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# **Formal Confusion: Virtuality and Utopian Space**

An exegesis presented with exhibition as fulfillment  
of the requirements for thesis:

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## Abstract

This exegesis details an investigation into the history and evolution of certain technologies, (binary coding, Platonic cosmology, and the linear perspective system) and the extent to which these technologies have distorted or appropriated our perceptions of reality. Special attention is paid to logical inconsistencies in apparently logical systems. The investigation focuses on the purportedly utopian applications of these technologies and the discrepancies that inevitably occurred whenever these ordered systems confronted the chaotic 'real' world. Information gleaned from this research then informs an analysis of methods for incorporating these concepts into the author's installation practice. An explication of recent drawing practice and its reconciliation with installation work will account for and inform a recounting of practical experimentation dealing with form and materials.

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## 1.

*'It has been claimed that, no matter how deeply embedded within unarticulated experience a skill may be, the knowledge it represents can be made explicit and objective by being built into machines.'* (Pacey, 1999, p 9)

My sculptural practice has always been informed by a physical relationship to technology, from kinetic work while I was at Art school, to the electronic interaction of recent years. While generally well received these recent works were, to me, less than resolved, therefore my rationale for completing my masters degree was to codify and make coherent the core areas of interest in these works through the explication of an exegesis and attempt to remedy aspects of construction, audience interaction and presentation in my work.

I will begin with a brief explanation of my position at the beginning of my year, and then proceed to a discussion of the work of Danish artist Olafur Eliasson (1967-). A review of the history of binary coding and symbolic logic systems will lead to the surprising conclusions of the Austrian logician Kurt Gödel (1906-1978). The work of Gödel then informs elements of my recent drawing practice which is also interpreted through the lens of Deleuze (1925-1995) and Guattari (1930-1992). I reference the utopian element to technology to introduce Plato's *The Republic* and the Platonic solids of the *Timaeus*, leading to a discussion of the linear perspective system devised by Brunelleschi (1377-1446) during the renaissance. After a brief examination of the work of twentieth century utopian Buckminster Fuller (1895-1983), an investigation of the process culminating in the construction of my final work will lead to the conclusion.

## 2.

*'mathematics may be defined as the subject in which we never know what we are talking about, or whether what we are saying is true.'* (Russell, B. 1918, cited in Knowles 1999, p.639)

Since 2003 my work has been centered on large-scale installations, that have featured a large array of lights which are controlled either from a bank of switches, or use video or motion sensor surveillance to react to the movements of, or involvement with, the viewer. These works also utilised structures of opposed mirrors to create artificial kaleidoscopic spaces in which the encoded interaction with the audience is repeated in vast and ever-changing patterns. In these works the intent was to create basic simulacra of the experience of interacting with computers and information technologies. The recreation of the formal elements of these systems, such as an organised feedback system ('if I do this then that happens') and a visual display unit, in the context of an art gallery, would stimulate in the viewer deeper questions about our relationship with these technologies.

Early in my masters year I exhibited twice, at the Blue Oyster Project Gallery in Dunedin and at Enjoy gallery in Wellington. The Enjoy show, *Actron and Reactron*, was crucial in that it provided me with a detailed critique that made apparent many issues that had previously been undefined and I was only peripherally aware of. This show featured three works: *Actron* was a bank of 240 rocker switches arrayed around three pyramids that allowed the audience to create

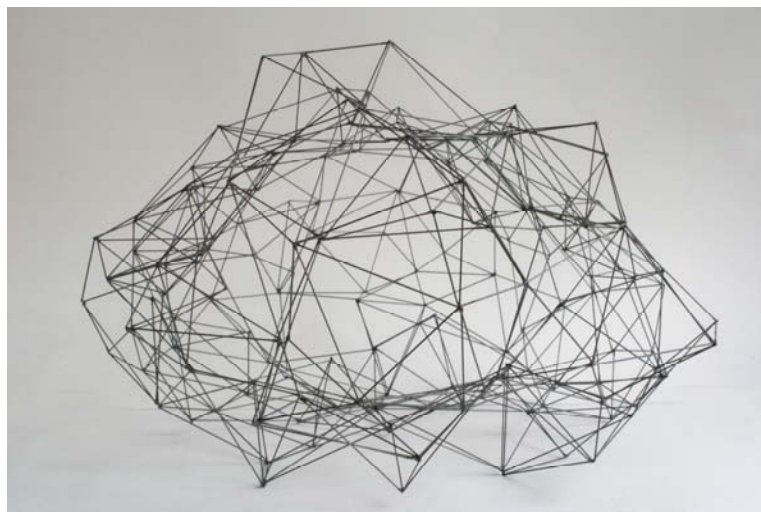
vague, low-resolution forms and potentially draw images on a television screen; *Reactron* consisted of a chamber of opposed mirrors, in which an array of lights triggered by motion sensors spread through the track lighting rack in the gallery created kaleidoscopic patterns of changing configurations. I also included a small 'drawing', a three dimensional construction of 0.5 mm mechanical pencil leads joined to make an irregular geometric outline of some complex solid. Although added late in the process this work, and the other explorations in the series it generated, were to prove crucial in resolving problems identified in both the larger works.



**Fig. 1. *Reactron***  
Author, 2007  
Enjoy Gallery, Wellington



**Fig. 2. Actron**  
Author, 2007  
Enjoy Gallery, Wellington



**Fig. 3. Untitled**  
Author, 2007

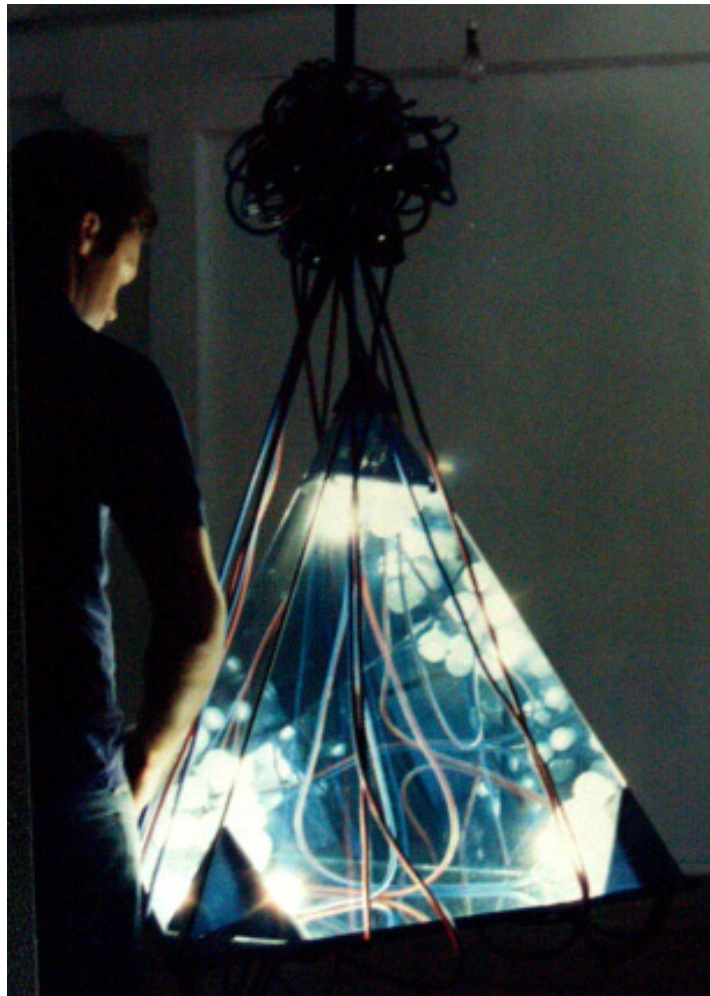
The first issue raised from the critique of the Enjoy exhibition was with the structure containing the works. To different degrees both *Actron* and *Reactron* required the construction of a framework or box to contain or support them. Because these frameworks served a purely functional role I had not given their aesthetics as much deliberation as other elements of the work I thought were central. Necessarily the aesthetics of these structural elements had an impact upon the reading of the works. Unplanned and unwanted associations of materials, finish and form confused and detracted from the works.

This issue was also present in *Constellatron*, at the Blue Oyster Project Gallery, in the form of nylon line used to suspend the clusters of LED lights. Some of these problems would be easily solved. Issues with colour and finish of paint can be resolved by use of better materials and more advanced construction techniques removing any need to paint or disguise perceived imperfections. Other problems such as choice of the shape and form of the structure would turn into major influences on my research and would eventually create valuable opportunities for change and development in new works.



**Fig. 4. Constellatron**  
Author, 2007  
Blue Oyster Project Gallery, Dunedin

A further issue lay in the interaction between audience and object. Key to all recent works had been elements of audience participation - unwilling in motion sensor or video surveillance works like *Tetragrammartron* or *Patron*, or more active in key and switchboard works like *Persevertron*. Questions were raised about the nature of the interaction and audience interpretation of it. *Actron* and *Reactron* did very different, or even opposite things. One the audience acted on, the other the audience was reacted to and a clear rationale was needed to move this aspect of the works from exploration towards resolution. Precisely what would take place between the audience and the object would prove a necessary and fruitful area of research and experimentation throughout my investigation.



**Fig. 5. *Tetragrammartron***  
Author, 2006  
High Street Project, Christchurch



**Fig. 6. Patron**

Author, 2007

Christchurch City Art Gallery; Te Puna O Waiwhetu, Christchurch



**Fig. 7. Persevertron**

Author, 2006

Engine Room, Wellington

### 3.

*'There are no more media in the literal sense of the word – that is, of a mediating power between one reality and another, between one state of the real and another.'*  
(Baudrillard, 1994, p. 81)

My work has been influenced and informed by the practice of many others but I have found an increasing convergence with the work of Olafur Eliasson, the Icelandic-Danish artist famous for works such as *The weather project* (2003) in the Turbine Hall of the Tate Modern in London. Eliasson has created many large works that investigate the artificial representation and manipulation of natural phenomena, as Holger Broecker writes:

*'This change of perception is the basic phenomenon in Olafur Eliasson's work. He is interested in "experiencing the light and perceiving the perception", and in the long run in comprehending both these features in their historical relativity.'*  
(Eliasson, 2004, p.53)

While his work is focused more on the physics of perception, whereas I see my practice as exploring our perceptions of our artifacts and technologies, there is an increasingly common aesthetic to both. I first became aware of Eliasson after exhibiting *Panoptahedron* in 2005; I was looking for other artists working with mirrors when I discovered *Your compound view* (2001). This is a large hexagonal kaleidoscope constructed from opposed mirrors that create the same spherical illusion I have utilised in many of my works. On further study I have found that, although working towards a different goal, Eliasson has pre-empted many features of my work. The idea of building objects where the kaleidoscopic effect is on the outside and disrupts and confuses the reflections of the surrounding environment, which has been a result of my investigations, was also arrived at by Eliasson in *The flower pavilion* (2003). This, and similar works share many formal qualities with the final works of my master's year. My stated goal of pursuing these works to a more irregular geometry will inevitably result in forms similar to that of *La situazione antispettiva* (2003). While Eliasson's work can be described as interactive, relying as it does on producing a consciousness of perception in the viewer, it is (with the exception of works such as *Your utopia* (2003)) a less active interaction than that I aim to produce in my work. Where Eliasson works to produce a perception of perception, and the social history of those perceptions, I strive to illuminate our interactions with our technological artifacts and the corresponding historical evolution of these relationships.



**Fig. 8. *Your compound view***

Olafur Eliasson. 1998

Aluminium mirror, metal, wood, 180 x 180 x 728cm

Kjarvalstadir, Iceland

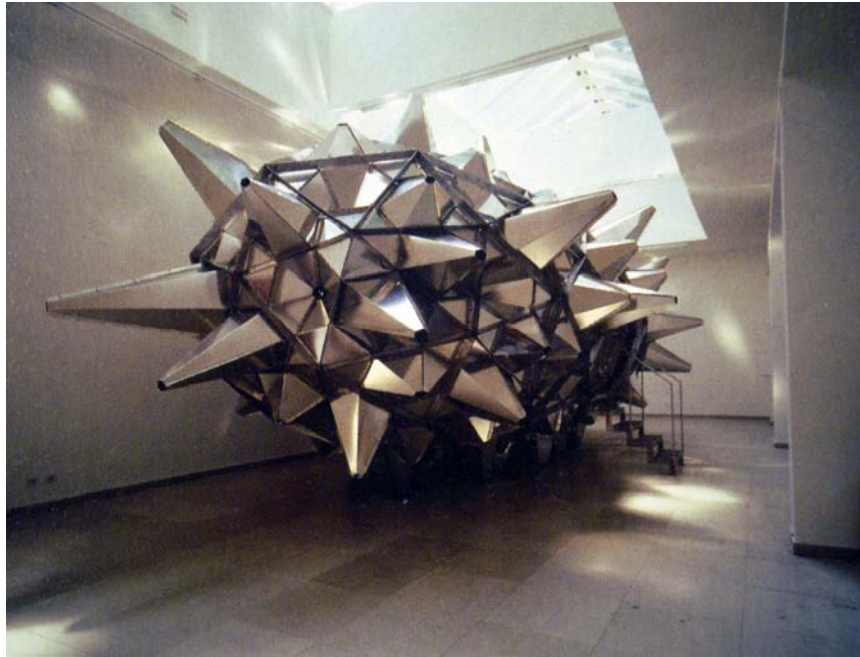


**Fig. 9. *The flower pavilion***

Olafur Eliasson. 2003

Stainless steel mirror, steel, 12.5 x 14 x 14m

5th Shenzhen International Public Art Exhibition, China



**Fig. 10. La situazione antispettiva**

Olafur Eliasson, 2003  
Stainless steel, steel, 5 x 5 x 15m  
Danish Pavilion, Biennale di Venezia, Italy

#### 4.

*'I etch a pattern of geometric shapes onto a stone. To the uninitiated, the shapes look mysterious and complex, but I know that when arranged correctly they will give the stone a special power, enabling it to respond to incantations in a language no human being has ever spoken. I will ask the stone questions in this language and it will answer by showing me a vision: a world created by my spell, a world imagined within the pattern on the stone (...) I design and program computers.'* (Hillis, 1998, p. 9)

Initially I thought my research would focus on the history of human interaction with technology, in particular those technologies that operate via binary systems such as computers. The history of technology is intricately tied to the history of utopias. The ubiquitous rationale and defence for any new technology has been that it will improve the quality of our lives, bringing our societies closer to some concept of a utopia. Implicit in this is the understanding that any new technology is an attempt to predict and control events in the natural world, to impose a human order on our surroundings. As George Basalla writes:

*'technology engages humanity in a direct, active relationship with nature. Men and women use their labor to shape physical reality, thus creating the artefactual realm. Once the natural world is transformed by work, nature becomes a virtual extension of the human body.'* (Basalla, 1988, p.207)

These technologies assume a form or order in the world, so that events may be made

predictable and recognizable. Once an order is imposed on the world, calculation within that order can create new artefacts that have no actual link to the world they exist in:

*'With computer graphics, it is actually now possible to produce images which are the outcome of calculation, and no longer of human gestures. All the images we are acquainted with are the result of a physical action, from the hand drawing signs to wielding a camera. The existence of synthetic images, for their part, has no need of any analogous linkage to the subject.'* (Bourriaud, 2002, p. 69)

I found some evidence that in their earliest incarnations many of these technologies for perceiving and quantifying the environment took the form of divination.

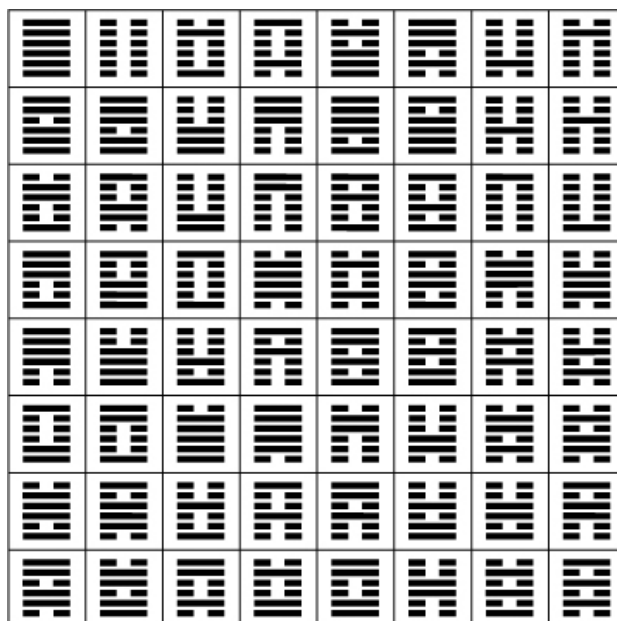


Fig. 11. Table of hexagrams, I Ching

At over 5000 years old, the Chinese classic the *I Ching* (book of change), passed down to us annotated and with commentaries by such figures as Confucius (551 BCE-479 BCE), is the oldest recorded use of a binary system. The *I Ching* is a method of augury that uses a code of 6 lines each of which can be either 'on' or 'off' - a binary code that gives a total of 64 combinations from each reading. The crucial effect of this binary language is that it limits the response of the world at each stage to the act of divining to a simple yes/no answer. As Barbara Maria Stafford put it:

*'In ancient cultures from China to the Mediterranean, the cracks fissuring bovine scapula or tortoise shells after they had been cast into flames during divination rites were carefully scrutinized for messages from the beyond. The portion of the notation termed the charge, (the topic of the divination) was usually, digitally, incised as negative and positive pairs located on opposite sides of the same shell*

*or bone. The enactive, yes-no, format of these graphic replies pressured the spiritual forces of the universe into fleeting dialogue with earthly beings. Over the centuries, this esoteric ancestor of the hypertext link evolved into sophisticated rituals of social contact centered on the visual interpretation of the expressive surface, and gestures of individuals.'* (Maria Stafford, 2001, cited in Maria Stafford and Terpak, 2001, p.25)

This quote, linking the early mechanisms for divination and fortune telling to our contemporary communication technologies was key to my research. In particular I was fascinated by the concept of religion as an early, if not the original technology. Technology here needs to be understood as any system where an information network is used to measure, predict or affect change or events in the natural (real) world. When understood in this fashion the concept of technologies necessarily implies recognition of virtuality: 'virtuality is the cultural perception that material objects are interpenetrated by information patterns.' (Hayles, 1999, cited in Lunenfeld, 1999, p. 69)

Any technology requires virtuality, an order or language of signs, inherent in the material world in order to quantify, measure and make subject to rules and systems. For Confucius this language could be read in the random fall of yarrow sticks, for Gottfried Leibniz (1646-1716) it was an "adamic language", (an original language spoken in the garden of Eden and of which all latter languages are merely sterile corruptions) which he hoped to rediscover, and which he expected to allow the truth or falsity of any statement to be determined solely by calculation. In fact much mathematical research into symbolic logic systems was aimed precisely at this target: a perfect language to enable us to perfectly control. As the mathematical work of people such as Leibniz and George Boole (1815-1864), pioneers in symbolic logic, paralleled by the improving industrial capacities of their societies, led to the development of binary code, the potential of virtuality to provide this ideal code became apparent. As a result I became interested in the question: are material objects equivalent to and interchangeable with information patterns?

The work of Kurt Gödel, an Austrian mathematician and philosopher whose key work *On Formally Undecidable Propositions of Principia Mathematica and Related Systems* (1931) deals with exactly this question. Throughout the history of mathematics and all the empirical sciences that math is the foundation for, doubt had persisted over whether any mathematical system actually related to the material world in any concrete way. One of the greatest mathematical problems has been the creation of a consistent set of axioms that could account for something as apparently simple as the natural numbers (1,2,3,4...). Much of the work of people such as Boole and Leibniz focused on this problem and sought to solve it through the creation of a system of signs that could logically explain and contain all the rules for its own use. It was from this search that the complex symbolic logic systems that would lead to today's computers emerged. Only a self-referential system inimical to logical inconsistency could satisfy this quest. Gödel himself was working on an incredibly elegant and sophisticated system to do exactly this when:

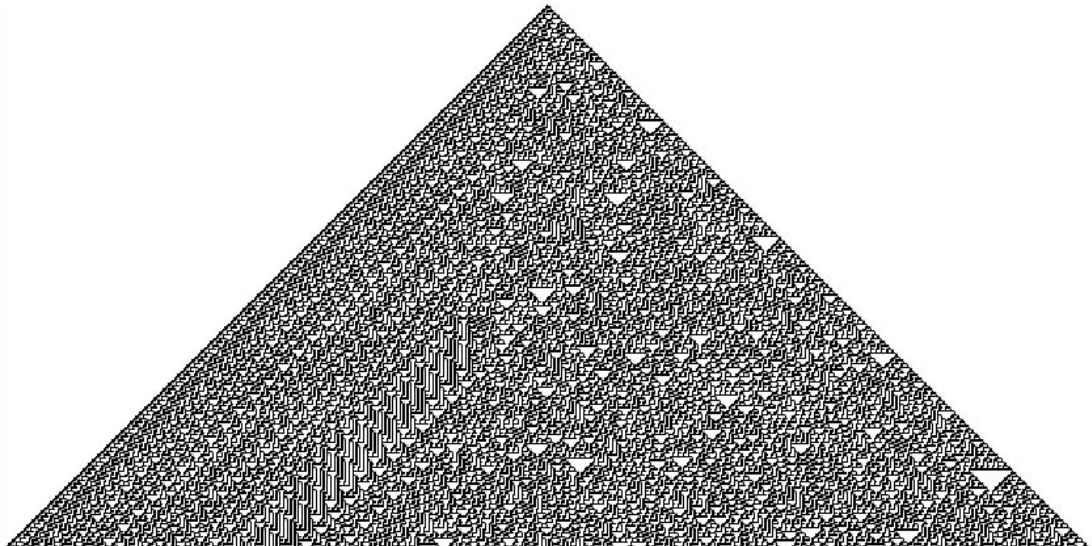
*'A totally unexpected solution was found in 1931 by Kurt Gödel, who showed that the consistency of any theory containing the theory of the integers cannot be proved within the theory itself. In other words, no theory pretending to be a foundation for mathematics can justify itself and must necessarily search for a justification in some external system.'* (Odifreddi, 2000, p. 46)

Known as the 'incompleteness theorem', Gödel's work apparently proves that mathematics and in fact any logical system is an entirely abstract system of signs. Abstract signs can operate with and upon each other to create structures of vast and powerful complexity, but these structures remain abstract and without tangible connection to the physical world. It seems paradoxical that Gödel's refutation of any consistent foundations for logical systems, first published in 1931, should be followed so closely by the creation of electronic computers (1942, Colossus computer, Bletchley Park), the machine that would allow the arcane world of symbolic logical systems to rise to such prominence. The key to this is contained in the final sentence of the above quote from Odifreddi: '...must necessarily search for a justification in some external system'. Lacking any actual foundations the sole value of Mathematics or any logical system must rest in how closely the abstract system can represent reality, the necessary 'external system'. Despite the fundamental flaws exposed by Gödel in the binary model, it ultimately succeeded because anything could be translated into its language. This system, originally planned to order and encode the world, thrives only because the world has been translated for it. I became fascinated by the concept of an inherently logical system forced to account to the chaotic real world for its utility. I became convinced that this dialogue between system and nature led in fact to its extraordinary success. Mathematics accounts for the natural world so accurately that through its ability to map, model and predict the world around us, arts and sciences such as architecture, engineering, physics and chemistry have flourished. Yet at its core, mathematics is a totally abstract system, a list of everything that has worked before rather than an insight to the fundamental structure of our world. From my original research into the history of binary code, my focus had shifted to the histories of technologies, the way they grow and are shaped by our human needs and the way in which they feed back into societal evolution. My goal was still the exploration of human interaction with our technological artifacts, but now I had found an opportunity to address this through an investigation of structure and form.

5.

*'Technology is as old as humankind. It existed long before scientists began gathering the knowledge that could be used in shaping and controlling nature.'* (Basalla, 1988 p. 27)

My research into the history and development of technologies had stimulated an investigation of structure and form. Fortuitously this happened while I was investigating the properties of my new three dimensional drawing medium: 0.5 mm pencil leads. At first I had experimented with these forms out of a frustration in depicting active systems in only two dimensions. After reading Stephen Wolfram's (1959-) book, *A New Kind of Science* (2002), I had become fascinated by cellular automata, simple graphically rendered programs that play out rudimentary or complex life cycles based on simple geometric evolutionary stages. I had experimented with these simple programs as a basis for artwork but was unsatisfied with the results. I came to the conclusion that these shapes and structures could only be communicated in three dimensions.



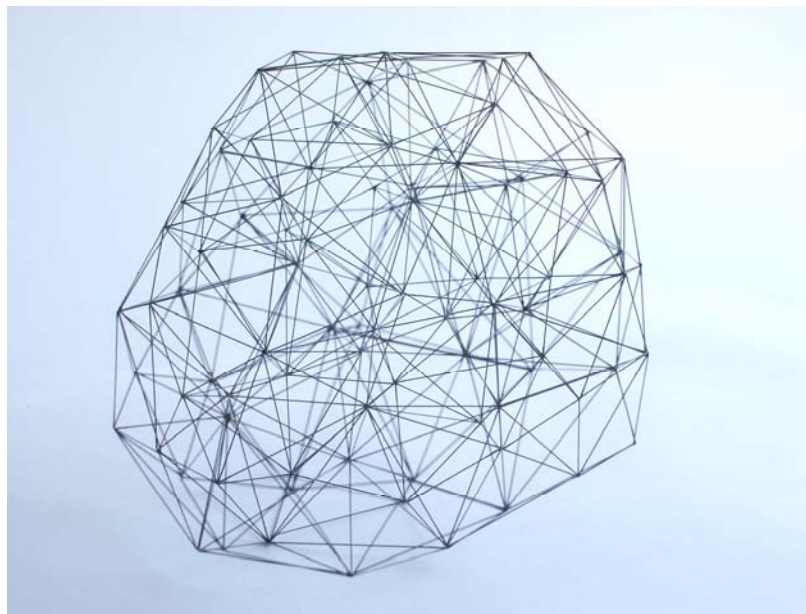
**Fig. 12. Rule 30**  
Stephen Wolfram. cellular automata image.

As I made the first of these works I thought of them in terms of crude, early computer rendering, wire frame vector maps, a technology for drawing and for predicting outcomes and forms in the real world. On reading Deleuze and Guattari's *A Thousand Plateaus* (1980) I came to consider them in light of their distinction between 'smooth' and 'striated' space. Smooth space being interpreted as natural, nomadic and chaotic and hierarchical, while striated space is characterized as artificial, ordered and hierarchical:

*'In striated space, one closes off a surface and 'allocates' it according to determinate intervals, assigned breaks; in the smooth, one 'distributes' oneself in an open space, according to frequencies and in the course of ones crossings.'*  
(Deleuze and Guattari, 1980, p. 530)

This dichotomy between smooth and striated seemed to fit, and add to, my conception of what these works were and what made them so interesting. I interpreted the structures as an illustration of a striated space struggling to account for an area of smooth space: ‘...in the case of the striated, the line is between two points, while in the smooth the point is between two lines.’ (Deleuze and Guattari, 1980, p. 530)

Viewing the works in this way enabled me to clearly relate them to my research. They became models for complex systems struggling to account for the simple realities of occupying space. Constructed from pencil leads, a tool so closely linked to the development and advancement of technologies, the obvious fragility and sheer unlikelihood of these structures reflected the tenuous foundations I had discovered in all logic-based systems. Furthermore the structures created a confused subset of readings of the form itself, as the multiplicity of lines mislead, distract and disorient the eye so that it can be difficult to discern the actual form, or even its dimensionality: photographs of these structures are commonly mistaken for drawings.



**Fig. 13. *Untitled***  
Author, 2008

These works also spoke about drawing itself. A drawing is a plan, a preliminary visualization of something to be undertaken in the physical world, and therefore drawing is actually an ancient technology, a system for organising and mapping information about the physical world and manipulating it in order to change or affect that world. These works have been a delight to construct and much of that pleasure has been because their physical construction has such a direct correlation to, and is informed by, my research. These structures are formed entirely from mechanical pencil leads, only 0.5 mm in thickness, glued together and then, when in a stable formation, most of the glue is burned off leaving a clean join. Because of the extreme fragility of the half-millimeter graphite, any structure formed by these means will necessarily be very delicate. While exploring the possibilities of different forms I was to receive a very extensive

education in the relative strengths and potentials of basic three-dimensional forms. Initially I was using leads of equal lengths and, inadvertently, was experimenting with the series of forms known as the platonic solids. Already I was intrigued by the possible readings of these three dimensional drawings as relating to the ideal forms postulated by Socrates in Plato's *The Republic*. Socrates uses 'those who study geometry and calculation' as an example to illustrate the properties of his ideal forms:

*'you know that they use visible squares and figures, and make their arguments about them, though they are not thinking about them, but of those things of which the visible are images (...) They make them into hypotheses as though they knew them, and will give no further account of them (...) Starting from these, they go on till they arrive by agreement at the original object of their inquiry.'* (Plato, 1906, p. 194)

The *Timaeus*, a dialogue in which Socrates explicates an entire cosmology and one in which the geometric shapes I had been investigating play a key role, explains the ideas behind the platonic solids;

*'Hence, in accordance with valid reasoning as well as probability, among the solid figures we have constructed, we may take the tetrahedron as the element or seed of fire; the second in order of generation [octahedron] as that of air; the third [icosahedron] as that of water.'* (Plato, 1965, p.70)

Socrates goes on to expound a grand unified theory in which the relations and interactions between the four classical elements; fire, earth, air, and water (represented by the four platonic solids (tetrahedron, cube, octahedron, icosahedron) account for light, heat, gravity and matter in much the same way neutrons, protons and electrons do today. The appeal of this system, where 'valid reasoning', 'probability' and even a form of aesthetics, play more of a role than experimentation and calculation seemed natural to me after I had gained some experience in constructing forms from the pencil leads.

There is a telling irony inherent in the logical edifice that Socrates builds upon this elegant yet dubious foundation- illustrated by the central role Tetrahedral Cosmology plays in Plato's theory of perfect forms. The theory of forms is a crucial factor in the utopian vision of *The Republic* as Socrates explains to Glaucon:

*'it will be fitting, Glaucon, to prescribe this study by law, and to persuade those who are to share in the highest affairs of the city to take to calculation, and embrace it in no amateur spirit. They must go on until they arrive by the help of sheer intelligence at a vision of the nature of numbers.'* (Plato, 1965, p. 209)

In *The Republic* geometry and mathematics are praised as vital to the education of the republic's guardians as well as being key concepts to aid the understanding of justice and virtue laid out in this work. In the classical western tradition, this most famous of utopian visions has already established a key idea of technology, namely that the most rigid and abstract of systems (mathematics/geometry) can be the basis for systems of ordering human life. According to this concept, the ability of mathematics to order, classify and predict action and influence in the real world can be exploited to render human action and society orderly and civilized.

Early in the series of pencil lead works there was a definite trend towards the platonic solids. I started constructing solid forms from equal length rods and the discovery of platonic solids such as the tetrahedron, cube, octahedron, and icosahedrons became inevitable rather than fortuitous. However in all these pieces the triangle was a shape that would recur inevitably, and I began to sense an organic nature to the forms that would evolve from these simple geometric roots. In fact one of the chief attractions of these works is the way in which the plethora of lines, bound by a simple set of geometric rules for growth and strength, struggle to form and translate an organic, smooth rounded form. The sheer number of lines required to create these forms in a robust construction, causes a confusion of form. The lines are so thin and fragile that perception of depth becomes difficult and the mind struggles to make sense of the forms that, like the common optical illusion of the transparent cube, alternates between readings of various depth and form. The work then becomes a space loosely translated, the fragility and sparseness of the structure describe and define a space that is confused and open to various readings and perceptions, the shape is that of a simple, striated system battling to confine and control that most subtle and indefinable element, space itself.

## 6.

*'For reasons that are obscure, we began to cultivate technology and in the process created what has come to be known as human life, the good life, or well-being. The struggle for well-being certainly entails the idea of needs but those are constantly changing.'* (Basalla, 1988, p. 13)

The idea of an abstract mathematical system struggling to cope with something as ubiquitous yet ineffable as space naturally led me to consider my work in relation to the development of the system of rendering perspective that is viewed as one of the lasting triumphs of the Renaissance. Early in the Renaissance various mathematical methods were employed to render three-dimensional space in only two dimensions. Some systems, such as the oblique construction used by Giotto (1267-1337) in works like *Meeting at the Golden Gate*, (after 1305) worked tolerably well within prescribed circumstances, while still appearing strange and malformed to the modern eye. The theory of artificial or linear perspective, whose discovery is attributed to Filippo Brunelleschi and was first described by Leon Battista Alberti, (1404-1472) is still the accepted method for the depiction of space in two dimensions. The system is a solely geometrical method for translating space:

*'Alberti sets forth the fundamental principle of Euclidean optics, and establishes the optical foundation of the pictorial diminution to a point, on which the new perspective system is constructed. The definition of the picture plane as an intersection of the visual pyramid is followed by a demonstration of the fact that all the pictured quantities are proportional to those found in the actual objects that are being reproduced'* (White, 1957, p. 121)



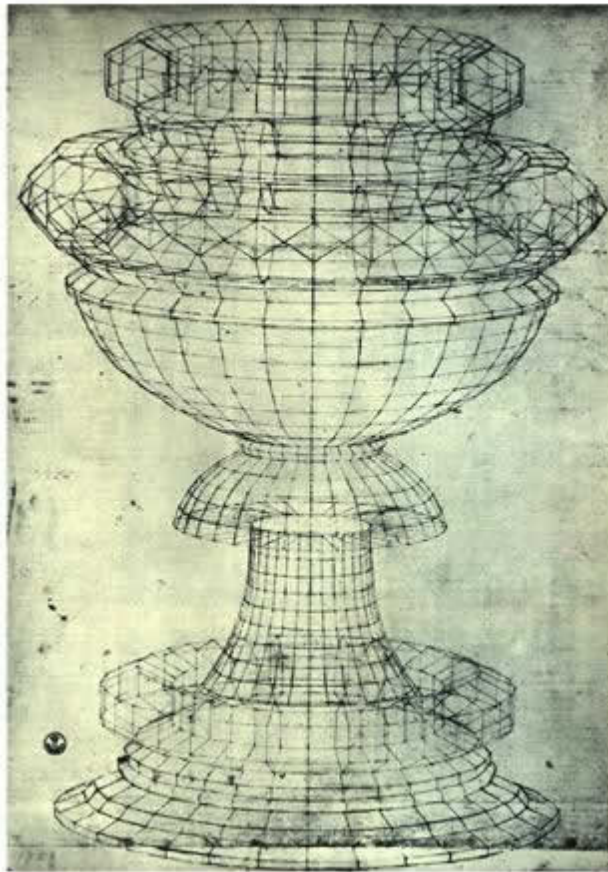
**Fig. 14. Meeting at the Golden Gate**

Giotto, After 1305  
Fresco, 200 x 185 cm  
Arena Chapel, Padua

The definition of the picture plane as a rectangle, parallel to the viewer, was of paramount importance to the development of this system and can be attributed to Brunelleschi's use of mirror in his famous experiments in the Piazza del Duomo in Florence, Italy. The flat rectangular picture plane of the Brunelleschi method was later to be vindicated by experiments with the camera obscura and the development of the camera itself. Because both these instruments display interpretations of reality onto a flat picture plan, analogous to the mirror used by Brunelleschi, the results were seen to prove the reliability of the Euclidean optics based linear perspective system. There is also a strong utopian element to this mathematical mastering of space, as seen in works such as *The Ideal City* (c1475-1492) from the school of Piero Della Francesca (1412-1492) in which the linear perspective is not just a system for transcribing reality, but has become an influence on compositional content as well. This 'ideal' city, arrayed in mathematical proportion and alignment, is notably devoid of people. Despite the continued success of the linear perspective system developed by Brunelleschi, it was neither the final nor most advanced perspective system developed during the Renaissance.



**Fig. 15. *Ideal City***  
School of Piero Della Francesca. c.1475-1492  
Oil on panel, 67.5 x 240 cm  
Galleria Nazionale delle Marche, Urbino



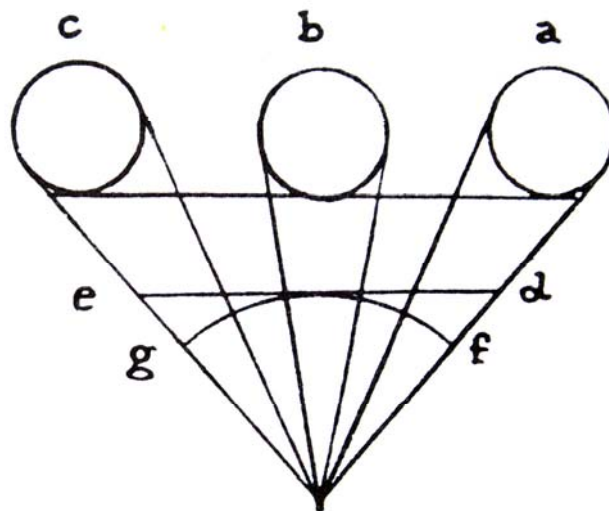
**Fig. 16. *Perspective Study***  
Paolo Uccello, c.1430-40  
Pen and ink, 29 x 24.1 cm  
Uffizi Gallery, Florence

The investigation of alternative systems continued with artists such as Paolo Uccello (1397-

1475) creating perspective studies such as his *Perspective Study*, which bears an uncanny resemblance to wire frame computer graphics, and clearly the tetrahedral cosmology of Plato's *Timaeus* was an influence on these. It was Leonardo Da Vinci (1452-1519) however who formulated the most advanced system of perspective although little of this work has survived to the present day. Da Vinci took the vital step of creating a system where curves are the foundation rather than lines:

*'Leonardo's method entailed foreshortening not only into the picture plane, but horizontally and vertically across it, and this is only possible in a system based on curves instead of on the straight lines used in artificial perspective and its forerunners.'* (White, 1957, p. 207)

The rationale for this new system of Leonardo's lay in several errors he had found in the artificial (or linear) system. Da Vinci attributed these errors to the rectangular picture plane interposed between the viewer and reality, the original mirror used by Brunelleschi. Notorious for dissecting cadavers, Da Vinci knew well that the eye is a sphere and naturally sought to better replicate reality through the use of a system of perspective, known as 'synthetic perspective'. This allows for the translation from three to two dimensional space to be rendered in a more consistent and accurate fashion through a foundation of curves rather than lines. And yet, despite proof of flaws in the system of linear or artificial perspective it is this system that has become the standard (and trusted) method, while Da Vinci's synthetic perspective has remained a novelty- its subtle 'fisheye' effect the exception rather than the rule.



**Fig. 17.**  
Diagram demonstrating flaw in linear perspective system  
Da Vinci, Manuscript A, c.1492

Here then, is another example, parallel and concurrent to that of the self referential

mathematics disproved by Gödel, of a flawed system for ordering space that has continued to thrive and serve despite its proven shortcomings and lack of internal consistency. I was fascinated to discover that these mathematically malformed reflections could become so inculcated in our perceptions that the disparity between their image and the subject it purportedly represents is barely remarked upon. It was this gap between the ordered striated systems describing reality and the chaotic smooth space they sought to explicate that was to generate my work and prove the focus of my practical investigation.

## 7.

*'Technology...the knack of so arranging the world that we need not experience it. The technologist's mania for putting the Creation to a use, because he can't tolerate it as a partner.'* (Frisch, 1957, p.182)

Much of the appeal of these poorly buttressed technologies lay in their alleged ability to offer the promise of utopia. Plato offers a logical, ordered utopia; Piero Della Francesca painted views of the ideal city. The twentieth century saw utopian orders such as Marxism, Capitalism and Fascism, battle for world dominance. Is it only a matter of scale that differentiates between these technological systems which purport to make our lives better and the utopian ideologies that aim to improve whole societies? While Nicolas Bourriaud tells us that:

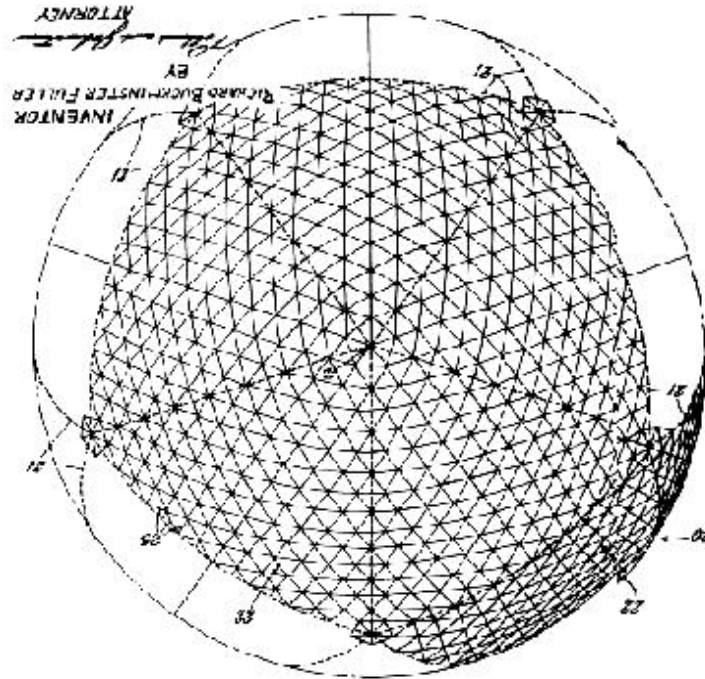
*'It is nevertheless quite clear that the age of the new man, future oriented manifestos, and calls for a better world all ready to be walked into and lived is well and truly over. These days utopia is being lived on a subjective, everyday basis, in the real time of concrete and intentionally fragmentary experiments.'* (Bourriaud, 2002, p. 45)

While in grateful agreement with Bourriaud about this decline of the grand utopian impulse, I would like to briefly examine some aspects of one of the last of the great advocates of a technological utopia, Buckminster Fuller.

Fuller proposed an unashamedly utopian world, where his engineering and socio-economic principles of geometric precision and efficiency were incorporated into an increasingly industrial cultural landscape. In 1963 Fuller claimed:

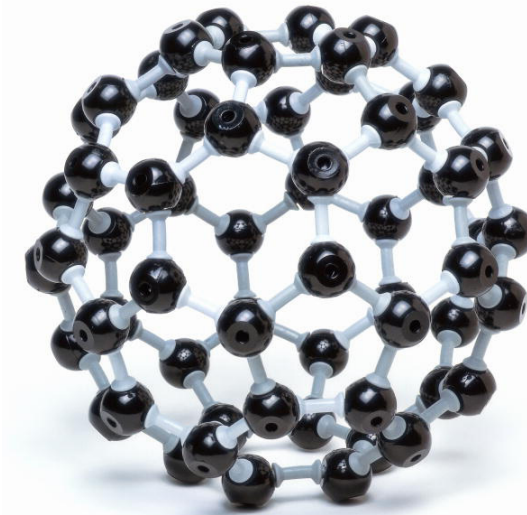
*'industrialisation trends to 'accentuate the positive and eliminate the negative,' first by measuring Nature and converting the principles discovered in the measurements to mastery and anticipation of the vagaries. Day and night, winter and summer, fair weather or bad, time and distance are mastered.'* (Zung, 2001, p. 72)

The use of tetrahedral structures enabled Fuller to construct huge geodesic domes boasting enormous strength for minimal weight and materials. Although optimistically planned as a method for housing the worlds underprivileged, the only large-scale application of his ideas was as housing for a network of military early warning radar radomes in Alaska.



**Fig. 18. Geodesic dome**  
Fuller, B. 1967

As well as the distinct similarities between these structures and the forms I was investigating in my pencil lead constructions, Fuller's work has had an interesting posthumous epilogue in the nascent field of nanotechnology. Researchers have manipulated carbon atoms into new configurations with unique properties, two of the most intriguing and potentially useful of these allotropes are known as 'Fullerenes' or 'Buckyballs'. The exploitation of neo-platonic geometry in this cutting edge technology provides further evidence of the recurrence of these tetrahedral memes in the sciences. The aesthetics of Fuller's work and legacy, both micro and macro, are mirrored in the forms my pencil lead structures evolve from and to.



**Fig. 19. Carbon 60 molecule or Buckyball**

**8.**

*'The mind is a neural computer fitted by natural selection with combinatorial algorithms for causal and probabilistic reasoning about plants, animals, objects and people. That toolbox, however can be used to assemble Sunday afternoon projects of dubious adaptive value.'* (Pinker, 1997, p.524)

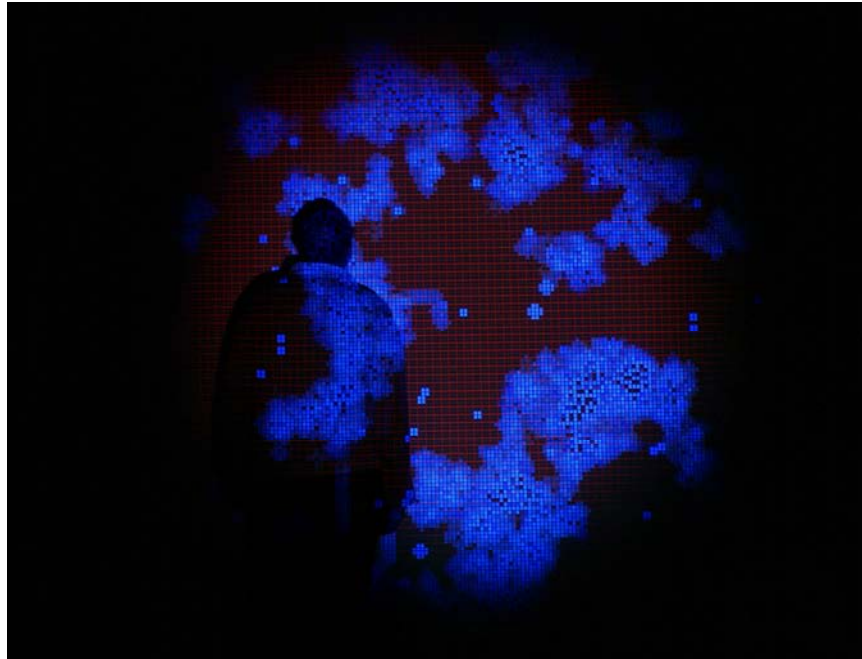
Alongside this research and experimentation with small works, I was investigating different methods of resolving the perceived weaknesses in my larger installation work. My main aim at this stage was to resolve the issue of a frame or box in which I constructed the mirrored, illusionistic spaces. I found it difficult to reconcile the shape, material and finish of these forms, which fulfilled a merely structural role, with the aesthetic aims of the work as a whole. A recurring reading from the audience was that of 1960's or 1970's low budget science fiction prop. As important as science fiction has been to me, I was unhappy with the theatrical, pantomime interpretations that seemed to recur in the reception of the work.

My first strategy was to appropriate the fragility that is such a potent element in the small drawing works, into the larger works. I experimented with a Fuller-type geodesic frame to support and contain the mirrored array. While this approach was more effective than the previous box type constructions, it still raised questions of material choice and even the need for any supporting construction at all.

Another avenue I explored in solving this issue was to use more advanced technology, such as a data projector, in order to render any frame or structure superfluous. I experimented with an interactive projection of cellular automata in which the viewer, through the use of a mouse, could 'seed' or alter colonies of projected pixels which obey simple rules of evolution to grow, move or die out. Cellular automata had interested me since reading *A New Kind of Science* (2002) by Stephen Wolfram, a computer programmer and artificial intelligence guru, who posited these simple linear growth systems as a biologically sourced solution to many of the issues confronting

research into artificial intelligence.

While the use of a data projector to actualize this work had negated any need for a structure that confused or complicated its readings, it also made the entire work virtual. There was nothing real (except for the mouse interface) or physically 'present' in the work. It was the tension and dialogue between the real and the virtual that I had aimed for and enjoyed in my previous work. The use of the data projector had denied one of my stated aims of creating the virtual in a physical object, and the lack of physicality to this work was one of the chief reasons I did not pursue it to a resolution.



**Fig. 20. *Untitled***  
Author, 2007

9.

*'A game is a machine that can get into action only if the players consent to become puppets for a time.'* (McLuhan, 1964, p.259)

I decided to investigate my materials further in the hope that a conscious analysis of these would provide answers. The material that had been central to most of my work was mirrors, usually set in opposition to each other so that the reflections were multiplied to an apparent infinity. I had initially become interested in mirrors as a low-tech analogue to a computer monitor or television screen, a reading reinforced by works such as *TV Buddha* (1974), by Nam June Paik (1932-2006). A mirror, in common with the window, computer monitor, television screen and conventional painting exists within a frame, and within that frame creates a space, (or rather 'non-space'), distinct from our physical position. When removed from the frame the distinction between place and non-place becomes confused. There is our environment and also a fragment of it reproduced in virtuality, a binary coupling that is illuminated by comments such as:

*'Place and non-place are rather like two opposed polarities: the first is never completely erased, the second never totally completed; they are like palimpsests, on which the scrambled game of identity and relations is ceaselessly rewritten. But non-places are the real measure of our time.'* (Augé, 1995, p. 79)

It is relevant that mirror (polished silver) was also the crucial material in Brunelleschi's discovery of linear perspective, in which the non-place was mapped in order to render the natural world reproducible.



**Fig. 21. TV Buddha**

Paik, N.J. 1974

Installation with bronze sculpture, monitor, and video camera, dimensions vary  
Stedelijk Museum, Amsterdam

A crucial point in my analysis of my material came as I studied the use of two-way mirrored glass in the design and construction of high-rise office block buildings. Downtown Wellington features several buildings utilising this material and when in close proximity to each other they reproduce the opposed mirror effect I have used in my own work. When these gridded reflections bounce off each other they confuse the actual form of the building, making the true dimensions less perceptible. Quite apart from being a cheap and effective building material, this mirrored glass serves to conceal, and ensures that the activity within is rendered invisible. Bearing in mind the financial and political aspects of the activity carried out in some of these buildings, I was intrigued by the potentially sinister readings of this 'formal camouflage' and its correlation to the structural illegibility I had so enjoyed in the pencil lead works.

In light of this observation and considering my research, I reached the (now obvious) conclusion that I should turn my opposed mirror structures inside out. Previously the mirrors have always faced inwards, creating a space (non-place) enclosed and separate from the viewer. As well as confusing the boundaries between place and non-place, I was hopeful that by creating a structure composed entirely of mirrors I could mislead and disorient the viewer in a

similar fashion to my small pencil lead works. The construction of an entirely mirrored form would also neatly eliminate the need for a containing or supporting structure, the aesthetics of which had been a major issue with the previous works. I decided that the construction of malformed platonic solids (forms that begin from striated mathematical precision but grow to an organically inexact smooth shape) from mirror was the ideal strategy to reconcile the strengths of both streams of work; the large installations and the small pencil lead structures.

On completing my first entirely mirrored form I photographed it in situ among the architecture that had been a feature in its genesis. These photographs underscored a reading of the work that I found especially interesting- as Brunelleschi had taken a mirror into the Piazza del Duomo in Florence and discovered a mathematical method for rendering space into two dimensions, this abundance of mirrors, in a contemporarily equivalent space had rendered an ordered civic space into a disorienting kaleidoscope. As interesting as I found this effect, it was obvious that it could be amplified by the construction of more complicated forms in the same materials.



**Fig. 22, *Untitled***  
Author, 2008

While the initial work showed much potential, the simplicity of the form limited the extent of the formal confusion created. If I wanted to present the audience with a form difficult to discern, I would need to construct a shape where the mirrors were opposed to each other. The next work was far larger in scale, and while still a regular solid, a pyramid, incorporated concave triangles of opposed mirrors so that the space was distorted as well as reflected. This work featured lights in the apex of these concave triangles that were triggered by an array of motion sensors. Responses to this work questioned what the lights added and it became apparent that this element actually detracted from the purely visual effect of the mirrors and the confusion of space that the mirrored structure achieved. While an improvement in scale and form on the first mirrored work, this piece made it clear that a significant juncture had been reached and decisions had to be made on exactly what form of interaction these new structures would have with the audience.



**Fig. 23. *Untitled***  
Author, 2008

**10.**

*'A 'sculpture' that physically reacts to its environments and/or affects its surroundings is no longer to be regarded as an object. The range of outside factors influencing it, as well as its own radius of action reach beyond the space it materially occupies. It thus merges with the environment in a relationship that is better understood as a 'system' of interdependent processes (...) a system is not imagined; it is real.'* (Celant, 1969, p. 179)

Having made this break with the previous works I was now ready to produce a large work that embodied the progress and decisions made. While still pursuing the irregular geometry of the pencil lead works, I was encountering severe difficulties in constructing these forms to a satisfactory standard. Mirror has useful structural properties, as evidenced by its ubiquity as a building material, yet to construct a solid form without any visible infrastructure was proving extremely difficult. After many abortive attempts, I re-examined the Platonic solids I had found so fascinating in my research. While these simple solids offered no concave forms so that the mirrors could reflect themselves in opposition, I found simple extensions from these solids could produce this effect. Working from an Icosahedral core, I extended each triangular face out to a long narrow pyramid. The resultant, spiky form had a slightly sinister, organic property-reminiscent of viruses (the Herpes virus, among many others, has an icosahedral form), radiolarians and other naturally occurring shapes.

The intended interaction in recent works has been for the audience to be seduced by an arresting, intriguing object, then slowly to become aware that that object is monitoring and interpreting their movements and activity into some coded language, the grammar and syntax of which they are not privy to. The use of motion sensors in my works had become more obvious since *Panoptahedron* (2005). In *Panoptahedron* the motion sensors were mounted high up in the lighting track of the gallery. The less obvious placing of these sensors made the encoding of the audience more subtle than in later works such as *Reactron* where the sensors were used more openly. While a return to a more discrete placing of the sensors may prove to be a solution, there are other methods of producing this coded switching which could be pursued. The installation of pressure switches in the floor would be an ideal solution, as would the use of wireless technology. While I am reluctant to dispense with the 'intestinal coils' of cabling which has become a feature of many of my works, I recognize that I should welcome the opportunity to challenge the audience with ever more mysterious interaction. The cables have provided a visual link between sensor/switch and the visual/audio display component of my work and I have often thought of them as a form of drawing where the cable functions as a line, a line that can carry a charge, a line that can convey information. I am eager to investigate the potential of wireless connections in future works, both in order to make the coding process more mysterious and to explore the ability of this technology to increase the distance over which the coding can take place. With the use of wireless or Internet technology, the information that my objects encode can literally come from anywhere and this provides enormous scope for my work to evolve.



**Fig. 24. *Panoptahedron***  
Author, 2005  
SOFA gallery, Christchurch

## 11.

*'Newton's physics is the mechanics of power and the unconciliatory two-party system, in which the strong win over the weak. But in the 1920's a German genius put a tiny third-party (grid) between these two mighty poles (cathode and anode) in a vacuum tube, thus enabling the weak to win over the strong for the first time in human history. It might be a Buddhistic 'third way', but anyway this German invention led to cybernetics, which came to the world in the last war to shoot down German planes from the English sky.*

*The Bhuddists also say*

*Karma is samsara*

*Relationship is metempsychosis*

*We are in open circuits.'*

(Paik, 1966, p. 24 cited in Paik, 2004, p. 76)

During the year I have spent on my MFA I have found an increased focus on drawing and smaller work has been one of the key advances. The small pencil lead works and associated drawings and photography have been of immense value in shaping the formal and contextual elements of larger installation work, as well as adding another dimension to my practice as works in their own right. I began the year with a goal of resolving the formal issues associated with the larger installation works and feel that, through a somewhat arduous process these problems are now largely resolved. My final work has been a breakthrough in that I could finally construct an entirely mirrored geometric solid, but is also a starting point in that it raised many possibilities for extending this construction technique in more ambitious work. In the future I wish to explore the possibilities of larger, more irregular geometric forms, and the use of one-way mirror to construct them. One-way mirror is a material I utilized in *Tetragrammartron*, and observations on its architectural use were crucial to a pivotal breakthrough. In light of advances made in construction techniques and forms I now suspect this material could be the core of new work that extends the progress I have made. The possibilities of different technologies for interaction, such as wireless switching and its potential for 'action at a distance' involvement will provide opportunity for my work to evolve in the near future.

Initially I expected my research to focus on the history of binary coding and the extraordinary power inherent in such a fundamentally simple language. Unexpectedly this investigation led me instead to an exploration of the history of certain technologies whose evolution illuminated fascinating aspects of humanities relationship to its technologies. The startling conclusions of Gödel's 'incompleteness theorem' and the demonstrated inaccuracies with Brunelleschi's linear perspective system have had little impact on their success or integration into our world. Viewed through the lens of Plato's *The Republic* and *Timaeus*, it became apparent that for all the logic and mathematical precision these works claim as proofs, their actual foundations are found solely in human perceptions, and their utility and success resides in how closely they mirror these perceptions. Rather than the smooth space of the material world being imbued with these

semi-mystical geometrical forms of some obscure higher truth, I found the hierarchical, striated shapes of our technologies to reflect a very human need to control and enforce some order on our environment. This faith in logic and hierarchy to improve life and society is the root of the utopian impulse, the idea that if only we could find the ideal form of society, the perfect shape for civilization, all its failings shall be remedied. The pencil lead works explore these issues through the fragility of their structure and the inherent illegibility of the actual form of a 'drawing' attempting to colonise the third dimension. In my installation work I have investigated objects that mediate aspects of our environment, and yet are (like the pencil lead work) difficult to discern the actual dimensions and form of. The greatest advance has been that I have taken a previously confused and apparently unrelated group of influences and interests and shaped them into a semi-coherent body of ideas. I feel that, through a reconciling of research, drawing and construction I have clarified and perhaps even resolved, many of the issues have troubled me about my practice. The vindication of many of my concepts through historical research, and the manner in which these concepts have made themselves central to the work through drawing and construction have enabled me to address these concepts through a physical investigation of structure and form. I have found a fascinating position to work from, exploring a fragility paradoxically emerging from an abundance of order, a complexity formed from a multiplication of illusions, a formal confusion.

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## Image credits

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Fig. 8, Olafur Eliasson. *Your compound view*. 1998. Aluminium mirror, metal, wood, 180 x 180 x 728cm. Installation, Kjarvalstadir, Iceland.  
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Fig. 9, Olafur Eliasson. *Flower pavilion*. 2003. Stainless steel mirror, steel, 12.5 x 14 x 14m. 5th Shenzhen International Public Art Exhibition, China.  
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Fig. 10, Olafur Eliasson. *La situazione antispettiva*. 2003. Stainless steel, steel, 5 x 5 x 15m. Danish Pavilion, Biennale di Venezia, Italy.  
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Fig. 11, Table of hexagrams, I Ching. From *The I ching and you*, (p.80) Hook, D. (1973). London: Routledge & Kegan Paul Ltd.

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Fig. 14, Giotto. *Meeting at the Golden Gate*, After 1305. Fresco, 200 x 185 cm. Arena Chapel, Padua. From *History of Italian Renaissance Art* (p, 79), Hartt, F. and Wilkins, D., (2003), New Jersey: Pearson Prentice Hall.

Fig. 15, School of Piero Della Francesca, *Ideal City*, last quarter of fifteenth century. Oil on panel; 67.5 x 240 cm. Galleria Nazionale delle Marche, Urbino. From Piero *Della Francesca* (p.318), Lavin, M. A. (2002), London: Phaidon.

Fig. 16, Paolo Uccello, *Perspective Study*, c.1430-40. Pen and ink, 29 x 24.1 cm. Uffizi Gallery, Florence. From *History of Italian Renaissance Art* (p, 265), Hartt, F. and Wilkins, D., (2003), New Jersey: Pearson Prentice Hall.

Fig. 17, Transcription of diagram demonstrating flaws in artificial or linear perspective system, Da Vinci, Manuscript A, c.1492. From *The Birth and Rebirth of Pictorial Space* (p, 209), White, J. (1957), London: Faber and Faber Limited.

Fig. 18, Fuller, B. *Geodesic dome*, 1967, Retrieved June 4, 2008 from [www.rhizomes.net/issue6/armand2.html](http://www.rhizomes.net/issue6/armand2.html).

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Fig. 21, Paik, N.J. *TV Buddha*. 1974. Closed-circuit video installation with bronze sculpture, monitor, and video camera, dimensions vary. Stedelijk Museum, Amsterdam. From *The worlds of Nam June Paik* (p.129), Hanhardt, J. (2000), New York: Guggenheim Museum Publications.

Fig. 22, Author, 2008.

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