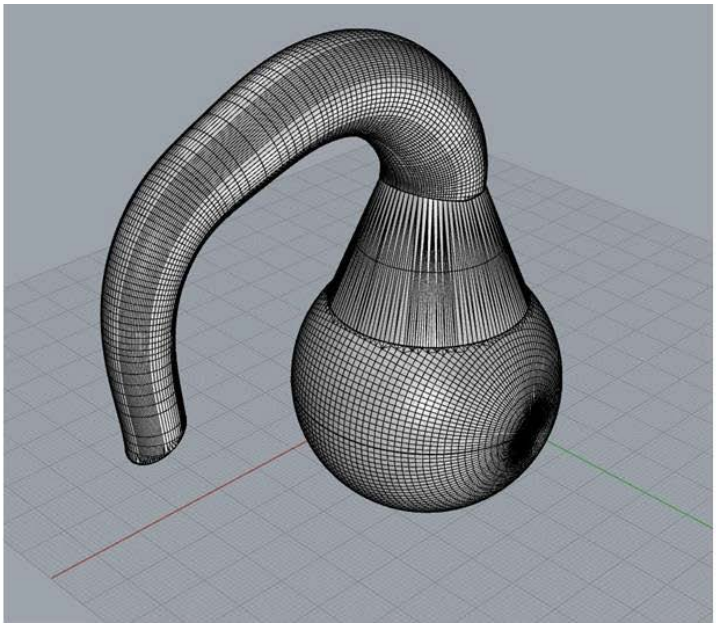


Figure 20: Wireframe alembics, screenshots from Rhino

Key to my developing ideas was the way the source texts used language and images to elaborate Alchemy's complex cosmology.

The key image in the development of the project was a cycle of representations of an alchemical vessel swelling, as if pregnant with a child at the start of the Ripley Scrolls (in this case most likely not a homunculus but the metaphorical representation of the philosophers stone).

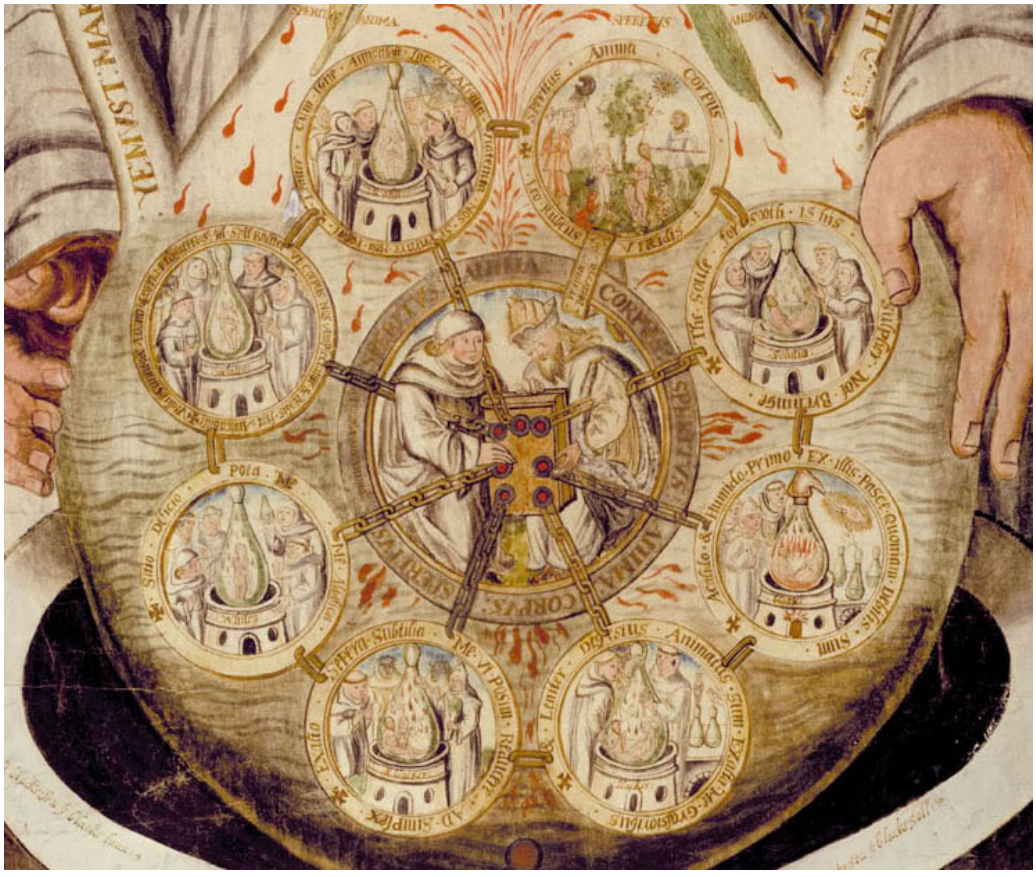


Figure 21: Illustration from the Ripley Scrolls, detail

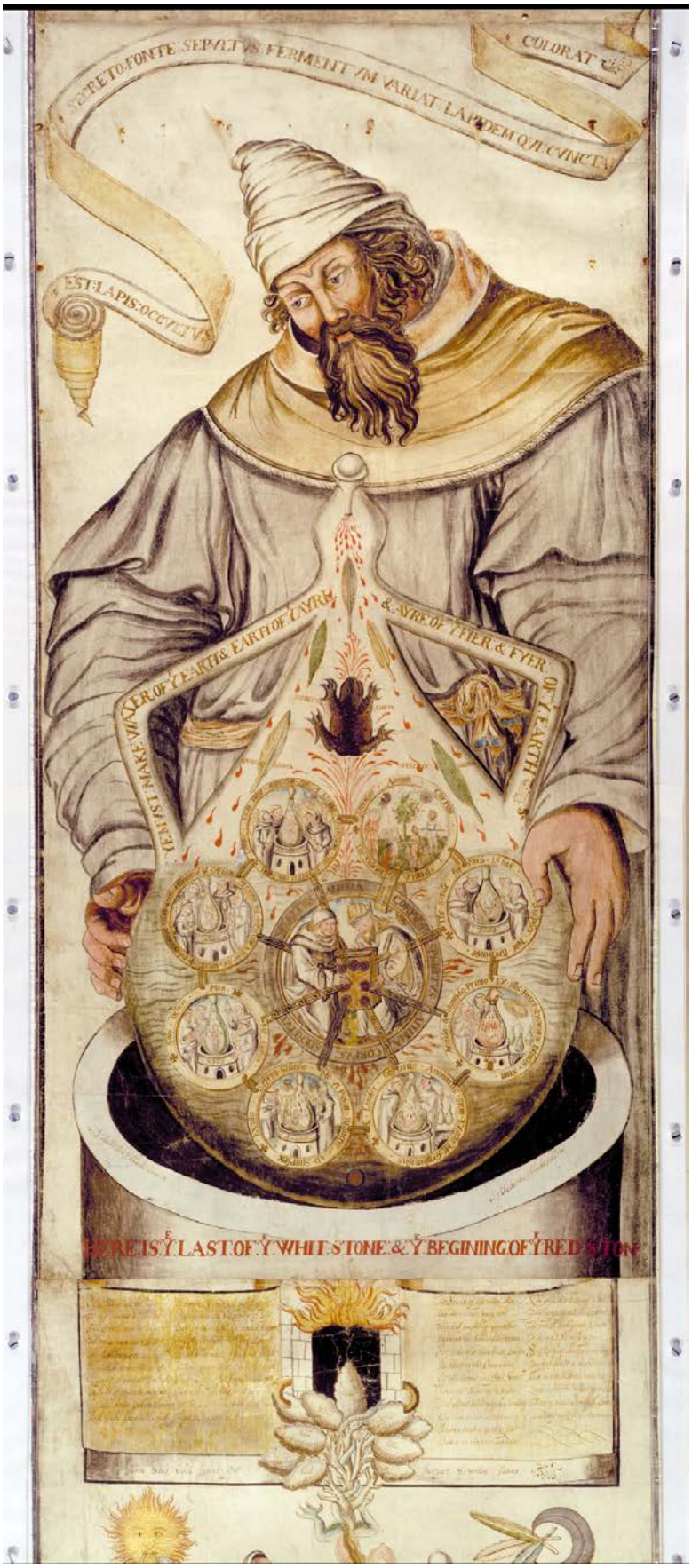


Figure 22: Full illustration from the Ripley Scrolls, C16 or early C17, British Library

The alchemical vessel as a gestating body led to the development of the anthropomorphised elements of the virtual alembics in the animation. Extended dream sequences are found in many alchemical writings to explain, in a coded fashion, the theories or recipes of the author. The use of CGI seemed a good way to recreate this dream-like space for the alembics to inhabit.

Further research led to a collection of primary texts ranging from the literary- *The Alchemist*, Ben Johnson, Goethe's *Faust* and others, to a wide range of alchemical writing accessed with help from the MHS, and online. The quality of the writing itself as much as its quasi-factual content seemed important to representing the richness, and peculiarity of the field. I decided to use exclusively re-wrought text derived from these primary sources for the script.

The composition of the video was given a final focus by a recently restored painting that was to be used as the centrepiece for the alchemy display.



Figure 23: Alchemist, Oil on wood, by unknown artist, probably C16, 80cm x 110cm, Museum of the History of Science, Oxford

Little is known of this 17th century work other than that it depicts an alchemist assisted by four cherubs/ angels or homunculi - the artificial men postulated by many alchemists. It might be reasonable to assume, as with most sympathetic depictions of alchemists, that the image is full of hidden symbolic and numerological meanings.

Dreams of Homunculi builds on this picture, imagining the Alchemist in a dialogue with an Homunculus as a way of exploring alchemical system building. The dialogue form was common in the alchemical writings of the 16th and 17th century when Francis Bacon, whose collection is

housed at the MHS, would have been considering the question of the homunculus and from whose writing some of the text is derived. By some accounts the Homunculus was a source of wisdom, and the ability of the alchemist to make this little man as a precursor to discovering the philosopher's stone was a not uncommon idea. In our video, the homunculus is a precursor to the real voices of reason that will ultimately unpick alchemy.

Grouping and editing excerpts from the texts we had collected I also found repeated motifs: structures of alchemical syntax such as the *just as* formula described in chapter two of the thesis. Phrases like *just as* and *just so* are used to connect related but not necessarily linked concepts to justify or rationalise leaps of alchemical imagination. An organic growth of these repetitive formula provides a central structure to the script.

The script was first iterated as a standalone text, then re-edited and adapted throughout the cut.

In parallel to the script development I had started to sketch a 'family' of alembics or 'alembicals' (a term we lifted from one of the texts) from the objects on the shelf in the painting.

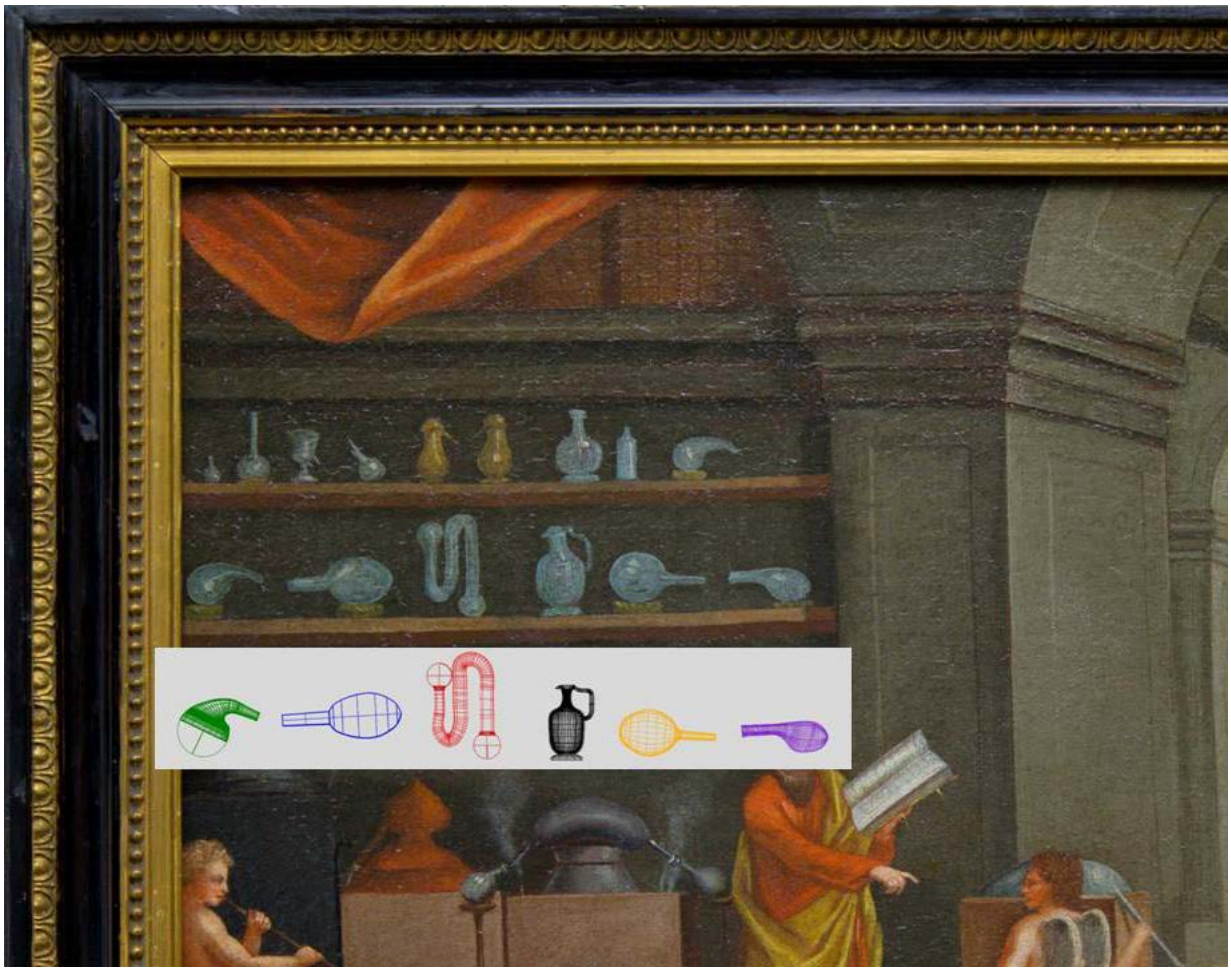


Figure 24: Showing the final 'generation' of vessels against the originals in the painting

Translating the often rudimentary form of the painted alembics into CGI was curiously satisfactory, a transfer of one imperfectly imagined reality to another. Some were represented in the painting by no more than three or four brushstrokes and would be quite 'impossible' in 'real life'. However, in the weightless sterility of the CGI window they found a comfortable home.



Figure 25: Working shot showing virtual camera tracks

As the vessels developed in the CGI package, their evolution from the simple early virtual models suggested a literal genealogical relationship. This dictated the first 'form' they assume in the work: the family tree. In this 'breeding' of forms I selected traits which are introduced through certain 'parents' in successive generations, reflecting on a science of genetics that is both entirely at odds with the origins of the subject matter and curiously redolent.

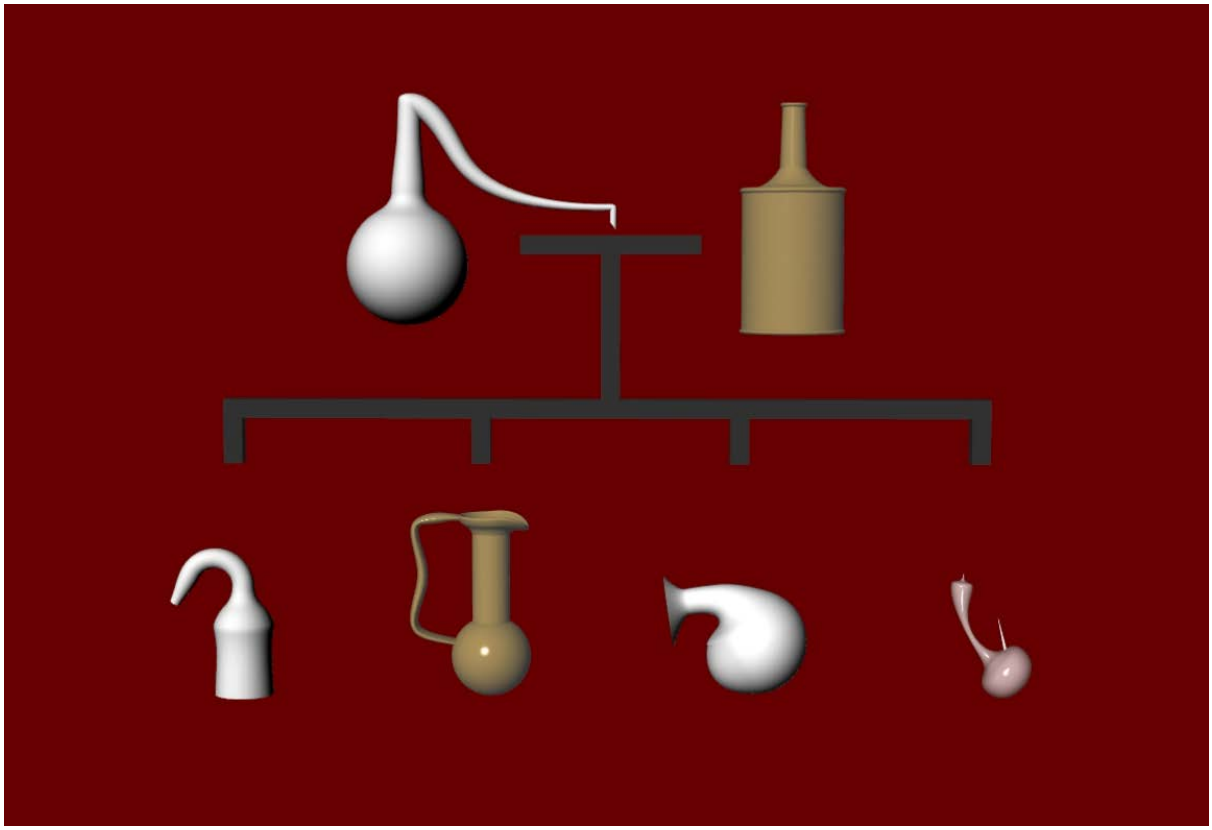


Figure 26: Still from Dreams of Homunculi showing 'family tree' developing

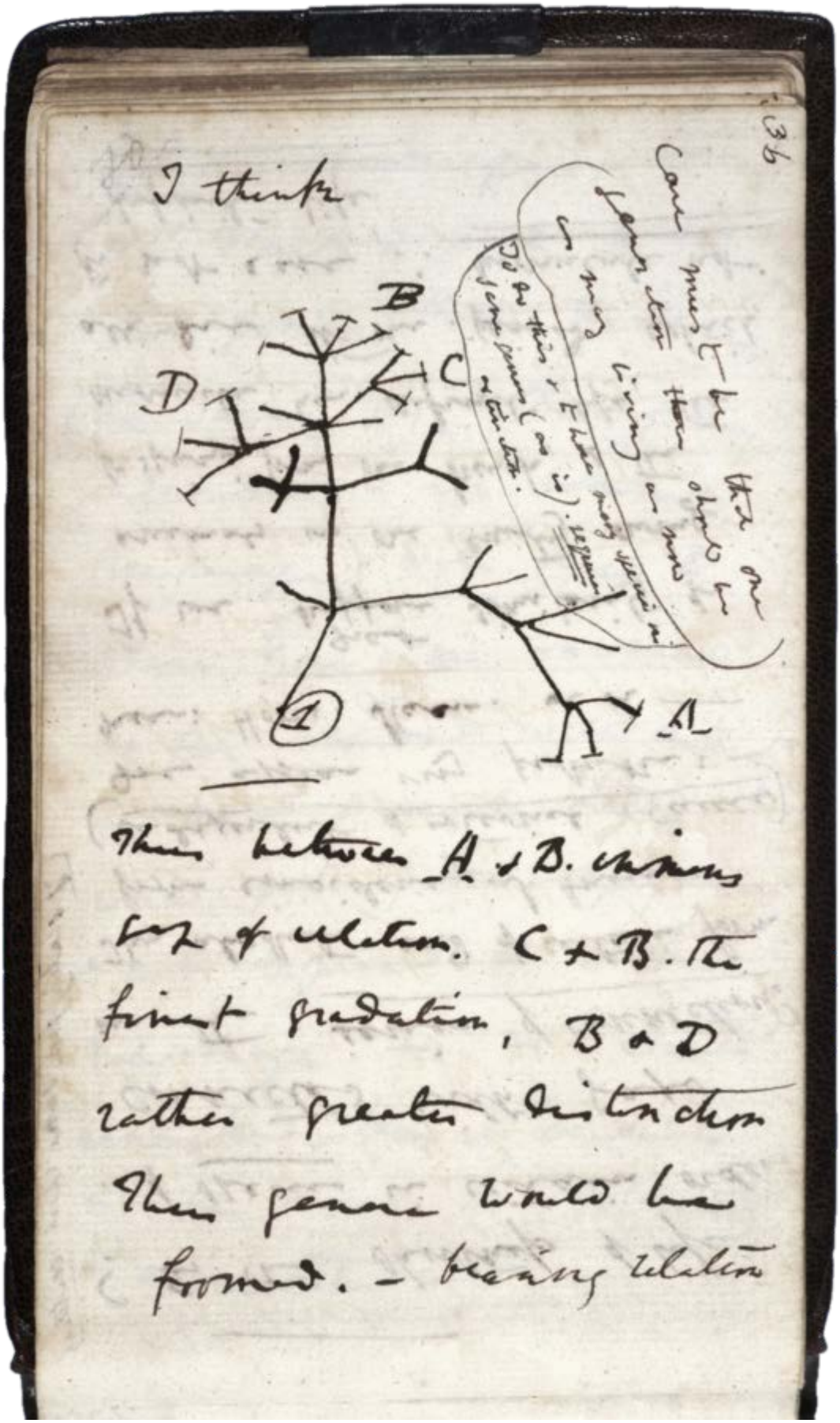


Figure 27: A family tree from the notebooks of Charles Darwin

We experimented at length over the representation of the text: font, size, layout and pacing all effecting the 'voices' in the dialectic and the corresponding or counterpointing rhythms of the video cuts.

Finally, the soundscape was recorded live over a screening of the final cut then edited to underline the patterns, interconnections and associations being played out in both the visual and text content of the work.

The work was presented on a small eye-level screen to accompany the show but, as a virtual thing, it can be shown online or projected in an auditorium or gallery.

This work also fed into a conference presentation on the use of virtual imagery:

Under the Scientific Picture, co-authored, Vid Simoniti and Dr Matthieu Chavent

At: *All About Imaging: Transactions*, 22nd-23rd May 2014, **University of Westminster**

As well as a conference presentation on the project:

Out Of Time Aesthetics: an artist's conversation with the Museum of the History of Science, co-authored, Vid Simoniti at: *Art Out of Time*, 26nd-27rd June, 2014 **University of Oxford**

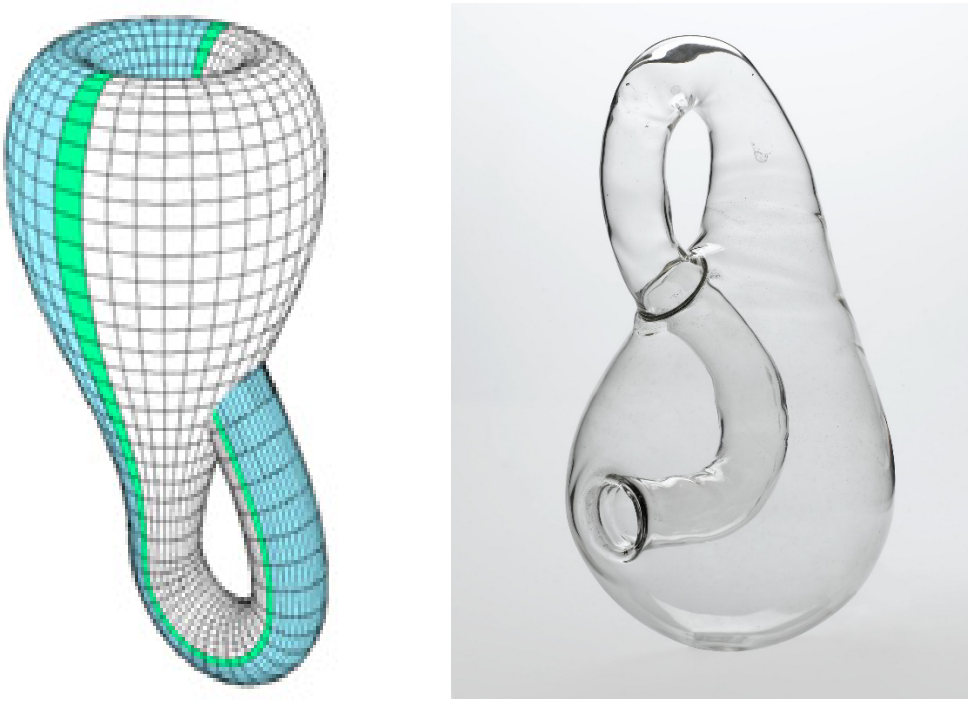


Figure 28: A plotted Klein bottle and blown glass version

This research also informed the development of another work.

2D/3D/4D – Klein Blue Bottle, 2016
Woodcuts,
795mm x 573mm
***Anonymous*, Noformat Gallery, 2016**

The Klein Bottle was 'invented' in 1882 by the German Mathematician Felix Klein (1849 – 1925). It is a mathematical object which has the property that it has only one surface. Like the Mobius strip, if you start walking anywhere on the Klein bottle, you will ultimately get back to where you

started, but unlike the Mobius strip, it is without edges. It might be said that the Mobius strip is a two dimensional thing (i.e. a plane) that can only 'exist' in 3 dimensions. In the same way, the Klein bottle is a 3 dimensional thing that can only actually 'exist' in four dimensions. Models of it in the real world have to 'break' its rules because the surface passes through itself. I find this interesting for several reasons. Firstly, it can be considered as a trope. The artist and outsider cosmologist Paul Laffoley uses it in several of his works, and it occurs in sci-fi and video games. Why? Well, as a visualise-able, indeed, construct-able shape that describes a four-dimensional mathematical object, it somehow validates the intuitive idea of four-dimensional space. Ironically, the fact that it exists *imperfectly* in three dimensions precisely because of its properties that require a fourth dimension, means that actually it provides no such intuitive crutch.

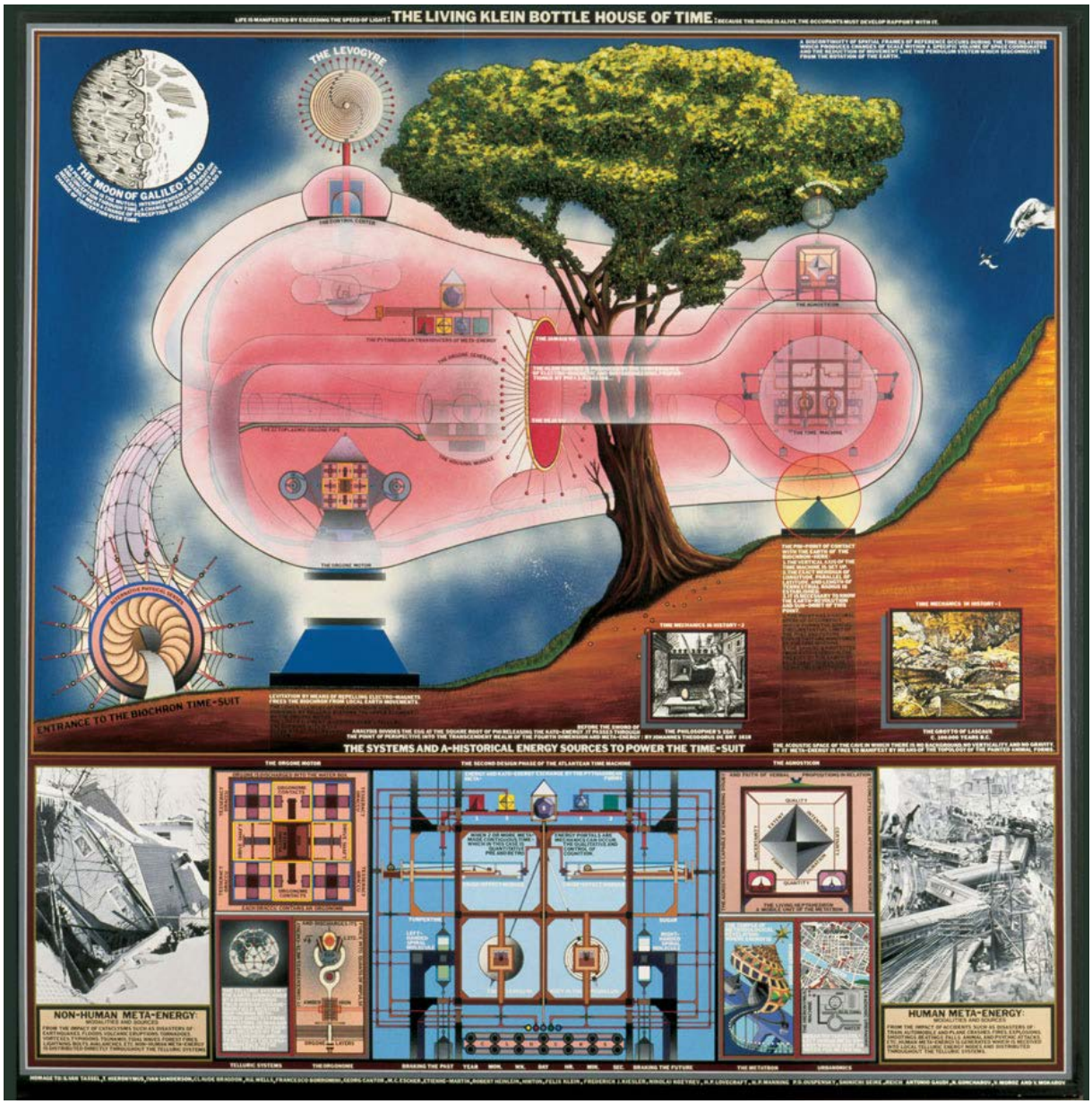


Figure 29: The Living Klein Bottle House of Time, Laffoley, 1978, Oil on canvass, 73 1/2 x 73 1/2 inches

The Klein Bottle also has a relationship to the ouroborous, the mythical snake that eats its own tail, and which features throughout alchemical history from early Greco-Roman drawings through

to the German chemist August Kekulé (1829 – 1896), whose dream of the ouroborous leads to his discovery of the structure of benzene. Finally, it is a confused cousin of my alembics.

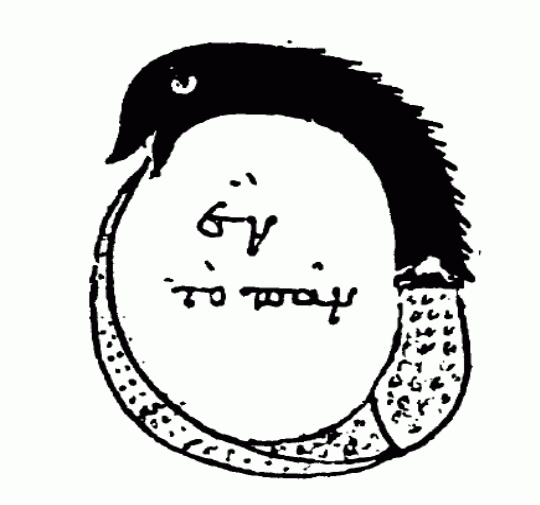


Figure 30: An early Greek ouroboros

The monochrome relief print is the reduction of the 3d (the carved woodblock) to the 2d (the ink surface that comprises the final image). In a woodcut of a Klein bottle, the 4d is reduced to the 2d. The work included in the portfolio is the result of some iteration of this idea. The wordplay in its titling it also functions like some of the conundrums in the following work, *Circling the Square*.



Figure 31: Klein Bottle wood cut, 180mm x 260mm

Circling the Square

Circling the Square, 2015
Glycee prints and frames, Bronze bust of Max Planck (in situ), 3m x 3m x .3m
Max Planck Institute for the Physics of Complex systems, 2015

In late 2014 I began a discussion with the Max Planck Institute for the Physics of Complex Systems in Dresden about producing a new work for their foyer space.

Visiting the Institute, I was struck by the curious eclecticism of the community there. Unlike most physics departments where buildings will typically be filled with scientists and mathematicians with adjacent subject matter, the MPI instead welcomed advanced researchers from across the biological, chemical as well as physical sciences who were using particular kinds of complex mathematical modelling in their research.

The open plan architecture of democratically repetitive small offices that made up the bulk of the building was adorned, as with many science departments, with the large, plotter printed posters used by scientists to illustrate recent research. These vary wildly in graphic design ambition (and success) and can range from an A0 sheet of largely text and equations, to lavishly gloss printed images, clip art with overlapping borders and pop out boxes.

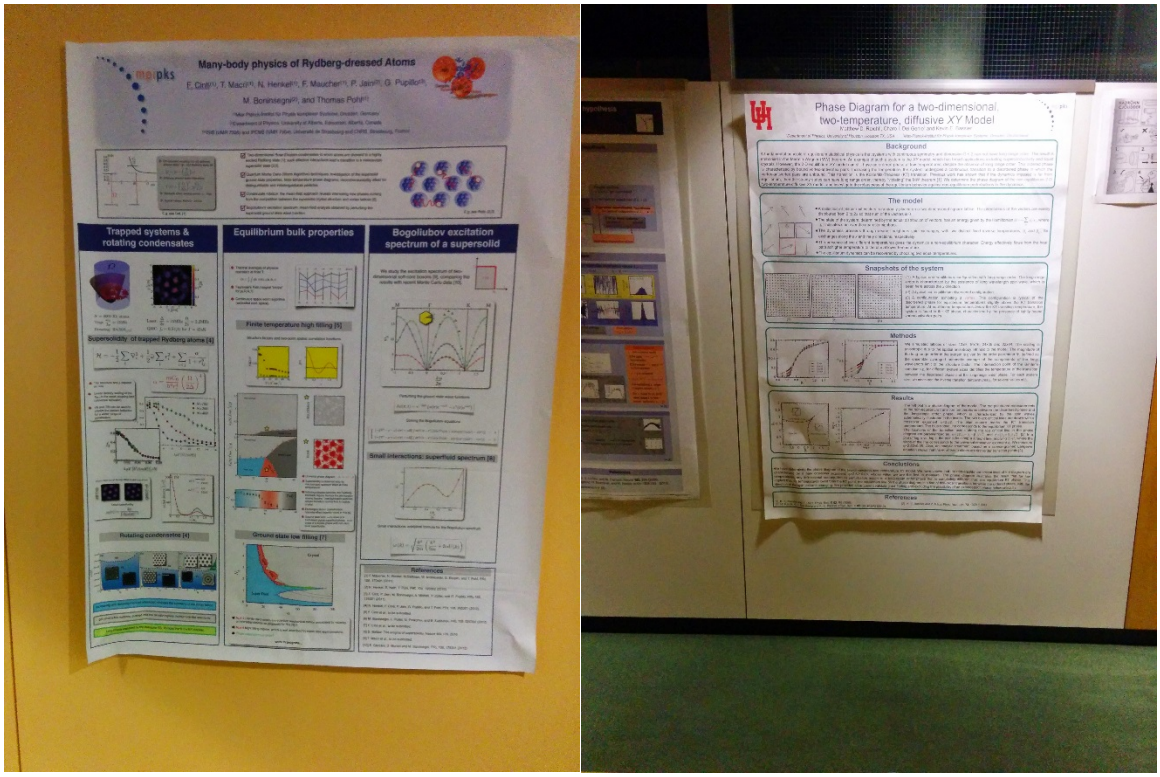


Figure 32: Example of posters from the Max Planck Institute in Dresden

What was clear from the corridors and corridors of posters was the wildly eclectic subject matter being studied at this institution. A shared desire to solve certain kinds of complex mathematical problems underpinned all the seemingly disparate goals of the work: the cell formation in a butterfly wing might be next to an exploration of particles at the big bang.

Spending some time in the corridors of the MPI I noticed another effect. Groups of researchers would gather around a poster, not as in a typical department to critique familiar work, but in a spirit of friendly rivalry, trying to understand often deeply unfamiliar material. The posters were like puzzles which had to be deciphered before they could be related to academically. Whilst the curiosity and conversation sparked by this adjacency of an otherwise unrelated diaspora of complex systems mathematicians was undoubtedly one of the intentions of the MPI, it was the sheer pleasure in tacitly competitive problem solving that struck me immediately and became the kernel of the work *Circling the Square.*

The work is a puzzle and was clearly advertised as such through a notice in the exhibition space and through a webpage, set up to allow a wider pool of mathematicians to compete: http://charlesogilvie.co.uk/portfolio_page/circling-square/. The prize is a trip to Bletchley Park, the home of UK code cracking, to have tea with my collaborator on this project, Dr Daniel Crow, and me.

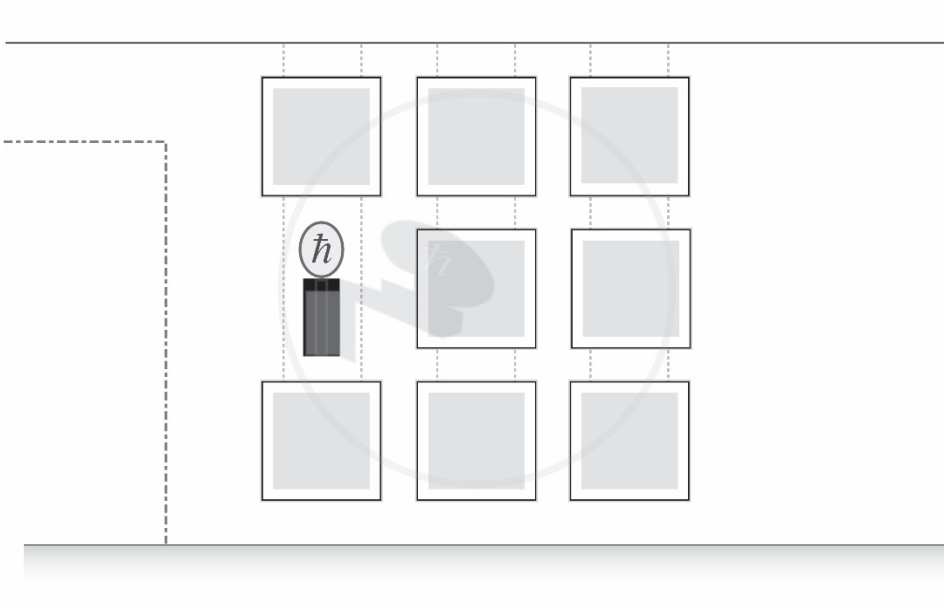


Figure 33: Schematic of the work

The work is laid out as a 3x3 grid. This format is readable as mathematical matrix – an essential tool in the type of work being done at the Institute. Indeed to 'solve' the work the separate cells must be read and computed as such to produce what is called the 'determinant'.



Figure 34: Detail from the work

The graphical quality of the work echoes the posters on the wall: vector and clip art greyscale. One of the 'cells' is replaced with the ubiquitous (to Max Planck Institutes across Germany) bronze bust of the man himself. This object features in the solution of the puzzle both as the mathematical function MAX, the numerical value of Planck's constant as well as its signifier $\hbar$. This gives a good indication of how much of the puzzle works. As well as calculations, there are visual puns and verbal games including a three by three letter crossword to solve, evoking ancient Egyptian word grids.

The name of the work refers to the ancient conundrum of constructing geometrically a square with the same area as a given circle. In this case it is reversed to imply the circling around a solution that might be involved in approaching this particular square (the grid also contains a faint embedded circle with its equivalent area).

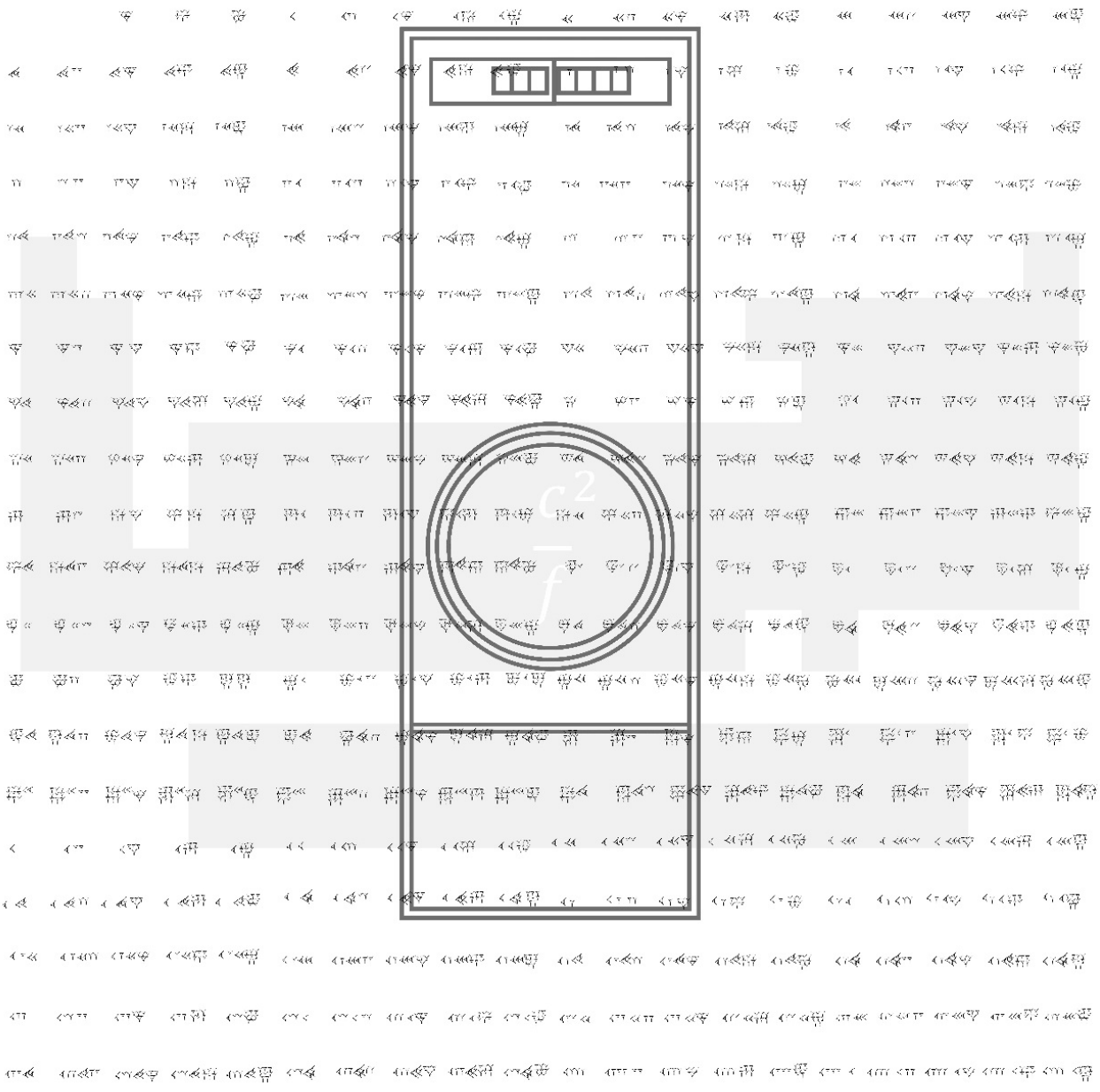


Figure 35: Detail showing one of the panels

We have received only three incorrect submissions to date, but the work may tour other Max Planck Institutes across Germany next year and will be featured in the Max Planck Society Magazine which I hope will lead to further solutions being offered.

At the vernissage I spoke about the increasing expectation that works of art can be ‘solved’ and how galleries and curators have fed this understanding through the way works are presented.

After the presentation we saw a familiar cluster of physicists and mathematicians scribbling notes around the work and closely photographing the images.



Figure 36: Mathematicians gather round the work at the vernissage

The images themselves are layered in different shades of grey so the compositional emphasis changes as you approach the work, revealing new details essential to solving the puzzle.

There are elements that can be solved simply, visual jokes and word games. But like the science being done at the institute there are other elements that will require time consuming analysis: looking for discrepancies in the fields of numbers that fill the backdrop of all but one square (including identifying the characters in the first place, as some are in ancient languages including hieroglyphs and Babylonian).

Pi Vessel, 2013
Gas fired and oak chip smoked handbuilt local clay and raku glaze
450mm x 450mm x 700mm
***Modern Makers*, Old Royal Naval College, 2014**

I like puzzle objects. These include things like tankards or jugs you have to drink with your fingers over certain holes, or pipes that reveal a naughty image if held in a certain way. Sometimes they come with a riddle as part of their decorations:

From Mother Earth
I claim my birth;
I'm made a joke for man,
        But now I'm here,
        Filled with good cheer
Come taste me if you can.

The Pi Vessel was another puzzle using ancient characters, one of the more successful of several I made.



Figure 37: Mid C19 English redware puzzle tankard, and an C18 German, glass Scherzkrug more than a little reminiscent of the glass Klein bottles

The Pi Vessel was made from clay I dug from my garden, cleaned and coiled, then glazed using a raku process, culminating in a reduction with oak chips. It was exhibited in the gallery with a riddle of its own:

> This pot is a riddle dug out of the ground:
> Coiled and carved but not turned around.
> Its nature is constant but unnaturally so
> It's not in the 's' but is in the 'o'.



Figure 38: Showing the construction and firing of the Pi Vessel, the raw clay was carved then bisqued then glazed. After the glaze firing the pot was packed in oak chips which were ignited. The whole vessel was then sealed under an airtight steel drum

The Principle of Collision

The Principles of Collision, 2016
Stop frame animation (10 minutes)
The Society for the Humanities, Cornell University, 2016

In the summer of 2012, I collaborated with the physicist and mathematician Dr Daniel Crow to produce a work for the Blythe gallery at Imperial College. The group show was a showcase of art and science collaborations set up by Imperial College and the Royal College of Art.

The collaboration was born of shared concerns about 'sci-art' projects. Many of the works in the showcase were illustrative: the artist producing an attractive rendering of one of the ideas or datasets within the scientists' research. Whilst many of these outcomes may have helped to communicate the science, I couldn't see their value as art; Dan felt that in 'reducing' the science down to these digestible cultural artefacts, the essence of what was actually being done by those scientists was often lost.

Perhaps he was just feeling left out, as Dan's research is completely unsuitable for this kind of treatment. He uses complex mathematics to build speculative models describing the operation of electrons within the solid state structures that make up superconductors, then solves these models using supercomputing to test them against experimentally observed values. The work involves the lengthy development of models, using Feynman diagrams, calculus and other mathematical tools, largely 'by hand' i.e. written out by hand or on a blackboard.

There is a heritage to using the blackboard within visual art and we joked that the only 'correct' illustration of his work might be simply photographing his blackboard, thus aping the illustrative approach in very literal terms. Instead the finished work was a slightly more developed critique of the sci-art going on around us.

The Renormalized 4-Vertex at one-loop and drawing of The Renormalized 4-Vertex at one-loop by the artist (see reverse), 2011
Chalkboard, paint, chalk
1800x1800x400mm
Blyth Gallery, 2011

This work showed one of the key ideas in Dan's research, the removal of infinities from his calculations through a process called 'renormalisation', developed by the Nobel Prize winning physicist Richard Feynman (1918 – 1988). Dan wrote out this process on one side of the board. I then copied it out on the other. As there was no way I could see what I was copying as I drew it out, the 'illustration' was peppered with mistakes- to such an extent that Dan burst out laughing when he saw it. To the gallery audience however, the work simply had two versions of the same unintelligible mathematics on it. Moreover, my version – that of the artist, was angled up and highlighted by the gallery lighting, appropriate of course as this 'drawing' of the 'science' is privileged in this context.

Dan and I have continued to develop these ideas over the course of this D.Phil. This exploration of my (and the art audience's) struggle with complex science, and the difficulties of building conventional art projects around these systems by extension, has clearly shaped the development of the thesis and the outsider systems the project has explored.

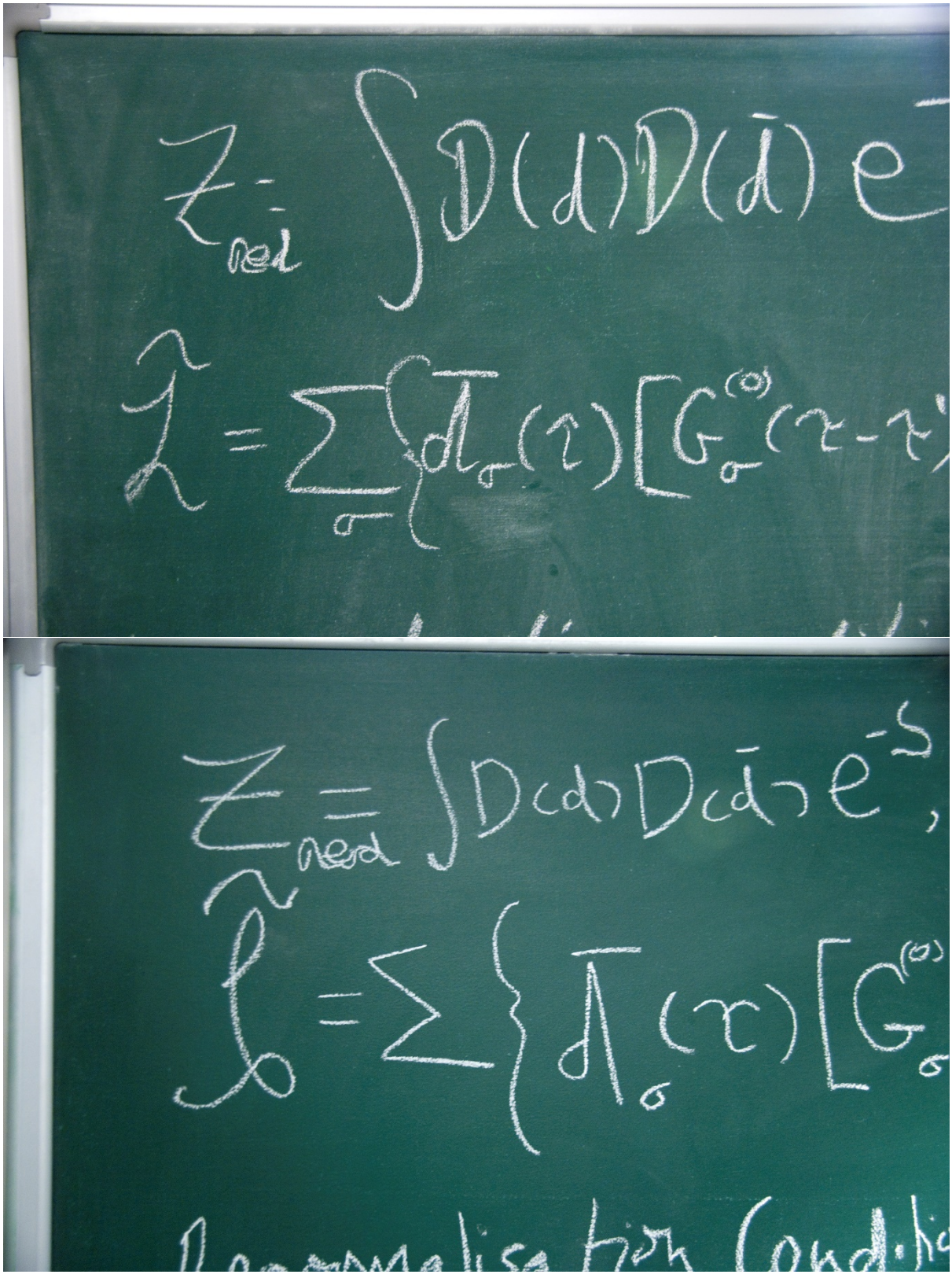


Figure 39: Details from each side of the board

A subsequent collaborative work was catalysed by the media coverage of the discovery of the Higgs Boson. Dan and I had collected news clippings of different journalists attempts to explain the discovery. These made for an impressive scrap book of imagery, whilst reflecting a pretty wide spectrum on the part of its authors, the science journalists, as to how confident they were of what they were reporting. I asked Dan to prepare what he might consider the simplest possible derivation of the Higgs particle so that we might make our own publication. The result was a set of etchings:

A Reflection on the Higgs Boson, 2015
Etching and aquatint
5 x 361mm x 418mm

The format follows the foolscap of the undergraduate science text, complete with a margin for explanatory figures. I gave the grounded plates to Dan to take to his office to work on and their ultimate state, pockmarked and scratched, reveal this wear and tear, whilst also suggesting the bubble chamber swirls and shadowed film negatives of the history of particle physics: seductive perhaps only to the suggestible.

Unlike that great art-science archetype, Dan can't write in mirror writing, so the plates themselves are reversed, Dan's handwriting in the wax ground reflected in the finished prints. Dan refused to use a needle for the text, preferring his usual biro, which led to thick lines in the ground, that wouldn't have held ink, so I added an aquatint to the plates before etching them.

The finished work is aesthetically appealing, and his donnish handwriting and the layout of the page suggest the academic content. However, they are ultimately pretty useless to the gallery goer as a source of information about the Boson itself.



Figure 41: Grounded and aquatinted plates in the acid

The most recent work in our collaboration has been the animation project *The Principles of Collision*.

I had been asked to make a video work for a presentation at the Society for the Humanities at Cornell University in collaboration with the composer Steven Potter. I introduced him to Dan and we found some common ground in the interpretation of avant-garde scores, a subject of interest to Steve. Latham had referred to his roller paintings as scores, as they operate across time and frequency and I had started to look at analogous material from the history of music, as well as recording various musicians trying to 'interpret' them. I had wandered into a rich seam of retro study, where subjects such as the role of the conductor, and the tyranny of convention were still explored by latter-day John Cages. In the making of the *Renormalisation* work I had discussed with Dan the Feynman diagrams, the distinctive constrictions of wiggles and arrows used by physicists to describe the transformations and interactions of subatomic particles. These too operate over a notional time axis, and basking in this coincidence we started developing the work.

I had been exploring frame by frame animation for another project and had started testing out animation cycles by drawing them up on the blackboard in my studio. Reading more about Feynman I came across his account of arriving at Los Alamos, where he had been invited to help on the Manhattan project. The accommodation had yet to be constructed so they lived in tents, but they had each been given a blackboard. These eminent scientists would walk around this building site, wheeling their blackboard behind them and engaging with the other physicists in conversations facilitated by their chalk scrawling. The chalkboard is also an art trope, indeed the spiral across *Sunstate,* one of Beuy's blackboard works, suggested the spiralling trails of the cloud chambers that detect the particle collisions with which the work culminates.

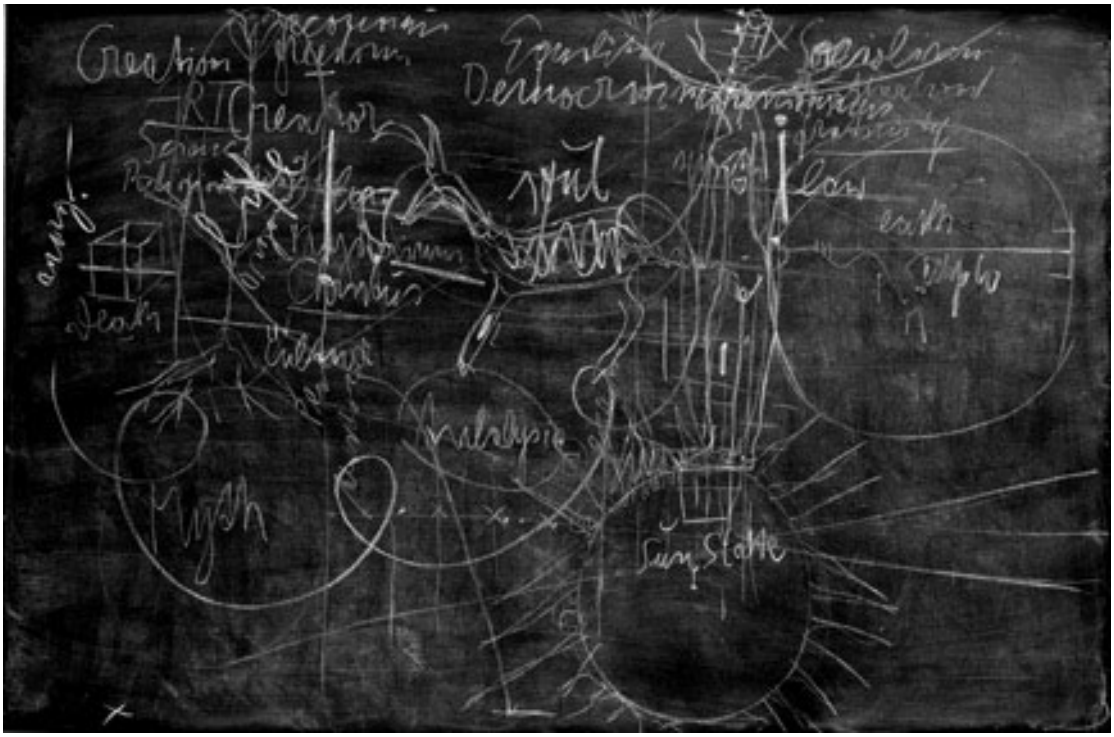




Figure 42: Sunstate, Joseph Beuys, chalk on blackboard, 48 x 72 inches, 1974 and a cloud chamber

The Feynman diagrams themselves (invented later) are a curious artefact. One can learn all their rules without understanding anything about what they mean. I found several primers on them online which laid out these principles, but without Dan's help, I would have been none the wiser about the actual physics.

Around the same time, I had been considering the construction of lettering – largely to facilitate the execution of some other ceramics projects.




SELF-INSTRUCTOR IN PENMANSHIP. 31

CAPITALS CONTRASTED, SHOWING PROBABLE FAULTS. RIGHT AND WRONG.

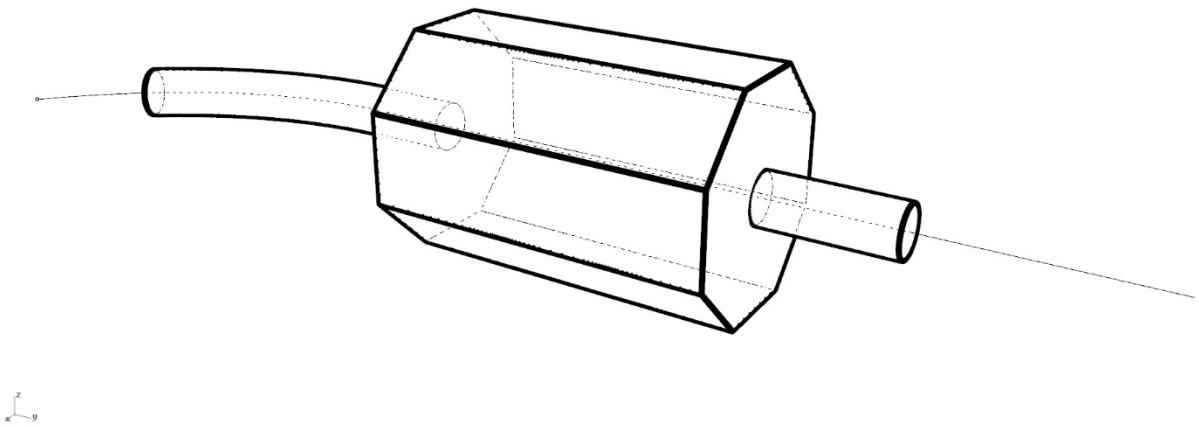
43: Spencerian script, as taught in the animation

I had found a Victorian handwriting manual and the similarities between this text and the Feynman primers was striking in its tone and structure approach.

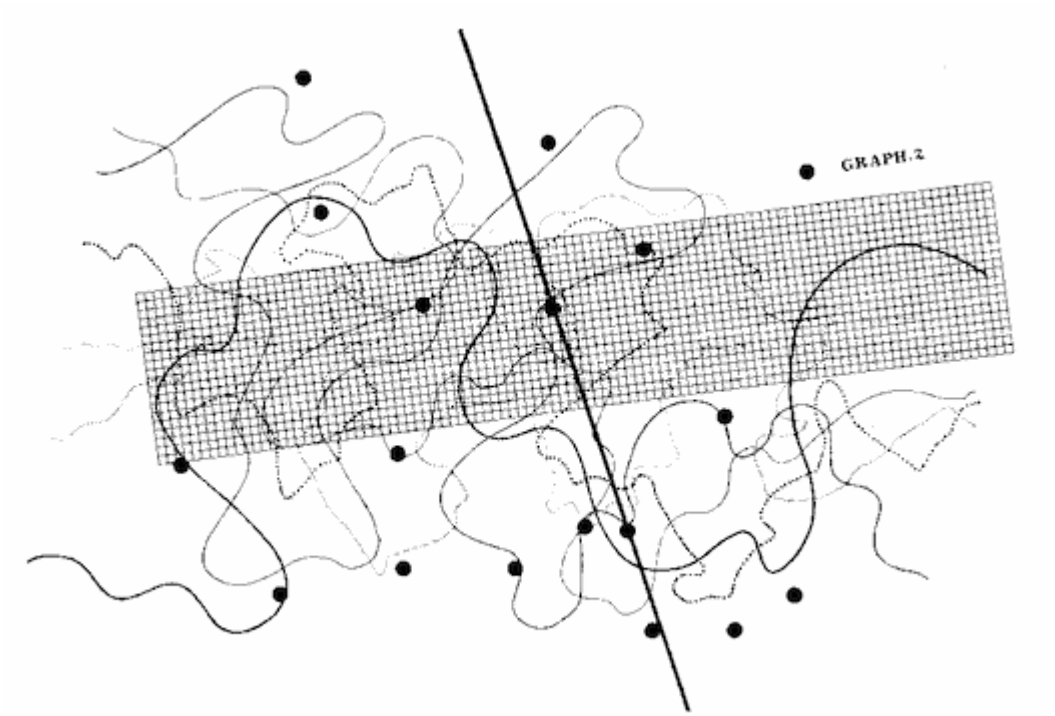
We built the 'script' around a real set of interactions, culminating with the collision of two particles in the reactor chamber of an accelerator such as that at CERN. The dreidel-like hexagonal prism object is a rendition of this chamber.

The piece follows the dialogic structure of the Homunculi work, in this case a pedagogue and student's exchange; exactly the device used by the Feynman primers and calligraphy manual.

My experience of pacing the arrival of words on the screen to create syntax and character from them was useful in creating this work, although the challenges of working with 'real' material rather than virtual made experimentation extremely time-consuming. Some sections are drawn in 20 fps which means over a thousand frames drawn up by hand in a minute of film.



44: Digitally animated element, for some of the animations; I pre-modelled them using Rhino and projected each frame up in turn



45: Extract from: Fontana Mix, John Cage, 1958

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46: Camera, lights and projector setup, with IR trigger to obviate the need to shuttle back and forth across the studio

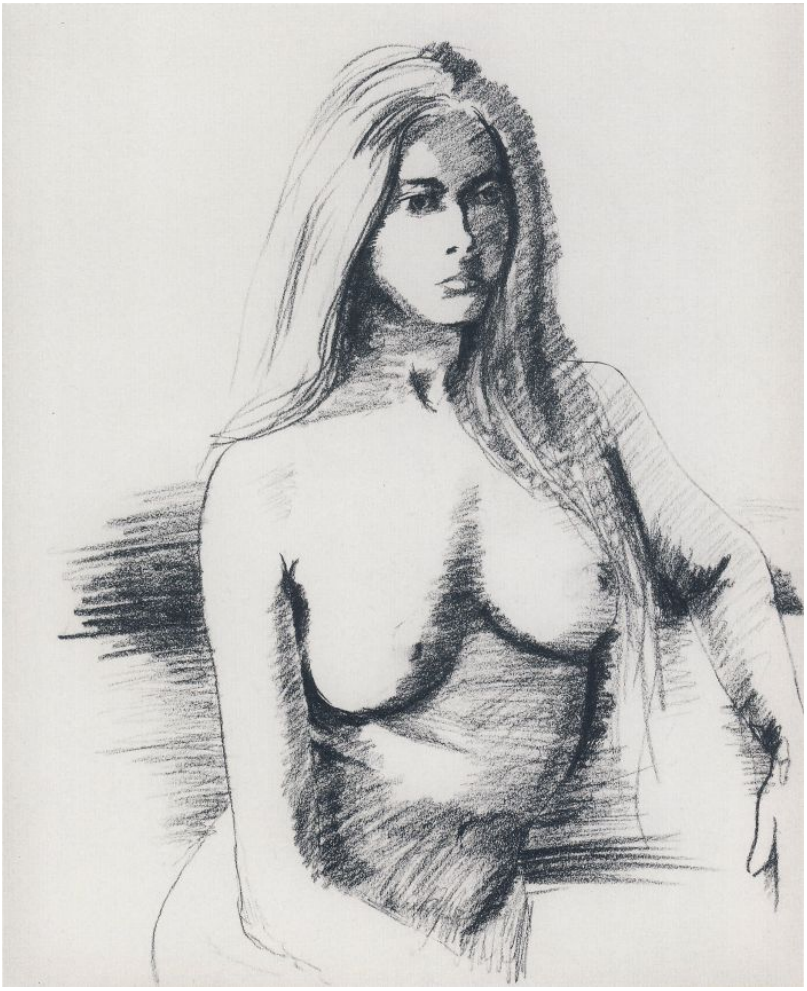


47: 'Prepared piano'

Many of the images and references outside the text come from Feynman himself (Looking through his sketchbooks, other than physics, he seems to have drawn exclusively nude females and dogs). As it 'teaches' the principles, the work tracks a development of ideas and floundering comprehension as the actual physics is taking place in the background.

The music was scored as a series of adapted Feynman diagram and performed live for the event at Cornell. The instruments and format were largely out of my hands: the ensemble consisting of the resident Cornell gamelan enthusiast who with Steve on the 'prepared piano', joined cellist and viola player. The musicians were 'conducted' by a clock which as well as being an appropriately dated Cageian conceit, usefully allowed for exact timings over the animation.

The strikingly retro ensemble and musical arrangement seemed appropriate to the subject matter and the diagrammatic musical score does relate to the underlying physics in the animation. Structures in the music resolve themselves over different timescales or frequencies, echoing the different 'order' Feynman diagrams used in the animations.



48: Portrait of a Nude Woman, Feynman, charcoal on paper, 1975

Whatever its ultimate impact on the gallery viewer, this work and its development has brought me closest to the kind of dissonance I uncover in Carter and Latham of any point in the project. Perhaps the axes of Foucault's contemporary knowledge space are laid a little too bare when physicist, Cage-ian composer and artist collide. We find common languages, and familiar terms like 'frequency' or 'energy' seem to speak of common ground; there are familiar modes of representation: the line and point, the chalkboard and dialog. But for all the cunning conceptual architecture and aesthetic wit, can we say that knowledge has been transmitted or a shared understanding really earned, or has it been like the work's own dialogue, an exercise in learning a language empty of meaning; putting together a house of cards just for pleasure?



49: Panerus Bonang and score, some of the gongs have been inverted to produce a different range of sounds.

Epilogue

[To be read last]

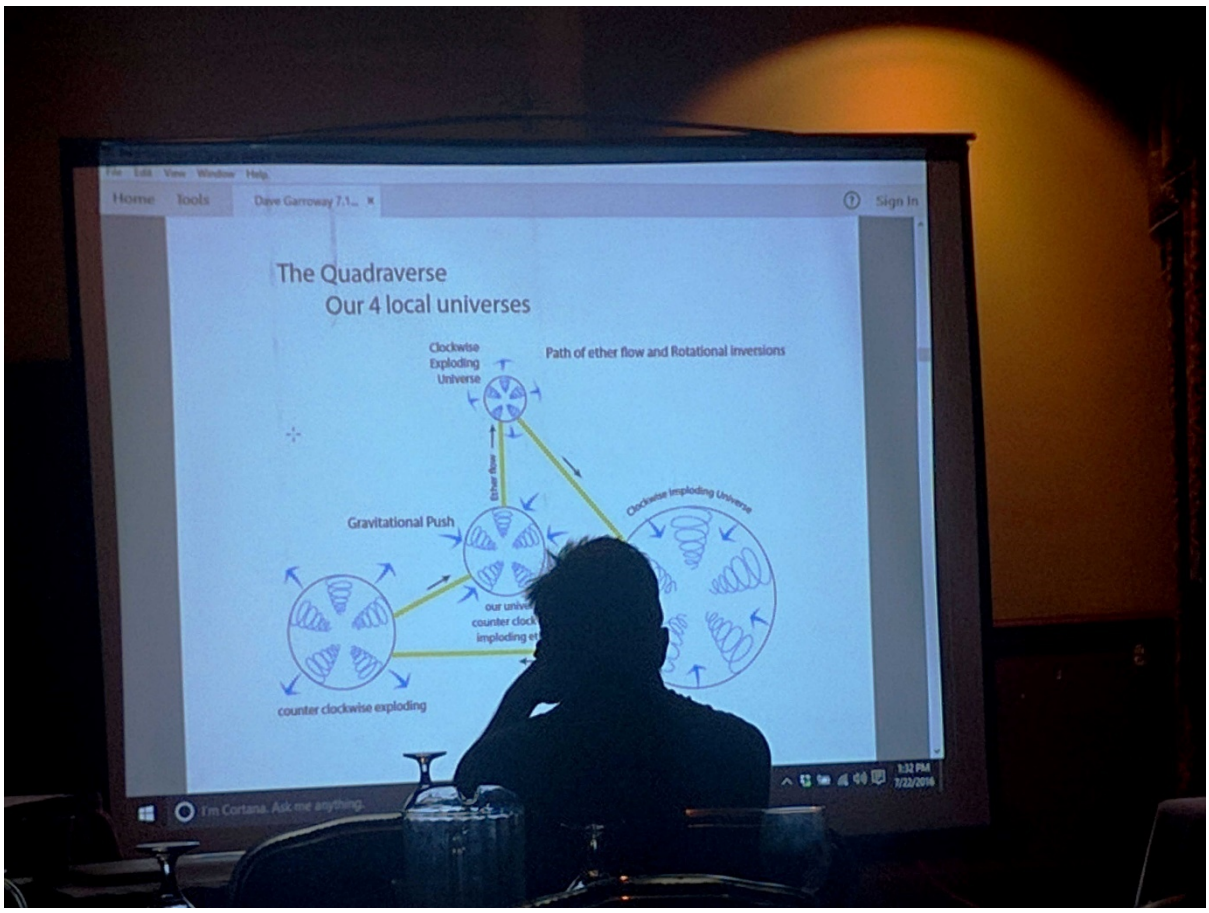


Figure 50: From the CNPS conference 2016, Washington D.C.

I had had little success in striking up a dialogue with James Carter over the period of this research project other than a few short responses to emails addressing specific questions about his cosmology. So, as I was completing the write up this summer (2016), I resolved to attend the NPA(CNPS) conference of outsider physics in Washington D.C., being held again for the first time in several years after the political schisms in the organisation alluded to in the thesis. I emailed Carter explaining my plans and expressing the desire to meet with him there to 'talk physics'. Receiving no reply, I got on a plane to D.C. hoping nonetheless to bump into him at the conference.

En route to the tired old motel on the beltway where the conference was being held ($30 per day attendance fee, lunch not included), I got an email from Carter. He was apologetic, but he wasn't going to attend; this new incarnation of the NPA was overly dominated by 'the Aether people'. He thoughtfully suggested that this preponderance of aether theories might also bother me, and that instead I visit him and his wife Linda on their sprawling trailer park in Washington State.

The conference was fascinating, although I won't offer a full account here. The attendees were universally male (with a couple of extremely patient spouses in tow) but ethnically and socially diverse, ranging from a Canadian Federal Judge to a Nigerian engineering professor. Each was a case study in himself. Many railed against organised academia. Some held theories which were explicitly spiritual, and some seemed to be simply contrarian by nature, not least in their theories but in every aspect of their character. As Wertheim observed, there was little actual discussion of the theories being disseminated. Most were on 'broadcast mode.' Having spoken, they retired to

the back of the conference hall to snooze or drink the stale coffee afforded in limitless supply by our hosts. The only galvanising moment occurred over a skype link presentation on the weaknesses of Einstein's theories: a successfully published German writer, from his bedroom in Germany, had the temerity to suggest that while some work was needed, Einstein was largely on the right lines. Much to his surprise, a queue formed of outsider theorists. Each took their turn to barrack him for his 'belief' in Einstein and promising to show him a better and more elegant solution to the workings of the universe.

Few of these men seemed to be actively engaged in an epistemological struggle though, as I had posited that Carter was in the thesis. These men had far more familiar targets in their sights. Despite the protestations of the opening speaker, they largely seemed like anti-establishment or conspiracy theorists, aiming their frustrations at slightly more intellectually respectable targets. The Republican conference was on at the same time and at least, I thought, their disenfranchisement wasn't being funneled towards some of the darker forces at work in D.C. that week.

Heading up to Enumclaw, an hour West of Seattle, to visit James Carter, I was concerned he might prove to be another such angry man.

The trip to Seattle gave me a chance to reflect on this project as a whole. As alluded to in the introduction to this portfolio text, a significant facet of the last four years has been a discussion about the nature of the practice-led D.Phil. If art can be research, then what are its epistemological claims? I was struck by the irony of interrogating one epistemological struggle, that of the outsider cosmologist, with another, that of my own practice-led research.

The portfolio described above has been an evolving exploration of knowledge creation. With hindsight, the taxonomies of the classical episteme, the relations of the alchemical logics, as well as the difficulties of relating culturally and personally to complex contemporary science were all discussed in the work. With admittedly disparate starting points, the strands of research into John Latham and James Carter converged in this research by practice and in the thesis, and became satisfactorily theorised in chapter three in terms of Foucault's ideas in The Order of Things.

Despite this dovetailing of the project, all of these roads lead not to a neat conclusion, but rather to another struggle: that of knowledge creation within the contemporary episteme. During a summer where the vilification of experts has been part of mainstream political discourse, it would be easy to draw lazy parallels to the state of the nation, but these phenomena are not trivially related. As such, this research has generated far more lines of enquiry than it has resolved: I look forward to further research into some of these questions, specifically the re-emergence of renaissance ways of thinking (like alchemy) in wider cultural and political spaces. Foucault concludes that the three-dimensional knowledge 'space' within the Analytic of Finitude makes any claims to knowledge creation essentially limited, but his Cartesian solution is in itself arbitrary. I hope to explore later developments in this field, especially as they relate to culture and complex science.

Finally, I hope that in documenting the struggles of Latham and Carter within the contemporary episteme I have also tacitly helped to validate art as research. As culture has moved beyond an absolute model of knowledge creation, these projects can create knowledge on their own terms. They are freer, perhaps, than some institutionally ordained fields to join the dots in Foucault's knowledge space, with reference to a wider cultural context.

James Carter was not an angry man. On the first day I arrived, he drove me up to the slopes of Mount Rainier, the ice-covered volcano which hovers like a sci-fi planet in the sky above the hills and trees for hundreds of square miles of Washington State. He told me about the projects he would show me over the next few days. The hydro power plant he installed in the gorge beneath the house he built, perched on a 200-foot cliff overlooking the river; the challenges

of heating the series of hot tubs and caves he had chiseled out of the rocks; the question of what on earth to do with the huge cavern he had excavated under his house (supported by some concrete someone had 'owed him'); the different species of trees he plants in huge circles amid the homogeneous Douglas Fir repopulated by the logging companies; and the myriad vehicles and machines with which he tinkers in his otherwise immaculate yard. Unlike the attendees at the conference, he had to be coaxed into talking about his theories. He would only get into the details over a beer in the evening, surrounded by his large Rottweilers and an aged Husky. All too easily he would return to talking about brazing a cast iron water pump, or how to build an energy storage device for his power plant.

He is generous about the other members of the NPA, but wry about the reality of their projects. 'Those guys think they're about to get a Nobel Prize,' he chuckles. It is clear that Carter is under no similar illusions about his own theories. Indeed, he accepts there is much work still to do before he's fully got to the bottom of explaining the world. Whilst I left the encounter no more convinced that Carter was a scientific genius than when I arrived, having experienced his world, where he has built, fixed or planted almost everything of note, suddenly his motives make much more sense. If he can intuit, digest and comprehend the workings of everything around him, and demonstrate this to his satisfaction in his myriad of projects then why not expect the fundamental rules of nature to work in a similar way?

Back at Tate Britain, a large Flat Time Roller dominates a corner of the recent *Conceptual Art in Britain* show; particularly striking as one of the few large sculptural objects in a show dominated by monochrome works on paper. A bored gallery attendant periodically unrolls it then rolls it up again. In a show unapologetically focused on the contemporary (1964 – 1970) concerns of the artists included, this whirring diagram of Latham's utopian outsider cosmology sits curiously askance to the explicit social commentaries and art theory posturing that surrounds it. If this show is implicitly part of the taxonomy of art, I am left wanting to ship the Flat Time Roller out to Enumclaw, Washington; to rescue it from the earnest greyscales of 70s Conceptualism and to install it in one of Carter's vast underground caverns where he could tinker with its ailing motor and scratch his head over how Latham's ideas might relate to his own.

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