

Romantic-Objectivism

Diagrammatic thought in contemporary art

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Dedication

I would like to dedicate this thesis to my parents for their unconditional love and support, and to my incredible wife Sangsun Bae who remains my inspiration and who convinced me to undertake this Ph.D. in the first place.

It is also dedicated 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, understanding and guidance that encouraged me as a young graduate in Biochemistry to set out on my own path of discovery and to become an artist.

Finally, this thesis is dedicated to Shiro Matsui, Professor of Sculpture at Kyoto City University of the Arts, a friend and teacher whose *concrete* advice, patience and humour 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 examines notions of diagramming within modern and contemporary art. It proposes that the diagrammatic format allows artists to create work which mediates between subjective, metaphoric self-expression and the detached, intellectual rigor of objective scientific investigation, in a style that I refer to as “Romantic-Objectivism”.

This study incorporates selected highlights from historical and pre-historical diagram creation in order to position the diagram as a fundamental mode of human knowledge production and communication, yet one that has been overlooked in terms of its importance to art where there is a distinct lack of critical discourse concerning its role.

A philosophical and semiotic analysis of the diagram aims to show how its relationship with the goals and techniques of the scientific project gave rise to the refined, skeletonized aesthetics of inter-connectivity with which it is now associated.

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 apply key features of the semiotic code of science and mathematics to the aesthetic code of art.

This approach allows artists to achieve a distinctive objective-subjective resonance in their work, leading to the creation of some of the most important and challenging art works of the modern, postmodern and contemporary periods.

The thesis also explores the development of my own symbolic vocabulary of diagrammatic objectivity as a practicing artist with a background in biomedical sciences. Representative works from my praxis over the last twelve years are correlated with key symbolic themes from the romantic period, to position my work as a Romantic-Objective meditation on our contemporary relationship with nature.

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 own artistic development of a symbolic vocabulary of diagrammatic objectivity. Representative works from my praxis over the last twelve years are correlated with key symbolic themes from the romantic period, including: the landscape, clearings and forest glades, the symbolic tree, the symbolic bird, and depiction of the human form. In this way, my work is positioned as a romantic-objective meditation on our contemporary relationship with nature, combining the austere detachment of the scientific diagram with the romantic emphasis upon a rich symbolic 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 ¹; 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.

1 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 Suprematist 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:

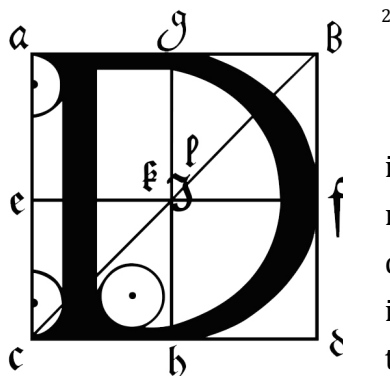
- 1) How does the diagram manifest itself in art and why is it relevant?
- 2) How do artists combine objectivity and subjectivity and why do they try to?
- 3) What are some of the qualities that works of diagrammatic art share and what are the differences?
- 4) What are the range of conceptual techniques 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



Diagrams 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. ³

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.

² From: Albrecht Durer, *Of the just shaping of letters* (Capital D), 1525

³ 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 developed 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 unifying 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 various titles, such as *The Invention of Drawing*, *The Origin of Painting* and *The Corinthian Maid*. In the painting (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 which is indexically related to the lover's profile - 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 δίαγραμμα (diáγραμμα).

Kenneth Knoespel points out that

“the root verb of *diagramma* (διαγραμειν) 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 Bacon then responds to during painting in a way that guides production but also remain within the structure of the finished work. 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.⁴ In order to be able to incorporate the whole field 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.⁵

4 For an philosophical account of the position of the diagram within the philosophical system of Deleuze, see Jakub Zdebik’s 2013 book “Deleuze and the Diagram”, Bloomsbury, London

5 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 four 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.⁶ 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

⁶ 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 blue-prints, 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.⁷

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

7 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 complex, disparate and new field of study 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* refers to 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 extensive but fragmented, and consists of researchers from a great variety of disciplines, such 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, and, to a lesser extent, musicology and fine art.

An acknowledgement of the diagram as an essential conceptual and communicative tool in all of these fields has come only relatively recently, giving rise to numerous, discordant projects and systems of 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 the arts, 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.⁸

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

8 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.

Ithaca, episode 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 *Ithaca* 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.⁹

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 stylistically and historically diverse practices of the artists discussed herein, but between the arts themselves and, as this thesis attempts to show, between the arts and the sciences.

9 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 a diverse range of aesthetics, processes of production and, in the case of installation art, architectural and land based works, means by which artists 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 constructed architecture-like structural arrangements based on precision geometric diagrams, to provide spiritual orientation with the landscape and celestial bodies for rites and rituals. James Turrell's *Roden Crater* is discussed as an example of our continued interest in our position in and relationship to the universe, mediated by the diagram.

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. An example art work created by the fourteenth century Italian cleric Opicinus de Canistris is discussed as a complex, hybrid diagrammatic system of spiritual investigation that combines fantasy and objectivity.

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. Examples are given of his work and philosophy to show how it was diagrams, for Leonardo, which provided a means to combine the creative, subjective process of *disegno* with the logical, objective rigor of *misura*. The early fifteenth century also saw the rise of the alchemical diagram as a means creating a coded, visual, didactic mix of sensual stimulus (Aphrodite) and the intellectual appeal (Hermes). The work of Copernicus and Galileo and their reliance upon diagrammatic thought experiments sets 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 philosophical ideals of the scientific project and particular qualities inherent in the diagrammatic art works discussed in chapters four and five. The ideals are summarised in order to show how they have helped shape the austerity of contemporary diagrammatic aesthetics and examples are provided and discussed. 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. Selected examples of the process of idealisation in art are provided from the modern and contemporary periods.

3.2 Essentialism: where to draw the line

The division of phenomenon into categories, or *natural kinds*, is one of the most fundamental tools of science. It underlies scientific classification systems of reality on all scales, and the concept is said to have originated with Plato's idea of 'carving nature at its joints'. 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. Example art works are provided to emphasise ways in which 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. Examples are given to examine the effect this has had upon the skeletonized icons of the diagrammatic aesthetic in art. A distinction is made between the terms reductionism in science and reductivism in visual art.

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 in relation to Goethe's studies of colour..

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, relying upon an element of irrationality and aesthetic choice in his work. Artists have also attempted to achieve *perspective-free* objectivity and a representative painting from early analytical cubism is provided in order to support the conception of this style as a romantically-objective, diagrammatic approach to making art. The practice of Richard Talbot is introduced as a contemporary example of the continued appeal of the detached, objective qualities of the diagram in art.

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 *tone* and *tuone*, indefinite significant characters that are fundamentally important in the arts and play a unique role in diagrammatic art. The scientific / mathematic semiotic codes are 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. Sol LeWitt’s 1974 series of geometric prints *The location of six geometric figures (circle, square, triangle, rectangle, parallelogram and trapezoid)* exemplifies the poetic use of geometry diagrams to create highly notational, low tone/tuone art works.

4.3 Bernar Venet: The monosemic image

The relationship of Bernar Venet’s artistic practice to the thoughts of the French geographer, cartographer and theorist Jaques Bertin is discussed in terms of Venet’s attempts to make what Bertin described as *monosemic* images in to art works. Appropriating the diagrams and notation of science and mathematics, Venet re-contextualised them as wall paintings, prints, canvases and even poetry, in an attempt to reduce signification to a single level of meaning (monosemic signification). Venet, like the other artists in this chapter later abandoned his idealist, anti-aesthetic stance.

4.4 Marcel Duchamp: The elements and the Elements

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

Chapter 5: Romantic Objectivism: The Diagram in contemporary art

This chapter presents a range of diagrammatic artworks from the contemporary period and is supplemented by *Chart 1: One Hundred Diagrammatic Artworks from the Last Century*, which depicts the relations between 100 twentieth and twenty-first century diagrammatic artworks.

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 symbolic vocabulary of diagrammatic objectivity as a practicing artist. It is structured according to key symbolic themes from the arts of the Romantic period: the landscape, the forest glade, the symbolic tree, the symbolic bird, and depiction of the human form. My praxis is positioned as a Romantic-Objective meditation on our contemporary relationship with nature, and is supplemented by *Chart 2: 100 diagrammatic art works from my practice over the last ten years*,

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 The forest glade: Clearings and excavations

The metaphoric Heideggerian concept of 'clearing' or 'forest glade' 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.