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Thinking Spaces: A Practice-Led Enquiry into Representations of Memory and Thought

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Declaration of Originality

I, Julie Brooke …….. hereby declare that the thesis here presented is the outcome of the research project undertaken during my candidacy, that I am the sole author unless otherwise indicated, and that I have fully documented the source of ideas, references, quotations and paraphrases attributable to other authors.

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THINKING SPACES: A PRACTICE-LED ENQUIRY INTO REPRESENTATIONS OF MEMORY AND THOUGHT

Abstract

This practice-led thesis investigates parallels between research in science and in the visual arts, and explores how thought can be represented in visual form. The project developed from a fascination with logic diagrams and the memory palace, an ancient technique for extending the capacity of the mind to store information. The aim is to develop images of 'impossible objects' that are analogous to scientific hypotheses, and to explore how the apparently cool logic of an experimental system can lead to a compulsive reworking of ideas that may be anything but rational. This exploration takes the form of multiple extended series of small pencil and gouache works in which the paper ground becomes a space in which to model and reflect on the processes of thought.

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Introduction

> Really, universally, relations stop nowhere, and the exquisite problem of the artist is eternally but to draw, by a geometry of his own, the circle within which they shall happily *appear* to do so.[1]

My practice-led project investigates parallels between research in science and in the visual arts, and explores how thought can be represented in visual form. This project developed from my fascination with logic diagrams and the memory palace, an ancient technique for extending the capacity of the mind to retain information in an organised fashion.

The first challenge was to develop a methodology that would allow me to record and analyse decisions made intuitively in the studio, as I will explain in Chapter One. In practice-led research it is necessary to maintain a critical, analytical distance, and yet become immersed in the experience of making. As Ross Gibson explains, this involves "two modes of cognition [that] are consciously distinct," one immersive, and the other analytical.[2] This raised the question of whether I could both work intuitively in the studio, and make the step-by-step process of experimentation visible. As the British painter Bridget Riley wrote,

> You cannot deal with thought directly outside practice as a painter: 'doing' is essential in order to find out what form your thought takes.[3]

My aim, then, was to establish an experimental system that would enable me not only to develop ideas in the studio, but also to discover what form my thinking processes take.

In scientific research, ideas are recorded and communicated in visual form using diagrams and graphs. These not only enable the researcher to represent experimental data, but also provide a stimulus for speculative thought, giving rise to the formation

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[1] Henry James, "Preface," *Roderick Hudson* (London: MacMillan, 1908), vii.
[2] Ross Gibson, "The Known World." *TEXT* Special Issue 8 (October 2010): 9. http://www.textjournal.com.au/speciss/issue8/Gibson.pdf (accessed 4/6/2011).
[3] Bridget Riley, "Work" (2009)," in *The Eye's Mind: Bridget Riley, Collected Writings 1965-2009*, ed. Robert Kudielka (London: Thames & Hudson, 2009), 59.

of hypotheses. As cognitive scientist Ruth Byrne writes, the ability to think hypothetically,

> … is one of the remarkable achievements of human cognition. People rely on hypothetical thought to conjecture and speculate, to plan and predict, and to explore alternative trains of thought…[4]

The researcher develops theories that provide plausible explanations for experimental results. This leads to further experimentation, and disproved hypotheses are discarded. In other words, scientific research involves thinking that is periodically speculative, multi-stranded and imaginative, but narrows to a single thread as each theory is tested, in a recurring process of expansion and collapse.

I was curious to find out how hypothetical thinking might operate in the visual arts. In drawing and painting, ideas are explored visually. How might a hypothesis be represented? And what similarities and differences might I discover between the formation of hypotheses in science and in painting? Furthermore, framing these questions revealed a paradox that I was keen to explore. The aim of the diagram or graph in science is to represent and communicate information clearly and unambiguously. However hypothetical thinking is by definition ambiguous, because it involves the exploration of "alternative trains of thought" that concern an unpredictable and uncertain future, as Byrne observes.[5] Could these complexities be represented in visual form?

In this project I have explored how thought has been represented in the past, in the form of logic diagrams and in ancient systems such as the memory palace. According to Frances Yates' definitive text on the subject, *The Art of Memory*, the memory palace was first described by Cicero in the 1st century BCE.[6] It functions in the following way: the practitioner imagines walking around a familiar or imagined location such as a house, then places at intervals 'objects' that represent a thought or memory. As medieval historian Mary Carruthers explains, these objects or images should be

[4] Ruth. M. J. Byrne, *The Rational Imagination: How People Create Alternatives to Reality* (Cambridge, Massachusetts: The MIT Press, 2007), 16.
[5] *Ibid.*
[6] Frances Yates, *The Art of Memory* (London: Pimlico, 1996), 17-20.

"emotionally heightened… grotesque and fanciful" in order to be readily recalled.[7] Because these memories are located in a structured environment, they can later be recollected in their correct order. Carruthers observes that in this tradition, the definition of memory is an

> … expansive concept, for it recognizes the essential roles of emotion, imagination, and cogitation within the activity of recollection. Closer to its meaning is our term "cognition," the construction of thinking.[8]

Constructing a memory palace is a creative act of the imagination. Thought and emotion are embodied in the architecture of the system, which not only structures information, but also allows connections to be formed between stored ideas.

The 16th century philosopher and scientist Francis Bacon proposed a new use for memory systems that, as Yates explains, involves,

> … the memorizing of matters in order so as to hold them in the mind for investigation. This would help scientific inquiry, for by drawing particulars out of the mass of natural history, and ranging them in order, the judgement could be more easily brought to bear upon them.[9]

A memory palace that can be categorised and interrogated becomes a database that can be used for scientific investigations. Information can be arranged and reconfigured into new orientations in the mind, allowing the formulation of original and creative hypotheses. Bacon's system for scientific speculation was derived also from circular logic diagrams devised by a medieval mystic, Ramon Lull (1232-1315). Lull developed what is known as the 'combinatorial art,' a logical method for perceiving divine truths, which influenced the thinking of philosophers, logicians and scientists for centuries after his death.[10] Lull's system involves circular diagrams that allow encoded information to be shifted into every possible combination. As the mathematician and author Clifford Pickover writes,

> Lull believed that each branch of knowledge rested on a few principles that formed the structure of knowledge in the same way that geometrical

[7] Mary Carruthers, *The Craft of Thought: Meditation, Rhetoric and the Making of Images, 400-1200* (Cambridge, UK: Cambridge University Press, 1998), 13.
[8] *Ibid,* 2.
[9] Yates, *The Art of Memory*, 358.
[10] Yates, *The Art of Memory,* 180-184.

theorems are formed from basic axioms. By using his wheels to produce all combinations of principles, one explores all possible structures of truth and obtains universal knowledge.[11]

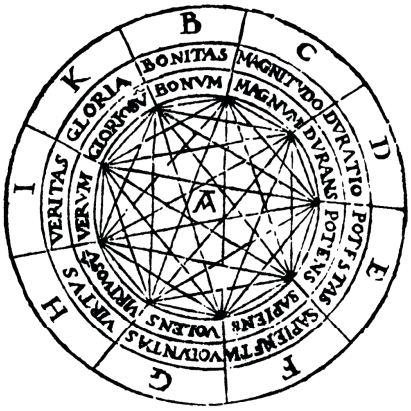

Fig. 1. Ramon Lull, *'A' Figure* (1617, original version 1305)

In the example shown in figure 1, letters in the outer ring encode different attributes of God, which are each inscribed in the next circle: *bonitas,* meaning goodness; *magnitudo,* greatness; *duratio,* eternity; *potestas,* power; and so on. Inside this is a ring of adjectives (good, great, eternal, powerful, wise, willing, virtuous, glorious), while the central web of lines traces all possible connections between each term. There are 36 possible pairings, each of which can be reversed, generating 72 two-word phrases. For example, as science writer Martin Gardner explains, "… we learn that His goodness is great… His greatness is good…"[12] Lull intended his readers to form these connections in an orderly way so that the mind could "conceive of geometrical truths not apparent to the senses."[13] According to deductive logic, if each term is an incontrovertible fact, then combinations of terms must generate further truths. Thus Lull believed that his diagrams were the key to universal knowledge.

A key aspect of Lull's diagram is its capacity to encode a lot of information in a compact form. However it does not simply store or represent ideas, but activates and is activated by the mind. Lull developed these into moving diagrams, or volvelles,

[11] Clifford A. Pickover, *The Loom of God: Tapestries of Mathematics and Mysticism* (New York: Basic Books, 1997), 106.
[12] Martin Gardner, *Logic Machines and Diagrams* (New York: McGraw-Hill Books, 1958), 12
[13] *Ibid*, 21.

composed of separate paper discs that may be turned to generate different combinations of terms. This allows more complex phrases to be generated, as I will explain using an example made during the course of this project (fig. 2).

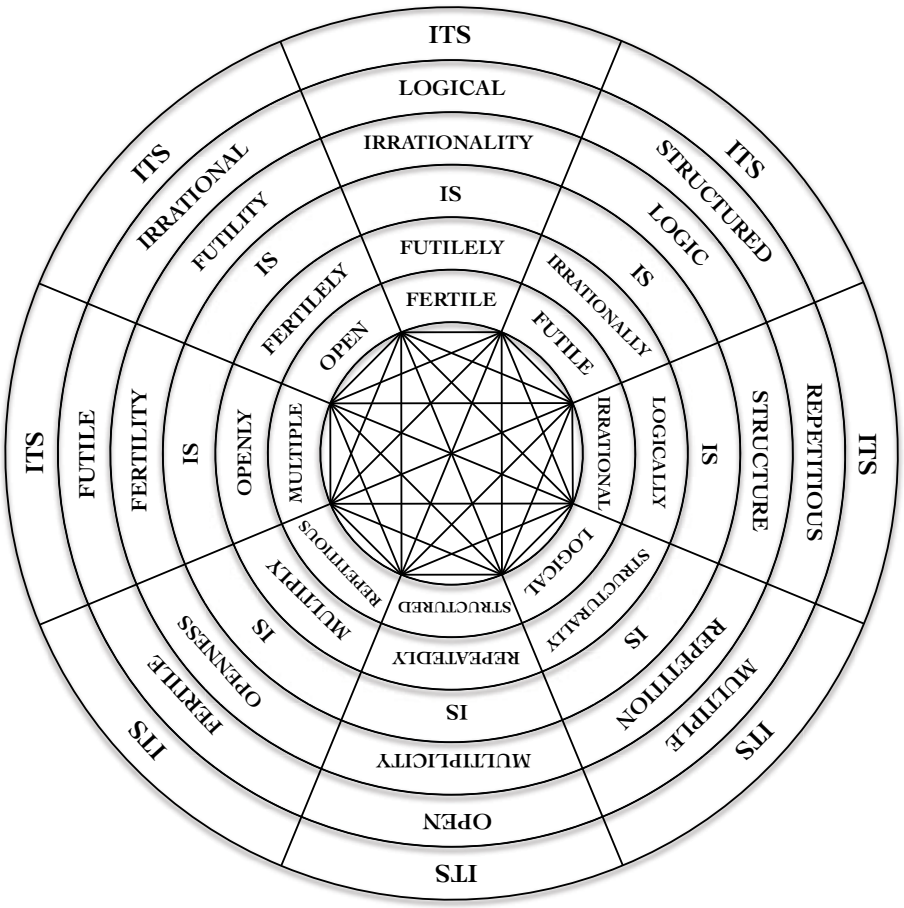

Fig. 2. *Sol LeWitt Volvelle* (2011)

The subject of this volvelle is a minimalist structure made by Sol LeWitt, *Cubic Modular Piece no. 3* (fig. 3). Following Lull's strategy, I identified eight key terms relevant to this work, and designed a volvelle that could rearrange these terms to create a series of descriptive sentences. For example:

> Its repetitious openness is logically structured
> Its structured repetition is openly futile
> Its futile logic is irrationally fertile
> Its irrational multiplicity is structurally open
> Its open structure is multiply repetitious

Fig. 3. Sol LeWitt, *Cubic Modular Piece no. 3* (1968)

This volvelle can generate 1,680 different six-word sentences, or over 10,000 words of original text. However, while each sentence is unique, the material created by such a system is clearly limited in its scope. Furthermore, the number of combinations generated will always be finite, no matter how complex the diagram. This raised further questions. Does combining information in this way generate new and original ideas, or does it simply reconfigure information into predictable and finite patterns? In developing this volvelle, I was identifying a conceptual link between Lull's combinatorial logic and LeWitt's systematic creation of works using different elements (for example, *All Single, Double, Triple, and Quadruple Combinations of Lines in Four Directions One-, Two-, Three- and Four-Part Combinations,* Chapter Four, fig. 74). The development of complexity by combining and reconfiguring individual elements is also key to concrete poetry and art.

Concrete art involves the development of compositions from combinations of geometric elements, without reference to objects in the real world. It is a movement associated with scientific objectivity and with the visualisation of mathematical thought. The Swiss concrete artist Max Bill defined it as an art form in which "[a]bstract ideas which previously existed only in the mind are made visible in a concrete form."[14] He continued, "Concrete Art, when it is true to itself, is the pure

[14] Max Bill, "Concrete Art (1936-49)," in *Theories and Documents of Contemporary Art: a Sourcebook of Artists' Writings*, ed. Kristine Stiles and Peter Seltz (University of Berkeley, Los Angeles, London: California Press, 2012), 91.

expression of harmonious measure and law."[15] In a similar vein, Argentine artist Gyula Kosice described his aspirations for a geometric art that was "of mathematical, cold, dynamic, cerebral, and dialectic spirit."[16] However in mid-20th century Latin America, concrete art was reinvented by some artists as an expressive and imaginative genre that referenced the body as well as the mind. This is particularly evident in the work of Latin American artists Lygia Clark and Gertrud Goldschmidt. The reassessment of geometric art is a continuing concern, as I will discuss with reference to contemporary artists such as Kerrie Poliness and Debra Dawes.

These areas of research – the memory palace, combinatorial and logic diagrams, and concrete art – form the foundations of my practice-led thesis. The Lullian diagram provides a means of visualising a research project in which ideas are combined and reconfigured in the studio. It enables me to bring into play ideas from different disciplines and periods of history, marking out an arena for speculative thought.

*

In Chapter One I explain how and why I established a methodology for investigating my studio process, and introduce several preliminary series of drawings and paintings that explore spatial illusionism. Chapter Two establishes a detailed context for this project, focussing on European and Latin American concrete art, and optical art. In Chapter Three I describe drawings and paintings that develop the appearance of biological forms, and explore the nature of their evolution. Chapter Four introduces paintings developed using a 'cellular' geometric unit. I investigate how these irregular, organic compositions record a negotiation between artist and image, opening up the emotional and expressive possibilities of geometric art.

[15] *Ibid.*
[16] Gyula Kosice and others (unnamed in text), "MADÍ Painting" (Buenos Aires, Argentina, June 1946), in *Inverted Utopias: Avant-Garde Art in Latin America*, ed. Mari Carmen Ramírez and Héctor Olea (New Haven and London: Yale University Press, 2004), 493.

Chapter One: Development of the Project

Introduction

In this chapter I will describe several series of drawings and paintings made in the first stages of the PhD project. I will identify the working methodology that I developed in these early investigations and have continued to employ throughout the course of my research. I will explain how this has enabled me to engage with multiple strands of enquiry, and to identify key points and research questions that have guided the development of this project.

This methodology involves making a series of experimental drawings or paintings in which I explore an idea without preconceiving the final outcome. It was not at all clear to me when I began which of the different elements of my proposed project would prove most interesting, and which I should address first. A challenge of practice-led research is that it is necessary to interrogate the experience of making work in the studio in order to understand and articulate the material, intellectual and aesthetic processes involved. However I find that the absorbing and intuitive nature of painting and drawing makes it difficult for me to retain a clear impression of decisions made in the studio. Practice-led research involves two contrasting modes of cognition. As Ross Gibson explains, the artist must "…delve inside the system whilst also maintaining… a reflective vantage on it."[1] He suggests that in the studio, these two modes occur "*almost* simultaneously, firing off each other so that you can experience a kind of intelligent shimmer…"[2] However, in my experience, this oscillation or "shimmer" is less regular and less rapid than Gibson suggests. I work most effectively in the studio when engaged for long periods "inside the system" with only occasional journeys to the "outside." When reflecting on my studio work in order to consider future directions, and to write, this process is reversed. I felt that creating a series in which each decision generates a new work might allow me to document my studio process and allow me to analyse it at leisure, without disrupting the immersive experience of drawing and painting.

[1] Ross Gibson, "The Known World," 9
[2] *Ibid*

A fundamental research question that emerged at this early stage of the project was therefore this: would making an open-ended series of drawings provide an experimental system that would allow me to investigate my decision-making process and track the development of research ideas? In other words, would such a series of works, made rapidly and intuitively, provide a data set that I could analyse to find out what and how I was thinking in the studio? If so, I could then identify further research directions to be pursued through drawing and painting, and through investigating relevant art historical and theoretical precedents.

This question first arose in response to a series in which I explored two basic aspects of illusionistic painting. I developed a set of geometric forms of three-dimensional appearance that evolved from drawing to drawing. Making this series generated further questions: can representational techniques be investigated in isolation, without reference to objects in the real world, and to what end? Can such techniques be used to conflict with one another rather than to create a convincing illusion of three-dimensional form, and if so, what might this achieve? And finally, would this rather reductive, scientific approach to the image (an approach that comes naturally to me) prove to be an appropriate way to engage with painting and drawing? Underlying these investigations was a concern that this might be too logical a way to consider a discipline that I was drawn to because of its affective, tactile and expressive potential.

Representation and memory objects

Before describing the first series of drawings, I will introduce the ideas under investigation at this early stage of the project. My intention was to use representational painting to explore the memory palace, the ancient memory training system that was devised to store information in the mind, and which involves the placement of imagined mnemonic objects or images in a virtual architectural setting. Each mnemonic device represents an item of information that the practitioner places into his or her personal palace, as I have outlined in the Introduction. In *The Art of Memory*, historian Frances Yates described the "active and dramatic, strikingly beautiful or grotesque" nature of the memory object.[3] She quotes Cicero's instruction that these should be "active, sharply defined, unusual, and… have the power of

[3] Yates, *The Art of Memory*, 32

speedily encountering and penetrating the psyche."[4] These attributes would ensure that the memory objects would be easy to recall, and were also qualities that I hoped to develop in my paintings.

Before starting this project my practice involved photorealistic and *trompe l'oeil* painting. It seemed natural to consider these genres as a starting point for creating my own memory objects, and I was attracted by the idea of representing such curious forms in paint. However, I was concerned that in doing so I was seeking new subject matter rather than investigating the nature of my studio practice. A superficial approach would neither shed light on the nature of the memory palace, nor make painting itself the subject of my research. I had already become less concerned with direct representation and more interested in the basic material, compositional and perceptual processes that create an illusion of form and space on the two dimensional surface. The PhD project marked a new starting point, and gave me an opportunity to question some of the devices of illusionism that I employed. With these concerns in mind, I was ready to undertake some preliminary research in the studio.

***Pleat* (2009)**

In this first series of drawings I experimented with some basic techniques of representation without direct reference to the physical world, because real objects carry associations and meanings that I felt would complicate my initial investigation. I therefore began by working with a simple flat shape that suggests a set of planes angled away from the viewer, so that they appear to occupy a shallow space behind the picture plane. This shape automatically suggests a 'stepped' or 'pleated' form, an effect that is enhanced when alternating planes are highlighted, as in the first drawings in this series (fig. 4). The basic shape creates a spatial illusion, because the trapezoid form cannot help but suggest a skewed rectangular plane. I used coloured pencil on black A4 paper because I wanted to introduce the appearance of light rather than shade, and to maximise the effect I was investigating by achieving a strong tonal contrast.

[4] *Ibid,* 33. Yates cites *Cicero, De Oratore* II, trans. E. W. Sutton and H. Rackham (Cambridge, Massachusetts: Harvard University Press, date unknown), lxxxvii, 358.

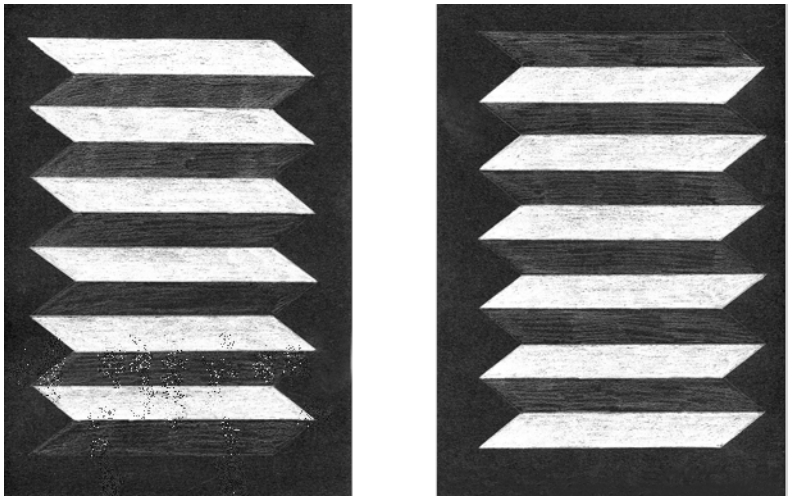

Fig. 4. *Pleat: Single Steps* (2009)

The fall and reflection of light is crucial to our perception of three-dimensional forms.[5] In painting, highlighted areas are of course used to represent the play of light over surfaces, allowing the artist to describe convincingly the form of an object on a two-dimensional support. I worked in pencil on paper at first because it allowed me to develop ideas rapidly. However I became increasingly aware of the connection this gave me to drawing from life, where the shifting focus of the eye becomes inextricably linked to the pressure of the pencil on the page. The graduations in tone this creates in turn evoke the curving and faceted surfaces of objects in the real world.

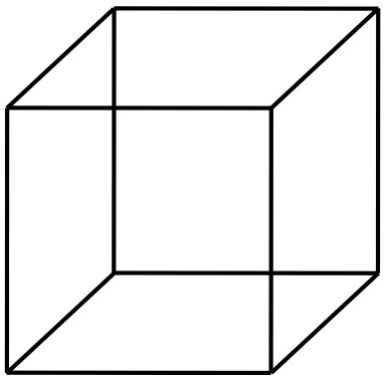

Fig. 5. *Necker Cube*

The illusion of three-dimensionality occurs because the viewer makes connections between the drawn or painted form and objects that exist in the real world. In our experience, light usually shines downwards, and so the top trapezoid plane of figure 4 (left) appears to face up, skewing the whole image to the right. When the planes are shaded following a different system in an otherwise identical drawing (fig. 4, right), the form appears to face in the opposite direction. However it is possible to imagine that light is shining up from below at this form, allowing the viewer to 'flip' the direction in which the image appears to face.

[5] See, for example, "From Light into Paint," in E. H. Gombrich, *Art and Illusion: A Study in the Psychology of Pictorial Representation* (London: Phaidon Press, 1977), 38-40.

This form is a 'bistable percept,' a well-known example of which is the Necker cube (fig. 5). Initially, this arrangement of lines tends to be interpreted as a cube that the viewer looks down upon. Staring at the image for a few seconds makes it shift into another acceptable conformation: a cube that is viewed from below. This occurs because there is insufficient information for us to settle on one interpretation, so the perceptual system tries out both options in turn, starting with the most plausible.[6] However in seeing the drawing only as a cube, our minds are selecting a very limited number of possible interpretations, as neuropsychologist R. L. Gregory explains:

> The two orientations of the Necker cube are roughly equally probable for an object which is indeed a cube. But there are plenty of other-shaped objects it could be: indeed, strictly there is an infinity of alternative three-dimensional shaped objects for any given plane projection such as a retinal image.[7]

In the second 'pleat' drawing in figure 4, the situation is slightly different: information is provided by the shading and by the form, but these two systems suggest opposite possibilities. The viewer can 'push' the image to tilt it to the left or to the right through a conscious effort. As with the Necker cube and other optical illusions, it is not possible to perceive both possibilities at once.

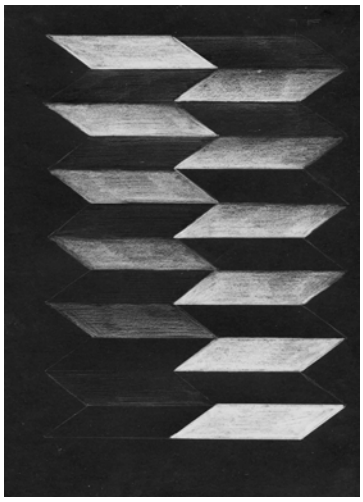

Fig. 6. *Pleat*: *Double Steps* (2009)

[6] R. L. Gregory, "The Confounded Eye." In R. L Gregory and E. H. Gombrich, *Illusion in Nature and Art* (London: Duckworth, 1980), 67.
[7] *Ibid,* 93.

I used two shading arrangements in the drawing in figure 6. Here it is not possible to decide which side of the image is 'in front' of the other, because either mutually exclusive option seems possible. However what is not possible is a compromise in which both halves of the image sit in the same plane. This is because the two systems of representation used (light and form) are in conflict, creating a mismatch in the information provided to the viewer. The drawing therefore depicts an impossible object that could not exist in the real world. This provided a means of creating tension as the image appears to cohere and yet also to move apart, as the two possible interpretations vie for attention.

Fig. 7. Debra Dawes, *Surrender* (2008)

Contemporary Australian artist Debra Dawes employs a 'pleated' format and subtle colour shifts to create convincing and yet conflicting spatial illusions. Like the Necker cube, *Surrender* (fig. 7) is a bistable percept. Focussing on this image causes it to shift back and forth between two plausible conformations, causing it to appear as a three-dimensional form lit either from the right or left. As Ross Gibson writes of Dawes' work, "[t]he push-pull of dimensions… detaches the painting from its planar geometry, taking it into a stereoscopic three-dimensionality."[8] Dawes uses visual confusion as a metaphor for political duplicity or 'doublespeak,' where an overtly acceptable message carries a hidden agenda, intended "to activate concealed prejudices by encoding divisive or discriminatory messages within apparently 'appropriate'

[8] Ross Gibson, "Debra Dawes: The Dynamism of Equilibrium," *Everydaynow* (Canberra: ANU Drill Hall Gallery, 2005), 22.

language."[9] I started to draw parallels between the duality of my images, and the two modes of cognition that Gibson suggests are involved in studio practice.

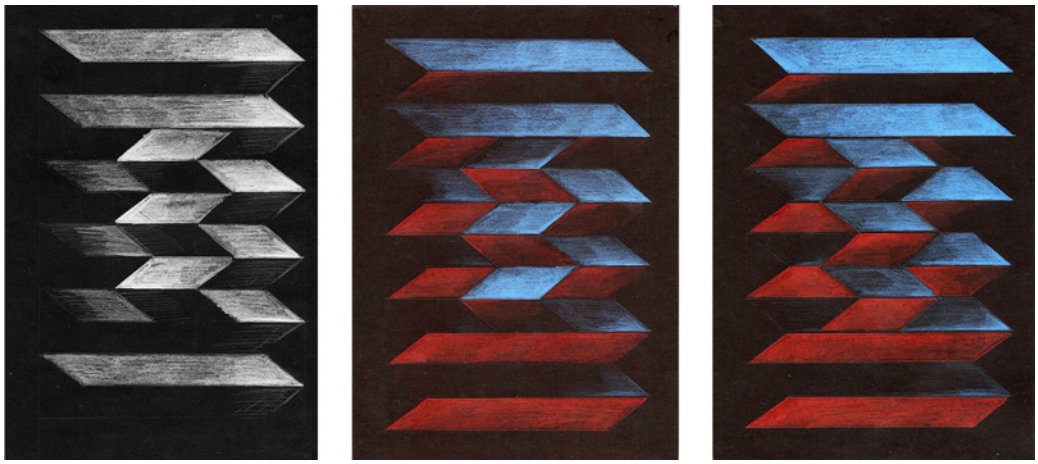

Fig. 8. *Pleat: Chevrons* (2009)

In the next drawings I introduced a new element that appears to hover in front of the image, as shown above (fig. 8). This form could be made more complex by introducing two colours, and by reversing the small centred pleat. It could be broken down further by introducing new and more complex colouring systems (fig. 9).

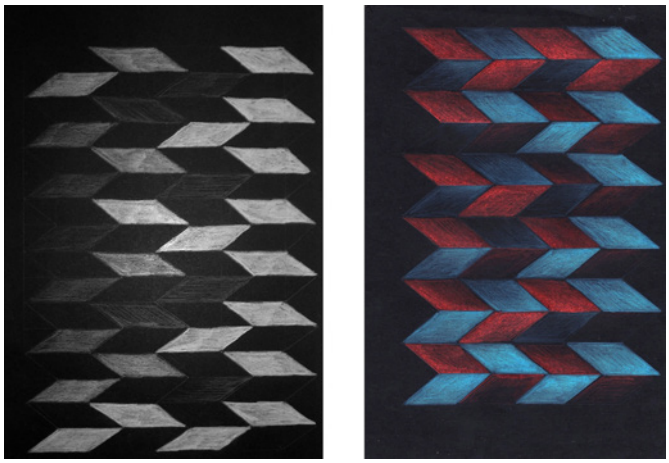

Fig. 9. *Pleat: Fragments* (2009)

[9] Jacqueline Millner, *Double Dealing* (Sydney: Gallery Barry Keldoulis, 2010), not paginated, http://www.gbk.com.au/files/DD_gbkCat2010.pdf (accessed 4 February 2013).

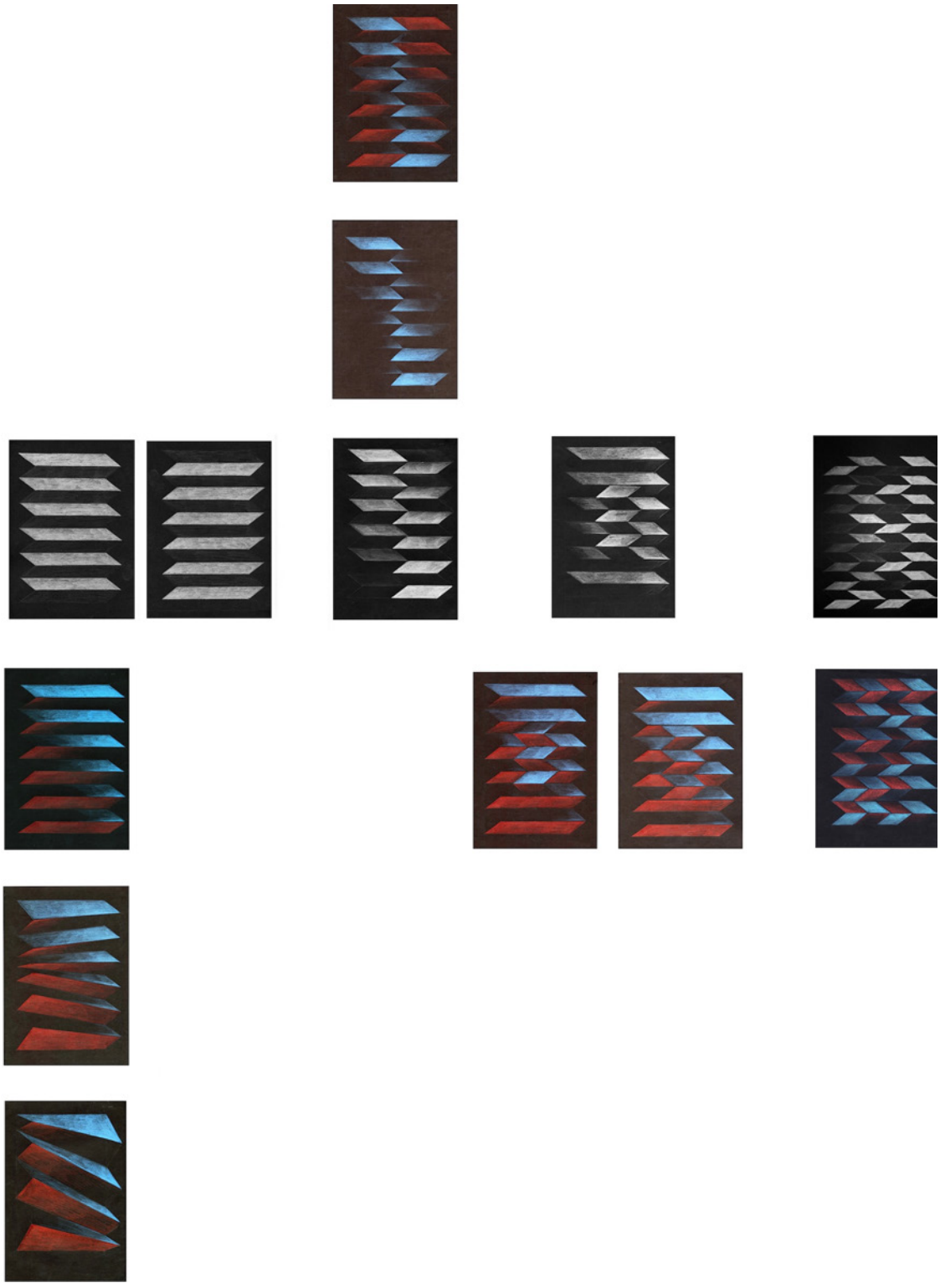

Fig. 10. *Pleat: Family Tree* (2009)

When reflecting on this set of drawings as a whole, I drew several conclusions. First, that a simple geometric form could provide a useful testing ground for investigating illusionistic effects. Second, that using these effects could generate a series of illusionistic 'objects' that referenced perception rather than the physical world. Third, that such effects could be used to conflict with one another to create an image that was visually ambiguous, creating a sense of movement or tension. And fourth, that each drawing suggests a change that I could introduce to create a new configuration of the basic form, thus generating a branching set of possibilities. I can arrange my drawings into a 'family tree' (fig. 10) that makes clear the interrelated nature of these works, and reflects the decision-making process in the studio. The black and white drawings evolve across the page from left to right, and the works to which each of these give rise are shown either above or below their progenitor.

This arrangement allows me to "step both outside and inside the mystery", as Gibson suggests, and to consider the decisions that I made in the studio.[10] Why did I introduce one change rather than another? What did I consider to be successful, and why? Was I interested in the aesthetics of these forms, and if so, what could this tell me about my aims and intensions? Was there an 'ideal' form that I was unconsciously trying to realise, and if so, what might it look like?

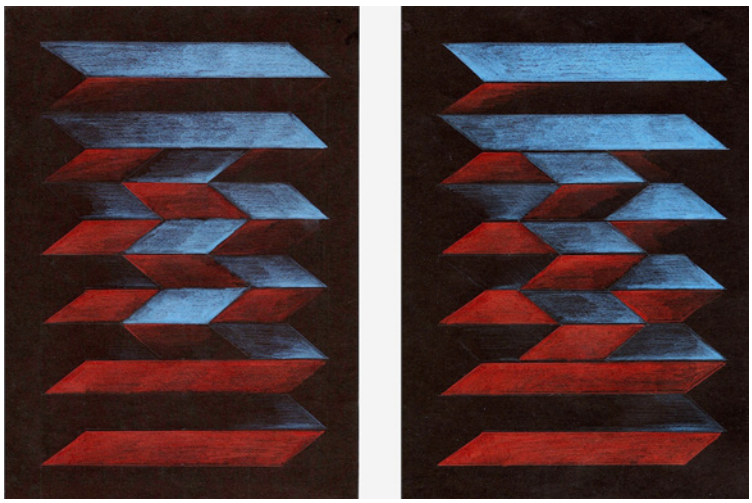

Fig. 11. *Pleat: Chevrons* (2009)

[10] Gibson, "The Known World," 4.

I felt that the final, fragmented drawings I made (fig. 9) were the least successful. These appear to depict separate planes in space rather than a complete object, perhaps because they are too ambiguous and therefore suggest too many competing readings. This indicates my preference for forms in which a balance or tension is achieved between cohesion and collapse, as in the *Pleat: Chevrons* (fig. 11). When viewed together, each of these drawings appears to undermine and reinforce the other simultaneously. The similarity between them reinforces their status as illusionistic objects. However, the two conformations are mutually exclusive, perhaps suggesting the possibility of movement between each configuration. This reflection caused me to consider how the units appear when viewed in relation to one other, rather than as individual works.

Intermediate drawings (2009)

In making the *Pleat* drawings, it had become clear to me that painting a direct representation of the memory object was no longer a pressing concern. Analysing the series allowed me to consider how I could enhance aspects of the drawings that I saw as successful. It was these ideas that I continued to explore, and through this exploration the pleated forms evolved into new configurations. However the idea of the memory palace continued to inform my studio practice, as I will describe.

Fig. 12. *Wall painting from the Cubiculum Nocturnum of the villa of P. Fannius Synistor* (c. 50-40 BCE)

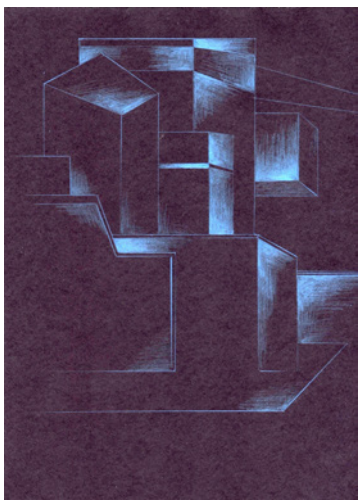

Fig. 13. *Cubiculum Nocturnum* (2009)

I continued making geometric drawings in coloured pencil, but this time referenced a pre-existing image, mapping the architectural structure of a Roman wall painting (fig. 12). According to the medieval historian Mary Carruthers, frescoes such as this provided a visual aid for constructing a memory palace.[11] Painted on the walls of the *cubiculum*, or study, the stage set-like appearance of the mural formed an architectural template. Carruthers suggests that "such a patterned series in one's most tranquil space could help provide an order or "way" for compositional cogitation."[12]

This drawing provided a useful step in changing the configuration of the image, and I have continued to reference works relevant to my research in order to introduce such changes. This is particularly helpful when an image becomes 'stuck' as such interventions allow new and relevant information to inform the evolving image.

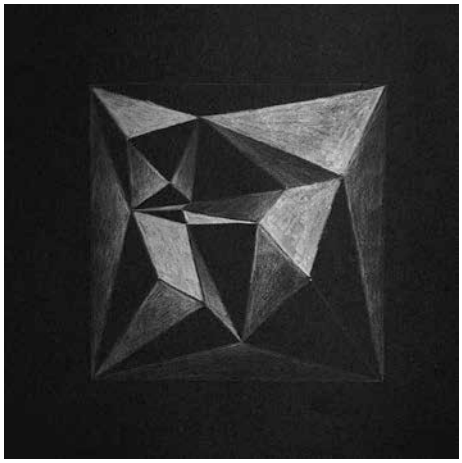

Fig. 14. *Cubiculum: Square* (2009)

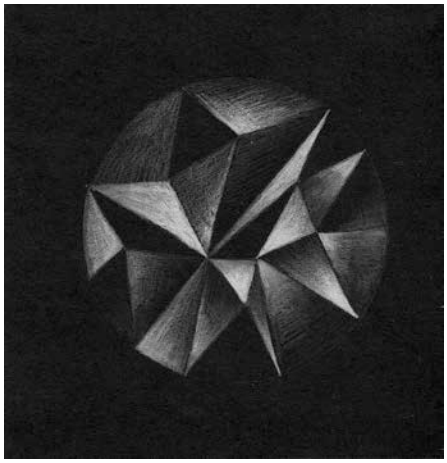

Fig. 15. *Cubiculum: Circle* (2009)

I adapted the fresco drawing freely in a variety of ways, and two examples are shown above (figs 14 and 15). These are constructed by drawing a square or circle in pencil on black paper. I then added a scattering of pencil dots inside the form, and joined these points randomly to create an informal grid. Using an arbitrary system to create the internal structure of the image introduces another conflicting system into the image, as the randomly created irregular 'surface' is held in tension by the ideal, closed form of the square or circle. This system generated an uneven tessellation of planes, some

[11] Carruthers, *The Craft of Thought*, 178.
[12] *Ibid.*

of which I shaded with a white pencil. By highlighting contiguous planes in different directions I could create the illusion that these angled into or out of the paper surface in impossible conformations, as I had in the *Pleat* drawings.

The circular image in figure 15 reminded me of Hieronymus Bosch's *Creation of the World*, in which solid ground emerges from the waters on the third day of creation (fig. 16). God sits at the top left corner of this painting, surveying his creation. I imagined that the faceted circle of my drawings resembled a bird's-eye view of the rocky, colourless surface of the newly formed earth, and I made a series of drawings that alluded to Bosch's composition (for example, fig. 17).

Fig. 16. Hieronymus Bosch, *The Creation of the World* (1500-1505)

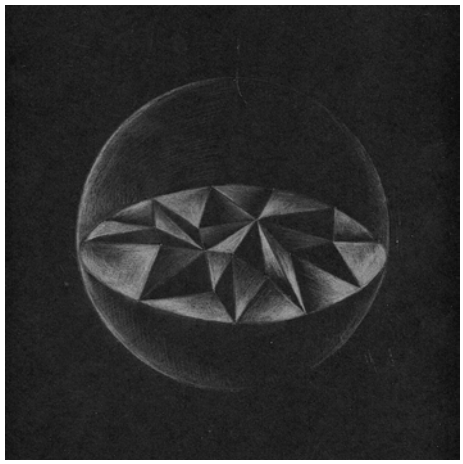

Fig. 17. *After Bosch* (2009)

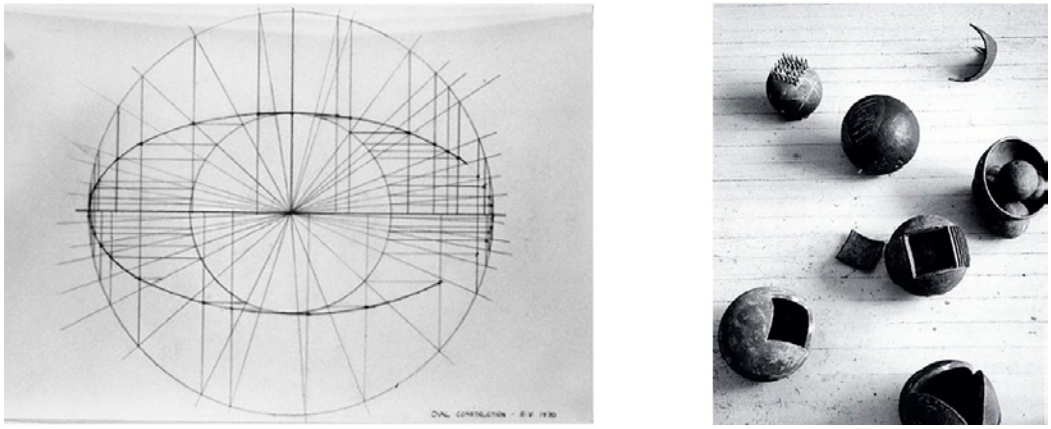

Fig. 18. Ruth Vollmer. Left, *Oval Construction* (1970). Right, *Assorted Spherical Sculptures in Bronze* (1963-66)

The geometric and mathematical work of the American artist Ruth Vollmer was also an important point of reference in this move towards the circular form. Figure 18 shows an eye-like drawing by Vollmer that resonates with Bosch's *Creation of the World,* and also a series of her sculptural explorations of the sphere. From this point I continued to work with circular images, making gouache paintings on white paper. I introduced concentric circles comprised of triangular planes, as I will describe shortly. This step was prompted in part by my analysis of other paintings by Bosch.

Fig. 19. Hieronymus Bosch (left), *Ascent of the Blessed* (after 1490) and (right) *The Seven Deadly Sins and the Four Last Things* (c. 1500)

I was intrigued by the circular tunnel in Bosch's *Ascent of the Blessed* (fig. 19). I like the illusionistic ambiguity of this painting, and the magic that happens when an apparently three-dimensional form is coaxed out of the two-dimensional surface. In the viewer's imagination, this flatness expands into another dimension. It reminds me of the device used in cartoons, where a character seeking escape draws a circle and steps through it to safety, then picks it up and walks away. This element of the painting is another bistable percept because it can be read as tunnelling into or protruding out of the picture plane: while it most obviously represents a hole, the small circular exit rendered in very light-coloured paint can also be interpreted as a highlight on a solid object. This effect is enhanced by the dark and formless ground from which the tunnel emerges.

***Volvelles* (2009)**

The *Volvelles* series is a set of gouache paintings in which I continued to work with the circular form (fig. 22). I drew concentric circles with a compass and then ruled arbitrary triangular divisions in the resulting rings. I used complementary colours to distinguish these divisions from one another as I had in the *Pleat* drawings, but this time introduced a further contrast by using an earth pigment (burnt sienna) to contrast with a pure ultramarine blue. I also mixed these colours to create a range of cool and warm tertiary greys of different tonal value. I changed the ground to white paper to enhance the effect of light in these works. I was thinking of the tunnel in the *Ascent of the Blessed*, but also wanted to test an opposite effect to that explored in the *Pleat* drawings.

Fig. 20. Ramon Lull, *Quarta Figura* (1305)

Fig. 21. Petrus Apianus, *Cosmological Volvelle* (1545)

The structure of these paintings was informed by Ramon Lull's circular paper diagrams, or volvelles. As I explained in the Introduction, these were simple paper machines in which concentric wheels can be moved to generate new combinations of information or ideas (for example, figs 20 and 21). Using a small number of elements, the volvelle can generate a vast number of limited yet unique combinations of information. I saw a connection here with the constrained system I employed in the *Pleat* drawings, where a restricted range of geometric forms and colours could be combined to create many possible forms. My adoption of the concentric circular composition in the *Volvelle* series was therefore not only an exploration of its physical appearance, but also a reference to the function of these paper diagrams.

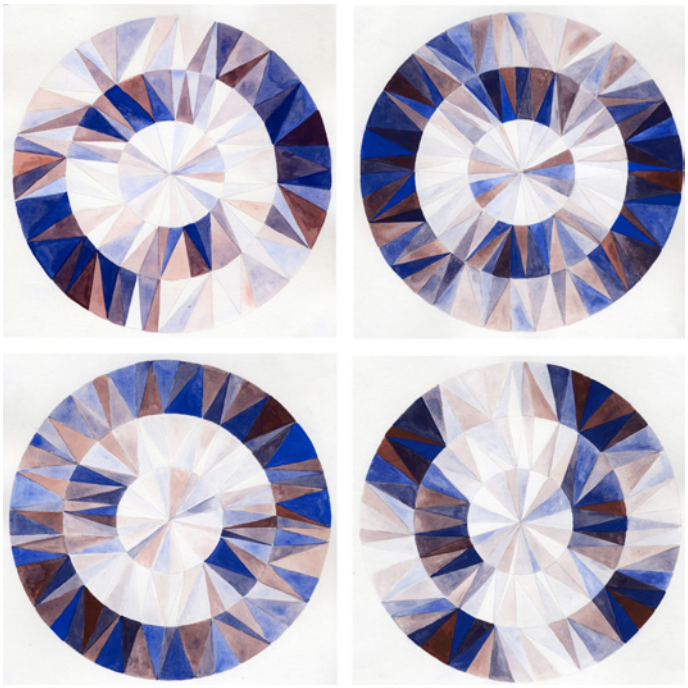

Fig. 22. *Volvelles: Concentric* (2009)

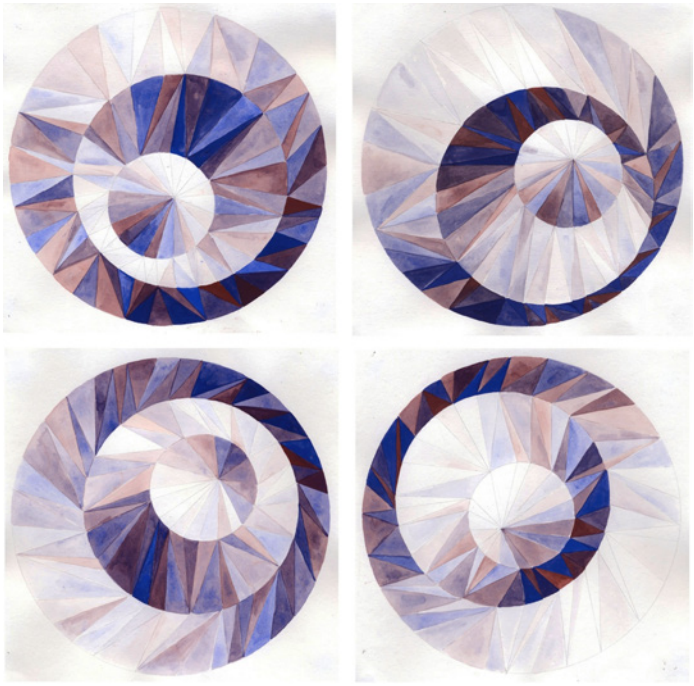

Fig. 23. *Volvelles: Eccentric* (2009)

I tested the effect of shifting the circles to eccentric rather than concentric configurations (fig. 23). Comparing these two sets of paintings allowed me to consider how this affects their appearance. The first set of paintings are flatter and more static, while the eccentric circles generate a sense of movement. Working in a series also emphasises the active nature of the image, as it presents a series of possible conformations for a single 'object'.

These paintings were created according to certain rules. For example, I juxtaposed the darkest and lightest areas because I knew this would enhance the spatial illusion. I also used darker shades in the narrower parts of the rings, allowing the paper ground to create highlights in the broader areas. In this way, tone and form worked together to create an illusion of three-dimensionality. However, I used an inconsistent lighting direction (in and between paintings), to create confusion about how these objects might exist in real space – it is not clear, for example, which areas are concave or convex, or how these connect with the ball-like element that floats or rests in the centre of each.

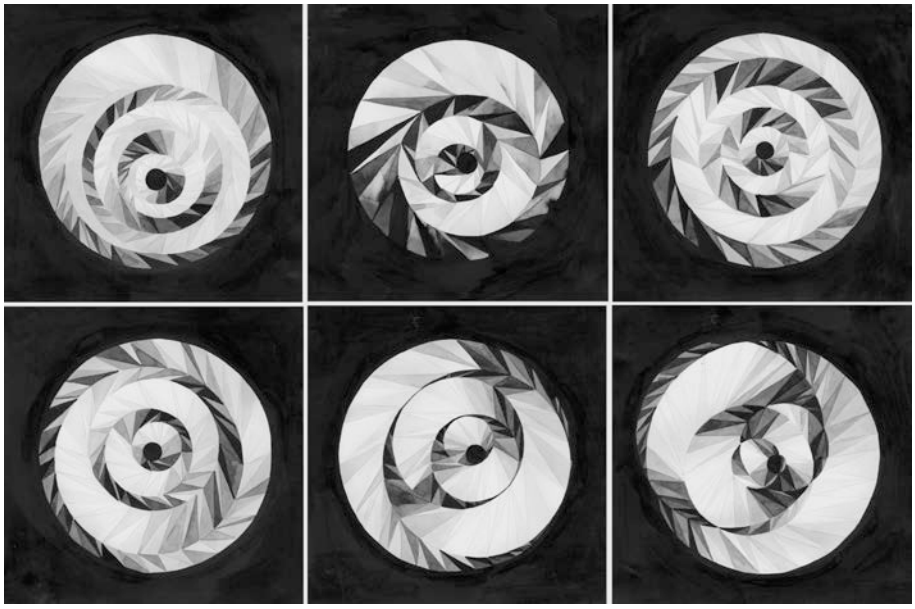

Fig. 24. *Ink Volvelles* (2009)

I reworked this form in different ways to experiment with these ambiguities. The paintings in figure 24 are comprised of six concentric rings to create a more complex

composition. I used black ink on paper as this allowed me to create a brightly highlighted image as I had in the earlier *Volvelle* paintings. By painting the surrounding ground black, I created a new space that seemed disconnected from the circular form. However I stabilised the form by reintroducing the ground in the centre of the image. Here I was again referencing the *Ascent of the Blessed*, in which the pale concentric circles that form the tunnel abut the darkest areas of the painting. These ink works take on a resemblance to mechanical forms such as cogwheels, and allowed me to reconnect with the idea of mental machinery suggested by the volvelles.

***Net* (2010)**

My studio work had taken an abstract turn away from the memory palace, and I was investigating a parallel development in the history of this system. The memory palace evolved into an increasingly stylised system of diagrams, such as Ramon Lull's logic diagrams (fig. 25) and Giordano Bruno's memory wheels (fig. 26).

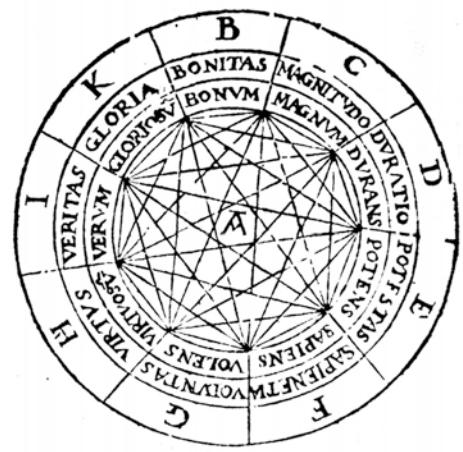

Fig. 25. Ramon Lull, *'A' Figure* (1617, original version 1305)

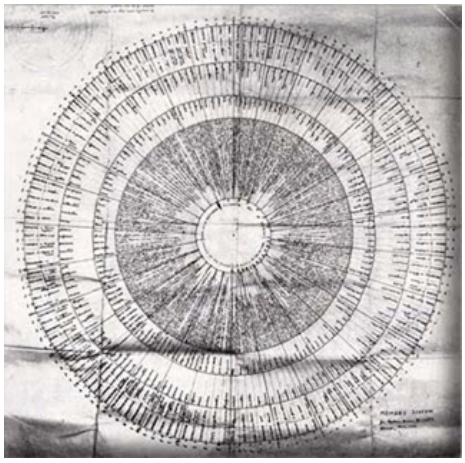

Fig. 26. Frances Yates, *Memory System based on Giordano Bruno's De Umbris Idearum (Shadows), Paris, 1582* (1960s)

These diagrams reminded me of the Richard Buckminster Fuller (1895-1983) *Plan for a Geodesic Dome* shown in figure 27. Although this may seem a superficial connection, exploring these forms in the studio allowed me to build on their similarities to develop the new series of paintings described here.

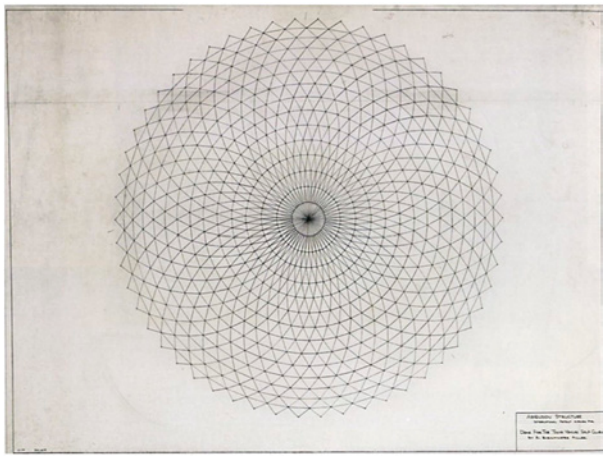

Fig. 27. Richard Buckminster Fuller, *Plan for a Geodesic Dome* (date unknown)

Buckminster Fuller's architectural plan represents a three-dimensional object in two-dimensions. However, it also creates a spatial illusion that is unrelated to the dome, as it appears to describe a surface that rises up from the centre to create a dimpled form. The plan is composed of short straight lines that join to form curves leading from the centre to the perimeter. These arcs draw the eye into and out of the circle, creating a centrifugal and centripetal dynamic. However concentric circles cross these arcs, creating dark nodal points that interrupt this inward and outward movement.

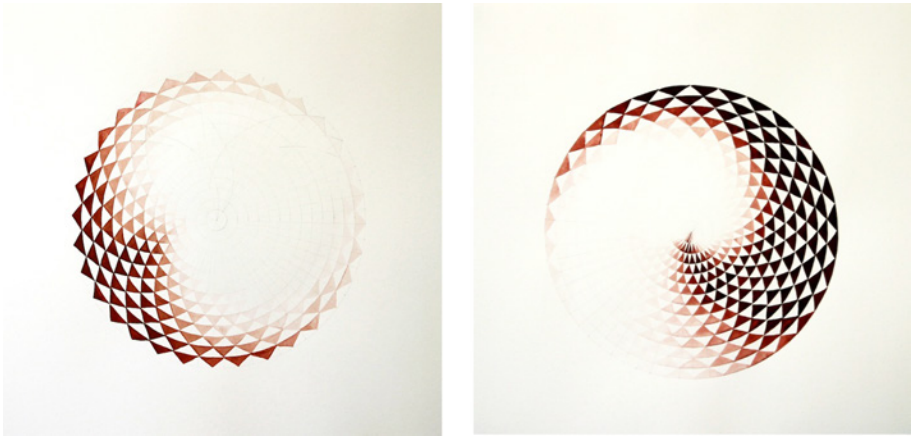

Fig. 28. *Net: Burnt Sienna* (2010)

I explored the shimmering complexity of this network of lines in pencil drawings based on Buckminster Fuller's plan, and used watercolour and gouache to define the triangular spaces within the grid. I could create spirals by using simple arithmetical progressions as I worked from the outer rings towards the centre (fig. 28). The

circular structure also allowed me to introduce two colours that could interact without physically mixing. For example, in figure 29 the burnt sienna appears pinker when surrounded by intense ultramarine. I experimented with this effect, making several series of works in which I paired colours such as cadmium orange and Payne's grey. These colours conflict in several ways: they are complementary warm/cool pairings; they create dull/pure contrasts; and they can operate tonally.

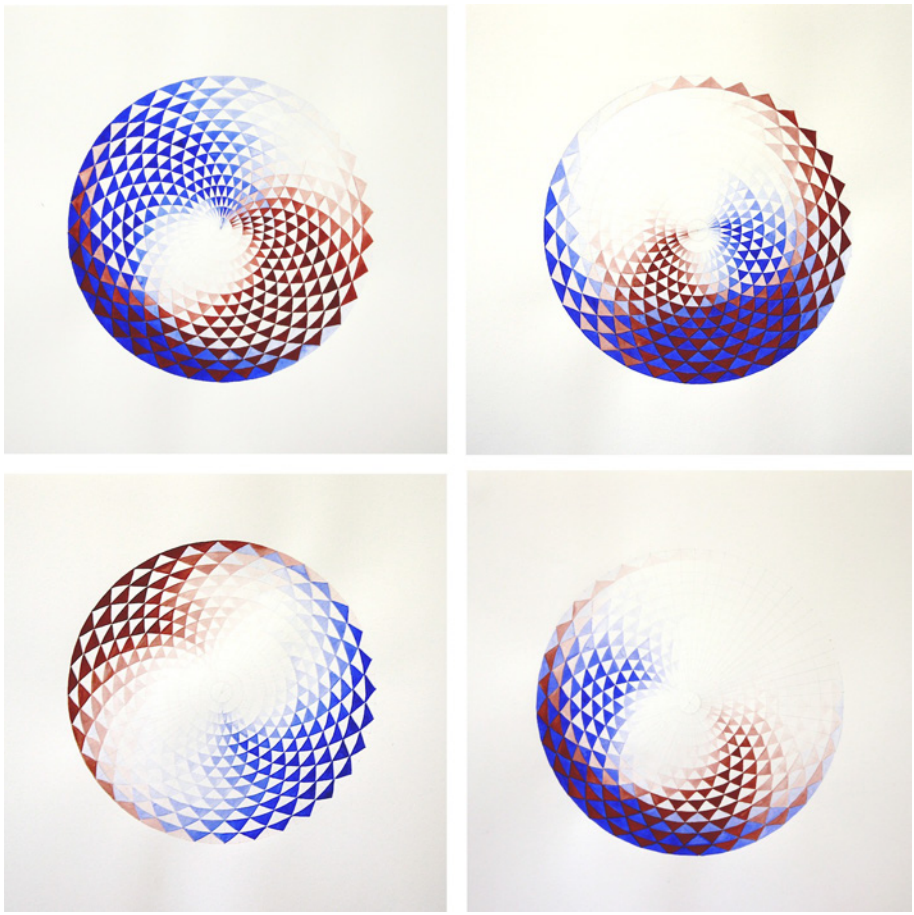

Fig. 29. *Net: Simultaneous Contrast* (2010)

The spiralling triangular planes fade away in these paintings, creating a 'burn out' effect, in which the unpainted area of the circle appears to be brighter than the ground surrounding the image. The viewer therefore 'reads' the ground differently depending on whether it is inside or outside the circular grid. The paper surrounding the form is clearly flat, while inside the circle it provides a highlight that appears to describe a curving surface. These conflicting interpretations of the ground activate the surface of the painting, an effect I investigated further, as I will describe in the next chapters.

In this series, copying the Buckminster Fuller plan gave way to investigating how I could use it as a template to construct more complex images that referenced thought diagrams. I used paint to give presence to the planes created by the intersection of three lines. In the Lullian circles, lines represent a creative connection between two ideas, as I have described. If I extend this analogy to the *Net* paintings, then each triangular plane is a territory delineated by three intersecting lines of enquiry. These planes then represent a more complex form of thought in which multiple ideas interact and change through time, indicated by the fluid movement of colour throughout this series.

Conclusion

At the beginning of this chapter, I asked the following question: could making an open-ended series of drawings provide an experimental system that would allow me to investigate my decision-making process in the studio? In these preliminary investigations, this appeared to be the case. I developed geometric structures – the pleated form and the circular grid – which provided templates for a diverse range of images. These basic, flexible structures appear to provide what Anton Ehrenzweig describes as a "fertile motif" – a form that is itself unresolved, but "points to its further development in the future."[13] As Ehrenzweig writes:

> A conscious analysis of the future fertility of a motif is impossible. This is true even where rules for its development exist… rational analysis of a motif cannot evaluate its future uses.[14]

The open-ended series provides a method for identifying such motifs, and for exploring and recording the unpredictable results of their development.

After making the *Pleat* drawings I was able to 'step outside' my studio practice, and observe how the image I had created evolved throughout the series. I could then analyse and query the decisions I made intuitively in the studio, because the series provided a record of each decision made. While these choices were simple ones

[13] Anton Ehrenzweig, *The Hidden Order of Art: A Study in the Psychology of Artistic Imagination* (London: Weidenfeld, 1993), 48.
[14] *Ibid,* 49.

concerning colour and composition, I was nevertheless able to draw conclusions that began to direct the course of this project.

For example, my preliminary work explored spatial illusionism, because I wanted to find out if I could investigate techniques of representation without reference to real objects. I constructed geometric forms of an illusory three-dimensional appearance and realised I could use colour, shape and tone to deliver conflicting information to the viewer. This resulted in the creation of visually ambiguous images of 'impossible' objects, and provided an approach I could use to create a sense of movement or tension. I realised too that the geometric forms I constructed alter the way in which the paper ground is perceived. In the *Volvelles* and *Net* paintings, the ground plays two roles – it is the flat picture surface on which the image is depicted, but simultaneously appears to describe a curving surface that reflects light. Thus it is 'read' as both two-dimensional *and* three-dimensional. Reflecting on these conclusions reinforced the importance to me of continuing to work with spatial illusionism, even if I had moved away from representation.

The ambiguities created in the figure and the ground represent conflicting realities that are held in tension in the same image. The flickering that we experience when seeing a visually ambiguous form suggests the "intelligent shimmer" that Ross Gibson describes, where the attention oscillates between distant objectivity and immersive subjectivity.[15] The neuropsychologist R. L. Gregory (whose analysis of the Necker cube is referenced earlier in this chapter) explains our perception of ambiguous forms such as optical illusions in terms of visual hypotheses, or plausible interpretations of the visual data we receive. As he explains, these hypotheses are a limited subset of the multiple ways in which an image could be interpreted, based on what we know about the world – we extrapolate from our experience when interpreting new visual information.[16]

Creating ambiguous images allows me to draw parallels between perceptual hypotheses, and the development of hypotheses in scientific research. In scientific research, experiments are performed, data are analysed, and the scientist develops hypotheses that seem most likely to account for experimental results. The next step is

[15] Gibson, "The Known World," 9.
[16] Gregory, "The Confounded Eye," 67.

to attempt to disprove the most plausible hypothesis by designing and performing another experiment. Until then, the 'truth' of the situation is unknown. In creating visually ambiguous objects, I felt that I could represent the form of thinking that for me was the most exciting and tantalising aspect of scientific research – where hypothetical thought operates as a kind of crystallised uncertainty, and the reality of a situation exists as several possible but mutually exclusive alternatives. In balancing visual ambiguities through a careful manipulation of colour and form, I could perhaps create images in which multiple alternative possibilities do not collapse into a singular reality (as they do in scientific research), but are instead held open in a state of unresolved tension.

Art theorist Anton Ehrenzweig suggests that ambiguities created by using conflicting spatial effects affect the emotions rather than the intellect. He writes that spatial conflict,

> … demands a resolution for which there is no intellectual recipe. I would maintain that the conflict between incompatible space experiences… may belong to the emotional subject matter of abstract art as it is now developing.[17]

This raises new questions concerning the affective, expressive potential for geometric art, which I will explore further in Chapter Four.

I wondered at the beginning of this chapter whether taking a reductive, scientific approach to the image would prove to be an appropriate way to engage with painting and drawing. At this early stage of my project, this approach seemed both personal and productive. I had developed an experimental methodology that enabled me to explore complex geometric forms, using illusionistic devices to create tension and perceptual ambiguity. These works generated further questions, which concerned my use of materials; the nature of the process by which an image evolves; the emotive or expressive potential of geometric art; the activation of the ground; and the status of the individual work in a series. In the next chapter I will consider these themes and questions in the context of artists who have worked with similar concerns.

[17] Ehrenzweig, *The Hidden Order of Art,* footnote to page 83.

Chapter Two: Contextualisation of the Project

Introduction

In Chapter One I described making exploratory drawings and paintings using geometric elements that I combined to make complex images. This chapter explains how I contextualised my project, and found art historical precedents that I could consult to see how the questions I was considering had been addressed by others. The approach I took was to identify the processes and characteristics of my preliminary work that seemed central to my project, and to find examples of artists who worked with similar themes. These themes include: the construction of images using geometric forms; the generation of complexity by combining geometric elements; the employment of illusionistic devices to create perceptual ambiguity; and the use of the series as an experimental system for tracing the development of ideas.

I will discuss these points in relation to concrete art, focussing on Waldemar Cordeiro's *Idéia Visível* (*Visible Idea,* 1956), Hélio Oiticica's *Sêcos* (1956-57) and *Metaesquemas* (1957-58), and Max Bill's *Fifteen Variations on a Single Theme* (1938). The optical art of Bridget Riley is another important point of reference, not only because her paintings engage directly with perceptual ambiguity, but also because her lucid accounts of her working process provide a valuable resource. This analysis has raised further questions for me concerning the activation of the picture surface, the status of the individual work in relation to the series, and the expressive potential and self-referential nature of geometric art. The purpose of this discussion is to indicate how engaging with a broader context influenced the development of my studio work.

Concrete art: a brief introduction

Concrete art immediately appeared to be most relevant to my studio practice, because it involves the construction of a non-representational image from geometric elements to represent abstract ideas in material form, as I will describe. I made this connection early in my project through the work of Waldemar Cordeiro (1925-1973), a Brazilian concrete artist and computer art pioneer. Because I was thinking of my preliminary work as a series of 'visible ideas,' I entered this phrase into the Google Images search

engine to find out what else might have been described this way. The image that caught my attention was Cordeiro's *Idéia Visível*, or *Visible Idea* (fig. 30), a painting that I continue to find compelling, and that I will discuss in more detail later in this chapter. It instantly brought to my mind Cicero's description of the ideal memory image: that it should be "active, sharply defined, unusual" and able to "penetrat[e] the psyche."[1] This encounter led me to investigate the complex and innovative concrete art of mid-to-late 20th century Latin America, and to attend an exhibition at the Juan March Foundation in Madrid (*Cold America: Geometric Abstraction in Latin America, 1934-1973*) as part of my field studies research.

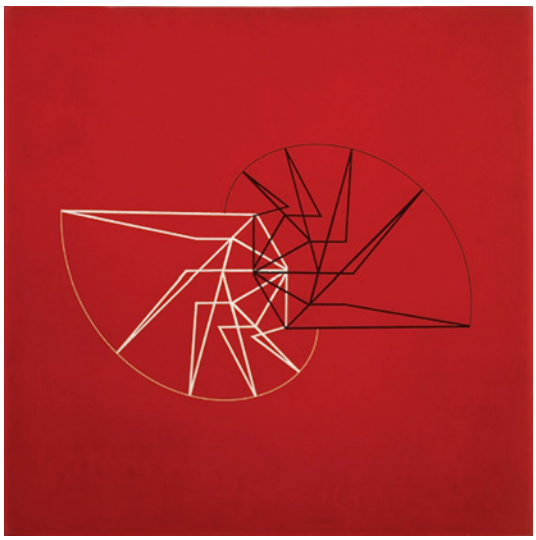

Fig. 30. Waldemar Cordeiro, *Visible Idea* (1956)

Concrete art was originally a European movement that emerged in response to non-objective art movements including Constructivism, *De Stijl* and Futurism.[2] It was first defined by the Dutch artist Theo van Doesburg (1883-1931) in the 1930 manifesto, "The Basis of Concrete Art."[3] This manifesto is comprised of the following six statements:

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[1] Cicero's instruction that memory images should be "active, sharply defined, unusual, and… have the power of speedily encountering and penetrating the psyche." Cicero, *De Oratore*, cited by Yates, *The Art of Memory,* 33.

[2] Jean-Claude Lebensztejn, "Passage: Note on the Ideology of Early Abstraction," in *Abstraction: Paths to Abstraction 1867-1917* (Art Gallery of NSW, Sydney, 26 June - 19 September 2010), ed. Terence Maloon (Sydney: Art Gallery of NSW, 2010), 44-45.

[3] Theo van Doesburg, "The Basis of Concrete Art," in *Constructing a New World: Van Doesburg & the International Avant-Garde,* ed. Gladys Fabres and Doris Wintgens Hötte (London: Tate Publishing, 2010), 187. First published in *Art Concret* (April 1930): 1.

1. Art is universal.

2. The work of art should be fully conceived and spiritually formed before it is produced. It should not contain any natural form, sensuality or sentimentality.

3. The painting should be constructed completely with pure plastic elements, that is to say, with planes and colours. A pictorial element has no other meaning than what it represents; consequently the painting possesses no other meaning than what it is by itself.

4. The construction of a painting and its elements should be simple and direct in its visualisation.

5. The technique should be mechanical, that is to say, precise rather than impressionistic.

6. Absolute clarity should be sought.

Van Doesburg's instruction that "[t]he painting should be constructed completely with… planes and colours" using a "precise rather than impressionistic" technique does describe my practice. However, the manifesto overall is highly prescriptive and seems to leave no room for intuitive exploration during the making process. Despite this, it is clear that van Doesburg did work experimentally: the composition of *Arithmetic Composition* (fig. 31, right), for example, was developed via a series of studies such as the *Sketch for 'Forme Universelle II'* (fig. 31 left).

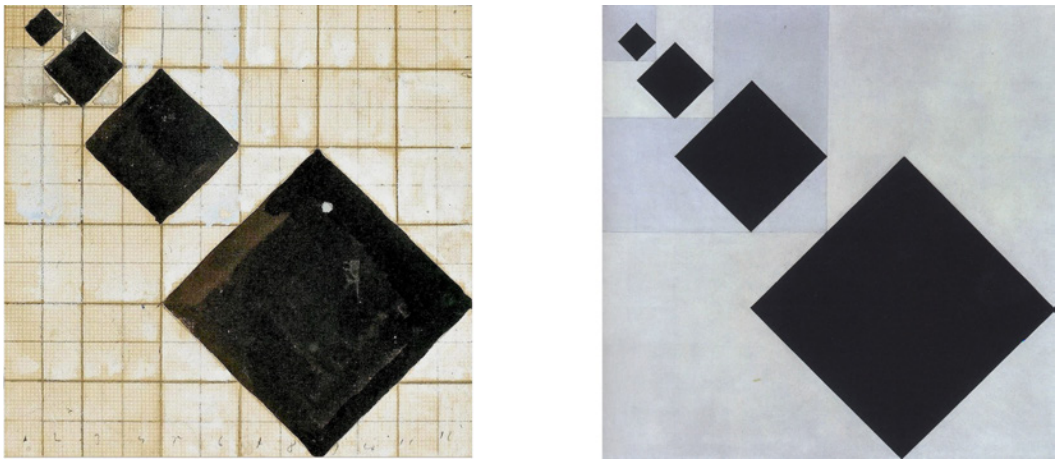

Fig. 31. Theo van Doesburg (left) *Sketch for 'Forme Universelle II'* (1930) and (right) *Arithmetic Composition* (1930)

If the "work of art… [is] fully conceived, and spiritually formed before it is produced," then this process of formation must occur in the studies and sketches. Following van

Doesburg's logic, these informal (and somewhat "impressionistic") works are distinct from the "work of art" itself, and therefore are not art. This provides a point of difference between concrete art in its original formulation and my project, because in my practice the series of studies or 'working drawings' in which a composition is developed is an end in itself.

In 1936, the Swiss artist Max Bill (1908-1994) identified concretism as an art in which ["[a]bstract ideas which previously existed only in the mind are made visible in a concrete form."[4] In a later essay, he suggested that mathematical elements provide a new subject matter for an art "in which intuitions or ideas or conjectures have taken visible substance."[5] Bill's reference to "intuitions" and "conjectures" suggests a more nuanced approach to concrete art in which speculative ideas might take visual form. Bill was influential in introducing concrete art to Latin America, and his paintings, prints and sculptures were exhibited in the Museu de Arte de São Paulo in 1950.[6] As the curator and writer Héctor Olea writes, artists "welcome[d] or… reinterpret[ed] the legacy of Russian Constructivism, Dutch Neo-Plasticism, and… the Höchschule für Gestaltung [Bill's School of Design in Ulm, Germany]."[7] Olea suggests that artists such as Cordeiro provided a "radical and creative re-reading of those original guidelines" indicating the importance of revisiting painting problems from the past.[8] Concrete art was re-imagined and reinvigorated in an intense artistic and political dialogue concerning the role and nature of art. This dialogue was articulated in part in the form of artists' statements and manifestos and led to the formation and dissolution of many factional groups.

In such statements, concrete art is frequently associated with scientific objectivity. For example, the Argentine artist Gyula Kosice wrote in 1946 of his intention to "set up an

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[4] Max Bill, "Concrete Art (1936-49)," *Theories and Documents of Contemporary Art*, 91.
[5] Max Bill, "The Mathematical Approach in Contemporary Art (1949)," *Theories and Documents of Contemporary Art*, 93.
[6] Ferreira Gullar, "From Construction to Deconstruction," in *Cold America: Geometric Abstraction in Latin America (1934-1973)*, Fundación Juan March, Madrid, February 11-May 15 2011 (Madrid: Fundación Juan March, 2011), 50.
[7] Héctor Olea, "Waldemar Cordeiro: From Visible Ideas to the Invisible Work," in *Building on a Construct: The Adolpho Leirner Collection of Brazilian Constructive Art and the Museum of Fine Arts, Houston*, ed. Héctor Olea and Mari Carmen Ramírez (New Haven and London: Yale University Press, 2009), 131.
[8] *Ibid.*

art of mathematical, cold, dynamic, cerebral, and dialectic spirit."[9] This aspect of concretism was reinforced by the title of the exhibition that I attended in Madrid, *Cold America*, a description specifically identified in the catalogue foreword as a means of challenging stereotypical views of Latin America:

> [I]t does not point to a hasty and clichéd identification of the continent with the intense heat of spontaneity… the works on view prove Latin America can in fact be measured in terms of objectivity. This was a geometrical, constructivist, and elemental America that moved between the rational and the "sensível," gravitating towards modern theories rather than local colour.[10]

However, as the statement above implies, concrete art in Latin America was not purely cerebral, but also encompassed the the realm of the senses. In their 1959 Neo-Concrete Manifesto, Ferreira Gullar and his fellow signatories[11] announced their break with "the kind of concrete art that is influenced by a dangerously extreme rationalism."[12] Gullar *et al*. describe the limitations of an art that, in excluding intuition and imagination, denies the sensorial experience of the artist and the viewer.

> By avoiding intuitive creation… the rationalist concrete artist hardly demands, from himself and from the viewer, a stimulating and reflexive reaction. He speaks to the eye as an instrument and not to the eye as a human means of possessing the world and of giving oneself to it; he speaks to the machine-eye and not the body-eye.[13]

It is this reformulation of concrete art that is of most relevance to this project, as I will describe.

Waldemar Cordeiro: *Visible Idea* (1956)

Cordeiro made a direct link between painting and thought in a 1956 catalogue essay, writing that "[a]rt is different from pure thought because it is material, and from

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[9] Gyula Kosice and others (unnamed in the text), "MADÍ Painting," *Inverted Utopias,* 493.
[10] Foreword, "Another America." No author cited, *Cold America,* 11.
[11] Amilcar de Castro, Franz Weissmann, Lygia Clark, Lygia Pape, Reynaldo Jardim, and Theon Spanudis
[12] Ferreira Gullar *et al.*, "Neo-Concrete Manifesto" (Rio de Janeiro, Brazil, 1959). *Cold America,* 442.
[13] *Ibid.*

ordinary things because it is thought."[14] His works at this time, all entitled *Visible Idea*, are a physical, visible embodiment of mathematical principles, constructed using measurement and calculation. In Cordeiro's *Visible Idea* (fig. 30), thought is visualised in the form of a delicately articulated network of lines based on the golden ratio. It is not "pure thought" because it is a tangible object, however neither is it an "ordinary thing," because it embodies an idea. It is a mathematical formula that draws itself into a visible object, which in turn is an expression of the original idea.

There is a connection here with the logic diagram which, as science writer Martin Gardner writes, "is a two-dimensional geometric figure with spatial relations that are isomorphic with [having the same structure and function as] the structure of a logical statement."[15] This self-referentiality also accords with van Doesburg's statement that "[a] pictorial element has no other meaning than what it represents; consequently the painting possesses no other meaning than what it is by itself."[16] However van Doesburg's logic appears flawed, because he does not take into account the viewer's interaction with the work. While a "pictorial element" such as a triangle or square may have no meaning beyond itself (although this is debatable), it does not follow that a combination of such elements will also be purely self-referential. This seems to indicate a difference between the artist's intention, and the viewer's perception of the work.

The philosopher Paul Crowther suggests that while artists may intend their works to have no meaning, "*once an abstract work is presented as art in the relevant kind of context, none of its immediately visible properties are virtually inert or neutral.*"[17] In reality, the viewer will always seek meaning, and to deny this is to deny the viewer's experience. For example, Cordeiro's *Visible idea* is constructed from lines, which individually may have no symbolic or affective import. However I automatically seek

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[14] Waldemar Cordeiro, catalogue accompanying the 1956 *National Exhibition of Concrete Art* in Sãn Paolo, cited by Claus Clüver, "The "Ruptura" Proclaimed by Brazil's Self-Styled "Vanguardas" of the Fifties," in *Neo-avant-garde*, ed. David Hopkins (Amsterdam and New York: Rodopi, 2006), 168-169.
[15] Gardner, *Logic Machines and Diagrams*, 28.
[16] Van Doesburg, "The Basis of Concrete Art," *Constructing a New World,* 187
[17] Paul Crowther, "Meaning in Abstract Art: From *Ur*-Nature to the Transperceptual," in *Meanings of Abstract Art: Between Nature and Theory*, ed. Paul Crowther and Isabel Wünsche (New York and London: Routledge, 2012), 272 (author's italics).

references in the whole image to the world that I know or imagine. The forms in this painting resemble mechanical creatures (to my mind, at least) and the delicate curve that each describes suggests a fragile shell, or the movement of metallic limbs. As the Argentine painter Alfredo Hlito observed in 1953,

> … it would be as absurd to suppose that the creative effort of the concrete artist is spent on not representing natural forms as it would be to believe that the effort of the figurative artist ends when he has managed to not make concrete art.[18]

The doubling of the form implies that it occupies two positions in time and space. Such an interpretation is imaginative and associative: the painting stimulates the viewer to visualise a rotation around the centre of the picture plane, and this illusion of movement creates a reciprocal activation of the form. Without seeking meanings beyond "what [the painting] is by itself," this activation could not occur. In the words of the Neo-Concrete Manifesto,

> …it is important to clarify that, in the language of art, these so-called geometric forms lose the objective character of geometry in order to become vehicles for the imagination.[19]

These reinterpretations of van Doesburg's original 'rules' of concrete art appear to open up the possibility of a geometric art that can be systematic and mathematical, and also expressive and imaginative.

Max Bill*: Fifteen Variations on a Theme* (1938)

Max Bill (1908-1940) wrote in 1949, "I am convinced it is possible to create a new form of art in which the content of a work could be based, quite substantially, on a mathematical line of approach."[20] His *Fifteen Variations on a Single Theme* – a set of sixteen lithographs arranged in a square grid – exemplifies this approach. The *Single Theme* at the top left corner is an angular spiral created by joining the edges of several superimposed shapes (a triangle inside a square, inside a pentagon, and so on), all of which have sides of the same length. This form is the mathematical proposal that Bill

[18] Alfred Hlito, "Concrete Art and Meaning (Buenos Aires, Argentina, January 1953)," *Cold America,* 433.
[19] Ferreira Gullar *et al.*, "Neo-Concrete Manifesto," 442-443.
[20] Bill, "The Mathematical Approach in Contemporary Art," 92.

explores. While some *Variations* resemble the *Theme* closely, others seem unrelated. For example, the stellar forms appear structurally distinct, but were created by joining points that map each turn of the spiral. The information necessary for creating every image is encoded in the *Theme*, and is used selectively to generate a diverse range of forms that explore colour and space. These therefore represent Bill's creative exploration of the simple mathematical hypothesis embodied in the original *Theme*.

Fig. 32. Max Bill, *Quinze variations sur un même thème* (*Fifteen Variations on a Single Theme*, 1938)

Bill explored what he described as "the mystery enveloping all mathematical problems."[21] These include,

> … limitations without boundaries; disjunctive and disparate multiplicities constituting coherent and unified entities; identical shapes rendered wholly diverse by the merest inflection…[22]

In *Fifteen Variations*, Bill set limits to his exploration that nevertheless allowed multiple (and perhaps infinite) variations to be made. The sixteen individual prints in the series are disparate but together constitute a "unified entity" that forms a single work. It is clear that many other images could have been included in this series. As Bill's widow Angela Thomas Schmidt explained to curator Friederike Fast,

[21] *Ibid,* 93.
[22] *Ibid.*

> … everyone who tried to explain his works mathematically eventually had to give up because they couldn't be reduced to pure mathematics: their most important aspect was always an element of creative decision-making… in *15 Variations*, he didn't just doggedly choose every possibility that could have been carried out but instead made a creative selection.[23]

Bill's "creative selection" implies that there is a negotiation between the mathematical system he has created and aesthetic or other considerations. When making the drawings and paintings described in Chapter One, I experienced the temptation to explore every permutation of colour and form that I could imagine within the framework of the pleated or circular grid. Such an exploration can very easily become obsessive as even small changes to the image give rise to multiple possibilities that can be realised on paper. This can lead to making works that are barely distinguishable from one another, and research questions driving the investigation may be lost in a vain attempt to 'complete the set.' Bill's approach made me consider how I would judge when a series was complete. Should this be the point at which the series creates a coherent 'story' for the viewer, or might it be interesting to pursue a system until it breaks down into an incoherent recycling of form? These questions will be explored further in Chapter Three.

Hélio Oiticia: *Sêcos* (1956-57) and *Metasquemas* (1957-58)

The Brazilian artist Hélio Oiticica's two related bodies of work, the *Sêcos* and *Metasquemas*, represent such an obsessive reworking of ideas. Together these comprise over 350 gouache paintings on cardboard made between 1956 and 1958, indicating the rapid pace at which Oiticica worked (producing on average at least one painting every three days). Like Bill, Oiticica (1937-1980) took an unashamedly scientific approach to his work. As art historian Wynne H. Phelan recounts, Oiticica was deeply influenced by his scientist father, and employed a "meticulous methodology" in his art practice.[24] According to Lynn Zelevansky, the Director of the Carnegie Museum of Art, Oiticica "compulsively categorized and ordered every facet

[23] Angela Thomas Schmidt in conversation with Frederike Fast, in *Max Bill: No Beginning, No End*, Museum MARTa Herford (Zürich, Switzerland: Scheidegger and Spiess, 2008), 27.
[24] Wynne H. Phelan, "To Bestow a Sense of Light: Hélio Oiticica's Experimental Process," in *Hélio Oiticica: The Body of Colour*, ed. Mari Carmen Ramírez (London: Tate Publishing, 2007), 75.

of his creativity, clearly numbering his works according to the class and subclass of objects to which they belonged or the project of which they were a part."[25] Oiticica himself described the Metaesquemas as an "obsessive dissection of space."[26] These series thus provide a precedent for an approach in which the apparently cool logic of an experimental system can lead to a compulsive reworking of ideas that may be anything but rational.

Oiticica's gouache paintings on cardboard form a hiatus between a series of early paintings and the three-dimensional and interactive works for which he is better known (for example, the *Núcleos* and *Parangolés*). The works on cardboard therefore mark a dissolution and reconfiguration of the artist's practice, and Oiticica later acknowledged that these had given rise to his mature work.[27] Between 1955 and 1956, Oiticica made several oil paintings that were influenced by the work of Paul Klee, Piet Mondrian and Oiticica's teacher, Ivan Serpa (fig. 33).[28]

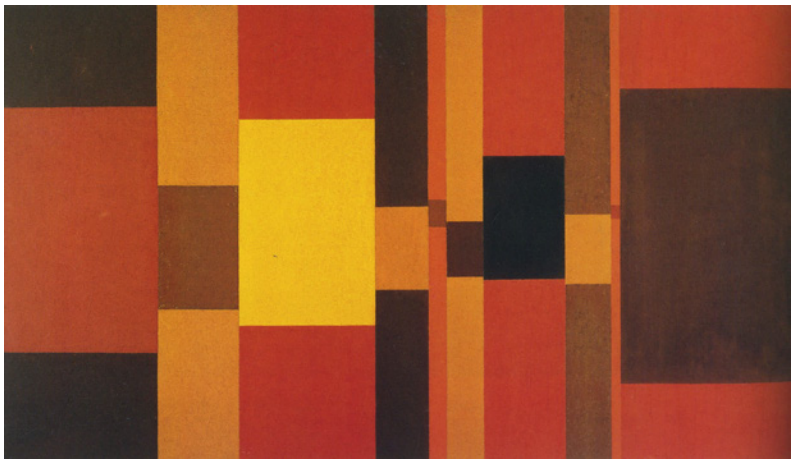

Fig. 33. *Sem Titulo* (*Untitled*, 1956)

[25] Lynn Zelevansky, "Beyond Geometry: Objects, Systems, Concepts," in *Beyond Geometry: Experiments in Form, 1940s-1970,* ed. Lynn Zelevansky (Cambridge, Massachusetts: The MIT Press, 2004), 19.
[26] Hélio Oiticica, "METAESQUEMAS 57/58 exhibition catalogue (Galeria Ralph Camargo, São Paulo, 1972," *Hélio Oiticica,* 147.
[27] "This work, always suggesting to me [something] "environmental," was indeed a foreshadowing of [the] nuclei I conceived later in the 1960s. I believe that now." Oiticica's 1968 notation on *Sêco 26* (1957). Figure legend to Plate 21, *Hélio Oiticica*, 146.
[28] Mari Carmen Ramírez, "The Embodiment of Colour – "From the Inside Out."" *Hélio Oiticica,* 37.

The *Sêcos* appear to explore questions raised by these thickly textured works. As curator Mari Carmen Ramírez suggests, Oiticica "embarked on the methodical cleansing of the dense color applications" of the earlier works.[29] In the *Sêcos,* Oiticica took a reductive approach to the image, breaking down the visual language of the oil paintings to explore the relationship between flat planes of colour and the cardboard ground, as can be seen in figure 34.

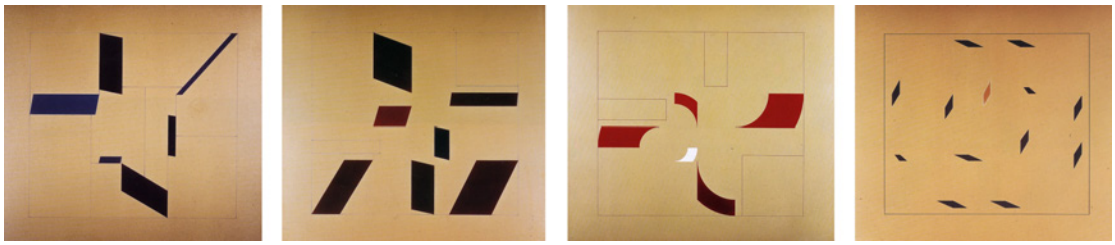

Fig. 34. Hélio Oiticica, *Sêcos 3, 11, 12* and *27* (1956-57)

In these works, flat planes of gouache are painted in a faintly drawn grid. The grid imparts a cohesive force that holds in tension the planes that simultaneously appear to be moving apart. This effect is particularly marked in *Séco 22* (fig. 35).

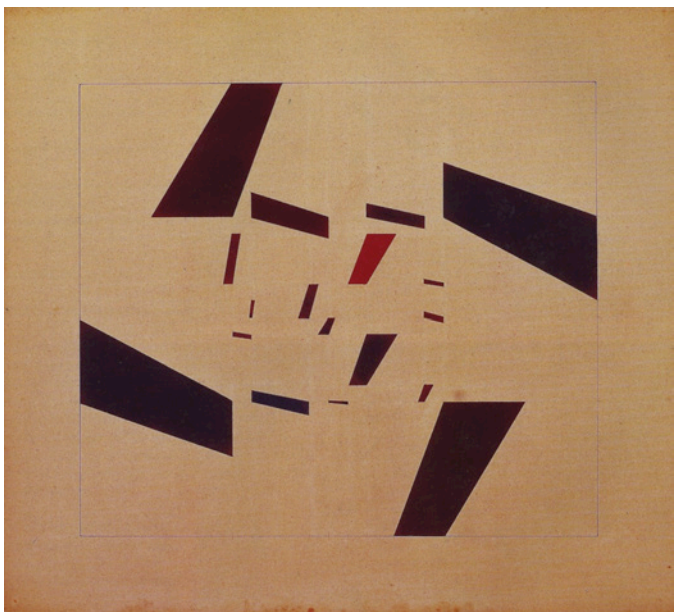

Fig. 35. Hélio Oiticica, *Sêco 22* (1957)

[29] Ramírez, "The Embodiment of Colour," 39.

Here, the largest black planes seem to spiral out of the picture, but are held in place by the sharply inscribed internal frame with which they align. A strong spatial illusion is created by the decreasing size of the central planes, creating the impression that the viewer is looking into deep space. The illusion is belied by the flatness of the paint and the cardboard ground, and the shift in colour towards red. The viewer interprets the central planes as being close (because warm colours appear to advance) and yet distant (because of their decreasing size). This results in an ambiguous composition that creates visual tension, activating the untreated cardboard surface.

The surface of *Sêco 22* is in fact not uniform, but bears traces of paler horizontal and vertical lines. These are hard to see when one focuses directly, but become apparent to the peripheral vision as the eye scans the planes and the internal frame. These insubstantial elements seem to be the traces of pencil lines that have been erased; each connects with an ink mark on the framing rectangle, and with the horizontal and vertical edges of the gouache planes. I recognise these traces and erasures because I employ similar processes when drawing the geometric forms with which I work. Perhaps because of this, I feel these blue biro marks provide moving evidence of the thought and planning that dictate the final appearance of the work.

Sécos means 'dry,' and perhaps Oiticica used this word to refer to his consciously scientific analysis of form. But while 'dry' implies the objectivity of the scientific investigation, it also evokes the sense of touch. I feel it might reference the material qualities of these works, contrasting the cool smoothness of gouache and the hygroscopic moisture-sucking roughness of card, with the stickiness of slow drying oils. Unlike oil paint, gouache dries to a powdery gravel on the palette and resists modelling. Gouache cannot easily be removed from the absorbent cardboard ground, so records each decision that the artist makes. Thus these particular materials provide a measure of authenticity – a contract between artist and viewer – as each step involved in making the work leaves its trace. This analysis informed my use of materials, as I wanted my work to be an authentic record of the decision-making process in the studio.

The *Sêcos* preceded the *Metaesquemas* in which Oiticica continued his investigation into colour, space, movement, and the nature of the ground. Operating within the

constraints of a restricted palette and limited materials, these works are a deep exploration of the surface through the use of repeated quadrilateral motifs (fig. 36). The title *Metaesquema*, a word invented by Oiticica, is comprised of *meta*, a prefix used to mean *beyond*, and *esquema*, a "scheme, diagram [or] arrangement."[30] Thus, it refers to an organisation of structure itself, or a system that investigates its own construction. As such, the *Metaesquemas* form a self-referential experimental system that constructs images in order to explore pictorial composition.

In this extended series, rectangles oscillate, vibrate, and jiggle for space within the constraints of a frame that seems to bulge and swell to accommodate them. This illusion of movement contrasts with the framing edge and the static flatness of the gouache to create a tension that activates the ground. Together, these works appear as a stable grid that holds the compressed energy of each painting in check (fig. 36). The controlled chaos of this systematic approach to dealing with ambiguity and uncertainty provides another parallel with scientific methodologies.

In a series of unpunctuated and elliptical statements accompanying a 1972 exhibition of the *Metaesquemas*, Oiticica wrote that these paintings "emerge from the solitary impregnation of WHAT IS CONCRETE," indicating that they explore a question – 'what is concrete?' – central to Oiticica's practice.[31] While I do not warm to Oiticica's analogy, it does make me consider the relationship between the artist, the research question or problem, and the work that emerges from this interaction. Oiticica seems to cast the question, "WHAT IS CONCRETE," into a passive role. But what if the question is the most active participant in this relationship? Oiticica's observation caused me to reconsider the power relationship between artist and practice, as I will discuss further in Chapter Four.

[30] James Lumpkin Taylor and Priscilla Clark Martin, *A Portuguese-English Dictionary* (Stanford: Stanford University Press, 1958). http://books.google.com.au/books?id=pyylwqkVIUoC&q=esquema#v=snippet&q=esquema&f=false (accessed 10 October 2013).
[31] Hélio Oiticica, "METAESQUEMAS 57/58 exhibition catalogue," *Hélio Oiticica,* 147.

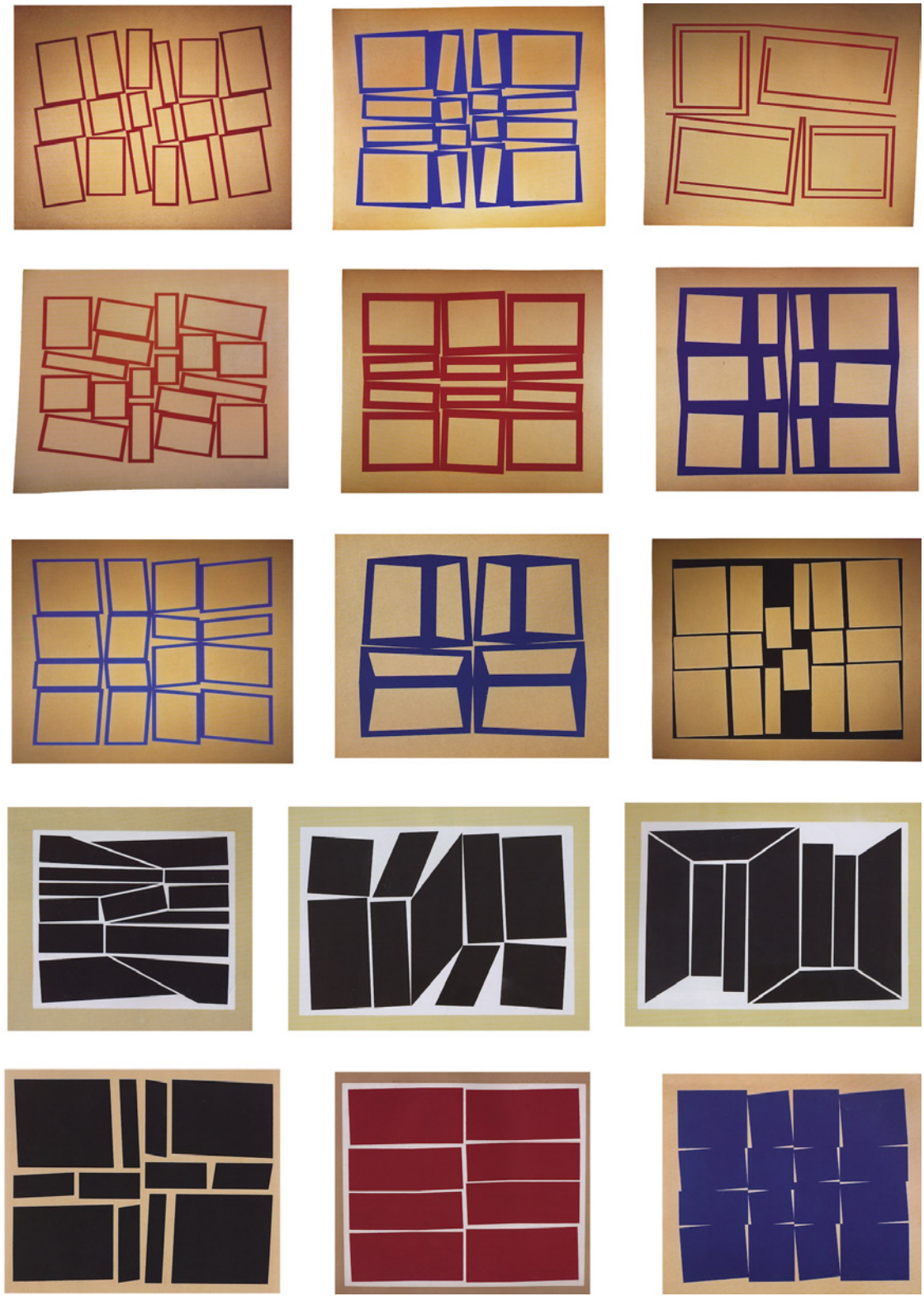

Fig. 36. Hélio Oiticica, *Metaesquemas* (1957-58)

Oiticica said of the *Metaesquemas*, "*by* scarcely *using color and using the cardboard* it continues to be painting. Simply because the space itself is painting."[32] Ramírez describes the raw cardboard in these works as,

> … an unstable void, which, in turn, suggests a sensorial incursion into the plane. In other words, the plane holding the Metaesquemas is an active surface, so vivid that it appears to challenge its two-dimensionality, which struggles to expand beyond the cardboard support.[33]

This interpretation questions the flatness of the ground, which expands to become a field that both artist and viewer experience not only visually, but also through the senses. Ramírez makes a distinction between the two-dimensional cardboard support and the picture plane, which becomes an expanding, "active surface." In this formulation, the surface of the ground is both flat material and an "unstable void," a contradiction brought into being by the painted planes of Oiticica's compositions. When describing the *Net* paintings in Chapter One, I considered how the circular geometric form activated the two-dimensional paper ground by causing the flat surface to appear curved. I now started to think of the paper ground as an amorphous space – "an unstable void" – that I could enter in my imagination, even before I started to draw. As the figurative painter Phillip Pearlstein wrote in 1962, "[t]he flatness of the picture plane is no more a truth than was the flatness of the world before Columbus. It's all a matter of how you look at it…"[34]

Bridget Riley

In the paintings of Bridget Riley (b. 1931), a very simple manipulation of geometric forms creates an overwhelmingly powerful illusion of space and movement. In *Movement in Squares* (fig. 37), there is an unsettling conflict between what I know (that the surface of the picture is flat) and what I see (a deep vibrating chasm). This conflict is so extreme in Riley's work that I disbelieve the evidence of my eyes, and I am forced to realise that what I see is an artefact of my visual system. Being tripped up by Riley makes me conscious that my mind creates provisional, necessary fictions about the world, and I catch a glimpse of other possibilities.

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[32] *Ibid* (italics in the original text).
[33] Ramírez, "The Embodiment of Colour," 41.
[34] Philip Pearlstein, "Figure Paintings Today are not Made in Heaven." *Theories and Documents of Contemporary Art,* 251.

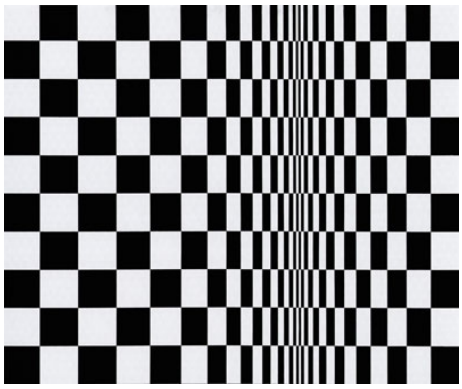

Fig. 37. Bridget Riley, *Movement in Squares* (1961)

The scale of Riley's work enhances these perceptual effects. These large paintings are developed through an extended process of experimentation in which Riley makes many small drawings and paintings. I am very drawn to the delicate intimacy of Riley's small, gouache studies (for example, fig. 38), and feel their shimmering beauty can become almost aggressive when the image is enlarged. This effect of changing scale made me consider the relationship between the 'working drawing' and the single large work, as I will discuss at more length in the next chapter.

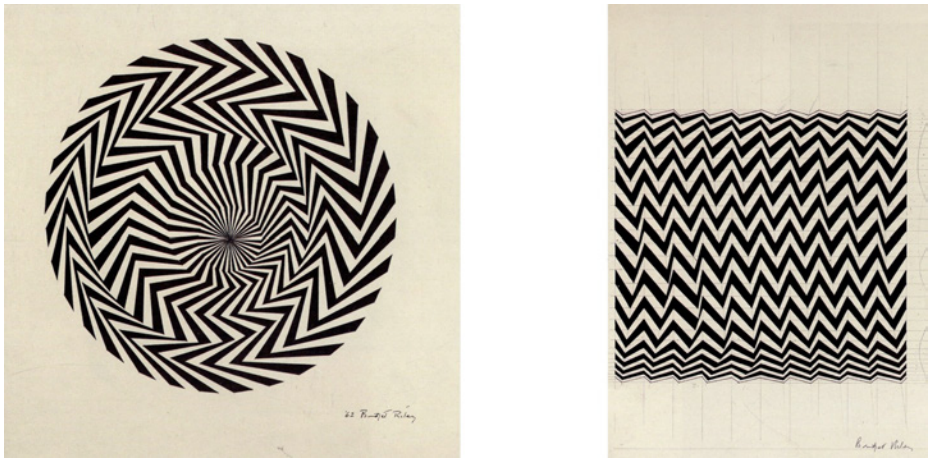

Fig. 38. Bridget Riley (left) *Study for Blaze* (1962) and (right) *Study for Fragments Print 3* (1965)

While Riley exhibits smaller works such as these, she does so in order to help the viewer understand her process rather than presenting them as works of art in their own right. In an exhibition I attended at the National Gallery in London in 2011, Riley's

paintings were shown with her studies, with works from the Gallery's collection that had informed her research, and with filmed interviews in which she demonstrated her working methodology.[35] As Riley explained some years earlier, "… the studies aid accessibility. I don't want there to be anything mysterious about the way that I work."[36] I find Riley's desire to draw the viewer into her research process appealing. Yet paradoxically, despite the clarity of her explanations and analyses, the central mystery of her work remains.

When asked about the role the studies play in the development of her larger paintings, Riley indicates their importance. They not only explore new directions, but are a necessary form of enquiry that,

> … can also develop one's powers of recognition so that one can see what one is doing more clearly – what used to be blind intuition is now conscious intuition. I think that intuition in its best form is conscious.[37]

It is in making the studies rather than the finished paintings that Riley gains this insight into her own practice, and this accords with my aim in making 'working drawings' that allow me to understand the decisions I make in the studio. As Riley said of her practice, "[y]ou cannot deal with thought directly outside practice as a painter: 'doing' is essential in order to find out what form your thought takes."[38]

Like the concrete artists discussed earlier in this chapter, Riley explores problems investigated by other artists in the past. In fact, she seems to suggest that such problems are the only real subject matter for painting:

> [I]t is the problems that provide the substance. The deeper a painter can penetrate the nature of pictorial problems… the more original the solution… Painting without its problems can no longer be painting. It depends upon them for it existence. From the viewpoint of the modern painter the true tradition lies less in a succession of solutions than in recognising that the

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[35] *Bridget Riley: Paintings and Related Work*, curated by Colin Wiggins, Michael Bracewell and Marla Pratha. National Gallery, London (24 November 2010 – 22 May 2011).
[36] Bridget Riley in conversation with Jenny Harper (2004), "The Spirit of Enquiry," in *The Eye's Mind: Bridget Riley, Collected Writings 1965-2009*, ed. Robert Kudielka (London: Thames & Hudson, 2009), 177.
[37] *Ibid.*
[38] Riley, "Work [2009]," *The Eye's Mind,* 59.

> problems of picture-making can never be solved as such. And it is just this that constitutes painting's continuing vitality. [39]

This explanation gives insight into the compulsive reworking of ideas by artists such as Hélio Oiticica. His self-styled "obsessive dissection of space" perhaps ended not when he had reached a solution, but when the system he created to investigate the problem was either exhausted, or had thrown up more interesting problems for him to address. It is the artist's individual response to the universal challenges of painting that "constitutes painting's continuing vitality."[40] Hence Riley's emphasis on the problem rather than its resolution, as the recurring problems of painting continue to provide compelling subject matter for the contemporary painter.

Conclusion

In this chapter I established concrete art as a context for my project. As originally described by Theo van Doesburg, this was a highly prescriptive genre. However van Doesburg's stringent guidelines were reformulated first by the Swiss artist Max Bill, and then more extensively by artists in Latin America. The neo-concrete movement in Brazil eschewed the strict scientific rationality of European concrete art, acknowledging the importance of the imagination and the senses in the viewer's experience of the work.

Investigating the work of Max Bill, Waldemar Cordeiro, Hélio Oiticica and Bridget Riley raised new questions for me, and also a set of paradoxes. For example, Oiticica's gouache paintings provide a useful precedent for the scientific investigation of an idea. However his extended series became an obsessive and compulsive interrogation that overwhelms the viewer through its sheer volume. Riley identifies the working drawing or painting as a line of enquiry that emerges in response to painting problems. However – paradoxically – this enquiry is made without the expectation of finding solutions, because according to Riley, "the problems of picture-making can never be solved, as such."

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[39] Riley, "Painting Now," *The Eye's Mind,* 302.
[40] *Ibid.*

This second paradox perhaps sheds light on the first, as the deep exploration of a pictorial problem generates more and more approaches, resulting in the effusion of possible answers that bodies of work such as Oiticica's *Sêcos* and *Metaesquemas* represent. The powerful illusions of Bridget Riley's paintings present a further paradox, as the flat surfaces appear to vibrate, flow, or tunnel into a deep space. Similarly, in Oiticica's *Metaesquemas*, the cardboard ground is simultaneously a flat surface and an "unstable void."[41] In each of the works I have described in this chapter, every element – whether figure or ground – is active.

In the case of Oiticica, and of other key protagonists in the neo-concrete movement such as Waldmar Cordeiro and Lygia Clark (whose work I will discuss in Chapter Four), their vigorous enquiries led to different points of departure from two-dimensional painting. Art historian Stephen Melville describes this effect as "the logical outcome of the complete collapse of the idea of a medium: painting, exhausted in its reduction to the square canvas, passes over into sculpture…"[42] However, Bridget Riley's evolving practice continues to explore pictorial problems. Rather than finding a single definitive answer to problems or research questions in the visual arts, artists clearly generate multiple, disparate, and co-existing responses.

In this thesis, the problem that I investigate is how I can use spatial illusionism to model the multivalent and contradictory nature of hypothetical thought, as I have explained. For this reason I have focussed on exploring the two-dimensional picture plane through painting and drawing, because my aim is to depict impossible forms for which a third spatial dimension must be imagined by the viewer. This element of perceptual speculation, on which my project is based, would vanish if these forms were realised in three-dimensions.

In the next chapter I will describe three series of paintings and drawings in which I continue to explore the activity of the ground, and the implications of my use of materials. These works also investigate the compulsive aspect of making an extended series, and I will consider further who or what is the driving force in an enquiry of this

[41] Ramírez, "The Embodiment of Colour," 41.
[42] Stephen Melville, "Aspects," in *Reconsidering the Object of Art: 1965-1975*, ed. Ann Goldstein and Anne Rorimer (Cambridge, Massachusetts: The MIT Press, 1996), 241.

kind. Other points to be addressed concern the evolution of the image; its resemblance to ‘real’ objects; the status of the individual work in the series; and the status of the study in relation to the ‘resolved’ canvas painting.

Chapter Three: Evolution and Compulsion

Introduction

This chapter is divided into two sections. In the first I will describe the development of two sets of drawings, *Rete Mirabile I* and *II* (2011), and in the second a series of paintings, *Strange Objects* (2011-12). These bodies of work evolved directly from the paintings described in Chapter One, and also employ a circular grid derived from the logic diagrams, volvelles and memory wheels that I investigated in those earlier works. Having contextualised my preliminary work in Chapter Two by describing work that influenced the development of my project, I was now able to rethink and extend my initial research questions.

Section I will address the implications of my choice of materials (pencil, watercolour and gouache on paper); the activation of the paper ground; the status of the working drawing or 'study' in relation to the large 'stand-alone' painting on canvas; the status of the individual work relative to the series; and the evolution of the image across a series. This evolutionary process will be explored in the context of drawings made by the evolutionary biologist Ernst Haeckel (1834-1919). Section II will continue to explore the evolution of the image; the compulsive nature of the serial expansion; and the continuing relationship between the circular form, logic diagrams and the memory palace.

Section I: *Rete mirabile*

Rete mirabile is a Latin phrase meaning 'the wonderful net,' and refers to a network of blood vessels at the base of the brain described by the Greek physician Galen (130-200 CE).[1] Galen believed it transported the air (or *pneuma*) breathed into the lungs to the ventricles of the brain, converting it into a *psychic pneuma* that was the vehicle of "sensation and movement."[2] I will discuss this further at the end of Section I.

[1] Julius Rocca, *Galen on the Brain: Anatomical Knowledge and Physiological Speculation in the Second Century AD* (Leiden and Boston: Brill, 2003), 250.
[2] *Ibid,* 196, 201-202.

***Rete Mirabile I* (2011)**

These drawings evolved from the *Net* paintings described in Chapter One. Although I had experimented with altering the grid and using different colours in those paintings, I did not feel I had fully explored the potential of the circular grid. In the *Pleat* drawings (Chapter One) I generated a range of diverse forms using a constrained system, and I wanted to find out whether the circular grid could be similarly fertile.

Fig. 39. *Rete Mirabile I: 3, 17* and *20*

Three examples of this series of 20 drawings are shown in figure 39. I used square paper, because this format is frequently used in non-objective art as a means of avoiding the representational connotations of the portrait and landscape format. It also provided a symmetrical ground that allowed me to play with different orientations of the image, as it can be rotated through 90 or 180 degrees without changing its appearance.

Each of the *Rete Mirabile* drawings is constructed from a circle of identical size. Inside this I drew internal concentric circles that were either centred or skewed, then subdivided these circles by ruling lines from the centre to the edge, and shaded the resulting planes. This created a visual contrast between the sharply inscribed lines of the grid, and the softer shaded areas of the drawing (fig. 40). I numbered each work so that I could trace developments in the forms.

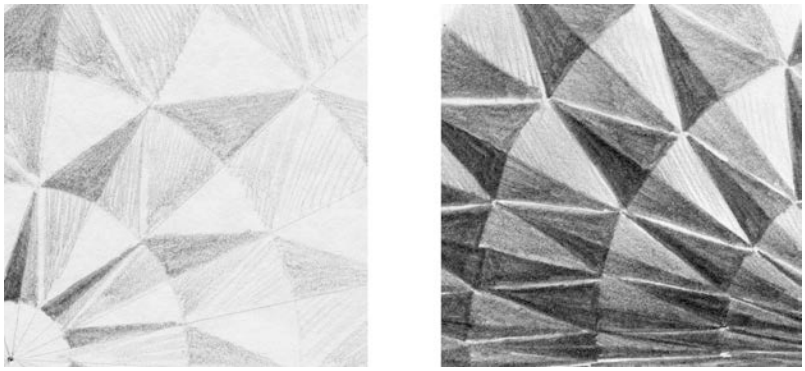


Fig. 40. *Rete Mirabile I* (2011, details)

In the *Pleat* drawings described in Chapter One I had developed images with a strong spatial illusion. This was not the case for the *Net* paintings, where I had focussed instead on the activation of the ground. In the *Rete Mirabile* drawings I wanted to exploit both strategies, and experimented with ways of reintroducing the illusion of three-dimensionality. I subdivided the triangular plane from which the circular grid was constructed, which allowed me to create a basic unit: a diamond made from four triangles. I shaded one triangle heavily, the one opposite lightly or not at all, and shaded the two remaining triangles to a mid-tone (fig. 40). This arrangement creates a spatial illusion, as the pyramidal structure seems either to 'pop in' or 'pop out' of the surface. The units could also be shaded heavily or allowed to fade out gradually, allowing me to model the flat circular grid. The circle can then start to suggest a near-spherical form (for example fig. 41, top right).

I continued to investigate the role the ground plays in the whole image. I described in Chapter One how the flat paper surface surrounding the circular grid of the *Net* paintings takes on a different appearance within the form itself. This disparity activates the paper ground, and I explored this further in my analysis of Hélio Oiticica's *Sêcos* and *Metaesquemas* (Chapter Two). In the works described in the last chapter, every element – whether figure or ground – actively contributes to the image, and I wanted to explore this idea further. The *Rete Mirabile* drawings operate in a similar way to the *Net* paintings when areas of the form are not shaded, because the white paper 'reads' as a highlighted surface, indicating curvature rather than the flatness of the ground. The viewer therefore interprets the paper support as two- or three-dimensional depending on its relationship to the drawn form.

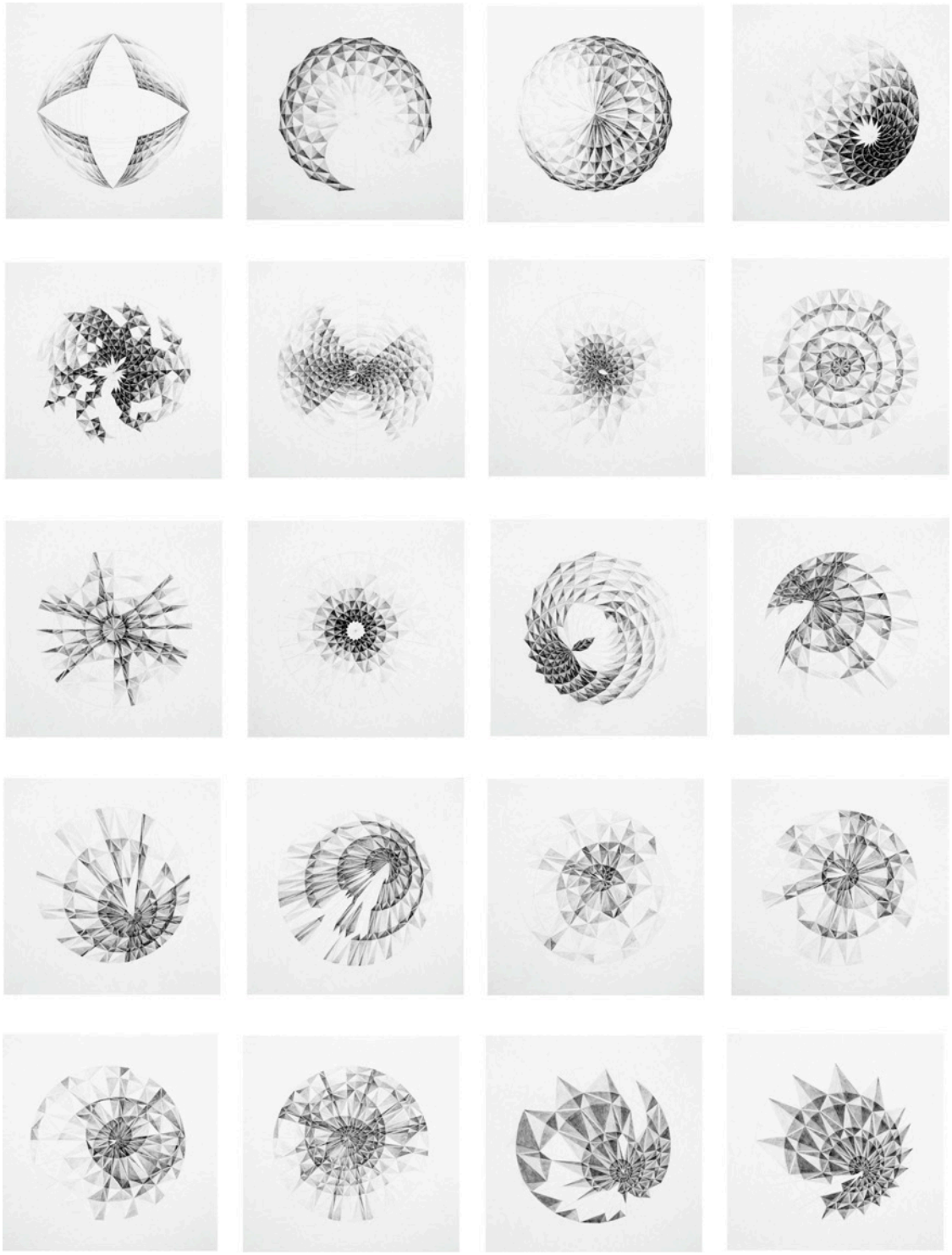


Fig. 41. *Rete Mirabile I: 1-20* (2011). Images arranged from left to right in 5 rows

In the *Rete Mirabile* drawings, however, the paper ground has a further role to play. In constructing these forms I left a space between the mid-toned triangles of adjacent units, because these similar elements would otherwise merge together. I realised as I continued shading that these gaps join to create arcing lines of white, which become an important structural aspect of the composition (fig. 40, right). The white lines are of course tonally identical, so appear flat, and this conflicts with the shaded form that appears to curve into or out of the picture plane. This effect is most marked in the heavily shaded areas of the drawing. These darker regions appear to be in shadow, and so seem to curve away into pictorial space. However this recession is undermined by the juxtaposition of the white paper and the dark pencil marks; the strong tonal contrast becomes a focal point for the eye, causing that part of the drawing to advance. These incursions of the ground therefore undermine the integrity of the drawn image. However, the white paper lines lead the eye from the circumference to the centre of the image and back, weaving across the surface of the form; thus, they simultaneously provide a structural device that forces the image to cohere. The paper ground is therefore an integral part of the drawing, operating on equal terms with the pencil marks.

I experimented with these effects by fragmenting the circular form, selectively shading the outermost units to create a spiked outline, and shifting the focal point of the grid away from the centre so that the arcing white lines take on an irregular appearance. Each drawing suggested how the next could be made differently: pursuing this line of enquiry within the constraints that I had set therefore caused the original form to evolve across the series, and in ways that I could not have predicted (fig. 41).

There is a correlation here with Max Bill's description of mathematical art as a field of

> … limitations without boundaries; disjunctive and disparate multiplicities constituting coherent and unified entities; identical shapes rendered wholly diverse by the merest inflection…[3]

In the *Rete Mirabile* series I set strict limits on the size and nature of each drawing, but nevertheless generated multiple unique forms. Small changes to the image gave rise to "disjunctive and disparate" drawings that together form a single body of work. In

[3] Bill, "The Mathematical Approach in Contemporary Art," 93.

Bill's description the series operates at different organisational levels – from the geometric element, to the individual work, and then to the series itself. I see parallels here with living biological systems, where molecules in a constant state of flux together form cellular elements that in turn build the larger structures of the body. In this comparison, the pyramidal units in my drawings are analogous to cells that grow to construct the image. Art historian Isabel Wünsche identifies such a parallel in the utopian constructivism of Kasimir Malevich, writing that:

> Just as nature built up its forms using molecules and cells, [Malevich] built his works using Suprematist elements, simple and similar in shape, which served as fundamental building blocks of a new world.[4]

The development of biology as a discipline has been identified as an important influence on non-figurative artists in the early twentieth century.[5] I will return to this theme, but will first discuss some concerns that I needed to address at this point in my project.

Scale and materials

I began to question my reasons for continuing to make paintings and drawings in series. At first I had considered these to be studies for large canvas paintings, particularly when I reflected on my work in the context of Bridget Riley's practice (see Chapter Two). I made several large (1.2 x 1.2 m) acrylic paintings on canvas based on the *Rete Mirabile* drawings. However these seemed flatter, less ambiguous, and more static than the drawings from which they had been developed. In the small works, the paper is a crucial component of the image, as I have described; the gesso surface of the canvas has very different material properties, and did not behave in the same way.

Paper clearly has a particular quality that I was (often unconsciously) taking into account when developing the geometric forms. I made ink paintings from the *Rete Mirabile* drawings on stretched paper (90 x 90 cm), so that the ground could operate as before. However this slowed down the evolution of the image considerably, and I

[4] Isabel Wünsche, "Life into Art: Nature Philosophy, the Life Sciences, and Abstract Art," in *Meanings of Abstract Art,* 12.
[5] See Oliver A. I. Botar and Isabel Wünsche, "Introduction: Biocentrism as a Constituent Element of Modernism," in *Biocentrism and Modernism,* ed. Oliver A. I. Botar and Isabel Wünsche (London and Vermont: Ashgate, 2011), 1-13.

realised that the materials and size of support I had chosen instinctively were those that allowed me to work at a 'thinking pace.' The large works – particularly those on canvas – were therefore not an authentic representation of the exploratory research process, as the small works in series were.

The small drawing or painting may also have an intensity that can be lacking in a larger work. For example, Eugene Carchesio (b. 1960) makes small works using watercolour, collage and found objects. Carchesio's *Signs of Life* (fig. 42) is comprised of twenty matchboxes arranged in a grid, embellished with paint and felt to create miniature 'constructivist' compositions. The differences between each and their divergence from a perfect rectangular form cause them to invite closer inspection, drawing the viewer into an intimate engagement with the work.

Fig. 42. Eugene Carchesio, *Signs of Life* (2005)

Such a series of small pieces together comprise one larger work, and so can allude to other levels of organisation, as described earlier. As art dealer Josh Milani writes, the human scale of Carchesio's "small, light, fragile structures" reflects "a certain kind of engagement with the world and the structures it contains, about a human's immersion in the midst of all this, particularly as a midpoint between the microcosmic and the macrocosmic."[6]

[6] Josh Milani, Michele Hemrich and Ihor Holubizky, *Eugene Carchesio: Heliocentricities*. Brisbane: University Art Museum, The University of Queensland (2002): 5-6.

A further consequence of choosing images to make at a larger scale is that it removes them from the series, thus taking them out of their original context. However, selecting representative images or data is also a necessary part of the analytical process. This is particularly important when an experimental system generates a profusion of information, whether it is in the form of scientific data, or visual art. In discussing a series such as Oiticica's *Metaesquema*, for example, attempting to describe every one of the more than three hundred works that make up the series would lead only to confusion. Making a creative selection is therefore necessary when creating clear explanations that do not overwhelm with detail. In this project, analysing the series as a whole helps me to understand my studio process. However, I need also to consider how the extended series is presented to the viewer, because a large assemblage of drawings such as that shown in figure 41 may not communicate to the viewer my intentions in making the work.

Rete Mirabile II

The idea of making a 'creative selection' provided the impetus for a set of nine new drawings. I was guided by Max Bill's *Fifteen Variations on a Single Theme* (Chapter Two, fig. 32), which provides a precedent for creating a self-contained series of different but related images. Bill arranged his variations on a mathematical theme into a square grid, and I used a similar format to organise new drawings that evolved from the first *Rete Mirabile* series (fig. 43).

Bill wrote that concrete art "organizes systems and gives life to these arrangements, through the means of art. It is real and intellectual, anaturalistic while being close to nature."[7] In other words, while concrete art does not represent or illustrate the natural world, it parallels natural phenomena in its capacity to organise and evolve. I see such a parallel between the drawing shown in figure 44 and the phenomenon of wave interference, as I will explain.

[7] Bill, "Concrete Art," 91.

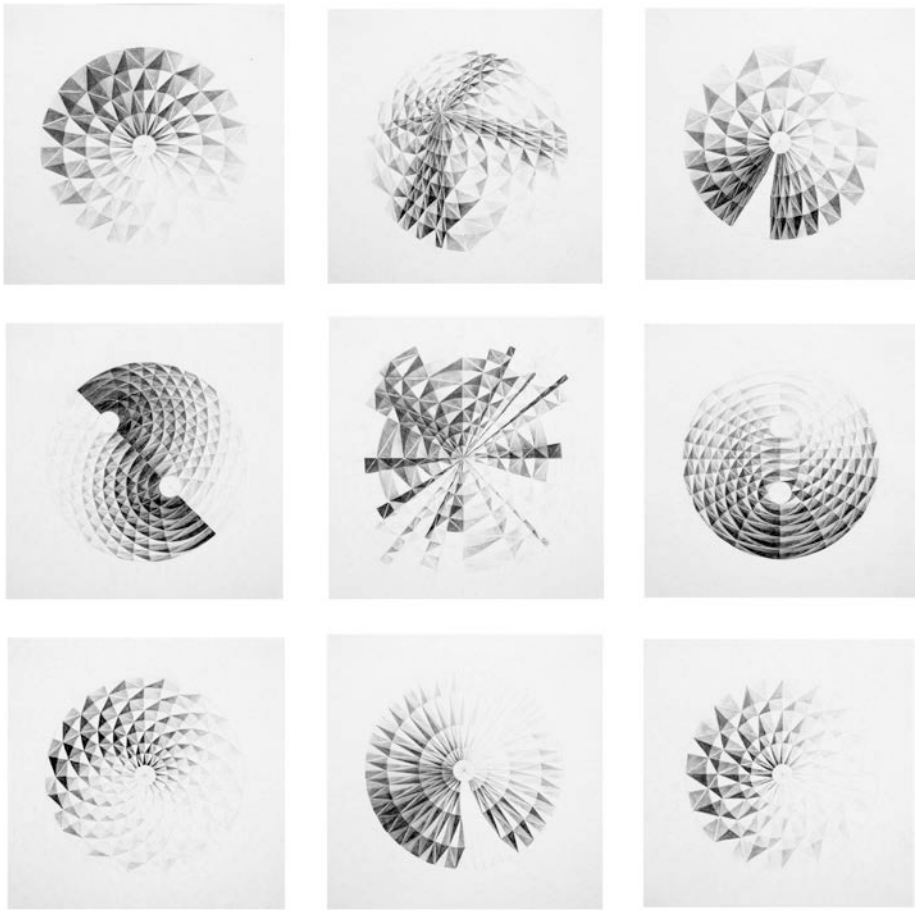


Fig. 43. *Rete Mirabile II* (2011)

I have established a link between my circular drawings and representations of thought such as the Lullian circles and volvelles. At the end of Chapter One I considered how conflicting readings of the same image correlated with the development of hypotheses and the coexistence of contradictory ideas. I wanted now to develop a more complex form that might represent two different ideas interacting in the same work. To explore this I created a more complex grid by introducing a second focal point. Here, triangular planes are formed by the intersection of the concentric circles that emanate from the two nodes (the unshaded circles in fig. 44, left). The units closest to these points are shaded most darkly and fade out across the image; this arrangement is then reversed across the axis that runs diagonally through the circular grid.

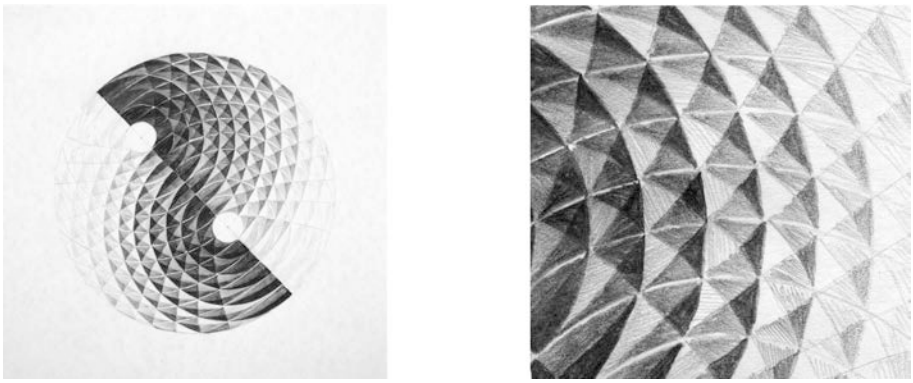


Fig. 44. *Rete Mirabile II: Wave Interference* (2011). Image (left) and detail (right)

This drawing resembles the interference of waves, a phenomenon beautifully illustrated by the artist and scientific photographer Berenice Abbott (fig. 45). Two vertical bars agitate the surface of a liquid, causing two sets of circular ripples to spread outwards. As these overlap, an interference pattern is created in which the energies from each set of ripples either add together to form larger peaks and troughs, or cancel one another out. The compositional similarities between such images and the forms that I am investigating are not superficial. I developed the new drawing from first principles to test the effects of bringing two conflicting waves of information into contact. There is therefore a correlation between the underlying principles that organise each image.[8]

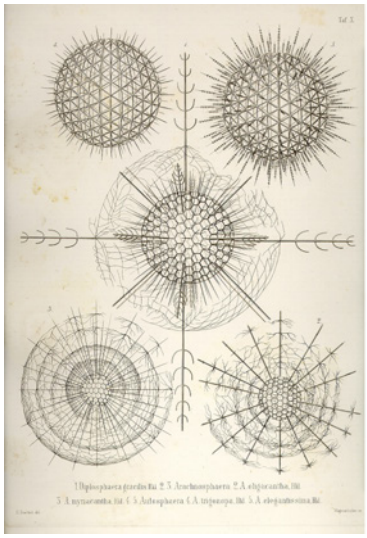
Fig. 45. Berenice Abbott, *Wave Interference Pattern* (1950s)

[8] However I do not see a connection of the kind described by van Doesburg in reference to *Arithmetic Composition* (1930, Chapter Two, fig. 31). He said that this painting is not "lacking in spirit, not lacking the universal and not, I think empty as there is *everything* which fits the internal rhythm: it is both the pyramid and the falling stone, both the stone skimming over the water and Echo; it is both time and Space, the infinitely large and the infinitely small." Fabres and Wintgens Hötte, *Constructing a New World*, 62.

In the gridded format each of the nine works exists as a separate entity, but is also part of an interconnected whole. This allowed me to think more clearly about the different levels of organisation that can be achieved not only within a single composition, but also in the series itself. As I explained above, I organised these drawings into a grid that I hoped would make clear the different structural levels at play – from the individual geometric elements to the square grid of the series. I described earlier the correlation I saw between this aspect of the series and biological systems. The reduced and gridded arrangement of *Rete Mirabile II* is also analogous to a page of diagrams, or a table of information. Paring away the confusion of the extended series enabled me to compare and contrast this limited set of works, and their similarities and differences became more obvious. I started to recognise their resemblance to objects in the real world – to the origami-like folds of paper lanterns, and the miniature complexities of microscopic organisms.

Ernst Haeckel

The extraordinary drawings of Ernst Haeckel provide an interesting point of reference for this series. Haeckel excelled in the 'artistic' presentation of scientific information, using pictorial strategies to convey his sometimes controversial scientific beliefs. My approach is essentially the opposite to this, as I draw on my experience of scientific research to develop a visual arts practice; it has nevertheless been useful to consider the point at which art and science converge in Haeckel's work.



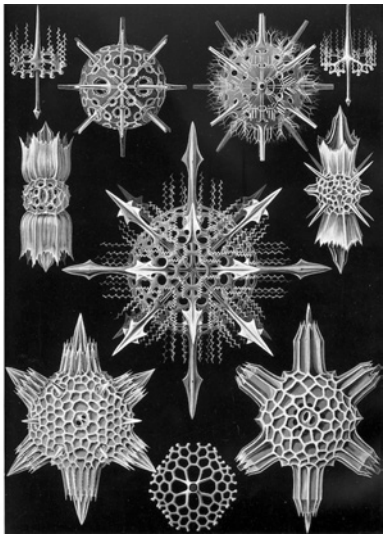


Fig. 46. Ernst Haeckel, *Diplosphaera Gracilis, Arachnosphaera, and Aulosphaera* (left) and *Acanthophracta* (right)

A contemporary of Darwin, Haeckel was an evolutionary biologist now best known for his intricate and detailed drawings of microscopic organisms such as the radiolarians.[9] These single-celled organisms have complex silica-based exoskeletons, and Haeckel explored their unique but related complexities in page after page of his book *Art Forms from the Ocean: The Radiolarian Atlas of 1862* (fig. 46).[10]

The symmetry of these organisms is reflected in their arrangement on the page and, as science historian Olaf Breidbach explains, this in turn illustrates Haeckel's belief in the "principal unity of all living things."[11] The carefully composed pages therefore represent a form of "argumentation in the image," in which the most complex – and hence, in Haeckel's view, the most evolved – form takes centre stage.[12] As Breidbach explains, "[f]or Haeckel, the illustration is not a depiction of existing knowledge, but is itself the acquisition of knowledge in nature. The truths of nature are seen."[13] The truth that Haeckel made accessible to the viewer in these works was that of Darwin's theory of evolution, which he believed provided "the magic word with which we will solve all the riddles around us."[14]

The extreme order of the composition is therefore itself a polemical device. Such an arrangement could not have come about by chance, and Haeckel expected the viewer to make a similar judgement concerning the radiolarians. As he said, "[t]hey all seem to be subject to the principles of symmetry, and are consequently not to be regarded solely as the result of a "game" of nature."[15] The order apparent in the organisms, and in their disposition on the page, thus hints at a higher order of design.

Compositionally, there are similarities between the radiolarians and my drawings which I found intriguing. Haeckel's arrangements of images opened up new ways for

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[9] Irenäus Eibl-Eibesfeldt and Olaf Breidbach, *Art Forms in Nature: The Prints of Ernst Haeckel* (Munich and New York: Prestel, 2004), 9.
[10] Ernst Haeckel, *Art Forms from the Ocean: The Radiolarian Atlas of 1862,* ed. Olaf Breidbach. (Munich and New York: Prestel, 2005), plates not paginated.
[11] Eibl-Eibesfeldt and Breidbach, *Art Forms in Nature,* 10.
[12] *Ibid,* 11.
[13] *Ibid,* 13.
[14] Oliver A. I. Botar, "Defining Biocentrism," in *Biocentrism and Modernism,* 20.
[15] *Ibid,* 10.

me to think about how different levels of organisation might operate within and between works in a series. I noted also that the tonal contrast between figure and ground is stronger in the works on black. This gives them a greater presence when viewed at a distance, and the dark ground also appears to create a deep void in which the crystalline forms are suspended. These observations led me to consider how I would approach the next series, as I will describe in Section II.

Rete mirabile: the curious maze

> That curious Maze, that admirable Nett/Through whose fine folds the spirit doth rise and fall.[16]

I have emphasised the biological aspect of my drawings in their title, *Rete Mirabile*. Almost two thousand years ago, the Greek anatomist Galen discovered the *rete mirabile* or 'miraculous net' of blood vessels located in the base of the skull.[17] It was believed to distil elements such as air and the objects we touch or see, and transport them to the brain as *pneuma*, "a subtle material that is the vehicle of sensation."[18] However the *rete* is not found in humans, although it is present in the sheep and oxen that Galen dissected, where it equilibrates the temperature and composition of blood.[19]

I was intrigued by this example of a highly developed and long accepted hypothesis that ultimately proved to be wrong. The function ascribed to this mythical structure is a real one – Galen's hypothesis is a creative speculation about how we develop internal impressions of the outside world. I saw a connection between the 'miraculous net' and the circular grid that I use to explore ways of representing thought.

Etymologically, 'concrete' is derived from *con-* (together) and *crescere* (to grow), indicating the appropriateness of this term as a description of geometric art.[20]

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[16] Guillaume de Saluste Sieur Du Bartas, "The Sixth Day of the First Week," in *The Divine Weeks and Works of Guillaume de Saluste Sieur du Bartas,* trans. Joshua Sylvester (1605), ed. Susan Snyder (Oxford: Oxford University Press, 1979), 281.
[17] Neil Rhodes and Jonathan Sawday, *The Renaissance Computer: Knowledge Technology in the First Age of Print* (New York and London: Routledge, 2005), 35-36.
[18] "Pneuma", *Encyclopedia Brittanica*: http://www.britannica.com/EBchecked/topic/465410/pneuma (accessed 25 July 2011).
[19] Plinio Prioreschi, *A History of Medicine: Roman Medicine* (Omaha: Horatius Press, 1998), 352.
[20] *Collins Dictionary Dictionary of the English Language*, ed. Patrick Hanks (London and Glasgow: Collins, 1982), 313.

However I can fracture this word to give *conc-* and *rete*, with *conc-* derived from *concha*, "a sea-shell… shell-fish… [or] mussel."[21] A shell is literally a *concrescence*: it is a tangible, lasting and inert structure secreted by a living creature, just as the elaborate forms of the radiolarians are. This gives me a new version of 'concrete' that is formed from a shell and Galen's mythical network, both of which seem appropriate when I consider the structure of the *Rete Mirabile* drawings.

con/crete to conc/rete

This word-picture brings to mind Waldemar Cordeiro's concrete painting, *Visible Idea* (Chapter Two, fig. 30). It reminds me too of Max Ernst's *La Clé des Chants I* (fig. 47) where these ideas seem to coalesce. Ernst's collage features a circular grid reminiscent of Abbott's *Wave Interference Pattern* (fig. 45) and a woman whose head has been replaced or covered by a giant mollusc. In a curious reversal, the woman's body is screened by the grid (associated with logic) while her head – the seat of reason – is masked by the slippery shellfish (symbolising female genitalia).[22] However there is something sexual in the circular grid itself, as the nodal points that draw the eye coincide with the navel and labia. In this surreal image, shell and net come together to create an image reminiscent of the memory images that formed the starting point of this project.

Fig. 47. Max Ernst, *La Clé des Chants (The Key of Songs) 1* (1933)

Fracturing the word 'concrete' and reassembling its elements seems an appropriate strategy, given the nature of concrete art. It seems to open up a more imaginative and

[21] *Cassell's Latin Dictionary*, ed. D. P. Simpson (London: Continuum Internal Publishing Group, 2007), 125.
[22] Gordon H. Williams, *Dictionary of Sexual Language and Imagery in Shakespearean and Stuart Literature* (New Jersey and London: Athlone Press, 1994), 932. See also: "Mr Slipper allegedly described female genitalia as "shell-less mussels."" Hannah Low and Katie Walsh, "Slipper Texts Reveal Sexist Gibes," *Financial Review*, 4 October 2012. http://www.afr.com/p/national/slipper_texts_reveal_sexist_gibes_eAMh0MsOdFVbhYkLdd9zmI (accessed 14 April 2013).

sensual approach to the logical progressions with which I work. I particularly like the contrast this creates with van Doesburg's original instruction that "[t]he work of art… should not contain any natural form, sensuality or sentimentality."[23]

Summary of Section I

Section I of this chapter describes two interrelated series of work, *Rete Mirabile I* and *II*. In the first, I made an extended series of drawing that I could use to track evolutionary changes in the image. When discussing the role of scale and of the series in my work, I concluded that while the whole series allows evolutionary changes to be tracked, it also overwhelms because of the quantity of work involved. This conclusion led me to make a new and smaller set of drawings intended to communicate more clearly to the viewer the diversity of images generated by the circular grid. In contrast, however, Haeckel exploited his profusion of imagery to convey a clear message concerning evolution and the interconnectedness of nature. He did so by organising his material in several ways. First, his numerous drawings were reproduced in book form, allowing the reader to view only one page at any one time. Second, drawings of several related organisms were arranged in a highly stylised configuration on each page. And third, he exaggerated the symmetry of each organism to convey the balanced logic of his argument. Considering Haeckel's images led me to draw parallels between my evolving geometric forms and biological organisms, and to consider the cellular and generative potential of my work. These observations gave me new ways to think about how an extended series might be developed, organised and displayed, as I will describe next.

[23] Van Doesburg's manifesto defines concrete art against the backdrop of surrealism. As Evert van Straaten writes, "Since one of Surrealism's guiding principles was intuition, he was forced to reconsider his own position in terms of both neo-plastic and elementarist notions of intuition… he now foreswore intuition entirely." Evert van Straaten, *Theo van Doesburg: Constructor of the New Life* (Otterlo, Netherlands: Kröller-Müller Museum, 1994), 99.

Section II: *Strange Objects* (2011-12)

The works on black paper described here evolved from the *Rete Mirabile* drawings. I began making *Strange Objects* after my return from the *Cold America* exhibition in Madrid, where I had seen the experimental gouache paintings of artists including Hélio Oiticica and Wassily Kandinsky. I was also struck by the powerful tonal contrast in Haeckel's white-on-black radiolarian drawings, and I wanted to find out how my circular forms would operate on a black ground.

This was in part an experiment in changing materials. I decided to return to gouache (used in the *Net* series), but to change the colour of the ground and increase the scale of the support slightly. However I also wanted to push the circular grid further than I had in the *Rete Mirabile* series. For *Rete Mirabile II*, I made a small number of drawings because my intention was to create a concise and comprehensible series. For *Strange Objects*, I used a different strategy. My aim here was to make an extended series so that I could discover what happened when the system was exhausted. What factors were involved in deciding when the series was 'complete'? Once again, I hoped that the series itself would give me insight into these questions. I needed to consider also how I would organise a large number of related works in order to make their interconnectedness apparent, without overwhelming the viewer. Figure 48 shows how I hung the works as I made them in the studio; this grid allowed me to keep track of the order in which I made each painting. However their branching evolution become lost in this arrangement, as had happened too with the *Rete Mirabile I* series.

Fig. 48. *Strange Objects* (2011-12)

The first paintings in this series of 48 works were an attempt to recreate in paint some of the more complex images from the *Rete Mirabile* series (for example, fig. 49, top left). I imagined I could use these resolved forms as a starting point for constructing more complex images. However I soon realised that I needed to return to a basic approach in which I simplified the image and developed complexity little by little (fig. 49). I worked within a constrained system, as before. Each painting began with a circle of the same diameter, centred on a square of black paper, and I developed a grid using concentric circles and radiating lines. I continued to build images using the pyramidal unit developed in the earlier drawings, however, I began now to introduce colour.

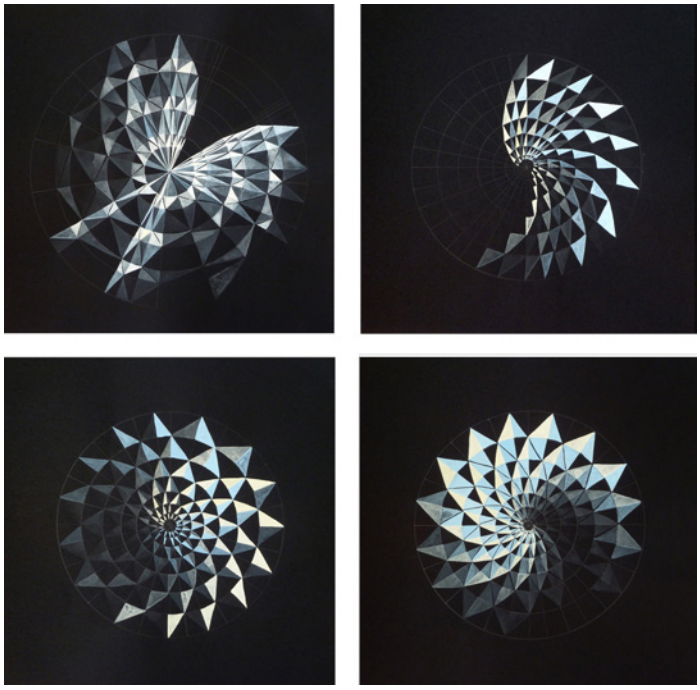

Fig. 49. *Strange Objects: 3, 6, 17* and *19,* reading horizontally from top left to bottom right (2011-12)

In the *Rete Mirabile* drawings I used tonal variations to create ambiguous forms. Colour gave me another dimension in which to explore the activation of the ground, and to develop conflicting illusions of three-dimensionality. For *Strange Objects* I used a limited palette based on the primary colours: a pure vermilion, a mixture of ultramarine and cobalt blue with white, and cadmium yellow with white. The mixed

blue was tonally lighter than the pure red. Blue tends to be read as a shadow, and to recede, while red appears to advance towards the viewer. However lighter shades also advance, so juxtaposing the deep red and pale blue confuses this conventional reading. Yellow, as the tonally lightest and 'brightest' paint, operates as a highlight. I worked with the same colour mixes throughout the series, however I could also deepen and 'dirty' the tone of each colour by diluting it, and allowing the black ground to show through. I also made paintings using two colours, or just one, to experiment further with the forms.

This enabled me to use colour as a structuring device that could push and pull the form to create the illusion of three-dimensionality. However every image is also a flat tessellation of triangles, and the contrasting colours act to maintain the separate identity of each plane. My aim was for colour to operate in both ways, but at different viewing distances. Close up, the image flattens and separates, because the colours are distinct in hue. I continued to let the ground enter the image in fine lines between the pyramidal units as before, to enhance this effect (fig. 50, left). However from further away these black lines merge into the image, tonal variation overrides colour information, and the spatial illusion takes over. Using dilutions of paint, I could allow the ground to enter the image in a more dramatic fashion, and also enhance the material feel of the work (fig. 50, centre). I hoped that this shift would suggest to the viewer the different organisational levels at which these images operate, where the geometric planes exist as separate elements, and also create a coherent whole. Hanging works together then creates another level of connection, as individual works become part of the larger system that is the series.

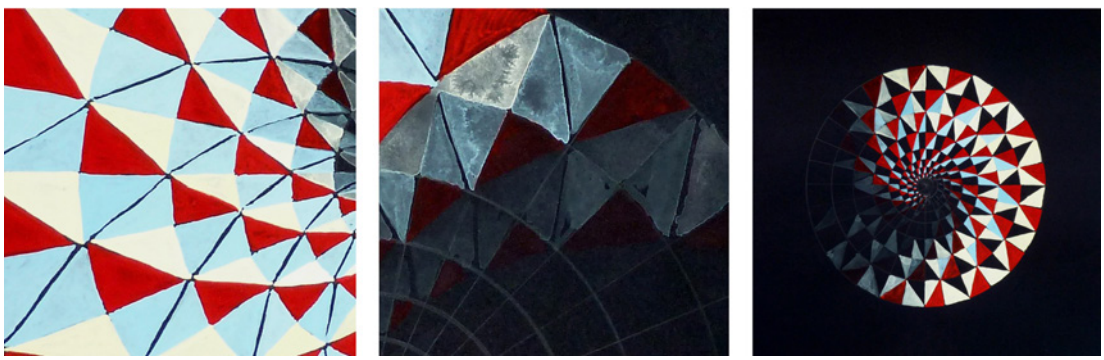

Fig. 50. *Strange Object: 25* (details, left and centre) and *23* (2011-12)

In constructing these paintings, I decided beforehand how the colours would be organised. However at times I lost concentration and made errors that introduced changes to the form. For example, in figure 50 (right), I accidentally confused the positions of yellow and blue, which gave rise to an outer ring of pyramidal units that included two black triangles. This allowed the black ground to puncture the form, creating a visually jagged surface. I pursued this unintended effect in the next paintings by degrading the edge of the circle in steps (fig. 51). Slippages of this kind therefore act as mutations in the system, resulting in the generation of new images.

Fig. 51. *Strange Objects: 25, 26* and *27*

The construction of these images was influenced by a photograph in the *Cold America* exhibition, Leo Matiz's *Polygon, Venezuela* (fig. 52). This photograph is of a long corridor lit at regular intervals to create a series of rectangular frames, reminiscent of the endlessly repeating reflections one sees when positioned between two mirrors. In the context of the memory palace, the alternating passages of light and shade appear to correlate with recollection and the loss of memory. The concentric geometry of this form also recalls Bosh's circular escape route in *Ascent of the Blessed* (fig. 53, right). However in Matiz's photograph there seems to be no prospect of escape from the claustrophobia of the endless tunnel. Its infinite regression brings to mind the obsessive repetition of forms in the extended series, a subject under investigation in the *Strange Object* series.

Fig. 52. Leo Matiz,
Polygon, Venezuela (1950)

Repeating rectangular and circular forms also appear in the work of Haruo Ohara (1909-1999), a Brazilian photographer of Japanese birth. In *Cyclone, Londrina – PR* (1957), the concentric circular forms reveal Bosh's illusion to be a compositional trick, as the 'light at the end of the tunnel' is no more than a reflection in the bottom of a bowl.

Fig. 53. Left, Haruo Ohara, *Cyclone, Londrina – PR* (1957) and right,
Hieronymus Bosch, *Ascent of the Blessed* (1500-1504, detail)

To introduce a sense of these complexities into my geometric forms, I applied gouache thickly and then use increasing dilutions to fade out the image. This creates a distinction between areas of the painting that either have strong tonal contrasts, or are more subtly modulated. The fading image appears to spiral back into a deep space (fig. 51). This is analogous to the activation of the ground in the *Net* paintings (Chapter One).

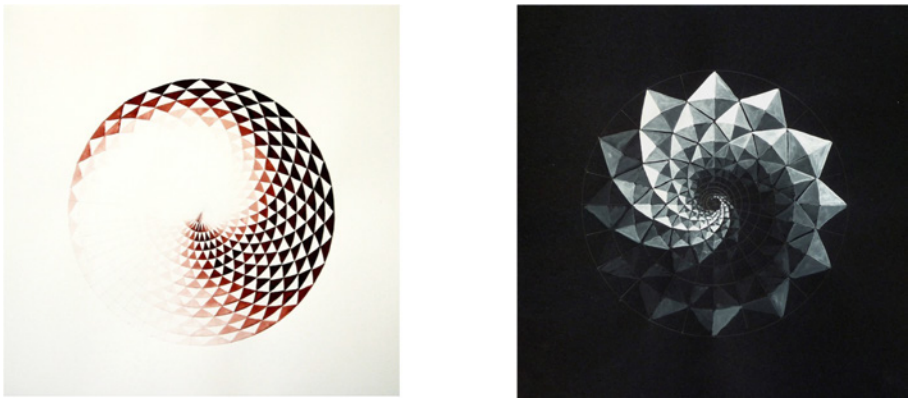

Fig. 54. *Net: Burnt Sienna* (2010, left) and *Strange Object: 39* (2011-12, right)

However on white paper, the fading spiral creates a highlight, whereas on black, the ground shifts from a flat plane to a more ambiguous void (fig. 54, right). When considering how thought is represented in these circular grids, I felt that the strong contrast of the crisply delineated areas might correlate with clarity and logic, and the fading, receding areas with uncertainty, ambiguity, and the loss of memory.

Thinking spaces: the cellular doctrine of the mind

There is a further connection between the composition of these images and thought, as I will explain briefly. In Section I of this chapter I described the supposed function of the *rete mirabile*, which was to distil the 'psychic pneuma' or 'animal spirits' that entered the hollow ventricles of the brain, facilitating sensation and movement.[24] While the ventricles are a real element of the brain's anatomy, brain function has long been localised to the cortex, or external layer. However in the 'cellular doctrine' – which was the prevailing model through the medieval era – the activities of the mind were believed to occur in these internal spaces, depicted in figure 55 as three regular chambers or cells.[25] Each chamber was ascribed a different function: the front housed

Fig. 55. *Head of Man showing 'Ventricles'* (1506)

[24] Rocca, *Galen on the Brain,* 196, 201-202.
[25] Edwin Clarke and Kenneth Dewhurst, *An Illustrated History of Brain Function*. Oxford: Sandhurst (1972): 10-24.

perception, the second reason, and the furthest back, memory.[26] If I was facing Magnus' subject, and could see into these 'thinking spaces,' they would appear as a set of concentric circles similar to those that construct the forms in *Strange Objects*. In this analogy, the outermost perimeter of the coloured disc represents perception, and the painted form spirals back and fades out into the space of the memory chamber.

Having experimenting with these possibilities, I pared the image back again to focus on the monochrome contrasts between white and black (fig. 56). I did not vary the tone, but relied instead on the changing size of the planes to suggest recession into space. I noticed in the first of these that the perimeter of the inner black circle appears to vibrate, and found that I could enhance this effect by 'stacking' long narrow planes around a broad centre. These images activate the ground in a different way to those already described. Here, the central black disc becomes active because its shimmering edge seems to expand and contract, conflicting with the spatial illusion caused by the diminution of the planes towards the centre.

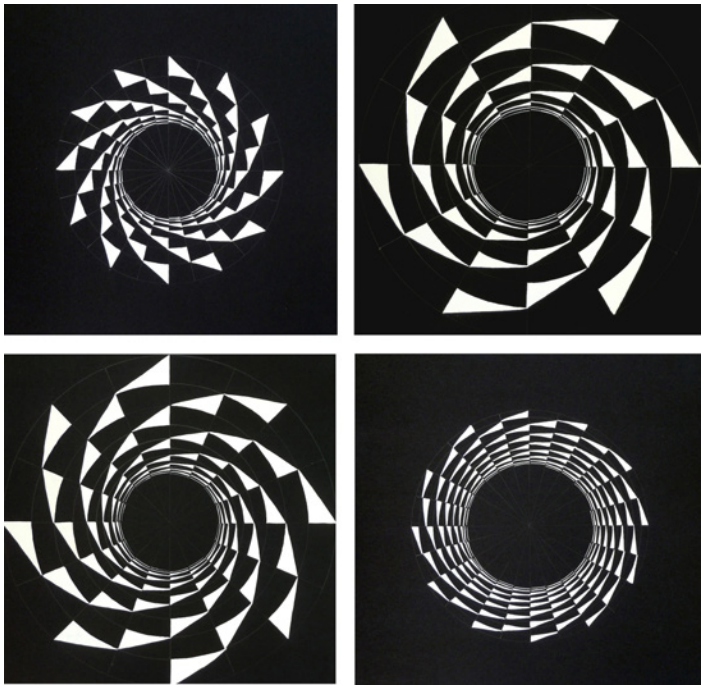

Fig. 56. *Strange Objects: 40, 41, 42* and *43* (2011-12)

[26] *Ibid*.

By this point, the series had generated four different but interrelated families of images, each of which is represented in figure 57. However as I continued to paint, the differences between consecutive images became smaller and smaller. At this point, the relentless circularity and centring of the images began to feel limiting, and my enthusiasm started to wane. I had been waiting for this to happen, as I wanted to find out how I would decide that the series had come to an end. Did this mean that the series was 'complete,' or were other factors involved?

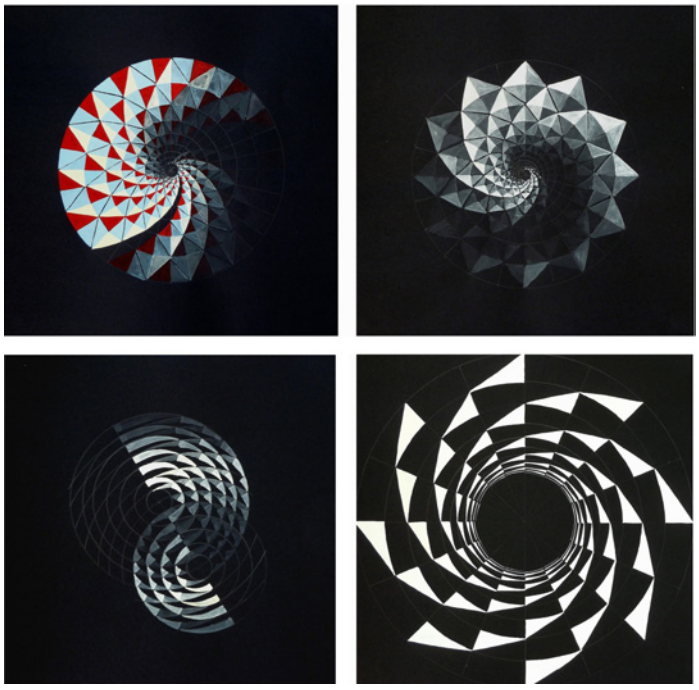

Fig. 57 *Strange Objects: 25, 39, 47* and *42* (2011-2012)

The real pleasure that comes from working with the series lies in its unpredictability, and in the opportunity it presents to try out new ideas. Each image suggests alternative ways in which the form could be constructed, so there is a constant sense of being pulled along on a journey of discovery. As Bridget Riley wrote of her experiments with colour and form, "… whether I felt prepared to make some advance – or not – I had no choice but to do so."[27] My choice of materials and a scale at which to work relates to this feeling of compulsion because I need to be able to keep up with the rapid evolution of the image in the early stages of making a series.

[27] Riley, "Work [2009]," *The Eye's Mind,* 58.

This feeling of being compelled by the work itself is also evident in the attitude of Spanish painter and sculptor Pablo Palazuelo (1916-2007) towards his spontaneous geometric drawings. When interviewed by art historian and author Carmen Bonell, Palazuelo

> … stated that while he is drawing a form he always feels in its structure the "shadow" – the presence of another form that insinuates itself and comes from it.[28]

No matter how narrow the constraints of a system are, it can still give rise to infinite possibilities. However when new images resemble very closely those that came before, the "shadow" figures that Palazuelo alludes to are less forthcoming, or perhaps less inviting. For example, I made the four paintings shown in figure 56 to find out how the optical 'shimmer' in the centre operated. Having satisfied my curiosity, logically there was little point in continuing with this particular line of enquiry, because I would simply have been copying the image without learning anything new. However I did find myself oscillating between a desire to move on, and a rather stronger desire to continue with a series that could clearly never be completed. The compulsion to make work that arose from an interrogation of the image had given way to a new compulsion. The first is generated by the possibilities of the image and leads me on an unpredictable journey, while the second arises from the comfortable safety offered by repetition and results in the futile recycling of forms. The *Strange Objects* series as a whole came to an end when I was able to recognise this, and I could leave the security of the circular grid to explore new territory.

Conclusion

In this chapter I have described three series of drawings and paintings that developed from the preliminary work presented in Chapter One. My initial enquiry into techniques of representation led me to develop geometric forms that explored the figure-ground relationship, and working in series provided a methodology that enabled me to analyse decisions made in the studio. This analysis led to new questions concerning the evolution of the image, the relationship between the individual work

[28] Carmen Bonell, "Life Through Art," in *The Visual Mind II*, ed. Michele Emmer (The MIT Press: Cambridge, Massachusetts, 2005), 104.

and the series, the status of the small work, and the capacity of the serial system to generate new forms.

In Section I of this chapter I described two series of drawings, *Rete Mirabile I* and *II*. I made connections between their increasingly biological form and the drawings of Ernst Haeckel, whose compositions provided new ways for me to think about the organisation of individual works within a series. I also deconstructed and reassembled the word 'concrete,' which enabled me to break away from its strict meaning to consider possibilities that are more sensual and imaginative.

These drawings gave rise to the gouache paintings described in Section II, *Strange Objects.* I extended my exploration of the figure-ground relationship while testing the ability of the series to continue generating new forms. I introduced the photography of Leo Matiz and Haruo Ohara to develop a correlation between the claustrophobia of the concentric geometric form and the exhaustion of a system that leads to reiteration rather than invention. In this analysis I identified the oscillation I experienced between an attraction to the series, and a frustration with its increasingly sterile output – between my desire to remain within, and also to break out of, the system. However it was the system itself that revealed this conflict: the increasingly repetitious nature of the final works was made obvious by a direct comparison of the serial images. I feel that such analysis allows me to move from what Bridget Riley refers to as "blind intuition" to "conscious intuition" (see Chapter Two).[29]

The non-objective painter Karl Wiebke (b. 1944) suggests that artists can "[work] themselves into a metaphorical corner or style, in effect reproducing themselves." To avoid this, Wiebke deliberately "alters the limits and sets the conditions in order to go elsewhere, to keep asking the questions of painting."[30] I have created branching points in my work by including compositional references to the work of other artists. I have also allowed chance to play a role in the evolution of the image, by working with the

[29] "The spirit of enquiry… can also develop one's powers of recognition so that one can see what one is doing more clearly – what used to be blind intuition is now conscious intuition." Riley, "The Spirit of Enquiry," *The Eye's Mind,* 177.
[30] Margaret Moore, "Three Means and a Choice," in *Karl Wiebke Painting: 1994-2012* (ANU Drill Hall Gallery, Canberra 7 April – 20 May 2012), curated by Anthony Oates (Canberra: ANU Drill Hall Gallery, 2012), 12-14.

errors that I make when attempting to adhere to a complex colouring scheme, as described above. However Wiebke's strategy is one that might allow a clearer and more conscious departure from established lines of enquiry.

I decided that considering the image to have an inherent fertility, or life of its own, could prompt such a departure. If the evolution of the image parallels natural processes, as I have described, then I am perhaps exerting too rigid a control over the changing form by confining it to the circular grid. And it may be this control that leads to the exhaustion of the system. In the next chapter I will describe work in which I allowed the pyramidal unit that I have developed to construct new forms in a less controlled fashion. These paintings investigate the effects of removing the constraining grid, while extending my exploration of the figure-ground relationship.

Chapter Four: Thinking Spaces

Introduction

In the last chapter I described three bodies of works in which I explored the possibilities of the circular grid. I investigated how the forms I developed activated the paper ground, and in doing so, created several families of related images. I realised that my exploration of this constrained system was ultimately leading me to develop forms that resembled one another more and more closely. If the series is to track the development of ideas as I hoped, it is important that it can be flexible enough to change when reworking the image no longer generates new ideas – when it ceases to be a "creative re-reading," and becomes a futile cycling, as I suggested at the end of Chapter Three.[1]

The circular forms of the *Rete Mirabile* and *Strange Objects* series were visually ambiguous and constructed from geometric elements, but nevertheless began to resemble real objects as they evolved. I considered whether references to evolution and biology in the visual arts might be more than purely descriptive terms. What would happen if I treated the evolving form as if it was in some way alive? My images were constructed from a pyramidal unit that I identified as 'cellular' in nature, and I wanted to find out how it would behave if released from the captivity of the grid. Would the image break down, or might the unit create a new system of its own? How would this new approach to structuring the image affect the figure-ground relationship? And, given that the circular works described in the last chapter reference thought and memory, what would happen to this connection when the form is disrupted?

In this chapter I will describe paintings that address these questions, and will refer to the work of Lygia Clark, Gertrud Goldschmidt, Timothy Nolan, Kerrie Poliness and Doreen Reid Nakamarra. I will also contextualise my work with reference to Pragmatism, a philosophical movement developed by the American philosopher William James (1842-1910), in which the truth of an idea relates to its practical value.

[1] Héctor Olea suggests that artists such as Cordeiro provided a "radical and creative re-reading of those original guidelines" indicating the importance of revisiting painting problems from the past, Olea, *Building on a Construct,* 131.

Experiments (2012)

In these paintings I changed from the square to the portrait format, because this introduces a sense of movement in the vertical axis and implies that the image is working with or against gravity. The portrait format also references the page, and the body. These works investigate two questions: what happens if I create geometric forms without using a pre-drawn structure such as the grid, and how do these new forms activate the paper ground? I continued to use ink or gouache on black or white paper, as I had in my earlier works. However when I used colour, the actively growing form dominated the neutral grounds (not shown), while monochrome images seemed lost in the expanse of paper (fig. 58). Both approaches resulted in a lack of tension in the composition.

Fig. 58. *Untitled* (2012)

Creating tension in the image is a central concern, because this had become the device I use to model speculative, hypothetical thought (see Chapter One). Tension results from presenting the viewer with conflicting visual hypotheses, turning the image into an unresolvable visual puzzle. I have described in earlier chapters the strategies I employ to do this, which include manipulating colour and form to create conflicting spatial illusions and to activate the paper ground.

To re-establish tension in the image, I used mixes of black and white gouache on coloured card. I also simplified my approach by dispensing with the pyramidal unit and constructing new forms from triangles. In these paintings (fig. 59), the neutral grey of the gouache is a 'quiet' colour that appears to recede. However the form it describes is angular and active, and can be manipulated to balance the activity of the vivid orange ground. Despite its intense hue, the orange card also provides a mid-tone between black and white, allowing me to work in shades of grey that are lighter or darker than the ground.

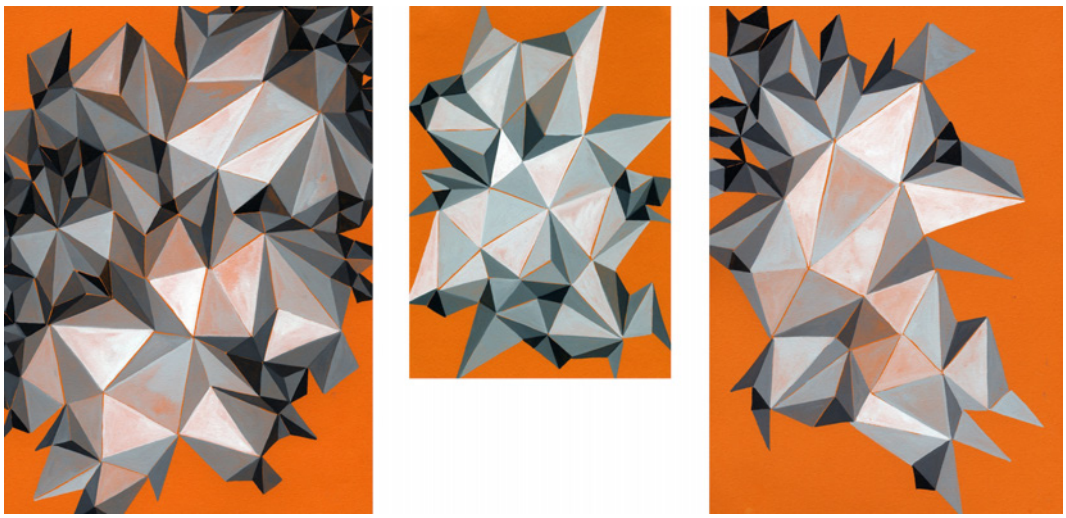

Fig. 59. *Experiments* (2012)

The opaque gouache gives the forms a solid, concrete presence as they approach the edge of the support. This creates points of tension at the paper's edge, and also demarcates areas of irregularly shaped ground around the figure. The form can be centred, or can 'lean' across the ground, seeming to reach out to the adjacent painting. Such variations were not possible with the centred circular forms described in Chapter Three, and this new approach creates opportunities for me to activate the space between the paintings when the works are displayed.

While gouache can block out the ground completely, I also diluted the paint so that the orange card shows through the triangular planes, giving a warm hue to the cool greys. I developed a simple relationship between tonality and size so that, broadly speaking, small planes are dark and large planes are paler, and often quite transparent. The triangular planes tessellate, mapping the surface of the paper. However the form

seems to expand out of the picture plane, because large, bright forms appear close, while darker, smaller elements recede. The diluted gouache also has an uneven visual texture, a technique painters use to draw the eye of the viewer and to pull elements of a painting into the foreground. I left spaces between some planes, allowing the orange ground to show through. In the darkest areas this creates an intense tonal contrast, which also attracts the eye. These effects can be seen in the two details in figure 60.

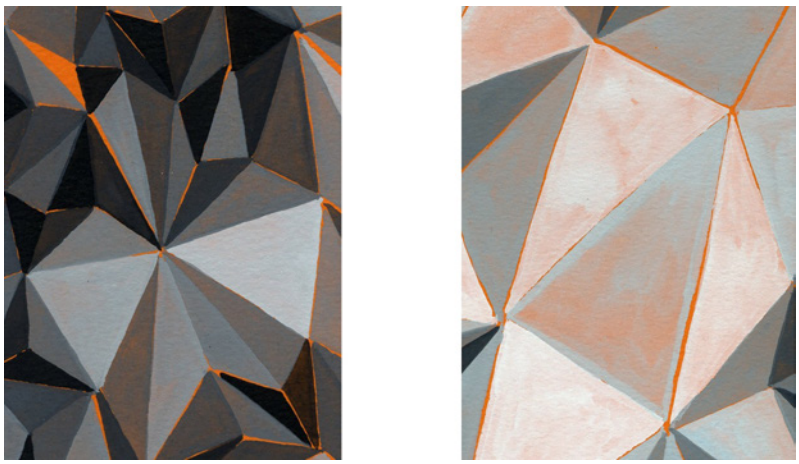

Fig. 60. *Experiments* (2012), details

The tessellating unit allows the forms to grow in an organic fashion – that is, in a loose, but not entirely haphazard, manner. The resulting form diverges from a regular grid, however the structure of the triangular unit dictates the final appearance of the forms that it constructs. I associate the grey tessellations with logical thought, in part because the grey gouache implies neutrality and objectivity (in contrast with the heat of the coloured ground). However this is also because of the connection I have made throughout this project between lines, planes, grids, and the logic diagram. In this analogy, the ground 'feels' more emotive not only because of its vivid colour, but because the paper ground operates both as surface and as void – as an uncertain and liminal space that emerges from the pictorial plane. The grey planes are also a very literal reference to concrete as a hard and rigid material. I imagined as I painted that I was laying a pavement over an unstable and insubstantial ground that constantly reasserted itself through cracks and fissures. This establishes the reciprocal nature of the figure-ground relationship, where paint structures a ground that both integrates with and destabilises the concrete form overlying it.

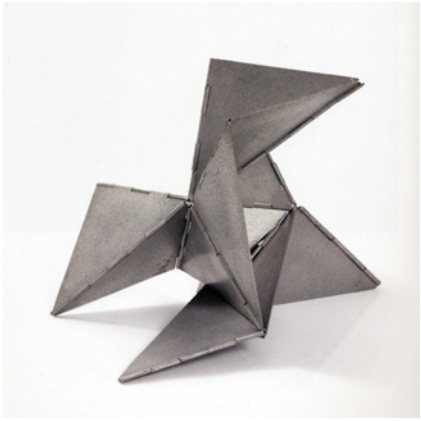

Fig. 61. Lygia Clark, *Bicho – maquette* (1960)

Lygia Clark

A key point of reference for these paintings is a work from the *Cold America* exhibition, Lygia Clark's adjustable metal *Bicho (Beast) - maquette* (fig. 61). Clark (1920-1988) was a key protagonist in the neo-concrete movement of 1960s Latin America. In 1960 she suggested in an essay, "The Death of the Plane," that the picture plane "offers man an entirely false and rational idea of his own reality."[2] As she explains, "the artist situated himself in front of the rectangle, he projected himself onto it, and… filled the surface with transcendent meaning."[3] The picture plane that creates this unnatural separation must be "exploded" and then "absorbed," in order to "join together all the pieces of the kaleidoscope in which the idea of man has been shattered and reduced to fragments."[4]

This fragmentation and reassembly of the plane occurs quite literally in Clark's transition from two- to three-dimensional work, as art theorist Susan Best explains. The structure of the *Bichos* developed directly from the *Espaço Modulado* (*Modulated Space*) series and the *Unidades* (*Units*), in which a "hinge space" or,

> … organic line is produced by bringing together planes of wood, or wood and canvas; the planes create the line rather than the artist drawing it. The line… then operates as a liminal space, a hinge that joins and separates two planes.[5]

[2] Lygia Clark, "The Death of the Plane (1960)," *Cold America*, 444.
[3] *Ibid.*
[4] *Ibid.*
[5] Susan Best, *Visualizing Feeling: Affect and the Feminine Avant-Garde* (New York: I. B. Tauris, 2011), 50.

This line is apparent in the example of Clark's *Modulated Space* (fig. 62) and becomes the hinge space that connects the planes of the *Bichos*, allowing the structures to adopt different conformations. I see a connection between this and the line space that I developed as a compositional element in my drawings and paintings (above, and in Chapter Three). The incursion of the ground into the figure allows me to negotiate the figure-ground relationship, and to develop visually ambiguous images, as I have described.

Fig. 62. Lygia Clark, *Espaço Modulado* (*Modulated Space*, 1957)

Examples of Clark's work can be seen in photographs from a 1965 exhibition at Signals Gallery in London (fig. 63). Here, the *Bichos* appear quite literally to have emerged from the *Unidades* on the gallery walls. Rather than being frozen into a single conformation as they are in the two-dimensional works, the triangular, square and semi-circular planes of the *Bichos* can be repositioned in different ways. As Best writes, "[t]he beasts are not static optical works – they must be handled…"[6] Such interactions between *Bichos* and the human body can be seen in figure 63, indicating that this handling is not a one-sided affair. The photograph prompts the question of who is unfolding whom as together, human and *Bichos* negotiate a series of possible configurations.

[6] Best, *Visualizing Feeling,* 53.

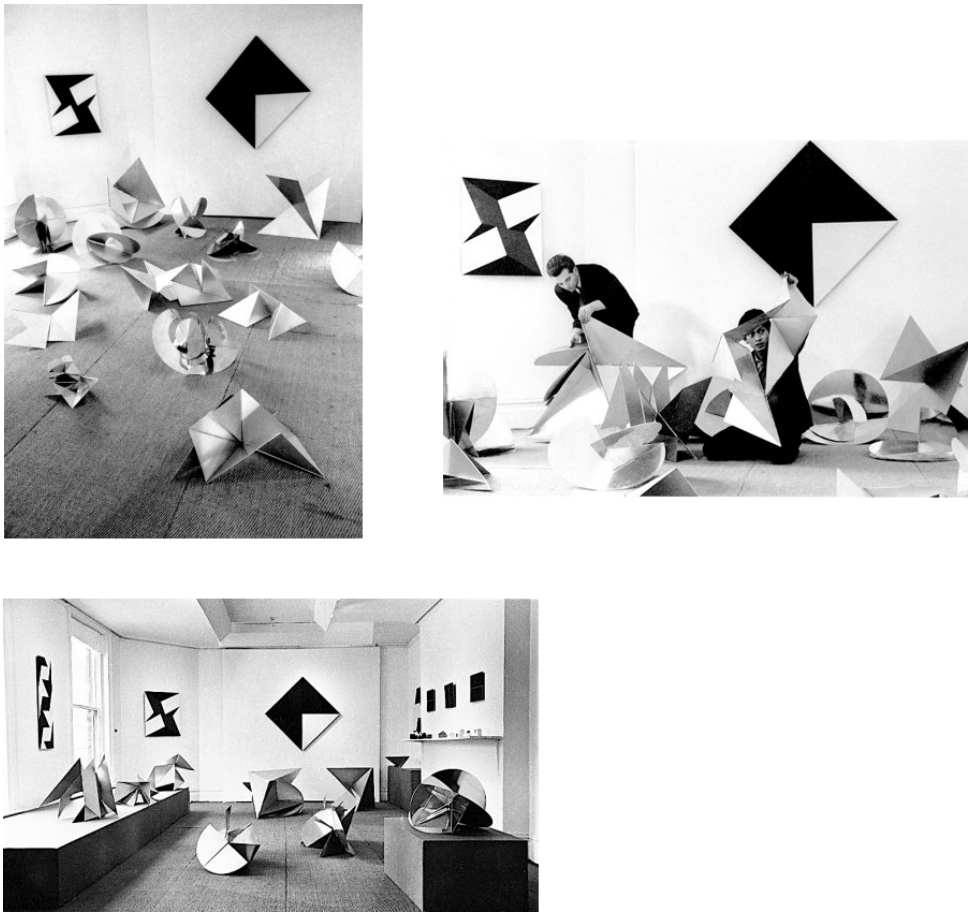

Fig. 63. Clay Perry, *Lygia Clark Sculpture: Room Installation at Signals, Wigmore Street* (1965)

This negotiation is, as Best indicates, "… deeply private, involving just the participant and the object… with which they interact."[7] As such, I feel it parallels the relationship between practitioner and volvelle described in the Introduction, in which the rotating discs of the paper machine are turned by the hands in an act of private contemplation. In both cases, moving the structure creates a reciprocal activation of the mind and body. In both cases too, there is freedom of movement within certain constraints. As Best writes, the *Bichos* "have their own logic and limits… We must initiate movement, but our action is caught in the reaction of the *Beast*... Both participant and beast are thus active."[8] This movement gives the *Bichos* what Best describes as an "illusory vitality," reflecting Max Bill's description of concrete art as "anaturalistic and yet close to nature."[9]

[7] *Ibid,* 48.
[8] *Ibid,* 53.
[9] Bill, "Concrete Art," *Theories and Documents of Contemporary Art*, 91.

Clark designed these works to be touched. However curatorial practices have turned them into sculpture – into the "static optical works" they were not intended to be.[10] In the *Cold America* exhibition, Clark's *Bicho* was displayed in a vitrine (fig. 64). It seems unfortunate that this active fragmentation of the plane should be imprisoned, and in a much less dynamic conformation than that pictured in the exhibition catalogue (fig. 61).

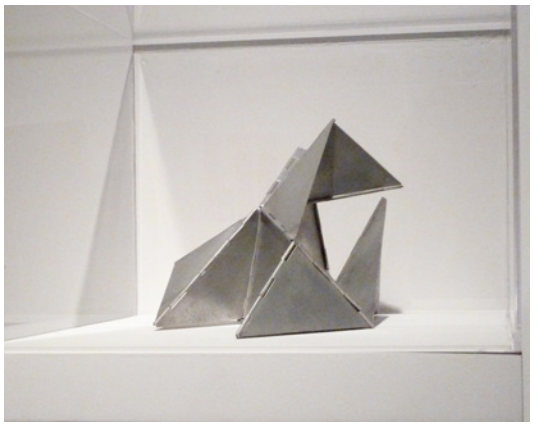

Fig. 64. Lygia Clark, *Bicho – maquette* (1960)

With the *Bichos*, Clark created a device that "join[s] together all the pieces of the kaleidoscope in which the idea of man has been shattered and reduced to fragments."[11] The hinge spaces that link the metal planes are lines of fracture that create the possibility of change and movement, while recording the trauma of their fragmentation. Before returning to the development of my work, I will discuss this disjunctive, connecting space with reference to the "mosaic philosophy" of William James.[12]

William James

The American psychologist and philosopher William James (1842-1910) was an early proponent of Pragmatism, a branch of philosophy in which the 'truth' of an idea is not an abstract concept, but depends absolutely upon its practical value. In his Preface to *The Meaning of Truth*, James states that:

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[10] "The beasts are not static optical works – they must be handled…" Best, *Visualizing Feeling,* 53.
[11] Clark, "The Death of the Plane," 444.
[12] "My description of things… starts with the parts and makes of the whole a being of the second order. It is essentially a mosaic philosophy, a philosophy of plural facts." William James, *Essays in Radical Empiricism. A Pluralistic Universe* (Gloucester, Massachusetts: Peter Smith, 1967), 86.

> The truth of an idea is not a stagnant property inherent in it. Truth *happens* to an idea. It *becomes* true, is *made* true by events. Its verity *is* in fact an event, a process, the process namely of its verifying itself, its veri*fication*.[13]

This gives rise to a definition of truth that is not static or absolute, but is instead contingent on perception and experience.

For James, our experience of the world "hangs together from next to next in a variety of ways."[14] He describes the sum total of our experiences as a mosaic, but one in which the individual pieces are held together not by cement, but by the transitions between them. As he writes, "there is no bedding; it is as if the pieces clung together by their edges, the transitions experienced between them forming their cement."[15] As we go through life, this mosaic expands, because:

> Experience itself, taken at large, can grow by its edges… one moment of it proliferates into the next by transitions which, whether conjunctive or disjunctive, continue the experiential tissue… Life is in the transitions as much as in the terms connected; often, indeed, it seems to be there more emphatically…[16]

The metaphor of a mosaic held together by transitional spaces brings to mind Susan Best's description of Lygia Clark's organic line. I feel this also connects with my experimental paintings, where the tessellating planes meet across "conjunctive or disjunctive" spaces.

***I can connect nothing with nothing* (2012)**

This series is comprised of small gouache paintings on red card. The title is from T. S. Eliot's poem *The Waste Land*[17] and is one I adopted because of the connection

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[13] William James, *The Meaning of Truth* (London: Longmans, Green, and Co., 1909), vi.
[14] William James, *Some Problems of Philosophy* (Cambridge, Massachusetts: Harvard University Press, 1979), 69.
[15] James, *Essays in Radical Empiricism,* 86.
[16] *Ibid,* 87.
[17] "On Margate Sands./I can connect/Nothing with nothing./The broken fingernails of dirty hands./My people humble people who expect/Nothing." T. S. Eliot, "The Waste Land." In *T. S. Eliot: Collected Poems 1909-1962* (London and Boston: faber and faber, 1990), 74.

between James' mosaic philosophy and Eliot's fragmented modernist vision of the world.[18]

I used a simple triangular unit to develop the experimental works discussed at the beginning of this chapter, but now returned to the cellular pyramidal unit of the *Rete Mirabile* and *Strange Objects* (Chapter Three). Removed from the grid, the unit can morph from a blunt square to a needle-like diamond, and this allowed the 'growth' of a variety of forms with smooth or jagged edges, which activate the ground in different ways. I also maintained the relationship established earlier in the chapter between size of the unit and tonality, as this had proved a useful tool for creating spatial illusions. This approach allowed different kinds of forms to emerge (fig. 65).

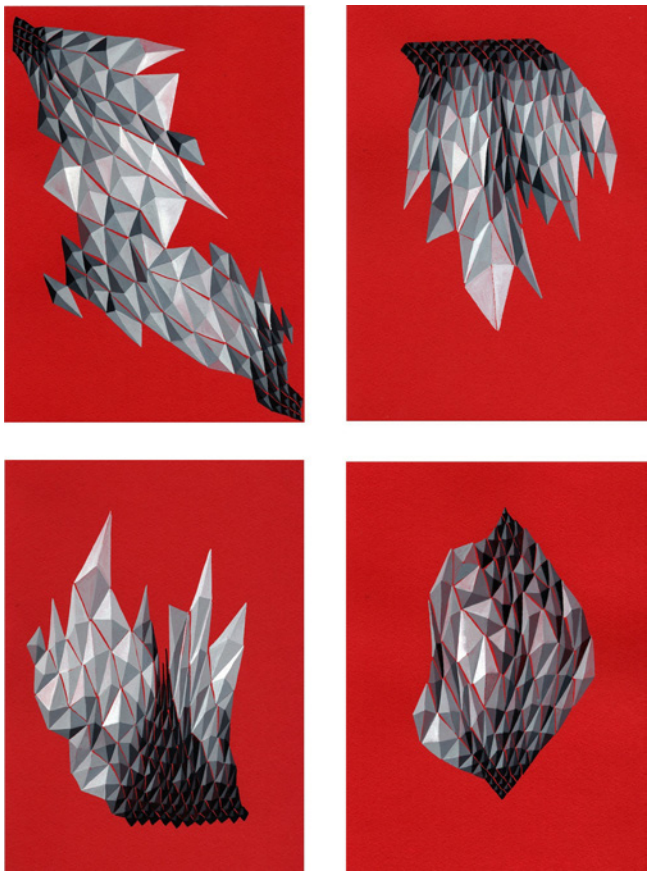

Fig. 65. *I can connect nothing with nothing* (2012)

[18] "William James said two things that seem to apply absolutely to the Wasteland… "reality seems to come at us as though fired at us from a revolver" and "the world is not made of one kind of stuff, it's a world that like a mosaic hangs together by its edges."" Steve O'Connor in conversation with Melvyn Bragg, "The Waste Land and Modernity," *In Our Time* (BBC Radio 4, 39 min 51 sec, 26 February 2009: http://www.bbc.co.uk/programmes/b00hlb38, accessed June 2012).

In these paintings I start with a regular tessellation of small, black units (fig. 66, left). The cellular units then grow out from this initiation point in rows, expanding and becoming tonally lighter. The form can either continue to expand, or be constrained back into a tight and regular conformation (fig. 65). As they grow, these compositions come to resemble crystals or rocky outcrops. While I guide the development of the image and decide when it is finished, I am not in complete control of its final appearance, as I will explain later in this chapter. The ground appears between the planes in regular lines (as in the circular works described in Chapter Three), and these transitions between the rows of units appear to glow through the dark areas (fig. 66).

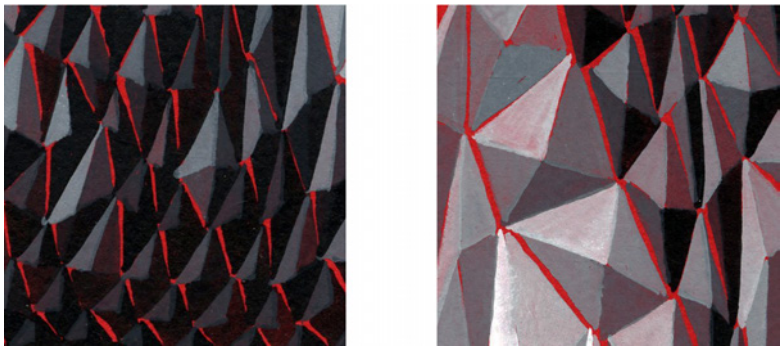

Fig. 66. *I can connect nothing with nothing* (2012), details

As the paintings developed, I continued to draw parallels between their geometric structure and thought. However, their cellular nature became more apparent in this series as the pyramidal unit gave rise to a greater variety of possible forms. I observed in Chapter Three that the unit might operate as a cell that could divide and grow across the surface of the paper if released from the constraints of the circular grid. I now extended this idea to include William James' use of cellular growth and "experiential tissue" as metaphors for our engagement with the world.

Gertrud Goldschmidt

References to biology and human experience can be found in the visual art and writing of Gertrud Goldschmidt (known as Gego, 1912-1994), who left Germany in the 1930s to settle in Venezuela. Her practice is a deeply focussed exploration of line and space in two and three dimensions.

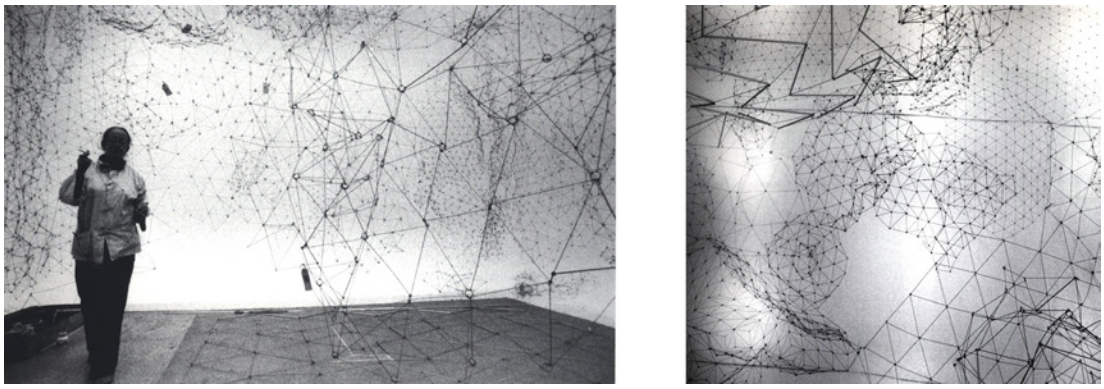

Fig. 67. Left, *Gego working on the permanent installation of Reticulárea* (Caracas, c. 1980-81), and right, *Environmental Reticulárea* (New York, 1969-70)

Gego's *Reticulárea* (fig. 67) is a vast and delicate network of interconnecting wire permanently installed in the Museum of Fine Art in Caracas, Venezuela. In a poem referring specifically to this work, Gego uses the phrase *Moleculum Gegum* (the Gego molecule), thus identifying herself with the triangular linkages from which the *Reticulárea* is constructed.[19,20]

inexhaustible
endless
consecutive
linkage

traces

linked

continuous

triangular linkage

cells

Moleculum Gegum

Like the *Reticulárea* itself, Gego's poem activates space, drawing to the viewer's attention the 'air' between its structural elements. The interconnecting lattices of Gego's structures suggest molecular forms, as she implies, yet allude to other scales of organisation. She observed that "[t]he clear and well-defined forms that live around us

[19] Gego, "Air (Sabidura 7)," in *Sabiduras and Other Texts by Gego*, ed. María Elena Huizi and Josefina Manrique (New Haven and London: Yale University Press, 2005), 72-75.
[20] "These writings were found in the file of Gego's archives corresponding to her 1969 *Reticulárea* exhibition, that is, the first installation of the work in the Museo de Bellas Artes de Caracas." Huizi and Manrique, *Sabiduras*, 67.

are proof of the greatness of formations and creations beyond what is visible on earth."[21] It is not only the microscopic that is beyond vision, and the *Reticulárea* appears also to reference the macroscopic and distant structures of the universe. As Susan Best writes,

> … this coalescence of different scales is indicative of the extraordinary power of this work… The sense of life she conjures up is at once cosmological and yet also biological.[22]

This interplay between disjunctive scales and space is, as Best observes, "like a field of relations suggestive of growth and interconnection."[23] It parallels James' view that the world is, in the words of French philosopher David Lapoujade,

> ... a gigantic network. Line and fragment, network and patchwork, are the two great axes of the construction and of the growth of the world. The world appears as a bundle of relations…[24]

In the poem "Line as human," Gego articulates the nature of these connections, emphasising both the human and the material aspects of her work.[25]

Line as human
means to express
the relation between
points, something
that is entirely abstract
in the sense: of not
existing materially
in nature.

Line as medium
indicates materially
the relation between
points in space,
expressing visually
human descriptive thought.

Line as object to play with.

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[21] Huizi and Manrique, *Sabiduras,* 123.
[22] Susan Best (curator), *Vibration, Vibração, Vibración: Latin American Kinetic Art of the 1960s and '70s*, University Art Gallery, Sydney, 7 July-13 September 2012 (Sydney: The University of Sydney, University Art Gallery, 2012), 5.
[23] *Ibid*, 4.
[24] David Lapoujade, "From Transcendental Empiricism to Worker Nomadism: William James," trans. Alberto Toscano. *Pli* 9 (2000): 197.
[25] Gego, "Line as human (Sabidura 4)," in *Sabiduras,* 53.

The line provides a "human means" of linking abstract ideas, as it does in the Lullian circles described in the Introduction. When embodied in material form, the "[l]ine as medium" connects space, and becomes a visual representation of "human descriptive thought."[26] Gego's work raises again the idea of the line as an expression of abstract thought while, like Lygia Clark, exploring the expressive potential of concrete art.

Lines of thought

I am intrigued by another connection between the drawn line and the depiction of thought, this time in a fifteenth century painting, *Evagiones Spiritus* (*The Erring of the Soul,* fig. 68, left). This is the remnant of a 'disciplinary' diptych, the missing panel of which would have depicted a man at prayer, with images suited to his religious devotion (see fig. 68, right, for comparison).[27, 28]

Fig. 68. Left, unknown artist, *Evagationes Spiritus* (*The Erring of the Soul*, 1430s), and right, unknown artist, *The Good and the Bad Prayer: Superbia versus Piety* (1430-1460)

[26] *Ibid.*
[27] "Originally, the panel was joined with another one... In the other, now lost panel, a praying man was depicted. The red lines that once departed from his figure and continue in this picture represent his erring thoughts." The Christian Museum, "Evagationes Spiritus (The Erring of the Soul)" http://keresztenymuzeum.hu/collections.php?mode=work&wid=22&page=&search= evagati0nes (accessed 4 June 2012).
[28] Gerhard Jaritz, "Ira Dei, Material Culture, and Behavior in the Late Middle Ages: Evidence from German-speaking Europe." *Essays in Medieval Studies* 18 (2001): 54.

In the remaining panel, the wandering mind strays to worldly concerns in an act of *curiositas,* or "mental fornication."[29] The red lines representing thought snake across the painting, branching out towards the horse, outbuildings, clothing, caskets of jewels, and under the skirt of the young and beautiful woman. I can create a relationship between these lines, which connect visually to the internal frame of *Evagationus Spiritus*, and my use of the red ground.

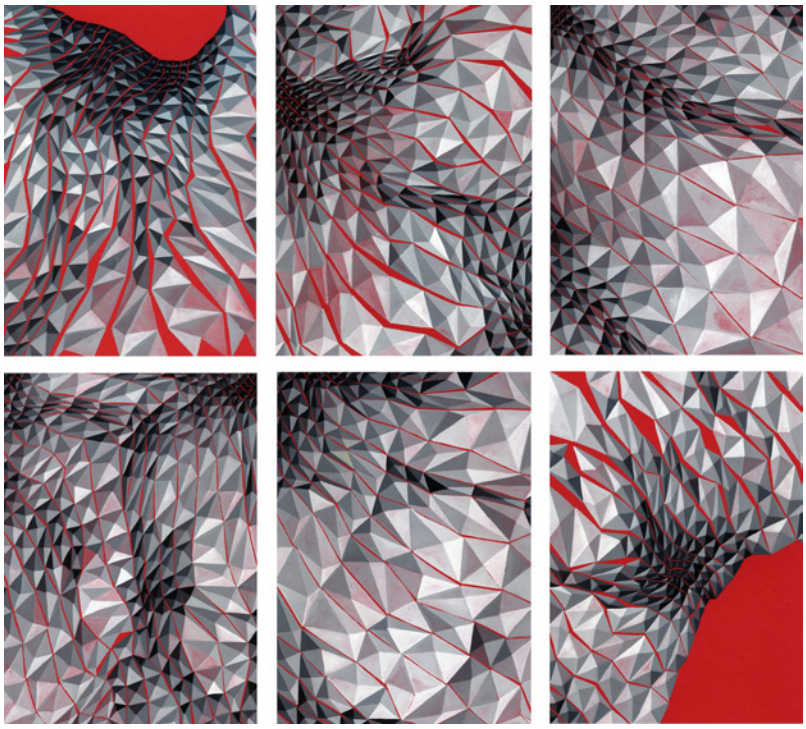

Fig. 69. *I can connect nothing with nothing* (2012)

This led me to consider how I could experiment further with the lines that emerge through the forms I paint. I continued the series *I can connect nothing with nothing* by making works in which the pyramidal unit grew across the support to form a cellular field (fig. 69). Furthermore, the individual paintings can be read together as a larger, torso-like form. In an evenly tessellated surface, the red lines of ground that show through the form would be straight and parallel. However, because the units grow and shrink, the lines bend and twist through the form. Varying the spacing between the

[29] "The mind can never be empty of thought. But it is inclined to laziness and to a kind of wandering about, which [the 5th century theologian John] Cassian also categorizes as a form of mental fornication." Carruthers, *The Craft of Thought,* 82-83.

rows of units creates uneven lines of red, which undermine the integrity of the structure. In these works, the units map the surface in a flat tessellation, while appearing to dip into and emerge from the ground rather like a creased or billowing sheet.

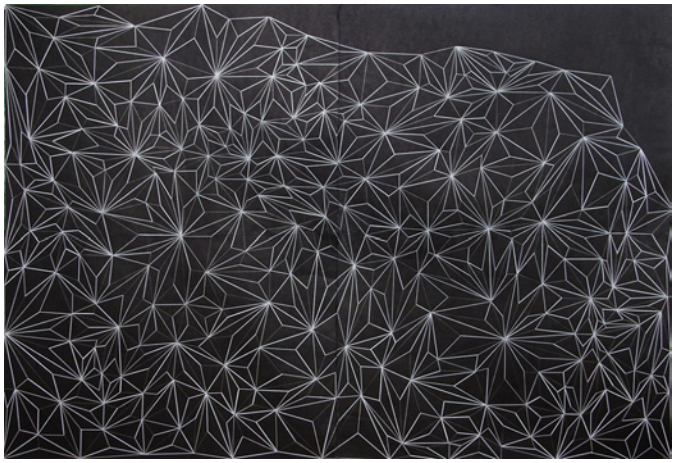

Fig. 70. Timothy Nolan, *Swell* (2007).

This effect can be seen in the asymmetric fractured planes of American artist Timothy Nolan's works on paper (figs 70 and 71). A skeletal field is mapped out in white, grey and silver pencil, and the shift between the tonalities of the lines enhances the illusion of a creased surface that appears to sag down from the top right corner of the work. Nolan's lines create an illusory, angular surface which folds into and out of the black ground. One can imagine pulling the corners of *Swell* and smoothing it out, only to find that the drawn image is too large for the surface that contained it – rather like the depictions of drapery in paintings such as Raphaelle Peale's *Venus Rising from the Sea – a Deception* (fig. 72).

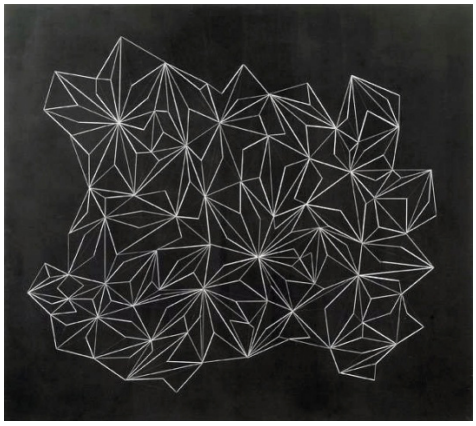

Fig. 71 Timothy Nolan, Pivot (2006)

Fig. 72. Raphaelle Peale, *Venus Rising from the Sea - A Deception (After the Bath)*, 1822

Nolan's line drawings create a tension between the irregularity of the final form and the restricted system used to generate it. I experience this tension when making the paintings such as those shown in figure 69. Even when I attempt to constrain the unit, to keep it small and regular, the overall image diverges from an orderly gridded appearance because I am not working to a pre-drawn structure. As the units in one area expand, those around must become smaller if the tessellation is to remain intact. This swelling and contraction requires continual negotiation, because constraining one area creates problems elsewhere in the image. When I push the system, it pushes back: it too has its own "logic and limits."[30] The more difficult areas to negotiate are those where extreme transitions from small to large unit size occur, creating stronger spatial illusions. I began to introduce such shifts in scale deliberately. I enjoy these complications, because they create interesting problems that need to be solved, and push me to engage more directly with the painting.

The absence of the pre-drawn grid invests the image with an activity that I experience while painting. Growing the image, unit by unit, involves many small decisions that accumulate to inform the final composition. Because of this, no two paintings are the same, although all are constructed using the same system. This is different to the earlier circular works, because in those, the 'life' of the image was apparent in its evolution from painting to painting. However, in the current series, each work is a record of its own organic growth.

Doreen Reid Nakamarra

A sophisticated negotiation of the picture plane is evident in the work of the indigenous Australian artist Doreen Reid Nakamarra (1955-2009). In *Untitled* (fig. 73), diagonal lines are meticulously constructed over a red ground from rows of dots that switch between a pale cream and sandy ochre. Lines of black are introduced between these diagonals to dazzling and dizzying effect. Together, these form horizontal elements that sweep across the picture plane. Nakamarra said of such works that she started at one end, and then she gestured to indicate how she worked her way across the canvas.[31] This composition is on the one hand highly organised, but there is

[30] The *Bichos* "are not simply passive objects that we can totally control but have their own logic and limits…" Best, *Visualizing Feeling,* 53.

[31] "Sitting before her winning work in the National Aboriginal & Torres Strait Islander Art

also a fluid negotiation of the picture plane by the horizontal elements that swell or narrow to accommodate one other.

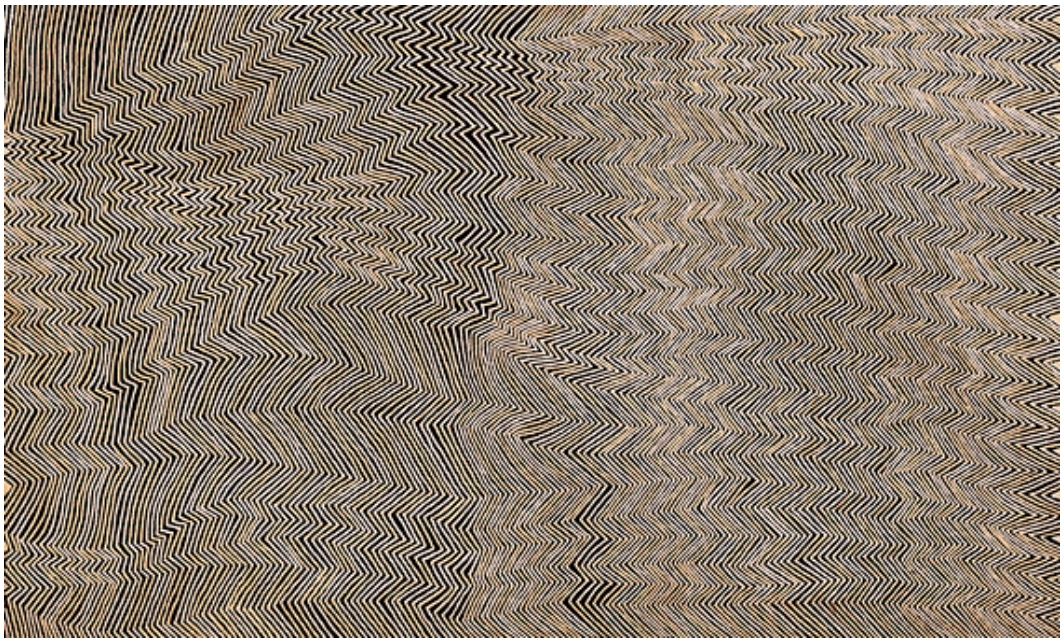

Fig. 73. Doreen Reid Nakamarra, *Untitled* (2007).

A regular series of near-triangles can be seen along the right hand edge of the canvas, and it seems likely that this is where Nakamarra began painting. Moving leftwards, these horizontal elements begin to swerve gently. However halfway across the canvas, dramatic shifts occur – the elements swell and bend, opening gaps between the diagonal dotted lines. The intervening black lines become more dominant, creating a shimmering tonal contrast with the pale ochre dotted lines, an effect made more powerful by the large scale of the painting. It is tempting to imagine that Nakamarra approached her painting in a different frame of mind when creating this more chaotic area. However as the elements are guided across the surface of the canvas there is a strong sense of control: as in Lygia Clark's work, the system has "logic and limits" that prevent the image from breaking down into chaos.[32]

Awards, Doreen Reid Nakamarra waves her arm in one laconic sweep. "It goes this way," she says, following her trademark short broken slashes and tight dots up and down her canvas. "That's the way I paint it."" Author unknown, "Doreen Reid Nakamarra: Shimmering Lands," in *Australian Art Collector* 46 (October – December 2008). http://www.artcollector.net.au/DoreenReidNakamarraShimmeringLands (accessed 16 November 2112).

[32] The *Bichos* "are not simply passive objects that we can totally control but have their own logic and limits…" Best, *Visualizing Feeling,* 53.

The silent swerve

Nakamarra's painting oscillates between organisation and entropy, bringing to mind the words of the English writer G. K. Chesterton (1874-1936):

> Life… looks just a little more mathematical and regular than it is; its exactitude is obvious, but its inexactitude is hidden; its wildness lies in wait.[33]

Chesterton concludes that this creates a "silent swerving from accuracy by an inch that is the uncanny element in everything."[34] In Nakamarra's painting, this inexactitude is not hidden, but is made apparent in paint. Nakamarra's system could create a linear schema in which the horizontal elements flatline across the canvas. The 'swerve' from mathematical exactitude is a shift in response to the living, breathing body.

Geometric paintings tend to appear more organised than they really are, and that which appears 'perfect' from a distance can break down on closer inspection. As art historian Jacqueline Millner observes of Debra Dawes' apparently meticulously rendered paintings (Chapter One, fig. 7),

> [e]ven though the canvases are mapped in advance through mathematical calculations, Dawes draws up her designs and paints by hand, so that each element of the pattern is unique, idiosyncratic, and 'imperfect.' The artist aims to make visible every decision made in the painting.[35]

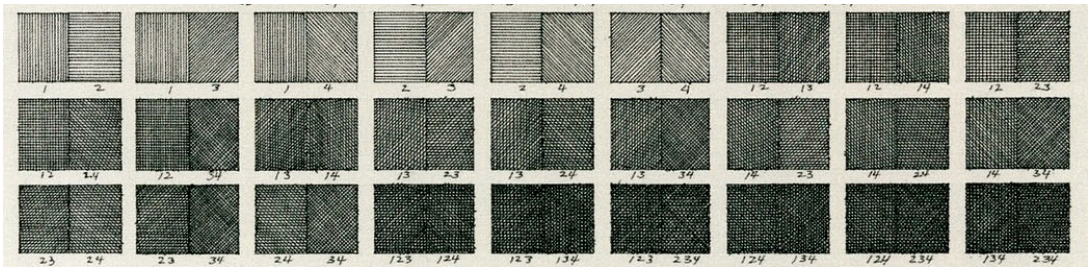

Fig. 74. Sol LeWitt, *All Single, Double, Triple, and Quadruple Combinations of Lines in Four Directions One-, Two-, Three- and Four-Part Combinations* (1969), detail

[33] G. K. Chesterton, *Orthodoxy*. Cited by Martin Gardner, *Penrose Tiles to Trapdoor Ciphers: And the Return of Dr. Matrix* (The Mathematical Association of America, 1997), 9. http://books.google.com.au/books?id=8-FlYl6-ML8C&pg=PA9&lpg=PA9&dq=#v=onepage&q&f= false (accessed 19 July 2012).
[34] *Ibid.*
[35] Jacqueline Millner, "Double Dealing" (Sydney: Gallery Barry Keldoulis, 2010). http://www.gbk.com.au/files/DD_gbkCat2010.pdf (accessed 4 February 2013), not paginated

Such slippages from perfect order also occur in the work of Sol LeWitt (fig. 74), creating a shimmer where his parallel lines diverge from a regular spacing. The contemporary Australian artist Kerrie Poliness plays with this disparity between order and imperfection in her wall drawings that, like those of LeWitt, are created by following a set of instructions (fig. 75). However, as curator Jenepher Duncan explains, Poliness leaves key decisions concerning the final appearance of the work to others. As Duncan writes,

> … an element of chance is structured by the artist into their realisation, which breaks down the systematised rationality of their execution. Once an initial circle has been marked on the wall, the installer must estimate appropriate points for its division, from which the full form is developed, ensuring the imperfection of its geometry.[36]

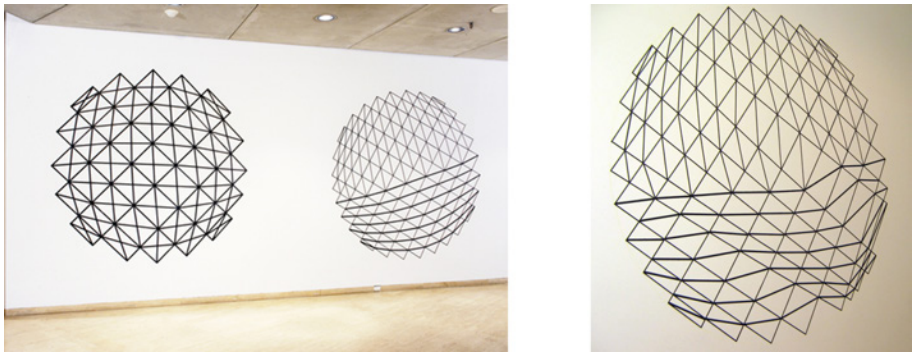

Fig. 75. Kerrie Poliness, *Black O Wall Drawings 1-6* (1997, detail). Installed in (left) Anna Schwartz Gallery, Melbourne and (right) The Dowse Art Museum, New Zealand

In these works, irregularities that are not always immediately discernable undermine the over-arching order of the gridded system. The works differ each time they are drawn, as can be seen from a comparison of two installations of Poliness' *Black O Wall Drawings* (fig. 75). The first, and 'tidier,' version is from the Anna Schwartz Gallery in Melbourne. The second was very recently installed in the Dowse Art Museum by New Zealand artist Cat Auburn, assisted by local art students.[37] This

[36] Jenepher Duncan, "Kerrie Poliness," in *Wall Power* (Perth, WA: Art Gallery of Western Australia, 2005), unpaginated.
[37] "Installation of Kerrie's work at The Dowse was from Tuesday 9 April to Friday 12 April. Wellington artist Cat Auburn lead the creation of the wall drawings with assistance from

idiosyncratic and dynamic iteration of Poliness' form indicates that small divergences from mathematical precision in the initial division of the circle give rise to much more obvious differences in the final drawing.

In Poliness' work, as in that of Nakamarra and LeWitt, it is not a question of the body marring the perfection of the system, but rather of the system behaving as a sensitive indicator of the living interaction between body, system and materials. In the series *I can connect nothing with nothing*, the organic growth of the pyramidal unit provides a record of decisions made in the work itself, which in turn arise from my negotiation of the picture plane in partnership with the unconstrained system.

***Conc/rete* (2012-13)**

Having established the pyramidal unit's potential for organic growth, I continued exploring the figure-ground relationship. I made brightly coloured card collages using different tessellating forms that would pose more of a challenge to the grey cellular structure (fig. 76). The sub-structure of the ground provides an organising principle that guides the growth of the grey form – I found that I tended to align the grey gouache planes with the edges of the squares and triangles, to accommodate the uneven, raised edges of the collaged card.

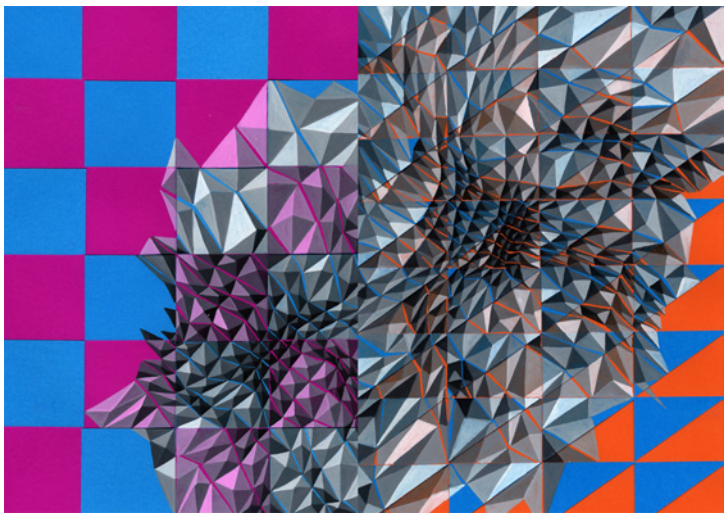

Fig. 76. *Untitled* (2013)

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a team of students from Massey University School of Fine Arts and local schools." The Dowse Art Museum, "Kerrie Poliness Black O," http://www.newdowse.org.nz/en/Exhibitions/Current-Exhibitions/Kerrie-Poliness-Black-O/ (accessed 27 April 2013).

When painting, the dyes in the card – particularly the warmer hues – were activated by water and dissolved into the gouache. This creates colour variations in the grey planes. Areas of the form with a warm background then 'pop' forwards, because the grey paint takes on a pink or orange hue relative to the cooler surrounding areas. Because of this colour mixing, the growing cellular form did not obscure the grid, but appeared to form a semi-transparent layer through which it could be seen. I pursued this rather literal activation of the ground further, as I will describe.

Fig. 77. Miniature painting from *The Book of the City of Ladies*: The Book of The Queen (by the Master of the City of Ladies)

The tessellated grounds were a reference to the geometric division of the picture plane in medieval illustrations of the kind shown in fig. 77, a miniature painting from *The Book of the City of Ladies,* by Christine de Pizan (1363-1434).[38] In this wonderful book, de Pizan describes the construction of a city where women can live untroubled by men. The stones with which she builds the city are the stories of women who excel in all walks of life – as artists, scientists, moral exemplars, mothers, authors, and so on. As an imaginary construction that is a storehouse of memories, De Pizan's city is a polemical memory palace. The combined geometries of the gridded 'sky,' the roof and floor tiles of the building on the left, and the growing walls of the city, have guided the composition of my current work.

[38] Christine de Pizan, *The Book of the City of Ladies*, trans. Earl Jeffrey Richards (New York: Persea Books, 1998, written 1405).

At the beginning of this chapter I described the effect of removing the pre-drawn grid on the development of the image; in these painted collages, the grid is reintroduced. However, it does not constrain the painted structure, which can grow across and through its edges, like a vine growing on a trellis. The framing edge of the support nevertheless still imposes a distinct boundary that the image cannot pass. The growing form therefore had only a limited freedom, something I could change by extending the ground where the image approaches its edge. This provided the stimulus for the next work, which is part of an ongoing project.

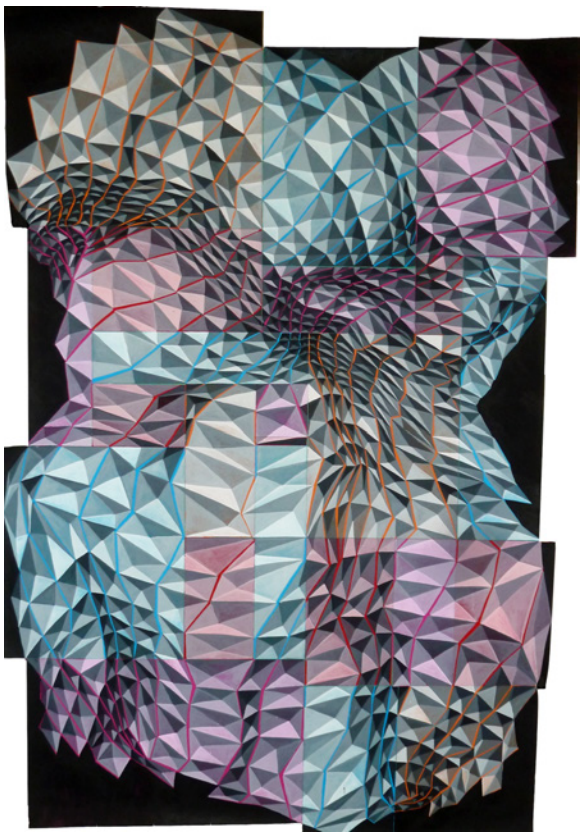

Fig. 78. *Conc/rete,* (2013)

The painting in figure 78 was made by collaging card as before, and then 'growing' a form from an initiation point (the dark central area towards the top of the image). As the form grew, I collaged further pieces of card to accommodate its expanding boundaries. I then painted out the surrounding colours using black ink, which gives the image a more contained appearance. This creates a much stronger contrast between the form and the surrounding ground. It allows the colours in the lines and planes to assert themselves more strongly, and emphasises the contrasts between the

warm and cool areas of the irregular grid. The brightly coloured ground is visible both between the planes and, with reduced intensity, in the gouache of the painting itself. The irregular frame suggests the possibility of further growth across the wall as the cellular form takes on a membranous, flesh-like appearance. I have returned to the term, *Conc/rete* (developed in Chapter Three), to describe these works. This fractured and reconfigured term, with its connotations of living biological structures, reflects the amorphous and growing network of lines and planes in my reinterpretation of geometric, concrete art.

Conclusion

In this chapter I have described the development of paintings constructed using a basic unit that is not constrained to a pre-drawn grid. This enabled me to construct dynamic forms that require a more active support to balance the figure-ground relationship. Using brightly coloured grounds then led me to focus more closely on the active spaces between the planes that form the painted image. I drew a comparison between these and the hinged spaces of Lygia Clark's *Bichos*, and discussed Clark's fragmented planar works in the context of William James' Pragmatism. For James, truth is not predetermined and universal, but is validated by experience. His worldview is "essentially a mosaic philosophy, a philosophy of plural facts."[39] This plurality is echoed in Clark's manipulable forms and in the complex lattices of Gego's *Reticulárea.*

In developing this series of connections I came to consider the painted forms in my series, *I can connect nothing with nothing*, as representing a mosaic of perceptual experience analogous to that which James describes. Like James' "experiential tissue," each cellular form "grows by its edges."[40] These images could develop more freely than those described in Chapter Three, where the pyramidal unit was confined to a grid. However the growth of the painted form operates according to restrictions that arise from the geometry of the basic cellular unit, restrictions that I have to negotiate when constructing these works. Using Doreen Reid Nakamarra's *Untitled* (2007) as an example, I explored how such negotiations generate a 'swerve' from predictable regularity, providing visual evidence of the intimate connection between artist and painting.

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[39] James, *Essays in Radical Empiricism,* 42.
[40] *Ibid,* 87.

The modernist author Gertrude Stein once wrote: "A sentence is not emotional a paragraph is."[41] Stein's sentences are carefully contrived, with a strong emphasis on balance and structure rather than meaning. The sentence is not emotional, because it is a logical construction built from the fundamental unit of the word. However the implication is that once sentences are assembled into the larger structure of the paragraph, a degree of uncertainty develops that evokes an emotional response. In Gego's *Reticulárea*, repetition gives rise to an overwhelming complexity that collapses geometry into formlessness.[42] What begins with a fundamental expression of structure (the "triangular linkage"[43]) becomes, in art historian Monica Amor's words, a "defiance of structure."[44] As with the planes of Lygia Clark's *Bichos*, there are many possible ways in which Gego's complex structures and Stein's paragraphs might be configured and interpreted. This results in a shift from the certainty of the individual unit, to the unpredictability and multiplicity of a complex whole that is infinitely greater than the sum of its parts.

The rational and the emotional are reconciled in works such as Gego's *Reticulárea* and Nakamarra's *Untitled* (2007) because when complexity is developed through organic growth, thought and feeling become part of the same sliding scale, rather than diametrically opposed opposites. Reflecting on my own processes and the work of others has enabled me to shift from deconstruction to construction – from analysis to synthesis – and it is this that I explore in my most recent paintings.

[41] Gertrude Stein, *How to Write* (New York: Dover Publications, 1975), 23.
[42] "At times [the *Reticulárea* might appear structural, and at times linear, at times clear and at times messy, at times geometrical but generally formless." Mónica Amor, "Another Geometry: Gego's Reticulárea, 1969-1982." *October* 113 (2005): 114-115.
[43] Gego, "Air (Sabidura 7)," *Sabiduras*, 67.
[44] Amor, "Another Geometry," 115.

Conclusion

> Being immersed in this mysterious form, I perceive an endless variety of cosmic and earthly, biologic and crystalline manifestations. I am concerned not to destroy the mystery while exploring geometrically.[1]

The genesis of this project was my fascination with the memory palace, where the imagination, emotions and senses combine to form an arena for creative, speculative thought. Together with logic diagrams and Ramon Lull's combinatorial diagrams and volvelles, the memory palace provided a means of approaching a central concern of this thesis, which is the visualisation of thought.

This seemed an overwhelmingly complex subject, and I took a scientific approach to my studio research, identifying two challenges that I would need to address. The first was presented by illusionistic painting, which I planned to employ in my exploration of the memory palace. The second concerned how I could work intuitively in the studio, yet also analyse and understand the development of my painting practice. I addressed both challenges by taking a deconstructive approach to representational painting. I explored spatial illusionism by creating a series of works, where each decision I made resulted in a new, yet related, drawing or painting.

This methodology allowed me to become immersed in the painting process – which is where the real joy of studio practice lies – and also to create a detailed record of my decisions for later analysis. My studio experiments resulted in paintings and drawings in which I used conflicting systems of representation to create visually ambiguous images. Such images cannot be resolved, but flicker between alternative plausible interpretations, and so provided me with a means of representing hypothetical thought. In scientific research, the multiple possibilities embodied in hypotheses are continually collapsed through the process of experimentation, as I have described. However when explored in the studio, my hypothetical speculations remain open as they are embodied in material form. In the words of William James, an idea is "*made* true by events. Its

[1] Ruth Vollmer, "Statement: 1966," Rottner, Nadja and Peter Wiebel, *Ruth Vollmer 1961-1978: Thinking the Line* (Ostfildern, Germany: Hatje Cantz, 2006), 203.

verity *is* in fact an event, a process..."[2] The process that verifies my visual speculations is that of painting and drawing.

While my scientific approach provided a starting point for exploring the visualisation of thought, I remained concerned that it could not adequately address the mysterious complexities of creative thought embodied in the memory palace. Like the minimalist artist Ruth Vollmer, I did not want "to destroy the mystery while exploring geometrically."[3] My concern grew as I contextualised my project within the area of concrete art, a form of geometric art that (in its original formulation by Theo van Doesburg) is so strongly associated with logic and objectivity, and so sternly rejects the emotions and the senses.[4] However the strictures of artists such as van Doesburg appear unrealistic, and do not match the real emotional and sensual experience of viewing and making geometric art. Concrete art was reinterpreted by Latin American artists including Lygia Clark and Gego, and continues to be reassessed by contemporary artists such as Debra Dawes and Kerrie Poliness. In the hands of these and other artists, geometric art is not simply a means of visualising rational thought, but of referencing the body and the emotions.

Using the methodology of the series, I found that small changes to a composition could result in the rapid evolution of the image. However, often a new work was very similar to that preceding it. As my experimental system became the subject of its own investigation, I experienced an irrational compulsion to 'complete' the series, a task that was essentially impossible, and led to a sterile repetition of imagery. When taken to an extreme, my methodology led not to insight and understanding but to a loss of meaning, thus undermining my apparently scientific approach. This forcing of an apparently logical system to its extremes reveals the irrationality that lies at its core.

Recognising that I had pushed my experimental methodology to the point of exhaustion prompted me to relax my control over the image. I discovered how the systematic growth of a geometric, cellular unit could generate complex and

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[2] James, *The Meaning of Truth,* vi.
[3] Vollmer, "Statement: 1966,".Rottner and Wiebel, *Ruth Vollmer,* 203.
[4] "The work of art should be fully conceived and spiritually formed before it is produced. It should not contain any natural form, sensuality or sentimentality." Van Doesburg, "The Basis of Concrete Art," *Constructing a New World,* 187.

unpredictable compositions. In investigating the work of Doreen Reid Nakamarra I re-evaluated the relationship between artist and image. I realised that when allowed to follow its own rules, a geometric system can embody this complex and shifting relationship in visual form. The development of complexity from the single unit to a concreted whole therefore models a transformative shift away from objective, logical thought, and towards fragmented and plural experience.

I approached this project from a scientific perspective with the aim of exploring parallels between science and the visual arts, and of developing a painting practice in which I could visualise speculative thought. Through the course of this exploration I have connected with the ideas and work of others. These lines of enquiry have intersected in the studio, just as ideas connect to generate new insights in the Lullian diagrams that form a central theme of this thesis. In drawing these connections, I have reconfigured concrete art into a form of geometric speculation that not only visualises thought, but also responds to and expresses the physical, sensual and emotional experience of painting.

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