# *Making Waves: connecting art, science and principles of ecomuseology*

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# Abstract

*How can geometric abstraction contribute to supporting the preservation of biodiversity and sustainable design?*

Grids dominate the visible and invisible landscapes that design and plan our world. Fast algorithms are paired with meshes to collect and compute data. The thesis addresses what I consider to be the biggest hurdle for the future, integrating design and nature in ways that are sustainable. In proposing solutions, it explains the development and value of slow algorithms in the creation of instruction-based artworks to produce large-scale wall drawings that are immersive, participatory, site responsive and convey fundamental concepts about diversity. The thesis examines the synergy between two distinct areas of activity in my arts practice. One is a contemporary art practice that explores conceptual and intuitive processes of abstraction to make geometric, non-objective art. The other is a collaborative, applied arts practice, working with a variety of everyday people and specialists to develop exhibitions and educational tools connecting local history and the environment in using an eco-museum framework. The thesis focuses on my development of a method of geometric abstraction that combines insights from eco-museology, physics and intuition to create new artworks which act as visualisation tools to convey patterns in nature and beyond in response to the current imperative to preserve biological and cultural diversity. The resultant artworks serve as reflective spaces in which to observe and experience the generation of diversity via abstraction. The thesis identifies future applications of the process of organic geometry, including the generation of adaptive meshes for use in conservation management to help refine our interrelationships with the natural world. Various artworks, projects and exhibitions are documented throughout the thesis and in two appendices to illustrate concepts within the pages of the thesis:

- The first Appendix, *Whoosh #1*, is a prototype instruction-based artwork used as a template for several series of wave drawings and future instruction-based artworks. As this Appendix is an original artwork, a redacted version is included here, access to the complete version of *Whoosh #1* is conditional, see page 321 for further details.

- A second Appendix, *Making Waves*: *activities and outcomes* (2012-19), documents artworks completed during the research period, these including four series of wave drawings, three public artworks and several workshops and talks as well an ecomuseum art program. This Appendix is attached to the thesis, see page 334.

## Declaration

This is to certify that:

(i) the thesis comprises only my original work towards the PhD except where indicated,

(ii) due acknowledgement has been made in the text to all material used,

(iii) the thesis is less than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

Signed:_____

Kerrie Poliness, December 2019

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# Abbreviations

3CR, 3 Community Radio

ARI, Artist Run Initiative

ATSIC, Aboriginal and Torres Strait Islander Commission

CEA, Cost Effective Actions

CFA, Country Fire Authority

CSIRO, Commonwealth Scientific and Industrial Research Organisation

CV, Curriculum Vitae

DIY, Do It Yourself

DELWP, Department for Environment, Land, Water and Planning

DSE, Department for Sustainability and Environment

EPA, Environment Protection Authority

EPBC Act, Environment Protection, Biodiversity, and Conservation Act

EVC, Ecological Vegetation Class

GGRP, Grassy Groundcover Research Project

GMK, Gallery Miroslav Kraljevic

IBRA, Interim Biogeographic Regionalisation of Australia

KGT, Koorie Gardening Team

NAVA, National Association for the Visual Arts

MCA, Museum of Contemporary Art

MLMW, Melbourne's Living Museum of the West, Incorporated.

MP, Member of Parliament

SEM, Scanning Electron Microscopy

STEM, Science, Technology, Engineering and Mathematics

SWOT, Strengths, Weaknesses, Opportunities, Threats

TEM, Transmission Electron Microscopy

UNESCO, United Nations Educational, Scientific and Cultural Organisation

VVP, Victorian Volcanic Plains

# Introduction

Nature arises in the most unexpected places, fills any gap, finds every opportunity, but today the natural environment is increasingly under threat. As we all know, changes such as loss of biodiversity are increasing due to dangerous climate change and untenable exploitation of natural resources, suggesting the need for new approaches to problem-solving. This thesis explores alternative models of art-led, interdisciplinary practice in a range of areas to prompt a transition to a more sustainable future.

## *connections through difference: the gecko and the spider*

In 2009, my family received an unusual message in the post when a marbled gecko and a huntsman spider were found living together in our letterbox. The pair were discovered under a clutter of brochures, which provided a dry, safe home until our disturbance caused them to disappear into the surrounding jungle-like garden in Melbourne's inner west. A keen observers of entropy, my family likes to let things go as much as possible in the garden. Emptying the letterbox wasn't an option as it meant destroying their home. Although hopeful the gecko and spider might return, the practicalities of keeping the letterbox functioning presented a dilemma. What if the creatures ran up someone's arm or were accidently squashed by a parcel? Rather than install a second letterbox, I devised a simple, practical solution to suit everyone, we made a miniature shelter for them inside the letterbox. A lean-to was fashioned using a ceramic tile propped under one edge with a bottle top so all new mail would fall onto the tile leaving the creatures undisturbed below, a few brochures were left beneath to provide nesting material.

That the gecko and spider were living together in the letter box was philosophically intriguing and ethically compelling to me. The two had found opportunity and relative stability in an inner-urban environment. To not support their arrangement seemed uncivilised and ridiculous. Constantly clearing out the letterbox to prevent their return would require more work than building them a shelter. But would they come back? Surprisingly, they did! In the weeks, months and years since, we occasionally check on the pair, carefully lifting the tile to see what is happening beneath. Sometimes, just the spider is there. At other times, only the gecko. Often neither is at home. Occasionally, they are found together.

In 2010, while working on an environmental project, I mentioned the gecko and the huntsman to an ecologist, who explained that huntsman spiders can live for up to 25 years and geckos around 20 years. Both creatures actively hunt for their food at night. The ecologist thought it was likely both creatures were too large for the other to eat. Despite various complications, they had developed a mutual relationship in the letterbox, perhaps even a routine. They had both found opportunity in an ever-evolving city environment and managed to achieve a state of relative stability. Perhaps the letter box serves as a trap for curious insects. Perhaps in living together, they influence each other in some way, learn from each other, maybe even join forces to block an insect's path of escape. Might their co-habitation shift their individual behaviour? Could it have consequences for the evolution of either species down the track?

Their relationship changed my behaviour and how I think about Nature. Any minor shift in thinking and behaviour can potentially have significant consequences. That is the nature of Nature. By helping the gecko and the huntsman continue to live in our letterbox, we participated in their story and visa-versa, a zone of intersection arose.

*Figure 1 Marbled Gecko, photo by Henry Cook.*[1]

In 1989, the author Bill McKibben hoped that describing 'The End of Nature' in a popular science book would trigger a mass call to action on climate change. The fact that Nature is already completely integrated with everything currently considered 'Not Nature' is both a very simple and yet complex, key concept**.** Such an integration is actively refuted because it questions concepts of ownership, responsibility and the dominant global economic model. The naming of the 'Anthropocean Period' and the marking of the 'Great Acceleration' of human activity both attempt to communicate the idea of Nature and people as integrated.

[1] Image source: http://www.arod.com.au/arod/reptilia/Squamata/Gekkonidae/Christinus/marmoratus

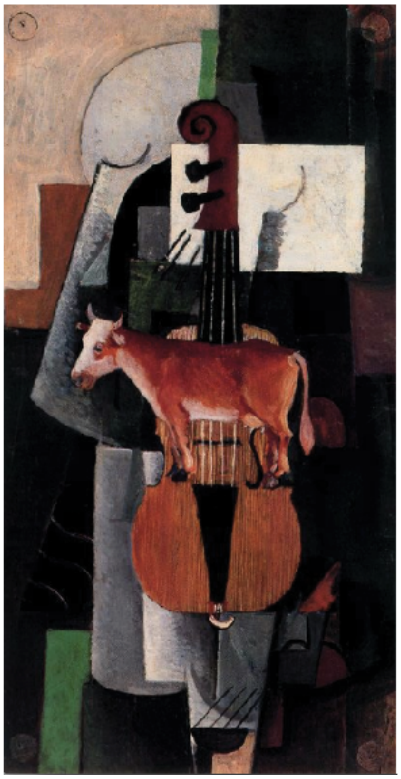

*Figure 2 Malevich, cow and violin, 1915.*[2]

This thesis explores alternative models of art-led, inter-disciplinary practice and research to assist in prompting a transition to a more sustainable future by addressing the need to find new ways to communicate this concept that people and Nature are interdependent and integrated within the one system. It conveys this concept by examining interconnections between science, inter-disciplinary collaboration, museology, geometric abstraction and non-objective art in my art practice. By geometric abstraction I mean the exclusive use of geometry, line and colour to make abstract artworks. By Non-objective art, I mean the conceptual foundation of geometric abstraction in contemporary art, which began to be defined by Malevich in Russia around 1915. Non-objective art is a form of abstraction, usually geometric, which doesn't represent any specific object, figure or scene. It may be influenced by personal feeling, experience and opinion as well as by fact, historical reference and theory. Its origins are here related to the concept of expressing the interdependency of people and nature.

[2] Image source: https://commons.wikimedia.org/wiki/File:Cow_and_Fiddle.jpg

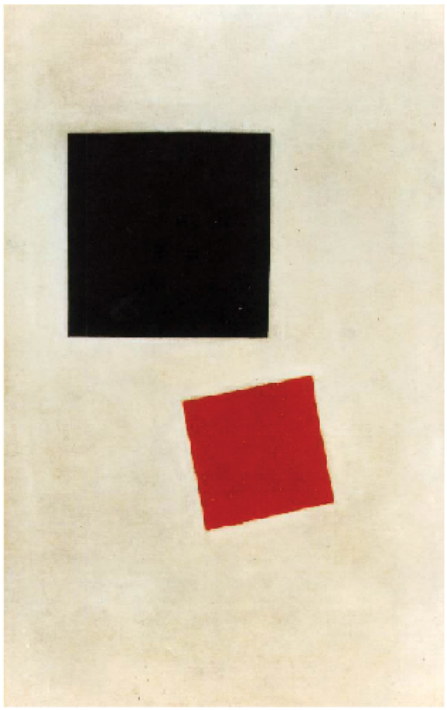

*Figure 3 Malevich, Red and black square, 1915.*[3]

## *Research question*

The relationship between the gecko and the huntsman is an analogy for this research, which brings together varied, seemingly disparate, activities and fields of practice through the following question:

*How can geometric abstraction contribute to supporting the preservation of biodiversity and sustainable design?*

The thesis addresses this question by discussing the development of site-responsive, participatory, instruction-based artworks, the later involving the production of wall drawings. While using the highly restrictive parameters of geometry, straight lines and specific rules, the process of making these drawings incorporates an element of freedom and self-directed exploration. Combined with scale, this provides an immersive space conducive to making personal analogies, a space for reflection. These artworks become a venue in which to frame and to demonstrate specific concepts about the manifestation of diversity and variation.

[3] Malevich, Red and black square, 1915, oil on canvas, 71.1 x 44.5 cm (MoMA)

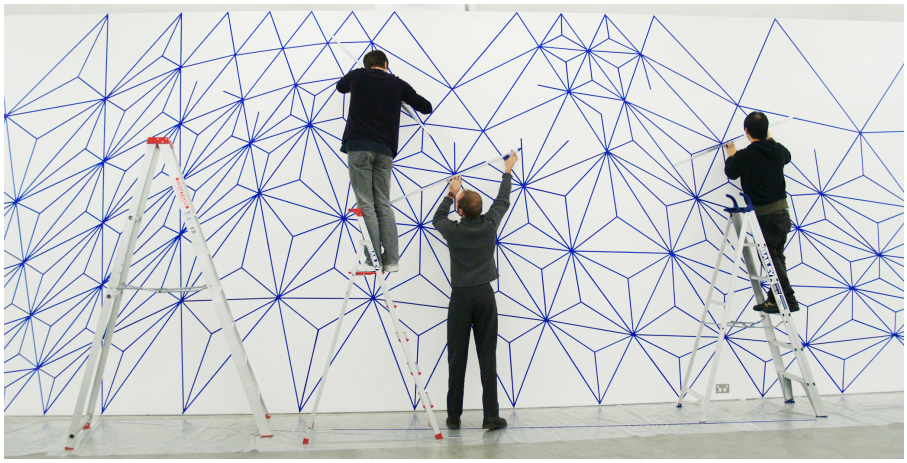

*Figure 4  Blue Wall Drawing, 2007.*

The thesis combines practice-led rsearch, geometric abstraction, physics and ecomuseology principles to develop new participatory instruction-based artworks as visual tools for understanding patterns in nature and information. The research arose from a need to understand particular scientific concepts in progressing my work. The study of physics has led to new connections and ways of working in my practice, the articulation of connections between science, history and the environment, and broad application of these concepts through making site responsive collaborative artworks. The thesis explores the scope for geometric abstraction to communicate complex concepts and interrelationships, addressing the urgent imperative to preserve biological and cultural diversity and knowledge. The research identifies various applications, including in teaching and learning, and in the generation of adaptive meshes, to integrate design and nature in refining our relationships with the natural world.

Building on more than 30 years of studio practice producing participatory artworks in association with specialists from other fields, the thesis examines how interdisciplinary exchange with archaeologists, architects, botanists, environmentalists, geologists, historians, physicists and local indigenous communities has informed the development of an individual art practice. This account provides an important context for establishing new interdisciplinary projects and future research within my arts practice.

## *The research context: multi-disciplinary, practice-led research*

The thesis is informed by first-hand experience of working within the operational philosophy of a community museum. In 1993, I began a longterm artistic residency working with a variety of specialists and others within an ecomuseum framework at Melbourne's Living Museum of the West (MLMW), inspiring the extension of my practice into new directions founded on collaboration and multidisciplinary research.[4] My role was to work as part of a small, but diverse team of specialists to assist the Museum achieve its Mission:[5]

> Melbourne's Living Museum of the West is a community Museum which actively involves the people of Melbourne's West and others in documenting, preserving and interpreting the richness and depth of the region's social, industrial and environmental history.[6]

Located in an industrial region of Melbourne's inner west, the MLMW was founded in 1984 by a group of residents including Joan Kirner, MP for Williamstown, and local historian, Olwen Ford, the Museum's first Director. The Museum was largely set up as an experiment according to the early principles of ecomuseology. The idea of an ecomuseum grew from the climate of social unrest and political activism in the 1960s. The idea of an Integrated Museum as shaped in 1972 at a pivotal United Nations Educational, Scientific and Cultural Organisation (UNESCO) regional seminar in Santiago. At this seminar, cultural experts discussed a new kind of museology that might support sustainable development in impoverished regions.[7]

The meeting issued a set of 'Guiding Principles of The Integrated Museum', which led to the broad re-evaluation of the purpose of museums internationally (Figure 5).[8] These principles comprehensively questioned the approaches of traditional museums to authenticity,

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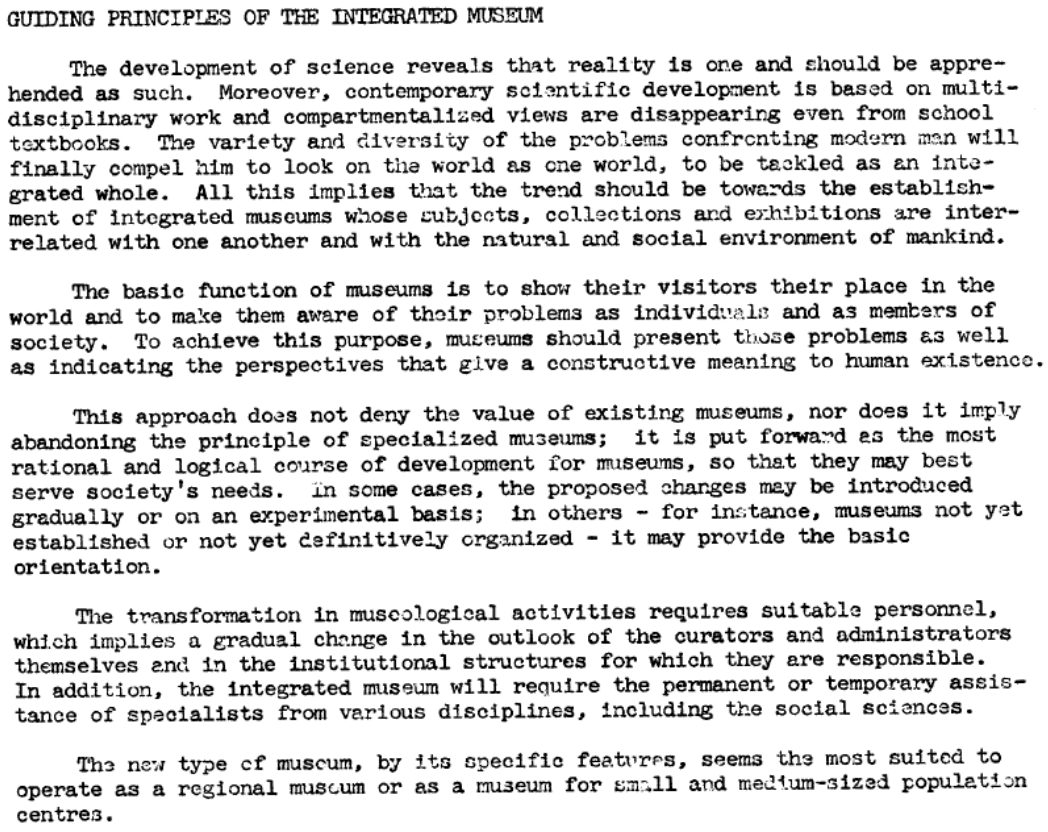
[4] Melbourne's Living Museum of the West Incorporated, Australia's first Ecomuseum, founded in 1984 http://www.livingmuseum.org.au the ecomuseum's or inclusive museum concept emerged in the 1970s through ICOMOS (international Council on Monuments and Sites) the specific concepts are discussed in chapter two.
[5] The core group of specialists at MLMW, although shifting somewhat, included an industrial archaeologist, local historian, Aboriginal cultural officer, horticulturalist and media team with additional specialists and local people involved in specific projects.
[6] 'Mission Statement' Melbourne's Living Museum of the West, Peter Haffenden, *Your History Mate, the Work of a Community Museum in Melbourne's Western Suburbs* (Melbourne: Melbourne's Liviing Museum of the West, 1994).p vi.
[7] This meeting took place in May 1972 sixteen months prior to the military take-over of Chile in September 1973.
[8] Hector Fernandez Guido, "Unesco Regional Seminar, Round Table on the Development and the Role of Museums in the Contemporary World, Santiago De Chile, Chile 20–31 May 1972," (Paris, : UNESCO Regional Seminar, 1973).p 39.

authority, control, meaning and value.[9] MLMW is dedicated to providing an integrated resource for Melbourne's inner west, its built and natural features, its people and their experiences being collected and told through stories, photographs, documents and the participation of its people to inform the region's sustainable development. [10]



GUIDING PRINCIPLES OF THE INTEGRATED MUSEUM

The development of science reveals that reality is one and should be apprehended as such. Moreover, contemporary scientific development is based on multidisciplinary work and compartmentalized views are disappearing even from school textbooks. The variety and diversity of the problems confronting modern man will finally compel him to look on the world as one world, to be tackled as an integrated whole. All this implies that the trend should be towards the establishment of integrated museums whose subjects, collections and exhibitions are interrelated with one another and with the natural and social environment of mankind.

The basic function of museums is to show their visitors their place in the world and to make them aware of their problems as individuals and as members of society. To achieve this purpose, museums should present those problems as well as indicating the perspectives that give a constructive meaning to human existence.

This approach does not deny the value of existing museums, nor does it imply abandoning the principle of specialized museums; it is put forward as the most rational and logical course of development for museums, so that they may best serve society's needs. In some cases, the proposed changes may be introduced gradually or on an experimental basis; in others - for instance, museums not yet established or not yet definitively organized - it may provide the basic orientation.

The transformation in museological activities requires suitable personnel, which implies a gradual change in the outlook of the curators and administrators themselves and in the institutional structures for which they are responsible. In addition, the integrated museum will require the permanent or temporary assistance of specialists from various disciplines, including the social sciences.

The new type of museum, by its specific features, seems the most suited to operate as a regional museum or as a museum for small and medium-sized population centres.

*Figure 5 'Guiding Principles of the Integrated Museum'.*[11]

The MLMW and its archive continues to function as venue and repository for activities and outcomes of engagement. It provides a rich source of materials, research and inspiration for people, including artists of varied disciplines, to develop new ways of interpreting and presenting their history and culture. Yet the Museum remains undervalued, under utilised, under funded and broadly unknown within Melbourne, Australia or beyond.

[9] Hugues de Varine-Bohan, "The Word and Beyond," *Museum* 148, no. (contains insert bulletin Volume 38 issue 4) (1985). P. 185. Note, Hugues de Varine-Bohan was present at the Santiago round table.
[10] Olwen Ford, *The Region Is the Museum : The Museum Is the Region - an Introductory Paper, Melbourne's Living Museum of the West*, ed. Melbourne's Living Museum of the West, Melbourne Western Region Cultural Heritage Study 1985-86 (Melbourne: Melbourne's Living Museum of the West, 1986).
[11] Guido, "Unesco Regional Seminar, Round Table on the Development and the Role of Museums in the Contemporary World, Santiago De Chile, Chile 20–31 May 1972." p 39.

There are more than 400 ecomuseum's world-wide, but MLMW remains the only Australian example as of 2019 based on the guiding principles of 'the 'Integrated Museum'. MLMW has had a positive impact on museology in Australia and has helped lead a shift in policy towards the inclusion and participation of communities in art and heritage projects.[12] Supporting and expanding concepts of intangible heritage, the activities of MLMW demonstrate the agency of the ecomuseum model in regard to sustainable development and community well-being. It is beyond the scope of this thesis to examine the broad influence of MLMW as Australia's only ecomuseum, but the thesis reveals the value of MLMW's operational philosophy and its archive in providing access to the interpretation of history, culture and the environment of any place as an inspiration to an individal artist.

The thesis encompasses three periods of time. The period of active research, 2011-2019, is the main focus. However, this period cannot be disengaged from the formation of my art practice (1985 –1992) or the equally formative period of working at MLMW (1993–2011). Both provide an essential context to the thesis in representing the convergence of theory and practice in art, ecomuseology and science.

In 1985, I began working as an artist full-time, primarily exploring abstraction. By 1988, my practice focused on making geometric and non-objective artworks, producing artist books and publications, while producing regular exhibitions. This extended to curatorial activities with fellow artists in establishing artist-run exhibition venues including Store 5.[13] When I began working at MLMW in 1993, I already had an established art career.[14] Working at MLMW significantly influenced the direction of my art practice while building on and extending my interest in a Do-It-Yourself (DIY) ethos due to its observance of the principles of ecomuseology. Working at MLMW also revealed that the research skills and knowledge acquired during a decade of contemporary art practice could be transferred to the development of educational tools and exhibitions about local history and the environment. While remaining two integral areas of practice and knowledge, contemporary art practice and ecomuseology began to intersect, creating a circuit of mutual exchange that influenced my actions and interests.

[12].Michelle Brown, "Ecomuseums: Creating a Sense of Place in Australia?" (University of Sydney, 2004). This master's thesis by Michelle Brown uses MLMW as a case study to investigate how the role of ecomuseum's may positively contribute to museology in Australia

[13] During this period (1989-93), together with the artists Gary Wilson and Melinda Harper, we co-founded and ran the ARI (artist run initiative), *Store 5*, in Melbourne; and in 1988 with four others I helped run Arson Street, in Bedford Street St Kilda.

[14] By 1993 I'd presented art in 10 solo and 40 group exhibitions, and was represented by Tolarno Galleries from 1991 – 1998, which was directed by Georges Mora then later Jan Minchin.

In support of this account, to summarise the outcomes of my work since 1985, I have presented artworks in over 200 exhibitions in Australia, USA, Europe and New Zealand. I have helped establish and actively support significant Australian artist-run initiatives (ARIs). My work is represented by prominent Australian commercial galleries and in key public, private and corporate collections in Australia. Since 1999, I have been regularly commissioned to design and produce large-scale public artworks.[15]

As part of the multidisciplinary team at MLMW, I began designing collaborative environmental and cultural heritage exhibitions using an "ecomuseum framework" of including various people's stories and perceptions in visual presentations. Combining the focus on geometric abstraction in my contemporary arts practice with the principles and methodologies of ecomuseology developed by MLMW led to the development of a new exhibition format and series of panoramic environmental displays using photographic montage techniques to produce immersive, experiential spaces. These synthesised expert knowledge of the biome of Melbourne's west, being titled *Pobblebonk* and *Volcano Dreaming*. These two museum displays were produced in partnership with Peter Haffenden who developed the exhibition texts. Printed in multiple copies they were designed to travel, to be easily set up in a variety of situations. Their aim was to communicate the understanding of many experts to each other and to a general audience. *Volcano Dreaming* (2009 -11) explores the complex, critically-endangered grassland ecosystem of the Victorian Volcanic *Plains* (VVP), drawing on the knowledge of over 50 experts, mostly scientists. *[16]* A photo-panorama, *Volcano Dreaming* enables viewers to explore information about this environment though an inviting and tranquil space. It provides a wealth of information via immersion and discovery rather than the dominant transmission model used in museums at the time. Discussions with specialists about the environment of Victoria's grassy plains revealed the specificity of their knowledge to my project partner Peter Haffenden and myself.[17] However, we saw that this specificity of knowledge isolated them from each other, making it often difficult for them to recognise and to share potentially related research.[18]

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[15] See a third Appendix, my CV, for further details; ARIs include Store 5 Gallery (1989 –1993) Board of Directors, West Space (2014 – present); commercial gallery representation includes Tolarno Galleries (1990–2000), Sarah Cottier Gallery (1994–2002) and Anna Schwartz Gallery (2001– present); public collections in Australia include Art Gallery of Western Australia; Museum of Contemporary Art Australia; Dowse Art Museum, New Zealand; Griffith University Art Gallery; Monash University of Art; Heide Museum of Modern Art; National Gallery of Victoria; Ian Potter Museum, University of Melbourne; QAGOMA.

[16] Kerrie and Haffenden Poliness, Peter, *Volcano Dreaming,* Photographic panoramic display about the complex relationships of the biodiversity of the Natural Temporate Grasslands of the Victorian Volcanic Plain. , 12 metres long 2 metres high. Inherit Earth. 2011.

[17] Peter Haffenden began work as a media officer at MLMW in 1984 and became the second director after Olwen Ford, in 1997, he is the author of the MLMW publication documenting the first 10 years of MLMW, Your History Mate, 1994.

[18] The full list of participants and contributors of research to *Volcano Dreaming* can be found at http://www.volcanodreaming.com.au/acknowl.html

The purpose of an ecomuseum is to be an accessible repository of people's experience and stories, fostering a more complete understanding of place. We saw the need for an exhibition that contextualised and synthesised the extensive array of detailed, specialist research on Victoria's native grasslands. To develop the exhibition required extensive, detailed research. Having little background in environmental research, we began to search for connections when collecting information. We literally produced a 'big picture' to accommodate the range and extent of research, allowing specialists and the public to orientate themselves in knowledge of the ecosystem. It took nearly four years to put the puzzle together in the resolved form of a panorama 12 metres long and 2 metres high, its scale being a direct outgrowth of connecrting the extent scientific research available.

At the time of writing this thesis, eight copies of *Volcano Dreaming* are in constant circulation, mostly by municipal councils whose territory encompasses the grasslands. The exhibition now forms the signature program of the Victorian science education centre in Bacchus Marsh, Ecolinc[19] where the content has been translated into VELS curriculum notes for schools to access free of charge.[20] It also features as a centre piece in the text book, *Land of Sweeping Plains*, *managing and restoring the native grasslands of south-eastern Australia*.[21]

The ethos, practices and processes of MLMW and Store 5[22] reflect the spirit of DIY culture, self-empowerment and the research model established by Sven Lindqvist, the Swedish writer who began 'the dig' movement with his 1978 publication *Dig where you stand, how to do research on a jo*b.[23] In 1993, Olwen Ford, MLMW's first director, drew my attention to this concept of the broader significance of documenting where and who you are. *Dig where you stand* guides workers in how to record their experiences and expertise regarding their job, reflecting the aim of recognising the contribution of all people to history, thus balancing official versions of history. On its opening page, Lindqvist argues:

> Do not fear the experts. You know your job. Your professional experience is a firm basis on which to stand when judging other people's activities – and non-activities. They may be experts, each one in his own area, but when they

[19] See "Footprints of the Western Volcanic Plains" http://www.ecolinc.vic.edu.au/programs/footprints-western-volcanic-plains
[20] See Ecolinc website: https://www.ecolinc.vic.edu.au/programs/footprints-western-volcanic-plains
[21] Nicholas S. G. Williams et al., *Land of Sweeping Plains : Managing and Restoring the Native Grasslands of South-Eastern Australia* (2015).
[22] Max Delany et al., *Pitch Your Own Tent : Art Projects* (Clayton, Vic.: Monash University Museum of Art, 2005).
[23] Sven Lindqvist, *Gräv Där Du Står : Hur Man Utforskar Ett Jobb* (Stockholm: Bonniers, 1978).

discuss your job, you are the expert. That is why your own job is such a good starting point for your research. Dig where you stand!'

*Dig Where You* Stand inspired the foundation of MLMW.[24] Following Lindqvist's point of view, this thesis examines my experience, presenting my 'research on the job of an artist' over more than 30 years.

Ecomuseology's stress on accessibility and participation is integral to this research. Accessibility means finding comprehensible ways to convey complex concepts to the widest possible audience.[25] This has involved working closely with different communities in contemporary art and ecomuseology who are increasingly linked physically and conceptually despite often not being known to each other. The work and ideas of curator Dieter Roelstraete have inspired artists to see historiography as a significant art practice linked to the politics surrounding the aims and authorship of history. Bill Gammage's *The Biggest Estate on Earth* shows how the history of Australian art is closely entwined with destruction of the environment and racial subjugation of Aboriginal people.[26] At MLMW, I regularly discuss the region's history and environment with artists in organising an artist-in-residency program since 2014 and hosting research projects with art students. This work helps artists connect to their local context in Melbourne and Australia, which is fraught with complexity, conflicted and missing histories, to international practice and to activities that connect to broader histories.

The thesis endeavours to 'kill several birds with one stone'. Like the exhibition *Volcano Dreaming*, it reflects my sense of the need to connect disciplinary specialists who do not normally talk to each other. Within my art practice, the fields of contemporary art and ecomuseology have become synergetic, each driving the other. This research examines the processes of interconnection, mutual benefit and challenge that seek to achieve deeper understanding of a second interconnection. This is the correlation of social, cultural and natural systems that might be achieved by linking actions, conceptualisations, specialist knowledge, skills and stories to preserve biological and cultural diversity in the face of their

[24] Ford, *The Region Is the Museum : The Museum Is the Region - an Introductory Paper, Melbourne's Living Museum of the West*.
[25] This research is presented for cross-disciplinary readers, sections about geometric abstraction and art have been written to convey concepts to artists and to non-artists, the sections about physics and science have been written to convey concepts to scientists and non-scientists.
[26] *The Biggest Estate on Earth: How Aborigines Made Australia, B. Gammage, 2011, Allen and Unwin.*

imminent threat.[27] The central focus of the thesis is to examine the nature of Nature, its detail and patterns by synthesising the knowledge derived from disparate fields.

## *addressing the research question*

*How can geometric abstraction contribute to supporting the preservation of biodiversity and sustainable design?*

Since 1994, my art practice has focused on the production of non-objective wall drawings to develop immersive, participatory, site-responsive spaces in order to convey fundamental concepts connecting diversity, matter and nature. What was initially an individual artistic investigation into spatial experience became participatory through my interest in the ecomuseum philosophy of inclusiveness. Participation expands the possibilities of what can be conveyed through the drawings, communicating ideas through the making process and by experiencing the finished outcomes.

It is relatively clear that *Volcano Dreaming* communicated concepts about biological and cultural diversity. Yet its production was only made possible because of concepts and insights gained through my non-objective contemporary art practice and then devolved to principles of ecomuseology. The thesis examines how the wall drawing projects and geometric abstraction can be used to convey concepts about the generation and preservation of biological and cultural diversity. The research process has required studying physics and developing a new instructional template for the drawings. The thesis encapsulates this story to contextualise the development of a series of new instruction-based artworks called 'wave drawings'. An appendix to this thesis titled 'Whoosh #1' is the first instruction-based wave drawing. The thesis discusses how these drawings might also be used as educational tools by teachers working with students of all levels and abilities to connect art and science or to support conservation planning through use as adaptive meshes in Geographic Information Systems.

This thesis examines the ability of geometric abstraction to communicate complex cultural, scientific and environmental relationships, eeing it become a technology or tool for explanation and interpretation. The thesis includes diagrams that embody key concepts underpinning the research. The reader is encouraged to complete an instruction-based

[27] The United Nations General Assembly at its 65th session declared the period 2011-2020 to be 'the United Nations Decade on Biodiversity, with a view to contributing to the implementation of the Strategic Plan for Biodiversity for the period 2011–2020' (Resolution 65/161)

drawing activity as a part of the process of reading the thesis to demonstrate the value of abstraction in conveying tacit understanding. The sequence of chapters follows the path of the research, presenting my engagement with abstraction as a process of ongoing conceptual and material experimentation that unfolds in connection with other fields.

## *structure of thesis*

After this introduction, the thesis comprises eight chapters, a conclusion and two appendices.

Chapter One, 'The Diagonal and Here', examines my formative engagement with geometric abstraction between 1984 and1989, providing a brief historical contextualisation. A main topic is the restriction of my practice to the diamond-shape and the diagonal as a means of exploring the significance of very small differences. This activity is significant in initiating my interest in science while maintaining an intuitive approach to the production of art. Chapter One establishes the fundamental relationship between material and conceptual experimentation in my practice, which lies at the heart of this research.

Chapter Two, 'DIY Art and Museums, Nature and History', connects my involvement establishing the artist-initiated gallery Store 5 with the principles of the 'New Museology' as embodied in the MLMW. The chapter links ecomuseology, the 'dig movement' and DIY to my art practice to frame the research politically.

Chapter Three, 'A Framework for Exchange, Contemporary Art and Ecomuseums', examines the introduction of 'participation' into my art practice through the influence of MLMW projects, seeing the emergence of participatory, instruction-based artworks. The chapter describes key MLMW projects from the 1990s, *Still Here* (1996)**,** *Womens Shelter* (1997**),** and *the Pipestacks* (1999), as case studies for a multidisciplinary, research-based art practice.

Chapter Four, 'Contextualisation and Work, Making Connections and Outcomes', connects eco-museology and contemporary art through local and international practice, identifying connections between the work of MLMW, its contemporary art programs and current international contemporary art and curatorial practice. This chapter discusses the influence of the artist Mladen Stilinovic on my arts practice. In connecting the origins of arts funding policy in Australia and the ongoing influence of British colonisation, it establishes

commonground between the principles of MLMW as an Ecomuseum and contemporary artists who question established perspectives of history, culture and work to develop ways to examine disenfranchised viewpoints. It discusses the development of artist in residency and contemporary art exhibitions programs at MLMW, making connections between local and international contemporary art projects while arguing the need for new models of accessibility, arts funding and cross-disciplinary collaboration.[28]

Chapter Five, 'Organic Geometry' introduces the place of 'organic geometry' in my work and the role of systems and series-based geometric artworks in leading to my first instruction-based wall drawings. The chapter includes the activity of producing a simple drawing using the process of organic geometry tto demonstrate the operational philosophy of my arts practice. It introduces the drawings' potential to convey a broad range of concepts through participatory processes of making art, especially in relation to science and technology.

Chapter Six, 'Formats and Themes of Interpretation and Engagement', considers my wall drawing projects in relation to the ground breaking work from the late 1960s of Sol Le Witt and Julije Knifer, who first combined geometric abstraction and conceptual art by working on walls. It discusses the format and process of making large-scale, instruction-based drawings in relation to the commodification of art and the potential for embodied learning and analogy making via participatory processes. The chapter explains the thematic development of my work across the series *the Red Matter drawings* (1995), *Black O* (1996), *Blue Wall Drawings* (2007) and *Field Drawings* (2008). Chapter Six introduces a new instruction-based wave drawing project *Whoosh #1* developed over the course of the research as its culmination, explaining the concept of morphogenesis which sits at its heart.

Chapter Seven, 'Connecting Art and Science', addresses the broader research question, explaining the connections between the wall drawings, the nature of Nature and sustainable design. The chapter discusses perspectives from physics into uncertainty and waves to show how the research proposes new ways to describe and experience these. The chapter provides a two-part narrative about the fundamental physical nature of matter, which can be paired with any series of my instruction-based artworks to enable them to be used to convey complex scientific principles to students of all ages and disciplines through the production of

[28] The collaborative residency / exhibition project with West Space, *The Region is the Museum the Museum is the Region*, helped to establish the Museum's artist in residency program in 2014 and attracted an ongoing interest in artists, new partnerships with the VCA University of Melbourne. The University of Melbourne Physics Department incorporated MLMW as a venue for the Universities RIPE program (2014-15).

collaborative large-scale drawings. This chapter explores the fundamental connections between the origins of geometric abstraction and quantum physics.

Chapter Eight, ‘Tools of Visualisation’ demonstrates how geometric abstraction can support the generation and preservation of diversity and the visualisation of complex information. It examines the use of an ecomuseum framework and the spatial research of my wall drawing projects in the development of immersive, photographic panoramas addressed to ecological history and the protection of diversity, notably that of the natural temperate grasslands of the Victorian Volcanic Plain. The chapter explores the visual consolidation of large quantities of data as a tool for knowledge transfer, discussing the use of algorithms paired with meshes to collect and compute data in relation to conservation planning. It demonstrates the application of organic geometry of *Whoosh #1* in this context as an adaptive mesh, which can be topographically overlaid on to any landscape to describe specific relationships between selected features.

The conclusion describes three key ways in which the research has answered the research question in investigating the application of geometric abstraction and immersive, participatory, site responsive spaces in modelling the generation of diversity to create first-hand physical experiences that people can reflect on and use in a self-determined way. The conclusion identifies future directions that have emerged through my exploration of ecomuseology and arts practice, establishing scope for the further development of transformative spaces for the connection and transmission of knowledge across disciplines and practices.

# CHAPTER 1
# THE DIAGONAL AND HERE

The ‘giant impact hypothesis’, the theory of the formation of the Moon, proposes that when the solar system was forming, the Earth collided with a very large object dislodging an enormous chunk of the planet. This remained within the Earth’s gravitational field, began to orbit and eventually formed the Moon. Specific details of the collision, such as the composition and scale of the objects involved, continue to be debated. However, it is thought that this giant impact caused a diagonal shift of 23.5 degrees in the Earth’s axis in relation to its orbit around the Sun.[29] See Figure 6. As the Earth’s axis is not perpendicular to the path of its orbit around the Sun, the seasons were established. The diagonal axis of the Earth’s orbit varies the exposure of parts of Earth’s surface to the Sun over the course of a year. During specific periods of the year, the southern hemisphere is brought closer to the Sun than the northern hemisphere and visa-versa. As a result, the Sun’s light and heat are broadly distributed, seeing temperatures across the planet’s surface become more variable and temperate. If this shift in the Earth’s axis had not occurred, the Earth would have evolved quite differently.

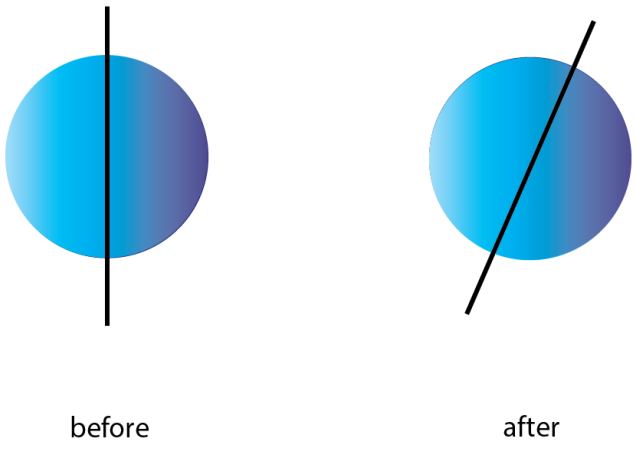


*Figure 6 The shift in Earth’s axis of 23.5 degrees after the ‘giant impact’.*

[29] Karen Jenvey, "Nasa Lunar Scientists Develop New Theory on Earth and Moon Formation," *NASA news feature* (2012), https://www.nasa.gov/topics/solarsystem/features/moon_formation.html.

## *diagonal lines and the diamond-shape; origins and focus*

During 1987, I began an experiment that developed into a 30-year art project. I began to focus on the diagonal in geometry and art. My work was already engaged in geometric abstraction, the exclusive use of geometry, line and colour to make artworks, but I decided to restrict it further to work exclusively with diagonal lines and the intersecting shapes that diagonal lines can form, that being primarily the diamond-shape (Figure 7).

*Figure 7 Showing the intersection of two diagonal lines form the diamond-shape.*

This restriction in the field of geometric abstraction is a form of specialisation similar to that in any field of study. A common path in research is for a line of investigation to become increasingly specific, shifting from generalisation to specialisation. While I expected this experiment in specialisation to last several months, it has grown into an enduring, self-determined research pathway. Most specialists I have worked with from other fields have had a similar experience. They describe how their research began with an initial attraction or curiosity which grew, through persistent intrigue, to observing and following a particular topic above all others. The work of specialists informs knowledge within their broader field. In effect, every art practice is a self-determined research pathway, which becomes a form of specialisation within the broader field of art. If an artwork or practice is to be considered ‘contemporary’, it will contribute to or perhaps challenge the broader, ongoing story of art. My interests in combining abstraction, geometry and science, engage with a long-established history of enquiry by many artists, especially women artists.

*Figure 8 Lyubov Popova, in her studio, 1916.*[30]

Prior to the twentieth century, experimental geometry was the domain of mathematicians and visual geometric designers. The practical applications of geometry are diverse, spanning construction and architecture, decorative arts, garden design, product design and urban planning. The emergence of geometric abstraction coincided with major shifts in scientific understanding.

In 1905, Einstein shook the world of physics by blurring the distinction between a particle and a wave, introducing a new model of *wave-particle duality* according to which similar and unlikely behaviours of electrons, atoms and light could be included.[31] Science was revealing a world of electro-magnetic waves and forces beyond perception, a new sense of spatial relationships and matter. The exploration of geometry as a form of communication, conceptually, emotionally and spiritually, emerged in the work of the Russian avant-garde at around this time, spreading internationally from the early 1920s, firstly throughout Europe, then to the United Kingdom and the Americas, arriving via these pathways in several different stages in Australia.[32]

[30] Lyubov Popova (1889-1924); images source: https://monoskop.org/Lyubov_Popova
[31] Knight, R, Physics for scientists and engineers, second edition, 2008, p601
[32] Sue Cramer and Lesley Harding, *Call of the Avant-Garde: Constructivism and Australian Art* (Bulleen, Victoria, Australia: Heide Museum of Modern Art, 2017).

*Figure 9 Lyubov Popova, 'Painterly Architectonic', 1917.*[33]

The emergence of geometric abstraction in Russia included a significant number of women artists. Alexandra Exster, Natalia Goncharova, Lyubov Popova, Olga Rosnova were pioneers of geometric abstraction along with Hilma af Klint, Sonia Delaunay and Emma Kunz in wider Europe, Agnes Martin in the United States, Bridget Riley in England and Grace Crowley in Australia. All explored form, colour and materials in relation to pattern-making, geometry and the grid as well as forces and realms beyond perceived reality.

Olga Rosnova, 1919 (Russia)

*Figure 10 Olga Rosnova, 1920.*[34]

[33] Image source: https://www.moma.org/collection/works/78444
[34] Image source: https://www.wikiart.org/en/olga-rozanova/abstract-composition

*Figure 11 Grace Crowley painting, 1950.*[35]

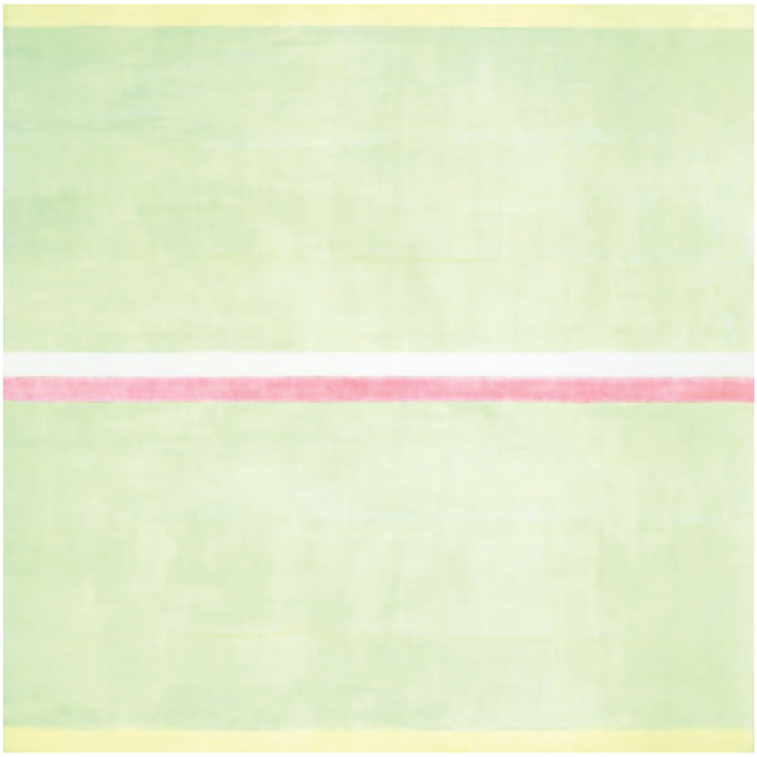

*Figure 12 Agnes Martin, Gratitude, 2001.*[36]

[35] Image source: https://cv.vic.gov.au/stories/creative-life/an-art-history-of-australia/abstract-painting-by-grace-crowley/

[36] Image source: https://aci-iac.ca/art-books/agnes-martin/key-works/with-my-back-to-the-world

The path of research which led to my area of specialisation within contemporary art began with an intuitive shift to making abstract art in 1980. Exposed to work of the Russian avant-garde at a formative time in 1984 via the work of John Nixon, Melinda Harper and Gary Wilson, I became increasingly involved in its conceptual, creative and critical possibilities. By 1985, I focused completely on geometric abstraction, only to reduce further in 1987 to concentrate on diagonal lines and the diamond-shape. Although I didn't know it at the time an intuitive attraction to a specific geometric shape, the diamond-shape, was to become a lifelong project.

Three key reasons have driven the diagonal and diamond-shape to become an ongoing framework for my practice, initiating varied threads of work that I explore within the research presented in this thesis.

## *Diamond reason 1: art as technology*

In 1987, faced with an overwhelming number of potential directions to explore, I decided to rigorously limit my scope of exploration to one shape and one direction — the diamond and the diagonal. This proved to be a liberation. Contemplating their meaning and physicality in art and in the wider world brought immediate focus to my art experiments, formally and conceptually. The diagonal suggests action and dynamics, being literally, visually and metaphorically counter to the horizontal or vertical. In this, the diagonal, and its product the diamond-shape, represented the possibility of alternative ways of thinking and subjects to explore as pictorial devices, symbols, metaphors and things in the world.

As a pictorial device, the diagonal is used to direct attention and create perspective, movement and counter-balance. The diagonal is a key formal device in geometric abstraction, emerging as a main aesthetic and conceptual element in some of the earliest examples of geometric abstraction, including in the work of Mondrian, Malevich and Van Doesburg. To better understand the nature of the diamond-shape and the effects of the diagonal, I began making paintings of a single diamond-shape on various material supports and diagonal painted objects such as a square, rotated 45 degrees. I tested many combinations of scale, figure-ground relations, proportion and colour. The process of engaging in physically making and painting diamond-shapes got me thinking about many things. Chief among these things was my observation that in certain proportions, a diamond-shape suggested an animated, human-like form, ranging from 'fat' to 'thin'. Through

experimentation, I arrived at a neutral proportion, lacking qualities of the anthropomorphic, but then wondered if this were a personal sensitivity or something universally human. I discussed this with others, thinking more and more about what potential differences in perception between individuals might mean in relation to making abstract art. I developed an interest in making the most tranquil version possible of a diamond shape, almost in defiance of the dynamism of the shape. The versions I determined to be the 'quietest' were symmetrical and had particular proportions. These became devices for making larger works and projects, which I continue to make.

From 1987, I painted many series of small diamonds on Perspex sheet. The transparent background enabled the paintings to mere with the locations in which they were installed. For example, when the four corners of a painted, symmetrical, diamond-shape touch the four edges of a plastic or glass rectangular ground, the diamond-shape becomes a refraction or representation of the materiality of the clear object-ground. It becomes a self-referential entity. When the corners of a painted diamond shape do not quite touch the edges of the material support, leaving a small gap, the painting resonates quite differently. When placed in a corner of a room, the 'object about itself' relationship extends to the built angles of the room and thereby to the building. When propped on nails so they lean against the wall, the painted diamonds cast shadows, but the clear plastic does not, emphasising the materiality of the thin coat of paint.

As well as being paintings, these works could be could be arranged in infinite combinations to make site-specific artworks (Figure 13). In this way, the diamond-shape and the diagonal became a tool, an art-technology for conducting experiments on various levels. This included conducting experiments conceptually, as these works challenged my idea of what a painting could be or could do. Exploring their possibilities of the diamond shape through the activities of making and arranging, presented the opportunity to shift my practice beyond the established concerns of geometric abstraction into the areas of materiality, perception, object-environment relationships, resonance and seriality. Like toys, these paintings could be packed away into small boxes at the end of the process.

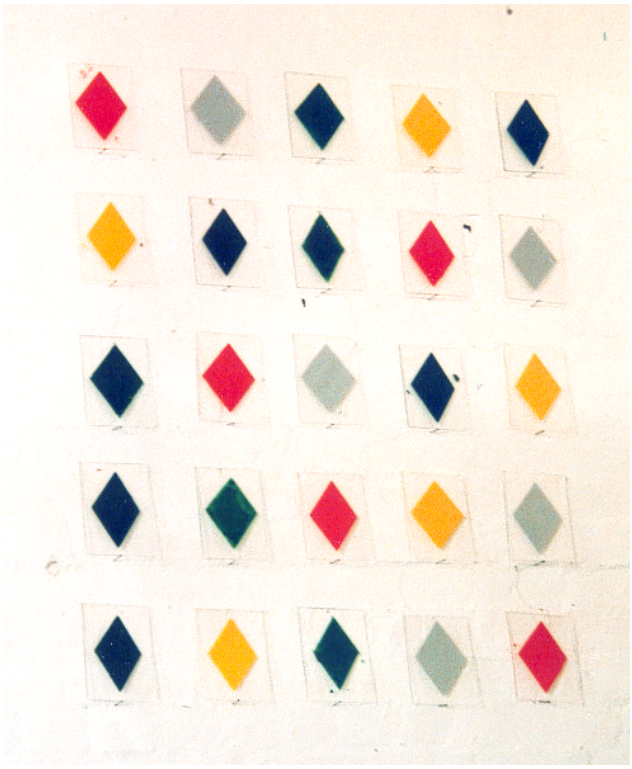

*Figure 13 Untitled Paintings, oil on Perspex, Maples Lane 1988.*

Various formations of these paintings seemed to resonate and hold together as systems. Some were more alluring than others and seemed to contain an energy that I wanted to understand. I began making symmetrical arrangements of the paintings as grids, finding that slightly breaking the symmetry of simple patterns and altering the number of objects in the grouping could result in a more cohesive group that felt self-contained. The process of making arrangements seemed analogous to atoms forming a stable molecule, leading me to think about the material composition of objects, what held them together and what set them apart in the world. I wondered if a stable molecule might have an essential resonance that reflected its ability to form a specific material as individual people form a collective humanity. I began to see the potential of the diamond-shape and geometric abstraction to draw analogies to other things, to represent various scales and to have a physical and material presence.

When the paintings were arranged in an obvious sequence, I saw them as less successful. They appeared sterile, less communicative and more like minimal art to which I have never felt aligned. The most successful arrangements were not complete patterns or sequences

and did not make immediate sense mathematically.[37] They followed simple rules that were slightly interrupted or a bit 'wrong'. Understanding these arrangements required visually deciphering what was odd about them, seeing the 'anti-pattern' elements. I began to think differently about the physical relationship between the viewer and the artwork. Through the manipulation of colour, scale and materials that process could be made inviting or repelling, easy or difficult, my use of formal elements becoming as much concerned with pragmatics as aesthetics. Later, I learned that the structure of molecules has an open-endedness that allows one molecule to join with another molecule, molecular receptors primarily communicate with each other through the compatibility of shape.

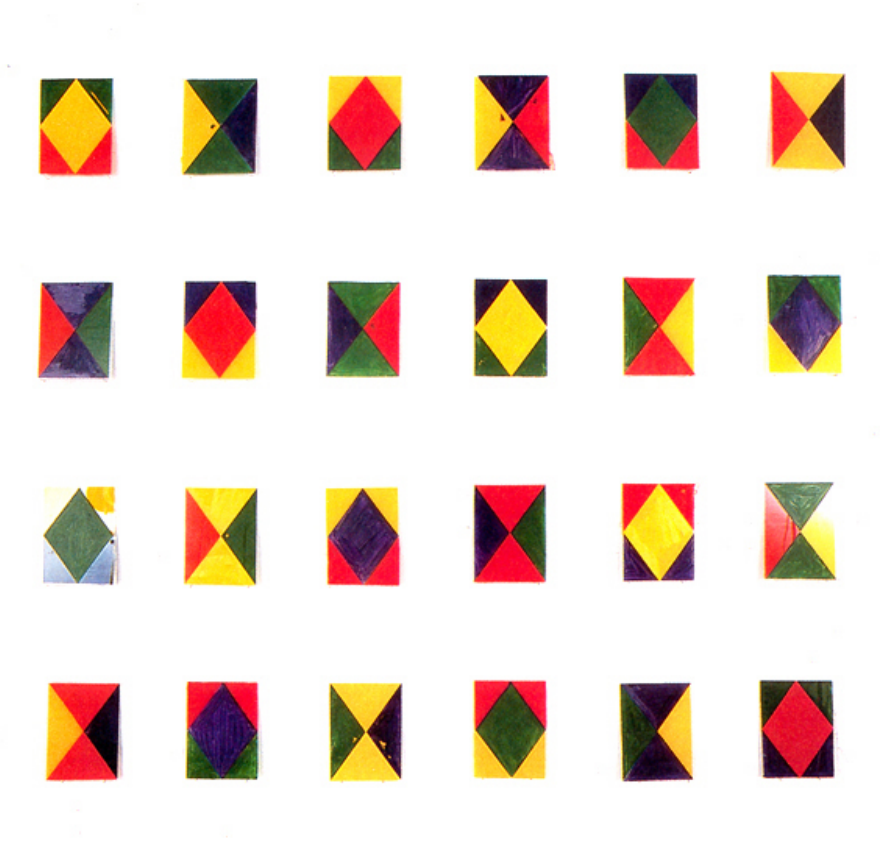

*Figure 14 Untitled Paintings, oil on perspex,1990,_Subversive Stitch, Monash University Gallery, Melbourne 1991.*

[37] My formal studies of mathematics ended after Year 11.

## *Diamond reason 2: the significance of very small differences*

The geometry of the diamond-shape can be used to convey relationships between people and places directly and metaphorically, a concept that can be explained through the nature and meaning of the vertical.

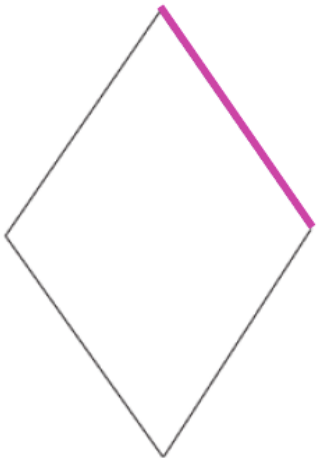

*Figure 15 the outline of the diamond shape is comprised of 4 diagonal lines, one here is highlighted in pink.*

Vertical is the position that we take in the world when standing upright. It represents the visually-dominant, upright presence of most built forms from skyscrapers to electricity poles. For thousands of years, a simple tool called a plumb-bob has been used to establish what is vertical (Figure 16). When suspended from any point, the weight of the bob makes the string-line taught and vertical. Like all objects, the bob is attracted by a gravitational field, directly downwards, toward the centre of the Earth. When the bob is motionless, the string presents a useful guide to determine what is vertical, particularly in building projects.

*Figure 16* Plumb-bob.

Gravitational forces determine both the vertical and the horizontal. Both are always relative to a specific location. Vertical represents a linear direction of attraction directly toward the Earth's centre from any specific location on the Earth's surface. Horizontal is perpendicular to vertical. All vertical lines converge towards the centre of the Earth, representing the direction of gravity. The manifestation of vertical is represented through physical forms across the globe. The relationship between Earth and the collective built vertical lines distributed across its surface can be represented as a gigantic pincushion (Figure 17).

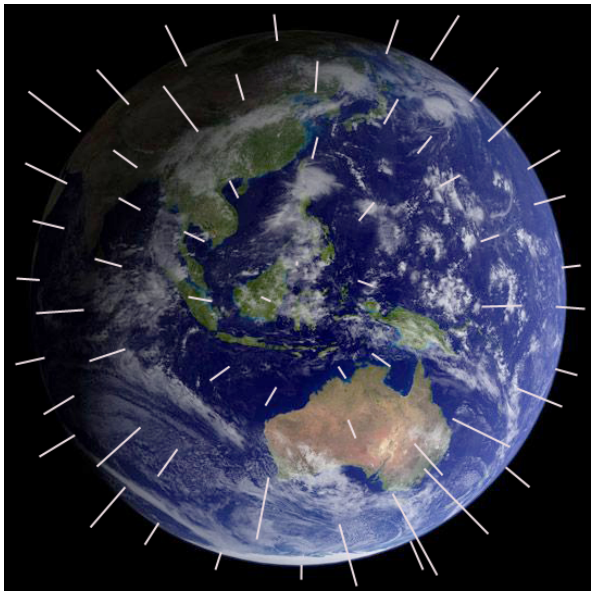

*Figure 17 The Earth as pincushion of vertical lines oriented towards the centre of the Earth.*

Because the Earth is a sphere, a vertical line in Sydney is not parallel to a vertical line in Melbourne, it is diagonal. Horizontality is different, a horizontal line in Sydney could be parallel to a horizontal line in Melbourne.[38] All fixed or built, vertical forms are always moving with the rotation of the Earth in relation to the universe. Relative to the universe and to each other and at any point in time, vertical lines are all diagonal. When standing upright on earth, we are diagonally related to every other person. Diagonality establishes our various perspectives from within the world as individual entities in various locations and through time.

[38] A curved plane of horizontality can be tracked across the surface of the Earth from any one location to any other while also remaining perpendicular to the axis through the centre of the Earth of every location between the two. It is not necessary to understand how this operates to understand this research.

*Figure 18 Earth with two vertical lines plotted at Melbourne and Sydney.*

In my work, the diamond-shape represents the 'diagonality' of things, the relationship of things to each other within a broad spectrum of scale, a place of intersection. I also use the diagonal and the diamond-shape to examine minute, imperceptible differences in things. The diamond-shape symbolises the fact that things might not be what they seem, are never perfect or still and always exist in relation to other things. The concepts of diagonality and verticality reveal an invisible truth about the nature of the built forms by establishing a collective relationship between them. The idea that the vertical lines of a building in a landscape are parallel to each other is integral to the construction of perspective and the creation of the illusion of pictorial space in visual art. Just as pictorial perspective is an illusion, so is the sense that the vertical lines of built forms are parallel.

A plumb-bob line hung at one end of a building is not parallel to a vertical line at the other end of a building; it is diagonal, even if only very slightly. The difference in angle is much smaller than a thin coat of paint, but it is nevertheless a physical reality of all built things in the world. This difference in angle may not have any bearing on any aspect of constructing a single building, but regardless of a lack of practical consequences it is true, the difference is conceivable and measureable on a global scale (Figure 19). On becoming aware of this, my sense of the precision of buildings and other vertical constructions dissolved and I began to see them instead as extremely subtle rhomboids or shapes out of alignment. Within the realm of my total perception of buildings and in relation to any considerations I might need to make about buildings, I cannot disregard this. This small shift in understanding the physical reality of things, this becoming aware of the minutely differing verticality of built form, has been pivotal to my art practice, influencing me to research the nature and significance of

very small differences. It has prompted me to look for situations where very small differences are important and to seek out and make analogies for this.

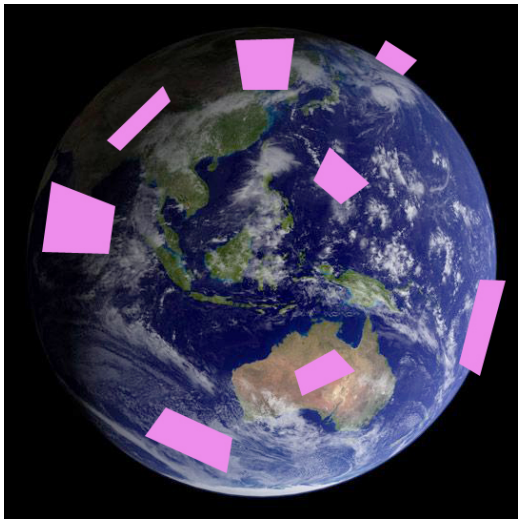

*Figure 19 The Earth with subtle pink rhomboids.*

Understanding the consequences and meanings of very small differences has also been the main driver of my pursuit of science as a fundamental element of my practice as discussed in Chapters Five, Six and Seven in realtion to my wall drawing projects, which focus on the minute, but real differences within and between things as expressed by unfolding relationships between angles and planes as the drawings are made. The science of physics explains that all objects with mass have a gravitational field of attraction, the larger the mass the stronger the field. The gravitational field of our galaxy dominates the Sun. The gravitational field of the Sun dominates the Earth. The gravitational field of the Earth dominates our lived experience. In my work, the diamond-shape represents the shape of intersection of two diagonal linear planes, the intersecting region of two brushstrokes, the centre of an ‘X’, being a place of attraction, connection and a potential source of gravity. The diamond-shape points to itself and to a particular location on Earth, proclaiming that location and itself as ‘here right now’, proposing a moment of clarity or truth.

## *Diamond reason 3: Intuition*

My decision to work exclusively with the diamond-shape in 1987 was intuitive. I found the diamond-shape compelling, a shape of attraction. Understanding of the geometry and

significance of the diamond-shape came later, through exploring its aesthetic and conceptual potential. To say that something feels right at an intuitive level seems subjective, although intuition is not irrelevant to science. If something seems promising on an intuitive level to a scientist, they design the means for its accurate appraisal, the outcome of their testing proving the validity of a hypothesis and informing better guesses. Breaking new ground in any field is generally founded on informed, intuitive, responses. Indeed, science is primarily about making more accurate predictions by assessing and understanding the significance of very small differences.

The human scope for processing information and making decisions is highly complex and not fully understood and includes the capacity to observe and make analogies. [39] Diverse research spanning areas of aesthetics, cognitive science, complexity theory, design theory, experiential learning, heuristics, intuitive mathematics and physics, neuroscience, ontology and the philosophy of physics is currently exploring this human capacity. Discussing the intuitive approach to mathematics in 1961, the mathematician W.W. Sawyer comments that, 'in daily life our thinking is nearly always intuitive … And with this kind of thinking we do manage quite well in practice, so there must be something quite sound in it.'[40] People generally establish their sense of the basic physical parameters of the world quite early in life, through trial and error. Intuition improves with experience, practice and knowledge.

The field of Intuitive Physics shows that people perceive the nature and behaviour of objects in the world differently to the intricacies of their physical reality.[41] However, the intuitive response to investigating a physics problem by a physicist is likely to be more accurate than someone with no knowledge or experience in that field. The example of the Carvone Molecule (Figure 20) demonstrates how finely tuned human perception is. Carvone is a substance found in caraway seed oil. It has two molecular forms that are identical except for the direction of their structural spin, known as 'chirality'. One form of the molecule spins to the right, the other to the left. To be able to 'see' the difference between the two mirrored forms of the Carvone molecule requires sophisticated equipment that uses the different polarizations of light exhibited by each molecule. However, the two can be easily differentiated by the human nose because one molecule smells like spearmint and the other like caraway.[42] That we are able to detect a significant difference between these two

[39] Melanie. Mitchell, *Analogy-Making as Perception: A Computer Model / Melanie Mitchell* (Cambridge, Mass.:: MIT Press, 1993).
[40] W. W. Sawyer, *What Is Calculus About?*, New Mathematical Library (New York: Random House, 1961).
[41] Dennis R. Proffitt and Mary K. Kaiser, "Intuitive Physics," in *Encyclopedia of Cognitive Science* (John Wiley & Sons, Ltd, 2006).
[42] Beth Nissen, """Mirror" Molecule: Carvone"," Video Science Explainer, 01/21/2011 (2011), https://highered.nbclearn.com/portal/site/HigherEd/browse/?cuecard=51988.

versions of the same molecule tells us what sensitive instruments our noses are, their complex structure of the receptors being configured to detect the differential molecular spin of Carvone Molecules.

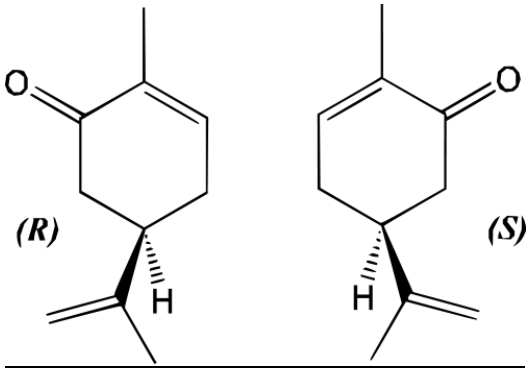


*Figure 20 Carvone Molecule showing mirror molecular structure of the two forms, left and right handed. Image source: Wikimedia commons.*

Most people also have the ability to hear minute shifts in frequency in oscillating sound waves to perceive music and words. Recognising harmonics in music is another example of human sensory sophistication and an articulation of what intuitively feels right. People of differing ages and backgrounds have similar intuitive responses to music and to art. Such phenomena bind us to each other and to the world. 'Cognitive Science' is an interdisciplinary field concerned with understanding how, why and what people are able to perceive and learn. Cognitive scientists do not yet understand what neuronal signals mean or how they work collectively to affect cognitive behaviour.[43] However, cognitive neuroscientists are finding that synapses vary in strength and ability over time, leading them to investigate system-level sensory integration, including the possibility that neuronal plasticity may correspond to variations in demand for information.[44] The more an activity is practised, the more accurate and appropriate intuitive responses are within that activity; practice leads to better informed guesses.

Producing visual art is an ongoing process of acquiring knowledge, every art practice a self-determined research pathway and a form of specialisation within the broader field of art. Most art students are introduced to the concept that an artwork either 'works' or it doesn't,

[43] Melanie Mitchell and Ebook Library, Complexity a Guided Tour, (Oxford: Oxford University Press, USA, 2009), http://UNIMELB.eblib.com.au/patron/FullRecord.aspx?p=472328 Connect to ebook (University of Melbourne only). p.17
[44] Laurence Owen Trussell, Arthur N. Popper, and Richard R. Fay, *Synaptic Mechanisms in the Auditory System*, Springer Handbook of Auditory Research, (New York, NY: Springer, 2012).

which generally means considering if the artwork fulfils or exceeds the intention of making or generates new questions and concepts. Failures lead to new and better-informed experiments, establishing an individual art practice as a research pathway that requires developing a complex and finely tuned understanding of relationships spanning formal, conceptual and material resonance. That understanding informs the language and ongoing story of art, the debate on what art is, what it is not, and what it could be. My arrangements of diamonds in galleries on walls and when placed in the landscape explore the resonance, harmonics, consequences and meaning of making and placing objects in space (Figure 21). It has been an activity of exploring and understanding context.

*Figure 21 Diamond paintings on Perspex placed in the landscape, Landscape Paintings, 1999.*

It is central to my practice that if things strike a chord, they are worthy of investigation.[45] This understanding is integral to this research and the artworks and activities it has generated. [46] It has informed the activities of my *Landscape Painting* project since 1999, when I first began to arrange monochrome diamonds paintings on clear Perspex sheets, making exhibitions outside. These paintings were eventually made en plein air, in the landscape. The scale and proportion of these painting is always the same. It was determined through many experiments, intuitively, as a scale which expressed a particular resonance or relationship between the environment and myself. The colour of each diamond painting is also determined through intuitive process.

[45] During this research I have sought out fields and thinkers that discuss analogy making and affect and intuition. These include the work of Kahneman and associates in psychological studies related to heuristics and affect heuristics, Kristeva's writing about sensation and language, related ontological texts of Deleuze, Spinoza and Kant, debates from the philosophy of science such as that of the 'realists' Karl Popper and Werner Heisenburg, Melanie Mitchell's discussion of analogy making as perception and complex systems, also, briefly, Chris Rust's ideas about tacit knowledge transfer and aesthetic theory.

[46] These are documented in Appendix 2, Making waves: activities and outcomes.

The idea of something resonating is a key element in the decision-making process of constructing an instruction based wall drawing. Participants are asked to make decisions which consider the resonance and physicality of the shapes they construct within a (gallery) space. The direction of lines in these drawings can be altered and adjusted to practise this process, linking people in different ways and on a personal level with the spaces they occupy.

The central focus of this research is to better understand the nature of Nature, its detail and patterns by and synthesising the knowledge from diverse fields. The thesis combines these three reasons for my ongoing engagement and interest in exploring the diamond-shape and the diagonal. It intuitively explores the use of art as a form of technology, a tool of visualisation, for conveying scientific research that investigate the significance of very small differences. The thesis examines the concept of Nature as an integrated system that includes everything currently considered as ‘not Nature’, including non-objective art. It has generated various new projects and research outcomes including a new format and series of instruction-based wall drawings to produce immersive, participatory, site responsive spaces in support of this concept. Nature finds opportunity where it can. Just as it is possible and, indeed necessary, to sometimes shift your perspective from letterbox-owner to letter-box tenant, it is possible that science and many other disciplines might make use of and find opportunity in non-objective art and visa versa.

# CHAPTER 2
# DIY ART AND MUSEUMS, NATURE AND HISTORY

A key motivation behind this research is the need to better understand the multi-dimensional contexts in which I make my work and those I actively avoid. Chapter Two examines my engagement with Do-It-Yourself culture (DIY) and the 'new museology' in relation to my involvement in the artist-initiated, Melbourne gallery Store 5 (1989-1993) and Melbourne's Living Museum of the West (MLMW). The chapter provides a political context for the research, defining an ecomuseum framework and process as a political stance in:

1) actively piecing together a more complete and balanced picture of history;

2) providing an in-depth understanding of nature towards effecting sustainable development and social change and;

3) including people in these processes by providing platforms for first-hand expression and experience.

In discussing Store 5, the chapter examines the importance of establishing connections and acting both individually and collectively in fields of specialisation. In discussing MLMW, the chapter examines the fragility of history and the importance of documentation and accurate historic representation in the face of the difficulties in preserving truth, the pivotally influential MLMW being under threat of being 'written out' of history.[47]

In writing this thesis, I find myself in the unfortunate situation of being one of a few people to inherit information that could help adequately represent the important work of a community museum in Melbourne's west in documenting, preserving and interpreting the richness and depth of the region's social, industrial and environmental history.[48] An 'ecomuseum' is focused on the holistic interpretation of history through local participation in the cumulative investigation of the identity of a place. [49] In this process, the practice of an ecomuseum also aims to enhance the welfare and development of local communities. The Museum's philosophy of supporting an inclusive process of recording, presenting and interpreting

[47] Melbourne's Living Museum of the West was not included in the key definitive text on ecomuseums referred to by Museum studies students, 'Ecomuseums, A Sense of Place' by Peter Davis. Although Davis has apologised for this omission nonetheless the ongoing impact of this omission for MLMW is significant.
[48] 'Mission Statement' Melbourne's Living Museum of the West, Haffenden, *Your History Mate*.p vi.
[49] Ford, *The Region Is the Museum: The Museum Is the Region - an Introductory Paper, Melbourne's Living Museum of the West*.

history has kept me involved in the organisation since 1993, aside from a three year break.[50] This long-term involvement is not ancillary to my art practice. It has extended my interest in making connections to rectify fractured, inconsistent and non-inclusive views of the world. In many ways, my participation in the organisation has been an ongoing artistic residency.

## *Store 5 and MLMW*

### *DIY and Store 5 (1989–1993)*

*Store 5 opened in April 1989 in the spirit of affirmative action as the most constructive and direct way of addressing the limited and limiting exhibition opportunities available to me and my peers at the time*.[51]

Gary Wilson, Melinda Harper and I established the gallery in a disused storeroom off Maples Lane in Prahran (Figure 22). The gallery operated for three years, with the encouragement and support of many people, initially developing with a small core of artists: Stephen Bram, John Nixon, Ann-Marie May, Callum Morton, Rose Nolan, Kathy Temin, Constanze Zikos, and later Marco Fusinato. John Nixon, who was from a generation older than the majority of this group, offered advice based on his extensive experience in establishing artist-run initiatives since the 1970s.[52] Store 5 provided a platform and opportunity, that was otherwise unavailable, for these artists and many others to regularly exhibit their work.

*Figure 22*

[50] Apart from a three-year break which occurred when I left the Museum in 2007 and was asked by the committee to return, during a period of difficulty in 2011.
[51] Deborah Hennessy, *Store 5 Is*, ed. Anna Schwartz, vol. Volume 1, Texts (Melbourne: Anna Schwartz Gallery / Black Inc., 2005), Exhibition texts. Statement by Gary Wilson, 1992, quoted from 'Abstract Art', exhibition catalogue edited by John Nixon and published by Roslyn Oxley Galleries.
[52] Carolyn Barnes, essay about Art Projects in the publication: Delany et al., *Pitch Your Own Tent: Art Projects*.

Following a brief, but extremely positive involvement in the short-lived Arson Street Gallery, St Kilda, in 1988, I was keen to establish a venue as an ongoing and serious concern, where artists shared collective responsibility for the curatorial and management roles.[53] Store 5 initially consisted of one small room on the first floor of a 19th century industrial building. The room was accessed via a narrow, external walkway and got its name from the existing sign on the door.[54] Harper, Wilson and I each had studios and lived in parts of the building, which was situated above and behind the shopping strip on busy Chapel Street. It was close to Victoria College, the art school we had previously attended.

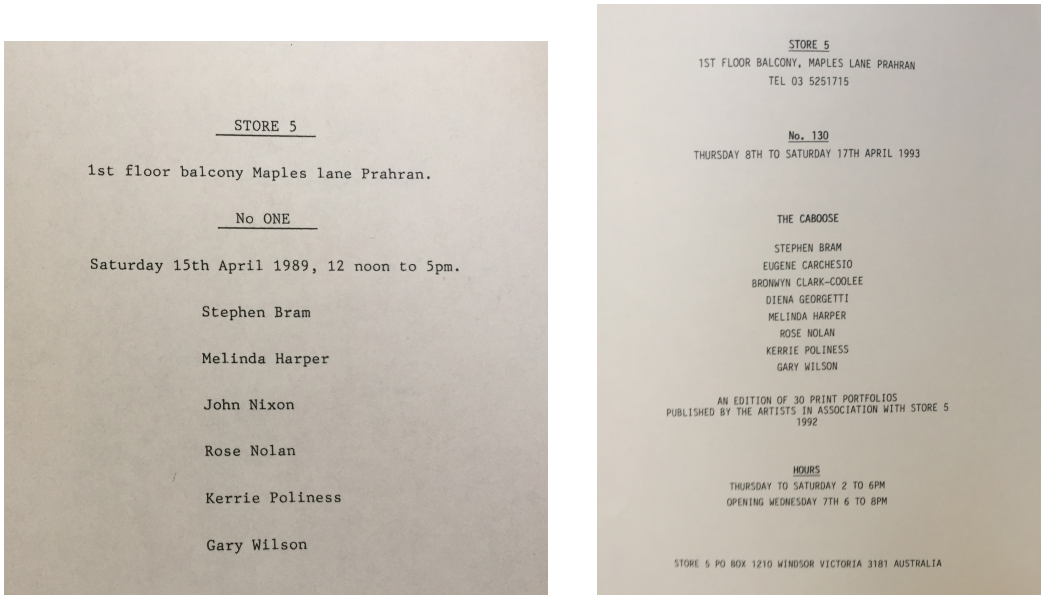


*Figure 23*

[53] Arson Street Gallery was established by Sarah King, Daniel Flood, Callum Morton and Jacquie Everitt in a fire damaged house next door to where they lived in Bedford Street St Kilda in 1988. Set up as an art interventional contemporary gallery where visitors were required to walk across burnt rubble and through various fire damaged rooms to view artworks hung on walls and were greeted at a desk adorned by a large vase of flowers typical of contemporary art venues of the time. The name parodied the convention of using the word 'Street' in the name of a contemporary art venues (such as Gertrude Street and Lennox Street). I had work in three exhibitions at Arson Street and curated an exhibition with work by Melinda Harper and Gary Wilson who installed track lighting in the ceiling in front of his paintings.

[54] The name, Store 5, was first suggested by Jacquie Everitt, one of the founders of Arson Street Gallery who shared a studio in Maples Lane.

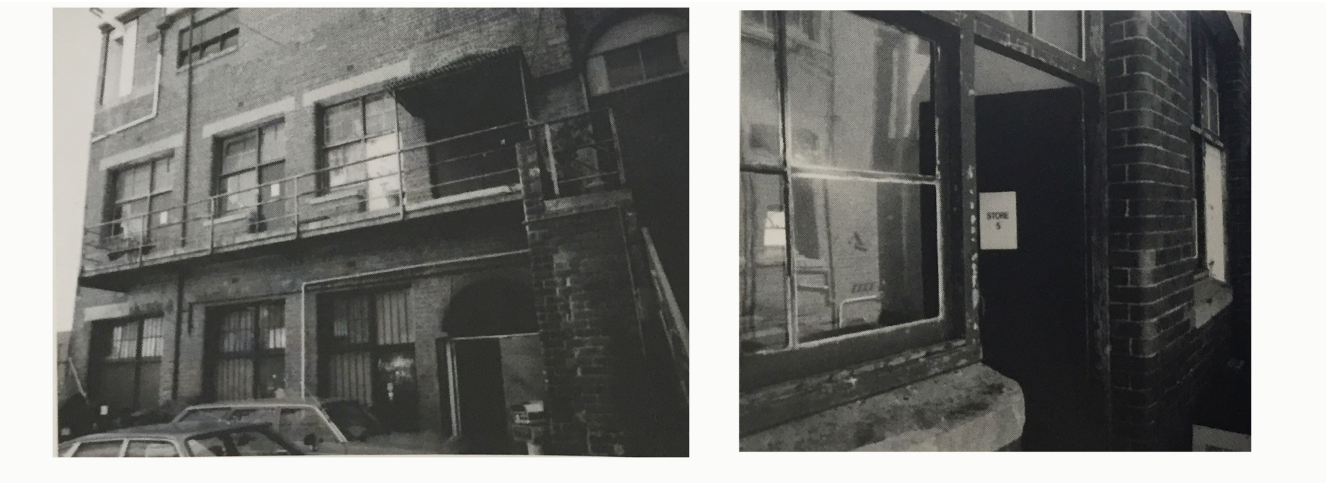

*Figure 24*

The access to regular exhibitions at Store 5 provided the opportunity to experiment in arranging my work, approaches to installation having become an important part of my working process for the perspex, diamond-shaped assembled paintings I was making (Figure 13). This was critical to the development of my practice, the limited and competitive institutional options to exhibit contemporary art in Melbourne at that time meaning that most artists lacked the scope to practice the activity of making exhibitions as a conceptual enterprise. Although small in scale, the opportunity to exhibit regularly soon saw Store 5 capture the attention of a growing audience of artists, curators and writers (Figure 23). The activity of exhibiting work became a dynamic element of my work in the studio. In many ways, Store 5 became a direct extension of the studio. No longer did I make artworks as things in themselves. I produced them with a physical environment and an audience in mind. This DIY gallery initiative developed a community, an ongoing dialogue and an active association between peers and interested parties.

*Figure 25 Showing work from six exhibitions at Store 5. Left to Right:from top row, Rose Nolan, Kerie Poliness, Callum Morton, Constanze Zikos, Rose Nola, Gary Wilson. Images, Gary Wilson and Kerie Poliness.*

The network around Store 5 quickly expanded interstate and then overseas, becoming affiliated with other artist-run spaces: aglassofwater in Brisbane and First Draft and CBD in Sydney. In 1991, Rose Nolan curated the exhibition Magasin 5 in Paris.[55] John Nixon, who regularly exhibited internationally, introduced various artists to Store 5 when they travelled to Melbourne, including Mladen Stilinovic, one of the leading figures in a movement labelled the 'New Art Practice' in Croatia. Many of these artists subsequently exhibited at Store 5,

[55] At Gallerie Canibal Pierce during a residency in Paris.

becoming colleagues. These connections provided opportunities for artists involved with Store 5 to exhibit internationally.

The core group of Store 5 artists and others in the network around the gallery have become my peers and lifelong friends. In the three and a half years for which the gallery ran from April 1989 to December 1993, we supported 150 exhibitions, many held for just one day. Gary Wilson embraced the role of 'Director', his practice expanding to encompass the conceptualisation of the gallery as an art intervention where every aspect of the gallery from its branding to its programming being considered in terms of fitness for purpose, echoing the modernist precept that form follows function. Programming exhibitions and the design of publications was generally a collaborative effort of the core group of artists, being the result of ongoing conversations about the nature of the activity, but as the front person, Wilson was the one who said 'no' to the growing stream of artists wanting to exhibit at the gallery.

By 1993, many of the core group of artists were regularly exhibiting in commercial and publicly-funded galleries. Wilson decided that he no longer wanted to run Store 5 and with no collective or individual interest in continuing Store 5 as it was or reformulating it, the program ended.[56] Store 5 hosted early solo exhibitions of Melinda Harper, Marco Fusinato, Anne-Marie May, Callum Morton, Rose Nolan, Kathy Temin and Constanze Zikos, now all prominent Australian artists. Despite the closing of the Store 5 space, the Store 5 community remains connected. The gallery influenced a younger generation of Melbourne artists to develop a variety of artist-run initiatives. Various texts document the significance of Store 5. Curators and writers directly associated with Store 5 include Carolyn Barnes, Sue Cramer and Ben Curnow. In 2005, Max Delaney's exhibition and scholarly catalogue, *Pitch your own tent*', selected Store 5 to represent a particular generation of artists and as one of the three most influential artist run initiatives in Melbourne.[57] Store 5 also features significantly in *Present Tense* a publication by art writer and commentator Doug Hall.[58]

## *DIY and Melbourne's Living Museum of the West, 1993 – 2017*

The experience of local and international participation in Store 5 which became a dynamic and critical independent platform for expression prompted my general interest in

[56] In 1993 when Store 5 was winding up I asked artists most closely and consistently affiliated if they would be interested in the idea of a new model for programming where each artist would curate and manage several months of exhibitions, however it didn't eventuate.
[57] Delany et al., *Pitch Your Own Tent: Art Projects*.
[58] Doug Hall, *Present Tense, Anna Schwartz Gallery and Thirty-Five Years of Contemporary Art* (Melbourne: Black Inc., 2019).

collaborative efforts and exercises beyond that focused on producing and displaying art. My interest in the politics of history and the environment had lead me to wonder about the role of art practice and exhibitions in developing interdisciplinary perspectives on these matters. I was also curious about crossing the boundaries between areas of knowledge to develop new solutions to deep-seated problems of the world and in learning more about the truth of the history of the place in which I lived. In 1993, a new phase in my work began after taking up a position at Melbourne's Living Museum of the West.

Involvement in MLMW expanded my activity as an artist into completely different domains, transforming it into a multidisciplinary arena for close collaboration with a wide variety of people including indigenous artists, arts political activists, cultural workers, academics, archaeologists, council staff, factory workers, filmmakers, gardeners, landscape and heritage architects, journalists, local historians, migrants, environmental activists, politicians, refugees, scientists, students, teachers, theatre people and other artists, among others. The term 'eco' in ecomuseum is interpreted to mean 'place' or 'here', emphasising the focus on community and locality. The conceptual focus of 'here', represented through the diamond-shape in my art practice, finds common interest with this focus of ecomuseology on a particular place. French museologists, Georges Henri Rivière and Hugues Bohan de Varine[59], developed the concept of an ecomuseum in 1971.[60] In a1993 lecture, Bohan de Varine defined a 'community museum' as:

> one which grows from below, rather than being imposed from above. It arises in response to the needs and wishes of people living and working in the area and it actively involves them at every stage while it is being planned and created and afterwards when it is open and functioning. It makes use of experts, but it is essentially a co-operative venture, in which professionals are no more than partners in a total community effort.[61]

Like those at Store 5, the inclusive and participatory practices and processes adopted by MLMW align with the ethos of DIY culture as reflected in the emergence in the late 1970s of the punk rock movement, independent music and independent theatre. Both Store 5 and MLMW were founded to provide a platform, a means for expression for and by those who

[59] Georges Riviere was the first acting Director of ICOM (International Council of Museums) 1948-65 and a Permanent Advisor from 1968. Hugues Bohan de Varine was Director of ICOM, 1965 – 1974.
[60] Ecomuseums: A Sense of Place, Davis, Peter, London: Leicester University Press 1999.
[61] Tomorrow's Community Museums, lecture by Hugues de Varine, on 15 October 1993, in the Senate Hall of the University of Utrecht.

would otherwise have none.  The commom ethos to give voice to the voiceless, of inclusion and independence, nurtured collaborative and community binding ecologies.

MLMW presented an opportunity for me to work with a large variety of people where I learnt to apply the skills, practical knowledge and sense of cultural and social politics gained in helping to run Store 5 to the development of innovative and experimental museum projects. In turn, I began incorporating what I learnt at MLMW into my art practice. The collective and collaborative nature of MLMW prompted me to develop new work around participatory elements, directly influencing my shift to the production of instruction-based works in 1994.

In 2013, there were approximately 600 ecomuseums internationally.[62] Their diverse locations ranged from Canada, China, Iran and Japan to Spain, with concentrations of ecomuseums in France, where the model was developed, and in Italy, Sweden and the United Kingdom.[63] At the time of writing this thesis MLMW is still the only ecomuseum in Australia in the exacting application of the term. It responds to the unique history and geography of Melbourne's western region, a large geographic area in which Melbourne's industrial inner suburbs merge into its outer suburbs and rural fringe. The geography is flat and rocky, the area sitting on an extensive basalt plain dotted with hills that are the remnants of volcanos. Climatically the area has low rainfall. Melbourne's western region has a population of around 680,000 people, coming from approximately 70 different countries, with more than 42% being born overseas in 2011.[64] The area had significant areas of economic disadvantage. This rich and varied cultural heritage has given rise to cultural and social dynamics that challenge conventional forms of interpretation.

As an ecomuseum, MLMW was established in 1984 as an inclusive, community-driven social history museum, which sought to empower local communities and facilitate social change and sustainable development in a political unit defined as the western region of Melbourne. The Museum's first steering committee comprised local residents in the main and framed a mission to use innovative techniques to involve local communities in researching, documenting and presenting the heritage of a neglected patchwork of sub-cultures. MLMW received a substantial start-up grant through project funding attached to Australia's 1988 bicentenary thanks to the work of MLMWs patron and supporter Joan Kirner

[62] 2013, description of ecomuseum, http://www.flodden1513.com
[63] Simon Stephens, 2013, http://www.museumsassociation.org/museums-journal/news/12042013-ecomuseum-sites-expanded-to-over-40-locations
[64] Australian Bureau of Statistics 2011 census data.

MP, then Minister for Conservation, Forests and Lands.[65] The first committee included meatworkers and union representatives.

*Figure 26*

Initially, the museum was based in a small office space in Williamstown and then in a small house in David Street, Footscray (Figure 26), where a team of 17 unemployed people with a variety of skills and cultural backgrounds were employed as museum staff. This team was guided by five co-ordinators with previous research experience, beginning to collect the intangible cultural heritage of the region and to document and interpret the stories of its people.[66] The museum's Mission Statement defines MLMW as 'a community Museum which actively involves the people of Melbourne's West and others in documenting, preserving and interpreting the richness and depth of the region's social, industrial and environmental history.[67] MLMW has become known for its successful involvement with the local communities and outreach programs. Early projects looked at the history of work in Melbourne's west, the place of women in the region's history and the contribution of migrants to the culture and heritage of the region. Over the years, the museum has explored the built heritage of the region, its Aboriginal and environmental heritage. Furthermore the Museum has enlisted the involvement of artists and art interpretations of history in the presentation of culture and heritage in a variety of formats, like postcards and calendars for example.

[65] Joan Kirner was Australia's second female premier, and the first in Victoria, and held the position until her party was defeated in a landslide at the 1992 state election.
[66] Haffenden, *Your History Mate*.
[67] Ibid.

*Figure 27 The launch of MLMW on the top of the Westgate Bridge in 1984 by the Victorian Minister for the Arts, Race Matthews.*

Rather than conduct research itself, the museum provides support to individuals and local communities to document and interpret their own heritage, for example, the involvement of the local Aboriginal community in documenting and explaining their heritage. MLMW's collection of intangible cultural heritage includes a collection of more than 700 personal stories in the form of recorded and transcribed interviews and over 20,000 photographs of people who have lived and worked in Melbourne's inner west.[68] The collection is generally accessible to anyone who is interested.[69] Since 1984, museum staff and volunteers numbering in the hundreds have been involved in over a thousand specific projects and scores of special programs, researching, photographing and writing about a wide range of topics to do with the unique history and heritage of the western suburbs of Melbourne.

[68] UNESCO definition of intangible cultural heritage: "The term 'cultural heritage' has changed content considerably in recent decades, partially owing to the instruments developed by UNESCO. Cultural heritage does not end at monuments and collections of objects. It also includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts While fragile, intangible cultural heritage is an important factor in maintaining cultural diversity in the face of growing globalization. An understanding of the intangible cultural heritage of different communities helps with intercultural dialogue, and encourages mutual respect for other ways of life.
The importance of intangible cultural heritage is not the cultural manifestation itself but rather the wealth of knowledge and skills that is transmitted through it from one generation to the next. The social and economic value of this transmission of knowledge is relevant for minority groups and for mainstream social groups within a State, and is as important for developing States as for developed ones." "Intangible cultural heritage is: traditional contemporary and living at the same time; inclusive; representative; and community based." For further details: http://www.unesco.org/culture/ich/en/what-is-intangible-heritage-00003

[69] There are some particular restrictions placed on access by recorded interviewees.

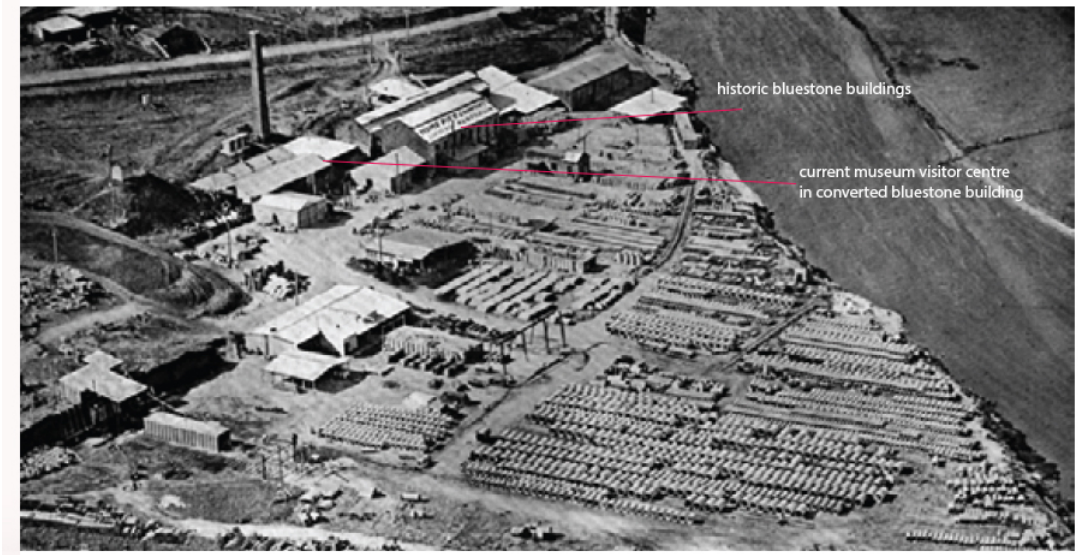


*Figure 28 Aerial view of Hume Pipes factory site c.1930.*

In 1989, MLMW relocated to a heritage building at the former Hume Pipes factory site (Figure 28) after a successful, community-led campaign to save the site and historic bluestone buildings as a public park, which MLMW helped to initiate and support. Pipemakers Park is situated on the banks of the Maribyrnong River in the City of Maribyrnong.[70] The impetus for the occupation of an industrial site was the village of La Creusot, France, where an entire village became a museum an ecomusée and the people who worked there recorded, documented and presented their own history and turned their village into a tourist destination. The MLMW mission takes the physical region that it serves and researches as the 'Museum', the Visitor Centre at Pipemakers Park being a resource centre in which to keep safe and provide access to the archive. 'The region is the museum, the museum is the region' became the Museum's mantra, being the title of Olwen Ford's 1986 introduction to the museum, an introductory paper and a key document in the establishment of Australia's first ecomuseum.[71] In 2018, MLMW was being run by a volunteer committee on which I have served since 2008, working to convert its archive into digital formats that can be accessed more readily by the public. Despite the absence of government funding since 2007, the MLMW committee continues to manage and deliver a program of events including a thriving artist-in-residence program with contemporary art

[70] Gary Vines and Olwen Ford Gary, "Pipemakers Park Conservation Plan and Analysis," ed. 1998 (Melbourne: Melebourne's Living Museum of the West, 1998).
[71] Ford, *The Region Is the Museum : The Museum Is the Region - an Introductory Paper, Melbourne's Living Museum of the West*. Western Region Cultural Heritage Study, commissioned by the Western Region Commission, 1985-86.

exhibitions held in the historic bluestone buildings since 2014, based on MLMW archival research residencies.[72]

## *Dig Where You Stand*

At MLMW, I began a long working relationship with Olwen Ford, MLMW founding Director (1984 -1997), Gary Vines, MLMW industrial archaeologist and heritage consultant, Larry Walsh, MLMW Aboriginal Cultural Officer (Cultural leader and Taunwurrung pure storyteller) and consultant and Peter Haffenden, initially MLMW Media Officer, journalist and photographer and later MLMW Director (1997-2007). Working with these people, I became immersed in investigating my locality and how it related to making art in Australia. Between 1993 and 2007, we worked together in the open office environment of the MLMW on multidisciplinary projects that was for me a form of 'university' in the original sense of the word.[73] These four key influencers on my work helped me understand the complexity of documenting history and the importance of understanding the history of a place and passing it on, such is the precariousness of historical knowledge.

Olwen Ford introduced me to a method of recording history that she called 'Dig Where You Stand'.[74] Ford, a local historian, migrated to Australia from Wales in the early 1970s and lives and works in Sunshine, where she raised five children. She is the author of two definitive histories, one on the McKay Sunshine Harvester company and the other on the City of Sunshine.[75] Until this research project, I assumed that Olwen's saying, "Dig where you stand" meant investigating where you are, but later learned of its formative connection to DIY culture, confirming the link between MLMW's ethos and my art practice. The expression is the title of a manual on oral history research — *Dig Where You Stand: How to do Research on a Job* — by the Swedish philosopher and researcher Sven Lindqvist.[76] The text

[72] The Living Museum gratefully acknowledges that it continues to receive an annual operation grant of $10,000 from the City of Maribyrnong. MLMW has continued to operate from buildings managed by MMBW (1989 – 1998) Parks Victoria (1998 – 2015) and the City of Maribyrnong (2015 onwards).
[73] The original Latin word "universitas" refers in general to "a number of persons associated into one body, a society, company, community, guild, corporation, etc.
[74] Olwen Ford, founding Director of Melbourne's Living Museum of the West 1984 – 1997.
[75] Namely Harvester Town, The making of Sunshine 1890 - 1925; and, Harvester City, the making of multicultural Sunshine 1939 - 1975.
[76] Dig Where You Stand: How to do research on a job', Sven Lindqvist,1978, not yet published in English (2016). Sven Lindqvist is a major Swedish writer. Since 1955 he has published 30 books of essays, aphorisms, autobiography, documentary prose, travel and reportage. Many of them have been the centre of Swedish literary and political controversy during these decades. Internationally he is best known for his books on China, Latin America and Africa.Sven Lindqvist was born in Stockholm in 1932. He has a PhD in History of Literature from Stockholm University, an honorary doctorate from Uppsala University and an honorary professorship from the

is a guide for conducting self-directed historical research on any work situation. During this research, I made contact with Lindqvist via a library in Sweden, receiving permission to access a draft of a forthcoming English translation of the book.[77]

In the late 1960s, Lindqvist travelled to Latin America to investigate social history and economic conditions for his book *The Shadow: Latin America Faces the Seventies*. There he found that practically every factory history had been written by authors, selected and paid *by* factory owners, 'to produce results that would then be *approved of by them*'.[78] Lindqvist returned to Sweden to find the same approach to documenting its industrial history, prompting him to argue that, 'No area of modern history has been more distorted by one-sided treatment than the history of business'.[79] Lindqvist highlights how a large proportion of people's history is completely missing. His grandfather had been a cement worker, giving him a special interest in the history of that industry. After reading the histories of eleven Swedish cement factories written between 1923 and 1973, Lindqvist observed that:

> The wisdom contained in these books could be summarised in five points: 1. Management has never made a mistake. 2. Management has never been morally at fault. 3. The contribution of the shareholders to the production of cement has been vastly more important than that of the workers. 4. The workers' contribution to the development of the cement industry has been mainly to raise unrealistic demands and to receive benefits from the company. 5. In over a hundred years, nothing has ever happened that might give a cement-worker legitimate cause for pride or anger. This wisdom seemed to me perhaps a trifle lopsided. I felt pretty sure that these books did not present the whole truth about their subject.[80]

Lindqvist concluded that every factory history should and could be written by workers investigating their own workplaces.'[81] In response to the scale of this enterprise, Lindqvist

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Swedish government. Since 1986 he is married to Agneta Stark, a leading feminist economist. http://www.svenlindqvist.net

[77] Forskarexpeditionen – Arbetarrörelsens arkiv och bibliotek, Research desk – The Swedish Labour Movement Archives and Library The translation is dated 2015 and was undertaken by text by Ann Henning.

[78] Dig Where You Stand, Sven Lindqvist, Source: Oral History, Vol. 7, No. 2 (Autumn, 1979), pp. 24-30 Published by: Oral History Society, Stable URL: http://www.jstor.org/stable/40178565

[79] Although many years later Lindqvist wrote, Terra Nullius: A Journey Through No One's Land, on Australia and its treatment of Aboriginal people and the genocidal consequences of western advancement, Translated by Sarah Death. Granta, London 2007. Pbk 2008. The New Press, New York 2007.

[80] Dig Where You Stand, Sven Lindqvist, Source: Oral History, Vol. 7, No. 2 (Autumn, 1979), pp. 24-30 Published by: Oral History Society, Stable URL: http://www.jstor.org/stable/40178565

[81] Ibid.

produced *Dig Where You Stand: How to do Research on a Job* to encourage and enable industrial workers to research the history of their job on the basis that workers in any job are the most qualified people to document the history of their work, being more qualified than management or academic historians, their stories being a vital contribution to the appraisal of history.

In the late 1970s and early 1980s, this argument sparked considerable resistance in academic circles, including in Australia in regards to the establishment of MLMW.[82] Resistance to more inclusive forms of history was equally reflected by resistance to the 'New Museology', which in the late 1960s and early 1970s was perceived by many museum professionals as a threat to the time-honoured conventions of museum practice, rather than a long overdue transformation to a museum's cultural and social role.

Lindquist's book was written in the same period that saw the emergence of punk rock, which saw a burgeoning climate of DIY culture, including in the flourishing of artist-run initiatives in art, music and theatre internationally. In 2014, Lindqvist describes how the 'Dig' movement named after his book had created:

> 10,000 'barefoot' research groups in Sweden, Scandinavia, Germany, Austria and Canada'. Their results were published in hundreds of exhibitions, books, pamphlets, and theatrical plays, and more permanently in 1,300 Swedish 'museums of working life' with technical and methodological support by a new national institution, the 'Museum of Working Life' in Norrkoping.[83]

The French ecomuseum idea and the Swedish Dig Movement came together in Melbourne in the early 1980s when Swedish-born Eva Yencken and her husband David Yencken spoke at a local community gathering at the electoral office of Joan Kirner, MP to establish a museum dedicated to the local history of Melbourne's west, an idea already appearing in articles written by David Yencken in *Overland* and by Olwen Ford in the planning journal *Space*.[84] Ford's paper at a national museums conference acknowledged the influence of the

[82] MLMW and the influence of overseas ideas on its establishment were criticised by Dr. David Dunstan in the early 1990s in an article he wrote in the Victorian Historical Journal.
[83] Barefoot or Do-It-Yourself (DIY) research techniques involve looking at the workplace, listening to workers, and placing value on workers opinions. This description is from and ILO (international Labor Organisation) publication: 'Barefoot Research: A Workers Manual For Organising On Work Security', (pp 2) describing techniques of Barefoot Research to gain an insight into achieving security in a workforce… in the case of this manual Barefoot Research is not an academic exercise. It is a practical approach for improving workers basic security with special emphasis on working conditions. The absence of basic security for workers can often mean that workers accept any working conditions for fear of not having a job or income.
[84] Source, email Olwen Ford, 2014

Yenckens, the ecomuseum idea and the Swedish Dig Movement on the founding and conceptualisation of the MLMW, listing the three contributing influences as:

1) local interest and commitment.
2) support and encouragement from government.
3) input of those in touch with museums development in a wider context. [85]

Lindqvist traces 'the idea of "digging" for truth close to home' to Friedrich Nietzsche, who wrote 'Wo du stehst, grab tiefhinein!' ('Where you stand, dig in deeply!')." [86]. The idea of workers researching their own history emerged during the Russian Revolution in Maxim Gorky's periodical *History of Factories and Workshops,* but work on publications that documented industrial history from the workers' perspective were suspended during World War Two, only to be, as Lindqvist argues, 'written by professionals to celebrate anniversaries'.[87] Yet a small museum in Melbourne's west many decades later revived this enterprise, inspired by Nietzsche's 'Poem 3' from *The Gay Science*, which charges:

> Undismayed.
> Where you're standing, dig, dig out:
> Down below's the Well:
> Let them that walk in darkness shout
> "Down below— there's Hell !"[88]

## *Ecomuseums in Australia*

The concept of an ecomuseum is particularly significant in Australia, a country where many aspects of history, not just the role of workers in industrial history, have been consistently ignored, denied, fabricated and whitewashed by institutions of authority and learning. The deliberate exclusion of any group's experience and stories from the broad historical record is a form of cultural theft and disempowerment. This information belongs to the people most

[85] Conversation Olwen Ford, 2014.
[86] Sven, Lindqvist, Dig Where You Stand Movement, essay included in: The Sage Encyclopedia of Action Research, edited by David Coghlan, Mary Brydon-Miller, Sage Publishers, 2014, pp 264-265. Here Lindqvist is referring to the book, The Gay Science (otherwise known as The Joyous Wisdom), published by Nietzsche in 1882.
[87] Sven Lindqvist, "Dig Where You Stand," *Oral History* 7, no. 2 (1979).
[88] Friedrich Nietzsche, The Joyful Wisdom, ("La Gaya Scienza"), translated by Thomas Common, with poetry rendered by Paul V. Cohn and Maude D. Petre. Published by New York, The Macmillan Company, 1924.

directly affected and is best documented and told at first hand, but it also belongs to wider society because it is part of the complex jigsaw that is history. In Australia, the most extreme and disturbing example of omission from the writing of Australian history is the experience of Australia's aboriginal peoples since the English invasion, a terrible process that has still not been fully acknowledged, documented or interpreted effectively with the consequence that a majority of Australians do not fully understand how the treatment of Aboriginal people has driven the cultural, physical and social fabric of Australia to the country's great detriment.

The history of Australia's factory workers, including the history of how women were slowly allowed to join the workforce, has also been neglected and excluded from school history curriculums. Without the inclusion of such stories, we cannot fully understand where we are or how we got here, including to convey this collective story to our children as the basis of an inclusive conversation on how everyone belongs to and contributes to history. The ecomuseum philosophy has a particular resonance in Australia in stressing the collection of oral history in preserving and interpreting the history of a place, given the pivotal importance of storytelling in Aboriginal culture and society. Aboriginal people have accurately preserved detailed knowledge of events for tens of thousands of years through storytelling, although European invasion brought with it relentless efforts to eradicate the languages and cultural practices through which this knowledge was passed on.

Robert Mate-Mate, MLMW's first Aboriginal cultural officer, provides an example of the preservation of history through Aboriginal storytelling in the case of the convict William Buckley, who escaped from the temporary early settlement of Sorrento to find himself stranded in a foreign land when the ship left and no other Europeans arrived for 30 years. Buckley, who nearly died, was rescued by and lived with Aboriginal people on the Bellarine Peninsula between 1804 and 1835, later working for John Batman as a translator. According to Mate-Mate, the language groups that Buckley learned while part of Aboriginal community could be used during his work as a translator across the Bass Strait in Tasmania.[89] This was despite Tasmania becoming an island when the Bassian Plain became submerged around 14,000 years earlier due to the global rise of sea levels at the beginning of the current interglacial period known as the Holocene.[90] Stories of William Buckley travelled along indigenous story-lines to reach northern Australia by the early 1800s.[91] Mate Mate made a pilgrimage to Buckley's cave in Point Lonsdale because he had heard stories about Buckley

[89] Conversation with Robert Mate-Mate (Gapingaru),1995, in relation to his research for *Barn da na: passing on the message, dialects of the Woiwurung & cultural comparisons,* Robert Ralph Mate Mate 1992, published by Melbourne's Living Museum of the West.
[90] Presland, Gary, The First Residents of Melbourne's West, 1987 p7.
[91] Conversation with Robert Mate-Mate (Gapingaru),1995.

in his indigenous language as a child living in northern Queensland before he could speak English.

Current social media platforms have greatly increased the capacity and the extent of people recording and communicating their own stories and experiences. Although almost instantly and globally accessible, these stories are stored in a relatively fragile format that depends on the ongoing compatibility with contemporary technology, changes to which might affect the long term scope to access this information. Currently, data is only accessible using electronic devices, which make it unavailable to people who have no access to such devices. During this research, the quantity of data that has become accessible via the Internet has changed significantly, but access to data has changed, with many sites expiring, becoming archived or placed behind firewalls or paywalls. MLMW engages with the current complexity of online information and social media by going about its business as usual and considering all technology as tools and adopting and adapting these technologies to facilitate its mission and purpose.[92]

A major priority for MLMW is to make safe the archives, which are currently in a vulnerable state, being comprised of hundreds of original items stored on unstable or redundant media such as audio cassettes, hand-written and typed texts, celluloid films, video, umatic and beta cassettes, photographic negatives and prints.[93] MLMW is making this archive safe and more accessible through transfer to the latest technological storage and communication systems (digitisation, database networks and the Internet) but recognises that as technology continues to evolve, the preservation of the archive will require ongoing transfer to newer technologies. More important, however, is ensuring the ongoing transfer and expansion of the archive through cultural activation and tacit knowledge transfer. In keeping with what we have learnt from indigenous people about the longevity of knowledge by passing it on to the next generation, the museum archives will be promoted and protected as a treasure trove for the development of all kinds of new projects which in turn can be added to the archive.

[92] See MLMW mission statement, in the introduction to this paper, p 29.

[93] Current at the time of writing this document, 2016.

## *The fragility of history and truth*

MLMW remains an ecomuseum in the original sense, aligned with the original principles of an integrated museum as shaped and defined at the pivotal 1972 UNESCO regional seminar in Santiago, at which museum professionals, including Hugues de Varine-Bohan, gathered to discuss a new kind of museology to support sustainable development in impoverished regions.[94] The nature and purpose of ecomuseums are largely defined by locations in which they evolve. The MLMW mission statement acknowledges its function as an ecomuseum, but stresses the need for a self-determination to adapt with the times and to remain inclusive and responsive in respect of its locality.[95]

The concept of what an ecomuseum is and does has also evolved since its inception through its application to a variety of theme parks, eco-centres and commercial ventures, leading to some confusion about its definition. A 1985 issue of the quarterly UNESCO publication *Museum* on ecomuseums and dedicated to the memory of George Riviere comprised essays on ecomuseums internationally as well as Riviere's last written work *The ecomuseum – an evolutive definition*.[96] Hugues de Varine-Bohan wrote the introduction to the issue and in 2014 continues to stress the conceptual differences between an ecomuseum and conventional museums while advocating the ecomuseum concept as vital to the future of museums in society.[97]

Locally-initiated history that is inclusive, first-hand and which works from the ground upward remains unpopular politically in many countries as is evident from the lack of communities with their own government-supported museum. Thirty years after the establishment of MLMW, there are only two museum's calling themselves ecomuseums in Australia, with MLMW being the only one to reflect the original concept of an inclusive, integrated museum. The Eco-Museum of the South West of Australia is a multi-million-dollar environmental and tourism project conceived by the Western Australian Government to link 18 existing tourist centres and national park visitor centres throughout the region and which interpret the environments of the region *for* locals and visitors. This venture is not an ecomuseum, but

[94] Guido, "Unesco Regional Seminar, Round Table on the Development and the Role of Museums in the Contemporary World, Santiago De Chile, Chile 20–31 May 1972."p 39.
[95] See MLMW mission statement, page 6 this document.
[96] George Henri Riviere, "The Ecomuseum – an Evolutive Definition," *Museum* 148, no. (contains insert bulletin Volume 38 issue 4) (1980).
[97] Hugues de Varine-Bohan, "The Modern Museum: Requirements and Problems of a New Approach," *Museum International* 66, no. 1-4 (2014).

rather a State imposed promotional initiative of Hendy Cowan, the Minister for Commerce and Trade, Regional Development and Small Business.[98]

At the time of writing this thesis, MLMW remains the only ecomuseum in Australia based on the guiding principles of the Integrated Museum (Figures 5 and 22).[99] Its aims and objectives, established in 1984, pre-date the adoption of similar concepts as policy by Australian cultural and heritage institutions and funding bodies. Although it remains largely unrecognised and under documented, MLMW has had a positive impact on museology in Australia and has helped to lead a shift in policy towards the inclusion and participation of communities in art and heritage projects.[100] The activities of MLMW demonstrate the agency of the ecomuseum model in regard to sustainable development and community well-being.[101] Its discussion here is to provide reference to future investigations and a base for understanding the political dimensions of my commitment to participation and multidisciplinarity in my practice.

## *DIY, New Museology and Nature*

Another core principle of an Integrated Museum, as developed at the 1972 UNESCO Regional Seminar round table in Santiago, was that following science, 'The variety and diversity of problems confronting modern man will compel him to look on the world as one world, to be tackled as an integrated whole.'[102] The Integrated Museum combines local museology with the concept of the world as an integrated whole that includes people (not just 'man'), technology and nature as one integrated system, where each aspect affects all others. This is not a new idea or recent consideration, being explained by philosophers, artists and scientists throughout the ages, but particularly since the beginning of the industrial age it has been readily dismissed, suppressed and confused by other issues and politics.

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[98] Media Statement, 1995, Hendy Cowan. https://www.mediastatements.wa.gov.au/Pages/Court/1995/02/SW-Eco-Museum-shaping-up-as-major-environmentaltourism-project.aspx

[99] See also page 7, introduction to this paper, Figure 5.

[100] The masters thesis by Michelle Brown uses MLMW as a case study to investigate how the role of ecomuseums may positively contribute to museology in Australia. Brown, "Ecomuseums: Creating a Sense of Place in Australia?."

[101] Contributing to this confusion is the definitive and authoritative international study on ecomuseums, '*A Sense of Place*' by Peter Davis omits MLMW from his international study tour of ecomuseums (1999) when representing ecomuseums in Australia. Although his reasons for this major oversight are not entirely clear he has since apologised to Olwen Ford for the omission in this book. Source: conversations with Olwen Ford, 2014 and 2017.

[102] Guido, "Unesco Regional Seminar, Round Table on the Development and the Role of Museums in the Contemporary World, Santiago De Chile, Chile 20–31 May 1972."p 39.

GUIDING PRINCIPLES OF THE INTEGRATED MUSEUM

The development of science reveals that reality is one and should be apprehended as such. Moreover, contemporary scientific development is based on multidisciplinary work and compartmentalized views are disappearing even from school textbooks. The variety and diversity of the problems confronting modern man will finally compel him to look on the world as one world, to be tackled as an integrated whole. All this implies that the trend should be towards the establishment of integrated museums whose subjects, collections and exhibitions are interrelated with one another and with the natural and social environment of mankind.

The basic function of museums is to show their visitors their place in the world and to make them aware of their problems as individuals and as members of society. To achieve this purpose, museums should present those problems as well as indicating the perspectives that give a constructive meaning to human existence.

This approach does not deny the value of existing museums, nor does it imply abandoning the principle of specialized museums; it is put forward as the most rational and logical course of development for museums, so that they may best serve society's needs. In some cases, the proposed changes may be introduced gradually or on an experimental basis; in others - for instance, museums not yet established or not yet definitively organized - it may provide the basic orientation.

The transformation in museological activities requires suitable personnel, which implies a gradual change in the outlook of the curators and administrators themselves and in the institutional structures for which they are responsible. In addition, the integrated museum will require the permanent or temporary assistance of specialists from various disciplines, including the social sciences.

The new type of museum, by its specific features, seems the most suited to operate as a regional museum or as a museum for small and medium-sized population centres.

*Figure 29 Guiding Principles of the Integrated Museum*[103]

Nothing is exclusively 'man-made'. Even the most highly synthesised materials, objects, systems, technologies and energies that people have developed have been achieved through processes engaging naturally occurring forces and matter. The implications of this concept of an Integrated Museum are complex and contentious because they do not suit the current rationalist growth model of economics in a self-regulating global market place.[104] This topic is discussed further in relation to MLMW and to the work of artists in Chapter Five. The world has changed significantly since industrialisation, making it more important than ever to discuss capitalist economics as it relates to global warming and the loss in diversity within cultures, societies and species. Exploring the idea that everything we do and make is a part of nature, being inextricably interwoven, is the driving force of my arts practice, the search for new ways to articulate this concept through making art being presented in this thesis.

[103] Ibid.p 39.
[104] Economic rationalism is an Australian term used to refer to macroeconomic policy. Economic rationalists tend to favour market deregulation, privatisation of state-owned industries, indirect taxation, reduction of state supported welfare.

When we accept that nature and the actions of people are inseparable, various concepts, structures and values become unsettled. For example, the environmentalist Bill McKibben, questioned the very concept of nature in his 1989 book *The End of Nature* in stating 'We are no longer able to think of ourselves as a species tossed about by larger forces – now we are those larger forces … Hurricanes and thunderstorms and tornadoes become not acts of God but acts of man. That is what I meant by 'end of nature''.[105] In 2016, the International Geological Congress proposed the concept of 'The Anthropocene' as a new period in the history of the Earth brought about by human impact on the planet's geology and ecosystems.[106]

When people and nature are perceived as integrated, nature becomes the common property of all species and anything that damages nature damages all species, including human kind. This idea proposes a duty of care that needs to be established through new international laws. Perceiving that people and nature are absolutely integrated challenges the structural hierarchy behind the interpretation of Nature as a dominion over which humanity has power and privilege. It questions the nature and degree of responsibilities that come with property ownership and the current economic model based on a 'right' to plunder Nature as property.[107]

There is an active movement to establish the act of 'Ecocide' as a crime against humanity recognised by the United Nations and made punishable through international law. [108] To implement such laws, however, would require co-operation between governments and in enforcing responsibility for environmental destruction would be opposed by many who seek to exploit nature such as globally powerful corporations whose profits would be affected. My arts practice in this research seeks ways to communicate the idea that people and nature are an integrated whole through making participatory art projects, while examining my work in developing environmental exhibitions using an ecomuseum framework.

An ecomuseum endeavours to preserve and communicate historical knowledge, culturally significant sites and objects, and intangible heritage in order to define the context of a place for the benefit of present and future society. When people clearly understand where they are

[105] McKibben (see notes on reading for exact reference page etc.), The End of Nature, (first published 1989
[106] Damian Carrington, "The Anthropocene Epoch: Scientists Declare Dawn of Human-Influenced Age," *The Guardian*, 29, August, 2016 2016. https://www.theguardian.com/environment/2016/aug/29/declare-anthropocene-epoch-experts-urge-geological-congress-human-impact-earth
[107] In 1850 French economist Frederic Bastiat (1801-1850) wrote a book called 'The Law' that re-interpreted the 'rights of individuals' leading to the current rationalist economic model.
[108] Referring to the ongoing international process of codifying 'Ecocide' as a crime, a draft Ecocide Act and mock trial tested in the UK supreme court in 2011 by the Hamilton Group.

and what has happened before them in any place and are included in the ongoing narrative of that place, there is less likelihood they will contribute unwittingly to the destruction of beneficial and significant aspects of that place. Understanding the past enables people to make decisions about the future that will build on what has gone before them, rather than unknowingly destroying it or repeating mistakes. As an ecomuseum, MLMW serves as a 'conservation centre, laboratory and a school' working towards the future benefit of society'.[109] Its significance towards informing sustainable development for the future well-being of society and the environment is yet to be fully recognised or understood. There is a cyclic connection between the loss of knowledge of the history of a place and the interests of the unrestricted development, which only fuel further loss in biodiversity, cultural diversity and heritage.

[109] Georges Henri Riviere, "Images of the Ecomuseum," *Museum* XXXVII, 4 (1985).

# CHAPTER 3
# A FRAMEWORK OF EXCHANGE: CONTEMPORARY ART AND ECOMUSEUMS

> *This laboratory, conservation centre and school are based on common principles. The culture in the name of which they exist is to be understood in its broadest sense, and they are concerned to foster awareness of its dignity and artistic manifestations, from whatever stratum of the population they derive. Its diversity is limitless, so greatly do its elements vary from one specimen to another. This triad, then, is not self-enclosed, it receives and it gives.*
> George Henri Riviere, "The Ecomuseum – an Evolutive Definition" [110]

Chapter Three examines the introduction of participation into my art practice, driving the emergence of instruction-based works through the influence of working in MLMW's multidisciplinary environment. It explores the benefits of the confluence and coalescence of ideas that arises when working with a diversity of people on the development of history interpretation, notably key MLMW projects from the 1990s — *Still Here* (1996), *Women's Shelter* (1997) and *the Pipestacks* (1999) — which serve as case studies for my development of a multidisciplinary, research-based visual art practice.

## *MLMW a multidisciplinary environment*

I applied for a job at MLMW in 1993 primarily to finance my art practice and living expenses, the need to work outside my field reflecting the very limited avenues of monetary support available for contemporary artists in Australia at the time due to the small local art market and highly competitive grant system. At the time, Store 5 was winding up, also through the lack of financial and material support.[111] A Commonwealth Government employment scheme had just been set up to place unemployed university graduates in approved organisations. This scheme aimed to support organisations by supplementing their wage costs while providing graduates with employment-based training and experience to develop the necessary attributes and skills for a career. To be considered for the job at MLMW, I drove across Melbourne from Prahran to Footscray for a 20-minute interview, but stayed for

[110] George Henri Riviere, "The Ecomuseum – an Evolutive Definition," ibid.148, no. (contains insert bulletin Volume 38 issue 4) (1980).
[111] At the time Australia Council for the Arts policy did not support artists in the role of administrators of major projects or artist-run gallery spaces. Despite having a track record of over 100 exhibitions over a three-year period and several attempts at securing small amounts of funding, project officers informed me that it was not within the Australia Council's policies to support artist administered initiatives.

four hours talking to staff and in fact beginning to work there immediately. This initiated a process of personal migration from Melbourne's east to Melbourne's west, to a region of my city I was only vaguely aware of, but where I have now lived as well as worked since 1995. More significantly, the position at MLMW began my introduction to indigenous culture.

In 1993, there were more Aboriginal people than non-Aboriginal people working at MLMW. These included the Museum's Cultural Officer, Larry Walsh, a trainee office manager, Kylie Freeman; and 12 or so young people employed as apprentice gardeners in the Koorie Gardening Team (KGT). Other Museum staff included Gary Vines, Olwen Ford, Peter Haffenden and Mark Dawkins (who ran the weekly MLMW radio program at 3CR) as well as a large team of people building the major outdoor project, a "history garden"[112], plus the KGT co-ordinators. Peter Haffenden describes the MLMW dynamic working environment as having a multicultural, multidisciplinary ambience, the open office environment enabling people with diverse skills and backgrounds to play varied and fluid roles across multiple projects to achieve creative and innovative outcomes. [113] Many studies evidence the effect of diverse teams creative output and innovation, Simon Page, in his book, *The Difference*, showing how multidisciplinary teams with diverse members outperform teams formed from like-minded experts.[114]

In witnessing a type of experimental participation in action, MLMW exposed me to the opportunities and possibilities of bringing diverse knowledge perspectives to a problem, project or situation. On museum projects, some team members would have directorial input. Others would contribute technological knowledge or other expertise such as research or writing. Still others would be the worker bees. The collaboration process required patience, engagement and a willingness to transfer accumulated means and knowledge — usually coveted as "the tools of their trade" — between experts and other participants. Project outcomes were always more creative and interesting because of the inclusion of multidisciplinary collaboration, the project *process* generating mutual tacit knowledge sharing in which the expert became empowered by receiving direct and intimate knowledge of the substance of the project topic and other participants became empowered through learning new ways to present and communicate their knowledge and culture.[115]

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[112] The *History of the Land Discovery Trail* was built on the site of the "Bottom Factory" in Pipemakers Park (1992-94) as a series of gardens, built structures and mosaics it is used for school excursions and tours to tell the story of the site,

[113] Haffenden, *Your History Mate*.

[114] Scott E. Page, *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies* (Princeton: Princeton University Press, 2007).

[115] Examples of some early projects and MLMW's development of this methodology are discussed in P. Haffenden, *Your History Mate*. Chapter 5, *Participation*, pp. 33-40.

My first task was to work with Kylie, the young Aboriginal trainee office manager, to install and organise openings for the photographic exhibition, *Daughter of a Dreaming*[116], which had arrived from the Museum of Victoria, and *Print Stories*, an exhibition of the work of Aboriginal artist and author Sally Morgan.[117] Neither Kylie nor Larry Walsh, Kylie's cultural mentor, had previous experience in staging exhibitions. I was chosen to work with them because of my experience at Store 5 and because the exhibitions concerned women. The three of us worked through the logistics, which involved the integration of cultural protocol, giving me my first lessons in the complexities and richness of Australian indigenous culture. The following three projects — *Still Here*, *Pioneer Women's Shelter* and the *Pipestacks* — are provided as case studies in the conduct of participatory multidisciplinary projects as well as working within the ecomuseum framework for developing exhibitions and interpretative monuments for the preservation of history, which incorporate ongoing participatory elements.

## *Still Here, A brief history of Aboriginal people in Melbourne's West*

The position I was hired for at MLMW was as research assistant to Aboriginal cultural leader and Taunwurrung pure storyteller;  Larry Walsh, to assist him with a local indigenous history project. In the light of the principles of MLMW this position would have ideally been filled by an indigenous person, but the criteria of the government scheme that subsidised the vacancy at MLMW required the recipient of the position to be a university graduate. I was shocked that despite MLMW's extensive indigenous network, the museum could not find an indigenous university graduate to fill the position due to the rarity of tertiary qualified Aboriginal people in 1993. Despite having attended an underresourced, crowded public secondary school and being the first person in my immediate family to receive a tertiary education, I found myself in a position of significant educational advantage over the region's indigenous population. This was the first in a series of sorry revelations and the beginning of a huge learning curve. Larry explained that there were other aspects of my background that qualified me for the job, namely having experienced forced adoption at birth and recent reunification with my family in 1991. For Larry, this meant that I had some understanding of the trauma and issues experienced by the stolen generations for whom he was then working

[116] Museum of Victoria. Aboriginal Cultural Heritage Unit, *Daughters of a Dreaming* (Melbourne: Museum of Victoria, 1990).
[117] Sally Morgan, *My Place* (Fremantle, W.A.: Fremantle Arts Centre Press, 1987).Exhibition, *Print Stories,* held August, 1993, Melbourne's Living Museum of the West.

as an official advocate. He pointed out that I could therefore unknowingly have Aboriginal heritage, like many Australians.

In 1994, Larry asked me to work on the development of the exhibition, *Still Here, A brief history of Aboriginal people in Melbourne's West*.[118] He had noticed that I was not precious about imparting my skills and technological knowledge to others while working on other projects, it being difficult to find someone to work on the design who was willing to take this approach. Larry described my role as enabling others to participate in the design process in a direct and hands on way, rather than controlling the design or personally interpreting the design from the content.

The process of sharing methods and skills required in-depth, ongoing discussion to gain understanding of all aspects of the exhibition content. Over a period of nearly two years I worked with Larry, other core MLMW staff and many others to help produce *Still Here*. Its eventual form was comprised of 14 portable, hand-painted panels, each presenting a different topic in relation to the exhibition theme and comprising a collage of current and historical cartoons, documents, news articles, paintings and photographs accompanied by two levels of narrative. The format was designed to fit into the back of a station wagon to enable the exhibition to be transported to a variety of locations, including people's homes, to tell the story of how Aboriginal people have always lived and worked in Melbourne's West and were "still here".[119]

*Still Here* addressed the historical and ongoing impacts of the relentless cultural genocide of the indigenous people of Melbourne's west. It was one of the first exhibitions in Australia to describe the process of colonisation as an invasion, this forming the title of one of the panels, and European occupation being identified in the exhibition as an ongoing war, the scope for recovery being framed by the exhibition from this perspective. The design and layout of the panels was developed to enable storytelling around key concepts researched and determined by Larry and other Aboriginal people. For example, the set of panels began and ended with panels titled "Still Here", to present a circular rather than linear sense of history, the combination of then current and historical source material exemplifying, as the exhibition narrative unfolded, how the past informs and influences the present. Panel topics

[118] Larry Walsh and Living Museum of the West (Melbourne Vic.), *Still Here: Exhibition Catalogue: A Brief History of Aborigines in Melbourne's Western Region up to the Present Day* (Victoria: Melbourne's Living Museum of the West, 1996).
[119] The MLMW website reproduces many of the photographs and the text of each of the panels and also includes the exhibition catalogue as a pdf publication that can be downloaded. https://www.livingmuseum.org.au/exhibitions/still_here/still_here_intro.html

included local ancestors, invasion, racism, assimilation, political movements, advancement, stolen generations, home and work, education, entertainers, locals and heritage (Figure 30).

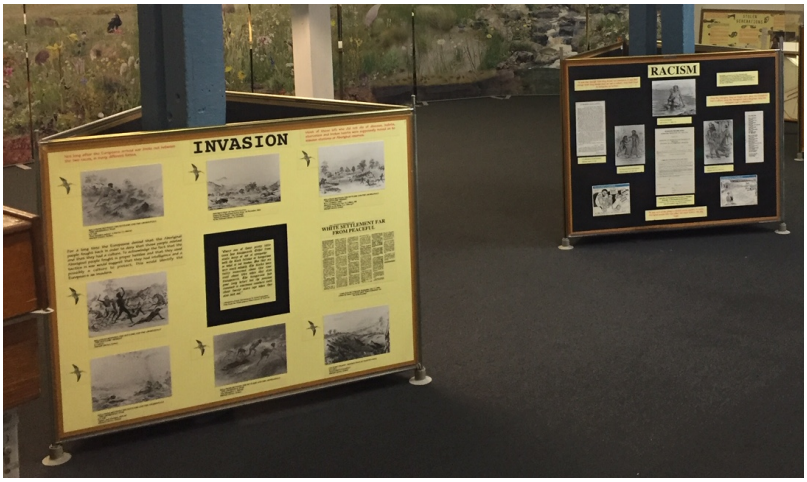


*Figure 30 Still Here panels "invasion" and "racism".*

The exhibition format for *Still Here* was conceived as a guide for other transportable exhibitions, which could be used in school education programs and its development process could be used as a model for other communities to create their own 'still here' projects. [120] Each aspect of its nature and purpose was considered by many people. The panel text was styled to convey Larry's voice instead of using the conventional style of interpretative text found in museum exhibitions. Every aspect of the text, as well as the colours and images had a specific strategic and political purpose. What not to include was as important a consideration as what to include. The process for reasoning through all of the decisions about the inclusion and exclusion of images and text was often surprising and a privilege to be a part of. It was so considered and collaborative that it took several years to develop the design and to incorporate the content. As Olwen Ford lucidly points out in the introduction to *Still Here, '*Until we all know more of the Aboriginal story and experience we have only a limited understanding of our country and ourselves.'[121]

In 2005, when the Aboriginal and Torres Strait Islander Commission (ATSIC) was abolished by the Howard government, positions for Aboriginal Cultural and Arts Officers at MLMW were no longer supported, resulting in a reduction of projects including education and

[120] Walsh and Living Museum of the West (Melbourne Vic.), *Still Here: Exhibition Catalogue: A Brief History of Aborigines in Melbourne's Western Region up to the Present Day*. forward by Paul Richardson (Koorie Education Co-ordination Unit, 1996), p1.
[121] Ibid. introduction by Olwen Ford, p.2.

outreach. *Still Here* continues to be used as a resource by organisations and groups in Melbourne's West in the same physical format, especially by the Aboriginal academic unit, 'Moondani Balluk', at Victoria University. The.pdf version of the catalogue is still accessible online.[122]

## *Pioneer Women's Shelter (1997)*

The *Pioneer Women's Shelter* was commissioned in 1997 by St Albans History Society and designed by Melbourne's Living Museum of the West for construction on the banks of the Maribyrnong River in Pipemakers Park. The shelter is a monument to the largely unrecognised lives and achievements of the regions early Irish immigrant women. While researching their family histories, the authors Joan Carstairs and Maureen Lane discovered the stories of their female ancestors were particularly difficult to piece together. Despite their significant contributions to society, like many women, their achievements and stories were missing from the pages of official history. As Lindquist discovered the experiences of factory workers were omitted from company histories, Carstairs and Lane uncovered the unacknowledged contribution of six women who came to Melbourne from Ireland in 1839 and 1840 and who were instrumental in the establishment and operation of the first punts, the first schools, first churches and first hotels in the region.[123] Their book *Pubs, Punts and Pastures* told the story of these women who were active in the new communities that grew up next to the Salt Water River, as today's Maribyrnong River was then known.[124]

Carstairs and Lane identify the common difficulties facing women colonists of the time, who were often single mothers as a result of the death of their husbands, frequently through alcohol-related accidents. In a time when women were not legally allowed to own property, most had to quickly remarry on becoming widows to keep living in their houses and to be able to maintain a stable environment for their children. Such relationships are shown in the book to be frequently disastrous, with women being taken advantage of. *Pubs, Punts and Pastures* was a popular and commercial success, suggesting that the formerly unrecognised lives of women were of interest and value to people in the present. Many of these women were left destitute and were subsequently buried in unmarked graves. Using the proceeds from sales of the book, the authors thought to commission a commemorative monument to

[122] https://www.vu.edu.au/about-vu/university-profile/moondani-balluk
[123] A punt is a kind of raft, these were used for crossing the Maribyrnong River prior to the establishment of bridges.
[124] Joan Carstairs, Maureen Lane, and St. Albans History Society, *Pubs, Punts & Pastures: The Story of Irish Pioneer Women on the Salt Water River* (St. Albans, Vic.: St. Albans History Society, 1988).

the pioneer women's lives in Pipemakers Park. The authors, already familiar with MLMW, approached the museum with their idea to find a suitable location and approach.

Initially, they envisaged a brass plaque naming the women embedded into a bluestone boulder, the stone element reflecting womens' struggles dealing with the rock-hard clay soils on the lava plains of Melbourne's west in order to grow food for their families. In a meeting with Olwen Ford, Peter Haffenden and myself, a shelter was proposed to commemorate the contribution of pioneer women, being simultaneously evocative of the work of Caroline Chisholm in building shelters to improve the conditions of women, especially those giving birth, while travelling between early Melbourne and the gold fields. The design of the small building became a collaboration between the authors, Olwen, myself and many other people working at MLMW during the period 1996–7.

We set out chairs for six people to represent the six colonial women in a circle on the lawn in front of the museum, moving the chairs until we found a mutually comfortable distance to sit across from each other while maintaining the scope for a chat. We measured this distance to established the width of the shelter, determining that is should have six sides, be built from recycled timbers sourced locally while including a foundational bluestone element bearing an inscription and naming the six women. Excited to design an object as a place and with an inside and an outside that would support the practical purpose of providing shelter and a contemplative purpose, I sketched a rough design using the skills on working with geometry developed through my art practice. I perceived that a hexagonal building with walls tilted outwards to expand the upper interior space would be more conducive to refection than one width with vertical walls. Although still defined by the space occupied by a group in conversation, the tilted walls retained intimacy without a claustrophobic feel, reflecting a archetypal open shelter-form with a broader roof than its base (Figures 31 and 32).

*Figure 31 Pioneer Women's Shelter, Pipemakers Park. Left, outside view (2009). Right, interior view showing plaque and proximity to river (2004).*

*Figure 32 Pioneer Women's Shelter, Pipemakers Park, showing trees planted by KGT (1997) and the garden created by Debra Harding and Clare Hart (2004).*

Once the process of social dialogue involved in establishing the design was complete, the collaborative process of costing and building the shelter began. This involved others working at MLMW at the time, specifically graduate architecture student Heidi Macievic, model-maker Paul Cater and film and animation graduate Joe Guario. Together, this team developed the technical drawings for approval and construction of the shelter, including the system of steel brackets used to support and connect the timber frame. These were commissioned from a local engineering shop to maintain the sense of the local and of the grounding of experience and productivity in Melbourne's West in a period in with the mutability and contingency of cultural and social boundaries was being emphasised by postmodern thought. Equally resisting the way the local became overtaken and marginalised by the priority of more affluent and powerful parts of Melbourne, the timbers were mostly recycled from the demolition of buildings from the adjacent Australian Defence Industries site, being acquired from the demolition contractors in exchange for slabs of beer. The most expensive element, a bluestone plaque set into the floor, was commissioned from Purdy's, traditional stonemasons in nearby Williamstown.

*Figure 33 At the launch event of the Pioneer Women's Shelter, left to right: Joan Carstairs, Lynn Kosky (local MP) and Maureen Lane.*

Reflecting an investment in their personal and shared social histories, many people contributed their skills and knowledge to the realisation and enhancement of the commemorative building. Purdy's donated their labour to construct of the bluestone path leading to the shelter in honour of their Irish ancestors. Rodney Purdy crafted a sandstone shamrock to set into the bluestone flagging in acknowledgement of his Irish heritage and to allude to early Sydney, a settlement built on sandstone, and colonial Melbourne, a town built

largely of bluestone. Some of the members of the Koorie apprentice gardening team based became involved in the design and planting of an indigenous garden around the building in acknowledgement of their own Irish ancestors. Local women maintained and added to the garden. Many descendants of the six Irish women discovered their connections via the book and continue to visit and have picnics and hold reunions in the shelter, which passers-by use daily as a practical, living monument to pioneer women. Several families have held memorial ceremonies for their ancestors who had no marked gravestones, but whose names appear in the shelter.

*Figure 34 Pioneer Women's Shelter, Pipemakers Park, local primary school excursion, c. 2000.*

## *The Pipestacks: an artistic interpretation of an Australian factory (1999)*

Pipemakers Park, which surrounds the MLMW, was previously the site of Hume Pipes, a major factory complex that produced concrete pipes for the growing City of Melbourne. The process of producing centrifugally-spun concrete pipes was an invention of international significance, conceived by the Hume company in the 1920s and tested and refined at the site. After a transportable version of the machinery was developed, the Hume technology provided an economic method of building sewerage and water infrastructure in remote locations internationally. During the 1920s, engineers from around the world visited the site to learn about the process, enabling water to be transported to arid and remote regions, significantly contributing to the development of many countries.

The public artwork *The Pipestacks*, in Pipemakers Park is dedicated to the achievements of this ground-breaking industrial invention, which was refined on the site, and to the people who worked in dangerous circumstances to enable its successful implementation. The artwork is built out of 147 eight-foot long concrete pipes left behind after the Hume Pipes factory shifted to nearby Laverton in 1979. The artwork is situated on the 'drying racks', a large flat area with concrete rails on which the pipes were once stacked to cure after production in the nearby 'Top Factory'. The pipes are stacked in the same manner as by Hume Pipes but arranged in a configuration conceived during my involvement in a project, auspiced by MLMW called, 'An artistic interpretation of an Australian Factory'.

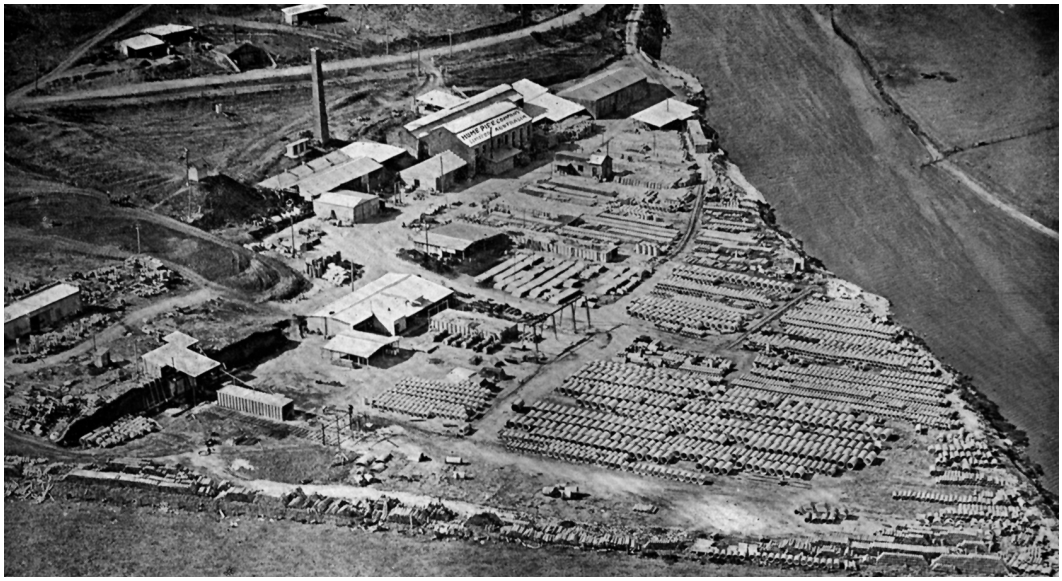

*Figure 35 Hume Pipes factory site, Maribyrnong c1920, next to Maribyrnong River, and since 1989 known as Pipemakers Park.*

*Figure 36 Hume Pipes occupied the site from 1910 to the late 1970s*

In 1998, MLMW secured funding from the Australia Council New Media Fund to include digital artist, Joe Guario, fellow Store 5 colleague and artist, Stephen Bram and myself in a multidisciplinary team of experts engaged in conservation works on former industrial buildings in Pipemakers Park. The working party included representatives from Heritage Victoria, Parks Victoria and the consultants who produced the Pipemakers Park Conservation Analysis and Plan (1998) industrial, archaeologist Gary Vines and historian Olwen Ford, as well as contracted heritage architects KaZoo. As a part of that process, Bram and I attended all working group meetings, which led to us focussing our interests on the Top Factory site and developing a CD Rom about the history of the factory with Joe Guario.

The CD Rom contains two sections. One section provides a history of the site, examining production processes and the contribution of factory workers through archival film footage and interviews. The second section focused on the exhibition, providing a photographic, interactive 'walk through' of the derelict factory site with virtual 'pop up' installations of artworks commissioned specifically for the virtual factory from six Store 5 artists: Rose Nolan, Melinda Harper, Marco Fusinato, Gary Wilson, Stephen Bram and myself. Each artist worked closely with Guario to develop and translate their ideas into the interactive virtual space.

*Figure 37 Virtual installation by Rose Nolan in the Top Factory CD Rom, 1998.*

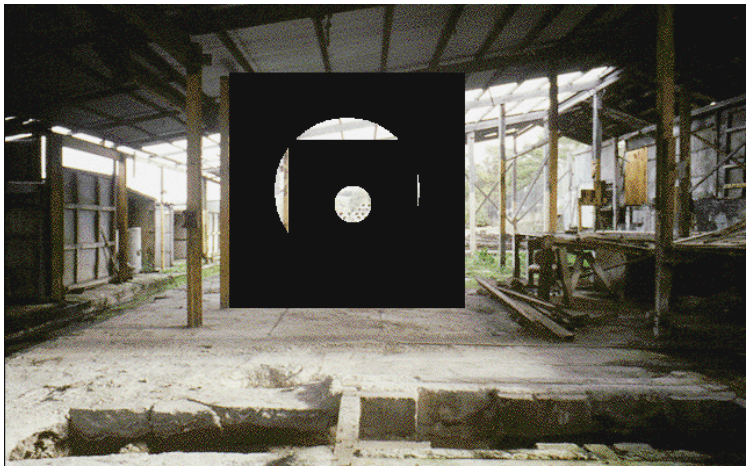

*Figure 38 Virtual installation by Gary Wilson in the Top Factory CD Rom, 1998.*

*The PIpestacks* design was originally my contribution to the digital component of the project. It was based on the idea of constructing a playground of differently sized stacks of remnant pipes after talking to Reg Hume who I interviewed during the project.[125] The son of Walter Hume, Hume Pipes founder, Reg grew up on the site playing among the pipes with local children, a popular but dangerous pastime. In the digital installation of the CD Rom, the pipes are arranged in a geometric configuration linked to my diamond grid series of Perspex paintings from 1989.[126] This was transformed into a game whereby the stacks of pipes could be changed by clicking on them. This simultaneously changed corresponding frog sounds, recorded from the nearby wetlands, which pre- and post-date the Humes factory, to make various frog songs.

*The Pipestacks* was built in 1999 through funding from the Arts Victoria program, "The Victoria Commissions".[127] The design was developed in consultation with the broader working party and references the significance of Humes' innovation in industrial manufacturing, the site needing some sort of landmark to recognise this important past activity and linking it to the park's present name of "Pipemakers Park". The number of enquiries MLMW received about the type of the pipes once made on site established this need, with many people often assuming the name referred to pipes for smoking tobacco.

Former Hume factory workers were sought out by the working group and MLMW to participate in making the artwork, these including Bruce Duff, who directed the moving and

[125] Reg Hume, son of Hume Pipes factory founder Walter Hume (1873-1943).
[126] See Figure 13 page 44.
[127] This was an Arts 21 initiative funded through the Community Support Fund to produce major commissioned works for the State of Victoria. Other examples of "The Victoria Commission" major works include "Tower" at Cheetham wetlands by William Kelly and 'sightline" by Louise Lavarack on Frankston pier.

fastening of the pipes to the concrete footings. *The Pipestacks* has become a memorial to Bruce Duff, who passed away in 2005. It commemorates the work of all Hume Pipes workers, many of whom continue to bring their families to visit Pipemakers Park. While making *The Pipestacks*, I worked closely with Bruce. Concrete pipes were his medium. He knew how to handle them, to move them, drill them and could recognise poor quality ones. Bruce took great pride in his knowledge of pipes and enjoyed being involved in the process of permanently setting in place pipes as an artwork and monument. The process of working with Bruce made me realise how knowledgeable people become in the detail and materiality of their job. The experience of working with Bruce in 1999 inspired my choice of materials and tradespeople for the public artwork, *Wave Drawings 1-8*, in 2013, which is one of the main outcomes of this research.

The Pipestacks sculpture is a playful, interactive public artwork that can be activated in a number of ways by visitors to Pipemakers Park. It is an immersive environment made of concrete sewerage pipes, a reflective place which is also an industrial setting which combines landscape, remnant materials and art.

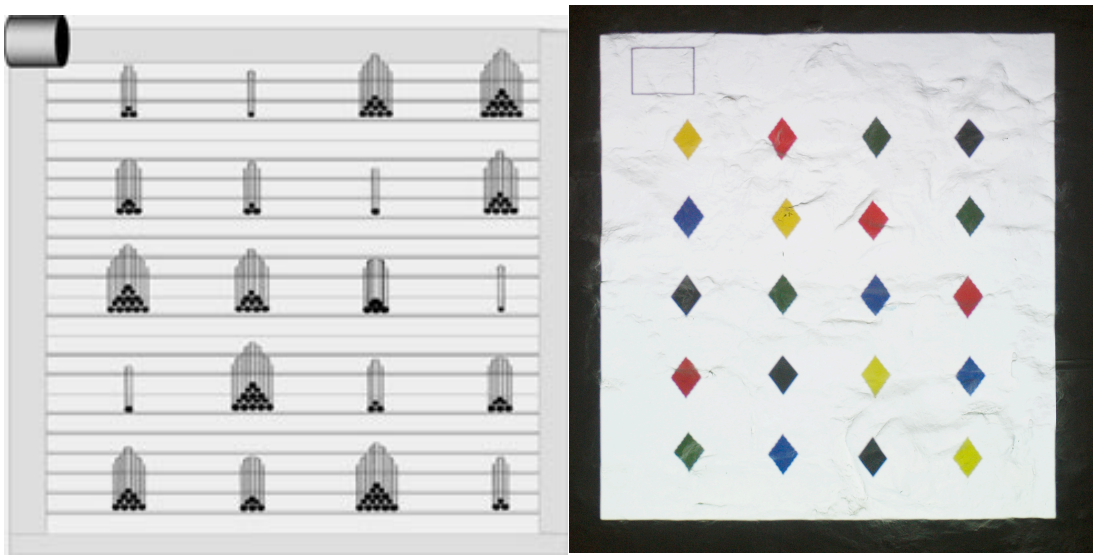

*Figure 39 images from the Pipestacks game design, from the Top Factory CD Rom, 1998.*

*Figure 40 The Pipestacks, a sculpture installed on the drying racks, 1999.*

## *The Ecomuseum framework as a process for making collaborative contemporary art*

As public artworks, each of these exhibitions ameliorate the imbalance in the perception of Melbourne's industrial West as a neglected area of historical importance. The exhibition *Still Here*, the *Pioneer Women's Shelter* and *The Pipestacks* are also each examples of interpretative outcomes developed within an ecomuseum framework used by multidisciplinary teams comprised of people each contributing in different ways. Riviere describes the ecomuseum framework as "a laboratory, conservation centre and school"; this triad, he further argues, "is not self-enclosed, it receives and it gives.[128] The ecomuseum framework guides a process where experts work with non-experts in a mutually respectful way, combining ideas, disciplines and skills and teaching each other along the way. It generates a collaborative energy and synergy to achieve multilayered outcomes that are considered and contributed to from multiple perspectives. Outcomes carry an inherent story, the ecomuseum framework seeking to create a space for activity that is equally multifaceted in connecting and interpreting past, present and future.

Riviere points out that the processes generated by an ecomuseum framework seek out common principles and cultural concerns in order "to foster awareness of its dignity and artistic manifestations, from whatever stratum of the population they derive.[129] The

[128] Riviere, "Images of the Ecomuseum."
[129] Ibid.

contemporary artist can contribute to this process in several ways. They can identify artistic manifestations within the culture that may otherwise not be apparent to experts in other fields. They can assist with finding appropriate forms to translate the ideas of the working group. They can help to “foster awareness of its dignity” by connecting the culture to contemporary art audiences. Similarly, my experience as a contemporary artist is that there is much to learn through adopting an ecomuseum framework of working closely with other people. Through the influence of witnessing, first-hand, ecomuseum principles in action at MLMW, I have continued to produce site responsive public artworks. These typically incorporate everyday industrial materials installed by skilled local tradespeople. While these artworks incorporate the expertise and skills of people working with materials and methods, with which they are familiar, they also often provide a welcome challenge. They involve working closely with others.

The ecomuseum process of working collaboratively to produce *Still Here*, the *Womens Shelter* and the *Pipestacks* informed and made possible later Museum projects such as *Pobblebonk* and *Volcano Dreaming,* discussed in Chapter Eight, and also informed an approach to making my own site responsive wall and field drawings, discussed in Chapter Six, and site responsive public artworks and workshops such as *Stream* and the *Playground Drawings*, discussed in the conclusion.

# CHAPTER 4
# CONTEXTUALISATION AND WORK, MAKING CONNECTIONS AND OUTCOMES

Chapter Four connects ecomuseum principles to international contemporary art practice. It establishes common ground between the foundation of Melbourne's Living Museum of the West as an ecomuseum and my critical art practice, which actively questions established perspectives on history and culture to propose alternative ways of thinking to foster more equitable and sustainable futures. Specifically, the chapter examines key intersections between the work of MLMW as an ecomuseum in Australia and that of contemporary Croatian artists and curators. In this frame, Chapter Four examines a range of projects at MLMW and overseas in relation to the idea of processes of contextualisation in terms of the imperative to make explicit the circumstances of an event, statement or idea. The chapter shows how processes of contextualisation involve connecting people, places and events across time. My involvement in MLMW prompted the formation of a contemporary art sub-committee and a program of artist residencies and exhibitions, this collaborative activity forms a significant part of my art practice. In this chapter, I link these activities to the history of artists' interventions and collaborations with archives and museums. A key theme here is the transfer of knowledge and understanding through direct, lived experience.

Building on discussion in Chapter Two, this connection is firstly examined in terms of the influence of Mladen Stilinović's 'manifesto of laziness' on my early work. Counter to its provocative title, this helped me to connect my practice to a global network of artists who contested what it means to work from within the interconnected 'art-world' system of local and international art institutions and markets. Integral to this discussion are the economic and practical challenges of working as a contemporary artist in Australia, which links in turn to the ideas presented by Sven Lindqvist in *Dig Where You Stand: How to do Research on a Job* and my job as an artist. In examining my embedding in a university research environment during my doctoral studies, the chapter argues that the concept of 'artist-in-residence' should be expanded beyond the usual cultural contexts to a far wider range of public, private and commercial contexts to harness the capacities of artists to their full extent and more adequately and equitably support their creative and critical investigations.

Through discussion of the processes of contextualisation and sharing, Chapter Four extends the consideration of the nature and purpose of acts of collaboration in order to deepen the

investigation of the overarching concern of this thesis — how an artist can make meaningful connections across fields and between people.

## *Residency, contextualisation from within*

The pursuit of contextualisation — wanting to make sense of the world and where I am within it — led to my interest in art and later to geometric abstraction, the diagonal, the diamond-shape and the significance of very small differences in matter. Later still, it triggered the direction of this research. As will be discussed in Chapter Seven, to progress my interest in geometric abstraction, I needed to better understand key concepts concerning the physics of matter by connecting with science and scientists, using connections and knowledge to advance my understanding being a cornerstone of my art practice. For example, the pursuit of contextuality led to my interest in DIY culture, the establishment of Store 5 and working with MLMW. There I learnt to use an ecomuseum framework to collaborate on projects about the environment, history and art. My involvement with MLMW led to my development of participatory, instruction-based artworks in which collaborative engagement in the process of making linear geometric drawings became a way of transferring knowledge, creativity and understanding to others through the vehicles of analogies, experience and reflection. The process of framing an idea for others to understand and discuss requires finding common ground. This thesis articulates the diverse dimensions of this.

### *Arts practice in an academic framework*

Research involves developing a research question that identifies what is deficient or missing in a field of knowledge, thus guiding the researcher's process in expanding disciplinary knowledge. To use the analogy of a tree and the example of marine biology, the trunk of the marine biology tree is its foundational knowledge from which research pathways branch out in new directions. In many fields of knowledge, new research develops along well understood pathways and processes. The paths of practice-led research in visual art are less straight forward due to the fact that contemporary art practice has evolved to take the form of self-directed research. Developing an art practice often involves researching the work of other artists across time and place to develop a referential dialogue with established

art that contributes to the unfolding of contemporary art. Art practice is thus self-determined and self-directed, yet engaged, while unfolding through research-related processes.

The process of defining and contextualising my research question has involved diverse fields and resources, ranging from the history of non-objective geometric abstraction, DIY culture and artist-led initiatives, museology, physics, and environmental studies with a focus on Victoria's critically endangered volcanic plains. Contextualising this research has involved the conceptualisation of a complex tree of multidisciplinary ideas within a forest of contemporary art practices. The aim of engaging this diversity is to forge new ways of knowing and understanding by modelling how a contemporary art practice can connect to other fields to help inform the future. The thesis models the idea of artists embedded within non-art projects as resident consultants to help provide useful alternative perspectives.

### *Practice-led residency*

Whether making a wall-drawing, a film, an installation or an exhibition, my art activities all involve an element of experimental site-responsiveness, which has now been conceptually extended by my experience of working within a university research context to include residency. Residency is now integral to the operational philosophy of my art practice and a central original contribution of the thesis in understanding the potential nature and purpose of contemporary art. Working within a university affords artists access to equipment and facilities, but most importantly to diverse intellectual resources and expertise, to networks of people beyond the sphere of art and the artist's existing knowledge and skills. Early in this research, I began talking with scientists in the School of Physics at the University of Melbourne.

My experience of collaborating with a wide range of people at MLMW helped me in finding common ground with the scientists, who generously fielded my questions. As our relationship developed, it made me see that my working processes largely involve exploring and participating in a context or experience. Over time, I came to learn about the scientists' research projects and a residency-like working association developed, which resulted in physics staff and students participating in several wall-drawing projects on campus. Projects between MLMW and the university science education program were also undertaken. In 2014 and 2015, MLMW hosted 50 indigenous secondary students from around Australia from the University of Melbourne's RISE program for an afternoon of talks and exhibitions

about Aboriginal and environmental heritage and the Victorian Volcanic Plains at Pipemaker's Park.[130] MLMW held a series of talks to support the University's science education outreach programs. The Museum's former Aboriginal Cultural Officer, Larry Walsh spoke to the students about the connections between science and indigenous plant foods, culture and knowledge in the Pipemakers Park gardens, where there are living examples of traditional plant foods and materials. In the Visitor Centre, I spoke to the students about the exhibition *Volcano Dreaming*.

*Figure 41 University of Melbourne RISE program participants at MLMW in November 2014. Image source MLMW annual report 2014-15, p. 25.*

A further project involved the university-based collective, We Are Real Physicists, which saw the upper level of the Museum's historic Bluestone Building host young people from the local community to encourage an interest in pursuing science and physics. The show, led by experimental particle physicist Roger Rassool, blurred the lines between physics and magic,

[130] The Residential Indigenous Science Experience (RISE) is an exciting week-long camp held at the University of Melbourne to engage Year 9 and 10 Indigenous students from all over Australia with science, technology, engineering, and maths (STEM) and inspire students to consider a career in STEM as an option for the future. https://science.unimelb.edu.au/home/engage/community-quick-links/science-in-schools/rise

employing laser lights, experiments with helium balloons and liquid nitrogen, dry ice, explosions, drama and audience participation to engage the young people (Figure 42).

The event exemplifies how the ecomuseum framework is based on a responsive programming structure dedicated to the flourishing of partnerships through collaborative activities and participatory events. These two projects were an organic product of my artistic residency within the Museum and the university's physics department. The partnership with the physicists informed the development of my wave drawing projects, especially the new instruction-based work, *Whoosh #1*, (discussed in Chapters Six and Seven) which shows this kind of fluid, responsive and reciprocally beneficial working relationship through the combination of geometric analogy and collaborative production.

*Figure 42 Poster advertising the University of Melbourne laser light show at MLMW in August 2014. Image source MLMW annual report 2014-15, p 28.*

## *Work-art-life*

A marine biologist visiting a beach on summer holiday is not an average beachgoer. Marine biologists continue to perceive the beach through the lens of their expertise, experience and their profession. Just like everyone experiences the world through the lens of their expertise, and experience, artists see the world from the perspective of art making. An artist is an artist whether they are on holiday, doing routine everyday activities or working in some other kind

of paid employment to support their practice. Artists are continually responding to their situation as a source for art, the experience of an artist being one of work-life-art fusion in which art activity is not limited to the context of the studio and gallery. In economic terms, however, the vocation of a contemporary artist has a more complex relationship to the concept of work than most other professions as artists do not usually get paid to be artists.

It is beyond the scope of this thesis to thoroughly examine the emergence of arts funding policy in Australia, but the following discussion of arts funding policy in Australia is important to include. It is informed by my experience of working as an artist in Australia, broaching some of the ways in which British colonisation has influenced the development of arts funding policy in Australia to contextualise the motivation for the establishment of many artist-run initiatives, collectives and organisations such as MLMW and Store 5. This discussion is informed by Raymond Williams's writings on culture and society from the 1980s, being brought to my attention through Anna Upchurch's work on the origins of the current arts funding policy and philanthropy in Britain.[131]

### *Art making, economics, context and origins*

When I began to pursue art as a career in 1980, this was not a practical career choice. There was limited interest in and resources for contemporary art and no guaranteed or regular income. The situation for Australian artists has been precarious since colonisation. Various Australian governments have sought to direct the course of Australian art to advance political agendas linked to national identity and biased views of valid art. This practice continues today despite the founding of organisations like the Australia Council for the Arts and the National Association for the Visual Arts (NAVA) which were designed to support the development of independent artistic and cultural expression by holding government and business interests at 'arms-length'. This story is key to contextualising the emergence of artist run initiatives and DIY culture, the organisations Store 5 and MLMW, and the historical and current making and exhibiting of art in Australia. Unravelling this historical legacy has become a focus for leading curators working within major institutions, including Sue Cramer, Max Delaney and Leslie Harding.[132]

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[131] Anna Upchurch, "John Maynard Keynes, the Bloomsbury Group and the Origins of the Arts Council Movement," *International Journal of Cultural Policy* 10, no. 2 (2004).10:2, pp 203-217.

[132] Evident through programs of the Australian Centre for Contemporary Art (ACCA) and exhibitions such as 'Sovereignty' (2016), 'Unfinished Business, Perspectives of Art and Feminism' (2018) under the directorship of Max Delaney, and exhibitions at the Museum of Modern Art at Heide, such as 'Cubism'.

*Figure 43, The Big Picture, Tom Roberts, 1903.*[133]

In the book *John Maynard Keynes, The Bloomsbury Group and the origins of the Arts Council Movement*, Upchurch discusses the art associations that led to the establishment of the British Council for the Arts in 1946, a main influence on the establishment of the Australia Council.[134] Encouraged by artists of the Bloomsbury Group and the ideas Roger Fry and Clive Bell on the 'life of the imagination', the British economist John Maynard Keynes used his role as Chair of the Council for Encouragement of Music and the Arts to argue for an arms-length approach to support for the arts in Britain, free from ideological interference and the taste preferences of politicians. When studying economics and moral philosophy at Cambridge, Keynes joined a secret society called the Apostles, where he met members of the Bloomsbury Group.[135] In *An Essay in Aesthetics*, Fry proposes that artists and those who truly experience art have a "clarified sense perception".[136] Fry has more to say on the value of the integration of art and artists into society, writing:

> And when we come to the higher works of art, where sensations are so arranged that they arouse in us deep emotions, this feeling of a special tie with the man who expressed them becomes very strong. We feel that he has expressed

[133] Image source: https://www.rct.uk/collection/407587/the-opening-of-the-first-parliament-of-the-commonwealth-of-australia-9th-may-1901
[134] Upchurch, "John Maynard Keynes, the Bloomsbury Group and the Origins of the Arts Council Movement."10:2, pp 203-217.
[135] *Origins of the Arts Council Movement: Philanthropy and Policy* (Place of publication not identified: Palgrave Macmillan, 2016); ibid. P. 24.
[136] , p 26.

> something which was latent in us all the time, but which we never realised, that he has revealed us to ourselves in revealing himself.[137]

Via Clive Bell, Fry's thinking influenced Keynes' thoughts on how a "civilised society" might be achieved through the integration of art. Bell's 1928 book *Civilization* argues that the presence of a leisured class with the time, money and consequent lack of obligation to do anything in particular as providing:

> time to cultivate and lead the imaginative life, to form a receptive community for true art and the products of the imaginative life. The existence then, of this leisured class, is the measure of civilization, not the form of government, technological superiority or wealth. Thus, a civilized society values the imaginative life over the necessities of the actual life, and consciously creates policy and social conditions that encourage artists, scientists and others to thrive and innovate.[138]

Bell is, of course, speaking from the position of being white, well-educated and wealthy, a condition which he shares with Keynes and other members of the Bloomsbury Group. His description of a "civilised society" closely resembles the type of society Australian Aboriginal people had developed prior to the British invasion of their lands.

### *Arm- length funding*

In *Origins of the Arts Council Movement: Philanthropy and Policy*, Upchurch examines the ideologies that led to the current arts funding model in Britain.[139] One member of the Apostles secret society was the renowned philosopher G.E Moore. Although never a member of the Bloomsbury Group, Moore's ideas of "naturalistic fallacy" and "organic unity", as set out in his *Principia Ethica,* significantly influenced their thinking[140] and in turn Keynes's ideas about the establishment of semi-autonomous public bodies.[141] Defined in the 1970s as the 'arms-length principle' of distancing governments from institutions they create and fund, such as hospitals, museums and universities, Keynes developed this stance to

[137] Ibid. p.20.
[138] Upchurch, "John Maynard Keynes, the Bloomsbury Group and the Origins of the Arts Council Movement."Anna Upchurch (2004) International Journal of Cultural Policy, 10:2, 203-217, p 206.
[139] *Origins of the Arts Council Movement: Philanthropy and Policy*. P. 206.
[140] G. E. Moore, *Principia Ethica* (Cambridge,: At the University press, 1903).
[141] Upchurch, *Origins of the Arts Council Movement: Philanthropy and Policy*; ibid. P. 113.

exclude the influence of businessmen and politicians on the type of art being produced to prevent its becoming debased or turned to propaganda. This model, in many ways reflects the model of independent value and objective peer assessment used for funding academic research, of which Keynes was familiar through his role as Bursar at Kings College in Cambridge. [142]

In the early 1940s, the Australian economist HG 'Nugget' Coombs, who trained with Keynes in London, used Keynes's idea of an arms-length funding in a proposal for Federal arts funding in Australia, proposed in his role as Director-General of the Department of Post-War Reconstruction. These plans were shelved when the Menzies Government came to power in 1949. In 1967, however, Coombs became the first chair of the Australia Council for the Arts. In 1975, an act of the Federal Parliament established the Australia Council as an independent statutory authority, funded by the federal government to formulate and carry out policy to support the arts in Australia.[143] Coombs's influence on the Act is reflected in funding being determined by peer review via the Council rather than by ministerial decision, although provisions were included to enable the Arts Minister to intervene via a parliamentary process if the actions of the Council conflicted with 'public interest'. [144]

Specific funding decisions of the Council were thus protected from government interference, especially at times like a change of government. Since the inception of the Australia Council, however, the greatest proportion of its funding has gone to support arts infrastructure and systems for administrating this infrastructure, bypassing peer overview. Moreover, the Australia Council distributes funding through a tier-based system according to which the greatest proportion of funding goes to major art institutions and performing arts companies followed by minor arts organisations, then artist-run initiatives, with individual or small groups of artists receiving the smallest proportion of the funds. Until the mid-1990s, the Australia Council did not financially support or encourage the concept of artists-run initiatives.[145]

The Council may have adopted a peer assessment process to distribute grants, but it does not apply this to the allocation of the bulk of its funding, only to the lowest tier of grants to individual artists and for artists' projects. The main decision-making power for arts funding resides with bureaucrats and politicians, skewing who becomes recognised as an artists and

[142] Ibid. P. 112.
[143] Australia Council Act 1975, Part II section 5, Functions of Council.
[144] My emphasis, as this structure enables the qualification of 'Public Interest', including the Ministers role as the elected representative while excluding personal bias by opening up the case of 'Public Interest' to debate via parliamentary process.
[145] Conversations with Australia council staff regarding Store 5, 1990.

what work is funded. Although all new art emerges from the bottom-up through the activities of artists, the Australia Council's model of arts funding is top-down.[146] This appears incongruous. Creative practice involves a lack of structure and spontaneity where the processes for applying for arts funding involves control and subscription to normative processes. Many progressive policies developed in Australian in the 1970s, to improve conditions and rights for artists were swept away in the 1980s and 1990s as a neo-liberal model of growth economics extended its influence to government policy. Neo-liberal economics favours a hands-off approach to the economy on the part of government, allowing markets to self-regulate, this being seen to allow business to grow and prosper. De-regulation might seem to align with the arms-length funding model of the Australia Council, but it has intensified competition between artists while requiring artists to navigate a proliferation of red-tape to operate their practices like small businesses. This is a major distraction for artists, reducing the time available for their work.

Economic rationalism, combined with cyclical financial crises, has diminished the idea that governments should be a source of public goods, such as arts funding. Initiated in 1984, the National Association for The Visual Arts (NAVA) was formed to lobby for the rights of artists within Australia's new systems of arts infrastructure and administration. Through its membership, NAVA has developed a 'Code of Practice' for the arts industry for any matters not covered by Australian law. The Code presents a set of best practice standards for the visual arts sector as the basis for negotiations between artists and the entities which they deal with professionally. The Code is a guide and not legally binding so artists who do not accept conditions and payments below the standards outlined in the Code are faced with the possibility of being excluded from exhibitions.

Today, market forces govern the global art market. Fields like art, design and media have been reconceptualised as cultural and creative industries, with their outputs viewed as commodities. Governments, which have come to see 'the market' as the source of all value, apply quantitative performance indicators to the arts. The top down model of funding allocation is based on an analysis of statistical data about the cultural sector. Since its founding in 1967, the Australia Council for the Arts has become increasingly absorbed with complex performance models. Arts administration competencies being required to provide a flow of data from arts organisations and artists to funding bodies and from there to government. Neoliberal macroeconomic frameworks have effectively negated the purpose

[146] This commentary is supported through the content of an independent research report commissioned by the Australia Council. Phip Murray, "Talking Points -a Snapshot of Contemporary Visual Arts, 2013-14," ed. Australia Council (Sydney, Australia: Australia Council, 2013-14).

for which the Australia Council was established by Coombs, this being to formulate and implement policy to support cultural sectors to deliver public good rather than profit. The Australia Council has increasingly framed art-making according to the economic and industry models of culture established in the late 1990s by the British Labour government. According to this model, cultural production either has potential commercial applications, including its exploitation as intellectual property, or it has artists fulfilling the role of primary producers in a cultural production chain, supporting the gallery, museums and arts festival sector as an entertainment, leisure and tourism industry.

Meagre public arts funding is available to maintain an underclass of artists who compete for the limited resources available, effectively transforming artists into the process workers of the contemporary art industry. Except for the few commercially successful or privately wealthy artists, contemporary artists receive the least remuneration and the least other benefits from their occupation, where other arts workers, such as curators and arts bureaucrats see an increase in benefits and wages as they rise up the institutional hierarchy of the art system. To work as an artist is characterised by precarity, artisthood being an acknowledged model for today's 'gig' economy. Unlike factory workers, artists do not accrue annual leave, long service or sick leave or superannuation. The pipeline of art school graduates continually replenishes the pool of active artists competing within Australia's limited network of contemporary art institutions, commercial galleries and arts patronage and its unstable climate of fluctuating art trends and interests. The system directs support to those artists whose activities are most likely to help deliver the required performance indicators for the visual arts sector established by government arts policy, while determining that artists and arts organisations develop increasingly sophisticated art administration activities and business and marketing skills. For artists, these administration and business skills are now taught in art schools, promoting the sense of an art practice as a competitive and commercially-focused domain, further displacing the activity of artists being artists.

From the early to mid 1990s, like many small arts organisations, MLMW was also encouraged to find new avenues of funding through business and philanthropic support to reduce the need for government funding. By the late 1990s, to receive government support — rather than demonstrate quality outcomes and achievements through community responsive programming — MLMW was increasingly required to provide business and strategic plans for reducing government support and replacing it with increased private sector funding. But an ecomuseum is based on the concept of people, rather than businesses and governments, determining and controlling the production of their culture and history. In addition, securing ongoing arts funding based on neo-liberal macroeconomics and

the private sector funding is inherently unstable as it depends on the maintenance of economic growth.

Since 2000, the small to medium arts organisations that most directly support the work of living artists have seen a significant reduction in their meagre proportion of overall arts spending.[147] This sector has also seen a significant increase in reporting requirements and the expectation of large proportions of their budgets to be allocated to marketing campaigns, with the terms of these continually changing. Today, a significant proportion of government arts funding is spent on arts administration and the out-sourcing of marketing products and event development and management to sub-contractors.[148] Within visual art institutions, a proliferation of curators are employed to appropriate the work of artists through their exhibition and program schemas, while artists working as curators in artist-run exhibition spaces must apply for grants to be paid to attempt to promote the work of marginalised artists. Artists are often last on the list to be paid for their work when it is loaned or commissioned for exhibition in public galleries. They are often expected to forgo reimbursement for the production, packaging, framing and even transportation of their work when it is included in an exhibition. The most prestigious and selective art competition can demand registration fees from artists rather than providing an artist fee to the artist for exhibiting.

From the late 1980s, the Australia Council has run an agenda of promoting Australian art within the global art system, but without first establishing a local art system that supports Australian artists. In 2013, the 1975 Australia Council Act was repealed and the Council was re-formed as a corporate body while being stripped of much of its independence in implementing federal Government arts policy.[149] Arts funding in Australia is increasingly the subject of radical change and political whim, buffeting artists and small arts organisations. In 2015, for example, the Arts Minister George Brandis retained $103 million from the arts funding budget for his preferred projects and 65 arts organisations lost their funding. Although NAVA has operated since 1984, in 2018 it still has to lobby for basic rights for

[147] NAVA website reporting on the 2016 research project commissioned and supported by City of Sydney. *The data in this study reveals that the small-to-medium (S2M) visual arts sector employs over 2,000 people, puts $100 million into the economy and produces 26,000 new art works each year with a budget worth just 0.03% of Federal Government revenue. However, there has been a 17.5% decline in per capita federal arts spending from 2008 to 2013.*

[148] Some artists make a living producing marketing materials and working as photographers to supply source materials to marketing products to arts institutions and many S2M organisations specifically outsource this work directly to artists, for example the website of ACCA was designed and by artist Rowen Mc Naught (2017).

[149] There are parallels here with the processes of development of 'Creative Scotland' in 2010, see Upchurch's description, Upchurch, *Origins of the Arts Council Movement: Philanthropy and Policy*; ibid. 206.

artists such as equal pay, superannuation and the concept of a small pension as an alternative to artists requiring the support of unemployment benefits.

Despite Australian Government aims for artists to be internationally active and competitive, Australian artists' precarious financial situation is compounded by physical and economic isolation from increasingly integrated contemporary art networks, private collectors and philanthropy in China, Europe and the United States. The general lack of knowledge and understanding of contemporary Australian art as a significant cultural expression has been eroded as major Australian art institutions increasingly present contemporary art as an entertaining participatory experience. In developing exhibitions to attract high visitor numbers and move those viewers quickly through exhibition spaces, scope for thoughtful, educational and interpretative exhibitions based on reflection has decreased. Such exhibitions are a poor fit when the emphasis is on tangible performance indicated by simple metrics like visitor numbers rather than intangible indicators like the quality of visitor experience.

Under these conditions, women artists experience greater difficulty than male artists in financially sustaining an arts practice. Although women represent a clear majority of art school graduates, their work is distinctly underrepresented in exhibitions and collections, both public and private. Employment in teaching or curating can offer artists a career path and financial stability, but permanent positions in such roles are highly competitive to secure, favouring artists with high performance measures and supporting the general status quo in the art world, which tends not to include many women. The consequence is that the decision to study art as a cultural and critical activity becomes highly fraught, with success involving close attention to the strategic conduct of an art practice in benefiting the artist's career or the business of art, not society.

## *Artistic Capital, Natural Capitalism and Social Benefit*

Paul Hawkin, Amory Lovins and Hunter Lovins proposed the concept of natural capitalism in their 1999 book *Natural Capitalism: Creating the Next Industrial Revolution.*[150] In mounting a critique on capitalism from within, the book argues that industrial capitalism is an inherently flawed system because its model of economic returns does not account for the value of the

[150] Paul Hawken, Amory B. Lovins, and Hunter Lovins, *Natural Capitalism : Creating the Next Industrial Revolution* (Boston: Little, Brown and Co., 1999).

natural and human resources that it exploits for free. It assumes that natural resources are infinite and that their exploitation comes at no cost to the planet or societies, counter to actuality, natural resources being finite and their unsustainable exploitation having severe implications, including real economic costs. Hawkin, Lovins and Lovins's system of natural capitalism assigns value to both human and natural resources, proposing an overhaul of cost accounting within the capitalist economic model and associated public policy to ensure investment goes back into these human and natural resources. Central to this change is shifting the emphasis from quantity to quality through the redesign and re-regulation of manufacturing processes around the reuse of materials.

New products designed through natural capitalism are required to demonstrate a net-benefit to society and the environment rather than simply generating immediate profits. For example, under the natural capitalism model emissions from a car or factory need to be clean enough to go straight back inside the car or factory or provide a secondary health or environmental benefit to be considered economically viable. The transition to natural capitalism requires thinking about production and the purpose of the economy differently. Natural Capitalism demonstrates how the rationalist growth model of economics neither cleverly nor sustainably harnesses the potential of capitalism as a system for organising the economy and society because it does not properly value nature or make effective use of people and innovative thinking to make the transition to environmental sustainability.

When the natural capital concept is applied to the art system, we see contemporary artists as an undervalued resource who could potentially contribute across society as conduits for independent, creative thinking in the shift to a more equitable and sustainable economic future. Although NAVA lobbies on behalf of visual artists for improved rights and remuneration for artists, their Code includes no broader plan on how to better use the skills and abilities of artists or to provide them with sustainable support for their activities. Lehman (2017) argues that dedicated research is needed into artist residencies as the basis for a model that "illustrates how the individual, the organisation, and the region intersect and interact in a range of different ways to form relationships, impacts, and consequently, value in a variety of forms".[151] For the majority of artists, maintaining an art practice as a primary occupation over the long term while pursuing a self-determined path of artistic investigation requires resourcefulness and resoluteness. Receiving sporadic, low level remuneration has required me to take on additional work in secondary fields on top of my full-time practice while forming collective initiatives and communities with other artists. Supplementary

[151] Kim Lehman, *Conceptualising the Value of Artist Residencies: A Research Agenda*, vol. 1 (2017).

employment often distracts from an art practice, although when the work is complementary to a visual art practice it can have important benefits. The nature of secondary work that is complementary to any individual art practice, and not distracting, varies with each individual artist. For me, being involved in cross-disciplinary, collaborative projects via the MLMW provided diverse life experiences to develop skills and knowledge across a variety of fields.

With adequate funding and the sense of a sustainable career path supported by the provision of expanded residency programs, artists could better plan and develop their research along the lines that Keynes described in his BBC broadcast of 1946 on the purpose of the Arts Council of Great Britain, which he argued was "to create an environment to breed a spirit, to cultivate an opinion, to offer a stimulus to such purpose that the artist and the public can each sustain and live on the other in that union which has occasionally existed in the past at the great ages of a communal civilised life."[152]

## *Other models*

When first employed at MLMW, I was already engaged in a DIY approach to cultural production through my links to Melbourne's alternative music and art scene and the artist-run gallery Store 5. The attraction to MLMW was intuitive, the Museum ethos was clearly in keeping with a DIY process of resistance and affirmative action. Forming my colleagues and peers, each of the artists at Store 5 and the core staff and volunteers at MLMW, in their own way, share a resistance to 'top-down' cultural authority. Both organisations were formed by individuals determined to make their own decisions of what to research, exhibit, produce or not produce. As a consequence of the nature and independence of their individual practices and research, they too experienced a lack of opportunity in the broader art and museum worlds to publish or present their work. Although difficult to maintain as a life-long project, for me, following a self-directed and independent research pathway is made possible because it attracts people who share and are supportive of this approach.

Store 5 and MLMW were founded by people coming together who each independently value and experienced the need for alternative platforms of expression. This coming together of independantly active individuals led to collective projects; to developing collaborations and

[152] Upchurch quoting John Maynard Keynes' BBC broadcast,1946, Upchurch, "John Maynard Keynes, the Bloomsbury Group and the Origins of the Arts Council Movement."

community binding activities; and, to MLMW and Store 5 (formally and informally) developing codes of practice as organisations. The following pages provide three examples of artists and curators working independently and together, locally and abroad, to explore and combine concepts of work, labour, economics, politics, life, history and art by 'digging where they stand', locally, developing independent research and networks through making and presenting art. These examples present global interconnections and new ways of knowing and understanding these topics.

## *Mladen Stilinović*

The artist John Nixon led the way in Australia for contemporary art, showing artists how to simply create their own opportunities, platforms and spaces to exhibit, and by continually connecting artists with each other he helped establish an alternative and dynamic art world in Australia. Nixon extended this project internationally, connecting artists and Australia to a global network of independent producers within the broader art world.

In 1990, through my involvement in Store 5, John Nixon introduced me to his colleague Mladen Stilinović (1947-2016) who also became a life-long friend, mentor and a major influence on my work. The most important ongoing connections with people, other than the Store 5 group and MLMW has been with artists in Croatia. This ongoing association with Stilinovic being intrinsic to how I have come to understand the work-life-art relationship connecting MLMW to making contemporary art and visa-versa.

I choose to study art in part as a result of personal reflection on what it means to work, to not work and to retire or not retire. In 1980, making art in Australia was often seen as a leisure or retirement activity rather than a career, although this connection did forge a link between making art and having time for reflection and personal pursuits. Choosing to study to be an artist partly involved a decision to reject a lifetime of work in a full-time paying job in order to pursue what interested me at a primary and immediate level. It was a rejection of having to fit my interests in art around paid work, to defer them to later in life or conceive them as a hobby and hence those interests not being deemed serious. It meant constructing the job of being an artist. Meeting Mladen Stilinović helped me to significantly develop my thinking about art production, the activity of being an artist, the work of an artist and "work" in general.

Mladen and his partner in art and life, the curator Branka Stipančić, were the first artists I had met from Eastern Europe. In 1990, Mladen spoke very little English, but he understood things very well. In helping him to install his exhibition at Store 5 and produce a small catalogue, we became friends and colleagues. Mladen invited me into his world of art production, which afforded me a more world-historical perspective on my own art production in Australia. This expanded my perspectives beyond the model of the Euro-American art industry. I quickly saw the parities between the situation of Australian artists exhibiting at Store 5 and Mladen's colleagues working in Eastern Europe, where they also needed to establish their own venues and projects to have an art practice.

Discussions with Mladen identified many common concerns and interests, especially a shared awareness of and resistance to art being defined and dictated from above by government, the art system or collectors with vested personal and political interests. I began to see more clearly the imperative of the "contemporary" in contemporary art as an innately political activity, that is, the sustained importance of the ongoing story of art rising upwards from the ground plane of the artist and everyday life. Mladen was insistent that to critically question the mechanisms and motives of the systems that define art from above — and to continue to operate within and despite them — artists must thoroughly understand these systems. Moreover, in circumstances where art is scrupulously controlled from above, the production of art and the conduct of artist initiatives depends on rigorously understanding of the work-life-art relationship.

*Figure 44 Mladen Stilinović, An artist Who Cannot Speak English is no Artist, 1991.*[153]

[153] Image source: https://mladenstilinovic.com/works/5-2/

Artists working in Australia and Croatia are isolated from the international art-world in various ways. Australia's isolation is primarily attributed to geographic isolation, now somewhat reduced by cheap air travel and the Internet. More important is the deeply embedded sense of isolation resulting from the forging of Australia art history around the politics and processes of colonial invasion and white nation-building, including the ongoing, unacknowledged war between mainstream Australia, and Aboriginal people and the Australian environment. In *The Biggest Estate on Earth* (2011), Bill Gammage shows how Australian art history is closely entwined with the racial subjugation of Aboriginal people and the destruction of the environment.[154]

Croatia, although geographically close to major European art centres, is isolated from the international art-world by language, economic and political disadvantage, and war; the Croatian War of Independence (1991-1995) breaking out in the former Yugoslavia the year after I met Mladen. Although living in a country with no contemporary art market and a very small art audience, from the early 1970s Mladen resolved not to work in order to be an artist, to be free in art and life in spite of constant and tedious political pressures.[155] He left school at an early age to design his own education, read extensively and developed his own philosophical path and life with art. Growing up in socialist Yugoslavia, Mladen experienced the workings of authority at first-hand, learning how to appropriate the techniques of propaganda to make art and thereby turn the tables on authoritarianism.

[154] *The Biggest Estate on Earth: How Aborigines Made Australia, B. Gammage, 2011, Allen and Unwin.*
[155] Mladen Stilinović in conversation with Sabina Sabolović, 'I've got time', Mladen Stilinovic, *Artist's Books 1972 - 2013 Second Edition*, ed. Branka Stipancic, trans. Nada Jacimovic Graham McMaster, Iva Polak, 700 ed. (Zagreb: Mladen Stilinovic, 2013).p 44.

*Figure 45 Mladen Stilinović, Dollar Without Value, 1993.*[156]

Central to Mladen's practice is targeting the concept of Work, as both fetishised and monitored by the Yugoslav State through active surveillance and censorship of any alternative or oppositional ideas, including via contemporary art. Mladen created artworks and situations using the simple sign-making techniques and materials of the street vendor to surreptitiously lampoon the absurdities of making art in Croatia and the wider art system. For Mladen, "humour is no joke, truth can be understood through humour".[157] With Branka Stipančić, he organised exhibitions and promoted like-minded artists and writers including the Group of Six Artists, of which he was a member, and a broader community that included Boris Cvjetanovic, Vlasta Delimar, Markita Franulic, Sanja Ivekovic, Ante Jerkovic, Jelena Peric, Branka Stipančić and Goran Tribuljak.[158] Many of these artists exhibited at PM Gallery (Gallery of Extended Media) which Stilinović ran in the Zagreb arts centre, House of Croatian Art (HDLU). During the war, the Croatian army used HDLU as a military base. In 1992 and 1993, Store 5 sold copies of hand-made artist-books produced by many of these artists, providing a venue for their art activity and sending the proceeds back to Croatia.

[156] Image source: https://mladenstilinovic.com/works/4-2/

[157] Mladen Stilinović in conversation with Sabina Sabolović, 'I've got time', Mladen Stilinovic, *Artist's Books 1972 - 2013 Second Edition*, ed. Branka Stipancic, trans. Nada Jacimovic Graham McMaster, Iva Polak, 700 ed. (Zagreb: Mladen Stilinovic, 2013). p 45

[158] The Group of Six Artists (Croatian: Grupa šestorice autora) was an artist collective founded in 1975 by the Croatian artists Mladen, Sven Stilinović, Fedor Vučemilović, Boris Demur, Vlado Martek and Željko Jerman in Zagreb, Croatia the 'Group of Six' were directly influenced by the work of an earlier group of artists, 'Gorgona' which included Josip Vaniata, Julije Knifer, Dimitri Basicevic Mangelos, Ivan Kozaric and Tomislav Gotovac.

Mladen's practice spans artists books, collages, films, installations, lecture performances, paintings, photography, poetry, slogans and signs plus the activities of critical writing, curating and directing artist-run galleries. He was constantly inventing new situations and ways in which to make art, regarding the nature and context for art practice as fundamental to effectively questioning assumptions about what it means to be an artist and to make art. His chief concern was the controlling influences of the art market and art institutions, advertising, global and local politics and economics on the scope for art and artists to pose questions about social control. His work reveals an economy of means to broach complex questions that show that things are not necessarily as they appear and that meaning is always relative to perspective. An example is the banner work painted on fake silk *An Artist Who Does Not Speak English Is No Artist* (Figure 44) to highlight the skewing of participation in the business of the art system, he and many of his artist peers speaking very little English.

*Figure 46 Mladen Stilinović, Potatoes Potatoes, 2001.*[159]

Mladen weaponised humour to undermine authority and expose uncomfortable truths. In *potatoes potatoes* (Figure 46), he sells Viennese cakes at a makeshift, cardboard-box, potato stand in the snow as a piece of social commentary based in the absurd. While calling out "*krumpira, krumpira* (potatoes, potatoes)", he presents cakes while hiding the potatoes behind him. Through deception, he presents a truth about perceptions in relation to degrees of hunger and poverty. The performance also makes reference to the presentation of objects

[159] Image source: https://mladenstilinovic.com/works/9-2/potatoes/

as art in the gallery as a basic form of exchange in the system of meaning and value that is the art world. *Potatoes, potatoes* thus presents food for thought, an analogy, an alternative perspective on whether art should offer fundamental sustainment — the potatoes — or diverting treats — the cakes.

*Figure 47 Artist at Work, Mladen Stilinović, 1978 (images 1 and 2 from the series of 8 photographs).*[160]

Mladen's 1993 manifesto, "The Praise of Laziness", challenged my perceptions about the nature and purpose of art, arguing that the business of art and the organisation of the art system had fundamentally corrupted art and eroded the artist's role as an initiator of ideas born of contemplation. On this he writes:

> Laziness is the absence of movement and thought, dumb time — total amnesia. It is also indifference, staring at nothing, non-activity, impotence. It is sheer stupidity, a time of pain, futile concentration. Those virtues of laziness are important factors in art. Knowing about laziness is not enough, it must be practiced and perfected. Artists in the West are not lazy and therefore not artists but rather producers of something … Their involvement with matters of no importance, such as production, promotion, gallery system, museum system, competition system (who is first), their preoccupation with objects, all that drives them away from laziness, from art. Just as money is paper, so is a gallery a room …[161]

Linked to this manifesto is a series of black and white photographs *Artist at Work* (1978) (Figure 47). These show Mladen lying in a bed to encourage the viewer to reflect on whether the artist is asleep or thinking; either way the titles make it clear that the artist is busy

[160] Image source: https://mladenstilinovic.com/works/
[161] Extract from manifesto, 'The Praise of Laziness', first published in 1993, Mladen Stilinovic, *Tekstovi / Texts*, ed. Branka Stipancic (2011).

working. As well as defying socialist ideologies that stressed the collectivisation of labour, knowledge and production for the good of the people and which rejected traditional and avant-garde art as bourgeois and counter-revolutionary, these images personify Mladen's own anti-ideology through which he defines himself as an Artist dedicated to laziness to have plenty of time. Paradoxically, the pursuit of laziness requires an active engagement in stealing back time. This becomes harder as time seems to accelerate and is consumed by an endless quota of daily tasks, including those administrative tasks required to operate within the art system.

## *Making connections*

Discussions with Mladen around the interrelated effects of art and politics influenced my interest in untold histories from Australia, my ongoing involvement in the work of the MLMW and the development of my instruction-based works with their investigation into how activities come to be acknowledged as art. Through the frequent visits of Mladen and Branka Stipančić to Australia from 1990, many ongoing connections have been established between Australian and Croatian contemporary art and artists, for example, *The Horse Who Sings, Radical Art from Croatia*, the 1993 exhibition Sue Cramer and Branka Stipančić curated at the Museum of Contemporary Art (MCA) in Sydney.[162]

This Australian and Croatian connection became more personally intriguing and relevant for me when in 1991 I discovered that my biological father was Croatian. Making first contact with my biological parents from whom I was separated at birth coincided with a visit to Australia by Mladen and Branka for an exhibition at Store 5. Both were familiar with the island of Pašman where my father was born, encouraging me to explore this unexpected personal connection. In 1997, I travelled to Croatia for two solo exhibitions of wall drawing projects, organised and partly facilitated by Branka Stipančić who translated the instructions for my works, *Red Matter Wall Drawings 1-4* and *Black O Wall Drawings 1-6* into Croatian to enable the works to be made by local artists and students in Dubrovnik and Rovinja. While in Croatia, I travelled to Zagreb and met many of the artists whose work I was familiar with through exhibitions in Australia. In 1997, many of these artists contributed artist's pages to a Croatian edition of the Store 5 publication *Circular* (#6), which I co-edited with Marco Fusinato between 1993 and 1997, Branka Stipančić serving as a third editor for this edition.

[162] Sue Cramer et al., *The Horse Who Sings: Radical Art from Croatia*, Contemporary Art Archive.

*Figure 48 Money Environment (1980), Mladen Stilinović, Van Abbemuseum, Eindhoven, 2008.*[163]

During my 1997 visit, the scope of the shared artistic interests and ethos of self-determination between the Croatian and Store 5 artists became apparent, these being promoted and documented by MLMW. Like Australia, Croatia has a small, relatively isolated and limited art market and a highly competitive grant support system. Artists must rely on a secondary occupation to support their practice. Unlike Australia, however, the Croatian government has established a peer assessment process that provides qualifying artists with a small government pension after a 30-year career for women artists and a 40-year career for male artists. The pension is not enough to live on and does not adequately represent the value of a life-long contribution to society through the arts, but it does recognise that art practice is a dedicated life-long pursuit that has no in-built superannuation scheme. In Australia, the only superannuation an artist might hope for is an increase in sales and the value of their work if they become more recognised.

[163] Image source: https://mladenstilinovic.com/works/

*Figure 49 Boris Cvjetanovic, Ocean (Australia), Peter, Markita, Kerrie (1998).*
*Image courtesy, Boris Cvjetanovic.*

In 1997, I worked with artist and curator Slaven Tolj, who ran the Dubrovnik exhibition and studio spaces Lazereti. In 1996, Slaven had developed an exhibition and symposium Otok (island), in response to the geographic, social and cultural isolation of artists in the regions of the ex-Yugoslavia post-socialism.[164] The project theme resonated with the situation of artists in Australia. In Zagreb, in 1997, I met the curator Markita Franulic, a contributor to Slaven's Otok project. In 1998, Markita travelled to Australia with her partner the photographer Boris Cvjetanovic. While in Melbourne, Markita spoke about the Otok symposium at MLMW to an audience of local artists and museum members. I took Markita and Cvjetanovic to Point Lonsdale to see the ocean, where Boris produced a series of photographs called *Ocean* that were exhibited as part of the Croatian exhibit at the 2003 Venice Biennale (Figure 49).

In 2001, MLMW supported Branka Stipančić's curatorial project *Veze/Connections: contemporary artists from Australia* for which 12 Australian artists exhibited their work in Zagreb, Croatia, and Ljubljana, Slovenia.[165] The exhibition catalogue includes essays by

[164] Slaven Tolj, Otok, exhibition catalogue, 1996.
[165] Veze / Connections included works by artists across 3 generations; Mike Parr, John Nixon and Lyndal Jones; Stephen Bram, Marco Fusinato, Geoff Lowe and Jacqueline Riva (A Constructed World), Tracey

Stipančić and Bernice Murphy, then Director of Museums Australia. In 2014, during this research, I returned to Croatia for a residency and solo exhibition of works and series of talks developed through this research in Gallerie GMK. Through this research, I discovered new international connections between the contemporary art programs at MLMW, the work of MLMW and the work of curators in Europe.

## *At Your Service*

In Croatia in 2014, I gave talks in Zagreb and Pula about MLMW and my practice, meeting with Markita Franulic in Zagreb where she holds the position of director of the Technical Museum.[166] The Museum was hosting *At Your Service - Art and Labour*, an exhibition curated by Silvia Eiblmayr and Christiane Erharter designed to intervene in the format of the "Technical Museum".[167] Commissioned contemporary artworks were installed within the Museum's permanent displays about innovation and technology with the intention to:

> open a new area of artistic discourse, engaging technology and art in a dialogue and analysing multiple aspects of labour in the context of the current economic and social crisis in Central and Eastern Europe. The exhibition illustrates the artists' approaches on the rapid transformation of labour processes, with a focus on the impact of mechanisation on people's lives. The initiative brings in discussion both the opportunities and the risks of contemporary labour forms.[168]

The exhibitions included videos by Harun Farocki, Adrian Paci and Anne Tallentire. Commissioned interventions on the theme of labour were staged by Pavel Braila, Anna Jermolaewa, Daniel Knorr and Ulrike Lienbacher. Some of the artists had migrant backgrounds or were from Eastern Europe, having first-hand knowledge of the stories they depicted in their works. For example, Paci, who was born in Albania and lives in Milan, exhibited a large-scale projection of his video *Turn On* (2004) near the Nicholas Tesla display (Figure 50). Paci's video depicts unemployed men from his home town of Shkoder who gather every day in the hope that someone will give them work. Paci employed these

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Moffat and Kerrie Poliness; and David Rosetsky, Sandy Nicholson and Chris Johnston. The exhibition catalogue included an essay by Bernice Murphy, founding Chief Curator of MCA and Director of Museum's Australia.

[166] The Technical Museum in Zagreb became the 'Technical Museum, Nicola Tesla' in 2016.

[167] The exhibition was originally designed to intervene with the Technical Museum in Vienna and travelled from Vienna to the Technical Museum in Zagreb.

[168] Andreea Gurau, "At Your Service - Art and Labour," news release, 2014, http://www.erstestiftung.org/cms/wp-content/uploads/2017/08/at-your-service_zagreb_press-release_en_fin.pdf.

men to act in his video where they sit together waiting on some steps, each with a generator connected to a light bulb. The men start up their generators powering their lightbulbs, "to illuminate their own resigned faces. The generated energy literally highlights their difficult situation, their untapped manpower".[169] The text accompanying the work highlights the unaccounted effect, an example of a real but hidden cost, of macroeconomic prosperity:

> A steady supply of electricity is not taken for granted everywhere. In Albania, frequent power cuts make generators an essential alternative. And while a generator is sufficient to meet the demands of everyday life and artisanal manufacture, industrial production requires a power grid. Low levels of industrialisation can be just as much a reason why workers are not needed as the opposite, namely automated production, which cuts down the labour force. The untapped manpower contrasts sharply with the exploitation of labour through work. And while muscle power becomes obsolete in direct proportion to the supply of energy and machines, methods of production still remain where physical work remains indispensable.[170]

*Figure 50 Adrian Paci, still from video, Turn On (2004), source: collection MoMA (USA), Fund for the 21st Century, © Adrian Paci, courtesy Francesca Kaufmann.*

[169] Ibid.
[170] Text accompanying the video work by Adrian Paci, Turn On (2004), transcribed from documentation of the exhibition, At Your Service at the Technical Museum Zagreb, 2014.

In the press release, Erharter describes the curatorial premise for, *At Your Service*:

> This exhibition has given us the opportunity to invite artists to produce new works of art. On the one hand, these works focus on current socio-political issues, such as labour market flexibility and migration. On the other hand, they explore the differences between working processes requiring in-depth knowledge and a high degree of technology and personnel- intensive processes, such as services. The interdependence of the Austrian labour market with those of Central and Eastern Europe also plays a role here.

Daniel Knorr was born in Bucharest and lives in Berlin. His work featured a robot with baby begging for coins, responding with a “thank you” when coins were deposited in a slot. Knorr references the law of robotics formulated by writer Isaac Asimov, “a robot must protect its own existence”, the money raised through begging being used for repairs or to manufacture other robots. Knorr’s aim is to manufacture the begging robot as an industrial product. Gurau comments of the work, “The question of who is more productive, man or machine, is brought into sharp focus by the notion of the begging robot. When Knorr refers to begging as one of the oldest forms of work, the definition of work is up for discussion”.[171]

*Figure 51 Daniel Knorr, Begging Robot Alpha and Beta, 2012. Installed at the Technical Museum in Zagreb at the exhibition, At Your Service - Art and Labour 2014 (image by author).*

[171] Gurau, "At Your Service - Art and Labour."

The press release for *At Your Service* explained that:

> The artists pointedly address a range of topical issues: How is labour changing? When is it a privilege, and when is it a burden? What does it mean when workflows are automated? Is our knowledge-based society and service economy the future of our working life? What does it mean to be flexible and mobile? How do work and unemployment affect the way we perceive ourselves?[172]

This exhibition established a dialogue about the nature of art as labour and the role of the museum reflective of the conception of ecomuseology and the establishment of MLMW. Through the integration of contemporary art into a technical museum, a conventional museum becomes a venue for the discussion of contemporary issues of labour, authority, economics and life. Anna Jermolaewa was born in St Petersburg, Russia, and now lives in Vienna. In *Northern Railways* (2012) (Figure 52), she exemplifies this role for art and the museum through three videos in which a different person speaks about travelling from their home country by train to work in Austria.

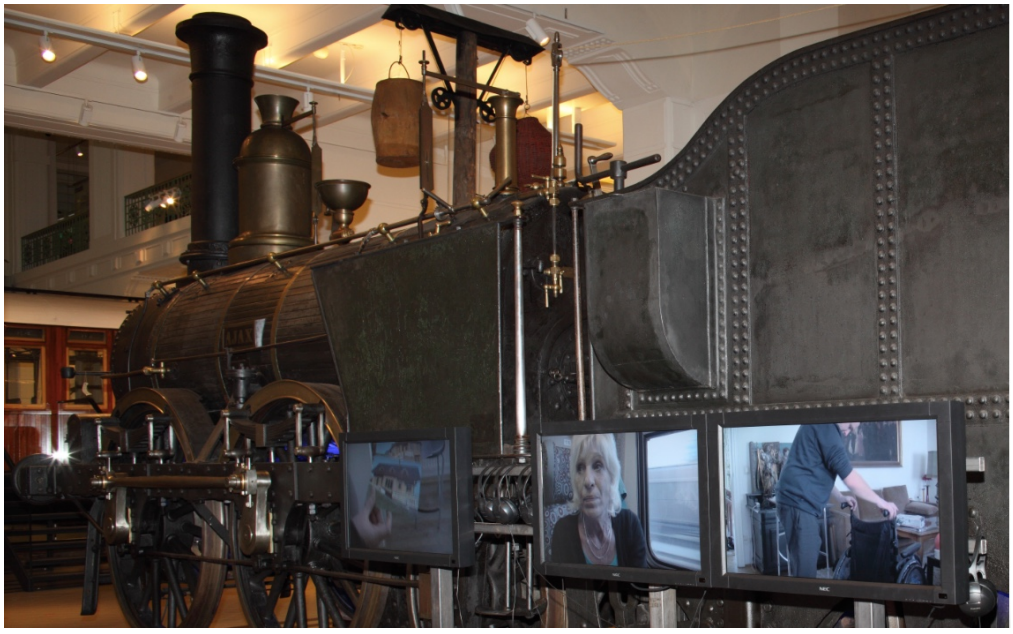


*Figure 52 Anna Jermolaewa, Northern Railways, 2012, installation Technical Museum Zagreb, 2014 (image by author).*

[172] Ibid.

## *The Museum is the Region, The Region is the Museum*

*At Your Service* was developed in Vienna at the same time as the exhibition *The Museum is the Region, The Region is the Museum* was being planned at MLMW with the artist run gallery West Space, its director Danny Lacy and curators Patrice Sharkey and Liang Luscombe. West Space was founded in Footscray in 1993, relocating to central Melbourne in 2000. In 2013, I joined the West Space board, the collaboration on *The Museum is the Region, The Region is the Museum* reflecting the aim of the West Space chairperson, Patrick Pound and Danny Lacy to re-connect West Space and Melbourne's western.

Lacy, Luscombe and Sharkey spent time in 'residence' with the MLMW archives and talking with MLMW volunteer staff to develop the exhibition premise. The exhibition title is an inversion of the title of a 1985 paper written by MLMW's first director Olwen Ford, "The Region is the Museum, The Museum is the Region". Following the discovery of Ford's paper, the exhibition aimed to make a critical proposition about museology.[173] The exhibition comprised the work of nine artists, the Australian artists Avni Dauti, Sam George, Susan Jacobs, Kim Munro, Kerrie Poliness, Lisa Radford and Geoff Robinson and the UK-based artists Mikhail Karikis and Uriel Orlow. Karikis and Orlow were invited to provide a specific work, with the other artists producing new works as outcomes of research residencies at MLMW.

*Figure 53 Foreground, 'It has to be more than just two foxes and a hen deciding what to have for lunch' (2014) collaborative video installation by Sam George, Kim Munroe and Lisa Radford; background 'Sounds from Beneath' (2010-12) collaborative video by Mikhail Karakis and Uriel Orlow.*
*Photo credit: Christo Crocker.*

[173] Ford, *The Region Is the Museum: The Museum Is the Region - an Introductory Paper, Melbourne's Living Museum of the West*.

As a premise for the commissioned works, to be exhibited in the historic Bluestone Building managed by the Museum in Pipemakers Park, a key passage in Ford's paper read:

> The concept of the region as the Museum and the Museum as the region relates to a certain space — the physical environment of Melbourne's West. But the focus is essentially on people. The region/museum is seen as an activity, a living organism, a process of exploring and investigating the history and heritage of a complex region or particular sites and neighbourhoods within it. Participation in heritage activity increases understanding and a sense of identity and value. Not only objects, but people, are seen in context, a context of time and space, which may include the heritage of countries overseas, as well as the more immediate heritage of a particular local or regional environment. Our heritage is complex and diverse. The process of becoming aware of our heritage goes on at a number of levels and through different activities.[174]

*Figure 54 Geoff Robinson's work titled, "The overlay of the Maribyrnong River between Braybrook and Avondale Heights onto the Living Museum of the West bluestone building as interpreted by Helen Grogan and Benjamin Woods through the oral history of Henry Dempster and Bob Simpson, 15 March 1984 / 6 September 2014." Photo credit: Christo Crocker.*

[174] Ibid.

Many of the ensuing works were developed to extend the Museum's archive or the work of museum volunteers. For example, Dauti and Robinson's work helped to digitise deteriorating analogue materials through their projects. George, Munroe and Radford collaborated on a video for which they interviewed members of the Museum's volunteer committee. Radford explains that to begin the research process, the trio 'recorded the labour of the labourers who recorded labour'. Their new video work, *'It has to be more than just two foxes and a hen deciding what to have for lunch'* (2014), considering how the desires of individuals can result in the foundation of organisations such as MLMW.[175]

Avni Dauti's video and installation, *Four Hundred Feet* (2014), explores the use of length and time as standards of measure in the documentation of history and place. Four hundred feet is the standard length of a single reel of 16mm film which translates into 13 minutes of moving image, the length of Dauti's video. Dauti uses a remnant concrete pipe as plinth to support a camera projecting his video directly onto a wall. His own observations become interspersed within cyclical processes of storytelling and documentation, where the past finds relevance in the present, and vice versa, through the combination of multiple layers of history, place and people's work. During his residency, Dauti found 16 mm film footage of Hume factory workers making pipes in the 1970s among boxes of materials classified "yet to be digitised". He arranged for the transfer of this material onto DVD via the technological process of "telecining" and donated the digital copy to the Museum's archive. Dauti documented the process of telecine laboratory staff digitising the Hume film footage, this process involving the use of spinning wheels and cogs similar to those used to make the centrifugally-spun concrete pipes, as shown in the 16 mm film.

There are many connections between *At Your Service* and *The Museum is the Region, The Region is the Museum*. Both exhibitions were developed for institutions not normally used as contemporary art venues. Both used the institutional context as a point of intervention and a place for artists to research and work, harnessing the curatorial premise and the agency of museology to present ideas, interpret history and uncover untold stories. *The Museum is the Region, The Region is the Museum* renewed artists' interest in MLMW, serving as a prototype for an ongoing program of artist residencies at the Museum. After an initial introduction to the Museum and its archives, participating artists are encouraged to propose a self-directed program of research that suits the needs and objectives of their particular art practice. In exchange for the use of MLMW facilities and volunteers' assistance, resident

[175] D. Lacy; L. Luscomb; P. Sharkey and K. Poliness, "The Museum Is the Region, the Region Is the Museum," (Melbourne: West Space and Melbourne's Living Museum of the West, 2014).

artists are expected to contribute to the work of the Museum in some way. This transactional approach is generative and has led to ongoing associations and projects between the Museum and artists, culminating in the establishment of a contemporary art sub-committee of artists and curators. This has seen the museum once again become a hub for postgraduate research and semester-long, undergraduate projects with Melbourne universities. [176]

### *The Living aspect of the Living Museum*

The MLMW's collection of 800 audiotapes, 20,000 negatives and many kilometres of video and film footage is unique, but fragile. The Museum's wealth of content from the past in urgent need of restoration to preserve this wealth of information for the future. Seeking funding for and digitising this material is currently MLMW's main activity and objective to maintain for its value in providing context for the present. When geologists read the landscape, they see a different world and timescale to most other people, perceiving in the current state of the world's surface a snap shot of ongoing processes of matter in motion, an ongoing story. Oral history can also significantly shape our sense and understanding of environmental change. Many landscapes assumed to be natural are now considered to be human-made.[177] Australia's landscapes were carefully constructed and cultivated over thousands of years by Aboriginal people. Because that unique landscape construction was not seen, recognised, understood or respected at the time of European occupation, much was senselessly destroyed through rapid colonisation. Australia has lost untold numbers of species of plants and animals compared to any other country, the loss of diversity continuing to snowball, seeing environmental scientists struggling to grapple with its consequences and devise ways to re-establish a sustainable relationship with the land.

Understanding temporal scales and processes beyond our own lifespan is critical to establishing sustainability frameworks, although this is increasingly difficult to achieve given the pace and constant change of contemporary life. The layers, mechanisms and meanings of time are easily lost today. By contrast, Aboriginal people established a working relationship with time by passing down knowledge through stories and special activities as 'Lore'. These stories are refined from generation to generation over such a long periods of time that they often trace geological time, recording phenomena such as volcanic eruptions,

[176] Artists and universities contributing and participating in residencies and exhibitions programs at MLMW (2014-2018) are listed in the acknowledgements section of this paper.
[177] Bill Gammage, *The Biggest Estate on Earth : How Aborigines Made Australia* (Crows Nest, N.S.W.: Allen & Unwin, 2012).

the end of the last ice age and the formation of Port Phillip Bay.[178] These processes of passing on knowledge across vast periods of time encompass a detailed and deep understanding of the interaction of complex and varied biomes, including how they can be adjusted to synchronise with the lives of people to minimise the need for work.

Pioneering a new kind of museology in Australia, in 1984 MLMW began collecting images and stories of the people who lived and worked in Melbourne's industrial west in order to establish broad community connections to time, place and to each other. The Museum adopted an innovative, ecomuseum philosophy, with its focus on a museum linked to a particular 'place'. The western region of Melbourne is an area containing more than 800,000 people. Its ecology is a dry savannah-like plain, its rural areas mostly supporting sheep grazing and vegetables production to feed the greater metropolis of Melbourne. By the1950s, the area supported the largest industrial complex in Australia, hosting many dirty, but lucrative industries such as abattoirs, munitions and petroleum refining. Following the Second World War more than a third of the population of the western region was born overseas, coming from more than 100 countries. The original research team of 24 people of MLMW was drawn from residents of the western region, many from migrant backgrounds, including Italian, Greek and Vietnamese backgrounds. The main areas of research in the first year were the meat industry, the munitions industry, migration and women working in industry. From these first few projects, the research extended to working on a diverse range of more than 1,000 projects that were initiated by staff, initiated by organisations working in collaboration with the Museum, initiated by migrant groups, initiated by Aboriginal people, projects initiated by local councils and initiated by individual artists among others. As part of the practicalities of fund raising the Museum also commissioned consultancies, which was another version of collaboration.

All projects required the participation of local people in their initiation and execution, this included the participation of local Aboriginal people. What seemed like an impossible task at the beginning of the 'experiment' has led to a large, unique archive about the natural and built heritage of a historically significant region of Australia, with many of the local industries being of national importance, and the Museum modelling an approach to recording local history and heritage that has placed industry at its centre. The key research tool used by MLMW is oral history, where everyday people are interviewed to tell their version of events. These stories helped to shape and to transform the abandoned Hume Pipes factory site into

[178] Gary Presland, Living Museum of the West (Melbourne Vic.), and Footscray (Vic.). Council., *The First Residents of Melbourne's Western Region* (Footscray, Vic.: Published for the Footscray City Council and the Living Museum of the West, 1987).

Pipemakers Park. Several structures in Pipemakers Park, *The History of the Land Gardens*, the *Pioneer Women's Shelter* and the *Pipestacks* were built by the Living Museum. The Park and riverside landscape and wetlands were re-vegetated by the 'Koorie Gardening Team', a group of Aboriginal apprentices via the Living Museum programs in the 1990s. Like Aboriginal Australia, Pipemakers Park is a human-made landscape, carefully constructed through interpretation of oral histories in the Living Museum's archives.

The complete digitisation of the MLMW archive will make these items safe and accessible, but the Museum's other holdings need different approaches. All its archives need very long-term thinking into ways of transferring knowledge through lived experiences and cultural practices and processes, using intangible and tangible means so concepts and knowledge can be embodied and absorbed. Enabling others and new generations to engage with the archive is the living aspect of the Living Museum. So the past can inform the present. My ongoing association with MLMW as a committee member is an ongoing artistic residency. Through my expertise as an artist, I actively support these kind of living activities at the Museum that expand the archive as a resource. Through this ongoing residency, I also explore new ways to integrate the ecomuseum concept, philosophy and methodology into the processes and activities of my art practice. This relationship is symbiotic.

The MLMW archives provide a rich resource of materials for artists of all disciplines to develop new artworks, events and ways of interpreting history and culture. The MLMW and its archive also function as a venue and repository for these ongoing activities, interpretations, ideas and outcomes.

## *New models of arts funding policy*

In the last chapter of Origins of The Arts Council Movement, Upchurch proposes the question, 'if the (arts funding) model has failed to enhance democracy and creative expression by a wide diversity of citizens, then what should be the focus of an arts policy?'[179] She discusses two significant elements of future arts funding policy advanced in 1984 by Raymond Williams in order to achieving greater social justice through cultural democracy.[180] Williams' "policies of the future" place artists and communities at their centre, Williams reasoning that a "prime responsibility" of government should be to ensure every person has access and opportunity to artistic means of production. He argues that, "there is a possibility

[179] Upchurch, *Origins of the Arts Council Movement : Philanthropy and Policy*. p.208-209
[180] Ibid.; ibid., p.208-209.

of defining a principle of holding the artistic means of production in public trust", adding that to archive this, the state should lease the means of production to "self-managing groups of artists of all kinds".[181]

Upchurch explains that the second main element of Williams' future arts policy was a focus on the local to be achieved by "relating a cultural policy to an actual community rather than to a relatively abstract and centralized state."[182] She notes that enacting such policies increases government responsibility for ensuring equitable access and opportunity to artistic means of production and for adequate funding. She provides clear guidelines for this:

> To make the means of production accessible to all citizens to make and engage with art will require more government funding for the arts, not less. It will require increased public expenditure on education at all levels and on the sites and facilities where the arts are produced and presented … It is time to embrace cultural democracy. Local governments should consult their citizens, then establish and fund the sites, the programs, and cultural expressions, in neighbourhoods and city centres, that their communities want, on the same terms as libraries, parks and leisure centres. The arts should not be forced to compete with each other and scramble for scarce resources, and funding redistributions should be taken with care for the artist whose livelihoods are at risk … The incomes and lives of artists and creative producers are notoriously precarious. 'Austerity' measures imposed on the arts are counter-productive, because they diminish the potential to use the arts to enhance democracy and social justice. … Now is the time to increase public spending on the arts in local communities, to work for cultural rights, and to give citizens the means to live flourishing lives on their own terms.[183]

Even when good policy is identified, implementation becomes an issue. Many years of inadequate and inequitable arts funding have resulted in a problematic culture within the organisations entrusted with distributing funding. A series of unfortunate events occurred at MLMW as a direct result of a lack progressive arts policy, combined with poor implementation, follow-through and due process. The Museum's survival over the last 25 years under different governments with different funding priorities is a miracle, exemplifying

[181] Ibid., Upchurch, p. 208-209, quoting Williams: Williams, Raymond. 1984. "State Culture and Beyond" in Raymond Williams: On Culture and Society, essential writings, (2014), Jim McGuigan, ed. London: Sage Publications, pp. 305–311.
[182] Williams, Raymond. 1984. "State Culture and Beyond' in Raymond Williams: On Culture and Society, essential writings, (2014), Jim McGuigan, ed. London: Sage Publications, pp. 305–311.
[183] Upchurch, *Origins of the Arts Council Movement : Philanthropy and Policy*; ibid. p.208-209

the need for more effective framing and implementation of arts policy and funding in Australia. Its survival is also a testament to MLMW's ongoing support by the community that it serves, this confirming the ongoing relevance of its principles and objectives.

In 2017, the museum secured matching funding from Heritage Victoria to assist the City of Maribyrnong carry out major underpinning construction works to the historic Bluestone Building to enable it to be used for exhibitions and events, but as the Museum currently has no paid staff, a community of volunteers led by the core group that forms the Committee of Management oversee its operations. My position on the MLMW Committee and work for the Museum is part of my arts practice, its main concern being processes of historical and geographic contextualisation. After establishing an aspect of this in Chapter Four, Chapters Five and Six examine my need to understand questions of matter and physics as a broader context for the activity of making a drawing based on paradoxes of the diamond shape and parallel lines.

# CHAPTER 5

# ORGANIC GEOMETRY

Organic geometry is the name I have given to the process I use to produce a series of geometric, instruction-based drawings, these being a key, ongoing, stream of activity in my arts practice.[184] These artworks include the *Red Matter Wall Drawings 1-4* (1994), *Black O Wall Drawings 1-6* (1996), *Blue Wall Drawing #1* (2007) and *Field Drawing #1* (2008) as well as significant new works made during this research. The process of organic geometry underpins this research and informs the operational philosophy of my arts practice. Chapter Five examines the development of the organic geometry concept in my work.

A primary concern of my work is to find new ways to demonstrate the interconnection of people and nature, conceptualising their interdependency in order to develop more functional modes of integration between the two. Enabling a broader understanding of this interconnection and interdependency is a first vital step towards achieving more sustainable practices across the full range of human activity. Chapter Five examines the use of the process of organic geometry to make drawings that enable participants to identify, observe, understand and discuss diversity as a path to its preservation in a broad range of fields and topics.

I began to produce instruction-based wall drawings in 1994, this merging principles of contemporary art and ecomuseology as discussed in the previous chapters. These drawings encompass participation, adaptation to space, the interpretation of place and DIY culture. They combine concepts of art, work and mass-production, reinterpreting the activities and materiality of the instruction-based format and conceptual potentialities of working on walls pioneered in the early 1960s by artists such as Julije Knifer (1924–2004) and Sol LeWitt (1928–2007). These foundational connections are outlined in Chapter Six. The development of the concept of organic geometry extended my research within geometric abstraction, the use of everyday materials, seriality and installation. In focusing in on the diagonal and the diamond-shape, organic geometry directs this research towards a deeper interpretation of the significance and meaning of imperfections as very small differences.

Chapter Five considers the concept of organic geometry as combining observations and research about anomalies in their role as a quality that binds together all objects and matter.

[184] There are very many other prior uses of the term 'organic geometry' including some applied to design and architecture in a different way.

It describes how the presence of anomalies, manifest as differences and imperfections, are fundamental to all materiality, linking processes of production in nature to those of manual and industrial production.

## *Everyday objects and materials in the everyday world*: *Small Red Drawings*

Much of my work stems from a seemingly minor conceptual and perceptual shift that happened for me in 1992, when making a series of small red, geometric, line drawings. While drawing with a pen and a ruler, both knowing and not exactly knowing what I was doing, I started to think that there is something essentially very right about being wrong. I thought about the activity of making mistakes — the essence of experimentation —the process of making mistakes being crucial to learning. I decided to explore that idea at a fundamental level through drawing. I chose to draw in red, red being the colour traditionally used for marking-up documents, for pointing out and for correcting mistakes. The ensuing group of small, grid-like, drawings were produced from straight, diagonal lines that were consciously made ever-so-slightly wrong, a bit wonky, not parallel, not quite right (Figure 55). The genesis of this research is in this idea, being demonstrated in this chapter through an exercise of making one of the drawings.

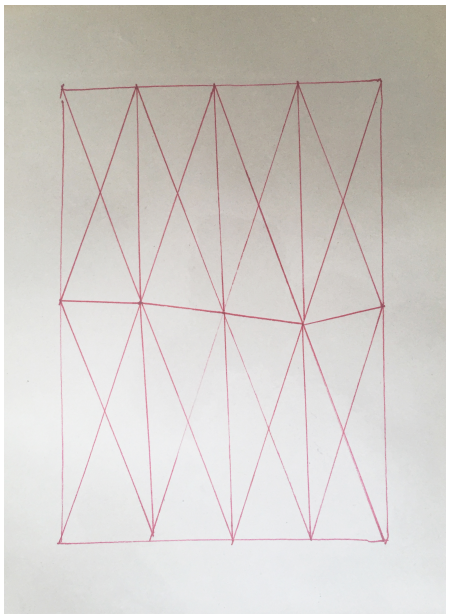


*Figure 55 small red drawing, c1992.*

These small red drawings prompted me to consider nature and matter as well as manufactured objects and systems of mass production in a different light. I realised that all objects in the world, whether naturally occurring or manufactured, possess individual

physical characteristics that render each a unique version within its own kind. It is important to stress from the outset that these differences, which I refer to in this chapter as anomalies and unique characteristics, are not only about incurred damage or wear and tear, but also refer to intrinsic physical attributes that arise through processes of development in matter. Exploring these considerations has become a long-term focus in my arts practice. This exploration led to the instruction-based series, *Red Matter Wall Drawings 1 - 4* (1994) being the first published example of organic geometry. The process of organic geometry arose through further exploring my interests in the significance and meaning of imperfections and very small differences, as discussed in Chapter One through the relationship between anomalies and diversity.

## *The significance of anomalies and the aims of organic geometry*

The presence of physical anomalies is common to all objects, both naturally occurring objects and those objects made by people. This includes tiny differences in industrially produced objects that are not visible to the naked eye, these only being observable using powerful microscopes. Industrially manufactured objects are mass produced to be identical, with any observable differences usually being perceived as a fault, as something detrimental. Yet the presence of anomalies in objects is important to the understanding of many things. For example, anomalies are used in various ways in the practical application of science. In manufacturing and engineering processes, the presence of variation is relevant in assessing material and structural tolerances.

Anomalies are observed, monitored, tested and controlled in order to be kept below a certain threshold in technical contexts. These processes help to render anomalies inconsequential and invisible in our everyday interactions with human-made objects. Within the natural sciences anomalies are carefully observed and analysed, being used, for example, to differentiate between species. When differences go beyond a certain threshold, a material or species is considered to be of some other kind.

Nonetheless, the presence of a level of variation within any kind of object or material is a fundamental physical fact, being a unifying aspect of all things in the world. How and why anomalies arise is not broadly taught to students in foundational science education programs, being difficult to explain and experience at first-hand despite being a fundamentally important concept that shifts basic understandings about the nature of Nature

and the nature of man-made systems of production and their interdependence within the one inclusive system.

My conceptualisation of organic geometry as an indeterminate system — a process for making geometric abstract art — is dedicated to helping people gain an appreciation of the nature and generation of asymmetry, difference, imperfection and variation. [185] The experience of organic geometry is made available through instruction-based artworks, presented in the form of books, which enable other people to make geometric drawings using only straight lines and limited colours. Each book provides a set of instructions that describes how to make a single geometric drawing in the form of a self-contained network of lines, with diagrams being included to exemplify its stages. The instructions provide very strict parameters of production, but include an element of randomness activated by participants during the drawing process to generate visibly unique iterations of the same drawing. This artmaking process replicates systems of industrial mass-production, where people make multiple versions of the same object, each having very small variations, but with the intention here that each drawing reveals the inherent aspect of variation that occurs during processes of replication. The point of organic geometry is to demonstrate the fundamental element of difference in both naturally occurring and human devised systems of production, where the parameters are quite tight, and thus suggest how the human and natural worlds mirror each other and are linked where typically they are cast in binary opposition.

## Making, experimentation and reflection

Organic geometry is demonstrated in this chapter through the provision of a simple drawing exercise, which reflects the nature of my instruction-based works. This exercise shows how anomalies arise and are shaped; this process of making anomalies tangible and visible enables variance to be experienced and understood. Making a drawing is the most effective method of conveying the conceptual underpinnings of this series of artworks. The role of instructions in my work is not to have other people make my artworks for me, others are not acting as a substitute for me, but as themselves. Each drawing incorporates decisions that the maker is asked to make during the drawing process, affording the maker a level of agency. For example, the makers are asked to use their own abilities to estimate distances and relationships which determines outcomes, rather than using tools to measure them.

[185] An “indeterminate system” meaning a system which contains an element of randomness which enables the possibility of various outcomes.

Their decisions introduce an element of randomness to the system of making a drawing, which result in unique and visibly different versions as outcomes. The makers of the drawing must be willing to make these decisions to incorporate an element of the experimental in the drawing process.

The drawings are also produced by more than one person at a time, with collaboration and interaction being fostered to make their production like a game, but also to multiply randomness through the interaction of the different participant's decisions. The different situations in which the drawings are made both adds to the individuality of outcomes and is also a way of integrating art into everyday life. In the context of these relationships, an element of 'residency' inhabits the conceptual nature of the drawings. Each geometric linear drawing — as translated into a set of instructions — is designed to be mass-produced, the drawings being manufactured objects. Yet unlike other mass-produced objects, the intention is to represent, reveal and emphasise the anomalies that arise during all processes of replication.

This chapter discusses the demonstration of organic geometry through a focus on the process of making a drawing as an instruction-based artwork. Chapters Six and Seven discuss this activity as providing access to elementary concepts of physics through art making, embodied learning and analogy making to convey how difference and diversity are generated. Chapter Six describes how these concepts are applied to each of my previous instruction-based drawing projects in various ways introducing and describing the new works produced during this research. These concepts are then revisited from the perspective of physics in Chapter Seven, showing the potential of these drawings as educational tools of visualisation.

### *Everyday skills and materials*

The instruction books each present a system for drawing a linear pattern using a pen and ruler as readily available everyday tools. Anyone from any field or background can either make or direct others to make one of these drawings. No specialist artistic skills or knowledge is required to make them, although in later works the process of making a drawing does see the exploration of formalist spatial experimentation becoming a more significant element, providing a platform in which it can be practised by anyone. The simplicity of the process and the familiar nature of the materials and equipment used, aims

to ensure people feel confident to make the drawings. They don't need to be good at drawing to make art. Although the drawings are comparatively simple to make, to enable this the instructions need to be meticulous, the instruction books being time-consuming to produce as artworks. Fear of making mistakes is eliminated from the process wherever possible. For example, the drawings are constructed from straight lines which are made by using a straight-edge as a guide, although if this is a ruler, it cannot be used as a measuring device. This removes the need for the skilful rendering of lines and regulates the linear quality of every drawing. Unlike knitting from a pattern or learning to sketch from a book where the aim is to imitate an ideal result, as long as the instructions are carefully followed, there can be no failed outcomes, only different drawings, each drawing being valid.

For example, the list of qualifications for *Red Matter Wall Drawings* (1994) which appears on the first page of the instruction manual, states:

> The 3 most important qualifications or skills required to produce these drawings are:
>
> 1 - The ability to understand the instructions in this book.
>
> 2 - The ability to guess half of something. Everyone (who understands the idea of 'half') has this ability … Every guess 'distorts' the drawing from appearing as a perfect grid. A good guess will slightly distort the work, a bad guess more so. To what extent is not important, just a different distortion to an otherwise apparently perfect appearance. Guessing results in an 'original' drawing, a drawing with visible characteristics different to any other.
>
> 3 - The ability to … draw lines using a straight edge as a guide. At least one person or a technical assistant should be good at doing this …[186]

## *Time and drawing*

The inclusion of a practical drawing activity in this chapter seeks to demonstrate the relationship and dependency of organic geometry on the participation of others. It affords the reader a time to think about whatever they like while doing something called making art. The

[186] Red Wall Drawings 1-4, K.Poliness, 1994, p 1.

instruction manuals are slow algorithms revealing liminal spaces. The drawing process thus becomes an exploratory space, an interlude from other activities, a reflective space. In this way, the process is more like an activity of retirement or leisure than a chore or work. Like following a knitting pattern, the parameters of action are set, but the pace of production is self-directed, allowing the activity to become a personalised, a self-guided experiment. Time can be taken at any point to pause and reflect, without the need to keep up with information being conveyed as might happen with a lecture on the science of variation.

By examining the instructional pages that follow, the reader can imagine themselves making a drawing. The activity of looking at the diagrams and reading through the instruction sequence also makes the conceptual processes of the drawing apparent so it might seem unnecessary to take the time to physically make a drawing, but by skipping this process, a crucial element will be missed. Time and drawing are interdependent in this instructional format, together providing an environment within which personal analogies may arise, engagement in the drawing process making the understanding more personally applicable and more likely to be remembered. When the underlying mechanics of variance are personally experienced, the potential for them to be absorbed and reapplied in other circumstances and in relation to other fields and topics is increased. The goal in these instruction-based wall drawings is not only that a drawing will be produced as an artwork-outcome, engaging with the process of physical making over time provides potential for things to happen during this time. The artwork-outcome becomes a personalised artefact of this process, as each drawing contains unique, visual characteristics generated through the production process.

### *Experimentation and the DIY format*

Removing the limitation of time, reducing the requirement of drawing skills, allowing a personal way-in to the process and eliminating the potential for failure encourages experimentation. To make a drawing the instructions must be followed, just like a laboratory experiment or a recipe, but this is not to say the instructions cannot be taken further by being incorporated into other activities. The instructional format of the drawings transfers an idea through doing and releases it into the world to be applied to any field or topic through a process of making, combining life, work and art in a way similar to Sven Linqvist's *Dig Where You Stand* which can be applied to researching any job.

In 2008, for example*, Blue Wall Drawing #1* was used by staff at the School of Accounting, Economics and Finance at the University of Wollongong to enable teaching and learning.[187] The students transformed the process of making the blue wall drawing in the School foyer into a fundraising activity for a local surf-lifesaving club, with lifesavers being sponsored by the community to make the drawing (Figure 56). The process was filmed and published on Youtube as a time-lapse video. At the exhibition opening, the life-saving club was presented with the proceeds of the fund-raising. I would never have thought of this practical application of the instruction books, its experimental adaptation informing my understanding of the potential uses for the artwork, its format and the concepts it aims to convey.

*Figure 56 Installation of Blue Wall Drawing by Public Relations students and volunteers from Surf Life Saving Illawarra, Commerce Department foyer, Wollongong University 2008.*[188]

[187]This project was initiated and developed by Professor Shirley Leitch, Judy Motion and Lois Burgess, staff at the School of Accounting, Economics and Finance at the University of Wollongong with commerce students. Installation of the drawing, by Public Relations students at the University of Wollongong and volunteers from Surf Life Saving Illawarra, was supervised by local artist Jennifer Jackson.

[188] Image source: Still images from Blue Wall Drawing video, documenting installation, Wollongong University (2008).

## *Drawing 1: How to make a small, red-matter drawing*

Through the process of making a wall drawing, concepts of organic geometry are experienced and communicated at an embodied level. The drawings are usually made on a large scale, by inscribing them onto walls and incorporating spatiality and a whole-body physicality into the experience of making. However, the fundamental concepts can be conveyed through drawing at a much smaller scale as in the following exercise.

### Materials and equipment

The following items are required to make the drawing:

- A4 sheets of paper (more than one sheet in case of mistakes);
- a red–coloured pen or biro; a grey-lead pencil (HB quality);
- an eraser for erasing the grey-lead pencil and a straight-edge for drawing lines such as a ruler.

A standard 30 cm long ruler might not be quite long enough to draw the four longest diagonal lines of the drawing, which could be up to 35 cm long. If no longer ruler is available to draw these four lines, a standard ruler can always be carefully shifted along to complete the longest lines.

#### *A4 paper*

A4 paper has been chosen as a ground for the drawing because it is the most common format of paper where I live. People are familiar with the A4 format and its proportions, the particular A4 shape, its height to width ratio or “aspect ratio”.[189] The series of papers — A0, A1, A2, A3, A4, A5 and A6 in descending scale — form the commonly used ‘A’ series of paper sizes ISO 216 as specified by the International Organisation for Standardisation.[190] A4 is the most commonly used size within the series, with the largest size, A0 having an area of 1 square meter. This dissertation is printed on A4 paper. All of the sizes in the ‘A’ series of papers have the same proportional relationship between the length of the shortest

[189] An aspect ratio is a proportional relationship between an image's width and height. For example, the aspect ratio of a rectangle, when oriented as "landscape", with a width twice as long as its height, is written, 2:1.
[190] ISO 216 is not used in Canada, Columbia, Dominican Republic, Mexico or the United States. Here, the current standardised “Letter” format of 8 x 11 inches can be used to determine the aspect ratio of the drawing.

sides and the length of the longest sides of the rectangle. It is of primary importance that the people making the drawing are familiar with the shape that contains the drawing pattern, particularly when it is scaled-up onto a wall. When A4 is scaled up in a particular way to make the red matter wall drawings, the aspect ratio, the familiar proportion of the A4 shape, forms a bridge of familiarity between the artwork, the architecture and the people making the drawing. On becoming aware of the history of the proportions of the "A" series and A4, I included it in the *Blue Wall Drawing Book #1*.[191]

*Figure 57 A4 paper.*

It is not necessary to understand the following mathematical information about A4 to make the drawing, which is included here to help convey the power of geometry to convey complex ideas. The aspect ratio of the papers in ISO 216 is such that the shape remains the same when folded or cut in half in "portrait" or "landscape" position. Each ISO paper size in the A", "B" and "C" series is one half of the area of the next largest size in the series. Figure 58 shows how the "A" series is determined, where A1 is half of A0 and so on. Figure 59 shows how this geometric progression can also be expressed geometrically as a descending spiral, highlighting how simple geometric arrangements can be used to visually express far more complex concepts usually explained mathematically or in words.

[191] Kerrie Poliness, *Blue Wall Drawing #1,* 2007. Book. Kerrie Poliness. P. 166-168.

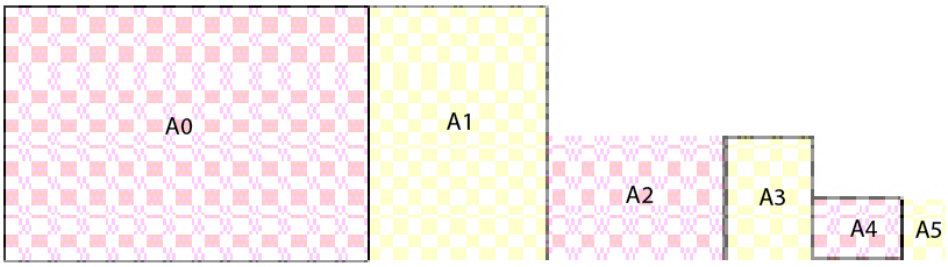



*Figure 58*

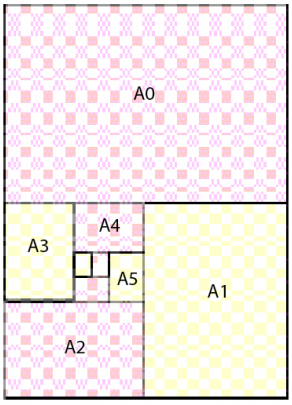



*Figure 59*

The aspect ratio of the A4 shape has an interesting historical background and mathematical relationship to the geometry of diagonal lines and the diamond-shape. The aspect ratio of A4 and all “A” series of paper sizes is derived from the length of the diagonal of a square. The length of the diagonal of a square is longer than the length of the side of the same square. As shown in Figure 60, where the orange lines are all the same length. The proportional relationship between the length of the diagonal of a square and the length of the side of the same square, has been used to determine the aspect ratio, the proportions, of the “A” series of paper sizes, ISO 216.

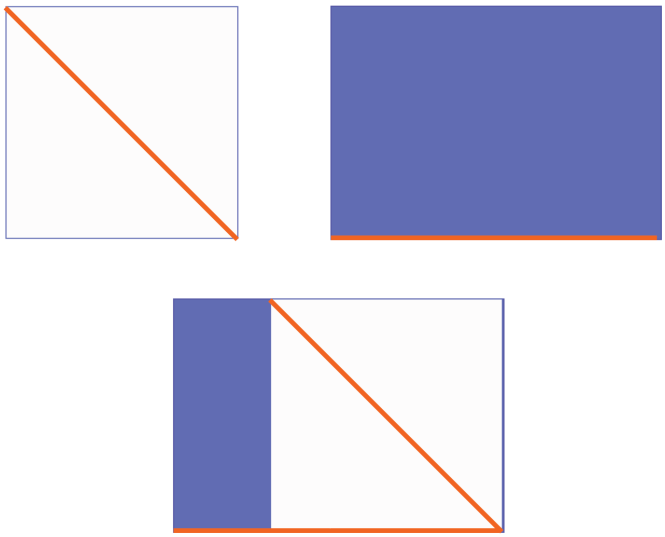


*Figure 60*

The aspect ratio of the "A", series of ISO paper sizes is √2:1, the square root of 2 to 1. If the length of the side of a square is equal to one, or considered "1" then the diagonal of that same square is √2, see Figure 61. Geometrically, this special aspect ratio, as determined by the diagonal of a square, determines that the aspect ratio remains the same when the paper is folded or cut in half, widthways in "landscape" position (Figure 58).

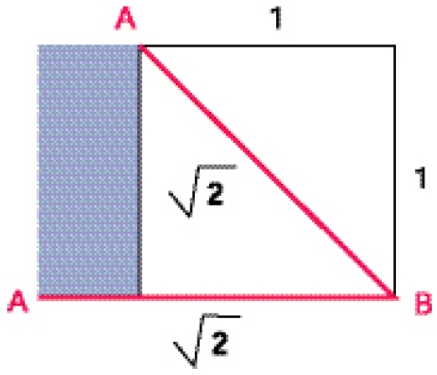



*Figure 61 A square cut in half diagonally, the ratio between the length of the diagonal to the length of the side of the square is √2:1, the aspect ratio of A4.*[192]

The square root of two was the first irrational number to be discovered. √2 is 1.41421356237309R, the decimal expansion continuing to infinity, apparently without any discernible numerical pattern. Being an irrational number, √2 cannot be expressed as a

[192] Diagram based on image, Jay Hambridge, *The Dynamic Symmetry of the Greek Vase* (1920), Fig. 10 p. 33.

fraction or completely as a number. √2 is known as Pythagoras's constant or theorem. The term "square root" received its name via the "diagonal crossing" of a square. The discovery of √2 as the first irrational number marks mathematic's discovery of incommensurability, in that the side and the diagonal of a square are incommensurable to each other. This example of numerical incommensurability can be expressed visually, geometrically, as a diagonal line crossing a square (Figure 61). Hippasus of Metapontum, who is purported to have discovered √2, was murdered. It has been postulated that he was most likely murdered to suppress the suggestion that the world was irrational as this threatened ongoing support for the Pythagorean's research.[193]

The aspect ratio of the "A" series is typically expressed as an approximation, as 1:1.414, which serves many practical applications such as using A4 paper, but it is not the truth numerically. It provides an example of the great range and power of geometry mathematically.

Although my choice of A4 as a proportional framework for scaling up the first series of wall drawings was intuitive, being based on commonality and familiarity (Figure 62), this approach reveals the further significance of the diagonal in geometry as a sequence of geometric progressions that derive from the first three irrational numbers, these being √2, √3, √5, via the diagonal crossing of rectangles to determine aspect ratios.[194] The diagonal seems to find further relevance in being used as a tool to visualise anomalies through this association with incommensurability, and symbolically, through crossing-out the square, the square being the fundamental unit of a uniform grid.

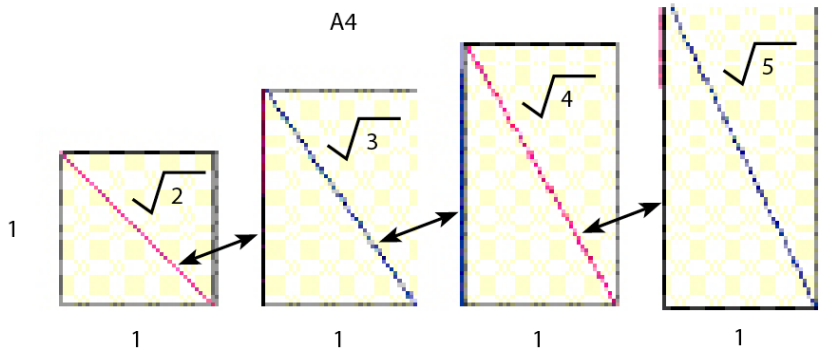



*Figure 62.*[195]

[193] The discovery of incommensurability by Hippasus of Metapontum, Kurt Von Fritz *Annals of Mathematics* Second Series, Vol. 46, No. 2 (April 1945), pp. 242-264.
[194] The √4 is not an irrational number, it is 2.
[195] Diagram based on image, Jay Hambridge, *The Dynamic Symmetry of the Greek Vase* (1920), Fig. 10 p. 34.

I have used the A4 proportion as a format for interacting with architectural spaces through processes of scaling in three series of instruction-based works *Red Matter Wall Drawings 1-4* (1994), *Black O Wall Drawings 1-6* (1996) and the *Blue Wall Drawing #1* (2007) series, Figure 63 showing how the A4 proportion is applied and interpreted in each series.

The height of the wall on which the *Red Matter Wall Drawing* is made determines the diagonal length of the drawing. In that the diagonal length of the drawing equals the height of the wall. In this way, the scale of the drawing on the wall has an innate relationship to the familiarity of the size and shape of an A4 piece of paper and to the first two steps of the geometric progression of the square root of two (Figure 62). Specifically, in relation to the scale of the wall and the width of the drawing, the wall height becomes $\sqrt{3}$ and the drawing height $\sqrt{2}$. Another way of looking at the aspect ratio of A4 is that the width is approximately 70 % of the height. This idea of judging and calculating 70% is much easier to comprehend and to use as a rule of thumb to achieve a sense of A4 proportional familiarity.

The drawing pattern in the *Black O Wall Drawings* is made within the boundary of a circle, inscribed on the wall using chalk, so that the diameter of the circle is always 70% of the wall height. The *Blue Wall Drawings* are able to expand in length in a particular way to accommodate any length of wall by using the proportion of A4 in relation to the length of the wall to establish a specific number of repeating geometric units, typically encompassing 70% of the length of any wall.

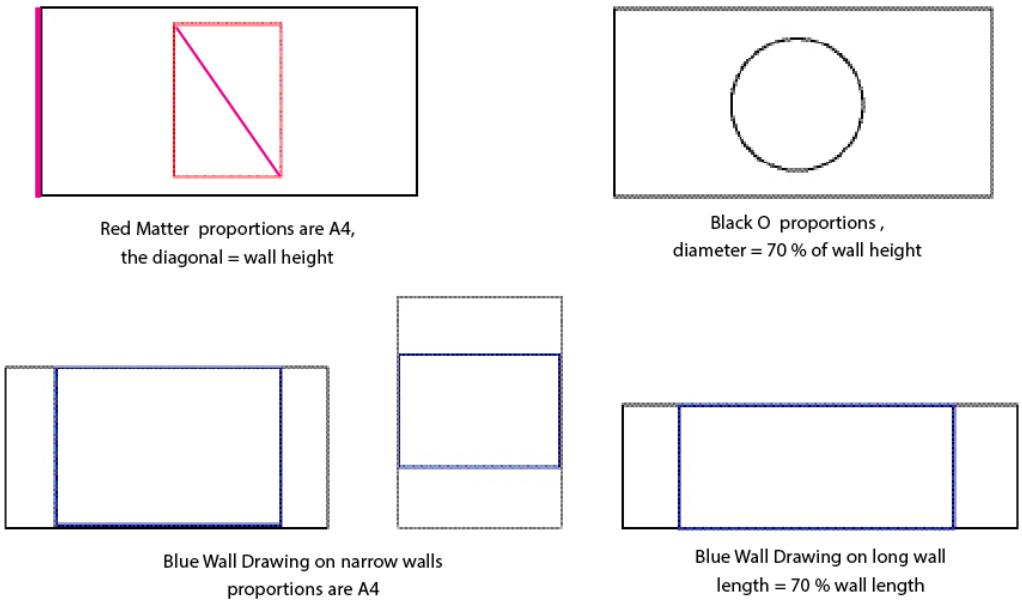



*Figure 63 The relationship of A4 to Red Matter, Black O and Blue Wall Drawings.*

*red pen*

Red biro is the main line-drawing tool. It should be a standard type available cheaply in bulk at a newsagent, at an office supplies store or supermarket. A red pencil can be used as a substitute. Red is used for these drawings because it is the colour traditionally used in marking-up documents to identify or correct mistakes. All of the lines in this drawing are correct. Each line that is drawn is a form of editing or adjusting the page or wall through drawing.

*grey lead pencil*

A standard HB grey-lead pencil is used to identify and mark out specific locations as part of the process of making the drawing. These markings are made using grey lead pencil so they can later be easily erased.

*eraser*

A standard pencil eraser is used to remove the grey-lead pencil markings once the drawing is completed. The decision to remove these markings, or not, is at the discretion of the maker. I do not have any preference. These markings indicate and direct attention to the process of making the drawing, which does not detract from the purposes of the artwork. The final quality of the finished drawing, which must adhere to the parameters of the drawing instructions, is the responsibility of the participants.

*Ruler (and the rule about the ruler)*

All the lines in the drawing are straight. They are made using a ruler as a guide. The ruler must not be used to measure or check the measurements of anything at any point during the process of making the drawing. The use of a ruler is purely to ensure that the quality of lines is uniform without uniformity being achieved by skilfulness. These artworks are not about manual mastery; the objective is to leave no evidence of any particular skilful hand in the quality of the lines. This eliminates artistic skill as a requirement and distraction from both the process and the final result. The drawn lines have a quality of anonymity and the egalitarian in that every maker of the drawing is as qualified as anyone else to make the drawing, including myself or any other artist. The straight lines of the drawing present a level playing field for observing other kinds of variation that are generated through the drawing process, this being this system of making drawings, which I call organic geometry.

## Instructions for small red matter drawings

The following six-step process describes how to make a specific linear geometric pattern. Each time this pattern is made, it will manifest in a slightly different way. It can be made as many times as you like and each drawing can take as long as you like to make. If you get distracted and make some other kind of drawing that is completely fine, however one of these drawings must be made by following these instructions to follow the concepts which ensue in this thesis.

### *Step One: guessing*

a) Take a single sheet of A4 paper and use the grey-lead pencil to mark a total of four locations, one on each of the four edges of the paper: top, bottom, left and right. The locations of these marks as the half-way or mid-point along each edge should be guessed (Figure 64). Do not use the ruler to measure or to check if your guesses are correct. These locations must be guessed. They are all correct as long as they are guessed and not measured.

b) Next, take the red pen and ruler and draw four straight lines to connect these marks to make a red, linear diamond on the page (Figure 65).

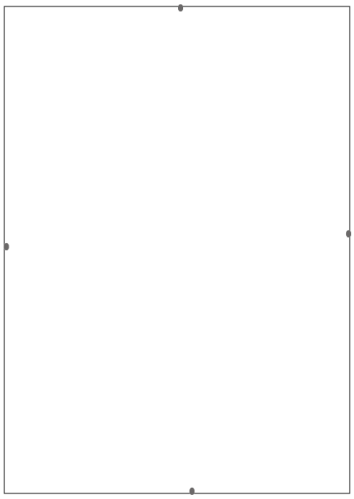


*Figure 64 mark four locations*

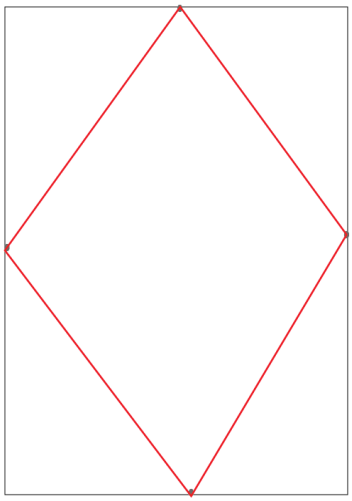


*Figure 65 draw four red lines*

### *Step Two: making a diagonal grid*

a) Use the grey-lead pencil to mark a further eight locations, two onto each of the four edges of the paper by guessing halfway points again, this time between each of the four corners of the paper and the four corners of the red diamond (Figure 66). Once again, do not use the ruler to measure, check or adjust your guesses.

b) Use the red pen and ruler to join these marks by drawing four straight lines, diagonally, across the page (Figure 67).

Note 1): If helpful, these marks can be numbered using the grey-lead pencil and erased later, once the lines are drawn.

c) Then use the red pen and ruler to draw four more straight diagonal lines across the page to complete a diagonal grid (Figures 68 - 69). Follow the diagrams.

Note 2): from now on in the instructional diagrams that follow, often the new lines are depicted as dotted. This is done to help clarify which lines are to be drawn next, to differentiate new lines from previously drawn lines at each step. All the lines of the drawing are to be draw as solid, not dotted. At this point, you may, or may not, begin to observe your diagonal grid is not completely uniform and is beginning to take a slightly warped shape.

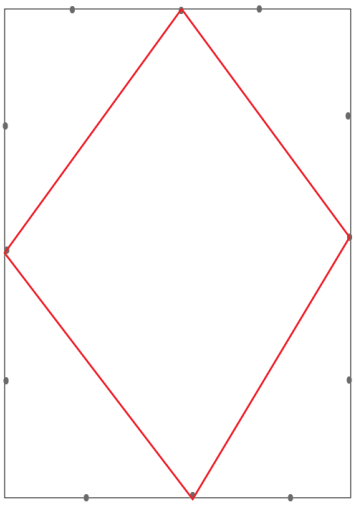


*Figure 66 mark eight locations*

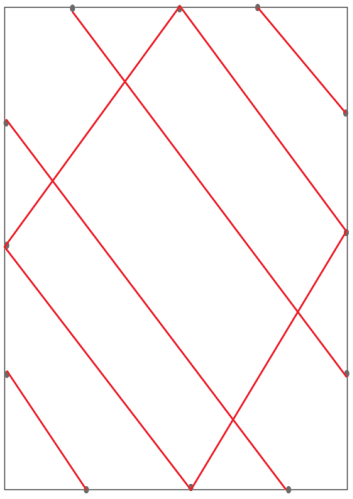


*Figure 67 draw four red lines*

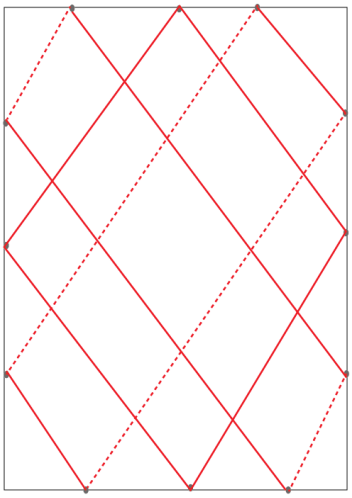


*Figure 68 draw four more red lines*

*(shown here as dotted lines)*

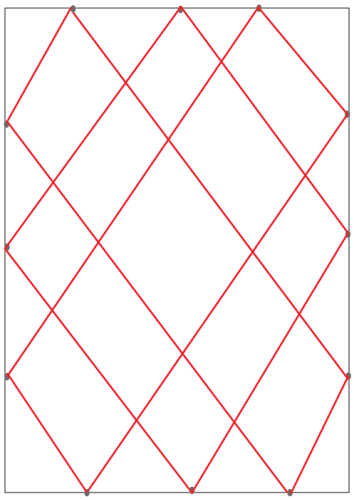


*Figure 69 completed diagonal grid*

## *Step Three: completing a diagonal grid*

a) Use the grey-lead pencil to mark sixteen further locations, four along each of the four edges of the paper by again guessing halfway points between each of the points of the red diagonal grid and also between the four corners of the paper. Do not use the ruler to measure or to check these locations, they must all be guessed (Figure 70). The guessing of the half way positions is the crucial part of the exercise.

b) Use the red pen and ruler to join these marks by drawing eight straight lines diagonally across the page in one direction (Figure 71).

This is the most difficult part of the drawing. It is important to ensure the right marks are paired correctly and connected by drawing lines. Working methodically across and down the page. For example, starting from the top right-hand corner to the bottom left, drawing each line to join each pair of marks one at a time, will help ensure the right marks are connected by lines.

Note: If it is helpful, these marks can be numbered using the grey-lead pencil and erased later, once the lines are drawn.

c) Use the red pen and ruler and draw eight more straight diagonal lines across the page to complete a diagonal grid (Figures 72 - 73).

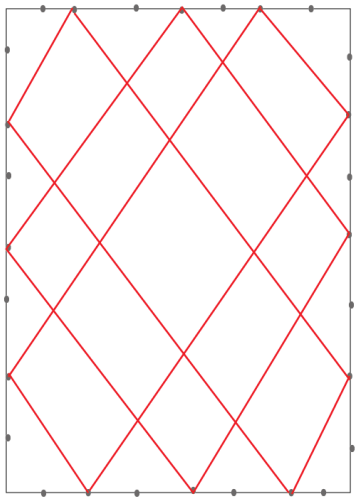


*Figure 70 mark sixteen locations*

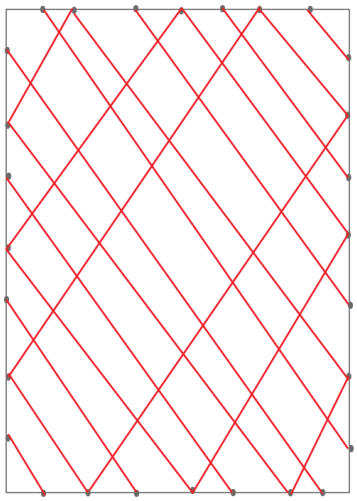


*Figure 71 draw eight red lines*

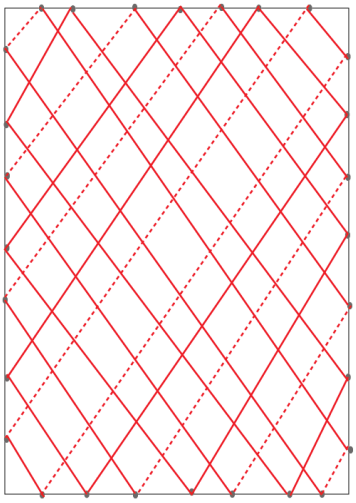


*Figure 72 draw eight more red lines*

*(shown here as dotted)*

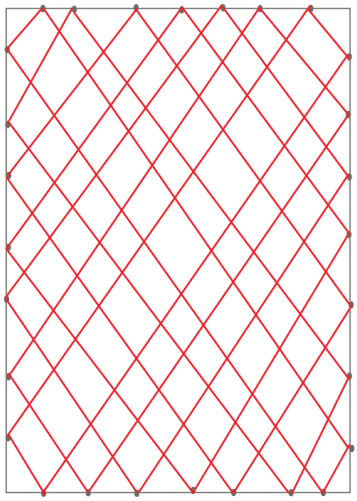


*Figure 73 completed diagonal grid*

### *Step Four: perceptual shift*

At this stage, a particular way of perceiving the diagonal grid of lines is required. Before continuing, the diagonal grid of lines must first be perceived differently, as a collective of irregular, diamond-shaped units surrounded by a series of triangular-shaped cells, which frame the four edges of paper. There are two basic shapes involved with this picture. A series of irregular triangles on the outside of the image enclosing a collection of irregular diamonds.

This construction process has created 28 triangle shapes around the edge of the drawing and 85 slightly warped diamond shapes in the body of the drawing.
Figure 74 has been marked to help differentiate within your drawing these two different types of shapes, diamond-shapes and triangles. In the image below, every diamond-shaped unit is marked with a single grey dot, whereas each triangular-shaped cell is marked with a grey X.

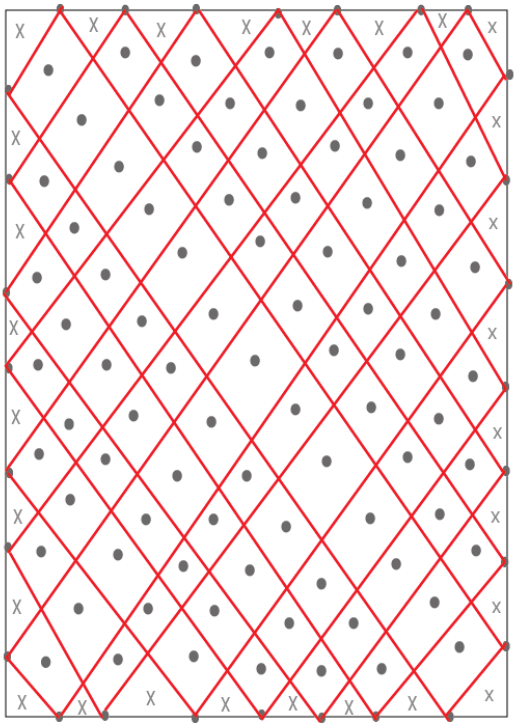


*Figure 74 The drawing comprises two types of shapes: grey dots mark diamond-shaped units, being surrounded by triangular shaped units marked with a grey X.*

## *Step Five: defining areas*

a) Use the grey-lead pencil to lightly mark all twenty-eight triangular-shaped cells around the edges of the paper, each with the letter X (Figure 75). No lines will be drawn in these areas. These Xs will be erased after the drawing is finished so draw lightly using the grey pencil.

b) Use the grey-lead pencil to lightly mark each of the eighty-five diamond-shaped units with a small dot (Figure 76). There is another step to go to illustrate the concept. The next red lines of the drawing will be drawn in these areas. Each dot will be erased one at a time as the drawing progresses, so mark these dots lightly with the grey pencil.

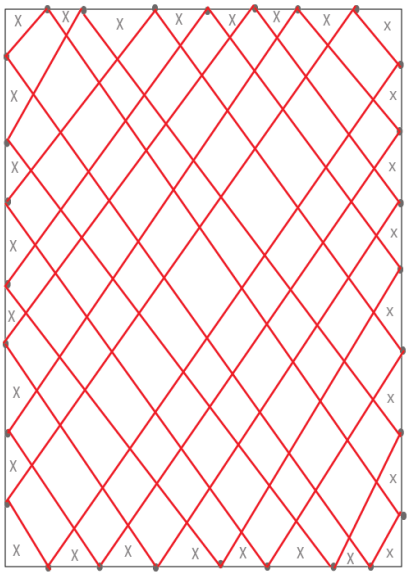


*Figure 75 mark all 28 triangles with an X*

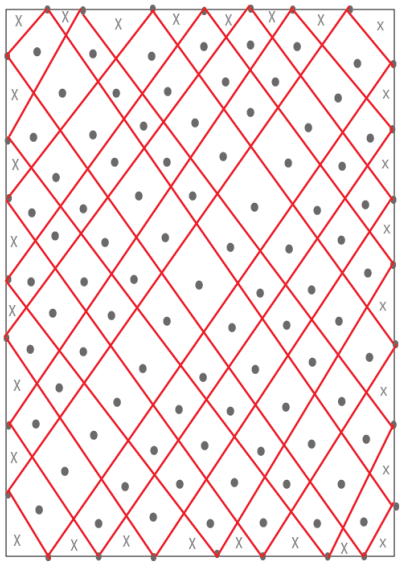


*Figure 76  mark all 85 diamonds with a grey dot.*

## *Step Six: confirmation of wrongness as right*

The diagonal grid of red lines you have made will not appear to be completely regular, symmetrical or uniform because of the guessing involved in the previous stages. The final stage of the drawing requires drawing many more small, straight lines to emphasise the unique character and form of the red diagonal grid of lines you have made.

- The final stage of the drawing requires drawing eighty-five short straight lines, one at a time, using the ruler and red pen.

- Each of these short lines will divide each of the eighty-five diamond-shaped units in half into two triangular-shaped cells.

- The figures that follow show a methodical sequence of drawing this series of eighty-five short lines. These new lines complete the drawing. Each short line will follow the eccentricities of your diagonal grid to accentuate its unique characteristics as a cohesive, geometric form established through guessing. These new lines unify the pattern and confirm the irregularity of the grid as being correct, the desitred outcome.

While it is important that every diamond-shape is divided into two triangles, one at a time, this can be done in any order. Initially, it can be difficult to identify each of the diamond-shapes, which is why each one is marked with a grey-dot. It can be easy to miss one and become disorientated within the drawing. Adopting a systematic approach simplifies the process, helping to distinguish each diamond-shape from each triangle as the drawing progresses. For example, you can erase each dot within each diamond-shape before completing each line. Diagrams are provided on the following pages to show a sequence of division that can be followed as a step by step, methodical process if desired.

Refer to the diagrams on the following pages. Figure 77 shows a line being drawn in just one of the eighty-five diamond-shaped cells, divided into two triangular regions, an upper and lower region, by drawing a single line from point to point. Each new drawn line must begin and end within the point of intersection of two long diagonal lines of the grid. In Figure 77, the new red line to be drawn is represented as a dotted line to differentiate it from all of the previously drawn lines of the diagonal grid, making it easier to recognise. The actual line should be drawn as solid, not dotted.

Similarly, in the diagrams that follow, every new sequence of lines, the ones to be drawn next, are represented as dotted red-lines.

a) Locate the uppermost diamond-shape along the left-hand side of the diagonal-grid, erase the grey-lead pencilled dot in in the centre and use the red pen and ruler to draw a single, solid, straight, line to divide the diamond-shape, horizontally, into two triangular shapes as shown from point to point (Figure 77). Figure 78 shows the close-up view. In certain places within the drawing it may seem possible and become tempting to draw several lines at once,

continuing straight through several points of intersection. It is important that each line is drawn one at a time. It establishes a rhythm and a build-up of ink in the centre of each point of intersection which, although subtle, becomes a material feature of the drawing. The build-up of ink becomes significantly visible and dynamic in large-scale wall drawings and helps draw attention to the drawing process and to the linear, geometric, structure.

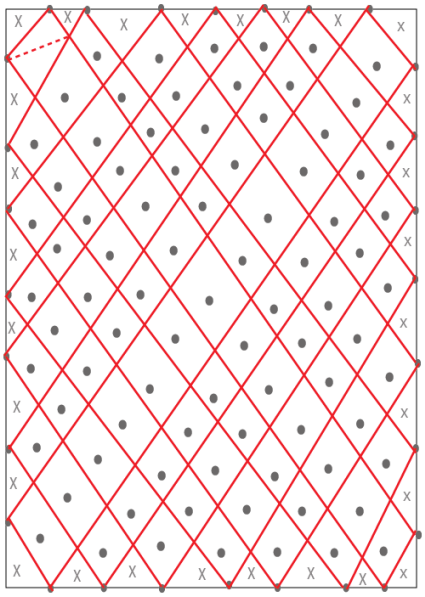


*Figure 77*

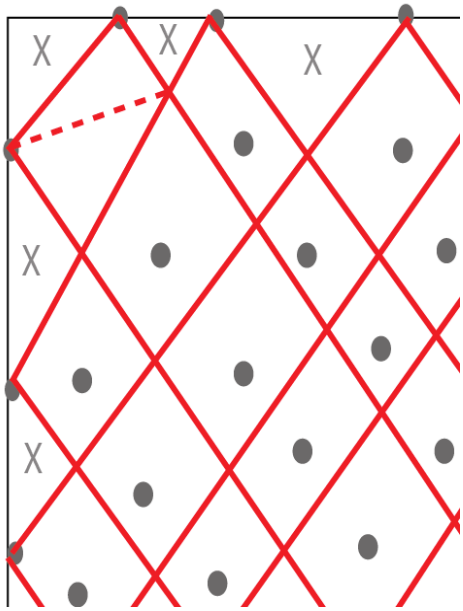


*Figure 78*

*In Figure 77 and 78, the upper left-hand diamond shape is divided by a single line indicated here by a dotted red line.*

b) Follow the sequence shown in Figures 79 to 84 to divide each diamond-shape in half horizontally, with a single line. Erase each dot and draw a new line to divide each diamond-shape horizontally, into two triangles, an upper and lower triangle, one at a time, until all of diamond-shapes are divided.

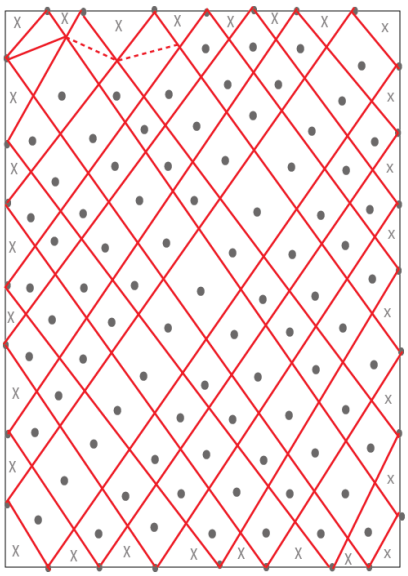


Figure 79

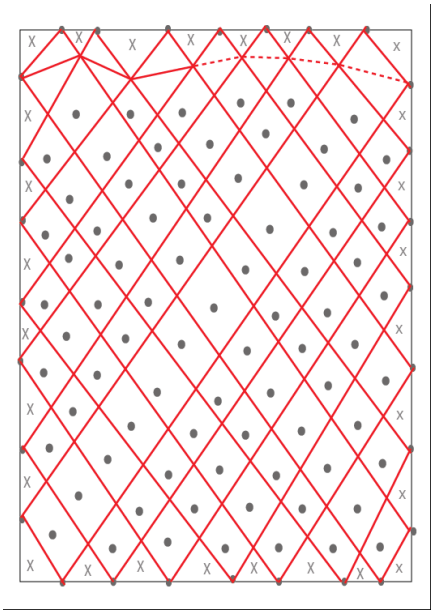


Figure 80

*In Figure 79, the next 2 diamonds divided (indicated here as dotted); and in Figure 80, the top row of 7 diamonds are divided.*

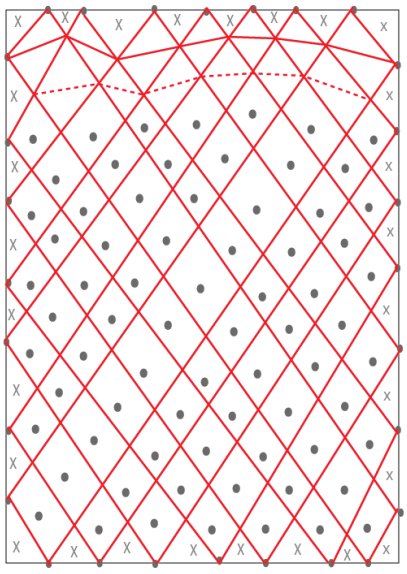


Figure 81

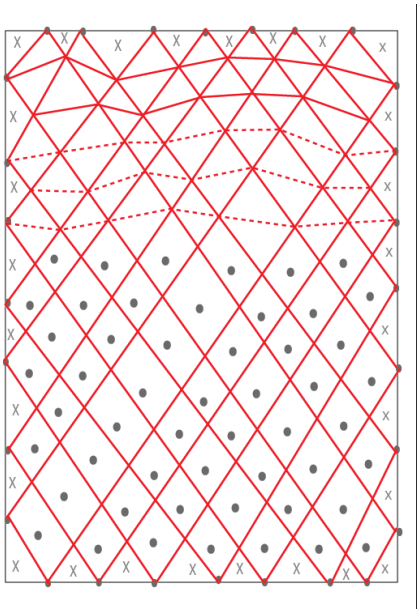


Figure 82

*In Figure 81 the next 6 diamonds are divided (indicated here as dotted); and in Figure 82, the top 5 rows of diamonds are divided.*

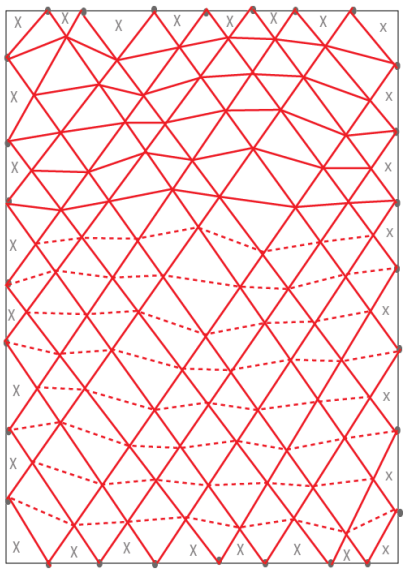


*Figure 83*

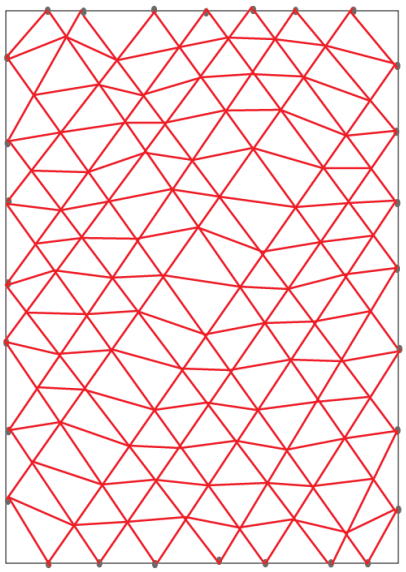
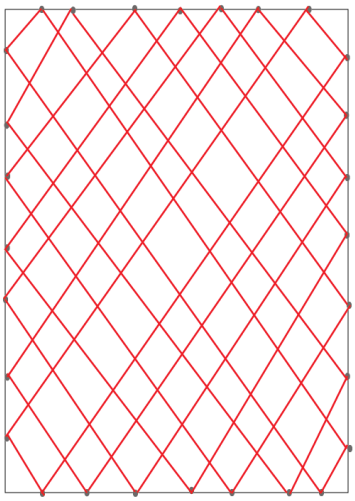


*Figure 84*

*In Figure 83 the remaining 8 rows of diamonds are divided; and in Figure 84, drawing is complete with pencil X's erased.*

c) Once every diamond-shape has been divided horizontally by a short, straight red line, erase all of the grey-pencilled Xs around the edge of the paper and the drawing is complete.

The activity of drawing the lines in Step Six defines the grid as an asymmetrical, cohesive geometric structure, as a pattern with particular characteristics that manifest as wave-like distortions across the grid. If the drawing were considered finished after Step Three (Figure 73), it might easily be perceived as a poorly rendered, irregular grid of lines, which is to say as being wrong. The final step of drawing the eighty-five short lines confirms the geometry as a cohesive structure establishing its integrity as a form. In this way, all iterations of the diagonal grid are confirmed as being correct, the grid not easily being considered poorly rendered. The distortions of the pattern are perceived as intentional. The same process is followed within all iterations of the base diagonal-grid structure to define a linear geometric pattern as a cohesive form. Provided the process is followed correctly, all versions of the drawing are different, correct, equal and valid.



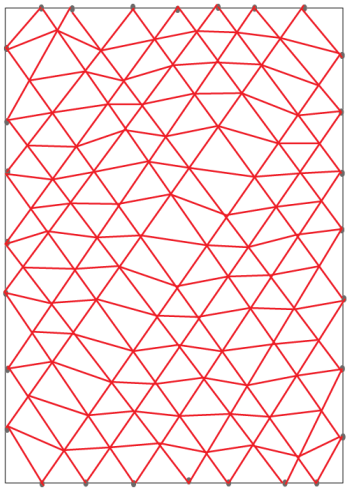


*Figure 85* *Figure 86*

*Comparing end of step 3 Figure 85 (same as Figure 73) with completed drawing Figure 86.*

## *Defining organic geometry*

These small red drawings evolved to become the large-scale, instruction-based artworks called the *Red Matter Wall Drawings*. These artworks equally ask participants to guess the half-way point between two points instead of using tools to measure the half-way points.

Each *Red Matter Wall Drawing* instruction book describes how to make a single, geometric-pattern, each which represents a different drawing type or different pattern. For example, the pattern that has just been used as a model to make this drawing is shown below in Figures 87 and 88. There are four different drawing types in the *Red Matter Wall Drawing* series, each representing one of four different patterns as generated in the instruction books 1 - 4. If the drawing you have just made was measured rather than guessed it would look like Figure 88. These two drawings have the same pattern and structure, they are the same ‘type’. Using the same instructions an endless number of different iterations of this type of drawing can be made.

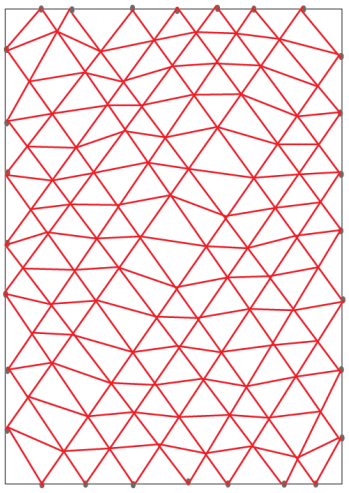


*Figure 87*

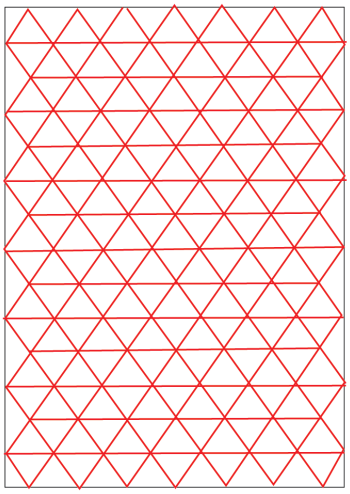


*Figure 88*

*A measured version of the drawing in this exercise would appear symmetrical and uniform, this pattern represents the drawing type of which iterations are made.*

## *Organic geometry and matter, instructional formats and mass-production*

When I made the first of these drawings in 1992, it occurred to me that they might reveal something fundamental about the nature of matter. Rather than guessing during the first steps, if the same drawing were made by accurately measuring the gaps and intersections in the formation of the linear grid, the final drawing would appear as a uniform grid of diagonal lines and a symmetrical pattern (Figure 88). Yet on closer inspection, especially if magnified, minute variations would be revealed, regardless of the accuratecy with which the grid was measured and rendered.

I imagined how the magnified edges of the lines would begin to break-up, at first appearing slightly rough or jagged, the distribution of ink-droplets eventually being revealed in their varied size and distribution, sitting on top of the paper's fibrous structure. With further magnification, a potentially endless coastline of red-ink molecules might be observed, revealing another world and entirely different sense of scale and matter. It occurred that every repetition of the drawing, regardless of accuracy, must be physically different to any other, even if the differences only became apparent through detailed inspection and magnification through the use of high technology electron microscopes.

Any seemingly perfectly rendered version of a drawing type or any other thing is just that, only a semblance of the perfect. On magnification, it would be observed to only closely simulate an ideal. It is not physically possible to make an perfectly uniform version, only theoretically, via the concept of averaging out of an infinite number of possible iterations of the drawing type. A perfectly symmetrical version of the drawing type is not physically possible and at a conceptual level, it simply represents a quality of drawing which is literally more middle-of-the-road in character than the other versions where variance is integral to their perception.

As an original contribution knowledge and understanding that has been derived through art practice and reflection on it, these artworks show that a perfectly symmetrical version is not an ideal version, expressly because there is a deep quality of honesty and revelation in these wonky line-drawings. Each drawing represents no specific thing, but in its place, they communicate a deep truth about matter and all things at a conceptual, embodied, experiential and procedural level, constituting a response to the question:

*Can any two things truly be physically identical? Is anything truly the same as anything else?*

Indeed, if nothing is truly identical, then everything is truly unique. The series *Red Matter Wall Drawings* poses this question to participants through the process of reading the instructions and making the drawings. This question connects the drawings to questions in the field of science, which is examined in Chapter Seven. Researching these questions took me deeper into the underlying science.

These drawings embody the concept that nothing is perfect even if it looks like it is. For many years, I wondered how far down in scale the concept that nothing is perfect even if it looks like it is holds true; at what point and within which parameters do the drawings depart physically or conceptually from expressing or contesting a truth of matter? What might these drawings and this geometry be used to convey? The thesis proposes various ways in which these drawings could be used as tools of visualisation and the questions they might address.

In Chapter Seven, this aspect of the research unfolds in relation to the study of physics, being exemplified through the development of a narrative for use in a new instruction manual for making wall drawings. Firstly, however, Chapter 6 discusses the format of instruction-based geometric wall drawings as a method of contemporary art practice, with origins combining conceptual art and formalist abstraction. The chapter explains the ways in which I

have adapted this format into my own work to explore new themes in a new series of artworks as a main outcome of the research.

# CHAPTER 6
# FORMATS AND THEMES
# OF INTERPRETATION AND ENGAGEMENT

Chapter Five introduced the concept of organic geometry, demonstrating this concept through a drawing exercise. Chapter Six examines the application of organic geometry to four series of instruction-based artworks produced since 1994: *Red Matter Wall Drawings 1-4* (1994), *Black O Wall Drawings 1-6* (1996), *Blue Wall Drawing #1* (2007) and *Field Drawing #1* (2008). Chapter Six also describes a new series of artworks, the main outcome of this research. In merging the principles of contemporary art and ecomuseology, these series of artworks encompass participation, adaptation to space, the interpretation of place and DIY culture. The development of the concept of organic geometry extended my research within the areas of geometric abstraction, the use of everyday materials, seriality and installation. Chapter Six describes how these instruction-based artworks combine concepts of art, work and mass-production, reinterpreting the instruction-based format and the conceptual potentialities of working on walls pioneered in the early 1960s by artists such as Julije Knifer (1924–2004) and Sol LeWitt (1928–2007).

Chapter Six describes how, within the instructional texts of each of these series, organic geometry is represented in different thematic ways to connect the drawing process to concepts that apply to a broad range of fields. Each artwork theme provides a specific direction for reflection, encouraging the development of analogies and cross disciplinary engagement. By combining the processes of making drawings and making analogies, specific narratives can be developed by specialists, enabling my instruction-based drawings to be used as tools to explicate and demonstrate a wide range of subjects. In this way, the artworks provide access to new ways of interpreting and conveying knowledge. This is further explained Chapter Six via the pages of a new instruction-based artwork titled *Whoosh*. Chapter Seven, “Connecting Art and Science”, then demonstrates the potential of the basic premise of organic geometry as an educational tool in relation to foundational studies in physics, which explain the formation of anomalies in matter at the smallest possible scale.

## *Working on walls, after Lewitt and Knifer*

Geometric abstraction began with the work of pioneers such as Hilma af Klint and the Russian constructivists in developing a visual language of abstraction and geometry. This research is also informed by the development of conceptual art, which emerged from the work of Marcel Duchamp in opening new avenues in art practice in 1913 by engaging with ideas and the everyday through his ready-made sculptures. Duchamp showed how the act of making art could be to declare an object such, questioning who defined art and how it was defined.

There are many other artists whose work aligns with my own interests and practice and likely many I don't yet know about. For example, I had not heard of Hilma af Klint until 2012 (Figure 89). This is not surprising. There are likely many significant abstract and conceptual artists, especially women artists and those who do not speak English, who remain unknown.[196] This chapter contextualises my arts practice while acknowledging the work of artists who I know have informed its development and the trajectory of this research.

*Figure 89 Hilma af Klint, Paintings for the Temple, 1906 -1915.*[197]

[196]Referring to Mladen Stilinovic's work 'An artist who does not speak English is no artist', see Chapter Four, Figure 44.

[197] Installation view of three paintings in the exhibition 'Paintings for the Future', Solomon R. Guggenheim Museum, New York, October 12, 2018 to April 23, 2019.

In my adoption of the format of the instruction-based wall drawings, the work of Sol LeWitt has been an important reference point. In 1968, LeWitt made a major breakthrough in contemporary art when he pioneered the use of instruction-based formats — as a form of conceptual art — for making geometric abstraction directly on walls (Figure 90).[198] LeWitt's work prompted me to consider both the use of walls and architecture as a medium and to contemplate the role of assistants in the production of art. I also connected the format of the instruction-based wall drawing to Duchamp's idea of ready-made artworks, exploring how a wall might function as a ready-made artwork. The inclusion of assistants in the production of my wall drawings drew on Duchamp's proposition of mass-produced objects as artworks via the idea of repeating the same wall drawing to produce a series of unique iterations. In my practice, each drawing becomes a unique inscription, which I haven't made, the wall being inscribed in this way as an artwork.

This is a considerable variation on the general theme and understanding of what mass-production meant to earlier exponents of this concept. When earlier artists drew on mass-production as an art source, there was an assumption that each object in the framework of that mass-production concept was identical. Questioning of the identical concept in works of mass-production, or replication in the case of my instruction-based works, completely changes the inherent message conveyed in the work. The principles surrounding my production of instruction-based wall drawings evolved slowly in my practice from 1984 when I began exploring repetition and variation in relation to materiality. The current form of this concept is organic geometry, which I use to demonstrate conceptual and material interconnectivity between people and nature through making art.

[198] In 1968 LeWitt created his first wall drawing for an exhibition at Paula Cooper Gallery in New York.

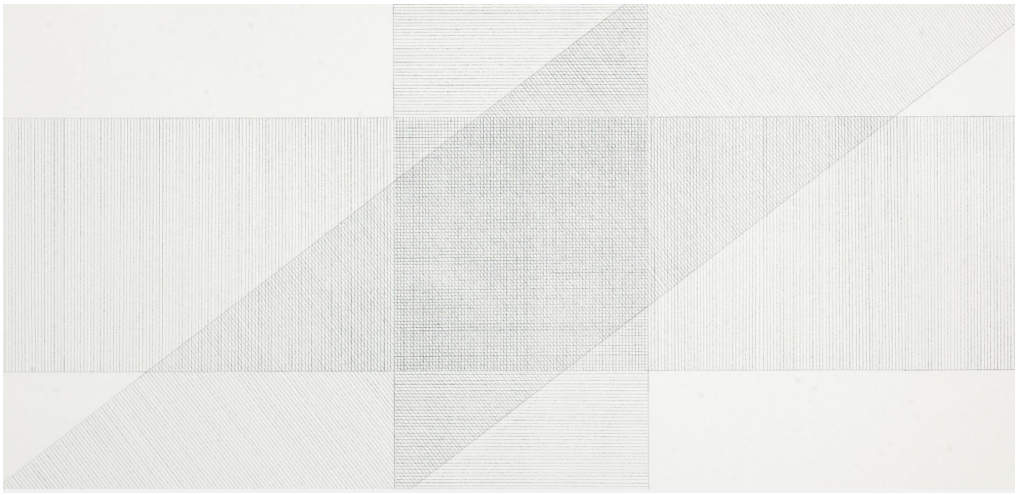


*Figure 90 Sol LeWitt, Wall Drawing #16, 1969. Black Pencil on wall. Bands of lines 12 inches (30 cm) wide, in three directions (vertical, horizontal, diagonal right) intersecting.*[199]

## *Found objects, found histories, abstraction and transformation*

From 1984 to 1985, I made hundreds of drawings using compressed charcoal on the pages of an enormous pile of discarded blank newsprint I found on the footpath outside a publishing house. My concern was how the two materials might relate to each other through drawing, being conscious of the carbon-based origins of each material and my own body. Newsprint, originally made from trees, could eventually become compressed charcoal, as could I, each representing a current evolutionary state of the one material. The drawings were a brief interventional encounter between different evolutionary states of a single material. The smooth, yellowing surface of the paper was the starting point for making quick, gestural abstract drawings *en masse*, each drawing a single instance of communication between three elements in seeking to develop a visual language (Figures 91- 92).

[199] Image source: MASS MoCA, https://massmoca.org/event/walldrawing16/

*Figure 91 Image of b + w drawings in studio 1985*

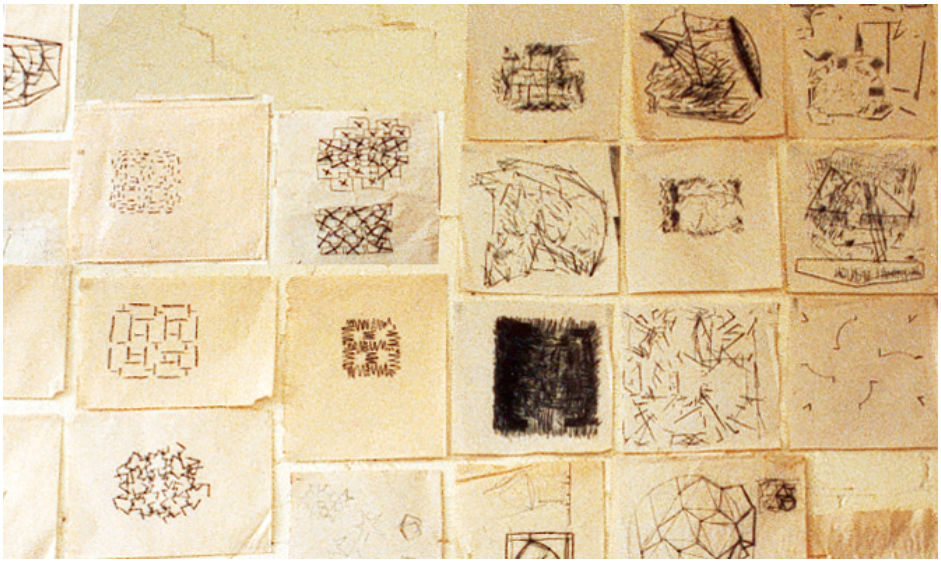


*Figure 92*

The drawings were influenced by the television program, *Mr Squiggle*, which I watched as a child in the 1960s.[200] Artist and puppeteer, Norman Hetherington, invented the character of Mr Squiggle, who transformed abstract gestural drawings (squiggles), sent to him by children from around Australia into cartoon drawings. The results were typically surprising,

[200] The Mr Squiggle, television series produced by ABC ran from 1959 to 1999.

humorous, poetic or absurd. As a child, I practiced making squiggle drawings, endlessly transforming abstract gestures into cartoons. The method I used to make these abstract charcoal drawings on newsprint was similar to Mr Squiggle's process, although is better understood as anti-squiggles. The drawing emerged through the materiality of the paper interacting with charcoal, with me consciously directing the process away from representation to produce abstract drawings that represented nothing but themselves.

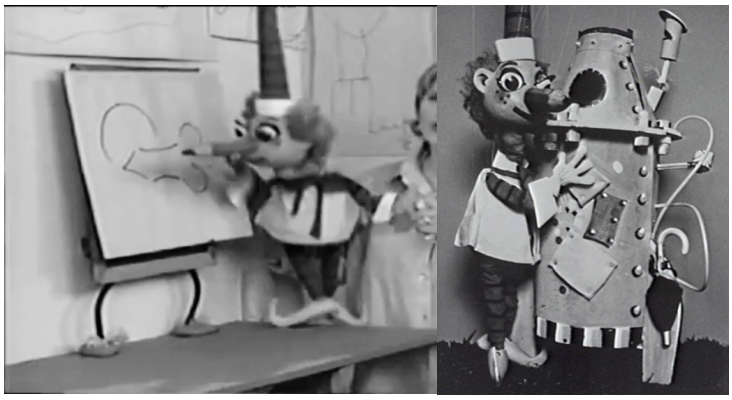


*Figure 93 Mr Squiggle, Norman Hetherington, courtesy ABC television productions.*[201]

Extending this practice of making 'something' out of 'nothing', in 1986, I began making paintings using pieces of broken plywood found on the street as ready-made supports. In these works, painting became an activity of adjusting various fractured shapes of broken plywood by applying paint, felt-tipped marker, crayon, fields of small gestural marks with compressed charcoal to re-present them as artworks. The activity of choosing, and of painting on, pieces of broken plywood equally involved directing a process of material interactions. The wood was a natural material that had been on a journey through time. Transformed from a tree through industrial processes into plywood sheet, it was purchased, used for some purpose to eventually become redundant, discarded, then found on the side of a road.

I saw conceptual parallels here to the work of Constructivist and Suprematist artists, which was foundational to all geometric abstraction, but neglected within discussions of Australian art and art history at that time. Although vestiges of geometric abstraction had infiltrated Australian art through the influence of the Bloomsbury Group and Abstract Expressionism, this was a fractured process of secondary interpretation. Although foundational, the work of Russian Constructivist and Suprematist artists was not taught in the art schools I attended. Discovering it requiring independent research, which brought together a group like-minded

[201] Image source: Film Australia. https://aso.gov.au/news/2010/12/7/rip-norman-hetherington/

peers primarily influenced by the work of John Nixon. Nixon pioneered an interest in non-objective art in Australia and generated a collective engagement with this locally neglected and missing history of abstraction, which led to the establishment of Store 5.

*Figure 94 Image of shattered plywood painting, 1986.*

Studying the surface of each piece of broken plywood, I looked for scope to respond in terms of Constructivist and Suprematist concepts of abstract space, determining how best to engage with the object to draw out an emergent sense of space with minimal intervention. I understood this process of making art to follow activities in nature, much as a bird might make use of a piece of plastic for its nest or a lizard might shelter under a supermarket brochure inside a letterbox. Using processes of imagination and transformation similar to Mr Squiggle, these paintings adjusted the surface and structure of objects to redefine them as art, using principles derived from Constructivist and Suprematist abstract space and which can be applied to any object; although some objects are more successfully transformed than others. This activity disrupted the plywood's journey, redirecting it from degeneration into the realm of art and introducing a set of new material and formal considerations, questions of time, through the history of the object, and the feelings, thoughts and sensations that emerge through the physical experience of engaging with surfaces, materials and objects; the practice of abstraction a concretisation of many things within these artworks.

### *Walls and instructional formats*

In 1987, I began developing sets of instructions to install series of small, diamond-grid paintings onto walls to form large paintings (Figure 95). Chapter One explained how these works saw my arts practice focus exclusively on the diamond-shape and on diagonal lines. Chapter One outlined three areas of research interest driving this shift:

- the relationship of art and technology (diamond reason 1),
- the significance of small differences (diamond reason 2) and
- the use of intuition (diamond reason 3).

This shift was influenced by considering the materiality of life through the shattered plywood paintings and drawings using compressed charcoal on found newsprint. Materially, diamonds are the most highly-compressed form of carbon, the physical end point of compacting life as matter while remaining an object retaining mass. Instructions form a conceptual as well as practical component of these artworks.

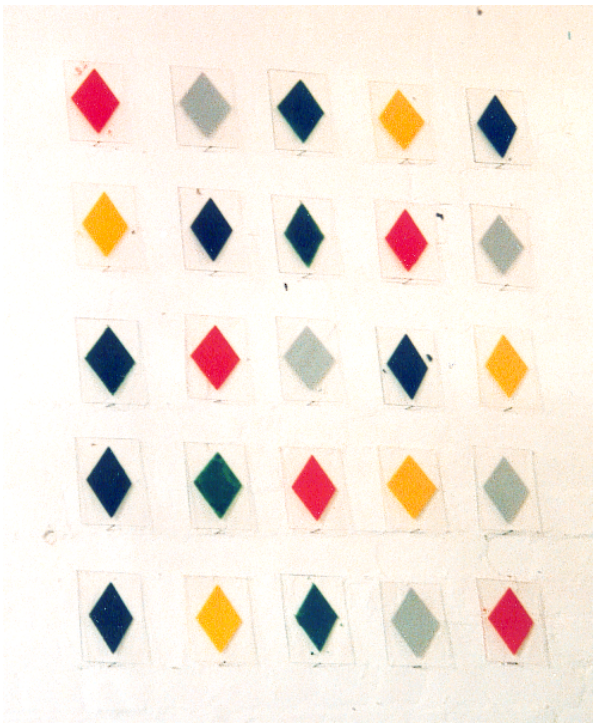


*Figure 95 Untitled Paintings, oil on Perspex, Maples Lane 1988.*

As described in Chapter One, I explored the possibility of what a painting could be. The groupings of small paintings, presented as box-sets, could be efficiently packed down into

small boxes to travel and store, expanding as single large paintings when installed on a wall in exhibitions. Each large painting was made by mass-producing multiple paintings as objects, using a factory-like, production-line process to quickly paint a repeating diamond-motif onto small pieces of clear Perspex sheet using a large brush. The material base of each small painting was made by snapping long, narrow offcuts of Perspex sheet into small pieces, these being discarded by the picture framing shop below my studio and gleaned from their rubbish piles. These multiple, repeated parts were each slightly different, the differences between each painting-unit apparent on close inspection. Close inspection also revealed the abrasion of the Perspex from its disposal in the rubbish pile and the roughly painted texture of the brushstrokes.

The instructional labels, usually printed on top of each box-set, show a pattern-grid arrangement of how each grouping should be installed on a wall, the wall being a significant part of these artworks. As the diamonds are painted onto clear Perspex, the wall is visible through each painting. The wall is also the primary structure that makes each painting a cohesive whole. Installations of these paintings is adapted to the dimensions and materiality of each wall. For example, on a brick wall, mortar-lines running between rows of bricks determine the spacing between each painting unit.

The small red drawing discussed in Chapter Five arose through this series of paintings. The instructions for the red matter drawings are a development of the concept of looking at the significance of very small differences, errors and anomalies. The instructions for the red matter drawings primarily developed due to the intention to include the participation of other people in their production; this introduced a random element into the works to convey concepts about difference and the generation of form via the drawing process. At the time, working directly on walls and making instructions seemed like a natural progression and a small shift to me, but it has become a major and enduring aspect of my work, drawing further conceptual importance through the role of assistants in the process evolved to drive the outcomes.

### *Walls and wealth*

Working on walls engages with a long story about the relationship between art and walls, dating back in time to cave paintings. It is also inextricably linked to the development of art as a commodity and the development of the art market. Walls have been a standard support

for paintings across different eras and cultures. The process of commissioning artists to produce works directly onto walls was commonly financed by patrons and institutions. Wall painting both established and enhanced the significance of a place while the production and repair of paintings on walls was a significant trade and source of income for artists. The emergence of an art market in Europe during the Renaissance was facilitated by the development of paintings on canvas and panel, the emergence of these portable, painting objects enabling the possession of and trade in art works. In the twentieth century, however, many artists began to challenge the integrity of two-dimensional works of art, their commodity form and values of elitism and preciousness.

When LeWitt's first wall drawing was exhibited in 1968, it represented a radical departure from the history of drawing. These drawings were conceptual artworks that called into question ideas of permanence, uniqueness and authorship in art. They put a contemporary slant on the use of walls as a support for art, re-invigorating the process and possibilities of working on walls, which had largely become the domain of advertising and interior decor. LeWitt's work liberated walls as a material for abstraction and conceptual art. Since the late 1960s, many artists have used walls as a medium and point of conceptual engagement in order to claim a place for art physically integrated into the world or the gallery context and often also nominating a place as art in this process.

*Figure 96 "This is not my world", Zeljko Jerman, 1976, Zagreb, (street banner artwork) made by writing with developer onto photo paper in the street in Belgrade as a performance.*[202]

[202] Image source: Proleksis Encyclopaedia. https://proleksis.lzmk.hr/32048/

Today, writing, drawing and spray painting onto walls and posting papers on them is also a realm of expression of the disenfranchised. Many forms of graffiti are seen as the acts of the disenfranchised claiming of territory. The artefacts of turf wars, of defacing, of competing as a mode of expression and creative revenge, this mark making creates visual clutter, rupturing the public's visual experience of the world. It is surprising that working on walls is a relatively under utilised medium for artists, but is perhaps explained by the reluctance of galleries and museums to allow their walls to be altered by artists and the obvious difficulty in selling wall works in the commercial art system. Working on walls maintains conceptual art's contestation of the commodity status of art, making art works as part of the built environment, continuing to blur boundaries around the role of art. My instruction-based wall works and actions in placing paintings in rural and urban settings outside the gallery system joins this conversation to consider the scope for art to harness the broader environment as a medium, while continuing to question ideas of art as commodity and object as well as art's relationship to people, place and society.

### *LeWitt walls and the role of assistants*

LeWitt wanted to work on walls to get away from the notions of painting and sculpture and instead get people thinking about art as being "three dimensional or two dimensional or combinations" [203] He was similarly concerned about the truth of objects and their physical materiality. LeWitt's wall works reflect the intent to make a "thing" as two dimensional as possible. He considered that a painting was usually a three-dimensional object, having a canvas ground or support so to make something really two dimensional, it needed to be made directly on to a wall.[204] LeWitt's additional intention of working on walls was to engage art and people in a dialogue about physical reality through presence.

In 2016, I met with Janet Passehl, curator of the LeWitt Collection in Chester, Connecticut.[205] Passehl worked with LeWitt for seventeen years, explaining that LeWitt's assistants had a complex involvement in realising his ideas, far beyond that of mere technical executors.

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[203] Sol LeWitt, interview by Paul Cummings, 15 July 1974, 1974, Originally recorded on 1 sound tape reel. Reformatted in 2010 as 2 digital wav files. Duration is 2 hrs., 6 min.Sol LeWitt and Paul Cummings, 'Oral History Interview with Sol LeWitt', Smithsonian Institution, (1974)

[204] Ibid.

[205] In 2016, I was invited by the Ian Potter Museum, University of Melbourne, to meet with Janet Passehl during her visit to Melbourne as part of the exhibition 'arcs and tangents' at the Art Gallery of NSW. Passehl is an artist and the Curator of the LeWitt Collection. Passehl worked in close proximity with LeWitt in Chester, Connecticut, USA, during the last seventeen years of his life, and she continues to work for the LeWitt family.

LeWitt formed a life-long working relationships with his assistants, this informing a two-way collaboration process. He created a community of colleagues through the production of his works, liking to converse with trades people and other artisans on a daily basis.

LeWitt produced hundreds of ideas for works to be made on to walls and hundreds of sketches and notes as instructions to enable that to happen. Coming up with new ideas and the transfer of his ideas onto walls (for two dimensional ideas) and into objects (for three dimensional ideas) became his main practice. Many assistants and manufacturers worked with LeWitt for many years. They became his collaborators and he called his works "collaborations", the community of people involved in making his art operating more like an extended family than a factory. For Passehl, the conceptualisation of his works as collaborations was consistent with and demonstrated LeWitt's generous personality.

### *Difference, sameness and ongoing projects*

Artist's assistants are usually expected to have a high level of technical proficiency. This was also the expectation of Sol LeWitt, his assistants becoming specialists in executing his work.[206] In a 1974 interview with Paul Cummings, LeWitt was asked about different groups of people producing different looking drawings. LeWitt commented that he thought it was good that other people leave their mark on the drawing. Just as any performance of a musical composition varies, LeWitt explained, "It's a collaboration, as long as they follow the plan and don't try to do a different work of art, then I think it's their interpretation." [207]

The level of tolerance in LeWitt's instruction-based works is set very high to ensure a small range of variability and a consistent outcome. Even with the scribble wall drawings, LeWitt set tonal percentage scales for the density of scribbles that need to be achieved. In the *Red Matter Wall Drawings* and other works, I have also set levels of tolerance or levels of variance, but contrary to LeWitt's levels of tolerance, I set these as low as possible so that the aspect of human variation becomes the focus.

[206] Specialist LeWitt assistants travelled to Australia from Berlin and Helsinki to oversee the installation of drawings at the Art Gallery of New South Wales in 2006.
[207] Sol LeWitt and Paul Cummings, 'Oral History Interview with Sol LeWitt', Smithsonian Institution, (1974)

In later series, I particularly encourage the people making the drawings to explore and push the limits of the drawing type to just before the point at which it would become something other than its type, thus providing potential for the work to be stretched to its limits. Through the process of making each drawing — which is framed within rules, geometry and materials designed to maintain each drawing as a cohesive pattern — people's individual or collective decisions about how to engage with the artwork can define the limits or expand the potential of each drawing conceptually.[208] Like the drawings, this research aims to expand the potential applications, interpretations and directions of the organic nature of this geometric drawing process, with the people making the wall drawings free to choose whether they see themselves as assistants, collaborators, directors, makers or producers in the process, it is up to them. However, the people making the drawings must be willing and interested participants and like Lewitt's work, the instructions for my wall drawings must be followed for the artwork to remain the same artwork.

My instruction-based wall drawing projects establish safe parameters for others to become somewhat lost in during the making process, while simultaneously remaining orientated within the geometry. The instruction manuals involved much slow, detailed and tedious work for me to produce. They must be both clear and concise to allow other people to make the drawing. It becomes my work to identify and resolve the devil in the detail, not others. The owners of each manual choose the wall location for each drawing. Once the people making the drawings have made their decisions in producing the main structural lines, the drawing then belongs to them. As they now understand the geometry and the concept behind the process, it becomes their responsibility to decide whether to complete the drawing or not. Following the intricacies of the geometry of the emerging iteration of the pattern-structure requires concentration and patience. It demands time and a particular type of focus, which is immersive to complete the drawing, but eventually the forms created by the structural decisions of the people making the drawing do unfold. As described later in this chapter, the drawings can aso be practised and the outcomes steered.

[208] As demonstrated through the Wollongong University, Blue Wall Drawing project, see page 142, Chapter Five.

*Figure 97 Wall Drawing #1274: Scribble Column (horizontal), Art Gallery of New South Wales, Australia, 2006, photograph by Christopher Snee.*[209]

LeWitt's scribble wall drawings made evident his concern with the nature of human perception, matter and physical processes. Through works including the scribble series, LeWitt channels the energy imparted through the human physical making of objects and individual's handling of this. In these works, energy emerges as material element, something physically tangible like the walls on which the drawings are made. The scribbles, although highly controlled, present a collection of individual scribble styles, energy being evident through the expression of the hand-rendered lines and other random elements that LeWitt entrusts to others.

However, LeWitt's wall drawings, like his minimalist sculptures, are typically symmetrical. In his 1974 interview, LeWitt comments of breaking the structural symmetry of the white cubes, "It's when you throw a thing off center. Then you, well you make it into something which is much more dynamic than anything that satisfies me. The things that satisfy me are much more placid."[210] My participatory wall works have a very different focus. The aim to have everything truly thrown off-centre led me to make instruction-based wall drawings, the nature of the instructions ensuring each drawing becomes a visibly different version of the same structure. This is why I continue to make instruction-based wall drawings. LeWitt's instruction-based wall drawings are numerous and varied. He also produced at least one series of irregular wall drawings. In 1990, I saw an exhibition of miniature gouaches of

[209] Image source: Art Gallery of NSW, Australia. https://www.artgallery.nsw.gov.au/collection/works/L2014.13/
[210] Sol LeWitt and Paul Cummings, 'Oral History Interview with Sol LeWitt', Smithsonian Institution, (1974)

LeWitt's irregular forms series at Tolarno Galleries, Melbourne, readily recalling the quiet, powerful presence of these small artworks while being irregular and small.

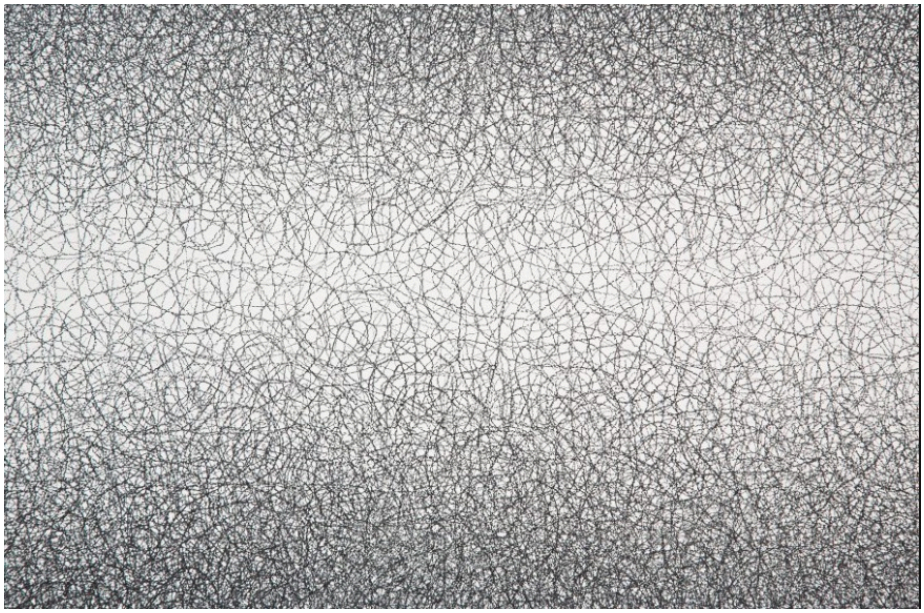


*Figure 98 Wall Drawing #1274: Scribble Column (horizontal), detail, Art Gallery of New South Wales, Australia,2006, photograph by Christopher Snee.*[211]

The primary point of difference between my wall drawing projects and LeWitt's is conceptual. In many ways, my project is the continuation of one small thread of LeWitt's work, taken in an alternative direction. LeWitt's wall drawing project involves the formal investigation of making geometric abstract art, resulting in a diverse manifestation of conceptual artworks through the invention of instruction-based wall drawings. My project uses the format of instruction-based wall drawing and geometric abstraction to investigate processes of making art and ways of thinking about authorship, creativity, matter, nature, production and tenure. The drawings and rules provide means for testing thresholds, breaking rules, practising formalism.

[211] Image source: Art Gallery of NSW, Australia. https://www.artgallery.nsw.gov.au/collection/works/L2014.13/

*Figure 99 In 1990 at an exhibition at Tolarno Galleries in River Street South Yarra, '17 Gouaches', I saw works by Sol LeWitt similar to these from the 'irregular forms' series, they were much smaller gouache on paper and not ink wash on wall. This image is of LeWitt's works #439 and #527, in 1985.* [212]

## *Knifer, repetition and nature / flow and flux*

Organic geometry and my reason for working on walls is more conceptually aligned to the work of the Croatian artist, Julije Knifer (1924-2004) than to that of Sol LeWitt. Knifer was a member of the Gorgona group of artists [213] who worked in Zagreb between 1959 and1966, running the exhibition venue Studio G, the group proposed various projects and activities and produced the eponymous "anti-journal" *Gorgona*.[214] The Gorgona group was connected by common aspirations towards existentialism, interests in neo-Dada, Fluxus and Zen philosophy, many of the group calling their paintings anti-paintings. Knifer reduced the visual elements of his paintings to horizontal and vertical lines and the colours black and white. Over the period 1961 to 2004, his form of anti-painting saw him endlessly repeat the same 'meander' motif in slightly different ways. Through activities associated with the Gorgona Group, Knifer's ongoing iterations of this motif extended to various mediums, shifting from canvas to walls in 1971. [215] For example, in the summer of 1971, Knifer produced a large

[212] Image source: MASS MoCA. https://www.artsy.net/artwork/sol-lewitt-wall-drawings-number-439-and-number-527

[213] Gorgona group, worked in Zagreb (1959-1966) included the painters Josip Vanista, Julije Knifer, Marijan Jevsovar, and Duro Seder, the art historians Radoslav Putar, Matko Mestrovic and Dimetri Basicevic 'Mangelos', sculptor Ivan Kozaric and architect Miljenko Hovat. They ran an exhibition venue called Studio G, proposed various projects and activities.

[214], p.15.

[215] Nada Beros, Marina Benazic, and Kristina Bonjekovic Stojkovic, *Highlights: A Guide through Collection in Motion [Muzej Suvremene Umjetnosti Zagreb, 2009]* (Zagreb: Muzej suvremene umjetnosti Zagreb, 2009). p.25

meander across the façade of an elementary school in the Zagreb suburb of Vrapce.[216] In 1975, he also made an enormous meander work on painted canvas in a quarry (Figure 101).

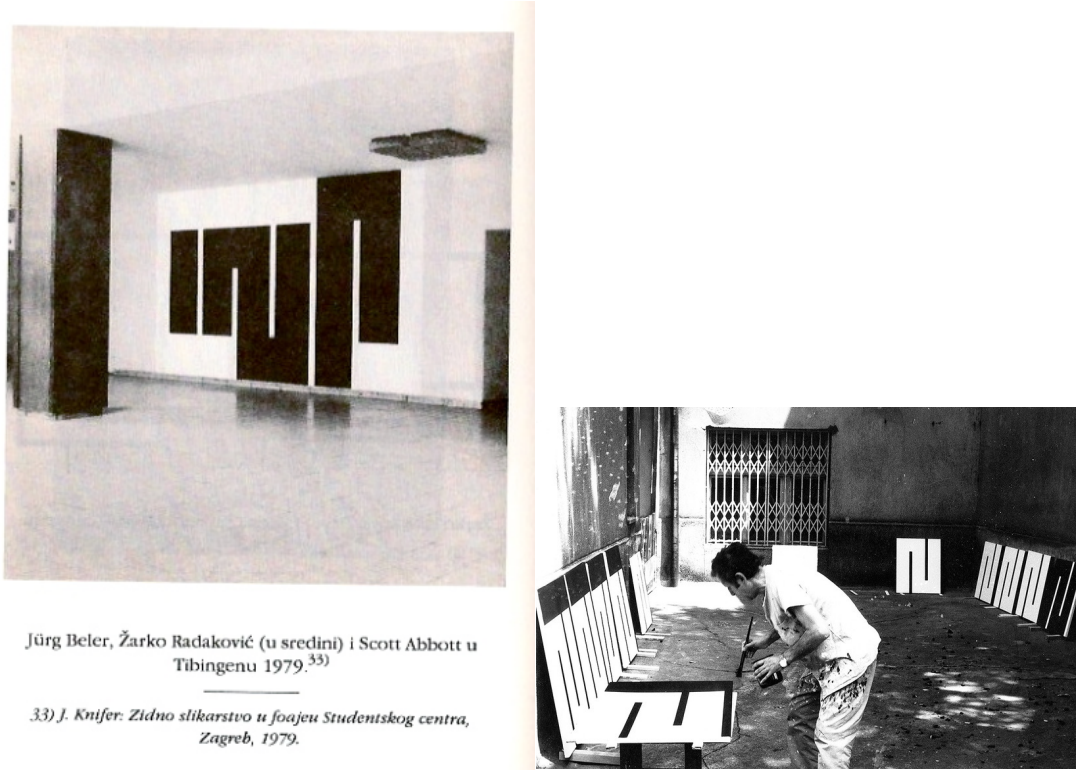



*Figure 100 Knifer, wall painting, 'Meander', Zagreb, 1979 (left); Knifer, Meander painting, C1970, Zagreb.*[217]

In 1997, I was introduced to Knifer and his work in Zagreb by the curator Branka Stipančić. Stipančić organised exhibitions of the *Red Matter Wall Drawings* in Dubrovnik, Croatia, and the *Black O Wall Drawings* in Rovinja, Istria, Croatia. She translated the *Red Matter Wall Drawing* instruction manuals from English to Croatian so that locals who did not speak English could be involved in making the drawings in Dubrovnik. As Istria was officially bilingual, the *Black O Wall Drawing* manuals were translated into both Croatian and Italian for the exhibition in Rovinj. Stipančić wrote the exhibition catalogue essay for the *Black O* drawings and we worked together at the Soros Centre in Zagreb, where she designed of the catalogue. Knifer, who had lived in Paris since the early 1990s, happened to be visiting Zagreb. Stipančić showed me some images of his work, explaining the Meander project and

[216] Julije Knifer et al., *Julije Knifer* (Zagreb: Meandar: Studio Rasic, 2002). Zvonko Maković, biography of Julije Knifer
[217] Image source: Zagreb guide. https://www.inyourpocket.com/zagreb/Julije-Knifer_74071f

organised for us to meet. Helping us communicate, Stipančić showed Knifer a proof of the exhibition catalogue and explained the concept of the *Black O Wall Drawings*. [218]

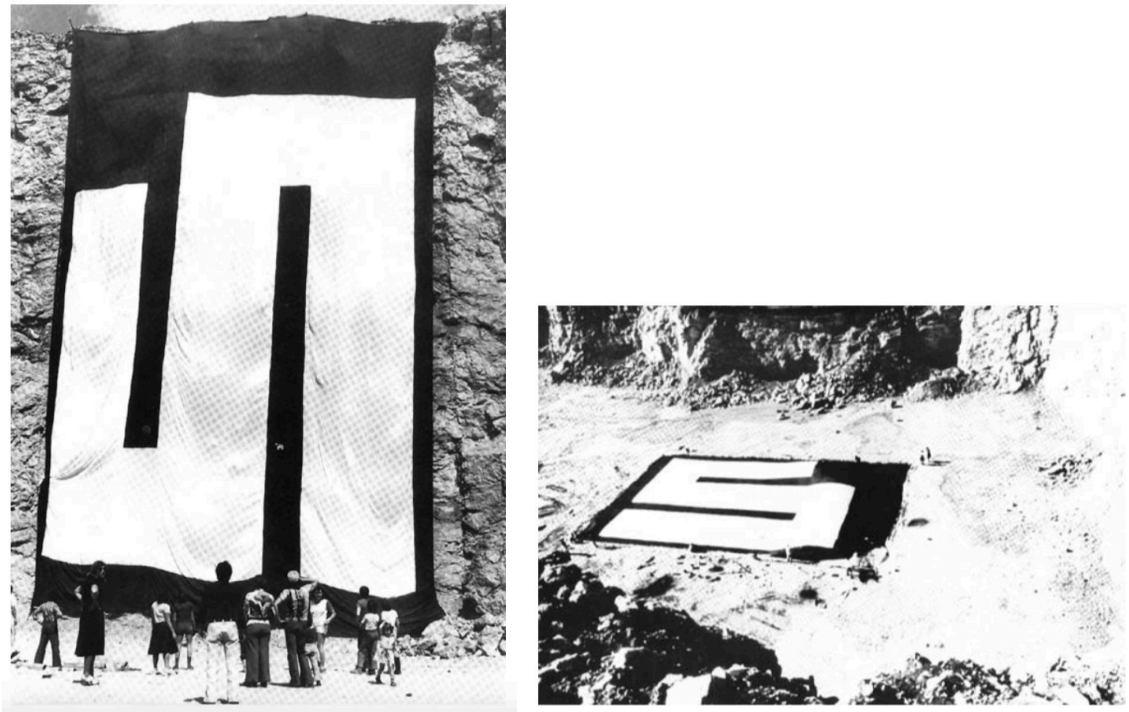


*Figure 101 Julije Knifer, Meander, (20 x 30 metres) paint on canvas at a quarry at Tubingen, 1975.*[219]

Until 2014, there were only two monographs published about the work of Knifer, but neither of these was in English.[220] In September 2014, a major Knifer retrospective opened at the Museum of Contemporary Art, Zagreb. Its curator, Zvonko Maković, writes of the meander:

> the meander, he explains, is making a kind of 'anti-image' that is used. The goal is to remove the "aura of metaphysical nature" from the works and see it (nature) in bare, factual incidence. This goal, factual nature artwork will affirm not only the work process, but also the physical components of the works. With thousands of iterations meander is revealed as an object, as a reified, reified formulas, as a tangible fact.[221]

[218] I don't speak Croatian.
[219] Image source: Julije Knifer: Bez kompromisa / Uncompromising - retrospektiva / a retrospective, 2018.
[220] Two monographs about the work of Knifer have been published to date: Julije Knifer: Méandres (Arnauld Pierre, Adam Biro, Pariz, 2001) and Julije Knifer (Zvonko Maković, Meandar & Studio Rašić, Zagreb, 2002). In 2016, Iva Stefanovski, produced a PhD dissertation on the work of Knifer in English.
[221] Translation from Croatian to English, from: "Julije Knifer", Zvonko Maković, Meandar & Studio Rašić, Zagreb, 2002.

This statement shows how Knifer's life-long project of the meander intersects with many of my own conceptual interests, which I am pursuing in this research through the format of organic geometry.

In 2014, Branka Stipančić curated the exhibition "Personal Cuts, Art scene in Zagreb from 1950s to Now" at the Museum of Contemporary Art, Nimes, France. The exhibition catalogue included English translations of selected writings by Knifer, notes on his art practice in which he explains his paintings as "anti-paintings" through categories such as continuous flow, monotony, non-development, repetition and rhythm: [222] Knifer says:

> My primary aim was to make an anti-painting through the process of reducing form and content. Since for me the absurd is a definite form of freedom, in that process of reaching a specific form of anti-painting, I went to the absurd. In the process of reaching the ultimate liminal rhythms, I stopped at the contrasts of white and black and the relationships between vertical and horizontal. … I wanted to achieve rhythm and extreme contrasts. The simplest and most important rhythm is monotony. Monotony is a flow and rhythm at once. From my work process a specific monotonous rhythm has emerged. Continuity matters, but chronology does not. My work is a course without continuity or an irregular continuity. Direction is irrelevant, what matters is the flow. My work is marked by a minimal or no evolution whatsoever. And if there is any, it only leads to the total disappearance of the painting. … Chronology and sequence have no importance in my works. Very likely I have probably done my last paintings already, my first perhaps not…'. [223]

Knifer presents the grey area of life in black and white through the ongoing flow of meander and anti-painting. In retrospect, it seems clear to me that Knifer recognised connections between our projects at the time of our meeting more easily than I. His meander project connects art and nature by assuming the nature of Nature through flow. Similarly, chronology has no importance in my wall drawing projects. What matters is flux, that the drawing process endlessly generates visibly discernible differences within the same form.

[222] , pp 29-30.
[223] Translated excerpt from Julije Knifer, "Zapisi (Writings), Zivot umjetnosti, No. 35, Zagreb, ibid., pp 104 -105. 1983.

*Figure 102 Julije Knifer: Uncompromising, a Retrospective, 2014. Installation view, MSU – Museum of Contemporary Art, Zagreb, 2014.*[224]

## *Wall drawings, the art market and relationships*

The *Red Matter Wall Drawing* instruction book series tests conventions of art ownership, authorship and the artwork as a commodity. The books are the art-object, the commodity, the thing for sale. Four different types of the *Red Matter Wall Drawings* (#1, #2, #3 and #4) have been produced as instruction books, each in an edition of ten. An opportunity to exhibit these works commercially presented the need to establish rules about how and where the drawings could be reproduced and sold, and how they would engage with the art market.[225] In 1994, the curator and writer Ben Curnow pointed out to me that LeWitt issued certificates of authenticity for each drawing, this being adopted as a solution to deter commercial exploitation of the artwork through the on-selling of drawings.[226] I adapted this approach and paired it with the instruction manuals to maintain the conceptual elements of the drawings. Considering new ways of structuring this relationship has become part of the evolution of each instruction-based work; certain elements remain static while others change with each new series.

[224] Image source: Courtesy Museum of Contemporary Art Zagreb. Photo: Žarko Vijatović.
[225] These four artworks were exhibited at Sarah Cottier, Sydney, in 1994.
[226] A Red Matter Wall Drawing was exhibited for the first time in the exhibition 'Disclosure' at Artspace, in Sydney (1994) curated by Ben Curnow.

The instruction books become a format for exploring ownership, copyright and the divisions between private and public art, in addition to explaining the construction of the geometry of each work. Each book clearly states that the owner of the book or an assistant cannot charge money for a drawing to be made nor use the book to on-sell drawings. The people making the drawings must be paid employees and/or willing and interested in doing the work. After having made a drawing, these people understand how the drawing is made and can potentially use their knowledge to make a drawing elsewhere if they so choose. There are no rules in place to prevent the people who make the drawings from taking notes or photographs. They could potentially later make a drawing for themselves on a wall elsewhere, but such drawings have no commercial value. They cannot receive money or payment for a drawing, nor for making a drawing for anyone else, nor for teaching others how to make a drawing. What I am most interested in promoting is the free application of the knowledge gained by making a drawing to other relevant subjects and topics to demonstrate and discuss their core ideas. Through such a process, the knowledge of how to make a drawing and its supporting concepts becomes more broadly understood.

The certificates for each series of instruction manuals are designed to foster concepts of democracy, difference and inclusion within the processes of commodification of artworks and the payment of artists for their work. For example, with the *Red Matter Wall Drawing* books, a certificate was issued to the owners of the manual after providing me with an image of each new drawing, the details of its installation and exhibition, the names of the people who made the drawing and its location. These certificates are to be kept in the back of each instruction manual, forming a record of activity for each book. In this way, I keep track of the drawings that are made so that each book develops a history of its activity as an artwork. The more certificates, the richer the story and the greater value the artwork accrues. The owners of the *Red Matter Wall Drawing* instruction manuals are entrusted and obliged to make an ongoing investment and exchange in the processes of making art and in supporting the artist with each new drawing. Each time a drawing is made and a certificate is issued, a specified percentage of the current market value of the instruction manual must be paid to the artist.[227] The overarching and expanding production is the collective work of *Red Matter Wall Drawing,* in which my direct involvement as an artist becomes something that may be assumed by an archivist and paid for via royalties, I am not required to be there in person.

Like any other book, the *Red Matter Wall Drawing* books sit on a bookshelf, their life as an artwork depending entirely on their engagement with people. Each book holds a potential to

[227] Typically, 10% of the current market value of the instruction manual.

generate an infinite number of possible drawing outcomes, the drawing system enabling infinite variations of a specific drawing type by combining elements of constraint and freedom through the use of organic geometry. By combining a set linear-pattern with the random element of the intuitive decisions made by the people making the drawing, each drawing generates a visually unique version. The result is that each person who uses the book to make a drawing produces their own unique version on a wall. They become the author of their iteration, the drawing outcome becomes their property. Each drawing becomes a kind of signature, a gesture, a characterisation, an animated version of a linear-form inflected through the involvement of others.

The format I have developed for the instruction-based wall drawings presents an alternative kind of relationship between owner, participant, viewer and artist. These artworks are inclusive and immersive. The drawings paired with the instructional format offer a system as a conduit for personal, self-directed exploration of formalist creativity and to consider specific concepts about art, the history of art and nature. The geometry of these drawings can be steered, played with and practised, like any skill, to make analogies. They become a realm for anyone to make formally "successful" artworks. However, some drawings are more beautiful than others. The drawings and rules provide means of access to participate in formalist art through making art.

## *Formats and themes of interpretation*

Since the production of the *Red Matter* Wall *Drawings*, I have created various series of instruction-based drawings by applying organic geometry to different spaces, places and materials, these being the *Black O Wall Drawings 1-6, Blue Wall Drawing #1* and *Field Drawing #1* and various new series of wave drawings during this research.[228] As conceptual artworks, each series questions concepts of artistry, authorship, collaboration, creativity, formalism, geometry, repetition and skill, but in different ways. *Red Matter Wall Drawings* draw attention to sameness and difference, *Black O Wall Drawings* examine power and balance and *Blue Wall Drawing #1* investigates symmetry and asymmetry. These broad themes are expressed within the instructions. For example, the drawing exercise linked to the *Red Matter Wall Drawing* in Chapter Five presented a practical demonstration of the themes of materiality and anomalies.

[228] While hundreds of drawings have been produced which could be transformed into instruction manuals the process of making books is lengthy and this list includes drawings transferred into manuals. These manuals also function as templates for further drawings in each series.

This drawing exercise showed how the activity of drawing enables a form of physical engagement and interpretation of these concepts when linked to specific concepts through the text of the instruction manual. The first-hand experience of the drawing activity provides a practical, physical and visual demonstration of the concepts described in the accompanying text. For example, Chapter's One and Five briefly discuss the significance to science and engineering of anomalies and very small differences that are mostly invisible to the naked eye, Chapter Seven of this thesis explores this in much greater depth.[229] When paired with the organic geometry drawing process, these concepts are demonstrated through the drawing exercise, making them available for consideration by the participants when they would normally not be noticed. The act of drawing in this exercise, thus provided a macroscopic physical experience, a point of access into microscopic processes, organic geometry drawing functioning as a technology or tool like a magnifying glass or microscope.

*Figure 103 detail showing materials and method of drawing straight lines directly onto the wall.*

When the drawing process is applied to a larger scale than a sheet of paper, as in the generation of wall drawings, it becomes simultaneously more physically demanding and immersive. The escalation in scale enables a more powerful physical experience, a whole of body engagement with the themed concept driving each drawing. The equipment used to make the drawing is scaled-up for use on a wall. Chisel-tipped permanent markers are used

[229] See, Chapter One, page 46; and, Chapter Five, page 130.

to draw the lines. Long strips of aluminium are used to enable the drawing of long, straight, lines. Once positioned correctly on the wall, the aluminium strips are secured with masking tape to enable a line to be drawn along their edge (Figure 103). While these larger scale drawings can be made by individuals, the nature of these drawing is best suited to a team of people. The process of making becomes a performance where onlookers observe the drawings develop, expanding the number of people who have accessed the themes driving each drawing. Yet galleries and other institutions are often reluctant to allow the public to watch the drawings being made. Stop-motion and video documentation have thus become a routine part of the of the drawing installation process, this being readily supported by institutions as a means of providing access to the making process.

These drawings are intended to be made at a self-determined pace, seeking to promote taking time for free-thinking and reflection. Once those involved in making the drawing have practised drawing lines on paper sufficiently so that they understand the pattern and structure of the geometry, completing the lines that comprise the internal pattern-making of the drawing becomes akin to knitting or weaving. As the geometry becomes familiar, the process gains a meditative quality. As the pattern-making process continues, it increases in complexity. The step-by-step process slows down as the people making the drawing begin to work on sectins individually and orient themselves within the geometry to absorb its complexity, looping the process and its experience back to the role of the artwork as a reflective space. For this reason, the instructions stress that anyone making or maintaining the drawing should be allowed a self-determined amount of time to complete a drawing and must have a self-determined interest in doing this work. As the artist, via writing the instruction manual, I simultaneously retain authority and loose authorship of the drawings by declaring that each drawing is of equal artistic quality and value, regardless of the outcome of the drawing process.

### *Red Matter, difference and repetition*

The primary theme of the Red Matter Wall Drawings is difference and repetition. They draw attention to the concept of making mistakes as being “correct” by explicitly linking difference and repetition to the development of anomalies in nature and matter. This is achieved by scaling up the processes demonstrated in the drawing exercise in Chapter Five and asking people to estimate the half-way point of a line rather than using tools to measure this. The varying scales of the walls on which the drawings are executed ensures an easily perceivable, unique iteration of the drawing-pattern emerges as a metaphor for processes of

reproduction in nature. The innate differences that result in duplicating processes are highlighted and magnified at scale across the different iterations, the instruction book for the *Red Matter Wall Drawings* explaining that, 'The nature of nature is such that a small shift within very tight parameters produces unique outcomes'.[230]

*Figure 104 Installation of Red Matter Wall Drawing 1-4, Sarah Cottier Gallery, 1994. L-R drawings installed by Sarah Cottier and Ashley Barbor (#1), Mathias Gerber and Andreas Reiter Raabe (#2), Vincente Butron and Janet Shanks (#3) and Hany Armanious and Kerrie Poliness (#4).*

## *Black O, power and balance*

Taking the concepts of difference and sameness presented in the *Red Matter Wall Drawing* series, the *Black O Wall Drawings 1-6* series looks at these in a different way by thinking about the democratisation of art. In loosely applying the theme of power and balance, the *Black O* series more directly incorporates personal intuition and decision-making into the drawing process. The *Black O* drawings demonstrate how creative authority — usually considered the domain of the artist — can be transferred to others through the simple intuitive act of considering what might constitute a "balanced" division of a circle into a specific number of parts. Each iteration of the drawing results in a distorted version of a spherical form, standing as a unique characterisation of one of the six drawing designs.

[230] Kerrie Poliness, *Red Matter Wall Drawing #1, #2, #3 and #4,* 1994. Book, instruction manual used to produce drawings on walls, A4 binder. Kerrie Poliness.

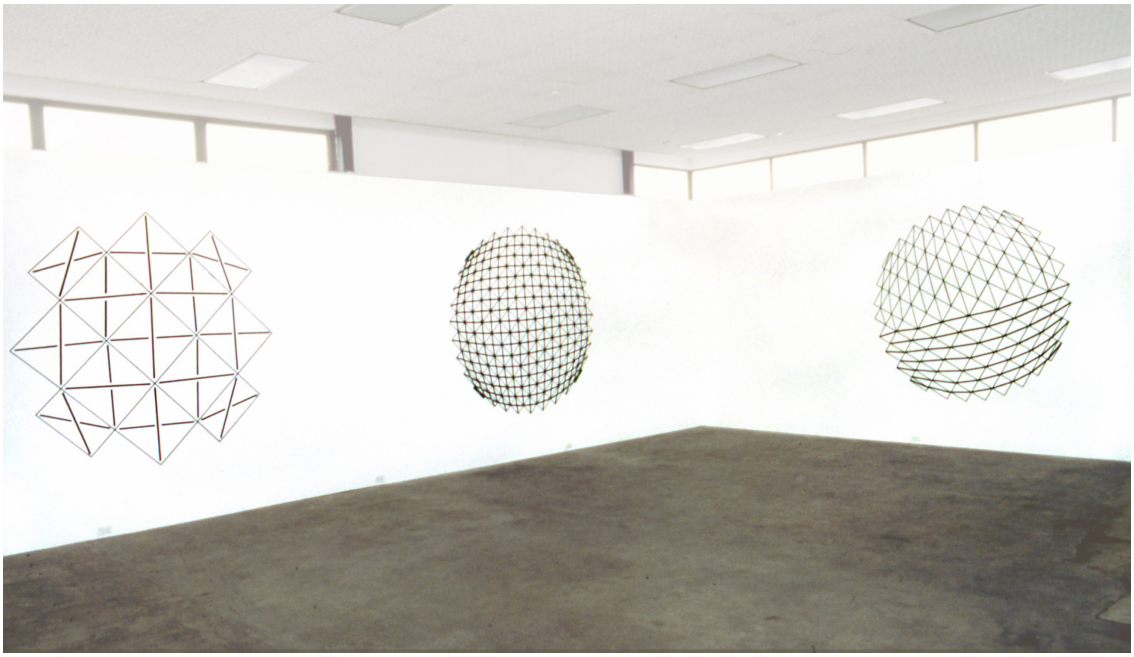


*Figure 105 Black O Wall Drawings #3, #4 and #5 (1996) installed at Artspace, Auckland, 2009.*[231]

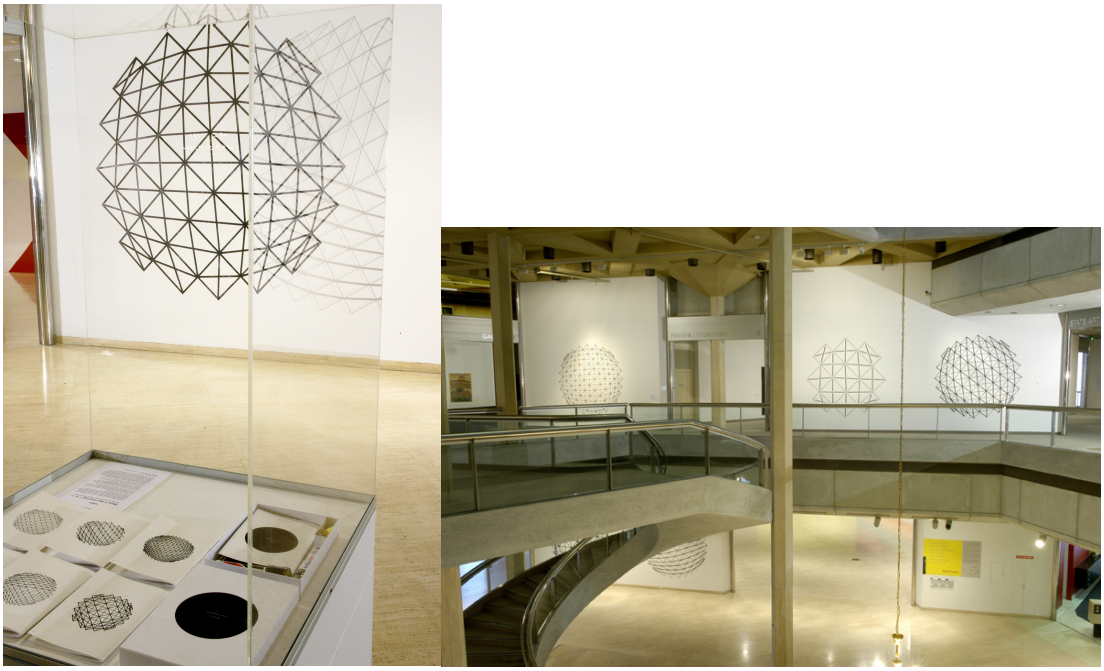


*Figure 106 Black O Wall Drawing 1-6 (1996). Left, a box-set, kit on display(foreground) drawing #1 in the background, at the Art Gallery of Western Australia in the exhibition 'Wall Power', 2003.*[232]

[231] Image source: Courtesy, Artspace, Auckland, New Zealand.
[232] Image source: courtesy Art Gallery of Western Australia

The artwork is produced as a box-set of booklets that describe how to make the six different designs. It is produced as a multiple, each box-set issued as a sequential number in an infinite edition, presenting an absurdity. If the edition is truly infinite, there is no point in assigning each set a unique item number. They could all be “number one” or any other number. The drawings demonstrate how difference and diversity are generated. By declaring a potentially infinite edition of box-sets, each with potential to endlessly prompt an infinite number of unique drawing outcomes, the artwork draws attention to the complexity of the concept of a physical “original”, “copy” and “edition” in relation to this work, to other artworks or to any other thing, questioning the logic of the concepts of “an original”, “a copy” or “an edition’.

These drawings reaffirm the origins of the project in the work of Duchamp, Conceptual Art and the DIY movement in the effect of the individual, momentary action and decision-making on the outcome of any topic or thing. They also signify a form of empowerment in allowing anyone to make a large-scale artwork and experience how the effects of a small decision can influence and shape the outcome of the whole.

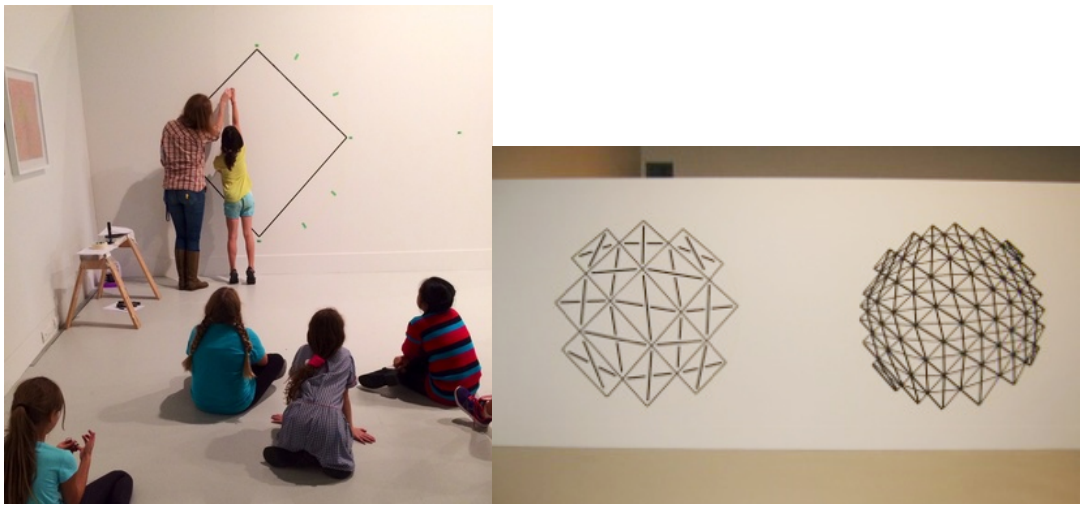


*Figure 107, (left) children producing Black O Wall Drawing 3, (1996) with a teacher during a workshop (right) completed drawings #3 and #4, at the Dowse Museum in New Zealand, 2014.*[233]

[233] Image source: courtesy Dowse Museum, Lower Hutt, New Zealand.

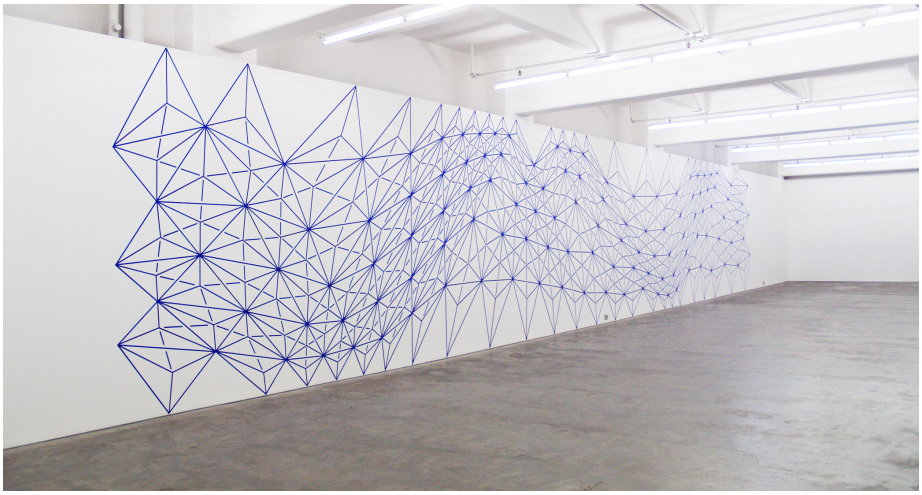


*Figure 108 Blue Wall Drawings #1, 2007, Anna Schwartz Gallery, Melbourne, 2007.*

## *Blue Wall Drawings, symmetry and asymmetry*

The theme of the *Blue Wall Drawing #1* (2007) is physical symmetry and asymmetry in the built form, the drawings seeking to demonstrate that all physical examples of symmetry we encounter present an optical illusion. In signalling this theme, the instruction explains:

> There is a great tendency to achieve the appearance of symmetry in made objects. For example, in mass production and often in architecture symmetry relates to ideas and aspirations of perfection and beauty. Technically we are very good art creating the illusion of symmetry in objects but this is not really how things work.[234]

The *Blue Wall Drawing #1* can be expanded in scale to fit any context in which the drawings are made, introducing a major asymmetrical intervention in an architectural space. The experience of asymmetry immerses the makers and viewers of the drawings by harnessing the scale and structure of the built space where the work is made. As in the *Red Matter Wall Drawing* and *Black O Wall Drawing* series, the makers of the *Blue Wall Drawing #1* are encouraged to decide between options during the process of production.

For example, the instruction manual provides a set of instructions labelled, "Method 2, Influencing the Dynamics" as an alternative to "Method 1, Guessing".[235] "Method 2"

[234] *Blue Wall Drawing #1*. P. 171.
[235] Ibid. p. 55.

encourages experimentation and if practiced can teach the maker how to steer the geometry of the drawing. Participants are invited to sketch out their ideas for the drawing on paper, to test the results and to experiment by stretching the possibilities of the drawing to its limits. “Method 1, Guessing” is provided as a way of opting-out from actively exploring the shaping of the drawing to make the artwork. By providing both options, the drawing process remains inclusive. The artwork can either be creatively experimental or pragmatically experimental. Both options result in an equally valid artwork that disrupts the apparent symmetry of the architecture.

The *Blue Wall Drawing #1* installation kit includes a small oval-shaped mirror that can installed on a wall opposite the drawing. Acting as a reflective screen, the mirror emphasises the pairing of the concepts, of symmetry with illusion and asymmetry with reality, which are expessed within the pages of the instruction book.

*Figure 109 Blue Wall Drawings #1, 2007, under construction Anna Schwartz Gallery, Melbourne, 2007.*

*Figure 110 Blue Wall Drawings #1, 2007, under construction Anna Schwartz Gallery, Melbourne, 2007.*

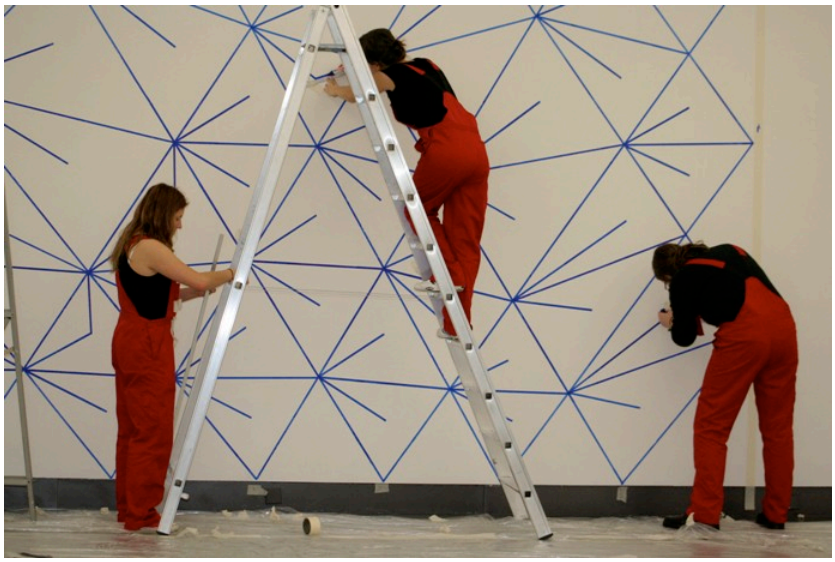


*Figure 111 Blue Wall Drawings #1, 2007, under construction Anna Schwartz Gallery, Melbourne, 2007.*

*Field Drawings, permanence and temporality*

The *Field Drawings* combine performance, ritual, play through the invention of games, and work. The nature of the surfaces on which the Field Drawings are made determines the materials and methods used. They encompass concepts of previous drawing series, but the Field Drawings are most concerned with the themes of permanence and temporality, work and entropy. The *Field Drawings* are made on outdoor surfaces that can be walked on and viewed from above, these being horizontal rather than vertical.

The first *Field Drawing* (2008*)* was made on a beach at Point Lonsdale, a town on the Victorian west coast, using a stick found nearby. It lasted only until the next high tide. A feature of the *Field Drawings* is that their permanence relies on ongoing work to maintain their presence. After an exhibition, the wall drawings are typically painted over, but remain buried within the surface of the wall. *Field Drawing #1* was the first in this series to be published as an instruction-based artwork with a manual. It can be made on grass, road, concrete or paved surfaces using environmentally-friendly paint and a DIY sports-line-marking machine.[236] The drawing is simultaneously permanent and temporary. It can be maintained indefinitely. It can removed by mowing or hosing the paint away with water, or it can be left to grow-out, wear-off and fade away.

*Figure 112 Field Drawing, Beach, Point Lonsdale, 2008.*

[236] The paint used for these drawings is plant friendly and washes away with water and rain, therefore regular recoating is required to maintain the drawing.

*Figure 113 Field Drawings #1, 2008, Werribee Park, Helen Lempriere Sculpture Prize, Melbourne, 2008.*

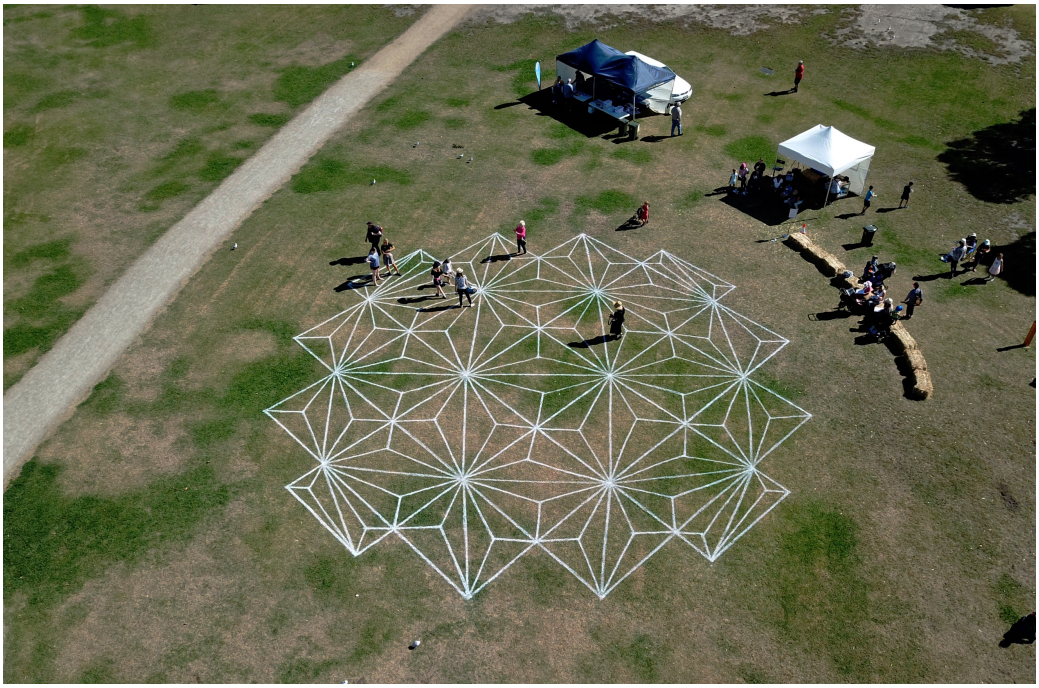


*Figure 114 Field Drawings #1, 2008, Pelican Point Hastings public installation event with sausage sizzle, 2018.*[237]

[237] Image source: courtesy Mornington Peninsula Regional Gallery, Mornington, Australia.

*Field Drawing #1* is produced as a multiple in an edition. It combines varied art disciplines including the artist's book, drawing, painting, performance, sculpture and video. Each of these can be considered separately or together. For example, *Field Drawing #1* is literally a landscape painting, being made in the landscape by applying paint. The audience for the work equally has options in relation to the work. They can either make, play with or walk directly on the artwork, disrupting, for example, the common interpretation of landscape painting from a place that is represented, then observed as a painting on a wall somewhere else, to a place that is experienced directly. As a sculpture, the paint adheres to each blade of grass or the texture of a hard surface, emphasising its physicality and materiality.

I developed the idea of "field drawing" in the context of entering the artwork in a sculpture prize to propose its merits as a sculpture conceptually and physically while also making commentary on art prizes, which combine processes of making and experiencing art as a strange sport. As a multiple, the artwork comprises a kit that includes a line-marking machine, a box of environmentally-friendly paint and a case containing the instruction manual and all other equipment required to make the drawing. As a performance, the process of making the drawings is choreographed on large open surfaces.

*Figure 115 Field Drawings #1, Werribee Park, 2008.*

The instruction manual describes a specific pathway to follow using the sports line-marking machine to create and maintain the lines of a temporary *Field Drawing*. The pathway documented in the instructions follows the principle of economy, or Ockham's Razor, used by both nature and science, presenting the most efficient method of making the drawing. The drawing system represents the pathway that a scientist and a spider would resolve as the shortest and simplest through trial and error and thus requiring the least amount of energy or work to produce. In *Field Drawing #1*, this principle was used to construct a complex, large-scale geometric artwork with no obvious purpose other than to be an artwork. The finished drawing, however, attracted a lot of activity, such as being used for spontaneous games, this use causing the lines to deteriorate fairly quickly.

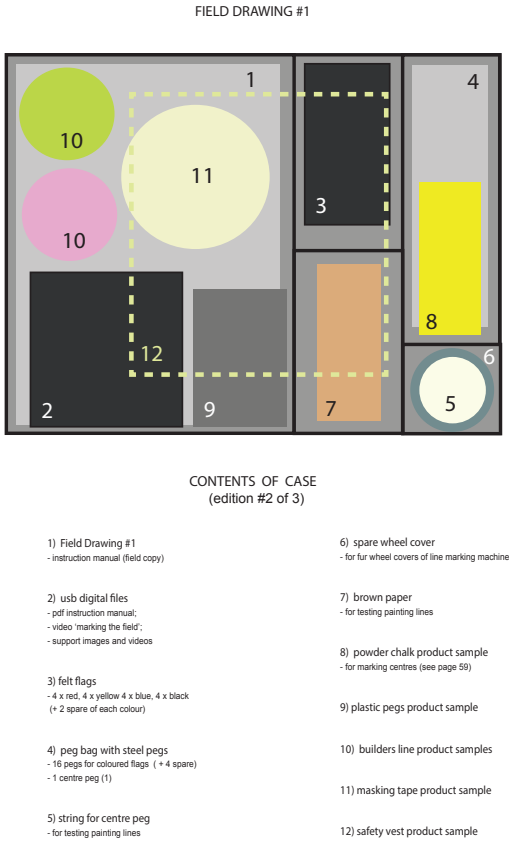



*Figure 116 Field Drawing #1, instruction kit, checklist, 2008.*

*Figure 117 Field Drawings #1, 2008, under construction Werribee Park, 2008.*

The pathway presented in the instruction manual for *Field Drawing #1* involved literally working in the field to resolve the most efficient use of the equipment and materials in relation to the site. The most efficient pathway avoids pushing the machine any unnecessary distances and avoiding running the machine over lines that are still wet. The instruction manual describes the shortest route as a choreographed pathway through the geometry. This route is presented in the manual through a series of diagrams for the initial creation and ongoing maintenance of the drawing. Figure 119 shows Diagram 33 of the step-by-step process. Like the lines on a sports field or chalk drawings on a pavement, each drawing is potentially temporary or permanent, its duration reliant on being maintained as an artwork via the instructions in the manual provided.

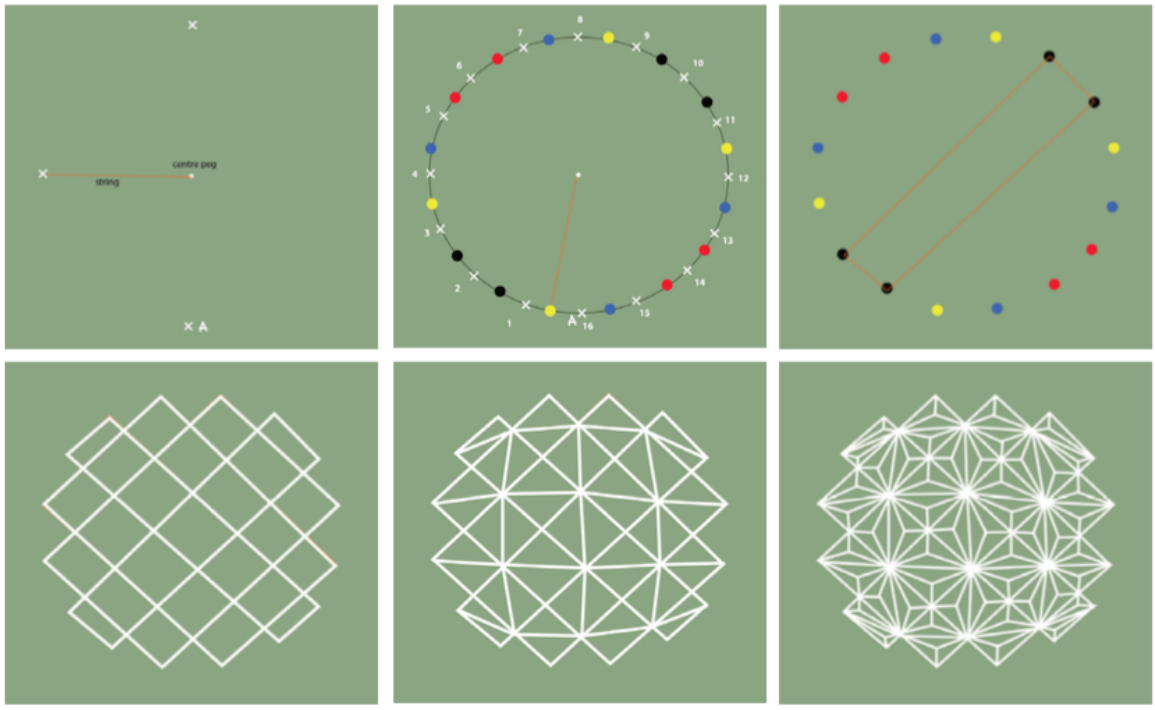
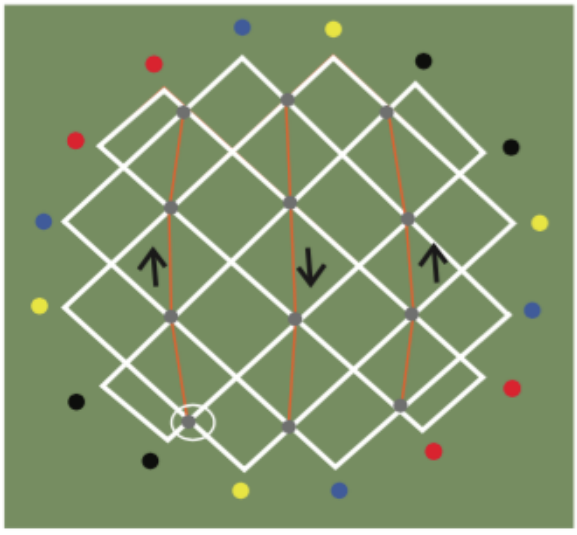



*Figure 118 The 'Stages of construction' from the instruction manual, Field Drawings #1, 2008.*



D 33

*Figure 119 Diagram 33 (D33) from the instruction manual, Field Drawings #1, 2008.*

After making several layers of lines, both the drawing pathway and the process of using the machine to apply paint becomes familiar. Once this is achieved, the instruction manual is no longer required to remain oriented in the drawing process. While focusing on the surface of the field and following the line through the drawing pathway, immersion in the moment becomes possible. The *Field Drawings* require space and time to produce, providing the space and time for reflection, the process of creating or maintaining the lines taking on the character of “walking meditation”, becoming a meditative exercise more like gardening.

The *Field Drawings*, like all other drawing series, can form the basis for workshops in the application of geometry, the drawing process being applicable to widely varying conditions and situations. For example, working with primary school students whose school is near a beach, the drawing geometry was used in 2018 to construct a “city”. The students worked together to trace the drawing onto the sand with sticks, the intersections and centre-points within the geometry becoming holes or castles with the lines between them functioning as roads. Students could choose to work individually or collectively on hole or castle projects.

*Figure 120 ‘Field Drawing workshop’ with students from Rye Primary School on their local beach where intersections and centres of the geometry of a field drawing became either castles and holes, the drawing process became an exercise in constructing a “city”, Rye beach, Victoria, 2018.*

## *New research: exploring time, scale, materiality, art and work*

The themes described in the instruction manuals for the *Red Matter Wall Drawings*, the *Black O Wall Drawings*, the *Blue Wall Drawing* and the *Field Drawings* are deliberately broad to allow open interpretations, via reflection, on the part of those applying, making or viewing one of the artworks. The intent is always to allow space for the construction of personal analogies, expanded projects and other applications. Chapter Five briefly described the process of making a *Blue Wall Drawing* #1 by the staff at the School of Accounting, Economics and Finance at the University of Wollongong to enable teaching and learning.[238]

Participation in the artwork was part of the student's course content, their interpretation of the instruction manual supporting a fundraising event for their local Illawarra Surf-lifesaving Club. In many ways, this application of the artwork led to this research in demonstrating the accessibility and adaptability of the drawings within a framework of broader projects and purposes. The University of Wollongong project revealed to me the deep and direct connections between my art practice and the work of MLMW. Among the most important of these connections was the way the instruction manual and the production of the drawing connected a university department to a local community group without any further input from me. The concept behind the artwork resonated with two communities, being taken on-board and used by both, acquiring a life of its own, a potential I wanted to examine further as something I had seen arise spontaneously from collaboration.

The University of Wollongong project directed my attention to the potential breadth of application of the instructional format, although the project did not actually link to the theme of symmetry and asymmetry as expressed within the text of the instruction manual. Instead, the students developed their own fundraising purpose for the project. I recognised this happened because the staff and students made a series of associations and observations about the artwork, drawing their own inferences. They were inspired by the fact that anyone could make the drawing, that the drawing process was collaborative, large-scale and provided a dynamic backdrop for an event; the drawings were blue and their geometry looked like waves in the ocean nearby.

The students' understanding and interpretation of the artwork was not incorrect or partial. On the contrary, *Blue Wall Drawing #1* was originally inspired by the ocean, by waves and the

[238] See page 142, Chapter Five.

benefits of understanding the mechanics of waves and tides in learning to surf. The mechanics of waves and tides were an inspiration to the work both as a metaphor and skill that is broadly applicable and learnt through immersion and whole-body experience. The drawings not only look like waves, through the medium of instruction-based drawing these artworks behave like a wave, as books are a medium through which ideas travel like currents and waves. The format enables the drawings to be produced through time in various places, as an ongoing activity, reinterpreted and used in ways beyond my control or imagining, that potential is explored and established through this research.

## *Next wave*

I recognised that the teaching and learning project that the university staff and students developed revolved on them using the artwork to develop and realise their own analogies. They combined the instructional format of the artwork, the mutability of the linear geometry and the blue colour to construct their own story; that surf lifesavers would make an artwork on a wall, a large linear drawing that looks like a wave in order to raise money for their club.

This development raised a series of questions and possibilities that led to and informed this research. By developing specific narratives, topics or themes to accompany the production of the drawings, could the drawings and their capacity for experiential, procedural and visual *analogy and demonstration* provide access to new ways of knowing? What might these topics of knowledge or stories be? How would they be determined and integrated? Who or what would do that? If the process of analogy making became more controlled or directed by assigning specific themes, would this increase or decrease the potential for reflection? Would such applied use of the artwork concepts still result in art?

The University of Wollongong's use of the artwork directed me to the next step in my arts practice and the topic of this research — the investigation of the potential of the instructional format and the conceptual underpinnings of the artworks to serve as educational tools that could be adapted to different themes and contexts to convey knowledge, thus establishing a new way of knowing based in art activity. It came to me that understanding the limitations and potential for conceptual representation of the drawings required studying physics, as described in Chapter Seven, connecting art and science. The realm of the diagonal was drawing me deeper than I could have imagined into the matter of matter.

By combining art-making and analogy-making, the drawings demonstrate how difference and diversity are generated. They can be used to visualise non-visual concepts to understand the impact of variation on a system. The University of Wollongong staff could have used the drawing process to convey complex, subject specific concepts to their students by plotting data onto the linear and geometric structure of the *Blue Wall Drawing*. The students were studying public relations, an activity developed to harness and steer the collective desires of people in a consumer-based society. The process of making the drawing could have been used to examine how public relations messages travel through a society as this is theorised by the discipline of marketing. The drawings also have scope to provide insight into how concepts and systems work by learning how to steer the geometry. The pattern as a system falls apart at a certain point, showing that there are limits to the geometry, the drawings offering scope for this to be explored, tested, reflected on and applied to other circumstances. The drawing-pattern geometry can be used to represent how an entity is influenced by random elements and how variation affects structural cohesion at a visual, experiential and procedural level.

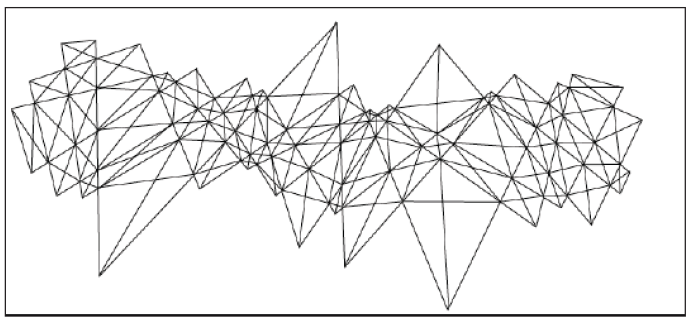
The processes of the wall and field drawings can do this because they apply organic geometry on a large scale, making the process of making more demanding while involving whole-body engagement with the themes expressed in the instruction manuals. The combination of scale and immersion provides a unique way of experiencing and considering such things, the format as a technology enabling conceptual and perceptual shifts to take place to imagine and better understand processes, for example, those that occur in the physical world at a minute or very large scale.

This research considers how broadly the format and the concept of organic geometry can be applied and how the drawings can be made relevant to diverse applications. To dig deeper, I saw it as necessary to revisit the concepts underpinning the *Red Matter Wall Drawings* of 1994 to verify what happens when the organic geometry concept is applied to the smallest scale of objects and matter and through this to investigate whether organic geometry can be used to practically demonstrate scientific and other kinds of knowledge. The themes and formats of my wall drawings have shifted focus from matter (*Red Matter*) to become wave-like (*Blue Wall Drawings*), steering my arts practice-led research to the study of physics and to wave-particle duality. The visual and conceptual associations between waves, matter and resonance is both primary and complex and is the subject of Chapter Seven. This research is presented as a narrative in Chapter Seven to accompany a new instruction-based work, *Whoosh #1,* which takes the wave element of the *Blue Wall Drawings* a step further conceptually and geometrically.

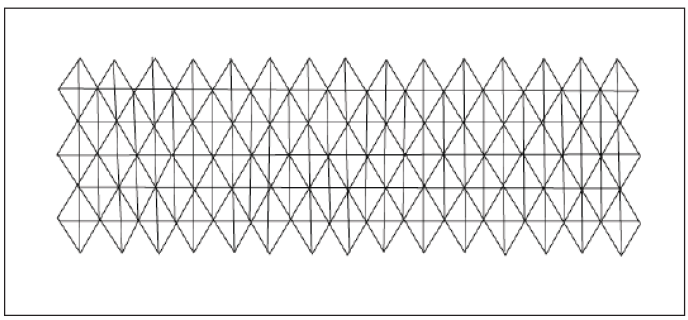
## *Whoosh*

A new category of instruction-based drawings, *Wave Drawings*, is the culmination of this research. The *Wave Drawings* test the conceptual nature of all my previous instruction-based drawing series, their thresholds as systems and geometrically. In the *Wave Drawings*, the shape of the drawing itself becomes an anomaly, having a unique external as well as internal linear structure. Through instruction manuals the element of participation determines the over-all shape of each *wave drawing*, enabling these dynamic, free-form drawings to be made on any surface using everyday materials.

The first series of *Wave Drawings* is titled, *Whoosh*. A new instruction-based artwork, a prototype wave-drawing, titled *Whoosh #1*, is an appendix to this research. The *Whoosh #1* instructions provide a template for further *Wave Drawing* artworks. The outer perimeter of each *Wave Drawing* can be manipulated to shape the drawing. Figure 121 shows two versions of the basic pattern of the *Whoosh #1* drawing type. A uniform grid-like version appears below an image of a potential iteration of the same drawing type, produced by following the instructions. These two versions of *Whoosh #1* indicate the degree of variation and potential for shaping the drawing type.



A visually asymmetrical 'geometric-wave' version of the geometric pattern of *whoosh*



Visually symmetrical version of the geometric pattern of *whoosh*

*Figure 121 Two versions of the same geometric pattern of Whoosh, page 4, Whoosh prototype manual, 2012.*

The overall shape of each wave drawing is an anomaly, each becoming a kind of signature or inflection realised through the process of following the instructions. The instructions for *Whoosh #1* were complex to resolve, they describe a step by step process which can be applied to a wall of any size and shape by anyone to realise the geometry and shape the drawing (Figure 122). Like my previous drawings, the instructions are an algorithm which prescribe a sequence of plotting points and drawing lines on to any wall. However, to make *Whoosh #1* each new step defines a specific range of wall area in which the next points are plotted, slowly shaping the drawing and defining its parameters on the wall through each subsequent step. Like my previous instruction-based drawings the geometry can be steered and the outcomes controlled by the people making the drawing, however these drawings more directly require a formalist negotiation of architectural space by people through the process of making the drawings. *Whoosh #1* provides a means of access to formally experiment with any space, to produce a uniquely shaped wall drawing on any wall.

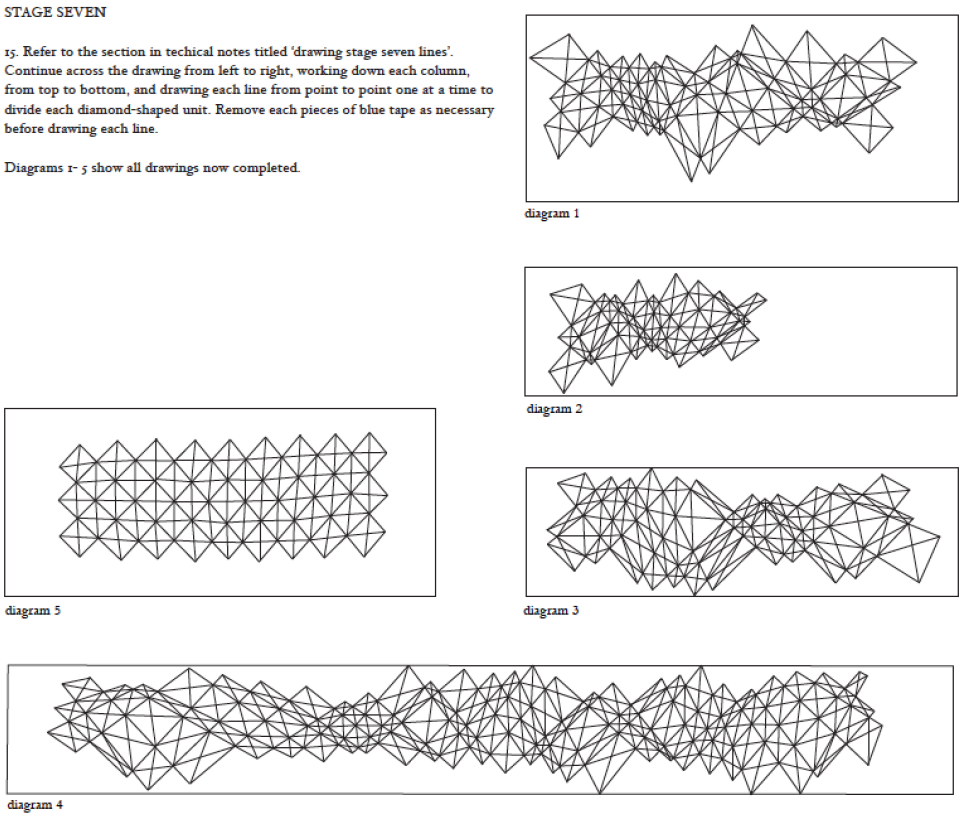



*Figure 122 showing five different versions (on three different walls) of the same geometric pattern of Whoosh #1. Source, page 69, Whoosh #1 prototype instruction manual, 2012.*

The inflection of each wave drawing has similarities to Litchenstein's brushstroke series (Figure 123). Each drawn iteration of *Whoosh #1* represents a complexly and slowly arrived at gesture, a squiggle. Litchenstein used his brushstroke series to "make comment on the elevated content and loaded brushwork of Abstract Expressionism", depersonalising the brushstroke as the token of the artists personal expression.[239] However, each example of Litchenstein's brushstroke series is beautifully composed. The same kinds of considerations are encapsulated in *Whoosh #1*, the integral beauty of the composition becoming the responsibility of the makers shaping the drawing.

The quality of each iteration of *Whoosh #1* is simultaneously incidental and open to debate. The Whoosh #1 instruction manual is a more complex tool of spatial practice than previous drawing series and provides a means of access to first-hand engagement with formalism, 'depersonalising the brushstroke (signature) as the token of the artists personal expression' by re-personalising it through assignment to anyone.

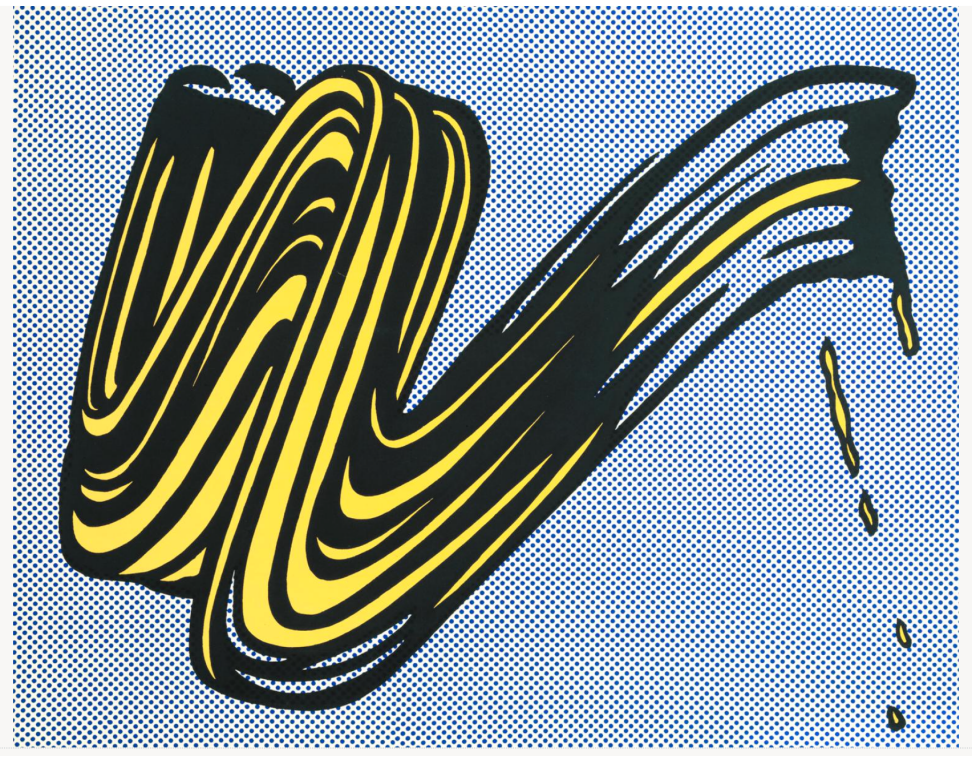


*Figure 123 Brushstroke, Roy Litchenstein,1965.* [240]

[239] Wall label describing Litchenstein's print, Brushstroke, 1965 Tate Gallery, London, 2008.
[240] Image source: Tate Gallery London, estate of Roy Litchenstein.

The geometry of *Whoosh #1*, has been used as a template for further new series of wave drawings produced during this research including, *OMG (2014)* (Figure 124), and *Green Wave (2014)* (Figure 125) as well four new public artworks. Documentation of these artworks is included in the appendix “Making Waves”. The public artworks (Figures 126 - 129) include: *Wave Drawings*, at Highpoint Shopping Centre (2013) (Figure 126); *Orange Wave for Yarraville*, Yarraville Rail underpass (2014) (Figure 127); *Green Drawing,* a vertical garden comprised of plants where the wave-drawing structure is used as a planting array developed with a botanist (2017) (Figure 128); and, *Stream* an integrated ground-surface-based artwork for the Drying Green Park, the central public park for the new inner urban suburb of Green Square in Sydney (2013 - 2016) (Figure 129) which will be constructed in 2020. *Stream* was developed working closely with a core team of people within the park architectural team at McGregor Coxall and the engineers and lighting designers I employed as consultants, Event Engineering and Electrolight, while working in conjunction with the broader park and public realm design team at City of Sydney and the public art advisory panel.

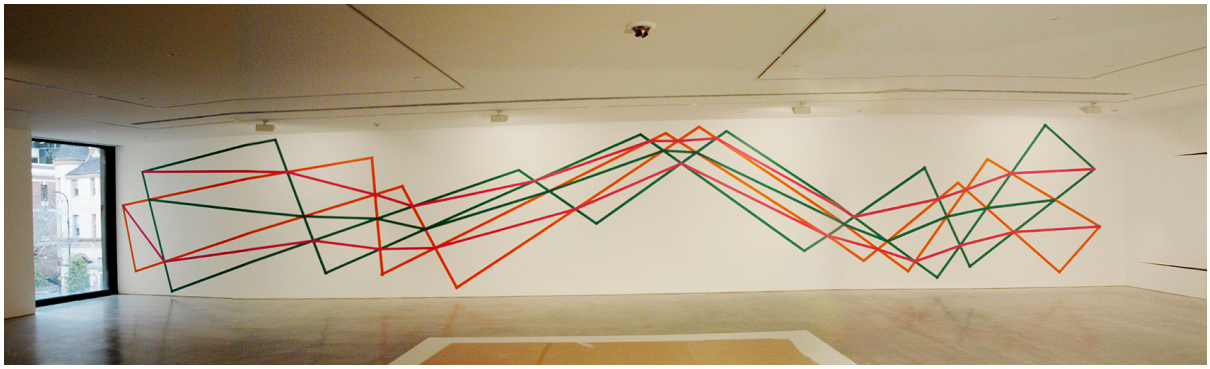


*Figure 124 OMG (orange, magenta, green) installed at the MCA in Sydney, 2016.*

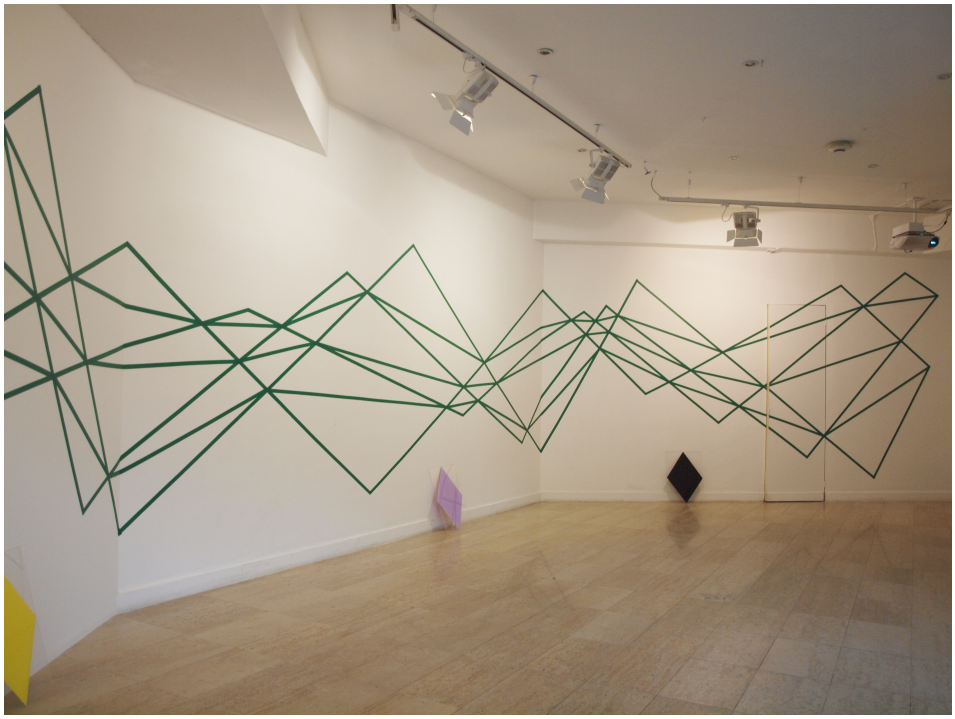


*Figure 125,  Green Wave, Gallerie Miroslav Kraljevic (GMK), Zagreb, 2014.*

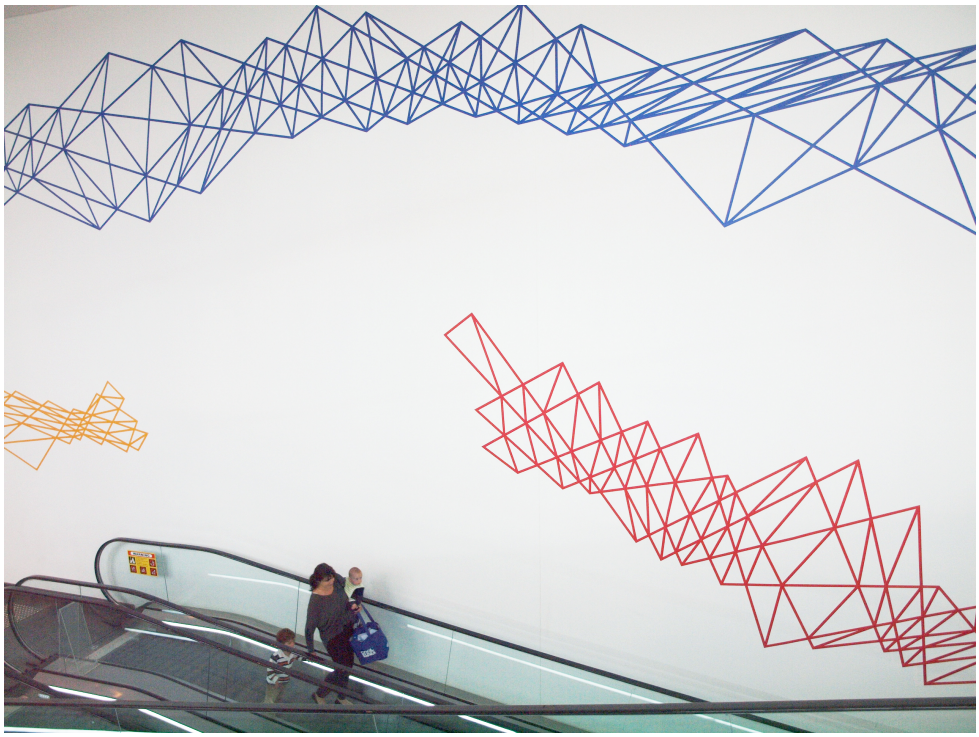


*Figure 126, 8 Wave Drawings, Highpoint Shopping Centre, Melbourne, 2013.*

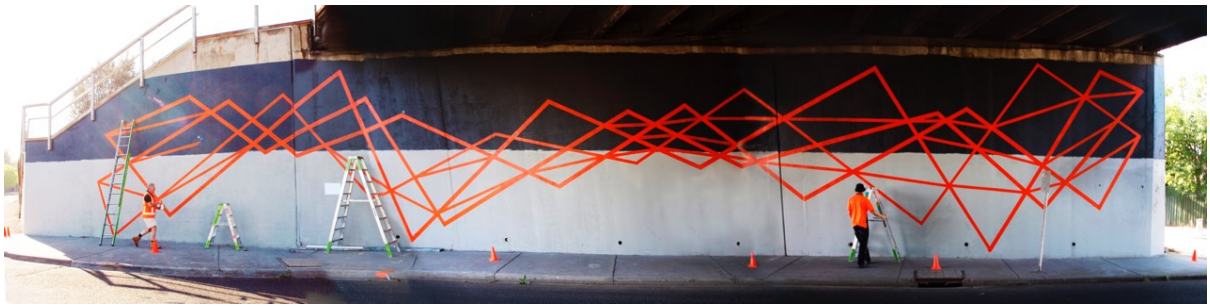


*Figure 127  Orange Wave for Yarraville, Rail underpass Yarraville, Melbourne, 2014.*

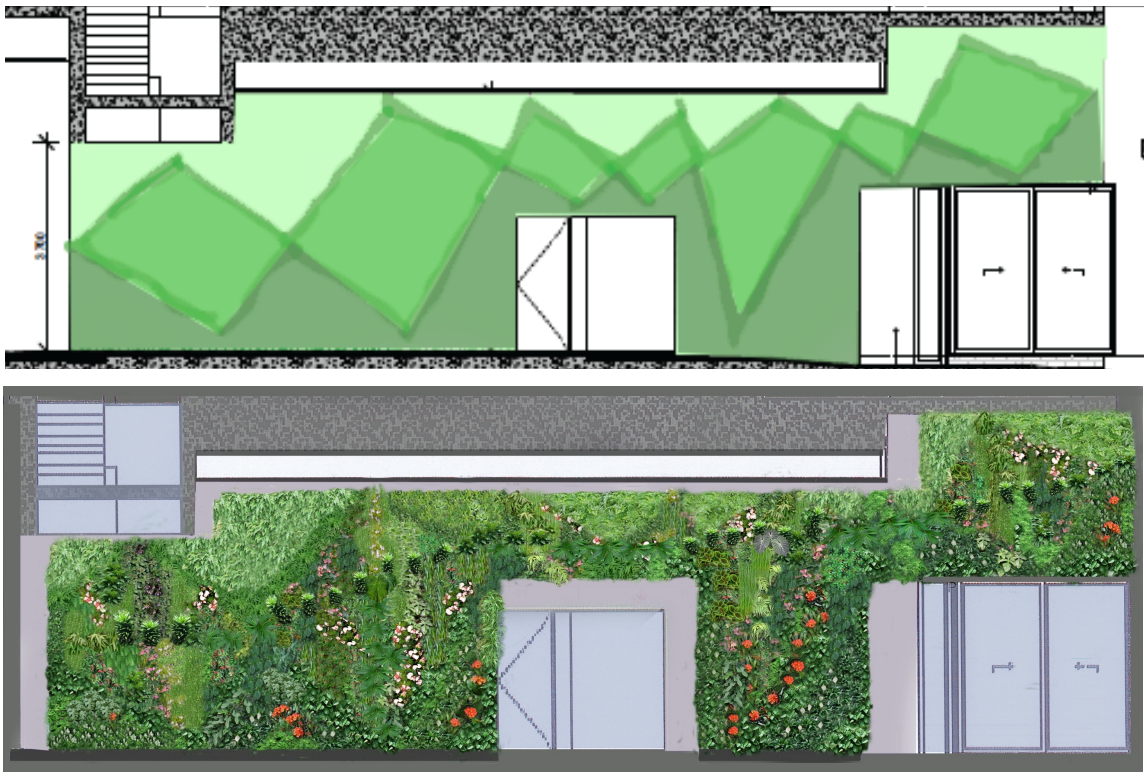


*Figure 128 Green Drawing, Haven at Newstead, wave drawing structure (top) planting array (bottom), Brisbane, 2017.*

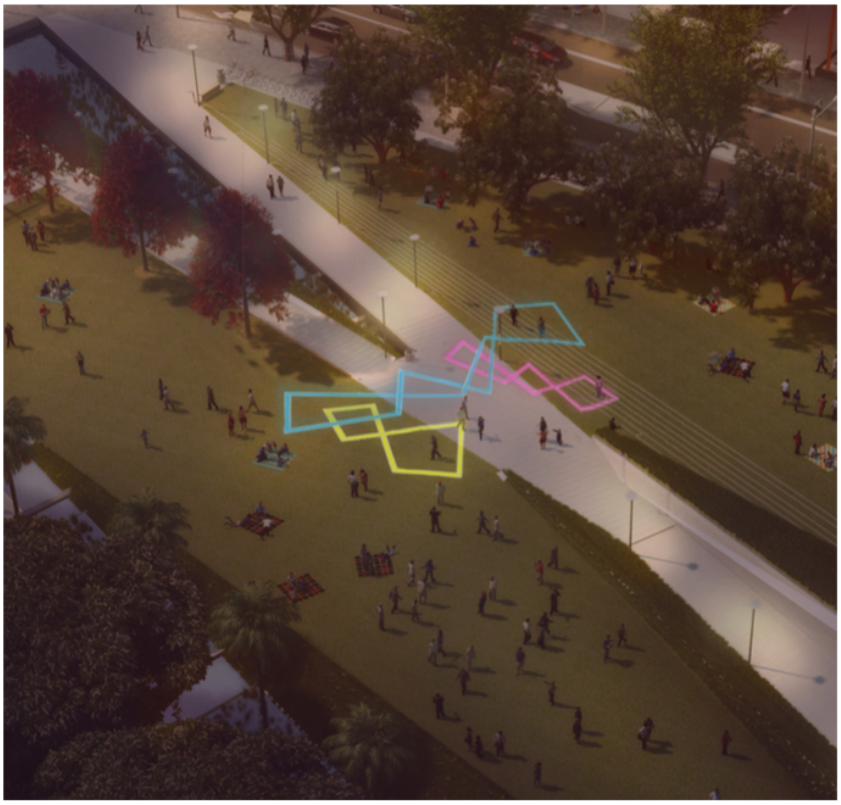


*Figure 129 Stream, (detail) design, series of trafficable internally lit pathways, Drying Green Park, Sydney, 2016.*[241]

Chapter Five introduced the theme of variation and interconnectivity in relation to the drawing exercises. Chapter Six described how the instructional text has been paired thematically in each wall drawing series. Chapter Seven presents variation and interconnectivity a second time as concepts that can be can be demonstrated, practiced and steered during the production of a wall drawing. The original premise of the *Red Matter Drawings* is more thoroughly investigated in Chapter Seven to confirm their value in communicating varied, specific concepts in other fields when framed within a theme of variation and interconnectivity.

Chapter Seven discusses time, scale and materiality in relation to current knowledge about physics. It presents a two-part narrative which can be paired with the production of any of the wall drawing series enabling these artworks to be used by teachers to convey concepts about physics through making art. The wave drawing template, *Whoosh #1*, describes how to make free-form wave drawings using organic geometry. When paired with the narrative presented in Chapter Seven, this research demonstrates how through shaping the drawings "formalism" can be used to convey scientific knowledge. The first part of the narrative is

[241] Image source: courtesy Poliness / City of Sydney.

geared towards introducing primary school students to the concepts conveyed through making the drawings, the second part is directed towards high-school and tertiary students.

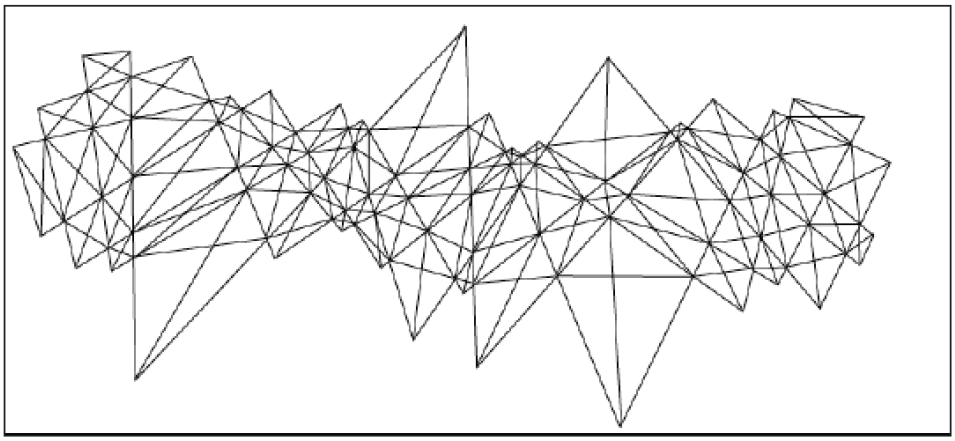
# CHAPTER 7
# CONNECTING ART AND SCIENCE

Chapter Five proposed the concept of organic geometry as combining observations and research about anomalies as a quality that binds all matter and objects together. The presence of anomalies linking generative processes in nature to manual and industrial production. Chapter Six examined my application of the concept of organic geometry to create various instruction-based wall drawings since 1994, including a new series of wave drawings. Chapter Seven revisits these concepts from the perspective of physics to explore how far down in scale the concept of organic geometry holds true, thus confirming the use of my instruction manuals and resultant drawings as a means of demonstrating scientific knowledge.

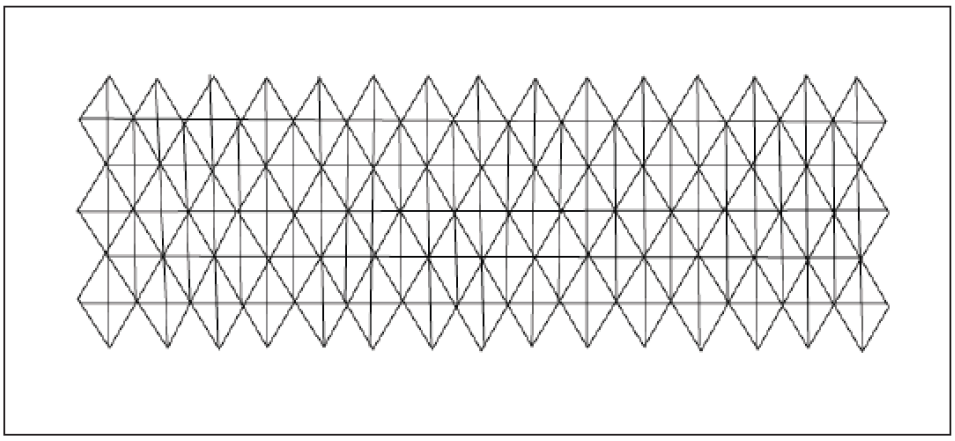
Through the pairing of concepts and themes about the creation of anomalies via processes of morphogenesis, *Whoosh #1*, and all previous drawing series, provide means of access to the production of formalist art that can be used to demonstrate knowledge and perceptions through analogy-making. Chapter Seven provides an accompanying narrative, discussing energy, materiality, scale and time that together explore the fundamental question:

*Can any two things ever be truly, physically, identical?*

Chapter Seven broadly examines the relevance and urgency of discussing concepts of anomaly and identicality in relation to current scientific knowledge, advancing the overarching aim of the research to develop new ways of conveying, interpreting and applying such understanding. Chapter Seven examines how the concept of organic geometry provides access to complex concepts of physics, and through this, provides access to ways to reconsider the phenomenal world, including in relation to increasingly pressing need for sustainable design. This chapter explores how my instruction-based artworks — as systems — do this by providing first-hand experiences in enabling understanding of a wide range of concepts, thereby offering access to new ways of knowing.



A visually asymmetrical 'geometric-wave' version of the geometric pattern of *whoosh*



Visually symmetrical version of the geometric pattern of *whoosh*

*Figure 130 Two versions of the same geometric pattern of Whoosh, page 4, Whoosh #1 prototype manual, 2012.*

## *A narrative for instruction-based artworks*

The primary concept, or hypothesis, that all my instruction-based drawing series demonstrate is that despite appearances, nothing is really physically perfect, this being an intrinsic characteristic of matter. To understand *How far down in scale this concept represented by the wall drawings holds true?*, in 2012, I began to informally study physics after seeking permission to sit in on undergraduate lectures in the Physics Department at the

University of Melbourne.[242] In becoming more informed about the principles of physics, I was able to extend the story of the Red Matter artworks through the format of instruction-based drawing. The following narrative explains why I am interested in the question of anomalies and how the vehicles of organic geometry and my instruction-based series of drawings have been developed for teachers at all levels and in all fields of study to explain key concepts in a range of fields, like science for example.

A key question of my research is - *Can any two things ever be truly, physically, identical?*

This is a simple, but fundamental question to ask of the objects that surround us. Knowledge of basic microscopy shows imperfection and variation to be true at a physical scale below what the naked eye can see. Wanting to dig deeper, I sought to understand whether this was a general principle of physics. The process of answering this question in the context of my research established the "region of truth", in which organic geometry operates, validating the relevance to all series of artworks discussed in Chapter Six to demonstrating current scientific knowledge and the potential application of artworks for deeply exploring many other concepts. The use of organic geometry as a tool for visualising, experiencing and understanding scientific knowledge is tested and demonstrated in this chapter through the process of answering the question, "*Can any two things ever be truly, physically, identical?"*.

The narrative begins by introducing observations about anomalies in a step-by-step fashion, along with images to make them more accessible. *Part One: difference and mass-production* is geared for primary school teachers and their students. *Part Two: digging deeper, translating scale and observation* is geared towards secondary and tertiary teachers and their students in a diversity of fields. The geometry of the *Whoosh #1* drawing (Figure 130), which tests and stretches organic geometry to its limits, finds relevance within this narrative as a tool of visualisation, being an adaptive, amorphous, mesh-like structure.

[242] In 2012 and 2013 I attended Physics 101 lectures and participated in laboratory sessions at University of Melbourne, and continued to discuss my research with Professors, Dr Roger Rasool and Dr Andrew Melatos.

## *Narrative Part One: difference and mass-production*

### *Materiality, comparing gum leaves and tins of baked beans*

Every gumleaf belongs to a particular species, but despite such membership, it is readily apparent that although the leaves in a species share common elements, each individual gumleaf is unique. Despite being mass-production by a tree, some leaves are longer, wider, or have a particular twist (Figure 133). Similarly, people are all unique within the physical context of being human. It is the nature of Nature that all naturally occurring objects are unique at some scale. It is also the nature of manufactured objects.

*Figure 131 Showing gum leaves mass-produced by a gum tree are all different and unique.*

A careful comparison of several tins of baked beans will most likely reveal small imperfections. The alignment of a printed label may vary in relation to some other physical attribute of the tin, such as the position of the ring-pull opening device. There may be some incidental damage from the manufacturing process. The variously-shaped beans, which like gum-leaves have been mass-produced naturally by a plant, can be imagined as packed together within each tin in slightly different quantities or arrangements. Close inspection combined with the power of imagination reveals that mass-produced tins of baked beans are only apparently, superficially, identical. Certainly, to make it to the supermarket shelf, each tin of beans must fall within a margin of similarity to all other tins of its kind, but the reality is that each tin of beans is slightly different than the others.

*Figure 132 Gum leaves (left) and manufactured mass-produced objects.*

## *the world and the head of a pin / SEM, scanning electron microscopy*

Advanced scientific magnification of forms and surfaces is an even more powerful way to reveal variation in materials and things. For example, the magnified image of the head of a pin (Figure 133) produced using 'scanning electron microscopy' (SEM imaging) shows a highly-refined mass-produced object that appears to the naked eye exactly the same as any other pin, to be asymmetrical in shape and possessing unique characteristics. SEM imaging highlights the physical anomalies incurred during production, the pinhead being seen to be comprised of multiple layers of material, piled-up like a stack of pancakes, or as a mushroom, on a stalk.[243] Through one image, a machine-made pin begins to appear more like an object of nature. Observing such anomalies provides a new way to consider the materiality of pins and provides insights into their manufacture, it appearing that tiny drops of molten metal that form the head of the pin have settled slightly differently to create a texture.

[243] This image was produced by scientists using the pin to provide a scale relationship to bacteria, being the subject of examination, which can be seen on one side beneath the head of the pin. It is difficult to find SEM images of everyday mass-produced objects, they are not widely available. They are generally only produced by technicians testing industrial material tolerances. I have begun to collect such images to make an exhibition.

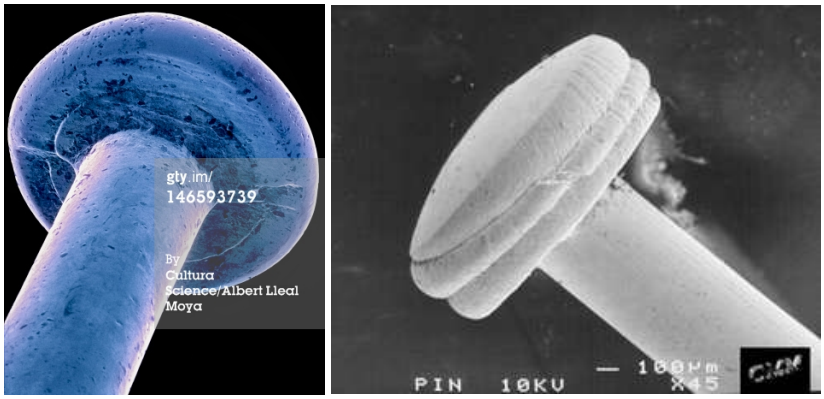



*Figure 133 SEM images of the heads of a pin revealing irregularities.* [244]

At even greater magnification, the surfaces of everyday objects become even more unrecognisable. The two images in Figure 134 both show the surface of aluminium foil. In the right image, the surface of the foil is smooth and shiny. The left image, made using SEM, reveals a highly textured structure when magnified. Increasing magnification provides extra information with which to consider the nature of matter, enabling us to better understand it. The SEM image suggests why kitchen foil remains rigid as a thin sheet, crumples the way it does or sounds as it does when handled and explains why it might be slowly dissolving in the air or that invisible fragments of its surface dislodge on contact with other materials.

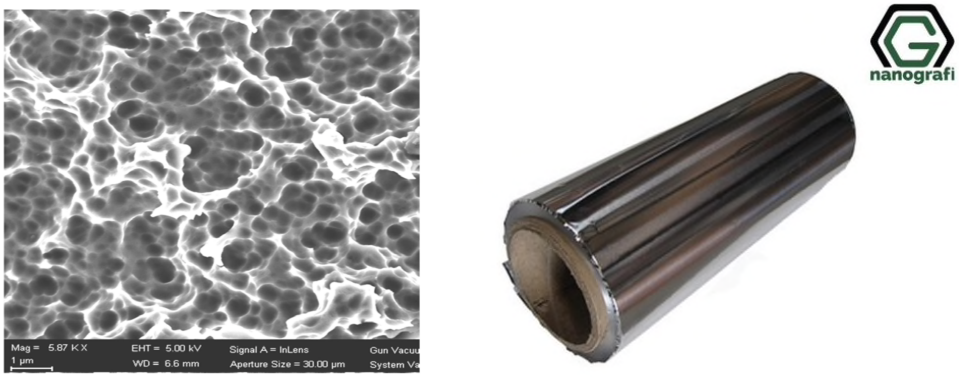



*Figure 134 Left, SEM image of aluminium foil, approximately 10 micro metres. Right, a roll of aluminium foil.* [245]

[244] Image source: Source: http://www.nanovision.qmul.ac.uk/media/

[245] Activated carbon-based electrodes in commercial supercapacitors and their performance - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/Figure/SEM-image-at-the-surface-of-aluminum-foil-substrate_fig7_256457223 [accessed 9 August 2019]

Industrially manufactured objects are mass produced to be identical. Observable differences are perceived as a fault, something detrimental. Conversely, studying the presence of anomalies is used in various ways in the practical application of science. In engineering and manufacturing processes, the presence of variation is used to assess material integrity and structural tolerances. Anomalies are observed, monitored, tested and controlled to be kept below a certain threshold and thus render them inconsequential and invisible in our everyday interactions with objects. Within the natural sciences, anomalies are carefully observed and analysed to differentiate species. Minute differences between tiny creatures, such as ants, although not visible to the naked eye, differentiate one species from another if they go beyond a certain level or threshold.

### *Can any two things ever be truly, physically identical? Why does this question matter?*

This question is fundamental to all objects in the world, including those I produce as art. Since the development of electron optics in 1926, magnification and material analysis technologies such as SEM or Transmission Electron Microscopy (TEM) have been used to observe and harness anomalies.[246] These technologies have advanced the human capacity to design and mass-produce new objects and materials. Advanced research in biomedicine and biology uses these technologies, connecting us more compatibly and sustainably to the natural world through enhanced understanding. Observations at a microscopic scale serve to clarify the nature of objects, revealing a point of fundamental connectivity, the innate physical individuality that connects the products of people and nature. Before the invention of microscopy, this connection was not apparent. It was technology that showed us that nothing is really physically perfect even if it looks like it is. It clearly refutes the sense of an inherent division between the human and the natural at a factual and philosophical level, that such a division is not aligned with or based on scientific fact.

A condition of modernity is that humans have increasingly surrounded themselves with objects mass-produced to appear identical. We engage with these objects in environments

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src='https://www.researchgate.net/profile/Vasile_Obreja/publication/256457223/Figure/fig7/AS:392759602106373@1470652594351/SEM-image-at-the-surface-of-aluminum-foil-substrate.png'.

[246] In 1926, Busch studied the trajectories of charged particles in axially symmetric electric and magnetic fields, and showed that such fields could act as particle lenses, laying the foundations of geometrical electron optics (Oatley, 1982 and references therein). A. Bogner et al., "A History of Scanning Electron Microscopy Developments: Towards "Wet-Stem" Imaging," *Micron* 38, no. 4 (2007). P 390

equally created to appear symmetrical and uniform. Yet at some scale, all objects are unique and all matter is imperfect. This knowledge contradicts our general understanding of things, the purpose of asking the question *Can any two things ever be truly, physically, identical?* being to seek to pierce the illusion of the world. Once possessed of this knowledge, it is possible to understand that objects and structures that appear to be identical or symmetrical are more accurately described as objects and structures that successfully hide their anomalies and asymmetry to the naked eye.

There are many aesthetic, economic and practical reasons that man-made things appear symmetrical and seem to be repeated identically. The attribute of symmetry has been associated with beauty and elegance by many human civilisations for thousands of years. The reduction of anomalies generally results in more efficiently produced forms. Objects required to move through other materials do so more efficiently with smooth surfaces. Patterns, moulds and dyes are designed to reproduce objects efficiently and cheaply en-masse. Identicality and symmetry signify humanity's separation from nature via technical advancement. This sense of control and distance is fundamental to human identity and humanity's relationships with the natural world, but is inherently problematic. Students of science learn to consider "The Observer Effect", that the researchers presence and the imprecision of equipment will influence any experiment in some way and must always be taken into consideration in proposing experimental findings.

Currently, the question *Can any two things ever be truly, physically, identical?* is linked to further, high-stakes, existential questions about how we see the world. For example,

- does the proliferation of apparently symmetrical and identical objects we encounter in everyday life contribute to a false sense of physical security and technological accomplishment and control?

- Has the assumption that it is possible to achieve perfect replication and physical symmetry established the sense of human dominance of and separation from nature?

- Does the proliferation of apparently symmetrical and identical objects present a barrier to understanding the nature of nature and physical reality?

- Does it support a relationship inextricably linked to the concept of the natural world as a bottomless resource to be plundered?

Understanding the impossibility of perfect replication and physical symmetry would contradict many long-held assumptions and beliefs about the world, suggesting that they may be the residue of other circumstance and another time. Dangerous climate change shows that it is clearly time to get real about the objects that we make. Might a small broad-based shift in perception about the fundamental nature of the objects we make and surround ourselves with have significant consequences?

The question, *Can any two things ever be truly, physically, identical?,* is concerned with the importance of observation and visualisation. Simply being told that all objects have anomalies and are unique does not mean we can integrate this idea into our experiential perception of the world or ways of operating in relation to it. The presence of variation within any kind of object or material is a fundamental physical fact, it is a unifying aspect of all things in the world. How and why anomalies arise is not taught to students in foundational science programs, being difficult to explain and experience at first-hand, despite it being a fundamentally important concept in understandings about the nature of Nature and human-made systems of production and their interdependence within the one inclusive system.

My conceptualisation of organic geometry as an indeterminate system — a process for making geometric, abstract art — is dedicated to helping people gain an appreciation of the nature, generation and dynamic effect of asymmetry, difference, imperfection and variation in a system. [247] My instruction-based drawings help educators to discuss these concepts with students of all levels through a participatory art process. In different ways, the new work, *Whoosh #1*, the product of this research, and my other instruction-based drawing projects are designed to generate drawings as artworks that reveal how processes of replication yield unique objects and variations. Before the advent of this kind of microscopic attention and other technologies, this kind of deep understanding of materiality was acquired through trial and error, through first-hand practice working directly with materials. The drawing process generated by my instruction-based artworks are designed to perpetuate such tacit, experiential learning on one level, which is then elevated to an explicit level in the hands of a teacher.

The concept of organic geometry is applied through instruction-based artworks to enable experiential encounter with the nature and significance of variation. The following narrative

[247] An 'indeterminate system' meaning a system which contains an element of randomness which enables the possibility of various outcomes.

encompassing the rest of this chapter, will assist the artworks to be used as a learning tool by educators. The artworks generated through organic geometry highlight the presence and potential influence of the tiny differences that exist within everything we do or make, which exist and need to be a fundamental consideration when designing anything new. My instruction-based drawings, culminating in *Whoosh #1*, provide a way-in to visualising, encountering and thinking about the reality of objects, bridging a critical gap in knowledge and understanding.

## *Narrative Part Two: Digging deeper, translating scale and observation*

How far down in scale do physical anomalies in matter hold true? Secondary school science describes all objects as being comprised of structures and particles invisible to the naked eye, molecules and atoms held together by forces that are also imperceptible. How do we apply this concept to the everyday world and our imagining of it? Molecular graphics were developed to help visualise and consider the structure of atoms and molecules, but technological advancements indicate these minute particles are not necessarily aligned and identical or joined together precisely, or uniformly, as represented in the 'ball and stick' models of atoms and molecules typically used to produce molecular graphics for classrooms as in Figure 135, but rather their organisation is asymmetrical and their forms imperfect.

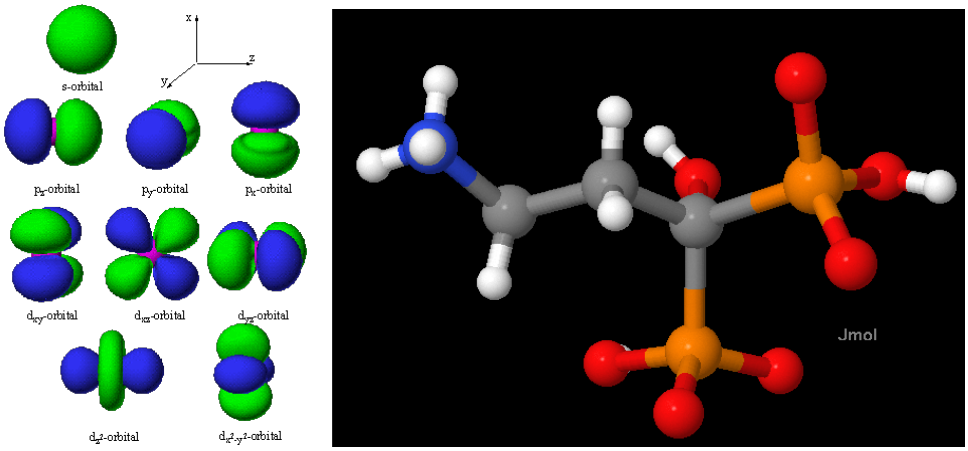



*Figure 135 Left, a typical example of graphic imagery used for visualising atomic orbitals*. [248]

[248] Image source: https://internal.eps.hw.ac.uk/subjects/chemistry/teaching/14_2QI2/notes/intro.html; and right, Pamidronic acid: Ball and stick molecular graphics created by program Jmol.

The question *Can any two things ever be truly, physically, identical?* is not only important to seeing through the immediate appearance of things. It represents something more fundamental about the representation of advanced scientific knowledge. The following text helps to broadly translate molecular graphic diagrams and ball and stick models in relation to the experience of everyday materials to establish how they do and do not represent the actuality of materials. Used in conjunction with the wall drawing, *Whoosh #1*, this information can also be used to communicate these concepts in new ways.

### *Materials Science*

Materials science and engineering is an interdisciplinary field concerned with the properties of matter and their application, particularly in relation to the design and discovery of new materials. The field began around 6000 BC with early metallurgy, progressing from random experimentation to inventing imaging technologies such as SEM, which have enabled the nature of the smallest of elements to be better understood, this leading to the establishment of the fields of nanoscience, nanotechnology and new biomaterials.

In the field of materials science, two primary types or forms of substances are seen as existing: crystalline and non-crystalline, also referred to as amorphous. These terms refer to the type of structural arrangement of atoms and molecules within any substance. In materials science, the structural arrangement of atoms and molecules in crystalline materials are referred to as ‘ordered’ and in non-crystalline it is referred to as amorphous or ‘disordered’. According to the current theory of crystallography, eighty percent of all materials are considered to be crystalline in structure, as ’ordered’. All crystalline materials are solids, whereas not all solids are considered crystalline. Glass, for example, is a non-crystalline material, an amorphous solid.

In materials science what do order and disorder mean? The structural arrangement of atoms and molecules in non-crystalline materials is considered disorderly, in that atoms may move around relatively freely depending on the type of material or whether it is in a solid, liquid or gaseous state. In crystalline materials, the arrangement of atoms and molecules remains relatively static. They are spatially arranged in repeated small groupings called unit-cells that form various, defined types of orderly rows and columns in three dimensions. This pattern is called a crystal lattice. In crystalline materials, the structural arrangement of atoms and molecules is similar to the ways in which tins of baked beans may be neatly stacked on the

supermarket shelf. However, spatially the arrangement of spheres makes a more accurate visual analogy. In graphic representational diagrams of crystalline lattice arrangements and ball and stick models, the spaces that atoms or molecules occupy are typically defined and represented as spheres. Figure 136 has atoms represented as green or purple spheres, packed closely together. Figure 137 shows the different types of structures that small groupings of atoms or molecules can form as unit-cells, repeating units that are packed together. Just as there are different ways to arrange and stack cans of beans on a shelf, there are different ways to arrange and stack spheres. There are seven different lattice systems and fourteen different ways to spatially stack spheres (Figure 138).[249]

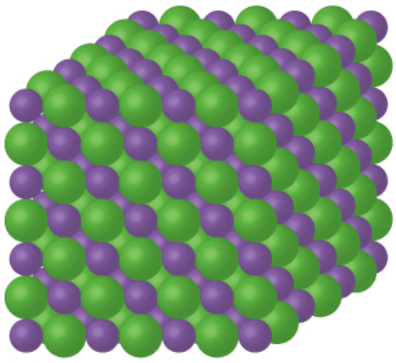


*Figure 136 Atoms are represented here as green or purple spheres packed closely together forming a crystal lattice.* [250]

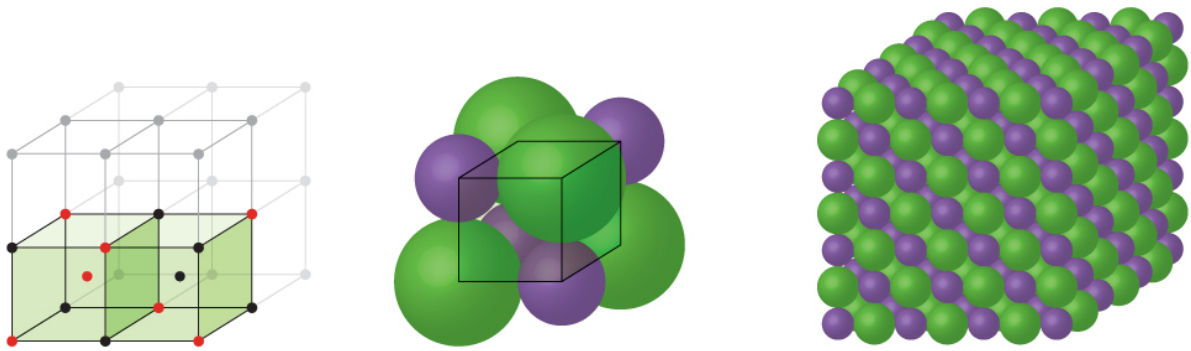



*Figure 137 The image on the left represents a single unit-cell with atoms represented as red or black dots, the two images on the right represent atoms as green and purples spheres as touching each other and taking up space within the unit cell arrangement.* [251]

[249] Clark, A, Oregon Institute of Technology: Che 201, General Chemistry 1, LibreTexts, 4.1 Unit Cells.
[250] Ibid,
[251] Ibid.

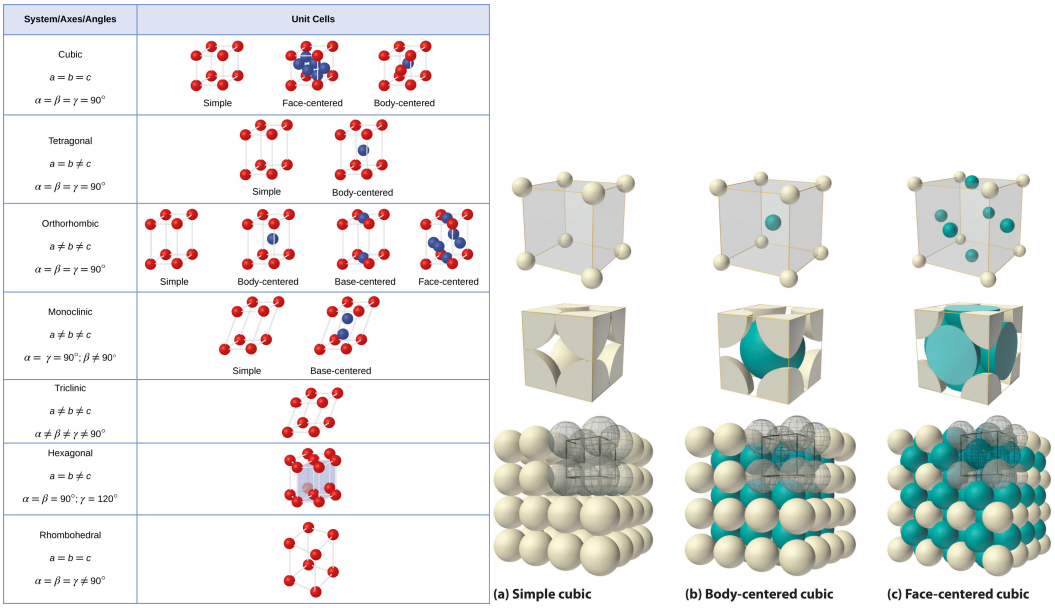



*Figure 138 The image on the left shows seven different lattice systems and fourteen unit-cell configurations. The image on the right translates three cubic unit-cell arrangements representing how atoms touch each other to take up space within three particular unit-cell arrangements.*[252]

Crystallography is the branch of science that deals with discerning the arrangement and bonding of atoms in crystalline solids and within the geometric structure of crystal lattices.[253] Classifying materials as 'crystalline' (orderly) or 'amorphous' (disorderly) in materials science has been developed as a means to work with matter. Matter is not entirely ordered or disordered, there being a continuous shifting between degrees of order (crystallinity degree) in materials. This ranges from those considered ordered (crystalline) to completely disordered (amorphous). Materials considered to have *no significant range* of pattern repetition are classified as amorphous.[254] Here, the concept of *significant range* is relative to the establishment of common terms of reference devised for carrying out analysis of materials in crystallography and discussing practical experiments with them. The terms long-range and short-range are used in crystallography to define the degree of crystallinity of a material. These terms refer to the breadth and significance of a repeating pattern of arrangement of atoms or molecules within a given material. However, it is not possible to manufacture a perfect crystal of a material or to obtain any substance in totally pure form,

[252] Image, right, shows three types of cubic unit cell arrangements, face centred includes base centred in this diagram. Image source: https://chem.libretexts.org/Courses/University_of_Arkansas_Little_Rock/Chem_1403%3A_General_Chemistry_2/Text/12%3A_Solids/12.1_Crystal_Lattices_and_Unit_Cells

[253] Definition, Encyclopaedia Britannica.

[254] The terms 'long-range' and 'short-range' are used in crystallography to define the degree of crystallinity of a material. These terms refer to the scale and significance of a repeating pattern of arrangement of atoms or molecules within a given material.

some anomalies are always present. [255] The crystal lattice diagrams in Figures 136, 137 and 138, represent an idealised, simplified system that can be used to understand and discuss many of the important principles governing the behaviour of solids.

The shifting degrees of order or disorder in the arrangement of atoms and molecules in the crystal lattice of a crystalline material occur in various ways and a for variety of reasons. Real crystals contain large numbers of defects, typically more than 104 per milligram.[256] Defects such as trapped or misplaced atoms and vacancies (holes), occurring as the result of missing atoms or ions (charged atoms), can occur as single points, in rows, groups or in various combinations forming impurities, which is to say anomalies. For example, 'even if a substance were 100% pure, forming a perfect crystal would require cooling the liquid phase infinitely slowly to allow all atoms, ions, or molecules to find their proper positions. Cooling at more realistic rates usually results in one or more components being trapped in the wrong place in a lattice (like the game of musical chairs) or in areas where two lattices that grew separately intersect. [257] The image on the left of gymnasts in Figure 139 is presented by the Spanish National Research Council Department of Crystallography in an introductory chapter to crystallography to represent defects typically present within an ordered crystal lattice.[258] The gymnasts stand in rows, but some are standing slightly out of alignment and some are wearing different clothing, representing imperfections. The image on the right of Figure 139 is a graphic representation of some common kinds of anomalies occurring in a crystal lattice.

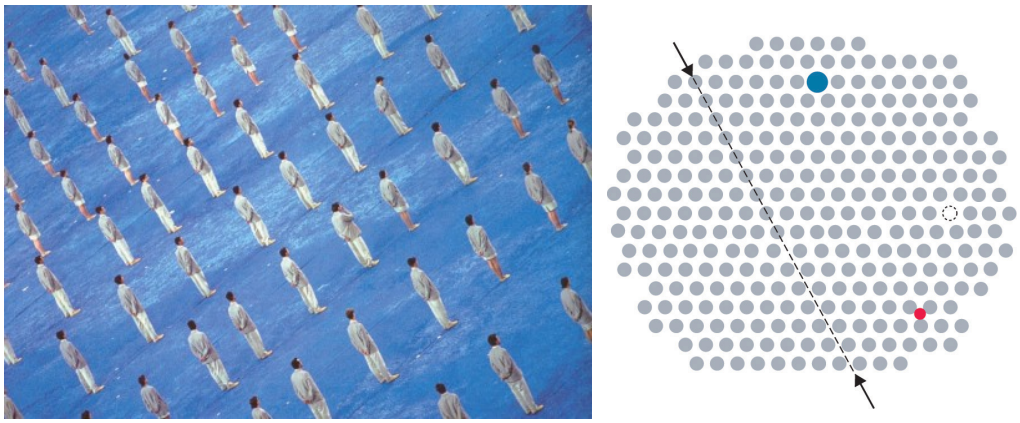


*Figure 139 Defects in the structural arrangement of atoms in a crystal lattice.*[259]

[255] Bruce Averill and Patricia Eldredge, *Chemistry : Principles, Patterns, and Applications*, 1st ed. ibid.
[256] Ibid. ibid.
[257] Ibid.
[258] http://www.xtal.iqfr.csic.es/Cristalografia/index-en.html
[259] Image source: Spanish National Research Council Department of Crystallography

The two images shown in Figure 140 are two-dimensional representations of crystalline (left) and amorphous (right) materials. The amorphous material is not entirely without a repeating pattern, but the repetition is distorted, the atoms are dispositioned resulting in an arrangement similar to the distortion of linear patterns made using organic geometry. These two images demonstrate clear parallels with the two different versions of the same geometric pattern of the artwork *Whoosh #1*, presented in the first Figure in this chapter and repeated here, see Figure 141.

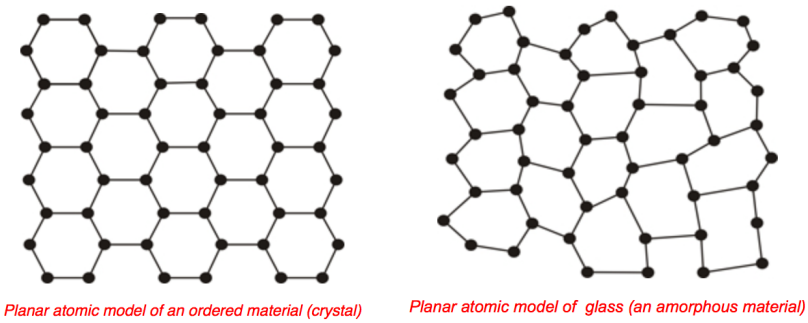
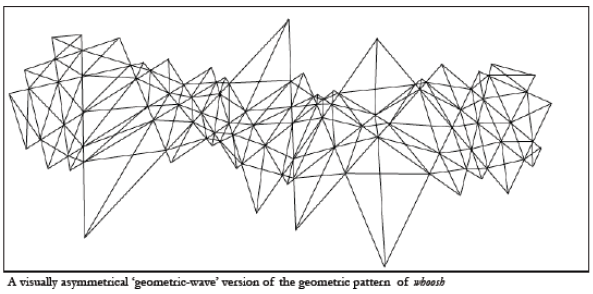



*Figure 140 planar atomic model images courtesy, Spanish National Research Council (CSIC) open science, archives and network. http://www.xtal.iqfr.csic.es/Cristalografia/index-en.html*



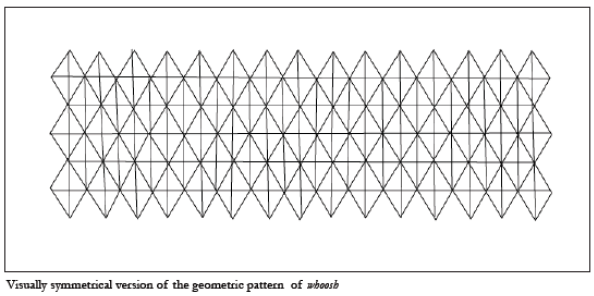




*Figure 141 Two versions of the same geometric pattern, page 4, Whoosh #1 prototype manual, 2012.*

The crystal lattice diagrams in Figures 136, 137 and 138, represent an idealised, simplified system used to understand the principles governing the behaviour of solids. The two images of the artwork *Whoosh #1* are both correct and possible outcomes of making the drawing. Closer inspection of any version of the drawing*, Whoosh #1*, which might initially look orderly, would reveal anomalies. For example, the drawn texta-colour lines would reveal anomalies. Because the two images in Figure 140 so closely reflected the basic pattern-structure and degree of variation possible in the artwork Whoosh (Figure 141), I became compelled to better understand why in the field of Materials Science amorphous solids are referred to as amorphous. This generally means without shape, but they have shape, and why are they considered disorderly when there is clearly both order and pattern repetition present in the amorphous solid represented in Figure 140. This observation led me to research even more deeply the definitions and terms of Materials Science to understand how this system of classification and representation was developed.

### *Theories of crystallography and amorphous solids*

Around 1781, the French priest and mineralogist René-Just Haüy noticed that when breaking up a large Calcite crystal it yielded smaller pieces of exactly the same shape. This observation led Haüy to consider macroscopic materials as comprised of repeated smaller units of the same shape, which he described as integrant molecules stacked three dimensionally in columns and rows. The internal structure of a crystal was not determinable until the invention of X-Rays by Rontgen (1895) and X-Ray diffraction technology was applied experimentally to observe the internal structure of crystals by Max von Laue in 1912.[260]

Haüys concept of repeated integrant molecules forms the basis of crystallography. It led to the development of a mathematical equation, the Crystallographers Equation, which is still used to predict the location of atoms and molecules within a crystal lattice structure. The equation is based on the idea of crystals macroscopically reflecting their internal crystal order. If this equation works to correctly predict the location of molecules or atoms within a material, the material is then considered ordered, a crystalline solid. If this equation does not work, the material is considered non-crystalline. Long-range pattern repetition in crystallography refers to the successful application of the Crystallographers Equation. However, the ‘theory of crystallography’ describes ideal crystal structures. The atomic

[260] Randall Dewey Knight, *Physics for Scientists and Engineers : A Strategic Approach : With Modern Physics*, Third edition ; Pearson new international edition. ed. p. 767

arrangements of real materials depart in many ways from the ideal, hence the development of theories of crystal defects and disorder.[261]

Some scientists propose that the current system of classifying materials as crystalline and amorphous requires updating, the premise of classifying materials based on order and disorder is inaccurate, inadequate and illogical. For example, the work of Zbigniew Stachurski proposes the need for a field of science of amorphous solids, separate to the field of crystallography. Stachurski argues that,

> One could say that to be disordered, there should exist a prior ordered state as a reference from which disorder can be measured. However, many amorphous solids do not have a corresponding crystalline form. Yet, it is still frequently assumed that amorphous materials are found at the limits of disorder, and amorphousness is usually defined by what it is not, rather than by what it is.[262]

The degree of crystallinity in any material is currently assessed in relation to how closely it adheres to the concept of an ideal lattice of a perfect crystal, using the Crystallographers Equation. Today, scientists are able to simulate molecular dynamics and predict the location of atoms in many amorphous solids, including those without a lattice, using a variety of advanced techniques, technologies and statistical equations developed after the Crystallographers Equation.[263]

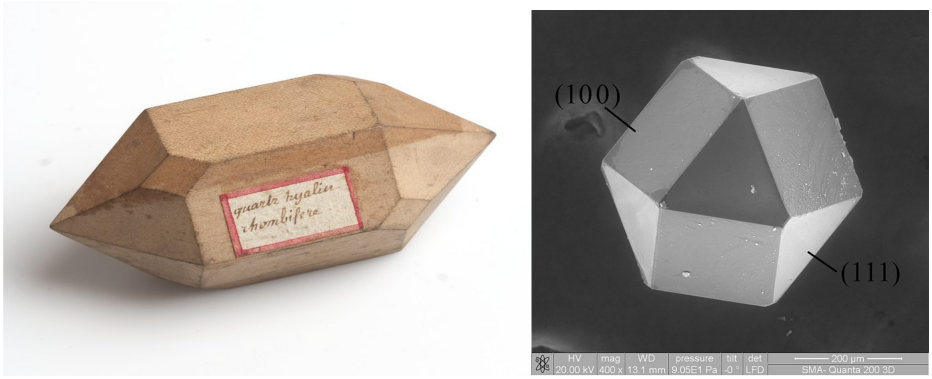



*Figure 142 Left, pearwood model of rock crystal rhomboid, made by René-Just Haüy[264] Right, A diamond cuboctahedron showing seven crystallographic planes imaged with scanning electron microscope.* [265]

[261] Zbigniew H. Stachurski, "On Structure and Properties of Amorphous Materials," *Materials* 4 (2011).
[262] Ibid. p 1566.
[263] Ibid. p1592
[264] By Teylers Museum, Haarlem, the Netherlands, CC BY-SA 3.0 nl, https://commons.wikimedia.org/w/index.php?curid=18244426
[265] By Ludvig14 - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=6643794

In many amorphous solids such as glass, a kind of order and structural lattice can be found that lies beyond the scope of the crystallographer's equation, being very similar to the type of mutable lattice expressed in the drawings produced using organic geometry. See Figures 140 and 141.

From the late 1950s, before it became possible to simulate molecular dynamics with computers, the scientists Bernal and Scott undertook work of modelling atomic motion by constructing physical models using macroscopic spheres to represent atoms and molecules. The aim was to arrange them in such a way as to replicate the structure of a liquid and use this to examine its behaviour. Scott and Bernal experimented with randomly packing spheres into various containers, Bernal also experimented by constructing ball and stick models of fluids.[266]

The model making process Bernal describes is similar to 3D versions of organic geometry drawings I have regularly made using balsa sticks and balls of wax, however my drawings are artworks, steered by me to test and explore the limits of the geometry physically and aesthetically in 3D form which are proposed as architectural models (Figure 143).

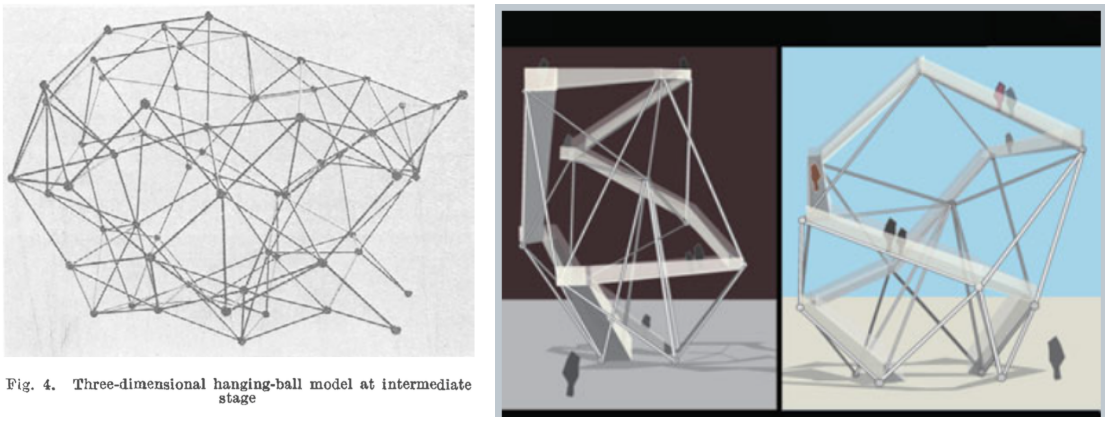


Fig. 4. Three-dimensional hanging-ball model at intermediate stage

*Figure 143 Left, model simulating the physical structure of a liquid, J.D. Bernal, 1959, [267]; right, proposal for a public artwork, SFSAD (staircase for simultaneous ascension dissension), K. Poliness, 2009.*

As a teaching and learning aid, the instruction-based drawings of organic geometry offer a practical exercise describing and facilitating the exploration of the mutable lattice structures

[266] G. David Scott, "Packing of Spheres: Packing of Equal Spheres," *Nature* 188, no. 4754 (1960).
[267] Ibid.

of amorphous solids. Bernal did not completely trust the scope of his own experiment to exclude human interference via the Observer Effect, but in conceiving these models he was able to deduce several important conclusions to guide further research into the nature of amorphous solids. For example, the realisation that the repulsive forces between atoms in a liquid were largely responsible for the structural arrangement of atoms prompted Bernal's famous paper, 'The Structure of Liquids', which argues, 'The actual structure must be determined largely by the form of the repulsive forces between close molecules. This necessity is not peculiar to the structure of liquids.[268]

### *Pattern repetition / degrees of order and disorder*

The orderly and disorderly arrangement of atoms and molecules in a substance is related to energy efficiency.[269] Atoms and molecules assume structural arrangements to continue to be the type of atom they currently are using the minimum amount of energy in relation to their current circumstances, that is, being collectively present in the substance they currently comprise. Like following a kind of molecular manifesto of laziness. When that is not possible for whatever reason — such as the application of heat or cold, or some force of compression resulting in less available space — atoms and molecules either change state or phase or form some other material that it is possible to be. The specific response presents the most efficient or conducive option at the time.

Bernal became interested in the structure of liquids through his interests in biochemistry, noting that "all living structures are mostly composed of water."[270] In 1959, he writes:

> At this stage, the problem of the structure of liquids resolves itself into two. First, there is the merely geometrical one — what is the Structure of a liquid?: that is, what are the mutual positions of atoms and molecules?: and, secondly, why has it got this structure? In what sense is this structure an expression of an arrangement of minimum energy? The first is a question of statistical geometry, the second of statistical mechanics. My contribution is only to the first. If liquids consist of heaps of molecules, we must ask what a heap is. This is very much a going back to the beginning.[271]

[268] "The Bakerian Lecture, 1962. The Structure of Liquids." p 302. Bernal continue 'A careful examination of the structures of crystalline solids shows that for most structures it is the repulsive forces that determine the particular kind of structure. In fact this is the basis of the Goldschmidt and Pauling theory of crystals.'
[269] See the Second Law of Thermodynamics.
[270] Bernal, "The Bakerian Lecture, 1962. The Structure of Liquids." p. 299.
[271] Ibid. P 303.

Bernal's description is analogous to understanding and predicting the arrangement of the contents of a tin of baked beans. In the paper, "On Structure and Properties of Amorphous Materials", Stachurski presents a geometrical concept of an ideal amorphous solid as a novel contribution to understanding of atomic arrangements in amorphous solids, arguing 'We believe that the right approach to a definition of amorphousness is through an appropriate geometric and topological model of the ideal amorphous solid as described herein.'[272] It is currently speculated that in amorphous solids, the positions of atoms cannot be predicted by any form of equation. In paving the way for a theory of amorphousness, Stachurski hypothesises that:

> in a perfect amorphous solid any straight line of arbitrary direction that passes through it will be divided by its spheres/atoms into irregular intervals of random sequence, which can be represented by a corresponding statistical distribution function … In a historical perspective one can contemplate the following hypothetical question: If Pythagoras were a statistician rather than deducing perfect harmony from ratios of pure numbers, would we have had a theory of amorphousness developed ages ago?'[273]

The study of defects and disorder in solids remains a central topic in solid state science.

### *Uncertainty and complexities, refining a question*

Carlo Rovelli explains that, "Science is not about certainty, it is about greater reliability of ideas."[274] In their first year of undergraduate studies, students of physics learn about the concept of the innate physical irregularity of things, which is to say, the asymmetrical physical structure of matter although this is not how it is formally expressed.[275] They must learn to accept and estimate ubiquitous physical variation. They learn about uncertainty and later the "Uncertainty Principle". First year physics students begin to learn how to make accurate predictions. Many will become engineers, so they need to be able to anticipate how things will work by calculating the range of accuracy and inaccuracy, understanding fields of tolerance being vital to what they design working safely. Answers to practical, material problems include a plus or minus variance, they do not equal a specific number. Practical

[272] Stachurski, "On Structure and Properties of Amorphous Materials." p1567.

[273] Ibid., p 1565.

[274] Carlo Rovelli, interview with Joe Gelonesi, radio national program: 'Carlo Rovelli and his quantum problem' on The Philosopher's Zone, June 2017

[275] Appendix A, Uncertainties and Error Analysis, School of Physics, Laboratory Manual, 2012, University of Melbourne.

experience in the laboratory helps physics students to understand that no calculation regarding a physical thing in the universe is ever exact because all things are in a continuous state of flux.

Understanding more about Materials Science makes it easier to imagine that the answer to the question *Can any two things ever be truly, physically, identical?* is likely to be no.

Reaching a simple and practical scientific answer to these questions is made more complex by the word *identical*, which renders the answer no in a new, albeit related, sense, which demonstrates why it is important to refine the wording of the questions. For example, perhaps no two objects can be identical because no two objects can physically occupy exactly the same space at the same time; this is what is required for two objects to be identical. Rephrasing the questions orients them towards my interest in understanding the truth about the materiality and repetition of everyday objects. For example, one could ask, *In a materialistic sense, can any two objects, be truly identical, aside from their location?*

Or more simply, *Is exact replication of an object possible?* The answer is still likely to be, no, primarily because the surrounding environment in which any object exists influences and changes the materiality of that object through time.

For an object to be replicated, an original object must already exist. Yet a replicated object must therefore already occupy a different space as well as be made at a different time to the original object. During the time taken to replicate any object, the original object will have changed. The environment surrounding the original object will have influenced its shape during that period of time, however infinitesimally. An exchange of sub-atomic particles and chemical processes will have begun to change the original object, such processes resulting in wear and tear, which we are all familiar with. Similarly, if two objects were produced simultaneously, the activity of occupying different spaces means the different environments would alter each object differently. This suggests an object could be replicated if it were not for external environmental influences on its shape or problems of occupying the same space at the same time. However, even this is not the whole story. *Is exact replication of an object possible?*

Examining this refined version of the question requires understanding more about the nature and shape of the smallest of particles, to find and observe particles which are so small they have no internal structure, particles thus considered to be elementary.

## *Visualisation, seeing inside an atom*

The smallest particles, quanta, exist inside the single atom. They are studied within the fields of quantum theory and quantum mechanics where new information about the nature of atoms continues to be discovered. As objects become smaller, the scale of relative space surrounding them becomes much larger. Familiar notions of materiality become incidental, transitory, influenced by quantum space and forces that are quite different to those we are used to engaging with in everyday life. These forces are not only unfamiliar, some are much stronger than we might imagine. An indicative comparison of scale relationships between familiar spaces and objects to those within an atom helps us to imagine the complexities of observing, measuring, understanding and contextualising the objects of quantum space. The following example was provided in a physics lecture, regarding electrons, protons and neutrons, some of the better known objects within an atom.

The path of moving electrons defines the space that is occupied by a single atom, this space represented by spheres in ball and stick models and graphic representations of atoms. Electrons are constantly moving at approximately 22,000 kilometres per second around the centrally located nucleus of an atom, which is comprised of two main types of particles, protons and neutrons, which together are referred to as nucleons. See Figure 144. This kind of speed is difficult to comprehend. The distance in a straight line through the centre of the Earth between the north and south pole is about 24,000 kilometres, therefore the speed of an electron is very nearly able to travel this distance in one second. Alternatively, given that the circumference of the Earth at the equator is about 40,000 kilometres, an electron could complete a lap of the Earth in less than two seconds.

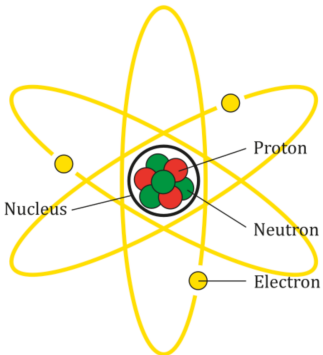



*Figure 144 Classic graphic representation of the main elements of an atom.*[276]

[276] Image source:courtesy AG Caesar [CC BY-SA 4.0 (https://creativecommons.org/licenses/by-sa/4.0)]

Unlike the typical graphic representations of atoms in Figure 144, this activity occurs within an environment that is incredibly vast compared to the scale of the atomic objects. The relative scale of electrons to the nucleus of an atom is comparable to grains of rice flying around the edge of a large concert hall, orbiting a centrally located pea. The nucleus is a tiny speck in the centre of an atom, about 1/10,000$^{th}$ the diameter of the scale of the whole atom, which is almost entirely comprised of empty space. [277] The spheres representing atoms in graphic representations of crystal lattice structures are depicted as spherical objects to represent the realm in which electrons, orbiting the nucleus of the atom, may be present and moving very quickly within at any point in time (Figure 145).

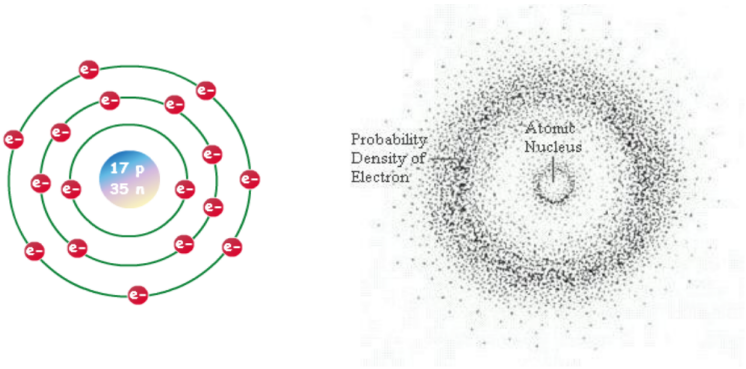



*Figure 145 Left, classic graphic representation of the main elements of an atom; and, right, a graphic representation of the probability density of an electron cloud.*[278]

This environment is often referred to as the electron cloud. The incredible speed of the electron means that the space defined by the electron cloud of an atom is space potentially occupied by electrons at any point in time. The two images in Figure 145 provide different graphic representations of the neutral chlorine atom, which has 17 electrons. The image on the right represents the diffuse nature of the electron cloud. Although both images represent the atomic objects involved, neither image accurately represents the relative scale and distance relationship between nucleus and electrons described above. Figure 146 suggests the impracticality of graphically representing on a page the relative scale of a tiny 1 mm dot within a sphere which is 10 metres in diameter. The difficulties of imagining these kinds of spatial relationships are discussed later in this chapter.

[277] Knight, *Physics for Scientists and Engineers : A Strategic Approach : With Modern Physics*. p. 1334.
[278] https://studylib.net/doc/5744033/bohr-vs-electron-cloud

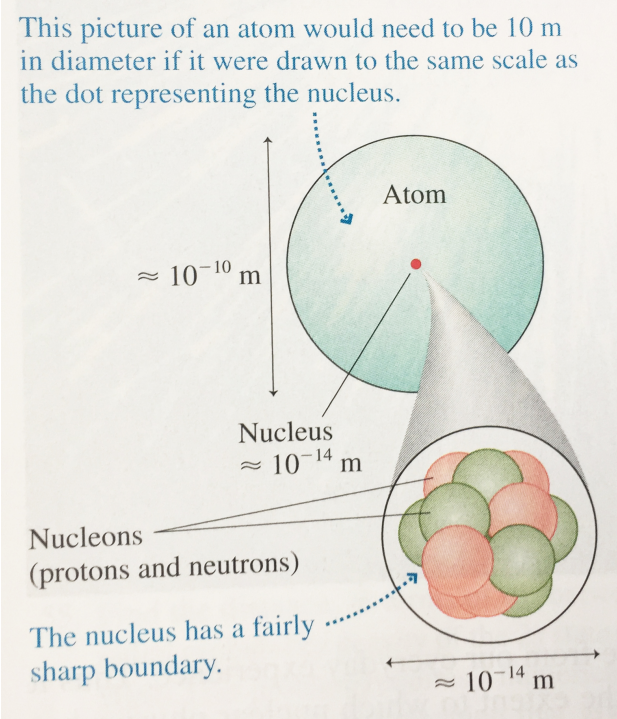



*Figure 146 image demonstrating relative scale of atomic particles, the red dot being about 1 mm across.*[279]

Having some understanding of the relative speed, scale and degree of space involved in the realm of atomic objects (quanta), helps us to understand why the laws of classical physics and forces such as gravity which we observe to have the greatest influence on our everyday lives are quite different to the laws and forces of quantum physics which have the greatest influence on the behaviour of atomic objects. However, there are also some important, readily observable similarities between classical and quantum physics. For example, electrons and protons are both charged particles, negative and positive respectfully. The dynamics of negative and positive forces of attraction and repulsion can be easily experienced by playing with magnets. Electrons are negative and protons positive, whereas neutrons are electrically neutral. Typically, the number of electrons is the same as the number of protons rendering an atom neutral. The negatively charged electrons are attracted to the central positively charged nucleus of the atom, but not too strongly as they remain in orbit. Electrons are held within the nucleon's field of electromagnetic attraction and are not yet dragged into the nucleus. Electrons are also transitory objects. By either losing or gaining an electron to or from a neighbouring atom, each atom may shift from being neutrally charged to positively or negatively charged. This balance is part of the dynamic interplay of

[279] Knight, *Physics for Scientists and Engineers : A Strategic Approach : With Modern Physics*. p 1334, Figure 43.1.

materiality at the atomic scale. Atoms simultaneously repel each other (negative to negative and positive to positive) and attract (negative to positive and positive to negative) in a constant dance of electromagnetic activity. Similarly, solids and liquids are systems in which the attractive and repulsive forces between atoms are balanced; if you try to force the atoms together, the repulsive forces resist while if you try to pull them apart the attractive forces resist.[280]

Unlike the atom's diffuse electron cloud, the nucleus of an atom is comprised of tightly packed protons and neutrons, also being typically represented in graphic diagrams as spheres (Figure 144). The nucleus of an atom is incompressible. Its density is 100,000,000,000,000 times larger than familiar liquids and solids.[281] This means that if the nucleus of a single atom were expanded physically to have the same density as a familiar solid it would take up 100,000,000,000,000 times the amount of space it actually does. An approximate physical analogy with the everyday world is five semi-trailer loads of sand being compressed into a single grain of sand.[282] Within the extremely dense environment of the nucleus of the atom, protons and neutrons are held together by an incredibly strong and yet seemingly short-range force called the strong force. It is stronger than the repulsive (positive to positive) force of protons to each other within the nucleus and yet is considered short-range as electrons are not drawn into the nucleus, but rather remain within its orbit. Electrons are considered elementary particles, meaning as far as we know they have no internal structure.[283] Electrons are capable of emitting and absorbing photons, which are massless smaller particles of light also emitted by the nucleus of an atom. Photons influence the motion of electrons and visa-versa. The nucleus of an atom is capable of producing hundreds of further types of particles, many of which are thought to be elementary or to comprise even more particles.[284]

In a solid material, atoms are situated so close together that each atom vibrates around an equilibrium position, moving and yet unable to move freely inside the solid. The location of atoms can be predicted using the Crystallographer's Equation. In a liquid, the atoms are slightly less close, the bonds being weaker so the atoms are able to move more freely,

[280] Ibid. p. 490.
[281] Ibid.
[282] 500 cubic metres of sand, where 1 cubic metre of sand at approximately 18 billion grains and 1 semi-trailer holds 100 cubic metres.
[283] Robert Feynman, "Part 3 - Electrons and Their Interactions," in *Douglass Rob Memorial Lectures, University of Auckland*, ed. Florida State University (Vega Science Trust, 1979).
[284] "Part 4 - New Queries," in *Douglass Rob Memorial Lectures, University of Auckland*, ed. Florida State University (Vega Science Trust, 1979).

causing the fluid nature of a liquid.[285] In materials such as lithium, a metal, two electrons are securely engaged in close orbit of the nucleus, but a third, outer electron is so weakly attached it is almost swimming in a sea of equally weakly attached electrons with other neighbouring lithium atoms. The activity and transience of these electrons is responsible for the material's conductivity.[286] Our macroscopic perception and physical experience of the spacing between atoms, combined with the strength of bonds of attraction and repulsion within materials means that for us, materials vary from being solid, rigid and difficult to manipulate to more pliable or fluid. However, in all materials, every atom is vibrating or moving about within a dedicated space and is itself mostly comprised of empty space. A basic understanding of this kind of interplay and motion, combined with some knowledge about the relative scale of space involved between such tiny objects within the atom, helps us to imagine materials as being comprised of extremely large quantities of space, extremely tiny objects and high-speed activity, which is why physicists describe mass as energy. The range of pencil density prescribed by Sol Lewitt in his scribble drawings, does physically define the distribution of energy on the wall surface.

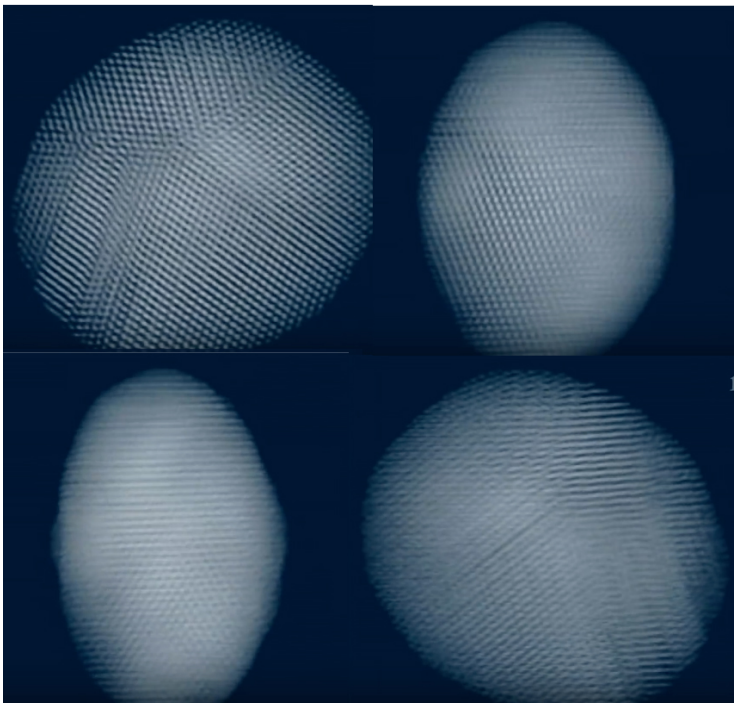


*Figure 147 Dislocation imaging using, transmission electron microscopy, TEM, showing 4 views mapping the location of atoms revealing dislocations in the lattice matrix of a single nanoparticle.*

[285] Knight, *Physics for Scientists and Engineers : A Strategic Approach : With Modern Physics*. p 481.
[286] Feynman, "Part 3 - Electrons and Their Interactions."

## *More imaging and imagining inside an atom*

Dislocations are a kind of anomaly in the crystal lattice structure of the arrangement of atoms. Dislocations can be observed by mapping individual atoms using Transmission Electron Microscopy (TEM). Three-dimensional imaging of dislocations within nanoparticles at atomic resolution is capable of producing images of dislocations from various angles. When viewed together, these images can be used to visually interpret the three-dimensional shape of a nanoparticle. The image in Figure 147 shows four different views of the same nanoparticle, estimated to contain approximately 27,000 atoms. The shape of the overall nanoparticle itself is clearly irregular. The dislocations are depicted as shifts in the structural alignment of the lattice pattern of atoms within the nanoparticle. Although subtle, dislocations can significantly change the properties of a material. TEM imaging shows visual similarities to images of some of the experimental models constructed by Bernal and Scott stacking ball bearings into variously shaped containers to observe points of contact and structural arrangements (Figure 148). However, the blur of TEM images conveys the ethereal quality of neighbouring electron clouds, which define the spaces that each atom occupies and vibrates within.

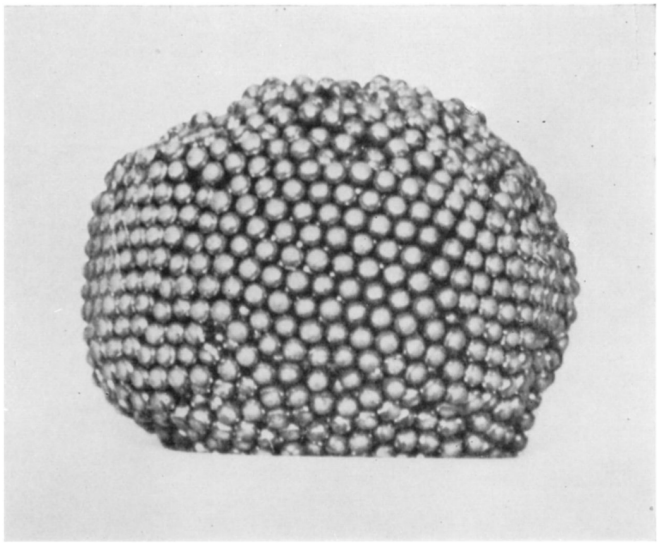


*Figure 148, Dislocations modelled by Bernal and Scott packing ball bearings into variously shaped containers, this image shows the arrangement of ball bearings packed within a balloon by Bernal.*[287]

TEM imaging directs beams of electrons through minute slivers of particles, using lenses and detectors to create images. See Figure 149. As the electrons interact with the electrons in the substances being observed, the process of achieving accurate images is complex.

[287] Bernal, "The Bakerian Lecture, 1962. The Structure of Liquids.", Figure 15.

Considering the scale relationships between the atomic objects (quanta) involved in the imaging, and that tiny particles of light (photons) change the trajectory of electrons inside an atom, makes it easier to understand how the process of observing might influence what is being observed. In the early 20th century it was discovered that not all atoms of the same element have the same mass.[288] Atoms can lose or gain an electron to become charged atoms (ions). When bombarded by protons, nucleons produce hundreds of different types of particles, including Fermions, Bosons, Baryons and Leptons, the list of particles expanding as more are being discovered. Many of these particles include more particles such as different types of quarks and the discovery of anti-particle equivalents. The concept of anti-matter further complicates the nature of the atomic realm. When anti-matter and matter of the same kind occupy the same space and time, they annihilate each other. Such activity also occurs inside the busy environment of a single atom where subatomic particles collide and interact with each other.

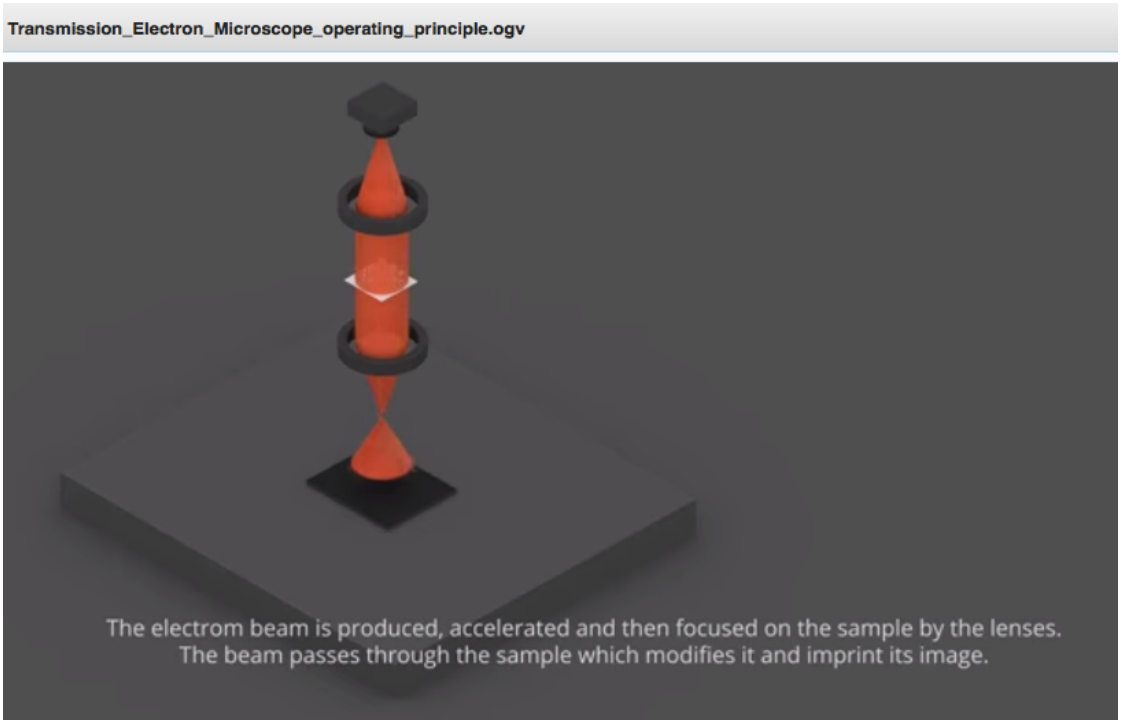



*Figure 149 Still from an animation, by Dafox, showing how TEM operates.*[289]

[288] Knight, *Physics for Scientists and Engineers : A Strategic Approach : With Modern Physics*. p1334.

[289] *Image courtesy Julien Bobroff and Frédéric Bouquet, Laboratoire de Physique des Solides, Université Paris Sud and CNRS) http://toutestquantique.fr/en/transmission-electron/*

It is not currently possible to observe electrons individually or as objects in ways that we are familiar with. Shining a light introduces photons, disturbing the motion of particles such as electrons which themselves emit photons, the process of observation and measuring influencing the results (the observer effect). Different types of particles are differentiated by mass, charge and spin, which are discovered by calculating how fast particles are travelling, how they interact with each other and how long they last. Such minute particles are observed, interpreted and predicted by setting up situations where attributes and behaviour can be detected, mapped and considered within time. The results are interpreted through unfamiliar processes of visualisation, by translating calculations. Any change in time allows for an interaction between an object and its environment, a physical shifting of materiality from one type of object or medium engaging with another. Everything is moving, intermingling and interconnected through forces, processes and time. No two instances of any single object are identical. A snapshot, if possible, of any instance of a single elementary particle would only reflect its current state in a unique moment. It is not entirely certain that particles currently considered elementary will not be observed to have an internal structure in the future through advances in technology and experiments.

Many elementary particles are considered to be massless and non-material, but mass is defined differently within theories of quantum mechanics.[290] Some elementary particles previously considered massless such as gluons are now considered to have mass as they change 'flavour' through collisions and interaction with other particles.[291] Photons are considered particles. They travel at the speed of light and according to quantum theory have energy and momentum, but no mass. In between collisions, particles are considered to be free. They are assumed to maintain their identity as particles, to exist as particles, only in-between collisions, collisions being events from which their velocities are derived.

[290] Erik Eriksen and Kjell Vøyenli, "The Classical and Relativistic Concepts of Mass," *Foundations of Physics* 6, no. 1 (1976). p 116.
[291] In Quantum physics 'flavour' refers to the type of species of elementary particles.

## *Uncertainty*

The Uncertainty Principle is a famous equation representing a theory of how to work with the unusual circumstances and behaviours of objects at a quantum scale. The principle provides a further explanation of the kind of uncertainty that arises through measuring things at the macroscopic scale of classical mechanics. The Uncertainty Principle is expressed as an equation that is applied to solve problems and develop theories in the quantum scale. It was conceived in the late 1920s by Werner Heisenberg, who concluded that the position and the speed of an object cannot both be measured exactly at the same time, even in theory. Heisenberg's equation enabled scientists to predict and test the behavior of atoms and the particles within atoms (quantum mechanics). Although at odds with many aspects of classical mechanics, the Uncertainty Principle was accepted because it worked in relation to calculating all kinds of practical things within the mysterious quantum environment.

The Uncertainty Principle was arrived at slowly, building on the work of many other physicists. Significant here was the work of James Maxwell, who in 1865 demonstrated that electric and magnetic fields travel through space at the speed of light as waves.[292] In 1900, Max Plank proposed that energy was emitted through electromagnetic radiation as discrete packets as quanta that are consistently proportional to the frequency of the wave.[293] In 1905, Einstein proposed that light similarly behaved as quanta.[294] These concepts, combined with the Uncertainty Principle, led to the development of the "Standard Model" of particle physics in the mid-1970s, this being the current model for 'Quantum Field Theory", incorporating weak and strong forces, the discovery of quarks and much more and which inform the work of scientists using the Large Hadron Collider at the Conseil Européen pour la Recherche Nucléaire (the European Council for Nuclear Research or CERN).[295] The Standard Model has provided continued success in experimental predictions and continues to prove to be theoretically self-consistent, although it is not considered a complete theory and does not incorporate some important work related to dark matter particles or the full theory of gravitation, these presenting a conceptual challenge to physicists internationally.

Quantisation is the procedure for constructing a quantum field theory starting from a classical field theory (macroscopic physics). It is the process of approximating a continuous signal of some kind, such as the speed of an elementary particle in between and beyond

[292] Referring to 'A dynamic theory of the electromagnetic field', by James Clerk Maxwell, 1865; and,
[293] Referring to 'On the Law of Distribution of Energy in the Normal Spectrum', Max Plank, 190, p 2.
[294] Referring to 'A dynamic theory of the electromagnetic field', by James Clerk Maxwell, 1865; and,
[295] https://home.cern/science/physics/standard-model

collisions using a set of discrete symbols or integer values. In practice, this requires dividing up something that is continuous or that varies — like the trajectory of an electron— into small, even pieces which can each be considered individually (more accurately than the whole) then reconsidered collectively to be able to make more accurate predictions about the whole. An equation is used to make calculations that approximate how the behaviour of an electron varies within small, defined and discrete periods. When considered collectively, these provide more accurate results than if the whole subject were considered in the same way. Each piece of information is considered to represent a discrete period where change occurs, an event, one piece being summarised and aligned with the next to find patterns and make further calculations to accurately predict the probability of an electron behaving in a particular way.

The smaller the pieces of information, the more accurate the results. By adding or subtracting these small periods as pieces of information, a better understanding of the whole is obtained. Each small piece is referred to and treated as an amplitude, like that of a wave, and as an event. An equation, the Wave Function, is used to work with amplitude waves and this equation is adjusted to make calculations about sub-atomic particles, including to predict the probability of their behaviour.[296]

Like the Crystallographer's Equation, the Wave Function serves as a practical prediction tool rather than providing a conclusive or uniting theory of nature. Through this research, I have been led to consider that if no thing in reality can be physically divided into exactly equal pieces, can a theory based on the concept of quantization address a theoretical truth about materiality? As Carlo Rovelli points out, 'science is not about certainty, it is about greater reliability of ideas.'[297] Nonetheless, the work of scientists using the Standard Model of quantum theory is incredibly accurate and reflected in the scientific effort to make new discoveries that enable ever more detailed predictions.

[296] Robert Feynman, "Part 2 - Fits of Reflection and Transmission- Quantum Behaviour," in *Douglass Rob Memorial Lectures, University of Auckland*, ed. Florida State University (Vega Science Trust, 1979).
[297] Carlo Rovelli, interview with Joe Gelonesi, radio national program: 'Carlo Rovelli and his quantum problem' on The Philosopher's Zone, June 2017

## *Connecting Art and Science*

How can we integrate the concepts of quantum mechanics into our perceptions of everyday objects? What significance do very small differences have for us and is it important to make these concepts broadly accessible?

The American experimental theatre stage director and playwright Robert Wilson argues, “To me, thinking is something I experience physically with the body. It is not just in the mind, but it is in the body that we know what we know.”[298] Understanding the behaviour of atoms and sub-atomic particles in scientifically controlled environments takes many years for students of physics to master, understanding being communicated via complex mathematics, largely excluding lay people from accessing them. The wall drawing projects can be used to conceptually demonstrate processes that occur at macroscopic and microscopic scale and perhaps also at some sub-atomic scale. The pattern of a drawing represents a stable structure in which variation is possible to a certain extent before its stability is forfeited. The position of each element in the pattern determines the position of all others to a certain extent and contributes to the shaping of and holding together of the pattern-form as an entity. The drawing structure and process aligns with and is analogous to how many different kinds of economic, ecological, physical and social structures operate.

## *Determinism, indeterminism and uncertainty*

As Bernal sought to remove his influence by introducing his ball and stick models of liquids, in developing instruction manuals to make the *Red Matter Wall Drawings,* I sought to take myself out of particular aspects of making an artwork, which creates a state of random variability within a system and within clear parameters. Participation in making the *Red Matter Wall Drawings* seeks to physically establish a situation where any calculation is the correct and desired outcome, the range of variation being a field of tolerance. Participants are asked to “guess half”, the probability of various drawing outcomes being predictable using statistical calculations.

[298] Cameron Woodhead, "Robert Wilson: Making Something out of Nothing," *The Age*, 19 August, 2019 2019.

When the same wall drawing is produced multiple times in the one location (within the same parameters) an 'average' version might be calculated. So too in the *Blue Wall Drawings* and *Whoosh #1*, where people are asked to experiment and can learn to steer the geometry, so testing the limits of the behaviour of the structure. What might an 'average version' look like? When repeated an enormous number of times, the 'average' version of all collective iterations might present as a symmetrical looking version of the drawing pattern, being a middle-of-the-road version. How many repetitions might that take? Could any drawing or any 'average' version of any number of drawings ever be exactly symmetrical and how long might it remain in such a state? Perhaps the averaging, or rounding-off, of multiple drawing outcomes, is not disimilar to how through time pebbles on a beach are rounded by the sea; planets are shaped by collective interstellar forces and the domain of an electron cloud may be calculated as occupying a particular location. Their shape and relative symmetry representing a current state of relative stability in ongoing processes, the collective variables and possibilities currently expressing as a holding together, as a form.

In computer science, mathematics and physics, a deterministic system is one that yields identical results when applied as a model, no randomness being involved in determining future states of the system. Quantum mechanics is not deterministic. Scientists can only determine probabilities. Professor Gian Paolo points out that, "It seems Einstein was wrong when he said, "god does not throw dice", in fact gambling led to the study of probability theory."[299] In probability theory and related fields, a stochastic process is a mathematical object used to introduce an element of randomness to create mathematical models to interpret phenomena that appear to vary in a random manner. Stochastic processes are applicable to various fields of science including biology, chemistry, ecology, neuroscience and physics and fields of engineering and technology such as cryptography and image and signal processing. Seemingly random changes in financial markets have motivated the extensive use of stochastic processes to predict market behaviour. All applications of stochastic processes are linked to the Brownian Motion problem of dealing with phenomena that result from randomly combined series of unpredictable and often unobservable events. Although each event may individually have a negligible effect on the outcome, collectively they contribute to and shape an observable final result.

[299] Wolfgang Paul and Jörg Baschnagel, Stochastic Processes from Physics to Finance, (Berlin ; New York: Springer,, 2013), SpringerLink http://dx.doi.org.ezp.lib.unimelb.edu.au/10.1007/978-3-319-00327-6 Connect to ebook (University of Melbourne only). Chapter 1, A first glimpse of stochastic processes, p1.

This research has led me to explore the uses of organic geometry as a visualisation tool applicable to many fields that seek to understand stochastic processes. Organic geometry is not intended to present an accurate visual portrayal of what happens at a microscopic or quantum scale, but to impart a conceptually and embodied sense of what happens at any scale when objects are formed, through morphogenesis, or when they are repeated through mass-production. Organic geometry represents the variation that occurs within the threshold of the material integrity of any entity at any scale and provides a format to understand these boundaries through self-directed exploration and practice, which can then be applied to any number of topics through free association.

## *Modelling reality*

Physics models reality using mathematics, but this is only one possible representational system.[300] During a conversation about the wall drawings geometry, the physicist Roger Rassool pointed out that the wall drawing process models uncertainty, suggesting that the instruction books and the drawing process were of potential use in conveying this concept to students of physics, who often find it difficult to accept the concept of uncertainty because their actual motivation in studying physics was to gain a sense of certainty about the nature of the phenomenal world.[301] Together, Roger and I planned to involve students in making drawing on the walls of the new Laby Centre at The University of Melbourne to coincide with its opening in 2012 (Figure 150).

[300] Professor, Gian Paolo Beretta Lecture 1, Tuesday, Jan.15, 2008, 9-11, MIT.
[301] University of Melbourne, Associate Professor, Roger Rassool. Areas of expertise are: Curriculum Teaching (VCE Physics curriculum, primary and secondary schools, science education, outreach) and Experimental Particle Physics (Particle and nuclear physics, nuclear particle photons, industrial applications of physics, instrumentation, silicon detectors, medical physics).

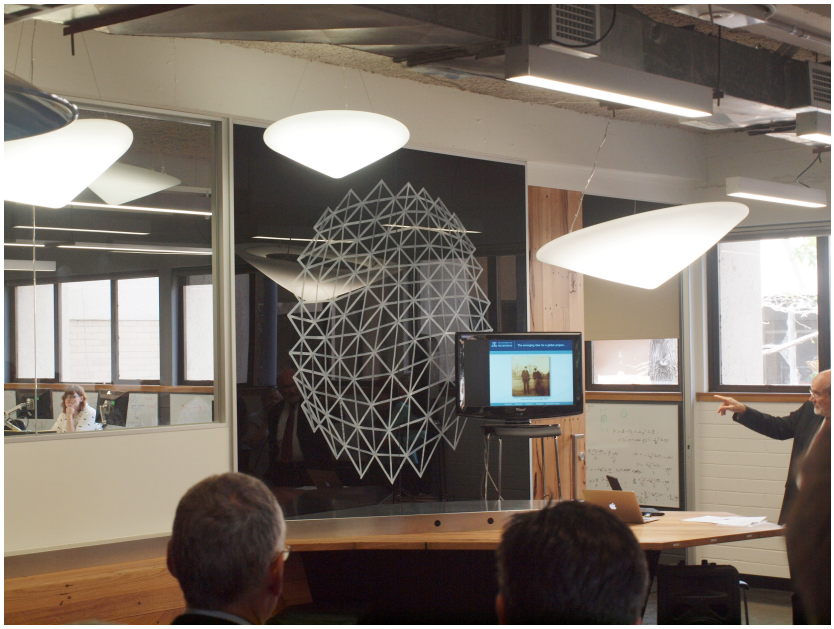


*Figure 150 White Black whiteboard drawing, Laby Centre, The University of Melbourne, 2012.*

An understanding of the relative scale of quantum space made me think how difficult it must have been to conduct experiments and make observations to deduce the structure of an atom. However, I still had no idea what this really meant in relation to the objects that surrounded me in the everyday world, so I decided to devise an experiment which would help translate the scale of an atom and molecules to something I'm familiar with through many everyday interactions. I chose water. I found a single drop of water, as a standard unit of measure, is considered to measure 0.05 ml and is comprised of approximately 1,700,000,000,000,000,000,000 water molecules.[302] A single drop of water is easy to imagine, but the number of water molecules in one included far too many zeros to comprehend. To translate the relationship, I found another small, familiar object to scale up 1,700,000,000,000,000,000,000 times to represent the mass of the number of water molecules in a drop of water. I chose the tip of a ballpoint pen, a sphere of about 1 mm in diameter, asking an engineering student, Laura Killian, for help with the calculations. Laura calculated that a spherically-shaped object equivalent to 1,700,000,000,000,000,000,000 ball point tips of 1 mm in diameter was a sphere about 11 kilometers in diameter. The tip of my pen in relation to the whole of the city and inner suburbs of Melbourne represented the relative scale of a single molecule of water to a single drop of water.

[302] https://socratic.org/questions/water-molecules-in-ml

*Figure 151, Image of a single drop of water.*[303]

Each water molecule is made up of three atoms bonded together, one hydrogen and two oxygen atoms. As with the water molecules in a drop of water, the scale of electrons and nuclei is similarly inconceivably tiny in relation to the space within a single atom, but now I can imagine this scale by thinking about looking at the tip of my pen and thinking about the span of Melbourne's inner suburbs. However, trying to then imagine the physical relationship of the hydrogen and oxygen atoms and all their sub-particles that comprise each water molecule and the spatial relations this encompasses only introduces a new conceptual challenge. Trying to imagine how such quantities of empty space can co-exist in one drop of water and reconcile this concept in relation to something as vast and physically tangible as the ocean, contradicts my lived, physical experience of the world, of space and matter. The kind of space involved in the quantum world seems incomprehensible, but this basic understanding of relative scale and the quantity of empty space elicits a type of imagining that exists in the realm of geometric abstraction.

## *Non-objective art, modelling quantum space*

The emergence of geometric abstraction in the art world coincided with major scientific revelations in the technical world, such as in the world of electro-magnetic waves, forces beyond the scope of human perception. The discovery of the degree of empty space in the quantum world was just becoming known as Kazemir Malevich made the major shift from cubism to Suprematism in 1915. This research saw me revisit the origins of non-objective art

[303] Image source, https://medium.com/predict/the-bold-research-shifting-the-data-storage-wold-50c721cabb76

in relation to my investigation into the dimensions of space in the quantum world, reconsidering the work of Malevich and other artists exploring form, colour and materials in relation to geometry and patternmaking to represent forces and realms beyond perceived reality.

Although I have intuitively been making art for more than 30 years, influenced by many things including the work of my peers, especially Melinda Harper, Gary Wilson, John Nixon, Rose Nolan and Stephen Bram, at its basis was always a quest to explore possibilities of the kind introduced by the discovery of the quantum world. To learn there was a distinct historical relationship between quantum physics and non-objective art was important, but independently establishing a need to investigate the scale relationships of matter has made this connection far more real for me. For example, I understand how my wall drawings projects and development of the idea of organic geometry serve as a type of emergent behaviour reflecting, like a by-product, the work of physicists who discovered the quantum world just over 100 years ago.

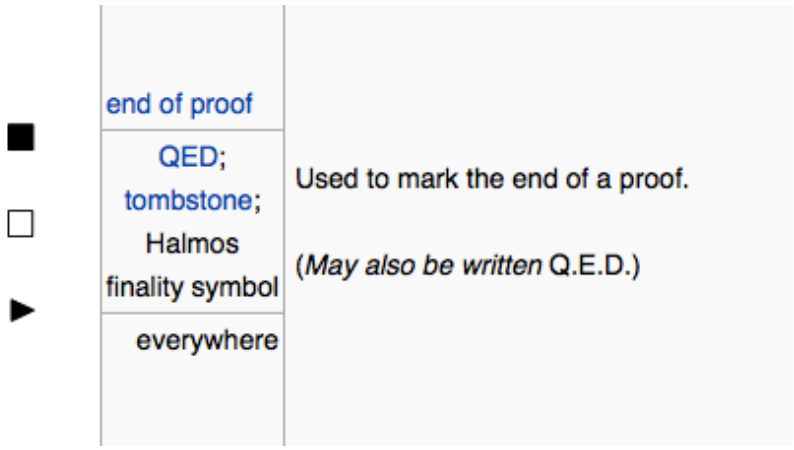
*Figure 152 Kazimir Malevich, Black Square, 1915.*[304]

Exposed to work of the Russian avant-garde at a formative time, I became increasingly involved in its conceptual, creative and critical possibilities. Abstraction took over my practice in 1982. By 1985, I was focusing completely on geometric abstraction, only to further reduce the range of my work in 1987 to concentrate on diagonal lines and the diamond-shape.

Through this process organic geometry emerged and evolved by finding new forms of relevance and application in this research, beginning with the question…

*How far down in scale does the concept of physical asymmetry and difference as expressed through the wall drawings hold true?*

…to explore relations between art and science. The nature of geometric abstraction is inclusive. It does not require traditional artistic skills. It relies on practising working with colour, form and space and can be practiced by anyone using everyday materials. As developed by Malevich, non-objective art does not represent any specific object, figure or scene. It can be used to express personal feelings and experiences or as a tool to explore forces and realms beyond perceived reality.




[304] Image source: Kazimir Malevich, 1915, Black Suprematic Square, oil on linen canvas, 79.5 x 79.5 cm, Tretyakov Gallery, Moscow.jpg

*Figure 153 A black square was first used as a mathematical symbol representing 'end of proof' by mathematician Paul Halmos in the 1950s.*[305]

$$\Delta\chi\Delta\rho \geq \frac{\hbar}{2}$$

*Figure 154 Uncertainty Principle.*

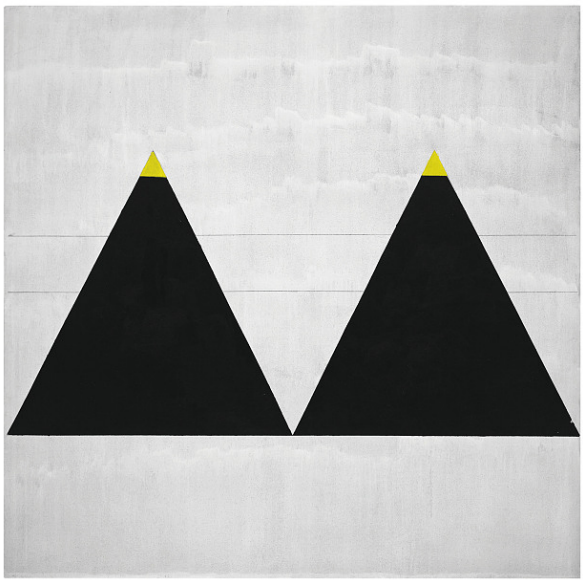


*Figure 155 Agnes Martin, untitled #1, 2003*[306]

In materials science, the nature or characteristics of any particular material is determined as being dependent upon the relationship between four, defined, influencing factors — structure, property, performance and processing — this relationship is known as the Materials Design Paradigm. The design, discovery of new materials involves understanding and exploring relationships between the structure, property, performance and processing of a material, as each of these aspects effects the nature or character of the material. The

[305] Paul R. Halmos, *I Want to Be a Mathematician : An Automathography*.
[306] Fondation Louis Vuitton, Paris. © 2015 Agnes Martin / ARS, New York.

materials design paradigm is typically represented visually and symbolically as a tetrahedron. See Figure 156. This diagrammatic model with the central focus of characterisation could easily be applied to the system of making wall drawings using organic geometry as the 'character', or nature, of each drawing outcome is dependent on four influencing factors: the instruction manual, the materials, the place in which a drawing is made and the people who make the drawing. See Figure 157. Although beyond the scope of this thesis, it seems plausible the premise of instruction-based drawings may be used and applied in some way by experts in the field of materials science to help visualise relationships between elements using the materials design paradigm. For example, to demonstrate or explain some types of spatial disposition of atoms in amorphous materials.

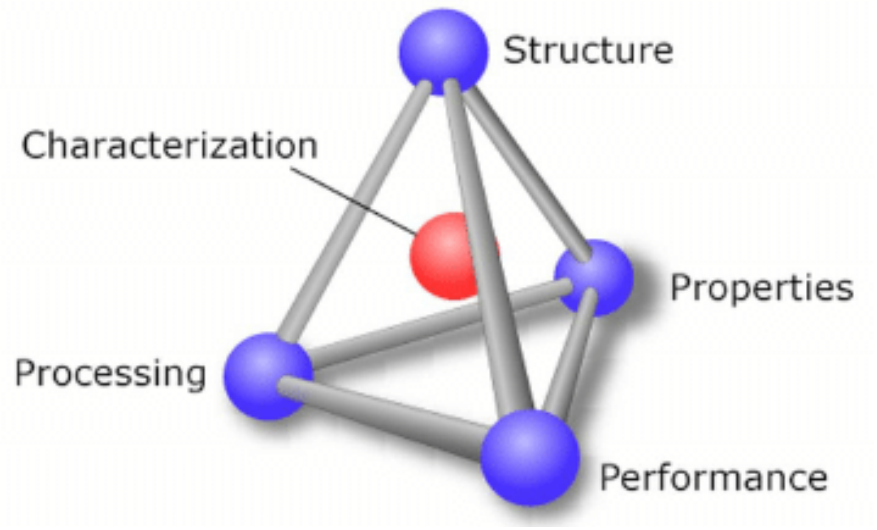



*Figure 156 'Materials Science Tetrahedron showing the role of characterization in the relationship between processing, performance, properties, and structure.'* [307]

[307] Fresh Fuel Characterization of U-Mo Alloys - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/Figure/Materials-Science-Tetrahedron-showing-the-role-of-characterization-in-the-relationship_fig1_255205069

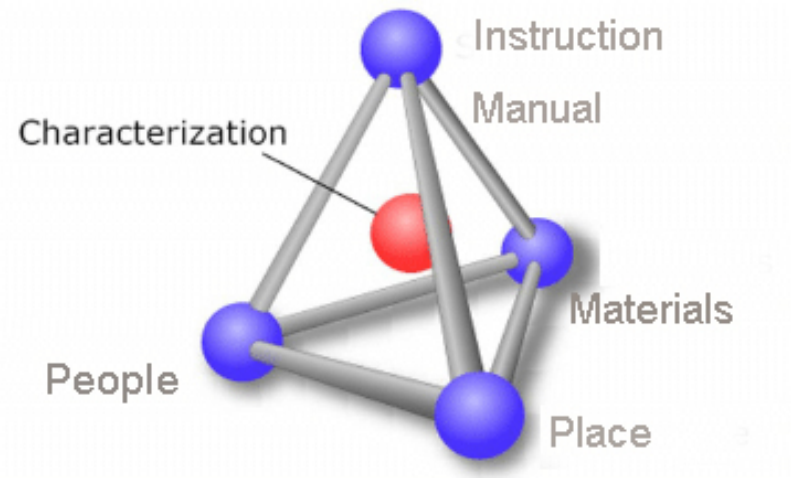



*Figure 157 symbolic visual representations of the materials design paradigm altered by the artist and used to describe a instruction-based wall drawing artwork paradigm.*

Through the pairing of concepts and themes about the creation of anomalies via processes of morphogenesis, *Whoosh #1*, and all previous drawing series, provide means of access to the production of formalist art which can be used demonstrate knowledge and perceptions through analogy-making. Chapter Eight explores this concept further, it discusses in detail how the principles of organic geometry and geometric abstraction can be used to develop new tools for scientists to discuss their research. This is exemplified through their application to the production of an exhibition about the critically endangered bioregion of the Victorian Volcanic Plains. It also demonstrates how organic geometry might be applied to physical examples and data to visualise complex relationships through this same ecological topic.

# CHAPTER 8
# TOOLS OF VISUALISATION

Chapter Eight addresses the overarching research question,

*How can geometric abstraction contribute to supporting the preservation of biodiversity and sustainable design?*

Chapter Eight describes how my long engagement with geometric abstraction and the principles of ecomuseology combined to develop two immersive, participatory site responsive exhibitions about specific environments:

- *Pobblebonk* (2005) and
- *Volcano Dreaming* (2011).

These exhibitions are used by teachers, scientists and others as education tools in delivering information on biological and cultural diversity and knowledge. Chapter Eight focuses on *Volcano Dreaming* and its presentation of information on the critically endangered Natural Temperate Grasslands of the Victorian Volcanic Plains (VVP) to the west of Melbourne.[308]

The VVP biosphere is a fragile complex structure, the conservation of which requires strategic consideration as a whole as well as in terms of its parts. Chapter Eight outlines the current approaches to this process of conservation, explaining why some approaches are inappropriate for a highly fragmented system on the brink of extinction. To enable recovery of the VVP as a system and to avoid its demise, it is a matter of urgency to care for, protect and reconnect all existing remnant parts of the VVP, no matter how small or isolated. Through the production of *Volcano Dreaming*, I began to collaborate with many people who were working to prevent the extinction of the VVP, literally from the ground up, indicating to me the importance of employing co-ordinated, connected and inclusive management

[308] T*he Natural Temperate Grasslands of the Victorian Volcanic Plains* were listed as 'critically endangered' by the Victorian State Government, Department of Sustainability and the Environment in 2008, following recommendations by,Threatened Species Scientific Committee Associate Professor Robert J.S. Beeton AM FEIANZ Chair, "Natural Temperate Grassland of the Victorian Volcanic Plain Listing Advice," ed. Department of Environment and Energy Australian Government (Canberra: Australian Government,, 2008). http://www.environment.gov.au/biodiversity/threatened/communities/pubs/42-listing-advice.pdf

methods to this end, a strategy for this being a major outcome of this research. Chapter Six explained how my instruction-based wall drawings can be used as a tool to explore the behaviour of things by making analogies. Chapter Eight demonstrates how organic geometry can be applied to the problem of the critically endangered biosphere of the VVP.

The geometry of my wall drawing projects demonstrates the dynamics of interconnectivity in linear matrix systems. It uses the geometry of a flexible matrix to illustrate how a small shift in the key structural points of a linear grid produces different outcomes. It can also be used to demonstrate how a small shift in key structural points of a system break the interconnectivity of its internal structure resulting in fragmentation of the pattern as a whole. Figure 158 shows the disruptive effect of a shift in location of a single key point on the internal pattern produces an in-cohesive version of a drawing, the following sequence of drawings identifying where the pattern has been disturbed and how by shifting elements of the internal pattern cohesion is restored.

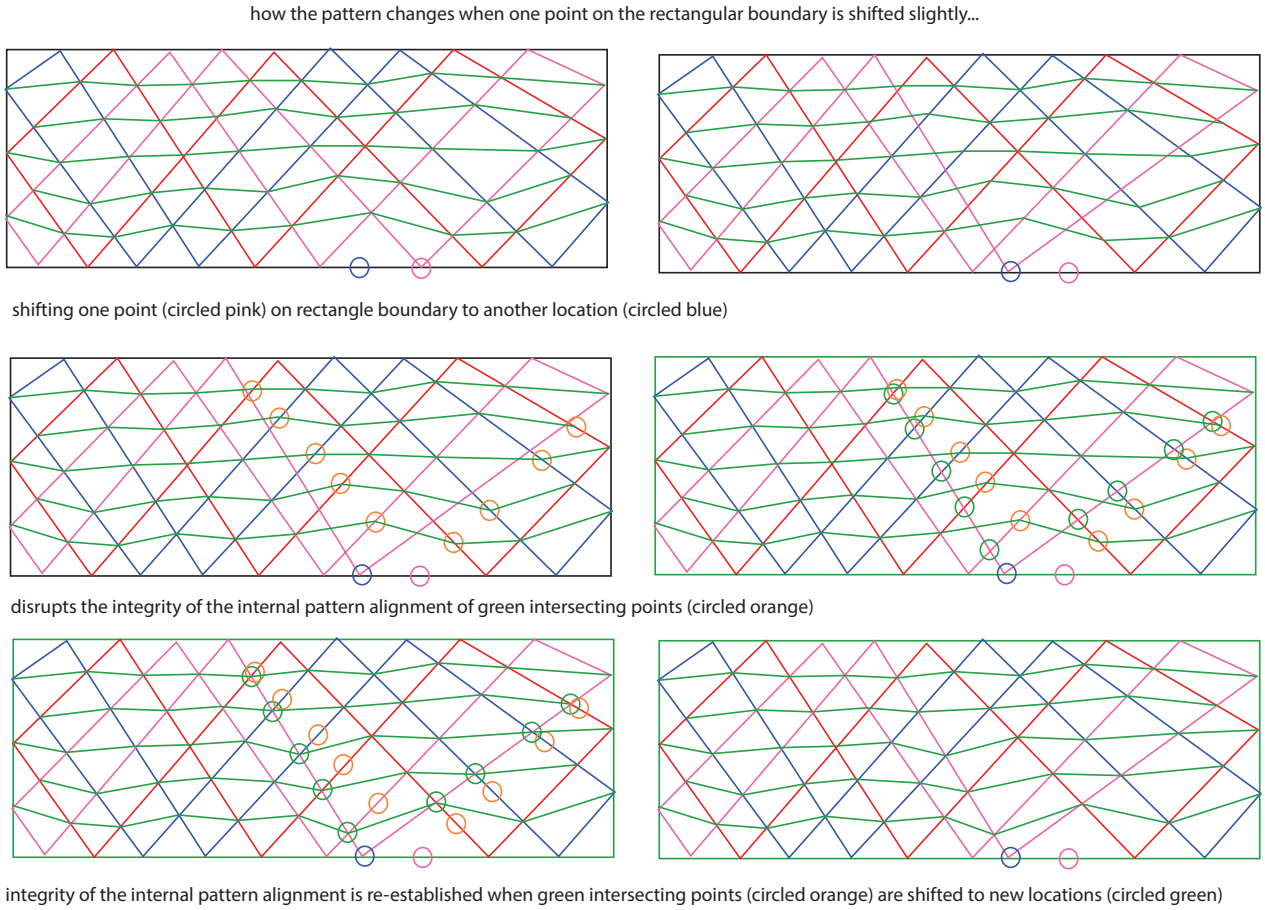



*Figure 158*

Since the production of *Volcano Dreaming*, during this research I sort to become more closely involved with several groups which have independently self-established to redress ongoing conservation inaction regarding the VVP.[309] My primary involvement remains helping to facilitate their use of *Volcano Dreaming,* however, as I became more closely involved in one of these groups, the Grassy Plains Network, through regularly attending meetings and seminars I developed an interest in better understanding the current, underlying political issues which seemed to have shifted since 2011, when *Volcano Dreaming* was completed. I began to research the structures impeding a Recovery Plan for the VVP which led to me to consider associated repercussions in relation to the processes and methods used to collect and assess data using Geographic Information Systems. I noticed that the particular geometry of the wall drawing artworks might be used to examine and interpret physical environments as,

(1) a kind of topographic overlay and
(2) a kind of graphic tool to visualise and compare data.

The wave drawing *Whoosh,* developed through this research, can be constructed within any physical shape, its geometry being able to be overlaid topographically on physical environments of any shape and scale forming an irregular cellular grid, a flexible matrix. As the major outcome of this research, Chapter Eight examines the use of a flexible cellular-grid as an additional topographical tool in visualising key points of interconnectivity requiring mapping, protection, monitoring and strategic restoration in the VVP. Through this research, I became aware of the importance to scientists of visualisation tools that could be customised to specific circumstances and that my system of organic geometry had potential to be used by scientists as a graphic tool to visualise the comparison of data.

Chapter Seven compared the instruction-based drawings to the Materials Design paradigm both systems describing the nature of an outcome (drawing or material) as the manifestation of interrelationships between four influencing aspects (Figure 156-157). Figure 156, representing the Materials Design paradigm, is repeated here (Figure 159). Both systems can also be used to understand the nature of something The *Red Matter* and *Black O* drawings are produced by plotting a particular number of key structural points along the parameters of a rectangle or a circle, while the wave drawings are used independent of a boundary to form new random shapes. The drawing outcomes present a geometric, visual interpretation of variable elements presented as a cohesive linear pattern with distinct form

[309] Namely, the Victorian Volcanic Plains Biosphere Committee, and The Grassy Plains Network.

or characterisation. The key structural points of the drawings are variable and can be determined in various ways, such as by plotting data. In Figure 160, the four sides of a rectangle have been used to plot specific data. Each side represents a range of values in one of four variables (wind speed, UV index, humidity and temperature) with the points plotted representing specific times of the day. By drawing lines according to the rules of the organic geometric drawings, the internal pattern of the drawing visually characterises relationships between the four sets of data, representing the "shape" of 6 October 2019 in Melbourne.

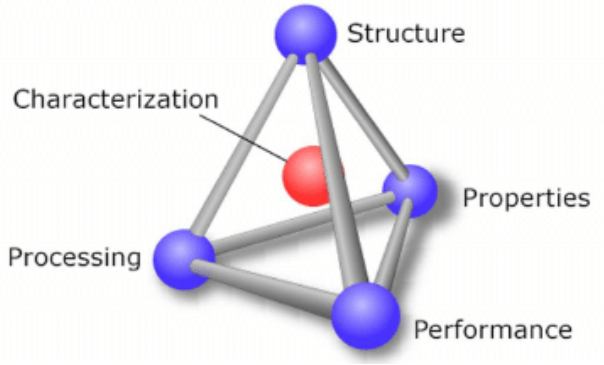



*Figure 159 "Materials Science Tetrahedron."* [310]

This system can be used to observe and compare changes in data over time, Figures 160 and 161 represent the same data recorded for 6 October 2019 and 7 October 2019 in Melbourne respectively. The visual differences between the various characterisations can be readily recognised by most people through visual pre-attentive processing skills; the ability to recognise differences in colour, line length, orientation and shape, these being typically acquired and developed by most people through subconscious accumulation of information gathered by engaging with the world. Customisable visualisation tools enable experts to communicate across disciplines and with lay people to understand, discuss and resolve ideas and issues. The following sections describes how organic geometry has been used to develop a tool of visualisation for the VVP as the exhibition *Volcano Dreaming* and how it could be used to help develop policy and practical strategies to restore the VVP by enabling better understanding of the significance of connectivity in this aim for diverse stakeholders.

[310] Image source: Fresh Fuel Characterization of U-Mo Alloys - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Materials-Science-Tetrahedron-showing-the-role-of-characterization-in-the-relationship_fig1_255205069

Through the process of making drawings, organic geometry shows how a small shift within tight parameters can result in significant outcomes, an analogy that can be applied to the issues of the VVP in several ways.

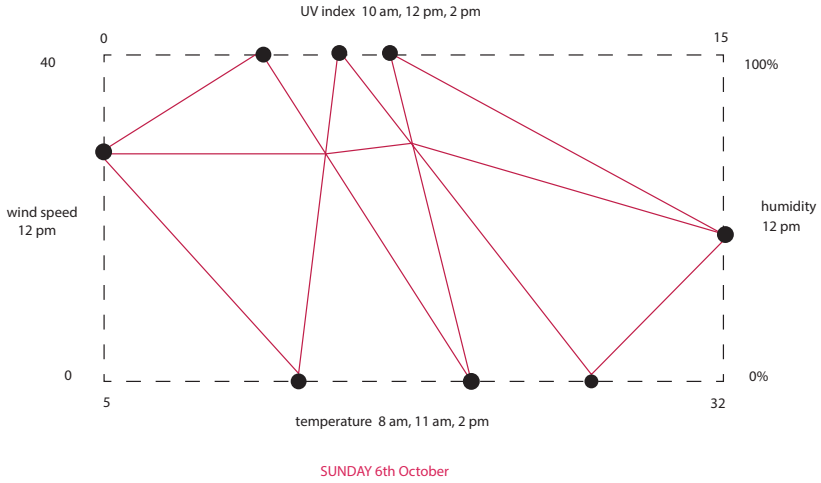



*Figure 160*

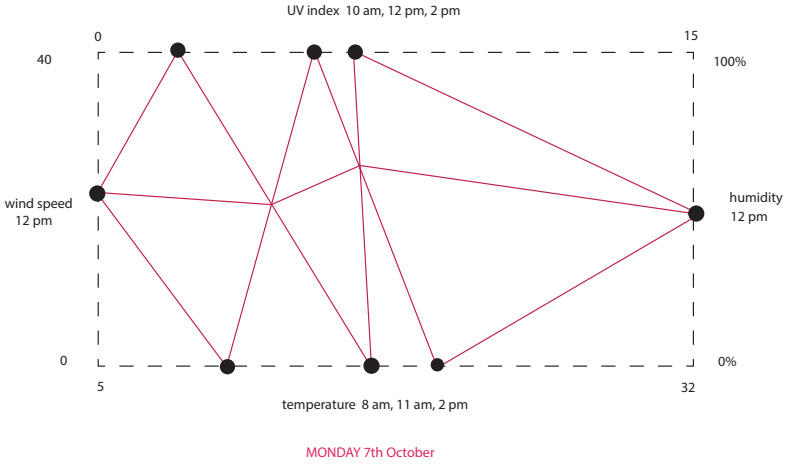



*Figure 161*

## *Making of Volcano Dreaming*

From 2009 to 2011, I worked with Peter Haffenden to research, design and produce *Volcano Dreaming*, a portable educational display on the remnant plant and animal species of the VVP. The development of *Volcano Dreaming* presents a case study for this research in

combining ecomuseum principles with contemporary art processes of conceptualisation and production. *Volcano Dreaming* was a multidisciplinary project linking research, knowledge, conceptualisations and people's stories to actions. I designed the exhibition format drawing on my arts practice, specifically the interpretation and manipulation of space to convey ideas through visual and immersive experience. The VVP covers around 10% of the state of Victoria to the west and south west of Melbourne, partially crossing into the state of South Australia to include Mt Gambier approximately 400 km away.[311] This is an area of c.23,000 square kilometres and includes more than 400 volcanos of various ages, the region being volcanically active for more than 4.5 million years (Figure 163). Most of these volcanos are extinct, but some are dormant, with eruptions occurring approximately every 10,000 years, the most recent eruption occurring c.5,000 years ago.[312] Volcanic events are documented in the stories of the aboriginal nations living in the VPP.[313]

*Figure 162 View from atop a volcano in south-western Victoria of the VVP.*

[311] Federally the VVP is known as the bioregion, Southern Volcanic Plain, SVP, Interim Biogeographic Regionalisation for Australia (IBRA), Version 7, 2016
[312] Jozua van Otterloo https://theconversation.com/australias-volcanic-history-is-a-lot-more-recent-than-you-think-58766
[313] Alan N. Williams, "A New Population Curve for Prehistoric Australia," *Proceedings of the Royal Society B: Biological Sciences* Volume 280, , no. Issue 1761 (2013). This paper presents a new reconstruction of prehistoric population of Australia for the last 50,000 years using the most comprehensive radiocarbon database currently available.

In 2011, it was estimated that less than 1% remained of the indigenous species present before European invasion.[314] There is far less remaining of the particular species groupings unique to the VPP, some estimates being less than 0.01% remains, which is less than 23 square kilometres scattered across an area encompassing approximately 23,000 kilometres.[315] The VVP is arguably Australia's most threatened ecosystem. Conveying exactly how and why that is the case is both complex and urgent.[316] As a highly complex interconnected system it could be argued that it is practically extinct, except for isolated patches of remnant stands. The VPP was managed by Koorie people for more than 40,000 years, but destroyed by invading Europeans in less than 100 years.

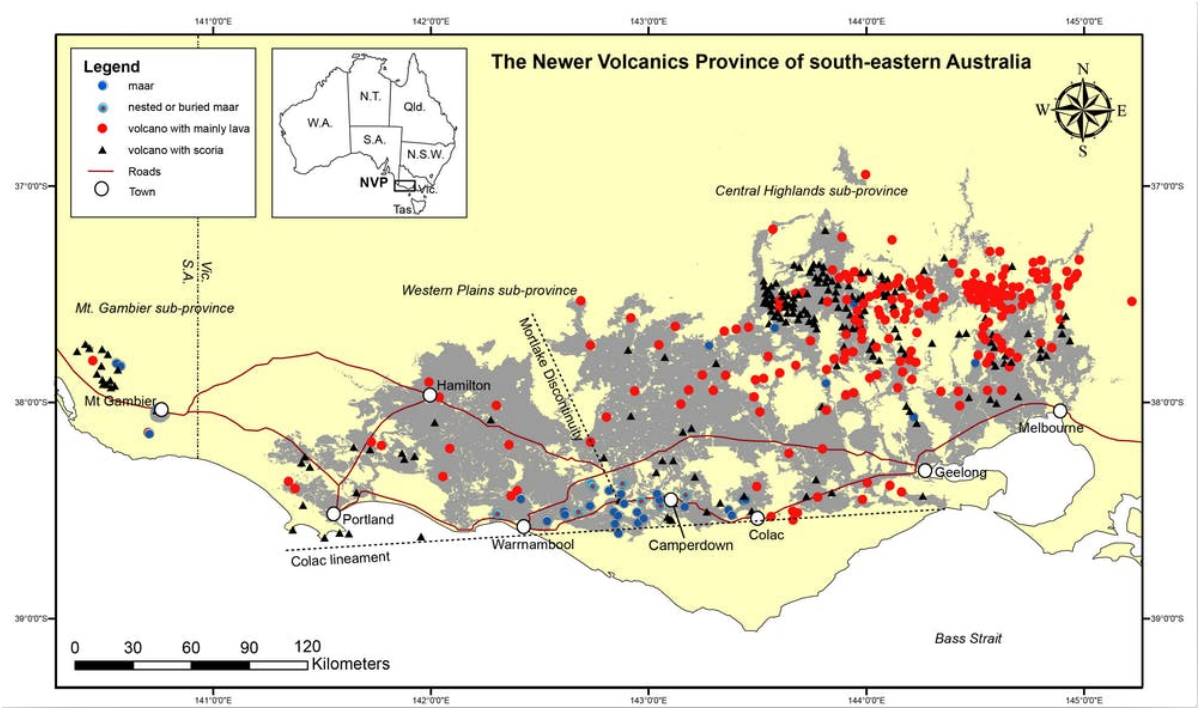



*Figure 163 VVP and volcano distribution, Jozua Van Otterloon, Monash University.*

[314] This figure is cited in a number of reports and publications, one example by greening Australia can be found here: https://www.greeningaustralia.org.au/projects/victorian-volcanic-plains/

[315] Insufficient mapping and data makes it impossible to confirm this figure which was consistently estimated to us by many experts in the field.

[316] The Natural Temperate Grasslands of the Victorian Volcanic Plains, was listed as 'critically endangered' June, 2008. Source: Australian Government, Department of Environment and Energy, Species Profile and Threats Database, (SPRAT), Natural Temperate Grasslands of the Victorian Volcanic Plain, EPBC. See legal status and documents, 2019. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=42

Through the production of *Volcano Dreaming*, Haffenden and I became part of a network of people working on the interpretation, preservation and restoration of the biodiversity of the VVP. This community includes individuals and groups working within government departments, universities, businesses and research units. *Volcano Dreaming* was designed specifically as a visual tool for use by these people to help them convey their research and convey the significance of the bioregion to the public, stakeholders and funding bodies.

Some of these people contributed to the CSIRO publication, *Land of Sweeping Plains: Managing and Restoring the Native Grasslands of South-Eastern Australia* in which *Volcano Dreaming* appears as a fold-out centre section, this including an interview with Peter Haffenden and myself by Dr. Karen Reid (2015).[317]

The ecological communities of the VVP are in a state of severe fragmentation. The communities of people working to save them are also fragmented, with people often working in isolation, unaware of what each other is doing. *Volcano Dreaming* was developed as a tool to address this fragmentation. Eight copies of the exhibition travel constantly throughout the VVP region in Victoria, each are available for loan by schools, libraries and community organisations.[318]

## The creation and destruction of the grasslands of the VVP

From around 4.5 million years ago, volcanic activity, shaped the landscape of the VVP, forming rivers and valleys as well as defining its ecology. The erosion of various types of solidified lava combined with volcanic ash, organic material and water slowly formed the specific soil types of the VVP. These soils enabled particular species of vegetation to develop, influencing the evolution of insects and animals to form a unique bioregion. Several dominant species of tussock grasses, or poa evolved on the Plain, forming the primary grassland-matrix as a ground-cover.[319] In between the tussock plants, herbs and tuber

[317] Williams et al., *Land of Sweeping Plains : Managing and Restoring the Native Grasslands of South-Eastern Australia*; ibid.provides a comprehensive account of the difficulties and urgency of conveying the significance of the biodiversity of the VVP. The publication includes an image of Volcano Dreaming as a fold-out central-section in the book between pp 194 and 195, interview by Dr. Karen Reid, Landscape Sociology Group, Department of Resource Management & Geography, University of Melbourne.
[318] In 2019 copies of Volcano Dreaming are held at: Melbourne's Living Museum of the West; Melton City Council; Hume City Council; City of Moonee Valley; Glenelg Hopkins Catchment Management Authority; Hamilton Field Naturalists (half scale events banner); Iramoo Sustainable Community Centre, St Albans campus, Victoria University; Ecolinc, State Secondary education Centre Bacchus Marsh.
[319] For example, *Themada triandra*, known locally in Australia as *Kangaroo Grass* is one of many species of the grass family Poaceae (grasses) found on the VVP.

species known as ‘forbs’ once flourished, being cultivated en-masse by the Aboriginal people as a stable source of food and medicine.

Aboriginal people developed a systematic fire-stick farming regime and other techniques to shape the VVP over more than 40,000 years. A key method involved setting fires in the right places at the right time. With exact seasonal timing and controlled burn-temperatures, dead inter-tussock-material, which otherwise accumulates at the base of each plant, was strategically removed opening up spaces for herbs and tuber plant-foods to grow.

Rather than destroying the plants, fires were set at the right time and temperature to replenish perennial Kangaroo and Wallaby grasses and introduce ash to fertilise the soil. Once burnt, tussock grasses produce new green-shoots and tender leaves, which attracted grazing mammals. Through fire-farming practices, Aboriginal people steered the activity of these animals to specific locations for harvesting. The Aboriginal people shaped and managed the ecosystem of the VVP as an efficient, productive and life-sustaining resource, as a farm. In many places, the people systematically removed young trees, leaving large older trees to provide shelter and habitat for varied species. They shaped narrow forests leading to water sources to provide themselves with cover and enable easy hunting of animals seeking water. Fire-farming practices led to the VVP having a “park” or “estate-like” appearance, described by early European explorers such as Major Thomas Mitchell, as having large trees carefully situated to provide shelter within a richly flourishing grassland.[320]

*Figure 164 Volcano Dreaming Panel 4 (detail) showing a burnt tussock grass with new green shoots.*

[320] Thomas Mitchell, *Three Expeditions into the Interior of Eastern Australia : With Descriptions of the Recently Explored Region of Australia Felix and of the Present Colony of New South Wales*, 2nd ed., 2 vols. (London: T. & W. Boone, 1839).

*Figure 165 detail from the exhibition Volcano Dreaming (panel 4) showing fire maintenance of grasslands is carried out by both DSE and CFA. Note, the person carrying the flame is a former Koorie Garden team member from MLMW now working for Parks Victoria.*

*Figure 166, Section detail, Volcano Dreaming panels 5-7.*

The single biggest factor in the early degradation of the natural ecology of the Victorian Volcanic Plains was the introduction of sheep to Victoria in the 1830s. The introduction of sheep influencing the development of Melbourne as a major Australian city. The introduction of sheep followed early glowing reports of fabulous pasture for sheep by many early European explorers. John Batman described the land as “the most beautiful sheep pasturage I ever saw in my life”. New South Wales Surveyor General and explorer Major Thomas Mitchell, who came overland from Sydney in 1836, called the grasslands of

Western Victoria Australia Felix, which meant Fortunate Australia. European invasion of the region coincided with a boom in the wool industry in Europe and the lack of any real barriers to the incoming settlers grabbing the land. Within six years from 1835 more than a million sheep had been brought into Victoria by sea from Tasmania and overland from New South Wales, by men who quickly established large areas for their flocks to graze over most of the grasslands. Ten years later, by 1851, there were six million sheep grazing on the Victorian Volcanic Plains. [321]

*Figure 167 detail, Volcano Dreaming panel 5.*

"The introduction of the sheep displaced established ecological processes and disrupted the land management techniques of millenia. The hard hooves of introduced sheep, cattle and horses replaced the soft pads of the local mammals. The sheep and cattle took a liking to some of the local tubers and quickly wiped out plants like Myrnong (yam daisy) that had flourished on the plains for many thousands of years and which were a staple food for the Aboriginal tribes who lived there."[322] "Major Thomas Mitchell describes lines of women walking across the landscape digging for roots, which we now know to be the Myrnong, a staple food much like our potato, but with a slightly ginger flavour. Studies have shown that Aboriginal groups or tribes used hundreds of different plants for food, medicine or tools.

[321] Panel 5; 'Sheep, have you any wool?' text by Peter Haffenden, Kerrie Poliness, *Volcano Dreaming, 2011*.
[322] Ibid.'

Tubers from many plants such as orchids, lilies and daisies were eaten and probably cultivated in an ongoing sustainable garden. More recent studies have indicated the existence of an 8,000 year-old aquaculture system in south west Victoria, used to harvest eels; some researchers identifying this system as the oldest aquaculture system in the world. It covered approximately 100 square kilometres around the Lake Condah region in the Western District, which points to a settled population rather than one that ranged across a defined territory."[323]

*Figure 168 Volcano Dreaming (Panel 7) showing inter-tussock zone and yam daisy with tubers.*

Much of the indigenous plants and animals of the VVP were rapidly destroyed in the late 1800s, through the introduction of sheep and incompatible European farming practices, enforced through conflict with the Aboriginal people during the period of the Eumeralla Wars.[324] European settlement displaced the Aboriginal people from their tribal lands, forcing them on to missions where their languages and complex cultural processes and tribal lore were prohibited, Government-led programs of the forced occupation of land and cultural assimilation in Victoria and Tasmania constituting a form of genocide.[325] Aboriginal people did not gain citizenship of Australia until 1968, children were still being separated from

[323] Ibid. Panel 6; 'Eumeralla Wars', text by Peter Haffenden, Kerrie Poliness, *Volcano Dreaming, 2011*.
[324] The Eumeralla Wars are named by the Gundijtmara tribes, near Mount Eccles, to describe a 20-year period of violent conflict during the 1800s.
[325] Still Here: a brief history of Aboriginal people in Melbourne's west, 1996

families in 1973 as a part of ongoing government-led assimilation practices.[326] With the occupation of their pastures and the destruction of local plants and animals, Aboriginal people resorted to taking sheep as a source of protein, leading some farmers to put out bags of flour laced with arsenic to stop this.[327] Knowledge about the complexities of the Aboriginal land management and farming system has recently become better known through the work of scholars such as Bill Gammage and Bruce Pascoe.[328]

*Relations between the Settlers and the Aborigines – The Settlers Remedy*
*W.A. Cawthorne (1844)*
*Illustrated Melbourne Post 27 July 1866 p308*
*'Conflicts on the Rufus' S.A. Murray Case Mitchell Library, Sydney*

*Figure 169 Detail, image from MLMW exhibition, Still Here, panel 3 "Invasion" (1996).*

[326] Although the federal government officially apologised for the practice of removing children from their families, broader acknowledgement the processes of genocide have not been acknowledged and Aboriginal people continue to struggle to deal with of the long-term effects of these processes and the lack of official acknowledgement.
[327] Conversation with an Aboriginal ranger at Werribee Park Mansion, 2007
[328] For example, especially through the popular publications: The Biggest Estate on Earth, by Bill Gammage (2012) and Dark Emu, black seeds agriculture or accident? (Aboriginal Australia and the Birth of Agriculture), by Bruce Pascoe (2014).

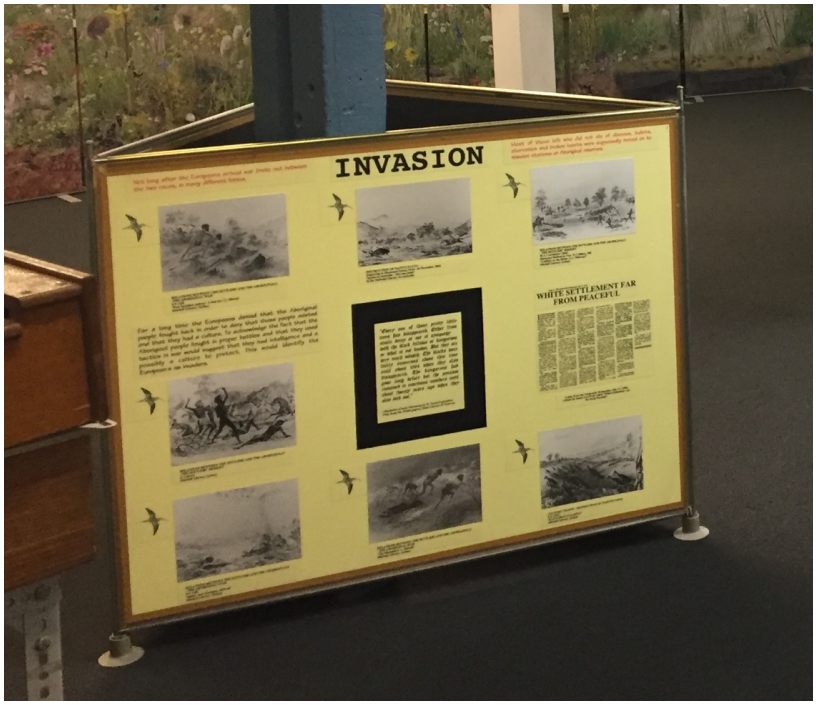



*Figure 170 Panel titled "invasion" from MLMW exhibition Still Here (1996).*

*Relations between the Settlers and the Aborigines – The Aboriginal War*
*'The Marauders' c. 1864-63*
*Mitchell Library, Sydney*

*Figure 171 Detail, image from MLMW exhibition, Still Here, panel 3 "Invasion" (1996).*

## VVP: a critically endangered bioregion

In the 1990s, the Interim Biogeographic Regionalisation of Australia (IBRA) began to map Australia's bioregions in order to plan and prioritise their protection through a national reserve system. Bioregions are relatively large areas of land defined by broad, physical natural features and environmental processes such as climate and geology. Currently, there are 89 recognised bioregions in Australia, the VVP being one of these.[329] The VVP is currently under-represented as a bioregion and remains within the most neglected category with less than 10% of the bioregion receiving protection within the federal reserve system.[330] The dark-brown regions on Figures 172 and 173 indicate the Plains Grassland and Plains Woodlands group of ecological communities of the VVP bioregion. Comparing these two maps indicates the scale of damage to native vegetation since European invasion. Figure 172 estimates the extent of these ecological communities pre-1750. Figure 173 depicts the extent of reduction and fragmentation in 2005.

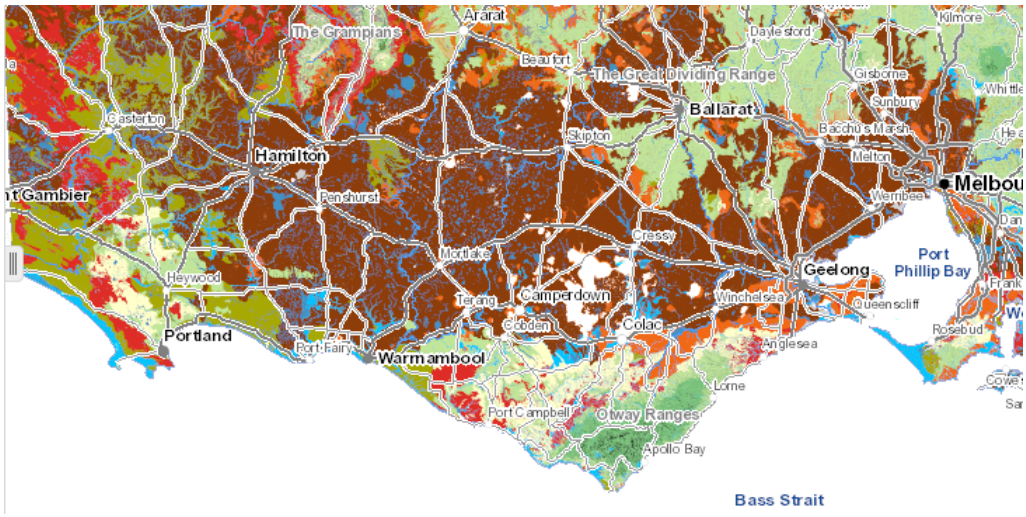



*Figure 172 Map by Department of Environment detailing estimation of the scope of the Plains Wood and Grassland ecological communities pre-1750, the dark brown area also representing the general bioregion of the VVP.*[331]

[329] *Interim Biogeographic Regionalisation of Australia, IBRA,* is 'Interim' because information is constantly updated and therefore the number and name of bioregions can change according to new data and scientific analysis.
[330] National Reserves System, Collaborative Australia Protected Areas Database, 2016. http://www.environment.gov.au/system/files/pages/3a086119-5ec2-4bf1-9889-136376c5bd25/files/ibra-underrep-capad-2016.pdf
[331] Image extracted by applying filters using the 'Nature Kit' mapping tools produced by Department of Land, Water and Planning, Department of Environment, Land, Water and Planning, State Government of Victoria. Filter used: pre-1750 EVCs. http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit

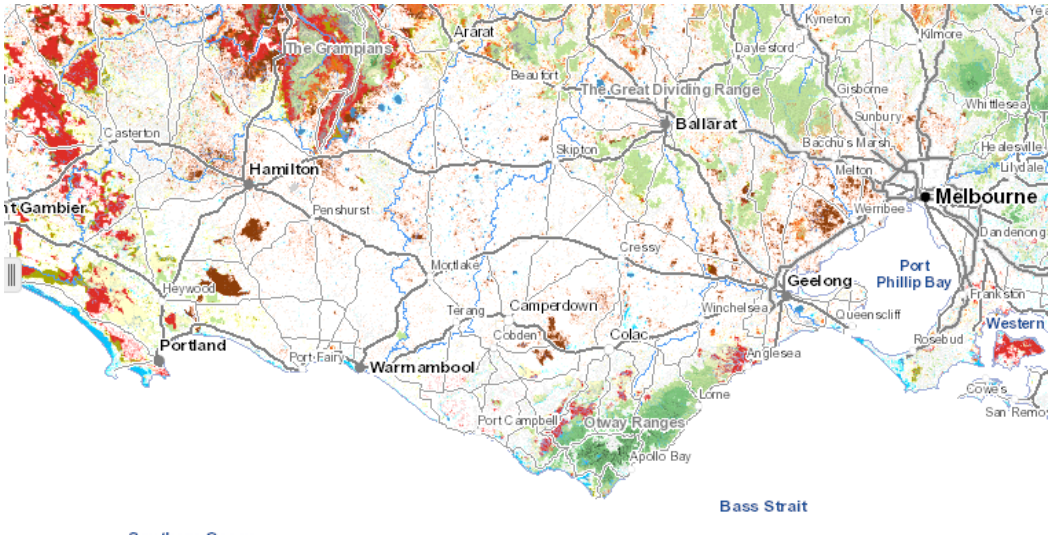



*Figure 173 Map by Department of Environment detailing estimation of the scope of the Plains Wood and Grassland ecological communities in 2005, the dark brown area representing remnant patches Plains Woodlands and Grasslands.*[332]

The VVP bioregion as a whole is listed as 'critically endangered' because that is the highest category for which an ecological community is eligible to be listed.[333] While these maps do indicate the scope of reduction of the collective Plains Wood and Plains Grassland ecological communities of the VVP, they do not show how little remains of many of the unique remnant native species and ecological communities within the Natural Temperate Grasslands and which make the VVP bioregion unique. The unique communities of VVP remnant species are typically found in small, isolated patches and on land that has remained relatively undisturbed for long periods of time, this including roadsides, edges of land reserved for cemeteries or for military use, next to railway tracks and sections of private farmland.

## Current management, protection and restoration of the VVP

To fully understand the urgent need to coordinate the management and protection of remnant sites, it is important to understand the extent of damage that has occurred and the ongoing threats and issues. Unfortunately, these include the systems currently used to assess the conservation status of remnant sites and to manage their protection. In 2008, the

[332] Ibid. Filter used: 2005 VVP, EVCs
[333] Associate Professor Robert J.S. Beeton AM FEIANZ Chair, "Natural Temperate Grassland of the Victorian Volcanic Plain Listing Advice."

Federal Government adopted some recommendations of the Threatened Species Scientific Committee to amend the Environment Protection and Biodiversity Conservation (EPBC) Act, officially naming the ecological community the Natural Temperate Grasslands of the VVP and listed it as critically endangered.[334] The Committee decided a recovery plan was required, noting that the VVP:

> is a National Biodiversity Hotspot; is one of the most intensively cleared agricultural regions of Australia; and is host to a range of Commonwealth interests including more than 25 nationally threatened flora and fauna species. A broad-scale bioregional plan would make the greatest contribution to the conservation of the large number of threatened species and ecological communities concerned. This plan should be undertaken with the co-operation of the Victorian government, local governments and Catchment Management Authorities, and take existing conservation initiatives into account.[335]

As yet, there are no federal recovery or threat abatement plans made or adopted for the Natural Temperate Grasslands of the VVP.[336]

Ecological Vegetation Classification is a State government system used throughout Victoria to assess the quality of sites containing remnant communities of plants to determine their conservation status. Each region is mapped and assessed as a particular bioregion based on the collective groups of Ecological Vegetation Classes (EVCs) it contains. An EVC represents a specific community of native plants typically associated with particular ecological conditions, such as elevation, soil type or annual rainfall, which may be repeated in different locations within a bioregion or beyond. EVCs represent places where similar ecological processes operate, where certain species of plants in certain quantities would typically and ideally be found. The bioregion of the VVP is comprised of an enormous variety of habitats and ecological communities. Many EVCs within the VVP bioregion are common to other bioregions, but many others are not. For example, EVC 9 of the VVP bioregion is called Coastal Saltmarsh, which repeats in other bioregions along the coast, whereas EVC 132, Plains Grassland, is unique to the VVP. There are currently 75 different Ecological Vegetation Classes within the VVP bioregion, 43 of which are considered unique and

[334] Australian Government, Department of Environment and Energy, Species Profile and Threats Database, (SPRAT), Natural Temperate Grasslands of the Victorian Volcanic Plain, EPBC legal status and documents, 2019. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=42
[335] Ibid.
[336] Ibid.

endangered, the highest category before extinct.[337] The dark-brown areas in the maps shown in Figures 172 and 173 represent the collective ecological communities of the Plains Wood and Grassland ecological communities of the VVP bioregion, which currently includes more than 70 different EVCs. Comparing the two maps does not give an accurate account of the level of the destruction of specific EVCs such as those sub groups within EVC 132 that are unique to the VVP bioregion, or unique groupings of plants and ecological communities that do not yet fit into the criteria of the EVC system for some reason, such as the scale of the remnant site or a newly discovered complex species grouping.

*Figure 174 Remnant 'Featherhead' Ptilotis, Doreen's Grasslands Altona.*[338]

Current legislation does not adequately protect or encourage the restoration of the most typical and fragile examples of remnant plant communities, these being small, isolated and not deemed to be of significant value under the Ecological Vegetation Classes (EVC) bench-marking system. For example, if a remnant patch is less than 500 square metres and does not contain more than 50% native species, it is considered too small or not significant enough for national listing or for protection under the Environment Protection and

[337] Victoria Department of Sustainability and Environment, Australia, "Bioregional Conservation Status for Each Bioevc," ed. Land Department of Environment , Water and Planning, Victoria, Australia (Melbourne: Victorian Government, Australia).

[338] Named after a local resident, Doreen Eddison, who identified and protected local flowers from the 1940's. https://natureoutwest.wordpress.com/2013/11/17/doreens-grassland-in-altona/

Biodiversity Conservation Act. However small, these isolated patches may signify important places of refuge and stability. They may also indicate the presence of other, nearby, significant sites, the existence of a new EVC, or provide an important node of interconnection to other ecological communities. Remnant sites are often linear and small. Depending on the time of year, they are often in a state of dormancy below the ground and are not detected in assessment studies. These sites are particularly susceptible to accidental damage through mowing or the use of herbicides. Sites of remnant ecological communities and plants are often surrounded by ecological or physical conditions and features, such as landforms and soil types, even built structures that act as buffer-zones, providing some form of relative stability that helps an isolated community to survive. Such places provide opportunity for research, protection, restoration and expansion, Beeton, arguing:

> The Natural Temperate Grassland of the Victorian Volcanic Plain is a dynamic and inherently variable ecological community. It intergrades with adjacent vegetation types notably Plains Grassy Woodland (EVC 55), Plains Grassy Wetland (EVC 125) and Stony Knoll Shrubland (EVC 649). The assemblage of species that characterises the grassland often occurs as an understorey component in adjacent woodland and shrubland. These intergradations can happen over relatively small distances and may be subject to site characteristics, for example drainage patterns of cold air or water. [339]

In May 2008, the Federal Minister for the Environment, The Hon. Peter Garrett, approved conservation advice from the Threatened Species Scientific Committee that the Natural Temperate Grassland of the Victorian Volcanic Plain "has suffered a very severe decline in terms of its extent and community integrity. It also has undergone a substantial rate of continuing detrimental change in the recent past." [340] The major threats included clearing, changes to land management practices of remnants, application of herbicides, addition of fertilisers, weed invasion, poorly managed subdivision and poorly planned land use in peri-urban areas, and lack of knowledge or understanding of native grassland remnants. [341]

[339] Associate Professor Robert J.S. Beeton AM FEIANZ Chair, "Natural Temperate Grassland of the Victorian Volcanic Plain Listing Advice." p 5.
[340] "Approved Conservation Advice for the Natural Temperate Grassland of the Victorian Volcanic Plain," ed. Department of Environment and Energy (Canberra: Australian Government, 2008). p1.
[341] "Natural Temperate Grassland of the Victorian Volcanic Plain Listing Advice." p 5.

In *Land of Sweeping Plains: A guide for management and restoration of native grassland in South Eastern Australia*, the authors identify threats,

> "likely to emerge and intensify over the coming decades which present an enormous challenge to the management of grasslands which need to be addressed immediately through developing innovative methods and commitment from stakeholders: (1) the long-lasting effects of historic habitat loss, (2) ongoing destruction of grassland, (3) exotic species invasions, (4) inappropriate disturbance regimes and (5) climate change."[342]

Despite being listed as a one of Australia's 15 'biodiversity hotspots', the destruction of the VVP continues today with ongoing clearing of some of the most pristine and intact remnant pockets to make way for the development projects of urban expansion of Melbourne.[343] Some of the most pristine remnant sites of the VVP exist within Melbourne's peri-urban zone, having somehow remained undisturbed in-between urban expansion, industry and farming.

In 2009, a system was developed by the Victorian State and Commonwealth Governments through the Melbourne Strategic Assessment (MSA) to reserve 15,000 hectares of partially degraded grasslands for revegetation and management as the Western Grasslands Reserves near Little River. [344] Funding for the Western Grasslands Reserve was proposed as a form of offset by developers in exchange for permission to destroy existing significant remnant sites situated within the bounds of new construction projects associated with Melbourne's urban expansion. The Western Grasslands Reserve offset system currently (2019) presents various issues. Ten years of delays and confusion with implementing the management of the Reserve now pose a significant threat to the remaining remnant sites and the viability of the land reserved for its restoration. The ability of the offset system to fund the Reserve is now in doubt. The land set aside for the Reserve has become further degraded through Serrated Tussock infestation due to a lack of management. Serrated Tussock is a vigorous weed that takes over native grasslands, being difficult and expensive

[342] Williams et al., *Land of Sweeping Plains : Managing and Restoring the Native Grasslands of South-Eastern Australia.*, Chapter 2, The native temperate grasslands of south-eastern Australia, co-authored by Nicholas S.G. Williams and John W Morgan, p 49.
[343] Outer Suburban/Interface Services and Development Committee, "Inquiry into the Impact of the State Government's Decision to Change the Urban Growth Boundary," ed. Outer Suburban/Interface Services and Development Committee (2009) (Parliament of Victoria, Government Printer for the State of Victoria, 2009).
[344] Department of Planning and Community Development The Victorian Government, "Delivering Melbourne's Newest Sustainable Communities," (Melbourne2009). MSA associated documents: https://www.msa.vic.gov.au/conservation-actions/western-grassland-reserve

to remove. Serrated Tussock was recently assessed to have smothered areas of the land specified for the Reserve ranging from 20-70%, where it continues to proliferate.[345]

The restoration of degraded native grassland sites in south-eastern Australia is complex and expensive compared to countries in the northern-hemisphere where governments have developed schemes for the restoration of meadows and prairies from the 1940s, providing substantial financial support to farmers to return degraded agricultural land to native vegetation.[346] Paul Gibson Roy and others through the Grassy Groundcover Research Project (GGRP) have developed innovative research on recreating the balance of local species found on degraded sites.[347] The chemical composition of soil has changed through introduced species and farming practices, indigenous grassland species typically not liking nitrogen rich soils.

Currently, the Grassy Groundcover Research Project process is expensive, at approximately $20,000 per hectare, at a research project scale, often using in-kind labour support. Its methods involve the development and use of specialised equipment to scrape back and prepare the soil and to directly sow native seed and plant seedlings. These projects require adequate, long-term financial investment, including establishing grassland farms and nurseries to cultivate seed. Restored grasslands take time to establish, which makes it difficult to convey immediate success to the public and stakeholders, making it difficult to secure long-term funding. [348] The translocation of rare, remnant, plants and animal species from one site to another is also complex and even more expensive.

[345] Ian Penna, submission to Senate Standing Committee on Environment and Communications, 'Australia's Faunal Extinction Crisis', Submission 402, September 2018.
[346] Williams et al., *Land of Sweeping Plains : Managing and Restoring the Native Grasslands of South-Eastern Australia*. Chapter 12, 'The restoration of native grasslands', co-authored by Paul Gibson-Roy and John Delpratt, pp 331-389.
[347] Paul Gibson-Roy is project head of the Grassy Groundcover Research Project partnered by Greening Australia (Victoria) and University of Melbourne.
[348] Williams et al., *Land of Sweeping Plains : Managing and Restoring the Native Grasslands of South-Eastern Australia*. Chapter 12, 'The restoration of native grasslands', co-authored by Paul Gibson-Roy and John Delpratt, pp 331-389.

*Figure 175 Volcano Dreaming, research field trip to observe the excavation and translocation of Pimelia spinescens, Spiny Rice Flower, a critically endangered plant of the VVP.*

## *A new type of environmental exhibition format*

The large 12 metre long exhibition*, Volcano Dreaming,* was designed to draw attention to the complexity of the grassland biome and the urgent need to protect its diversity and remnant species currently existing in the wild. Peter Haffenden and I were commissioned to produce the exhibition by Victoria University with funding provided by the Environment Protection Authority of Victoria. The University was able to secure funding using our previous project MLMW *Pobbblebonk*, which focused on the animals of the Maribyrnong River Estuary, as a model of what the exhibition could look like. Early in the exhibition's development, we realised we did not have images of most of the required species. Purchasing these was well beyond the budget, but I was used to this kind of situation through my work as an artist, being familiar with how a challenge can also provide opportunity. I decided to photograph the animals myself and began visiting zoos and wildlife reserves where I observed them first-hand and learnt more about their behaviour by talking to zoo-keepers.

I found local amphibious wildlife at Healesville sanctuary, where I photographed turtles working together to herd small fish into shallow water to trap them. It became obvious to me that presenting animals and plants in their context, would better link their appearance and form to understanding their behaviour. For example, a grey-brown possum in a tree is difficult for predators to see immediately. The relative scale of one species to another and their degree of camouflage within their environment represents complex information about the relationships between animals and plants. The mechanics of the food chain could be better shown by placing animals in a visual context at their actual relative scale. *Pobblebonk* used an enormous landscape as a backdrop, making an elegant, inviting, uncluttered exhibition format that could be explored to locate camouflaged animals in their natural environment.

The single panoramic image, digitally constructed from a large number of photographs, merged a series of habitat-types, for example, a wetland merged with a forest to demonstrate aspects of species behaviour and their interrelationships as well as significant threats they faced.

*Figure 176 Detail from the exhibition Pobblebonk, 2005, (panels 1-6 of 10) showing photographic panoramic exhibition format.*

The exhibition format for *Pobblebonk* and *Volcano Dreaming* drew on my large-scale, instruction-based wall drawings, requiring a formal exercise in spatial manipulation to achieve an immersive, reflective space. It also included design principles of ecomuseology such as participation and inclusivity, linking people's stories and experiences with scientific research to interpret a place. It combines multidisciplinary skills, people working closely in collaboration to produce an outcome which can be used for broader understanding of a place. Both exhibitions required spatially negotiating various parameters. Sometimes it was

necessary to shift the order of elements to cohesively include every habitat-type. The topic of VVP was much more complex to produce than the animals of the Maribyrnong River estuary, taking three years to research and produce. It involved over 100 field trips and consultation with over 50 people working with the ecosystem.[349]

Like my wall drawing projects, *Pobblebonk* and *Volcano Dreaming* were designed to be immersive and enable the exploration of complex information at a self-directed pace. Placing the animals within their habitat-type using their camouflaging techniques allowed the overall scene to remain uncluttered while enabling the animal's behaviour and relationships to other species to be discovered and observed. The process of learning is physically engaging and active. Opportunities for the public to directly experience the landscape to understand their complexity of the relationships between creatures and their habitat is impeded by difficulties. *Volcano Dreaming* presented the opportunity for an immersive experience that could be used as a tool for interpretation by educators and scientists.

*Figure 177 Students, Beeac Primary School, image Stuart McCallum, Greening Australia.*

[349] The people we worked closely with are included in the acknowledgements section of this thesis.

*Figure 178 Volcano Dreaming detail panels 1-4.*

*Figure 179 Volcano Dreaming panels 5-8.*

*Figure 180 Volcano Dreaming panels 9-12.*

## *Visualising the invisible*

*Volcano Dreaming* is literally a 'big-picture' representing the biodiversity of the VVP. It was commissioned by Victoria University to help convey issues facing the critically endangered grassland species of the Keilor-Werribee Plains. The university's St Alban's campus included the Iramoo Grassland reserve, nursery and research centre. [350] Early in the project it became apparent that the reserve was infested with Serrated Tussock. When we sought to source images elsewhere in the Keilor Werribee Plans region of the VVP, it was clear that it too comprised a fractured, largely invisible and vulnerable network of remnant patches that were rapidly diminishing while we searched to find them. Examples were the Plains Wanderer, a tiny species of quail, and the Sunshine Diuris, a small white-flowering orchid once known as 'snow in the paddock'. We were directed to a small patch of land between a busy junction of railway tracks in the Melbourne suburb of Sunshine, where we photographed possibly the last example of the Sunshine diuris while in-flower in the wild. We suddenly realised that without us and us having a better understanding the VVP ecosystem, the assigned topic of the critically endangered grassland species of the Keilor-Werribee Plains could not be properly described.

[350] Iramoo Sustainable Community Centre, Victoria Unicversity, St Alban's campus.

*Figure 181 Field trip, Volcano Dreaming, site of possibly the last Sunshine diuris in the wild in Sunshine.*

*Figure 182 Field trip, Volcano Dreaming, site of possibly the last Sunshine diuris in the wild in Sunshine.*

As we travelled regional Victoria in search of remnant ecological communities, we met groups of people working to save what was left of species in their area, identifying a much broader need for the exhibition we were developing. The difficulties we faced in coming to grips with the ecosystem reflected the difficulties in explaining the VVP ecosystem and its issues more broadly. As well as the isolation and fragmentation of ecological communities, division of the VVP into two distinct regions, city and country, caused a lack of knowledge sharing between various groups and individuals. We decided to expand and self-fund the project to encompass the entire bioregion of the Volcanic Plains.

The major difficulty in conveying the complexity and fragility of the VVP is that most of the time the plains appear as containing little more than brown grass with the occasional small flower. To the untrained eye, native vegetation is indistinguishable from introduced vegetation. The wildflowers appear in flushes which may last only several days and the creatures are mostly tiny. To locate remnant species requires specialist local knowledge and regular monitoring. A network of people enabled us to produce the exhibition, letting us know when and where species would appear so we could photograph and observe them.[351] It is impossible to easily convey to people who have not seen the various phases of seasonal change of the landscape how it operates, what is there lying dormant below the surface and the complexity of interrelationships between these things.

*Figure 183 Field trip with Brett McDonald, ecological interpreter, to Evans Street Grasslands. Brett is explaining what we cannot see in this small patch.*

[351] It was critical to see the species first-hand to understand the exact hue and the scale of plant species in relation to each other as well as to the invertebrates and other animals etc.

At a wetland workshop in Westmere, I met the microbiologist Joan Powling, who introduced me to small, prehistoric, creatures called shield shrimp (Figure 184), which operate in a different time-cycle and state to most other creatures. There are desert species of shield shrimp and VVP species. Their tiny eggs remain dormant in a desiccated state for dozens of years, only hatching after significantly heavy storm events to feed on water borne microorganisms to quickly grow to about 2 cm in length. Many VVP species such as shield shrimp and orchids remain dormant and invisible for dozens of years.

*Figure 184 Shield shrimp, photographed in a wine glass for Volcano Dreaming.*

As a tool of visualisation we decided that *Volcano Dreaming* should represent all included species of flowering plants in a state of full bloom at the same time, an impossibility in the wild but necessary to visually convey the significant and yet often invisible mechanisms of the ecosystem. The reality in the field is that some orchids may be dormant and easily

overlooked, their presence may be indicated by a single tiny basal-leaf only a specialist can recognise. Other species have no visual presence while dormant, but their location is sometimes marked with a small tag. The plant specialist can imagine the plant developing below the ground and in full bloom, but the long period of invisibility for many VVP plants is a significant factor in the challenge of conveying issues about the VVP.

*Figure 185 Inter-tussock spaces containing a grassland species of Drosera, a tiny, insect-eating, carnivorous, plant thriving in between Kangaroo grasses, Woorndoo, central western Victoria.*

*Figure 186 Field trip to Woorndoo in central western Victoria. A ladder was used to photograph images of plants from various angles to integrate digitally into the display. One of the few places where the sense of the unique flowers of the VVP can be seen in numbers.*

*Figure 187 Detail of background of Volcano Dreaming digitally constructed from images taken during several field trips to Woorndoo to show species diversity in the inter-tussock zones.*

The biodiversity of the VVP is often a result of what happens beneath the ground. The complex relationship between mammals, plants and soil is exemplified by the story of dung beetles, as explained to us by the ecologist, Ian Faithful. A large variety of dung beetles once inhabited the VVP, some often collecting dung from one species of mammal such as the nocturnal Eastern barred bandicoot. The beetles roll pieces of dung into small balls and deposit them within intricately constructed underground nests comprising a series of tunnels that radiate horizontally from deep central hole.[352] In a chamber at the end of each tunnel, they lay eggs and deposit a small ball of dung, which feed the beetle's offspring after they hatch. Every dung beetle works constantly building multiple nests (Figure 190).

Understanding this process made it possible for us to visualise the subterranean structure of the grasslands as being sponge-like. Aerated and fertilised by Dung beetles, water can more easily penetrate the soil, encouraging the growth of fungi in inter-tussock spaces, which the Eastern Barred Bandicoots, currently listed as extinct in the wild, likes to eat along with

[352] Peter Lilywhite at the Museum of Victoria was able to show us maps of recorded locations of species of dung beetles in the Museum's collection.

berries, beetles, grubs and worms. When bandicoots scratch the ground looking for food, they till the soil and bury seeds, which helps seeds to germinate more easily. Many of the VVP's indigenous mammals were rapidly reduced in number or made extinct by the introduction of foxes, dogs and cats. Dung beetle species specific to these smaller mammals were similarly affected, as were many communities of plants dependant on this complex relationship. *Volcano Dreaming* represents these type of complex interrelationship, the lowest section revealing the region beneath the ground at a magnification well beyond actual size to make visible the usually invisible. Although a departure from simply representing relative scale, the visual manipulation of scale is presented consistantly and enables the inclusion of many significant stories of VVP species interrelationships.

*Figure 188 The mainland sub-species of Eastern Barred Bandicoot is listed (2018) as extinct in the wild, this young female was photographed at Werribee Zoo where there is a breeding program.*

*Figure 189 Detail, Volcano Dreaming, panel 5, the same Eastern Barred Bandicoot digitally montaged into the display.*

*Figure 190 Detail, Volcano Dreaming, panel 6, Dung beetle and nest imaged using photoshop based on conversations with Ian Faithful.*

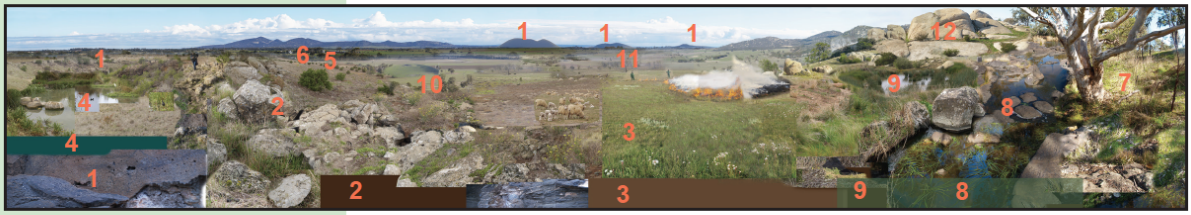
*Figure 191 Detail from the exhibition Volcano Dreaming, representing some of the issues associated with Melbourne's urban growth impact on the VVP such as weed invasion, loss of habitat through processes of clearing of land, removal of topsoil, introducing herbicides, fertilisers, and foreign soils containing seeds and plants from elsewhere and the importance of establishing buffer zones for remnant species.*

### *Connectivity and contextualisation*

When I met wetland phycologist, Michelle Casanova at a grassy wetland workshop in Westmere in 2009, she explained the significance of wetland connectivity to frogs. Like most creatures, frogs must diversify their gene pool to remain healthy. They achieve this by travelling across land at night in search of different colonies to breed with, but they can only cover a certain distance before they must find wet or damp places to safely shelter during the day. Without damp places to shelter in, frogs quickly dehydrate and die. When farmers construct dams to maximise water collection, these dams divert the natural flow of water from established small, soggy small patches of land used by frogs to find new colonies. The lines between wet grassy patches and wetlands form an intricate invisible network for frogs. Through making *Volcano Dreaming*, I learnt of the significance of wetland interconnectivity for frogs, seeing it as analogous to the plight of many species of the VVP.

A major problem of the VVP is the lack of connectivity on several levels. Lack of connectivity between remnant sites, between specialist research activities and between the groups and people caring for particular species or places. For example, the methods and field-trials of grassland restoration being developed by Paul Gibson Roy in 2010, through the Grassy Groundcover Research Project, were not known by the people working on the ground at Iramoo Grasslands, who were trying to eradicate Serrated Tussock, and no-one at the Hamilton Field Naturalists group had heard of Iramoo Grasslands. *Volcano Dreaming* sought to provide a much needed big-picture vision of the VVP bioregion, to connect these people; by accommodating every issue we identified as significant to the conservation of key species of the VVP. With the help of specialists and others, we ensured that each of the more than 700 species of plants species was placed visually within the right context in the exhibition, *Volcano Dreaming*; those contexts being grassland plains, wet-grassland depressions, plains swamp, incised river-valley, grassy-woodland, free-flowing stream, crater wetland-lake, stony-rises and granite-outcrops. The exhibition also required constructing an image to convey the key issues of the VVP: the continued loss of habitat and the introduction of invasive species due to urban development and incompatible farming practices; the significance of maintaining and reinstating wetland and other forms of habitat connectivity in order to maintain gene pool diversity and the significance of ecological processes which occur underground and underwater.

1 Volcanic rises (above and under ground), 2 Rocky escarpment (above and under ground), 3 Grassland plains (above and under ground), 4 Crator lake/pond (both above and under water), 5 Incised river valley, 6 Redgum woodlands, 7 Greybox forest, 8 Basalt stream (both above and under water), 9 Wetland swamp (both above and under water), 10 Stony rises (basalt), 11 Wet meadows, 12 Granite rocky outcrop.




*Stage One - August 2009 - photographic sketch of exhibition landscape / habitats structure.*

*Figure 192 Image from August 2009 grant progress report to EPA we produced during the development phase of the 'image' structure of Volcano Dreaming showing draft digital sketch connecting the important types of land-features to include.*

## *Organic Geometry and modelling connectivity*

In researching *Volcano Dreaming* in over 100 field trips, while driving at 100 km along country roads, I began to notice the visual clues that indicated the presence of remnant species. These clues were glimpses of specific colours of flowers and hues of green, combined with colours of soil. Most people we met working with the VVP have acquired this colour-knowledge. It became crucial that colour was accurately translated through the printing of *Volcano Dreaming*.[353] Working with geometric abstraction influenced the design and production of *Pobblebonk* and *Volcano Dreaming* in several ways. Both projects include the manipulation of space and materials to develop a visual format which is physically immersive and inclusive, providing an environment for making personal connections and analogies. Designing the exhibitions involved a similar type of manipulation of space as required to steer the outcome of a wall drawing, where shifting one aspect of the overall dynamic affects the whole, breaking the cohesive structure, and necessitating specific adjustments to restore cohesion. This practical experience informed the development *Volcano Dreaming* in particular, which was constantly adjusted to maintain a cohesive visual structure to effectively represent the complexity of the VVP.

[353] We were particularly pleased when Beth Gott, Adjunct Research Fellow in the School of Biological Sciences at Monash University, complimented the accuracy of colour in Volcano Dreaming.

Draft versions were examined by specialists to ensure we did not omit key species, habitat-types or issues. After discussions with Colin Hocking, a new section was included to highlight the issue of weed invasion through urban development.[354] The entire image was adjusted to include the concept of wetland-connectivity after discussions with Michelle Casanova.[355]

Once the overall structure was in place, adjusting the exhibition detail was akin to completing the internal pattern of a wall drawing, requiring connecting key points by providing relevant detail. The grassland section was inspected to remove several weed species and to correct insect-to-plant relationships by Brian Bainbridge.[356] After discussions with Liz Fenton and Anthony Watts about the importance of city and country regions working together strategically, Country Fire Authority volunteers and Department of Sustainability and Environment staff were included in the fire management section.[357]

Just as the instruction-based wall drawings can be reinterpreted in various materials, the panoramic image can be adapted to suit various contexts, it can be printed on to various surfaces and materials at various scales. The primary format is a panoramic, diorama-style display of 12 metres by 2 metres high, made from 12 cloth-panels with collapsible frames into bags to enable the panorama to fit on the back seat of a car and be easily set-up at schools and libraries. The exhibition has been printed in multiple copies in this format which are housed by various organisations and municipal councils throughout the VVP, made available for use by schools and libraries and for events.[358]

In Chapter Seven, I introduced the Materials Design Paradigm, a conceptual tool used by materials scientists in the design and discovery of new materials (Figures 156-157). It involves exploring relationships between four specific aspects which effect the characterisation of a material:

- structure,
- properties,
- performance and
- processing.

[354] Conversation with Dr. Colin Hocking, Senior Research Fellow, Institute for Sustainability & Innovation, Victoria University, 2010.
[355] Conversation with Dr. Michelle Casanova, Wetland and Water Plant Ecologist, Royal Botanic Gardens, Melbourne, 2010.
[356] Conversation with Brian Bainbridge, President of the Indigenous Flora and Fauna Association.
[357] Liz Fenton, Indigenous Nursery Operator and Beef Cattle Farmer, Hamilton Field Naturalists Club; Anthony Watts, Roadside Program Facilitator, SW Area, Country Fire Authority, 2010.
[358] A smaller version which fits into a small back-pack is also used by several groups for in-the-field excursions.

Applying the concept of the Materials Design paradigm in reverse, deciphering the aspects responsible for the characterisation of something, provides a way to consider the nature of any outcome.

With the wall drawings, it was a fairly simple exercise as the resulting characterisation of each drawing, as a variable outcome, is clearly analogous; and there are also four analogous elements effecting each drawing outcome (characterisation):

- the instruction book (structure),
- the materials (properties),
- the place the drawing is made (performance) and
- people making the drawing (processing).

The Materials Design Paradigm can be applied to the exhibition *Volcano Dreaming* to develop a template for exhibitions about other environments. For example, if the characterisation (outcome) is the resulting image then key elements involved in the design process can be identified:

- panoramic photographic montage of images and text (structure),
- research (properties),
- cohesiveness, effectiveness and useability (performance) and
- collaborative expertise (processing).

Each of these aspects can be examined individually to ascertain how they might be adapted to achieve an effective exhibition about a different environment of the same format. Having produced *Pobblebonk* and *Volcano Dreaming*, the steps to developing a template for displays about specific ecosystems became apparent, these being:

(1) understanding the issues and threats,
(2) understanding the seasonal and geographic mechanics of a place and how this effects the dynamics of its ecological communities,
(3) identifying the particular habitat types needed to convey these things,
(4) constructing a cohesive image comprised of all the relevant habitat-types and
(5) identifying and placing the key species and text that represent the issues in the right locations within the image.

These steps involve artists collaborating with scientists and others, using principles of ecomuseology such as listening to others and including others throughout design development to accurately convey their stories to others.

### *Issues with current modelling*

The Victorian State government Ecological Vegetation Class (EVC) benchmarking system is primarily concerned with identifying sites by applying existing criteria and data. It is used to assess the quality and significance of remnant sites across Victoria, treating each in the same manner regardless of whether sites are critically endangered or not. This benchmarking system is sometimes expanded when an ecological community of remnant plants is encountered at a scale that indicates the need for a new EVC, but the system is not conducive to understanding, or designed for reinstating connectivity in a critically endangered biosphere. It does not allow for the concept that every remnant site is unique and precious. It is based on the repetition of an ideal model of an ecological community as an EVC, which pre-determines what a good quality example of a particular site should contain. It is not inclusive of zones of transition, broader ecological timescales, or reconnecting isolated plants.

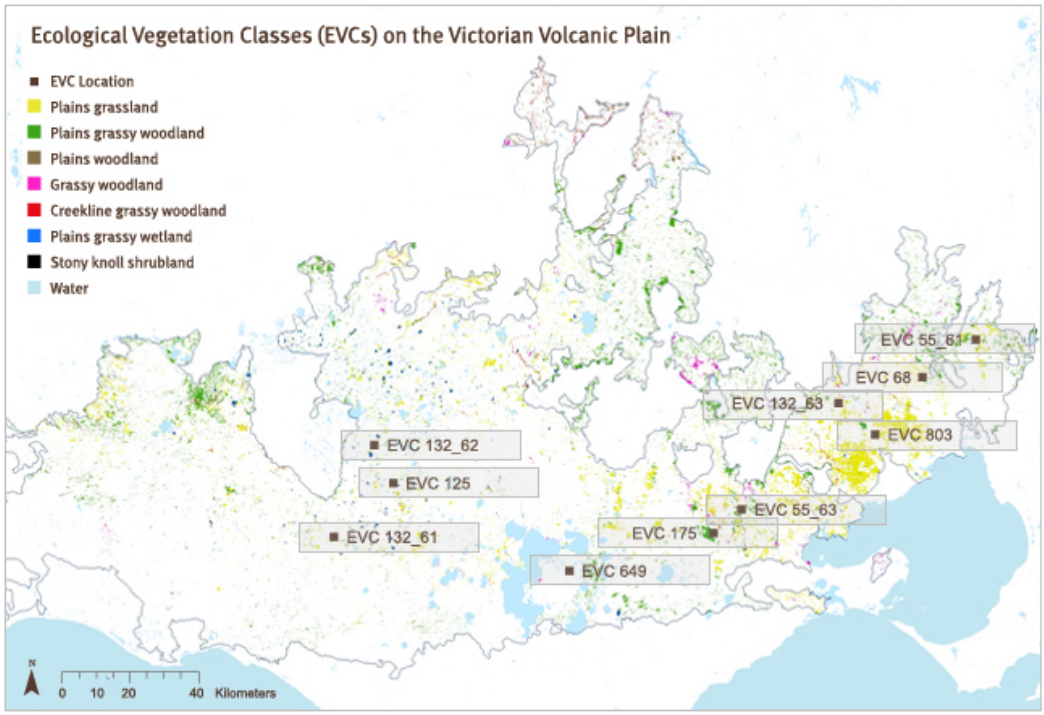



*Figure 193 Map showing distribution of Ecological Vegetation Classes (EVCs) on the VVP.*

In my wall drawing projects, shifting one element in the system of organic geometry influences many others, breaking the connection between points in the geometry and altering the dynamics and stability of the whole (Figure 158). The nature of these drawings made me begin to think about the VVP geometrically as a whole dynamic structure. I began to imagine each remnant patch of vegetation and plant as a node with lines of connectivity to other nodes and thus an influence on the stability of the whole. This stressed the need to maintain any existing connection, however tenuous, plus the buffer zones around each node and lines of connection through a co-ordinated system of identification and management to protect the ecosystem of the VVP as a whole. Much later when I became involved in the Grassy Plains Network in 2018 I began to understand how this concept conflicted with conservation planning of the VVP in many, fundamental, ways.

The Victorian State Government Department of Land, Water and Planning develops and implements conservation policy and planning for the State of Victoria. Its current initiative, Biodiversity 2037 (2019), seeks to "stop the decline of our native plants and animals and improve our natural environment so it is healthy, valued and actively cared for".[359] The recommendations of the Threatened Species Committee (2008) to develop a Recovery Plan for the VVP are not included in Biodiversity 2037, which assesses the Strategic Management Prospects of conservation programs in order to result in "Cost Effective Actions". The VVP is not considered "cost effective" so does not receive any special consideration under the Environment Protection and Biodiversity Conservation Act despite being a "critically endangered" biosphere. The actions most required to protect what is left of the VVP are not ranked cost effective actions by the Department of Land, Water and Planning, primarily because they are expensive and do not deliver short-term, measurable, quantitative results. Figure (194) exemplifies how the Department of Land, Water and Planning ranks Cost Effective Actions.

[359] https://www.environment.vic.gov.au/biodiversity/biodiversity-plan

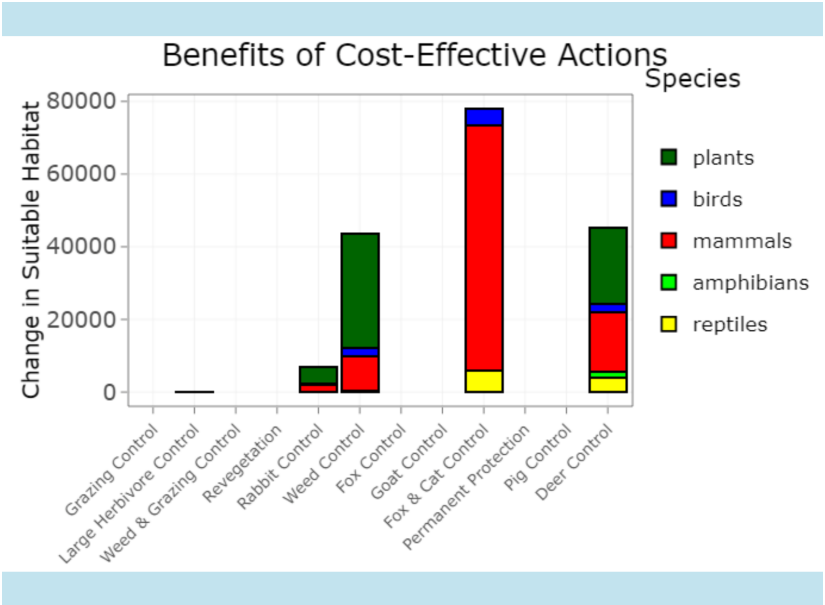



*Figure 194 source, the Department of Land, Water and Planning website, Using Strategic Management Prospects in Biodiversity Response Planning. Source: http://.maps.arcgis.com/apps/MapJournal/index.html?appid=c3c3c31345a3440883146a08bd1ed983#*

The Strategic Management Prospects in Biodiversity Response Planning set out in *Biodiversity 2037* (Figure 195) represent financially based principles that fail to allocate sufficient funds to properly map, monitor, protect and reconnect ecosystems. The level of funding to the environment is a less than adequate form of disaster planning, attempting to halt the decline of vulnerable or near threatened species and opting for ex-situ solutions for critically endangered and endangered species with no mention or special provision specifically for critically endangered or near extinct biospheres. The VVP receives no special provisions and the same if not less allocation of funding as other bioregions in the State. See Item 5, Figure 196. Funding is rather prioritised for areas and Cost Effective Actions that which might deliver *results, in the top 20%* Cost Effective Actions where very high state-wide benefits are most likely to be achieved.[360] See Figures 197 and 198 showing Cost Effective Actions % layers, the white areas represent 'no action'.

[360] Strategic Management Prospects: Overview, http://Department of Land, Water and Planning.maps.arcgis.com/apps/MapJournal/index.html?appid=e0289e3fe12f436490ef63d4444a05df#

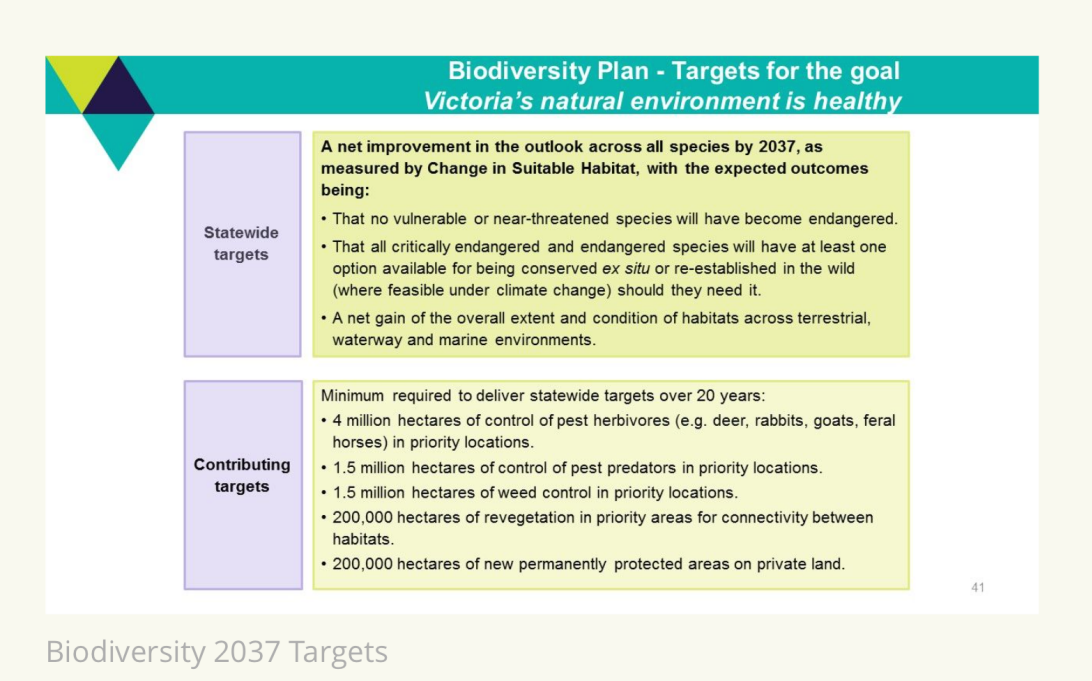



*Figure 195.* [361]

Table 1 – Geographic Area Indicative budget and phasing

| Area | 2018/2019 | 2019/2020 | 2020/2021 | Total indicative budget |
|---|---|---|---|---|
| 1. Murray River | $ 414,000 | $ 498,000 | $ 560,000 | **$ 1,472,000** |
| 2. Mallee | $ 1,249,000 | $ 1,501,000 | $ 1,689,000 | **$ 4,439,000** |
| 3. Wimmera | $ 491,000 | $ 590,000 | $ 664,000 | **$ 1,745,000** |
| 4. Glenelg/Grampians | $ 603,000 | $ 725,000 | $ 816,000 | **$ 2,144,000** |
| 5. Volcanic Plains/Otways | $ 743,000 | $ 894,000 | $ 1,006,000 | **$ 2,643,000** |
| 6. Port Phillip/Westernport | $ 414,000 | $ 498,000 | $ 560,000 | **$ 1,472,000** |
| 7. Gippsland and inlets/islands | $ 414,000 | $ 498,000 | $ 560,000 | **$ 1,472,000** |
| 8. Eastern Forests | $ 1,108,000 | $ 1,332,000 | $ 1,500,000 | **$ 3,940,000** |
| 9. North East Forests and Alps | $ 421,000 | $ 506,000 | $ 569,000 | **$ 1,496,000** |
| 10. Box-Ironbark, Northern Plains, Inland Slopes | $ 1,157,000 | $ 1,392,000 | $ 1,566,000 | **$ 4,115,000** |
| 11. Marine and Coastal | | | | **$2,500,000*** |
| Total pre-allocation to Areas | **$ 7,014,000** | **$ 8,434,000** | **$ 9,490,000** | **$ 24,938,000** |
| Total allocation to competitive pool (30%) | $ 3,006,000 | $ 3,614,000 | $ 4,063,000 | **$ 10,683,000** |

* Note: Marine and Coastal geographic area indicative budget is for Marine and Coastal Targeted Actions and will be subject to different criteria than outlined in this document.

*Figure 196* [362]

[361] *https://www.environment.vic.gov.au/__data/assets/pdf_file/0017/119213/Biodiversity-Response-Planning-Guidance-Note.pdf*

[362] Ibid.

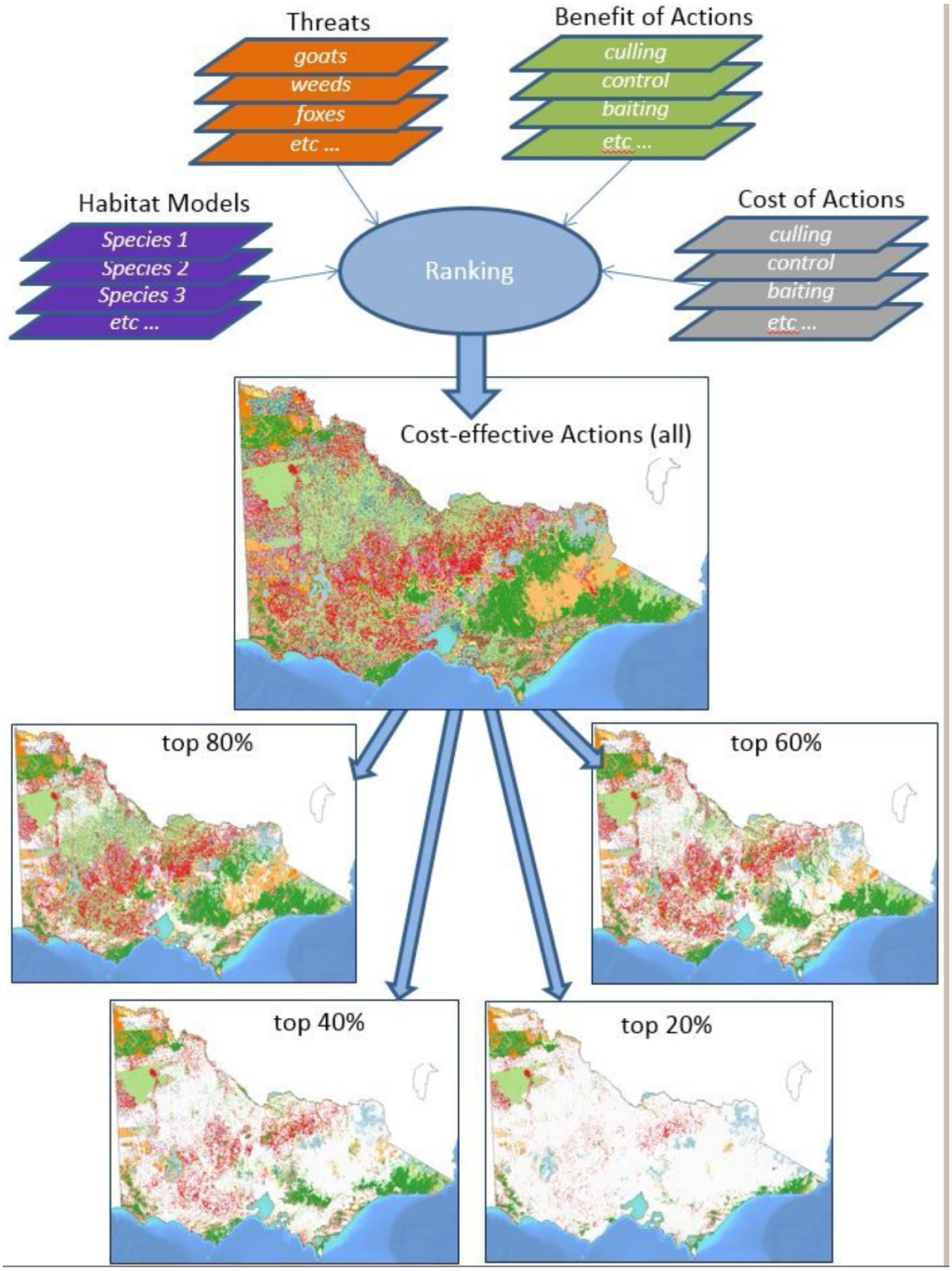



*Figure 197* [363]

[363] Using Strategic Management Prospects in Biodiversity Response Planning, http://Department of Land, Water and Planning.maps.arcgis.com/apps/MapJournal/index.html?appid=c3c3c31345a3440883146a08bd1ed983

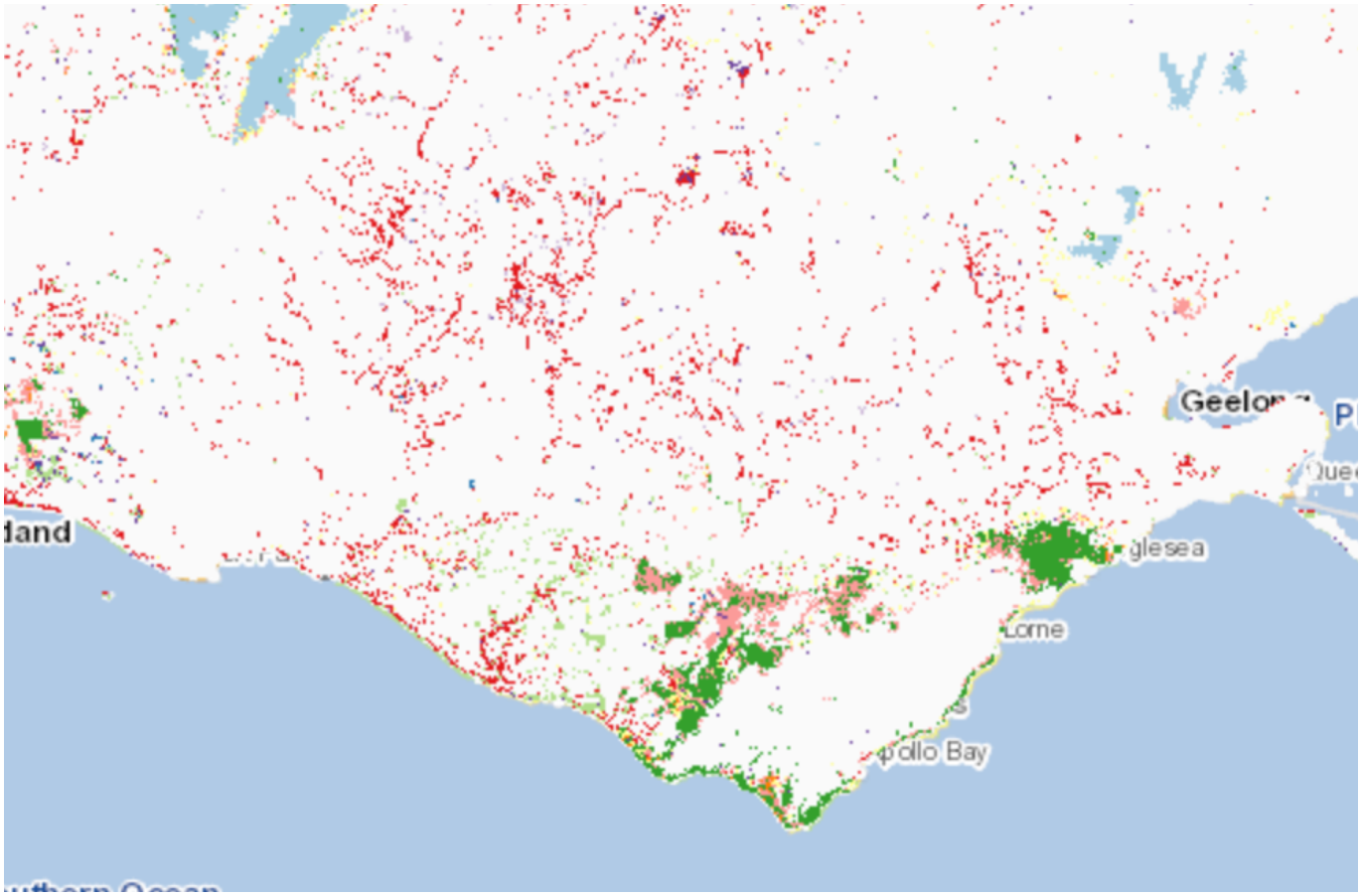



*Figure 198 Detail of 20% Cost Effective Action ovelay layer for VVP. The white areas on this map represent 'no action'; colours represent following CEAs: red areas, 'predator, rabbit and weed control'; the darker green areas, 'control large herbivores and weeds'; pink, 'control predators and large herbivores'; pale green, 'control predators and weeds'; orange 'control herbivores and weeds.* [364]

The Department of Land, Water and Planning's Biodiversity Response Planning documents repeatedly state that "evidence-based decision making is critical to improving outcomes for biodiversity". However, evidence is often based on insufficient data and mapping to properly determine Habitat Distribution Models to guide the development of Cost Effective Actions for each location. [365] See Figure 197.

The Ecological Vegetation Classification (EVC) system, used state-wide, excludes the most vulnerable and significant remnant patches of grassland on the VVP, not being a benchmarking system designed to address a biome with less than 1% remaining of its original area, thus excluding biomes in greatest need of protection. Strategic Management Prospects Analysis "describes and ranks locations according to the relevant contribution that

[364] Using Strategic Management Prospects in Biodiversity Response Planning, http://Department of Land, Water and Planning.maps.arcgis.com/apps/MapJournal/index.html?appid=c3c3c31345a3440883146a08bd1ed983

[365] NaturePrint, Habitat Distribution Models and Habitat Importance Models, https://www.environment.vic.gov.au/__data/assets/pdf_file/0036/82989/2-NaturePrint-Habitat-Models.pdf

actions will make to improving biodiversity conservation outcomes over the next few decades."[366] According to Strategic Management Prospects and Cost Effective Action mapping of the VVP, which currently determine Biodiversity Response Planning, the majority of funds allocated to the bioregion must be distributed to projects which involve controlling predators, large herbivores, rabbits and weeds to the exclusion of other actions such as mapping, monitoring, permanent protection, revegetation, reconnecting habitat or developing an overarching Recovery Plan.[367]

The current system of modelling remnant grassland by the Department of Land, Water and Planning combines Ecological Vegetation Classification benchmarking with the use of Zonation computer algorithm software.[368] An algorithm is a set of step-by-step instructions. Like the instruction manuals for my wall drawings, an algorithm defines rules and steps that determine the outcome of a process. The algorithms used in computer processing seek to find the most accurate and efficient solution to a specific problem or real-world application. The Zonation version 4 user's manual describes Zonation as "a decision support tool for conservation resource allocation", explaining that:

> Zonation identifies areas important for retaining habitat quality and connectivity for multiple species, habitats or ecosystems, indirectly aiming at long-term persistence of biodiversity. When including costs, Zonation produces cost-efficient solutions. With suitable inputs, Zonation can (among other things) be used for answering questions about reserve design, reserve network expansion, impact avoidance, biodiversity offsetting and spatial targeting of habitat management or restoration.[369]

"

The phrases "indirectly aiming" and "suitable inputs" raise questions. The Zonation user manual includes key disclaimers, stating that ...

> Even though the Zonation software has been done with the best of intentions, it is quite beyond one small research group to ensure its correct operation under all

[366] Biodiversity Response Planning: Project Proposals, Guidance Note and Project Criteria for Working Groups
[367] 'Biodiversity Response Planning, Project Proposals - Guidance Note and Project Criteria for Working Groups', https://www.environment.vic.gov.au/__data/assets/pdf_file/0017/119213/Biodiversity-Response-Planning-Guidance-Note.pdf
[368] Nature print, Strategic Biodiversity Values, p1. https://www.environment.vic.gov.au/__data/assets/pdf_file/0031/82993/3-NaturePrint-Strategic-Biodiversity-Values.pdf
[369] Atte Moilanen, *Zonation: Spatial Conservation Planning Methods and Software*, ed. Atte Moilanen and Victoria Veach Federico Montesino Pouzols, Version 4 ed., vol. Version 4 (Helsinki, Finland: C-BIG Conservation Biology Informatics Group Department of Biosciences University of Helsinki, Finland), User Manual. p 2

operating systems and environments … use the software with care and make an effort to understand how the inputs connect to outputs.' [370]

Zonation was developed by scientists in Finland for processing data in relation to a broad variety of ecosystems. Its effective application to the needs of the VPP are arguable, including that decisions about the protection of this critically endangered biosphere are not informed by comprehensive, detailed mapping of all VVP remnant sites.

Zonation is deterministic and not stochastic.[371] As touched on in Chapter Seven, in Probability Theory, a stochastic process is a mathematical object used to introduce an element of randomness in mathematical models used to interpret phenomena that appear to vary in a random manner. The widespread and ongoing destruction of the remnant species of the VVP is random in nature, although the various forms of destruction are not entirely unpredictable. For example, a farmer may create a dam on their property changing the interconnectivity of nearby wetlands. A road crew fixing a series of power poles may unwittingly drive their trucks on top of unmarked remnant patches of roadside plants. A construction company might build a drainage channel across a dormant remnant patch of orchids. The Melbourne Strategic Assessment process, as the Responsible Authority for Melbourne's urban development and expansion, is not informed by comprehensive, detailed mapping of remnant sites and may be contributing to the random, ongoing destruction of the VVP.

Furthermore, the limits of Zonation as a deterministic system need to be urgently considered in terms of managing interconnectivity of grasslands species. How can and how do Zonation outputs reconcile and assist the urgent need to re-establish interconnectivity of highly fragmented examples distributed randomly throughout the biosphere of the VVP, considered as a whole? The Zonation user manual states:

Zonation software is intended for the analysis of biological data with the aim of aiding conservation decision making. In the broader sense, the output of Zonation should be seen as an analysis of conservation priority which feeds into a broader land use planning framework where political decisions are made. The purpose is not always to produce a detailed conservation plan for a large region, but it could be to identify

[370] Ibid. p 2
[371] Ibid. p13

> priority areas of the landscape that could be subjected for more detailed analysis and planning together with stakeholders.[372]

The producers of Zonation clearly and freely describe the limitations of their software. Ecological Vegetation Classes data is mapped topographically across the VVP as a uniform matrix of cells. According to Zonation user manual:

> the [Zonation] algorithm proceeds by iteratively removing the least valuable cells from the landscape while minimizing marginal loss of conservation value and accounting for connectivity needs and priorities given for biodiversity features. As a result, a nested sequence of highly connected landscape structures is obtained with the core areas of species distributions remaining last and previously removed areas shown as buffer zones. In this way, landscapes can be zoned according to their potential for conservation, and differing degrees of protection, maintenance, or restoration effort can be applied to different zones.[373]

Many remnant sites of species unique to the VVP are less than 500 square metres. They do not contain more than 50% native species, therefore do not fit the EVC benchmarking quota and therefore are considered too small or not included in the existing mapping identification and data collection. What methods and processes determine the potential for conservation of a landscape and how it is zoned. How is this potential assessed? What systems are in place to monitor sites that contain remnant species which Zonation considers the least valuable?

A biosphere like the VVP that is highly fragmented cannot afford any further loss of remnant sites. Every remnant site provides clues to identifying potential zones of interconnectivity to other remnant sites. In 2008, the Threatened Species Scientific Committee recommended,

> a broad-scale bioregional plan would make the greatest contribution to the conservation of the large number of threatened species and ecological communities concerned. This plan should be undertaken with the co-operation of the Victorian government, local governments and Catchment Management Authorities, taking existing conservation initiatives into account.[374]

[372] Ibid. p10
[373] Moilanen, *Zonation*, Version 4 p
[374] Ibid.

Until such a plan is implemented, every remnant example requires investigation, monitoring and protection.[375] Detailed, quality data collection, mapping and monitoring of the VVP is the key first step in providing its protection and reconnection and is also what Zonation requires to work effectively.

Currently, the modelling achieved by the Zonation system is based on limited data.[376] From my basic studies of physics, I learned that predicting the trajectory of an electron requires the analysis of very detailed information. To make good decisions about a critically endangered biosphere more detailed information is clearly required for the Zonation system to properly assess and plan for the long-term, to re-establish functioning species connectivity within the VVP.

In producing *Volcano Dreaming*, I became aware of the existence of a dedicated network of volunteers and specialists working throughout the VVP to actively monitor and report sightings of remnant species to each other and the organisations they are associated with. Many correctly fear that drawing public attention to these sites risks further destruction. They reported examples of private property owners destroying sites in fear of caveats, plant enthusiasts removing plants and seed for their own gardens or to sell, interested public unwittingly trampling and disturbing sites. The detailed knowledge of this community needs to be formally included into the urgent process of developing a VVP Recovery Plan via Zonation, this process best undertaken as inclusive, ground-up approach supplying the information to inform responsible top-down decision making and enforcement.

### *modelling systems of conservation and restoration planning*

For many years, the Victorian Volcanic Plains Biosphere Committee have lobbied Australia's federal and state governments for the VVP to be given the status of an internationally recognised Biosphere Reserve.[377] This United Nations Educational, Scientific and Cultural Organisation program of Biosphere Reserves requires sites to be nominated by national governments and remain under the sovereign jurisdiction of the states where they are located. There are currently 701 biosphere reserves in 124 countries, including 21

[375] Australian Government, Department of Environment and Energy, Species Profile and Threats Database, (SPRAT), Natural Temperate Grasslands of the Victorian Volcanic Plain, EPBC legal status and documents, 2019. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=42

[376] Strategic Management Prospects: Overview, (Point 3. Benefit of Action ) http://Department of Land, Water and Planning.maps.arcgis.com/apps/MapJournal/index.html?appid=e0289e3fe12f436490ef63d4444a05df#

[377] Victorian Volcanic Plains Biosphere Committee, is currently led by Stuart McCallum.

transboundary sites.[378] The VVP which does not easily conform to UNESCO's criteria of a biosphere as a cohesive place. With climate change and population growth, it is likely more sites in Australia and internationally will become fragmented and vulnerable. The situation of the VVP exemplifies a global issue in how the remaining examples of fragile sites are treated and how decisions about them are made. As it is being used as a primary tool for conservation management of the VVP the Zonation Algorithm provides a good example, and also perhaps a good analogy for a broader perspective.

The Zonation output results depend on what you plug in as the "desired outcome" so when configured to "budget optimisation" it prioritises economic, over ecologically-based, solutions. I agree with the producers of Zonation, when the Zonation Algorithm is optimised to reach economic solutions rather than environmental stability, it should not be used as the deciding factor of what is excluded and included in VVP land management policies, planning and budgets. Such decisions should be made collectively with multiple stakeholders, and based on the stakeholders fully understanding the options.

The notes from the Zonation producers clearly describe how inadequate input data and inappropriate set-up and choice of "cell removal rules" can have dire consequences. [379] None of the four Zonation cell removal rules is wholly appropriate for the VVP. Core Area Zonation seems to be the most conducive approach in considering the biological value of individual cells to minimise biological loss, but this application is still based on the removal of cells deemed of least biological value. The state of near extinction of the VVP requires that any computer algorithm software should be used primarily to identify areas requiring buffer zones. Zonation's producers clearly recognise the importance of connectivity in conservation management. Zonation 4 includes a new corridor building method that adds "the capability to operate on path-like connectivity".[380] The makers of Zonation openly acknowledge a specific limitation in explaining:

> At present Zonation only has a single option per selection unit, that is, protect or not, restore or not, maintain or not, etc. In a more advanced analysis one could envision multiple alternative outcomes for each location (for example, different levels of protection or restoration). However, one can do analysis where alternative

[378] http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/
[379] Moilanen, *Zonation*, Version 4 pp 16 -18.
[380] Ibid. p 79.

conservation options are explored. This involves developing sensible restoration scenarios and then running Zonation prioritization for each.[381]

The fact that the algorithm is fundamentally set up to make "protect or not" decisions linked to financial criteria leaves its use open to misinterpretation and misuse.

### *algorithms and grids*

Like the Ecological Vegetation Classification system, the Zonation Algorithm and system is based on exclusion rather than inclusion, producing a hierarchical prioritization of the conservation value of a landscape.[382] It is unclear how Ecological Vegetation Classifications and Zonation might work together to provide solutions conducive to reconnecting fragile, fragmented biospheres such as the VVP. Given the perilous fate of highly fragmented environments on the brink of extinction like the VVP, an alternative algorithm concerned with re-establishing long-term connectivity is needed.

The "greedy algorithm" is famously used to find the shortest route between various destinations for a travelling salesman. As it is primarily inclusive and connective, it occurred to me that perhaps a version of the greedy algorithm could be adapted to locate potential corridors of re-connectivity, especially if a cellular grid with flexible rather than fixed geometry were used as a topographical overlay for establishing connectivity. The paper, *Using Siting Algorithms in the Design of Marine Reserve Networks*, helps confirm the first part of my supposition.[383] It explores how SPEXAN, another software package used internationally for conservation planning and management, deals with issues of demographic interconnectedness. The study is based on the premise that planning units with a high irreplaceability value are the first sites that should be targeted for protection and uses bethnic (bottom of a body of water) habitat data from the Florida Keys (USA) to compare spatial annealing (a 'connectivity' function also available in Zonation) and greedy algorithms use with conservation software SPEXAN (adapted as MARXAN as marine reserve software).

The results confirm that the greedy algorithm included far more sites than spatial annealing while comprising less total area (Figure 199). It also explains, that with an overall 85%

[381] Ibid., see section 2.14, Assumptions and Limitations, p79.
[382] Ibid. p 28.
[383] Heather Leslie et al., "Using Siting Algorithms in the Design of Marine Reserve Networks," *Ecological Applications* 13 (2003).

longer site perimeter scattered sites present other difficulties and expenses, which helps to explain the low cost-effective ranking received by the VVP:

> more compact reserve systems may be preferable for both ecological and sociopolitical reasons, as they can facilitate movement of organisms and biological materials, as well as enforcement and management of reserves (s195*).* [384]

The paper concludes in supporting the value of considering,

> multiple iterations of the conservation goals in the initial stages of planning a network of reserves, so that stakeholders gain a visual sense of how different goals affect potential network designs and implementation strategies. (s196).[385]

It also is apparent, from Figure 199, how strategic zones of connectivity maybe identified through overlaying multiple versions of visualised data.

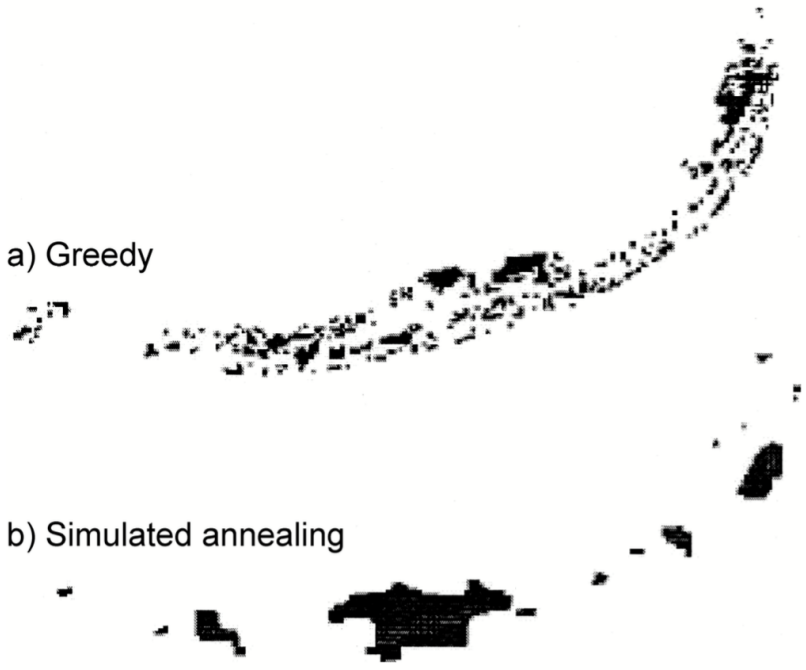



*Figure 199* [386]

[384] Ibid. s195
[385] Ibid. s196
[386] Ibid. Figure 7, p194.

Pavel Vachal et al., in their paper *A Node Reconnection Algorithm for Mimetic Finite Difference Discretizations of Elliptic Equations on Triangular Meshes*, discuss the concept of "adaptive meshes" where, as a topographic overlay, the scale and number of matrix cells can be refined in areas requiring more or less precise calculations, the smaller the cell and the greater the number providing more detailed results.[387] An adaptive rather than a static grid approach, applied as an overlay to the VVP, could be adapted and customised to consider the special circumstance of the VVP so that the Ecological Vegetation Classification requirements accepted a percentage of remnant species under 1%.

If the Ecological Vegetation Classification criteria were also reduced by 99%, that is, divided by 100, it would seem more equitable as a benchmarking system for a critically endangered biome. If the criteria were adapted proportionally to the VVP to properly account for the fact there is less than 1% remaining, a remnant patch qualifies for protection if it is more than 5 square metres and contains more than 0.5% native species. This change would enable a significant proportion of the Natural Temperate Grasslands of the VVP to have its needs addressed, matching the status afforded it through the Threatened Species Committee amendments to the EPBC Act in 2008. Perhaps the cell sizes used by Zonation software could be adapted to match the level of detail required in sites of critically endangered remnant species. This research suggests that a fundamentally "connective" algorithm software program for environmental planning would be of benefit for recovery planning of fragmented and critically endangered environments such as the VVP.

### *Adaptive meshes*

Chapter Seven proposed the idea that the structure of my instruction-based wall drawings can be used to explore the behaviour and dynamics of various topics by making analogies and drawing parrallels. The following discussion proposes how organic geometry could be used as a topographical overlay in various ways to support the interpretation of data. Pavel Vachal et al. describe a geometry of triangles being used in conjunction with algorithms to assist with problem-solving via discretisation. In mathematics, discretisation is the process of transferring continuous functions models, variables and equations into a series of smaller discrete problems that when solved individually can then be reconsidered collectively to make more accurate predictions about the whole of a broader problem that is continuous or that varies.

[387] Pavel Vachal et al., "A Node Reconnection Algorithm for Mimetic Finite Difference Discretizations of Elliptic Equations on Triangular Meshes," *Commun. Math. Sci.* 3, no. 4 (2005).

Discretisation is similar to the processes of quantisation used to predict the behaviour of an electron in quantum physics by collectively analysing a series of smaller events to make more accurate calculations about the whole, discussed in Chapter Seven. Each cell in a grid or matrix represents one such smaller event, a discrete unit, which can be analysed and accounted for to reach practical outcomes and decision-making through numerical analysis.

Numerical analysis is the study of algorithms for solving the problems of continuous mathematics involving real or complex variables, being an outgrowth of approximation theory.[388] It is used in engineering, physical sciences and more recently life and social sciences, medicine and business, a grid or mesh being used to divide a topic of study into smaller discrete parts that can then each be analysed to make accurate predictions about the whole. Each individual grid is a small-sized geometric shape that covers the physical domain, its objective being to represent a discrete, deterministic, relatively unchanging part of the whole. Marshall Bern and Paul Plassmann explain that:

> A mesh is a discretation of a geometric domain into smaller simple shapes, such as triangles or quadrilaterals in two dimensions and tetrahedra or hexahedra in three. Meshes find use in many application areas. In geography and cartography, meshes give compact representations of terrain data. In computer graphics, most objects are ultimately reduced to meshes before rendering. Finally, meshes are almost essential in numerical solution of differential equations arising in physical simulation.[389]

Finding the right shaped grid or mesh for the job is essential to achieving accurate numerical solutions, hence the development and use of ‘adaptive meshes’.

With advances in computation since the 1950s, numerical analysis has grown into one of the largest branches of mathematics. Geographic Information Systems (GIS) is a framework used by hundreds of thousands of organisations world-wide to make maps that communicate, perform analysis, share information and solve complex problems. [390] GIS relies on numerical analysis. Developing fast algorithms that quickly converge to approximate answers that are accurate enough for a scientific or engineering applications,

[388] Lloyd N. Trefethen, "Numerical Analysis," in *Princeton Companion of Mathematics* (Princeton University Press, 2006). p 605.
[389] M. Bern; P. Plassmann, "Mesh Generation," in *Handbook of Computational Geometry*, ed. J. R. Sack and J. Urrutia (North Holland, 1999).
[390] https://www.esri.com/en-us/what-is-gis/overview

numerical analysis is the specialty of thousands of researchers who publish in dozens of journals in mathematics, the sciences and engineering.[391]

Vachal et al. describe an 'edge swapping' algorithm they have developed which can be applied to triangular-grids to make more accurate calculations and predictions through a process of "node reconnection".[392] See Figure 200. The method uses lines to divide the cells of a matrix diagonally in various ways according to the algorithm.

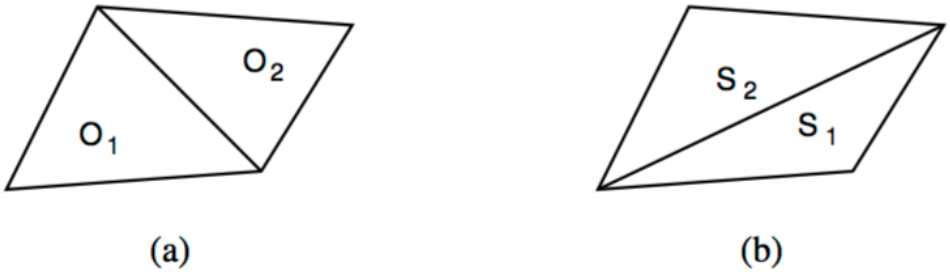



*Figure 200 "Definition of an edge-swap. A pair of original triangular elements O1 and O2 (a) and the pair of triangular elements S1 and S2 (b) that results from swapping of the common edge."*[393]

The authors explain the three basic strategies used to generate adaptive meshes to obtain more accurate results.

- The first is 'h-adaption', where the scale and number of matrix cells are adapted, the smaller the cell and the greater their number providing more detailed results.
- The second is 'c-adaption', which introduces new nodes and connections to increase accuracy, this being the type of mesh adaption the algorithm of Vachal et al. has refined.
- The third is called 'r-adaption', which shifts the location of nodes in a matrix.[394]

Shifting the location of individual nodes in a matrix results in what are called 'unstructured' meshes. Vachal et al.'s edge swapping algorithm can be applied to adapt structured and unstructured triangular meshes (See Figures 201 and 202).

[391] Trefethen, "Numerical Analysis." p 604
[392] Vachal et al., "A Node Reconnection Algorithm for Mimetic Finite Difference Discretizations of Elliptic Equations on Triangular Meshes." p.665.
[393] Ibid. Fig.4.1 p671.
[394] Ibid. p 665.

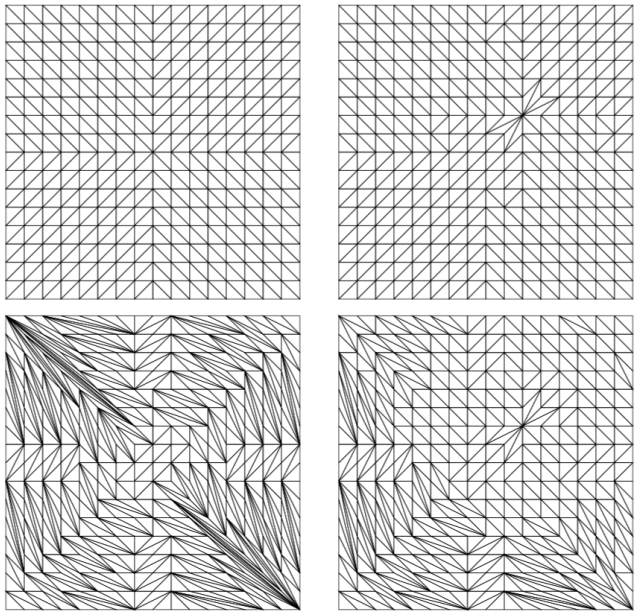


*Figure 201 "Original meshes are shown on the left panel. The corresponding adapted meshes are shown on the right." [395]*

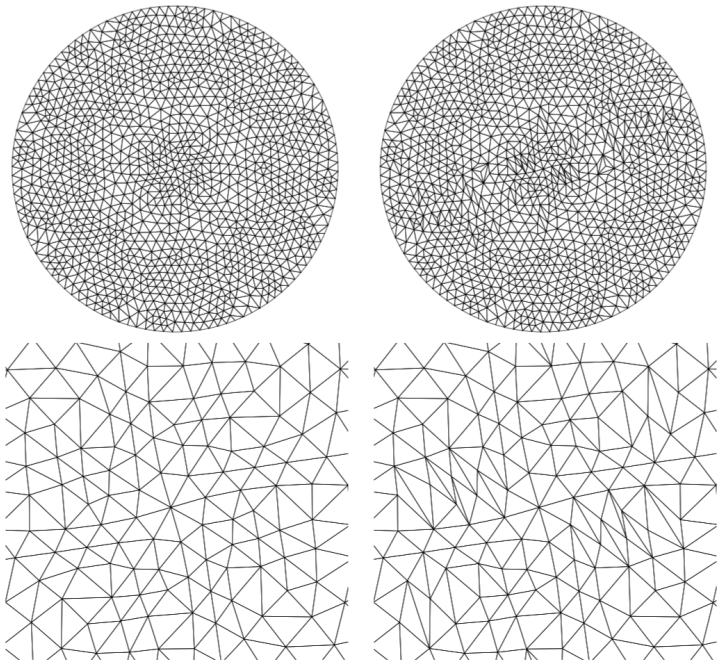


*Figure 202 "The top left picture shows the original mesh, the top right shows the mesh after one iteration. The pictures in the bottom line show details of the region centered at point (0,0)." [396]*

[395] Ibid., Fig 5.2, p 675.
[396] Ibid., Fig 5.4, p 677.

Unstructured two dimensional meshes are typically comprised of triangles.[397] They are very similar in essence to the most basic patterns made for wall drawings using organic geometry. For example, *Red Matter Wall Drawing #3* is an example of an unstructured triangular mesh, an irregular grid being established and each diamond-shape divided in half one at a time to form an irregular grid comprised of triangles (Figure 205 and 206). Vachel et al's. edge-swapping technique (Figure 202) is a system I regularly use to construct and distinguish the internal patterns of wall drawing, such *as Red Matter Drawings* 1- 4 (1994). Integrating my understanding of the behaviour of dynamic grids and what I have learnt about the VVP has led me to reflect on the inequitable topographic overlay of Ecological Vegetation Classification benchmarked cells in relation to a critically endangered biosphere and the use of computer algorithm software designed to exclude cells to identify only what are deemed as Cost Effective Actions. This led me to consider whether an adaptive mesh overlay similar to the wall drawing geometry might produce more accurate data gathering and decision making in relation to the protection of the VVP.

*Figure 203 installation of Red Matter #3 (1995), outside George Paton Gallery, Student Union Building, University of Melbourne, 2014.*

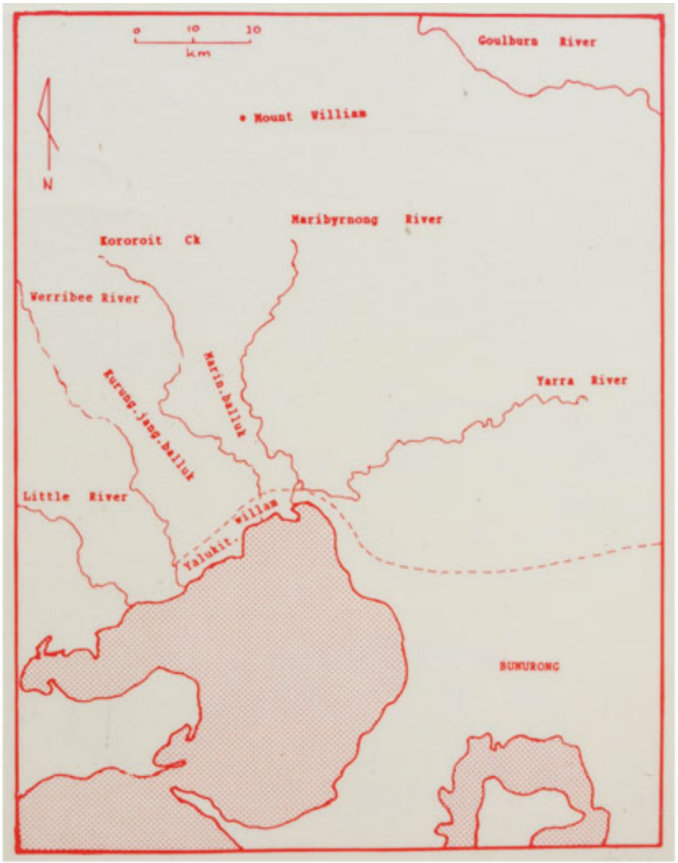
[397] Plassmann, "Mesh Generation." p 2 (of chapter).

*Figure 204 Red Matter #3 (1995), Every Brilliant Eye, National Gallery of Victoria, Melbourne.*

Through discussions with other members of the Grassy Plains network about the appropriateness of generic grid overlays for the conservation and recovery planning of the VVP I became aware of the governments use of Zonation software, the pairing of algorithms and grids to make decisions about conservation planning and broader use and applications of Geographic Information Systems. When I began to make some drawings overlaying the concepts of organic geometry onto to topographical maps, I realised an analogy of making topographical overlays to the different systems of mapping country by Aboriginal people and the mapping of territory through European colonisation.

The division of the landscape into a rigid matrix of squares and rectangles to establish property boundaries is fundamentally different to the system of mapping country used by Aboriginal people which based on the location of physical features such as rivers, mountain ranges etc. The European model is a top-down approach of engaging with a landscape whereas the indigenous peoples emerges from within the landscape itself. Figure 205 Shows a map of clan and language boundaries in Melbourne's West. Gary Presland explains:

the Marin-balluk and their estate was all the area between Kororoit Creek and the Maribyrnong River and stretching up to Sunbury. The area to the west of Kororoit Creek as far as the Werribee River was the estate of the Kurung-jang-balluk. Both of these clans were a part of the Woiworung linguistic group (or tribe) whose territory was all the area drained by the Yarra River and its tributaries, down to where the Yarra and Maribyrnong joined, and west as far as the Werribee River. The other tribe in the Port Phillip region was the Bunurong who lived on the Mornington Peninsula and around Western Port Bay. The Bunurong also claimed a strip of land which stretched around the top of Port Phillip Bay to the Werribee River. This narrow strip, perhaps a few kilometres wide, was the estate of a clan called Yalukit-willam and would have taken in all of Williamstown, most of Altona and the southern parts of Footscray, Sunshine and Werribee.[398]




Clan locations in Melbourne's West.

*Figure 205 Source: Melbourne's iving Museum of the West, Still Here, map provided by G. Presland.*

[398] Presland, Living Museum of the West (Melbourne Vic.), and Footscray (Vic.). Council., *The First Residents of Melbourne's Western Region*.

The series of diagrams (1-12) in Figure 206, present a series of drawings overlayed on to a small corner I've selected randomly of the area designated as the Western Grassland Reserve. These drawings show how organic geometry can be used to develop a site-responsive, adaptive, triangular-mesh to articulate relationships between specifically selected landscape features. For example, in these diagrams a study area has been selected which includes a section of Little River. To form an adaptive mesh, a specific number of points are plotted along the course of the River at regular intervals with the same number of points plotted regularly along two perimeters of the study area boundary (images 1-3). The points are then joined using organic geometry to construct two diagonal grids which are then triangulated by drawing further lines to divide each diamond-shape, one at a time, to produce two cohesive, site-responsive, triangular meshes (images 4-7). These meshes visually describe the relationship between the course and location of the river and the shape, scale and location of the study area boundary as a triangular mesh.

These adaptive and responsive meshes may be used to visualise information and relationships, to help arrive at solutions to complex problems in various ways. Each unit maybe used as a discreet 'area' for analysis, or further divided through drawing more lines of triangulation, each unit may be compared in scale to all others, further patterns and folds in the mesh can be recognised, which may be interpreted in various ways. For example, in terms of conservation planning perhaps they represent courses of potential connectivity or areas more vulnerable to weed invasion. When combined with current grid overlays of data these topographically adaptive grids may be used to help identify areas requiring special treatment in conservation planning.

This research and making these drawings has led me to become aware of a completely new area of research relevant to organic geometry which may have reciprocal benefits and lead to new projects, exploring the potential and using the geometry of my wall drawings to generate adaptive meshes. Therefore, this research demonstrates how geometric abstraction can be used to support the generation and preservation of biological diversity and the visualisation of complex information.

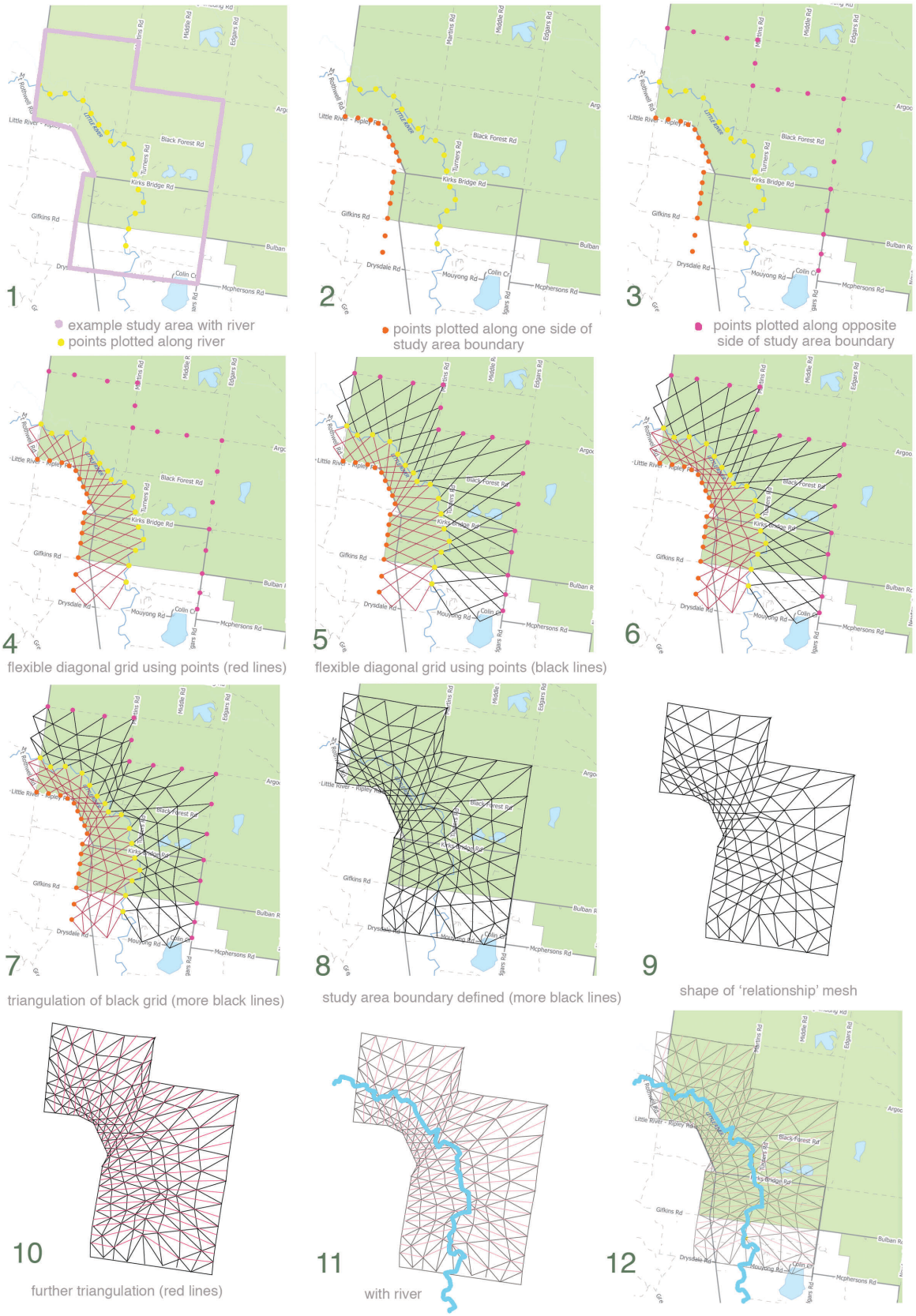

1
example study area with river
points plotted along river
2
points plotted along one side of study area boundary
3
points plotted along opposite side of study area boundary
4
flexible diagonal grid using points (red lines)
5
flexible diagonal grid using points (black lines)
6
7
triangulation of black grid (more black lines)
8
study area boundary defined (more black lines)
9
shape of 'relationship' mesh
10
further triangulation (red lines)
11
with river
12

*Figure 206*

In 2018, the Department of Environment, Land, Water and Planning commissioned a copy of *Volcano Dreaming* for permanent public display in the windows of its head office in Nicholson Street, Melbourne (Figure 208). The commission coincided with the launch of Biodiversity 2037. The Department recently asked Haffenden and myself to assist in making a website about the VVP for Biodiversity 2037 through the provision of images. After reading the Cost Effective Action documentation regarding Biodiversity Planning and consulting with our networks of grasslands specialists, we declined the offer, seeing the website as an instance of 'greenwashing'. We hope the placement of *Volcano Dreaming* helps to raise awareness in the Department and the public of the richness, but also the precarity of the VVP and inspires people to discuss its plight of the VVP in relation to the governmental system supposedly in existence to prevent its demise.

*Figure 207 Left, Volcano Dreaming at the launch of Biodiversity 2037 at the Department of Land, Water and Planning offices Melbourne: and, right, at the same event Haffenden and Poliness with the Minister for the Environment, Lily D'Ambrosia.*

*Figure 208 Volcano Dreaming installed in the windows of the foyer of 3 Nicholson Street, Melbourne, the head offices of the Department of Land, Water and Planning, 2019. Photograph, Karen Forsyth, 2018.*

# CONCLUSION

*How can geometric abstraction contribute to supporting the preservation of biodiversity and sustainable design?*

## *Answering the research question*

This research has resulted in naming, articulating and examining the scientific relevance of the concept of Organic Geometry, which has been developed through my art practice by combining geometric abstraction and principles of ecomuseology. The thesis has identified that Organic Geometry can be used to inform the preservation of biodiversity and sustainable design in three key ways to convey the power of geometry, the significance of art and to demonstrate connections between art and science:

1) As an education tool through processes of making large-scale, collaborative drawings to assist educators in conveying knowledge to students about the nature of Nature and about human integration and interaction with the natural world.

2) As a tool for visualisation that may be useful in conservation planning to inform the construction of adaptive meshes for processesing information where environmental relationships are complex, fragmented and require identifying patterns of interconnectivity.

3) As a system of drawing that can be practised and learnt by anyone, thus providing access to making formalist artworks and developing skills that could be applied to various fields of study and design where the need is to identify, understand and fine tune physical interelationships and patterns.

Each application of Organic Geometry to engage the world through making art will inform the future direction within my research, my arts practice and collaboration with others.

## *Outcomes and insights*

### *New connections*

The thesis has addressed the research question in combining geometric abstraction and principles of ecomuseology to articulate connections between art, history, science and the environment. These connections may contribute to supporting the preservation of biodiversity and furthering of sustainable design through broader dissemination of these connections in several ways.

Via the discussion of the exhibitions, *Volcano Dreaming* and *Pobblebonk*, in their combination of principles of ecomuseology, contemporary art and geometric abstraction, the thesis has provided a set of practical visualisation tools and a process for the development of informational exhibits about other environments. The thesis describes a range of activities and projects that connect contemporary art practice, principles of ecomuseology, scientific knowledge and DIY culture to demonstrate the power of harnessing first hand experiences in passing on culture, ideas, knowledge and stories, while also showing how art and artists can play a vital role in such processes.

### *Demonstrating adaptive, collaborative, cross-disciplinary practice-led research*

The thesis exemplified an adaptive, collaborative, cross-disciplinary model of practice-led research. This required simultaneously analysing and conducting various streams of my arts practice to investigate the research question in multi-lateral ways. There are multiple and diverse outcomes of the research which are presented in two appendices.

Appendix 2, *Making Waves, outcomes and activities*, documents the art-related activities produced in parallel to the writing of this thesis. Here, the research question informed the combination of geometric abstraction and principles of ecomuseology to develop public and architecturally-integrated artworks, exhibitions, events and workshops.

Of significance here are new kinds of art workshops with students. An example is based on my *Landscape Painting Project*, which began in 1999. Within the workshops, the *Landscape Paintings* serve as tools that are produced by students, then used by them to explore their surrounding environment to enable them to see it differently. See Figures 209 and 210.

These workshops represent a potential fourth way of addressing the research question, connecting my *Landscape Painting* and *Wall Drawing* projects in the use of art to provide new ways to engage with Nature through first-hand experience.

*Figure 209 Epping Secondary College Year 8 students Landscape Painting workshop, Heide Museum of Modern Art, 2017.*

*Figure 210 Epping Secondary College Year 8 students Landscape Painting workshop, Heide Museum of Modern Art, 2017.*

## *Harnessing the power of geometry as a language*

The thesis demonstrates the power of ecomuseology principles in enabling artists and others to engage with disciplines and practioners across fields to engage in collaborative, project-based research. It demonstrates how to develop long term associations through interaction with art for mutual benefit and for the benefit of society.

The thesis has also shown how the visual dimension and experience of geometric abstraction can address complicated ideas at a conscious and sub-conscious level and act as a conduit for cross-disciplinary research and the transfer of ideas. It has investigated how via the development of analogies, the inherent abstraction of geometric abstraction enables the development of insights in other fields. In particular, Chapter Eight demonstrated the use of my concept of organic geometry to plot relationships between very small instances of remnant species through the incorporation of adaptive meshes into current environmental protection systems to aid their survival.

The process of working on *Volcano Dreaming* for three years revealed the potential connections between this highly fragmented ecosystem and the patterns and processes of geometric abstraction that I had been exploring for several decades. With no previous knowledge of informatics or numerical analysis, in combining detailed local knowledge, gained through ecomuseological principles and an art practice focused on geometric abstraction, I reached the same conceptual supositions as scientists exploring the use of algorithms in conservation planning and mathematicians developing adaptive meshes and inclusive algorithms. These connections were established through a practice-led approach, identifying the potential for future applications of organic geometry in conservation practice, a possibility I will continue to research and develop through collaboration with conservationists.

The research indentified connections between my wall drawing series and stochastic processes, the drawing projects having potential to serve as a visual tools to describe these in a range of scientific fields, including biology, chemistry, ecology, neuroscience and physics with applications related to the behaviour of financial markets, cryptography, engineering, and image and signal processing.

## *Future directions*

### *Engaging new fields and boundaries*

This research has expanded my awareness of the application of ecomuseology principles within my arts practice to continue investigation with my local context while actively making connections globally through contemporary art networks, as described in Chapter Four through the exhibition *At Your Service*. My awareness of the importance of interconnectivity has informed my work in fostering artist residencies, a new exhibition program and university partnerships at MLMW. The research has resulted in ongoing connections with scientists, including biologists, through the Grassy Plains Network, and the development of workshops with students at primary, secondary and tertiary institiutions. Through each of these activities, I continue to explore new possibilities for the application of Organic Geometry in new projects; including the potential for a practical application of the topographical matrix, as described in Chapter Eight, which has not yet been discussed or tested with scientists.

In 2017, I gave the artist key note address to the inaugaral art education conference “Art Everyday” for primary school teachers and art educators at the Museum of Contemporary Art, Sydney. There, I met several educators with whom I continue to discuss future directions for my research on the role of artists in cross-disciplinary projects and my next set of instruction-based artworks. I was surprised to learn at the conference about the interest from primary teachers in my artworks. The teachers confirmed the value of the inclusive dimension of the works, that they do not rely on traditional drawing skills and use everyday materials that schools can afford and children can use. Teachers have been enthusiastic to use my instruction-based artworks to engage students in activities that connect art and science, including around the main concepts I seek to convey, namely integrating design and nature in ways that are sustainable, and the expression of diversity.

*Figure 211 Playground Drawing workshop, Sydney Grammar, 2019.*

The conference inspired me to develop a protoype system for children to make large-scale walking drawings as a whole class activity on the types of surfaces found in school grounds. The *Playground Drawings* are made using coloured jumbo chalk, which is cheap and readily available. The instruction manuals can be cheaply replicated in numbers. I have designed a drawing stick to be used in conjunction with the chalk. It can be made cheaply from materials readily available from hardware stores. The materials and equipment are safe and familiar. The adaptive geometry of the wave drawings is perfect for making drawings on the oddly-shaped spaces found in schoolyards, whether large or small. The drawings wash off with rain, can be hosed away or just left to wear away. The finished drawings can be used to invent games, while the drawing principles can be used to invent new drawings and games. To make the drawings requires collaboration, whole body physical activity, with the quality of the lines produced expressing collective energy. The Playground Drawings, paired with the narratives developed in Chapter Seven of the thesis, will form the basis of a new series of instruction-based artworks.

Among the most interesting concepts encountered in my research was the idea of anti-matter and the collisions between particles and anti-particles that occur within the realm of an atom. As discussed in Chapter 7, particle physics explains that the mass of different particles can be calculated by observing collisions between them. The processes of generating the *Playground Drawings* involve groups of children drawing lines upon lines with chalk, unleashing harnessed energy and revealing applications for concepts of organic geometry in completely new areas of physics that I am yet to explore.

*Figure 212 Playground Drawing workshop, Sydney Grammar, 2019.*

*Figure 213 Playground Drawing workshop, Sydney Grammar, 2019.*

*Figure 214 Playground Drawing workshop, Sydney Grammar, 2019.*

What might this consideration of particle collisions mean in relation to developing new wall drawing projects? Perhaps these ideas can be integrated into collaborative workshops, the harnessing of the whole of class energy and minor, random collisions being useful in visualising the nature of activity inside an atom. I am interested in developing new artworks that intersect at the point where it is hard to distinguish whether something is either mass or energy. The Playground Drawings have the potential to convey concepts about movement, time, variation and velocity. What might these drawings communicate? How would they be constructed? Where might they be relevant? What might they achieve? And where might this take my research as an artist? I look forward to discussing these ideas with new colleagues established through this research and beyond and to developing new ways of including others in this process.

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# Appendices

**Appendix 1)**

The first Appendix, *Whoosh #1*, is a prototype instruction-based artwork used as a template for several series of wave drawings and future instruction-based artworks. As this Appendix is an original artwork, material has been removed by the author of this thesis for copyright reasons, a redacted version is included here (see page 321).

**Appendix 2)**

*Making Waves: activities and outcomes* (2012-19), documents artworks completed during the research period, these including four series of wave drawings, three public artworks and several workshops and talks, as well an ecomuseum art program co-ordinated with the Living Museum's committee and art sub-committee. (see page 334)

**Appendix 1)**

*Whoosh #1*, is a prototype instruction-based artwork used as a template for several series of wave drawings and future instruction-based artworks. As *Whoosh #1* is an original artwork, material has been removed by the author of this thesis for copyright reasons, a redacted version is included here.

Pages 11 – 68, and pages 70 - 77 have been removed from the redacted version of Appendix 1.

Access to the complete version of the artwork, *Whoosh #1* is conditional, permission is required by the artist who may be contacted directly or via Copyright Agency.

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# Appendix 1

# Whoosh #1

## Making Waves:
## connecting art, science and ecomuseology

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Note: REDACTED VERSION

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whoosh

2012

# whoosh
# (DRAFT)
# january 2012

Kerrie Poliness

2012

*whoosh is a wall drawing  inspired by sound, motion, wave dynamics and time*

*As a drawing on a wall whoosh captures an instance of the broader work of whoosh, an ever-evolving gesture. These instructions describe how to construct a geometric free-form (gestural) wave.*

*As this set of instructions ensures the possibility of an endless repetition of different versions of the form, the sequence of all future instances of the work may be considered as a slow-motional-gesture-through-time.*

*Frozen in time when drawn on any wall surface, 'whoosh' is a description of the collective sound of all the future manifestations of this particular work.*

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## introduction...

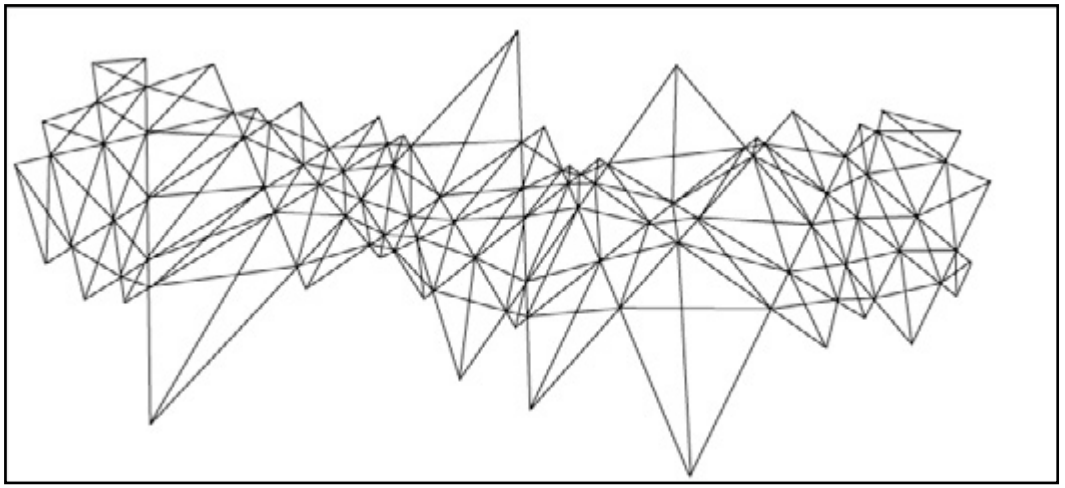
These instructions describe how to make a large geometric pattern onto a flat wall surface. The structure of this pattern is mutable. The instructions ensure that it is not likely that anyone will produce a visually symmetrical version of the pattern; although that may be possible it is not what is intended, required or desired.

Apart from some initial measurements of the wall, and the occasional checking of distances between structural points now and then, all other measurements used to make this drawing must be determined by the makers, as set out in these instructions. In order to make this drawing they must either use their own senses of rhythm, balance and invention or alternatively somehow select random locations to develop the shape and character of the drawing.

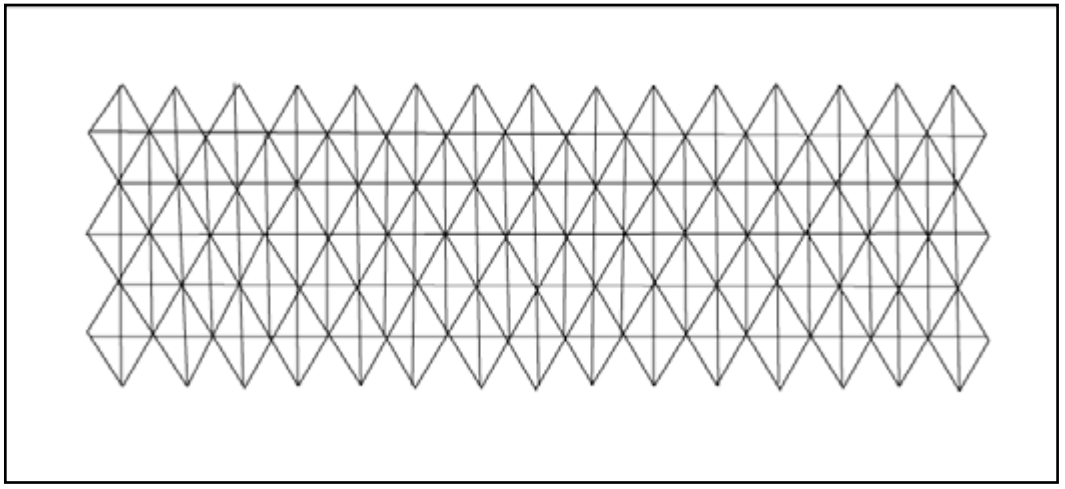
Their decisions  determine the dynamics of the drawing and the level of distortion of the geometric pattern. Their involvement results in a geometric-wave of a particular quality, a large unique gesture, made through the connection each of their decisions with a series of straight lines.

The intention is that the process of producing these drawings reveals something about how difference arises during the formation of matter, that difference is inherent to all matter and that all things are constantly in a state of flux. The process of making this drawing also directly includes decisions that are either 'felt' or 'introduced randomly' by people using this book to create new artworks.

The more often someone makes the drawing and plays with the dynamics the more likely they are to understand and control the possible outcomes of this work. It is important to understand that there is no correct or incorrect outcome in terms of the nature of the wave dynamics that are created. Whoosh incorporates the possibility to actively steer and play with the geometry or to invent new ways of the randomly forming the dynamics, or inventing new ways to help the drawing generate itself.



A visually asymmetrical 'geometric-wave' version of the geometric pattern  of whoosh



Visually symmetrical version of the geometric pattern  of whoosh

## skills required

The emphasis in this work is not on the skillful execution of line drawing. Anyone can make this drawing, they do not need to be concerned with being artists or specialists of any kind. A pristine finish is not required however making this work does require concentration and effort. The instructions must be followed carefully or the work may not be successful produced.

The method and materials used in this work should remain evident, and so a rough look, especially close up, is not necessarily seen as a technical problem. This book ideally should be on display somewhere in the vicinity of the drawing.

Accidental errors such as smudges and marks on the wall, produced during the process of making the work are sometimes unavoidable and can be considered a part of the finished work. Such marks should only be removed if the producers believe that they detract from the work or they are not happy to leave them.

Only people with an interest in making these works should be employed to make them.  The most important skills required to produce these drawings are:

1. The patience to read and follow the instructions in this book. Either read, or have someone read to you, each page comnpletely before beggining to follow the instructions on that page.

2. The willingness to make decisions as instructed and to trust in and use one's own judgement and senses.

3. The ability to work with other people collaboratively as a group to discuss and design the drawing.

4. The ability to make reasonably accurate measurements (to determine the size and position of the drawing) and to carefully draw lines using a straight-edge, taped to the wall, as a guide. Some of the lines of this drawing will be more than several metres long and will need to be drawn while standing on a ladder or scaffold. At least one person or a technical assistant should be good at doing this.

## collaborative possibilities

It is possible for one or more people to direct another or others to produce the drawing by following the instructions in this book.

It is also possible to invent new ways to make the drawing. For example, someone may choose to ask many people to particpate and therefore the dynamics of the drawing are determined by the collective participants.

As long as the spirit of the work is adhered to, with the intention to create a visually unique drawing by following this book, new methods of determining the location of the points may be invented.

This work may be lent to others including: schools, groups and individuals to produce a wall-drawing as long as the conditions described in the section titled # ? © are met.

If your group cannot afford to meet these requirements or if you have an idea or proposal for the use of this work please contact the artist / gallery.

## MAKING THE DRAWING + TIME REQUIRED

From the onset of constructing a version of this drawing it can be a publicly presentable artwork. Whether it is or not may be determined by the organisers and the makers of the drawing together.

The process of creating whoosh is as much a part of the artwork as the finished drawing. If the people creating the work are happy to be observed doing so the process may become a performance piece. The materials, the sequence of applying the materials to the wall, and the activities involved are designed so that every stage and step of the drawing is presentable as an artwork.

There is no time limit for making a drawing. It should take as long as is needed and may be constructed slowly over an extended period of time. Galleries and other venues should make an installation plan and schedule with the preparitors. The people making the drawing should be given plenty of time to develop the drawing, to think about the decisions that they need to make and not be placed under undue pressure to hurry that process.

Only people interested in making the work should be employed to do so. Ideally they will be enthusiastic to follow these instruction and use their senses and personal judgment to make decisions in order to make the work and not be stressed by this idea. They should be willing and able to work collaboratively with other people and be able to participate and help construct the drawing as a group.

The people making the drawing should read this book beforehand and practice by making smaller to-scale versions of the drawing on to paper first. This can be very helpful if a group are working together to discuss and work together to 'design' the wave; or if gallery assistants must complete the work within a limted time frame and would like to create a working plan in advance.[1]

The people making the drawing should also practice drawing with the markers and long aluminium strips before drawing on the wall. At the end of this book is a section titiled *technical notes* which explains how to use the materials and equipment to draw lines and make guides and tools as required. This section should be read either before or while making the drawing at each step that it is referred to.

People should work in pairs. The drawing size varies according to the size of the wall. It may take between six and twelve hours for two people working together to produce on a wall 10 metres long by 3 metres high. Extra people enlisted to help towards the end or on a larger wall may reduce the time it will take to make. These people should be briefed about the drawing, where it is up to and supervised by the others until they are clear and comfortable about what they are doing.

Generally a pair of people for every five to seven metres of wall length is a good number. More than this and it becomes crowded, less and it becomes physically taxing.

To be safe allow two to three days to complete a drawing. Progress on *day-one* should provide an indication as to how long it could take. Each situation will be different, so allow plenty of time and a couple of days for contingencies.

1 Interview with installation team MUMA, Blue Wall Drawing #1, for the exhibition Networks Cells and Silos, 2011.

# ? ©

This book has been produced in an edition of 12. The number within the edition is written on the inside cover. Copyright laws apply to the book and the reproduction of any part of its contents.

Only two drawings from this particular book can exist at any time. To make a third drawing, one of the previous drawings must be painted over. Two wall drawings can be produced, after which any further drawings are subject to a royalty payment to the artist of 10% of the current market value of this work/ book.

By purchasing this book the owner agrees to these terms and agrees to provide the artist/gallery with written notification and photographic documentation (1 image) of every drawing produced via this book with the date and the location of each drawing. A copy of this information must remain with this book and be provided to the new purchaser in the event of on-selling this book.

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## materials and equipment...

PERMANENT MARKERS
Blackfelt tipped pens – 10 mm chisel tip – for drawing the lines. Depending on how absorbent the wall surface is - a 3 metre high wall that is 10 metres long would require at least 8 of these markers.

Two blue and two red markers used for marking points on to the masking tape.

PAPER AND PEN
For taking notes, writing down measurements, making sketches of the wall etc.

TAPE MEASURE
For measuring the wall and finding the position of the drawing on the wall.

MASKING TAPE
The amount of masking tape required is dependant on the size of the wall drawing. For a wall that is about 10 metres long by 3 metres high you will need at least 6 rolls of 50 mm masking tape for masking sections, marking points, securing the line-drawing guides, and defining a rectagular area for the drawing.

CALCULATOR
Helpful for calculating the wall type, the size of the drawing and the position of the drawing on the wall.

GREY WOOL OR STRING
For dividing the wall into sections lengths of wool or string need to be taped to the wall.

HAMMER + NAILS
Small nails 30-40 mm with flat heads – for marking points and supporting the line-drawing guide.

LADDERS x 2
2 free-standing ladders high enough to reach the top of the wall, for larger walls a scissor-lift would be very helpful.

ALUMINIUM STRIP x 3
3 lengths of Aluminium strip (width @ 20 mm and depth @ 3 mm)
3 x the length of the wall height.
Two of these can be taped together if the wall is particularly high for drawing the longest diagonal lines and one is to be cut down into shorter lengths in stages six and seven for drawing the shorter lines. These strips can be kept and re-used.

HACKSAW
For cutting down the long lengths of aluminium strip to use as guides for drawing the shorter lines.

METHYLATED SPIRITS
For cleaning excess marker ink off the Aluminium strip use a cloth dampened with methylated spirits.

RULER
A short flat ruler used as a guide for drawing the ends of the long lines made in difficult or cramped locations eg. very top of walls.

WALL SEALER
Required to cover-up mistakes and for painting over the drawing. As the markers are spirit based a special sealer must be painted over the marker before applying the usual wall paint, otherwise the marker will seep through. Use a white pigmented shellac-based primer-sealer.

STAGE ONE

FINDING A WALL

This drawing is best suited to long walls however a version of this drawing can be made on any size wall. If you would like to make a large drawing choose a large rectangular wall where the width is greater than the height. The drawing can be made by using the entire wall or by defining an area on a wall as described here...

DEFINING THE DRAWING AREA ON ANY WALL

Define an area on the wall where you would roughly like the drawing to be made by making a rectangular area using masking tape. The height of the defined area must be less than 70% than the width. (you can calculate this by multiplying the defined area width by 0.7. , so: *area width* x 0.7 = ? , the area height must be less than that answer).

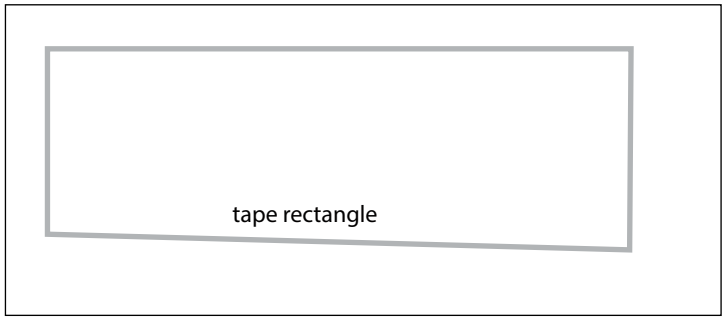

diagram 1

It does not matter how accurately it is formed as a rectangle, make a shape that feels right on the wall that is roughly rectangular, then check that the height is less than 70% of the width. If it is not then adjust the taped area so that it is.

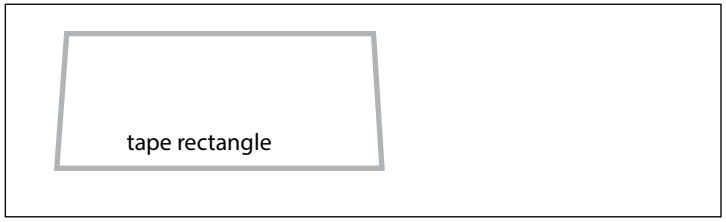

diagram 2

The drawing must not cross over any fixtures or protrusions or run under or over any fittings such as pipes, skirting etc. and ideally will not be obscured by lights or ducting etc. Take these things into consideration when marking out a rectangular shape on the wall. The finished drawing will only roughly be contained within this area, it is important to allow for some expansion. Read through this book and look at the diagrams before beginning.

If you would like to make a very large drawing on the wall that will cover most of the wall area first two ends of the drawing must be defined. Define the two ends of the drawing by placing two vertical strips of tape running from the floor to the ceiling (diagram 3 +4 opposite), one at either end of the wall. If you choose to do this you will need to first measure the entire length of the wall so that you can calculate to leave a minimum of at least 5% of the total wall length as blank space at either end (wall length x 0.5). The symbol > 5% in these diagrams means greater than 5%. You will need to check that the height of the wall is less than 70% of the length of the wall area between the tapes.

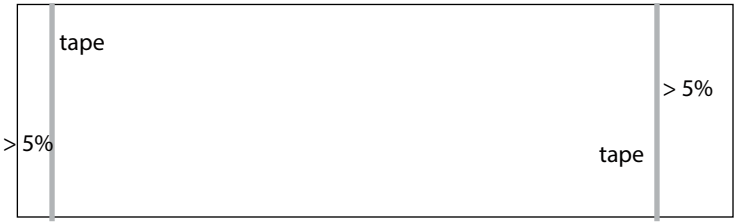

diagram 3

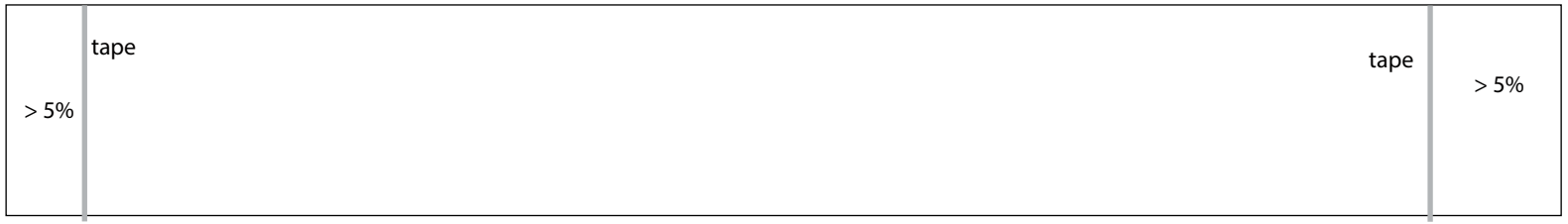

diagram 4

NB It doesn't matter if these taped lines are a bit wonky, if you stretch the tape taut across the wall before pressing it down these lines will be straighter.

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STAGE SEVEN

15. Refer to the section in techical notes titled ‘drawing stage seven lines’. Continue across the drawing from left to right, working down each column, from top to bottom, and drawing each line from point to point one at a time to divide each diamond-shaped unit. Remove each pieces of blue tape as necessary before drawing each line.

Diagrams 1- 5 show all drawings now completed.

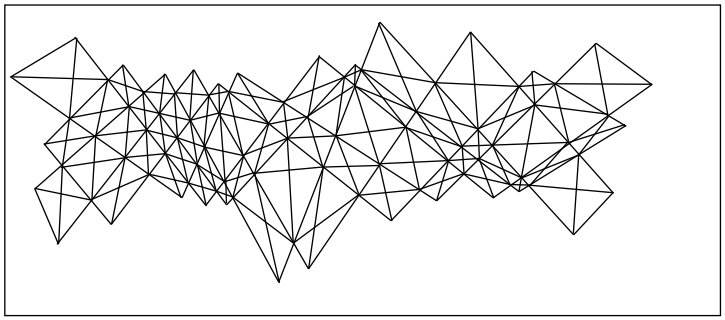

diagram 1

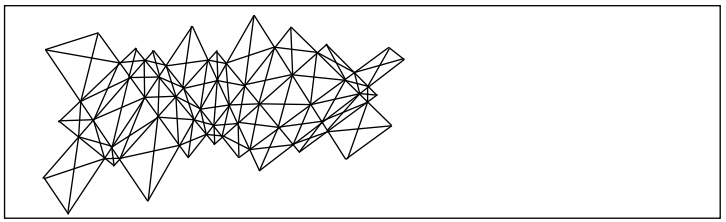

diagram 2

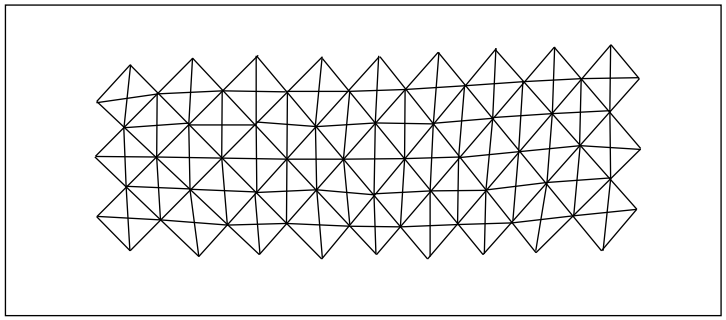

diagram 5

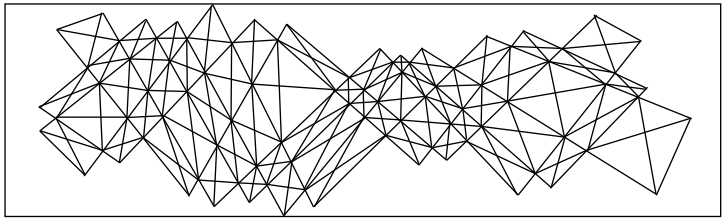

diagram 3

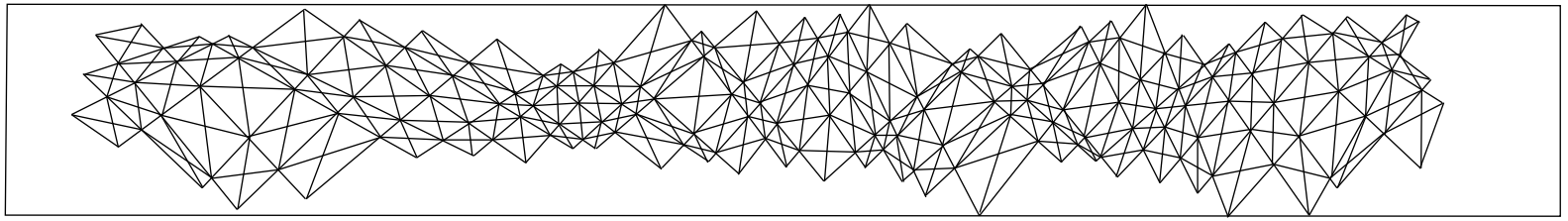

diagram 4

# Appendix 2

## *Making Waves:*
## *connecting art, science and ecomuseology*

## *activities and outcomes*

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# *Making Waves, public outcomes 2012 - 2019*


*(1) Research related: public and integrated Artworks, workshops , exhbitions, talks and installations*

*Whoosh #1 prototype, Royal Institute of Science, Australia (RIAuS ), Adelaide, 2012.....P4*
*White Black Whiteboard Drawing, Laby Centre, Physics Department, University of Melbourne, 2012.....P11*
*Wave Drawings 1-8, Highpoint Shopping Centre, Melbourne, 2013.....P14*
*Field Drawing, Agora Lawn, La Trobe Museum of Art, Melbourne, 2013.....P18*
*Field Drawing installation and film, Gallery of Modern Art (GoMA) Brisbane, 2014.....P21*
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# *Whoosh #1 prototype installation*

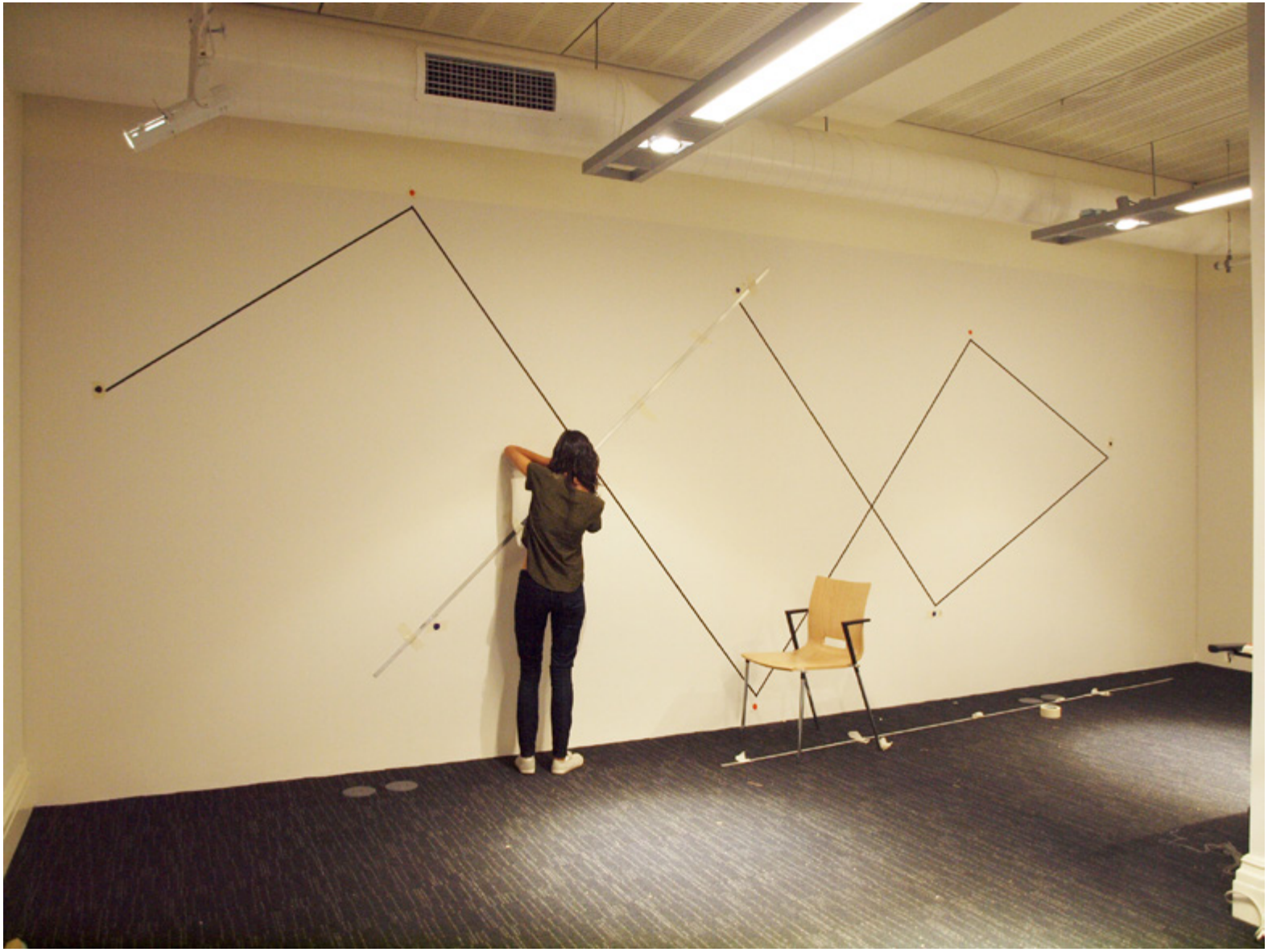
*Royal Institute of Science, Australia (RIAus )*

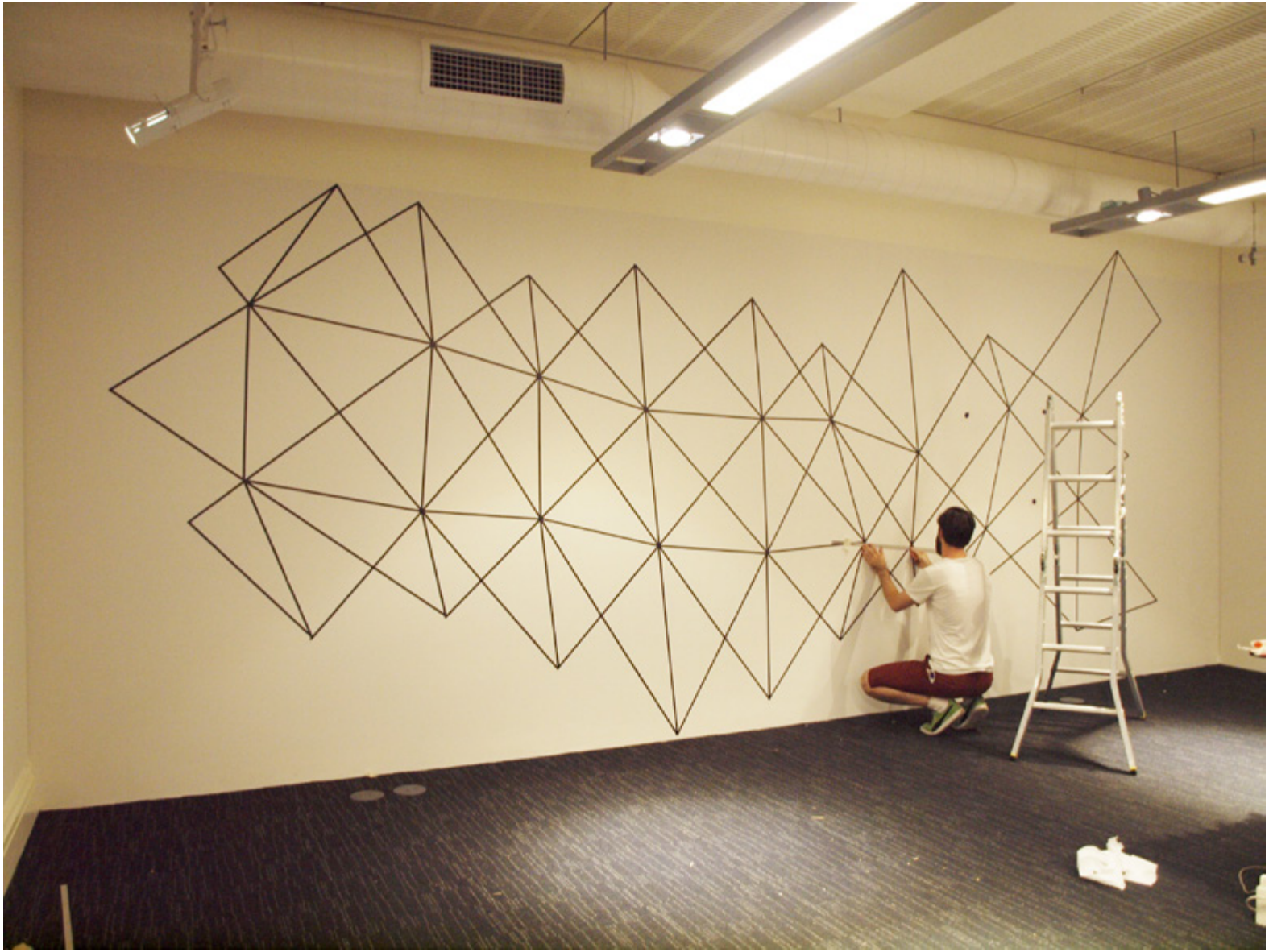
*Adelaide, 2012*

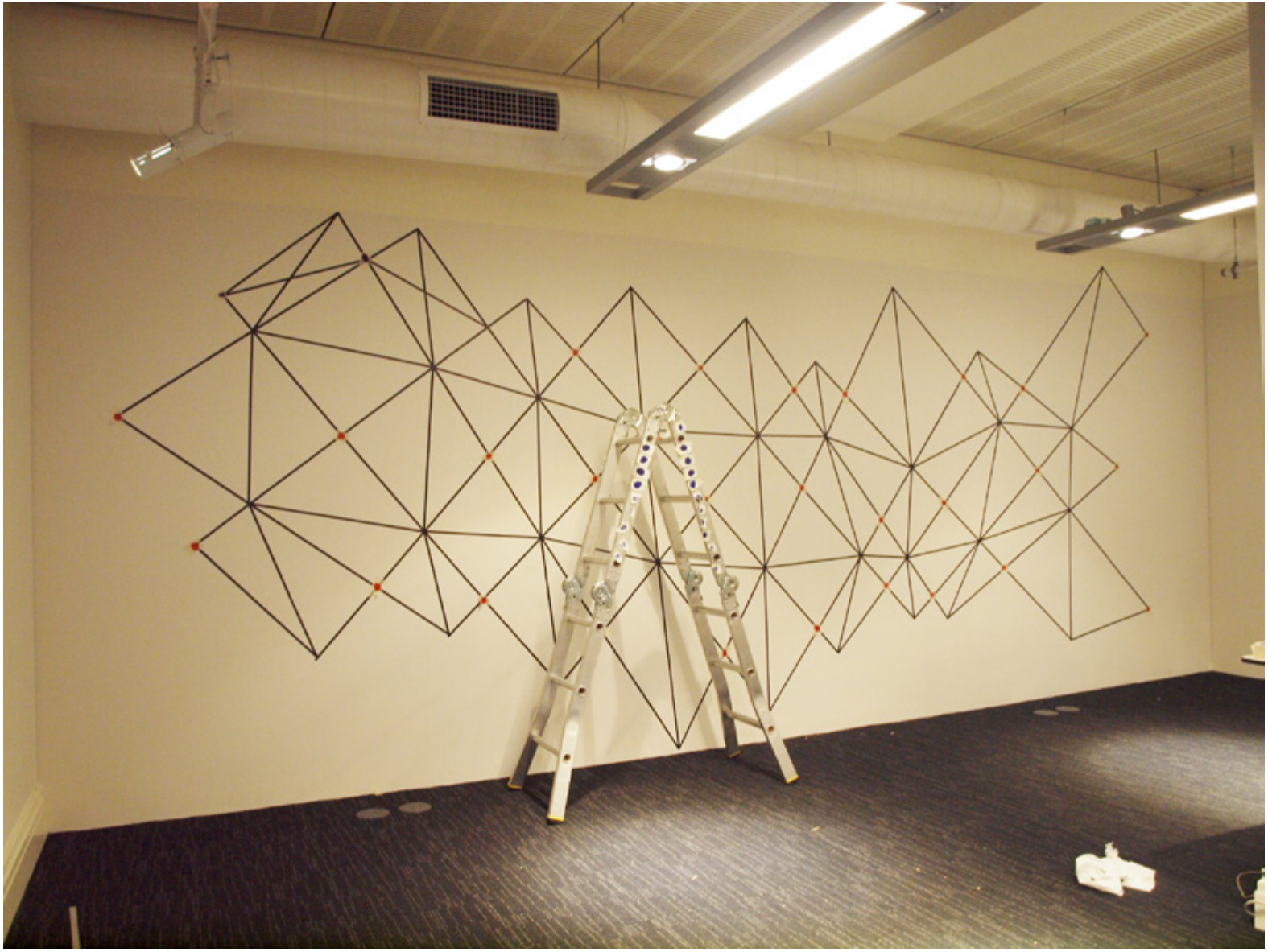
*exhibition: Pattern and Complexity*

*artist talk and public panel:*
*RIAus*

*journal article: not quite right, Artlink magazine,*



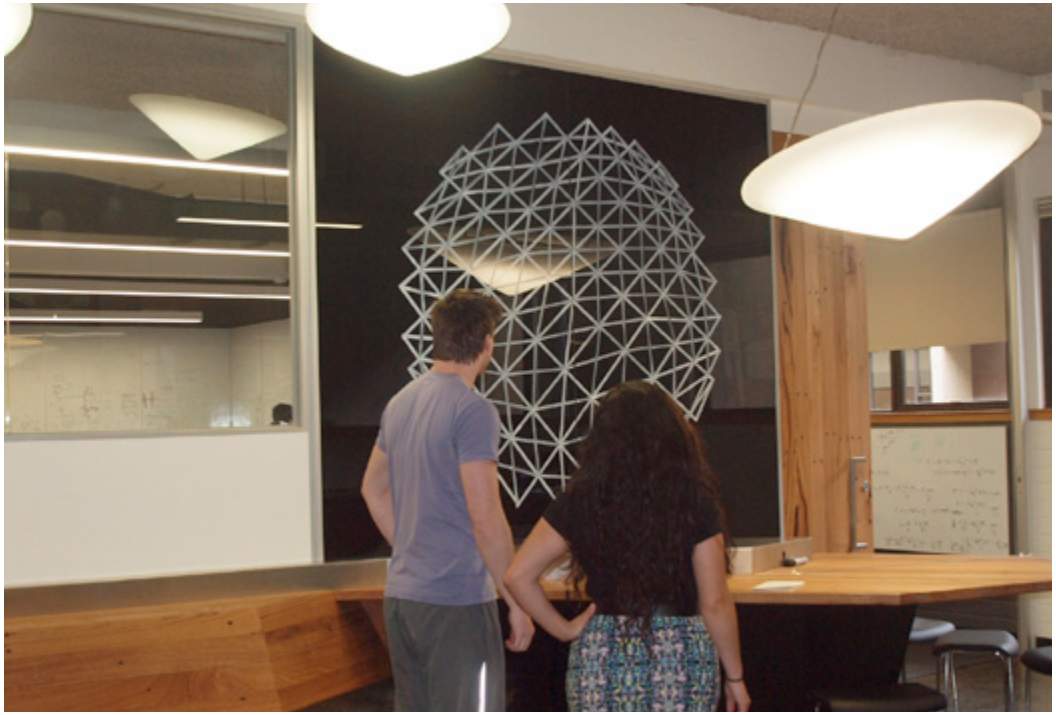




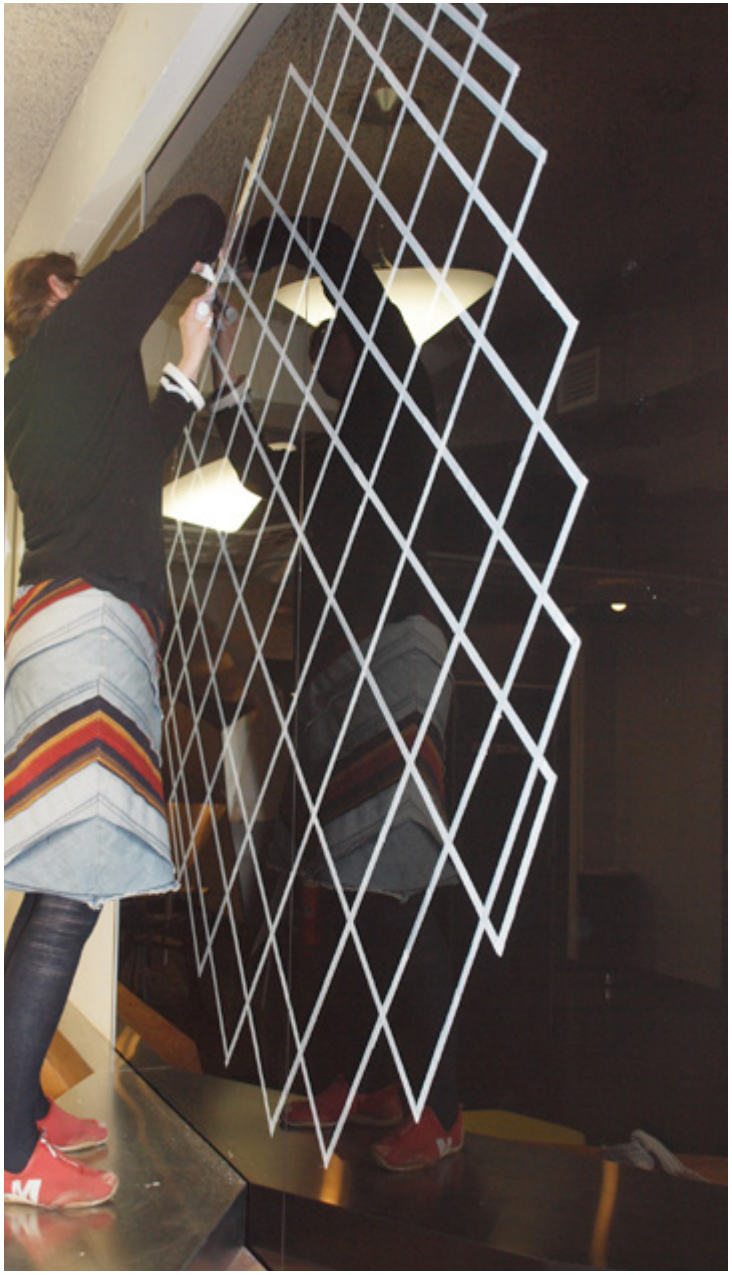
# *White Black Whiteboard Drawing*

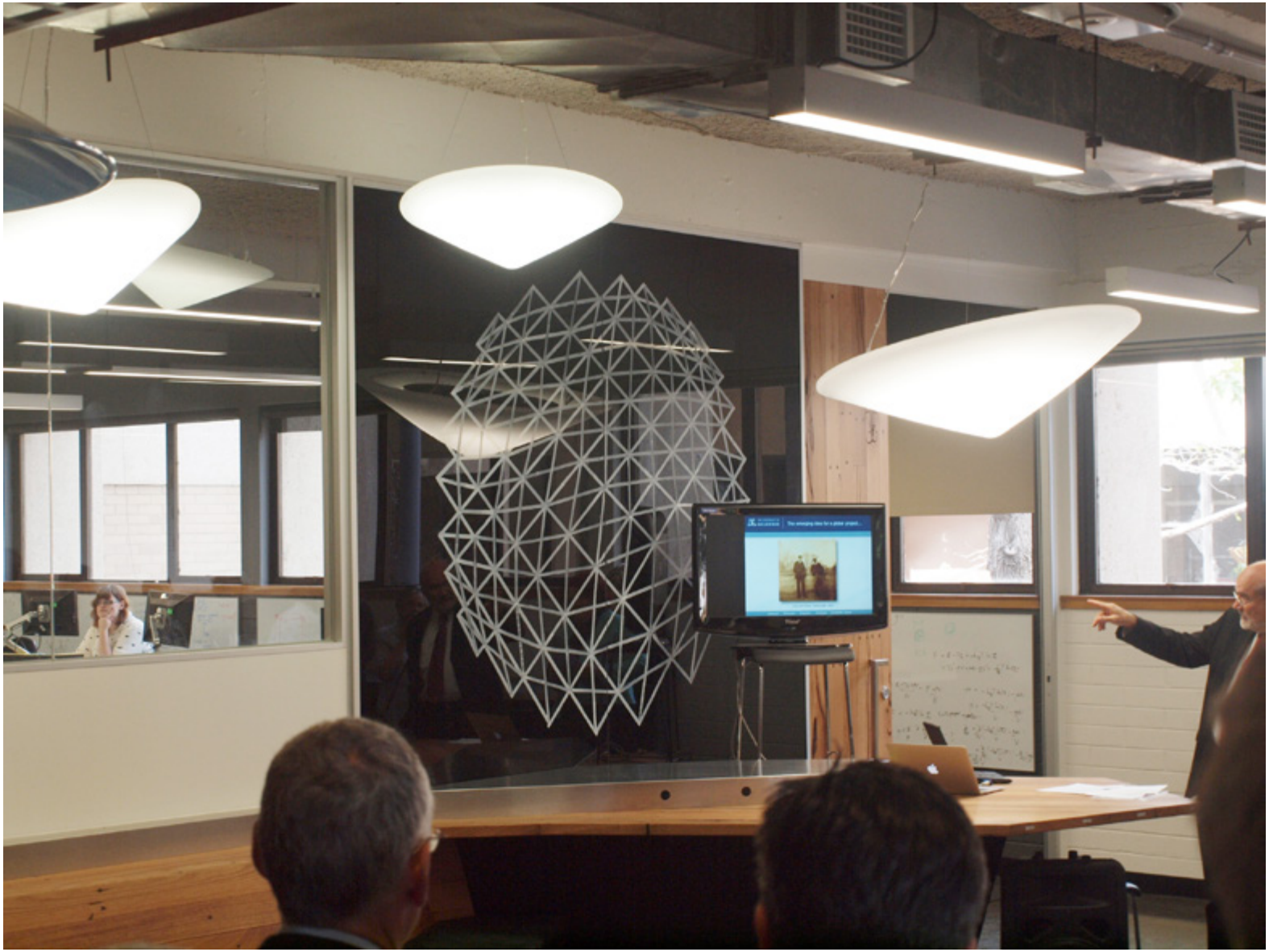
*Laby Centre, Physics Department, University of Melbourne, 2012.*

*workshop and installation with physics students*



White Black-Whiteboard Drawings, made with assistance of Physics students in the new Laby Ideas Centre  study space, Department of Physics University of Melbourne.





# *Wave Drawings 1-8*

*Highpoint Shopping Centre, Melbourne, 2013*

*permanent public artwork*

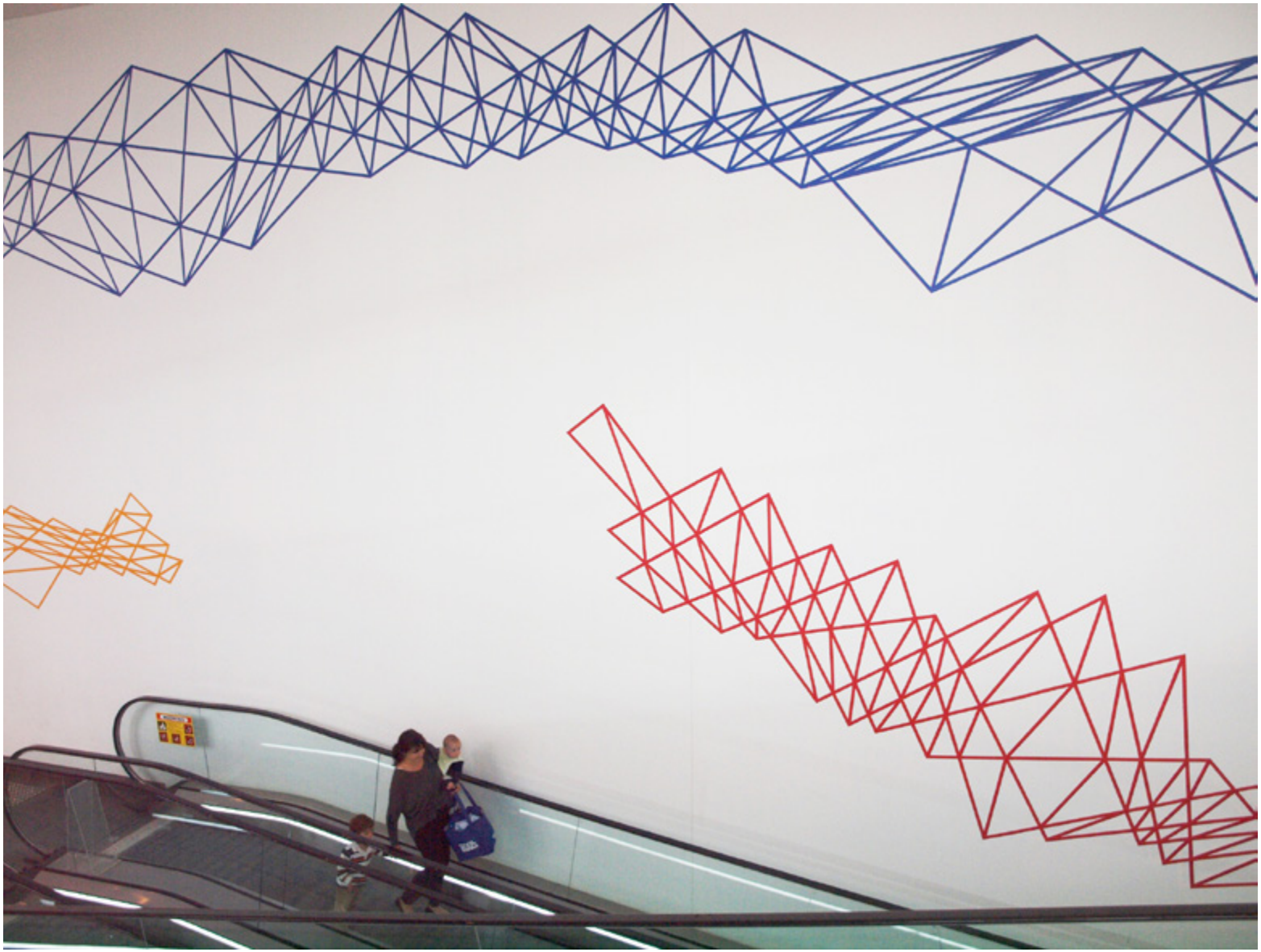
Highpoint – Eastern VT Artwork

These drawings geometrically represent wave formations and refer to the manifestation of waves and wave dynamics across multiple media including light, sound, geomorphology, water, time and culture.

The connection between the location of Highpoint and the geology, flora and fauna of the Victorian Volcanic Plains is particularly significant. Highpoint sits on the crest of a massive, ancient lava wave, on the 'high point', from where tens of thousands of years ago water ran-off to form the Maribyrnong river valley. The solidified lava known as 'bluestone' once quarried beneath Highpoint is the stone from which much of early Melbourne was built. Waves of people have migrated from around the world to the region. Waves are an appropriate metaphor to describe the phases and layers of the western region of Melbourne. These 'geometric-wave' wall drawings represent a crossroads of activity, the interaction of waves through time and space, materials and culture.

The dynamics of each drawing interact with each other throughout the space. Inspired by the sweeping curves and materials of the architectural elements within the centre, the combinations of shapes, dynamics, colours and patterns of the drawings were considered to engage with four points of entry across four levels and the passages of transition between each floor and to and from the new open areas of the centre.

Kerrie Poliness
October 2013



WARNING

# *Field Drawing for the Agora*

*Field Drawing, Agora Lawn, La Trobe Museum of Art, Melbourne, 2013*

*solo exhibition, pop up art series*
*curated by Vincent Alessi*

Field Drawing on the Agora made with assistance of passer by engineering students .

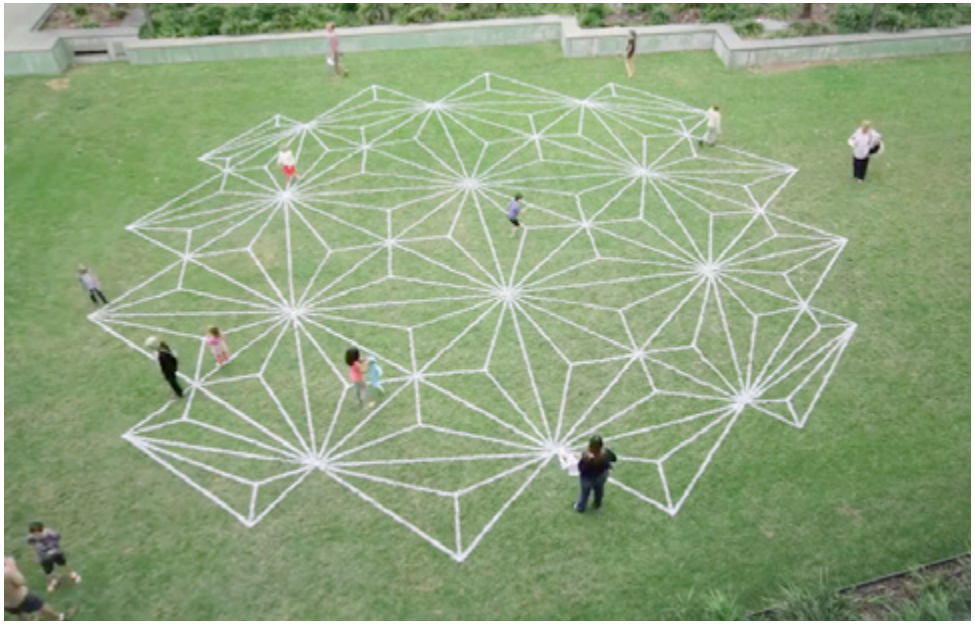
# *Field Drawing*

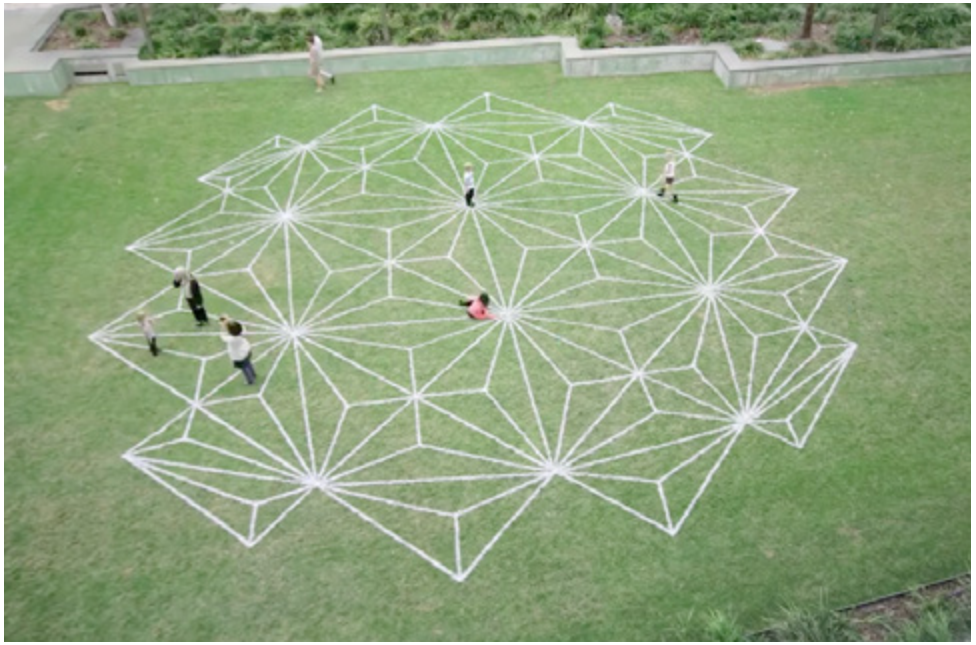
*GoMA, Queensland Art Gallery, Brisbane, 2014*

*Exhibition: Trace: Performance and its Documents*

*drawing installed as performance on Maywar Green, Brisbane*
*stop motion documentation of process*

Field Drawing at GoMA was made as a public performance and documented using stop motion technology t o produce a video for exhibition in Zagreb, 2014.

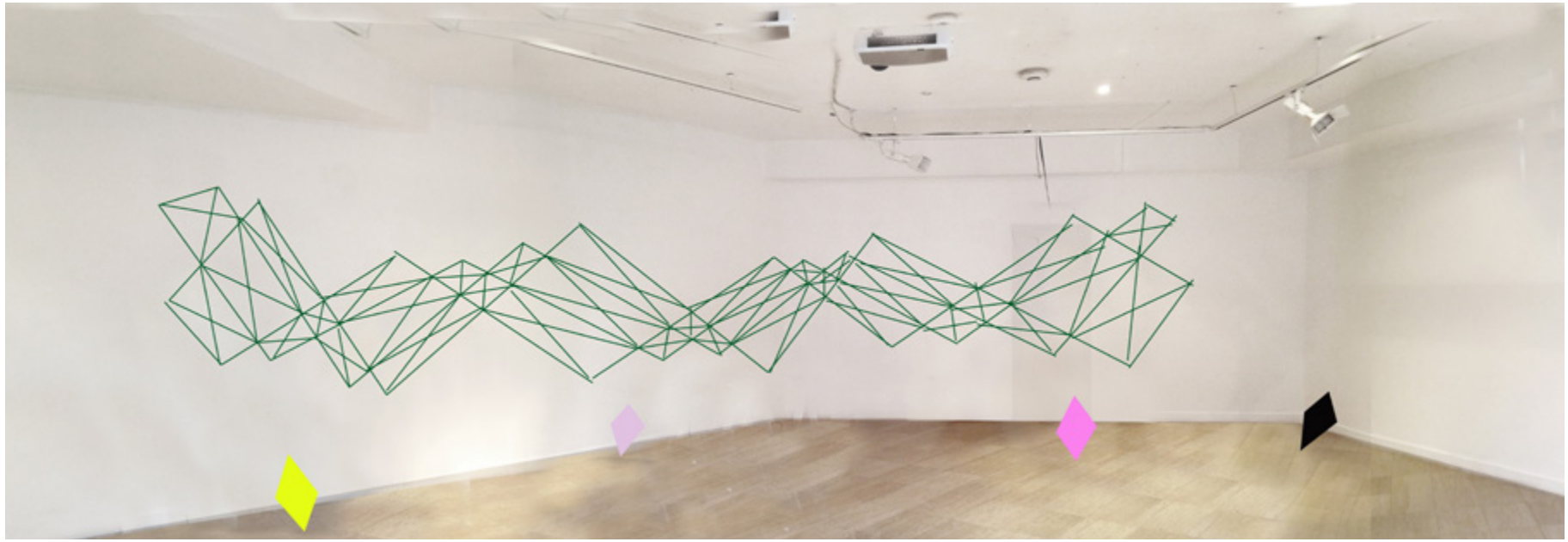




*Wave Drawings (orange and green)*
*Landscape Paintings (Lake Bolac and Zagreb)*

*residency and solo Exhibition: G-MK, Zagreb, Croatia, 2014*

*artist talks:*
*GMK gallery, Zagreb*
*and Croatian Association of Artists, Pula*



This exhibition at GMK gallery in Zagreb Croatia was the result of a two week residency in Zagreb which involved combining wave drawings with Landscape Paintings and making postcards. It connected two unlikely places, Lake Bolac and Zagreb, both associated with my own personal heritage.

Landscape Paintings, Lake Bolac - Zagreb, 2014

In the middle of the Victorian Volcanic Plains (South Eastern Australia) there is a vast body of water called Lake Bolac. Lake Bolac was formed around 20,000 years ago through volcanic eruptions. Lava flows dammed the river creating an enormous shallow teardrop shaped depression that filled with water, the shoreline of Lake Bolac is 27 kilometres long.

Eels have migrated along a strange but steady path to reach the waters of Lake Bolac. The life cycle of the numerous eels that inhabit the rivers, streams, lakes, swamps and estuaries of the plains is an epic story.When they reach breeding age, which can be anywhere between five and thirty years, mature eels swim out of the rivers around Australia, including western Victoria and head along the Australian continental shelf to the seas around northern Queensland and Papua New Guinea, several thousand kilometers away, where they breed and die. The young eels, called elvers, are transparent and leaf shaped. They take a couple of years to return to the rivers of the south east coast of Australia, Tasmania and New Zealand. Then, usually in early Autumn, they swim up the rivers and even slide across damp ground to find a home in the still fresh waters of lakes and wetlands, including those on the plains.

From the ocean the eels must cross 100 kilometres of land to reach Lake Bolac. Aboriginal people built a vast aquaculture system from the volcanic stones along the shores of the lake, trapping and harvesting the eels. For at least eight thousand years (most probably a lot longer) in Autumn people gathered for a festival of eels. Mainly to eat them. The organisers of the festival built an enormous stone arrangement in the shape of an eel, the size of a football field, by shifting massive boulders into position.  Eels are thought to have been traded widely among Aboriginal groups, forming the basis of a sedentary society.

When Europeans invaded Australia the eel festivities and systems of aquaculture ceased for around 150 years. A highway was built through the middle of the giant stone eel. Eels are still caught and traded now, and exported as far afield as Germany and Korea. The largest eel processing plant in the southern Hemisphere is situated at a small rural town called Skipton, on the Glenelg Highway.The eel festival resumed in 2004 and is organised by a committee of local people of both Aboriginal and European descent.

Four non-objective monochrome paintings on perspex painted yellow, black, pink and lilac were made on the shores of Lake Bolac, ‘en plein-air’ style, in March, 2014, during the eel festival. The choice of colours was inspired by the lake, the volcanic stones, the light and the place. The shape, scale and materials of these paintings were developed in 1999 as a format that is neither overwhelmed by nor is intended to overwhelm trees. These non-objective monochrome paintings are ‘landscape paintings’, designed to collaborate with the landscape.

To Zagreb

These four particular ‘landscape paintings’ were taken to Zagreb and installed in an exhibition at G-MK gallery (June 2- 28, 2014). During a two-week residency I followed trails and paths alone and with friends through Zagreb finding places that hold some affinity with these paintings. Places where the paintings feel somehow ‘at home’, or relevant places with which the paintings can make some small collaboration. Vacant shops on the Ilica, the big old oak trees in the little forests of the Tuškanac, rambling gardens of empty homes and mansions on the hills of Zagreb, accompanying weeds and little potted plants and other small incidents of ‘wilderness’; all beautiful places in-between order and disorder, in-between people and ‘nature’, places where ‘flux’ can be seen. Places that somehow relate to or have empathy with these paintings (materials, size, shape and colour), some of these places also seem vulnerable to processes of ‘tidying up’ or ‘progress’. These places all have stories too. They have histories. The paintings have been placed in these landscapes and photographed, made into postcards ready to be sent elsewhere. Small ripples from Lake Bolac.

Kerrie Poliness, May 2014

http://www.g-mk.hr

Slike pejzaža (jezero Bolac i Zagreb)

“Usred viktorijanske vulkanske ravnice u jugoistočnoj Australiji nalazi se veliko jezero Bolac. Jezero Bolac se formiralo prije približno 20,000 godina kao posljedica vulkanskih erupcija te je mjesto od velike važnosti.

Četiri ne-objektne, monokromatske slike napravljene su na obalama jezera Bolac, koristeći ‘en plein-air’ pristup. Te slike su “slike pejzaža”, stvorene sa svrhom suradnje s krajolikom. U Zagrebu, sljedila sam puteve i staze, sama i s prijateljima, ne bi li naišla na mjesta koja sadrže sličnost s tim slikama. Slike su bile postavljene i fotografirane unutar tih krajolika te pretvorene u razglednice, spremne za slanje negdje drugdje. Malo mreškanje s jezera Bolac”.

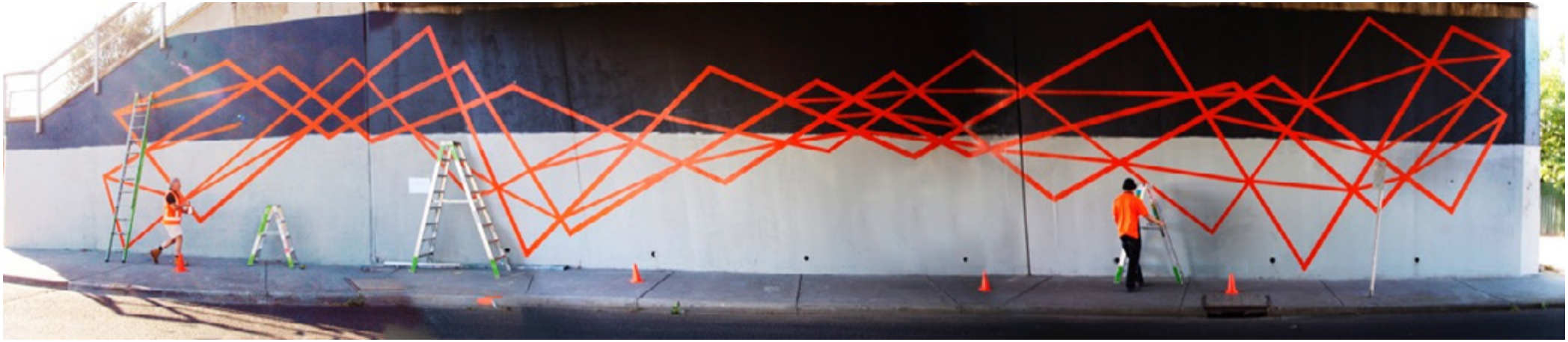
popluna
- beskonacna
William
Blake

GALERIJA
MIROSLAV
KRALJEVIĆ

# *Orange Wave*

*Wood Street & Somerville Road Underpass, Yarraville, Melbourne, 2014*

*permanent public artwork*
*commissioned by City of Maribyrnong, Streetworks, program*

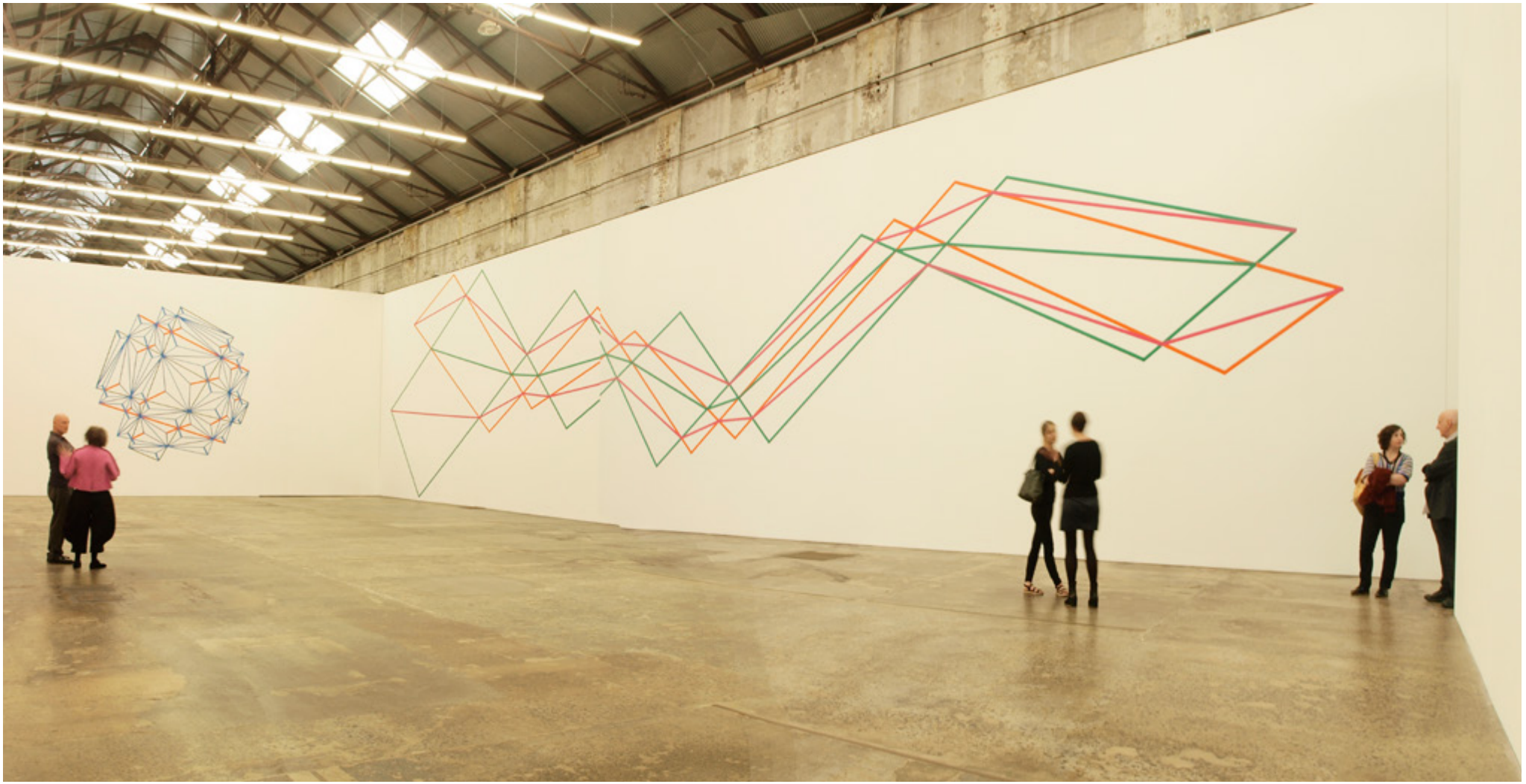


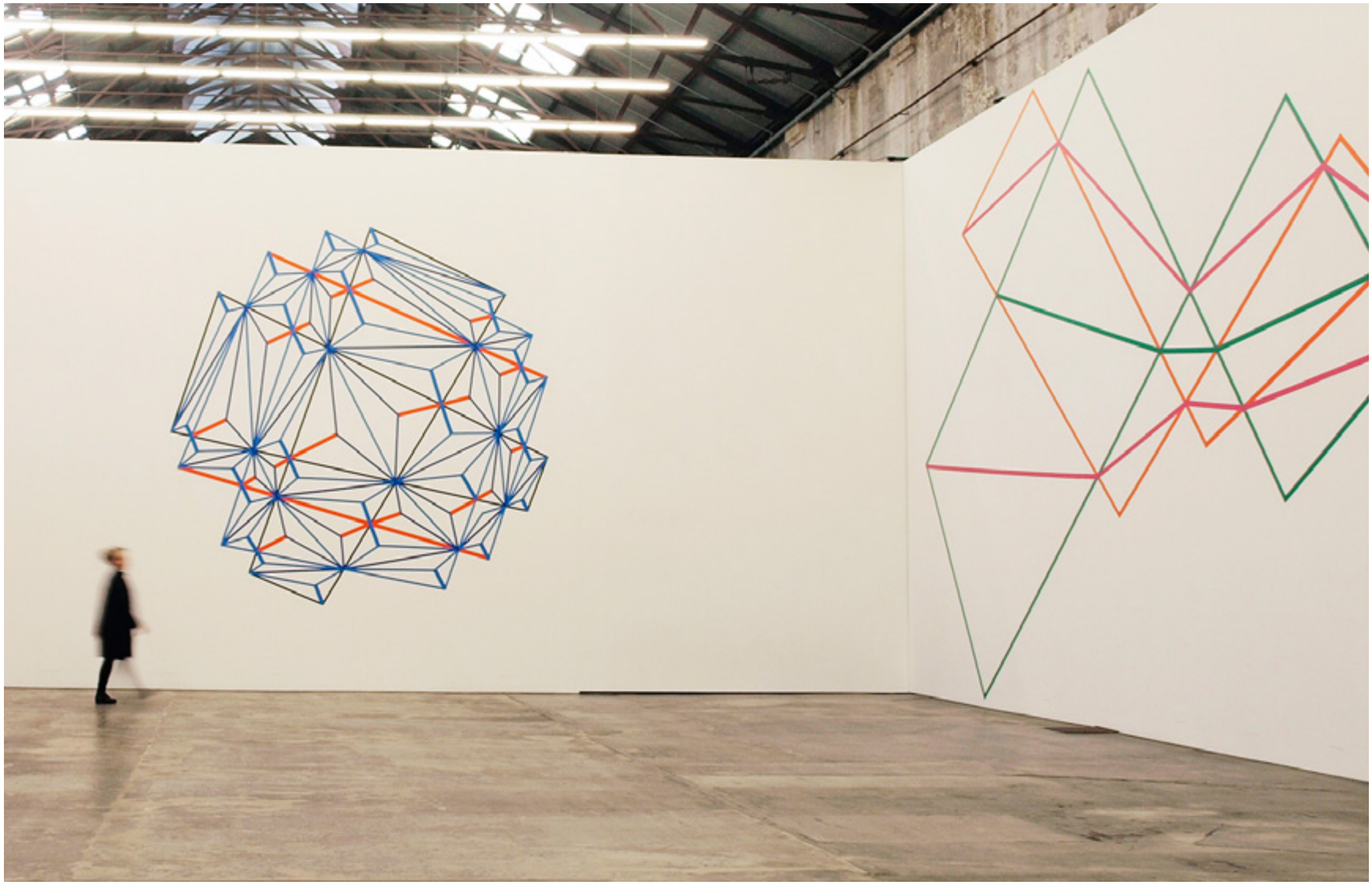
Orange Wave was hand-painted by the Stafford family, three generations of signwriters in the one family.

# *OMG and BBKO*

*Anna Schwartz Gallery, Carriageworks, Sydney 2014*

*exhibition: Wall Works, with Rose Nolan and Stephen Bram.*

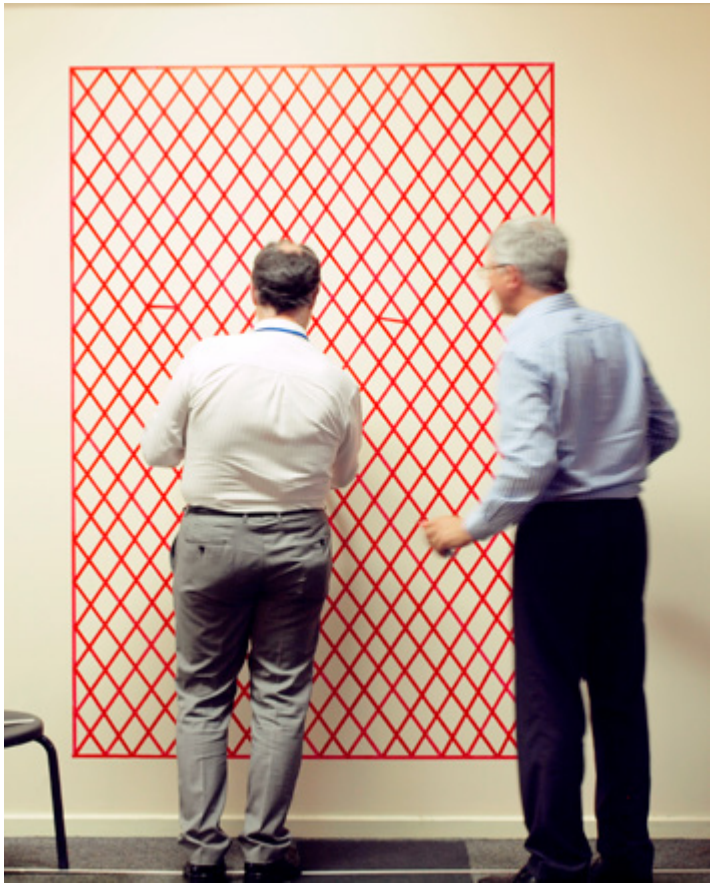


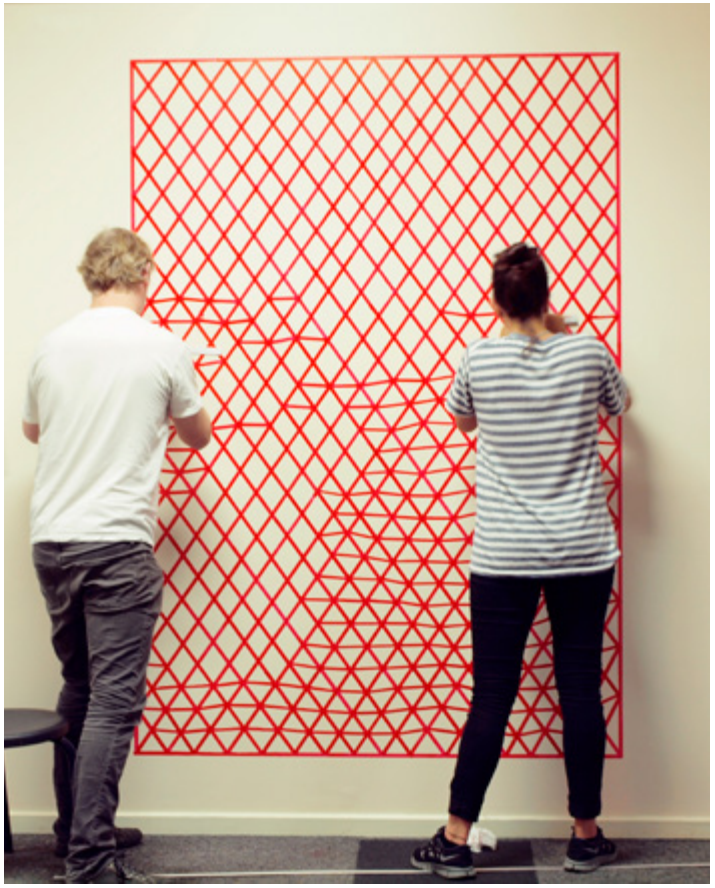


# *Installation of Red Matter Wall Drawing with Physicists*

*Permanent artwork, George Paton Gallery entrance*
*Melbourne University Student Union Building, 2015*

*exhibition:*
*f generation: feminism, art, progressions, George Paton Gallery, Melbourne, 2015*

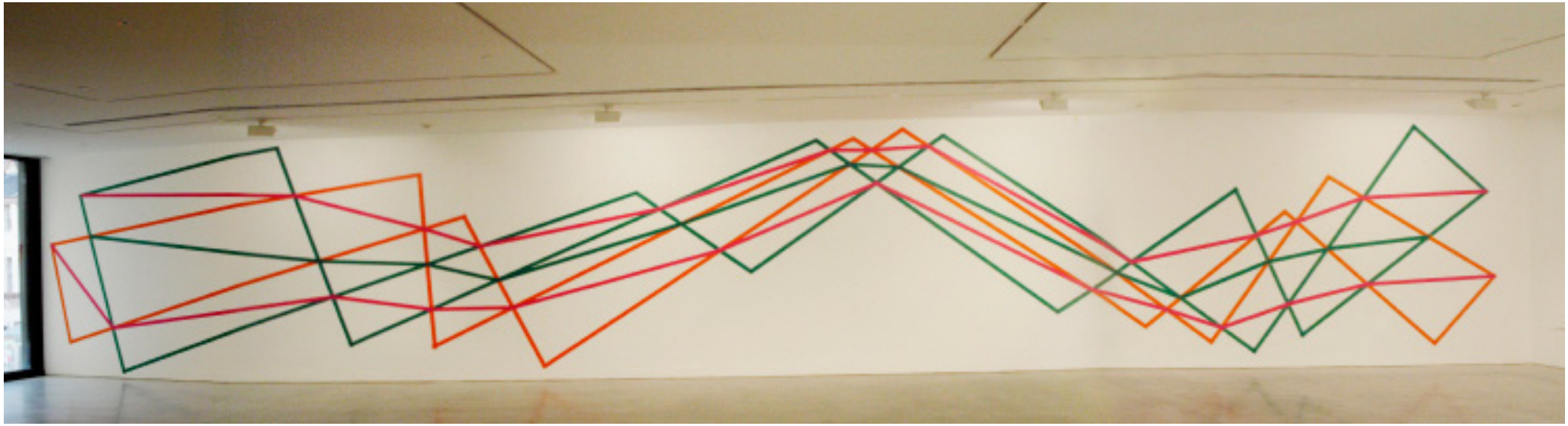




# *OMG*

*Museum of Contemporary Art, Sydney, 2016*

*exhibition: MCA Collection: Today, Tomorrow, Yesterday,*



photograph Jacquie Manning

photograph Yaya Stempler

photograph Yaya Stempler

# *Landscape Painting Avoca*

*The Avoca Project at Watford House, Avoca, Australia, 2016*

*residency and exhibition:*
*A Wallaby Once Sat Here: Small Acts of Celebration and Concern – Ecology and the Feminine*
*curator Lyndal Jones*

1854
Lalors
PRESCRIPTION DEPOT

an exhibition with Watford House, 16 Dundas St, Avoca, Victoria

**on the last weekend November and first weekend December 2016**

**Prepared House as artwork / curation by Lyndal Jones with invited works by...**
Gosia Wlodarczak, Jeanette Skrokov, Simone Slee, Kerrie Poliness, Jill Orr, Mel Ogden, Gayle Maddigan, Katve-Kaissa Konturi, Norie Neumark & Maria Miranda, Anne Marsh, Tara Gilbee, Penelope Hunt, Phoebe Haffenden, Lily Hibberd, Megan Evans, Lesley Duxbury.

Including ***Watford with Flowers***, an episodic performance with a number of women and girls from Avoca directed by Jones, on-line connection with opening in Hobart of ***Fall of the Derwent*** by Margaret Woodwood and Justy Phillips. Also, works from the TAP collection by Jane Trengove, Lindy Lee, Bea Maddock, Louise Haselton, Katarina Frank, Terri Bird, amongst others.

**Opening Friday 25th November 6.30pm - 9.00pm**

**Exhibition hours**
**Sat 26th Nov & 3rd Dec 11am - 9pm + Sun 27th Nov & 4th Dec 11am - 4pm**

Further Information: lyndalmjones@gmail.com
For accommodation: http://www.visitpyrenees.com.au/townships/avoca/

# *Stream*

*Drying Green Park, Green Square, City of Sydney, 2013 - 2017*

*integrated public artwork, due for construction 2020*

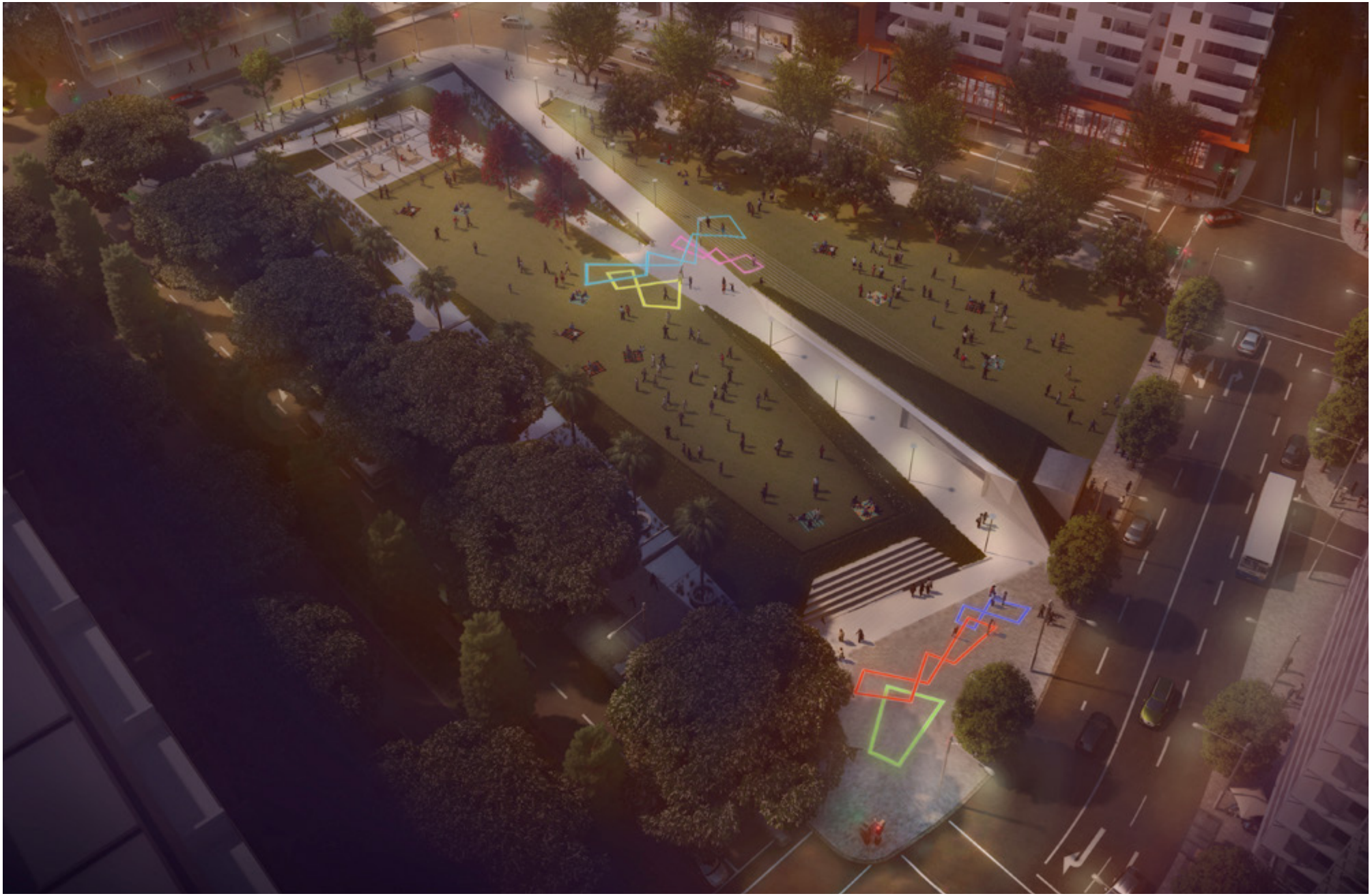
Stream was inspired by the ongoing relationship of the Drying Green site to water, including its transformation from swamp and wetland to a dam for industry, through the current use as a storm water culvert and a return to wetland within the park.

– Kerrie Poliness, 2014

Stream consists of a series of intersecting straight lines forming a meandering glass pathway across the Drying Green Park. It produces a flexible diamond structure within the lawn, through the central paths and over raised, tiered rows of benches. The highly integrated artwork is embedded within the park design, materials and forms and becomes a functional secondary route through the park.

Stream's geometry of waves reflects upon the manifestation of waves across a variety of phenomena such as water, sound, energy, light, geomorphology, and migration. Waves can relate to physical movement and transfer of energy, or can be a metaphor for the phases of history and culture, in constant motion and transition.

The artwork is conceptually linked to local ecology and history. Stream also refers to the active process of following physical and conceptual paths and making connections. The work evokes the flow and collection of knowledge, the forming of ideas, the evolution of stories, and the interlinking layers of history.



*6 Seascape Paintings*
*2 videos: Time to Go, and Sorrento*

*Mornington Peninsular Regional Gallery, Melbourne*

*Residency at Police Point, 2017*

*Exhibition: : Coast, 2018*
*curated by Danny Lacy*

Still from video, 'Sorrento', made in real time, duration: 52 minutes

Exhibition, Coast, installation image, showing 10 Seascape paintings and video,
'Time to go', made in real time, duration: 12 minutes

# *Green Wall Drawing*

*Haven Apartments foyer, Brisbane, 2017*

*permanent public artwork, foyer and thoroughfare, Newstead Brisbane*

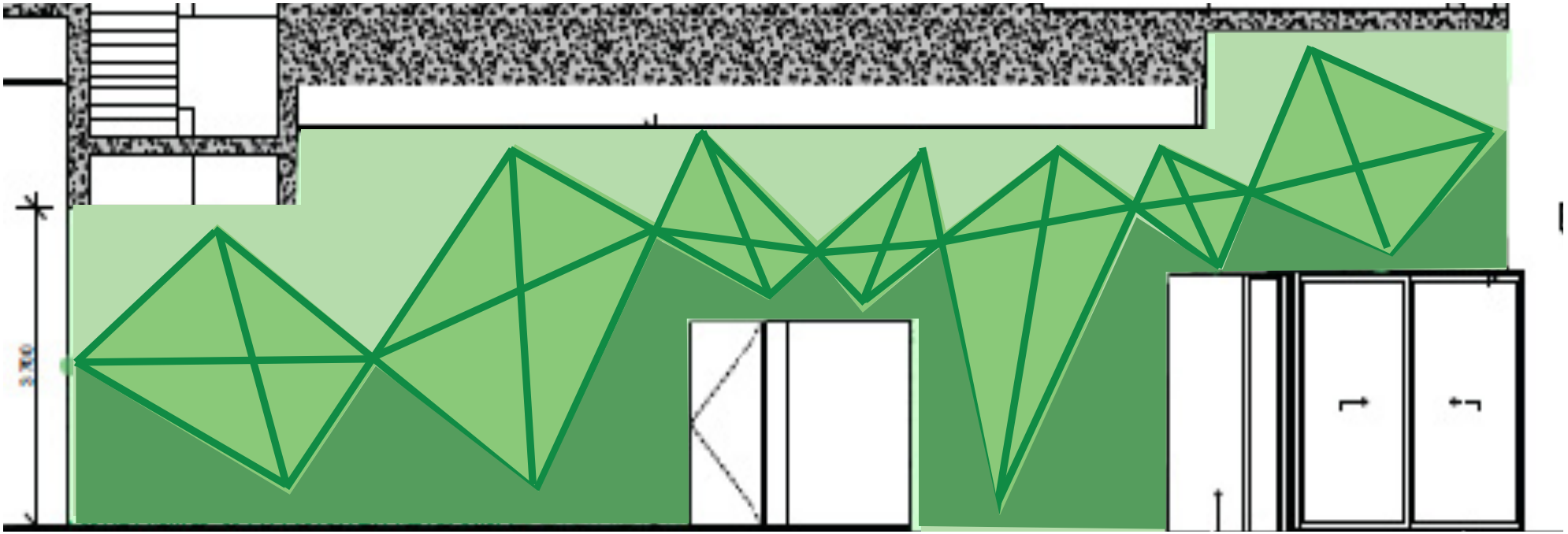
In April 2016 Kerrie Poliness was approached by the project manager to submit a draft design concept for the Haven green wall. The concept design was accepted and the project moved into the final design phase.

Kerrie Poliness worked with Fytogreen and their botanist, overlaying the Fytowall panel with the concept design to assess how the configuration transitioned to a potential planting grid. The Fytogreen planting grid is ideally suited to this project, and will be particularly effective in achieving the vertical and diagonal elements required by the artist.

The artist and the botanist began discussing very broadly, each species' performance potential. The results of these discussions would determine how the design would translate to change in aesthetic over time. Both parties were keen to resist designing with plants as products, rather wielding plants an ongoing medium, acknowledging their changing aesthetic as they transition from juvenile to adult growth-forms and adaptive mixed-species ecologies.

HN
HAVEN
NEWSTEAD

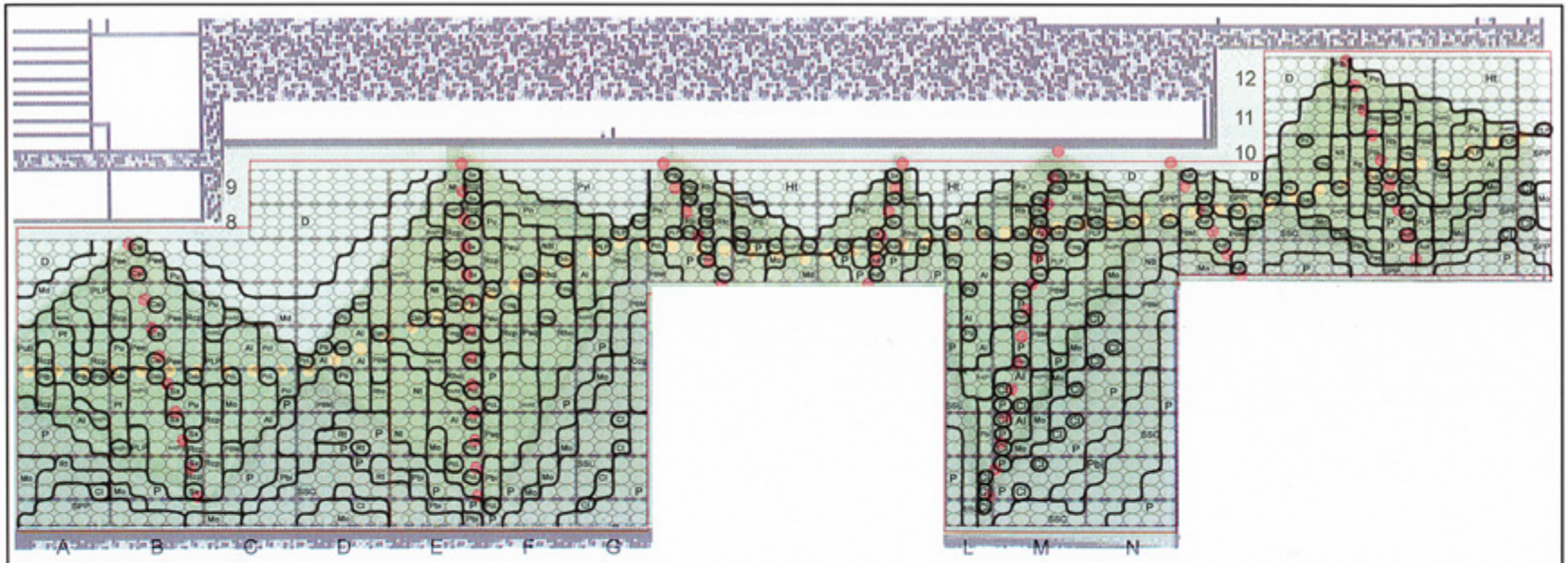
## GREEN WALL DRAWING - 3 PLANTING ZONES



zone 1
(upper area )

zone 2
(middle area )

zone 3
(lower area )




SPECIES SELECTION

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adf | -Adiantum fragrans | x | Al | -Aeschynanthus longicaulis | x | An(Pi) | -Anthurium andreanum (Pink) | x | AnAE | -Anthurium 'Amalia Elegance' (White&Pink) | x | Ccg | -Chlorophytum comosum (green) | x |
| Cl | -Clivia miniata | x | Csi | -Chirita sinensis | x | D | -Davallia fijiensis | x | Ddc | -Dracaena deremensis 'compacta' | x | Fmg | -Ficus microcarpa 'Green Island' | x |
| Ht | -Humata tyermanii | x | Md | -Microsorium diversifolium | x | Mo | -Monstera obliqua | x | NB | -Nematanthus 'Bijou' | x | P | -Philodendron scandens | x |
| Pbi | -Philodendron bipennifolium | x | PBM | -Philodendron imbe 'Burle Marxii' | x | Pcl | -Peperomia clusiifolia | x | PcL | -Philodendron campii 'Lynette' | x | Pee | -Peperomia enervis | x |
| Pf | -Polypodium formosanum | x | Pg | -Philodendron gloriosum | x | Phm | -Phlebodium mandianum | x | Pii | -Pilea involucrata | x | Plb | -Platycerium bifurcatum | x |
| PLP | -Philodendron 'Lil Phil' | x | Po | -Peperomia obtusifolia (green) | x | Ppz | -Philodendron pastazanum | x | PSA | -Philodendron 'Super Atom' | x | Psq | -Philodendron squamiferum | x |
| Pu | -Peperomia urvilleana | x | PuB | -Peperomia urvilleana (Burnley) | x | Pyl | -Pyrrosia lingua | x | Rb | -Rhipsalis baccifera | x | Rcp | -Rhipsalis compos-portoana | x |
| Rg | -Rhipsalis goebeliana | x | Rho | -Rhipsalis houlletiana | x | Rt | -Rhaphidophora tetrasperma | x | SPP | -Spathiphyllum 'Power Petite' | x | SSC | -Spathiphyllum 'Sweet Chico' | x |
| SSL | -Spathiphyllum 'Sunshine Love' | x | Sx | -Streptocarpus saxorum | x | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Project/Title: | HAVEN<br>GREEN WALL ELEVATION - PLANTING PLAN | | | | |
| Date: 2 FEB 2017 | Drawing No: FY7706/PLANT/01 | Revision: | | | |
| Scale: 1:50 | All dimensions and levels must be checked on site and not scaled from this drawing.<br>This drawing is subject to copyright and must not be reproduced or used in any other form without prior written permission from Fytogreen Australia Pty Ltd.<br>Images shown are indicative only and may vary slightly from actual appearance. | Rev | Date | Description | |

Fytogreen Growing the Built Environment
VERTICAL GARDENS GREEN FACADES ROOF GARDENS
Fytogreen Australia Pty. Ltd. ABN. 20 099 581 736
3 Webbs Lane, Somerville, VIC 3912
ph. 1300 182 341 fax. +61 3 5978 0744
E. info@fytogreen.com.au www.fytogreen.com.au

| | |
|---|---|
| Project Number | FY7706 |
| Drawn By | ERIK VAN ZUILEKOM |
| Checked By | |

P
Q
R
S

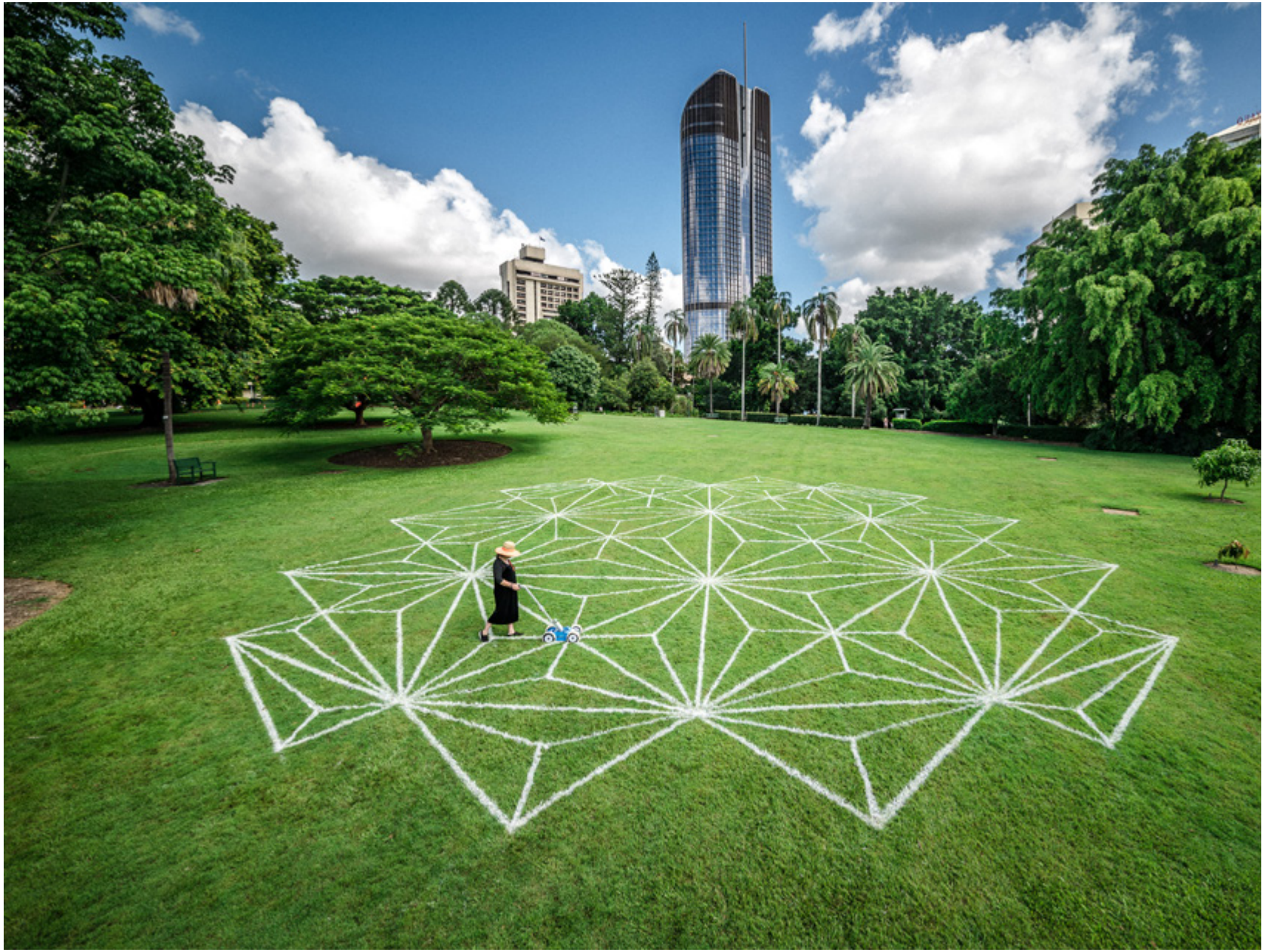
# *Field Drawing*

*City Botanical Gardens, Brisbane, Queensland, Australia, 2018*

*exhibition: Botannica*
*City of Brisbane*

*curated by Beth Jackson*

*two artist talks: one on site including public workshop,*
*one as part of panel discussion*



# *Beach Drawing*

*workshop with Rye Primary School*

*Rye front beach, Victoria, Australia, 2017*

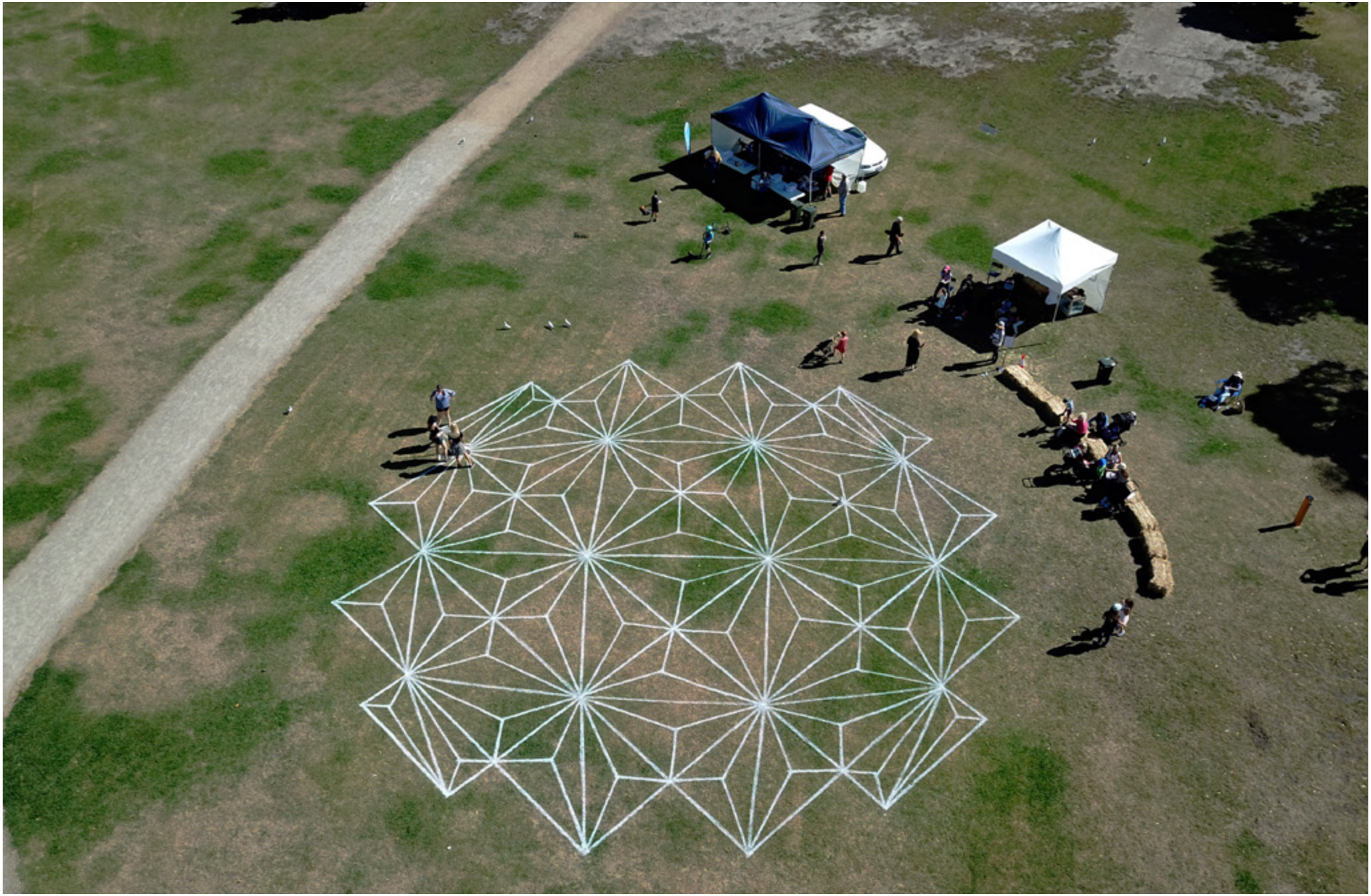
*organised by Mornington Regional Gallery education program*

# *Field Drawing with sausage sizzle*

*public workshop*

*Pelican Point, Hastings, Victoria, Australia, 2017*

*organised by Mornington Regional Gallery education program*



# *landscape painting workshops*

*Epping Secondary College, Year 8 students, 2017 + 2018*
*at Heide Museum of Art, Heidelburg, Victoria, Australia*

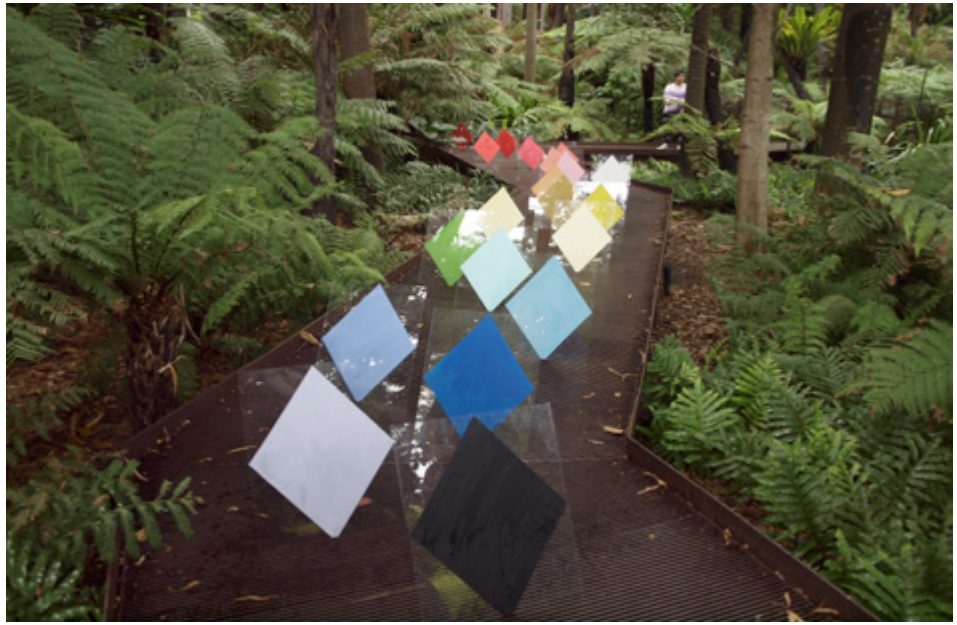
*Victorian College of the Arts Secondary School (VCASS),*
*Year 11 students 2018 + 2019*
*Botanical Gardens, Melbourne, Victoria , Australia and*
*Australian Centre for Contemporary Art (ACCA) precinct, Southbank, Victoria, Australia*

Year 8, Epping Secondary College Students,
Grounds of Heide Museum of Art

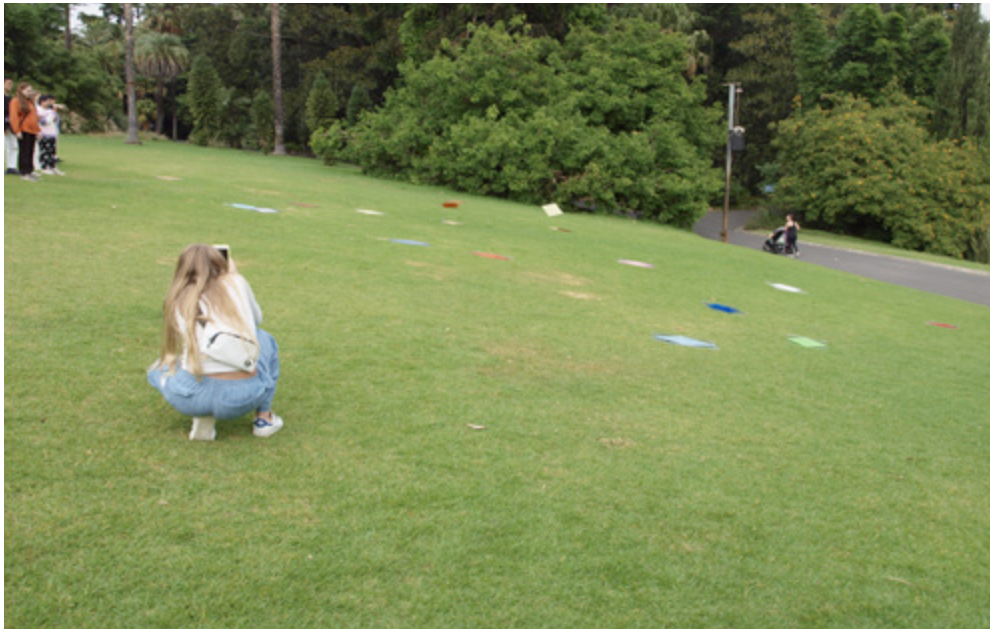
Year 8, Epping Secondary College Students,
Grounds of Heide Museum of Art

Year 8, Epping Secondary College Students,
Grounds of Heide Museum of Art

Year 11, Victorian College of the Arts Secondary College Students,
ACCA precinct



Year 8, Epping Secondary College Students,
Grounds of Heide Museum of Art



Year 8, Epping Secondary College Students,
Grounds of Heide Museum of Art

# *wall drawing workshop*

*Art Everyday,*

*Museum of Contemporary Art (MCA), Sydney, Australia*

*inaugural, national art education conference, 2018*

*https://www.mca.com.au/learn/professional-learning/teachers/art-every-day-national-primary-visual-arts-conference/*

*talk: keynote*
*workshop: with teachers*

Art
Every Day

# *Playground Drawings*

*workshop and residency, 2018*

*Sydney Grammar School, Sydney, Australia*

*collaborative teacher: Janna Tess Adams*

*(2) Melbourne's Living Museum of the West*

*artist in residency and*

*exhibitions program, 2012 - 2018*

*The museum is the region, the region is the museum*
*A West Space Project at The Living Museum of the West, 2014.*
*Avni Dauti, Lisa Radford and Kim Munro and Sam George, Susan Jacobs, Mikhail Karikis & Uriel Orlow, Kerrie Poliness and Geoff Robinson.*
*Co-curated by Danny Lacy, Liang Luscombe and Patrice Sharkey.*

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**Introduction**
Kerrie Poliness

*"The concept of the region as the Museum, and the Museum as the region, relates to a certain space – the physical environment of Melbourne's West. But the focus is essentially on people. The region/museum is seen as an activity, a living organism, a process of exploring and investigating the history and heritage of a complex region or particular sites and neighbourhoods within it. Participation in heritage activity increases understanding and a sense of identity and value. Not only objects, but people, are seen in context, a context of time and space, which may include the heritage of countries overseas, as well as the more immediate heritage of a particular local or regional environment. Our heritage is complex and diverse. The process of becoming aware of our heritage goes on at a number of levels and through different activities.*

*Melbourne's Living Museum of the West is inseparable from the life of the people of the region. Its continuance and growth is important for the region and its people. Strong government support is needed to build on the heritage programs and activities already undertaken and planned."*

Olwen Ford, 1986.

When geologists read the landscape, they see a very different world to that of other people: they see the land as a series of layers and events, the current world surface as a relatively brief moment in an ongoing process, an ongoing story.

Understanding context is about understanding time. This requires research, experimentation and documentation, and finding ways of successfully passing on this knowledge. Through oral history Aboriginal people established a working relationship with geological time, passing down stories that remained intact from generation to generation that trace phenomena such as volcanic eruptions, the end of the ice age and the forming of Port Phillip Bay.[1] They impart knowledge of, not only how to survive, but how to syncronise life and work with an extremely complex physical environment. Through oral history, Aboriginal people acquired a highly detailed understanding of their environmental context. One of many important lessons we might take on board from this tradition is the strength and importance of oral history, and what it can accomplish.

Oral history has significantly shaped our environment in ways we do not fully understand. Many landscapes assumed to be 'natural' are now considered to be human-made.[2] These landscapes of pre-European Victoria were slowly and carefully constructed, and because that was not recognised or understood at the time of first contact between Indigenous Australians and white settlers, much was brazenly destroyed through rapid foreign invasion. Despite several hundred years of occupation and modern technology, we are yet to re-establish a sustainable and effective working relationship with our local land. The importance of understanding time – how to work with a timescale beyond our own lifespan – is something that is fragile and difficult to imagine. History and continuity can easily be lost. The pace of life and work leaves little time to understand the mechanisms, layers and meanings of time.

In the western suburbs of Melbourne in 1984 a pioneering museum experiment began, applying contemporary (European) museum theory to the western region of Melbourne to establish an inclusive museum.[3] As Australia's first 'Ecomuseum',[4] the Living Museum of the West began collecting the stories, photographs and memories of ordinary and extraordinary people who lived and worked in the region.[5]

Hundreds of people's stories were recorded on to audiotape with the intention of beginning to establish a broader community connection to time, to place and to each other. The aim of this collection was to enable a greater and ongoing community understanding of context.

These stories have helped to shape and to transform the abandoned Hume Pipes factory site into Pipemakers Park. The History of the Land Gardens, the Pioneer Women's Shelter and the Pipestacks were built by the Living Museum, and the landscape and wetlands were re-vegetated by Knoxie Gardening Team apprentices via the Living Museum in the 1990s. Pipemakers Park is a human-made landscape carefully constructed through interpretation of oral histories and the Living Museum archives.

Contemporary art practice is an active process of contextualisation that involves exploring meaning and context, and questioning where we are and what this means, as well as finding ways to communicate this to others. It requires having time to do nothing; time to play with time; time to think, observe and to listen.

The exhibition *The Museum is the Region, the Region is the Museum* presents a group of contemporary artists engaging with the Living Museum of the West's archive. Today, the collection of 800 audiotapes, 20,000 negatives, and many kilometres of video and film footage are fragile and unique; rapidly disintegrating messages that could potentially enable us to connect to the voices of our ancestors. This exhibition actively makes new these connections, helping the Living Museum's project to continue.

1 Olwen Ford, *The Region is the Museum: The Museum is the Region – An Introductory Paper*, Melbourne's Living Museum of the West, Melbourne Western Region Cultural Heritage Study, 1986, p11, 1986.

2 Gary Presland, *The First Residents of Melbourne's West*, 1987.

3 Bill Gammage, *The Biggest Estate on Earth*, 2011.

4 An experiment influenced by the research and writing of Stan Lindquist who in the late 1960s travelled to Latin America researching social and economic conditions and history for his book *The Shadow: Latin America Faces the Seventies* and found that "practically every factory history has been written for them, by writers selected by them, and paid by them to produce results that would then be approved of by them". He came to the conclusion that 'factory history could and should be written from a fresh point of view – by workers investigating their own workplaces' in a burgeoning climate of active participation in culture (DIY, making your own music, theatre and art etc. in the late 1970s early 1980s) and wondering the fact that there were thousands of companies whose histories needed writing he decided to write a manual for oral history research that would encourage an enable people to research the history of their own job and wrote 'Dig Where You Stand: How to do Research on a Job' (1978).

5 The concept of an inclusive museum was developed and the term 'Ecomuseum' first used by Georges Henri Rivière and Hugues de Varine in 1971 at the ICOM conference in France.

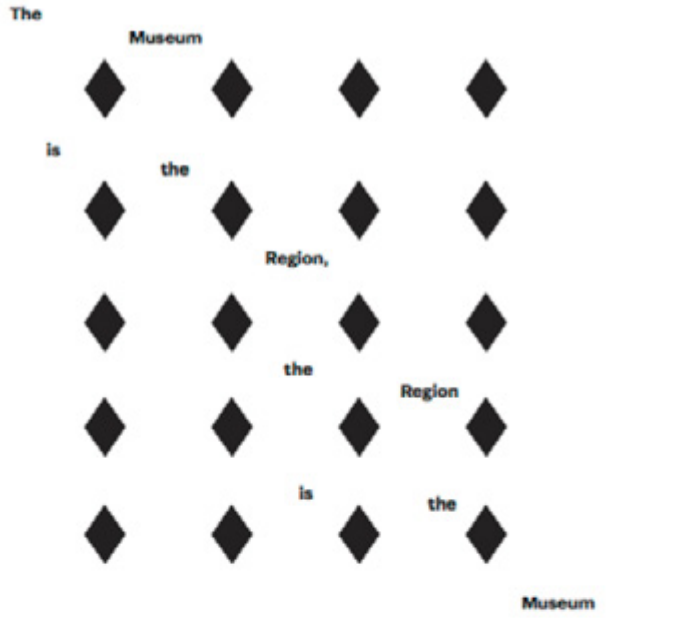
6 In 1984 the Western region of Melbourne included the municipalities of Altona, Bacchus Marsh, Essendon, Footscray, Keilor, Melton, Sunshine, Werribee and Williamstown.

**ACKNOWLEDGEMENTS**

West Space would like to thank all of the participating artists for the time, energy and ideas they have brought to their projects in the exhibition. We extend special thanks to Kerrie Poliness and Peter Haffenden, as well as the Living Museum of the West's committee and volunteers, who have made the exhibition possible. We would also like to acknowledge Brian Scales for his installation assistance, Grant Miles, Maribyrnong Mayor, for opening the exhibition and Martin King for performing, as well as West Space's staff, Board, Programming Committee and volunteers.

Avni Dauti would like to thank Tom Parsons, Rob Sinclair and David Thomas. Sam George and Kim Munro and Lisa Radford would like to thank the Living Museum of the West volunteers and members: Peggy Cole, Sara Coward, Olwen Ford, Bill Gillies, Peter Haffenden, Roger Holloway, Marie Kehoe, Kerrie Poliness and Phoebe; the actors: Brendan Barnett, Laurie Fildes, Emma Hall, Rosa Nix, Frank Otis and Rik Stowmare as well as Amanda Kerley, Taree Mackenzie and Isabelle Sully. Geoff Robinson would like to thank Helen Grogan, Peter Haffenden, Liang Luscombe, Kerrie Poliness and Benjamin Woods for their assistance and contribution to his project.




***The Museum is the Region, the Region is the Museum***

**Avni Dauti, Lisa Radford and Kim Munro and Sam George, Susan Jacobs, Mikhail Karikis & Uriel Orlow, Kerrie Poliness, Geoff Robinson.**

**Curated by Danny Lacy, Liang Luscombe and Patrice Sharkey.**

**A West Space Project presented at the Living Museum of the West.**

**7 September to 5 October 2014**

*The Museum is the Region, the Region is the Museum* is an exhibition project envisaged as a way of beginning to re-establish West Space's connection with the western suburbs of Melbourne, where West Space was founded in 1993. Presented off-site from West Space at the Living Museum of the West—and drawing upon the rich history of the western suburbs, as documented in the Living Museum's own archive—this exhibition features newly commissioned work by a range of local artists that each respond to the geography and built heritage of this unique site. The exhibition also features artworks that have a strong visual connection to the rich industrial history of the site.

As the starting point for their project, Sam George and Kim Munro and Lisa Radford's interviewed the volunteer committee of the Living Museum of the West – the people that keep the place running day-to-day. The committee is predominately made up of those that have both recorded and archived the wide-ranging material from the Western suburbs; some had conducted interviews, others photographed events or researched the area that forms the Living Museum's archive. Through their interviews George, Munro and Radford archived the Living Museum's archivists, detailing their relationship to the Museum and their desire for its presence as a document of the Western suburbs – or, as Radford described the process, '[re-corded] the labour of the labourers who recorded labour.' These interviews will be given to the Living Museum, so that they too become part of the archive.

The trio's resulting video work *It has to be more than just two fishes and a hen deciding what to have for lunch* (2014) is a consideration of how the desires of individuals can result in the foundation of organisations such as the Living Museum. The video documents a number of subjects (whom range in age and gender) addressing the camera directly. Jumping from speaker to speaker through a quick series of cuts, the video presents a vocabulary of personal longings and personal reflections on the nature of desire, collectively hitting a range of notes: the melancholic ('a sense of purpose'), the all too common ('a holiday') and the humorously necessary ('sex, drugs and rock 'n' roll'). While these jumble of desires are described to the audience, each speaker's dialogue is broken by a beige-out that creates a moment of space or a pause within the work, perhaps a moment of doubt. This stopgap is amplified by the numerous times we witness the speakers pause, uncertain as to what to say next.

Mikhail Karakis & Uriel Orlow's video work *Sounds from Beneath* (2010-12) is set in the desolate post industrial landscape of an old coal mine, a similar barren landscape to the site of the Living Museum of the West (before it was rejuvenated as a park). The first part of the work features old Kentish coal miners reproducing the sounds of their former mining activity, which came out of a lengthy work-shopping process that Karakis undertook with the ex-miners. Over a period of several months, he asked them to recall and vocalise the sounds they heard when they worked in the mines. Partnering with filmmaker Uriel Orlow, Karakis created a film in which the men stand on top of a desolate mine (where some used to work) and sing these sounds under his direction. The area of Dover (where the film is shot) has beachbow sellers and the video also

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*Co-curated by Danny Lacy, Liang Luscombe and Patrice Sharkey.*

Photo. David Easteal

*ECHO - Sunday July 5 at 3 pm, 2015*

*Echo is the culmination of a brief research project by Eliza Dyball and Ash Kilmartin at Melbourne's Living Museum of the West.*

*Laura Delaney*
*Merchant City, 2015*
*(off site) Newport Substation*

*Susan Jacobs*
*Vessels for mixed metaphors, 2015*

*Jane O'Neil*
*Municiple City Baths, 2015*

*Curated by Jane O'Neil, Living Museum art sub-committee member.*
*Rangoli, 2015*

*Catherine Johnstone and Caroline Phillips,*
*Relatedness, 2015*

*Fred White,*
*Transference, 2015*

*Charlie Sofo, A Gap Open's Up*
*August, 2016*

Year of the Floods. Poems, video, sand bags, curtain in response to the Living Museum of the West. With Georgina Criddle, Living Museum of the West bluestone building. Image credit Christian Capurro (2017).

*Georgina Criddle and Mel Deerson*
*The Year of the Flood, 2016*

Year of the Floods. Poems, video, sand bags, curtain in response to the Living Museum of the West. With Georgina Criddle, Living Museum of the West bluestone building. Image credit Christian Capurro (2017).

*Victorian College of the Arts, University of Melbourne*
*2nd Year Painting students, lead lecturer Lisa Radford*
*exhibiton: What Are Chives For, 2018*

*Living Museum / curated by Matthew Davis , Sue Long*
*Raaf Ishaak; Zoe Ali and Cristos Tzolkas; Kim Munro, Sam George and Lisa Radfiord, Andrew Hazewinkel*
*The Archiva Reflex, 2017*

*Alisha Abate,*
*Red Wine Cheers to Industry, 2018*

*Nina Sanadze*
*Bollard City, 2018*

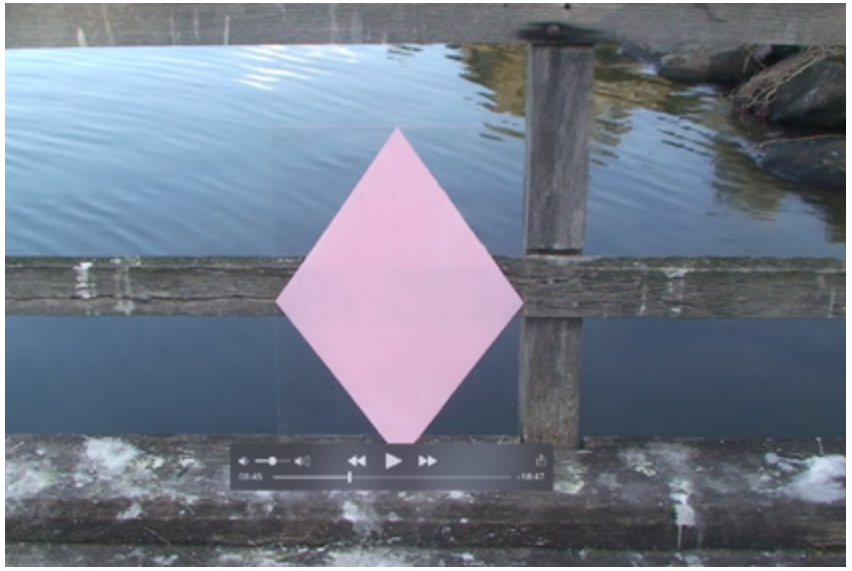
Ben Woods
Beeswax flutes, 2018

*Living Museum , current  resident artists*
*Matthew Davis Raafat Ishak, Jessye Wdowin-McGregor, Ben Woods, Kerrie Poliness*
*Groundwork, 2018*

Ben Woods
Beeswax flutes, 2018

Carly Fischer,
sculptures

Raafat Ishak
10 posters



Kerrie Poliness
video

*(3) Kerrie Poliness, Curriculum Vitae*

*1984 - 2019*

KERRIE POLINESS

1962 Born Melbourne, Australia
1984 Bachelor of Arts: Fine Art, Victoria College, Melbourne
1989-93 Co-founder Store 5 with Gary Wilson and Melinda Harper, Melbourne
1993-00 Ed. 'Circular' artist book, (6 editions) with Marco Fusinato.
1993-07 Associate, Melbourne's Living Museum of the West
1999 – Committee of Management, Friends of Buckley Park
2009 – Co Director, inheritearth, environmental consultancy, with Peter Haffenden
2010 – Committee of Management, Melbourne's Living Museum of the West
2011-12 Heritage Advisory Panel, City of Maribyrnong
2012–19 PhD candidate, Centre For Ideas, VCA, University of Melbourne
2014 – Board of Directors, West Space, Melbourne

Represented by Anna Schwartz Gallery

CURRENT

City of Sydney, Drying Green Park integrated artwork, Green Square, Sydney. http://www.creativecitysydney.com.au/blog/gentle-stream-drying-green/ http://sydneyyoursay.com.au/drying-green

SOLO EXHIBITIONS

2018 Field Drawing #1, HOTA, Gold Coast
Field Drawing #1, Pelican Point, Hastings, Victoria
2016 Red Matter Wall Drawing #2, Museum of Contemporary Art, Sydney
2014 Green Wall Drawing / Lake Bolac to Zagreb, GMK, Zagreb, Croatia
2013 Field Drawing, The Agora, Latrobe University Museum of Art, Melbourne
2013 Kerrie Poliness: Black O, Dowse Art Museum, Lower Hutt, New Zealand
2008 Blue Wall Drawing #1, Wollongong University
2007 Blue Wall Drawing, Anna Schwartz Gallery
2006 Wall Drawings, Dunedin Public Art Gallery, Dunedin
2004 Something & Something Somewhere Else, North Melbourne Town Hall, Melbourne
Wall works, Arts Lifts, National Gallery of Australia, Canberra
1999 The Pipestacks (permanent installation), Pipemakers Park, Maribyrnong
1998 Wall Drawings, Artspace, Auckland, New Zealand
Wall Drawings, Art Gallery of Western Australia, Perth
1997 Black O Wall Drawings 1 - 6, Sarah Cottier Gallery, Sydney
Red Matter Wall Drawings 1 - 3, Kovacka 3 gallery, Dubrovnik, Croatia
Black O Wall Drawings 3 & 4, Gallerie St. Toma, Museum of the City of Rovinj, Istria
1996 Red Matter Wall Drawings #1 - #4, Tolarno Galleries, Melbourne
1995 Wall Drawing #1, Phoenix Hotel, San Francisco
Drawings, Sarah Cottier Gallery, Sydney
Black Wall Drawing & Painting, CBD Gallery, Sydney
1994 Pavilion #2, Tolarno Galleries, Melbourne
Red Matter Wall Drawings #1- #4, Sarah Cottier Gallery, Sydney
1993 Pavilion #1, No. 140, Store 5, Melbourne
1992 136 Paintings, Tolarno Galleries Melbourne
No. 123, Store 5, Melbourne
1991 12 Paintings, Tolarno Galleries, Melbourne
104 Paintings, Deakin University Gallery, Geelong
Wall Painting, No. 99, Store 5, Melbourne
1990 No. 55, Store 5, Melbourne
1989 No. 4, Store 5, Melbourne
No. 25, Store 5 Melbourne
1987 Shattered Plywood Paintings, 312 Lennox Street, Melbourne

LANDSCAPE PAINTING SOLO EXHIBITION EVENTS

2019 Thirteenth Beach 1; Swan Bay 1
2018 Queenscliff- Sorrento Ferry 1; Pt Lonsdale 3, 4 and 5; Maribyrnong 2 and 3
2017 St Andrews beach; Sorrento,1and 2; Portsea 1, 2 and 3; Diamond Bay
2016 Avoca and region 1, 2 , 3, 4, 5 and 6
2015 Pt Lonsdale 1
2014 Landscape Paintings (Lake Bolac and Zagreb) and Wave Drawings (orange and green), G-MK, Zagreb
Landscape Painting Exhibition event Zagreb and region 1, 2, 3, and 4
2013 Lake Bolac 1 and 2
2003 Rockbank 1,
2002 You yangs 1
2001 Truganina 1, Footscray 1 and 2
1999 Maribyrnong 1, Top Factory, Pipemakers Park
1998 Flinders Street Station, Melbourne

GROUP EXHIBITIONS

2019 Unravelled, Wellington City Gallery, New Zealand
Drawing Folio 3, Block Projects, Richmond
Portico, Conners Conners, Fitzroy Town Hall
Never The Same River, Anna Schwartz Gallery, Melbourne
IN-Formalism Now: 1968-2019, Casula Powerhouse Art Centre, Liverpool, NSW
'Play On: The art of sport', Western Plains Cultural Centre, Dubbo
'Play On: The art of sport', Riddoch Art Gallery, Mt Gambier
'Play On: The art of sport', Bunbury Regional Gallery, Bunbury
Dobell, Drawing Prize, NAS, Sydney
Today, Tomorrow, Yesterday, Museum of Contemporary Art, Sydney
2018 'Play On: The art of sport', UQ At Museum, Brisbane
'Play On: The art of sport', UQ Devonport Regional Gallery, Devonport
Groundwork, Melbourne's Living Museum of the West, Melbourne
Today, Tomorrow, Yesterday, Museum of Contemporary Art, Sydney
Konica Redman Art prize, NAS, Sydney
'Play On: The art of sport', Mornington Regional Gallery, Melbourne
Coast, Mornington Regional Gallery, Melbourne
Monochrome: Empty and Full, Margaret Lawrence Gallery, Melbourne
Botanica, City Botanical Gardens, Brisbane
'Play On: The art of sport', Hazelhurst Regional Art Centre and Gallery
2017 Call of the Avant-Garde: Constructivism and Australian Art, Museum of Modern Art at Heide, Melbourne Every Brilliant Eye: Australian Art of the 1990s, National Gallery of Victoria Australia, Melbourne;
9×5 NOW, Margaret Lawrence Gallery, Melbourne;
Today, Tomorrow, Yesterday, Museum of Contemporary Art, Sydney
SNO 129, SNO (Sydney Non-Objective), Sydney
2016: A Wallaby Once Sat Here: Small Acts of Celebration and Concern – Ecology and the Feminine, The Avoca Project at Watford House, Avoca, Australia;
MCA Collection: Today, Tomorrow, Yesterday, Museum of Contemporary Art, Sydney;
Resident, Motorworks Gallery, Melbourne Grammar School
2015 CAD#5 (Contemporary Australian Drawing #5), SACI Institute, Florence
f generation: feminism, art, progressions, George Paton Gallery, Melbourne
2014 Kerrie Poliness, Rose Nolan, Stephen Bram, Anna Schwartz Gallery, Sydney
The Region is the Museum the Museum is the Region, West Space at Melbourne's Living Museum of the West
Trace: Performance and its Documents, GoMA, Queensland Art Gallery, Brisbane
The less there is to see the more important it is to look, Ian Potter Museum of Art, Melbourne
20/200, Sarah Cottier Gallery, Sydney Short Fictions, Abstraction from the Dowse Collection, Dowse Museum of Art, New Zealand

2014 Certain abstract things: from the Griffith University Art Collection, Griffith University Art Gallery, Brisbane
Melbourne Now, Drawing Now, National Gallery of Victoria, Melbourne

2013 Basil Sellers Art Prize, Gold Coast Art Gallery
Melbourne Now, Drawing Now, National Gallery of Victoria, Melbourne
Nothing Happening, Kings Artist Run Initiative, Melbourne
Obscura, Motorworks Gallery, Melbourne Grammar School
Reading the Space: Contemporary Australian Drawing #3, New York Studio School, New York
Proud 2013, Margaret Lawrence Gallery, VCA, Melbourne

2012 Basil Sellers Art Prize, Ian Potter Museum of Art, Melbourne
Drawing Folio 2, Block Projects, Melbourne
Red matter, Drawing installation #3, MCA Collection, Sydney
Small Room for Animals and Humans, MARS, Melbourne
Art, Complexity and Pattern, Royal Institute of Science Australia (RiAus), Adelaide
Less is More, Heide Museum of Modern Art, Melbourne
Australian Contemporary Drawing 2, University of London, UK and Gallery Langford, Melbourne
Volume One: MCA Collection, Museum of Contemporary Art Australia, Sydney

2011 NETWORKS (cells and silos), Monash University Museum of Art
Studio Masatotectures Presents: House me within a geometric quality, Platform, Melbourne
Kaleidescope, Kids space, NGV St Kilda Road, Melbourne

2010 RMIT Print residency exhibition, Project Space RMIT, Melbourne
Just what is it that makes today's interiors so seductive, so alluring?, Light Projects, Melbourne
Contemporary Australian Drawing, RMIT Gallery, Melbourne
Multiple Choice, Gallery of Modern Art Queensland, Brisbane

2009 The Shilo Project, Ian Potter Museum of Art, Melbourne University
+/-, Monash University Gallery, Clayton and Gippsland campus
Drawing Folio, Block Projects, Melbourne
Works from Vizard collection, Ian Potter Museum of Art, Melbourne
Contemporary Australian works from the collection, R M Drawing #1, NGV, Melbourne

2008 Paintings, Gesellschaft für Kunst und Gestaltung e.V., GKG, Bonn
Contemporary Australian works from the collection, The Ian Potter Centre NGV, Melbourne
Urban Sculpture Prize, Melbourne Trust, Federation Square, Melbourne
To make a work of timeless art: MCA Primavera Acquisitions, MCA Sydney,
Later, Carlton Club Gallery, Melbourne
Australia - Contemporary Non-Objective Art: Kunsthalle Dominikanerkirche, Osnabrück; Museum im Kulturspeicher, Wurzburg
Black O Wall Drawings (#4 install), Monash University Library, Clayton
Monash University Collection 1961 to 2007, McClelland Gallery, Premonitions, Langwarrin
Drawing the Line, (series of 12 paintings), Maroondah City Gallery, Melbourne
The Helen Lempriere National Sculpture Award, Werribee Park

2007 New Acquisitions, Bendigo Art Gallery, Victoria
Artists Make Videos, Griffith University, Griffith, Australia.
Australia - Contemporary Non-Objective Art, Gesellschaft für Kunst und Gestaltung, Bonn
Are you being flocked?, Carlton Club Gallery, Melbourne
Abstraction/Architecture/Space, RMIT Project Room, Melbourne

2006 Drawn, National Gallery of Victoria, St Kilda Road, Melbourne.

2005 Store 5 is, curated by Deborah Hennessy, Anna Schwartz Gallery, Melbourne
Pitch your Own Tent, curated by Max Delaney, Monash University, Clayton
Colourless, Macquarie Lake Gallery, Lake Macquarie
SNO, curated by John Nixon, Sydney
Wall Power, curated by Jenepher Duncan, Art Gallery of Western Australia, Perth

2004 Painting, Gallerie Royale, Munich, Germany

2003 Picnic, (curated), Melbourne's Living Museum of the West Inc, Melbourne

2003 See Here Now, Vizard Art Collection of the 90s, Ian Potter Museum of Art, Melbourne
2002 Good Vibrations: the legacy of Op art in Australia, Heide Museum of Modern Art, Melbourne
ARCO 2002, Anna Schwartz Gallery, Madrid, Spain
Veczoennections: Contemporary Artists from Australia, curator: Branka Stipancic, House of Croatian Artists, Zagreb, and Ljubliana
The Helen Lempriere National Sculpture Award, Werribee Park, Werribee
2001 Geometry of the Earth, Orange Regional Gallery, Orange
low down recent acquisitions, Monash University Gallery, Monash University, Clayton
Good Work, Dunedin Public Art Gallery, New Zealand
Good Work, City Gallery, Wellington, New Zealand
Melbourne University Collection Exhibition, Ian Potter Gallery, University of Melbourne
2000 Crystal Chain Gang, Auckland City Gallery
Gold, Sarah Cottier Gallery, Sydney
1999 Kerrie Poliness, Melinda Harper, Fabrics, Anna Schwartz Gallery, Melbourne
Kerrie Poliness, Melinda Harper, Fabrics, Sarah Cottier Gallery, Melbourne
48 hours North Arts Forum, North Melbourne Town Hall, Melbourne
Cartographs, Glen Eira City Gallery, Melbourne
Open House, Pestorius Sweeny House, Brisbane
Probe, 'Paintings & Trees', Herring Island, Melbourne
1998 Construction in Process VI, The Bridge, (two sites & exhibition poster): Flinders Street Station and Bluestone Buildings Pipemakers Park, Melbourne
Two Timing, Metro Arts Centre, Brisbane
Moet & Chandon Touring Exhibition, National Gallery of Victoria, Melbourne; Queensland Art Gallery, Brisbane; Art Gallery of South Australia; Art Gallery of New South Wales
Adding - The Blue Pacific, Ivan Doherty Gallery, Sydney
Inaugural Exhibition, Elizabeth Street, Sarah Cottier Gallery, Sydney
1997 Recent Acquisitions, National Gallery of Victoria, Melbourne
Wall Works, David Pestorius Gallery, Brisbane
Geometric Painting in Australia 1941 - 1997, University of Queensland
Art Basel, Switzerland
Contemporary Voices, Touring Regional Galleries of Victoria
Stephen Bram, Kerrie Poliness, Dion Workman, Hamish McKay Gallery, Wellington, New Zealand; Gallery 23A, Auckland, New Zealand
1996 Practice as Technology, 200 Gertrude Street, Melbourne
Moet and Chandon Touring Exhibition, National Gallery of Victoria, Queensland Art Gallery, Art Gallery of South Australia, and Art Gallery of New South Wales
Art Basel, Contemporary Art Fair, Switzerland
Pool, Centennial Pool, David Pestorius Gallery, Brisbane
Aerophost, Dublin, Ireland
Raindrops on Roses, Sarah Cottier, Sydney
1995 Aspects of Australian Printmaking, National Gallery of Victoria, Melbourne
San Francisco International Art Fair, Sarah Cottier Gallery, Sydney
Artage Video Compilation, ABC TV, Australia
Smorgon Donation Exhibition, Museum of Contemporary Art, Sydney
Wall Drawings, 200 Gertrude Street, Melbourne
Favourite Objects/History of the Soul curated; Melbourne's Living Museum
Primavera, Museum of Contemporary Art, Sydney
Monash University Art Prize, Monash University, Clayton
Portrait show, (curator Vincente Butron), Artspace Sydney
Drawings, Mornington Peninsula Art Gallery
Group Show, Tolarno Galleries, Melbourne
1994 White, Sarah Cottier Gallery, Sydney
Colour, Anna Schwartz Gallery, Melbourne
Store 5, Institute of Modern Art, Brisbane
Baillieu Myer Collection, Museum of Modern Art at Heide, Melbourne
Paperwork, Sarah Cottier Gallery, Sydney
Untitled 1994, Hamish McKay Gallery, New Zealand

1994 Disclosure, (curator Ben Curnow), Artspace, Sydney
Melbourne Seven, David Pestorius Gallery, Brisbane
Monash Collection, Monash University Gallery, Clayton
Group Exhibition, Tolarno Galleries, Melbourne
Loop: Part One, A Critical Cities Project, Longford Cinema, Melbourne

1993 Margaret Stewart Endowment, National Gallery of Victoria
Red, Nuns Garden, Abbotsford, Melbourne
The Caboose, No. 130, Store 5, Melbourne
No. 132, Store 5, Benefit Exhibition, Melbourne
Margaret Stewart Endowment Pt. 2, National Gallery of Victoria, Melbourne
Kaleidoscope, Residence, Sydney
1 Day Exhibition, Tolarno Galleries, Melbourne
Marco Fusinato, Melinda Harper, Kerrie Poliness, Gary Wilson, The Bond Store, Tasmanian Museum and Art Gallery, Hobart

1992 Abstract Art, Roslyn Oxley9, Sydney
Store 5 No.111 Works on Paper, No. 115 Chairs
S.W.I.M. , Fundraiser, Linden Gallery, Melbourne
The Caboose (Print Portfolio), Arts Multiplicata, Sydney
Octopus, University of Adelaide Art Museum, Adelaide

1991 W.T. Rawleigh Building, Melbourne
Store 5: No. 76, No. 90 Drawings, No. 100, No. 101
Production, Institute of Modern Art, Brisbane
Magasin 5, Gallerie Cannibal Pierce, Paris, France
S.W.I.M. , Fundraiser, Linden Gallery, Melbourne
Artworkz, Caulfield City Gallery, Melbourne
New / Abstract, Tolarno Galleries, Melbourne
Subversive Stitch, Monash University Gallery, Melbourne
Mori Gallery Annexe, Sydney

1990 In Full Sunlight, The Greater Western-Melbourne, First Draft West-Sydney, Aglassofwater-Brisbane
New Melbourne Abstraction, Artspace, Auckland, New Zealand
In the Lightwell, First Draft West, Sydney
Store 5: No. 52, No, 62, No. 75, Melbourne

1989 Resistance, 200 Gertrude Street, Melbourne
Store 5: No. 1, No. 6 'Other Photography', 11 A3-10,
No. 24 The Donkeys Tail', No. 31 A3-20',
No. 36 Other Photography / 2. Melbourne

1988 Fifty Artists, Royal Showgrounds, Melbourne
Arson Street (June July and September), Melbourne

1986 312 Lennox Street, Melbourne

1985 St Kilda Art Awards, Linden Gallery, Melbourne

PUBLIC ARTWORKS (completed and under construction)

2017 Stream, Drying Green Park, public art commission, Sydney, due for completion in 2020

2014 Orange Wave, Wood Street & Somerville Road Underpass, Yarraville, Melbourne
40 Pipe Paintings, The Pipestacks, Pipemakers Park, Melbourne
Field Drawing, Maywar Green, GoMA, Brisbane

2013 Field Drawing, Agora Lawn, La Trobe Museum of Art, Melbourne
Wave Drawings 1-8, Highpoint Shopping Centre (eastern entry), Melbourne

2012 White Black Whiteboard Drawing, Laby Centre, Physics Department, University of Melbourne

2005 White Grey Mirror Glass Drawings 1-4, North Tower Foyer, Watergate, Docklands, Melbourne

2000 Black O Wall Drawing # 5, Government Superannuation Buildings Foyer, Melbourne

1999 The Pipestacks, Pipemakers Park Melbourne Street, Maribyrnong, Victoria Commission, Arts Victoria

1998 Top Factory interpretative Signage, Pipemakers Park Melbourne
Red Matter Wall Drawing, Computer Technology Foyer, Monash University, Clayton
Black 0 Wall Drawings, Library, Monash University, Clayton.

1997 Pioneer Women's Shelter, Pipemakers Park Melbourne

BIBLIOGRAPHY (*requires updating)
2015- 2019*


2015
Kerrie Poliness, 'I have no time', essay commissioned to accompany reprint (ed. Matt Hinkley & Fayen d'evie), June/July
2014
Anna Schwartz Gallery, Kerrie Poliness, Rose Nolan Stephen Bram, exhibition catalogue, Sydney
Danny Lacy, Patrice Sharkey, Liang Luscombe, The Museum is the Region the Region is the Museum, exhibition catalogue, West Space
20/200, Sarah Cottier Gallery, Sydney
G-MK, Zagreb, room sheet text / catalogue, translation into Croatian, Lake Bolac – Zagreb
Adrian Marshall and Karen Reid, Land of Sweeping Plains: managing and restoring the natural grassland of south eastern Australia (book), interview about the making of Volcano Dreaming, University of Melbourne

2013
Dewi Cooke, 'Original art and bamboo, the new-wave thing at Highpoint', The Age, March 13

2012
Carolyn Barnes, 'Conflicted Territory: Aesthetics and practices inn the work of Melinda Harper, Anne-Marie May, Rose Nolan and Kerrie Poliness', UN MAGAZINE, Issue 6.1
Margot Osborne, Art, Pattern and Complexity, exhibition catalogue, Ri Aus, Adelaide
Glenn Barkley, MCA Collection Volume One, exhibition catalogue, MCA, Sydney
Donna Leslie, Basil Sellers Art Prize, exhibition catalogue, Ian Potter Museum of Art, University of Melbourne
Sue Cramer, Less is More, exhibition catalogue, Heide Museum of Modern Art, Melbourne
Janet McKenzie-Spence, Contemporary Australian Drawing, book, McMillan, London
Kerrie Poliness, Not Quite Right, Artlink magazine

2011
Geraldine Barlow, Networks Cells and Silos, exhibition catalogue, Monash University Museum of Art MUMA

2010
Bradley Haylock, Just what is it that makes today's interiors so seductive, so alluring? exhibition text, Light Projects, Melbourne Stephen Roche ed., Art-isan, Studio Arts for VCE Units 1-4, (secondary school textbook), Cambridge University Press
2009
Chris McCauliffe, The Shilo Project, exhibition catalogue / texts, Ian Potter Museum of Art, University of Melbourne
Danny Lacy, +/-, exhibition catalogue, Monash University Gallery, Clayton and Gippsland campus

2008 Damian Smith, Drawing the Line, (exhibition text), Maroondah City Gallery, Melbourne
Simon Warrender, Melbourne Urban Sculpture Prize, exhibition catalogue text, Melbourne Trust
Isabel Finch and Clare Lewis, To make a work of timeless art: MCA Primavera Acquisitions exhibition catalogue / education kit, MCA Sydney

2007 Christoph Dahlhausen, Australia - Contemporary Non-Objective Art, exhibition catalogue, Bonn, Germany Justin Andrews, Abstraction/Architecture/Space, exhibition catalogue, RMIT Project Room, Melbourne Kim Machan, Artists Make Videos, proiect catalogue, Griffith University, Griffith, Australia. Blue Wall Drawing, exhibition catalogue text, Anna Schwartz Gallery, Melbourne
Blue Wall Drawing, translation into German, Gotthard Killian

2006
Jenepher Duncan, Wall Power, Art Gallery of Western Australia, Perth
Maria Zagala, DRAWN from the collection, exhibition catalogue text, National Gallery of Victoria

2005
Ashley Crawford, 'Who's minding the Store?', The Age, April 9
Max Delany (Ed.), Pitch Your Own Tent: Art Projects , Store 5, 1st Floor, exhibition catalogue, Monash University of Art, Melbourne
Deborah Hennessy (Ed.), 'Store 5 is…', Anna Schwartz Gallery, Melbourne
Meryl Ryan, Colour(less), exhibition catalogue, Macquarie Lake Gallery, Lake Macquarie

2004
Steven Tonkin, 'Art lifts!', Artonview, National Gallery of Australia, Issue No.39, Spring

2003
Ashley Crawford, See Here Now, Vizard Art Collection of the 90s, Ian Potter Museum of Art, Melbourne
Zara Stanhope, Good Vibrations: the legacy of Op art in Australia, exhibition catalogue Heide Museum of Modern Art, Melbourne

2002
Branka Stipancic (ed.), Veczoennections: Contemporary Artists from Australia, House of Croatian Artists, Zagreb
Jenepher Duncan and Linda Michael ed., Monash University Collection four decades of collecting, book, Monash University

2001 Ben Curnow, Picnic, catalogue essay, Melbourne's Living Museum of the West, Melbourne.
Justin Paton, Good Work, (the Jim Barr and Mary Barr collection), exhbition catalogue, Dunedin Public Art Gallery, New Zealand Jenepher Duncan and Juliana Engberg, low-down recent acquisitions Monash University Collection, exhibition cataogue, Monash University Gallery.

2000 Allan Smith, The Crystal Chain Gang: prismatic geometry in recent art, exhbition catalogue, Auckland City Gallery

1998 Peter J. Hutchings, Adding the Blue Pacific, curated by Brian Thompson, Ivan Dougherty Gallery, Sydney, (August 6-September 5). Moet and Chandon Touring Exhibition, exhibition catalogue

1997
Carolyn Barnes, "Elaborating the terms", Geometric painting in Australia 1941-1997, University of Queensland Art Museum, Brisbane
David Pestorius, Geometric Painting in Australia 1941 - 1997, catalogue, University of Queensland, Brisbane
Bruce James, 'Black O Wall Drawings', Sydney Morning Herald, Friday July 18
Branka Stipancic, Black O Wall Drawings 1 - 6, catalogue Rovinja - Italian and Croatian text
SCCA Zagreb, Black O Wall Drawings 1 -6 and Red Matter Wall Drawings 1 - 4, translated into Croatian
Branka Stipancic, Interview, Soros Centre of Contemporary Art, Zagreb, Croatia
Blair French, 'Black O Wall Drawings', Art Text, No.59 October
Soros Centre Contemporary Art, Zagreb, Black O Wall Drawings 1 -6 and Red Matter Wall Drawings 1 - 4, translated into Croatian
Mark McCaffrey and Anne Mulroney, Aerphost: an exhibition of contemporary Australian Art, exhibition catalogue, The Debtor's Prison, Dublin, Ireland

1996
Robyn McKenzie, 'Wall Drawings', The Age, July
Naomi Cass, 'Moving Portrait', Herald Sun, July 2
Gregory Adamson, Stephen Bram, Kerrie Poliness, Dion Workman, exhibition catalogue essay, 23A gallery Auckland , New Zealand

1995
Max Delaney, Wall Drawings, catalogue, 200 Gertrude Street, Melbourne
Sue Cramer, Primavera, Museum of Contemporary Art, Sydney

1994
Edward Colless, 'White, Sarah Cottier Gallery, Sydney', Art Text, No.48
Robert Lindsay, Baillieu Myer Collection of the '80's, Museum of Modern Art at Heide, Melbourne
Sue Cramer and and Caroline Barnes, Store 5, Institute of Modern Art, Brisbane
Ben Curnow, Disclosure, exhibition catalogue, Artspace, Sydney
Michele Helmrich, Melbourne Seven, exhibition catalogue, David Pestorius Gallery, Brisbane

1993
Jeff Gibson, 'The Good The Bad And The Abstract', Art Text, No.44
Eve Sullivan, 'The Caboose', review of print portfolio, Art Text, No. 44

1992
Caroline Barnes, 'Proliferation and the Archaeology of the Pictorial', Broadsheet, Volume 20 No. 3, September
Caroline Barnes, The Practice of Abstraction, 'Abstract Art', Roslyn Oxley9 Gallery, Sydney
Caroline Barnes, Octopus, catalogue, University of Adelaide

1991
Caroline Barnes, 'Kerrie Poliness', Agenda, No.18 July
Ben Curnow, For the verses already somewhat formed, catalogue, Deakin University
Natalie King, Subversive Stitch, Monash University, Melbourne

1990
Ben Curnow, New Melbourne Abstraction catalogue, Artspace, Auckland

1989
Caroline Barnes, 'Cosmic Resistance', Agenda No.5 June

PUBLIC COLLECTIONS
Artbank
Art Gallery of Western Australia, Perth
Australian National Gallery, Canberra
Bendigo Art Gallery, Bendigo
Deakin University, Geelong
Dowse Museum, New Zealand
GoMA, Queensland Art Gallery, Brisbane
Griffith University, NSW
HOTA, Gold Coast, QLD
Margaret Stewart Endowment
Monash University, Clayton
Museum of Contemporary Art, Sydney
Museum of Modern Art at Heide, Melbourne
National Gallery of Victoria, Melbourne
Queensland Art Gallery, Brisbane
The University of Melbourne
Vizard Collection, Ian Potter Museum, University of Melbourne
Wollongong University, NSW

GRANTS, SCHOLARSHIPS & RESIDENCIES
2019 Residency Sydney Grammar School, Sydney
2017 Residency Police Point, Point Nepean, MPRG, Mornington, Victoria;
Residency Overnewton College, Melbourne
2016 Residency, The Avoca Project, Avoca
2014 Residency GMK, Zagreb, Croatia
2014 Travel Grant, Victorian College of the Arts (VCA)
2013 Residency Melbourne Grammar School, Melbourne
2012 APA, PhD Centre for Ideas, VCA, University of Melbourne
2011 Visual Arts and Craft Fund, Australia Council
Research Residency, Iramoo Sustainable Community Centre, Victoria University
2010 Residency, RMIT Print Studio Workshop
1999 Victoria Commissions, Arts Victoria.
1998 Design, Production & Exhibition of Fabrics with Melinda Harper, Women

Artists Project Grant, Office of women's Affairs and Arts Victoria
1997 Travel to Croatia for two solo exhibitions, Arts Victoria.
1997 Interpretation of an Australian Factory, New Media Fund of The Australia Council
1995 Studio Residency, Besozzo-Italy, Visual Arts & Craft Board of The Australia Council

COMMISSIONS / ARTWORK DESIGNS

2019
Bondi Sound, Eastgate Façade, Bondi Junction (Design Development) with UAP
Stream, under construction, The Drying Green, Green Square, City of Sydney (current)
Crossing Lines, NSW Rail Metro Station, Victoria Cross, shortlist design proposal with UAP.

2018
Shimmer, Façade, 303 Carlisle Street, St Kilda (private)
Oracle, with Rose Nolan and Emily Floyd (design proposal) with FREO2 and UAP
Envoy, with Rose Nolan and Emily Floyd (design proposal) with FREO2 and UAP
Field Drawing for Cato Square, Prahran (design proposal) with UAP, City of Stonnington
Volcano Dreaming, Nicholson Street foyer, Department of Land Water and Environment, DELWP, Victoria

2017
In Bloom, Façade, Leroy Apartments, Packington Street, St Kilda (private)
Green Wall Drawing, Haven Apartments, Newstead, Brisbane
OMG, installation, Today, Tomorrow, Yesterday, Museum of Contemporary Art, Sydney

2015
Pobblebonk, copy, Moonee Valley City Council

2014
Stream, artwork design development, The Drying Green, Green Square, City of Sydney (current)
Orange Wave, Woods St tunnel, Yarraville, StreetWorks, City of Maribyrnong
Field Drawing #1, Maywar Green GoMA (May – July)
Purple Tide, Canada Bay, NSW (design proposal)
Volcano Dreaming, copy, Moonee Valley City Council

2013
Wave Drawings, Highpoint Shopping Centre, Melbourne
Field Drawing #1, The Agora, Latrobe University, Melbourne
Red Matter Drawing (bag), MCA store, MCA Australia
Volcano Dreaming, copy, City of Melton
Volcano Dreaming, copy, City of Hume
Volcano Dreaming, copy, Glenelg Hopkins Catchment Management Authority

2012
White, Black-Whiteboard Drawing, Laby Ideas Centre, Physics Department, University of Melbourne
Volcano Dreaming, copy, Hamilton Field Naturalists

2009-11
Volcano Dreaming, Victoria University and EPA Victoria

2008
Snow Drawings, Silverski Lodge, Falls Creek, Victoria

2006
Diamond Kilometre, Eastlink Freeway, Connecteast. Victoria (design proposal)

2005
Pobblebonk: animals of the Maribyrnong River Estuary, Melbourne's Living Museum of the West, EPA

2003- 2005
White Grey Mirror Glass Drawings 1-4, North Tower Foyer, Watergate, Docklands Melbourne.

1999
The Pipestacks, Pipemakers Park Melbourne.

1998
Design of poster for Construction in Process VI , The Bridge, by 'The Bridge Committee".
Design development the 'Olympic Car Park - Homebush Facade', by the Olympic Co-ordination Authority.
Top Factory, Design of visual elements for the Interpretative Signage of Buildings in Pipemakers Park with Gary Vines, Olwen Ford and Clare Hart by Melbourne's Living Museum of the West Inc.

1997
Top Factory Interpretation project Pipemakers Park, Maribyrnong by Melbourne's Living Museum of the West Inc
Design proposal commissioned for North Atrium Stairwell, Federal Law Courts Building Melbourne, by the Attorney Generals Department.

1996
Still Here - A brief history of Aboriginal people in Melbourne's West, co-design and production of the exhibition & catalogue by Larry Walsh, Aboriginal Cultural Officer for Melbourne's West.
Pioneer Women's Shelter, Pipemaker's Park, Maribyrnong. Design, production co-ordination of building & publication, by St Albans History Society & Melbourne's Living Museum of the West Inc.
Red Matter Wall Drawing, Computer Technology Foyer, Monash University, Clayton.
Black 0 Wall Drawings, Library, Monash University, Clayton.

PUBLICATIONS

13th BEACH (video) 2019
Swan Bay (video) 2019
BACK AND FORTH (video) 2018
TIME TO GO, (video) 2017
NICE PLACE (video) 2017
OMG (orange, magenta, green) Wave Drawing, (artist book), 2014.
BBKO (blue, blue, black, orange) Wall Drawing, (artist book), 2014.
Material, artist page ed. John Nixon and Danny Lacy 2014.
Field Drawing #1 film, install at GoMA, 2014
Landscape Paintings - Lake Bolac to Zagreb, postcards, 2014
Whoosh, (artist book), 2012
Yellows, (artist book), 2012
Wildflower thinking (non-objective wildflowers), (artist book), 2012
Points of Attraction (yellow), (artist book), 2011
Red and Green EP (exponential paths), (artist book), 2011
Red Furl, (artist book), 2011
Single Shelters for the Victorian Volcanic Plains, (artist book), 2011
Volcano Dreaming, flora and fauna of the Victorian Volcanic Plains, Victoria University and EPA with Peter Haffenden
(exhibition printed in multiple copies touring Victoria)
Index No. 1, artist pages, ed. Justin Andrews, 2010.
Field Drawing # 1 (artist book), 2008.
Blue Drawing # 1 (artist book), 2007.
Blue Wall Drawing, exhibition catalogue and text, Anna Schwartz Gallery 2007.
Pobblebonk – Animals of the Maribyrnong River Estuary, Melbourne's Living Museum of the West, 2005.
STORE 5 is, exhibition catalogue, artist statement, Anna Schwartz Gallery, ed. Deborah Hennessy, 2005.
PICNIC, exhibition catalogue, ed. Kerrie Poliness, Melbourne's Living Museum of the West Inc., 2003.
Annex No1. artist pages, ed. Stephen Bram, 2003.
RUBIK 13, book, artist pages, ed. James Lynch, Melbourne 2001.
The Top Factory CD Rom, designed and ed. with Melbourne's Living Museum of the West, 1998.

PUBLICATIONS (continued)

Material, artist page ed. John Nixon 1998.
Circular 6, (Croatian / Australian edition) ed. With Branka Stipancic, August 1997.
Black O Wall Drawings 1-6, 1997.
Pioneer Women's Shelter, A5 Booklet (ed. with Joan Carstairs), St Albans History Society/ Melbourne's Living Museum of the West 1996.
Black O, Wall Drawing Instruction Book 1996.
STILL HERE VIDEO, (co-produced with Nigel D Fewkes and Larry Walsh), Melbourne's Living Museum of the West, 1996.
STILL HERE, exhibition catalogue (co-author Larry Walsh), Melbourne's Living Museum of the West, 1996.
Favourite Objects/History of the Soul, exhibition catalogue (ed. with Peter Faber), Melbourne's Living Museum of the West, 1995.
Red Matter Wall Drawing Instruction Books; #1, #2, #3 & #4 1994-5.
Circular 4, March 1995 (ed. with Marco Fusinato & Janet Shanks).
RIP 1, Video (ed 1994) for Loop collection (ed. Callum Morton) for ArtRage Compilation, ABC 1995 (ed. Kim Machan).
Circular 3, April 1994 (ed. with Marco Fusinato).
Bond Store , Hobart, catalogue (ed. with S. Cramer, M. Fusinato, M. Harper, G. Wilson) 1993.
Circular 2, October 1993.(ed. with Marco Fusinato).
Red Matter (Print Portfolio), 1993.
Circular 1, May 1993 (collection of poetry co-edited with Marco Fusinato).
Pavilion 1 (artist book), 1993.
Caboose 2, 1992. (Print Portfolio co-ed with Gary Wilson).
Red Matter 1 (artist book), 1992.
Rosebud 2, (ed. Gary Wilson) 1992.
Deakin University, exhibition catalogue, with Ben Curnow,1991.
Kerb Your Dog, No.15, (ed. by John Nixon) 1991.
Rosebud 1, (ed. Gary Wilson) 1991 (artist page).
Pataphysics 5, 1991 (artist page).
Pataphysics D/E, 1989 (artist page).

TEACHING, WORKSHOPS, TALKS

Melbourne's Living Museum of the West, 1993- 2007/ 2010-2019
General talks to groups, schools, communities and stakeholders about: the Museum, Australia's first ecomuseum; buildings, public artworks, industrial history and environs in PIpemakers Park; local history; the environments of Victorian Volcanic Plains and Maribyrnong River Estuary
Managed contemporary art exhibition program and artist in residency program, 2014-2019
Supervised research students, student work placements 1995-2019

University programs at the Living Museum
VCA, Painting students (2nd year undergraduate), semester 1 + 2, 2019
RMIT, Interior Design students, School of Architecture (2nd year students) , semester 1 + 2 2019
VCA, Drawing students (3nd year undergraduate), semester 3, 2018
RMIT, media and communications students, (2nd year undergraduate) semester 2, 2018
VCA, Painting students (2nd year undergraduate), semester 3, 2017

Workshops
Playground Drawings, Wembly Primary School (September) 2019
Play On Art and Sport, public workshop, Dubbo (September) 2019
Art Education Victoria Conference (May) 2019
Sydney Grammar, (May) 2019
MCA, Art Everyday, inaugural teachers conference, 2018
Museum of Modern Art at Heide, Melbourne, 2006, 2017, 2018
Overnewton College, 2018
VCASS, 2018, 2019
Melbourne Grammar, 2013

Talks / conferences (selected)
Basil Sellars, Play On Art and Sport opening, Western Plains Cultural Centre , Dubbo, 2019
Art Education Victoria, AGM speaker (August) 2019

Talks / conferences (selected, continued)

MCA, Art Everyday, inaugural teachers conference (keynote) 2018
VCA, University of Melbourne, PhD completion seminar, 2018
Museum of Modern Art at Heide, Melbourne, artist talk re Call of the Avant-Garde exhibition, 2018
City Botanical Gardens, Brisbane, artist talk re exhibition, Botanica, 2018
NGV, artist talk re exhibition Every Brilliant Eye: Australian Art of the 1990s, 2017
GoMA, Queensland Art Gallery, Brisbane, artist talk, Trace: Performance and its Documents, 2014
Royal Institute of Science Australia (RiAus), Adelaide, artist talk re exhibition Art, Complexity and Pattern, 2012
University of Melbourne, Ian Potter Museum of Art, artist talk re exhibition, Basil Sellers Art Prize, 2012
Monash University Museum of Art MUMA , artist talk re Networks Cells and Silos, 2011

*Landscape Painting exhibition*
*Point Lonsdale 2018*