Romantic-Objectivism

Diagrammatic thought in contemporary art

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Dedication

I would like to dedicate this thesis to John M. Wood (1938–2008), Professor of Medical Biochemistry, and to Karin U. Schallreuter, Professor of Clinical and Experimental Dermatology. It was their friendship, guidance and understanding that encouraged me as a young graduate in Biochemistry to set out on my own path of discovery and to become an artist.

It is also dedicated to my parents for their unconditional love and support, and to my incredible wife Sangsun Bae, who remains my inspiration, and who inspired me to undertake this Ph.D. in the first place.

Finally, this thesis is dedicated to Shiro Matsui, Professor of Sculpture at Kyoto City University of the Arts, whose *concrete* advice, humour and patience helped me to complete this project.

Declaration

I hereby declare that except where specific reference is made to the work of others, the contents of this dissertation are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other university. This dissertation is my own work and contains nothing which is the outcome of work done in collaboration with others, except as specified in the text and Acknowledgements.

Michael Whittle
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Abstract

This thesis aims to add to the growing body of knowledge surrounding contemporary diagram usage. It describes a diagrammatic aesthetics in fine art that takes in to account their prehistoric origins, rapid co-evolution with the scientific project, and complex semiotic qualities. This is done in order to more fully understand the appearance and use of diagrams within modern and contemporary art, and the author's own artistic practice.

Despite their fundamental importance within visual communication, there is a distinct lack of critical discourse concerning the role of diagrams in art. Over the last one hundred years, artists have employed a variety of strategies to take advantage of the unique visual and conceptual properties of the diagram, allowing them to achieve a distinctive objective-subjective resonance in their work. These works combine the intellectual rigor of scientific investigation with the sensuous, metaphoric nuance of fine art in a romantically-objective style referred to in this thesis as "Romantic-Objectivism".

This thesis proposes that the underlying poetics or artistic aims of diagrammatic art is not to produce work that makes a clear distinction between two types of idealism: the subjective and the objective; neither is it an attempt to collapse their differences and to make the outside objective world and the inner subjective self appear identical. Rather, a uniting feature of diagrammatic art is that it attempts to produce art works able to mediate between the two ideals.

With art's incorporation of diagramming as part of its tools and techniques of conception and production, we can see not only the transformation of artistic practice via diagramming, but also a transformation of our notion of what the 'diagram' is itself.

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Aims and objectives

The aim of this thesis is to describe the development of and potential for a diagrammatic aesthetics in fine art, one that allows artists to achieve a distinctive objective-subjective resonance within their work, by relying upon a variety of strategies that take advantage of the unique properties of the diagram. The resulting art works combine the intellectual rigor of scientific investigation with the sensuous metaphoric nuance of fine art in a style that I refer to as "Romantic-Objectivism".

This study incorporates an introductory prehistory and history of the diagram in order to position it as a fundamental mode of human visual communication, yet one that has been overlooked in terms of its importance to art. A philosophical analysis of the diagram aims to show how its relationship with the goals and techniques of science helped create the refined, skeletonized aesthetics of connectivity with which it is now associated.

Examples of key art works, critical texts and interviews with major artists of the twentieth century, including Marcel Duchamp and Sol LeWitt, provide support for the idea that artistic and philosophical involvement with diagrams and diagrammatic thought at a very fundamental level allowed artists to create some of the most important and influential art works of the Modernist period.

The thesis also explores my development of a symbolic vocabulary of diagrammatic objectivity, contrasting representative works from my praxis over the last twelve years with key symbolic themes from the romantic period. These include the landscape, human action in nature, the symbolic tree, the symbolic bird, and depiction of the human form. In this way, I present my work as a romantic-objective meditation on our contemporary relationship with nature, combining the austere detachment of the scientific diagram with the romantic emphasis upon landscape and the subjective expression of the individual.

To locate my own practice within the field of a contemporary diagrammatic aesthetics, the thesis also visually maps and contextualises numerous other examples of artworks by artists whose practices are involved with the diagrammatic format. This thesis investigates the inter-relatedness of these works in terms of their shared aesthetics and their "poetics" - that is to say, their artistic aims (from *poetica*: a work's artistic purpose) [1]

Some recent attempts have been made to apply the philosophical theories constructed around Diagrammatics and Diagrammatology to a limited number of individual, art historical works. Little has been said, however, about the use of the diagram in terms of the practice of artists, art historic movements, periods or the subject as a whole.

For example, in chapter 13 of Frederik Stjernfelt's influential book *Diagrammatology*, he presents a technical analysis of two art historical paintings [a]; this Stjernfeltian analysis is extremely important in terms of establishing much needed links between fine art and diagrammatology, but it focuses upon a narrow definition of the diagram as a geometric, perspectival tool and not as a creative instrument with which the artist breaks rules and subverts generally accepted uses of diagrams. [2]

For the purposes of this thesis I prefer to remain as fluid as the context allows in terms of defining the diagram and thus diagrammatic art, so that I am able to incorporate all modes of fine art production and the whole range of fine art practice.

Many of the artists discussed in this thesis have been intimately involved in the sciences, technology and architecture, either through academic study and professional training or a lifelong interest in those subjects. As a trained biochemist, (a subject almost entirely semiological and diagrammatic in nature), and as a practicing artist (actively involved in making and researching diagrammatic art), I am in a position to write about diagrams from multiple perspectives.

a Eckerberg's Altar Piece for Frederiksberg Church, c. 1839 (discussed in terms of the art historian Erik Fisher's analysis of the creative perspective techniques used in the painting), and Kasmir Malevich's Suprematicst composition: *White Square on White*, 1918

As such this thesis aims to contribute toward:

1) Making and understanding diagrammatic art and the processes involved;
2) Broadening our understanding of what a diagram is and can be through art;
3) Developing art's creative relationship with the sciences through the medium of diagrams;
4) Promoting discussion of the roles the diagram has played in art historically;
5) Demonstrating the diagram's continued influence on contemporary art;
6) Suggesting its potential importance as a means of art production in the information age and the experiential revolution that is virtual reality.

The questions I attempt to answer include:

1) How does the diagram manifest itself in art and why is it relevant?
2) How do artists combine objectivity and subjectivity and why do they try to?
3) What are some of the qualities that works of diagrammatic art share and what are the differences?
4) What are the conceptual techniques and physical mediums that are used to make this kind of work?
5) What kind of issues do diagrammatic art works deal with?

Chapter 1: Introduction

1.1 Romantic-Objectivism and diagrammatic art

> " Isn't it that one wants a thing to be as factual as possible and at the same time as deeply suggestive or deeply unlocking of areas of sensation other than simple illustration of the object that you set out to do? Isn't that what all art is about ? " [3]
>
> Francis Bacon

[b]

iagrams are one of the most ancient, ubiquitous and fundamental modes of visual communication, and yet there is a distinct lack of critical discourse about the role of diagrams in art despite their continued appearance since prehistoric times.

The great significance of the multitude of roles they play in human knowledge production has only recently started to be fully understood and appreciated. This chapter introduces the unique qualities of the diagram that allow it to not only present complicated visual data clearly, but to actively work with complex concepts, and thus order and re-order structures of thought. [c]

As one of the primary visual languages and conceptual tools of science, diagrams played a fundamental role in establishing the modern scientific project, and their use in art carries with it a history of this intimate co-evolution with the scientific process.

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b From: Albrecht Durer, *Of the just shaping of letters* (Capital D), 1525

c Both the painting and the diagram can be *looked at* and *regarded*, just as both can be *considered*, and at a higher symbolic level, both can be *read* and *interpreted*. However a diagram can also be *used* and can be *followed* in an instructional sense, due to the diagram's ability to provide guidance and instruction, and to clarify process and procedure.

Over the last century numerous artists have develop strategies to integrate diagrammatic aesthetics, processes and concepts in to their work. Diagrammatic art incorporates the objective and reductive features of science, while offering the viewer a very distinct form of nuanced, subjective experience. This thesis employs the term Romantic-Objectivism to describe the resonance of the selective objectivity of the artist with the projected subjectivity of the viewer.

The underlying poetics/artistic aims of diagrammatic art are not concerned with producing work that makes a clear distinction between two types of idealism, the subjective and the objective, neither is it an attempt to collapse their differences and to make the outside objective world and the inner subjective self appear identical. Rather, a uniting feature of this territory of work is that it attempts to produce art that is able to mediate between the two ideals. The American poet William Carlos Williams wrote that

> … all art is sensual and poetry particularly so. It is directly, that is, of the senses, and since the senses do not exist without an object for their employment all art is necessarily objective. It doesn't declaim or explain, it presents. [4]

Similarly, the viewer of the diagrammatic artwork is *presented* with imagery that has been reduced, essentialised and in many ways idealised, thus appearing as detached and objective despite its subjective origins. In an attempt to decode the artist's open system of signs, the viewer must enter into a subjective relationship with the work by projecting their own subjective experiences onto it.

In his *Natural History* (circa 77-79AD), Pliny the Elder gives an account of the origins of drawing in the story of *Butades of Corinth*. Pliny writes that both the Egyptians and Greeks take credit for the first picture, but adds that there is general agreement that it began with the simple outlining of a shadow upon a wall. "It was through his daughter that he made the discovery; who, being deeply in love with a young man about to depart on a long journey, traced the profile of his face, as thrown upon the wall by the light of the lamp." [5]

As in the legend describing the origins of sculpture 'Pygmalion and Galatea', art's origins are based around acts of love, and the anecdote of Butades gained great popularity during the romantic period, during which time it became a popular sub-genre, depicted by artists under titles such as *The Invention of Drawing*, *The Origin of Painting* and *The Corinthian Maid*. However in the painting *Invention of the Art of Drawing* (figure 1), Joseph Benoit Suvée depicts the daughter of Butades in a constrained, rational, balanced composition, typical of the Neoclassical style. As such, it can be read as a symbolic illustration of the Platonic aesthetic theory underlying classical art, with its emphasis on art as an imitation of reality.

"The image serves as a kind of allegorical epigraph to the display, foregrounding the emotional basis of technological attempts to record a person's presence. It also posits the silhouette portrait as an authentic form of realism, in that its shape marks out the actual physical space that the subject has occupied and subsequently left." [6]

Figure 1: Joseph Benoit Suvée, *Invention of the Art of Drawing* (detail), 1791, Oil on canvas, 267 x 131.5 cm, Groeninge Museum, Bruges

Suvée's painting is an early example of Romantic Objectivism in art, portraying the emotive subjects of love, loss and longing, but doing so in the restrained and balanced mannerisms of Neoclassicism. The key idea underpinning the poignancy of both the allegory and the painting is that human subjective experience is somehow being distilled into a single line. A gesture that is at once both Romantic-Objective, and diagrammatic in nature.

1.2 Defining the diagram in art

Figure 2: Cy Twombly, *Synopsis of a Battle*, 1968, Oil-based house paint and wax crayon on canvas, 200.66 x 261.94 cm, Corcoran Gallery of Art, Washington.

The majority of diagrammatic art takes the form of an 'open work', in Umberto Eco's terms, presenting the viewer with semiotic sign systems that are open to multiple readings, and thus making them an interactive process with a generative, creative potential. [7] Roland Barthes described the surreal juxtaposition of images in the plates of European Enlightenment encyclopedias in these terms, and Gilles Deleuze discusses the creative strategy of Francis Bacon as a generative, diagrammatic system. [8,9]

Diagrams as closed semiotic systems aspire to low noise and high fidelity information storage, presentation and distribution. They mobilize and shape knowledge with an axiomatic rigor that makes them essential to science and mathematics. Diagrams thus have the ability to both stabilise and destabilise meaning, and, importantly, allow the use of intuition and rational thought, a characteristic inherent in the etymology of the word. From the French *diagramme*, back to the Latin *diagramma,* the modern word can be traced even further to its Ancient Greek form διάγραμμα (diágramma).

Kenneth Knoespel points out that

> "the root verb of *diagramma* (διαγραγειν) does not simply mean something which is marked out by lines, a figure, form, or plan, but also carries a secondary connotation of marking or crossing out... it suggests writing on a wax tablet where writing with a stylus would involve crossing over the marks which would have been drawn previously. In this sense, *diagramma* embodies a practice of figuring, defiguring, refiguring, and prefiguring." [10] (figure 2)

Most definitions of the diagram in fine art incorporate the philosophical ideas of Charles Sander Peirce, Michael Foucault, and Giles Deleuze with Felix Guattari, all of whom acted in various ways to open up the very concept of what a diagram is and the potential for what it can become. In his 2009 essay 'Diagrams of the Mind', Sven-Olov Wallenstein writes that "the word 'diagram' seems indeed to have entered current thinking about art, architecture, and the visual/spatial arts through the influence of Deleuze, and in particular his book on Foucault…" [11]

Deleuze presented several different concepts and definitions of the diagram in relation to the work of Francis Bacon, Marcel Proust and Michel Foucault, however, "[Deleuze's] concept of the diagram as 'abstract machine… a map of relations between forces'… has been most influential in the spatial design disciplines." [12] In terms of Bacon's paintings, Deleuze uses the term 'diagram' to describe how the artist introduced chance marks to a canvas, which he must then deal with and respond to during painting, so that they guide production but also remain within the structure of the finished painting. In an interview with David Sylvester, Bacon describes how

> "(v)ery often the involuntary marks are much more deeply suggestive than others, and those are the moments when you feel that anything can happen…The marks are made, and you survey the thing like you would a sort of graph. And you see within this graph the possibilities of all types of fact being planted." [13]

Deleuze describes Bacon's process as striving toward "a creation of original relations that are substituted for the form." [14] As interesting and productive as this remarkable leap in our understanding of what a diagram may be however, it remains only one aspect of art production in terms of the diagram's potential. In order to be able to incorporate all modes of fine art production and the whole range of diagrammatic fine art practice, this thesis bases its semiotic analysis of diagrammatic art upon aspects of C.S. Peirce's pragmatic and fundamental work in semiotics and diagram research, an extensive and unfinished body of work which still remains highly influential today. [d]

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d Stjernfelt's book *Diagrammatology* is based upon C.S. Peirce's mature work, and the relationship between Peirce's semiotics and diagrammatic art is discussed in chapter 4 of this thesis.

Diagrams are a universal mode of communication found in all fields of human knowledge enquiry, and consequently there is a great diversity of specialized and trans-historical definitions and conceptualizations of their qualities, functions and uses. Contrasting and comparing the various synonyms associated with the word *diagram* helps to map out the fields of meaning surrounding and overlapping the term:

chart	scheme / schema	conception
blueprint	pictogram	plot
draft	ideogram	device
notation	layout	index
figure	perspective	symbol
table	outline	emblem
icon	plan	design

Such a breadth of meaning risks diluting the meaning of the original word, so that it becomes hard to distinguish from other less-helpful, vague terminology such as *drawing, figure, form, sketch, system, pattern, metaphor, archetype, allegory, analogy and structure.*

In his book *The Domain of the Image*, James Elkins examines the problems of classifying 'images', basing his approach upon a consideration of each object's own internal sense of organization. [e] Elkins tentatively proposes the triad of writing, notation and picture as one way of attempting to deal with the scope of the subject. In his chapter discussing diagrams, Elkins opts instead to use the term *schemata*, which he describes as "… a kind of image that is strongly notational, but also infused with the full panoply of forms [such as] writing, pictures, framing elements, numbers, allographs and so forth, with a high complement of geometric forms." [15]

In their book *The Culture of the Diagram*, John Bender and Michael Marrinan define the diagram as "… a proliferation of manifestly selective packets of dissimilar data correlated in an explicitly process-orientated array that has some of the attributes of a representation, but is situated in the world like an object." [16]

The concept of diagram in fine art exists not only as an aesthetic, or a process of production, but as the curation of experience, as is evident in multimedia installations and art works that are architectural or land-based in nature. The conceptual framework of the diagram is able to function in a way that allows it to incorporate a vast array of

e This is done as part of Elkins argument for extending aesthetic inquiry beyond the conventional bounds of art-historical research, in an attempt to include all of humankind's visual artifacts or 'informational images' (of which fine art forms only a tiny minority).

artefacts and phenomenon, so that Bender and Marrinan's 'packets of dissimilar data' could be picture, text, video, photograph, a three-dimensional object, other diagrammatic systems, or even other people.

At this higher level of abstraction, graphic connecting lines become lines of sight and physical passage, and the diagrammatically organised installation becomes a 'hodological space' in the experiential, psychological sense, as developed by Kurt Lewin, a founding figure in social psychology.

In contrast to a mathematical concept of space provided with by maps, plans and blueprints, hodological space incorporates the subjective experience of passing through a landscape (*hodos* being the Greek word for 'path' or 'way'), and is thus able to take into account the physical, social and psychological effects which installation art has upon the viewer(s) experiencing it.

The role of diagrammatic thought in art can also be extended to the curatorial process: time spent selecting the artworks and then devising the probable order of experiences for each visitor to the space, and what information is made available to support the work and curatorial concept, is a diagrammatic phenomenon on multiple levels.

An added complication to our notion of the diagrammatic in fine art is the concept that vision, perceptual experience and consciousness itself can all be described in diagrammatic terms, thus raising the question that perhaps the experience of any artwork can, in essence, be described as a diagrammatic. [f]

> It is possible that the experience of both seeing and projecting shapes onto the visual field underlies intro- and extra- mission theories of vision. Extra-mission reminds us that vision is fundamentally experienced as directing sight that may be perceived abstractly as extending a visual line to a particular object. As such vision may be experienced as a practice of continual diagramming. [17]

In this sense "diagrams are closer in kind to a Jackson Pollock than a Rembrandt." [18]

Figure 3 shows Sasha Archibald's superimpositions of original eye-tracking data gathered by the Russian psychologist Alfred Lukyanovich Yarbus (1914 -1986) with the image his subjects were asked to look at. [19] Yarbus made a series of seminal eye movements studies that he published in 1967 as *Eye Movements and Vision*. [20]

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f For example our ability to shift our focus of visual and auditory attention from point to point, to shift the scale of our perceptual awareness from the overview to the detail, and the importance of context to both the way we perceive phenomenon and make sense of the inter-relatedness of our sensory input.

Subjects were asked to look at a reproduction of the 1884 painting *An Unexpected Visitor* by Ilya Repin, but they were asked to do so in a number of ways, including: examining the painting freely, estimating the material circumstances of the family and assessing the ages of the characters.

Figure 3: Sasha Archibald (2008) Selection of patterns from Yarbus's eye tracking experiments, overlaid on to the original painting. Left: Original image; Middle: viewer asked to freely examination the image; Right: viewer asked to estimate the material circumstances of the family.

Yarbus was able to show that subjects visually interrogate the picture in a completely different way depending on what information they have been asked to determine. But the eye tracker also reveals that they do so in a very diagrammatic way, shifting their focus of attention between definite points within the image.

A clearer understanding of the diagrammatic nature of vision, and of the role the diagram plays in art as an aesthetic, a production process, and a means of organising viewer experience, reveals the fundamentally important role played by the diagram in art, and to the transformation of artistic practice via diagramming, as well as the transformation of what is understood by the term 'diagram' itself. In many ways this is what artists excel at: the interdisciplinary nature of their work and their ability to engage with, absorb, subvert, redefine and re-present new ideas allows for the rapid development and mutation of those ideas into new concepts and forms.

This thesis aims to address the need for a study of diagrammatic art and its Romantic-Objective qualities, and start an ongoing interest and interdisciplinary discussion amongst practitioners and researchers in diagrammatic art - in a timely attempt to fill the current void in contemporary diagrammatic research.

1.3 A note on the fragmented nature of diagrammatic study

The academic study of diagrams is a highly complex and relatively recent phenomenon that overlaps various paradigms of knowledge and inquiry, and can be broadly divided in to two distinct domains. Diagrammatics is generally understood to be the study of diagram application and function across different fields, and Diagrammatology as the study of the diagram as a phenomenon itself. (See Appendix A: Diagrams, an international, biannual conference series)

The scope of contemporary diagram research is thus both extensive and disparate, and consists of researchers from disciplines as varied as the sciences, semiotics, mathematics (logic and reason), philosophy, history, engineering, physics, education, geography, cartography, linguistics, artificial intelligence, cybernetics, graphic and industrial design, computer design and programming, architecture, fine art and musicology.

In all of these fields, an acknowledgement of the diagram as an essential conceptual and communicative tool has come relatively late, giving rise to numerous, discordant projects and nomenclature as attempts are undertaken to define what diagrams are and how they are created and used in the vernacular of each specialist subject.

The majority of diagram research dates back to the 1980's and 1990's, and focusses primarily upon semantics (what signs mean), semiotics (how signs mean), syntactics (the formal or structural relation between signs) and pragmatics (the relationship between signs and the effects they have on the user). (For a transdisciplinary overview of Diagrammatic research see Appendices B and C)

There is a distinct lack of critical discourse on the diverse roles played by the diagram in art, despite their continued appearance since prehistoric times. Discussion and debate has tended to come from the applied arts, such as visual design, information graphics and, in particular, architectural theory. [g]

The role of diagrams in music tends to focus on C.S. Peirce's use of the symphony to present his conceptual triad of tone, token and type, as well as on the rich field of composers who wrote and drew intricate notational scores as open diagrammatic systems, to be interpreted and reinterpreted by performers during each individual performance.

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g For a contemporary and multidisciplinary account of the diagram in architecture, see Mark Garcia's 'The Diagrams of Architecture' for a critical study of the history, theory and futures of the architectural diagram. (2010, UK: John Wiley and Sons)

Within literature and poetry, a contemporary trend toward subjective writing means that many of the texts that could be describe as Romantic-Objective in nature and diagrammatic in structure are to be found in the modernist period, with the work of James Joyce providing an exemplar.

The 'Ithaka Episode', (chapter 17) of Joyce's Master-work *Ulysees* greatly influenced my own thought and working practice as an artist. The chapter's philosophical and stylistic approach are entirely Romantic-Objective in nature. The prose style of this chapter parodies the severe, detached discourse of science, but is offset with playful puns and linguistically creative reminders of the imperfect nature of science as an 'all too human' project. The text's non-narrative use of questions and answers and dense interconnected systems of references promotes a complex web of concepts and analogies, an encyclopaedic poetics of objectivity:

> I am writing Ithaca in the form of a mathematical catechism. All events are resolved into their cosmic physical, psychical etc. equivalents . . . so that not only will the reader know everything and know it in the baldest coldest way, but Bloom and Stephen thereby become heavenly bodies, wanderers like the stars at which they gaze. [21]

Joyce himself described 'Ithaka' as "a mathematico-astronomico-physico-mechanico-geometrico-chemico sublimation of Bloom and Stephen (devil take 'em both)". [22] Its completion in October, 1921 also marked what Joyce considered to be the completion of the book itself, and in an unpublished letter, wrote of how he considered it to be "the ugly duckling of [*Ulysses*], and therefore, I suppose, my favourite" chapter of the novel. [23]

The work of Donald F. Theall has revealed fascinating parallels between the writing of James Joyce and the artistic processes of Marcel Duchamp. [24] Theall calls attention to Joyce and Duchamp's use of multiple layers of meaning and interconnection in their work, and their subtle use of connotation, analogy and nuance. [h] It falls beyond the scope of this thesis to explore the diagrammatic and Romantic-Objective features shared by key works of these two twentieth-century masters, and their subversion of scientific objectivism to poetic ends. However it is important to note that a Romantic-Objective use of the diagrammatic format is a connecting factor not only between the practices of the artists discussed herein, but between the arts themselves and, as this thesis attempts to show, between the arts and the sciences.

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h These features directly relate to chapter 4 of this thesis, which proposes a pictorial - semiological basis for understanding the subjective - objective qualities of diagrammatic art using C.S. Pierce's concept of *tone.*

1.4 Introduction to chapters:

Chapter 1: Introduction

1.1 *Romantic Objectivism* and diagrammatic art

Diagrams played a fundamental role in establishing the modern scientific project, and their use in art carries with it both a visual and conceptual history of this intimate co-evolution with the scientific process. Diagrammatic art appropriates the objective and reductive features of science, and yet is able to offer the viewer a very distinct form of nuanced, subjective experience. The ability of these works to act as mediators between objective and subjective ideals is referred to in this thesis as Romantic-Objectivism.

1.2 Defining the diagram in art

The diagram in art exists as an aesthetic, a process of production and, in the case of installation art, architectural and land based works, a means by which the artist can organise viewer experience.

Definitions of the diagram in art usually incorporate the work of Charles Sanders Peirce, Michael Foucault, and Giles Deleuze with Felix Guattari, all of whom acted in various ways to open up the very concept of what a diagram is and the potential for what it can become. However it is C.S. Peirce's pragmatic, foundational work on semiotics and diagrams that allows the incorporation of the multitude of ways that the diagram is considered and used in art a systematic way.

1.3 A note on the fragmented nature of diagrammatic study

The academic study of diagrams is a highly complex and relatively recent phenomenon, which overlaps various paradigms of knowledge and inquiry.
The current scope of diagram research is wide, varied and disjointed. Diagrammatics is generally understood to be the study of how diagrams work across different fields, and Diagrammatology as the study of the diagram as a phenomenon itself. However there remains a distinct division between the humanities and the sciences, and diagram research in the arts exists only in the most rudimentary of forms.

1.4 Introduction to chapters

Outline of the main themes of each chapter

Chapter 2: Development of the diagrammatic form

2.1 Prehistory

This section explores the earliest known occurrences of the diagram in its broadest sense. The diagrammatic format is traced back to prehistoric times where their elemental components are found in the symbolic, iconic and indexical signs of early cave wall pictograms and ideograms. These skeletonized markings are far older than the pictorial images found at Lascaux, and their discovery at sites worldwide hints at the development of logograms and phonograms of early written language. An object believed to be one of the first Palaeolithic map-like petroglyphs provides evidence of the combined use of mental maps and diagrammatic artefacts as a way in which early man related to the environment. Later Stone Age monuments such as Stonehenge suggest that early man used architecture-like structural arrangements and diagrammatic thought to provide spiritual orientation with the celestial bodies for rites and rituals.

2.2 Middle Ages

The diagram developed alongside the rise of geometry and anatomical investigations in the medieval science of Europe and the Muslim world. The resulting mathematical, geometric revolution of the Middle Ages built the foundations for the scientific revolution of the Renaissance.

2.3 Renaissance

Leonardo Da Vinci was the most prolific early Renaissance producer and user of the diagram, as evinced by his attempts to reduce the complexities of nature to their basic underlying mathematical forms. The work of Copernicus and Galileo and their reliance upon diagrammatic thought experiments set the stage for the culmination of the scientific revolution: Newton's work on the laws of gravity and his diagram based theory of optics.

2.4 Enlightenment

Enlightenment science centred itself around the production of encyclopedias as compendiums of human knowledge. The use of the diagram as the primary visual medium of the encyclopedic projects of this period marked the start of an exponential increase in both production and variety of diagrammatic forms. The diagram also underwent a process of evolutionary refinement in terms of graphic style, technique of production and scope of intended use.

2.5 Romanticism: the romantic-objective divide

Chapter 2.5 elaborates upon the choice of thesis title, and puts the research into historical perspective by considering one of the first key features of the modern scientific technique: the division of the world into primary and secondary qualities, an idea dating back to ancient Greece.

This successful, albeit controversial, distinction forms the basis for a dualism in which only the primary, measurable qualities of nature are considered to be real. The secondary qualities revealed by the human senses are supposed to be illusory, subjective interpretations of reality. Such a view was a major contributing factor to the rise of the European Romantic movement, and the stance it took against scientific rationalization. Sir Isaac Newton's study of white light with prisms is an example of this division of qualities in early modern science. In direct response to Newton's work, the German polymath J.W. von Goethe developed his own theory of colour, attempting to avoid such divisions of reality due to differentiation of qualities. Goethe did this by directly involving the human senses in his thought experiments and by taking a more holistic approach to his studies, which have been described as 'Romantic Science'.

Chapter 3: The Scientific Project and the Diagrammatic Aesthetic

This chapter aims to establish a connection between the diagrammatic aesthetic of the works to be discussed in chapters 4 and 5 and the philosophical ideals and goals of the scientific project. It summarizes these philosophical ideas and divisions which have helped shape the austerity of contemporary diagrammatic aesthetics. The philosophy of science continues to regard idealisation, essentialism, reductionism, objectivism and the division of qualities as controversial, despite the great success of their use in science.

3.1 Idealism: Adding simplicity and removing complexity

The philosophical division between ideal forms in simplified conditions and real world objects in complex conditions has engendered a long and complex relationship with both the sciences and the arts, dating back to its origins in Greek philosophy. Idealisations can generally be divided into those adding simplicity (Galilean / Platonic), and those removing complexity (Aristotelian / minimalist), although the categories themselves are not mutually exclusive and these approaches are often used in conjunction with one another.
Visual examples of the process of idealisation in art are provided from the modern and contemporary periods.

3.2 Essentialism: where to draw the line

As one of the most fundamental tools of science, the division of phenomenon into categories (or 'natural kinds') drives the systems of humankind's classification of reality on all scales, a process said to have originated with Plato's idea of 'carving nature at its joints' – the process of revealing the 'natural kinds' that make up reality. Despite the success of this technique in science, critics suggest that this reductionist approach reveals more about the human mind and divisions we project onto nature that may or may not exist in reality. Examples are provided to show how the philosophical issues raised by essentialism are of great interest to artists.

3.3 Reductionism: A componential analysis of the world

The 'reduction' of higher levels of meaning and being into the lower level of elemental parts—the process of continual fragmentation and analysis—is a way of thinking that has dominated the modern period, and examples are given examining the effect this has had upon the skeletonized icons of the diagrammatic aesthetic in art. Avant-garde art of the twentieth century is pervaded by a reductive sensibility that evolved in tandem with the evolution of abstraction.

3.4 Primary and secondary qualities

The mathematicisation of the natural world relies upon qualities that are measurable and thus primary. It is believed that these measurements are of qualities that exist in the things themselves, that they can be determined with certainty and do not rely on subjective judgments. Qualities arising directly from the human senses cannot be expressed mathematically in any direct way, and thus do not provide objective facts about things in the world. One consequence of this is the conceptual mistrust of colour as a subjective secondary quality of reality, leading to a distinct lack of engagement with colour in most diagrammatic art works. The work of Olafur Eliason is provided as an exception of this, and is discussed in relation to Goethe.

3.5 Detached objectivity: The absent artist and omnipresent observer

A pillar of the scientific method, objectivity aims to minimise the effects of human subjectivity upon scientific experimental designs and interpretation of data.
In creating diagrammatic art works, artists have similarly sought to objectively remove themselves entirely from the process of making art. Sol LeWitt warned against the creative sterility of such an approach, preferring to take what can be describe as a 'feigned' objective stance, by relying upon an element of irrationality and aesthetic choice in his work. Artists have also attempted to achieve perspective-free objectivity, and an

example of early analytical cubism is provided in order to support its conception as a romantically objective, diagrammatic artwork.

Chapter 4 Developing a pictorial semiotics of diagrammatic art

4.1 Semiotic codes and Peirce's tone/tuone

This chapter proposes a revitalisation of Peirce's overlooked concepts of *tone* and *tuone*, indefinite significant characters that are fundamentally important in the arts and play a unique role in diagrammatic art. The scientific / mathematic code is also discussed in relation to the aesthetic code, and the creation and interpretation of diagrammatic art., and how this relates to Umberto Eco's concept of the 'open-work'.

4.2 Sol Lewitt: Minimising tones and the poetics of geometry

While the tone/tuone plays a key role in the creation of nuanced signs in the arts, they are regarded indifferently or negatively in the diagrams of contemporary science and mathematics. Examples of this are given and geometric art works are presented as highly notational, low tone/tuone pictures, such as Sol LeWitt's series of geometric prints *The location of six geometric figures (circle, square, triangle, rectangle, parallelogram and trapezoid)* (1974).

4.3 Bernar Venet: The monosemic image

Marcel Duchamp's little known 'assisted ready-made' *Unhappy Readymade* (c.1919), is provided as an example of a Romantic-Objective artwork that juxtaposes the platonic ideal concepts of geometry with the chaos and entropy of the real-world environment.

4.4 Marcel Duchamp: The elements and the Elements

Chapter 5: Romantic Objectivism: The Diagram in contemporary art

This chapter presents the range of diagrammatic art in the contemporary, and is supplemented by a chart that maps the relations between 100 twentieth and twenty-first century diagrammatic artworks. (Map 1)

5.1 The taxonomy of neurosis: Yves Netzhammer and Mark Manders

The works of Yves Netzhammer and Mark Manders deal with the realities of contemporary neuroses, with Netzhammer's work tending to focus upon societal and Manders upon personal neurosis. Both artists employ a distinctly diagrammatic approaches to their work, which spans drawing, installation, sculpture and video.

5.2 The technological sublime: Maurizio Bolognini and teamLab

Maurizio Bolognini's *Programmed Machines* series of the 1990s is contrasted with teamLab's recent computer modelling project *Universe of Water Particles* (2013), to demonstrate the history, range and ambition of diagrammatic–technological art and its modernisation of the romantic concept of the sublime.

5.3 Complexity and emergence: Matthew Ritchie and Julie Mehretu

Two other contemporary artists using the diagram as a form and process to incorporate ideas of chaos, complexity and emergence in their works are Matthew Ritchie and Julie Mehretu. This section explores how research is part of their practice, specifically how they use the diagram as a way to open up new creative approaches to making art.

5.4 Traces of thought: Nikolaus Gansterer and Alejandro Guijarro

This section contrasts the projects of two different artists who reconsider the role that the diagram plays in education. The performance, installations and research projects of Nikolaus Gansterer and the photographic works of Alejandro Guijarro explore the diagram as medium to both work with and present concepts and information.

Chapter 6: The development of a personal diagrammatic aesthetics

This chapter charts my own development of a personal, symbolic vocabulary of diagrammatic objectivity, and is supplemented by Chart 2: '100 diagrammatic art works from my practice over the last ten years'. Chapter 6 is structured according to key symbolic themes from romantic period landscape painting that appear as reoccurring themes in my work: the landscape, human action in nature, the symbolic tree, the symbolic bird, and depiction of the human form. My praxis is considered as a 'romantic-objective meditation on our contemporary relationship with nature', combining the austere detachment of the scientific diagram with a romantic emphasis upon landscape and subjective expression of the individual.

6.1 The fragmented landscape: conceptual suspensions

Section 6.1 charts the de-materialisation of the landscape in my work, from an early involvement with props, scenery and stage sets to the conceptual suspension of landscape within the white ground of the image.

6.2 Clearings and excavations

The metaphoric Heideggerian concept of 'clearing' is described in terms of its appearance in my artworks, in which the clearance is depicted as the results of man's activity in nature, rather than as a natural occurrence.

6.3 The symbolic tree: imposing patterns upon nature

The symbolic tree is an important image in Romantic art and a recurring theme throughout my own work, where it has evolved in terms of complexity and level of abstraction, from platonic forms to non-Euclidian geometry and, most recently, virtual computer models of complex phenomenon such as the origins of human language.

6.4 The symbolic bird: avian anatomy

In a process similar to that of the landscape, the depiction and consideration of the image of the bird in my work has undergone a series of reductive and essentialising steps into its component parts, based upon the roles these organs play, such as in song or flight.

6.5 The human figure: icon to symbol

Appearing either indirectly in the form of dislocated hands, feet or limbs, or as truncated anatomical images and skeletal icons, the complete human figure rarely appears within my sculpture and drawing. This final section considers my use of diagramming and division making as an artist to deal with the human form, and natural tendency to partition existence in to an outside objective reality and an inner world of subjectivity.

Chapter 2: Development of the diagrammatic form

2.1 Prehistory

" -You have been referred to as the 'originator' of wall drawings…

- I think cave men came first. "

Sol LeWitt in conversation with
Andre Miller Keller [25]

h

tempting to trace the diagrammatic format back to its origins raises numerous issues, especially in terms of discerning a functional context. Boundaries easily taken for granted, such as those between current academic disciplines, start to overlap, blur or vanish as early as the Renaissance, so that attempts to categorise Leonardo da Vinci's diagrammatic images as part of the creative-investigative frameworks of either art, science or engineering prove to be more limiting than helpful.

Such difficulties become even more apparent when discussing diagrammatic forms found from the Stone Age in terms of their intended use and how to take in to account the vastly different world view of their makers when considering symbolic meaning.

What does remain clear, however, is that diagrammatic modes of presentation are a fundamental and ancient way in which humans think and communicate in an abstract symbolic manner, and this chapter explores the variety of these ancient formats. Paleolithic cave art provides a rich archive of early human symbolic behavior, and if one were to include the primitive skeletonized icons, paintings and schematic images found within caves throughout the world as a form of diagrammatic image making in its broadest sense, then evidence has been uncovered at archaeological sites throughout the world that such signs were being produced as early as thirty to forty thousand years ago. [26]

h The Phoenician letter Aleph gave rise to the Greek Alpha (A), from which the Latin A and Cyrillic A were derived.

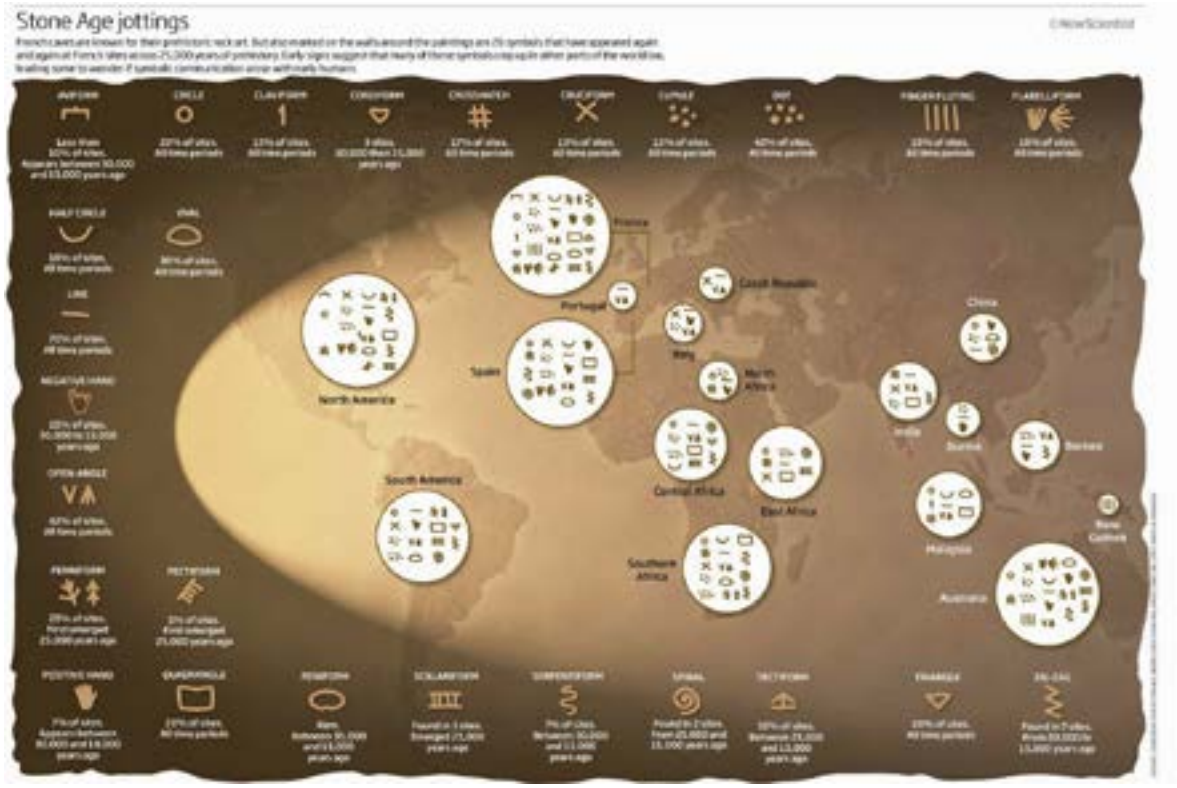

Figure 4: Research by Genevieve von Petzinger in to symbolic Stone Age markings, *New Scientist Magazine*, 20 February, 2010, Image courtesy of New Scientist Magazine

The images found in cave paintings can be divided into figurative (animals and humans) and non-figurative (geometric) symbols. In an unprecedented survey of ancient cave art from 146 locations in Southern France, Genevieve von Petzinger compiled a relational database of the geometric marks she found there in an attempt to organize a typology, and to compare them to marks found at various other caves throughout the world. [i] (figure 4)

The symbolic, iconic and indexical mark making techniques that compose early cave wall pictograms and ideograms appear to have come out of Africa with the last great migration at the beginning of the Cro-Magnon period in Europe. [27] Petzinger's work has helped to establish that a significant correlation exists between the symbol types found in France and other sites across the globe, revealing what appears to be an instinctual urge and proficiency in early man to make abstract symbols. (figure 5) Such marks laid the foundations for the development of later technologies such as the more complex, relational symbolic groups of proto-writing and early diagrammatic maps.

The work of artists such as Cy Twombly (figure 2), "...invites us to see how our earliest writing is also a form of drawing (and vice versa that drawing is a form of writing) and both may be called diagrammatic." [28]

i An ongoing research summary and interactive symbol map can be found at: http://www.bradshawfoundation.com/geometric_signs/geometric_signs.php (Accessed 22/08/2014)

Figure 5: Schematic, geometric symbols (Quadrilateral signs and lines of dots), from the cave of El Castillo, Cantabria, Spain (Approximately 27-16,000 BCE)

The gradual evolution of these simple graphic marks into more complex technical presentations such as petroglyph maps, has been shown to occur as early as 13,600 BCE. A research team led by Pilar Utrilla from the University of Zaragoza, Spain, spent fifteen years deciphering the etched lines and markings on a hand-sized stone weighing one kilogram, unearthed during excavation of a cave in Abauntz in the Navarra region of northern Spain in 1993. (figure 6a)

> We can say with certainty that it is a sketch, a map of the surrounding area. Whoever made it sought to capture in stone the flow of the watercourses, the mountains outside the cave and the animals found in the area…The landscape depicted corresponds exactly to the surrounding geography, complete with herds of ibex marked on one of the mountains visible from the cave itself. [29]

Figure 6b presents a reading of the various layers of signs and symbols believed to refer to the local geography, flora and fauna. Diagrams used in this way by our Stone Age ancestors appear to have been a means of coding the space in which they lived and hunted, as well as storing and working with ideas. Such maps may have been used to preplan hunting trips, re-experiencing past events and memorizing local terrain. It is the temporal dimension to the diagram that afford them to not only

> ...explain what has happened and what has been seen but what will happen and what will be seen. It is precisely the recognition of continuity in such visual patterns that explains why visualization technologies are of such utmost importance for the registration of continuity also permits the detection of variation. [30]

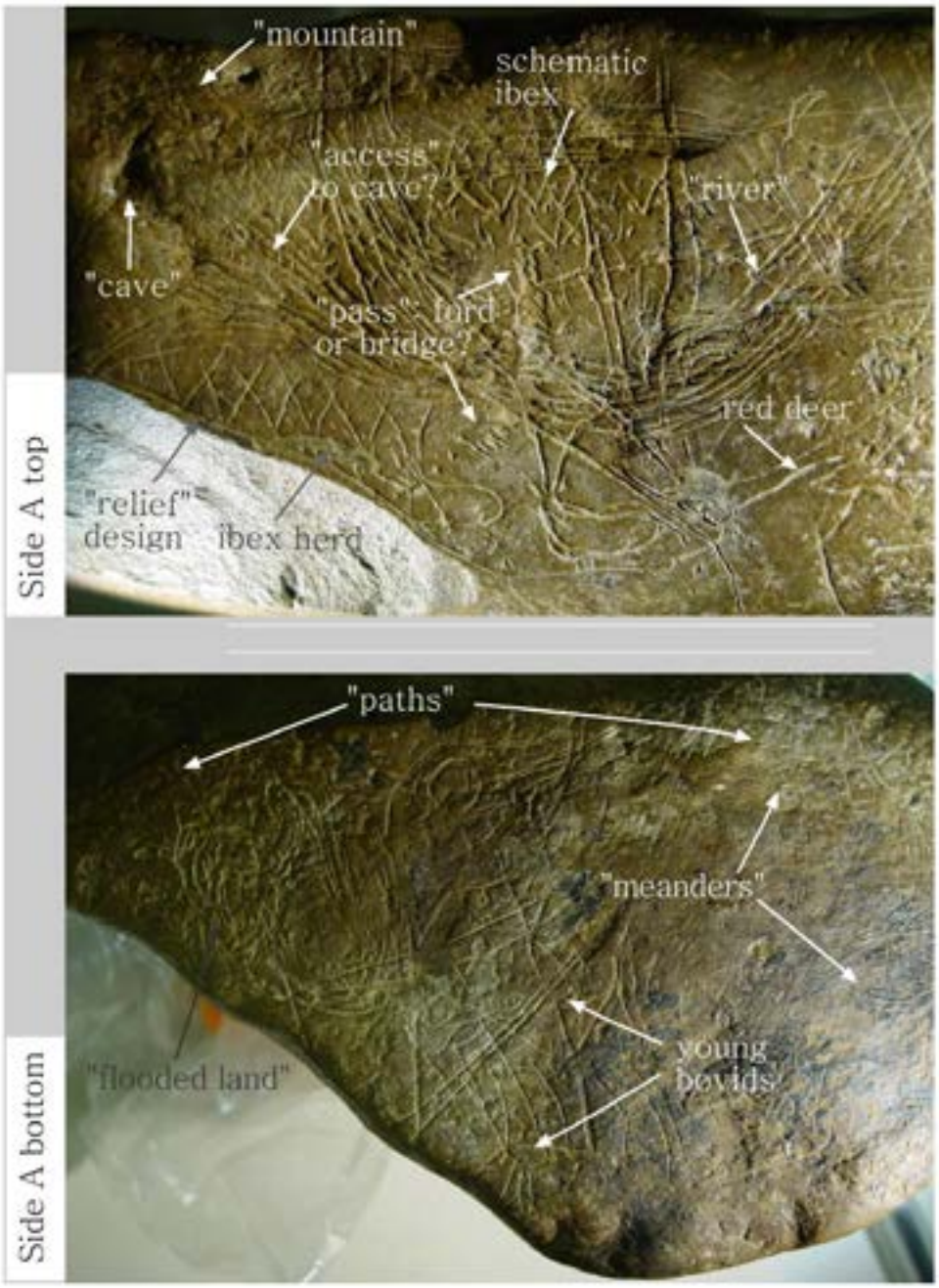

Figure 6a: Engraved Stone Blocks, Earliest known Petroglyph Map
from the Late Magdelenian in Abruntz cave (Navarra, Spain) c. 13,600 BCE
Journal of Human Evolution, 57:2 (2009), Image courtesy of Pilar Utrilla

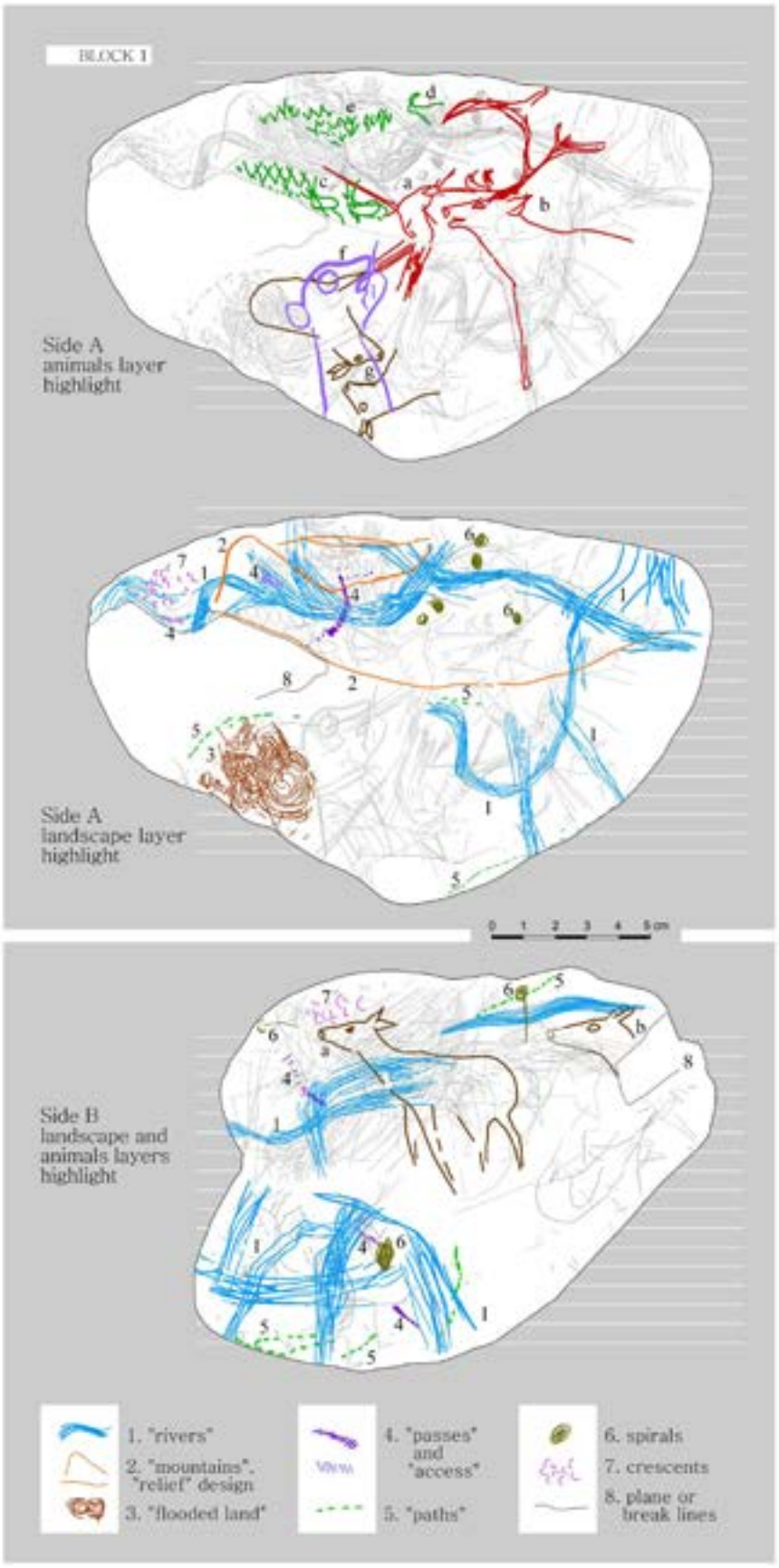

Figure 6b: Diagrams highlighting the various layers of deciphered images found upon the stone tablet shown in figure 6a. Journal of Human Evolution, 57:2 (2009), Image courtesy of Pilar Utrilla

By 4000-2000 BCE however, a far more sophisticated temporal and spatial relationship with the diagrammatic form was beginning to emerge, as Neolithic and Bronze age humans developed ways to relate to their world by means of constructing monumental architecture. Newgrange in Ireland (3200 BCE), Stonehenge in the U.K. (3000 - 2000 BCE) and various other archaeoastronomical sites throughout the world, have come to be understood four-dimensional, dynamic, architectural, diagrammatic forms of remarkable scale and sophistication, expressing long-lost cosmologies.

Archaeoastronomers have found evidence that such structures were often pre-designed and precision built to be astronomically aligned with the motions of the sun, moon and other heavenly bodies, so that as diagrammatic entities, their conceptual framework is measured in light years. [31]

These Neolithic creators were already adept at architecture, geology, engineering, art and astronomy, and the various sites are believed to have combined a diagrammatic awareness of space and place with seasonal rituals and rites. A site such as Stonehenge "occupied the minds and labour of generations for over a millennium", with numerous structural additions and alterations over time, however the

> ...neolithic communities who built Stonehenge were far from exhaustively preoccupied with the sky, or with the landscape beyond the stones.
> The design is a celebration of intellect and discovery, and the final stone construction heralded a new and enlightened age where technology and creativity flourished, where long-established ancestral traditions were yielding to the dawn of the inquisitive and dynamic world with which we are more familiar. [32]

The major line of symmetry of Stonehenge lies along an astronomical axis of the summer-winter solstices, however, underlying the regularity and precision of the structural arrangements of the various posts, stones and ditches from all periods of its construction is a preoccupation with its internal geometry and integrity.

The discovery of the Bush Barrow lozenge 1808 at a site close to Stonehenge provided supporting evidence of stone age creators familiarity with geometric principles such as the construction of hexagons from radii, the subdivision of angles, the setting of accurate right angles and the investigation of other geometric forms, such as decagons and pentagons, all with clear links between such draftsmanship and field surveying skills necessary to construct monuments such as Stonehenge. [33] (figure 7) [j]

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j In terms of technical stone-age drawing, there is a striking resemblance between the Neolithic gold lozenge discovered near Stone-henge and smoothed pieces of red ochre found at Blombos cave on the Southern cape shore of South Africa in 2002. These objects belong to the Paleolithic period and as such, greatly predate all of the discoveries mentioned above, being dated at over 70,000 years old (Appendix D).

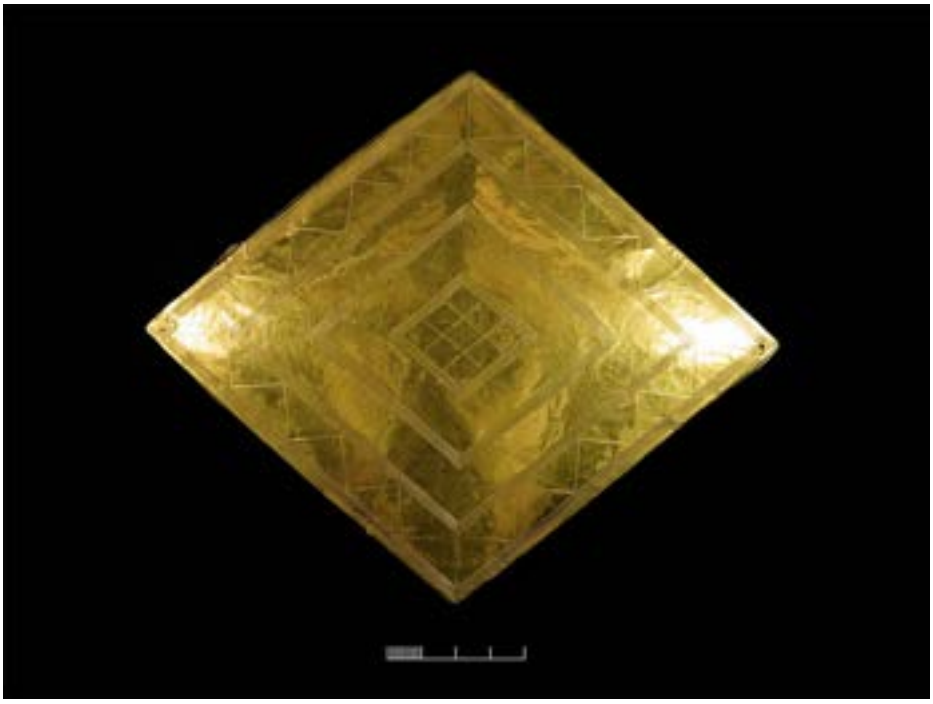


Figure 7: The Bush Barrow lozenge, engraved gold, c. 1500 BCE
(originally formed over thin wooden support with beeswax) 15.7 x 18.55 x 0.01 - 0.02 cm

Despite the great distances in time between the creation of these early artifacts and the modern world, our fascination with the celestial dome and sacred geometry continues, and it is very often the sparse precision of the diagrammatic format that is chosen by contemporary artists to express this ancient fascination in the context of a modern world-view. (for a list of other examples of very early diagram use, see Appendix E)

The American artist James Turrell has spoken of the influence archaeoastronomical sites have had upon his work, and of his admiration of the ancient observatories at Borobudur, Angkor Wat, Pagan, Machu Picchu, the Mayan pyramids, the Egyptian pyramids, Herodium, Old Sarum, Newgrange and the Maes Howe. “These places and structures have certainly influenced my thinking. These thoughts will find concurrence in Roden Crater.” [34]

In 1977 Turrell purchased a 156 square mile ranch in Arizona, U.S.A, containing the 400,000 year old extinct volcano known as Roden crater. The project involved moving approximately one million cubic metres of earth to carefully re-shape the caldera and create a network of precisely aligned tunnels. These passageways connect 20 chambers, some with multiple viewing spaces, and were designed in ongoing consultation with astronomers in order that they specifically channel light from the sun, moon and certain stars (figure 8).

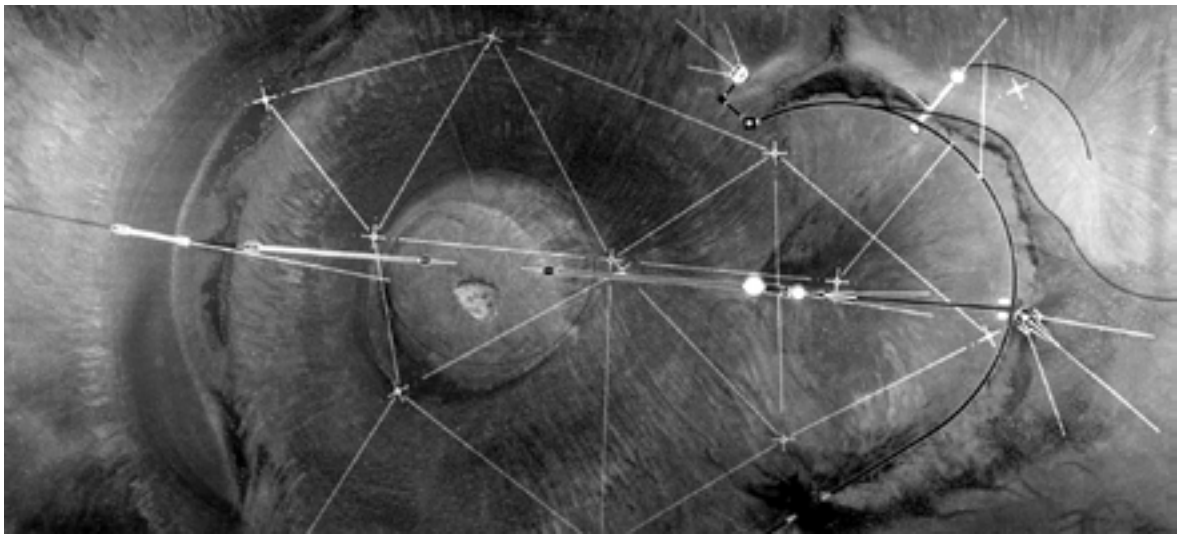


Figure 8: James Turrell, *Study for Craters* (Overall Site Plan with Survey Net), 1987.
Photo-emulsion on wax and mylar with ink and wax pastels, 148.6 x 183.8 cm.
Image courtesy of Brooklyn Museum

The structure takes in to account astronomical events over the next 2000 years and, in the case of the chamber designed to monitor the precession of the earth's pole from Polaris to Vega, 12,000 years, after which time Vega will become the new North Star.

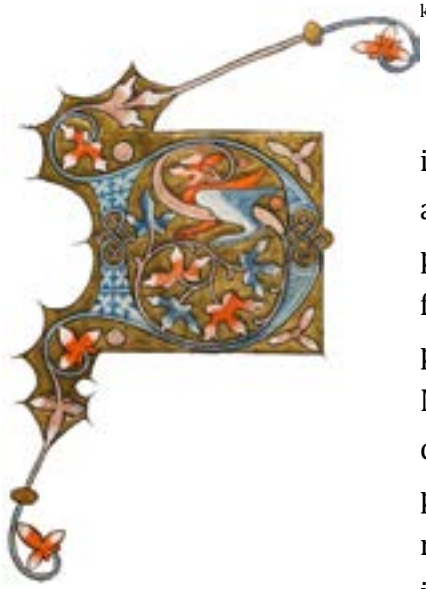
> Roden Crater has knowledge in it, and it does something with that knowledge. Environmental events occur: a space lights up. Something happens in there, for a moment, or for a time. It is an eye, something that is itself perceiving. It is a piece that does not end. It is changed by the action of the sun, the moon, the cloud cover, by the day and the season that you're there…. and it keeps changing. When you're there, it has visions, qualities, and a universe of possibilities. [35]

Turrell's project at Roden crater has been described as "even unfinished, as important as any artwork ever made." [36] Considered in its entirety, the project provides an excellent example of a Romantic-objective, diagrammatic approach to art that is vast in both scope and ambition. Turrell's use of locally sourced materials to construct sparse, minimally decorated interiors acts to highlight the intensely subjective experience of the viewer within his objectively designed environments.

The artist's manipulation of subjective-objective nature light and colour directly connects his practice to that of Goethe's work on colour theory and his *Romantic Science*, as discussed in section 2.5. In describing his manipulation of the visual senses, Turrell compares his approach to an artistic, visual form the Buddhist koan:

> We live within this reality we create, and we're quite unaware of how we create the reality. So the work is often a general koan into how we go about forming this world in which we live, in particular with seeing. [37]

2.2 Middle Ages

 [k]

iagrams have a long history in medieval image making, and it is during this period that important changes took place in their creation and use. As a result diagrams offer a unique commentary on the ratiocination, thought processes and modes of intellectual perception of the Middle Ages. [38] Diagrams from the medieval period combine utility with beauty and practicality with metaphysics, and display aesthetic tendencies towards visual refinement and clarity, or towards elaborate adornment in an ornate Gothic decorative style.

The rise of Scholasticism lead to a proliferation of didactic tables and diagrams, classifying and interpreting abstract concepts in clear and memorable stylised mnemonics. The heuristic power and explicit nature of the diagrammatic format allowed it to be easily adapted to create a didactic array of artistic, philosophical, theological and scientific tools for expression, exegesis and explication. However esoteric and early alchemical diagrams of the period became increasingly hermetic in their interpretation, their makers having incorporated arcane symbols and chaotic systems of references to imbue their mystical art with an aura of concealed meaning and secrecy.

The ability of diagrams to express several layers of meaning simultaneously rendered them particularly well suited to medieval attempts to anthropomorphically connect time, matter, the cosmos, man and God. Complex charts of conceptual interrelations were compiled in an attempt to reveal underlying patterns, harmonies and connections in nature.

The large parchment shown in figure 9 is an intricate diagrammatic illustration created by the fourteenth century Italian cleric Opicinus de Canistris. His densest surviving composition, this work contains over twenty different sets of information: the major prophets, minor prophets, planets, two different sets of zodiac symbols, the doctors of the Church, four monastic orders and their founders, months, days, an implied world map, the genealogy of Mary, the *Ave Maria*, three personifications of the church, two crucifictions, the gifts of the Holy Spirit, the four types of Biblical exegesis, the four Evangelists, the apostles, and the names of the letters of Paul. [39]

k An inhabited letter D from the *Wettinger Graduale*, a 14th century manuscript made in Cologne.

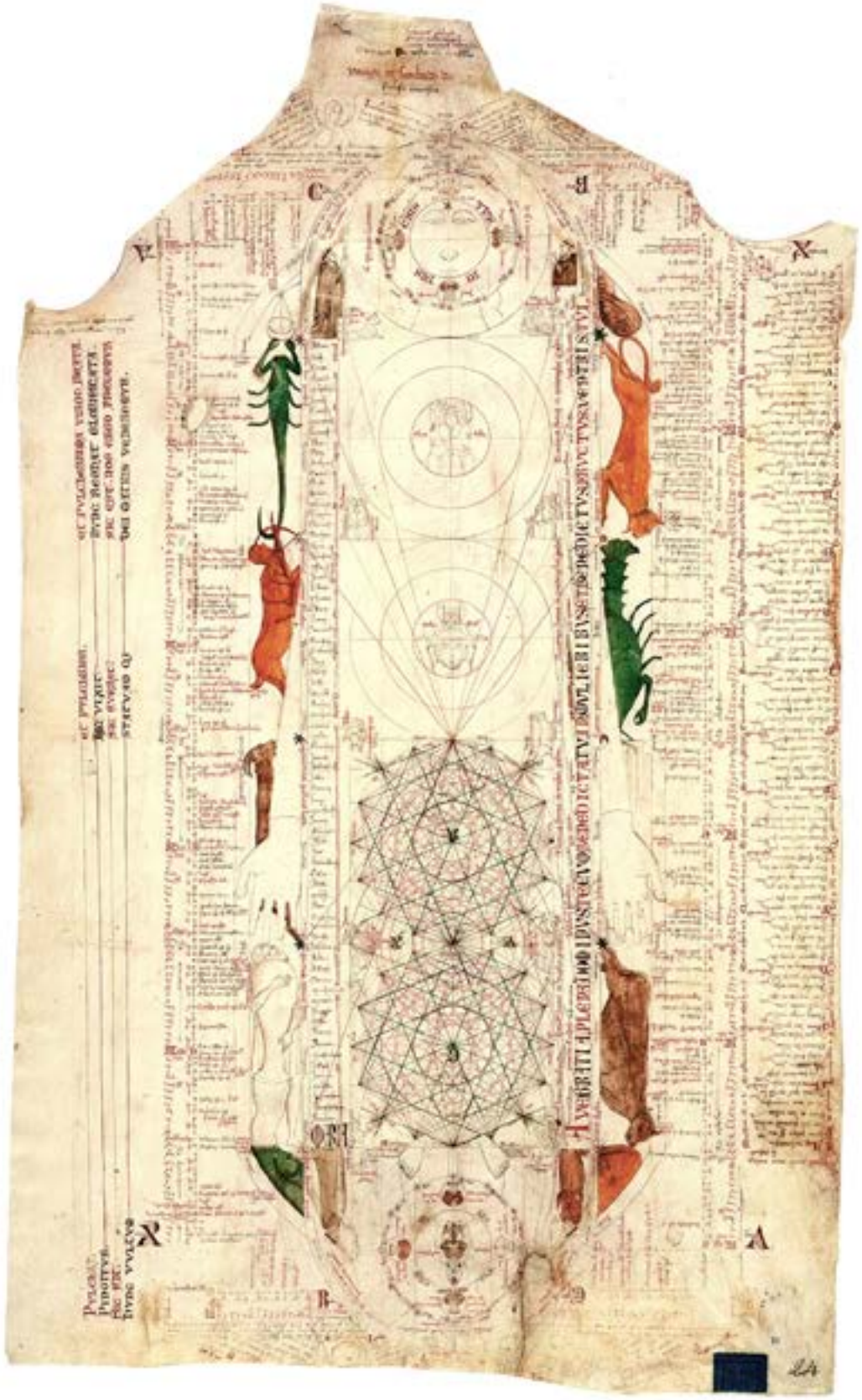


Figure 9: Opicinus de Canistris (1296–ca. 1354) *Diagram with Zodiac Symbols,* folio 24r
Avignon, France, 1335–50 Biblioteca Apostolica Vaticana, Vatican City, Pal. Lat. 1993
Image courtesy of the Metropolitan Museum of Art, New York

This list of featured information is interconnected with a logic that is highly diagrammatic as opposed to linear, allowing there to exist

> ...an built-in indeterminacy of meaning and even of relationship of parts to medieval diagrams, for they follow the logic of recollection, which is associative and determined by individual habit - and not the universal logic of mathematics... Every medieval diagram is an open-ended one; in the manner of examples it is an invitation to elaborate and recompose, not a prescriptive schematic. [40]

The diagrammatic drawings of Opicinus mediate between the classic medieval binaries: human/divine, matter/spirit, visible/invisible, appearance/truth and the microcosm/macrocosm. However what sets the cleric's work apart from other medieval artists of the time, and makes it of great importance to this thesis, is the way in which he combines empirical objectivity with creative subjectivity.

Opicinus integrated within his work the most technically accomplished cartography of his day in the form of mariners' sea-charts (portolan charts), thus providing an empirical foundation with which to creatively re-frame the traditional, theoretical and primarily text based imagery, and create a completely new type of representation. Two circular wind roses containing images of Christ are presented in figure 9, positioned centrally one above the other, below the image mid-point. These diagrams consist of networks of *rhumb lines*, ubiquitous within Opicinus's work and always associated with maps, so that their use here suggests the birth, life and death of Christ within the physical space of the earth. [41]

The accommodating, fluid nature of the diagrammatic format allowed Opicinus to work and rework figures in a variety of positions and layouts, searching for new ways to arrange the various beliefs and hypotheses encoded within his works. Maps are overlayed with other maps to create complex, hybrid schemes of varying transparency and opaqueness, and this visual and conceptual combination of Medieval metaphysics with the apparent logical rigor of the diagrammatic format gives rise to a disorientating mixture of factual accuracy, fanciful creativity and divine revelation that pushes recognition and interpretablility to its limits. [l]

> ...Opicinus sought a new value of truth, attempting to find a way to reconcile new science with theological tradition while simultaneously seeing the potential of empirical observation to frame old questions in new ways... his drawings anticipate the concept of man as the measure of all things. [42]

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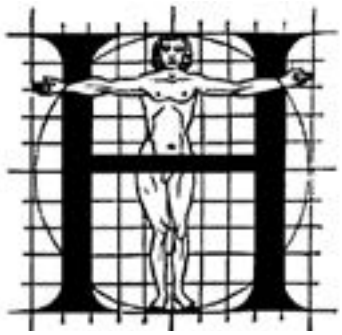
l There is evidence that Opicinus suffered from stroke like symptoms on the 31st of March, 1334, at which time he became paralysed, mute and lost his memory. He also experienced divine visions during which he saw visions of continents and oceans transformed into human figures .

With the gradual rise of Medieval science in Europe and the work of the great Arab philosophers of the golden age of the Muslim world, the diagram entered a new stage in the evolution of its form and content. This includes the development and refinement of mathematical geometric diagrams, ray diagrams in optical research, diagrams of technological designs, genealogical maps in the form of family trees, perspective constructions and gridded maps etc. (For a list of other examples of early diagrammatic innovations from this period, see Appendix F)

The philosopher of science James Franklin believes that medieval geometrical diagrams played an essential role in establishing the foundations of the scientific project:

> The first successes of the Scientific Revolution were exclusively geometrical, if geometry is taken in a wide sense. They were possible because Europe had had several centuries of training with reasoning with diagrams … The Scientific Revolution could exist because it inherited a Medieval Mathematical (mostly geometrical) Revolution… The imagination was regarded as literally full of pictures, and so a medium for scientific visualisation. It was the medium Galileo used for his thought experiments. [43]

2.3 Renaissance



[m]

igh renaissance Europe witnessed the diagram become not only the dominant visual language of science, but a key component of the scientific process itself in the form of thought experiments and diagrammatic reasoning. At first, Renaissance diagramming was a continuation of Medieval developments, especially geometry, but this rapidly changed in terms of levels of symbolic abstraction, complexity and sophistication by the culmination of the Scientific Revolution.

The surviving notebooks of early Renaissance artist and polymath Leonardo da Vinci (1452-1519) reveal his masterly use of diagrams. Geometry was fundamental to Leonardo's process of understanding both the visible forms of nature and the hidden mechanisms and forces underlying natural phenomena.

The Pythagorean theory of musical harmonics was still being used as the basis for the Renaissance science of music, and the development of this relationship between objective, underlying physical laws (in this case mathematical harmonics) and the creative poetics of artistic self-expression (i.e. the writing and performing of music) is one of the one of the underlying concerns of this thesis. Leonardo applied the concepts of proportional harmonics to his paintings, sculpture, and depictions of architectural perspective.

Leonardo studied the proportions of the human body in great detail throughout his career, and actively applied this understanding in drawings such as *The Vitruvian Man* (c.1490), based on the work of the first century Roman architect and engineer Marcus Vitruvius Pollio (c. 75–25 BCE). In his book *De Architectura*, Vitruvius founds his theory of architecture on the proportions of the human body, which he considered to be nature's greatest work. Leonardo's figure reflects Renaissance theories linking the proportions of the human form to architectural design (figure 10). Ancient thinkers had long invested the circle and the square with symbolic powers, the circle representing the cosmic and the divine; the square, the earthly and the secular. The Vitruvian man was one of a number of renaissance attempts to fit the human form within both shapes to support the metaphysical proposition that the human body wasn't only designed according to the principles that governed the world; it was the world, in miniature.

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m Capital letter H (Homme) from Geoffroy Tory's 1529 book The Champ Fleury, abandoning the manuscript and Gothic writing style in favour of a greater typographical clarity, and the representation of the human body as a model of correct proportions.

For Leonardo, “every form – however complex – was constructed on the basis of underlying rules of a geometrical nature”, and Leonardo’s vision of the interplay of these rules was transformative and dynamic rather than static, a kind of geometry in action:

> The muscles of the human body worked immaculately according to the laws that governed levers. The flow of the blood in the vessels and of the air in the bronchial tubes in the lungs was governed by the geometrical rules that applied to all branching systems. A flying bird was designed in perfect conformity with the geometry of airflow. [44]

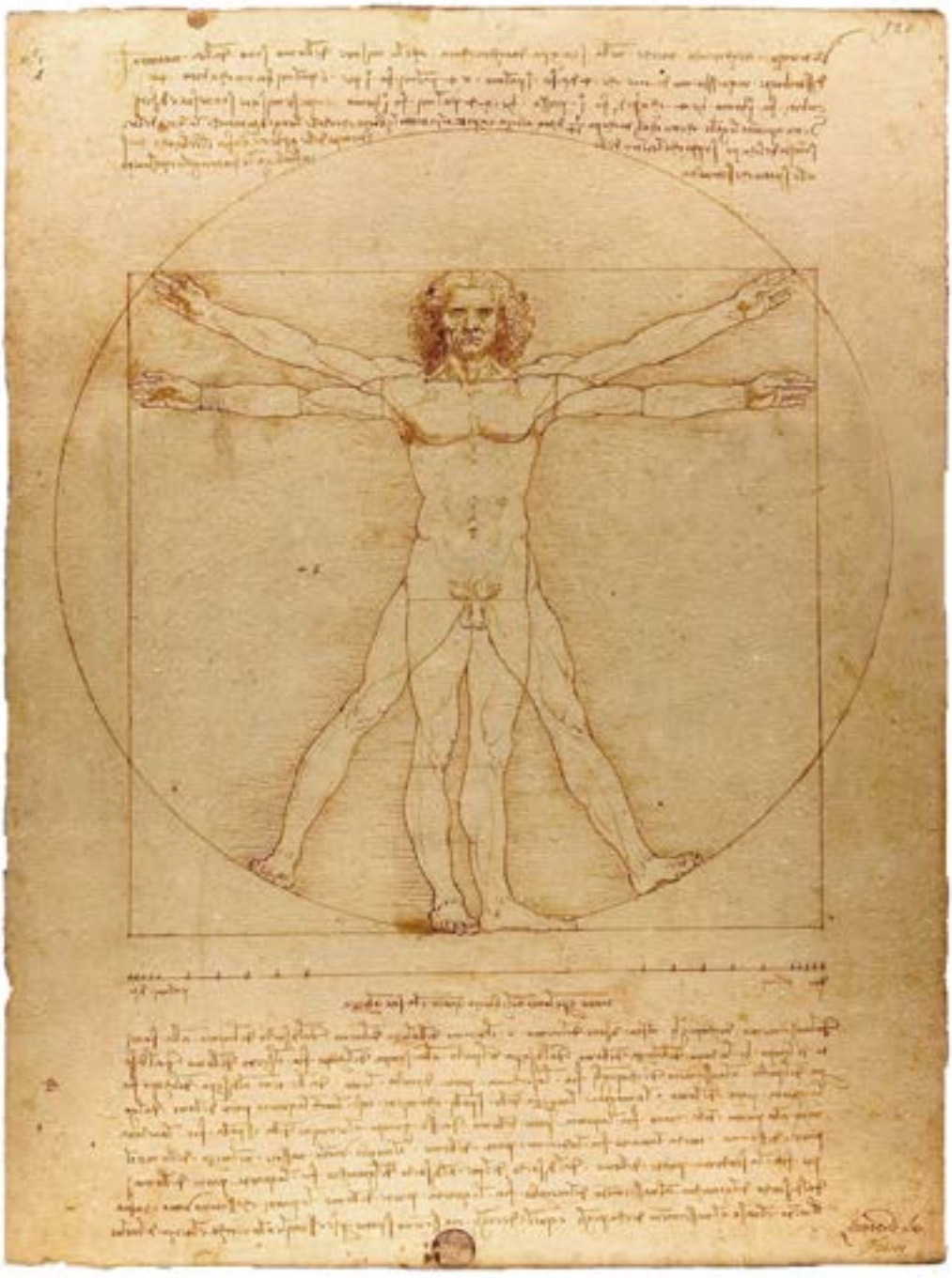


Figure 10: Leonardo da Vinci, the *Vitruvian Man*, (*Man inscribed in a square and a circle*) c.1490, Ink on Paper, 34 x 26 cm, Venice, Galleria dell’ Accademia

Leonardo's preference for proportion over number, and his emphasis on transformation and underlying patterns connects his thought to Goethe's theory of Archetypes, some two to three centuries years later (See chapter 2.4). However even twenty first century philosophical notions such as Rhizomatic interconnectedness, conceptual mobility and contained disorder, as found in Gilles Deleuze and Felix Guatarri's exploration of the diagram [n], also have their roots the works Leonardo da Vinci, with a lineage traceable back to the dynamic diagrammatic forms of Opicinus de Canistris.

Kemp describes Leonardo's unfinished painting The Adoration of the Magi (1481), of which figure 11 was a preparatory sketch, as a paradoxical combination of contained measure and unconstrained improvisation, characteristic of many of Leonardo's drawings. [45] The immaculately depicted perspective geometry of the tiled floor and the static architecture of the temple interior acts to highlight the turbulent graphic images of the figures and animals depicted within it.

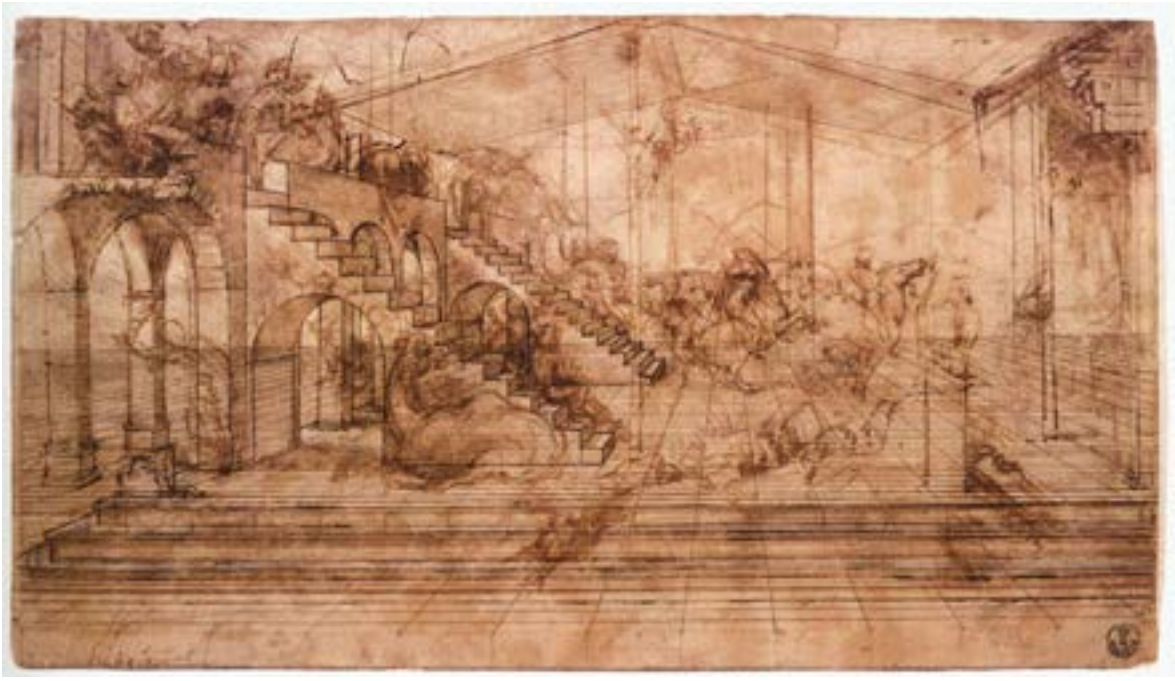


Figure 11: Leonardo da Vinci, *Perspective study for the adoration of the Magi*, c. 1481, Ink on paper, 16.3 x 29 cm, Florence, Galleria degli Uffizi

The reduction of complex natural forms to their underlying geometrical relations was, however, more of an intuitive process for Leonardo than one relying upon the techniques of mathematics. Martin Kemp has suggested that this preference may have been two-fold, both in Leonardo's own limited abilities at mathematics and algebra but also as an intellectual preference for a more fluid model of a dynamic world based on the beauty of proportions, interrelations and first-hand experience of the world.

n For a recent interdisciplinary study of the central position that the diagram holds in the philosophy of Gilles Deleuze, see: Jakub Zdebik, Deleuze and the Diagram, 2012, London: Bloomsbury.

Leonardo referred to geometry as "the science of continuous quantity'" whereas he referred to numbers and mathematics as dealing with "discontinuous quantities" with little correspondence to the nature of actual physical forms. [46]

In his essay for the book accompanying the exhibition *Leonardo da Vinci: Experience, Experiment and Design* (2006) at the Victoria and Albert museum in London, Kemp discusses Leonardo's use of *disegno* to think visually. *Disegno* was a common term used by Renaissance draughtsmen and is normally translated in English as either drawing (in the fine art context) or design (in the context of applied arts). Leonardo's use of *disegno* allowed him to integrate the subjective imaginative faculty or *fantasia* with the intellect, which in turn achieved expression in the Renaissance concept of science (*scientia*). *Misura* was the term used to describe the measuring of proportions, the construction of perspective systems and rules of light and shade, and was regarded by Leonardo as the fundamentally scientific aspect of expression in painting. [47]

Kemp uses the following quote from Leonardo to support his claim that *disegno* was considered as the supreme tool that served the eye as a means of investigation and exposition, and that when Leonardo praises the eye, he was essentially making claims about the power of *disegno*:

> Now do you not see that the eye embraces the beauty of the world? The eye is commander of astronomy; it makes cosmography; it guides and rectifies all the human arts; it conducts man to various regions of the world; it is the prince of mathematics; it's sciences are most certain; it has measured the height and size of the stars; it has disclosed the elements and their distributions; it's made predictions of future events by means of the course of the stars; it has generated architecture, perspective and divine painting. Oh excellent above all other things created by God… And it triumphs over nature, in that the constituent parts of nature are finite, but the works that the eye commands of the hands are infinite. [48]

The systems Leonardo is praising, however, all relate to the power of diagrams and diagrammatic thought, and this becomes evident if we examine the examples Leonardo refers to, which include astronomy and celestial charts, the theory and practice of the systems of proportions governing artistic beauty, cosmography, cartography and navigation, mathematics including trigonometry and geometry, the analysis of dynamic and static systems in the behavior of earth, water, air and fire, architectural plans, elevations, sections and systems of perspective and the 'divine' science of painting with its 'roots in nature'. [o] Thus it was diagrams, for Leonardo, which provided a means to combine the creative, subjective process of *disegno* with the logical, objective rigor of *misura*.

o Cosmography was considered a science between the fifteenth and seventeenth centuries, attempting to map the general features of the cosmos or universe, describing both heaven and earth (but without encroaching upon geography or astronomy)

The early fifteenth century also saw the rise of the alchemical diagram as a means of documenting, exploring and codifying alchemical ideas of formation, reformation and transformation of both the internal and external world. What had previously been a text dominated field of allegory, explication and word-play was rapidly overtaken by a panoply of symbolic forms drawn from ancient myth and fable, depicted in complex relational networks.

The nature of the diagrammatic form was perfectly suited to an alchemical arts that emphasised the fluid nature of concepts and forms, and their portrayal in a symbolic language of authority and secrecy. Over the following two centuries, the success of the alchemical diagram meant that they no longer merely punctuated alchemical texts but were organized into whole series and into synthetic pictorial representations of the principles governing the discipline. [49] (figure 12)

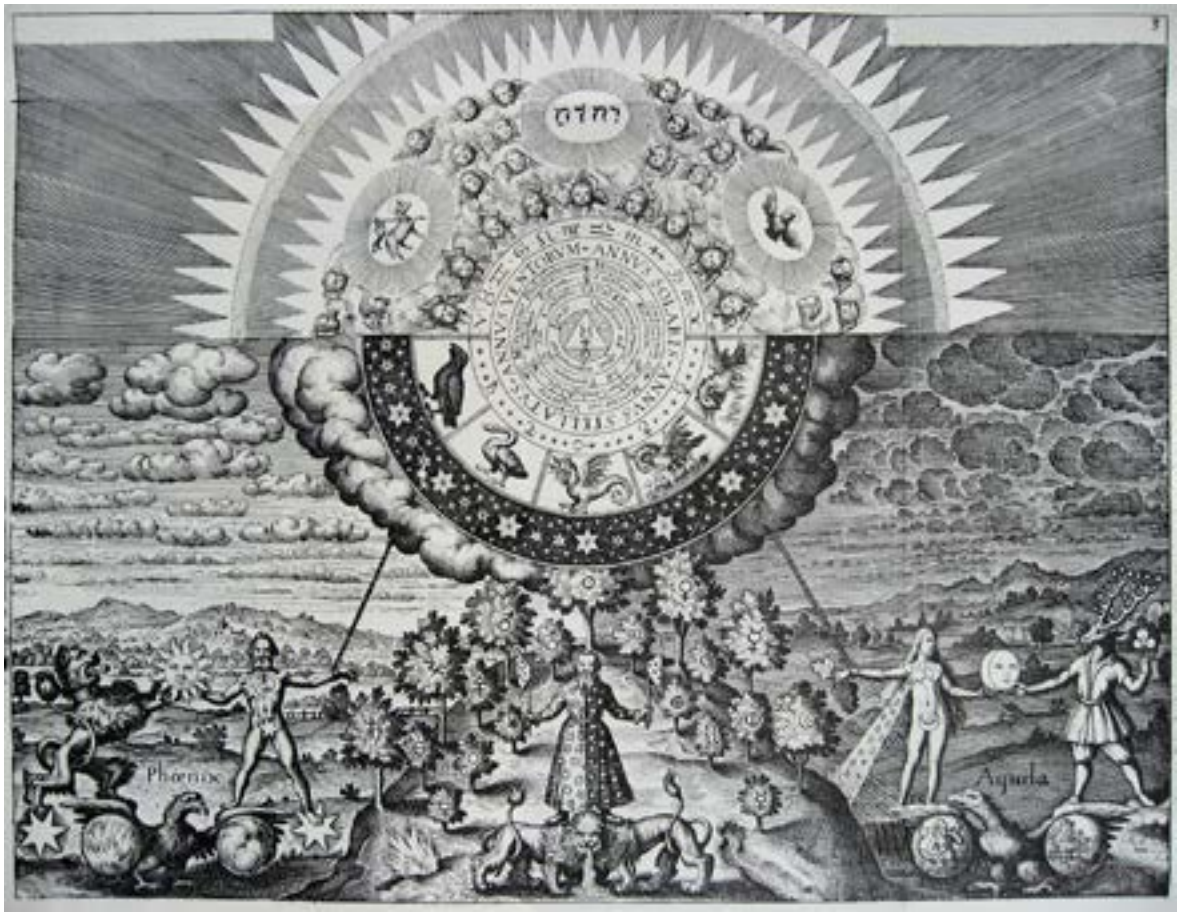


Figure 12: Matthäus Merian, *Tabula Smaragdina* (The emerald tablet),
first published 1618, Engraving, size unknown.

Text was often relegated to title, label and caption, and certain alchemical treatise, such as *The Silent Book* (Mutus Liber, La Rochelle, 1677) were compiled entirely of emblematic images, diagrammatically outlining the processes involved in manufacturing the *philosophers stone*, the base matter from which all other materials could be created.

The result was a chaotic system of references, and a constantly changing matrix of symbols and code names for arcane substances and experiments. According to the motto of the Rosicrucian Michael Maier, the goal was "to reach the intellect via the senses", as depicted by the alchemical motif of the hermaphrodite, a mix of sensual stimulus (Aphrodite) and the intellectual appeal (Hermes) aimed at man's intuitive insights in to the essential connections, not at his discursive ability, which is largely held to be a destructive force. [50] (figure 13)

Interestingly, this is the reversal of the basic premise of this thesis, which proposes that modern and contemporary diagrammatic art "attempts to reach the senses via the intellect", or rather the subjective via the objective, by engaging with the diagrammatic form as it now exists following it's incorporation as part of the scientific method. (See Chapter 3)

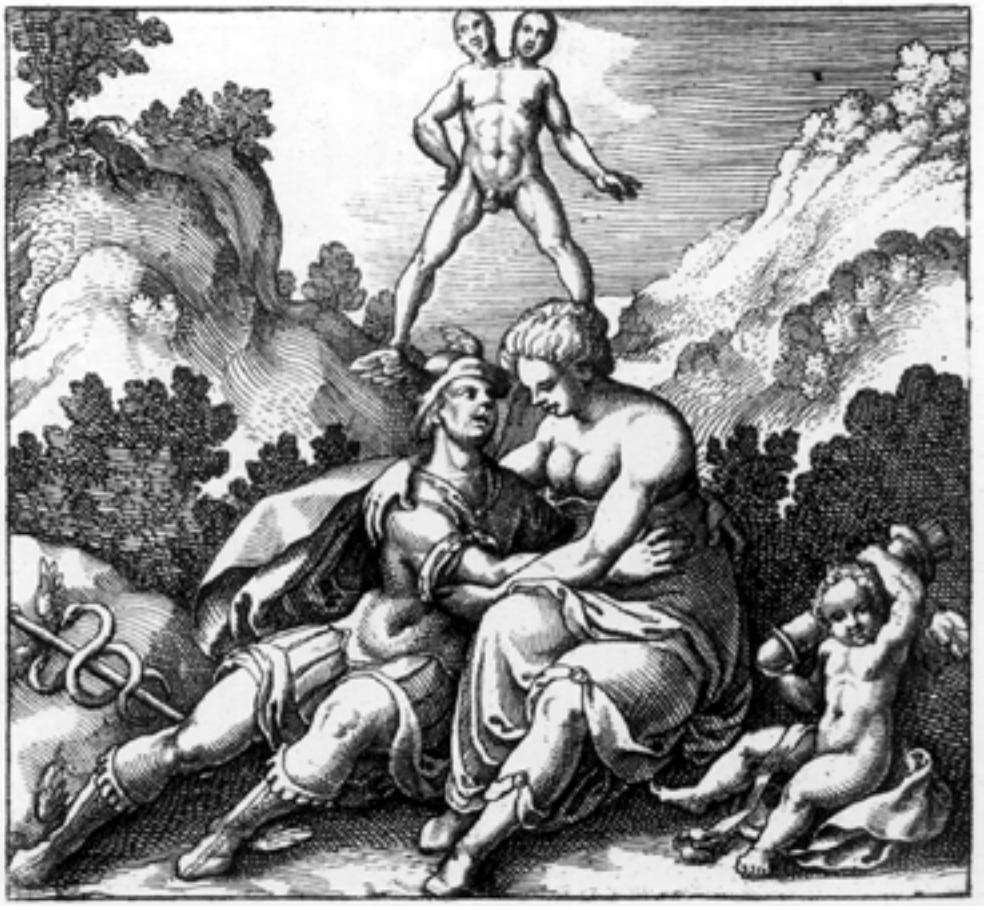


Figure 13: Matthäus Merian, Emblem 38 (Rebis the hermaphrodite produced from the mountains of Mercury and Venus), illustration from *Atalanta Fugiens*, by Michael Maiers, Published in 1618, Frankfurt

In stark contrast to the world of alchemical obscurity, figure 14 shows Copernicus's elegantly simple diagram, inserted at the start of the book which contained his life's work, *De Revolutionibus Orbium Coelestium* (On the Revolutions of the Celestial Spheres, 1543). And yet despite its visual simplicity, the diagram is capable of instantaneously summarizing the subsequent 400 pages of texts and calculations of Copernicus's theory and the evidence for it, and encapsulating his findings within one image.

The fully-predictive mathematical model of Copernicus, published in 1543, overthrew the Geocentric Ptolemaic model of Medieval science, and with it, fourteen centuries of belief. The resulting Copernican revolution was a counterintuitive paradigm shift in the understanding of our position in relation to the heavenly bodies, and arguably diagrammatic in nature, and 1543 is generally taken to be the starting point of the scientific revolution itself.[p]

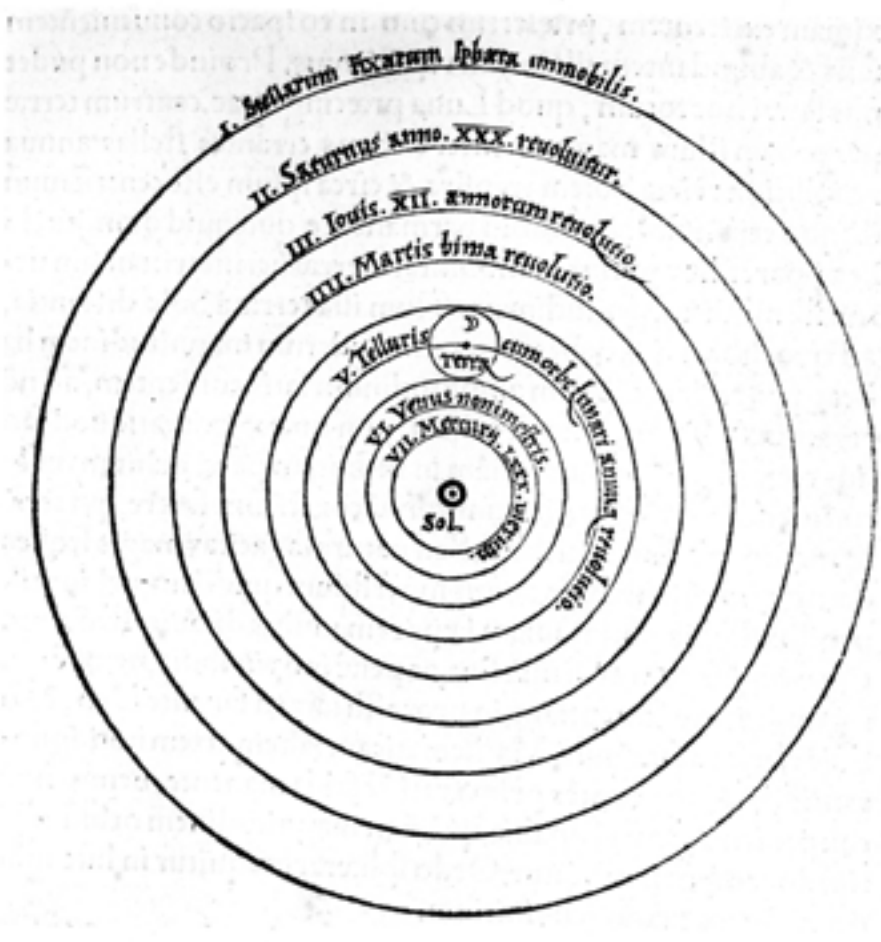


Figure 14: Nicolaus Copernicus, Diagram of the Heliocentric model of the Universe, 1543, from *De revolutionibus orbium coelestium*

p Johannes Kepler elaborated upon and expanded the Copernican model with his 1598 publication *Mysterium Cosmographicum,* and further supporting observations made using a telescope were presented by Galileo Galilei (1564–1642), providing further empirical evidence for the Copernican theory.

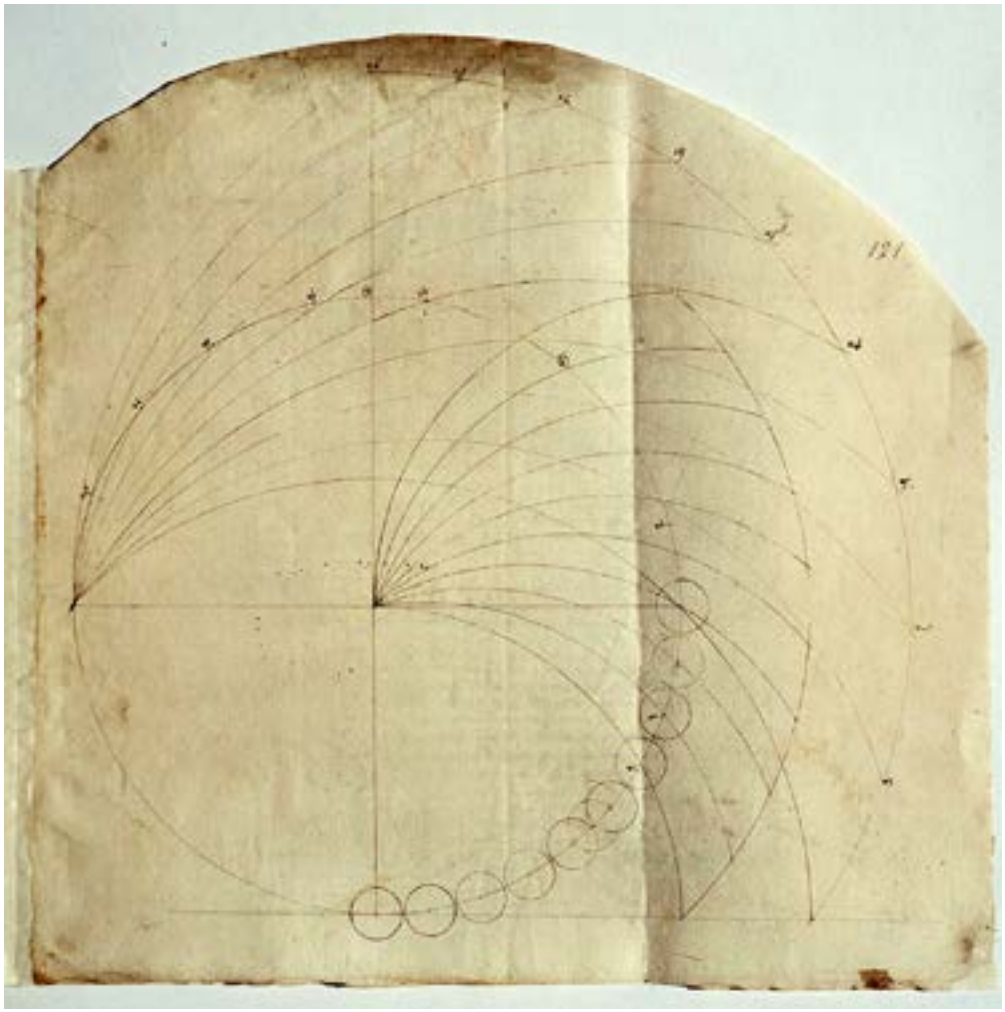
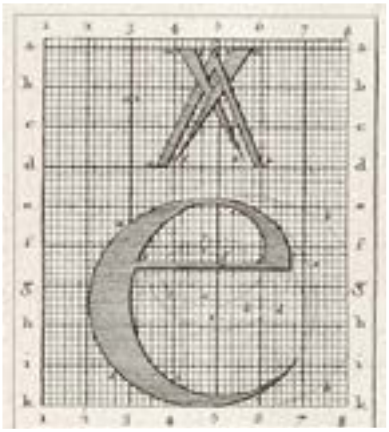


Figure 15: Galileo Galilei, Folio sheet 121r, from Codex 72 (published 1638)
Image courtesy of the Biblioteca Nazionale Centrale,
Florence Instituto e Museo di Storia della Scienza.

Figure 15 shows a study by Galileo's of a body in orbital motion, drawn in a style that is easily recognisable today as an essentialised, idealised scientific diagram. As one of the first modern scientists to clearly state that the laws of nature are mathematical, Galileo played a key role in the Scientific Revolution of the 17th century and is considered by some of the most important figures of 20th and 21st century science, such as Albert Einstein and Stephen Hawking, to be the father of modern science.[51, 52] The influence Galileo has had on diagrams and diagrammatic thought and thus the diagrammatic aesthetic are discussed in chapter 3.1.

It was not until over a century later however, that Isaac Newton (1643–1727) formulated the laws of motion and universal gravitation, publishing his *Philosophiæ Naturalis Principia Mathematica* (known simply as the *Principia*) in 1687, a date generally taken to mark the completion of the Copernican Revolution and the highpoint or 'grand synthesis' of the Scientific Revolution.

2.4 Enlightenment



[q]

nlightenment science centered itself around the production of encyclopedias as compendiums of human knowledge. The use of the diagram as the primary visual medium of the encyclopedic projects of this period marked the start of an exponential increase in both the production and variety of diagrammatic forms. The diagram also underwent a process of evolutionary refinement in terms of graphic style and the techniques of production and intended use.

Bender and Marrinan use the rise of the diagram in the eighteenth century as the starting point for their analysis of the visual culture of the diagram, and equate these rapid stylistic developments of the encyclopaedic diagram to the historical moment when diagrammatic knowledge moved to center stage and remained the principal leitmotif of a "culture of the diagram". [53]

Certain diagrams were arranged to clearly present context, comparison and contrast among objects and ideas. Others were constructed to present a variety of scales, vantage points and cross sections, allowing a change in focus and resolution, as well as the portrayal of internal structure. Diagrams were also designed to direct the viewer's focus of attention through carefully-arranged vignettes, in order to depict process and functionality. What these diagrams started to share in common however was that "... both a didactic work... based on a severe demand for objectivity... and a poetic work...", as Roland Barthes describes the plates of the Renaissance encyclopedia, " an aesthetics of bareness… and almost sacred simplicity… an austerity of creation." [54]

One of the foremost encyclopedic projects of this era was the encyclopedia of Denis Diderot and Jean le Rond d'Alembert, which took over 21 years to complete (1751-1771); of the 28 volumes, 11 consist entirely of picture plates, rich in a diagrammatic images. One of the many goals behind the project was the attempt to comprehend and connect the diversity of scientific knowledge and to arrange the various new branches of scientific research into a coherent, reductive structure, a symbolic tree of knowledge.

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q Lowercase letter e, from Louis Simonneau's 1692 typeface *Romain Du Roi (King's Roman)*, proposing ideal letter forms derived using quasi-scientific, rational design processes, and a landmark of typography in the Age of Enlightement.

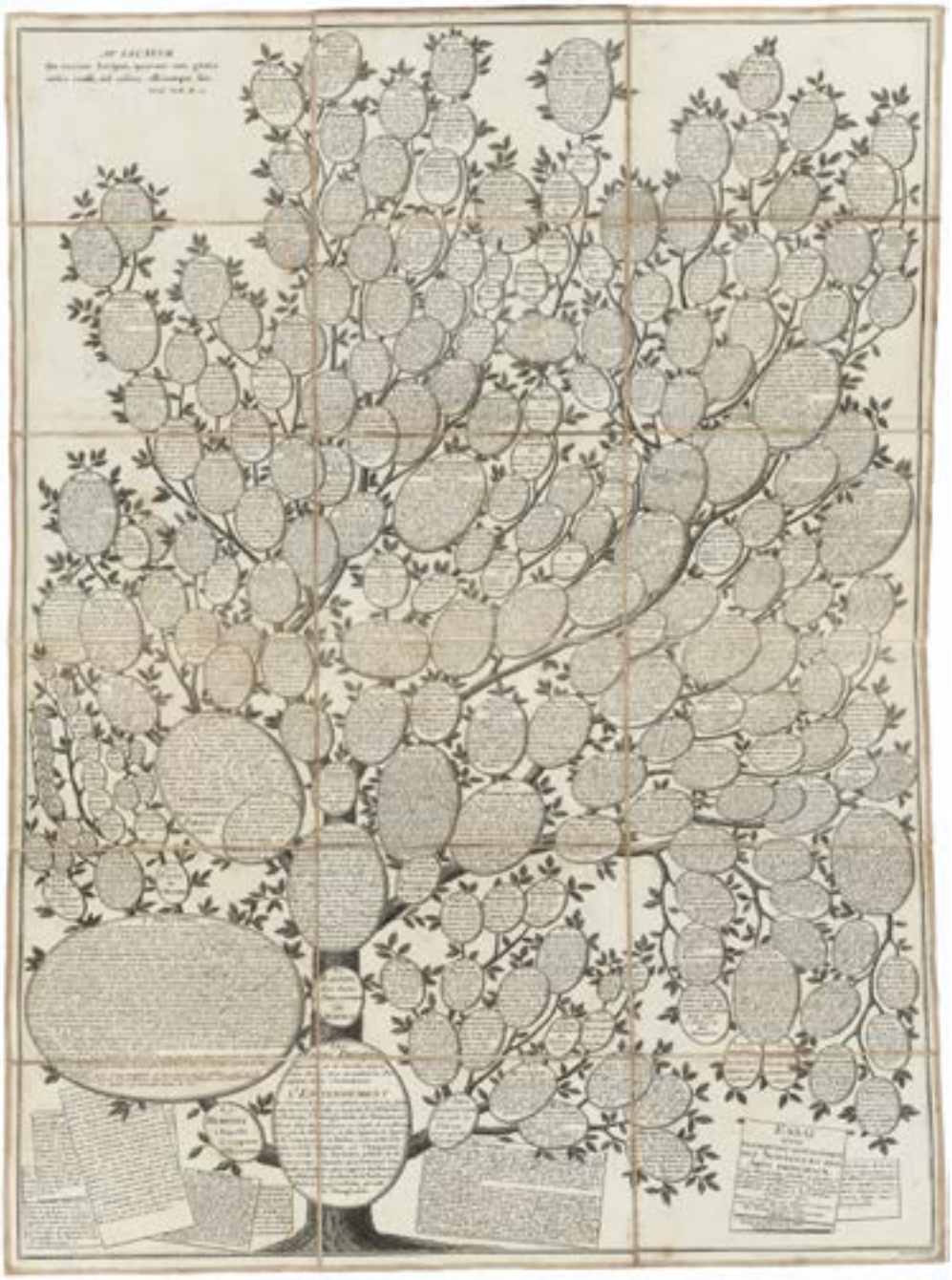

Figure 16: Fold-out frontispiece from the first volume of the indices to the *Encyclopedie, ou Dictionnaire Raisonne des Sciences, des Arts et des Metiers*, edited by Denis Diderot and Jean d'Alembert (1751 - 1777)

The internal logic of the books was alphabetically based, relying upon a complex system of interconnections and cross references, making the process of using the books a diagrammatic experience in itself, in that concepts are linked from chapter to chapter and volume to volume in a guided process, yet still open to indeterminacy and chance connections, reminiscent of the medieval diagrammatic folios of Opicinus as discussed in chapter 2.2, but within a more rigorous logical matrix. (figure 16)

Bender and Marrinan reinforce this view, reminding us of the way in that

> (m)ost critical readings of the encyclopedia align its mode of presentation with a rationalist enterprise of analytic subdivision in which large and complex subjects are broken down - or fragmented - into small units of study. Our view, informed by Diderot's understanding of the relationship of parts to whole is not to treat the entries or illustrations of fragments of an idealised entity, but as a proliferation of independent elements that, when interconnected, produce knowledge of the whole. [55]

Enlightenment science was also marked by a growing reliance upon quantitative, mathematical methods, largely as a result of the work of Galileo and of Newton. As a consequence, an increased distinction was made between what came to be referred to as primary and secondary qualities. One of the most famous examples of this distinction can be found in Newtons experiment to disperse white light in to a spectrum using a prism, as shown in figure 17. This highly simplified ray diagram was used by Newton to record and support his experimental findings. The visual clarity and brevity afforded by the Diagram allowed other scientists an instantaneous overview of Newton's method, results, the conditions of his experiment and, if necessary, gave a clear idea of how the experiment could be reconstructed and the results replicated.

In the process, Newton replaced the phenomenon of colour with what he called a *degree of refrangibility*, (now known as angle of refraction), and Newton achieved his ultimate aim of substituting a series of numbers for the sensory experience of different colours. Hence, something which could be numerically quantified replaced the phenomenon of colour, and the idea of 'colour as colour' began to be eliminated from a primary physical account of the world. [r] (Further discussed in chapter 3.4)

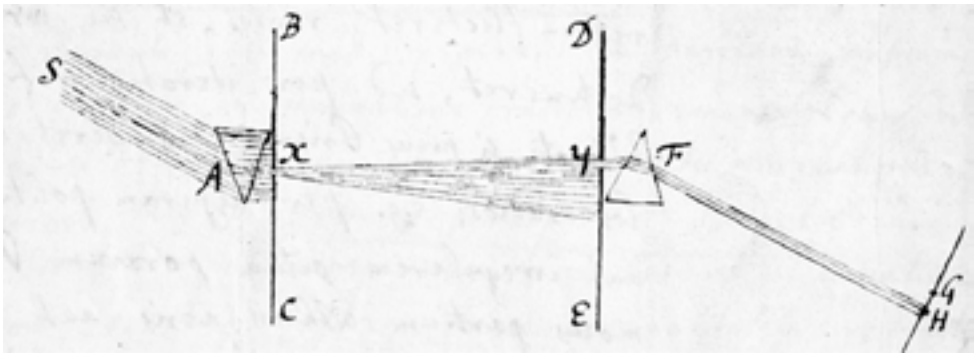

Figure 17: Isaac Newton's ray diagram of an experiment on light with two prisms, from a letter to the Royal Society, 6th June 1672.

r Prior to the experiment it was thought that colours were a modification of pure, white sunlight. Newton refracted a narrow beam of sunlight (S) through a triangular prism (A), thus refracting the waves into the spectrum of colours. By selecting individual colours though two small holes (x and y) and passing them through a second prism (F), further refraction proved that the individual colours could not be broken down any further, thus remaining the same colour at point H, with nothing observable at point G. Newton's approach to comprehending and quantifying light and colour exemplified the ideal of modern science: understanding is reached when the scientist is as far removed from the experience as possible.

2.5 Romanticism: The Romantic-Objective Divide

"A Keats and a Newton listening to each other might hear the Galaxy sing"

Richard Dawkins [56]

s

dichotomy underlies our approach to investigating and describing the world. In The Two Cultures, Charles Percy Snow's now famous 1959 Reith lecture at the University of Cambridge, Snow described how:

> the intellectual life of the whole of western society is increasingly being split into two polar groups… Literary intellectuals at one pole—at the other scientists, and as the most representative, the physical scientists. Between the two a gulf of mutual incomprehension—sometimes (particularly among the young) hostility and dislike, but most of all a lack of understanding.
> They have a curious distorted image of each other. Their attitudes are so different that, even on the level of emotion, they can't find much common ground. [57]

A series of debates and intellectual exchanges in the 1990's (also known as the Science wars) only helped to remind that such a schism still persists in academia. Scientific realists found themselves having to defend the validity of scientific truths against claims of relativism made by postmodernist critics from literary studies and the social sciences. The culmination of events in the publication of the Sokal Hoax gave rise to a number of constructive debates and reconciliatory articles, only to reconfirm that distrust between the disciplines was based upon a deep illiteracy across their respective fields. [58, t]

These relatively recent events, however, are part of a more general and ancient divide that can be traced back to Plato's critique of poetry, and his statement that "there is an old quarrel between philosophy and poetry". [59]

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s Capital A, Multicolore font, Ivan Filipov, 2012

t This infamous hoax exploded in academic circles when a fake academic paper, written by physicist Alan Sokal and containing fashionable theoretical jargon from various humanities disciplines and various scientific inaccuracies, was unwittingly published by a humanities journal. Sokal's aim was to reveal scientific illiteracy and uncritical subjectivist thought in the humanities.

The hostility between a factual, rational, philosophical stance and a metaphysical, metaphoric, poetic approach to understanding reality has been a part of Western science and philosophy since their inception. This objective-subjective divide was to continually resurface in Western philosophy and culture throughout the ages, under various different guises, and the substitution of the term *romantic* for *subjective* in the title of this thesis makes direct reference to one such divide in particular: the European Romantic period. Romanticism was an artistic, literary, and intellectual movement that originated toward the end of the 18th century. It arose for a variety of reasons, partly as a reaction to the Industrial Revolution, partly due to social and political conditions of the Age of Enlightenment and, foremost for this study, as a reaction against what was considered to be an excessive reliance upon mathematical rationality in the scientific description of nature.

Figure 18: William Blake, *Newton*, 1795, Watercolour, paint, Ink
(Monotype first completed in 1795, reworked and reprinted in 1805),
460 x 600 cm, image courtesy of Tate Britain

The Romantic mode of thinking placed enormous emphasis on the powers of subjectivity, self-expression, and emotion, as well as the celebration of the mystical and transcendental. This placed the Romantics in direct opposition to the philosophy of the Enlightenment period, and to the Neoclassical style in art which was prevalent at that time. In figure 18, the mystic poet, painter and printmaker William Blake has placed his portrayal of Newton with his back to an intricate mound of fractal-like, natural forms. Newton's eyes are cast downwards to an unwinding scroll, upon which he manipulates a compass to mark out a diagram of geometric forms.

German polymath Johann Wolfgang von Goethe (1749–1832) strongly criticized Enlightenment science, believing that the mathematisation of scientific investigation could only lead to a fragmented world-view - this approach, he believed, was epitomized in the work of Newton. As Frederick Amrine has remarked:

> For the conventional scientist, mathematics is the sole guarantor of certainty, while perception and thinking are the sources of all error. Consequently, the thrust of modern science has been to quantify everything that can be quantified (and much that properly cannot), while banishing the remainder to the realm of subjectivity. Goethe rightly saw this as an impoverishment of cognition. Conventional science seeks its refuge in axiomatic islands, insulated from the threats of perception and thinking. [60]

Goethe is widely considered as one of the founders of Sturm und Drang, a proto-Romantic, counter-Enlightenment movement, [u] yet later in life he became a staunch critic of the German Romantic movement, choosing to distance himself from what he regarded as the excesses of subjectivity and a growing emphasis on emotional extremes. Goethe's mature compromise involved a complex philosophical golden mean between the extremes of objectivity and subjectivity, an alternative intellectual system that he referred to as a *delicate empiricism*.

This self-reflective, holistic approach to science attempted to reincorporate the senses into the heart of scientific investigation, the logical rigor of which he still held in high esteem. An emphasis was placed upon the interrelatedness of all processes in nature, aiming to fuse artistic, poetic creativity with scientific rationality, the ultimate goal being the spiritual growth and deeper development of humankind as scientist–artists. [61]

For Goethe, scientific experiments are to be designed so that they act as a mediator between subject and object, and he thus became one of the chief proponents of *Romantic science*, taking an anti-reductionist stance while promoting experience over abstraction and transformation over appearance. [62] Goethe developed his deep interest in continual transformation as he evolved his concept of *ur-phenomenon*, a kind of archetype that exists as the essential pattern or process of a thing, dictating what it is and what it can become. He believed that such a phenomenon was the highest level of experience attainable:

> …because nothing appreciable by the senses lies beyond them, on the contrary, they are perfectly fit to be considered as a fixed point to which we first ascend, step by step, and from which we may, in like manner, descend to the commonest case of everyday experience. [63]

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u Literally translated as "Storm and Drive", this phrase is conventionally translated as "Storm and Stress"

He stressed, however, that despite their fixed nature, ur-phenomenon are not to be confused with the scientific first principles from which everything is derived, because:

> …an archetypal phenomenon is not to be considered as a principle from which manifold consequences result: rather it is to be seen as a fundamental appearance within which the manifold is to be held. [64]

In applying this concept to his work on botany, Goethe described the archetypal plant, or urpflanze (from here on referred to as 'urplant'). Such a plant cannot be said to exist in the physical world in any real sense, except for its myriad variations undergoing constant change. In this way, the urplant could be considered a Neoplatonic concept, giving rise to the various forms of 'plant' that we encounter in nature (figure 19).

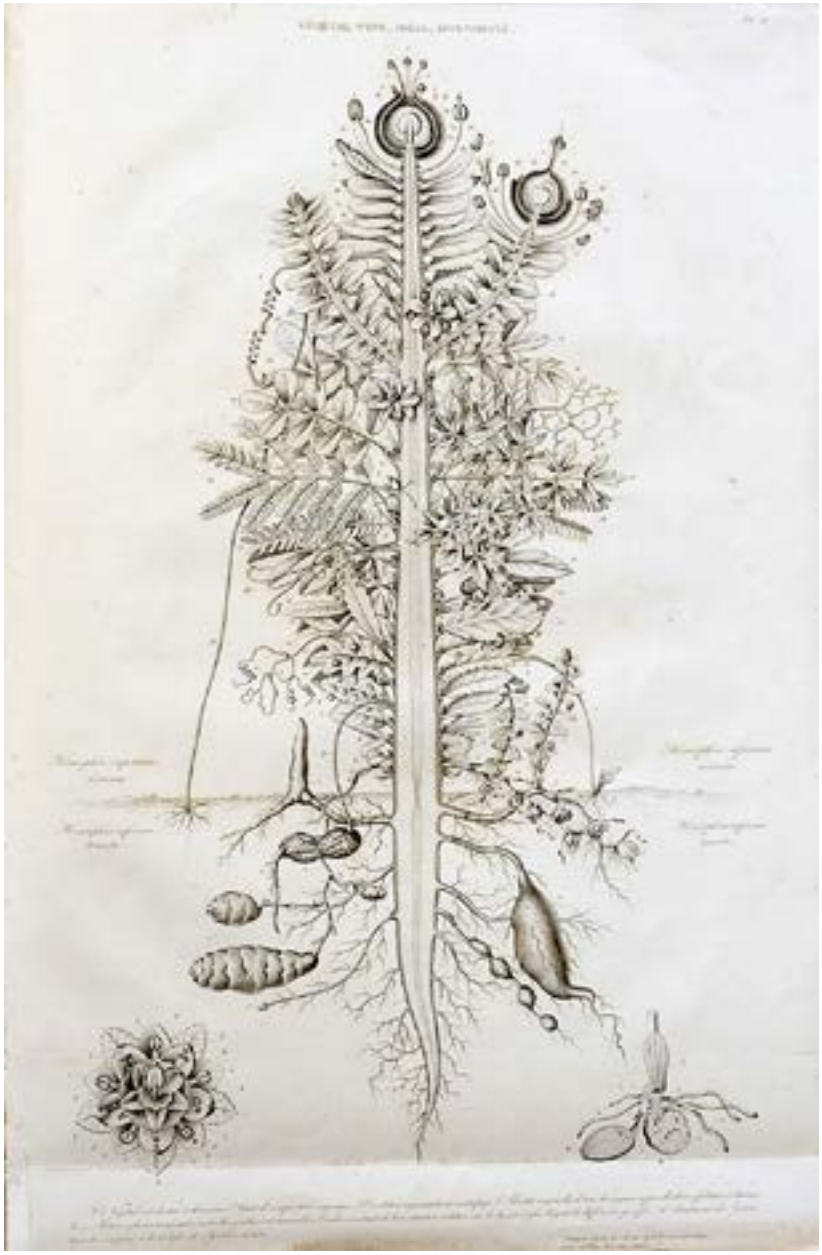

Figure 19: P.J.F. Turpin, *The Plant Archetype*, from an 1837 Edition of Goethe's Works on Natural History, Published in France, 1837

Goethe's concept of the urplant appears to equate what modern biologists refer to as 'design space' or 'search space', the theoretical space in which all-possible genetic variants of an organism could be imagined to exist - the outcomes of which are dependent on environmental conditions in the form of a feedback loop, where the development of the organism is affected by and in turn affects the environment in which it is developing.

Goethe claimed to have been able to picture in his mind the essentialised nature of such an archetypal urplant based upon his botanical studies of difference and similarity, combined with the key understanding that a single plant as we experience it is only ever at one stage of its development in the real world. It is always reshaping itself, and thus when observed at any one moment, is perpetually caught becoming something else. Thus the true nature of the plant can only be fully comprehended through the holistic study of its development, in reference to the urplant, the underlying source pattern for myriad potential forms a plant can take. This emphasis on formation, transformation and process as the locus for explanation, rather than appearance, has lead Sanford Kwinter to describe Goethe as the father of the modern concept of the diagram. Kwinter argues that Goethe marks a conceptual shift, rejecting the absolutist Kantian-Newtonian model in favor of a fluid, genetic interpretation of form. [65]

> The archetypal plant shall be the most marvelous creation in the world, and nature herself shall envy me for it. With this model and the key to it one can then invent plants ad infinitum that must be consistent, i.e. that could exist even if they do not in fact, and are not just picturesque or fanciful shadows and shows, but have instead an inner truth and necessity. [66]

Understood in these terms, plants can be regarded as the emergent properties of an underlying system, providing both its origins and dictating its structural development. What Goethe advanced was a non-static, diagrammatic concept of natural, generative forms, and he had done so prior to both Charles Darwin's theory of evolution and the discovery of DNA. The archetypal ur-phenomenon is a Neoplatonic source capable of an almost infinite number of variations on a theme.

This chapter has outlined the development of the diagram, from its Stone Age origins to its foundational involvement in the scientific project. Attempts have been made to incorporate the varied roles the diagrams has played in some of the major advances in the way humans relate to and understand the world.

The use of the diagram and diagrammatic thought to combine the objective and subjective in the work of Opicinus de Canistris, Leonardo da Vinci and J.W. von Goethe is incredibly advanced in terms of scope, ambition and level of abstraction. The following chapter explores these ideas further by examining the aesthetic effects that the philosophical ideals of the scientific project has had upon the Romantic-Objective use of the diagram in fine art.

Chapter 3: The Scientific Project and the Diagrammatic Aesthetic

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iagrammatic modes of presentation rapidly co-evolved along with scientific developments of the sixteenth and seventeenth centuries, in such an intimate way that their use in fine art has come to visually and conceptually incorporate may of the most important philosophical ideals and techniques of the scientific project.

Science influences the world-view of an age, to which art responds. Chapter three considers the basis of this connection in order to provide a scientific and philosophical basis from which to examine the various qualities of diagrammatic art. Examples are thus provided of important diagrammatic artworks from both the twentieth century and the contemporary period, which best capture the nature of this relationship, its development and current manifestations.

Idealisation, essentialism, reductionism, objectivity and the division of primary and secondary qualities have a complex and controversial philosophical interdependence within the philosophy of science. Diagrammatic art in particular embodies these concepts and works with them creatively to present the viewer with, and involve the viewer in, a complex web of these interrelated qualities.

t Marcel Duchamp, Glider Containing a Water Mill in Neighbouring Metals, 1913-1915, Oil and lead wire on glass

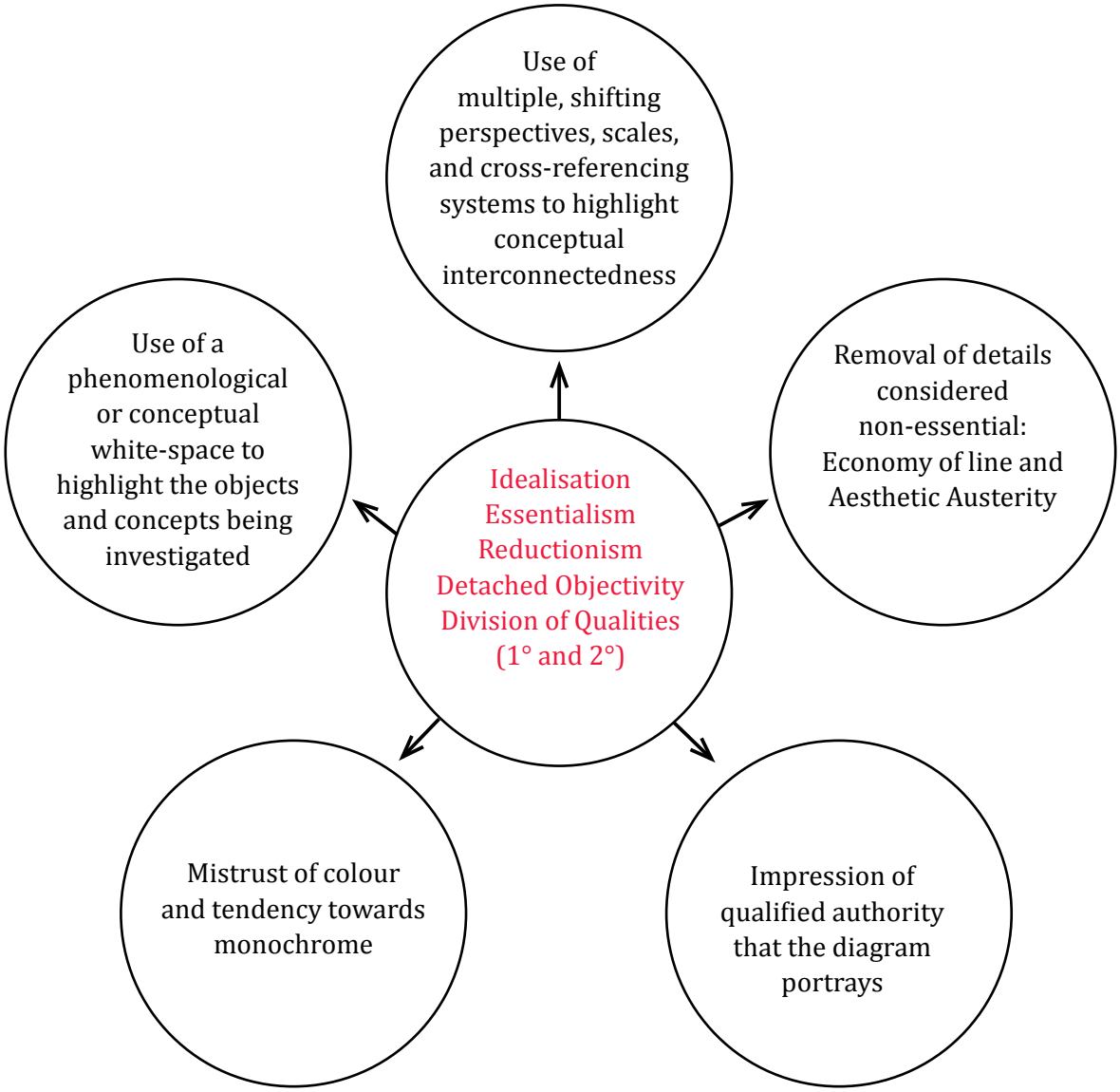

Figure 20: Some of the fundamental philosophical aspects of scientific investigation and their relationship to the diagrammatic format

Figure 20 presents a summary of these scientific-philosophical concepts (shown in red) and provides examples of the effects they have had upon the production of the scientific diagrams and thus, this thesis argues, the development of a diagrammatic aesthetic in fine art. Examples are provided of artists who have made important diagrammatic art works that embody the ideas being discussed, or whose practice is based upon principles that directly connect their work to the philosophy of science and the scientific diagram.

In their book *The Culture of the Diagram*, John Bender and Michael Marrinan outline the philosophical and visual processes at work in the encyclopedic plates of the 18th century, a period that marked the re-emergence of the diagrammatic format. Contrasting selected plates from Diderot and d'Alembert's encyclopedia, such as the entry entitled *Agriculture, Labourage* (Figures 21 a,b) with Dutch landscape painting.

Bender and Marrinan describe how the farming equipment loses its context of use and

> is disintegrated in to component parts and revealed in multiple points of view upon the whiteness of a page conceptually resized by scales of reference. Here the physicality of objects and their use is leached away and natural light struggles to cast token instances of shadow. We, however, are allowed to see with a clarity and precision not part of everyday life. Whiteness, the catalyst that binds tableau to visual catalogue, enables a trenchant knowledge that is the descriptive gain of the graphic economy of the diagram.[67]

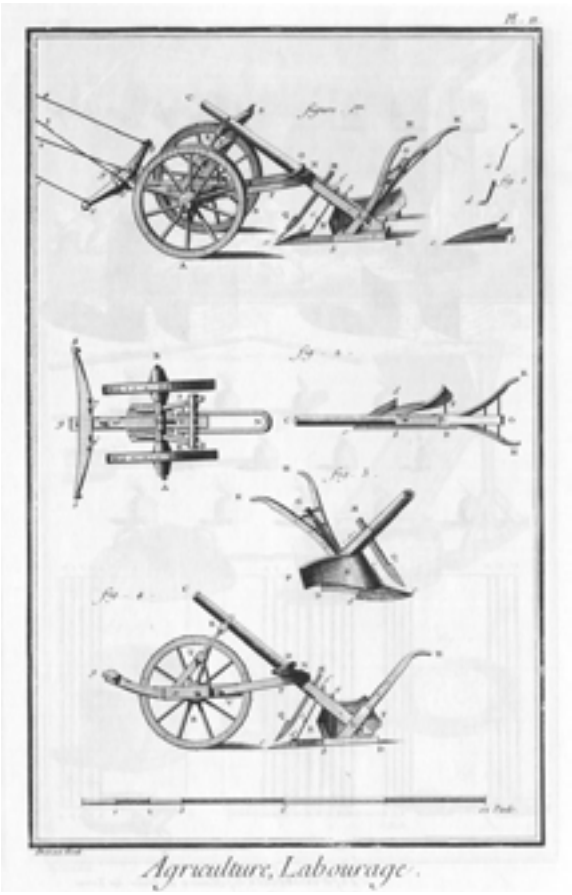

Figure 21a, b: *Agriculture Labourage Plates I and II*, Illustration in: *Encyclopédie ou, Dictionnaire raisonné des sciences, des arts et des métiers, par une société de gens de lettres.* 1751-72

The diagrammatic plates of the encyclopedia provide not only an important visual illustration but a historical documentation of how the key concepts shown in figure 20 began to come together to synthesise a visual format that was in-line with the underlying philosophy of the scientific process itself.

3.1 Idealism: Adding simplicity and removing complexity

"Reduce, reduce, reduce was my thought…" [68]

Marcel Duchamp

Figure 22: Mark Manders, *Kitchen (Reduced to 88%)* and detail, 2002, Painted wood, canvas, stainless steel, water, 165 x 187 x 81 cm, Image courtesy of Mark Manders

[u]

oth western art and science have a long and complex relationship with the concept of idealism. Whether as humanist renderings of the figure, archetypal objects, mathematical concepts, scientific ideal states or the goals of ancient Greek sculpture and architecture, idealism has remained an ongoing theme in the Western tradition.

In science and mathematics, the process of idealisation is the deliberate simplification of a phenomenon in order to make it more tractable in terms of conception and computation. The crudity of ordinary objects has the potential to obscure their mathematical essence, and idealisation is used to combat this tendency.

u French, Thomas E A Manual of Engineering Drawing for Students and Draftsmen (New York, NY: McGraw-Hill, 1911)

Idealisation allows the manipulation of impossible objects with impossible qualities under impossible conditions, and yet enables one to come to very real conclusions about the fundamental nature of reality. According to the philosopher of science Michael Weisberg,

> the practice of theoretical science seems just absolutely run through with idealization in all parts. Perhaps some of the most fundamental physics might avoid this, but just about all the science that makes contact with everyday things involves all kinds of approximations, distortions, leaving things out and so forth.[69]

Idealisations are generally divided in two categories: adding simplicity (Galilean/Platonic), and removing complexity (Aristotelian/minimalist), although these are not mutually exclusive approaches and are often used in conjunction with one another. Platonic and Galilean idealisations both compare reality to ideal states and structures which don't or can't exist, but towards which approximations can be made. Concepts such as frictionless surfaces, ideal gases, and perfect platonic spheres are all forms of Platonic or Galilean idealisations (See figure 15, Galileo Galilei, Folio sheet 121r).

If Galilean idealisations are the deliberate addition of distortion to a model of reality, Aristotelian or "minimalist" idealisation aims at excluding as many negligible variables as possible, maintaining only the core causal factors of the phenomenon. The goal is to understand the essential nature of the phenomenon being studied in order to retain the fundamental aspects and to decide which inconsequential elements can be removed.

As the artist Mark Manders writes of his work *Kitchen* (Reduced to 88%) (figure 22):

> This work brings together a number of ideas I have been working on over the years. Actually, it can be seen as a three-dimensional painting. At the back of the piece is a large, empty, unprepared canvas. Around it I have made a giant frame in the form of a kitchen. In the end, the kitchen became the front of the work. I have stripped the word "kitchen" to the point that only the naked essence of the concept of a kitchen remains. [70]

Returning to the analysis of the plates shown in figure 21 a and b, it becomes apparent that both Platonic and Minimalist *subtypes* of idealisation are at work. Extraneous details such as the landscape, flora and fauna, including the human users themselves, are systematically removed to highlight the objects being examined. Deliberate distortions are added to the images, such as the scale of human figures, the removal of gravity so that objects float in white space, and the use of an omniscient viewpoint (discussed in section 3.4).

Avant-garde art of the twentieth century is pervaded by an idealistic and reductive sensibility that was further refined with the evolution of abstraction. Many such works have strongly diagrammatic characteristics. Piet Mondrian's utopian, geometric paintings of the 1920s attempted spiritual transcendence by purity of form and the omission of all extraneous details. In Russia, at approximately the same time, the politically motivated Constructivists rejected bourgeois taste and Romantic notions of artistic subjectivity, to develop an alternative aesthetics of formal, objective clarity.

Naum Gabo studied science and medicine at the University of Munich from 1910 to 1912, and later moved on to study philosophy and art history until 1914. Simultaneously, he studied engineering at the Technische Hochschule in Munich, which housed a large collection of mathematical models, real-world objects designed to represent highly abstract idealised concepts.

Figure 23: Naum Gabo, *Linear Construction No. 2*, 1970 - 71,
Plastic and nylon threads, 113 x 50 x 69 cm, Image courtesy of Tate Gallery

Gabo often worked from templates to produce serial replicas of his work. *Linear Construction No.2* was one of Gabo's favourite works, and exists in twenty six versions (some virtually identical, others at different scales; hanging and with bases; with and without black insets). [71, v] (figure 22)

v Gabo's ongoing search for ideal, skeletonized forms connects his practice to C.S. Peirce's theory of sign systems, as discussed in Chapter 4.

Rejecting conventional notions of mass, volume and line, Gabo replaced them with the concepts of time and space and interpreted time as movement. His ideas were strongly influenced by Albert Einstein's theory of relativity, and the clarity of the then newly created modern plastics allowed for a clarity of concept and form that held great appeal to Gabo. In discussing the influence of mathematical diagrams upon his *Crystal* series, he stated how his aim had been to "take this complicated formula and change its realisation to prove that what was basically a fantasy (the intuition of the mathematician) could be seen through the intuition of an artist" [72]

Figure 23: Alberto Giacometti, *The Palace at 4am*, 1932,wood, glass, wire, string, 63.5 x 71.8 x 40 cm, Image courtesy of Museum of Modern Art, New York

In art as in science, idealisation often involves aspects of both essentialism (section 3.2) and reductionism (section 3.3), and figure 23 provides a key example. Giacometti's *The Palace at 4 a.m*. appears to be a delicate maquette constructed for a theatre performance.

The three overlapping, open plan constructions that create the architecture of the work have been compared to Giotto's depiction of houses. Giotto, however, simultaneously depicts two spaces but only one event, whereas Giacometti presents several spaces simultaneously alongside events that occur at different times in a way that is similar to the medieval conception and rendition of the stage. [73]

The Palace at 4 a.m. can be read as a Romantic-Objective, self-directed psychoanalysis. The little that Giacometti did reveal about the symbolism of the work highlights its deeply personal nature: the three panels representing the three windows of his childhood bedroom, the chess piece-like female figure as his mother, and the central structure cradling the small round ball as Giacometti himself. The caged spine and skeletal bird, which appears to be flying through an open window, are connected to aspects of a failed love affair. [74] Giacometti is said to have commented that the sculpture was the result of

> ...a period of six months passed in the presence of a woman who, concentrating all life in herself, transported my every moment into a state of enchantment. We constructed a fantastical palace in the night - a very fragile palace of matches. At the least false movement a whole section would collapse. We always began it again. [75]

The unusual appeal of the work is perhaps the result of Giacometti's use of an austere, skeletonised visual language to capture the subjective extremes of his self-psychoanalysis. In this way, the sculpture can be read as a didactic, theatrical model resulting from a process of emotional idealisation; an object used by the artist to examine and replay his oedipal relationship with his parents and the difficulties he faced in forming lasting relationships with women. Revealingly, in the same year, Giacometti published a book detailing the events of his childhood - *Hier, sable mouvants* (Yesterday, Shifting Sands) - in which it is suggested that he had finally learned to live with himself. [76]

Finally, in terms of reductive, diagrammatic idealism being applied in a way that is Romantically-Objective, it is worth considering the artistic education and practice of Marcel Duchamp. Duchamp was born at a time when the French education system was undergoing a series of national reforms to its curriculum, including the introduction of new programs for drawing instruction to its public schools. [w] Rather than focusing upon the imitation of nature and the human body through the study of the old masters, classical sculpture and art of the renaissance, the new curriculum focused instead upon laying a foundation for fluency in measured, mechanical drawings, a skeletal, diagrammatic style which Molly Nesbit terms 'the language of industry'.

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w The 'Ferry reforms' of the French national school system were made in the 1870's and 80's, Duchamp was born in 1887.

> By and large this was a language meant for work, not for leisure, and certainly not for raptures or poetic, high cultural sighs. This language was "*preaesthetic*", a public culture based upon mechanical drawings, "*sans* colour, *sans* nature, *sans* body, *sans* the classics, some would have said *sans* everything. [77]

Nesbit is here describing the reductive nature of diagrammatic idealism and its relationship to the scientific *division of qualities* as discussed in chapter 3.4. and elaborated upon in terms of C.S. Peirce's semiotics in Chapter 4. The drawing course was divided in to objects depicted in perspective (i.e. reproduced the way they appear to the eye), and in projection (i.e. ideal forms as they 'really are', independent of a human observers). [78]

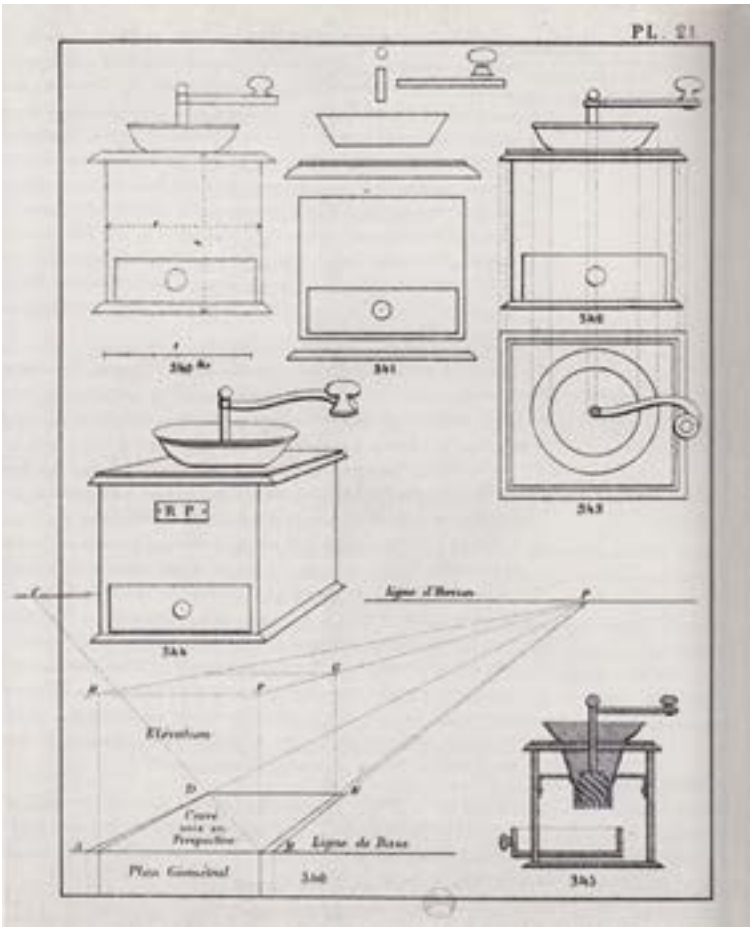


Figure 25: Ris-Paquot, Image of coffee mill in perspective and projected forms, *Desin d'imitation. Cours Préparatoire aux examens pour les brevets de capacité de l'enseignement première* (Paris: Laurens, 1887, pl.21)

Figure 26: 7(Coffee Mill), 1911, Oil paint and graphite on board, 33 x 12.7 cm

Then director of the Beaux-Arts School in Paris, the sculptor and critic Eugène Guillaume, elaborated upon the program:

> Drawing is by its very nature exact, scientific, authoritative. It images with undeniable precision (to which one must submit) things such as they are or as they appear. Not one of its configurations could not be analyzed, verified, transmitted, understood, realized. In its geometrical sense, as in perspective, drawing is written and is read: it has the character of a universal language. [79]

In such a way a distinction was made for French students between apparent and true representation, a distinction Duchamp would later refer to as retinal and non-retinal art. (See chapter 3.3, Quote reference: 88)

Figures 25 and 26 present Nesbit's contrast of the diagrammatic presentation of a coffee mill both in perspective and projection (from the French preparatory book of drawing practice of 1887) with Duchamp's 1911 painting *Moulin à café*. This early painting by Duchamp precedes his *Nude descending a staircase* by one year, and was made as a wedding gift for his brother the artist Raymond Duchamp-Villon. Duchamp described how the work was "based on the idea of 'dismantling' the grinder" and already show the influences of cubism such as fractured line and multiple projected view points. [80]

However even at this early stage, it appears that Duchamp was already incorporating ideas of physicality and sexuality in contrast against to the stark, idealised qualities of the 'pure' diagrammatic form. *Moulin à café* is a symbolic and functional forerunner of the element identified as a chocolate grinder in Duchamp's *The Bride Stripped Bare by her Bachelors, Even*. In a series of notes written to accompany The Large Glass, Duchamp explained that, "The bachelor grinds his chocolate himself", suggesting that the Coffee Mill is a metaphor for masturbation.[81] Duchamp later commented that: "Always there has been a necessity for circles in my life, for, how do you say, rotation. It is a kind of onanism." [82]

Duchamp further developed his non-retinal use of the reductive, idealising properties of the diagrammatic line in his work in a number of important ways, from his use of one dimensional plumb lines, which he dropped to make *3 standard stoppages* to redefine the meter, to the two dimensional preliminary sketches for his Large Glass with their archetypal Goethean ur-lines suggesting platonic skeletons. Once completed, the large glass contained complex idealised representations depicting various machine parts, apparatus and virtual projections from the forth dimension. (See also chapter 3.3) His various projects embody a more general shift in science and culture, from drawing as representation of natural world, to drawing as a means of depicting the technical nature of the structural and functional systems which underlie reality, by means of the diagram.

3.2 Essentialism: Where to draw the line

"I don't paint things, I only paint the differences between things." [83]

Henri Matisse

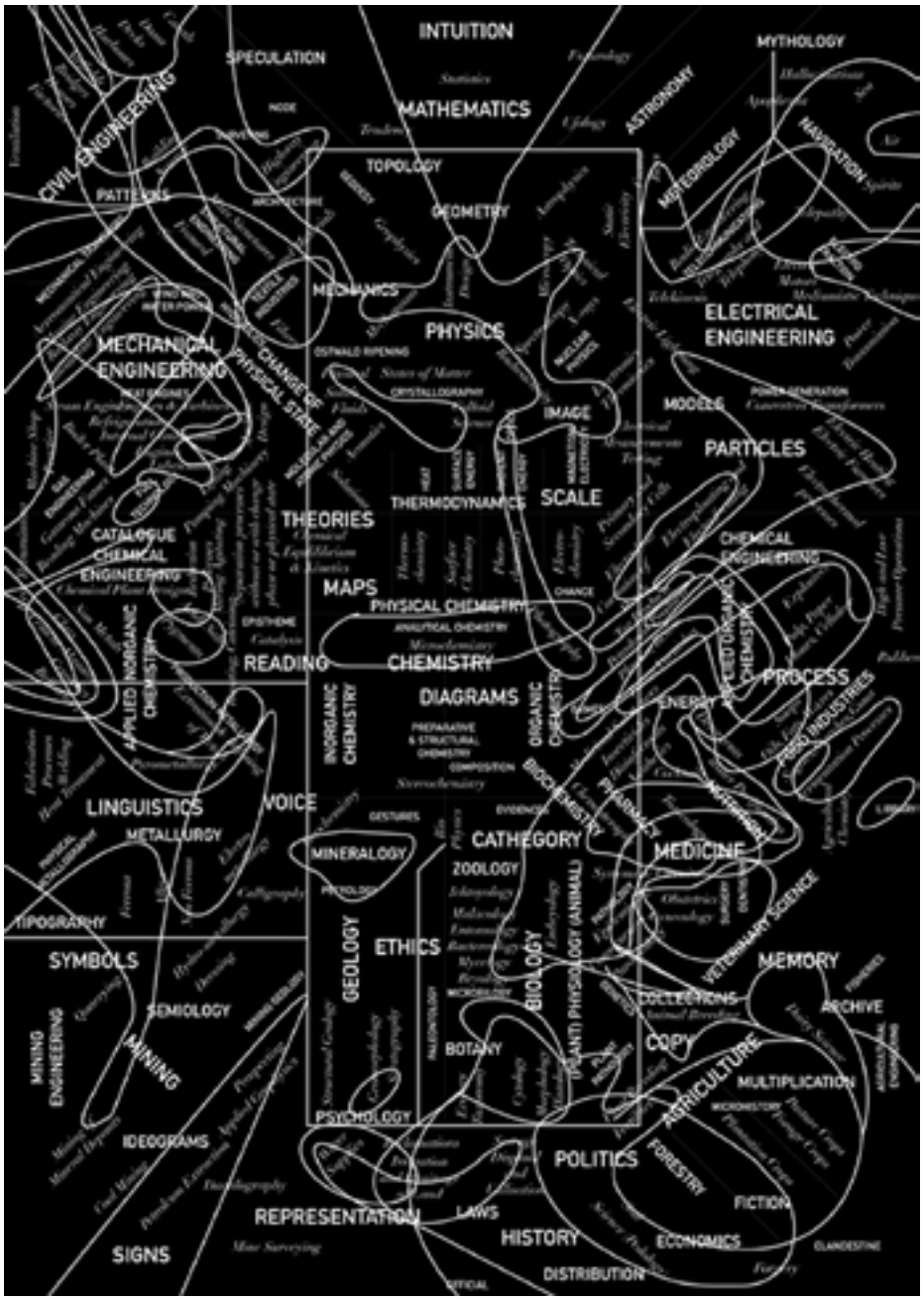
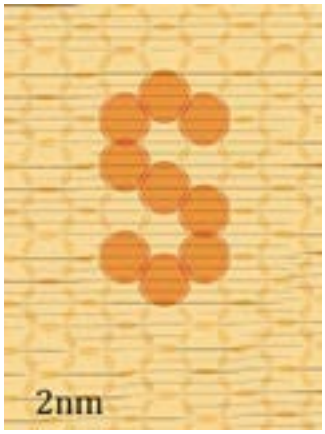


Figure 27: Erick Beltran, *The personal-social order,* (from the Calculum series) 2008, printed poster, Image courtesy of Erick Beltran



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cientific essentialism is the philosophical position that things, and especially 'kinds of things', can be grouped according to certain essential properties they have in common. These key features allow them to be distinguished from other things or other kinds of things. The origins of this idea in Western thought can be traced back to the philosophy of Ancient Greece, particularly to an argument over whether or not the 'essence of a thing' lies without or within the thing in question. Plato's idealism proposed the existence of pure essences, ideal forms that lie behind reality and make things what they are. Aristotle's counterproposal posited the existence of 'categories', an essential 'substance' within things themselves as the source of their characteristics.

One of the key aspects of essentialism is the concept of 'natural kinds', in which phenomenon are believed to fall naturally into distinct, classifiable sets and orders, independent of humans. In the dialogue *Phaedrus*, Plato proposes that successful theories should "carve nature at its joints"; [84] Harry Binswanger updates this ancient metaphor to suggest that:

> objectivism holds that Nature is like a roast chicken. It's true that the roast chicken isn't already cut up and it doesn't already have dotted lines on it saying 'cut here'… On the other hand, it doesn't mean we can't take the knife and just cut anywhere. [85]

The elements of chemistry and the fundamental particles and forces of physics provide examples of natural kinds. At the other extremes of scale, astronomy classifies distinct forms of galaxies, stars and black holes according to certain criteria.

Systems of classification based upon natural kinds has proven to be a great success in science, and yet there is still considerable philosophical debate as to whether they are scientific discoveries or inventions - that is, whether they are a feature of the architecture of reality or constitute the architecture of science itself. One fascinating and somewhat ironic example demonstrating the issues of essentialism is Newton's description of the rainbow as seven distinct colours, rather than six as one might expect. His division of indigo and violet was motivated by his own interest in Pythagorean musical harmonics, a set of beliefs held by Ancient Greek sophists who argued that there exists a connection between colors, musical notes, known objects in the solar system and

x Complex Patterning by Vertical Interchange Atom Manipulation using Atomic Force Microscopy (Yoshiaki Sugimoto, Pablo Pou, Oscar Custance, Pavel Jelinek, Masayuki Abe, Ruben Perez, Seizo Morita), Science Magazine, 2008.

the days of the week. Seven is an important harmonic number in this system, and hundreds of years after it had been surpassed by a superior understanding of the universe a single number influenced one of the titans of Western science to make a subjective, artificial division that would exist for centuries to come. [86]

Natural kinds in biology also reveal that distinctions become blurred and subject to change when applied to the complexities of organic life. The taxonomic division of Darwinian species has an arbitrary nature, complicated by the fact that they are evolving, dynamic populations (as discussed in terms of Goethe's work on the metamorphosis of plants in chapter two).

Kinds, or 'sets', which are subject to ambiguity such as species, race and gender are often referred to in semiotic terms as *floating signifiers* - the words are more concrete that the concepts to which they refer. Floating signifiers have a "vague, highly variable, unspecifiable or non-existent signified, [and may] mean different things to different people: they may stand for many or even any signifieds; they may mean whatever their interpreters want them to mean". [87]

This grey area of suspended certainty has proven to be a source of fascination to artists, who have developed numerous ways to subversively introduce uncertainty into empirical systems of classification. Such artists often choose the authoritative language of the diagram to do so.

The Mexican artist Erick Beltrán's practice is an ongoing, accumulative investigation into the current structural mechanisms of division, connection and control that regulate the flow of information, and thus power, within the information age. Beltran provides a re-evaluation of the role played in society by the editor, and presents visitors to his projects with walk-through installations of information graphics and charts covering the walls, floor and ceilings that combine fact, fiction and ambiguity with an air of diagrammatic authority.

Notions of diagramming, archiving, and cataloging are central to his work, especially in terms of how images are "defined, valued, ordered, classified, selected, reproduced, and distributed in order to create political, economical and cultural discourses in contemporary society." [88] Alexander Gerner describes Beltrán's conceptual map *The Personal Social Order* (figure 27) as a:

> meta-diagrammatic machinic map experimenting with orders of thinking, representations, and operations in different orders of knowledge, the sub-concepts and lines of which can be related, folded/unfolded in multiple representative and non-representational "clandestine" ways. [89]

The Japanese Artist Shusaku Arakawa's entire career was a diagrammatic investigation into construction and deconstruction of shared experience and meaning. After deciding to leave his studies in art at Musashino Art University, Arakawa moved to New York where he became friends with Marcel Duchamp, and established a personal and artistic partnership with writer and artist Madeline Gins which would span more than four decades. Together their interest in architecture and philosophy produced a body of work spanning a vast range of media, and almost entirely diagrammatic in nature, and which Jean-Francois Lyotard said "makes us think through the eyes." [90]

Arakawa developed a diagrammatic form of visual 'fuzzy logic', exploring the limits of image, text and understanding which incorporated the philosophical ideas of Ludwig Wittgenstein. Systems of classification are fundamental to Arakawa's approach to art, and his process mimics the methodical scientific dissection and analysis of phenomenon into their individual elements in order to understand the mechanisms of their meaning.

However Arakawa's humorous attempts to reassemble and reconnect the dismantled parts into new structures, only helps to reveals the fragility of our techniques of classification and nomenclature, as well as the dissonance between subjective mind and objective reality (figure 28). As Italo Calvino writes:

> An Arakawa painting seems precisely cut out to contain the mind, or to be contained in it… After studying one of Arakawa's paintings it is I who begin to feel that my mind is 'like' the picture. [91]

Over time Arakawa and Gins's interest in using the diagram to probe the relations between linguistic, semantic and perceptual expression shifted to incorporate the body in architectural environments and a syncretic questioning of human life and death. In a statement that architecturally and hodologically connects the practices of Arakawa and Gins to Erik Beltrán's, and the way in which these artists question kinds, sets and signification, Gins writes that "Jottings and memos having to do with what anything in the world consists of should be made large, even enterable". [92]

Gins and Arakawa produces a rich new vocabulary to map out the poetic-conceptual terrain their work explored, in some cases suggestive of new fields of study, such as biotopology and coordinology. However, the organising, de-organising and re-organising principle which remaining of central importance to their exploration of the human condition in all its manifestations was the diagram:

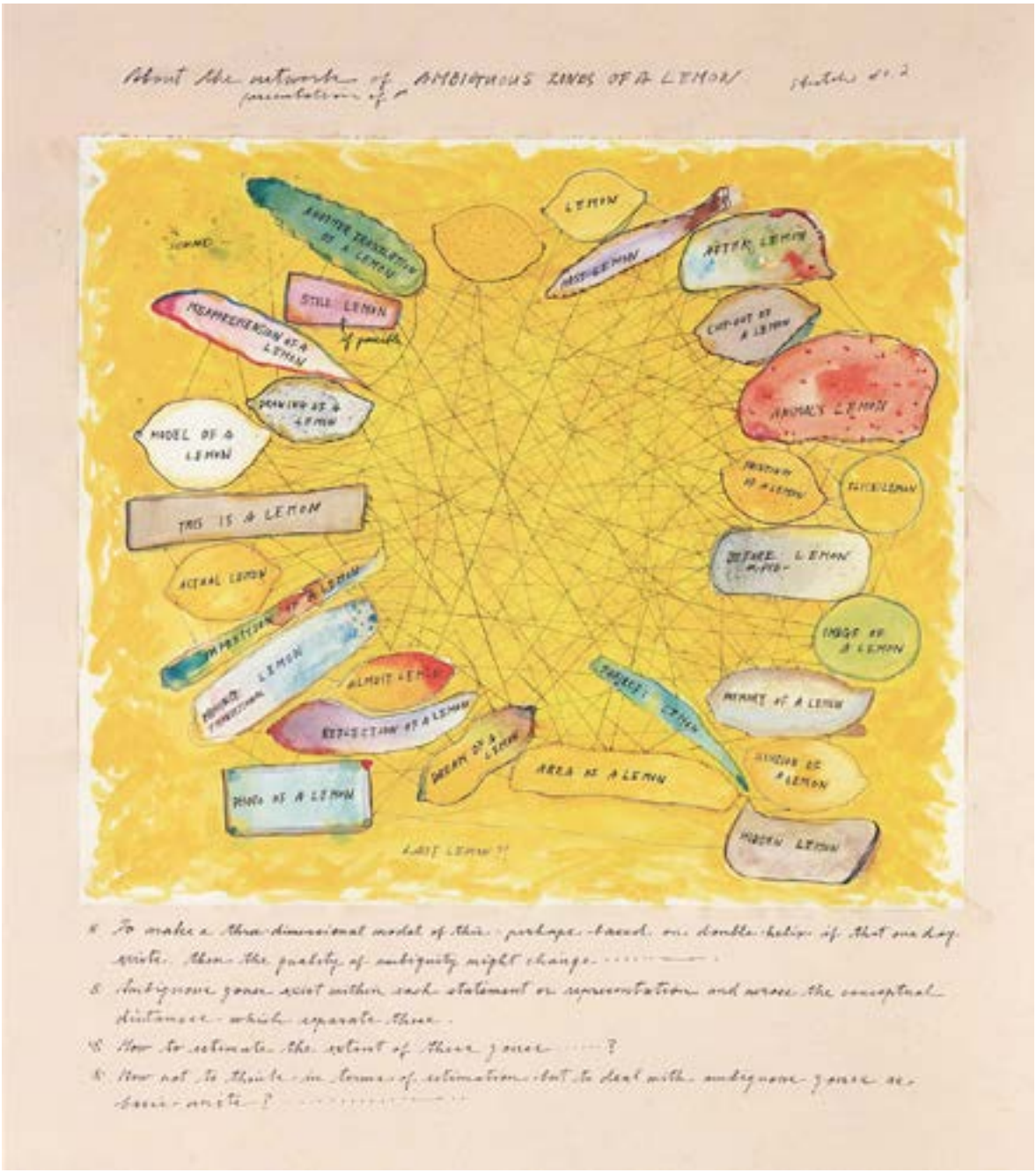

Figure 28: Arakawa, About the network of AMBIGUOUS ZONES OF A LEMON (Sketch No.2), Ink on paper c. from "The Mechanism of Meaning" c. 1963 – 88, Ink on paper (size unknown)

A biotopologist produces ongoingly organized and redistributing gatherings of all that pertains to that organism that persons who happens to be the biotopologist herself, including the slightest of slight urges and what only faintly indicates itself as being operative as an organizing principle; she calls these ongoingly and redistributing gatherings of her making "diagrams." [93]

3.3 Reductionism: A componential analysis of the world

"Math is really logic. Logic is really philosophy.
Philosophy is really psychology. Psychology is really biology.
Biology is really Chemistry. Chemistry is really physics.
Physics is really math." [94]

Ben Mordecai

Figure 29: Damian Ortega, Cosmic Thing, 2002, Suspended automobile components, cable, Dimensions variable, Installation view: The Institute of Contemporary Art, Boston

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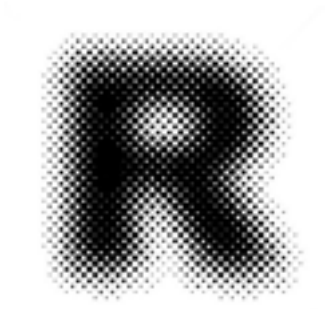

eductionism is the collapse or 'reduction' of higher levels of meaning and being to lower levels of elemental parts, a cascade of continual fragmentation and analysis that is underpinned by the concepts of essentialism and idealism. This attitude or manner of thinking, has dominated the modern period, and forms a theoretical and methodological framework which is the basis of many of the well-developed areas of modern science.

y Capital letter R, Halftone raster font

Reductionism and reductivism are terms which suffer from a lack of clear cross-disciplinary definition. What is often referred to as reductive in art theory (most often used to describe minimalist art) refers to essentialism, that is the addition of simplicity or removal of complexity in an art work, and to idealism, when art works make reference to the ideal forms of geometry, rather than the scientific understanding of the term as the fragmentation of a phenomenon in to its component parts for careful analysis.

Often placed in opposition to a synthetic and hierarchical approach that consolidates and integrates systematic components in to higher level systems, the analytic reductionist approach seeks the essential nature of an object in terms of its constituent parts and the relationships between those parts. In this sense reductionism

> ...assumes that understanding a given phenomenon requires first, the discovery of a new, more fundamental level of reality that lies beneath or behind the familiar level of understanding, and second, that this new basic level can be analysed or broken down into subsystems, elements, relationships, processes, and so on, which account for and explain the observations at the familiar level.[95]

Hierarchical reductionism posits that rather than trying to explain complicated phenomenon in terms of their smallest component parts, scientific explanations must take in to account which level within the hierarchy of reductive knowledge is appropriate, so that we are "explaining cars in terms of carburettors rather than quarks". [96]

Mexican artist Damian Ortega often dismantles objects and ideas in to their component parts, displaying the results in the format of exploded diagrammatic installations, such as the dismantled Volkswagen Beetle in *Cosmic Thing* (figure 29). The sculpture executes in three dimensions what the standard exploded diagram does in two, and is poetically reminiscent of the fact that in physics, the more matter is reduced in to component parts of ever decreasing dimensions, it had been revealed as being composed mostly of what appears to be empty space. In describing the process of dismantling the car, Ortega states that his:

> ...desire was to offer the expanded vision of an object. [...] In the process I started to understand the conceptual importance of technique, and how it is related to form: the whole working process is what composes the piece. [97]

In a more absurd and ephemeral work that deals with order in disorder, *Elote Clasificado (Classified Cob, 1998 - 2005)*, the artist has numbered each individual kernel of corn on its cob in his own pseudo-scientific project and left the object to dry for a period of seven years, so that its slow fragmentation over time has left it now scattered with gaps.

Marcel Duchamp applied the objective, idealist, essentialist and, importantly, reductive approach of science to that which is most human, namely sexual attraction and the complex, somewhat farcical rules of bourgeoisie courtship and mating. Duchamp used the diagram as his visual medium of choice, and in doing so created one of the most important and enigmatic art works of the twentieth century: *The Bride Stripped Bare by Her Bachelors, Even*, other wise known as *The Large Glass.*

The Large Glass metaphysically diagrams the fragmented psychology and mechanics underlying human desire and sexual relations, broken down to their various component parts. The work presents its subjects mechanomorphically, as if under the unrelentingly austere, reductive and analytical gaze of modern science. However, Duchamp's keen sense of irony and subtle humor led him to incorporate an array of hidden puns within the work. This, in combination with the absurdly applied faux-scientific, diagrammatic seriousness ensures that the work retains an element of the subjective (as discussed in terms of C.S Peirce's concept of *tone* in chapter 5).

The Large Glass is the result of a combination of chance procedures, carefully plotted perspective studies, and laborious craftsmanship, and is accompanied by copious notes made during the planning of the work's structure. Many of these notes were published both during his own lifetime, by Duchamp himself, and posthumously to accompany an exhibition of his work at the Pompidou centre in Paris in 1980. Some 478 documents have been released for publication at the time of writing, consisting of: *Box of 1914* (16 notes), The *Green box* of 1934 (94 documents), *A l'infinitif*, 1966 (79 notes), and finally *Marcel Duchamp notes*, 1980 (289 notes).

Figure 30: Marcel Duchamp, *The Bride Stripped Bare by Her Bachelors, Even* (*The Green Box*), (1934), Box containing collotype reproductions on various papers, 33 x 28.3 x 2.5 cm

Rather than the reduction of an object to it's physical component parts, as in Ortega's *Cosmic Thing*, the notes represent Duchamp's thought process itself fragmented in to elemental notions, gathered as a mobile collection of sketches, diagrams and texts, a mobile, rhyzomatic archive of ideas. Duchamp regarded his reference notes as essential to experiencing and understanding *The Large Glass*, in order to avoid it being considered merely on aesthetic grounds. He chose to publish a selection from them as his alter ego Rrose Sélavy as *The Green Box*, stating in interview that*:*

> I wanted that album to go with the Glass, and to be consulted when seeing the Glass because, as I see it, it must not be "looked at" in the aesthetic sense of the word. One must consult the book, and see the two together. The conjunction of the two things entirely removed the retinal aspect that I don't like. [98]

Duchamp took a great deal of care when deciding upon a printing technique (collotype) and appropriate papers, in order to ensure the reproductions would match the original notes as closely as possible. *The Green Box* was eventually published in French as an edition of 300 with twenty deluxe versions in 1934. (figure 30)

By 1956, the British artist Richard Hamilton has compiled a diagram of Duchamp's *Large Glass* carefully detailing which notes from the Green Box corresponded to which parts of the glass, which he then sent to Duchamp. Duchamp, would later refer Hamilton as *mon grand déchiffreur* (my great decipherer), [99] and was so pleased with Hamilton's fastidiousness that he proposed that he work on an English language translation of the entire contents of *The Green Box*. Duchamp suggesting that Hamilton work together with George Heard Hamilton, a professor of art history at Yale who had already translated a limited number of notes in 1957. The result of the collaboration was the 1960 English publication of *The Green Book*, described on its title page as *The Bride Stripped Bare by Her Bachelors Even, A Typographical Version by Richard Hamilton of Marcel Duchamp's Green Box, translated by George Heard Hamilton.*

Over forty years of research later, in 2000, Hamilton once again selected notes from Duchamp's *Green Box,* this time assembling them in a direct visual relationship with *The Large Glass*.[z] Hamilton chose to create the work as a print titled *Typo/Typography of Marcel Duchamp's Large Glass*, juxtaposing ninety three textual and diagrammatic notes with a carefully designed, digital vector image of *The Large Glass*, thus finally uniting both the visual and literary elements of Duchamp's project. (figure 31). The texts occupy the empty space of the unmarked glass in original *Large Glass*, Duchamp having chosen glass as a medium in order to avoid having to paint a background so that the images floated in a space comparable to the white ground of the plates of Diderot and d'Alembert's encyclopedia, as discussed at the start of this chapter.

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z Several versions of the print were produced, the definitive version being that of 2003.

Commenting upon the nature of the Duchamp's notes, Hamilton points out the elaborate, interconnected nature and creative potential arising from Duchamp's reductive, diagrammatic project (diagrammatic in multiple aspects), explaining how the notes are

> packed with clues but these clues must be patched together with those from other papers in the box to build the overall concept. There are often restatements, modifications and developments of the same idea on different sheets … One continually senses, when handling the documents of the box, a desire to be perfectly explicit simultaneously with an indifference as to the result The expression of the urge, rather than its conclusions, is important – one variant is as valuable as another and the idea gets a bonus from this multiplicity of expression – the system is synergetic.[100]

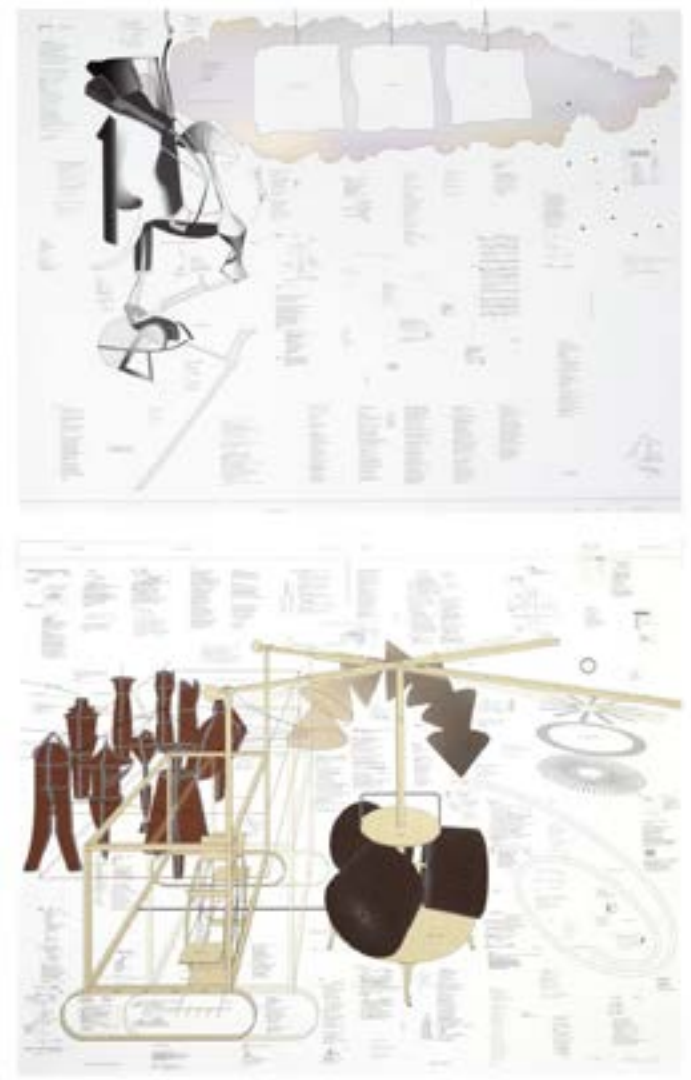

Figure 31: Richard Hamilton, *Typo/Topography of Marcel Duchamp's Large Glass*, 2003, Graphic material, Printed ink on paper, 42 x 29,6 cm

3.4: Primary and Secondary Qualities

"The observer, when he seems to himself to be observing a stone, is really, if physics is to be believed, observing the effects of the stone upon himself." [101]

Bertrand Russell

Figure 32: Olafur Eliason and Ma Yangson, *Feelings are facts*, Fluorescent lights (red, green, blue), aluminium, steel, wood,ballasts, haze machine, Dimensions variable

aa

eality is divided by science into primary and secondary qualities. Primary qualities such as number, magnitude, position, and solidity, are measurable aspects of physical reality - characteristics said to convey facts. These measurements are intended to consider only qualities that exist in the things themselves, qualities that can be determined with certainty and do not rely on subjective judgments.

aa 'What we call *reality*, is symbolized by the letter R in the diagram, which consists of an elaborate papier-mâché construction of imagination and theory filled in between a few iron posts of observation.' Wheeler, J.A. and Zurek, W.H. (2014) Quantum Theory and Measurement. Princeton Uni. Press.

Knowledge arising from secondary qualities, however: sight, sound, smell, taste and touch - cannot be expressed mathematically in any direct way, and thus do not provide objective facts about things in the world. Human senses are not to be relied upon to make objective observations about the world, and are therefore relegated to a secondary position suitable only for reading the scales, charts, dials and numerical data from measuring equipment and scientific apparatus.

This distinction forms the basis for a basic dualism: only the primary qualities are considered to be real, while secondary qualities are supposed to be the result of the effect on the senses of the primary qualities. In other words, our perception of reality is the illusory result of our human, sensory interpretations of primary qualities. A major aim of positivist science is to replace experiential phenomenon with a mathematical model incorporating only their primary qualities. This quantitative result is intended to be more real than the phenomenon observed by the senses, and the task of science becomes a kind of "metaphysical archaeology" striving to reveal an underlying mathematical reality. [102]

The primary–secondary quality distinction has its roots in the ideas of the Ancient Greek philosophers Leuccipus and his student Democritus (c. 5th century BCE), and is also found in Plato's dialogues and medieval scholastic thought. It is not until the work of Galileo Galilei in the scientific early modern period, however, that we see a definitive formulation of this distinction, and in terms corresponding to their contemporary usage.

Galileo developed the ancient ideas of atomism to describe reality as the manifestation of an infinitesimal number of geometric points, thus legitimizing atomism with mathematics and paving the way for a reductive mathematical process in science. This mechanistic view proposed that all aspects of everyday reality were ultimately reducible to the shape, position and relations of invisible atomic building blocks. In his 1623 treatise *Il Saggiatore* (The Assayer), Galileo writes:

> …I think that tastes, odors, colors, and so on are no more than mere names so far as the object in which we locate them are concerned, and that they reside in consciousness. Hence if the living creature were removed, all these qualities would be wiped away and annihilated. [103]

The primary-secondary quality distinction lies at the intersection of key issues in metaphysics, epistemology, and the philosophy of perception, and remains an ongoing debate in the philosophy of science. [ab]

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ab For a full historic survey of primary and secondary qualities and the current debate, see: Nolan, K. (Ed.) (2011) Primary and Secondary Qualities: The Historical and Ongoing Debate. Oxford: Oxford University Press

The lasting effect this debate has had on diagrams (and thus diagrammatic art) is an intellectual distrust of colour as a secondary quality, so that whiteness came to be promoted to the "highest expression of the indifference that lies beyond all that is relative and partial... " and that truth embodied in the idea was "like a visible form bleached of its colour." [104, 105]

Alongside line, colour was employed by Sol LeWitt as an elemental component within the logical system of his artistic production, rather than being used for its aesthetic appeal: "It might seem to some that color is synonymous with decoration, but I try to use color objectively... I do not use color for effect, although I see no evil in that." [106]

LeWitt's early practice was drawn towards purist, colour limiting ideals (see figures 39 a,b), but took on an increasingly personal tone over time, whilst still maintaining its strict, formulaic basis. [ac] One major transition for Lewitt's was from a use of pencil and crayon for his wall drawings to multiple layers of vibrant ink washes. The artist credits this shift to his encounter with the frescoes of Giotto, Masaccio, and other early Florentine painters, after moving to Spoleto, Italy, in the late 1970s. [107] Quattrocento art played a motivating factor in LeWitt's escape from what he called the creative prison of the ideological pronouncements and inhibitory rules he had established for himself in his early works, looking instead for "something more universal, more important", than an avant-gardist stance alone could provide. [108] LeWitt was also quoted at the time as saying how he aspired "to produce something [that he] would not be ashamed to show Giotto." [109]

Olafur Eliasson is a contemporary artist whose practice both embraces and investigates the *subjective* nature colour, and who is actively engaged with the cognitive aspects of vision. Proposing that "the analysis of colours is, in fact, about the ability to analyse ourselves", Eliasson's installation works *Your Rainbow Panorama* and *Feelings Are Facts* (figures 32, 33) create hodological spaces that present the viewer with formulated structures of immersive colour experience. [110] The very title *Feelings Are Facts* places itself in opposition to the scientific duality of primary and secondary qualities, and also to Sol LeWitt's proposition that "*Perception is Subjective*". [111] It also aligns Eliasson's work on colour with Goethe's theory of colours and the various physical and psycho-biological contexts in which humans perceive colour, rather than the detached mathematisation of the visual spectrum established by Newton.

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ac An example of this is LeWitt's *Wall Drawing 46* in 1970, created two days after hearing of the death of his friend the artist Eva Hesse. Rather than the usual straight lines used to construct his wall drawings, the draughtsman is instructed to use a hand drawn 'not straight' line, a motif that appears in this work for the first time, and was created in tribute to the organic nature of Hesse's work.

Figure 33: Olafur Eliasson, *Your Rainbow Panorama*, 2007,
(Diameter 52 metres), Kunstmuseum, Aarhus

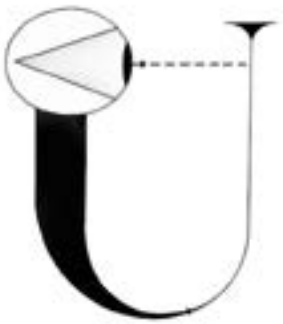
The importance of physical motion, spatial orientation and the fluid, subjective experience of colour become very apparent in Eliasson's own description of his installation *Your Rainbow Panorama*, constructed on top of the ARoS Aarhus Kunstmuseum, in Denmark in 2010:

> Imagine Your rainbow panorama as an instrument that tunes you – its user – so that your body is transformed into a colour resonator. Enveloped in the rainbow environment, you produce afterimages in hues complementary to the colours in the glass panes around you. If you look at the city through red glass, your eyes develop a green afterimage. If you maintain a quick pace, the colours remain vibrant. But if you pause in one colour zone, the hue around you grows pale while the colours in your peripheral vision, where the walkway curves, intensify. Colour intensities depend on your speed. [112]

Also of note in terms of creating a diagrammatic understanding of the romantic-objective nature of colour is Eliasson's ongoing project with a colour chemist to mix paint in the exact colour of each nanometre of the visible light spectrum (approximately 390 to 700 nm). Starting in 2009, Eliasson refers to the project as his *Colour experiment paintings*. Taking an objective, scientific stance to explore an art-historical and ephemeral use of colour, Eliasson applied his project to Turner's watercolour paintings in the 2014 Tate Britain exhibition *Turner Colour Experiments*. By examining how much colour, which colour, how much light and how much darkness turner used in selected paintings, Eliasson created a set of seven circular colour wheels based upon each painting. "The schematic arrays of colours on round canvases generate a feeling of endlessness and allow the viewer to take in the artwork in a decentralised, meandering way." [113] (For an image of *Turner Colour Experiments,* see Appendix G)

3.5: Detached Objectivity: The absent artist and omnipresent observer

> "Essentially, perspective is a form of abstraction. It simplifies the relationship between eye, brain and object. It is an ideal view, imagined as being seen by a one-eyed, motionless person who is clearly detached from what he sees. It makes a God of the spectator, who becomes the person on whom the whole world converges, the Unmoved Onlooker." [114]
>
> Robert Hughes



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niting all of the art works within the category of diagrammatic art considered within this thesis, is an aura of detached, objective indifference, a form of artistic 'un-expressionism'. Objectivity is a deeply integral, idealistic goal of scientific enquiry that aims to keep the claims, methods and results of science free of personal opinions, interests and prejudice, as well as societal and community biases.

The goal of objectivity is therefore a representation of the world as it is, unmediated by human minds and other distortions. Scientific realists believe in the effectiveness of the models and theories of science to successfully describe both the observable and unobservable aspects of the world with a perspective-free objectivity. Thomas Nagel calls this the "view from nowhere", and Bernard Williams describes it as the "absolute conception".[115, 116] Just as pure objectivity in science is an ideal concept however, it also remains an ideal in art, with artists choosing to affect objectivity rather than attempt the scientific ideal of complete detachment in their work. (This points is covered in more detail in chapter four in relation to C.S.Peirce's concept of the *tuone*, and how even the most objective artworks retain notions of subjectivity and aesthetic decision making).

The ambition to escape from the singular human perspective remains a source of fascination, either by imagining reality through multiple perspectives or by taking the position of an invisible, detached or omnipresent observer. For the catalogue accompanying his exhibition *The Absence of Mark Manders*, the titular artist writes that "(u)nder a table you have the possibility to test your own absence. The realization that life is taking its course, even without you, is an intense human experience; it shows the finiteness of personality." [117]

ad Physicist John Wheeler's diagram of the Universe as a self excited circuit: starting small (thin part of 'U' at upper right), the Universe grows (loop of 'U') and in time gives rise to observer participancy (upper left) which in turn imparts "tangible reality" to even the earliest moments of the Universe.

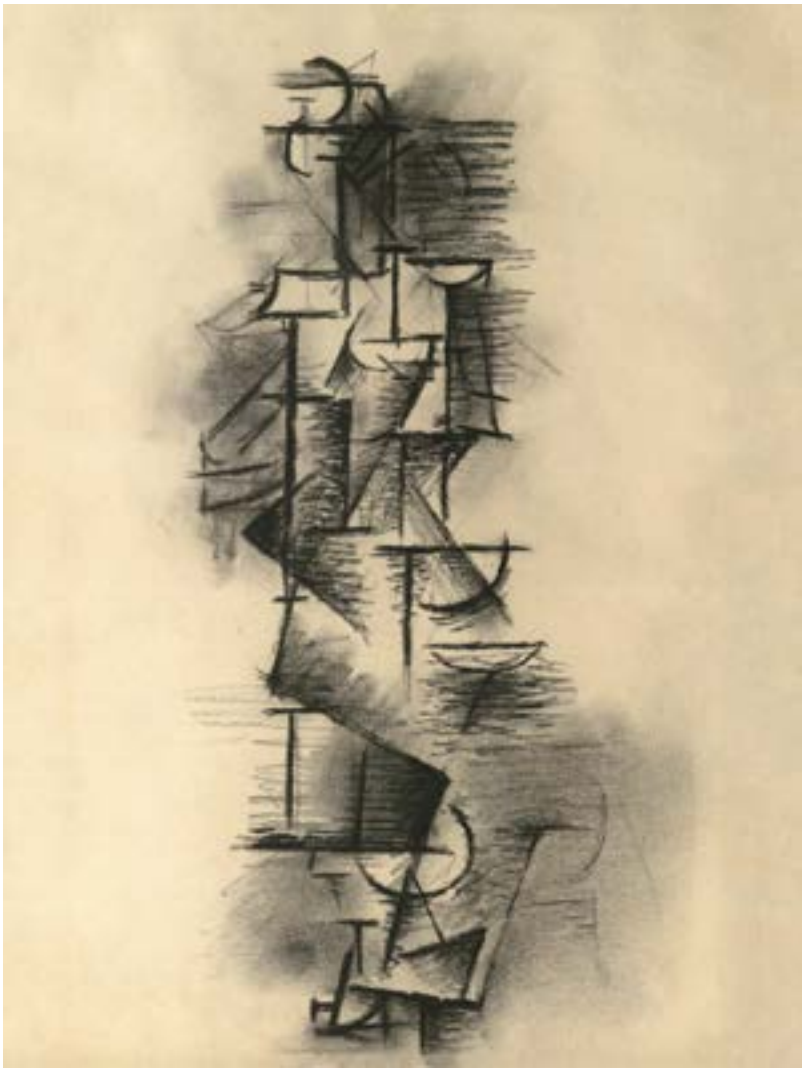

Figure 34: Pablo Picasso, Standing Female Nude, 1910,
Charcoal on paper, 48.3 x 31.4 cm

Figure 34 shows Picasso's *Standing Female Nude*, an example of what has come to be referred to as analytic cubism (taken as the early stages of cubism, as opposed to the subsequent synthetic cubism), an approach to image-making which structurally dissects subjects using multiple viewpoints and overlapping planes. Structural forms in analytical cubism are emphasized using a highly simplified colour palette, and density of image tends to be at the centre of the canvas. By combining an air of objective indifference with multiple detached viewpoints, the art works of analytic cubism keep the viewer at a distance whilst appealing to their intellectual curiosity to decipher the meaning of the work and become engagement as a "component in a dynamic system of meaning". [118]

The Romantic-Objective nature of such work relies upon its diagrammatic qualities, and this kind of art implicitly acknowledges and poetically benefits from its impersonal, objective stance and austere, hermetic symbolism. The critic David Sylvester proposes that the works of *late analytic cubism* are the result of the artists working on a deeply instinctual level, beyond reason or theoretical rationalization. [119]

Sabine Rewald refers to this period as *high analytic cubism* (1910-1912), and describes how Picasso and Georges Braque were appealed to by their friend and dealer Daniel Henry Kahnweiler to give their pictures realistic titles in order to provide a conceptual reference point for their increasingly abstract images. [120] It was during this period that the artists began to add letters and numbers to their work, often creating puns and referring to the contents of the painting as a way to re-introduce a subjective element. (The title as conceptual key to diagrammatic art is also discussed in chapters 5 and 6.)

The features of analytic cubism, and especially late analytic cubism, relate in style to the diagrammatic visual arrays developed during the production of encyclopedias during the European Enlightenment by placing emphasis upon:

> their strict frontality, their discontinuity with the fictive spaces of tableaux, their pervasive whiteness that joins visual parts to the network of numbers and letters keyed to a text - [which] fail to converge in a single vantage point or entity that might be called a viewer. [121]

The contemporary practice of artist Richard Talbot employs the machinery of perspective and technical drawing usually associated with perspective studies, geometry and construction plans. However Talbot puts these systems to work creating spontaneous poetic forms, intricately rendered in two dimensions. Central to Talbot's practice are issues of point of view, perspective, materiality (the creation of ideal forms as real world objects), and the interplay of prescriptive and intuitive mark making systems.

Combining his own practice with research in to the construction of early Renaissance paintings, Talbot has argued convincingly against the prevailing view of linear perspective as a tool or pseudo-mathematical device for creating the illusion of three dimensions. Instead he proposes that the geometry of linear perspective serves as a remarkably flexible, creative tool within Renaissance painting, giving rise to a spatial ambiguity between surface and depth. In this way, Talbot is also able to work intuitively in his own practice, and to think, structure and speculate within an apparently rational system.

Talbot also references Leonardo daVinci's suggestion of using accidental images as a means to allow forms and ideas to emerge which would have otherwise been entirely unpredictable, and how he himself incorporates intuition and chance in his work:

> I make some marks and lines that are purely diagrammatic and some which describe forms. I have become very aware of the interplay between them and the spatial effects that they produce. These lines and other marks, which do not initially have any visual purpose, become just as much part of the drawing as anything else. In addition I am not defining objects absolutely and they remain transparent. The overall sense of transparency it creates is an essential part of the process, allowing forms and ideas to emerge. [122]

This connects Talbot's approach to Deleuze's use of the term diagram in his analysis of the paintings of Francis Bacon. Bacon introduced involuntary, spontaneous marks to his canvases to disrupt his own painting process and force himself to deal with and incorporate the marks in to the work. Bacon described these marks as suggestive of "much deeper ways by which you can trap the fact you are obsessed with", a means to arrive at an image unachievable by a more considered, illustrative approach alone. [123]

Talbot's working process gives rise to drawings as open-ended systems which retain the complex matrices of their own working-out. They also contain aspects of stereotomy [ae], orientation, reorientation and the juxtaposition of multiple view points (both rotated about an arbitrary axis in three dimensions and as a mirror image). Talbot has suggested that such an approach promotes the idea that it is the process of drawing itself that can be considered the medium of his work, rather than the materials chosen to make the work manifest. [124]

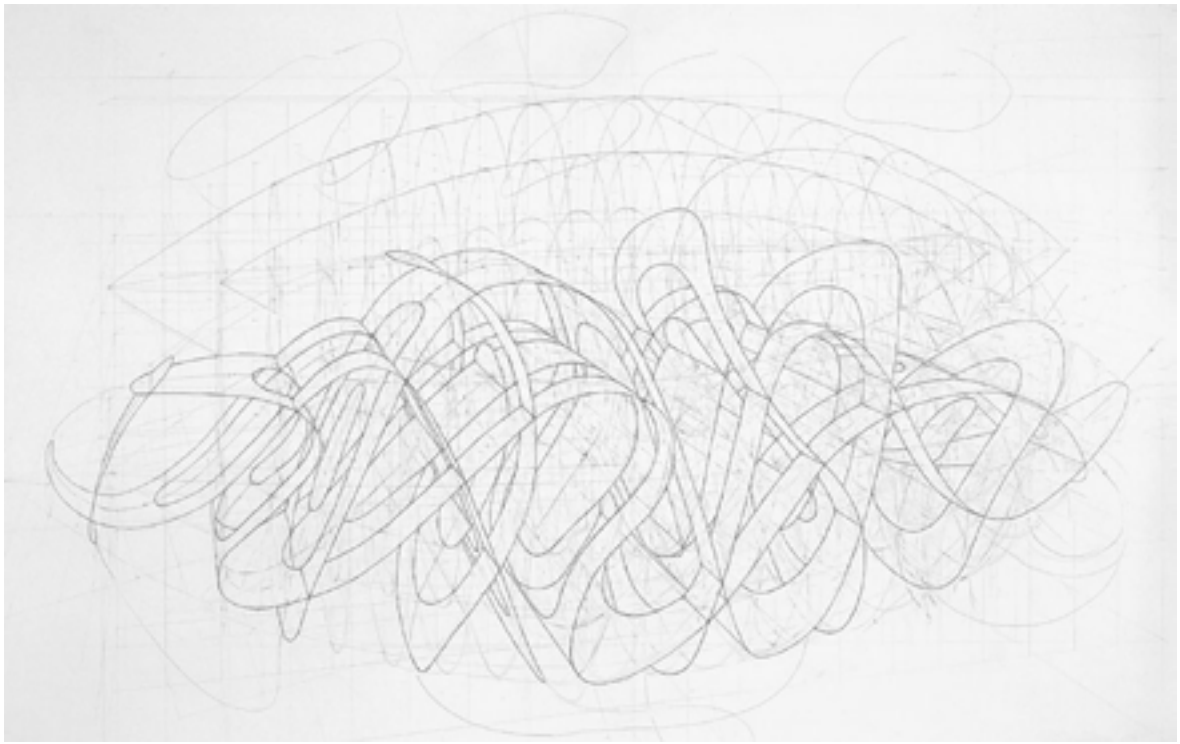

Figure 35: Richard Talbot, *Missing the Target*, 1989, pencil on paper, 140 x 80 cm,

Talbot refers to the matrix of marks from which his images arise as a kind of scaffolding holding the three dimensional forms. [125] Drawings such as *Random Moves* (figure 35) highlight a connection between Talbot's technique and Goethe's concept of the *urphenomenon*, the essential underlying pattern or process of a thing from which specific individual forms arise.

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ae The art or science of cutting and arranging solid bodies (i.e. stone) in to desired shapes and arrangements.

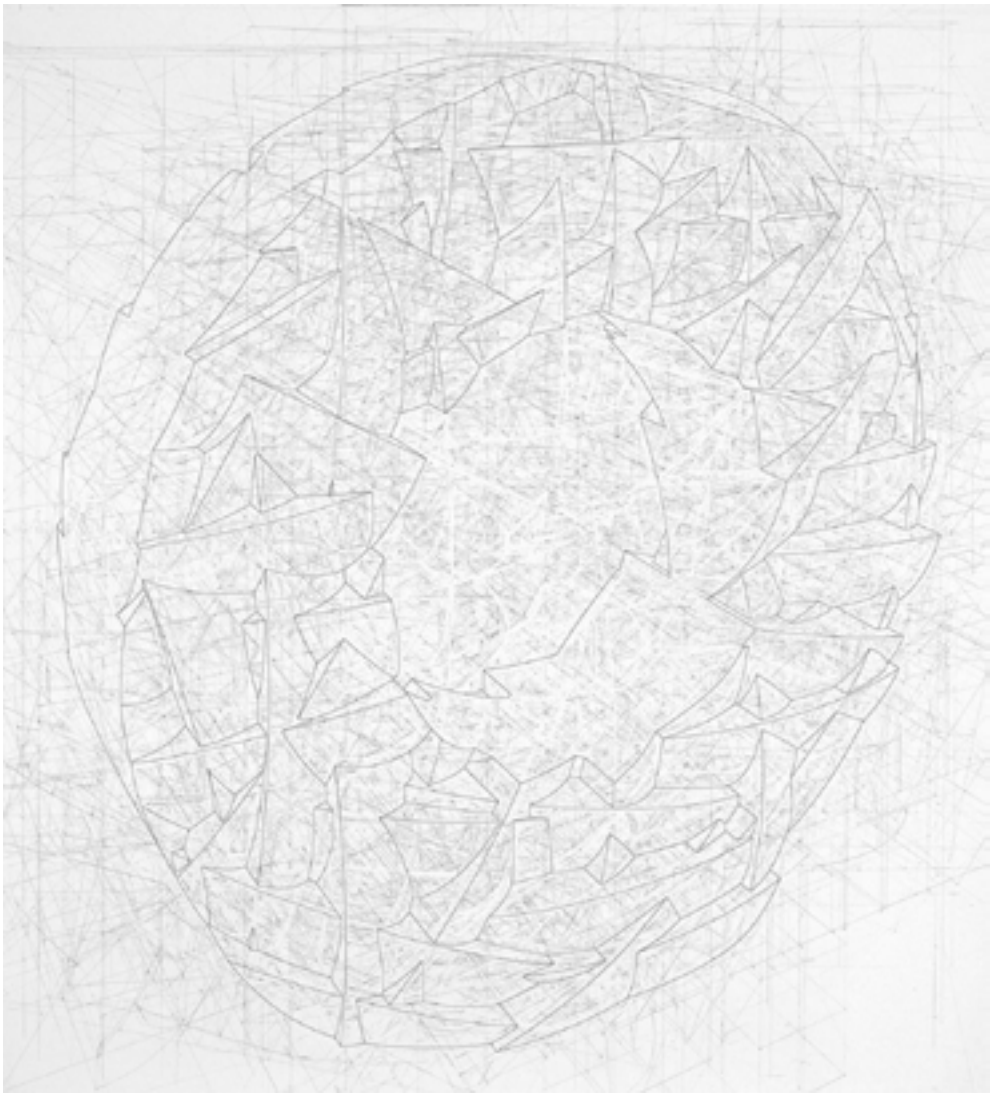

Figure 35: Richard Talbot, *Random moves*, 120 cm x 120 cm,
Pencil and ink on paper. 1989,

Such an image as figure 35 and the processes involved in its making embodies all of the traits of diagrammatic art's relationship to the philosophy of science, as listed at the start of this chapter (figure 20): idealisation, essentialism, reductionism, objectivity and the monochrome tendencies resulting from the division qualities.

Talbot has written of how his objects defy gravity, how they show no signs of the ware and tear of the real world environment, such as chipped corners or edges. [126] Instead they exist as skeletal, idealised forms, readable as representations of objects at any scale, from the intimate to the infinite, analogue versions of the scalable vector graphic as opposed to the pixelated jpeg. The pictorial space occupied by the images appears immediate and shallow rather than the continuum of a horizon-less white space, allowing Talbot to relate his drawing process to more physical ideas of sculpting space and of cutting, slicing and revealing hidden component parts. [127]

When asked in interview about his approach to using colour, Talbot admits to "having always avoided it, as I've never understood it. It's a complete mystery. If I was making a drawing, I can't see any reason to use colour. But then equally I probably can't see any reason not to use it. But then I would probably be thinking well, why do I ?" [128]
(For the full transcript of the interview, see Appendix H)

Richard Talbot's practice is one of several that are positioned on Map 1 in the immediate vicinity of a circular Heideggarian clearing. This void represents an ideal, metaphorical and unreachable position that numerous artists working with diagrammatic imagery have both approached and retreated from (a subject that will be dealt with in depth in the following chapter).

Talbot recounts an early encounter with the British - Romanian Artist Paul Neagu whilst a student in London:

> I distinctly remember that when I did my MA at Chelsea, the external assessor we had was Paul Neagu... the work I'd made at Chelsea had become really quite austere, and extremely minimal, and he said… 'don't forget the other side of yourself', and I realized exactly what it was he meant. That we can easily kind of forget. But then I think that also we need those extremes sometimes, to realize something. We need to go beyond in order to know where the edge was. It's only when you fall over the edge that your realize there was one. [129]

This chapter has focused upon the underlying aesthetic and philosophic connections between the use of the diagram in science and its use in fine art. Chapter four explores the semiotics of the diagrammatic art, and considers the subtle but fundamental differences between the way that the diagram is used in science and its use and subversion in the field of fine art.

Chapter four also presents selected works by Sol LeWitt, Benar Venet and Marcel Duchamp as important examples of artists who, like Richard Talbot, have employed the diagram in art in order to approached the 'event horizon' of perfect objective austerity, in order to see just how little subjectivity is required to produce a work of art.

Chapter 4: Developing a pictorial semiotics of diagrammatic art

"The Science of Unclear Thinking"

C.S. Peirce [130]

aa

emiotics allows us to examine the basic components and structure of diagrammatic art works in detail, providing the tools to develop a deeper understanding of the paradoxical nature of the subjective–objective resonance found within these works. This approach provides a broad system of analysis, and is capable of incorporating the great range of media and forms taken by diagrammatic art.

Chapter four applies American philosopher-scientist Charles Sanders Peirce's overlooked concept of tone/tuone to diagrammatic art in order to develop a clearer understanding of the semiotic mechanisms at work in the Romantic-Objective nature of these artworks. The diagrams of science act to minimise Perice's *tones* and *tuones* in order to achieve high levels of legibility and coherence. A comparison is made between the use of diagrams in science/mathematics and their use in fine art

Whereas chapter five makes a comparative study of diagrammatic art in order to map out the contemporary terrain, chapter four presents selected works by three artists who have investigated what occurs when tone minimisation is followed towards its idealist conclusions: Sol LeWitt's wall drawings and his series of prints *Six geometric figures*, Benar Venet's *Equation paintings* and Marcel Duchamp's *Unhappy Readymade*. Representative works by these artists are positioned in Map 1 in the immediate vicinity of a circular, Heideggarian clearing - an event horizon drawn around a void to represent an ideal, metaphorical and unreachable position of perfect objective austerity.

In various ways, these art works highlight the collision of Platonic *type ideals* with the real world environment. They also provide excellent examples of the theorist Jaques Bertin's *monosemic image*, as tone-minimised diagrammatic art works that flirt with the extremes of astringent and colourless objectivity to create a refined poetics - an approach that all three artists abandoned to some extent in their later works.

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aa Letter S, British Sign Language (BSL)

4.1 Semiotic codes and Peirce's tone/tuone

Semiotic codes are one of the most fundamental concepts in contemporary semiotics. The underlying idea is borrowed from information theory, where the term code refers to precise sets of rules for the correlation of signals. In the field of semiotics codes are understood as "…procedural systems of related conventions for correlating signifiers and signifieds in certain domains… provid[ing] a framework within which signs make sense: they are interpretative devices which are used by interpretative communities". [131]

The *aesthetic code* is the semiotic system used to describe sign production and interpretation within the domain of the arts, where creativity (and thus deviations from rules) must be accounted for. Within Umberto Eco's theory of codes, innovative art gives rise to new rules and thus acts to change, or *overcode* the original rules of the aesthetic code. [132] This process results in a semiotic surplus of information on the level of both content and form, which acts to open up a work to multiple interpretations. [133] The aesthetic code "celebrates connotation and diversity of interpretation, in contrast to the logical and *scientific codes*, which seek to suppress these values". [134] [emphasis added]

The scientific code aims at creating imagery which works within a single level of semiotic communication, and the texts, charts, graphs, diagrams and mathematical codes of science are specifically designed to minimise any openness to misinterpretation.

In order to understand how this is possible and to investigate in more detail the objective-subjective resonance of diagrammatic art works that adopt the language of the scientific code as part of their aesthetic code, we must first consider the work of the American philosopher, logician, mathematician, and scientist Charles Sanders Peirce. Peirce's highly influential work on semiotics and logic has provided a foundation for a great deal of research being done in the fields of diagrammatics and diagrammatology today. [ab]

Peirce lived through a time of tremendous change and development in the sciences and human knowledge, and his investigative stance avoided rigid nineteenth century notions of the structural finality and integral determinism of nature's laws. Instead Peirce preferred to take a view of science as empirical, but also as fluid, open and revisable. Peirce's polymathic and often pioneering writings in several fields led Bertrand Russell to write that "beyond doubt ... he was one of the most original minds of the later nineteenth century, and certainly the greatest American thinker ever." [135], whilst Karl Popper considered him "one of the greatest philosophers of all times." [136]

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ab See: Stjernfelt, F (2011) Diagrammatology, an investigation on the borderlines of Phenomenology, Ontology and Semiotics, New York, Springer.

Central to Peirce's thought is his theory of signs or *semeiotic* (Peirce's own spelling), a project to which Perice continually returned throughout his life, and the importance of which he emphasised in a letter to one of his correspondents Lady Welby, written in 1908 when Peirce was approaching his seventies:

> ...it has never been in my power to study anything, — mathematics, ethics, metaphysics, gravitation, thermodynamics, optics, chemistry, comparative anatomy, astronomy, psychology, phonetics, economics, the history of science, whist, men and women, wine, meteorology, except as a study of semeiotic. [137]

To Peirce "...the entire universe is perfused with signs, if it is not composed exclusively of signs", and his goal was nothing less than to classify these myriad sign relations precisely and comprehensively, and to characterize all the possible modes in which we recognize and represent the world around us. [138] Peirce lists a disparate array of examples classifiable as signs, including images, pictures and diagrams, but also:

> ...pointing fingers, symptoms, winks, a knot in one's handkerchief, memories, fancies, concepts, indications, tokens, numerals, letters, words, phrases, sentences, chapters, books, libraries, signals, imperative commands, microscopes, legislative representatives, musical notes, concerts, performances, natural cries, in other words, anything able to create mental images which emanate from something external to itself. [139]

For Peirce there cannot be anything which in principle cannot be a sign, and a Peircian pan-semiotic universe does not consist of a dualism of two exclusive things - signs and non-signs. Thus Peirce's semeiotics is fundamental distinct to that of Ferdinand de Saussure's two part *dyadic* model of signs, consisting of a *signifier* - the form that a sign takes, and the *signified* - the concept it represents. Rather, Peirce formulated a three-part *triadic* model as his starting point:

- *Sign (representamen)* - the material or immaterial form that a sign takes (similar to Saussure's signifier)
- *Interpretant* - an idealised particular effect which the sign has upon its interpreter (similar to Saussure's signified, except that it is itself a sign in the mind of the interpreter)
- *Object* - that to which the sign refers (a category unique to Peirce's model)

Peirce then further divides each category in to its own triadic subcategories:

- Signs (representamen) are divided in to: *Tones*, *Tokens*, and *Types*
- Objects are divided into *Icons*, *Indexes*, and *Symbols*
- Interpretatants are divided into *Rhemes*, *Dicisigns*, and *Arguments*

Peirce proposed that every sign appears as a bundle of different categories of signs, and that the three trichotomies give rise to ten *classes* of signs, or, in even more complex combinations and subcategories, to sixty six or even 59,049 potential classes. [ac] Perice's semeiotics is an idiosyncratic system combining abstract notions with concrete logic and the a-priori with the empirical, in an attempt to incorporate all of reality.

> In Peirce, as in no other semiotician, there is a ruleless dialectic between a desire for absolute, categorical order (down to the 59,049th case) and the equal, and incommensurate, interest in happy phenomenal chaos (geometrical planes, stuck doors, and the 'feeling of red'). [140]

Thus for Peirce, the universe considered in its entirety is a sign, "a vast representamen, a great symbol (...) an argument", and in so far as it is an argument, it is "necessarily a great work of art, a great poem (...), a symphony (...), a painting." [141]

The potential scope of Peirce's unfinished system of classification is as vast as it is complex, and is composed of a terminology which underwent a constant process of revision over the course of his thirty year investigation, leading to a confusing array of apparently inter-related words. [ad] Despite these complications, Peirce's work does provide a scaffold of terms and guiding patterns of though with which we can attempt to understand diagrammatic, Romantic-Objective art. It allows us to gain some insight as to why the artists considered in this thesis are instinctively drawn to a skeletal, diagrammatic approach, and how this is best understood in modern terms when considered as the interrelation of key aspects of the aesthetic and scientific codes.

Between 1906 and 1908 Peirce introduced his triad of terms: tone, token and type to describe the functionality of signs, a distinction that allowed him to differentiate between three types of signs: the *qualisign* (tone), *sinsign* (token) and the *legisign* (type). The qualisign is a tone or quality that is a sign, the sinsign is an actual, singular thing such as a fact, event or state etc., and a legisign is a sign which is a law, rule or convention. [ae]

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ac In his correspondence with Lady Welby, Peirce describes his expansion of the list of trichotomies to ten, capable effectively generates some 59,049 (3^{10}) classes, but which, subject to restrictions in the way they interconnect, he renders down to sixty-six classes of signs. (Collected Papers: vol.8, para.344)

ad For a speculative discussion of Peirce's unfinished system of classification see:
Sanders, Gary. (1970). Peirce's sixty-six signs?, Transactions of the C. S. Peirce Society 6, p.3-16
Also: Weiss, Paul & Burks. (1945) Peirce's sixty-six signs, The Journal of Philosophy 42 (1945), p.383-8.

ae Peirce also renamed the trichotomy: *Potisign* (referring to the notion of potential, or positive possibility), *Actisign* (referring to the act of experiencing 'here and now') and Famisign (in reference to a familiar habit of use), before later re-instating his original terms. See: Peirce, C. S. (1998). The Essential Peirce: Selected Philosophical Writings Volume 2 (1894–1913), The Peirce Edition Project, Ed. Bloomington, IN: Indiana University Press

Peirce illustrates the relationship of token to type with an example from linguistics:

> A common mode of estimating the amount of matter in a … printed book is to count the number of words. There will ordinarily be about twenty 'thes' on a page, and, of course, they count as twenty words. In another sense of the word 'word,' however, there is but one word 'the' in the English language; and it is impossible that this word should lie visibly on a page, or be heard in any voice …. Such a … Form, I propose to term a Type. A Single … Object … such as this or that word on a single line of a single page of a single copy of a book, I will venture to call a Token. …. In order that a Type may be used, it has to be embodied in a Token which shall be a sign of the Type, and thereby of the object the Type signifies. [142]

The Stanford encyclopedia of philosophy uses a line from Gertrude Stein's 1913 poem *Sacred Emily* to show the distinction being applied: "Rose is a rose is a rose is a rose". [143] It is equally true that the sentence contains both three words (in repetition) and ten words (in total). In the first case it is three word types that are counted, and in the second case ten word tokens. Thus types are singular, ideal entities that have no spatio-temporal location, but are able to *determine* things that exist, whereas tokens can exist multiple times within a single page or book, which Peirce refers to as *replicas*.

The third term of Perice's triad, tone, has fallen out of general use in contemporary mainstream philosophy, in favour of a simplified two-part division of type and token. However for this study, discussion of Peirce's semeiotics focuses upon tone in relation to diagrammatic art. In Peirce words:

> An indefinite significant character such as a tone of voice can neither be called a Type nor a Token. I propose to call such a sign a Tone. [144]

Like types, tones do not physically exist but are able to *characterise* things that do. The unique qualities of the words: '**and**' (cambria font, black, 12pt size, bold,), '*and*' (cambria font, black, 12pt size, italics) or '*and* ' (Edwardian script font, black, 18pt size, regular) provide examples of 'indefinite but significant' changes to each of the three token words. It also illustrates how tokens rely upon the qualities of tones in order to exist, and thus the fundamental role played by tones and its qualisigns as one of the minimal units of Peirce's semeiotics. Unlike types each tone is unique. Unlike tokens, tones can not be repeated but can only be very similar. [145]

Peirce had also considered the term *tinge* for this category, thus providing a visual correlative to the auditory nuance of the term tone. Later still he proposed the term *potisign* and then *mark*, suggesting a refinement in emphasis to image, notation and writing: "(f)or a 'possible' sign I have no better designation than a Tone, though I am considering replacing this by 'Mark.'" [146]

Peter Cudmore suggests that:

> This first term might benefit from a designation appropriate to the sensory organ, so that auditory signs are tones, visual ones tinges and so on. 'Mark' seems a hylozoic stage beyond this immediate apprehension, suggesting that a judgement has already been made. [147]

Peirce also introduced the term *tuone* as a combination of tone and tune, in an attempt to account for the subtle complexities of music's aesthetic effects; the *tuone* being "a quality of feeling which is significant, whether it be simple, like a tone, or complex, like a tune". [148] (Peirce seems not to have provided an equivalent visual combinatorial concept for mark which tone finds in tuone.)

The symphonic musical form provides a useful demonstration of Peirce's triad of signs, and remind us of the scope of and ambition of his project. In the case of the symphony, its compositional structure can be understood as a type, and exists in an abstract, general way. Each single performance of the symphony can be considered as a token, a single instance or manifestation of the type. Although each performance may be different, it is an iconic token (sinsign) of that particular work. Lastly, the aesthetic effects of the token performance upon an audience member relies upon what Peirce refers to as a tone. Thus one of the key roles of the conductor in interpreting the score is to formulate the minimal tone / tuone structures of the music.

It should also be noted at this point that divisions between sets remains fuzzy, with signs able to change between tone, token and type depending upon the context in which they are used or interpreted (ie: tone as qualisign or tone as interpretant). This context is also referred to as the 'semantic framing' or 'semantic moment' and relates to the gap between artists intention and viewers interpretation or projection on to a work. [149]

*Tone*s, *tuone*s and their qualisigns are all nuanced signs. Such signs carry certain connotations and have the ability to indirectly evoke thoughts and feelings, which are often vague and ambiguous. This encourages a diversity of interpretation in the arts, a subject explored in detail by Umberto Eco in his 1989 book *The Open Work*. [150]

Eco's study focuses on the importance and potential of multiple readings of all genres of art, including literature, cinema, music, and fine art. Conventional works can be understood as conveying conventional meaning, existing to support a conventional view of the world; the open work conversely, emphasises ambiguity and the destabilization of meaning, this multiplicity of meaning allows for, (somewhat paradoxically) open works to convey large quantities of information.

Tones and tuones are key components in the aesthetic subcode of diagrammatic art, and their significant (yet indefinite) nature bolsters Eco's idea of openness, the collision of clarity and vagueness. [af] The use of tones/tuones in the aesthetic subcode of diagrammatic art is distinctly different to that of other forms of fine art. Artists involved in making diagrammatic artworks generally suppress the tones and tuones within their work, while selectively retaining certain specific tones. This can be demonstrated by comparing the diagrams of mathematicians to the diagrammatic works of artists: how exactly are tones and tuones treated by the mathematical-scientific code as compared to the aesthetic code?

The diagrams used in geometry pre-suppose the substitution of real world tokens for ideal types. For example, a 'token' point of ink on paper can represent a conceptual 'type' point of zero dimensions, and a hand-drawn 'token' ink line can represent a perfect one-dimensional 'type' line of zero width. In order to effectively portray and read the idealized types, tones in geometric diagrams are minimized during production and overlooked during reading such images. As Peirce understood it, "the diagram as the specific figure one contemplates – that is when perceived as a token with a certain tone, is read as a type by prescinding [leaving out of consideration] 'the accidental characters that have no significance'". [151]

Figure 33 shows a simple diagrammatic proof of the Pythagorean theorem: the relationship between the three sides of a right-angled Euclidean triangle. The theorem states that the square of the hypotenuse is equal to the sum of the squares of the other two sides.

However, as is evident in the sketch, accuracy is not a prerequisite for the token image in order for us to grasp the concept of the ideal type, and various tones exist within the diagram. The hand-drawn lines have some considerable thickness, and yet are assumed to represent ideal lines of one dimensional length and zero width. As shown by the blue dotted line, lengths and angles are wildly inaccurate, and magnification reveals the true image to be disjointed and pixelated, thus neither truly straight or appropriately connected.

Yet despite the various forms of token imprecision, we are not only able to grasp the nature of the proof in its ideal form, but to perform even further conceptual manipulations of the diagram. It can be understood that the figure does not portray a single triangle of the precise size shown in the sketch, but can be taken to represent all the possible sizes and proportions as a continuum of conceptual, right angled triangles. [ag]

af The aesthetic code can be broken down into subcodes, (i.e. the style of Cubism) and personal subcodes (i.e. the individual style of Picasso)

ag For further exploration of this idea, see: Stjernfelt, F (2011) Diagrammatology, an investigation on the borderlines of Phenomenology, Ontology and Semiotics, New York, Springer.

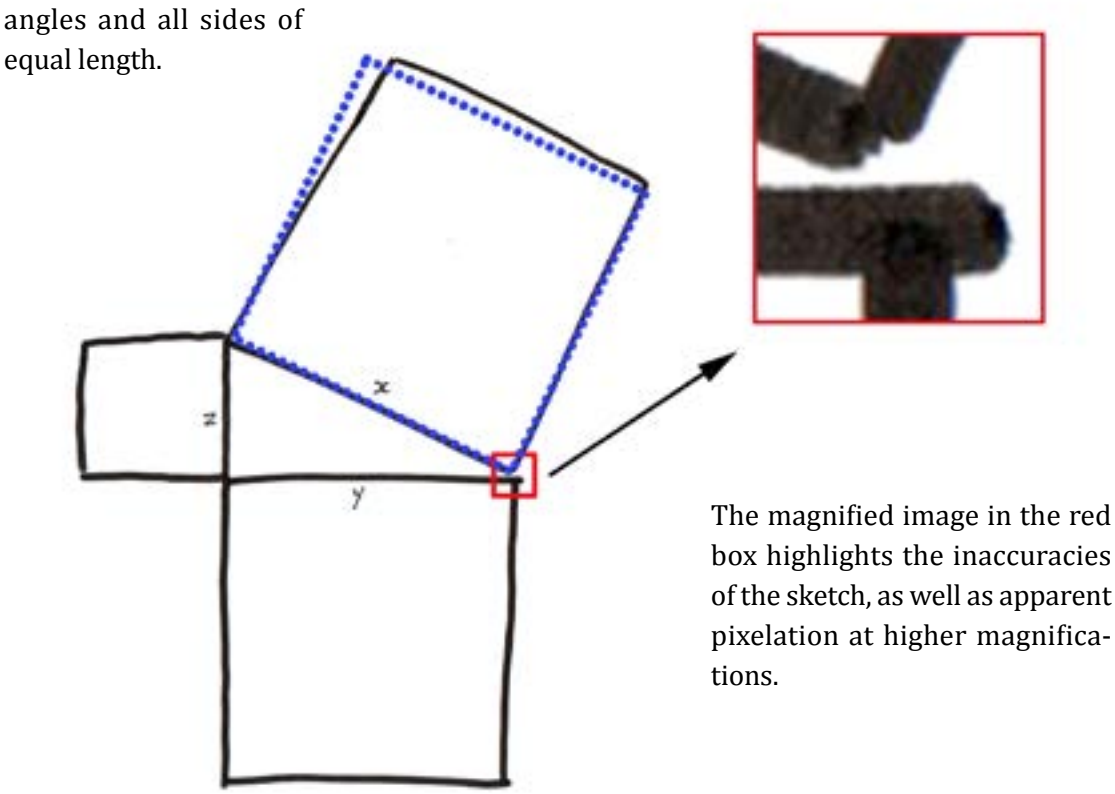

Figure 37: Sketch of the diagrammatic proof of the Pythagorean theorem highlighting the imprecisions of a real world token representation of an ideal type.

The tone or tuone in a work of art, however, play a key role due to their direct involvement in the aesthetic experience. The nature of tone promotion and suppression in the diagrammatic aesthetic subcode is more complex, as the use of the diagrammatic format acts to minimize tones within the work, while different artists choose to actively highlight particular tones in order to create their own distinct, personal, diagrammatic aesthetic.

The Grouping of diagrammatic art works according to semiotic approach and aesthetic style is presented in Map 1, one hundred diagrammatic art works from the last century. Map 1 illustrates the interconnected nature of the diagrammatic domain of art, and the great range of issues these works raise and forms that they take. Many of the artists included are either directly or indirectly involved with science and mathematics, and diagrammatic art is shown to be increasingly international in nature.

4.2 Sol Lewitt: Minimising tones and the poetics of geometry

It is instructive to apply Peirce's concept of tone to Sol LeWitt wall drawings, and their attendant process of translation and transcription. Towards the end of the 1960s, LeWitt made a series of groundbreaking works, which exist primarily as concepts. These concepts are established by precise sets of diagrammatic instructions specifying the lines, shapes, colours and dimensions to be used in order to recreate said concept as a high-fidelity artwork. When the diagrammatic instructions are purchased, the accompanying certificate validates the authenticity of the artwork (figure 38) and grants the owner permission to reconstruct the work in a location of their choice.

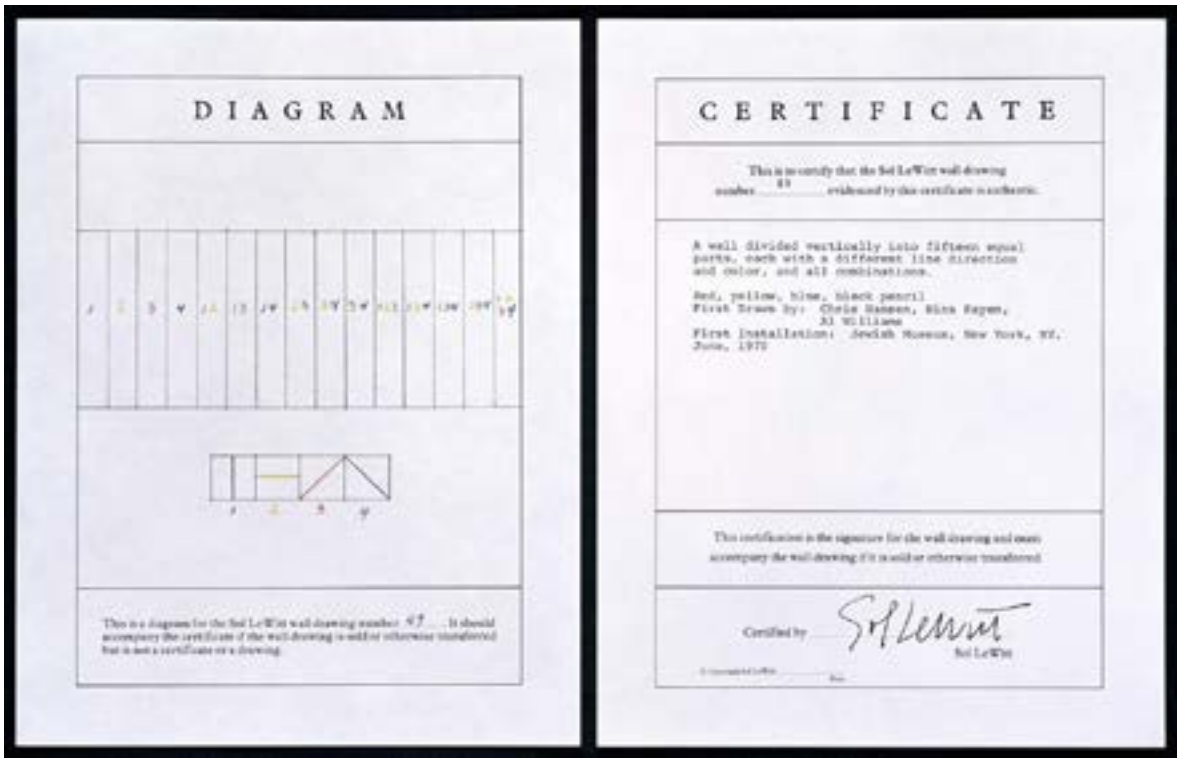

Figure 38: Sol LeWitt, Diagram and certificate for Wall Drawing #49, 1970, Ink on paper

By attributing absolute priority to concept, LeWitt gave a Platonic dimension to these artworks, insisting that they exist in essence as ideas (types) in a purely abstract, immaterial way, but with the potential to be rendered as a tokens physical form, each of which contains the tones of its production. "The Idea becomes a machine that makes the art." [152] LeWitt's explained his attempt to minimise tone in his work in the following statement:

> If the artist wishes to explore his idea thoroughly, then arbitrary or chance decisions would be kept to a minimum, while caprice, taste and other whimsies would be eliminated from the making of the art… To work with a plan that is preset is one way of avoiding subjectivity… This eliminates the arbitrary, the capricious, an the subjective as much as possible. [153]

Germano Celant discusses LeWitt's work in terms of its entropy, a scientific term for measuring the level of disorder within a system. In this case, the system is the personal aesthetic subcode of Sol LeWitt's art, and in which Celant says that the

> entropy of communication is reduced to the ideal state… in which the visual element is the exact result of a conceptual process [and] permits the extreme purification of the idea or concept, to the point at which it is presented for what it is, a rational and objective entity that does not admit those subjective or empathetic conditions that are part of the usual aesthetic operation. [154]

Celant's comments are idealistic in terms of the extent to which it is possible to strip an artwork entirely of its subjective nature, and are more suited to the early monosemic works of Venet, as we shall see in chapter 4.3. LeWitt himself discussed the importance of what he referred to as the *mark* of an individual maker left during the execution of each wall drawing. [155] In this way different individuals following identical sets of instructions for the same art work, at different times, do produce wall drawings that differ in subtle and idiosyncratic ways, and this thesis proposes that in such diagrammatic art forms, the poetics arise from such subtle but important *marks* and *tones,* as well as acting as an index of human activity. [ah]

Examining the first five propositions from Sol LeWitt's *Sentences on Conceptual Art* helps clarify the artists position, and his conception of the roles that intuition and logic plays as a device in his work:

1. Conceptual artists are mystics rather than rationalists. They leap to conclusions that logic cannot reach.
2. Rational judgements repeat rational judgements.
3. Irrational judgements lead to new experiences.
4. Formal art is essentially rational.
5. Irrational thoughts should be followed absolutely and logically. [156]

In making these statements, and by using the provocative term *mystic* in a 1960s art scene described by Robert Storr as "avowedly positivist", LeWitt warned against what he considered to be an unfruitful reliance on logic and rationalism, and the commitment of some of his fellow artists (including Donald Judd) to a predictable and aesthetically sterile empiricism. [157] The subjective free-play of LeWitt in his choice of concepts prior to the logical execution of these irrational thoughts demonstrates how his work has a subjective rather than abstract matrix, based on a human and not technical a priori, which thus helps explain their ability to transcend their methodology.

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ah Interestingly, LeWitt, like Peirce, uses the example of the concert performance to discuss what he refers to as mark, and what Peirce refers to as both tone and mark (See ref. 151).

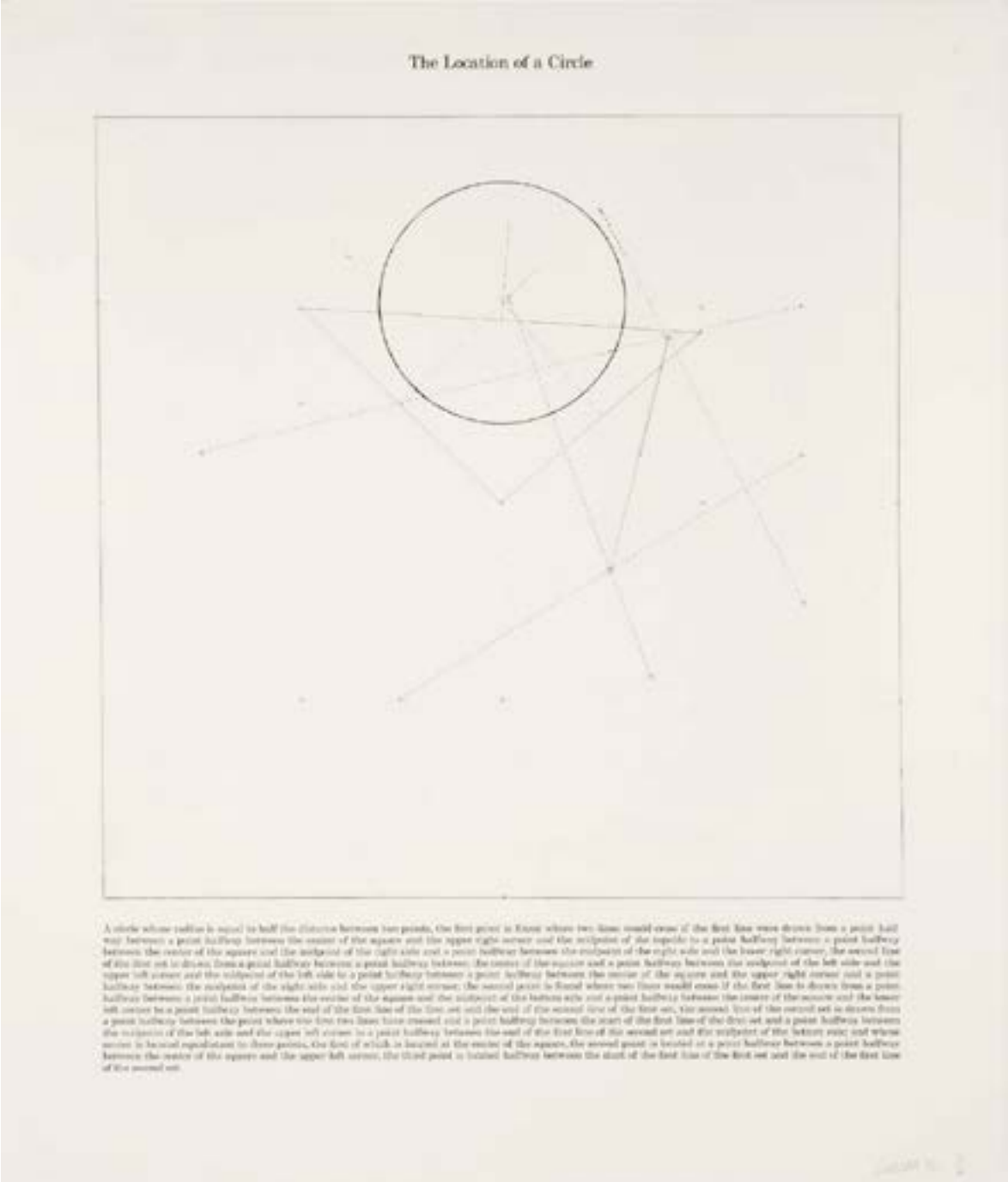


Figure 39a: Sol LeWitt, Location of a Circle, from the series:
The location of six geometric figures (circle, square, triangle, rectangle, parallelogram and trapezoid), 1974, Set of six etchings, Edition of 25, 10 AP

By following LeWitt's tone-minimising approach toward its conclusion, we arrive at his *Location* series, an austere, geometric world of Platonic-type geometric forms accompanied by labyrinthine poetic-instructional texts (figures 39 a,b). These works approach becoming what James Elkins describes as *pure notation*, in his tripartite analysis of Images, into text, picture and notation (discussed in terms of its application to diagrams in chapter 1).

Location of a Circle:

A circle whose radius is equal to half the distance between two points, the first point is found where two lines would cross if the first line were drawn from a point halfway between a point halfway between the center of the square and the upper right corner and the midpoint of the topside to a point halfway between a point halfway between the center of the square and the midpoint of the right side and a point halfway between the midpoint of the right side and the lower right corner, the second line of the first set is drawn from a point halfway between a point halfway between the center of the square and a point halfway between the midpoint and the left side and the upper left corner and the midpoint of the left side to a point halfway between a point halfway between the center of the square and the upper right corner and a point halfway between the midpoint of the right side and the upper right corner; the second point is found where two lines would cross if the first line is drawn from a point halfway between a point halfway between the center of the square and the midpoint of the bottom side and a point halfway between the center of the square and the lower left corner to a point halfway between the end of the first line of the first set and the end of the second line of the first set, the second line of the second set is drawn from a point halfway between the point where the first two lines have crossed and a point halfway between the start of the first line of the first set and a point halfway between the midpoint of the left side and the upper left corner to a point halfway between the end of the first line of the second set and the midpoint of the bottom side; all whose center is located equidistant to three points, the first of which is located at the center of the square, the second point is located at a point halfway between a point halfway between the center of the square and the upper left corner, the third point is located halfway between the start of the first line of the first set and the end of the first line of the second set.

Figure 39b: Sol LeWitt: Text accompanying Location of a Circle

However, Elkins proposes that in the case of highly notational images as geometric diagrams,

> ...it might seem that pictures would be left behind in the far reaches of geometric rigor, but I am arguing the opposite. Picturing is at stake even in the most torturous geometric labyrinth: It is pictures that are being 'harassed', driven to their limits. [158]

LeWitt uses the high-fidelity, low-entropy notation of geometry, but contrasts it with a convoluted textual description of, or instructions for, each of his six geometric diagrams. LeWitt also chooses to write the texts using everyday language, rather than the efficient and specialised symbols of mathematics, and the result is a single sentence, hundreds of words long and impossible to mentally reconstruct.

The texts accompanying each geometric image become almost religious mantras, where meaning is lost within the sounds of the words themselves. This fascinating juxtaposition of text and pure notation rescues the works from the sterility of formal rationality LeWitt warned against, resulting in a poetic resonance that is Romantic-Objective as well as diagrammatic in nature. [ai]

Nicholas Baume describes *the location of six geometric figures* (also produced as wall drawings) as one of LeWitt's most disciplined and exacting works, and yet also his most absurd and wryly funny, suggesting that the text is a "form of abstract verbal play" for LeWitt. [159]

Importantly, LeWitt himself once remarked that he considered his Location series his "poetry". [160]

Note:

Despite LeWitt's insistence on a strict methodology of production, his 1975 Wall Drawing #271(Black circles, red grid, yellow arcs from four corners, blue arcs from the mid points of four sides), first executed at Dia:Beacon in 2007, was, under the instruction of LeWitt, painted over and re-made. The drawing had remained as a concept on paper for 32 years and yet, at some point in the process of its realisation, had failed to meet certain aesthetic criteria set by LeWitt, resulting in the decision for it to be redrawn. [161]

ai For a strikingly similar example of pure geometric notation in contrast juxtaposed with its dense textual description from the note books of Leonardo da Vinci, see Appendix I

4.3 Bernar Venet: The monosemic image

In 1966, at the age of 24, the French artist Bernar Venet started his series *equation paintings*, literal reproductions of specialist mathematical diagrams and symbols with a conceptual emphasis upon their linguistic/semiotic nature. (figure 40) In making these early and important conceptual works, Venet's focus was upon the fixed, unambiguous nature of Bertin's concept of monosemy.

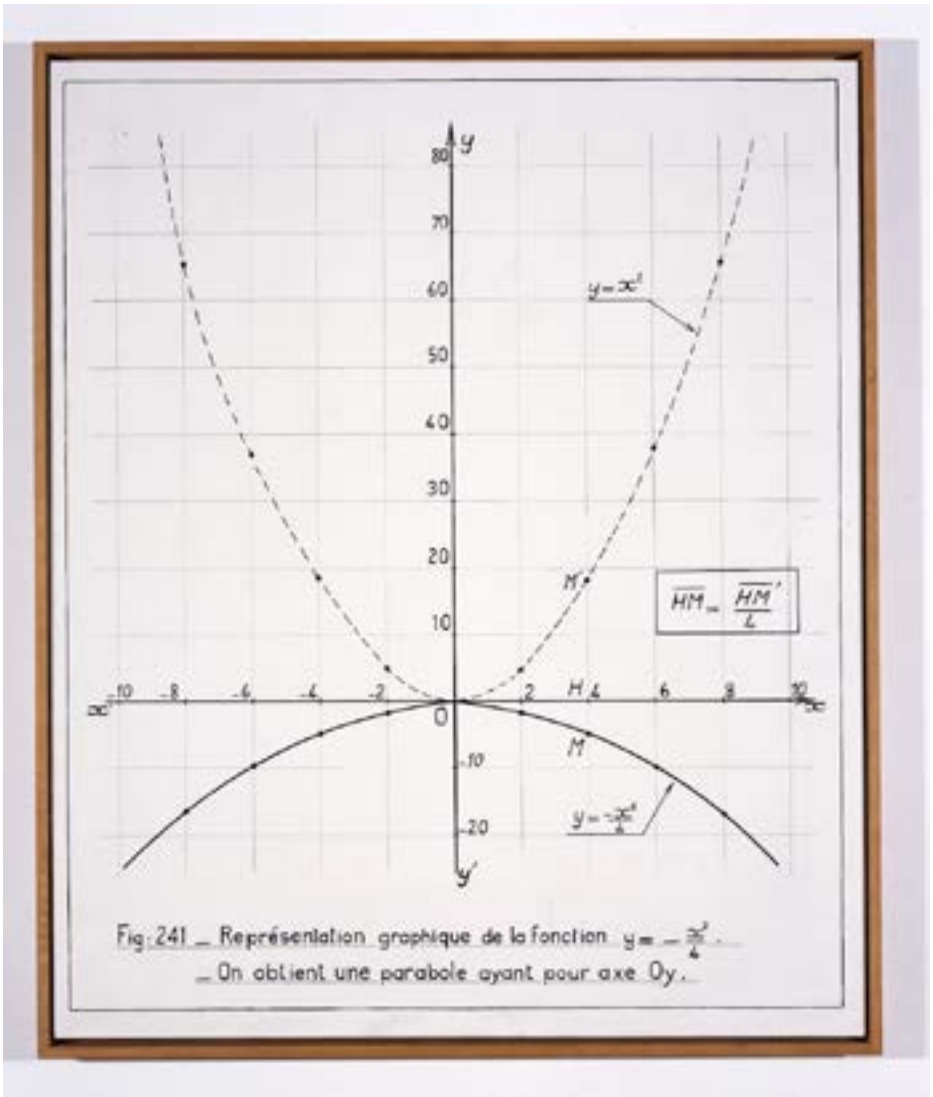


Figure 40: Bernar Venet, *Représentation graphique de la fonction y=-x^2/4*, 1966, Acrylic on canvas, 146 x 121 cm

The French geographer, cartographer and theorist Jaques Bertin proposed three levels of signification in his monumental work *Semiologie Graphique* (Semiology of Graphics), which, published in 1967, laid the foundations for the modern study of information graphics.

Bertin proposed the term *pansemic* to describe those abstract images with what he called a universal, or seemingly infinite number of possible readings, as is the case with Eco's *open work*. Polysemic or figurative images on the other hand were restricted in the number of ways in which they can be read, whilst monosemic images presented only one level of signification and thus one way in which they are intended to be read. Venet made this the subject of his 1971 painting *Degrees of Abstraction After Jacques Bertin*, a diagrammatic summary of his conception of monosemic art (figure 41).

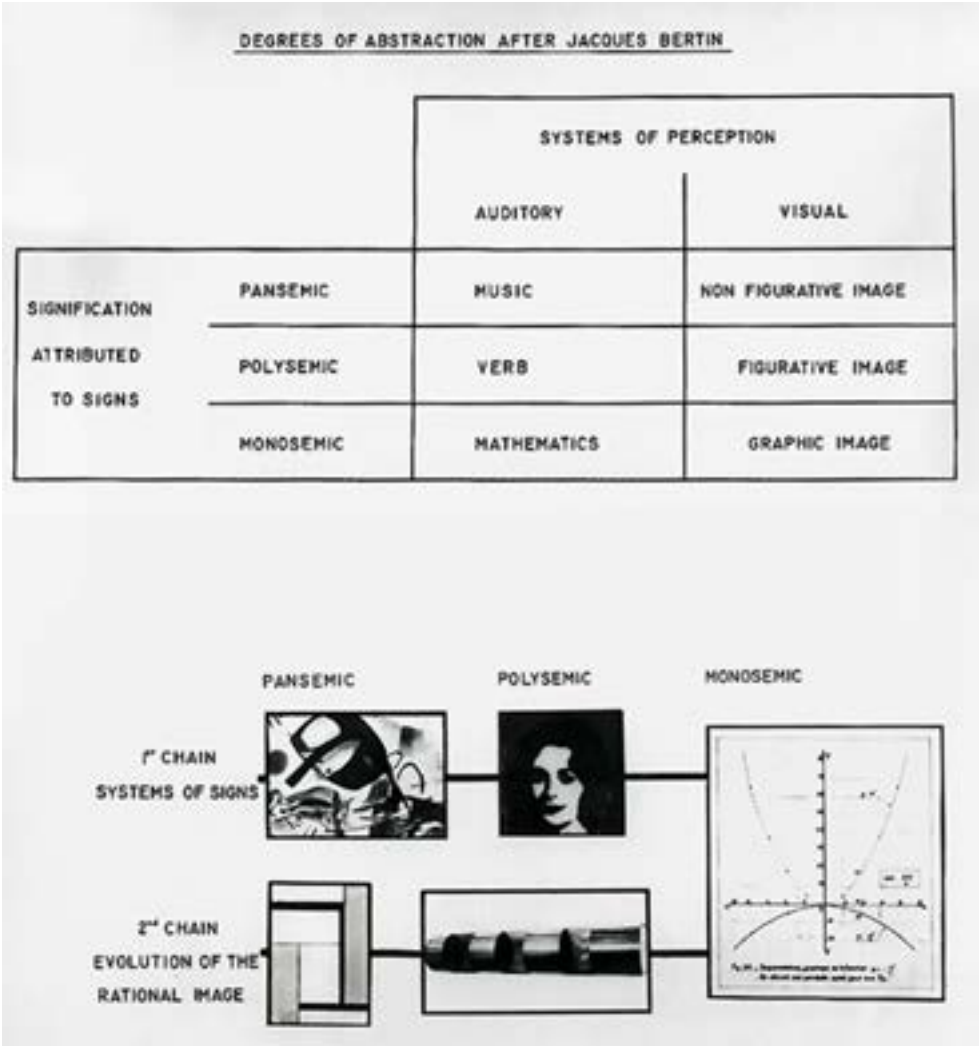


Figure 41: Bernar Venet, *Degrees of Abstraction After Jacques Bertin*, 1971, Ink, collage on paper. Private collection, Italy.

To the majority of non-specialist viewers and, as Venet readily admits, to the artist himself, these symbolically hermetic equations written in the vernacular of applied and pure mathematics remain impenetrable concepts.[aj] Venet has described his reverence toward the symbols that he uses in religious terms, and this in turn has effected his choice of materials, such as his use of the colour gold with it's connection to Russian icon paintings.

aj In semiotic terms, Venet is employing signs with extremely low *motivation*. The less motivated the sign, the more learning of an agreed convention is required in order to understand their meaning.

In a move that mirrors Sol LeWitt's rejection of a the colourless austerity of his early works, and the saturation of his later works with vivid colour, over time Venet's equation paintings have come to deal directly with issues of artistic aesthetics, such as colour, form and materiality. (figure 42) Venet himself states that "I thought that I had pushed my process to its extreme limits and this called for an end". [162] In describing his 2012 exhibition of his saturation paintings, Venet states that:

> All these equations come from Kurt Gödel, who was the most intelligent and most abstract mind that ever existed on earth, and knowing that, to me, it's a bit like the word of God. So painting these equations in gold, they become icons, like the ones you see in Russia, that you look at with great respect. And when I use shaped canvases, which is what I'm doing now, they recall the oriole of the Saints. We are in the sublime. [163]

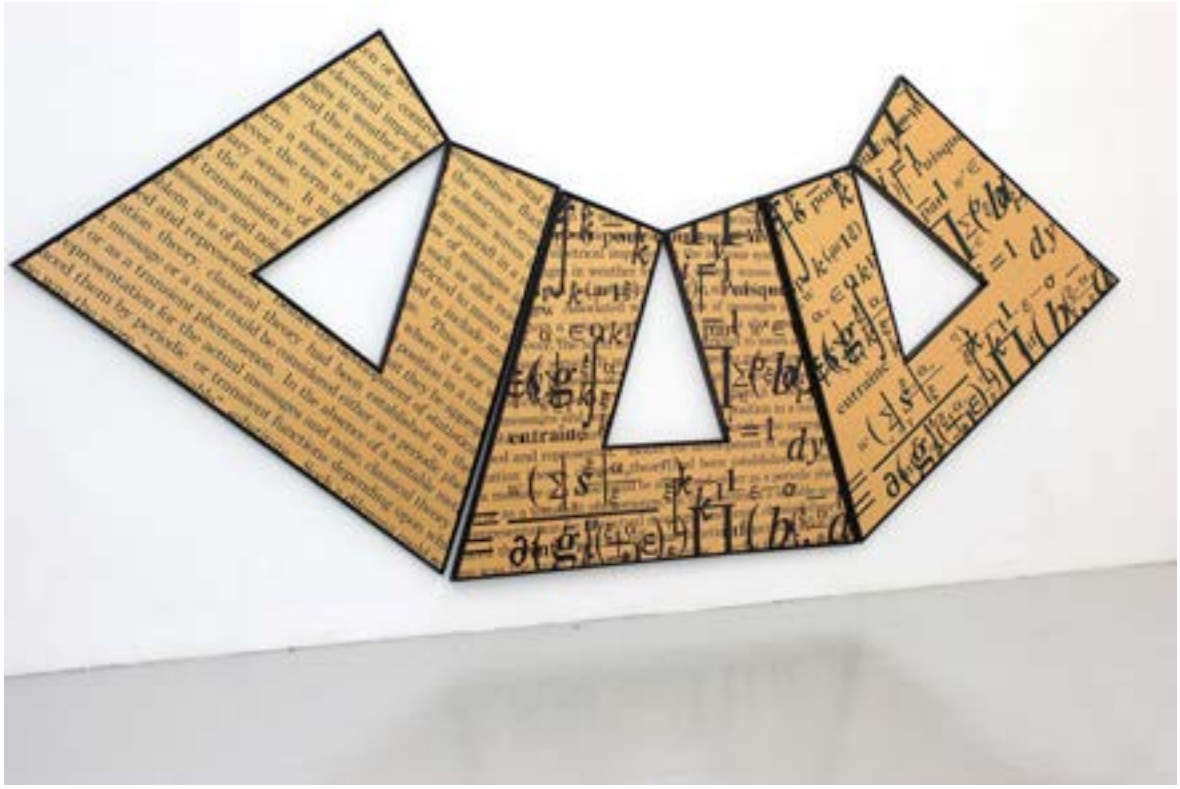


Figure 42: Bernar Venet, Gold Triptych with Two Saturations, 2009,
Acrylic on canvas, 247 x 592.5 cm

Donald Kuspit writes of the interplay of romantic notions of the sublime with the intellectual world of mathematics in Vener's work:

> Bernar Venet seems to be the most intellectual of conceptual artists, but his intellectuality is a means to a romantic end - what Kant called "the feeling of the sublime." Venet has had a life-long affair with mathematics, but the mathematical murals - his descriptive term - that are its grand climax, are more sublime than mathematical, or rather use mathematics as a spring-board to the sublime. They are in fact an inspired rendering of what Kant called "the mathematically sublime." [164]

The poetry of Bernar Venet is also aligns itself with his artistic philosophy, in that it employs non-romantic means to a romantic end. The nineteenth century English Romantic poet Samuel Taylor Coleridge proposed that poetry consists of "the best words in their best order". [165] Much of Venet's process of composition relies not on diction (choosing the "best words") or syntax (arranging the "best order") but on re-contextualizing readymade language.

Venet's approach also rejects William Wordsworth's assertion that "all good poetry is the spontaneous overflow of powerful feelings", in that Venet chooses to fashion found poetry from texts which come from newspapers, scientific and technical publications, dictionaries and other indexes. [166]

Like his art, the poetry of Venet challenges comprehension and accessibility, and the majority of non-specialist viewers are left pondering the hieroglyphic symbols of a specialist scientific and mathematical vernacular, such as with the poem Monostique, the title referencing a monostich, which is a one-line poem, a form that can be traced back to antiquity (See figure 44). The important role that this particular equation was to play in Venet's practice is summarised by Ken Allen in his essay *The A-Poetic poetry of Bernar Venet*:

> ...Venet employs the mathematical symbols and scientific language that were found in his work of the middle to late 1960s. The piece that started him on this track is called Monostique,which was originally conceived of as a poem. Several years ago, Venet decided to install a wall drawing to revitalize his minimalist apartment surroundings, so he cleared off a wall and printed on it the equation of Monostique, one of his earlier mathematical equations-as-poetry. The startling effect of the equation on the wall compelled Venet to reorient his art practice in this direction. [167]

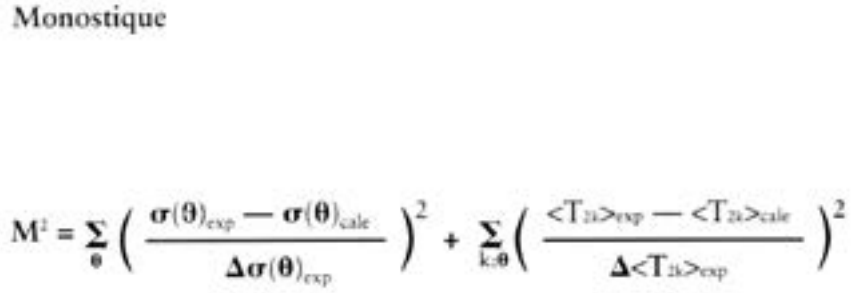


Figure 43: Bernar Venet, *Monostique*, found equation, date unknown.

4.4 Marcel Duchamp: The elements and the Elements

Jaques Nayral wrote of Duchamp's work in a cubist exhibition at the Galeries Dalmau in Barcelona that "[t]he Mathematical spirit seems to dominate Marcel Duchamp. Some of his pictures are pure diagrams, as if he were striving for proofs and synthesis." [168]

Duchamp was deeply interested in the detached, objective qualities of technical diagrammatic drawings, expressing his desire to make "paintings of precision" with a "beauty of indifference." [169] Duchamp writes of his aim to

> go back to a completely dry drawing, a dry conception of art. I was beginning to appreciate the value of exactness, of precision and the importance of chance… And the mechanical drawing was for me the best form of that dry conception of art… a mechanical drawing has no taste in it. [170]

However an often overlooked work which questions our notions of ideal forms in geometry with a degree of poetic pathos is *Unhappy Readymade*, an assisted readymade by Marcel Duchamp, c.1919. (Figures 44 a,b and c) Foreshadowing the production process of LeWitt, Unhappy Readymade consisted of a simple set of instructions sent by post as a wedding gift to his sister Suzanne Duchamp and the artist Jean Crotti. In an interview with Pierre Cabanne, Duchamp described his instructions for Crotti to buy a

> …geometry book which he had to hang by strings on the balcony of his apartment in the rue Condamine; the wind had to go through the book, choose its own problems, turn and tear out the pages. Suzanne did a small painting of it, 'Marcel's Unhappy Readymade.' That's all that's left, since the wind tore it up. It amused me to bring the idea of happy and unhappy into readymades, and then the rain, the wind, the pages flying, it was an amusing idea… [171]

Duchamp's unhappy readymade relies on the contrast between ideal geometric types , their manifestation as token textbook diagrams, and the resulting tones that act to emphasise Duchamp's artistic intentions.

Linda Dalrymple Henderson points out that this was in fact one of Duchamp's last specific comments on geometry, and that the book used was a copy of Euclid's elements, so that, ironically, the plane geometry of Euclid was in contrast to damage caused by the wind and rain, producing tones within the structure of the work as "non-Euclidean deformations of the Euclidean geometries in the text." [172]

In a letter to his sister, Duchamp wrote: "I liked the photo very much of the Ready Made sitting there on the balcony. When it all falls apart you can replace it." [173]

Duchamp also suggests that this is a lesson to be repeated, a reminder of the fundamental difference between an essentialised, idealised, conceptual landscape of perfect forms, and the chaotic nature of decay and change, which composes our everyday experience of the world. Some years later Duchamp told one interviewer that "he had liked disparaging 'the seriousness of a book full of principles,' and suggested to another that, in its exposure to the weather, 'the treatise seriously got the facts of life'". [174]

Duchamp's thoughts echo the romantic period conception of the "dusty textbook universe of the enlightenment", and Goethe's rejection of Diderot's Encyclopédie and d'Holbach's Systems of Nature. [175] To Goethe this academic, hermetic world was dangerous, dark and death-like,

> ...a system of nature was announced; and therefore we hoped to really learn something of nature, - our Idol… But how hollow and empty did we feel in this melancholy, atheistical half-light, in which earth vanished with all its images, heaven with all its stars. [176]

Jochen Bockenmühl, describes the difficulties faced by Goethe in his pursuit of the archetypal phenomenon as the risk of "freezing oneself in abstraction or losing oneself in mystical reverie", adding that "[t]o avoid these potential errors, observers must direct their gaze upon their own thinking activity as well as on the thing itself." [177]

Duchamp and LeWitt's introspective use of wit, irony and failure in their work act as antidotes to these issues, and reminders of the limitations of rational investigation, and how a very human form of poetry can exist when such limits are creatively confronted.

This chapter has explored some of the fundamental semiotic differences between the diagrams of science and those of art. It also highlights the particular aspects of diagrammatic art that allow it to appear objective in nature and yet maintain a subjective element in order to create what I describe as a Romantic-Objective resonance.

Chapter 5 considers the diagrammatic aesthetic of contemporary fine art, and how artists incorporate aspects of contemporary science, culture and society, as well as respond to the information technology revolution in a romantically objective way.

Figure 44a:
Unknown artist,
Photograph of Unhappy
Readymade, 1920

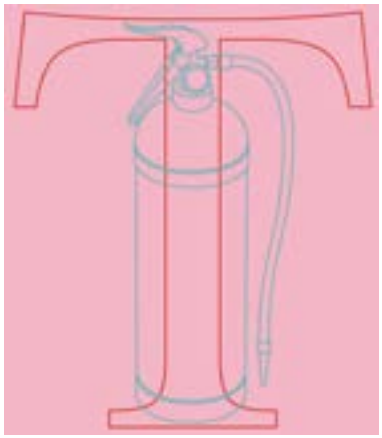
Figure 44b:
Suzanne Duchamp,
Unhappy readymade,
Oil on canvas, 1920

Figure 44c: Marcel Duchamp,
Unhappy ready made, Box in
a valise version, re-touched
photograph, 1935 - 41

Chapter 5: Romantic Objectivism: The diagram in contemporary art

"Art is the imposing of a pattern on experience,
and our aesthetic enjoyment is recognition of the pattern." [178]

Alfred North Whitehead



af

The aim of this chapter is to provide an insight into the scope of contemporary diagrammatic art in order to begin to map out the variety of ways that contemporary artists incorporate the diagram in their practice. Map 1 juxtaposes one hundred diagrammatic artworks from the last one hundred years, classifying them into subgroups in order to explore the ways in which these artists and their works relate to one another. From this list, six artists have been selected to highlight the great range of media capable of being incorporated diagrammatically, and to underline the complex range of issues that a diagrammatic approach to art allows them to explore.

The above quote from the physicist Alfred North Whitehead can be brought up to date by adding that there is a certain type of enjoyment to be found in not entirely recognizing what one is looking at, when, in Umberto Eco's words, the interpreter "tries to accept the challenge posed by this open message, and to fill the invisible form by his or her own codes". [179] The visual aesthetic style of the diagram is normally associated with a clarity and precision of explanation, an authoritative presentation of information made plain. When the diagram is involved in the construction and erosion of literal meaning in an artwork, we are left with a Romantic-Objective resonance, the uncertainty felt among a multiplicity of meanings, which the viewer must deal with in a poetically-constructive way.

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af Michael Craig Martin, Alphabet Series, Letter T, Screen Print, 2007

In discussing scientific diagrams as part of a *generative* cognitive field, Kenneth Knoespel writes that:

> Paintings, like diagrams, identify the cognitive space in which meaning is generated… While oriented by language, our thought process is shaped in fundamental ways by pattern recognition and pattern manipulation. Models and diagrams embody strategies of writing that function as vehicles for constituting idiosyncratic coherence and meaning. [180]

Diagrammatic art occupies all three levels of Bertin's semiotic categories, from the Pansemic abstract work of Cy Twombly and Wassily Kandinsky, to the polysemic figurative works of Picasso's analytic cubism and Francis Bacon . As we have seen in chapter 4, several artists have made various attempts to reduce tones to their bare minimum, the most reduced of which are to found on map 1 in closest proximity to a central heideggerian clearing - an ideal, unreachable and self-contradictory goal of pure objectivity in artistic expression.

A commonly shared feature of all of these approaches (towards open *and* closed semiotic code systems) is that they present the viewer with a diagrammatic art work that is "... both a didactic work... based on a severe demand for objectivity... and a poetic work...", as Roland Barthes describes the plates of the Renaissance encyclopedia, " an aesthetics of bareness… and almost sacred simplicity… an austerity of creation." [181]

Other concepts around which artists works converge, as revealed in Map 1, are:

- Diagramming Gesture: physically and restraint
- Sensorial diagrams: visual, acoustic and somatic
- Anatomical and psychological diagrams
- Hodological diagramming: restricting and controlling movement
- Mapping objects, concepts, places and experience
- Difference and similarity
- Complexity and Emergence
- Didactic diagramming
- Narratives
- Dimensionality and the attempt to depict higher dimensions
- Constructive and deconstructive diagrammatic forms
- Encyclopaedia-like categorisations
- Ideal Platonic forms
- Perspective
- Astronomy and astronomical alignments
- Colour
- Indexical diagrams

5.1 The Taxonomy of Neurosis: Yves Netzhammer and Mark Manders

The Swiss artist Yves Netzhammer and the Dutch artist Mark Manders present us with methodological systems of investigation into the hidden psychology of space, object and image. Each artist has developed ways of inducing uneasy feelings of empathy within the viewer while maintaining positions of radical detachment. In a world ruled by understanding, they present us with objects, images and installations that cannot be entirely comprehended, leaving the viewer to rely upon their own subjective intuition in order to identify with the work.

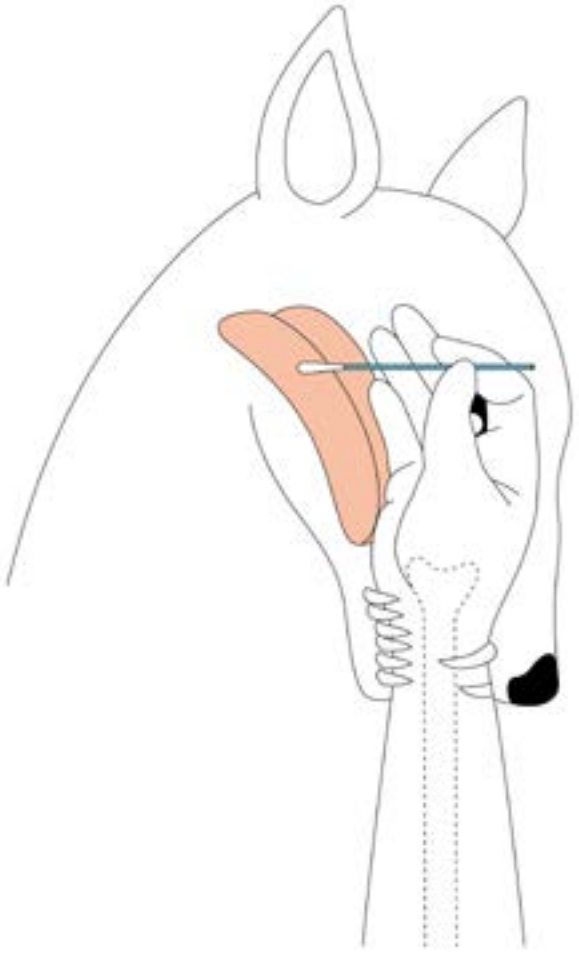

Figure 45: Yves Netzhammer, Untitled, Seilzeichnung, 2011,
computer drawing, courtesy of the artist.

Netzhammer begins with what he describes as a *stockpile of conjectures*, a growing collection of preliminary sketches that compose his process of visual thinking. [182]

Netzhammer then develops these ideas into finished drawings, animations, sculptures and installations, all with a distinct aesthetic of economised line, form, colour and movement (figure 45, 46). His use of computer illustration and modeling programs further distances the hand of the artist from his own work in a way that is reminiscent of Duchamp's idealised *paintings of precision*, artworks purified of all irregularities that are left to exist in an airless, ideal realm.

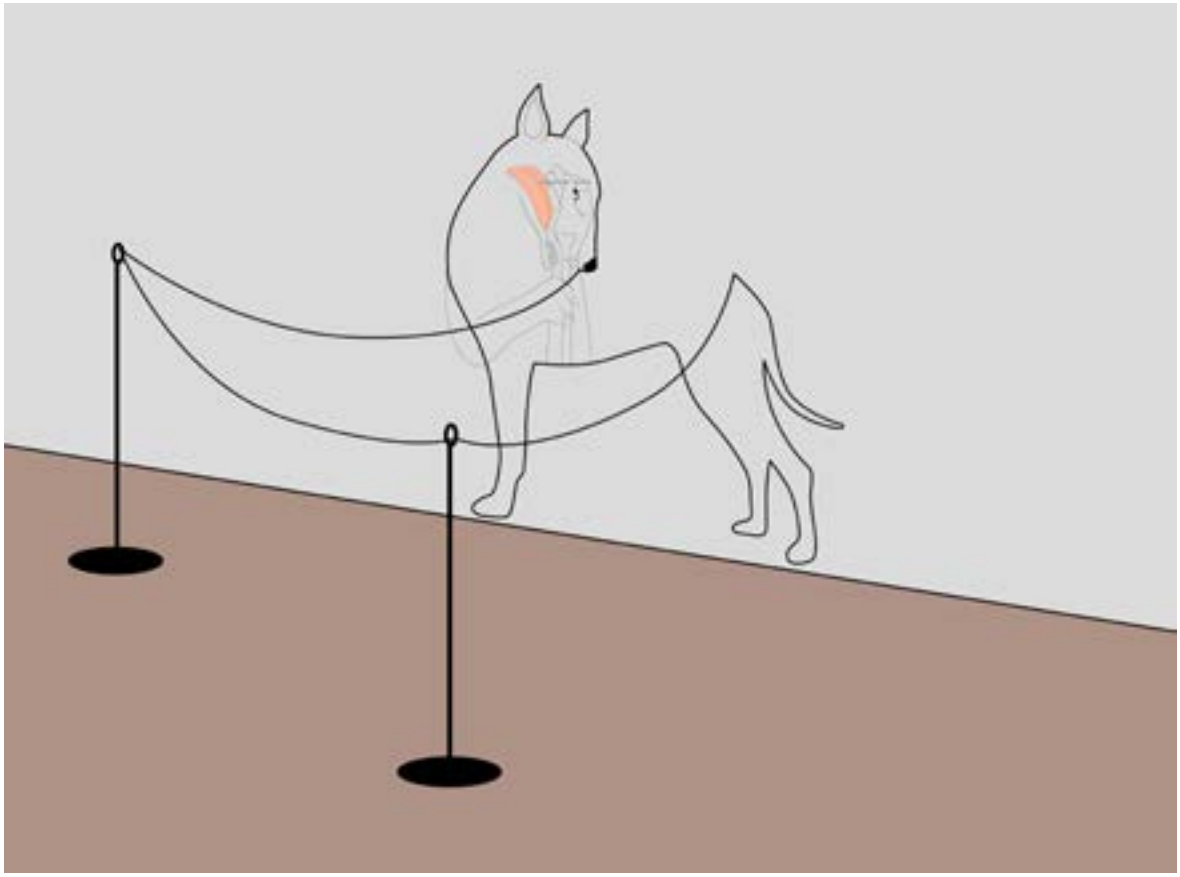

Figure 46: Yves Netzhammer, *Untitled*, *Seilzeichnung*, 2011,
Rope, metal, wood, glass and colour, variable dimensions

Netzhammer explores the philosophical and psychological aspects of the complex relationships between humans, animals, objects and tools and the natural environment. Certain symbolic elements of his work are common to other diagrammatic artists, such as Mark Mander's use of cross section, architectural spatial constructs, interconnected forms and the lines which not only divide but connect, and in some cases bind, objects and ideas together. Emotionally engaging elements within the work encourage feelings of both repulsion and empathy and serve to involve the viewer subjectively, accentuated by the antiseptic aesthetic of the imagery.

After initial studies in architecture where he received training in architectural draughting, Netzhammer enrolled at Zurich's Hochschule für Gestaltung und Kunst, where he attended the figurative arts course.

Netzhammer depicts human forms in a way that highlights their artificiality: featureless, art school life drawing mannequins, crash test dummies and shop display models. These human forms are presented in spaces constructed in the idealised, neutral style of computer-aided design programs of architectural modeling, with a single light source to directed the viewers attention to the objective artificiality of this system of visualisation.

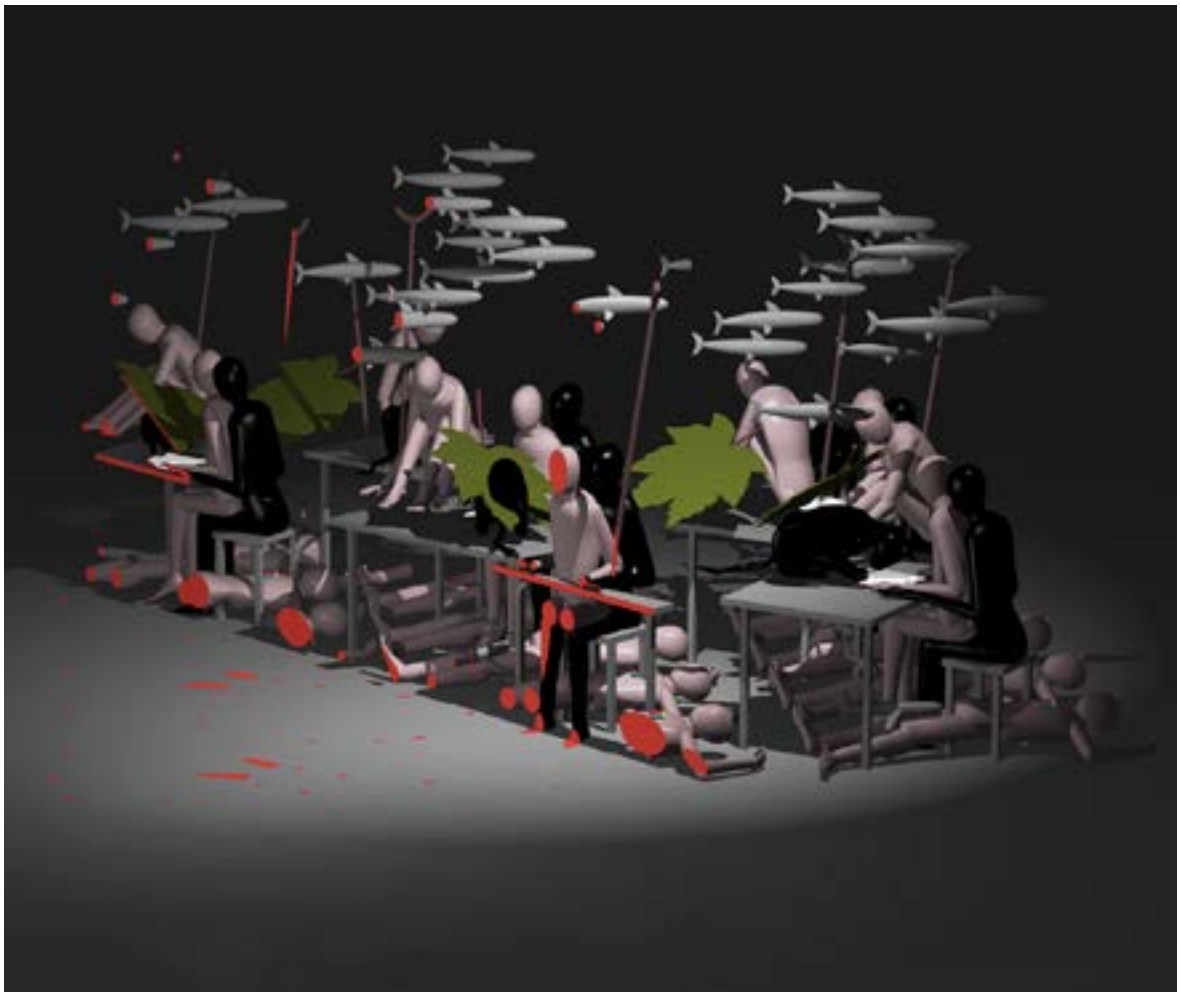

Figure 47: Yves Netzhammer, video still from installation *Dialogical Abrasion,* Liverpool Biennial, 2010, Immersive sculptural installation with a animation.

When questioned about his use of the diagrammatic format in his drawings, installations and video works, and what it affords him as an artist, Netzhammer replied that

> It started, in my case, in looking for another way to show a new form of subjectivity. I positioned the computer between me and my thoughts/wishes. I guess, I prefer the diagrammatic "style", because I'm really trying to find "something" (connected to philosophical questions). Not in the common scientific sense of discovery, but something which appears close to our questions about identity. I hope that an artistic approach to forms of empathy can generate such results, especially, when it comes in a paradoxical format like drawings, which stands in the tradition of explanation. [183]

Mark Manders describes himself as "a human being who unfolds into a horrifying amount of language and materials by means of very precise conceptual constructions." [184] Since 1986, Manders has been constructing what he calls a 'self-portrait as a building'. He uses this conceptual framework to represent the fictional artist, "Mark Manders", a distinct alter-ego that he describes as a "neurotic, sensitive individual who can only exist in an artificial world." [185]

The building as self-portrait exists as an evolving floor plan, a Platonic ideal or, in C.S. Peirce's terms, a type, so that each exhibition results in a constantly-changing token installation (figure 48). Manders uses this architectural, diagrammatic concept to actively develop his work, referring to his ideal building as a machine which makes decisions that guide his practice. Such an approach simultaneously references both LeWitt's idea of the art-making machine and Deleuze's description of the diagram as abstract machine, with Manders writing that "The work wants me to do things that I would never do as a person." [186]

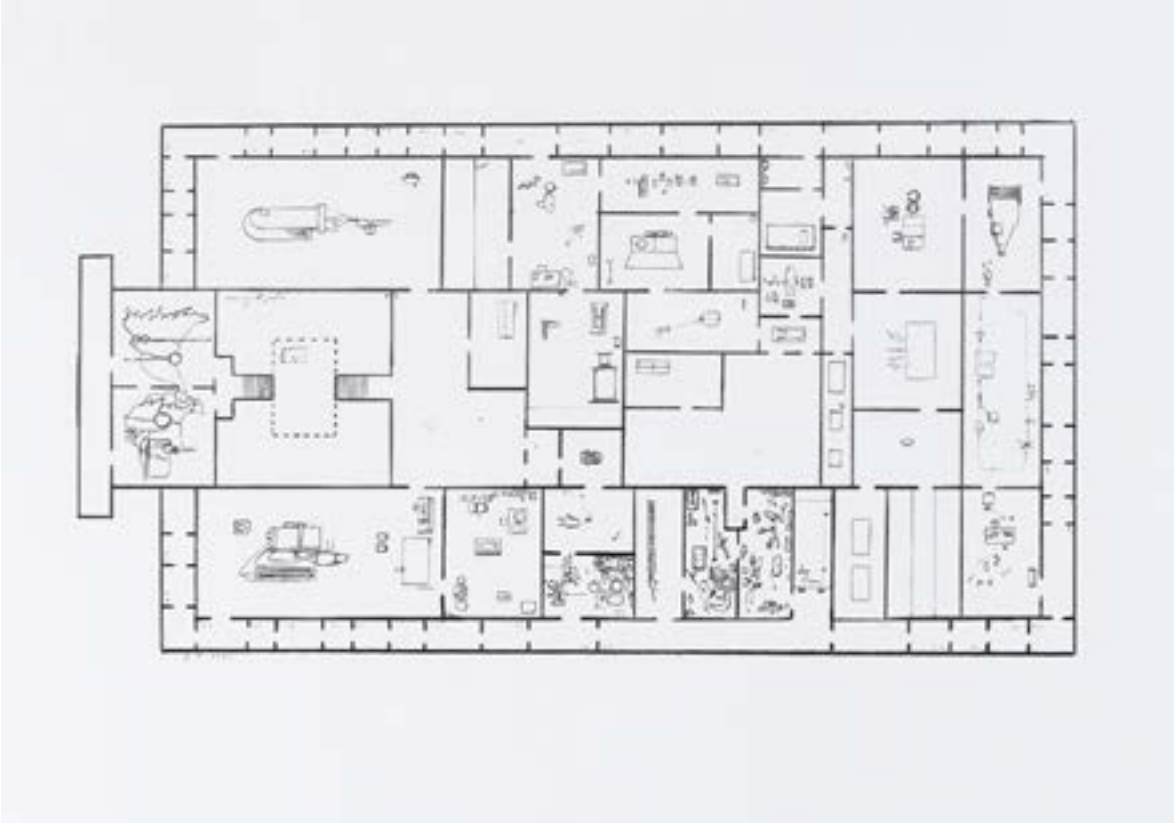

Figure 48: Mark Manders, Drawing with Shoe Movement /
Floor Plans from Self-Portrait as a Building, 2002, Pencil on paper

> The building is fiction, but everything inside exists in reality. The building is like a gigantic stage set frozen in time with lots of rooms that all seem as if they have just been abandoned… Like an encyclopedia, the building is always ready, even though it keeps on changing and growing or shrinking. [187]

Manders' machines and factory-like constructions have been described by Stephen Berg as "laboratory constellations for uncertainty and unknowable discoveries, production plants for dissident thoughts, transmitters for contacting the fictional." [188] The viewer is presented with an authoritative air of preplanned functionality and methodological certainty, which, to a large extent relies upon the use of a diagrammatic format.

Figure 49: Mark Manders, *Finished Sentence*, 1998-2006,
iron, ceramic, teabags, offset print on paper, 336 x 185 x 85 cm

Like Netzhammer, Manders' practice incorporates the diagrammatic format in all three of the ways that this thesis proposes the diagram is used in art; that is, the diagram as aesthetic, as creative tool and as organised (hodological) experience. Many of his sculptures present themselves as formal, diagrammatic constructs, models and pseudo-scientific experiments left unattended. Manders' floor plans and delicate pencil drawings show his use of the diagram as a creative visual and conceptual tool, whilst the architectural nature of Manders' installations guide viewers through carefully prearranged objects in a series of constructed environments, which the artist refers to as "memory spaces". [189]

In a short 1998 text *On Drawings*, Manders describes how the process of drawing "is more an investigation of thought than an investigation of observation. Before I've drawn them, the drawings are often as short and compact as thought. It's interesting to look at yourself from the outside as you are drawing and see how the thoughts you portray are partly visual and partly linguistic... A drawing is a transparent skin suspended between the artist and the spectator for comparison." [190]

Manders interest in linguistics is apparent throughout his practice, and is referenced sometimes as a title, as with the sculpture shown in figure 49, or in a series of works such as the artist's Newspaper project (figure 50). Manders claims to have compiled a finite database of all existing words in the English language, from which he constructs random texts to be printed as newspapers. Each word can only be used once, thus limiting the number of newspapers that can be made. The result is a chaotic, surreal and disjointed text, which he intersperses with photographs of his studio works in progress and ephemeral images of dust and detritus from his studio floor.

Figure 50: Mark Manders, *Perspective Study*, 2010,
offset print on paper, pencil on paper, chicken wire, wood, 91.4 x 61 cm

This over-arching use of the diagrammatic format results in a feeling of conceptual coherency to the artistic practices of both Manders and Netzhammer. It is also strikingly apparent in the practices of Duchamp, Arakawa and Eliason, as observed in chapter 3, and the practice and theoretical writings of Mathew Ritchie as discussed below.

5.2: The technological sublime: Maurizio Bolognini and teamLab

In 1988, Maurizio Bolognini began using personal computers to generate what he called *flows* of continuously-expanding random images. In the 1990s, the artist pre-programmed hundreds of computers with vast numbers of images and left them to run their algorithms, often sealing the monitor connections with wax to prevent any display of their graphic output. The images are forced to exist within the computers as binary codes, and viewers walk among the buzzing machines of the installation attempting to imagine the virtual aesthetic dimension in which the images could be said to exist (figure 51). Bolgnini states that:

> I am not interested in the formal quality of the images produced by my installations but rather in their flow, their limitlessness in space and time, and the possibility of creating parallel universes of information made up of kilometers of images and infinite trajectories. My installations serve to generate out-of-control infinities. [191]

Figure 51: Maurizio Bolognini, Untitled, 1992-2003,
Installazione di Macchine programmate/ Programmed Machines (Sealed series).

As opposed to an aesthetics of form, Bolognini's work is associated with Mario Costa's theory of an *aesthetic flux* and his notion of the *technological sublime*. The artist himself traces his work back to Dada, John Cage and conceptual artists such as Sol LeWitt, whose combinations of basic forms were also determined by external rules. [192]

Preferring the expression *superimage* to describe the virtual images generated by his machines, Bolognini's concept of the metaphysical origins of his art is comparable to Goethe's archetypal phenomena (Urphanomen) as discussed in Chapter 2. Bolognini himself describes how he never thinks of computer code or devices in terms of style, but rather as a kind of DNA, and how new technologies allow artistic research to finally move from the representation of reality to the functioning of reality. [193]

Bolognini's SMSMS (Short Message Service Mediated Sublime) and CIMs (Collective Intelligence Machines) allows an intervention into the flow of superimages being created by his sealed computers. This is done by means of a mobile phone text message that temporarily allows images to be displayed by a projector on to a gallery wall. The system, which is based on a collective intelligence technique, causes the images to change continuously, according to the preferences of the public. (figure 52)

Figure 52: Maurizio Bolognini, *SMSMS (SMS Sublime Mediated)*, series CIMs (Collective Intelligence Machines), installation (programmed computers, telephones, projectors), 2002-04.

teamLab is a group of ”ultra-technologists” based in Japan, consisting of specialists from the world of information technology including programmers, user interface engineers, database engineers, network engineers, hardware engineers, computer vision engineers, software architects, mathematicians, architects, CG animators, web designers, graphic designers, artists and editors.

Figure 53a: teamLab, *Universe of Water Particles*, 2013, computer graphic, ultra high resolution monitor

Describing their work as an "ultra-subjective space", they create artworks in virtual computer environments according to an aesthetics of logical construction that they consider to be unique to Japanese spatial awareness in art. [194] Like the work of Bolognini, many teamLab projects interact with the viewer by means of smart phones and computer tablets.

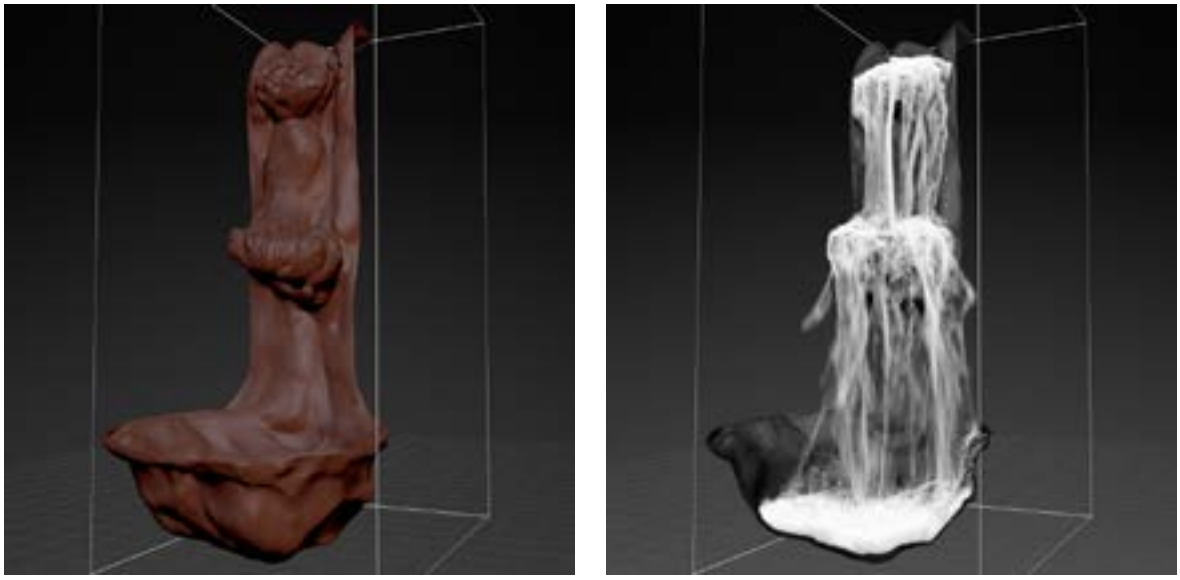

Figure 53b: teamLab, computer model of geological formation for *Universes of water particles*

Universe of Water Particles is a computer simulation of a waterfall created in ultra-high resolution (five times that of current consumer HD display capabilities) which allows the intricacies of the work to be captured in overwhelming detail. Having first sculpted a computer model of a virtual rock (figure 53a), hundreds of thousands of water particles are rendered to simulate the physical motion of their cascade over the virtual geological form in accordance with the laws of physics (figure 53b).

However the aesthetic aim of the simulation is not entirely towards hyper-realism. Instead the rendering involves the subtle imitation of the depiction of fluid motion in traditional Japanese painting to create what this thesis refers to as a Romantic-Objective resonance within the work. In order to do so, teamLab create a time lag during the simulation, leaving afterimages of the particles as slowing fading lines.

> *Universe of Water Particles* embodies an integration of the modern objective world, as regulated by common sense, and the subjective world of our ancestors... When viewing the work, if one feels that rather than just it being a physical simulation of a waterfall, there is something within the lines from which they feel a presence of life, then perhaps there is an element of that subjectivity of our ancestors that is extant in our objective perceiving of the world today. [195]

The algorithms employed by teamLab in order to model water embody a combination of essentialism (the deliberate simplification of a phenomenon), reductivism (the fragmentation of a phenomenon in to its component parts for analysis) and idealism (the grouping of 'kinds of things' according to essential properties). The model also relies up on our modern understanding of the molecular nature of water and the complex equations of fluid dynamics underlying the emergent properties of laminar and turbulent flow.

Viewers of the work are presented with the natural phenomenon of a waterfall whilst aware of its existence as a simulation arising from high resolution, data-intensive computing, thus aligning the work with Bolognini's concept of *flow* made manifest in his SMSMS projects, and the technological sublime. In recent projects teamLab actively incorporate the wire-frame constructs of their computer models as part of the presentation, revealing the generative processes and rendering of the image via the monitor. Taking flora and fauna from traditional Chinese and Japanese genre-paintings, these organic forms develop, move and interact before the viewers eyes, often programmed in a way that produces Japanese Kanji (Chinese logographic characters) within the structure of the image. (figure 54)

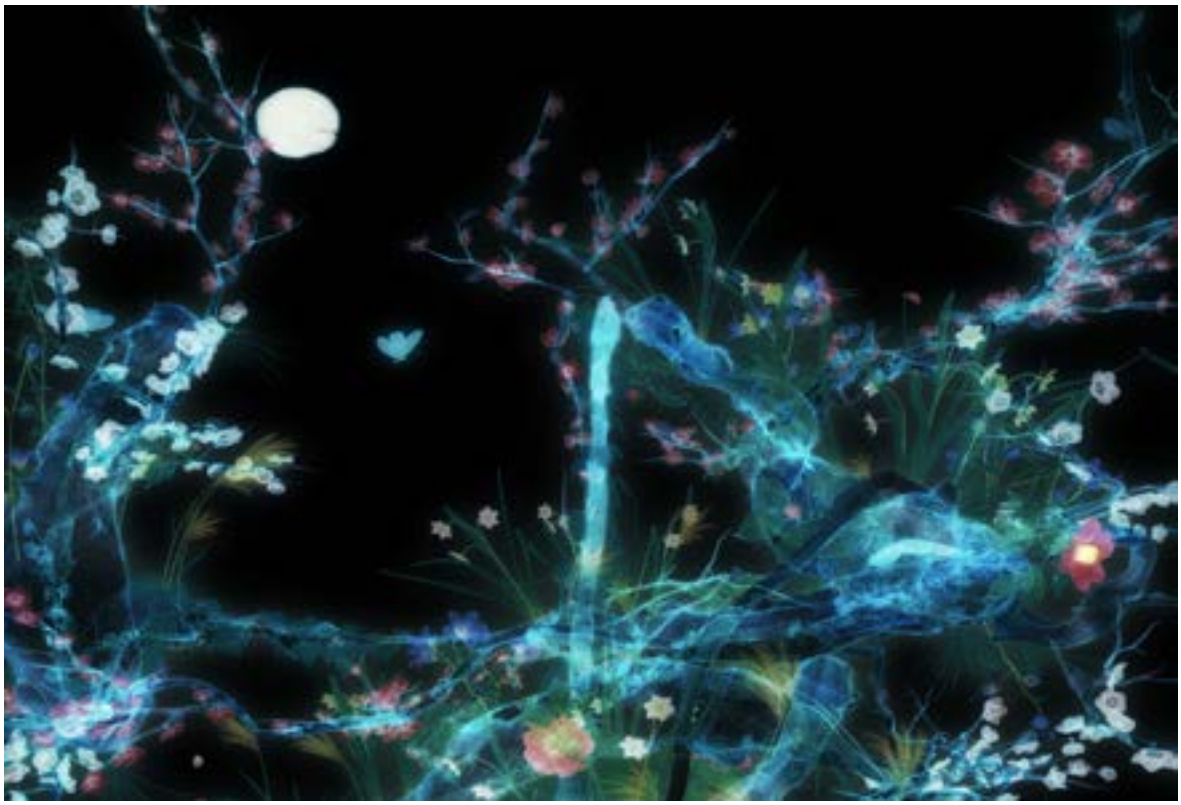

Figure 54: teamLab, *Cold Life*, detail of still from Digital video, 2011, 7mins, 15sec (loop)

5.3: Complexity and emergence: Matthew Ritchie and Julie Mehretu

> "If all this seems romantic, it is. The diagram is a trace of our collective efforts to articulate and negotiate an almost impossible circumstance: reality itself." [196]
>
> Matthew Ritchie

The ambitious goals of Matthew Ritchie include not only to represent the entire universe, but also the conceptual and visual structures of knowledge and belief constructed by humans in their attempt to understand it. Ritchie compares this impossible task to "trying to describe and include what cannot be systematized", correlating it to what is known as an outside context question. [197] Such questions include whether or not Bertrand Russell's paradoxical 'set of all possible sets' can exist, issues of a priori consciousness and the origins of the source materials of the Big Bang.

In other words, Ritchie is attempting to reconsider new ways to "perceive the structure that contains the model of our perception." [198] His practice deals with information and ways of mapping and interacting with it that ultimately lead to the emergence of new, and tangible objects. The ever expanding horizon of his project makes no discrimination between our personal knowledge structures and those officially sanctioned as scientific, so that conspiracy theories are placed alongside the Grand Unified Theory of science, and creationist debates set side by side with evolutionary theory.

Figure 55: Matthew Ritchie, *Afterlives*, 2002, oil and ink on canvas, 223.8 x 391.7 cm.

The process and results of Ritchie's investigations constitute:

> an omnivorous visualisation system constantly generating multiple meanings [driven by] a fathomless desire, both a weakness and a strength… in order to do such a thing, you have to turn information into a physical form. [199]

The forms chosen by Ritchie include elaborate and interconnected constellation of drawings, prints, paintings, sculptures, projections, light box images, floor-to-ceiling installations, performance and short stories. The visual languages of these forms consist of complex, organic diagrams and models which unite the diversity of his work together into a narrative structure that evolves over time; from information, to map, to object, location and experience - abstract forces generating figurative environments.

The painting *Afterlives* (figure 55), taken from the 2002 exhibition of the same name, is an exploded diagram of the landscape in its literal sense, one of the themes running through the exhibition being a mythical narrative suggestive of apocalypse and the day of judgment. Amongst the turbulence of debris and disassembled figures are sketched lines that appear to denote clarity of position, movement and order within the chaos, as if the all knowing intellect of Laplace's demon is at work, following in the most minute of details some epic, final process of deconstruction. [ag] As a backdrop to the exhibition, black, acrylic wall drawings ran behind the paintings and a large mural *Off the Hook*, in sintra and enamel spills onto the floor and from which metal spears arise.

Ritchie's practice is part of a lineage of artists exploring alternative ways of dealing with information in its pure form, and how it can be made manifest in a process mediated by the use of the diagrammatic format in its various guises. From the basic technologies involved in Sol LeWitt's instruction based wall drawings to the pre-programmed computers and telecommunication networks of Bolognini's SMSMS project, it is an interplay of deterministic order and pattern with the indeterminacy of chance and chaos from which a Romantic-Objective resonance arises. In LeWitt's case there is a certain poetry to the gestural traces of the makers hand in contrast to the clinical logic of the process of execution. In Bolognini's case the participant who accesses his closed system of flow has a momentary chance to interact with the sublime via their mobile phones.

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ag Pierre-Simon Laplace in 1814 proposed "An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit these data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes." To a creature of such vast intellect and awareness, according to a classical, deterministic view of the Universe, the future would be foreseeable. This entirely mechanical and thus predictable view of the universe is no longer compatible with the view of contemporary science due to the findings of chaos theory, thermodynamics and quantum dynamics. (Laplace, Pierre Simon, A Philosophical Essay on Probabilities, translated into English from the original French 6th ed. by Truscott,F.W. and Emory,F.L., Dover Publications (New York, 1951) p.4)

In Ritchie's case however, the scope of his approach is vast and all inclusive, revealing the multitude of ways in which information can act as a fountain head for the creative processes. Ritchie draws upon the whole gamut of technological processes and construction techniques from engineering to manufacturing and architecture, proposing that it is the duty of the artist living in a knowledge and information based society to blur the lines between fact and fantasy, and to unlock the vast potential of our whole ideosphere, a conceptual landscape of memetic evolution where ideas are created, evaluated and evolve. [200]

What is also becoming increasingly apparent is that it is by diagrammatic means that we will access, manipulate and transmutate this abundance of information, and find new ways to deal with the stuff of thought through diagram's close association with metaphor, the creative process and our experience of reality itself.

Figure 56: Matthew Ritchie, *The Evening Line*, 2008-9, Aluminium, epoxy, vinyl, video. In collaboration with: Aranda\Lasch, Daniel Bosia & Arup AGU (Concept, drawings & video by Matthew Ritchie), Installation view: International Biennial of Contemporary Art of Seville

The evening line is a collaborative project between the artist and architects Benjamin Aranda and Chris Lasch, researchers who specialize in algorithmic design and write of how the project was

> Imagined as a ruin from the future... a drawing in space, where each line connects to other lines to form a network of intertwining figures and narratives with no single beginning or end, entrance or exit, only movements around multiple centers that together trace out a dense web of ideas concerning the history and structure of the universe and our place in it. [201]

Figure 57, Matthew Ritchie, Benjamin Aranda and Chris Lasch,
rendered computer models of *The Evening Line*, 2008 - Present.

The collaborative network which led to its design, construction and use spreads much further however, and includes other artists and architects, physicists, mathematicians, engineers, musicians, and performers, each of whom contribute specialist information to create new forms. Together they investigate the question how an architectural language can be developed where geometry and expression are intrinsically united.

Conceived of as both an autonomous and site specific modular structure, *The Morning line* was envisioned as an infinitely scalable construct based upon a truncated tetrahedron, a unit referred to by Ritchie as a 'bit', a fractal building block. (figure 57) Sanford Kwinter believes that the project

> ...introduces a new type of object into our world: environmental but not burdened by rationale and utility as would be a standard work of architecture; logical in its propagation and organization yet also in a state of magic compression, like the cosmological constants that characterize at once the universe of the late-medieval cosmologist Nicholas of Cusa and the contemporary "scientific" universes of string and brane theory. [202]

Ritchie is also actively engaged in diagrammatic research, organizing conferences and exhibitions such *The Temptation of the Diagram* held in 2013 at the Martha Rosen Gallery, New York. The show consisted of hand-made diagrams, described by Ritchie as occupying:

> the impossible space between idea and reality. Perhaps they can somewhat counter the residual presumption that thinking runs counter to aesthetic contemplation; that intelligence is not beautiful. [203]

The intricate, architectural, narrative works of Julie Mehretu make various art historical references, from the mystical, geometric abstraction of Kazimir Malevich to the dynamism of the Italian Futurists. They also incorporate elements of Abstract Expressionist colour field painting. Mehretu describes how the use of abstraction allows her to fuse architecture and drawing to develop a form of "investigative drawing", enabling the creation of marks that could not exist through rational thought processes alone.[204] The way Mehretu uses these marks to help dictate forms relates her process of working to the diagram in the Deleuzian sense, and to that of Francis Bacon (as discussed in Chapter 1).

The architectural aesthetic of skeletonized blueprints and refined draftsmanship allow Mehretu a framework upon which she is able to build and develop a subjective poetics in her work, described by the artist as an "intuitive knowledge which is underneath the surface" of the painting. [205] The diagrammatic aspect to Mehretu's working process is also apparent in the way the artist talks about her preparatory work in the studio, how ideas for the work arise as a network of intuitive abstractions made from the many images which she surrounds herself with in her place of work. In this way, individual images don't enter the work directly, but allow Mehretu to create her own visual language at at higher level of abstraction. [206]

Figure 58: Julie Mehretu, *Stadia II*, 2004, Istanbul,
Ink and acrylic on canvas , 272 x 355.6 cm

Each of Mehretu's paintings acknowledges but also evolves away from the works which preceded it, in a cumulative nature that is similar to the working processes of Yves Netzhammer, Mark Manders, Maurizio Bolognini and Matthew Ritchie.

Within Mehretu's deeply-layered images are diagrams of architectural facades, floor plans of international airports, stadium plans, and systems of public transport. These are overlaid one upon the other until they become a dense pattern of lines and intricate shapes. There are also contrasting sensitive and aggressive gestural marks, fragments of graffiti, newspaper photographs, tattoos and coloured brush strokes, all acting to emphasise the dynamic visual nature of the paintings that directs the gaze of the viewer among the various systems of her imagery.

Mehretu also draws upon various geographies, political histories and wars to create narratives that signify social agency, capturing a contemporary preoccupation with power, history and globalization. Her paintings also suggest the unraveling of a more personal biography, and a communal identity in relation to space and place.

Stadia II (Istanbul) was painted in the immediate aftermath of the 2003 invasion of Iraq by the United States, followed very closely by the 2004 Olympic games in Athens. (figure 58) This contrast of events, both set on the World stage, was the context within which Mehretu worked on her painting of stadiums depicted as super-imposed super-structures, volatile arenas of conflict and aggression, and saturated with so much signage as to become, in the words of the artist, "one abstract language". [207] Mehretu recalls the way in which everyone talked about both the events of war and international sports as if they were "happening in this massive arena. It felt like the whole world had been reduced to that kind of space." [208]

> ...the coliseum, the amphitheatre, and the stadium are perfect metaphoric constructed spaces clearly meant to situate large numbers of people in a highly democratic, organized and functioning manner...[It] is in these same spaces that you can feel the undercurrents of complete chaos, violence and disorder. [209]

As in the work of Ritchie, the fragmented, dismantled and exploded view contained within this imagery appear as frozen snap-shots, and it is often difficult to tell whether the scenes captured are about to collapse in to a state of complete disorder, or remain in balance somehow on a knife edge between chaos and equilibrium. As in Leonardo da Vinci's *Perspective study for the adoration of the Magi*, (see figure 11), the architectural framework provides a backdrop of order, repetition and structure against which the life's dramas and distractions are played out.

Another diagrammatic aspect to Mehretu's paintings are her use of multiple vanishing points, a technique she relates to her interest in Caravaggio, having based her black-and-white painting *The Seven Acts of Mercy* on Caravaggio's *Seven Works of Mercy*, claiming that the painting is constructed using "seven unique vanishing points for the different acts so that each act happens in its own place while existing in the picture simultaneously with the others". [210]

In her recent exhibition *Grey Area* at the Solomon R. Guggenheim Museum, New York, Mehretu showed works that were made using an original process in which she built up primary structural layers of black and white line drawings, subsequently covering them with a second layer containing multiple colour washes (figure 59).

For this group of new paintings however, Mehretu added a new process of erasure, sanding the surfaces to remove sections of colour and structure, in a process reminiscent of Knoespel's etymology of the word 'diagram' in relation to the wax tablet, as discussed in Chapter 1.

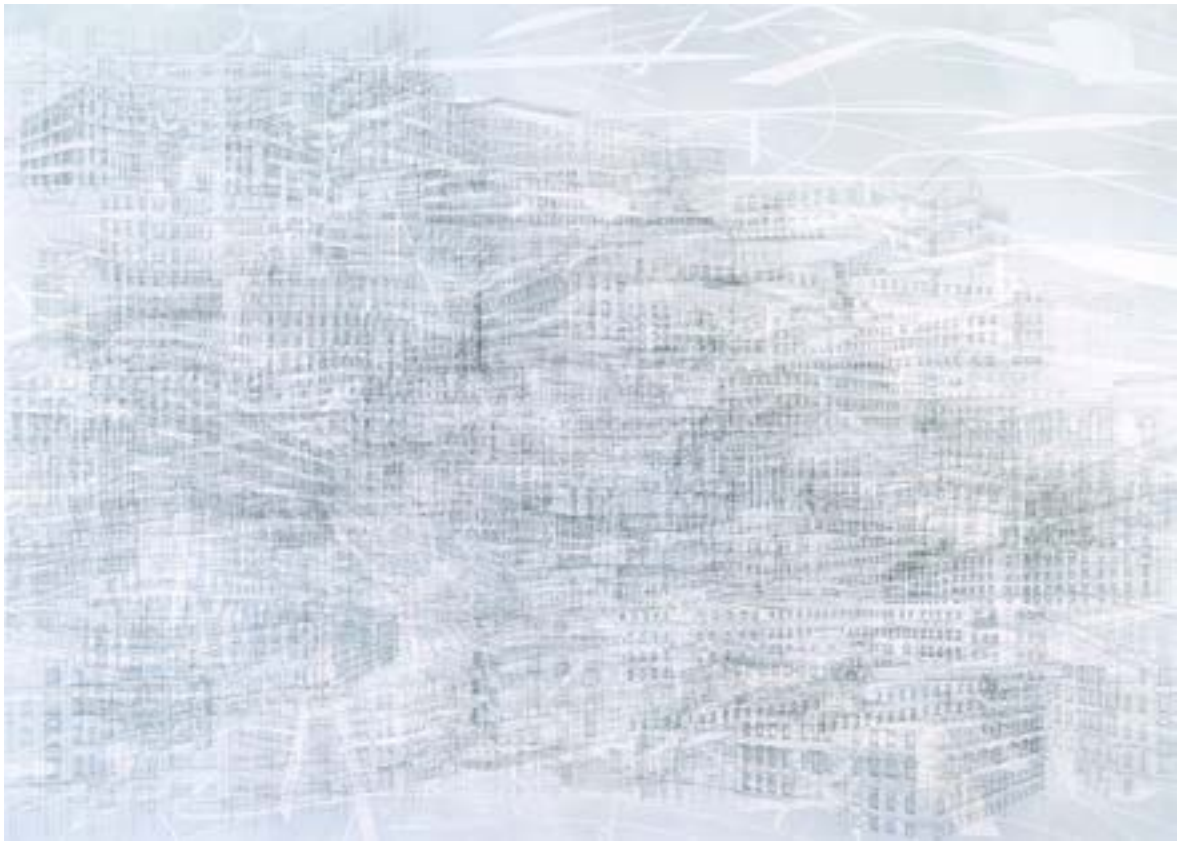


Figure 59: Julie Mehretu, *Berliner Plätze*, 2008–09,
Ink and acrylic on canvas, 304.8 x 426.7 cm

5.4: Traces of thought: Nikolaus Gansterer and Alejandro Guijarro

> In the landscape of contemporary and artistic operations, by which we can understand those practices which seem increasingly difficult to separate from theoretical work… the diagram- a writing or drawing "dia," "through," a scheme that is worked out or traversed by lines that are not only physical but also immaterial, lines of flight as well as lines that constitute dead ends and machines of capture – has become an eminently useful concept. [211]
>
> Sven-Olov Wallenstein

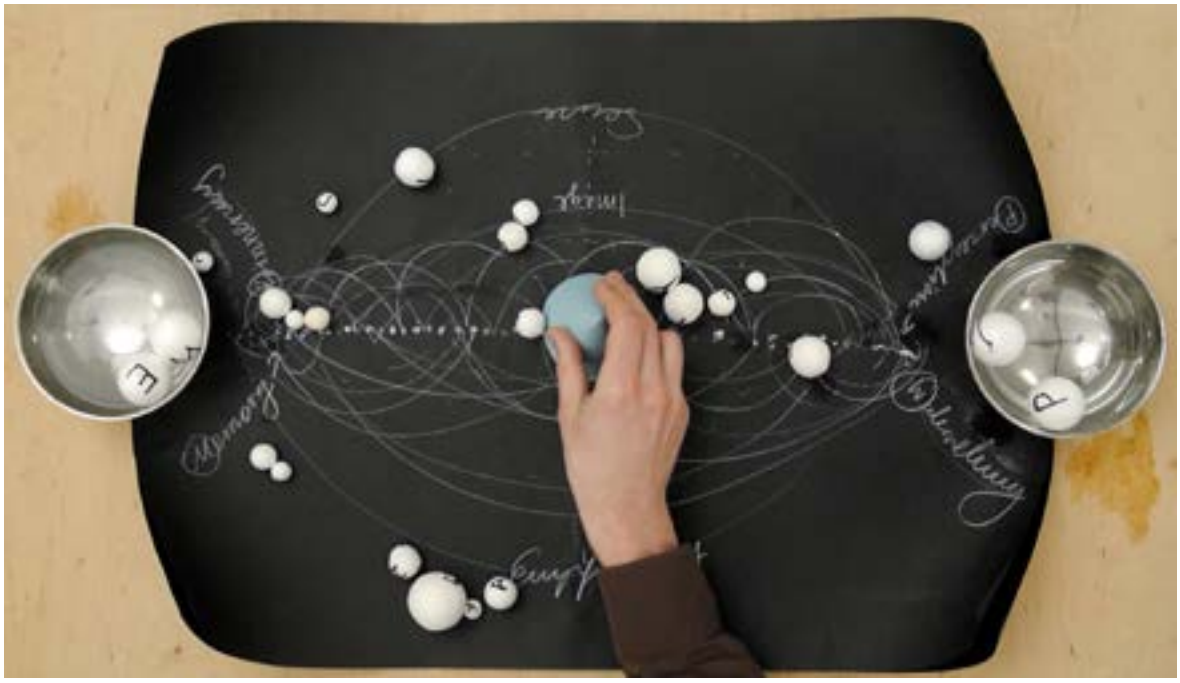


Figure 60: Nikolaus Gansterer, video still from *Thinking-Matters-Lecture*, 2013, chalk and objects on blackboard

Nikolaus Gansterer embodies Sven-Olov Wallenstein's category of artists whose practice is becoming increasingly difficult to separate from theoretical work. Following his degree studies in anthropology, Gansterer went on to study sculpture and transmedia storytelling, producing work that examines lines of connection and separation between nature and culture, art and philosophy.

Gansterer revitalises the didactic, diagrammatic tradition of artists such as Paul Klee and Joseph Beuys, combining the diagram's academic and authoritative appearance with its ability to show the traffic of concepts in real time, and the traces left by this process. His informational, teacherly aesthetic is contrasted against a delicate, poetic exploration of the ephemeral structures of thought and explanation found in cultural and scientific networks. (figure 60)

Gansterer's 2011 book *Drawing a Hypothesis* investigates "…the ontology of shapes of visualizations and… the development of the diagrammatic view and its use in contemporary art, science and theory". [212] It scrutinises the links between drawing, thinking, action and exploring by creating a collection of diagrams with their supporting texts and data removed, leaving a hermetic skeleton of pure notation.

Gansterer then asked artists to attempt to interpret these hieroglyphic images, the results of which range from the creation of fictional narratives to dry analysis of form and connection. Drawing a Hypothesis also contains a series of essays written by artists, writers and scientists about the speculative potential of diagrammatic sketches and their role in the production and communication of knowledge.

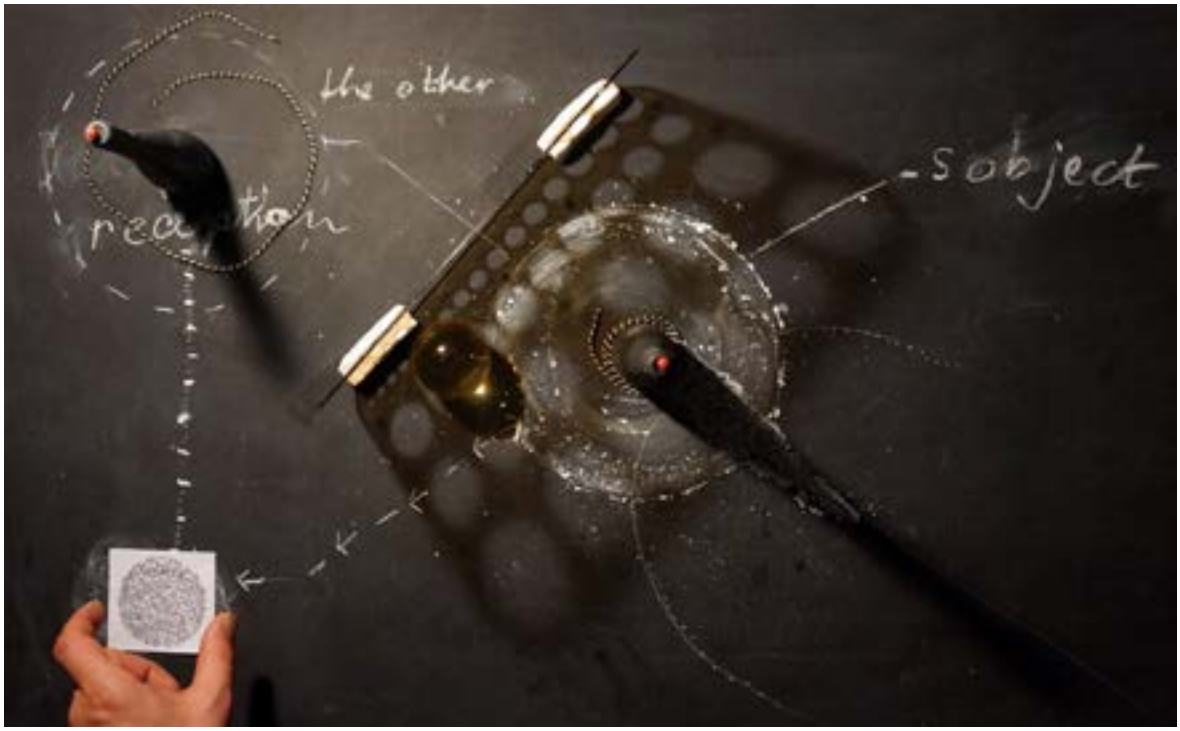


Figure 61: Nikolaus Gansterer, Thinking Matters Other Others:
A Translecture, SCORES No 9: no/things, Tanzquartier Wien, 28.11.2014

As an artist, Gansterer promotes the idea of the gallery as laboratory, and combines lecture programs, live performance and video projection, united by his use of diagramming and drawings which incorporate materials normally found in the classroom and lecture theatre. There is also a distinctly alchemical aspect to Gansterer's approach to research, image making and performance, in that he employs the diagram as "[a] tool for the making of relationships and for the abandonment of rational procedure." [213] His approach is reminiscent of the densely symbolic visual world of European alchemy, and the and hermetic, archaic, diagrammatic illustrations of the 16th and 17th centuries, with their emphasis on physical and spiritual transmutation. Symbolic codes are studied and deciphered, which in turn dictate the performance of rituals of an indefinite meaning and outcome. (figure 61, 62)

In describing the role of drawing within his practice Gansterer explains that

> The drawing not as an end result—the framed artwork, but rather, taking it seriously as an activity, as verb, as a specific form of visual thinking and speaking. Concepts like spatial-diagram, diagrammatic thinking, and expanded drawing as a form of action using all means, and thereby generating relations that leave behind traces, play a major role [214]

Gansterer describes his interest in creating installations which develop through time, rather than being set in advance, so that entire exhibitions take the form of a material dance and are continually rebuilt every day, each time became more coherent until a point of stability is reached. [215] As with so many of the artists discussed in this thesis, the diagrammatic aspect to his practice affords Gansterer a means to integrate indeterminacy in to his practice, and to negate the prescribed and predictable whilst maintaining an important element of control. This approach means that for Gansterer

> set disciplinary ways of operating might gradually become undisciplined, unlearnt, undone, reversed or upturned by experimenting 'between the lines' of drawing, choreography, and writing. What if line becomes movement or sound; what if language is danced; what if words are drawn rather than written? [216]

Figure 62: Nikolaus Gansterer, Emma Cocker, Mariella Greil, *Choreo-graphic Figures* (part of *Beyond the Line*, Bonington Gallery), 2014, Photo: Julian Hughes

The photographs of Alejandro Guijarro present palimpsests of thought and explanation, albeit with an entirely different approach to that of Nikolaus Gansterer. In the *Momentum series* (2010-2013), Guijarro traveled to several international academic institutions that specialize in quantum mechanics: CERN, Stanford, Berkeley and Oxford. In a form of documentation, Guijarro photographs blackboards in university lecture theatres, meeting rooms and offices. The blackboards are then measured and the photographic images are printed at a 1:1 scale and installed, unframed, in the gallery space.

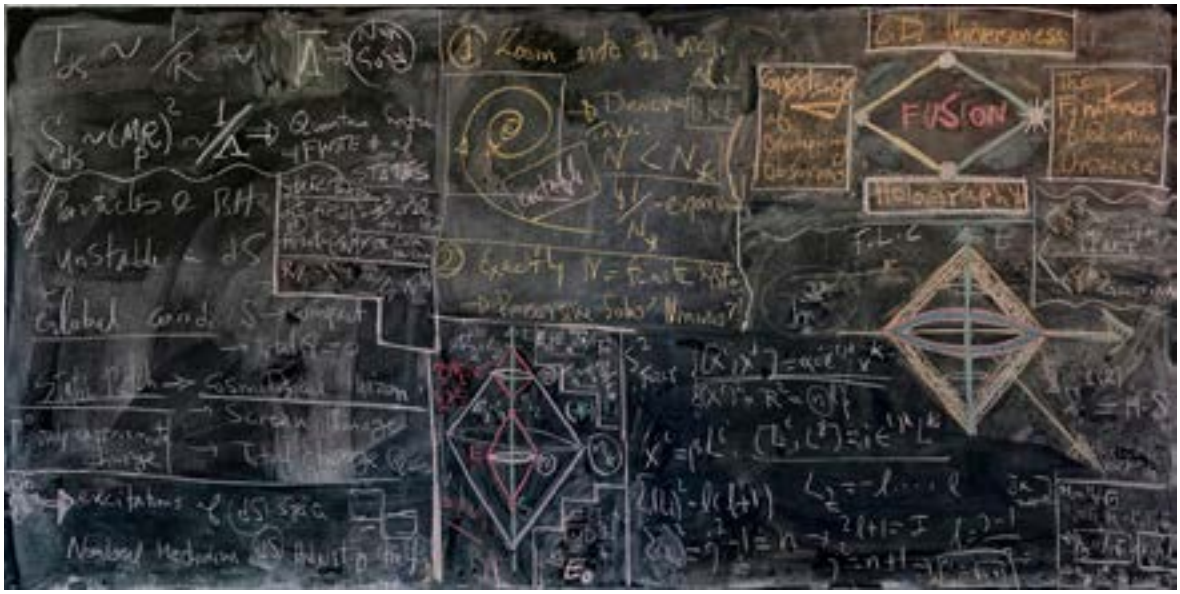


Figure 63: Alejandro Guijarro, *Berkeley II*, 2012, C-type print,
112 x 236 cm (from the Momentum Series, 2010 -13)

The resulting images capture the transitive nature of diagrams and mathematical notations at play in the creation and flow of information. (figure 63)The diagrams of science act as "either a stabilizing agent within ready-made science or as an agent that combines both rhetorical and instrumental functions within a domain of science in the making", and it is the second notion, the diagram as an engine of knowledge creation in science, that separates the notion of the diagram in Guijarro's work to its use in Berner Venet's. [217]

Whereas Venet presents the diagrams and formulas of science and mathematics as refined and perfected autonomous entities, Guijarro's images provide a glimpse of the diagram in use as part of the generative process of explication and transmission of ideas. The photographs also provide evidence that this process is a physically involved, highly gestural performance. (figure 64) As the process of explanation unfolds, writing notation and images branch out following particular trains of thought or area of questioning. The act of erasure can also be considered diagrammatic in that it portrays the motion of the body, the disjointed abstract patterns of the partial erasures and of trial and error, or complete erasures which present themselves as rhythmic movement in

wave-like patterns, never quite achieving the tabula rasa. (figure 65) Guijarro's project is reminiscent of Duchamp's Unhappy Readymade (chapter 4.3), in that each image is a token of something lost, a record of thought manifesting itself visually in the world only to be erased, leaving only its physical substrate and traces of the signs and symbols of the embodiment of thought in the world. In Duchamps case, it is the wind and rain which adds entropy, in the case of Guijarro's blackboard its is the hand of the professor, janitor and student.

Figure 64: Alejandro Guijarro, *CERN (II)*, 2012, C-type print, 100x180cm, (from the Momentum Series, 2010 -13)

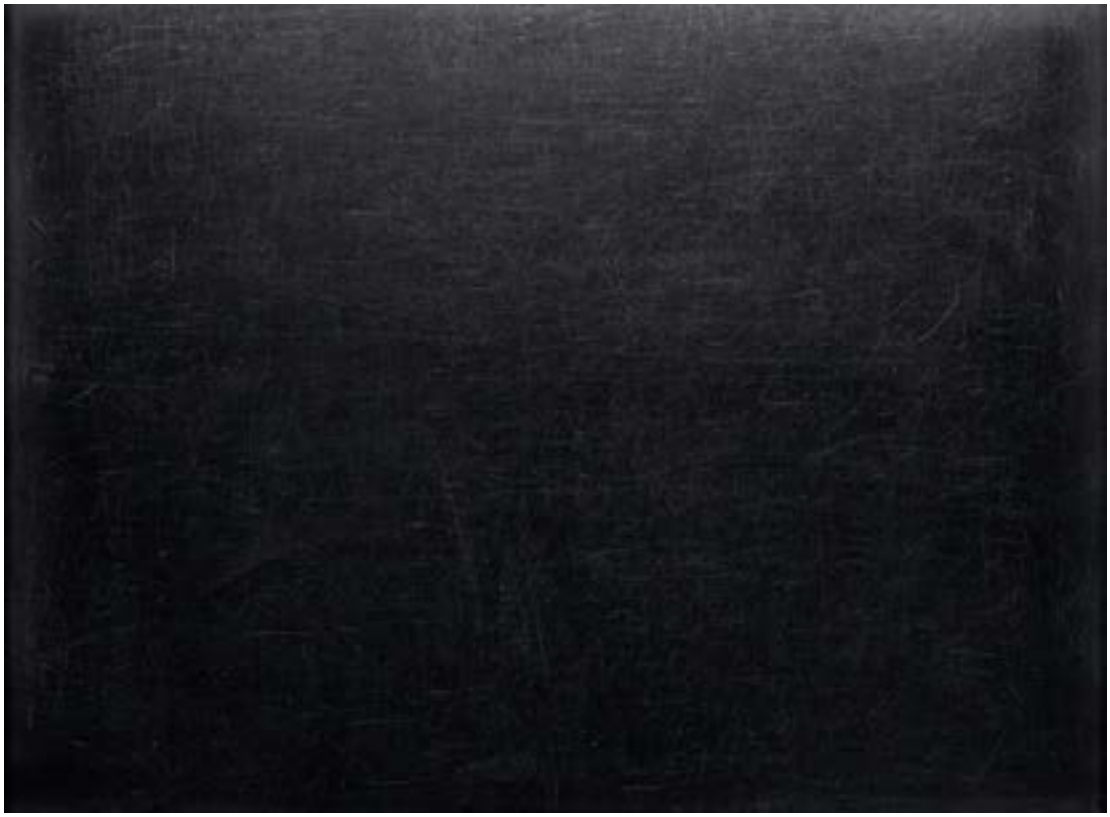


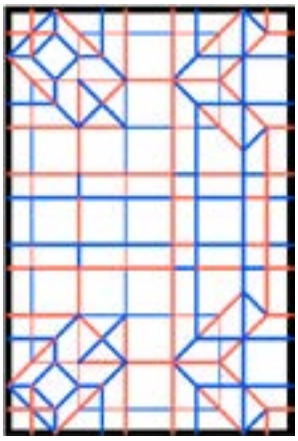
Figure 65: Alejandro Guijarro, *Oxford (I)*, 2011, C-type print,

110 x 150 cm, (from the Momentum Series, 2010 -13)

Chapter 6: The development of a personal diagrammatic aesthetic

"My voice proclaims
How exquisitely the individual Mind
(And the progressive powers perhaps no less
Of the whole species) to the external World
Is fitted:--and how exquisitely, too,
Theme this but little heard of among Men,
The external World is fitted to the Mind . . ." [218]

William Wordsworth



[ah]

hapter 6 presents my artistic practice as a Romantic-Objective meditation on our contemporary relationship with nature. The interplay between the rich symbolic landscape of the mind and the landscape within which we have evolved. This approach combines the austere detachment of scientific objectivity, inherent in the diagrammatic format, with a romantic emphasis on symbolic landscapes and subjective self-expression.

From its inception, Romanticism was preoccupied with the landscape, which the Romantics considered as a work of art in itself, a rich emblematic language constructed by divine imagination. Truth could only be reached by attempting to connect with nature, which Goethe referred to as "the living garment of God." [219]

Artists turned to nature not only as a source of inspiration, but also as a vehicle to express their emotions, and this led to the development of a rich visual symbolism and mythic narrative. Symbols came to be regarded as the human aesthetic equivalent of nature's emblems, and were valued for their ability to suggest many simultaneous concepts, as opposed to the singular nature of allegory.

It is within the context of a conceptual landscape that the practice will be discussed, and subdivided according to key ideas and symbolic forms from Romantic period art.

---

ah Origami Maze Puzzle Font, Capital letter C, Demaine, E.E., Demaine, M.L., K,J., MIT Computer Science and Artificial Intelligence Laboratory. [Online: http://erikdemaine.org/fonts/maze/]

Chapter Six explores the development of a personal, diagrammatic, Romantic-Objective aesthetic, in terms of some of the key features of Romantic period art:

6.1	The Fragmented Landscape:	Conceptual Suspensions
6.2	Clearings and Excavations:	Clarity and Exploration
6.3	The Symbolic Tree:	Imposing Patterns upon Nature
6.4	The Symbolic Bird:	Avian Anatomy
6.5	The Human Figure:	Icon to Symbol

Discussion of the works selected for Chapter 6 is supported by Map 2, a diagram of one hundred artworks selected from the last twelve years of my practice. Map 2 marks out thematic groups to reveal underlying connections between various drawings and sculptures, and a continual involvement with the diagram.

Core concepts around which art works converge, as revealed in Map 2, are:

- The human visual system (lens, tear glands / ducts, tarsal glands, blood vessels)
- Human anatomy (the brain, heart, kidneys, adrenal glands, gonads and lungs)
- Other sensory systems (the inner and middle ear, the tongue)
- The human hand (as used in encyclopedias as a detached explanatory aid)
- Avian anatomy (wings, lungs and skeletal system)
- Clearings and excavations (clearings of vegetation, archaeological digs, ruins)
- The Symbolic Tree (as models and explanatory devices)
- Historic boats and small wooden vessels (as military crafts and wrecks)

6.1: The Fragmented Landscape: Conceptual Suspensions

ai

epiction of the landscape in this body of work has undergone a process of dematerialisation over the last decade, toward a horizon-less white space in which objects float. Connections exist as tenuous lines and objects are grounded to patches of abstract, token wasteland by guy ropes.

Chapter 6.1 marks out this gradual transition, starting from the solidity of geological cross sections, to the construction of mobile landscapes for theatre, and finally, fully fragmented geological forms suspended in immaterial whiteness. This process mirrors the visual reduction of landscape in the diagrammatic strategies of the 18th century Enlightenment encyclopedic project of d'Alembert and Diderot (see chapter 2.4). The depiction of landscape as a system of vignettes is designed to phenomenologically highlight objects placed within them by minimising the level of background visual noise, what C.S. Peirce referred to as tones. (see chapter 4.1)

Comparable real world environments include deserts, sparse wilderness and wastelands, which act in a comparable way to the white cube of the gallery space, the white ground of the canvas/paper and the design space of virtual reality. Archipelagos, managed farmland and golf courses also present similar vistas, but are inherently diagrammatic in nature, embodying systems of division, containment and connection which involve acts of organised movement and navigation (See Appendix J for visual examples of these environments).

The use of these 'low-noise' landscapes is apparent in Chart 2 (figure 66), a series of early cartoon-like images presented as a table of 49 miniature vignettes. Each contains the name of an influential philosopher flown as a flag, inserted as a signpost or attached as a label upon an object or building, many of which are movable props. Landscape is suggested by a horizon line or is depicted as a detached object itself, supported upon stilts and shown in cross section.

---

ai L.E.M. Jones, The Landscape Alphabet, Capital Letter D, c. 1818 – 1860.

The open, non-prescriptive nature of the images invites the viewer to project their own knowledge of each of these great thinkers onto individual scenes, in order to make sense of what may or may not be suggested by the association of a philosophy with the contents of each image. [aj]

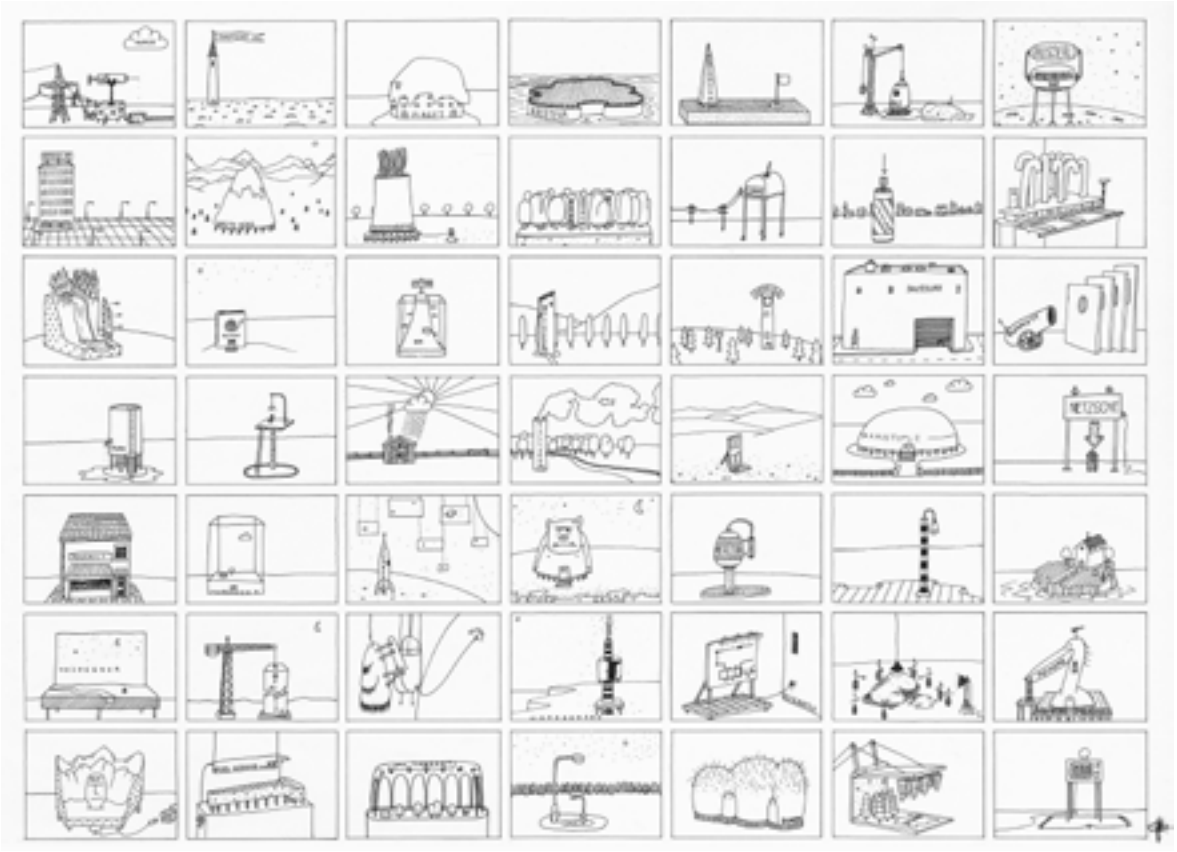


Figure 66: Michael Whittle, *Chart 2* (*Philosophers*), 2002, Ink on paper, 42 x 60 cm

Studies in structural geology allowed me to adopt its symbolic language to depict igneous, metamorphic and sedimentary rock types with greater clarity than observational drawing alone would allow. The dip of rock beds, faults, folds, unconformities, intrusions and erosion all appear in these early drawings, structures and processes which are occasionally detectable or observable as outcrops on the surface, but which could be made fully visible using the cartographic conventions of geological cross sections.

Drawings such as figure 67, *Wind out of Blackness*, is one of a series of drawings that presents landscape in cross section in order to appear to act as a stage for the events (or lack of events) taking place upon its surface. Whole cross-sections are usually supported by legs and raised above the ground so that landscape itself becomes an object or model.

aj *Chart 1* (*Neurobiology*) was a similar combination of 49 obscure terms taken from the index of a neurobiology text book with organic mechanisms depicted in detail for each.

Despite a distinct lack of human forms in this series of works, objects are presented as props for performances which are about to, or have already taken place. The title *Wind out of Blackness* is taken from George Steiner's book *Grammars of Creation*, in which he uses the titular expression in reference to what he calls "the controlled insanity of the Holocaust", an event where human beings were proclaimed as "…guilty of being. Their crime was existence, was the mere claim to life". [220]

In the context of the title, the hunting tower becomes a watch tower surrounded by lamps and wire fences, and the Heideggarian forest clearing takes on an entirely different tone. All of these associations are set in stark contrast, however, to the inert neutrality of the underlying bulk of bed rock.

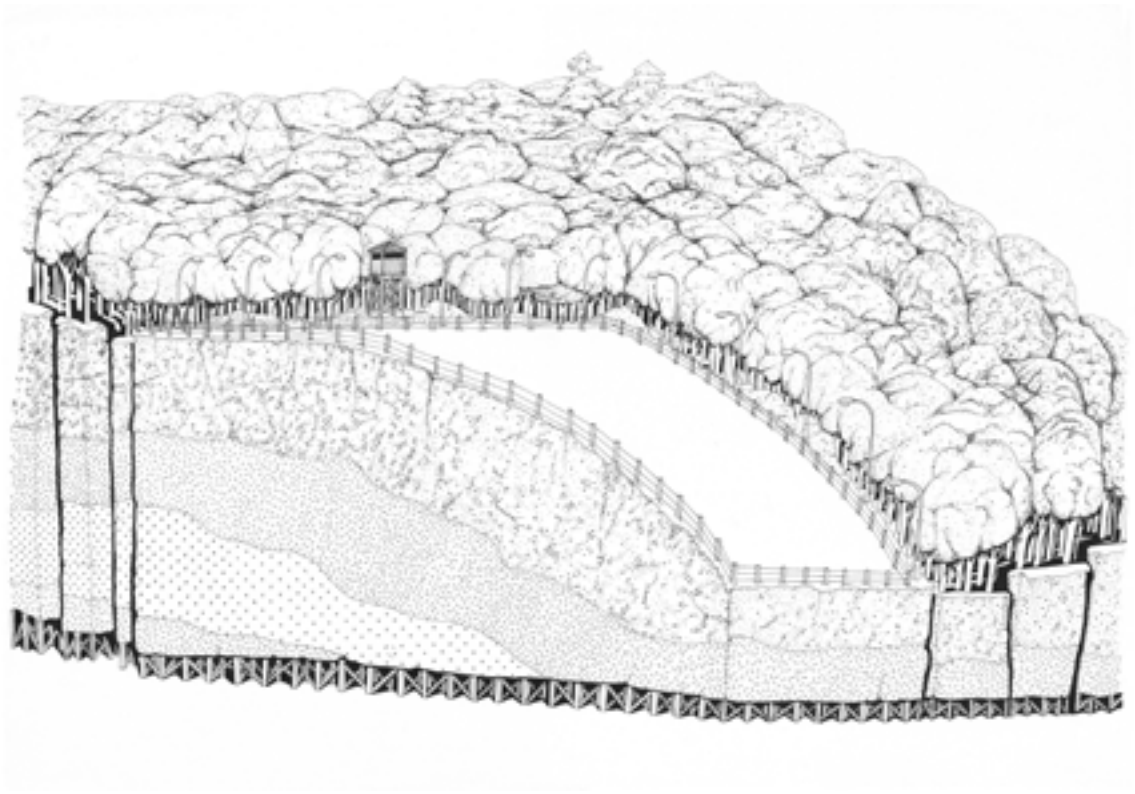


Figure 67: Michael Whittle, *Wind out of Blackness* (3), 2002, Ink on paper, 42 x 59 cm

These ideas were developed sculpturally in the 2002 work *Niemals Niemand Nirgends* (*Never Nobody Nowhere*) (figures 68a, b), which consists of a series of table-like islands stacked upon one another, divided by small wooden legs. The edge of each island is presented in geological cross section of, and on each green, striped, surface are installed miniature Belisha beacons, each flashing to the same time interval, but out of time with one another. [ak] Taken out of their normal context, these British road signs are now only able to draw attention to their own existence.

ak A flashing yellow orb atop a striped pole, used as a road sign in England to draw attention to pedestrian crossing points on roads.

Figure 68a: Michael Whittle, *Niemals Niemand Nirgends* (*Never Nobody Nowhere*), 2002, wood, MDF, particleboard, electronic circuits, plastic, metal rods, 140 x 150 x 130 cm

Figure 68b: Michael Whittle, *Niemals Niemand Nirgends* (*Never Nobody Nowhere*), 2002, wood, MDF, particleboard, electronic circuits, plastic, metal rods, 140 x 150 x 130 cm

This interest in the props, stage sets and backdrops of theatre led to producing and designing a large scale performance titled *Morning, Noon and Night* as part of the 2002 graduation exhibition at Duncan of Jordanstone College of Art, Dundee. Based upon the Russian folktale Vasilissa the Beautiful, each scene was arranged by the actors during the performance, who re-positioned a series of boards and props on wheels in order to create the individual sets for the story (figure 69).

Morning, Noon and Night was staged in a three thousand square metre warehouse basement, and the audience of one hundred and fifty people sat in the clearing of an indoor forest of black and white striped trees.

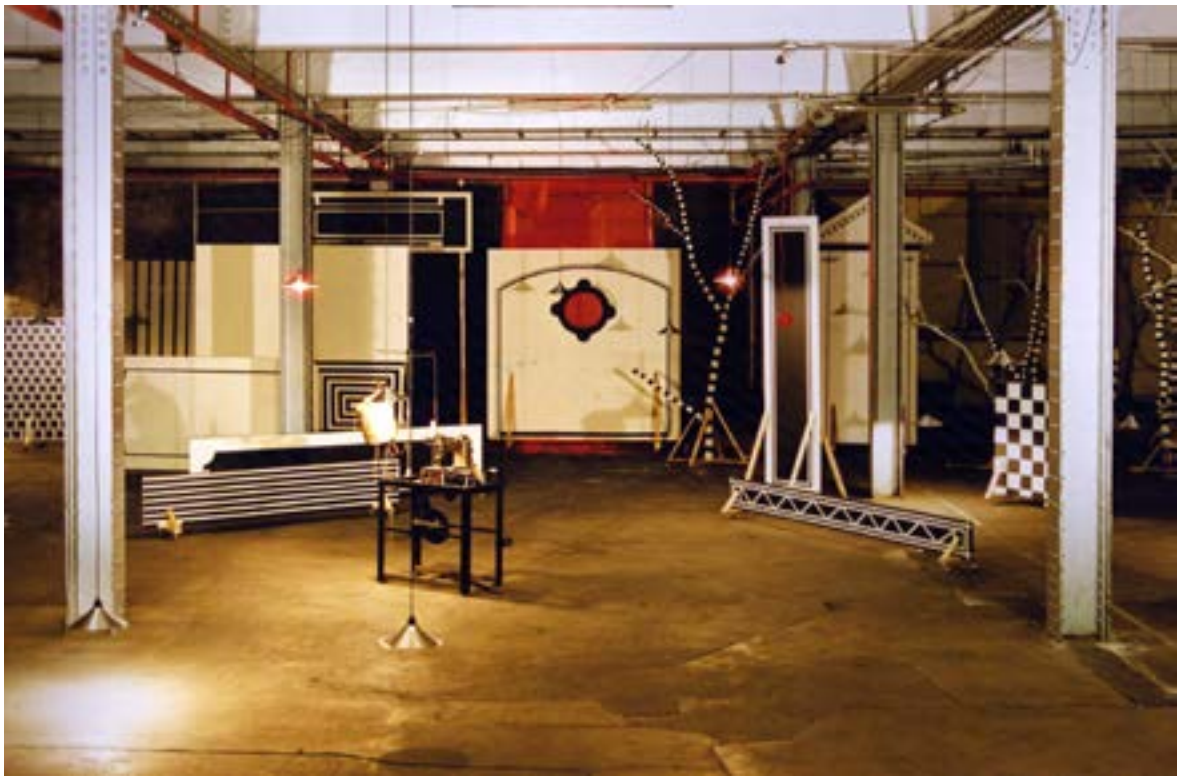


Figure 69: Michael Whittle, Main stage set for *Morning Noon and Night*, 2002
Mixed media, dimensions variable

Pedro Calderón de la Barca's 1635 play *The Great Theatre of the World* proved highly influential at this time, especially in terms of staging. Actors in de la Barca's play portray archetypes from all levels of society, and are shown being given their roles by God, the omnipotent director. Each actor in their new role then enters the stage (of their lives) through a door marked 'cradle', from which point they appear free to make their own choices. Towards the end of the play, the characters exit a second door marked 'grave', and only then does the Supreme Being once again intervene in order to decide their ultimate fates.

The theatre stage came to represent an archetypal settings for a series of pre-scripted events, and thus a space in which a performers freedom of action is constrained during their embodiment of their role. An engagement with the artificial and highly symbolic nature of stage design continued from my BA course to my MA studies at the Royal College of Art. Figure 70 shows the drawing *Jumps* (2003), a series structures suggesting various ways of being propelled into existence and awareness, with a cosmological backdrop of stars draped over an invisible set of underlying slopes.

The solitary streetlights to the left of the drawing was a common icon in the work at this time, directly referencing the early journals of the American poet Sylvia Plath and her description of "…the lone street light on the corner, hanging solitary in a nimbus of light, beyond it the gray indistinguishable fog and the rain sound blending with the wash of the sea." [221]

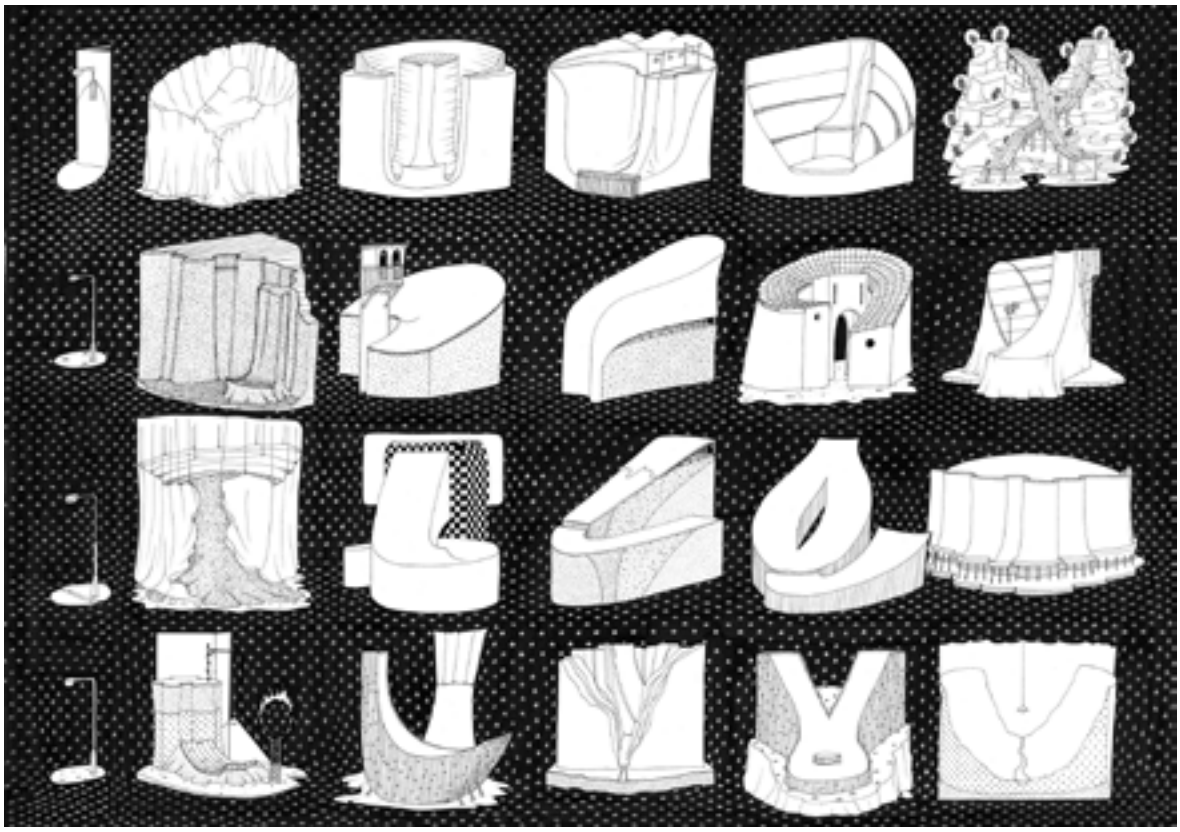


Figure 70: Michael Whittle, *Jumps*, 2003, Ink on paper, 42 x 59 cm

The nature of fog as backdrop to Plath's scene resonates with W.H. Auden's use of fog as a neutralising agent in the landscape of his 1973 poem *Thank You, Fog*. [222] The nullifying nature of fog in both poems suggested a way to reduce background distraction and concentrate visual information in my own work, and to create what Roland Barthes describes as "a density of meaning, but involving little noise... an aesthetic of bareness" as found in the diagrams of renaissance encyclopedias. [223]

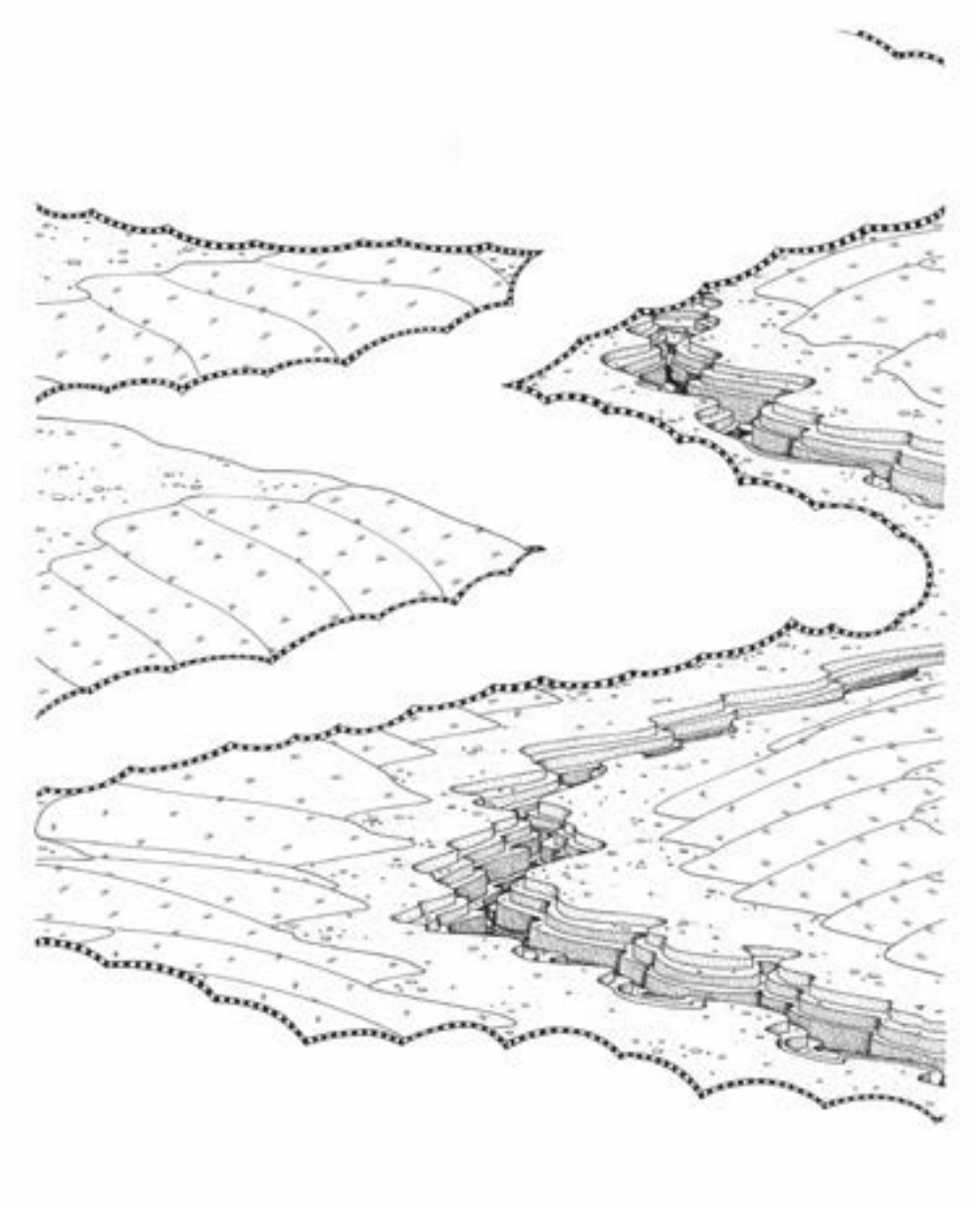


Figure 71: Michael Whittle, *Cloud (Hidden Valley)*, 2004,
ink on paper, 53 x 45 cm

An exchange program trip to Kyoto City University of the Arts in 2004 allowed time and cultural distance to create a series of studies of negative space in traditional Japanese painting. Areas of scroll or paper is left blank (or in some cases covered in gold leaf) in order to indicate distance or imply mist, clouds, a seascape of the sky. This is done in order to graphically fragment the reading of landscape paintings, maps and narrative picture scrolls.

Cloud (Hidden Valley) (figure 71) is a drawing is an early attempt to apply this technique, in which a central pattern of clouds obscures a stylised landscape composed of geological and cartographic symbols. The edges of the cloud structure are striped black and white, a pattern which has come to represent the dualistic qualities which underlie the history of Western philosophy and science within these art works.

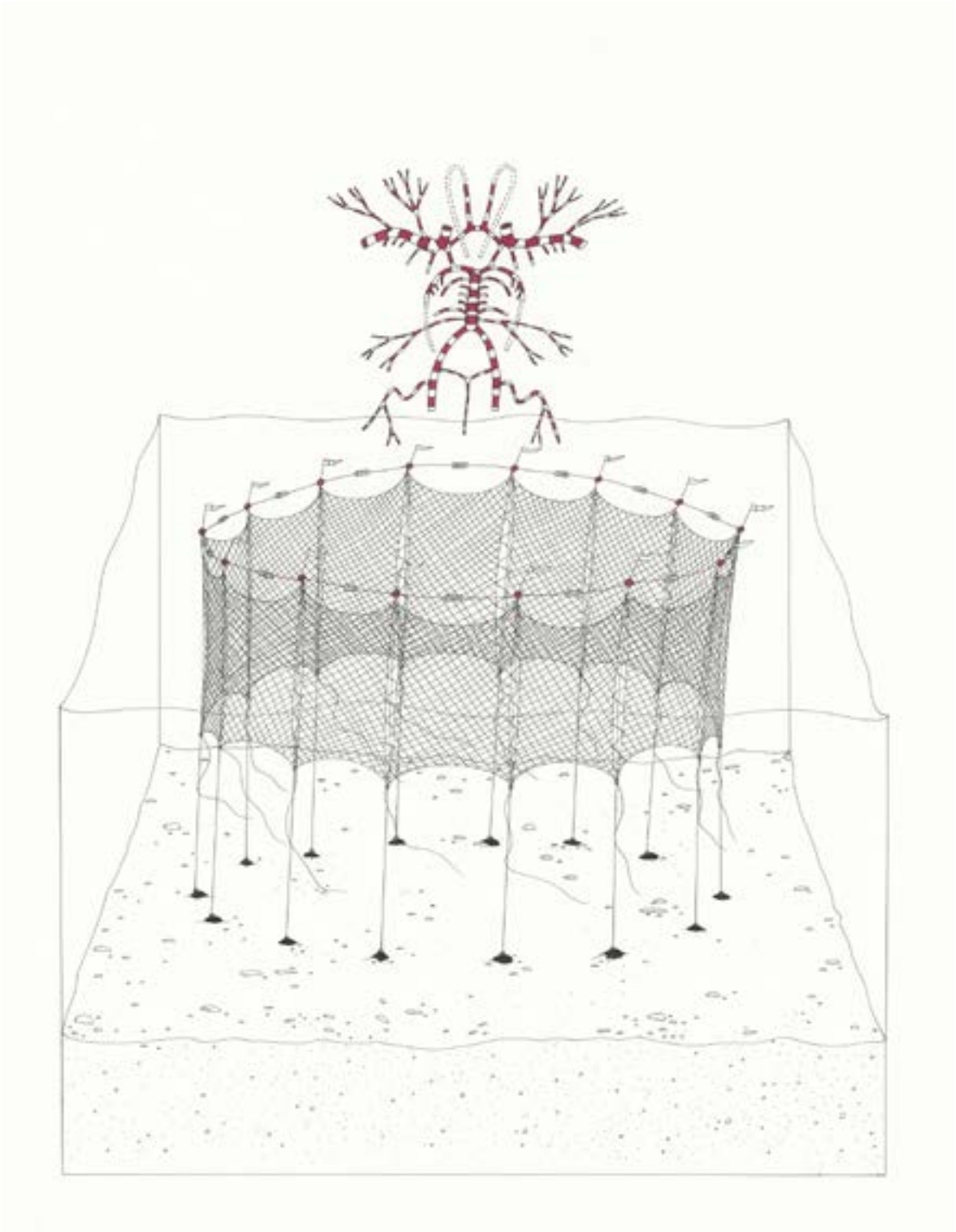


Figure 72: Michael Whittle, *Circle of Willis*, 2004, Ink on paper, 45 x 37 cm

Two other representative landscape drawings from this period are *Circle of Willis* (figure 72), and *ABC: Hand, House, Seabed* (figure 73), which mark a shift to the depiction of objects suspended in water and finally free floating in space. *Circle of Willis* is a drawing that references thought by symbolic metaphor (the net as a sensory filter of our experience) and metonymy (the vague association of cerebral blood vessels with the sustenance of consciousness). The circular structure of the net is kept in position by a series of tethered weights, and its position marked at the surface by flags and buoys.

The Circle of Willis is a polygonal arterial structure, part of the blood vessels found at the base of the human brain, where it provides energy for, and removing the waste products of thought itself. The shape of the structure gives rise to what is known as 'collateral circulation', the maintenance of blood flow within the brain in the event of narrowing or occlusion of certain vessels; a backup system for consciousness. In this drawing this miniature anatomical halo is depicted as a dislocated system of red and white striped vessels floating above the surface of the volume of water.

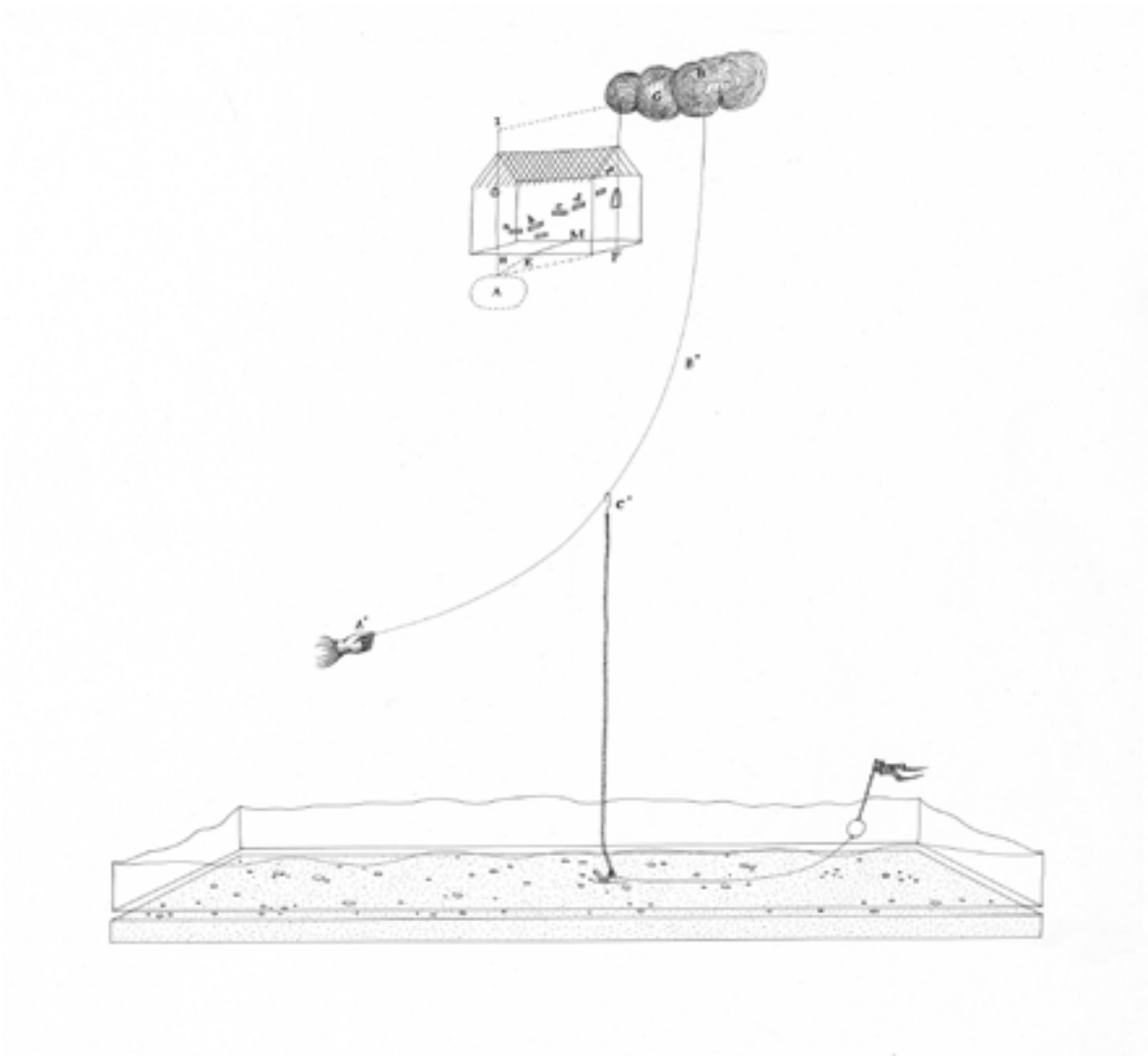


Figure 73: Michael Whittle, *ABC: Hand, House, Seabed*, 2005, Ink on Paper, 53 x 45 cm

ABC: Hand, House, Seabed (figure 73) appropriates the symbolic language of found encyclopedic plates, images rich in the strange juxtapositions described by Barthes:

> "... by "entering" in to details, by displacing the levels of perception, by revealing the hidden, by isolating the elements from their practical context, by giving objects an abstract essence, in short by "opening up" nature, the encyclopedia can only, at a certain moment, transcend nature, attaining to a supernature: it is by dint of a didacticism that a kind of wild surrealism is generated here..." [224]

In the drawing the volume of water is also made to hover above the sea-floor in which is embedded an anchor. Attached to the anchor is a buoy topped by a striped flag, and a chain connected to a rope which connects a dislocated hand to a storm cloud, a scene reminiscent of Benjamin Franklin's famous kite and key experiment of 1752. The diagrammatic framework of the house contains symbols that suggest the occurrence of an unknown event within the structure, and somehow related to the other objects within the drawing.

Martin Heidegger's writings were an important influence upon the work at this time. (further discussed in chapter 6.2) Heidegger's discussion of building, dwelling and thinking and his analysis of human hands and tools played a role in determining the choice of imagery. Lightning provided a strong visual metaphor for Heidegger, in the way that the flash of light suddenly brings together our awareness of the objects which surround us:

> Lightning abruptly lays before us in an instant everything present in the light of its presencing. The lightning named here steers. It brings all things forward to their designated essential place. [225]

The Topology of Being (2005) was drawn in preparation for a first solo exhibition of the same title (figure 74).

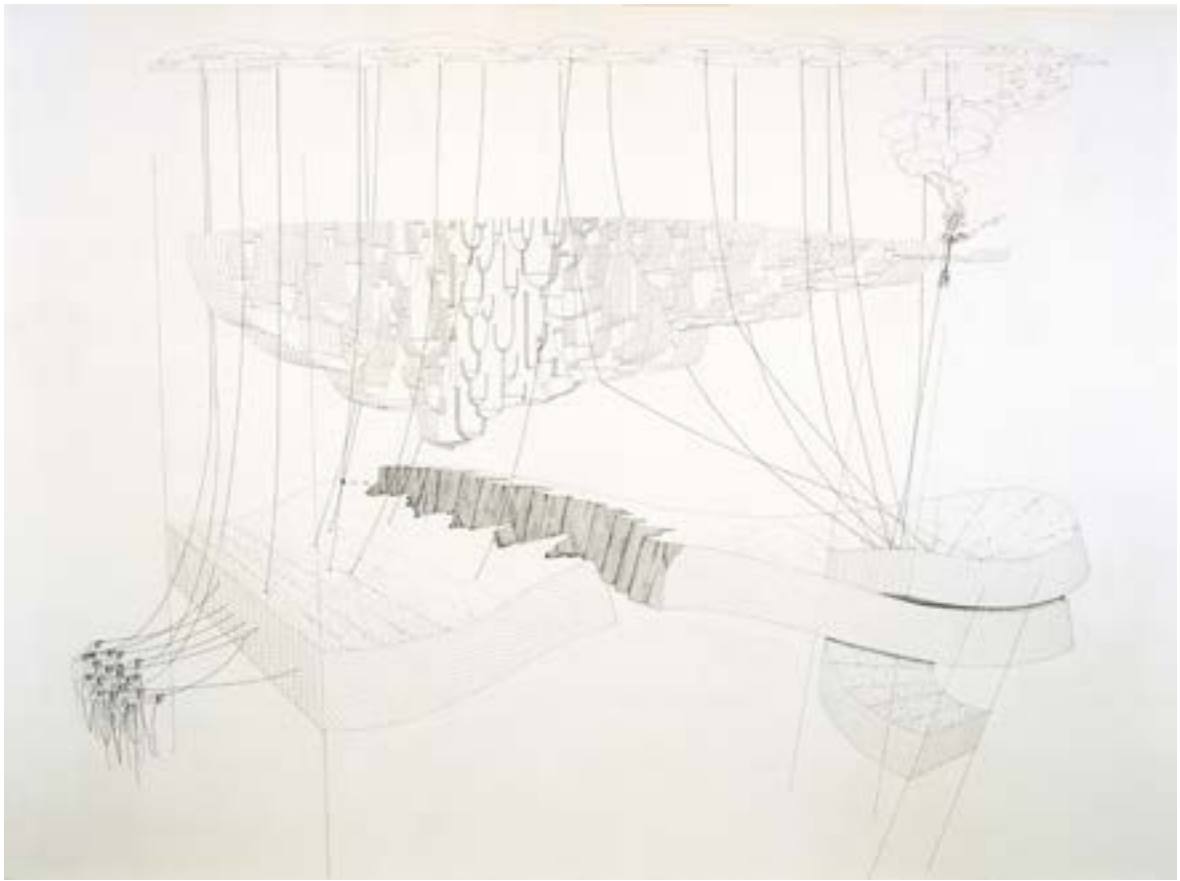


Figure 74: Michael Whittle, *The Topology of Being*, 2005, Ink on Paper, 115.5 x 95.5 cm

The title is taken from George Steiner's introductory text to the writings of Heidegger, whose methodological stance Steiner describes as one of "radical astonishment" at existence. [226] The drawing presents landscape as a divided object, a rift valley or the mid-Atlantic ridge running between two tectonic plates which rise above and are forced below one another in a spiral configuration.

The surfaces of the plates are marked in stripes, similar in style to geomagnetic diagrams of the ocean floor which provide magnetic evidence of sea-floor spreading due to polar reversals. The geological cross sections, however, are marked by symbols taken from the neurobiology of vision rather than geological rock types, and depict the ocular dominance columns and orientation columns of the 'ice cube' model of the visual cortex of the brain.

From this 'ocular rift' rises a three dimensional form of the symbolic tree structure (discussed in chapter 4.3). Each branching division contains what appears to be a volume of water, and the one farthest to the right contains a symbolic burning bush. The fire and rising smoke act as indirect metaphors for consciousness, "the fire in the minds of men", as Dostoyevsky wrote in his book *The Possessed*, rather than the traditional Judeo-Christian burning bush of the book of Exodus.

The final drawing to consider that contains a dematerialisation of landscape is *Arena Suspended* (*Neurotransmitters*), made for a 2008 exhibition titled *Suspensions* (figure 75). In this image, landscape is presented in two ways: an array of suspended stones, and gathering of dust and fragments in the white space beneath.

The subtitle Neurotransmitters refers to the biochemicals responsible for the transition of signals from axon to dendrite across a synaptic cleft (i.e. from neuron to target neuron). Neurotransmitters are an essential element of communication within the human nervous system and thus a fundamental component of thought itself. This image contains several of the most common neurotransmitters of the human brain. The molecules are represented indirectly in the drawing by fine threads tying the rocks together in a particular atomic sequence. Once understood in this way, the individual rocks can be read as the molecular structure of the different neurotransmitters.

In this image, thought and landscape have been fragmented into their component parts to form a set of hybrid symbols. Small amounts of dust and the occasional string are shown falling to the ground, adding to the shadow of detritus forming underneath this Arena, a word defined as 'a place or scene of activity, debate, or conflict'. [227]

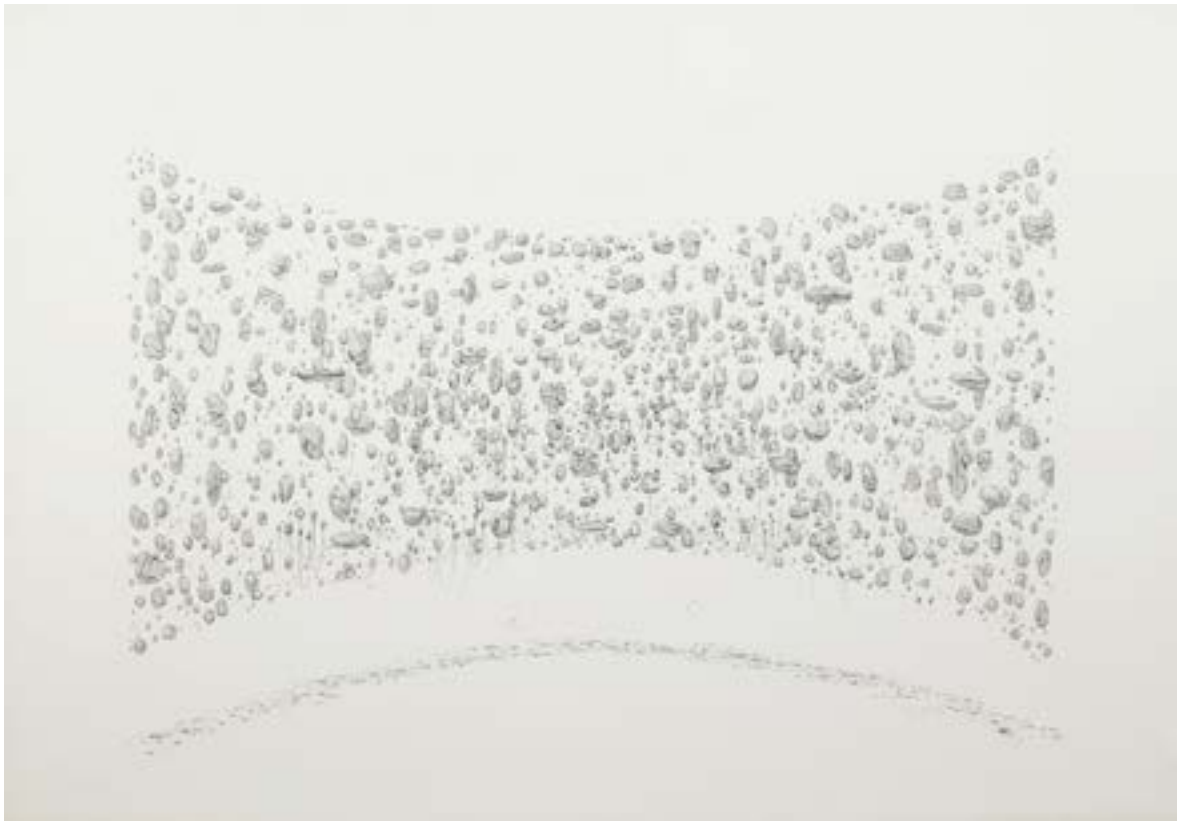


Figure 75: Michael Whittle, *Arena Suspended (Neurotransmitters)*,
Ink on Paper, 115.5 x 95.5 cm

6.2: Clearings and Excavations: Clarity and Exploration

al

f central importance to Martin Heidegger's philosophy of being is his notion of the 'clearing', a metaphoric, open space within a dense forest. *Lichtung*, the original German word for clearing, means lighting, and this reinforces the visual power of the term, connoting an image of sun-rays penetrating a dense canopy to create a pool of light in the midst of darkness.

The clearing represents both a material space and a field of consciousness, the forest suggesting not only a shadowy, primeval landscape but philosophy itself, a conceptual terrain where labyrinthine paths of thought can be pursued. "In the forest clearing to which his circular paths lead, though they do not reach it, Heidegger has postulated the unity of thought and of poetry. " [228] These concepts also influenced my choice of structure for an MA dissertation in a fundamental way. The final text was presented as a large foldable map, which diagrammed interconnecting paths between selected texts, quotes and images, denying the viewer a clear starting or ending point.

Chapter 6.2 discusses the various kinds of clearings which exist within my own work, where insignificant details are reduced in order to reveal essential underlying forms, thus relating them to the scientific-philosophic processes discussed in chapter 3.

Unlike the metaphorical, naturally-occurring clearing presented in the work of Heidegger, these clearings are the direct result of the activities of humans, tools and machines, an application of aggressive technology in the Heideggerian sense of the word. Clearings are used in the following works to present a divide between humankind and nature, rationality and spirituality, objectivity and subjectivity, while refraining from promoting either one or the other. They are active and transformative rather than passive and unchanging.

In the context of Heidegger's clearings, references to the Holocaust in my earlier works allude to the German philosopher's active membership of the Nazi party and a secret denouncer of many of his university colleagues, as well as the silence he maintained throughout his life concerning his involvement and actions.

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al Claude mellan, Initial letter O with open eye, in a frame. 1639/43, Engraving

In the early drawing Wind out of Blackness (2002) (figure 67), the Heideggarian clearing takes the form of a fenced-off field surrounded by rows of dense trees and overlooked by a watchtower or 'hunting blind'. This arrangement suggests very different implications for anyone who should pass from the dense shadows of the forest into the floodlit enclosure of Heideggerian enlightenment.

Figure 76 depicts the clearing as a form of excavation into the white ground of the image. Topsoil has been removed to expose a collection of roots suspended above dirt, and the excavation site is carefully marked out by stakes and taut strings in the style of a planned archaeological dig, restricting entry into the area of investigation, and staking out the limits of excavation, like the edge of the forest clearing that marks the boundary between the unknown and the known. The terminology coined by Heidegger to describe his notions of 'un-concealment' and of 'bringing things in to the open' sometimes employs a language that is almost violent, as when he says that "entities are torn out of hiddenness", an expression that is particularly appropriate for both the roots in the drawing *Excavation*, and several of the symbolic tree drawings in chapter 6.3. [229]

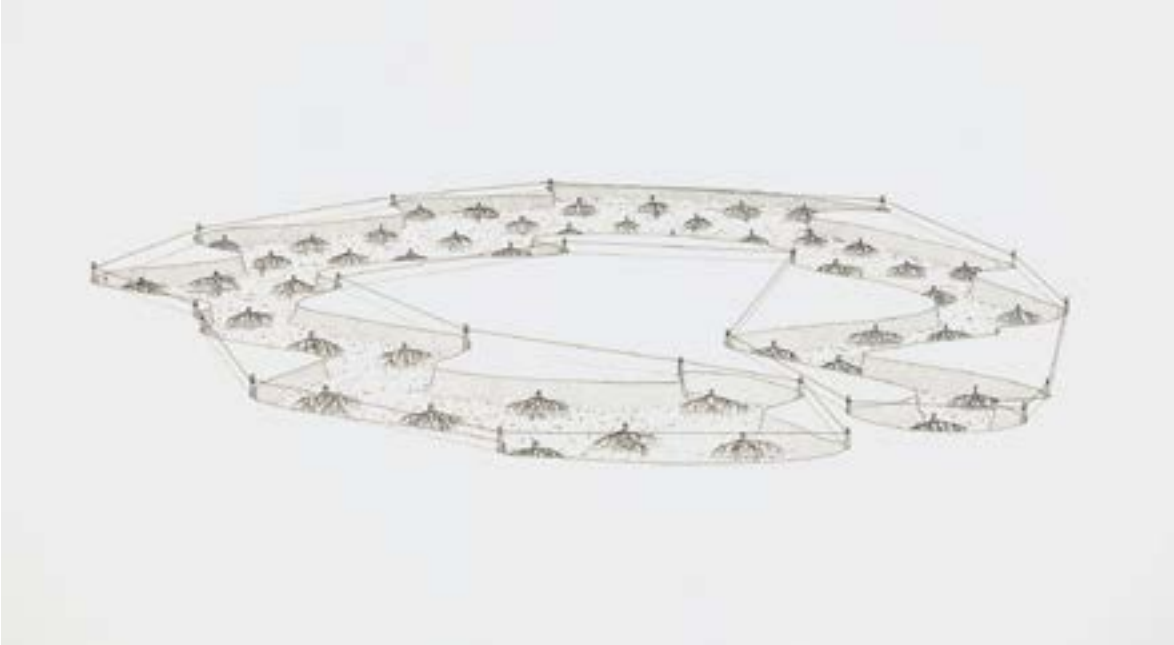

Figure 76: Michael Whittle, *Excavations*, 2006, Ink on paper, 47.5 x 78 cm

As Merleau-Ponty later articulated the analogy:

> we must rediscover the structure of the perceived world through a process similar to that of an archaeologist. For the structure of the perceived world is buried under the sedimentations of later knowledge. Digging down to the perceived world, we see that sensory qualities are not opaque, indivisible 'givens'...We also find that spatial forms or distances are not so much relations between different points in objective space as they are relations between these points and a central perspective - our body. [230]

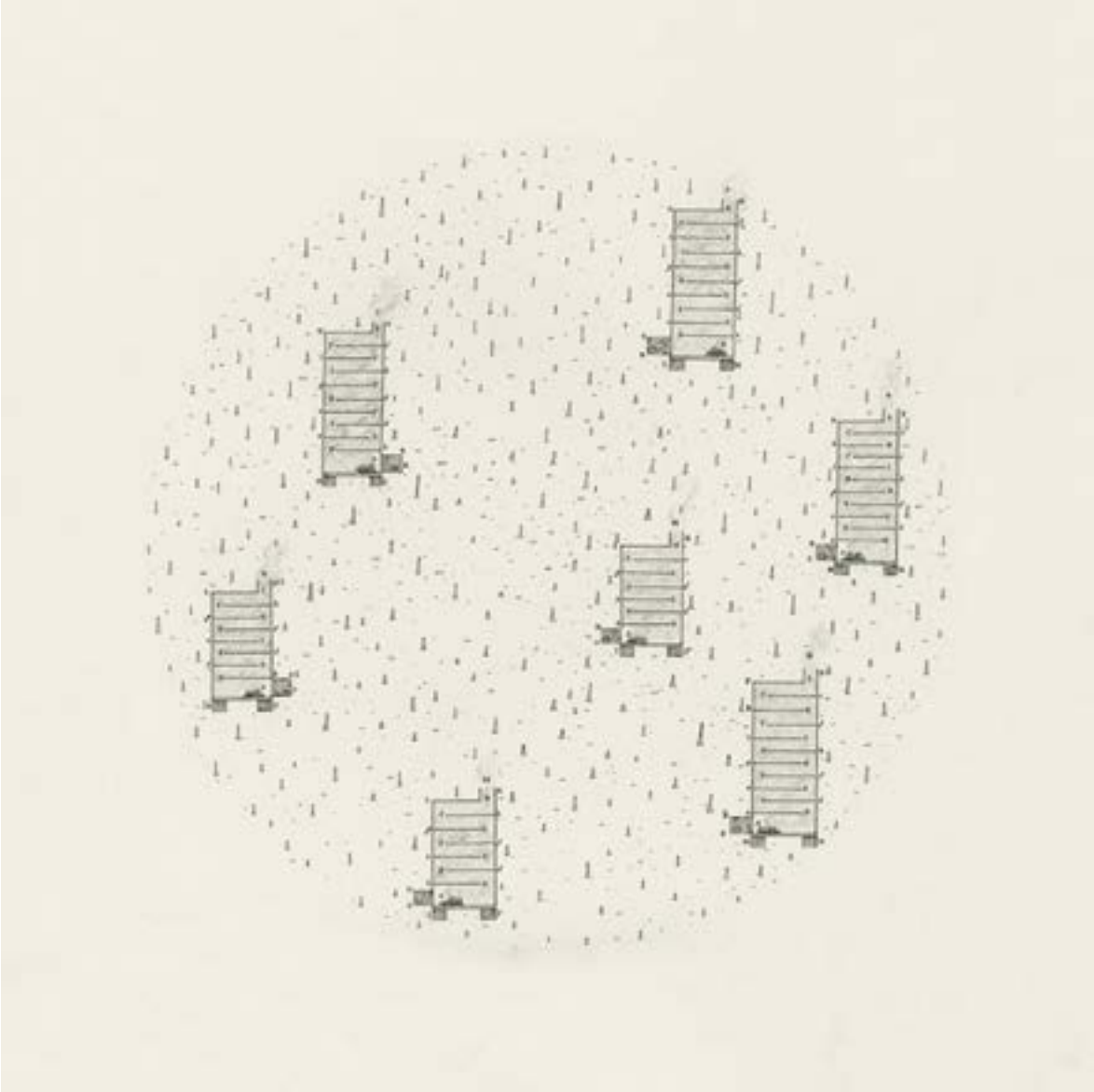

Figure 77: Michael Whittle, *Combustion drawing* (II), 2007, Ink and pencil on paper

The clearing in *Combustion drawing* (II) (figure 77) is depicted as having just occurred, with the cut vegetation being disposed of in a series of what appear to be several ovens or wood burning stoves. Again the clearing is the result of an active process, of human agency and intension.

These smoke-stack structures are drawn in diagrammatic cross section and labeled to demonstrate the route of the smoke passing through each system. The stubble of the vegetation, the stoves, rocks and dust are drawn in a stark and shadow-less environment.

This drawing is the last of a series of images which depict stoves constructed within forests, excavated quarries and libraries, indirectly referencing crematoria and the burning of books.

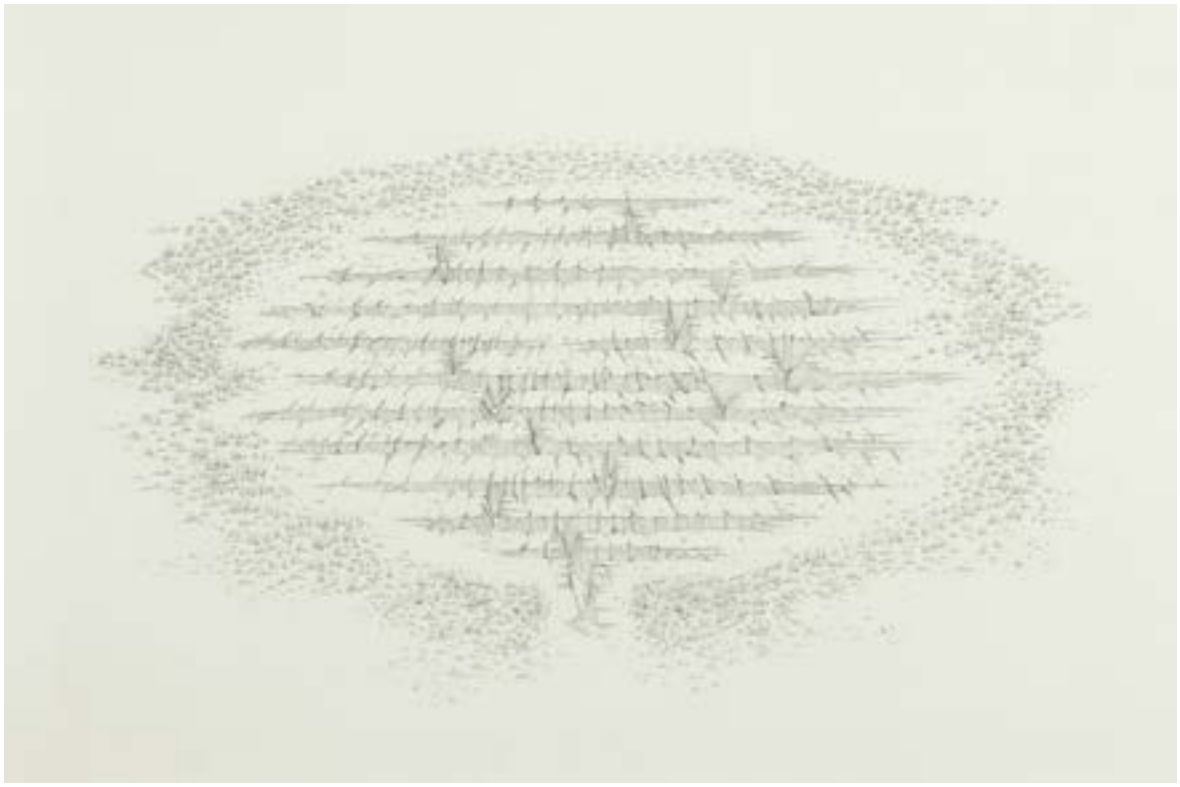

Figure 78: Michael Whittle, *The Desert grows*, 2010, Ink on paper, 63 x 107cm

The Desert Grows takes its title from Nietzsche's epigraph to the acknowledgment of uncertainty: "The desert grows, and woe to him who conceals the desert within him..." [231] (figure 78) The quotation is taken from the poem *Among the Daughters of the Desert* in the final part of *Thus Spake Zarathustra*. The drawing itself is a larger version of a 2008 sketch titled *Drained Landscape*, implying that the desert is in fact a man-made artifact, and thus more in keeping with Nietzsche's original use of the expression to describe the modern condition and the death of God.

In *The Desert Grows*, the process of drying has caused the earth to crack open into a series of trenches, the narrowness of which gradually act to restrict those entering, either physically or conceptually, dictating the possible directions of movement or thought. Surrounding the area of desert is a circle of grassy wasteland, presenting a contrast between natural vegetation and the arid, drained pattern of cracks.

The drawing *Temple Entropy* (figure 79) shows the ruined foundations of a temple, certain details of which were taken from various art historical paintings of the Chinese, Ming dynasty-era novel *Journey to the West* by Wu Cheng'en. The clearing that the travelers discover during their pilgrimage is one initially constructed as a place of worship but which has since been abandoned to decay and is in a process of being reclaimed by nature.

The tiled platform of the temple ruins is comparable to Leonardo Da Vinci's *Perspective study for the Adoration of the Magi* (figure 10). Both consist of a concise, gridded underlying structure, a foundation of geometric precision from which arose rigid architectural constructs to house the organic unfolding of life's events.

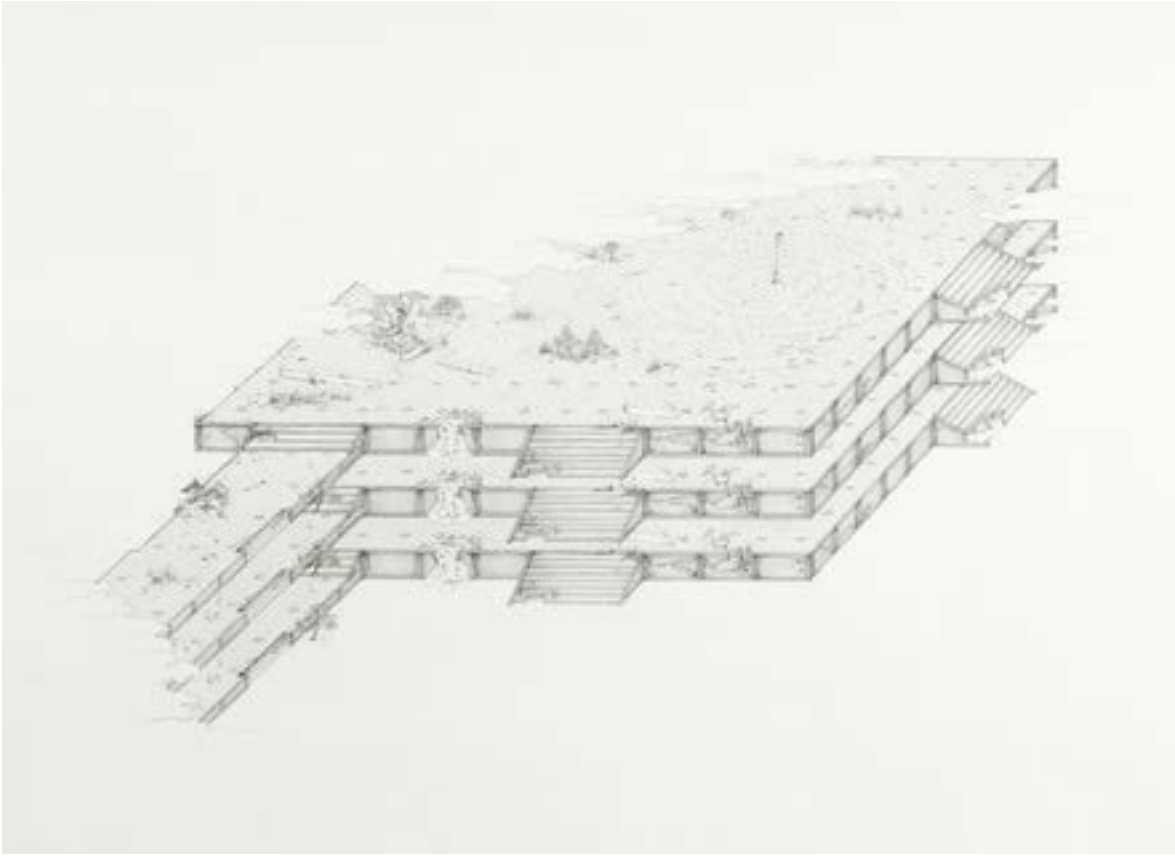

Figure 79: Michael Whittle, *Temple Entropy*, 2008, Ink on paper, 115.5 x 95.5 cm

The platforms in *Temple Entropy* are depicted in triplicate, one above another, in painstaking detail so that each step, board, plant and individual stone are identical in each. Tiles are missing, parts of the walls have collapsed and all that remains of the original temple is an occasional column and an architectural palimpsest of columnar bases.

The image itself is eaten into by fingers of mist so that the white ground of the drawing invades the surface, threatening to envelop it completely. A single flag has been left attached to a post, inserted between the tiles into the earth. The presence of the flag acts as an index in two ways: as an indicator of the movement and direction of a cross wind and as an indicator of human presence. Surrounding the point of the flag's insertion into the temple tiles are concentric circles of grass.

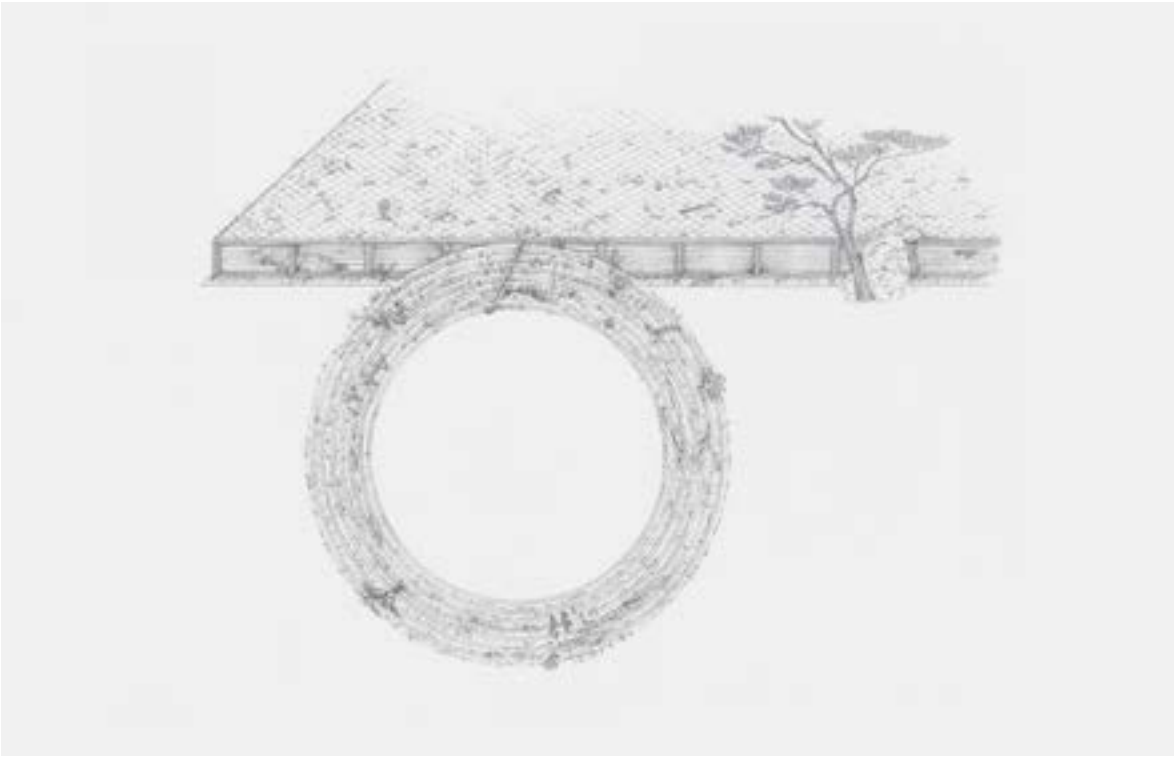

Figure 80: Michael Whittle, *Temple Circle Steps*, 2008, Ink on paper, 76.5 x 54 cm

Temple circle steps (figure 80) is a drawing of a single raised platform developed from the sketches for Temple Entropy. The non-Euclidian geometry of the staircase passing between ground level and the temple structure suggests either an inaccessible or inescapable zone, a Heideggerian clearing or a physical singularity of entrapment respectively.

The parallel layers of the *Temple Entropy* series and the closed loop of steps in *Temple Circle Steps* were drawn a year after a team of Scientists at Oxford University made a mathematical discovery, the potential of which was described as "one of the most important developments in the history of science". [232] The team, led by David Deutsch, showed that key equations of quantum mechanics arise from the mathematics of parallel universes.

6.3: The Symbolic Tree: Imposing Patterns upon Nature

am

deep and rich history of pre-scientific, metaphoric usage underlies the use of the symbolic tree in my practice. Such imagery dates back to a time when "geometry [was] still unmeasured and half hidden", and it provides a means to connect the symbolism of ancient mythology with that of contemporary science. [233]

The tree structure still remains a common method of presenting diagrammatic information in the sciences, especially in biological nomenclature and the visualisation of genetic heredity. The inclusion of the root structure of the symbolic tree in my work presents the tree in its entirety, as a bi-directional gradient between the earth and the atmosphere; a complex, organic system powered by the physical differences between the two mediums.

Figure 62 is one of a set of early drawings made in 2004 based on the Irish existentialist playwright Samuel Beckett's play *Waiting for Godot*. The drawing depicts the excavation of Beckett's iconic, solitary tree under which Vladimir and Estragon must wait. Beckett claimed the play was inspired by the painting *Two Men Contemplating The Moon* by the German Romantic painter Caspar David Friedrich [234] (For an image of the painting, see Appendix K). Friedrich's Romanticism was objective in nature, "intensively contemplative, focussed inwardly by melancholy, but created through a strict formalism." [235]

Beckett saw the painting during his stay in Germany, and described Friedrich as the "only kind of romantic still tolerable". [236] Figure 81 combines many of the elements discussed in chapters 6.1 and 6.2. Landscape is drawn as a mobile geological cross-section and reveals the subterranean structure of the tree as a multipolar neuron, with its cell body and dendrites unearthed and supported by striped poles. The pit formed by the excavation is fenced off and water has started to pool on its floor. The arrows appear to index the motion of the wind, the rain or perhaps the earths magnetic field.

am Johann Theodor de Bry's 1595 Neiw Kunstliches Alphabet: Arborede vetita - Adamus: Letter 'A' in strapwork interspersed with a tree, flowers, birds and fruit; seated on the letter are Adam at left holding an apple, Eve at right offering Adam an apple and the snake above in a woman's body with dragon wings and a tail; in the middle of the letter there is a skull; underneath the skull is an eagle with two heads. 1595

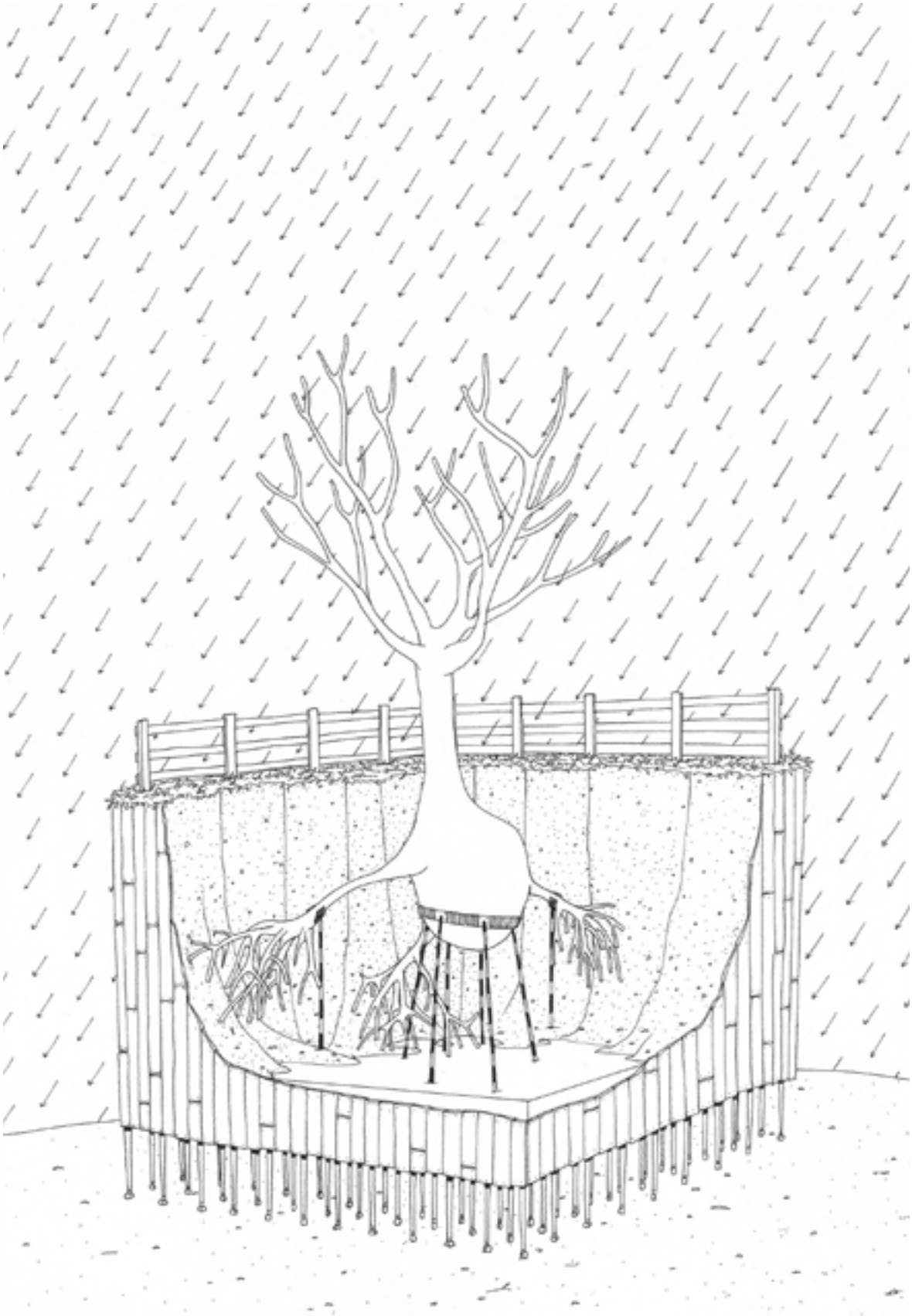

Figure 81: Michael Whittle, Untitled (Scene from Waiting for Godot), 2004, Ink on paper, 29 x 21 cm

Cryptomeria (2004) (figure 82) is based upon sketches made at Ryoanji Temple in Kyoto. The national tree of Japan, *Japanese cedar* (known locally as *Sugi*) is scientifically classified as *Cryptomeria Japonica*; cryptomeria means hidden parts, a reference to the tree's hidden reproductive structures. The trees at Ryoanji are an carefully pruned over many years, creating highly distinct, ornamental structures. In the drawing, excavations surround the bases of the trees (as in figure 76) and the hidden parts within this image are dismembered hands and feet through which the manipulated trunks have grown, a cross-reference to the persecution of Christians in Japan during the sixteenth and seventeenth centuries.

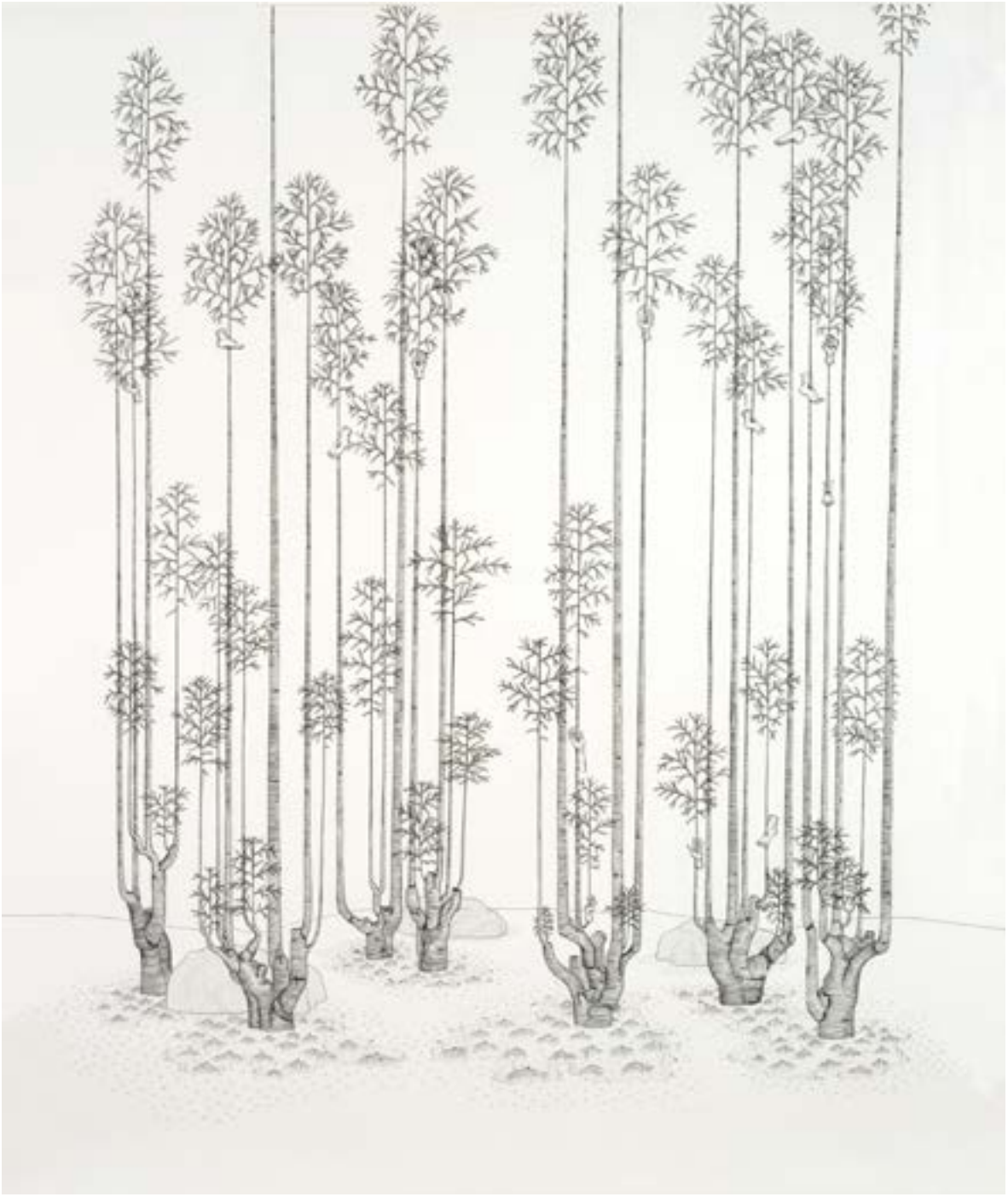

Figure 82: Michael Whittle, *Cryptomeria*, 2005, Ink on paper, 137.2 x 101.6 cm

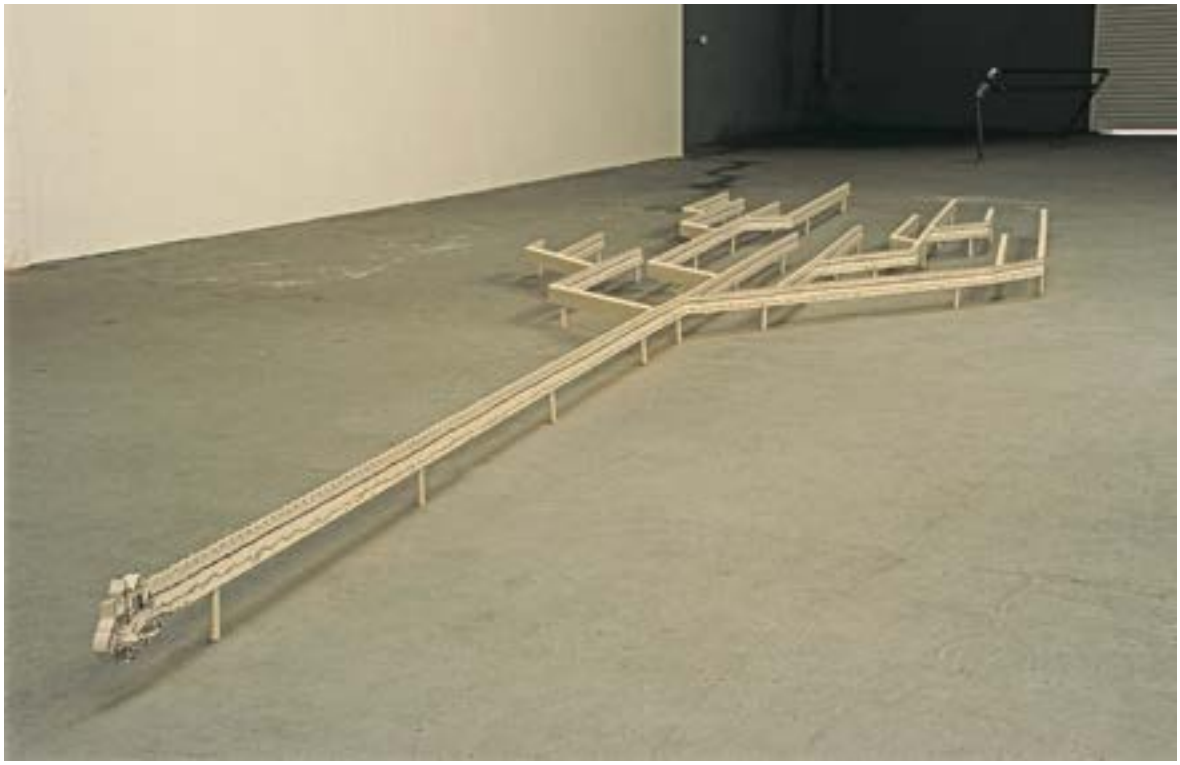

Figure 83a: Michael Whittle, *Der Welt* (*The World*), 2005,
Paint and ink on wood, 35 x 750 x 450 cm

The origin of the illustration in the sculpture *Der Welt* is an incidental scene from a city map in an early European encyclopedia (figure 83a). Two guardsmen at the city gate perform target practice with crossbows outside the city walls (figure 83b, detail 1).

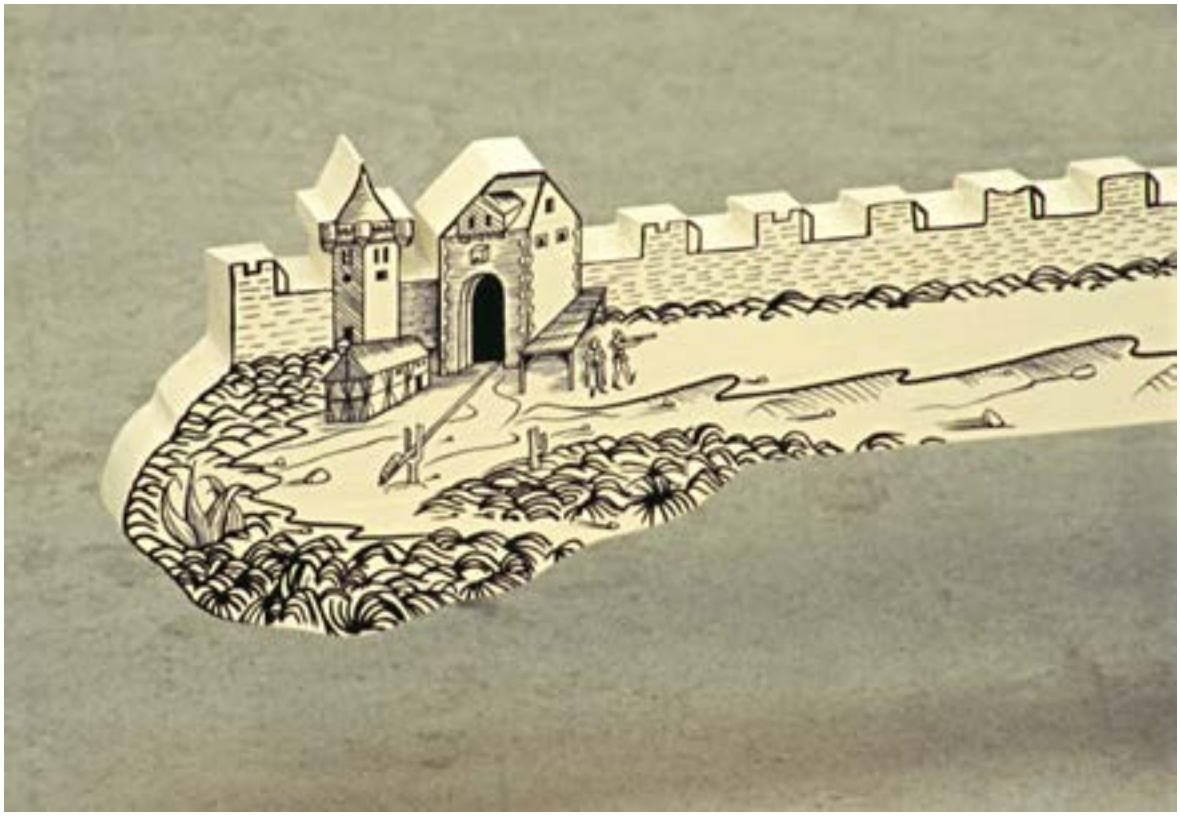

Figure 83b: Michael Whittle, *Der Welt*, (detail 1: city gate with archers)

The small area of wasteland between the guards and the target has been expanded in the sculpture to produce a branching structure, a tree of possible outcomes. The castellated wall, the strip of grass beneath it, the empty road covered with sunlit boulders, and the series of small cliffs are all multiplied to produce a highly abstract pattern in this expanded space. (figure 64c, detail 2)

Figure 84c: Michael Whittle, Der Welt, the terminal targets of the branches (detail 2)

Nine sides of air (figure 84a,b) incorporates an element of traditional Japanese architecture in which small roof-like protective structures are constructed over larger beams and columns of exposed wood to preserve the material and protect it from rain damage. The structure of the sculpture has been carefully burnt in order to leave a layer of black soot, a complex mix of organic compounds and elemental or black carbon.

The ends of the sheltered columns in the sculpture are positioned at viewing height to highlight the growth rings of the tree. The heat created during the burning process has caused each beam to split to its central point, and a network of cracks to appear surrounding the origin of each tree. Branches were carefully chosen, burnt and connected to the beams at certain points, contrasting the cut and prepared nature of the lumber for human use with the fractal, branching qualities of the tree's natural form. [an]

an The title of the sculpture is taken from the title of a flute track by *The Sun City Girls,* an American experimental band formed in 1979 in Phoenix, Arizona. From the album *Box of Chameleons* 3-CD box (Abduction) 1997

Figure 84a: Michael Whittle, *Nine sides of air,* Burnt Wood, 500 x 215 x 285 cm

Figure 84b: Michael Whittle, *Nine sides of Air* (detail:
roof structure over cross section of split beam)

There are several series of drawings that involve the projection of increasingly complex geometric systems onto the symbolic tree.

The *Origami Series* combines the tree structure with the pattern of folds in origami design. Figure 67 is the fold pattern underlying the structure of a paper butterfly, and the branches and ropes of the image have been drawn in accordance with the fold lines of the paper. The resulting structures in the drawings resemble ship masts, and the movement of air through the branches is indicated by the direction of falling leaves and small pieces of rope moving in the wind (these resemble 'tell tails' on ship sails which indicate the movement of wind across the surface of the sail).

Like many of the tree structures in these works, the trees of the *Origami Series* are presented as having been uprooted or excavated, to show their structure in its full form above areas of token wasteland. The trees still appear to be alive, though falling leaves indicate that the process of death has started, and this concept connects the drawings of uprooted trees to the aesthetic philosophy of Japanese *Ikebana*.

In a short article titled *The Japanese Art of Arranged Flowers*, the Japanese philosopher Keiji Nishitani writes that:

> Plato said that all living things seek eternity in this living changing world through procreation… Ikebana is a severing of this very life of nature. Flowers in the field or garden pollinate in order to procreate. This is part of the natural will or desire of life. The arranged flower has this will or desire cut off. It is rather in the world of death, poised in death. It has become severed from the life which denies time, and has itself entered time and become momentary. [237]

However, unlike Ikebana, the processes of death depicted in the drawings has been started not by cutting the tree from its roots, but by digging up the whole root structure and presenting the complete organism, in line with scientific botanical illustrations. In terms of the Japanese art of *bonsai*, which also places great emphasis upon 切れ (kire), or the act of making the 'cut'. The drawings suggest that the growth of the tree has also been controlled by selective pruning, not in order to create a Japanese aesthetic form, but according to various diagrammatic patterns that in this case relate to origami.

The complexity and abstraction of the underlying diagrammatic references have increased over time to include diagrams of magnetic fields, traditional Chinese window designs, non-Euclidian geometry (Reimann space), molecular patterns of high pressure physics, and finally a series of complex computer models depicting the origins of the human language (figures 86 and 87). (See also Map 2 for a comparison of these tree structures in my work)

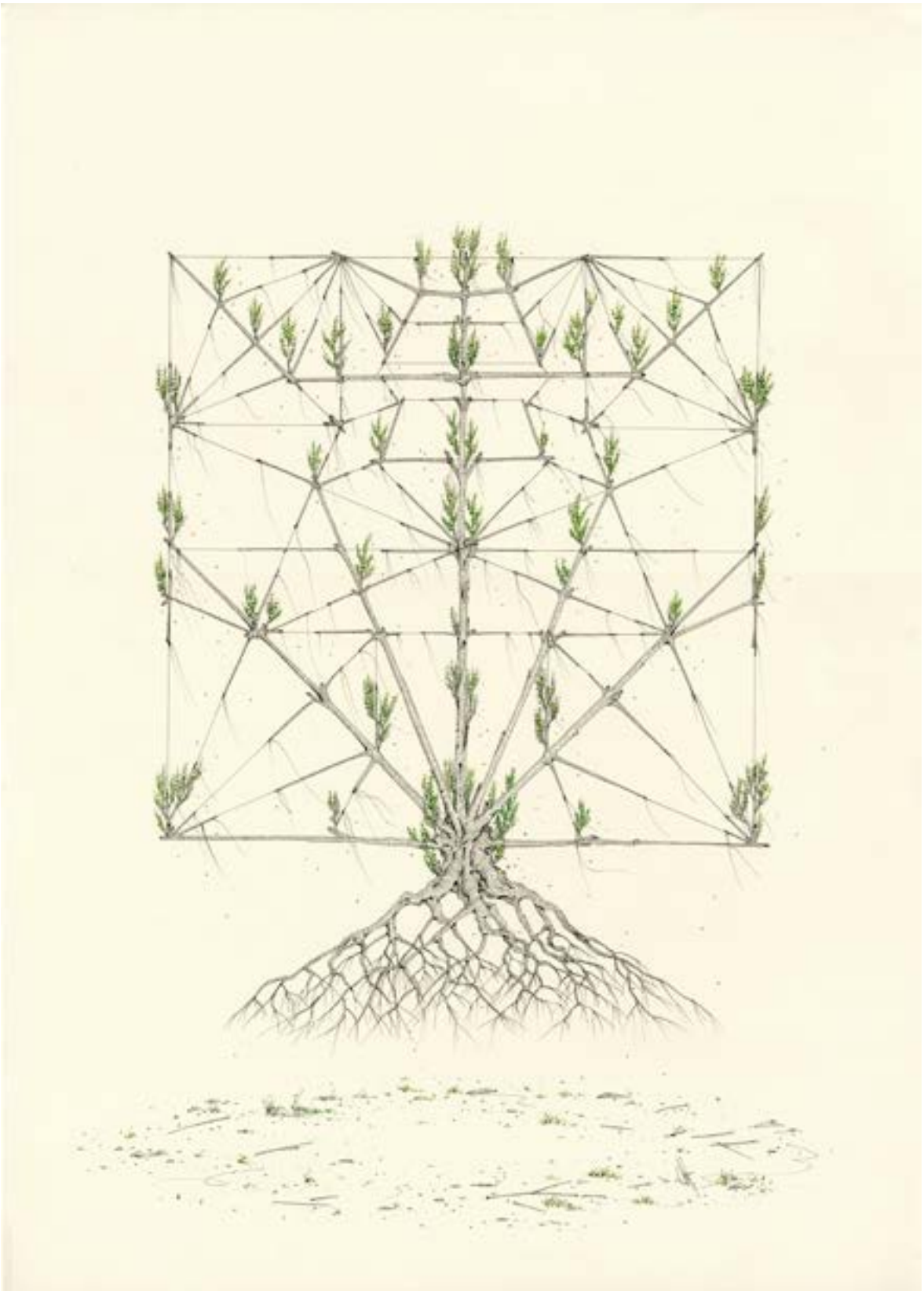

Figure 85: Michael Whittle, *Butterfly* (Origami Series),
Ink and watercolour on paper, 55.5 x 39.5 cm

Model for the origins of human language (Plane and Torus), were developed from three dimensional models of a diagram published in Nature magazine in 2003. The diagram detailed the results of research carried out by Russell Gray and Quentin Atkinson.

Gray and Atkinson applied Bayesian phylogenetic methods to study the evolution of human languages, in a move that came to be regarded as one of the most controversial and exciting developments in the filed for over a decade. The statistical technique they applied is a set of algorithms first developed in biology to designed to estimate evolutionary divergence times of DNA. (For an image of the original diagram, see Appendix L)

From their original diagram I developed a series of three dimensional computer models which transformed the original two dimensional diagram in to virtual objects such as spheres, planes and tori. All traces of the origins of the data was stripped away from the structures, including text and figures, leaving only the title as a suggestion of the diagrammatic object's origins. (For an image of the computer model for the Plane structure, see Appendix M)

Both the plane and torus are depicted as rhizome-like networks of tree roots and branches. The branches of the warped planar structure take on the appearance of a deciduous versions of the Japanese Cedar of figure 63, shown as an inverted grid-like structure with radial negative spaces according to the positions of language branches of the original data. In this way the plane structure suggests the 'design space' or 'search space', a theoretical space in which all possible languages could be imagined to exist, as discussed in chapter 2.5 in terms of Goethe's urplant.

The Torus is a 'ring torus' with an aspect ratio of approximately 2:3, shown punctured so as to reveal its internal structure. [ao] The centre of Gray and Atkinson's original diagram can still be clearly seen through the central hole of the torus and forms the densest part of the image, the 'big-bang' of human language where clear and individual language branches cannot exist as singular entities, but become fused in to a dense modernist grid, a void network where the computer model breaks down due to a lack of reliable data. The map of human language has been contorted in to a self contained universe, and the negative spaces on the surface in to which the branches grow denotes the sea of all possible languages.

For the first time, the torus is positioned between two opposed landscapes, so that leaf debris and the delicate guy-ropes fall both upward and downwards towards polar opposite token wastelands. The red buoy-like objects in both drawings are based an a graphic feature of the original diagram

ao Given by Major radius (R) divided by minor radius (r).

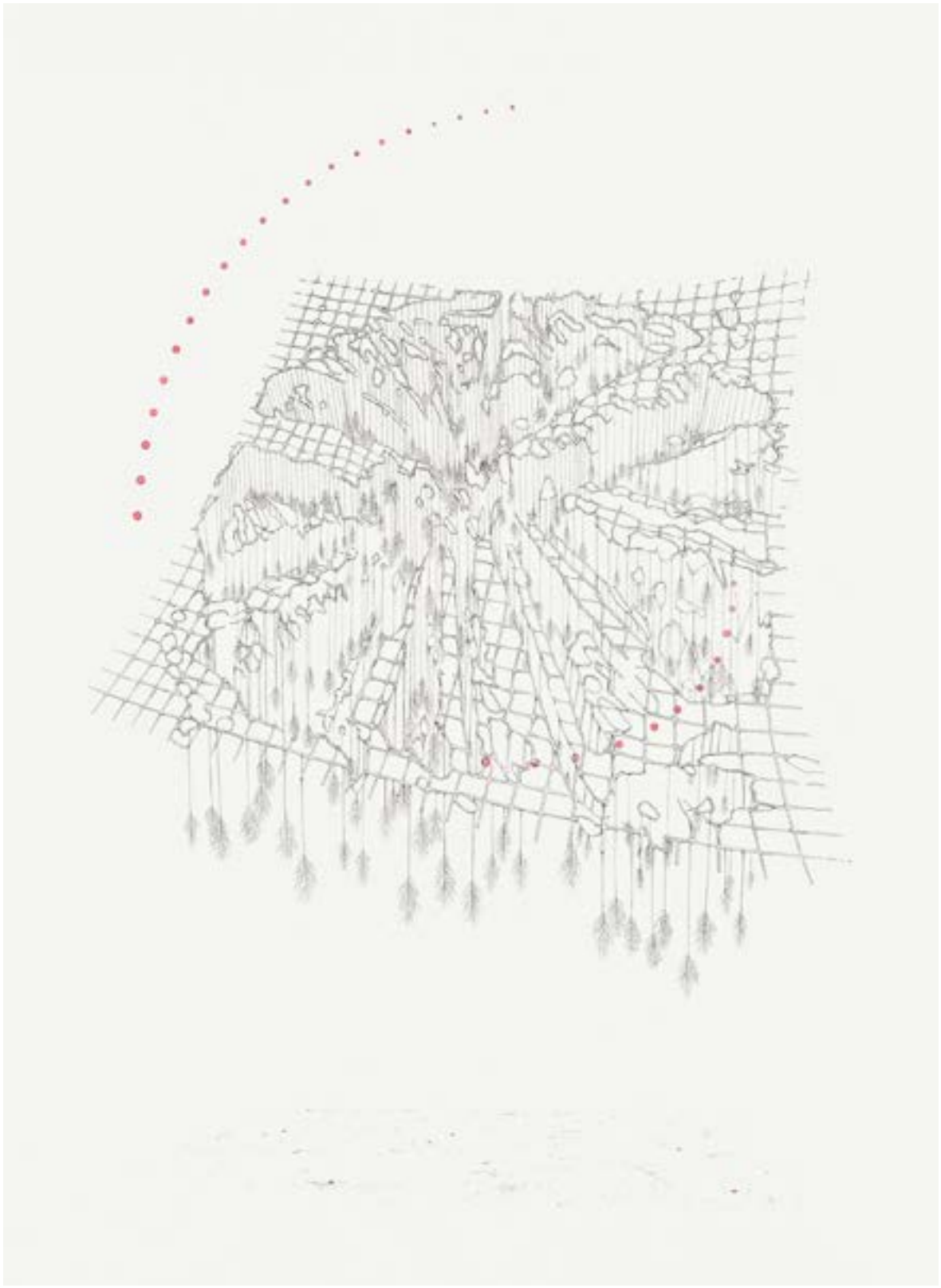

Figure 86: Michael Whittle, *Model for the origins of human language - Plane*, 2011, ink and watercolour on paper, 142 x 104 cm

Figure 87: Michael Whittle, *Model for the origins of human language - Torus*, 2011, ink and watercolour on paper, 142 x 104 cm

6.4: The Symbolic Bird: Avian Anatomy

"A bird is an instrument working according to mathematical law" [238]

Leonardo daVinci

[ap]

nother recurrent theme in the work is the bird, a symbol which predates the romantic period and is found worldwide as a symbol of the mysterious and the spiritual: "Every winged being is symbolic of spiritualization …the bird as symbolic of the soul…found… all over the world", where the act as collaborators with man, messengers, deities and stand for spiritual processes and spiritual relationships. [239]

The ancient symbolic use of the bird is evident in romantic poetry, so that the albatross in Coleridge's *The Rime of the Ancient Mariner* represents purity, innocence and sacrifice associate with Christianity, whilst the nightingale in John Keats's *Ode to a Nightingale* I makes reference to pre-Christian deities Dryad, Bacchus, the Muses, and is employed to represent the immortality of the human soul and as a symbol of escape from the sorrows of the world to the joyful world of art,through birdsong.

The bird in this body of work relies upon this symbolic history, and contrasts it against the clinical precision with which they are anatomically and genetically defined by the classification system of modern science: as a member of the *Animalia* Kindom, in the Phylum *Chordata* (Subphylum *Vertebrata)*, Clade Dinosauria, Clade Ornithurae, in the *Aves* Class. Birds are the last surviving lineage of dinosaurs, having evolved from a group of feathered dinosaurs called *theropods* from the Early Cretaceous period of Earth's history, around 120-130 million years ago.

The use of the bird in this body of work, like landscape, has undergone a process of dissection and fragmentation, starting with the early drawing *¡Qué esfuerzo!*"in 2002 (Figure 88). This drawing shows a floodlit billboard featuring two yellow canaries perched on a black and white striped ring. Canaries have a very high heart rate, ranging between 300 and 1000 beats per minute, and an extremely high metabolic rate, which means that they must constantly seek nutrition.

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ap Vultures as hieroglyphs had the phonetic value of the letter A. Egypt. Ancient Egyptian. New Kingdom 18th Dynasty, Karnak.)

Figure 88: Michael Whittle, *¡Qué esfuerzo!*, 2002, Ink on paper, 36 x 29 cm

The great effort made by small birds (as individuals and groups) to find food, shelter and mates is what birds have come to represent in these works: icons of effort and nervous energy. In this particular drawing the birds are pinned like taxidermy specimens, and behind them are placed rows of Belisha Beacons. At the foot of the steps leading up to the birds are placards showing labeled, brown organic forms which could equally be read as embryonic forms or as faecal matter.

As with so many of the other drawings, the title provides a means to decipher the context, or as Marcel Duchamp described it, to add a "cerebral colour, not in an intellectual way, but in the way you make another frame for the painting, a new way for seeing and understanding the artwork." [240] *¡Qué esfuerzo!* is the first line of the poem *Muerte* (Death) by the Spanish surrealist poet Federico García Lorca (See Appendix N for the original poem). Variously translated into English as 'It is hard!', 'What effort!', or 'How hard they try!', the poem starts with a series of transformations and efforts by beings to become one another in a surreal chain of life and death.

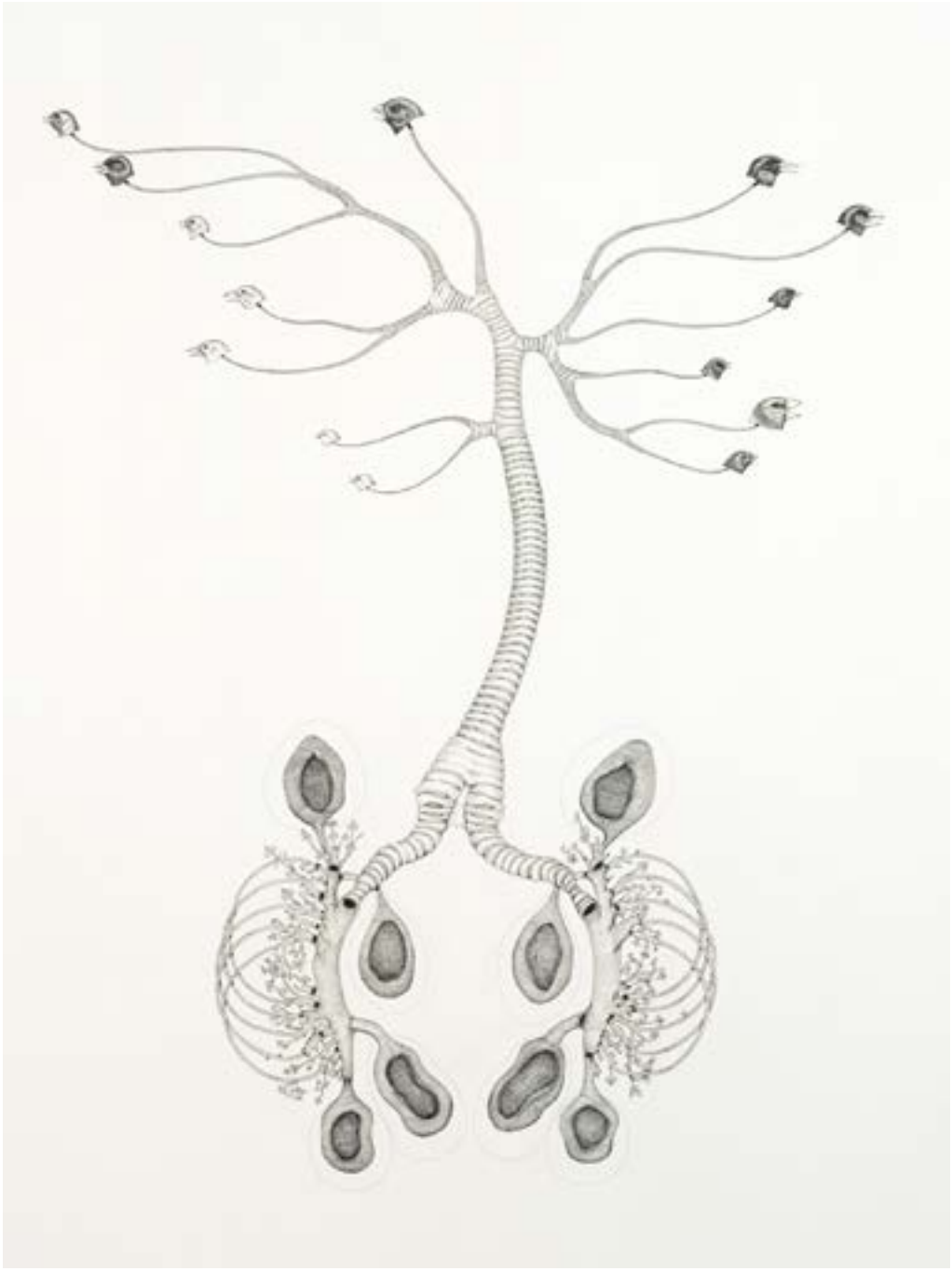


Figure 89, Michael Whittle, *Dawn Chorus*, 2005, Ink on paper, 90 x 72 cm

The drawing *Dawn Chorus* contains the heads of the finches first described by Charles Darwin on his visit to the Galapagos Islands in 1835 at the age of twenty six (Figure 89). The birds are highly adapted according to their food sources, and were to play an important role in Darwin's development of a theory of evolution by natural selection.

Unlike mammals, birds have a set of air sacs attached to their lungs, depicted in Dawn Chorus as broken, hollow structures at the base of the image. These sacs allow each breath of air to pass through the bird's lungs twice, increasing efficiency and enabling them to sing while in flight.

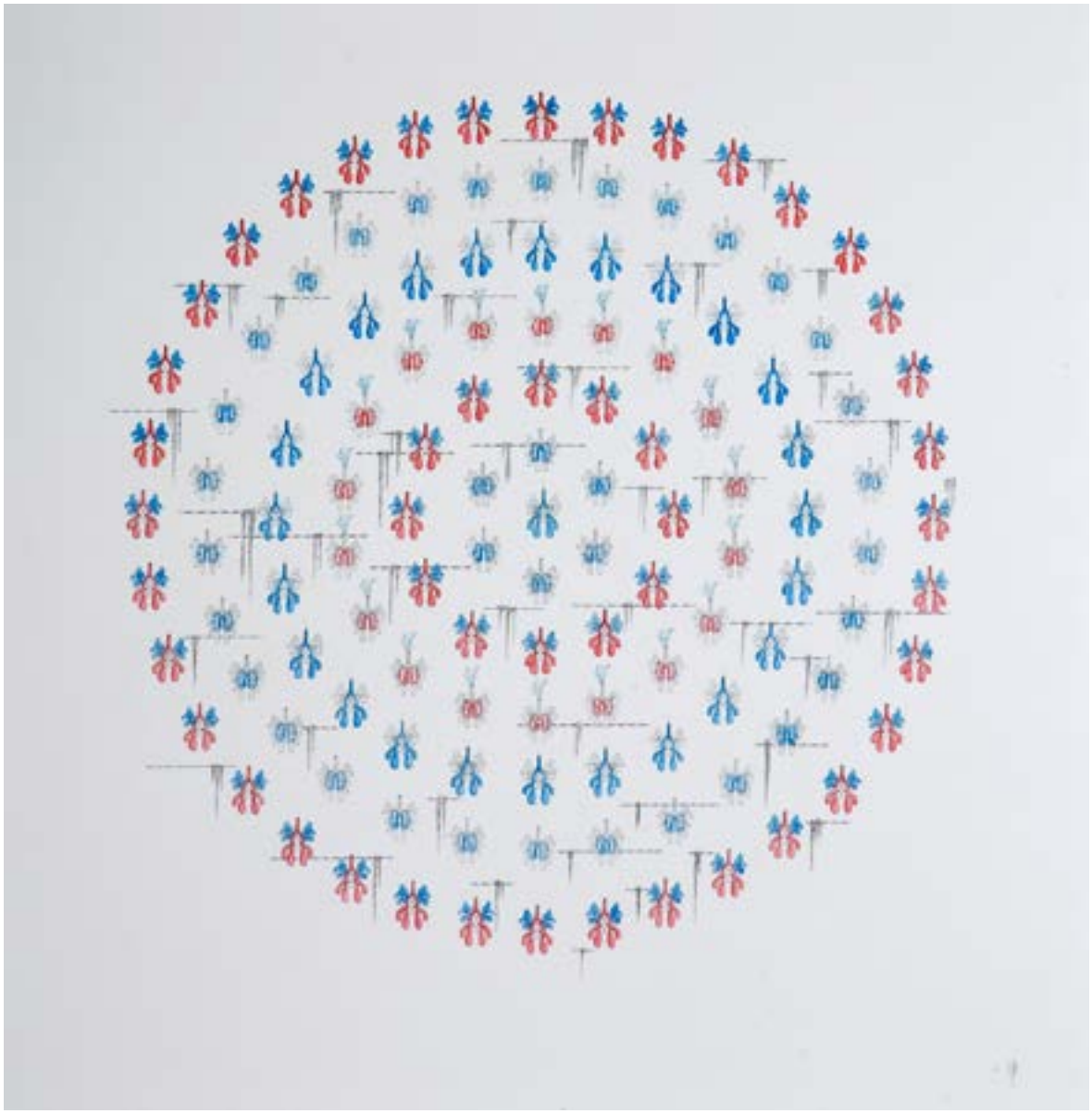


Figure 90: Michael Whittle, *Concentric Dawn Chorus*, 2009,
Ink and water colour on paper, 76 x 76 cm

This idea was reworked in the drawing *Concentric Dawn Chorus* (2009) which shows the functional cycle of the simple lungs and air sacs as a series of concentric circles (figure 90). The pattern is analogous to the ripples of sound waves spreading out through the air from their point of origin at the bird's beak, as well as incorporating the cyclical nature of the birds complex breathing cycles

Colour in the work indicates the oxygenation state of the blood, as is standard in anatomical textbooks, and dispersed among the sets of lungs are standardised black and white striped measuring rods draped with green leaves.

Figure 91: Michael Whittle, *Bird Call, Full Moon*, 2009,
Ink and water colour on paper, 42 x 42 cm

The final reworking in the bird lungs series is the drawing *Bird Call Full Moon*, an image reduced to a single exhalation of air through diagrammatic lungs in to the bird's syrinx. The drawing is haiku-like in both its objectivity and simplicity of form, relying upon the title to suggest a trio of avian lungs, bird call, and the circle of the full moon (figure 91).

Thread (figure 92 a) is a collaborative drawing with my wife, the artist Sangsun Bae, made as part of our collaborative exhibition *Dividing Line – Connecting Line* (2013-14). The image contrasts a pen-and-ink rendering of the bones of bird wings drawn in fine detail with the feathers drawn in charcoal by Bae.

A fine thread connects the dismembered wings to one another, and each is drawn on a separate sheet of paper. (figure 92 b) All that remains of the bird are the intricate structural components of flight, the end result of millions of years of evolutionary design by blind trial and error.

Figure 92a: Michael Whittle, Sangsun Bae, *Thread*, 2014,
Ink and charcoal on paper, 56 x 84 (x2)

Figure 92b: Michael Whittle, Sangsun Bae, *Thread*, (detail)

Presented in a style similar to anatomical drawings, the single gesture of tying the thread between the dislocated shoulders of the bird is essential, a minimally romantic one.

6.5: The Human Figure: Icon to Symbol

aq

epictions of the human form in contemporary diagrammatic art are normally made indirectly, if at all. The exceptions rely heavily on the use of anatomical depictions in medical imagery, or on methods of reducing the figure to highly motivated icons such as the graphic icon (Yokoyama Yuichi) or simplified computer model (Yves Netzhammer) (See Map 1).

In my practice, the human form was at first suggested using the disembodied hands of demonstrative encyclopedic plates (figures 54 and 55).

The head and torso in the sculpture *Once, once and no more* (figure 93) is the white Aryan male of a wartime German anatomy textbook. The title is take from a translation of the German poet Rainer Maria Rilke's Duino Elegies (Elegy 9):

> Everyone once, once only. Just once and no more. And we also once.
> Never again. But this having been once, although only once, to have
> been of the earth, seems irrevocable. [240]

Rilke's Duino Elegies deal with the mysteries of human life and our attempt "to use our self-consciousness to some advantage: to transcend, through art and the imagination, our self-deception and our fear." [241]

As in the sculpture *Nine sides of Air* (figures 84a and 84b), the wooden blocks of the structure are turned on their sides to highlight the growth rings of the trees, which appear as target-like circles surrounding their central points of origin. The wooden panel and the fragmented image of the body has been atomized, the units kept in place and under pressure by the tension of the metal cable.

aq Letter D, from Alfabeto in sogno, esemplare per disegnare di Giuseppe Ma Mitelli 1683

Figure 93: Michael Whittle, *Once, once and no more*, 2004,
paint on wood with wire and tension hooks, 240 x 230 x 80 cm

Certain glands are highlighted in red in the anatomical image: the pituitary of the brain, the adrenaline glands above the kidneys and the testicles of the adult male. These glands are a basic and ancient system of communication within the body via hormones, evolutionarily predating the speed and efficiency of the electrical nervous system.

The poles used to apply pressure, the measuring rod suspended to the right of the image and the Y-shaped support behind the structure are divided into black and white, ten centimetre units. The green laurel wreath of Greek mythology has taken on multiple historical meanings, being used to represent victory, education and memorial at various different times. Rilke refers to laurel in the first line of elegy nine (For the text of the poem, see Appendix N).

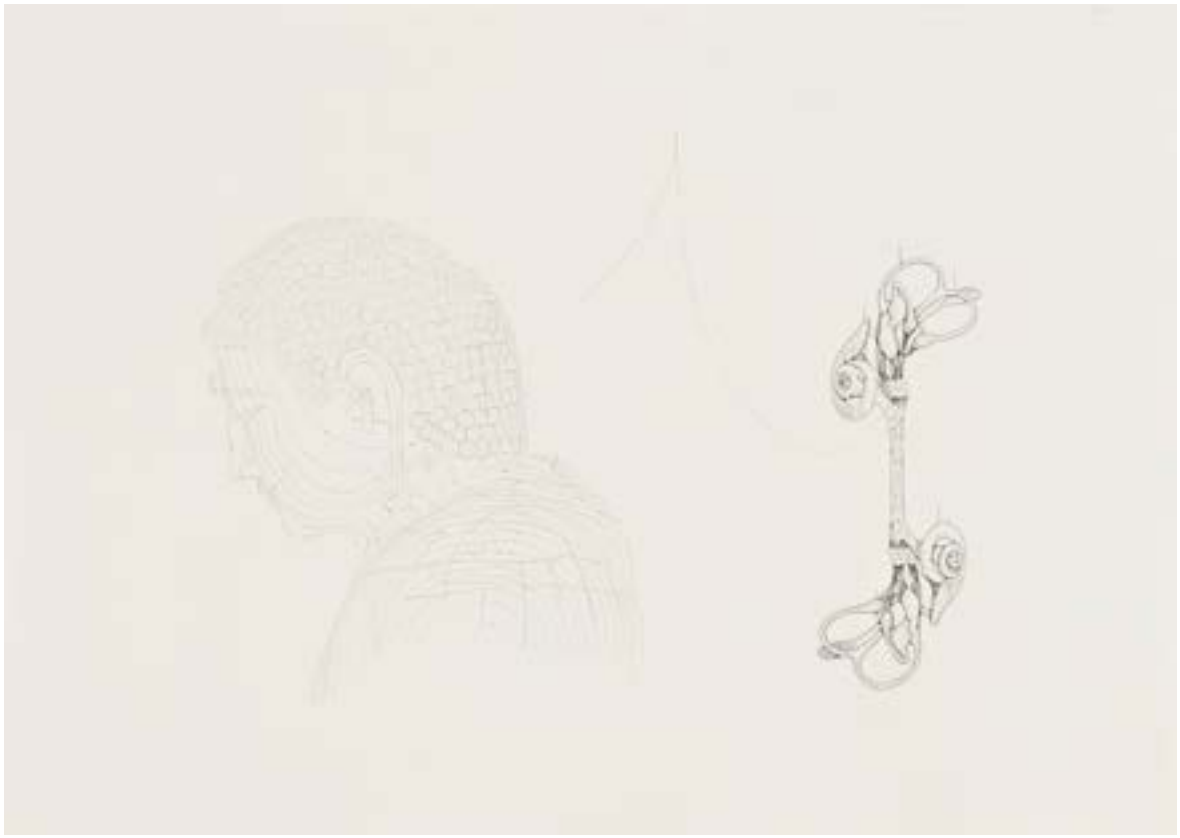


Figure 94: Michael Whittle, *Buddha with Silence Doubled*,
2011, Ink on paper, 79 x 111 cm

The Buddha contour drawings/Buddha topographies are a series made between 2008 and 2012, based on a small diagram from an unknown Japanese encyclopedia depicting the results of the late 1970s laser documentation of the Great *Daibutsu* monument of Todaiji Temple, Nara, Japan.

Considered diagrammatically, these drawings are the end result of a two-stage process of token formation from artistic, religious and scientific philosophical ideals. First, a 500 ton bronze statue was constructed in order to represent Birushana Buddha (Vairocana in Sanskrit), the great cosmic Buddha said to embody the Buddhist concept of Emptiness. Its massive size and brilliance is meant to serve as a philosophical reminder by extreme opposites, that all conditioned existence is empty and without a permanent identity. Second, and at a much later date, the statue was mapped and documented using precise laser measurements, in a cataloguing process attempting to conform to strict scientific ideals.

Based upon the encyclopedic illustrations of the laser-mapping project, my resulting drawings present something of the paradoxical nature of such endeavors. The construction of a giant statue to represent the unrepresentable Buddha of emptiness, and the contemporary attempt to scientifically measure, document and catalogue, as accurately as possible, something which, by its very nature, represents the immeasurable.

Figure 94, Buddha with Silence Doubled contrasts the Buddha diagram with the cochlear and vestibular systems of the vertebrate inner ear, responsible for providing hearing and balance respectively. In this image the structures of two ears are fused together into a self-sensing, organic system denied access to direct auditory stimulation from the outside world. The surface textures of the inner ears have been drawn to mimic an aged and disintegrating wooden structure, riddled with insect holes. This idea is the direct result of having obtained a series of photographs taken as part of an ethnographic study of religious artifacts (Appendix 0).

The susceptibility of wooden and paper artifacts to environmental conditions and biological deterioration became accepted as an inevitable, natural process in Japan. The different ways in which this physical deterioration were considered and dealt with came to reflect key Buddhist philosophical ideas of permanence and impermanence. Even today, whole temple structures are periodically dismantled and re-constructed, and black and white under-drawings are maintained and recopied as blueprints for Buddhist paintings.

From Greek mythology in the West, we have the Theseus Paradox, a question of identity following extensive physical restoration of an object. The original paradox was a thought experiment in which the boat Argos, used by Theseus and his crew, was replaced plank by plank during a voyage: the riddle is whether or not the boat returning to harbour is the same boat that left.

As a student of biochemistry, I first came across this paradox as it applies to the human body. With an individual's DNA supplying the blueprint, cellular turnover within the body is such that a majority of tissue is replaced within a relatively short period. Although you may think of your body as a fairly permanent structure, most of it is in a state of constant flux as old cells are discarded and new ones generated in their place. Each kind of tissue has its own turnover time, depending in part on the workload endured by its cells.

The symmetrical network of household plastic water pipes in *Thoughts of a Dry Brain in Dry Season* (figure 95) are based on the blood vessels that sit beneath the brain and nourish the human brain (See figure 72). The pipes are connected to the rain gutters of the damaged, burnt roof that provides shelter above as a kind of skull. The original drawings for the sculpture show the pipe system being uncovered in an archaeological dig, with puddles of rainwater leaking from the cut ends of the vessels as it is being uprooted, or, in Heidegger's terms "torn out of hiddenness". [244]

Figure 95: Michael Whittle, *Thoughts of a Dry Brain in Dry Season*, 2011
Burnt wood, Chinese ink, metal fittings, plastic

The title of the work is taken from T.S. Elliot's poem *Gerontion*, written originally as the preface to *The Wasteland* but later published as an independent poem. Starting with the lines: "Here I am, an old man in a dry month, / Being read to by a boy, waiting for rain", the poem also includes the line: "A dull head among windy spaces," the final couplet being "Tenants of the house, / Thoughts of a dry brain in a dry season." [245]

The lack of any water in the final work and the references in the title act to highlight the idea of the air inside the pipes; a metaphorical dry and empty skull in a desert, a vessel that once contained the thoughts of a whole life, now empty of its tenant.

Figure 96 was also made as part of a collaborative exhibition Dividing line – Connecting Line. The body and arms of the figure are constantly inflating and deflating in random directions. These fan-powered windsocks are normally used to display advertisements in South Korea, but like the Belisha Beacons of earlier works (figures 1, 2), when removed from its context is only able to draw attention to itself as a semi-figurative object moving within a landscape without changing its position.

Figure 96: Michael Whittle, *Figure 1*,
nylon windsock and electric fan,250 x 140 x 45 cm

In this installation, the frantic motion of the sculpture is placed in contrast with the stillness of the Japanese garden. The stripes are each ten centimetres wide, and, as in the earlier sculpture *Once, one and no more* (figure 93), suggest systems of empirical scientific measurement.

Summary and Conclusions:

The diagram exists in art as a conceptual tool, a means of structuring experience and as a distinct aesthetic. These categories are not mutually exclusive however, and art works often include elements of all three approaches, as indicated by the fields of diagrammatic art in Map 1.

The use of the diagram as a conceptual tool can be traced back to Paleolithic stone maps depicting iconic images of deer and schematic ibex within complex symbolic landscapes. This suggests their use in physical and conceptual orientation, but also as a way of planning ahead or reflecting upon past events, and thus learning. Daniel Dennett includes such diagrams as part of an important set of philosophical tools for thought experiments, which he refers to as intuition pumps. Intuition pumps (such as language and mathematical notation) provide structure to the way problems are thought about, and as such, the diagram played a major role in some of the major events in the history of human thought, such as the creation of the ideograms and pictograms of early writing. [245] The diagram as thought experiment also played an essential role in the scientific revolution, where it came to be established as a key component of the scientific technique. Diagrams have come to play an increasingly important role in the information age in terms of their investigative and didactic properties, and their presence in contemporary art reflects this involvement.

The diagram as a means of structuring experience also has its origins in the Stone Age with structures such as Stonehenge providing physical, spiritual and ritual orientation. Such monuments provided a means of diagrammatically incorporating time and seasonal change within their architecture, resulting in a structured relationship between humans, their environment and the heavenly bodies. Modern architectural and hodological studies investigate the effect that the environment has upon human psychology, and also rely upon the diagrammatic nature of human sensory experience in relation to the landscape.

The concept of a diagrammatic aesthetic arose along with early modern science, in particular the European encyclopedic projects of the Enlightenment period. It was during this time that the diagrammatic form flourished, and their distinctive visual appearance was established and refined that is still recognisable today. The complex interrelationship between the diagram and science gave rise to a distinctly reduced aesthetic, encapsulating the intellectual rigor of scientific-philosophic techniques such as: idealisation, essentialism, reductionism, objectivity and the division of primary and secondary qualities.

The lasting visual effect this has had upon the diagrammatic aesthetic in art includes an economy of line, restricted use of colour, multiple or shifting perspectives and the emphasis of a phenomenological or conceptual 'white space'. Artists have developed a variety of strategies that take advantage of the unique properties of the diagram to create a distinct objective-subjective resonance in their work, as tool, experience and aesthetic.
Diagrammatic art combines the detached objectivity of scientific investigation with the sensuous metaphoric nuance of fine art, in a style that I refer to as Romantic-Objectivism. Romantic-Objective art works are capable of mediating between the subjective and objective ideals. They simultaneously promote feelings of detachment and involvement in the viewer, relying upon the diagrams appearance as an authoritative, scientific and objective mode of communication, whilst introducing elements of disorder and subjective self-expression.

Scientific and Mathematical diagrams rely upon the minimization of what C.S. Peirce refers to as tones, the indefinite but significant character(s) of a set of semiotic signs. Within these fields of study, users of these types of diagrams are conditioned to overlook irregularities in order to read, understand and use such diagrams as ideal types. Artists making diagrammatic art works, however, tend to select and highlight particular tones, or combination of tones (tuones) in order to avoid the formal sterility of the purely geometric image. This enables diagrammatic artworks to subtly transmit subjective, nuanced information to the viewer, creating an objective–subjective resonance that is more than the sum of its objective parts.

Diagrammatic art involves both the creation and erosion of meaning, resulting in what Umberto Eco refers to as an open work. Open works emphasise ambiguity and present viewers with a multitude of possible meanings, despite their reduced visual aesthetic. The diagram has played a key role in twentieth century art, uniting the practices of some of its leading figures. Avant-garde art of this period is pervaded by the reductive sensibility of a diagrammatic aesthetic, which developed alongside the evolution of abstraction. These processes are very evident in the early analytic cubism of Pablo Picasso, George Braque of the 1900's, key works of Marcel Duchamp, the formalism of the Russian Constructivist movement and artists such as El Lissitzky and Aleksandr Rodchenko, and Piet Mondrian.

The scope and flexibility of the diagram has allowed it to constantly adapt to the changing needs of artists, and contemporary diagrammatic art is a rich and active field, comprising some of the most innovative international artists from disciplines spanning a diverse range of mediums and themes. The all-encompassing, innovative nature of art has expanded our notions of what a diagram is, and yet despite its prevalence and success in art the diagram remains largely overlooked as a subject of academic discourse.

This thesis attempts to provide a clearer understanding of the terrain and features of not only diagrammatic art, but also the diagrammatic domain in which it developed. The diagram plays an important role as mediator between objective and subjective ideals, and thus between science and art.

The thesis allowed the positioning of my own work as an artist within a wider artistic, philosophical, cultural and historical context, drawing upon my previous studies and interest in science to gain a deeper understanding of my own artistic practice. (See Map 2)
Parallels exist between the changes that the diagram underwent during the enlightenment encyclopedic projects, and the development of my own work as an artist over the last 12 years. In both cases, landscape and image content have undergone processes of essentialisation, idealisation and reduction, leaving only simplified arrays of objects floating in a neutral white space, and, in the case of my sculptures, objects and installations that resemble oversized scientific models.

By appropriating the specialist symbolic language of science, medicine and technology in to my work, this also allows specialists within those fields direct access to the symbolic meaning of those works than might normally be possible. Such an approach provides a constructive way of involving scientists in contemporary art and, vice versa, contemporary art in science, without resorting to popularizing strategies, which risk oversimplification and generalisation of ideas from specialist fields.

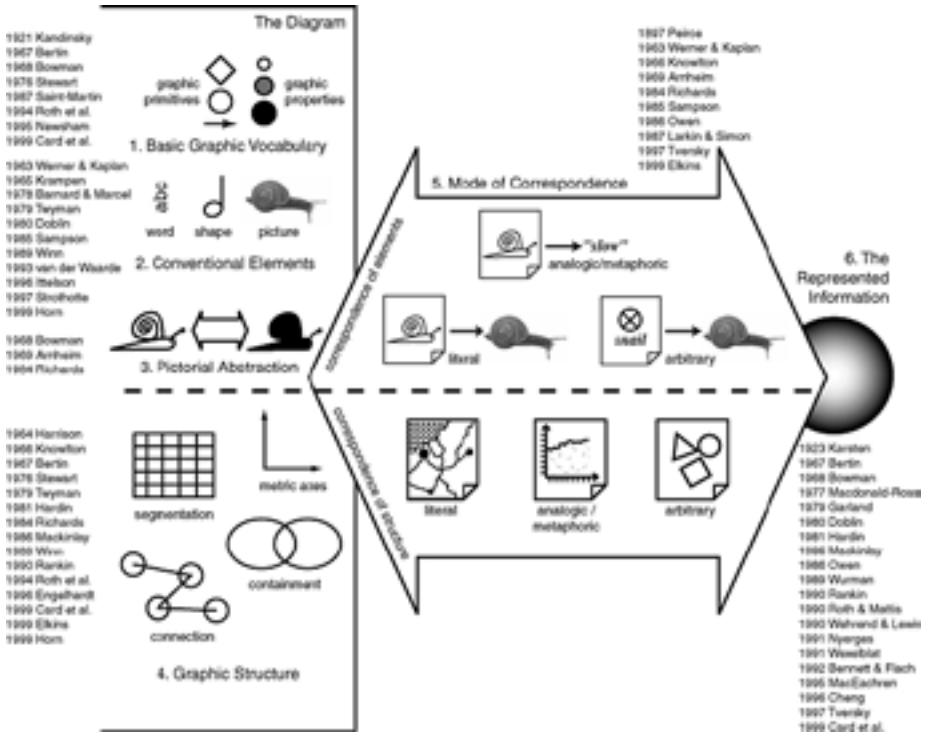
Appendices:

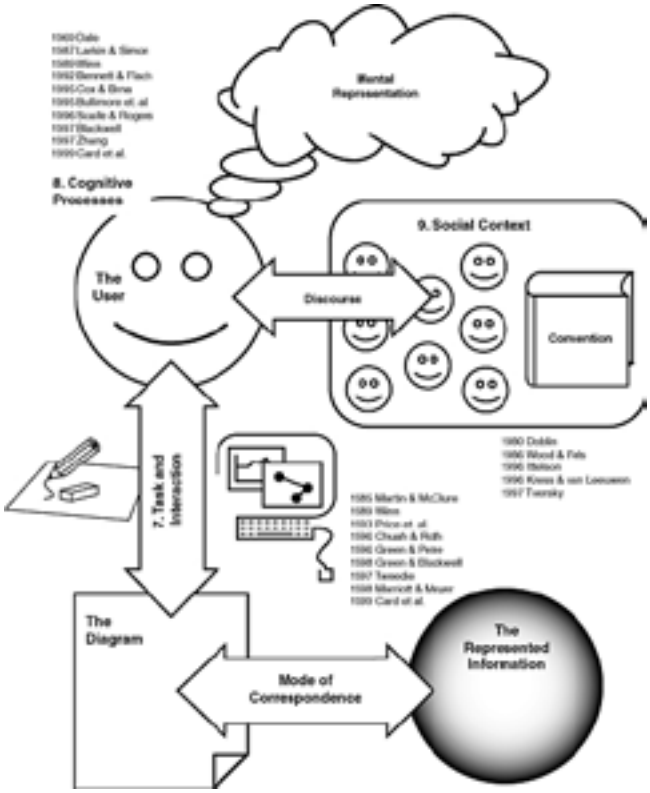
Appendix A: Range of subjects covered at *Diagrams*, a Biannual International Conference Series on the Theory and Application of Diagrams

- applications of diagrams
- computational models of reasoning with, and interpretation of, diagrams
- design of diagrammatic notations
- diagram understanding by humans or machines
- diagram aesthetics and layout
- educational uses of diagrams
- evaluation of diagrammatic notations
- graphical communication and literacy
- heterogeneous notations involving diagrams
- history of diagrammatic notations
- information visualization using diagrams
- nature of diagrams and diagramming
- novel technologies for diagram use
- psychological issues pertaining to perception, comprehension or production of diagrams
- software to support the use of diagrams
- usability and human-computer interaction issues concerning diagrams

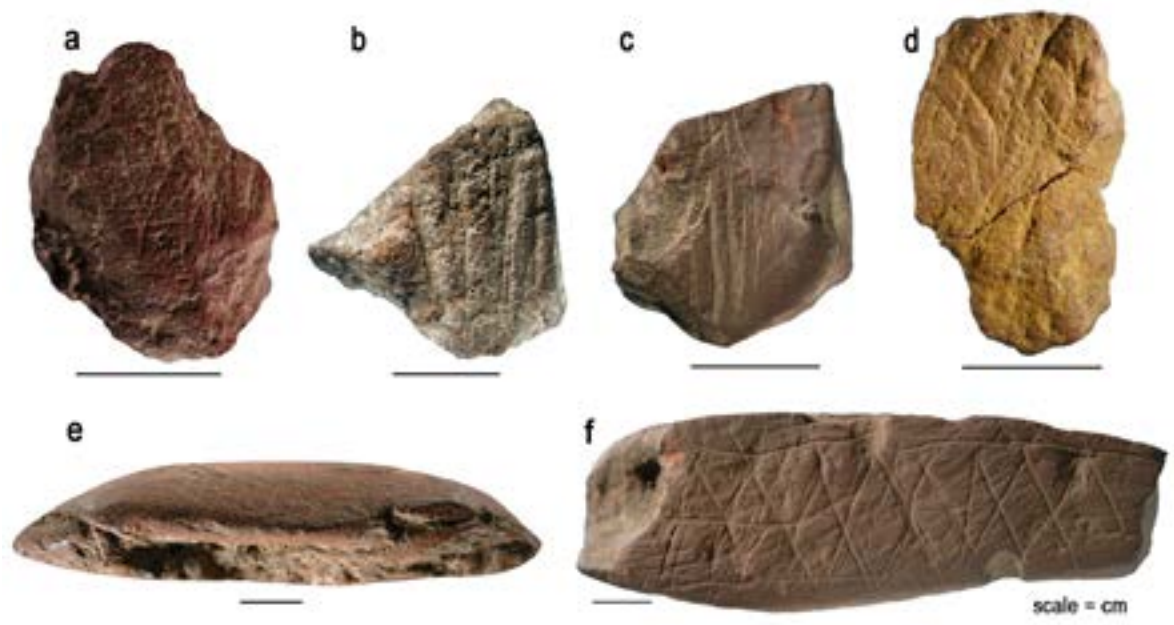
Appendix B, C :

Metataxonomy of diagrams: Representation-related taxonomic aspects, Alan Blackwell and Yuri Engelhardt, from the chapter '*A metataxonomy for Diagram Research*', Anderson, M. Meyer, M. (Eds.) In: *Diagrammatic Representation and Reasoning*. Springer (2001)





Appendix D:



These are engraved ochres from the Still Bay M1 phase at Blombos Cave (modified after Henshilwood et al. 2009). This shows; a) Two groups of incisions, one on the center and one close to the edge. In the center two joining lines form a 'Y' that is crossed by a few perpendicular parallel lines. Three incisions cross these lines; b) Two lines that cross perpendicularly on the top right margin. Converging lines produced with a single lithic point; c) this piece retains only a small area of the original engraved pattern. Three straight oblique lines incised on the top left with two sinuous lines that cross them; d) three distinct sets of lines engraved on a natural surface. Piece was then knapped and a part of the engraving removed; e) a group of sinuous lines engraved on one face. The opposite face is highly scraped and engraved with a cross-hatched pattern; and f) Cross-hatched pattern incised on one long edge. Credit: Christopher Henshilwood

Appendix E: Chart containing examples of the variety of early diagram uses

Example	Location:	Use:	Date:
Stick Navigation charts (Rebbelib, Meddo, Mattang)	Marshal Islands	Sea faring Cartographic Navigation	c. 2000 - 500 BCE
Babylonian clay tablets	Iraq (Ancient Mesopotamia)	Recording Mathematical Notation in Cuneiform script, including geometric diagrams	c. 1900 -1700 BCE
"Book of the Dead" Papyrus scrolls of funerary texts	Egypt	Depiction of complex religious beliefs and rituals relating to the afterlife	c. 1550 -50 BCE
Ugarit tablet	Syria (Hurrian Civilization)	Earliest known example of Musical notation	c. 1400 BCE
Imago mundi (Babylonian Map of the world) Clay tablet	Iraq (Ancient Mesopotamia)	Earliest known diagrammatic, labeled international map	c. 600 BCE
Huangdi Neijin (written records)	China	Chinese Medical practice of Acupuncture	c. 300 -200 BCE
Ptolemaic system	Greece	Geocentric map of the Universe	c. 140 -150 ACE
Porphyrian tree	Lebanon	Tree diagram depicting the organization of knowledge	c. 300 ACE

Appendix F: Chart containing innovations in diagrammatic use in the Middle Ages

Use:	Location:	Example:	Date:
Astronomical Observations	Iran	Lunar Eclipse Diagrams of Abu Rayhan al-Biruni	c. 1019 ACE
Systems of Hereditary identification and social positioning	UK	Development of diagrammatic Heraldic symbolism	1127 ACE
Genealogical Documentation (family trees)	France	Genealogy of Christ Peter of Poiters	c. 1230 ACE
Navigational Sea Charts	Italy	Carta Pisana (The chart of Pisa)	c. 1275 -1300 ACE
Scientific research in Optics	UK	Opus Maius (Roger Bacon)	c. 1267 – 69 ACE
Medieval Military Technology Designs	Italy	Texaurus Regis Francie Aquisitionis Terre Sancte de ultra mare (Guido da Vigevano)	1328 ACE
Design for an Astronomical Clock and Planetarium	Italy	Astrariun (Planetarium) (Giovani de' Dondi)	1364 ACE

Appendix G:

Appendix G: Olafur Eliasson, Turner Colour Experiments, Tate Britain, 2014

http://olafureliasson.net/archive/exhibition/EXH102309/olafur-eliasson-turner-colour-experiments

Appendix H: Interview with Richard Talbot, Newcastle University, October 25th, 2013

Interview with Richard Talbot, Newcastle University, October 25th, 2013.

MW: You originally had studied Astronomy and Physics ?

RT: I did, but realized early on that I had chosen the wrong subject. I noticed also that you had studied Biomedicine.

MW: Yes, so I was immersed in diagrams, especially Biochemistry, which as a subject deals with diagrams on many levels.

RT: Yes, when I was at school, all the chemistry diagrams and the glassware we used, I still find very exciting, it still gives me a buzz when I look at those diagrams. Also I suppose that Alchemical drawings which are in a sense diagrammatic, but which also refer to broader cultural aspects and spiritual things. But I think it is that combination of diagrammatic mixed with something else where things become very interesting.

MW: Especially for the initiated few who can decode and read the Alchemical imagery and illustrations such as those in Michael Maier's books. And you were also interested in optics and optical diagrams ?

RT: Again, I always was - by the geometric diagrams of optics: the eye, mirrors, the idea of 'looking through', I was interested by that whole system; the picture of the eye, the rays coming in to the eye, or out of the eye. I find all of those things exciting, and I think that it's because you're almost standing outside of the system, and you can see what this system is.

MW: That's something I wanted to ask you about because you had mentioned that you were interested in landscapes, and the idea that maybe the drawings you make are detached, conceptual landscapes. I remember reading to the lighthouse by Virginia Woolf, and there's a very short chapter in the middle of the book, which describes time passing in an empty room. But it does so from outside the book, an omnipotent narrator, an all seeing eye.
I wondered if that was something you were interested in as an artist?

RT: Yes, I think so. I suppose maybe it's this kind of hyper-consciousness, just this thing, observing, and you just become very aware of time and space, and of yourself as a little entity within this. It's almost as if time disappears.
The other thing I remember reading a lot as a student was Nietzsche, and the image of time as a snake eating its tail. He called it 'eternal recurrence', where you're trying to imagine that every moment could be relived exactly the same, so it kind of neutralizes time, because as animals we're stuck with this as a problem and try to find strategies to overcome that sense of things in the future and things in the past.

MW: I read that time was something that you would like to take out of your drawings, or perhaps avoid referencing in some way. Also that you presented the objects in your drawings as Platonic forms, without any signs of wear and tear or reference to scale.

RT: Yes, that's right, I started off by making objects, but always found it really frustrating in terms of size, or what you make it with. But I suppose that a lot of the twentieth century was about that problem, about objects, and their separateness to us all.

MW: Such as the use of Plinths to present work ?

RT: Yes, for example Plinths.

MW: So did you ever regard your sculptural works as models, as a way to perhaps overcome these issues ?

RT: I suppose I did think of them as 3 dimensional diagrams, but then I suppose that made me unhappy about the materials they were made from. I always imagined whether perhaps it could be made out of perfect marble perhaps.

MW: I started to consider making works from elemental materials, such as aluminium or carbon, just to try to deal with the problem of simplifying or neutralising that issue of materiality. One of the 3 dimensional works that you made called 'boat' was made out of rubber wasn't it ? Hanging as a collapses frame on the wall, the skeletal form of a boat.

RT: Yes, it's funny that that particular series of works didn't end up going anywhere; I'm just trying to remember what the actual sequence was. I think sometime in the early eighties, I was put forward for a commission; it was one of those completely random invitations to do something. It was for the Savoy Hotel. It was one of those awkward things of, well, do you design sculpture, or do you use something you've already got? So I started playing around with drawings and making cutouts from drawings of things. I ended up with some large sheets of rubber and started cutting it out to see whether it was something I could use. I didn't intend to end up with something which would hang on the wall, but I did that in the studio by putting it to one side, and it's quite extraordinary how that works. So it was quite accidental, but was just the recognition of having taken it in to that different area that I didn't have any control of, so it was quite accidental. It was all cut by hand, so it was a very crisp line cut with a scalpel.

MW: About your working process, you wrote very beautifully about that initial process of orientation, the initial white sheet that you approach, and the infinite possibilities you're faced with - setting up some kind of initial starting conditions. You used the analogy of the Gothic Cathedral with its ground plans, and then the more organic process of construction that follows that. There was also another article in the same book (Writing on Drawing: Essays on Drawing Practice and Research) by Terry Rosenberg about ideational drawing, a process of drawing which I though really suited your work very well.

RT: Yes, I mean I must say that I haven't read fully all of the articles in that book, but have skimmed through them.

MW: There were a couple of essays that really stood out for me personally, yours and Terry Rosenberg's. I enjoyed the way you talked about your use of perspective, not as a tool to create realistic drawings, but as a tool to allow you to use your intuition.

RT: Well I think that also goes back to that idea of self-consciousness, sort of knowing that you're this entity that looks at something from the outside. I used to play around with spatial perspectives, and then I thought that actually one way of neutralising these issues was just to use it, just to actually use the system. So that to get over that whole issue of viewpoint, for example when you make a piece of sculpture, how do you look at it ? If there's no best side as it were. So I thought, well if I just take it on full, this issue of perspective, and to absolutely use it as it was set up to use, then it falls by the way side, as an issue.

MW: Turning the problem in to part of the solution?

RT: I think it's like sometimes in Mathematics, when a problem can't be solved directly, they will call on a tool from other part of mathematics, and using that tool they can then move from one place to another. But in the end result, that tool disappears, it doesn't ultimately play a part in the answer, but it has been a useful tool to get you from one place to another.

MW: That reminds me of the role enzymes play in Biochemistry.
They're completely essential to facilitating the process, but don't take part in a reaction in a way that they are altered themselves in the outcome.

RT: Yes, that's right, yes. So it is a kind of a vehicle, but then it's using that perspective that makes me then question how it was originally used in the Renaissance, because when you're actually working with it on the paper, there are so many interesting things actually going on that art historian looking in from the outside wouldn't grasp. And it is to do with that idea of play, between the diagrammatic and the spatial element. Perspective isn't all about creating a space, it is about the surface and how these things operate 2 dimensionally as well.

MW: I was very interested in the way you talked about the depth of space in your drawings, and not using deep space, but keeping things relatively shallow and immediate.

RT: Yes, I think that this also relates to my sense of what these Renaissance artists were doing. The picture that is portrayed of perspective is all about getting everything in terms of the horizon. But I don't actually think that's it at all. You are really working in a really shallow space. All those Renaissance paintings are also working in a really shallow space, and I think when you're actually constructing that on the paper, there's a real, almost physical connection to the space.

MW: I don't normally use colour in my work, it's actually something I avoid, and have for a long time. Then I came across a book by David Batchelor called Chromophobia. He was writing about colour and how it has been perceived as the additional, the exotic, the lipstick.
Or at least that's how it was regarded by artists and writers who saw it as extraneous.
And so I'm interested to ask you how your deal with colour in your work.

RT: Well I have to admit as to having always avoided it, as I've never understood it.
It's a complete mystery. If I was making a drawing, I can't see any reason to use colour.
But then equally I probably can't see any reason not to use it. But then I would probably be thinking well, why do I ? But then I know with somebody like Michael Craig Martin, I suppose he's somebody in the seventies who was producing very austere, paired down work, such as his linear drawings, which were initially all black and white.
But then he probably just stopped worrying and started to use incredibly strong colours in his work. And now the colour is really significant to his work. But its interesting that Michael Craig Martin was taught by Joseph Albers.

MW: That's interesting, I didn't know that.

RT: Yes, at Yale. So he would have had a real grounding in colour, and it's almost as if he, you know – 30 years later or whatever it was – just decided to start using these colours. It is odd how we set rules for ourselves and at the time we kind of need them, but occasionally we just think 'drop them', and stop worrying about them.

MW: There were a number of times when looking at your works and reading what you wrote about

them that reminded me of mathematics, and the idea of skeletonized forms.
The idea of an equation, where the aim is to remove as much information as possible and leave only the knowledge - the process of essentialising something. Also the way that you talk about using intuition, and how intuition can be very immediate, or how it can require you to put the work away for many years. A slow boiler that you come back to much later.
Is mathematics something you're interested in? Or is it restricted to geometry, or patterns of thought?

RT: Yes, I'm interested, not in the sense of reading books on mathematics, but when I'm near mathematicians and they talk about what they are doing, I do feel an affinity with what they are doing, and I suppose that with my drawings, they become very complex, but I do have that hankering after something really, really simple. I do have this idea that one day I'll just be able to draw a line, and that that will be the finish! And in a way I suppose you do occasionally see it in some art works – and think that that is just an extraordinary piece of drawing, but then that in a way embodies everything they've ever done – 40 years later they've managed to make this extraordinary thing !

MW: Richard Dawkins wrote a while ago about the idea of a conceptual space containing all possible genetic variations, a kind of hyper-space of all possible genetic forms, and I was always fascinated by that idea. I think that also Douglas Hofsteader in Goedel Escher Bach, described the idea that Bach, in composing, had the ability to look over all the millions, well almost infinite combinations of musical notes, and was able to see patterns, islands or constellations of musical forms. And I wondered if that idea was perhaps something you were interested in. A vaguely discernable, fuzzy possibility of the form you're searching for, and how this idea relates to diagrammatic forms.

RT: Yes, I think that is definitely true, and I suppose that one of the things I am aware of is that in some ways, the drawings all start from the same point. That blank paper, that orientation.

MW: The tabula-rasa ?

RT: Absolutely, and you know that it could go in a completely infinite number of directions, and yet there is a sense that there is some solution there - that you setting things up. It becomes very obvious sometimes. I wouldn't compare myself to Bach, but I can see that way of thinking - that there is an infinite number of possibilities, but you alight on a particular form that is true for you in one sense or another. It's hard to really articulate that process.

MW: How would you describe the relationship between the forms in your drawings and the marks which make up the background from which the image appears ?

RT: I think when I first started using perspective I was still in that mindset of drawing objects as things in space, but then quite quickly I became aware of how potent the workings-out - you know, the plans, the elevations and so on - how potent they were and how they were working with the kind of forms which were being described. It was also in trying to pin things down, I became aware of the balance between leaving things open ended and tying something down and saying 'this is that form'. It was that form, but not in such a positive or fixed way.
I stopped using ink on the drawings. I was using ink to go around the forms I was building, but that stopped. And so I started getting a much more subtle interplay between the workings out -and those workings out would be the plans, and elevations, and a myriad of other kind of con nections which were being built, a kind of scaffolding.

MW: And you saw inking in as a kind of finishing process ?
RT: I did. You know you suddenly think that it has in a way killed off the drawings.

Not inking became a way to leave the drawing as an open-ended thing. Perhaps when a work is too 'closed down' it can end up being very uninteresting. For example Raphael. I've never enjoyed looking at Raphael's paintings because they seem so overly fixed, whereas, Piero de la Francesca's paintings seem almost as if they are propositions.

MW: Very early on in coming up with the questions that I wanted to ask in my PhD, I pretty much hit the same problem you did in realizing that I had always studied sculpture, but always made drawings. And I thought of the drawings as sculptural drawings and, luckily for me, my teachers at the time thought the same. So I had to decide whether to investigate the relationship between 2D and 3D diagrams - and thus include sculpture, or the way in which artists use diagrammatic image making to a romantic end, a subjective end; the way in which Marcel Duchamp played subject against object and also struggled with the issues of dimensionality. Where do you stand in terms of subject and object ?

RT: Yes, well I don't think I would come down either way, because I don't think that coming down on either side actually gets you anywhere. I suppose that in my student days, this dilemma about the objective and subjective was helped by there being, at Goldsmiths - which was something which was great about Goldsmiths at that time - was that there was a huge range of practice within the staff. So you did have conversations with people who were systems thinkers, right through to people who were watercolour, or landscape painters. People weren't trying to ram the stuff down your throat; you were just having these interesting conversations, and then weighing it up about your own situation.

Thinking about what you were doing, what you thought you were trying to do, what you were actually doing ! You know, all those worries you have about, you know, 'is it art ?' I found myself really being able to make work when I stopped worrying about what side of the fence I was on, and finding a way of working where I felt as if I wasn't having to choose one way or the other. But both sides of me could be involved in that hankering after perfection.
It's a case of playing these things off against each other.

I distinctly remember that when I did my MA at Chelsea, the external assessor we had was Paul Neagu, I think he's dead now, but he was very well known. He was one of the artists who Richard Demarco brought to this country, alongside such artists as Joseph Beuys. Anyway I remember that the work I'd made at Chelsea had become really quite austere, and extremely minimal, and he said… 'don't forget the other side of yourself', and I realized exactly what it was he meant. That we can easily kind of forget. But then I think that also we need those extremes sometimes, to realize something. We need to go beyond in order to know where the edge was. It's only when you fall over the edge that your realize there was one !

MW: So there is actually nothing within your body of work that you see as a mathematical proof, some foundation to build upon ?

RT: No, I would certainly never say that there is anything that I'm demonstrating that is mathematical, no. I could say that when I was at Goldsmiths, I was taught by people who were involved in systems, and there were several people I knew, for example Malcolm Hughes work ing at the Slade, who had students working with experimental systems, building computers to generate paintings and so on; and I always felt that there was a problem in that they knew the kind of thing they were aiming for, and that it just seemed as if, well, you could make that paint ing without that system. It was almost as if they were using that system as almost a 'get out'. The paintings would always end up looking like lots of other abstract constructive paintings that weren't made with a system, that were just made purely intuitively. And so I have a distrust of the idea of a system, and I think that that system is always, ultimately being driven by you.

MW: What are you working on at the moment ?

RT: Well apart form being heavily tied up in administration, I've finished some drawings and I've also been playing with film and video, which I can show you if you want.

It's very long drawing, based on a system in a sense, and was a definite play on the standard idea of a single viewer's perspective. They start with a really basic perspective grid, a 'unit', drawn in such a way that I can simply add these units together and extend the space in any direction. Strangely, it adds the possibility of time, in that your eye can travel along the drawing and the space continues always to make sense.

The video is another simple grid that is constantly shifting from the 2 dimensional surface in to the 3 dimensional image. Originally I had intended it to be projected on to a screen, but then I had the chance to project it in one of the large spaces downstairs, and the results were quite extraordinary - because it did actually become part of the space, which wasn't fully intentional, but those were the results. The question of the artist's intention is also an interesting problem I think within the history of perspective; the well-known analyses of key renaissance paintings demonstrate that the spaces in the paintings are sometimes not quite what they seem to be. There is often some uncertainty, yet it is usually thought that perspective is fixed - that it's an unambiguous and rational thing.

MW: Watching the video is like a trying to solve a puzzle in perspective, there are moments when the lines are like a 2 dimensional pattern of shifting compositions, and then suddenly something in the visual cortex takes over and there's the impression of instant depth from those very same lines. It reminds me of watching animations of higher dimensional cubes rotating. You think you have understood what is happening and there's a sudden unexpected shift, you have to grapple with different kinds of depths.

RT: Well - I don't know - It's to do with my intention, I'm not settling down to produce something which has a specific result. I know they do result in that, but I'm not setting out to do that.
I am showing this work – I've never tried it before. I hope it works… It's actually going to be projected on to three screens, the same image, butted up against itself, but slightly out of synch. So the whole thing will be 'shifting', so that a more complex thing will be going on. I have no idea what it will look like – it might just look awful, but then I'm trying it – for this show.

Appendix I: Leonardo da Vinci, Profile of a Man, plant, geometric figures etc. (also known as the '*Theme Sheet*') (detail) c. 1448, pen and ink, Windsor Castle, The Royal Collection.

Associated text:

"The triangle abc is similar to a third of the large triangle dbf because it is made up of two equal parts, that is abe and bec, and the large triangle is made up of 6 parts, and each of these parts is equal to each of the said 2, and the 6 parts are these: dec and ced and so on, in similar parts. And if the triangle abc had its sides similar to its axis, cb, the triangle dbf would receive in itself 4 of these triangles, whereas at present it receives 3; thus to see the difference from one of the triangles which are ¼ of the large one and one of those which are ⅓, have the large triangle divided in to twelfths, and say that it is 12 twelfths. Then say that the triangle which is a ⅓ of it is 4 of these twelfths and the triangle that is a ¼ of this large one contains three of these twelfths, so that the difference between 4 and 3 is one twelfth, whence we can say that the smaller is ¾ of the larger."

Appendix J: Examples of 'low noise' landscapes, which act to highlight objects placed with in them phenomenologically.

(Inner city wastelands, sparse wastelands and deserts act as 'grounds', whilst island archipelagos, golf courses and farmed landscapes act as diagrammatic scenes of containment, navigation and connection.)

Inner city wasteland

sparse wastelands

Desert

Island Archipelagos

Golf Courses

Farmed Landscape

Appendix K: Caspar David Friedrich (German, 1774 – 1840),
Zwei Männer Betrachten den Mond
(*Two Men Contemplating the Moon*), c.1833,
Oil on Canvas, 34 x 44 cm.

Appendix L: Russell Gray and Quentin Atkinson,
The shape and Fabric of Language evolution

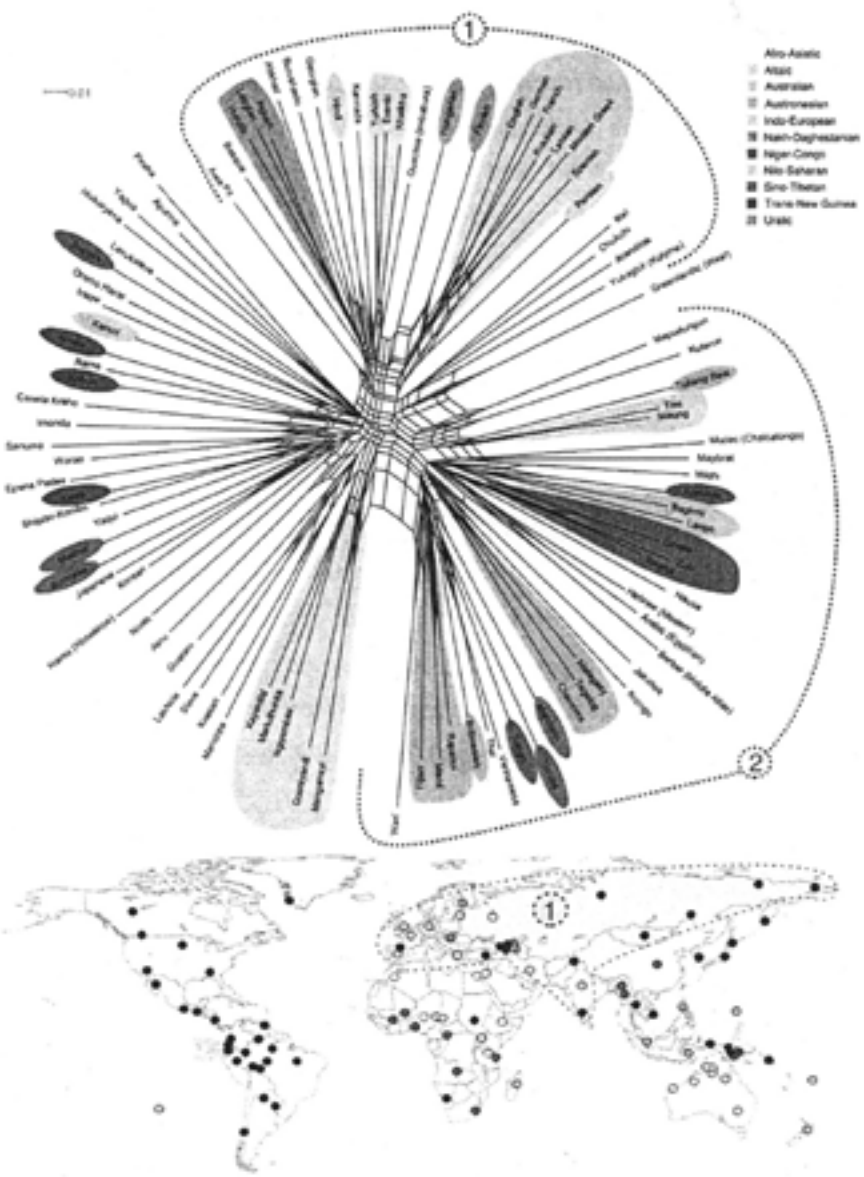
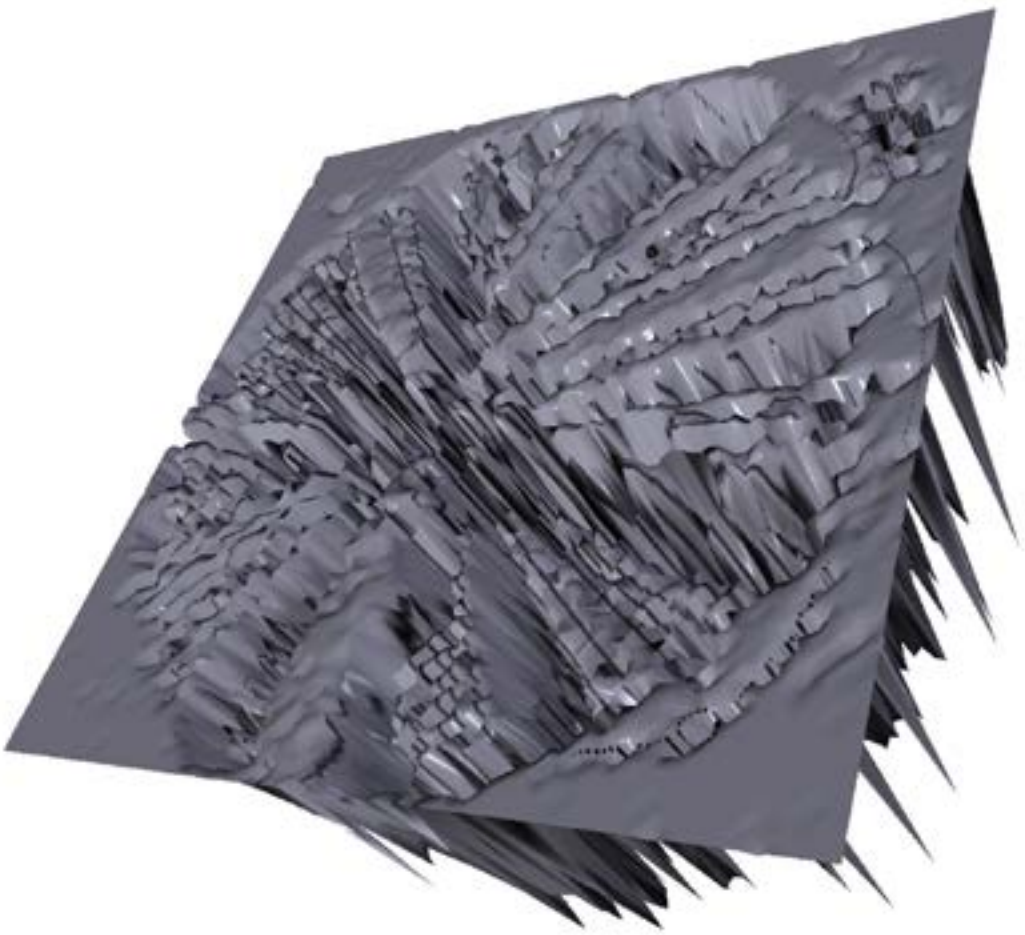


Figure 1: NeighborNet for the 99 most well-attested languages in the WALS database. This network is based on 138 typological characters and shows the signals grouping languages. The length of the branches on the network are proportional to amount of divergence between languages, and the box-like structures reflect conflicting signal. Family groups are color-coded, and potential language areas are marked with dashed lines and numbered as described in the text. The dashed area and arrows on the map show the extent of the third Eurasian cluster.

The shape and fabric of language evolution

Appendix M: Computer Model for *Model for the origins of human language - Plane*



Appendix N: Muerte (Death) by the Spanish surrealist poet Federico García Lorca

Source: Lorca, F, G. In: (2002) Poet in New York. Maurer, C. (Ed.) Simon, G. White, S. F. (transl.) London: Penguin Classics.

Muerte (Death)

How hard they try !
How hard the horse tries to become a dog !
How hard the dog tries to become a swallow !
How hard the swallow tries to become a bee !
How hard the bee tries to become a horse !
And the horse, what a sharp arrow it presses from the rose,
what a pale rose rising from its lips !
And the rose, what a flock of lights and cries
knotted in the living sugar of its trunk !
And the sugar, what daggers it dreams in its vigils !
And the daggers, what a moon without stables, what nakedness,
eternal and blushing flesh they seek out!
And I, on the roof's edge, eternal and blushing angel I look for and am !
But the plaster arch, how vast, how invisible, how minute,
without even trying !

Appendix O: Reiner Maria Rilke, Opening to Duino Elegy Nine:

Source: Rilke, R.M. (1923) Duino Elegies, Young, D. (transl.) (1993) New York: WW Norton & Co.

Why, if it could begin as laurel, and be spent so,
this space of Being, a little darker than all
the surrounding green, with little waves at the edge
of every leaf (like a breeze's smile) - : why then
have to be human – and shunning destiny
long for destiny?....

Oh, not because happiness exists,
that over-hasty profit from imminent loss,
not out of curiosity, or to practice the heart,
which could exist in the laurel.....
But because being here is much, and because all
that's here seems to need us, the ephemeral, that
strangely concerns us. We: the most ephemeral. Once,
for each thing, only once. Once, and no more. And we too,
once. Never again. But this
once, to have been, though only once,
to have been an earthly thing – seems irrevocable.

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