Re-sculpting the future: Climate change and sculptural practice

AN EXEGESIS SUBMITTED FOR

THE DEGREE OF THE

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Declaration of Originality

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

The discipline of sculpture relies more on the use of technology than other disciplines such as painting, drawing and printmaking. This technology enables sculptors to manipulate materials like metal, timber and stone, and to produce very large scale works. However, research into the damaging impact of climate change on the environment confirms that such technology plays a role in this destruction. Does this make sculptural practices that rely on technology an environmental liability? Can a sculptural practice engage with environmental issues without being hypocritical? Can technology be a part of the solution rather than contributing to the problem of climate change / environmental destruction?

The bond between humans and technology is deeply symbiotic (Heidegger 1977, p. 25); it has enabled our vast global population (Flannery 2005, p. 79); it gives us unprecedented agency to travel, communicate, heal and consume by revealing how these actions are possible. Yet it also controls our actions existentially (Latour 2005, p. 71). As we manipulate technology it in turn manipulates us – politically, psychologically and environmentally (Heidegger 1977, p. 28), (Gifford 2011, p. 293), (Flannery 2005, p. 209). And many can prove that technology is the cause of climate change. In being a cause then many think there are only two ways to deal with it: live with the status quo and continue damaging the environment, or live without technology and save the environment. But there is actually a third way. This option lies within a renegotiation of what technology can do and whether the balance of environmental protection and technological advancement is possible.

Considering the observations of a selection of artists, scientists, psychologists and philosophers I have researched I have attempted to find ethical solutions for my sculptural practice to engage with the issue of climate change while deploying technology in a way that is not also hypocritical or damaging to the environment.
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Dan Stewart-Moore

RE-SCULPTING THE FUTURE

CLIMATE CHANGE AND SCULPTURAL PRACTICE
Preface

Practice-led research structure

This exegesis documents my practice-led research in the discipline of sculpture. More specifically, my practice is a modern-day extension of the genre of art that since the 1960s has been called Environmental Art, via its direct engagement with, or issues relating to, the environment. This has evolved out of research into a number of art practices as well as the findings of climate change scientists, psychologists and philosophers. The works submitted for examination in June 2016 are the culmination of various approaches and methods pursued through my ongoing research across all of these fields to attain a deeper level of understanding towards achieving an effective way for my practice to critically and ethically engage with the dialogue around climate change.

Chapter contents

There are four chapters in this exegesis:

- The first chapter deals with the context of my research. This includes a review of artists who work in the field of Environmental Art, an examination of the psychological phenomena that concern climate change and an argument for a more holistic approach for artistic discourse on climate change.

- In the second chapter I discuss the philosophy of technology and how the connections between climate change, psychology and politics highlight the difficulties of understanding and re-configuring the relationships that humans have with technology.

- The third chapter details my artistic process, documenting how and why my studio practice has developed into what it is today.

- The fourth chapter concerns the works submitted for examination.
Introduction

1.1 Identifying a gap in Sculptural Practice

Traditionally sculpture, more than any other visual art form, deploys materials and processes that could be seen as contributing to or even causing environmental damage. This makes it difficult for many sculptors to engage with environmental issues without appearing hypocritical. Within the genre of Environmental Art, I am suggesting there are two significant avenues of practice that sculptors can take to avoid this.

Firstly, artists such as Andy Goldsworthy and Richard Long have practices that use the natural environment as material and process. Theirs is a highly moral practice producing fragile artworks that may only last a few moments, which also in the 1960s was designated as Ephemeral Art (Tate). Being so short-lived their documentation becomes pivotal, as viewers typically only get to see the work as a photograph. Ephemeral Art rarely demonstrates environmental concerns; it mostly avoids political critique, rarely reflecting on how technology is encroaching upon the natural world, and contains little or no actual ‘human’ narrative (though their abstractions cannot exist without human intervention). Rather than demonstrate what concerns an artist might have in this realm, these works simply reflect nature’s beauty and thereby imply ways for humanity to live in ethical complement – with greater respect for the environment.

Secondly are sculptors who do demonstrate specific environmental concerns. Key to such practices is the engagement of issues in their works. While some are direct and / or didactic, others create experiences in order to elicit a sense of individual responsibility in the viewer through their engagement. An artist such as Olafur Eliasson does this by demonstrating fundamental scientific principles in works such as Ice Watch 2015. Displayed during COP 21 – the United Nations Climate Change Conference in Paris – this consisted of 12 pieces of ice weighing a total of 80 tonnes that slowly cracked and melted during the conference to symbolise the effects of climate change and the urgency required to address the issue.

The diverse materials and processes deployed in the production of these more political works ranges from having very low to very high environmental impact. As successful as these works often are, they also contain a paradox; while engaging with an artist’s environmental concerns a viewer may feel conflicted about the environmental damage a work may cause via its materiality, scale and/ or the energy used in its production / exhibition. Indeed, in trying to demonstrate environmental concerns while causing environmental damage presents as an ethical dilemma.

Though Ephemeral Art can highlight the power, fragility and beauty of nature, practitioners in this field rarely convey more than this, preferring an approach that avoids political entanglement. While Chris Drury’s practice is an exception – as discussed in section 2.4, titled ‘Pleasure and angst’ – artists like the aforementioned Richard Long and Andy Goldsworthy are bound by self-imposed standards such as only working in the landscape, with natural materials, and using tools found on site, such as sticks, rocks and water, to create their mostly abstract works. Rather than engaging with climate change or any environmental concerns, these works are predominantly
concerned with the formal qualities of spatial relationships, visual dynamics, materiality, surface and colour – through human interventions – in the natural world. By not dealing with specific issues - like sea level rise in Olafur Eliasson’s *Ice Watch* 2015, or air pollution in Tomás Saraceno’s *Aerocene* 2015 – environmental concerns may arise only by proxy.

The disparity between these two types of practice signifies a gap in the Environmental Art genre that led me to explore ways of addressing the ethical dilemma of producing environmentally engaged works without causing environmental damage - demonstrating how my work can express my concerns without a sense of paradox.

1.2 Research question

My research is not an attempt to distinguish my practice from other artists in the field or to claim any sense of total ‘originality’. Rather, this exegesis attempts to explore the ways my practice extends beyond the artistic impasse that climate change as a subject presents. My question is:

*How can a sculptor contribute to the artistic discourse around issues of climate change without entailing the ethical paradox of deploying materials or methods that may be seen as contributing to it?*

This question highlights the problem of a delicate balancing act sculptors need to address while working in the field of Environmental Art. I propose that sculptors can avoid ethical paradoxes by choosing appropriate materials and processes to express their specific environmental concerns – in my case around issues of climate change – as well as by looking into the deeper issues around how and why environmental issues arise – in my case through climate change psychology, climate science, philosophy and the artistic context of climate change.

1.3 Establishing a context

The presence of ethical dilemmas in my work, and more broadly in sculpture that pertains to the genre of Environmental Art, highlights a number of inconsistencies that occur in artistic decisions that can inadvertently disregard the mitigating qualities of their own actions by, for instance, ensuring efficient energy consumption, recycling materials or using renewable energy sources. These ideas assisted my artistic process, yet they also gave me cause to consider why I had to create these self-imposed caveats whilst those that had opposing beliefs did not. Clearly the difference between a climate-change sceptic and an environmentalist is their beliefs. While the latter accept the findings of climate-change science, sceptics deny or refute its validity. The reasons why sceptics do this varies quite widely, from economics to ideology and/or religion, but there are also psychological explanations (Gifford 2011, pp. 290-302). The recent development of climate change psychology exposes a number of phenomena that account for the beliefs of climate change sceptics (Rachlinski 2000, pp. 1-35). During the course of my research their findings had two distinct outcomes on my work. My first instinct was to demonstrate how these psychological mechanisms work through the abstract sculptures I was making in the early stages of my research. This resulted in some didactic concepts that were too alienating for viewers so they were unusable. The influence of climate change psychology continued being contextually relevant as I began exploring possible ways for humanity to survive in the future.
The notion of ‘technosalvation’ was an important concept that grew out of climate change psychology. As explained by psychologist Robert Gifford, this is an overconfidence in science and technology that ultimately serves as a barrier for individual action in mitigating or adapting to climate change (Gifford 2011, p. 293). On a broader level, technosalvation also affects governments who might seek short term, low cost solutions such as artificially lowering atmospheric temperature through geo-engineering strategies that allow the continued use of fossil fuels that are largely responsible for the problem in the first place (Hamilton 2013, 139).

It would seem there are two main avenues to combat climate change (Surampalli 2013, p.504). The first is mitigation, which is the act of reducing the amount of pollution that causes climate change by phasing out fossil fuels and employing renewable energy sources. The second is adaptation, which is the act of preparing for changes in the climate that will affect the environment and life on the planet – such as building walls to protect against sea-level rise, changing building codes to resist extreme weather events and researching ways for agricultural activity to survive disruption. Governments are deploying both mitigation and adaptation strategies using technical and scientific solutions (Measham et al 2011, pp. 889-909), (Jones 2007, pp. 658-712). While many of these are ethical solutions there are some avenues that are deeply concerning.

One of the greatest concerns is geo-engineering – the act of engineering the earth’s climate – as some effects can be more damaging than good. One of the most popular propositions is known as ‘global dimming’ or ‘solar radiation management’ (Caldeira 2013, p. 232). Global dimming involves releasing sulphur dioxide (SO$_2$) into the atmosphere to increase the reflectiveness of the earth’s atmosphere and reduce the impact of solar radiation i.e. temperature rise (Blackstock 2010, p. 527). It has all the hallmarks of technosalvation, promulgating an overconfidence in the capacity for science and technology to manage climate change instead of encouraging individual responsibility and action (Gifford 2011, p. 293). But such solutions as global dimming would be ineffective (Hamilton 2013, p. 139), ultimately having negative outcomes on the environment such as a continuation of CO$_2$ production levels and lower solar radiation – affecting agriculture, solar energy production and reducing the capacity of the biosphere to absorb CO$_2$ through photosynthesis. More information on geo-engineering will be discussed in 2.8 ‘Climate Change Psychology’.

If geo-engineering is to be adopted in the mitigation of climate change it is necessary to consider solutions that work with the environment rather than against it. In a later chapter I will discuss the possibility of environmentally positive technological solutions in relation to Martin Heidegger’s idea of humanity’s ‘free relationship’ with technology.

For the purposes of my research, one such solution might involve the creation of machines from our pollution that autonomously absorb greenhouse gases without producing any negative environmental side-effects. But how could this be done? This became the principle investigation of the work I submitted for examination in June 2016. From this I created a speculative future narrative based on the current predictions of climate science, climate change psychology and a number of geo-engineering proposals. In essence the setting for this work is a post-apocalyptic world where only the most remote and self-sufficient human settlements have survived violent changes in the climate and the resource wars that follow. A tiny fraction of today’s human population survive and are divided into two distinct groups: those from the ‘old world’ who scavenge a living in ruined cities, and INZMAT inhabitants who have managed to avoid war and adapt to climate change. Although the human contribution to climate change has been greatly
reduced, the effects of previous contributions continue to have an impact. INZMAT develops a carbon absorption technology program known as CAT using two types of machines they call ‘clouds’ and ‘shells’. The clouds are solar balloons with an on-board supply of algae that filters and converts carbon dioxide (CO₂) into benign oxygen. The shells also filter and convert CO₂ from the ocean using algae. Both machines are made from reclaimed plastic that is captured and recycled from oceanic gyres via autonomous ships with enormous filters and machines that produce the clouds and shells. The ships are solar powered and have vast algae farms on board to load into the clouds and shells. This was all developed through a background narrative about a journalist writing a story about INZMAT’S CAT program as a way of illustrating a future where this type of technology could be politically possible.

Speculating on this future narrative helped me identify a potential sculptural material: high-density polyethylene, or HDPE, a plastic commonly used in milk and fruit juice bottles. After some early experiments I devised a method of recycling milk bottles by cleaning, scoring, cutting and fusing them into my sculptures. Because it’s recycled I’m saving it from polluting the environment, so it’s a material that enabled me to express my environmental concerns without causing any ethical paradox.

HDPE was not the first material that I experimented with, but my research started in a related but distinctly different direction, with a different objective. This, however, will be discussed in more detail in a later chapter that deals with my processes of production.

The next chapter of this exegesis deals with the contextual elements that assisted me to identify a rather significant gap in sculptural practice, including in the genre of Environmental Art, through the psychology of climate change, the science of how the earth’s biosphere is so interconnected, and theories such as the Gaia principle enabled me to find ways that artists can participate in the discourse of climate change without being hypocritical or presenting any ethical paradox.
Environmental Art occurs in many forms. From Alan Sonfist’s installation works with plants to Robert Smithson’s excavated sculptural landscapes, from Andy Goldsworthy’s interventionist ephemeral works in nature to Olafur Eliasson’s high tech immersive gallery experiences. Because Environmental Art practices are so diverse this chapter explores shared interests and makes thematic comparisons in an attempt to contextualise my practice within this genre, as well as discussing issues such as ethical paradoxes that artists practicing in this genre must face.

2.1 Ethical Paradoxes

A recurring feature of this chapter is the dilemma of ethical paradoxes that occur in Environmental Art.

These ethical paradoxes are seen to arise through the following:

- Material ethics
- Production ethics
- Aesthetics
- Conceptual pathways

Material and production ethics concern the materials used to produce an artwork and how they are used in the production process. The most common dilemma occurs when an artwork that deals with environmental issues uses materials and/or processes that are environmentally damaging. Even artists considered to have environmentally friendly practices like Chris Drury, Richard Long and Andy Goldsworthy create this paradox through such things as fuel consumption for personal transport or the freight of their works/materials, deforestation for publishing about their work, and in some cases using fossil fuel powered tools/machinery or high emission materials that cause environmental harm. The use of traditional sculptural materials like bronze or steel are particularly problematic because their production processes require a significant quantity of ore to be mined and then refined at very high temperatures which produce vast emissions of greenhouse gas.

Because all material production has an environmental impact to a greater or lesser degree my practice has evolved such that I now focus on using recycled waste materials and less resource-intensive processes in the production of my work.

With regards to aesthetics, artworks also need to convey some sustainable relationship between material, form and ideas. For instance, works dealing with climate change that are developed or produced using computer-aided design and/or industrial production techniques can give the resulting artworks a precise and machine-like aesthetic that would conflict with conventional ideas concerning the environment. On the other hand it is important to consider if the organic forms and colours of leaves, mud and sticks associated with the environment are appropriate in the context of climate change when we know that technology has such a clear role to play. If we accept the anthropogenic evidence of climate change, we must also accept that our relationship with technology is contextually appropriate for making artwork conceptually linked to climate change, therefore machine-like forms should be aesthetically appropriate, as demonstrated by Tomás Saraceno, Olafur Eliasson and Theo Jansen.
By conceptual pathways is meant the relationships between forms, material, the overall aesthetic and the concepts an artwork – or an artists’ practice – engages with, and whether each justifies or warrants the other. My earlier practice did not consider these relations so the materials and forms I worked with did not succeed in conveying my concerns. However, through the discoveries made during my research-based practice process I now have imposed limitations on my material and processing choices – to avoid any of the ethical paradoxes I came across. This has involved me working with unfamiliar materials and processes, which in turn required a reworking of the concepts my work represents: a balance between material, process, aesthetic and concept must be met for a work, or practice, to avoid ethical concerns or conceptual misrepresentations.

What follows is an outline of the changes made in various approaches to my work during my research, from a practice that contained ethical paradoxes – represented in the steel sculptures Waiting (2011) and Watching (2011) (Fig. 20 & 21) that initiated my research project – to a series of works that were relatively didactic e.g. Adaptive Paradox (2013) (Fig. 69) intended to confront the viewer with impending disaster, blame and bitterness about climate change – to my final works which became an exploration of forms from a fictional future that I developed to convey my thoughts and fears about where we are heading if we don’t take action on climate change.

2.2 Environmental Art Practices

Climate change is one component of the wider discourse around environmental issues that are dealt within art. The artists discussed have practices that focus on these broader environmental issues. Other artists might only deal with climate change in a single work, but this does not make them Environmental Artists. My research focussed on trying to identify how Environmental artists – those who have devoted their practice to their environmental concerns – developed their practices and how they achieved a balance between their methods, materials and ideas to achieve respect and success in this field.

As mentioned, Environmental Art comes in many forms, perhaps the most notable being Ephemeral Art. This type of art has been produced since the 1960s and is named thus as it is made only to last for a short period of time.

The ephemeral art movement of the 1960’s has been defined as,

...reflecting a desire to dematerialize the art object in order to evade the demands of the market, or to democratize or challenge art museums (O’Neill 2007).

This included – and today includes a resurgence in – a number of freestanding genres such as Performance, Video, and Temporal (or time-based) Art, Land Art and (environmentally based) Ephemeral Art. The latter has been described as,

...ephemeral gestures in the environment (Ross 1998).

The ephemeral works I am focussing on here are those which demonstrate the artist’s fascination with the natural world and the ways in which artists can demonstrate their empathy and connection with the environment, often using naturally occurring materials in arrangements that
decay over a short period of time. Examples include Andy Goldsworthy’s *Ice Star* (1987) (Fig. 1) – a short-lived star-shaped sculpture made from icicles he found in Scaur Water, Penpont, Dumfriesshire – a river in the south-west corner of Scotland (Fig. 1) – or Richard Long’s *A line made by walking* (1967) (Fig. 2) – created by his walking back and forth to form a straight line in a field of grass in Wiltshire which he then photographed.

As discussed earlier, the consideration of materials, form and aesthetics of these works all have a very light, if not invisible, impact on the environment and as such succeed in their relationship to their concept – which is to highlight the beauty of nature. They contain no ethical paradoxes.

Other Environmental Art focuses on delivering an experience through e.g. large gallery installations that create an atmosphere or aesthetic that might emulate or impress certain environmental issues upon a viewing audience. An example is Olafur Eliasson’s *The Weather Project* (2003) (Fig. 3). Installed in the Tate’s Turbine Hall it comprised a fine mist that transformed light in the space thrown from a semi-circle of orange lights at one end – like a post-apocalyptic sun – into a foreboding environment with a mirrored ceiling that implicates the viewers below. Tomás Saraceno’s *Aerocene* (2016) (Fig. 4) is quite a different project that consists of giant inflated spheres made from silver and transparent Mylar to explore the idea of flight without fossil fuels and through the title plays on the term Anthropocene, suggested by Paul Crutzen and Eugene Stoermer in 2000 to:

... *denote the present time interval, in which many geologically significant conditions and processes are profoundly altered by human activities* (Zalasiewicz 2014).
With regards to material and productions processes, both of these artist’s works are developed using design and production techniques that are heavily reliant on machinery and/or technology which is evident in their aesthetic: Eliasson’s work is composed of machine-produced items, the lights indeed being a type of machinery that require electricity to work, and Saraceno’s works being design and machine-produced, though they might only use solar energy to rise into the atmosphere. While both are concerned with environmental issues their use of synthetic materials presents an ethical paradox as their aesthetics, production methods and materials are contradictory with their concerns.

The challenge for my newly evolving practice was to find materials, techniques and an aesthetic that enabled me to use natural forms to advocate my concerns for climate change without contradiction. To do this I started to experiment with recycled plastic, as it is a readily available waste product and a noted pollutant in our oceans. The forms I began experimenting with went through various stages until I arrived at forms derived from nature, including geometric patterns...
or sequences such as the Fibonacci series. The mathematical nature of these forms led me to Buckminster Fuller and his geodesic domes that were advanced technology for his time and mimic biological forms (Curl 2006, 310) (Fig. 5).

![Fig 5. R. Buckminster Fuller, Union Tank Car Dome, 1958.](image)

An artist’s approach to environmental issues is important because their intentions will be revealed in their final work. The choice of materials and processes must be sympathetic to their ideas and intentions. The use of natural materials can serve to justify the methods or processes of the artist if they do not incur any damaging impact on the environment. This becomes a balancing act that moves away from traditional sculptural approaches such as casting bronze or working with steel toward the use of more innovative concepts, methods and materials.

**2.2 Materials: Natural versus artificial**

Alan Sonfist’s work *Time Landscape* (1965-1978-present) (Fig. 6 & 7) was a 100 square metre ‘forest’ installation in Greenwhich Village, Manhattan. To create this he planted pre-colonial vegetation in a vacant block to serve as both a link to the past and a contrast with the urban landscape of New York City (Rosenthal 1983, 60). Sonfist was very careful to create the work in an ethical way, researching, selecting and cultivating species that existed in the Manhattan area before European settlement and planting it all by hand. In this Sonfist highlights that the natural world is an integral part of, by being a precursor to, civilisation.
Sonfist’s *Time Landscape* used indigenous plants as his medium and Manhattan as his canvas. In complete contrast, Robert Smithson’s *Spiral Jetty* (1970), on Great Salt Lake in Utah, used the natural world as both medium and canvas. Sometimes known as a ‘maximal’ artwork – a name derived from its ‘minimalist’ aesthetic and its ‘maximum’ scale (Altieri 2005, 1) – it is a 500 metre-long, 5 metre-wide raised earth spiral pathway that required large earth-moving machinery to move black rock, salt crystals and earth in its production and relocation of materials into and across the lake. Categorised as Land Art – a type of Environmental Art that does not necessarily express any concerns about the environment – Smithson’s intention was to create art using natural materials within nature without any consideration of, for example, the greenhouse gas emissions his use of machinery would have produced or the ecosystem of the local area.

An artist with a completely different approach is Dutch engineer and artist Theo Jansen. Decades after Smithson’s and Sonfist’s above seminal Land Art works, Jansen has been producing his *Strandbeests* (1990-present) – Dutch for “beach animals” – out of recycled PVC pipes, a waste material found in a skip outside a house undergoing renovations. These works are propositions to maintain the Netherland’s sand dunes and hold the sea back from flooding Holland’s reclaimed land, which is below sea level, as he explained in an interview with Dutch newspaper *De Volkstrant*:

> The sea is constantly rising and this is threatening to erode the boundaries of our land back to where they were in medieval times. And we all know that there’s not a lot we’ll be able to do in that tiny portion of land. So the big question is: how can we get more grains of sand onto our dunes? It would be fantastic if we had some sort of animal that could stir up the sand on our beaches, tossing it into the air so the wind could carry it to the dunes. (De Volkstrant newspaper, 1990)

His animals resemble millipedes with the sideways scuttle of crabs. With anything from 6 legs to 60, they move with an elegant mechanical synchronicity powered by wind captured by wings that act like wind turbines that drive pumps that pressurise up-cycled PET bottles that drive a crankshaft that drives the movement of the individual legs.

This use of recycled synthetic materials and renewable energy advances the ‘natural versus artificial’ discussion regarding environmentally concerned art. Rather than Sonfist’s emphasis on restoring natural vegetation – in contrast to urbanisation and technology’s increasing dominance in our lives – or Smithson’s domination of a landscape through the use of technology, the cumulative knowledge displayed in Jansen’s *Strandbeests* shifts towards an environmentally-
concerned art that can use materials and incorporate and/or influence the use of technology to work with – or towards maintaining – the environment.

Jansen’s machines are only proposals and prototypes for the autonomous maintainence of Holland’s sand dunes and hold back the sea to maintain the country’s landmass; they are not actually used in the fight against sea-level rise. But I found them inspiring because they established a way for an artist to use waste material and create work that connects physically as well as conceptually to climate change issues: Jansen’s Strandbeests work towards a solution for sea-level rise, working autonomously with the environment rather than contributing to the problem.

Where the works of Sonfist and Smithson challenge our assumptions about nature and the impact of humans in the landscape, Jansen’s and my work intends to rework these issues using materials that are synthetic to explore ways to deal with the environment and more specifically, climate change. This enables my work to be ethical on the level of materials, production processes, aesthetics and conceptual pathways.

2.3 Anthropocene: Impact or no impact

Unlike the large scale artefacts of traditional sculpture that impose the artists’ mark on the world through long lasting materials like bronze or marble, or artists who use the Landscape as their medium with heavy greenhouse gas emitting machinery, the fragile interventions of ephemeral artists ensures that their impact is minimal and integrated with the natural world. Artists like Andy Goldsworthy, Richard Long, and Chris Drury challenge the permanency of sculpture and its environmental impact through the latter (Seymour, Fulton & Cork 1991, 12). Created in nature from nature (Fulford 2007, 596), they use their hands, or bodies, to create their work, which determines its smaller scale and its fragile nature.

Considered both a sculptor and photographer, Andy Goldsworthy makes permanent structures such as Stone River (2002) and Three Cairns (2002) but as discussed his work is mostly ephemeral. Composed of found natural materials such as twigs, stones, leaves, water and icicles his delicate arrangements may only last a few moments, leaving little trace of his presence except that his work is documented photographically. Perhaps the most fragile works by Goldsworthy are his ice works, made using naturally formed ice structures he rearranges into forms such as Ice Spiral (1995) – a helix of ice around a tree trunk – and Ice Star (1987) – a spikey star-shaped icicle piece. In other works he also uses time. For example, Pebbles around a hole (1987) (Fig. 9) uses river stones that he wets and leaves to dry for different lengths of time. Then he places the wettest stones in a circle, adding further concentric circles of dryer stones to the driest stones in the centre, creating a tonally gradated round work. Goldsworthy demonstrates the potential of sculpture that does not need to impose a lasting presence in the environment; instead his photographs offer viewers a chance to see the moment in which his ephemeral works exist.
Richard Long’s work is also based on his short-lived presence in the environment. Perhaps his most well known work is his earlier mentioned *A line made by walking* (1967), made by walking back and forth across a field. He documented this moment in time photographically, showing the compression of grass made in a line that stretches toward the horizon (Seymour 1991, 24). Other
works have involved the use of rocks, dirt and mud he creates in simple geometric shapes such as circles – as with *A circle in the Andes* (1972) – or rectangles – such as in *Dusty boots line* (1988). Often these works are made on site, during a walk that can last anywhere from a few hours to the best part of a month. Like Goldsworthy, he also exhibits his interventions in nature through photographs as well as text maps, earthen wall works and installations like *Whitechapel slate circle* (1981) that bring his natural interventions into the synthetic construct of a gallery space.

The subtlety of works like these places significance on the limited impact of an artist; both Goldsworthy and Long provoke questions about the necessity of an artists’ impact on the environment and the materiality of an artwork, as well as its longevity.

Chris Drury’s work is more political than Long or Goldsworthy’s, often taking the form of ephemeral provocative interventions that are also documented photographically. His work is often sited at locations where human intervention has caused significant environmental change or loss. *Winnemucca Whirlwind* (2008) (Fig. 10), for example, is a 91m wide pattern that he raked into the dry bed of Lake Winnemucca. Consisting of four interlocking spirals around a central axis, the pattern is based on a native basket-weave design (Wolfe 2010, 23) to highlight the loss the indigenous peoples in the area experienced when, over one hundred years prior, the government diverted the important Truckee River away from the lake for farming irrigation.

![Fig. 10. Chris Drury, Winnemucca Whirlwind, 2008.](image)

Politically based environmental art sometimes attempts to shame or humiliate politicians or corporations who are responsible for environmental damage, but a greater proportion of this kind of work provokes questions about issues like energy use, food waste and plastic pollution. Do works that only highlight environmentally damaging actions help viewers understand the deeper elements at play? Sometimes they create a source of ‘cognitive dissonance’ (Festinger 1957, 291), because our connections with nature can conflict with those we have with technology. It’s likely for such works to be dismissed as environmentalist propaganda that either push viewers away or creates feelings of guilt and frustration. Works from my early research had this effect because they were didactic (discussed later), so I sought to move beyond conservative vs. progressive politics to find a deeper understanding of how technology affects us existentially, psychologically, politically and environmentally. This enabled the reframing of my research from an examination of
human failure to a discourse of possibility for humanity to renegotiate its relationships with technology and the environment.

My research involves working on an impact of human life: pollution. My process explores ways to reuse waste materials that damage the environment – like plastic – and create works that complement it, designing and reinventing our garbage into sculptural components to assist the environment in the time of the ‘anthropocene’, so called because of the human contribution to changes in the earth’s climate since the industrial revolution. Through a vision of the future (discussed further on), I am attempting to transform the source of my angst – my concern for the future of humanity and how our relationship with technology funnels our actions toward environmental disaster – into inspiration for my art – thinking of how we might re-imagine our relationship to technology in order to care for the biosphere and survive as a species.

2.4 Pleasure and Angst

_I would say that the way I make my work is from the things that give me pleasure and the materials that I like using – my work doesn’t come from a kind of angst or discontent._

Richard Long (Seymour 1991, 251).

In reference to Richard Long’s quote, there seems to be two kinds of Environmental Art. These are based on an artist’s motivation for making their work as well as their process of production. In the first instance, artists like Long and the earlier discussed Smithson and Goldsworthy have an affinity for the natural environment and use it as their source of ideas and material. Their works are derived from the pleasure of working with the environment, not by expressing anger or seeking solutions to environmental issues.

Richard Long’s practice, as discussed, is predicated on his empathy for nature, and although he acknowledges the connection between his work and environmentalism, it is not the primary motivator for his work, as below:

_I suppose if you have to put some historical or political slant on my work, I hope it does tie up in some ways with the Green philosophy, ‘small is beautiful’, and of seeing the world as one place, and using its raw materials with respect._ (Seymour 1991, 252)

Andy Goldsworthy rarely speaks about environmental issues such as climate change but his works – like those above – highlight the beauty and fragility of the natural environment through his elegant abstractions of colour, texture and form. Derived out of his respect for and pleasure working with nature they are indirectly political by using beauty to inspire respect in others for the natural environment rather than from any kind of angst (Miles 2010, 21):

_Nature is in a state of change and that change is the key to understanding. I want my art to be sensitive and alert to changes in material, season and weather. Each work grows, stays, decays. Process and decay are implicit. Transience in my work reflects what I find in nature._ (Williams 2009, 355)

Robert Smithson’s aforementioned Spiral Jetty demonstrates the artist’s pleasure of working in and with the natural environment, using landscape as both material and installation space to
create work at the scale of the landscape itself. Like Long and Goldsworthy, his works are site-bound, so their photographic potential is important, though Smithson’s can also been seen from outer space. *Earthrise* (1968) was the first image that depicted Earth as a finite resource. Smithson created *Spiral Jetty* two years later.

![Earthrise, December 24, 1968, NASA](image)

*It suddenly struck me that that tiny pea, pretty and blue, was the Earth. I put up my thumb and shut one eye, and my thumb blotted out the planet Earth. I didn’t feel like a giant. I felt very, very small.*

Neil Armstrong, 1969. (Michaloudis 2017, 1)

![Spiral Jetty, 1970](image)

In contrast to art that is derived out of pleasure, the second type of Environmental Art is motivated by angst, out of the artist’s concerns for anthropogenic forces that degrade the environment. Artists and designers such as Chris Drury, Olafur Eliasson, Tomás Saraceno and Buckminster Fuller seem to have varying degrees of this angst so it is their political and environmental concerns that define their approach to their work.
As discussed, Drury’s work is motivated by his concerns for the environment. His *Winnemucca Whirlwind* also demonstrates his empathy for – and pleasure in working with – the natural environment. Choosing his sites carefully he makes minimal works using materials found at, and in relation to, each site. At times there is a fine line between highlighting environmental issues and undermining those whose actions cause ecological damage in pursuit of profit. *Carbon Sink* (2011) (Fig. 13) is such a work. Made in the grounds of Wyoming University, which receives significant funding from the coal industry, it comprises a spiral form resembling a fingerprint that seems etched into the lawn. His materials comprised locally mined coal – which contributes to global warming by emitting CO$_2$ when burned – and logs from trees killed by pine beetles – the victims of global warming (Scientists observed that warmer winters enabled pine beetles to feed for longer periods which caused widespread devastation in Wyoming’s conifer forests (Bentz 2010, 602)). When the local coal industry learned of this work they threatened to withhold their funding, so the university removed it, causing much controversy and criticism for not standing up to the coal industry (Frosch 2012, 1). By using the physical evidence of environmental degradation (a dry lakebed or dead trees) as his material, Drury’s works avoid any ethical dilemmas and shifts his art from being a conceptual argument to one of direct engagement with the issues.

Fig. 13. Chris Drury, *Carbon Sink*, 2011.

Olafur Eliasson draws aesthetic inspiration from elements of nature such as light and water but his work is more complex. He is environmentally concerned but rather than being didactic in his approach his works engage his audience through physical experience to incite thinking and / or realisations that environmental responsibility requires personal responsibility, and that small personal acts can evolve into more significant interventions (Eliasson 2009). Works like his aforementioned *The Weather Project* (2003) and his later *Your Mobile Expectations* (2008) seem to be explicitly concerned with climate change, but they contain a degree of ambiguity to allow the viewer to draw their own conclusions about the artist’s views.

The long time art critic for *The New Yorker* Peter Schjeldahl writes of Eliasson:

*He refrains from burdening us..., like hosts of the politically righteous, with exhortations to improve our moral hygiene.* (Schjeldahl 2008, 1).
Schjeldahl may be an experienced critic but to advocate for a refrain from the burden of better moral hygiene is surely a misplaced sentiment. It also denies the art historical significance of politicised artists or movements — from Rodin to the Gorilla Girls, Dada to Expressionism, and so on — or current artists like Ai Weiwei, Pussy Riot, or Banksy whose practices have political concerns. Schjeldahl does, however, raise an issue that relates to my earlier, more didactic work, which is how artists can draw attention to political issues without raising the ire of the audience or critics. Artists like Drury have dealt with this conundrum by examining climate change in isolated links, such as: coal and pine beetles, which is an effective vehicle for the viewer to think about what other small and innumerable forms climate change impact is having, and how these are continually building, so we have to take action now.

Climate change is an issue easily held at arms length for wealthy nations because they won’t feel its effects in any meaningful ways for generations, even with a growing refugee crisis. Though it may have low visibility, there are predictions that over the next two to three centuries our global population will decline to a few million due to the accelerating effects of climate change such as: shifting rainfall patterns that prevent effective agriculture; increased storm activity including hurricanes, cyclones and typhoons; polar ice melt causing sea level rise and ocean current variations (Hamilton 2010 a, 204). Is it reasonable to expect future generations to endure this because Schjeldahl did not want to see any cause for action and requested artistic ‘refrain’?

In 2013 Yale University published their findings from a climate change questionnaire. It found that an estimated 41% of US citizens believe that climate change is caused by human activity as opposed to 97% of scientists. It also found that only 42% of those questioned believed that most scientists agree that climate change is even occurring (Marlon 2013,1-2). These startling statistics can be attributed to fossil fuel-industry funded attacks on climate science (Flannery 2005, 242). Although Schjeldahl may not have wanted to accept the broader implications of Eliasson’s work, his statement is worthy of consideration as artists need to be smarter than simply highlighting information. Neither journalists nor propagandists, artists can perhaps best reach their viewers not through the intellect but through the heart.

Eliasson’s work exemplifies such a strategy, however its political ambiguity makes it harder to understand his motivations as even Schjeldahl missed his intent. In a TED talk Eliasson said:

*So what is between thinking and doing? And right in-between thinking and doing, I would say, there is experience. And experience is not just a kind of entertainment in a non-causal way. Experience is about responsibility. Having an experience is taking part in the world. Taking part in the world is really about sharing responsibility. So art, in that sense, I think holds an incredible relevance in the world in which we’re moving into, particularly right now.* (Eliasson 2009)

Eliasson’s high-tech installations and art works are drawn from his pleasure in creating experiences for his viewers. But they also come from a place of angst because his motivation to engage the viewer in these experiences is to encourage their personal responsibility towards climate change. However, unlike the earlier discussed artists who use the environment to discuss these issues, Eliasson’s materials and processes are not environmentally friendly. For example, the lights in his *The Weather Project* were not powered by sustainable energy sources, and the mirrored ceiling required the production and installation of hundred’s of square metres of plastic panel that were rendered useless at the end of the exhibition. This goes back to my earlier discussion of ethical dilemmas, though this work is dealing with climate change its materials and /
or making may be contributing towards it. I relate to this because much of my previous work, before this body of research, was also made using environmentally unfriendly materials and processes. And as discussed, even the opportunity to research new methods of art making found me facing similar dilemmas.

Tomás Saraceno is an artist with a background in architecture. Also motivated by an angst, or anxiety, his intention is to provoke thought about ways for humans to live without impacting on the environment as well as ways to survive severe climate change. In response, his ideas are presented as propositions, often in the form of structural installation-based object environments. For example, his *Cloud City* (2012) at the Metropolitan Museum of Art, New York City is comprised of a series of dodecahedron ‘pods’ made of glass and stainless steel that are interconnected to form cloud-like structures as possible airborne habitats for climate change survivors. These hark back to Buckminster Fuller’s *Cloud Nine* project (Baldwin 1997, p. 190) (also referred to as Spherical Tensegrity Atmospheric Research Station: STARS), which were giant life-supporting geodesic spheres containing habitats that could float in the air like solar balloons. While using high emission materials to portray his environmental concerns, architects must ensure that lives will be safe and secure in their structures so they use must different materials to artists. Environmentally friendly habitats – from buildings to cities – are defined by their performance (Ingerson 2012, 11), so while issues such as solar orientation, thermal mass, insulation, ventilation and the use of low emission technologies ensure a low carbon footprint and keep occupants comfortable the materials used in their construction – e.g. concrete, steel beams, timber and certain recycled materials – keep the inhabitants safe. This is what Martin Heidegger refers to as humanity’s “free relationship” with technology i.e. using technology in harmony with the needs of humans and the human environment (see later discussion in 3.1).

Considering these things Saraceno’s choice of materials e.g. stainless steel, glass and plastic present less of an ethical dilemma than they may seem. He is building structures for people to live in so must use materials that ensure structural integrity. Saraceno’s speculative interventions are an important evolution of Buckminster Fuller’s ideas because they propose ways that humanity can adapt to climate change. It should be noted that, like Belgian sculptor Panamarenko and his life-sized models of imaginary aircraft and other machines with no functional ability (Cooke 2001), Saraceno’s cloud cities are experimental models for human survival.

Theo Jansen’s aforementioned *Strandbeests* are kinetic models for sand-dune maintenance, land-saving machines motivated by his anguish for the Netherlands’ issue of rising sea levels and that much of the country is below sea level reclaimed land. Although his early investigations were concerned almost entirely with kinetic applications of recycling plastic pipe as a waste material, once developed he began considering ‘real-world’ applications for the technology. Jansen sees his creations as living creatures and incorporates mechanisms that allow them to respond to the terrain and weather of their environments so they essentially actually mimic nature.

Richard Buckminster Fuller’s work was also motivated by anguish and foreboding, His career defied a singular description - an entrepreneur, designer, architect, artist, educator, engineer and author. He wrote and conceived various ideas about improving life for humanity via technological innovation. This included the geodesic dome (Curl 2006, 310) and many other inventions both physical and conceptual. A large proportion of his works were proposals that were rarely brought into production, but he designed and used his proposed and built forms to promote his concerns and provoke thought about environmental issues and helping humanity to survive.
Fuller developed the principle of ‘design science’, proposing that design, art, engineering and architecture were not separate entities but parts of a holistic creative practice. This questions the conventions of design, engineering and architecture as client-based professions or ‘slave functions’ as Fuller saw them (Pawley 1990, 154). In place of these conventions he proposed a practice that is part art, part science so that designers and architects could act like artists, pursuing projects pro-actively and speculatively. This has encouraged a crossover of disciplines so that artists like Panamarenko, Eliasson, Saraceno and Jansen have made or proposed works that have benefitted from Buckminster Fuller’s legacy and straddled art and design.

Considering Buckminster Fuller’s vast contributions to knowledge in the fields of engineering, art, the environment, and architecture, it appears that emotional drivers like angst and pleasure can motivate amazing work. It is unclear whether these emotions are the only source of the above discussed artists creativity but it is clear, particularly in relation to Buckminster Fuller’s work, that their desire to deal with environmental issues and their abilities to welcome, absorb and learn from their failures are the foundations of their success.

The motivation for my own work fits – as discussed – into the category of angst. My concerns for climate change, the psychological barriers that underpin the anthropogenic origin of the issue, and the threats it presents to the environment and to humanity’s survival have motivated my research. Forms in nature that have evolved with the survival of various species, such as the way a mollusc shell is constructed, the microscopic structures of pollen, rock formations, weather cycles and the relationships of natural phenomena to scientific theories and beliefs underpin my practice. And although I seek and often find pleasure in the thinking and physical processes of making art, my motivations are defined by my experience of the world and how I choose to live. Overhanging all of this is always the threat of failure, yet another source of angst, yet for some this notion of failure is merely a necessary step toward success.

2.5 Failure or Not Failure

*There is no such thing as a failed experiment, only experiments with unexpected outcomes.* R. Buckminster Fuller. (Parry 1997, 696)

My research has had a number of what could be considered failures. The reason is because I found my work constantly up against issues posed by the questions: ‘How do I stop my ethics destroying my art?’ and ‘How do I stop my art destroying my ethics?’. But these ‘failures’ have resulted in me pushing myself to find solutions, sometimes – like Fuller – in unexpected ways.

As discussed, almost every traditional sculptural technique has some impact on the environment. Bronze casting, for example, requires mining, refining, transportation, wax, plaster, and heating the metal to over 1000° – a number of steps and materials that clearly have a significant environmental price to pay. Other techniques might incur more or less degrees of environmental impact, so an artist with a sculptural practice may choose to work with environmentally friendly materials and techniques but, in the making of objects, it is difficult to eliminate all environmental injuries. This then shifts the impetus from achieving an outcome that is somehow reproachless, to attempting to find a balance between the intent of a work and a reasonable provision of environmental responsibility. Artists like Long, Goldsworthy and Drury have incredibly high ethical...
standards, yet still their work will produce ethical paradoxes. These are usually of little consequence such as the environmental cost of personal transport and publishing, especially considering that on average a tonne of paper produces 3,300 kg of emissions and consumes 18 trees, 67,500 L of water and 9,500 kWh of power (Langdon, 2010). Entering a discourse around environmentalism or climate change is to adopt a potentially hostile position where any number of observations can be attacked by climate sceptics and/or environmentalists. Earlier mention of Schjeldahl’s response to Eliasson’s work and the controversy surrounding Chris Drury’s Carbon Sink demonstrate this.

During the first year of my research I found that attempting to eliminate ethical dilemmas from my work was proving very difficult, not least because it interfered with my creative process. I had originally tried to represent connections between psychology and climate change, but the works became literal and unavoidably didactic, as my Waiting and Watching (2011) (Fig. 20 & 21) demonstrate. The more I tried to draw these connections, the more overtly moralising and less engaging the work became. It also seemed that the climate psychology, science and anthropology I was reading had taken over from the initial point of my enquiry – about making art. I had to accept that this stage of my research was a potential failure.

Although these areas of research continue to be significant, this ‘failure’ was necessary as I then found a way to resolve my difficulties by shifting my approach towards thinking about how my works could exist in a speculative future. This enabled me to build on my discoveries and pursue a more positive methodology that avoided my drawing direct relations between the environmental psychology material that I had reviewed – which I will return to in a later chapter – and the ethical paradoxes in my work.

Obviously a number of artists have had to struggle with possible ‘failures’ along their creative journeys. Tomás Saraceno, for example, installed his aforementioned Cloud City at the 2011 Perth Festival. It consisted of thirteen hundred cubic metres of helium pumped into a network of dodecahedrons floating off the ground, made from plastic sail material. Sadly the installation, tethered as it had to be, was torn from its moorings by the wind and was last sighted heading out to sea (Kernebone 2011). Unfortunately this ‘failure’ served to discredit the artist’s ability to properly engineer the work and brought into question the premise of his work, which was a speculation on possible ways for people to live in these solar balloon ‘cities’ as a means of adapting to climate change. Advocating a whimsical or fantastic idea was Saraceno’s intention; demonstrating how it might lead to the danger of future citizens was almost certainly not.
Buckminster Fuller had many so-called ‘failures’, but as his earlier quote demonstrates he invariably built on them to find a successful outcome. His most famous failures were probably the Dymaxion car and his Wichita House, both designed and produced in the 1930s. The Dymaxion car incorporated aircraft design elements – such as aerodynamic streamlining of the car’s shape and giving it three instead of four wheels; one at the rear for steering, and two at the front providing the ‘drive’. The car succeeded in being more efficient and maneuverable than its contemporaries. Only two cars were made due to a fatal accident during a test drive involving auto manufacturers (Pawley 1990, 62) so it never went into mass production. Wichita House was intended to be the first mass produced, re-locatable home as after the Second World War there was a huge housing shortage and a need for military aircraft manufacturers to make new products. Produced as a prototype, Wichita House was well received by the public and industry, but it ‘failed’ to reach mass production due conflicts of interest between Fuller and his business partners (Pawley 1990, 112).

As architecture professor at the infamous Black Mountain College 1948-49, despite not having any formal qualifications in architecture (Pawley 1990, 116, 12), Fuller developed the geodesic dome. A triangulated geometry producing a very strong tension is what holds geodesic dome’s shape, and theoretically the bigger the dome, the stronger the tension and structure. This came to Fuller’s attention when a student named Kenneth Snelson created a work using tensioned wires to hold and separate sculptural elements. The Geodesic dome then became a project in Fuller’s class in 1948. The first experiment was a failure but ‘Bucky’ identified why so the next construction worked. Fuller later named the force, or tension, that supports the dome as ‘tensegrity’, which was famously demonstrated in the ninety one metre tall Skylon, designed by Philip Powell and Hidalgo Moya for the festival of Britain in 1951 (Pawley 1990, 120). Geodesic domes were embraced by the growing conservation movement as an alternative to traditional housing due to their high strength using minimal materials. Both the geodesic dome and Fuller himself became synonymous with the 1960s counterculture movement as his books Ideas and Integrities and Operating Manual for Spaceship Earth were essential reading for socially progressive readers (Turner 2009, 146). As many as three hundred thousand domes were constructed between 1954 and 1984 (Pawley 1990, 14), and in 2001 the geodesic dome was the primary structure for an environmental/art scheme called The Eden Project in Cornwall, England (Nakajima 2001, 116). Later I will discuss my own use of triangulated geometry, but before I created any geodesic structures I stumbled upon tensegrity when I created a work called The Keeling Curve (originally Ostrich) in 2014. This ultimately failed because of its didactic nature, but it brought the work of R. Buckminster Fuller to my attention.
Although they are beautifully made, poetic and effective, I would classify Olafur Eliasson’s aforementioned works as failures due to the ethical paradoxes that arise between his use of high emission materials and processes and his intent to highlight his environmental concerns by inciting his audience to have a sense of personal responsibility. I must question if it is fair to lead the viewer to feel responsible when the artist uses materials and processes that are unavoidably linked with climate change? Eliasson positions his immersive experiential works as being neither didactic nor overtly environmentally conscious, but I disagree. In *The Weather Project* the viewer experiences a possible post-apocalyptic future foggy environment glowing with light from a clichéd red ‘sun’. Upon closer inspection the illusion reveals itself, and the viewer is engaged in the experience of discerning their involvement through their reflections on the ceiling, which implies both a collective and individual responsibility. Their experience of a highly likely outcome of climate change demonstrates what is called a ‘commons dilemma’ (Hardin 2009, 243), which is the conflict between realizing individual responsibility for the environment which can only be dealt with collectively.

Eliasson’s *Your mobile expectations* (2008) works in a similar way. Commissioned by the automotive company BMW, and built using a hydrogen-fueled racecar, Eliasson conceals the car under a geometric canopy of ice-covered triangulated welded steel pipe and mirrors. Around 2000 litres of water was used to spray over the car in sub-zero temperatures to form the ice ‘skin’ (Engberg-Pedersen 2012, 427). It seems contrary to use large amounts of energy to constantly refrigerate two tons of ice in a work questioning the history of the car and our seeming unwillingness to deal with its long-term contribution to climate change. Rather than the environmentally friendly technology this particular car has been developed with, it is ‘the car as object’ that Eliasson is asking us to rethink, and our duplicitous techno-social engagement with it that needs to be re-thought.

Eliasson’s use of stainless steel is not an environmentally friendly practice, but there is an argument for the material to be considered so. Stainless steel is estimated to be composed of
eighty percent recycled material (Suzuki 2010, 9), and as sculptor Bert Flugleman discovered in his research (for Cones (1982)), high-grade stainless steel has an estimated life span of seventy-five thousand years (Hart 2013, 3). So though the initial emissions of the material are high, it is worth considering its lifespan Eliasson’s use of ice is more difficult to justify – not just to produce the frozen carapace but to maintain the sub 0°C environment that Your mobile expectations had to be kept in. Perhaps Eliasson is asking us to consider another way of thinking about materials in the context of environmental art, but does it stand up to ethical scrutiny?

Some of these issues may be considered failures – from Saraceno’s escaped solar balloon to Bucky’s failed car and dome experiments to Eliasson’s contradictory use of environmentally unfriendly materials to promote environmental consciousness, but each artist has learned from these to produce more successful works. Eliasson, for example, seems to manage the ethical paradoxes contained in his work by broadening its scope from being a potentially didactic concept-as-object to an immersive thinking-through-experience.

2.6 Recycled Plastic

Artists like Theo Jansen and Tomás Saraceno are among many artists who are well known for using recycled plastic as a primary source of material.

An interesting work in this context was designed and installed by StudioKCA (architects Jason Klimoski and Lesley Chang). Titled Head in the Clouds (2013) it used an estimated 53,000+ plastic bottles to form a large sculptural cloud as a pavilion on Governor’s Island in New York. Some of the bottles contained a small amount of blue liquid, giving the work a blue-sky tinge when seen from inside (McQuarrie 2013). The intent is to highlight the 53,000 plastic bottles discarded in New York City over the course of one hour, delivering a didactic narrative with a whimsical aesthetic. The sculptural duality of the cloud as form and discarded bottle as material set a remarkable precedence in light of my own research. Head in the Clouds was conceived as a description of plastic pollution: do we have our head in the clouds about the contribution we make every time we buy a drink, let alone when we throw away the empty bottle once we’ve finished its contents?

Fig. 14. StudioKCA, Head in the clouds, 2013.
This inspired me to look further into the use of the cloud as a symbol in other artist’s works, such as Anish Kapoor’s *Cloud Gate* (2004-2006) at Millennium Park in Chicago – more like a bean than a cloud though 80 percent of its surface reflects the sky – and contemporary Canadian artists Caitlind R.C. Brown and Wayne Garrett’s *CLOUD* (2013) at Moscow’s Garage Museum of Contemporary Art. Made from thousands of used light bulbs their cloud explored the ‘universal language of environmental imagery’ (Brown 2015), including the way that cities are places of immeasurable quantities of materials, mass-produced objects, people and the situations that these materials and objects are used for.
Clouds symbolise climate change for me because of the gloom they impart on an overcast day and the doom they are often used to represent in relation to post-apocalyptic imagery. Clouds are ephemeral, ambiguous, divine, menacing, delightful and defy a singular symbol. SKCA’s *Head in the Clouds* may have been a dreamlike form and space, but while Klimoski and Chang demonstrated how recycled plastic bottles can be aesthetically elevated to being more than a waste product they also ask its audience to ‘get their head out of the clouds’ and think of the environmental consequences of our consumption.

The materials and forms used by the above artists and designers made me look at the differences rather than the similarities in my own work, particularly how some of them dealt with the ethical dilemmas I was trying to avoid.

2.7 Compatibilities and variations

My initial investigations into links between art, philosophy, psychology, climate change science and geo-engineering revealed a discourse enabling me to propose sustainable artworks that are intended to benefit the natural environment (sometimes referred to as ‘nature’) rather than damaging pro-industrial interventions in nature, like Robert Smithson’s *Spiral Jetty*.

The earlier discussed works by Goldsworthy, Long and Drury demonstrate how environmental issues in an expanded sculptural practice can be legitimately pursued without posing significant ethical paradoxes. The ephemeral nature of their work has an environmentally sustainable material ethics that enables the successful highlighting of environmental concerns to reverberate beyond the sphere of art.

The works outlined by Tomás Saraceno, Olafur Eliasson, Buckminster Fuller and Theo Jansen demonstrate ways for art to engage in an environmental discourse that uses artificial / synthetic materials, and that there are a variety of methodologies that legitimise the use of technical innovation without destroying the environment, or when alternatives are considered may be the better option.

On another level, works by Saraceno, Fuller and Jansen demonstrate ways forward for an aesthetics of environmental art that deploys patterns and forms which are ultimately derived from nature – as I will discuss in a later chapter – and their propositions for a speculative future allow the viewer the opportunity to imagine ways in which we might work with, rather than against, nature.

These holistic approaches are admirable but why is it that humanity has difficulty adopting this type of sentiment? Climate change psychology has identified some key phenomena that explain this behaviour.
Philosophy

This chapter explores humanity’s relationship with technology. The reason I focus on technology is because the origin of climate change is not environmental. It is largely of human origin, and our use of technology is key to understanding how this occurred. My readings of Martin Heidegger’s ‘The Question Concerning Technology’ (1954), Bruno Latour’s ‘Reassembling the Social’ (2005) and Karen Barad’s ‘Meeting the Universe Halfway’ (2007), have helped me attain at least some understanding towards this. Through these readings I will demonstrate how technology and humanity are deeply interconnected, and that for all of the benefits that humanity gains from technology, the trade off is that we are existentially, psychologically and politically vulnerable, all contributing to the problems we face with climate change.

They also articulate possible ways for artists engaging with climate change to reframe the ethical paradoxes I discussed earlier regarding materials and processes as well as ways to start a dialogue around the mitigation of climate change as they clarify how our ability to take action relies on our knowledge of technology’s relationships to humans and its roles in society. This also connects to my research on the psychology that causes various difficulties regarding climate change (through social conditioning).

While such knowledge helps to find a clearer path towards a sustainable future, it also helped to clarify the direction of my work. Particularly that all three philosophers point out that rather than technology itself causing climate change it is what technology is used and how it is used to benefit those who design, run and / or receive financial gain from it e.g. military hardware or fossil-fuel reliant electricity (which is not ‘necessary’ as there are other means of production)

My research supports and promotes ways for technology to be used for the reverse: to benefit all. Using it this way is a key to action on climate change: creating and using technologies that work with the environment to help maintain the earth’s biosphere and with it, human life.

3.1 Martin Heidegger’s The Question Concerning Technology

Heidegger’s essay, The Question Concerning Technology, is apt for sculptors dealing with issues of climate change while knowing their materials or processes may be causing environmental damage. To avoid this, it seems these artists have only two options: either evade the use of technology as much as possible – as Andy Goldsworthy or Richard Long do – or work within the existing technological frameworks – like Olafur Eliasson and Tomas Saraceno. Heidegger suggests that there are more than these options.

...the essence of technology is by no means anything technological. Thus we shall never experience our relationship to the essence of technology so long as we merely conceive and push forward the technological, put up with it, or evade it. (Heidegger 1954, 4)

For Heidegger the difference between the ‘essence of technology’ and the devices and machines that we commonly known as ‘technology’, is that Heidegger’s essence is an ethereal force of our own making. It isn’t belief or ignorance that allows the essence of technology to emerge; it is the promise of greater efficiency, less physical effort and more profit. Our ignorance and misplaced
belief is a product of technological promises being kept — shining a light on what is technologically possible whilst keeping other, truths in the dark.

Heidegger’s ‘essence’ of technology is formless and therefore somewhat ambiguous, but in this it is a way for revealing some truths (Heidegger 1954, 12) while it also conceals others (Heidegger 1954, 27). If artists could adopt and adapt technology, they could manipulate it or use it as a tool to reveal truths in or through their work. Those working with climate change, for instance, could use the technology to reveal truths about the environment, which may include ways of finding harmony. If combined with the use of recycled materials and renewable energy, then technology could be integrated with natural systems such as photosynthesis, solar, wind and oceanic tides and currents, so any ethical conflicts to do with using technology in a practice would be dissolved.

Heidegger says the human-technology relationship can be viewed in two ways. The first way is instrumental – technology is used as a means to an end – a tool used to complete a task. The other is anthropological – it is a tool designed, built and used but also maintained, and we always try and advance or improve technology (Heidegger 1954, 5). Then he points out that this relationship is more complex:

Wherever ends are pursued and means are employed, wherever instrumentality reigns, there (also) reigns causality. (Heidegger 1954, 6)

Because a means to an end is something that must be imagined and created, or contrived (Heidegger 1954, 5), there must be ‘causality’ i.e. how this contrivance comes into existence. To demonstrate this he uses Aristotle’s four causes of how a silver chalice is made. The four causes are:

1. *Causa materialis* – The material that a thing may be made from – in this case silver.
2. *Causa Formalis* – The shape or form imposed upon the material – the chalice form.
3. *Causa finalis* – the reason for the object to be made in the first place – the sacrificial rite
4. *Causa efficiens* – The maker of the object – the silversmith (Heidegger 1954, 6).

Each cause is partly responsible for the chalice’s creation but cannot claim complete ‘causality’. This network of attribution secures the idea that technology is a type of instrumentality. However, Heidegger questions whether this model is adequate to describe technology.

He asks ‘What is the source of the unity of the four causes?’ (Heidegger 1954, 9). Is there one cause that plays a role in gathering the other causes together? Though the material, the form, the intention and the maker are interdependent, he argues that the role of the silversmith is what draws the other causes together to create the chalice (Heidegger 1954, 8). This is because the silversmith is more than his or her skill (Heidegger 1954, 8), it is their overall ability, including their intellect and creative ability – known as technē – which draws all four causes together (Heidegger 1954, 13).

Most artists realise that their causality is superior to the other three causes. As I have discussed, artists who deal with climate change issues – which is their intention – must carefully choose their materials and their forms to express their ideas. Heidegger’s interpretation of Aristotle’s four causes demonstrates that an artist has great responsibility and opportunity through their causality, and he calls this process of creating unconcealment. The word for unconcealment for the ancient Greeks was Aletheia, which also means truth (Heidegger 1954, 13)
Heidegger describes how humanity’s relationship with technology ‘unconceals’ i.e. reveals some truths. His notion of truth is as a constant, like gravity or the speed of light. If technology can be used to reveal truths, it is not only the things that do exist but also the things that could possibly exist. So artists can view technology as a vehicle via what he calls ‘causality’, which is how things are created or changed to reveal these truths.

However, technology can also be a trap for unsuspecting users.

*The revealing that rules modern technology is a challenging, which puts to nature the unreasonable demand that it supply energy that can be extracted and stored as such.*

(Heidegger 1954, 14)

Modern technology transforms our view of nature into a set of resources that technology can unlock energy from. Just as Aristotle’s silver concealed the chalice, a natural resource conceals energy. Natural resources that can fuel technology he calls ‘standing reserves’ (Heidegger 1954, 17) so in turn the objects of nature become transformed into what he describes as nodes within a network; a tree is no longer a plant that provides shade or produces fruit, it becomes a nexus for construction technology - or a node within food technology.

Humans can also be viewed as standing reserves. For example, a woodcutter who works with the standing reserve of a forest is also a standing reserve – a resource that contributes to revealing the possibilities of the trees (Heidegger 1954, 18). But humans can step outside of being seen as standing reserves by making changes to or removing themselves from a network. For me, a sculptor working in the context of climate change, it is important not to follow conventions such as using high emission materials and processes, as then I become a standing reserve for technology.

But artists looking to avoid using technology should reconsider. Although a highly ethical decision in one sense, technology cannot reveal truths without being used. Only by adopting technology can an artist participate in redefining the role of technology in the mitigation of climate change.

Heidegger uses the term ‘enframing’ to describe the way that resources in nature, including human beings, are seen as standing reserves for modern technology. Enframing also exemplifies climate change psychology. For example, though they have limits, both atmosphere and ocean are enframed as infinite containers for our waste. Heidegger explains this happens because:

*Modern science entraps nature as a calculable coherence of forces.* (Heidegger 1954, 21)

Some sciences reduce natural resources, and humans, to numbers. For example, the work of scientists like Oppenheimer, Watt, Tesla, Bell, Einstein and Schrödinger was formulated using abstract concepts and numbers to quantify electrons, atomic weights and yields of energy, enabling natural resources to be used in ever improving ways to produce energy. Now we feel as though we have a right to ‘civilised’ things like electricity, transport, communications, etc. But our reliance on technology for these things has led to the belief that technology can solve every problem (including climate change), which I outlined is what climate psychologists call ‘techno-salvation’. This belief prevents us from entering a healthy relationship with technology – instead we are enslaved in the belief of always moving forward without any question or concern about where that might be.
If enframing reduces existence to a resource for technology, Heidegger considers how humanity works within this system.

> Always the unconcealment of that which is goes upon a way of revealing. Always the destining of revealing holds complete sway over man. But that destining is never a fate that compels. For man becomes truly free only insofar as he belongs to the realm of destining and so becomes one who listens and hears, and not one who is simply constrained to obey. (Heidegger 1954, 25)

Destining is the actions that occur because of enframing. For example: An enframed view of a forest could be to see trees as a supply of timber. The destining of that forest is that each and every tree is cut down and milled into timber. Heidegger’s point is that although we may need timber but we should be aware of our actions and attempt to understand that we may also need timber in the future and that the trees support ecosystems or perhaps that these trees have uses in other areas such as medicine, agriculture or science. Importantly he is not suggesting that we should abandon technology altogether – in fact he is saying that destining is the very point we should be aiming for but that it must be done with wisdom, research and ethics.

Humanity has a choice to exist outside of the realm of being enframed for technology. Heidegger suggests that if humans seek a deeper understanding of what the essence of technology is they can form a ‘free relationship’ with technology and choose their own path. A ‘free relationship’ with technology is Heidegger’s ultimate goal for humanity. It is the ability to interface with technology without being its slave and without enslaving others.

Considering that a human can choose his or her own fate, what happens when a human doesn’t make any such choice? What danger could threaten such an individual?

> The threat to man does not come in the first instance from the potentially lethal machines and apparatus of technology. The actual threat has already affected man with the possibility that it could be denied to him to enter into a more original revealing and hence to experience the call of a more primal truth. Thus, where enframing reigns, there is a danger in the highest sense. (Heidegger 1954, 28)

Heidegger is suggesting that the threat that technology presents is not so much a physical threat, from the machines of war or industry for example, but from our ability to be blinded by the truths that technology reveals, at times leading us to believe that these are the only truths. Such as a tree being seen only as a source of wood; when this happens we enframe the resources around us AND ourselves because we have assumed a role within the essence of technology and therefore our role as conceivers and users of technology is reversed and we simply become another part of the essence of technology giving away our agency through our complicity.

As an artist this presents an existential threat, as it does to all sentient technological participants but also a threat to the credibility of my art. I must question if my art has come from an enframed view by seeking to understand the context upon which it is based. For me this is climate change. The many resources and individual technologies that are presented as contributing to climate change are vast and many of these are categorised as necessary for civilisation. These paradoxes challenge me to see beyond these contemporary conundrums so that I might seek a credible avenue of art making – compelling me to ask: Can this material be used for sculpture in this context? How can I use technology to advance action on climate change? Is this the only solution?
With the threat that technology poses Heidegger seeks another way of revealing truth other than using technology:

_Could it be that the fine arts are called to poetic revealing? Could it be that revealing lays claim to the arts most primally, so that they for their part may expressly foster the growth of the saving power, may awaken and found anew our look into that which grants and our trust in it?_ (Heidegger 1954, 35)

Technology is a part of our lives but some of us need to remove the tendency for enframing and see how technology can reveal other truths e.g. that a tree is a home for fauna. Art can strike at our core, it can reveal the human condition. Like the essence of technology it reveals some truths. However powerful art may be, art should not be seen as a rival – able to combat the essence of technology. Instead we must see that technology is a reflection of our actions. The understanding that both art and technology reveal truths but in very different ways means that they can be used to help us understand how we might best use technology. For example, the films _Blade Runner, The Terminator_ and _The Matrix_ were made to caution us about the development of artificial intelligence. The imaginations of artists help us to see possibilities, as with Leonardo da Vinci’s helicopter, Stelarc’s third ear or Patricia Piccinini’s genetic mutants. Like technology, art can reveal what is, as well as what could be. The difference is that the intention of art is not to harvest the world’s resources but to see the beauty in them.

To summarise, Heidegger sees technology as a means to an end and therefore causal. He points out that we have the ability to play a pivotal role as the creators and users of technology but that we can also become existentially trapped. This occurs when we fail to accept that there may be truths other than the truths that technology reveals – this is called ‘enframing’. When people with an ‘enframed’ view act upon these beliefs this is called ‘destining’. However, Heidegger points out that ‘destining’ is necessary to reach a ‘free relationship’ because it is only at this point that we can use our wisdom and creativity to negotiate ethical uses of technology.

### 3.2 Bruno Latour’s Reassembling the Social

‘Causality’, as discussed, describes how things are created or changed. Heidegger used Aristotle’s four causes of the silver chalice to explain this. Latour looks at causality from the perspective of the ‘actors’ of these causes. In particular the products of our technology, like a hammer or a remote control:

_anything that does modify a state of affairs by making a difference is an actor – or, if it has no figuration yet an actant._ (Latour 2005, 71)

He asks how these ‘actors’ affect causality:

_If action is limited a priori to what ‘intentional’, ‘meaningful’ humans do, it is hard to see how a hammer … a mug, a list, or a tag could act._ (Latour 2005, 71)

As humans we make decisions and act on them. For example: A sculptor might notice that their angle grinder needs a new grinding disc. To get a new disc involves numerous acts and pieces of
technology e.g. driving car to buy disc, paying for disc via credit card, etc. Latour’s point is that the objects used along the way affect our causality. Without technology we would not even have angle grinders. And without such ‘actors’ sculptors would not be able to carry out their intentions / actions.

With regards to Aristotle’s silver chalice discussion, Latour argues that the chalice can itself be considered an actor. This is because technology affects our lives so much that its products should also be seen as participants, if not actors. So technology becomes a multitude of objects that become actors within transpiring events. Heidegger, on the other hand, views the essence of technology as a system that reveals or conceals truths but its products are the artefacts of our relationship with technology. If both philosophers considered a hammer being used to remove a lump of coal for a power station, Latour could view the hammer as an actor because it enabled the coal to be removed and changed the course of events (the coal becoming an actor itself). Heidegger would view the coal as a standing reserve that has been removed by technology to serve technology.

Latour’s causality touches on the encroachment of technology on our lives, as to some extent we are controlled by the objects around us and our causality is both enhanced and curbed by technology. Latour often uses the example of a speed bump; it helps enforce safe driving speeds but also limits the actions of the driver. Sculptors investing in certain actors e.g. tools (like the grinder) enable their ability to work with certain materials eg. steel. But investing in such specific tools also allows the technology to determine their future direction, which might be considerably limited. This limits our causality and makes our behaviour more predictable, so we might ‘fit’ into the networks of the social and technological more easily. As Heidegger suggests that giving into the essence of technology makes us existentially vulnerable, Latour implies that social and technological structures limit our agency, confining our acts into predictable patterns and giving the forces that have influence over such networks even more control over our lives.

> For sociologists of associations... what is new is that objects are suddenly highlighted not only as being full-blown actors, but also as what explains the contrasted landscape we started with, the over-arching powers of society, the huge asymmetries, the crushing exercise of power. (Latour 2005, 72)

Could it be that technology can be used by some as a social mechanism enabling one human to have power over another? Heidegger speaks of the essence of technology as an ethereal parasite existentially feeding off humanity, revealing truths that support further investment and endeavour into technology and concealing other truths that do not. Though the perspectives of Latour and Heidegger differ they both seem to support the statement that: the essence of technology drives humanity to make choices that benefit technology. It’s clear that individuals who can control technology will benefit more than those who cannot, and that people who use technology to work together get even more benefit e.g. comparing the support and ‘success’ of individual inventors against the research and development departments of large corporations. But when the benefits of technology are seen and pursued without pausing to consider other possible truths, Heidegger calls it ‘destining’ and as previously discussed the unchecked actions of those with an enframed view can devastate a resource. When we consider that humans can be one of those resources, or ‘standing reserves’, the power of those who control some technology over those that do not becomes clear.
Technology can create social justice issues, favouring one group of humans more than others. The greatest emerging social justice issue for this century is climate change, which as I have explained is largely a product of technology – or our uncontrolled uses of technology.

So it is perfectly true to say that any given interaction seems to overflow with elements which are already in the situation coming from some other time, some other place, and generated by some other agency. (Latour 2005, 166)

Being aware of the fact that actors, actants and participants within Latour’s ‘actor network’ have a history that can affect the present or the future is important to me, especially as my art is made from materials with long and well-travelled lives. Most people know that plastic is a petroleum product and that such products come from oil. Oil is the product of photosynthesis and time - plants from millions of years ago geologically trapped until recently. The reality is that my art is made with pre-historically stored solar energy. Latour’s point is that every event has actors with a history, and that events don’t just happen spontaneously – they are a confluence of actors in the same space and time. Every decision, chance, action and thought has consequences. For me, this reaffirms that the best possible chance we have to survive climate change is not to avoid technology but to use it to reveal truths so we can work with the environment rather than against it. We have been releasing this stored solar energy into the atmosphere since the industrial revolution. The agency of such actants are the chemical cause of climate change. But through my art I am asking: Are the materials that constitute what we know as fossil fuels only useful for energy, or is there another way?

3.3 Karen Barad’s Meeting the Universe Halfway

Like Heidegger and Latour, Barad seeks to resolve the question of how technological agency works within the natural world through one of Heidegger’s least favoured fields: quantum physics. She seems to provide a middle ground between Heidegger’s transition from causality to enframing and destining and Latour’s actor network theory; Barad has developed the notion of ‘intra-action’, which combines the causal effect of apparatuses or technology and the products of technology, including ideas, in the natural world. She describes it as:

A mutual constitution of entangled agencies. (Barad 2007, 33)

For Barad, the ability to move atoms around a molecule with technology demonstrates an unexpected truth. The agency of any actor is not independent. Instead the ability to act emerges from within the relationship with other actors. In a way this is an inverted view of Latour’s Actor Network Theory as he is approaching the same idea from the standpoint of a sociologist investigating technology’s ability to limit human agency. Barad might argue that such a notion is a matter of perspective as Latour’s speed bump may limit the agency of a human but that the intra-action of the human and the speed bump allows the agency of the speed bump to emerge.

Like Heidegger, Barad recognises that we have come to view natural resources as a means to an end. Barad cites William Thomson, otherwise known as Lord Kelvin (1824-1907), who formulated the second law of thermodynamics and the absolute temperature scale now known as the Kelvin scale, as he began to:
...regard the idea of natural agency – electric, magnetic, thermal etc. – An expression of the capacity to produce work, and to regard natural systems as engines. William Thomson (Lord Kelvin) (Barad 2007, 231) (ref – (Wise 1988, 80)

Thomson’s statement echo’s Heidegger’s observation that technology transforms our view of natural resources to become ‘standing reserves’ – or energy resources – for technology.

Barad’s alignment with Heidegger diverges as she examines how humans interface with the products of technology or apparatuses. She suggests that rather than humans acting as standing reserves or nodes in technology – attempting to seek a free relationship with technology – our exchange of agency with each other, nature and technology is our means of advancement. However, this advancement is not something that can be predetermined because of the infinite number of possible intra-actions. Instead it is the ongoing accumulation of knowledge that allows us to move forward.

*Humans do not simply assemble different apparatuses for satisfying particular knowledge projects but are themselves specific parts of the world’s ongoing reconfiguring.* (Barad 2007, 184)

In many ways Barad’s ‘reconfiguring’ is similar to Heidegger’s ‘destining’. What both are saying is that through the combined agency of humanity, technology and nature we have the opportunity and responsibility to reveal all kinds of truths and because we are sentient beings we should seek to use this knowledge with wisdom and empathy.

Artists experience a type of ongoing reconfiguring through process and context. The process involves the practical making of objects. The context involves the concept they are working with, the materials and forms they choose to express their concepts and the artistic precedents that come before their own work. As an artist’s process and context inform each other, Barad suggests that technology and humanity inform each other, and that the trajectory of discovery is evolutionary rather than revolutionary. It takes years to build skills and transform ideas as the process of informing, whether in the arts or in technology, is not static; it is ongoing, growing and evolving.

*Furthermore, apparatuses do not simply detect differences that are already in place; rather they contribute to the production and reconfiguration of difference.* (Barad 2007, 232)

If a photographer captures an image of a sunrise over soaring mountains, this action allows others to see the sunrise. Do other people notice the hues of orange and pink? Does the image stir emotions in the viewers or inspire them to do the same? The act of making art reconfigures our reality; our examinations and refinements build a body of knowledge. Technology that gathers information does not operate in isolation. It’s very existence has caused an intra-active difference – by being a means to an end – affecting standing reserves that have been processed and manipulated into becoming a piece of technology but once it is in operation its role makes its agency unusually powerful. The gathering of data may cause minute changes in the collection, such as the shadow of the photographer in an image, but the impact from the use of this data, such as a photograph, a birth date, a 3D scan, a credit card number or an ultrasound has greater implications. As data itself is a standing reserve it can contribute to enframing. A good example of this is the difference between social media and government statistics that both collect data from
the same population. Social media providers collect data from users concerning what users might find entertaining or interesting and then sell that to advertisers. Government statisticians collect other data e.g. health services, bank services, etc. and use it to create policy. If we were to swap these data collections each would have almost useless information. The collection of data for climate change, in this sense, is no different. Scientists have been collecting data on weather patterns, natural disasters, atmospheric temperatures, etc. for more than five decades – building the data into a clear trend. When a policy maker with no scientific background sees the collection of data it is hard to make any sense of it. Likewise the scientist with a collection of data concerning policy would be just as lost. It is not a question of whether the policy maker believes the science to be correct but that the frame of reference is not compatible, therefore making climate change data almost useless to the policy maker. The enframed view of the data is reinforced by the objectives to collect it. When we then add all of the psychological phenomena previously covered this presents some circumstantial reasons for the seemingly slow and embattled political response we experience today. Whether the data is a photo of the sun setting or fifty years of CO₂ measurements Barad’s point is that the technologies that collect data have greater agency than technologies that do not.

To Barad technology is more than a tool; she sees that the employment of technology begins a cyclical relationship where technology increases knowledge, which strengthens technology, which increases knowledge and so on. It follows that technology designed to observe or detect information has even greater agency and therefore a greater ability to contribute to making a causal difference to our lives. Like Heidegger, Barad concedes that this comes at an existential cost, but then she does not hold the same outlook as Heidegger’s notion of ‘destining’, where technology appears to be a self serving entity that we must engage with in order to reach a free relationship, her view is more open-ended:

*One way to mark this might be to say that intra-actions are constraining but not determining.* (Barad 2007, 234)

And later:

*Even when apparatuses are primarily reinforcing, agency is not foreclosed* (Barad 2007, 235).

Rather than Heidegger’s proposition that creative thought and action within a technological relationship provide the agency for humans to enter a free relationship, Barad sees human agency within intra-actions (the emergence of agency through the exchange of knowledge, skill, material, action etc.) in a more optimistic way, as open to possibilities.

After many years of building skills and knowledge around working with their preferred material(s), it takes courage for sculptors to break away and experiment with new materials. Working in the context of climate change means they need to seek, and work with, with more environmentally friendly materials and/or challenge how climate change can be viewed. For me, Barad’s point is that although my practice was trapped with a framework that could be seen as acting upon enframed views (working with steel), I was able to make a choice – my agency was not foreclosed.

*Agency never ends; it can never ‘run out’. The notion of intra-actions reformulates the traditional notions of causality and agency in an ongoing reconfiguring of both the real and the possible.* (Barad 2007, 235)
What are the possibilities for my practice? Considering that intra-action is the emergence of agency from the proximity of actors, what are the actors and actants for sculptors? Concepts, contexts and materials - tools, skill based knowledge and the understanding of space, scale and form. Because Barad’s intra-action considers that ideas and knowledge as well as objects are causal, their agencies come into play as well. My work is specifically looking at what is possible in my own speculative considerations of the future but it is real in the sense that my sculptures can be touched and my narrative read. My ideas about CO₂ filters created from recycled ocean based plastic have the potential to become a reality as they are the confluence of actual proposals and prototypes. Barad’s point is that if we can share our knowledge and skills we not only advance our reality but we make possible future realities too.

Perhaps what is needed is a politics of possibilities (Gilmore): ways of responsibly imagining and interviewing in the configurations of power, that is, intra-actively reconfiguring spacetime matter. (Barad 2007, 246)

If we were truly able to see all the agency of every actor then would we know all possible outcomes? Do we even know who or what all the actors are? Considering that intra-action considers ideas causal, how would we deal with the ethics of recording an individual’s thought? A politics of possibilities would require an impossible device or system somehow capable of logging causality. Could we use such a system to avoid disasters like war or climate change? Or would it only confirm their inevitability? Like sophisticated weather modelling software in weather forecasting we would need to map the space/time of all actors and participants. We would actually need to know where everything and everyone (and their history) is in the whole world. It could be argued that, at least some of this information is already being gathered by credit card companies, CCTV and social media. Barad’s idea quickly becomes reminiscent of George Orwell’s 1984. Fortunately this is not her intention and given that the likelihood of such a system ever being deployed is low, what does Barad really mean?

Perhaps we could rely on wisdom rather than knowledge. We don’t need to know every act in every space in recorded time to know how societies continue to evolve - any sociologist, philosopher or criminologist would surely agree. What a ‘politics of possibilities’ could do with information collected from such research fields is help to avoid situations where technology is employed for the sole benefit of the owner(s) of that technology, so technology benefits the many rather than the few, or technology itself.

I believe that democracy will struggle to combat climate change, and that for any system of government to endure they will need to have better relationships with experts in science and technology. Part of my research was to imagine a politics of the possible, so I wrote a fictional short story set in the future with a technocratic government. This is because democracies are vulnerable to economic pressure, popular sentiment and fear mongering rather than using conclusive evidence to make decisions. In a future where millions are dying from limited resources a system of government that does not react appropriately will collapse or be removed. If government is to save a threatened population from the evolving effects of climate change, a popular vote will not be effective because voting to act on climate change is not a vote to save humanity, it simply slows the process. There are too many situations forcing democratically elected politicians into crippling compromises, so a system of government composed of experts in their fields seems a more effective option.
Barad’s ‘spacetimematter’ refers to the possible – where, when, with what? Politicians and governments of our time plan for the future through research, creating policy and establishing laws. However, this is not what Barad means. As humans we are subjects of research and investigation with our identities a part of the World Wide Web. We also welcome technology into our homes and workplaces only caring about whether and how it works. Technology (in essence) is a political force. With some limitations, it defines our roles in society – determining our agency through our privilege or lack of it, our ability to effect change. It allows us to pursue knowledge but reveals truths that benefit technology more readily than those that do not. However, when we look at the technologies of energy resources we can see more fundamental agencies at play.

Beyond the functional causality of fuelling transport and energy supplies, it is clear that fossil fuel is the foundation for the growth of technological agency since the industrial revolution. An example of this is the scientifically observed link between anthropogenic greenhouse gas emissions and accelerative atmospheric/marine temperature increase. As seen below, ocean temperatures have risen at an average of 1.3°C every decade since 1955 and atmospheric temperatures have risen 1.1°C since the industrial revolution. So, what happens when energy resources are threatened? In the face of this evidence we have seen some politicians actively argue against action on climate change, for complex economic and political reasons which link back to psychology. The threat of debasing the foundation of technology’s agency forces people with enframed views to act, sometimes denying the evidence but always to protect the system in which we exist. In the next chapter there is a graph that breaks down where anthropogenic greenhouse gasses come from, around 70% of these gasses come from direct and indirect uses of carbon based fossil fuels.

Fig 17. Ocean heat content, Environmental Protection Agency, 2015
I would suggest there are three reasons to create or support technology: to help our biosphere, to further technology, and to create economic gain. Most technologies only contribute to the latter two. However, as Barad’s politics of the possible is based on making responsible choices, the ‘politics of possibilities’ would surely censor technologies that do not help the biosphere. Numerous technologies have been created only to lever advantage for one human being over another, including but not limited to war machines, nuclear warheads, poker machines and space exploration. This is not to say that these have not supported other technologies or made some contribution to the betterment of humanity, but that their absence would likely mean a healthier environment today. How could any type of politics hope to stand in the way of such technologies? In many ways these are beyond the frame of governance; they did not become a causal force after the careful consideration of a political committee, they were the natural evolution of humanity’s relationship with technology. Barad doesn’t attempt to guide us toward this type of politics but her sentiment echoes Latour’s concern of:

*the over-arching powers of society, the huge asymmetries, the crushing exercise of power.*

(Latour 2005, 72)
3.4 Practice-led philosophical perspective

With the insight of these philosophers I was able to look deeper into the issue of climate change. They helped me define my ideas and strengthen links with science, psychology and artistic practice in the context of climate change. The fundamental problem, as I now see it, is our socio-technological network. There are many layers of political and corporate activity and psychology before we arrive at the fact that human beings are capable of sacrificing our environment and each other because of the structure of our society, which includes technology. In Heidegger’s vocabulary, we have resulting enframed the biosphere. To cast climate change as only being an environmental issue is a vast underestimation because it is actually the consequence of the way our technologically driven society uses resources.

In his book *Requiem for a Species*, Clive Hamilton explains why the earth’s biosphere is likely to survive climate change but humanity probably won’t. He suggests we will die before addressing climate change. This is due to our psychology and our beliefs, but perhaps this is where Heidegger’s *The Question Concerning Technology* is relevant. Might it be that climate change is occurring because we have not yet arrived at a free relationship with technology? Or is it Latour’s idea that we have not been able to flatten the *overarching powers of society*? Otherwise let’s hope Barad’s politics of the possible is relevant to help us to make better decisions regarding technology. It has been demonstrated many times over that we have the technical capacity to mitigate anthropogenic greenhouse gasses by employing renewable technologies (Pacala et al 2004, 968). The reasons we have not made these changes are not environmental – they are, as I said above, socio-technological. This is why I no longer think of my art as being about environmental issues: psychology, technology and politics are the areas that I now inhabit as an artist reacting to climate change.

Using recycled HDPE is my attempt, as Heidegger might say, to enter a free relationship with technology. I am converting a problematic waste material into an artwork that is inspired by the problems of and possible solutions for climate change. This evolved from a search for materials that could be used to ethically represent my ideas about climate change psychology.

The philosophy and psychology that I have researched are strongly connected. Our untethered relationship with technology has provided the right conditions for psychological phenomena related to climate change to occur. Specifically, psychological phenomena like techno-salvation, which can be linked with Heidegger’s ideas. Setting and relying on an alarm clock to wake yourself in the morning should not be extrapolated into relying on the constant advancements in applied science and technology to solve problems like climate change – yet it happens. This is the kind of existential trap that Heidegger discussed. The unquestioning acceptance of technology means that it can be used by anyone for anything – without question.

What seems to underpin all climate change psychology is that humanity has a hard time disconnecting belief from logic. Most of the time our beliefs are based on some kind of evidence. Like the alarm clock always working and waking us up – but what happens when one day it does not? As discussed earlier, when evidence for something clashes with our beliefs its called ‘cognitive dissonance’. Our ability to defy and deny the evidence of a situation helps us to remain emotionally stable, yet to willingly continue this in the face of climate change indicates that our emotional health is of more value than the biosphere; our emotional strength is a weakness.
As humans we are fallible so we develop technologies to deal with our weaknesses. They can be physical, intellectual or even psychological. We make machines that can physically transport heavy objects and power communities. We have the Internet through which we can retrieve more information than has ever been available, strengthening our access to knowledge.

But what is psychological technology? It is firstly the deliberate use of technology to influence a human being; though we rarely recognise the psychological element of technology, it is in almost everything. Secondly, technology is rarely deployed to benefit the individual psychologically; psychology is used in conjunction with technology to limit individual agency in order to benefit a group (Latour 2005, 72). If we return to Latour’s a speed bump: technology funnels us into various roles – a consumer, a human resource, a client, a consultant. We are conditioned to play these roles and behave according to this technological infrastructure. This harks back to Heidegger’s concept of humans as standing reserves.

Here are two examples:

1. A consumer is offered a dazzling selection of product choices making them feel empowered. However technology allows service providers and manufactures to conceal the true value of a product that a consumer might purchase (monetarily and environmentally). Marketing and public relations create an unrealistic value in enough consumers’ minds that the product sells. Is an iPhone really worth twice the value of an android phone? Does owning a Ferrari really give you any advantage over the owner of a Toyota? Is an exercise machine really going to make you any fitter than going for a walk? So the consumer is a reduced to a resource that allows technology to improve itself and its delivery.

2. A factory worker fills in the gaps where a machine is unable to perform a task. The worker’s environment is that of a machine and as such the human does not feel part of the natural environment. By serving the technology around them the worker psychologically loses control over their actions and decisions, though they can actually leave that job at any time.

Latour, Heidegger and Barad show us that our agency (or lack of it) is the result of ‘actors’ in our reality. These impose a certain psychology that encourages the promotion of further technological integration and ‘improvement’ in our lives. This is not all bad, as we want technology to aid aspects of our lives, so the agency technology provides is arguably greater than the agency that it limits. Knowing that we are psychologically vulnerable to the darker side of technology, with notions of enframing and so on, may not change our circumstances but it does demonstrate how we came to have certain beliefs.

Our relationship with technology is highly refined yet almost completely ungoverned. This leads to the deeper and more difficult issue I was referring to earlier, which is that we need to address the pursuit of technologies that are harmful to humanity and the environment. Technologies driven by fossil fuels may benefit many but serve to profit a small number of human beneficiaries and offer economic and political power. While fossil fuels do benefit most of humanity through e.g. transport and electricity, there are also proven non-toxic alternatives. Governing the continued pursuit of technologies driven by fossil fuels is a near impossible challenge. We have seen a number of climate summits now that have tried and failed to do it. Before we dismiss trying we should consider where we are heading, as Hamilton’s Requiem for a Species paints a bleak picture.
The body of work exhibited in my examination is based on a fictional future where humanity is able to survive in the face of climate change. To do this they create machines that soak up CO₂. Are these characters attempting to create a balance between humanity, technology and nature? Are they entering a ‘free relationship’ with technology by using it to attempt to heal the biosphere? As discussed, the government of the future’s dwindling population is a technocracy rather than a democracy. Expertise and knowledge rather than popular sentiment are its ruling factors. I created this fiction by trying to imagine how such events as the CO₂ absorption program could take place. Each time I tried to imagine a democracy dealing with a future of unpopular decisions I could not see how it could take them on and survive. Is this the politics of possibility that Karen Barad has teased us with?

By highlighting the complex causality of humanity’s relationship with technology the power of technology is revealed. Martin Heidegger, Bruno Latour and Karen Barad reveal that our relationship with technology is so deeply interconnected that we are vulnerable, and in relation to climate change becoming more so. It would seem that we are prepared to sacrifice existential freedoms to play a role in our socio-technological network that is presented with the thinnest veneer of sustainable permanence yet is actually that of a host for a parasite and an enabler for human greed (Heidegger 1954, 28). We rarely acknowledge that our communities are so driven by technology that our sacrifices only partially benefit humanity; they also benefit the technology itself. If so much is being afforded to technology we need to question why some technologies do not benefit all of humanity. Why should we support technologies that pollute our biosphere? The work of these philosophers covers various perspectives and issues, but they clearly agree that our relationship with technology imposes limitations on our agency rather than it being inherently malevolent.
Processes
Making my art

I have found that the act of making art is less an intellectual activity than an emotional one, though emotions can provoke behaviour and thought. Where my previous chapters have outlined the intellectual contexts of my research and work, this chapter describes the more emotively driven aspects of my research regarding various materials, forms and methodologies. It is loosely chronological, to clarify how I arrived at the final works I presented for examination and which are discussed more fully towards the end of my thesis.

Although I have already outlined the issues and philosophies that inform the context of my current practice, this chapter describes how I arrived at engaging with Environmental Art. It also outlines my experiments and experiences of working with a range of different materials, including my attempts to ‘ethically’ use natural materials such as stone and timber. And there were discoveries made through experiments with various forms, from my early didactic works to my unsuccessful tetrapods, which then led to links with geo-engineering and the prior discussed concept of technosalvation. I also discuss how my personal experiences on the remote Pacific islands of Druadrua and Uiha impacted my research. There were several moments of ‘failure’ involved, where I felt I could not continue, but then – like Bucky – I managed to find an unexpected way to take my research forward and find a solution.

4.1 Discovering my Subject

Whilst writing this PhD research proposal I exhibited two works in my exhibition *Metaphors for a Stuff-up* at Canberra Contemporary Art Space in 2011. Titled *Waiting* (2011) and *Watching* (2011) (Figs. 20 & 21), they were flat, painted steel wall pieces with circular, iris-like centres that I installed to face each other – like unblinking eyes in a “stare off”. One was red with a black ‘eye’, the other white with a red ‘eye’ to represent my personal frustration at the lack of action by governments and corporations in moving towards a sustainable future, preferring instead to wait until someone else does something and watching to see if they prove viable. Some viewers found it hard to interpret my work, but I found expressing my ideas on this subject exciting. The significance of these works is that they were my first step toward making sculpture that links climate change and psychological phenomena.
Fig 20. Dan Stewart-Moore, *Watching*, 2011

This problem of inaction on climate change exemplifies the earlier mentioned ‘commons dilemma’ that Garrett Hardin first described in 1968 (Hardin 2009, 244): the failure to act for the greater good in favour of short-term personal gain. This inspired me to look further into climate change psychology, where I discovered that Jeffrey J. Rachlinski and Robert Gifford identify other psychological phenomena that concern climate change. I felt this could be a rich vein of material for my research and wrote a research proposal with the intent of developing a body of work based on the findings of climate change psychology. This was in addition to the other component of my research, discussed earlier, around the ethics of using various materials in art – or more particularly sculpture – that deals with climate change. Where my prior discussions were related to other artist’s practices – Goldsworthy, Eliasson etc. – what follows is regarding my own practice.

My first investigation into materials was to look into the 2009 report on greenhouse gas emissions by the International Panel on Climate Change (IPCC). The diagram in Figure 22 is a visual representation of the main sources of these emissions (Rogner et al 2007, 99). As discussed, sculptural materials such as bronze produce identifiable greenhouse gas emissions, whereas stone such as granite or sandstone does not – because it’s a naturally occurring material that does not require refining or processing. The only emissions applicable to stone come from quarrying, transporting and using certain tools. The granite I worked with was collected from the ground, and I work in a studio with solar power, so I thought it might be an ethically appropriate material to use and began researching its potential in my work.
Fig 22. International Panel on Climate Change, World Greenhouse Gas Emissions in 2005
4.2 Natural Materials

I started looking at artists who work with stone and came across Peter Randall-Page’s work *Seed* (2007) (Fig. 23), a good example of how a work successfully combines materials, form and concept. *Seed* was the centrepiece for the earlier mentioned *Eden Project* in Cornwall, England (Fig. 23 & 24), which comprises a series of large-scale greenhouse structures, or biomes, based on Buckminster Fuller’s geodesic domes. The purpose of the *Eden Project*, and the biomes, is to conserve, display and educate people about the most important plant species on earth. Like Buckminster Fuller, Randall-Page’s use of organic form integrated geometric and mathematical patterns (*Seed* being based on the Fibonacci series), which occur in nature. I found this very appealing, particularly with his use of a natural material (granite) to do this, as it represents an endorsement of humanity’s ability to work with the environment. *Seed* and its place in the *Eden Project* highlights one of many relationships between humanity and nature, in this case through horticulture.

Fig 23. Peter Randall-Page, *Seed*, 2007

Fig 24. *Eden Project*, biome outer wall, Cornwall, UK
The first time I worked with stone was terrible. It was a piece of sandstone sourced from a local sand and gravel supplier but its inconsistent structure chipped and cracked and crumbled as I tried to carve it. I then tried working on a small piece of granite, carving it with a tile-cutting disk on an angle grinder to produce my first stone sculptures (Fig. 25 & 26). This encouraged me to proceed further, but working on a larger piece I had to find more appropriate tools.

![Fig 25. Dan Stewart-Moore, Untitled #1, 2012 (R)](image)
![Fig 26. Dan Stewart-Moore, Untitled #2, 2012 (L)](image)

While making studio, tool, etc. changes so I could shift my practice to sculpting stone, my research took an unexpected turn. In 2012 my wife was one year into a research project examining disaster management in the Pacific, so we took our children on a scoping trip to Fiji and Tonga. This meant postponing a coursework component of my research program, but the opportunity presented some significant avenues of enquiry: on investigating Pacific art I found that the University of the South Pacific in Suva had a program specifically for traditional carving. I made an appointment to meet with the head of the Oceania Centre for Arts, Culture and Pacific Studies program, Dr Vilsoni Hereniko.

Dr Hereniko is from Rotuma and lived for a time in Tuvalu, the small Pacific island that is most affected by sea level rise. I was able to gain direct insight into his perspective on climate change and its consequences. What became most apparent is how small developing countries see larger, developed nations as being responsible for climate change. And the psychological impact of climate change on people in small Pacific nations is vastly different to that in Australia. For example, the religious practices and cultural traditions of victims whose houses have been damaged or destroyed by high tides or cyclonic activity can be marginalised by local communities. This is because its custom to share everything, which means aid goes to the whole community rather than those who need it, so their homes remain destroyed and their lives at the mercy of the community. Druadrua, an island I lived on for over a month, had three Christian churches in one village of two hundred people. In these communities, the church sees the effects of climate change as acts of God, so community members who lose homes or find crops ruined are seen as sinners receiving ‘divine’ justice. In turn, these issues impact how support or aid from wealthier
nations is distributed which creates a divide between Pacific nations and the wealthier nations who are frustrated by the lack of local compliance.

One of the pivotal moments for me was meeting the artist Paula Ligairua (Paul) who was ‘artist in residence’ at the University of the South Pacific. Working on a large-scale wooden carving (Fig. 27) I found his approach refreshing in the way he made formal decisions by considering the form of the log that stood before him. Using handmade tools such an adze – rather than machinery – he created his forms by responding to what the raw timber presented: its structure. This reminded me of a quote by Michelangelo:

*Every block of stone has a statue inside it and it is the task of the sculptor to discover it.*  
(Peck 2014, 106) Michelangelo di Lodovico Buonarroti Simoni, 1475-1564

Although I recognise the historical precedent of the way Michelangelo responded to his material, I had never worked in this way – I had always imposed predetermined or designed forms that I wanted to produce by using machinery on my materials.

We visited a small Fijian island named Wayasewa, where I found a piece of brain coral (Fig. 28). Its shape and structure symbolised climate change psychology because it looked like a human brain and is a life form very vulnerable to changes in the climate; large areas of coral reef are being destroyed by chemical and temperature changes in our oceans due to climate change and human activities like agriculture.
When we returned to Australia I made a porcelain maquette of the work I had imagined, a loosely knotted cylinder with a coral pattern (Fig. 29). To make it I rolled porcelain clay into a sausage form and then tied it into a knot joining the two ends to complete a circuit. This was to represent the ‘cognitive dissonance’ that people experience about climate change. From photographs I took in the Pacific I etched the brain coral pattern into the clay using a wooden skewer. When I attempted to carve this form in stone I found it was beyond my skills and experience; I hoped to re-visit this exercise after allowing myself the opportunity to become a better craftsman.

In the hills above Queanbeyan I found a dumping ground for stone offcuts from Canberra’s new parliament house building. Experimenting with ways to demonstrate a Keeling curve (Fig. 30) – a graph that represents growing CO₂ levels in the atmosphere – I made plasticine maquettes of forms that were technically achievable for me to produce in the stone but which were small enough to be multiple components of a larger work.
Fig 30. The Keeling Curve, Mauna Loa Observatory CO₂ measurements, 2009

Fig. 31. Dan Stewart-Moore Untitled Experiment # 4, 2012
Fig. 32. Dan Stewart-Moore Untitled Experiment # 4, 2012
Fig. 33. Dan Stewart-Moore Untitled Experiment # 5 (and tools), 2012
Fig. 34. Dan Stewart-Moore Untitled Experiment # 5, 2012
I made these various forms out of stone (Figs. 36-37) I didn’t feel that any of them successfully represented the links between psychological phenomena and climate change that I was seeking; they were too amorphous and could be referencing anything, or even nothing.

4.3 Tetrapods

In my search for a repeatable form that could operate as a component for a larger work about climate change and climate psychology I came across the ‘tetrapod’. These are used to build seawalls in countries like Japan and the Netherlands to keep sand or soil from being washed away (Fig. 38), and are sometimes used as foundations for extending land into the sea. While considered as an adaptive measure against sea-level rise, ironically the processes involved in producing these concrete and steel constructions involves large amounts of greenhouse gas emissions (Sovacool 2011, 745). This paradoxical situation perfectly fits my interest in the issues and behaviours of climate change psychology: somehow humanity overlooks the clear paradox of using tetrapods to minimise the effects of rising sea levels when their production actually contributes to global warming and the melting of ice that causes sea level rise. To suggest a new
type of environmentally sound material or process may alleviate the problem. However, finding adaptive solutions are only half the problem; the other half is mitigation.

We have already developed proven renewable energy technologies that could replace or reduce our reliance on fossil fuel technologies for transport, communication, manufacturing and so forth. But the reason they have not been adopted is more than just politics or economics, it is also because of the psychological issues I have outlined regarding climate change psychology. So I thought our ongoing use of the tetrapod made it the perfect symbol of our psychological inability to find appropriate measures for either adaptation or mitigation.

I made a number of plasticine tetrapod models to explore scale and composition for a sculptural installation (Fig. 39). It became clear that if I made them with four identical legs they should be easy to make. The most difficult area of constructing tetrapods would be the central join. To find the correct angle I conducted some experiments with off-cuts of timber but had trouble reconciling the mathematical intersection of the four ‘legs’ in three dimensions. I had a rough idea of what the angle should be and began a trial and error process. I made four test joins and found that an angle of 36° fitted accurately (Figs 40 & 41).

I used scrap timber to make a tetrapod out of wood (Figs 42-46). I had to change the profile of the timber from square to hexagonal by tilting the blade of the table saw to 60°. The hexagonal profile allowed me to mark out the three connecting faces of each leg. Using a mitre saw I was able to make the 36° cuts to each leg. After this I sanded back the corners of the legs into a circular profile, tapering the legs and with some minor adjustments got it to fit accurately.
I started thinking about how I could make tetrapods in stone. Up until this point I had only used hand-held stone working tools and realised I would have to make special jigs to allow me to cut the angles accurately. The other technical issue was cutting perfectly circular forms. With other materials I would use a lathe but the thought of attempting to carve stone in this way seemed dangerous and impractical. The machine I imagined would need to hold and cut stone at low speed in a wet environment, it would also need to be adjustable so I could change the scale of the tetrapods. I realised this machine would be time consuming to make and that larger tetrapods would mean this machine would be have to extraordinarily large. My choices were to scale down or let go of this idea.

4.4 Fiji

In 2012 was given the chance to live in a community affected by climate change when my wife conducted interviews on the Fijian island of Druadrua. With a population of around two hundred people it was surprising to find there are three churches but it was difficult to access health services. Due to rising surface ocean temperatures Druadrua has experienced increasingly damaging cyclonic activity. One village had lost a row of homes and more than ten metres of beach. The dwelling we stayed in was roughly two metres from the sea at high tide and suffering structural damage. Another dwelling regularly had seawater underneath that was slowly degrading the ground supporting its wooden foundations (Figs 47 & 48).
The Druadrua community feel that they are owed compensation from their government for their losses. Traditionally compensation is shared amongst a community rather than allocated to individual families, so while all families receive aid the victims whose houses were destroyed remain homeless. The local pastors’ message that “God will save the faithful” implies that victims of climate change must have disregarded their Christian duties – this must be their punishment, divine retribution.

Druadrua residents have significant challenges that need sensitive external assistance because the psychology of dealing with climate change as a victim is very different to that of a perpetrator, which is how I see countries like Australia. We may blame ourselves for our impact, or deny its direct evidence to ease our psyches, but the Fijian victims of climate change blamed themselves too. This was the result of religious and cultural leaders on the island pressuring others into conforming to views based on belief rather than evidence. The cultural and religious belief
systems that enable such psychological phenomena to occur are different from our own society, however it suggests these phenomena are universal, victim or perpetrator.

When I returned from Druadrua I explored using the negative space around tetrapods; I pictured an organic form desperately clinging to a tetrapod as if it were a life raft (Fig. 49), which I saw as a metaphor for nations who can’t afford adaptive measures – like saving their shores by using tetrapods. After removing a piece of ‘clinging’ plasticine from around a tetrapod I realised I could use this as a representation of the tetrapods’ negative space, and in acknowledgement of the Pacific nations I would impress a common weaving pattern on its surface (Figs. 50 & 51).

![Fig. 49. Dan Stewart Moore, sketch for Vestige, 2012](image1)

![Fig. 50 & 51. Dan Stewart-Moore, plasticine tests, 2012](image2)

I scaled up the plasticine maquettes using granite from a quarry in Eugowra, New South Wales. On the way to the quarry I stopped at sculptor Senden Blackwood’s home and studio near Orange. Having carved stone for a number of years he was a wealth of knowledge about tools, safety and technique.

I purchased 600kg of granite, and was given another 600kg, so I now had 1200kg to take back to the workshop. I had to refuel twice and ended up with a collapsed jockey wheel on the trailer; I was keenly aware my trip had not been environmentally friendly.
The next day I began cutting into the stone and realised how ineffectual my tools were so my work would be limited until the summer break (Figs. 52 & 53).

During summer I made great progress and completed the roughing out process of carving the stone (Figs 54 & 55). However, due to noise complaints I was moved from the main work yard to an area outside the foundry. Then I had to put it all on hold to do more travel and research.

4.5 Tonga

In 2013 another opportunity to visit a climate change ‘challenged’ Pacific island occurred when my wife had to do further research on the Tongan island of Uiha. Much like Druadrua, Uiha experiences sea level rise and increased cyclonic activity. The island is very flat with its highest point only two metres above sea level. King tides and cyclonic ocean surges regularly cause flooding with water sometimes travelling kilometres inland reaching the middle of the island. Six months after our visit Cyclone Ian devastated the island, making 70% of dwellings uninhabitable, one of the few left standing was the small building we stayed in (Fig. 57).
I took two significant items with me: Clive Hamilton’s book *Requiem for a Species* and some tools – a set of chisels and a wooden mallet.

Hamilton’s book was a turning point in my research because until reading it I had believed that climate change could be mitigated if we acted immediately. While explaining that this is not the case he argued that action on climate change is not just about preserving our way of life but the challenge to preserve all life. It took some time to come to terms with knowing that our climate will change significantly but eventually grief gave way to accepting that we must attempt to save what we can.

The carving tools I took with me allowed me to vent creatively. I asked the locals about carving traditions but there seemed very little interest on the island. I found a piece of driftwood and attempted to emulate the carving I had seen at the University of the South Pacific the year before, addressing the form in response to the wood’s textures and patterns. I discovered several wood eating grubs in the timber as I carved. One was as large as my finger. I extracted everything I could find but decided it would be too difficult to get through Australian customs and perhaps the work belonged in context on the island. (Figs. 58-61).
I returned to Australia to finish the granite carving for a solo exhibition *Between a Rock and a Hard Place* at Canberra’s M16 Artspace to be held in August 2013. The form was still inconsistent; I wanted to adjust the cut-away section, carve a pattern into it and then polish the stone. I experimented with various patterns on the cut away section by drawing in permanent marker on the surface (Fig. 62). I didn’t want to appropriate a particular weaving pattern as these sometimes have particular meanings, so I tried to keep the pattern as generic as possible (Fig. 63).

The final granite sculpture I titled *Vestige* (Fig. 64) to represent the land that is disappearing from the Pacific islands I had visited due to impact of climate change.

My second work related to the forms that could stop this land degradation (tetrapods) but I had to use timber because I was not equipped with the right tools to produce the forms I wanted in stone: I had been experimenting with paper coffee cups, testing compositions that structurally resembled an electron microscopic image of pollen (Fig 66), which looks remarkably like a sphere...
of interconnected tetrapods (Fig. 65) that conjured images of entire continents being fortified from rising seas as large sections of the Japanese coastline is today.

With a tight timeline to the exhibition at M16 Artspace, I decided to use forestry stewardship council certified wood to create the tetrapods rather than stone, which would have taken months rather than the weeks that I had. I cut around 70 legs, rounded them off, and inserted them into a plastic cup to ensure they were the right size and shape (Fig 67).
I joined the legs with PVA (Fig. 68) then joined the tetrapods to each other using a dome-shaped scaffold to place them so they touched each other at the tip of the legs and then glued and joined them all together with dowel to create the work I titled *Adaptive Paradox* (Fig. 69) in reference to the prior discussed conflict between the use of tetrapods against sea levels that their production contributes towards.

To accompany the two sculptures in the exhibition I also created a looped soundtrack of waves crashing in the background and trickling water in the foreground. The hope was that viewers would associate the works with the sounds waves crashing on the beach.
4.6 Getting stuck

I took the opportunity to have a PhD panel review while the exhibition was on. Everyone had a very different point of view about the works, or rather, why they were not as effective as I thought they would be in communicating my ideas. I found this pretty confronting but came away with the understanding that being so immersed in my project meant that the various meanings were too obscure and disconnected - they were lost in the forms I had been seduced by – so the others had no way of knowing how to access the work, where they had come from, what they were, what they represented.

I decided I needed a new approach. I wanted to continue working with the theme of climate change psychology, but in a more direct manner. I did several drawings of ‘everyday actions’ featuring human skeletons to link climate change issues with some of the psychological phenomena I discussed earlier (Figs 71 & 72). From these drawings I developed two maquettes. The first is a ‘shock jock’ (Fig. 73), which was in response to being forced to listen to a radio talk show being hosted by Alan Jones while sitting in a waiting room. The program enabled climate change deniers to converse and assure each other that their views were justified. Science and logic were presented as opinions rather than evidence, with Jones and the callers bullying their opinions against facts. This reinforcement of bias is what is known as a feedback loop: listeners who identify with the extreme opinions being presented are encouraged to voice their own, which then influences other listeners to complete the feedback loop. I titled the proposed work after this process of ‘biased assimilation’.
With the other maquette I wanted to highlight the reality of using coal to produce energy, what it is doing to the environment, and how we seem to largely ignore the dangers. Titled ‘Coal Angel’ (Fig. 74), I found the dark ideas of the maquette and the technical challenge of creating a skeleton exciting because of the connection between climate change and human extinction. However, I felt that a departure from abstract to figurative sculpture would be risky as I didn’t trust that my skills would be up to the task. I was also aware that these works were overtly didactic, which would likely exacerbate my problem of alienating the viewer. So I tried another approach.

An opportunity presented itself with an invitation to take part in Portrait of a Nation: Unmade Edges, a community/public art project based in Uriarra Village for Canberra’s centenary celebrations. I based the work of art on the topography of the village and used materials key to the history of the site as a forestry outpost responsible for most of Canberra’s structural timber: radiata pine. Following this I designed the work to be made of components that could be installed with and by the community. These components took the form of a simplified roofing truss and were inspired by a work titled Upside Down Again (2012), by Hilde A. Danielsen (Fig. 75) that I saw at Sculpture by the Sea in Sydney in 2012.
My small maquette (Fig. 76) was approved so I went into production of the work, titled Loop, making one hundred triangles from radiata pine to represent the one hundred homes in Uriarra Village and Canberra’s centenary year.

I managed to complete production in a week and took a weekend to install the work on site (Figs. 77 & 78), though the cold and wet conditions dramatically reduced the community’s contribution.
Loop provided me with another possible avenue of research regarding my earlier notion of ‘ethical paradox’ against my material choices. Perhaps the materials used in this project were not entirely appropriate for environmentally themed artworks, but I considered how an architectural context would regard them as functional components that had to be structurally sound. How much damage was caused in the material’s production? How long would the materials last? How much energy was used to make the form out of these materials? I wanted to see the process holistically, looking at the lifecycle of a work of art to determine the ethical relationships between the elements involved in production and how they measured against environmental loss or gain.

I started to see this relationship as triangular. One side represents ‘production’: which measures the impact of materials used in a work via the emissions involved in their production and/or removal from the environment. The second side represents ‘longevity’: a work with longevity will have lower emissions than one that needs periodic restoration or re-fabrication (if made from similar materials). The third side represents ‘difficulty-of-use’: this is measured by the amount of energy or time involved in producing a work. This triangular relationship of my concerns about the act of using traditional materials demonstrates that variations in one element (or side of the triangle) lead to variations in at least one other element.
Steel is a remarkably easy material to work with provided that the artist has the right tools. Its longevity is much lower than stone and its production costs are a significant impost on the environment. To improve its longevity an artist can work with stainless steel but this will increase the difficulty of use and production impost.

Stone has fantastic longevity (particularly granite) but it is also the most difficult to work with. The larger the stone the more the production imposts go up – in some cases making its production values higher than timber. This represents the difference between working with found material or commercially mined material. It is also worth noting that softer stones are easier to work with but last significantly less time.

Timber, which has a lower ‘longevity’ and ‘difficulty-of-use’ value but a higher ‘production’ value than stone, looks quite different. It has sides that are relatively equal. While the production imposts are not as bad as steel, it can be more time consuming, although often less energy intensive, to work with timber.

Applying this triangular methodology against the traditional materials I could use in my work revealed some interesting outcomes. For example, if the ‘longevity’ of a material has a high value then either or both of their ‘difficulty-of-use’ and/or ‘production’ values will be high. For example, stone has a high ‘longevity’ value but it has a high ‘difficulty-of-use’ value. In its favour it can have
a low ‘production’ value because the extraction of stone can be as simple as picking it up off the ground. This means that can be represented as a skinny wedge like triangle.

Using the above diagrams, timber is the more ethical option (assuming that it is ethically sourced) but the deeper revelation for me was that all materials are compromised to some degree or another. I decided the most ethical practice – that causing the least ‘ethical paradox’ – would be to use timber as the main material but joined with minimal amounts of more durable and less ethical material i.e. those with high production values but also high longevity – stainless steel instead of galvinised steel. Loop was quite a difficult work to complete because of the way it was joined. So while I was changing the material I needed to modify the system of cables, spacers and swaging I had used in Uriarra Village. It needed to be adjustable so that I could move timber pieces at any time and I needed to change the cable from galvanised to stainless steel to deliver greater longevity for a modest increase in production.

I was also trying to work out how a work like Loop could relate to climate change psychology. To make the link I decided to use simple metaphors that represented different psychological barriers against action on climate change. I did some concept drawings of sculptural forms (Figures 79-81). One idea was to literally suspend a twisted crescent from the ceiling – to represent how ‘cognitive dissonance’ can suspend emotional and logical resolutions concerning climate change. Another comprised two interlocking spiral forms to represent ‘feedback loops’ that moved ‘inward’ like a retreat from scientific evidence or ‘outward’ like the momentum of fanatical climate deniers. The idea of ‘loss aversion’ was a closed circular form protecting an internal space i.e. personal or financial investment against of political and technological change.

I decided to test this new process with a work I would title ‘Ostrich’ (Figure 83), which is what climate science deniers are sometimes called – sometimes overtly, such as in Haydn Washington and John Cook’s book *Climate change denial: heads in the sand*. My ‘Ostrich’ was to appear to have its ‘head in the sand’, as anyone who doesn’t want face up to reality is described.
I wanted the timber component of the work to have a more elegant composition than the Uriarra piece, which was screwed together and joined with gang-nails. My new cable ‘system’ enabled me to twist the work as well as curl it, but with much more control (Figures 83 & 84). It also had more stiffness and was better able to resist collapsing under the weight of its component triangles, as Loop would have done without spacers between each element. It seemed to me that the work was held together using tension rather than compression. In an earlier chapter I discussed my discovery of Buckminster Fuller’s term tensegrity, which is when a structure relies on tension for its strength; I had adopted this construction method in Ostrich, creating a further link in the evolution of my research process.

Instead of a system of swages – permanent cable fixings I used in ‘Loop’ – I decided to use adjustable collars with grub screws (Fig. 84). This meant I could easily make adjustments if I needed to. My research revealed that these collars would be quite expensive. Though I was prepared to make this sacrifice I thought best I test this system to see if it worked.
I was then invited to participate in a gallery exhibition titled *Portrait of a Nation, Unmade Edges, legacy exhibition* at the Belconnen Arts Centre that would bring together all of the Uriarra Village Canberra centenary projects. I entered *Ostrich* and decided to have another PhD panel review. The work was badly received. The main concerns were that the concept I was trying to convey did not come across, and that if it was to be so didactic then the materials I had used were a contradiction. The panel suggested that I stop and reassess my work before I took my next step. One member even suggested that I destroy the work by burning it.
4.7 Moving on

I went through a grieving process and considered pulling out of the PhD program. I took counselling and spoke to the acting course convenor who convinced me to continue. I felt I needed to regain some control over my research but I also needed help.

My first step was to change my supervisory panel. We set new goals and had regular meetings. I worked hard on my writing and attended ANU academic skills who reviewed my writing and made constructive criticism. I had regular meetings with my new theory supervisor who encouraged me in the process of rebuilding my research.

Regarding my sculpture, I decided to reinvestigate the use of a form that had led me to climate change in the first place: clouds. I had produced clouds in pre-PhD works (Figures 88 & 89) that were fabricated from steel and coated with auto paint. Though these high carbon emission materials were not appropriate to the direction of my new work I explored the symbolic potential of using clouds in my pursuit of encouraging a dialogue around climate change through my sculpture.
Setting aside the issue of climate change psychology I focused on the issue of finding ways for sculpture to represent issues about climate change. I did a number of drawings and looked at how I could manipulate the symbolism of clouds to more specifically represent my ideas. From these drawings I developed two maquettes. One has bullet holes representing humanity’s impact on the atmosphere, the other looks like a sponge being wrung out to represent my desire for humanity to remove the greenhouse gases that have been absorbed by the atmosphere (Figures 90-92).

Someone had suggested I could use the materials used in straw bale houses in my work. I conceded it was possible, but felt that my work would be overly rustic and fragile. To prove it to myself I made two clouds with a straw/lime/sand mix. I inserted sticks from around the garden as rain (Figure 93). I didn’t like them but felt the experiment was necessary if only to put this proposed avenue of sculptural research to an end. The material was fragile and difficult to use on a small scale and would have proven almost impossible to transport for exhibition in a larger scale. The aesthetics were unrefined and to me, this made them unappealing. I also had concerns about using lime as it is produced in a similar way to cement.
I arranged another critique with the sculpture workshop. The big issues seemed to be my use of didactic metaphors and viewer alienation. One person suggested that my material choices (timber) were neither sustainable nor environmentally friendly. I attempted to argue the case that all materials are compromised and that properly sourced timber is the most ethical, but this was largely ignored. Another suggested that I should be recycling waste like plastic bottles. This annoyed me because I considered using rubbish in environmental works to be too clichéd, though I concede that works of art engaging with clichés are easier to interpret. With the suggestion of creating clouds with waste plastic I could initially only envisage crudely arranged crushed and dirty plastic. But I later remembered Buckminster Fuller and his solar balloons and geodesic domes, which I found far more exciting.

Apart from the cliché of using recycled materials, my concerns had been aesthetic as well as being wary that objects that have ceased to fulfil their original purpose should not automatically be considered as environmentally friendly material. The detriment to the environment during its production does not undo because of its redundancy, or re-use. However, recycling material does lower demand for new items out of new materials, which means lessening consumerism, lowering further carbon emissions for their production, and reducing rubbish that new materials and new objects create. If I was going to use recycled materials it had to be incorporated into the concept of the work as well as the context.

I remembered Fuller’s solar balloon cities and Saraceno’s *Cloud City* and imagined what it would be like to see a geodesic cloud made from plastic floating in the sky, wondering about where it came from and what its doing. I imagined it as an autonomous device on some environmentally significant mission. It had to be something from a possible future...
I began looking at proposed technologies that might assist in mitigating climate change and other environmental problems, and I found an article on *EcoWatch.com* (2014) about a plan to remove plastic from the north Pacific gyre. Gyres are ocean currents that circle clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere. These include the Indian Ocean, the north Pacific, south Pacific, north Atlantic and south Atlantic gyres. The idea came from a 19 year old Dutchman named Boyan Slat, who proposed using small autonomous boats to collect plastic from the ocean’s surface and then return the plastic to shore to process for some other use (Spear 2014, 1). What if my cloud material came from this process?

Later I read an article in *Michigan Tech News* (2011) about an experimental CO₂ ‘scrubber’ (a device for removing atmospheric CO₂) developed at Michigan Technological University by a research team led by Professor Komar Kawatra. This demonstrated that CO₂ could be captured relatively cheaply, and although the prototype was less efficient than other CO₂ filters it created a saleable by-product, which is a proprietary secret for now, that could be used in the building industry (Goodrich 2011, 1). I speculated about a future where gyre plastic was collected autonomously and used to make ‘lighter than air’ artificial clouds with some integrated scrubber-like technology to absorb carbon dioxide from the atmosphere.

The gyre plan from the first news article was criticised because it failed to realise the scale of the problem. Most of the gyre’s plastic is well below the ocean’s surface, and it also breaks down into micro particles, making it difficult to capture. I imagined a massive vessel that could suck up micro- and non-micro plastic to clean the ocean (Figure 94).

![Fig. 94. Dan Stewart-Moore, sketch for ocean plastic extraction vessel, 2014](image)

I also realised that carbon dioxide is not just an atmospheric problem. It is affects the oceans in a far more serious way as it absorbs more CO₂ than the atmosphere and has seen significantly accelerated temperature increases compared to the atmosphere (Craig 2014, 85). I imagined a sea-based device, constructed to absorb CO₂, in a form that would resemble a mollusc shell, with a large aperture for taking seawater on board and passing it through some kind of CO₂ filter. The mollusc shell is also a form I had also used in previous work (Figure 95).
I wanted to put all of these ideas together in my work so I developed a narrative around them. I came up with a speculative future where all but the most remote and robust nations had collapsed due to the ramifications of climate change. The few nations that survive work out a way to create and implement a carbon dioxide absorption program using modified tanker ships that collect plastic from the sea which is then used to create air- and sea-based devices that absorb carbon dioxide in order to conserve and maintain life and the earth’s biosphere.

I wrote a short story describing this future world (see Appendix) and how these CO₂ absorbing devices – which I call ‘clouds’ and ‘shells’ in relation to their forms – are created, function and exist. Initially my intention was to realise the purpose of the technology and how this might make them look. However, as I wrote I realised that this story should be considered as part of the work I would submit for my PhD, its complementary nature intended to allow insight into the works rather than defining them.

An important element of the story is the vessel that manufactures the clouds and shells. I had imagined that, like the clouds and shells, it might be based on a form found in nature. I looked at marine creatures including whales and bivalve molluscs and came up with a ship that could open like a clam to remove plastic but travel efficiently through the ocean without sinking because it would only filter the water.

Although the idea was exciting I had to admit that the water filtering, CO₂ device-manufacturing ship would itself be hard to manufacture in a resource-poor future. I also had concerns about how, or if, I would produce and exhibit such an object: did it fit into my practice? I decided to develop the concept of a practical and operative ship by looking at tanker and container ships and as well as twin-hulled platform ships used for installations of oil drilling platforms at sea. I came up with a
twin-hulled ship with a combination of photovoltaic cells and algae tubes on deck (Figure 99). The solar cells power the vessel’s movement and provide energy for the production of the clouds and shells below deck. The algae is grown on deck and supplied to the clouds and shells during production. Below the surface the ship has a large net for gathering plastic. And rather than making a model of the ship I felt that drawings and photo-shopped images would be more appropriate as the short story is a first person account of a journalist and not a designer or an engineer.

Fig. 99. Dan Stewart-Moore, sketch for twin hull vessel, 2015

I experimented with the cloud and shell forms and also with using recycled high-density polyethylene or HDPE from used milk bottles as a material (Figure 101). These gave way to paper models instead of HDPE (Figures 102 & 103) as at this stage the materiality was less important than developing the translation of triangular shapes seen in Buckminster Fuller’s work into patterns that create complex forms that would look like they had been made by a machine.

Fig. 100. Dan Stewart-Moore, plasticine maquette for sea-based ‘scrubber’ (L)
Fig. 101. Dan Stewart-Moore, HDPE experiment, 2015 (R)
This was particularly important for the shell prototypes because I needed a pattern that was simultaneously repetitious, scalable and that could grow from the centre to the aperture in a smooth linear fashion consistent with the shells of actual molluscs.

My early shell patterns were drawn with a pencil and ruler and the patterns would gradually collapse with entropy, ending with the pattern being skewed beyond workability (Figure 105). Using Photoshop I was able to copy, paste, scale and rotate the image of my model to create an image of what a ‘shell’ may look like (Figure 107). The models I made gave me a chance to see what the shells could look like in three-dimensions.
To combat the skewing and warping of the hand drawn patterns I used Illustrator to develop a pattern that could be copied, pasted, and scaled up - building the pattern from very small to very large scale. I was able to then repeat this process with groups of patterns, allowing me to repeat it infinitely which theoretically meant I could make a spiral form as large as I wanted it to be (Figure 108).

I printed the Illustrator pattern onto an A3 sheet of paper and cut it out. I saw that many of the smaller folds might not be easy or even possible with HDPE, this meant that transferring the process to HDPE would need to be done at a more usable / larger scale. I completed the paper model to gain more insight as to what the finished work might look like (Figures 109-112).

Fig. 108. Dan Stewart-Moore, pattern made with illustrator, 2015

I then began experimenting with making the clouds with HDPE. My limitations were set by the amount of flat material I could extract from 3 litre milk bottles. Initially I tried to create a pyramid pattern based on 45° triangles, as this had worked well in paper but didn’t translate well to HDPE because of the limited amount of flat material. The idea was that these pyramids came together in the pattern to form hexagons – six triangles for one hexagon. However, because of the limitation

Fig. 109-112, Dan Stewart-Moore, folding process for paper model of shell section, 2015
of the material size it was not economical to make one pyramid per sheet so instead I made a pattern that interlinked with itself to form pyramids once joined.

Initially the joins with the HPDE were obvious and unappealing. I tried a variety of methods: a slot and tab mechanism lacked rigidity and left gaps. Superglue with a primer was better but easily broken. Silicon failed more easily than superglue. I tried heating the plastic so it could fuse but it was hard not to melt large areas and cause the plastic to burn. It was also ‘hit-and-miss’ with the integrity of the join. Finally I found that clamping two pieces together and creating small, numerous penetrations with a soldering iron worked (Figure 113).

![Fig. 113. Dan Stewart-Moore, clamping HDPE pyramid forms, 2016](image)

I modified the clouds’ pyramid pattern to create a much lower pyramid than the original 45° and inverted it to allow better access to the tabs for joining. It also meant that the form was much smoother than the original spikey experiments and more cloud-like in comparison (Figure 113).

![Fig. 114. Dan Stewart-Moore, flat section of pyramid forms – geodesic skin, 2016](image)

I made a number of cloud pattern pieces and expected them to produce a complex curve allowing me to create a ball-like form, which could then be joined with other ball forms to create cloud forms. To my surprise it seemed to be getting flatter (Figure 114). I investigated geodesic domes and noticed that the pattern was not completely uniform, it explained why my pattern wasn’t curving, but I couldn’t see how to modify my pattern to make it curve. On investigating my son’s black and white soccer ball I realised I needed a pentagon in the middle of my hexagons to get the curve working correctly. I attempted various other things until I finally got the curve I sought.
Having made a large section of hexagon only pattern for clouds I wanted to have a proof of concept that the pentagon surrounded by five hexagons would work before I modified what I had already done. To do this I scaled down to test that this system would actually achieve a dome or sphere (Figure 120). Within a few days I successfully completed a small dome using pentagons surrounded by hexagons (Figure 120).
4.8 Summary

During my PhD candidature my research of ideas, forms and materials took me and my work in many different directions in an exploration of the possibilities for a sculptor wanting to work in the context of climate change. Seeking low emission materials, I started with natural substances. My stone forms were too abstract and obscure and my concepts were unworkably didactic. My experiences in the Pacific showed me how climate change is affecting some of the world’s most vulnerable people, which helped me to understand more of the practical issues we need to deal with and the problems we will face in the future. Emotionally this was difficult because I have seen how the effects of climate change make so many lives miserable, yet to point out how psychology, technology and social networks are responsible for the core elements of climate change through the medium of sculpture was almost always met with fierce criticism. My research bounced from one form to another, seeking a way to symbolise the collective issues that I saw. I hoped, perhaps naively, that if I could communicate them poetically enough the viewer might see my perspective. Ultimately this proved to be my downfall and after a lot of soul searching I sought a different path, looking at what may happen and what we might do about it. I used my imagination to think about our future rather than seeking to criticise the here and now. Creating a public artwork for Uriarra Village was my first attempt at using tensegrity, which led me toward Buckminster Fuller’s geodesic domes, solar balloons and recycled plastic. Looking back on my research now I can see the abundance of dead ends that plagued my progress. However, I feel that the problems I found, or even created, only serve to highlight how important this line of enquiry is. If I had somehow avoided the problems that I discovered I think my research would be the lesser for it. Understanding the various genres in Environmental Art and how they might or might not be appropriate in the context of climate change led me to the view that climate change is an issue that breaks the parameters of Environmental Art and that technology is a key element. Developing an understanding of Heidegger’s work in the area confirmed this. Latour and Barad added further weight to the argument. My final works represent an accumulation of physical craft and material investigation but they also represent a refinement of concept, an acknowledgement of the work of those whose ideas have helped to shape my own – guiding my initially feeble concepts toward more tangible results.
4.9 Future possibilities

There are many avenues that I could pursue after all the research I have undertaken for the PhD program. At this stage the two strongest candidates for further exploration are:

- Sculpting forms that contain algae farms that absorb CO$_2$. I envisage them being made from clear plastic tubing, allowing the algae to photosynthesize, with a solar powered pump used to aerate the algae. They could be large-scale public works or smaller elegant pieces that might be more domestically appropriate. The use of recycled materials would again be an imperative in the construction of this living algae farm to further demonstrate my intention to have a free relationship with technology. These works might be based on cloud-like or mollusc-shaped structures operating within the parameters of biomimicry, which is defined by the Biomimicry Institute of Missoula, Montana and founded in 2006 by Janine Benyus and Bryony Schwan as ‘...an approach to innovation that seeks sustainable solutions to human challenges by emulating nature’s time-tested patterns and strategies.’ (biomimicry.org 2017) The algae farm would perform natural functions, absorbing CO$_2$ and creating oxygen, whilst using a natural form such as a cloud or a shell. The intended outcome is to create an artwork that actively plays a part in mitigating climate change rather than only using climate change as a topic or concept.

- Using recycled plastic to create more immersive installations that look at technology as a component of climate change. With a large amount of cheap recycled (and recyclable) material, quite large gallery spaces can be transformed into experience-based works of art allowing the viewer to see themselves as a part of the work. The intention of such works would be to highlight the possibilities for transforming our waste with a view to entering a free relationship with technology.
Three works of art are being submitted for examination. Titled Clouds, Shell and The Diary, all are based on speculations set in a hypothetical future world. The narrative approach approximates science fiction but is inspired by the work of non-fiction authors such as Tim Flannery and Clive Hamilton. The two sculptural works are based on proposals for experimental innovations such as Boyan Slat’s filters for collecting ocean gyre-based plastic, Theo Jansen’s kinetic land-conserving Strandbeests and the solar balloon habitats first developed by Buckminster Fuller and being revisited by Tomás Saraceno.

The hypothetical future world that my works operate in continues to suffer the effects of climate change long after the supply of fossil fuels has run out. As proposed in Clive Hamilton’s book Requiem for a Species, billions of people have died from a lack of drinkable water and food. Hamilton details the role of climate change psychology in hampering current action on climate change and why the planet is moving towards increased temperatures of +4°C, endangering all life on earth (Hamilton 2010a, 101, 228).

My narrative takes place in a future where resource wars have devastated all but the most remote and hardy plant, human and animal populations on earth. The dwindling human population has split into two groups: scavengers who live in the ruins of the old world and those in INZMAT, a coalition of remote states formerly known as Iceland, New Zealand, Mauritius and Tasmania who manage to survive by embracing renewable technology and adapting their agricultural techniques to the changing climate. INZMAT’s civilisation is based on a respect for the earth, which runs so deeply they even have a religion founded on James Lovelock’s Gaia principle. Like his theory, this religion is based on the interrelationships between all life forms on earth and the functioning similarity its ecosystem shares with a singular organism for survival (Lovelock 1979, vii). That Gaia will endure climate change and one day return to equilibrium is the fundamental belief of this religion.

The government of INZMAT is a technocracy: A non-democratic form of government run by high-level technical experts (Teik 2014, 415). Members of the general population do not vote unless they are acknowledged as an expert in their field – from child-care to plumbing to quantum mechanics. Rather than professional politicians, parliamentary members are elected by guilds that represent fields of expertise such as defence, communications, science, etc. From the elected experts a Chancellor is chosen by a secret ballot and serves for 3 years. The outcome of this governmental style is that decisions are based on expert dissertation rather than by popular vote. This protects ruling governments from electoral problems when making unpopular but necessary decisions.

As the climate continues to push toward +4°C in my narrative, the planet’s system of absorbing greenhouse gas struggles to cope. INZMAT combine their resources to create a CO₂ Absorption Technology (CAT) program. Using materials salvaged from the old world and renewable energy they create machines that scour the oceans gathering plastic pollution from gyres. The plastic is then transformed into CO₂ absorption machines – my proposed ‘Cloud’ and ‘Shell’ forms – that autonomously roam oceans and skies to convert CO₂ into life-supporting O₂.

Today, plastic pollution is posing a serious threat to marine life. It has been calculated that there is 268,940 tons of plastic in the ocean (Eriksen et al 2014, 1). The most concerning impact of this
plastic are the toxins released as it slowly breaks down into microscopic particles. Typically the plastic gathers in ocean currents known as gyres. The current prediction for sea-level rise is that it will be seven metres above today’s level (DeCanio 2009, 916), so plastic from low-lying cities will vastly add to these figures. It is difficult to predict exactly when this will happen but large areas of land-based ice have already seen dramatic melting.

The impact of plastic on ocean life may seem to have little impact on our own lives, or on the climate, but when considering that an estimated 90% of the excess heat produced by climate change is absorbed by the ocean (Roemmich et al 2012, 425) it’s only a matter of time before the ocean’s heat absorbing capacity will collapse. How much is plastic pollution contributing to the weakening of the ocean’s heat-absorbing systems, and if it continues to grow, how long until it collapses?

If with each breath we retained a tiny percentage of the air we breathe, our capacity to exhale is reduced. Eventually we would reach a point where we could no longer breathe. We can choose to exhale and regain a breathing equilibrium, but what if we didn’t have a choice? If James Lovelock’s Gaia principle is correct and the earth’s biosphere behaves like a singular organism to optimise its survival, then it is obvious that greenhouse gas emissions upset this equilibrium and while we can we must attempt to mitigate climate change to assist the biosphere to maintain its equilibrium – for survival.

One intention of my three final works is to provoke thought on geo-engineering and how it could be utilised for the good of the planet. The *Clouds* and *Shell* are imaginary geo-engineering propositions but geo-engineering is not imaginary; it is a design discipline with many functioning examples and future proposals being worked on. ‘Global dimming’ is one example. This is based on the ‘albedo effect’, which is what happens during volcanic eruptions when emissions of sulphur dioxide (SO₂) into the upper atmosphere forms great ‘clouds’ that lower the earth’s temperatures over large areas. ‘Global dimming’ is the artificial creation of SO₂ clouds to create the same effect. In *The Diary* the main character Frank talks about the darkening of the sky before the old world fell, inferring the impact of global dimming. Such proposals are being considered as proposals for combating climate change in the present day (Boyd 2008, 722). The pumping of billions of tons of SO₂, the chemical responsible for acid rain, into the stratosphere to block sunlight and reduce the earth’s temperature is being offered to governments globally today (Hamilton 2010 a, 178). The danger is that it may prove too tempting because it is a cheaper, short-term option than investing in long-term mitigation and adaptation projects. However, consequences include the adverse effects of blocking sunlight on agriculture and the efficiency of solar power, the disruption of weather systems by changing the chemical composition of our atmosphere and that greenhouse gasses will remain in the atmosphere long after the effects of SO₂ dissipate. If governments used the SO₂ option it would also allow the continued mining and use of using fossil fuels (Hamilton 2013, 139). The problem is that SO₂ delivery requires intensive fossil fuel use, which will become increasingly scarce in the future. When there is no more jet fuel and no way to deliver SO₂ the climate would suddenly and violently shift.

The theme of geo-engineering becomes the main context in *The Diary*. I attempted to imagine a type of geo-engineering solution in a world that has exhausted its fossil fuels so the story’s protagonist Frank investigates the CAT program’s collecting and recycling of oceanic plastic pollution to create their CO₂ absorption machines. Though this imagined CO₂ absorbing technology may not function today as the estimated 35 billion of tons of CO₂ we produce each
year (Olivier 2014, 4) is too much for it, in a future world without fossil fuels – with reduced CO₂ production – such a program would help to stabilise the climate.

The purpose of geo-engineering is to counteract climate change, either by reducing solar radiation or absorbing CO₂ from the atmosphere (Caldeira 2013, 231). The most effective way to reduce CO₂ levels would be to stop using fossil fuels. Lowering solar radiation would effectively lower atmospheric temperatures but does nothing to address the cause of climate change, so this is an adaptive measure rather than a form of mitigation.

My first exposure to adaptation technologies was researching how countries like Japan and the Netherlands have addressed sea-level rise and protection from increased typhoon activity: my earlier discussion of pre-cast concrete tetrapods addresses one measure. My time in Fiji provoked my awareness as the house we lived in was slowly being washed away by rising sea levels degrading the island’s shores. I researched ways for the locals to save their homes and that’s when I discovered Japan’s use of the tetrapods to protect beaches and populated areas from tsunamis, typhoons, violent storms and erosion from sea-level rise. However, that literally half of Japan’s coastline is covered in this concrete is a paradox as the amount of CO₂ produced to manufacture this ‘solution’ has probably done more to increase the long-term global potential for extreme weather events and sea-level rise. This is when I made the connections between geo-engineering and climate change psychology. The belief that humanity can successfully adapt to climate change using technologies that are proven to emit greenhouse gas is paradoxical. This demonstrates the psychological issue of Technosalvation (Gifford 2011, 293), which I outlined in Chapter 3. Not only is geo-engineering an often misguided attempt to enable our survival by adapting to climate change, Gifford highlights its role in providing an excuse for individuals to remain inactive.

If we must resort to geo-engineering to mitigate climate change it is hoped that decisions are based on the best ratio of mitigation versus environmental damage, not on the most cost effective or convenient measures. Geo-engineering should not be an excuse to continue supporting industries that threaten life on earth; it should be used to ‘heal’ the planet, which is in desperate need of care.
This short story is written in the first person and follows a journalist from INZMAT (a collective of surviving nations) into the ruins of the old world where the CO₂ absorption (CAT) program is based. I wanted to give a first-hand account of the predicted outcomes of climate change. To do this I felt the vehicles of utopia and dystopia best suited the narrative. ‘Utopia’ was first coined by Thomas More in his book *Utopia* (1516); the concept is also attributed to Plato’s *Republic* (360 BC). Used as a literary device in genre’s like science fiction, utopian societies are the best possible community that the author can imagine – what exactly they are is up to individual authors. The term ‘dystopia’ is simply the opposite of ‘utopia’, allowing the author to construct malevolent societies. The juxtaposition of the two allows the writer to develop narratives driven by clashes of cultures, beliefs, ethics, and other explorations. Much like Fritz Lang’s character Freder in his film *Metropolis* (1927), *The Diary*’s main character is from a utopian society, but rather than being led through the context of capitalism vs. communism in the underworld of a mechanised society we follow Frank through a dystopian landscape where he discovers the hopes and fears of technology, including the likely consequences of some of the predictions of today’s climate science. And rather than use a dystopian setting like that in George Miller’s *Mad Max* (1979) – where only the strong can survive – I attempted to incorporate my experiences of remote communities in the Pacific islands (2012), south-eastern Africa and Mongolia (2001) because I feel that dystopian societies must in some way be sustainable. This story is about survival, not the end of the world, so it had to mimic societies that survive in difficult circumstances.

My intention was that the reader experiences a sense of foreboding and loss. To achieve this I used warning signs and juxtapositions of present and future. One strategy was to name key
characters. For example, in 1914 Ernest Shackleton led an infamous expedition to the Antarctic in which their ship *Endurance* was crushed. The Captain of *The Diary’s* yacht is Shackleton; the yacht he captains is the *Endurance*; and my journalist Frank is named after famous Australian photographer Frank Hurley who was on the 1914 expedition (Hurley 2001). As a warning sign I also refer to the Farallon islands, a terrifying group of jagged rocks that sit off the San Francisco coast that journalist Susan Casey describes in her non-fiction book *The Devil’s Teeth* (Casey 2005) about living on the islands with the biologists who study the great white sharks that gather there each year. While detailing many gory and terror-inducing moments about the massive sharks it seems the islands themselves are like enormous teeth from some long-dead giant beast. And my ruin of a bunker refers to her description of a lookout the biologists use for shark-spotting; built from cast concrete it was once the base of a lighthouse, but today it’s stripped of anything the elements might claim.

Another present / future juxtaposition was to set the story in the city of San Francisco because it has experienced a number of disasters in the form of earthquakes, but also because the death of a beautiful thing is sad. I named streets but not the city as Frank only sees a ruin of the old world, where people cling to life any way they can. I used landmarks such as the Hobart Building, which does look like it will topple at any moment, as well as the bronze statue of Mahatma Gandhi with a raised hand and currently located outside a ferry terminal. In the story it becomes the sailor’s good luck tradition to touch the hand as they set sail. All this to demonstrate sea level rise and provoke thought about what elements of humanity might survive.

The carbon absorption technology program is another juxtaposition of present and future. The ship CAT07 is based on a present day ship called the Pioneering Spirit, which is a giant catamaran, used for moving offshore drilling rigs (Allseas 2014). It uses massive amounts of fossil fuel to deliver machines that extract the fossil fuel oil, the basis of plastic and CO₂ emitting fuels such as petroleum and diesel. My CAT07 is its opposite: not only is it powered using renewable energy but it’s deployed to remove plastic pollution from the sea and create machines that absorb CO₂.

The characters in *The Diary* are based on three different personal experiences: working in the media, fishing charters and living in developing countries in Africa and the Pacific islands.

After more than a decade of working in the media I have met many hard working and well-intentioned journalists. I also met ruthless journalists with ‘flexible’ ethics. Frank was originally ruthless, ignorant and successful, but I realised that working in a technocracy he wouldn’t last long: in a technocracy accuracy, referencing and balanced reporting would replace the present reliance on ratings and online click-bait so journalists would need to be observant, curious, meticulous and independent, more like a research-based academic than many journalists today.

Since the early 2000’s I’ve been on numerous fishing charters. We normally arrive at the docks around 6am and spend 5 or 6 hours fishing on a small boat off the continental shelf around Bermagui. My reputation is as the most likely to get seasick. On one recent trip we got caught in a storm on our way back. The wind picked up, the rain fell and the sea went from deep green to an oily black. As the swell got bigger the boat was tossed sideways and we had to cling to anything that was bolted down. Several times we thought the boat was going to capsize. We made it back with a few bumps and bruises but we could have capsized and been stranded until help arrived or we somehow made our way back to shore. This helped me to write Frank’s experience on the *Endurance*. 

In my mid twenties I travelled through eastern and southern Africa. It was my first experience of
the hardships of living in poverty. Though I defined myself as a traveller rather than a tourist my
experiences were observational rather than immersive. More recently, and as discussed in my
thesis, my wife, children and I spent time on remote islands in Fiji and Tonga where we lived in the
local communities. For five weeks in each location we cooked, farmed and fished as they did
(although not nearly as well). I used these experiences to write about the locals in The Diary.

The Diary is one part of a larger work of art, a literary piece designed to accompany the sculptural
works. The story was developed to bridge gaps between the scientific consensus about a future
+4°C world, climate change psychology, geo-engineering, Heidegger’s principle of a free
relationship with technology, Lovelock’s Gaia principle and homeostasis, Barad’s politics of the
possible and my sculptural works. Exhibiting these works in a gallery enables the visualisation of
their form, surface, scale, translucency and colour. By placing them into a narrative I can
demonstrate their origin, purpose and speculate on their possible future purpose / intention /
functionality.
5.2 Clouds

My research has involved looking at various materials, techniques and forms or symbols to enable ways for a sculptor to deal with climate change issues in their work. Clouds are a form I had used prior to my PhD research project, which became important for me to revisit when I felt I had exhausted other avenues of enquiry. It began with my drawing of a cloud that was being wrung out by some invisible force, twisting like a sponge that was forcing black liquid to run down the page. It echoed my wish for a reversal of climate change, the extraction of atmospheric pollution and how I felt about the difficulties of my research.

My use of clouds as a symbol for climate change aims to provoke thought about our relationships with nature, technology and the impact we have on the environment. Like an overcast day, the issue of climate change can seem impenetrable and omnipresent, but what is causing these clouds, and how might they occur in the future? Today they still occur in response to ‘natural’ global weather patterns, though these are increasingly disrupted with climate change which is causing more extreme conditions such as drought, where there are no clouds or they are insufficient for rain, to heavy cloud cover that causes flooding, mud slides and other natural disasters.

In the speculative future of The Diary, there are two possible cloud forms I present to provoke thought about what might happen if climate change remains unmitigated and certain geo-engineering solutions are implemented: the permanent darkness of clouds induced by ‘global dimming’, and the floating forms I speculatively imagined to absorb CO₂ from the atmosphere. The
latter are what informed one series of works I created and presented in the exhibition for my final examination, titled *Clouds*.

The juxtaposition of these organic, cumulus-like cloud forms use the meticulousness of geodesic design to create an aesthetic duality which is intended to create a visual nexus between natural and artificial structures, a way for viewers to consider the relationships we have now with nature and technology and what we could have in the future.

Humanity’s impact on the environment, or the globe, is vast and diverse; I have chosen to interrogate what is acknowledged as a problematic impact. The question of impact or no impact became an important factor in my work. It actually deploys one impact of humanity, which is our rubbish, or pollution. Plastic pollution in the ocean is one of these, and our recognition of this is a problem awaiting a solution. My response was to think of a way to use recycled plastic waste to create my natural vs. artificial forms.

My presence, ideas, research and the physical manipulation of my materials will each in turn have some impact on the world, from ephemeral thought to emotional responses to my work and the physical impact I and my work have on the environment. My ideas are represented through the manipulation of material and the arrangement of objects in space. The work I make doing this attempts to represent my thoughts about the future in regards to climate change, psychological barriers and our relationships with technology. The impact of my research is evident in the aesthetic, material and intellectual relationships it has to prominent artists in the field, such as Buckminster Fuller, Olafur Eliasson and Tomás Saraceno. What is not evident are the many different attempts made to translate my ideas, wishes and theories into the physical form of an artwork.
5.3 Shell

The mollusc shell in Figure 124 is unlike any living mollusc and this for two reasons. The first is that this shell is a kinetic sculpture; it spins slowly and horizontally in the gallery space, centimetres from the floor. I thought the spiral form was quite dull as it moved in space, so taking its formal pieces apart and reconnecting them this way allowed the object to constantly reveal and conceal its parts (as Heidegger suggests that technology reveals some truths and conceals others). In Fiji I saw Paula Ligairua overlook the consideration of predetermined form for something far more interesting; in this moment I did the same. The second reason is that it felt more convincing as an object designed to ‘digest’ ocean based CO₂ with an algae-based filter needing temperature control, air and water – and so this moving / living abstracted form came into being.

The structure of a spiralled gastropod shell is often attributed to the Fibonacci sequence, a series of numbers in which each number is the sum of two preceding numbers: 1, 1, 2, 3, 5, 8, 13... and so forth. It is occurs in nature in spiralled forms such as shells as well as in theories of art relating to proportion and beauty. It can be seen in the measurements for squares that compose a simple fractal, a curved line linking each square forming a spiral. These numbers also represent exponential growth.
A mollusc shell symbolises protection and growth; they provide a protective layer around an otherwise soft and vulnerable organism. Looking at a spiral shell is evidence of the organism’s growth; it begins at the centre of the shell and is completed at the opening. The spiral pattern of the shell also represents humanity’s spiralling growth, which has grown exponentially since we started using fossil fuels. But what will happen to this pattern once fossil fuels run out – will the mollusc shell continue to represent our own growth pattern?

I imagine unravelling a spiral shell. I would see a long conical form with tiny ridges indicating the growth of the shell over time. If I put the shell on a piece of paper, with the small end at the bottom left hand corner and traced the form, the drawing would look like the Keeling curve (see Fig. 30), which is the first chart of the steady growth of CO₂ indicated by a steadily climbing line from left to right across the page (Park et al 2013). Its simple saw tooth line indicates the seasonal variations in CO₂ as the vegetation in the northern hemisphere grows in the warmer months and declines in the cooler months.

A mollusc shell is a good metaphor for Technosalvation. Pinning our hopes for the future on geo-engineering solutions such as global dimming is like a panic room solution; ‘at least we can deploy this scheme if it all goes wrong’. We can climb into the protective shell of hope that global dimming offers. But like all shells, there is only one way out: the way we came in. Current geo-engineering solutions like global dimming are a trap because once we are in their ‘shell of hope’ there is no way of knowing whether we can get out again. This transforms hope into anxiety, and if no solutions can be found, despair.

My reasoning for using the Shell form also has a sombre tone. My initial research in the context of climate change looked largely at the science. Graphs like the Keeling curve, ocean heat anomalies and average global temperatures seem only to move upwards as it travels with time across the page. With growing levels of CO₂ so grows the temperature of the atmosphere and the oceans, and so grows my anxiety. The spiral form, also like my anxiety, starts from a centre and slowly builds outward until it stops at an aperture. As a reflection of science’s predictions, the hole is not a beginning – it is an end. No more CO₂ growth, no more anxiety, but also no humans. But at this juncture the hole is also a beginning, a metaphor for the way back to a stable climate, a more innocent or perhaps a more ignorant time – or a time for wisdom and a politics of the possible. Although this work is made from spiral components it is not a spiral but a reconfiguration of the form we know as a spiral. Just as I have re-imagined how we might deal with climate change – I have taken what I can see apart and sought new perspectives in the hope of revealing a truth.
Conclusion

This research has been a journey investigating the possibilities of making sculpture that deals with climate change with a reasonable understanding of the science behind it; then the psychological conditions that have contributed to the problem; and a philosophical investigation that considers some deeper elements. All this before any actual art is made. In truth this is the path I wish I had known to take from the start. The temptation to proceed without a grounded understanding of the issues at play led to some dead ends and impossible choices.

The journey I ended up taking consolidated my practice once I decided that my approach to my chosen subject should start by being ethical, and it revealed itself from there. As Heidegger described Plato’s ‘aletheia’ (truth) as unconcealment, so artists often take a similar approach in their work to reveal truths, and if the work is ethical then it will ring even truer and touch the heart of the viewer.

*The artist’s aim is to turn his audience into accomplices.* (Koestler 1964, 399)

In this exegesis I sought to investigate and explore my process in answering the question: *How can a sculptor contribute to the artistic discourse around issues of climate change without entailing the ethical paradox of deploying materials or methods that may be seen as contributing to it?*

It would seem that part of the answer lies with having a better understanding of materials, technology and production, in my case to avoid ethical paradoxes of environmental impact. Certainly these elements have been important and have caused significant improvement in my practice. Changing from steel to stone to timber and finally to recycled plastic enabled an in depth exploration of the materiality, process and conceptual connections of all these materials to the basis of my environmental concerns, with the imperative for my early research to find a material that had low or no greenhouse gas emissions associated with it, which was then followed by having to decide between using recycled or raw materials.

The argument for recycled materials did not appeal to me in the early stages of my research because I had developed a certain aesthetic in my work that included gently curved planes and carefully crafted joins that I wanted to keep. I could only imagine ugly rusty steel rendered into disjointed forms. But I was also not convinced that using recycled materials was necessarily environmentally friendly; the production of a material that caused environmental damage in its creation is not reduced to zero simply because it is claimed for another use after its intended purpose. I decided that attempting to find a naturally occurring raw material with low emissions would be more consistent with my aesthetics and more ethically sound.

Working with stone initially made sense to me because the material is naturally occurring and does not always need processing or refining. Some stone – like the granite I planned to use – can be picked up from the ground and sculpted. However it was beyond the scope of the tools in my solar-powered studio to use, so I had to use a better equipped but coal-fired studio. Eventually I conceded that stone could not be considered consistent with demonstrating my environmental concerns or avoiding any ethical paradoxes.

My previous investigations about the ethics of materials failed to consider the fact that something must be done with waste products, and recycling or upcycling is a highly practical solution. Although their initial production has caused damage, transforming waste material into a work of
art both removes pollution from the environment, and no damage can be attributed by using new materials as the work is the next incarnation of a material that already exists.

In conjunction with the development of my narrative about a speculative future I began to see a way to express my environmental concerns and avoid any ethical paradoxes. Recycled materials were an excellent candidate for my work. Though there may be aesthetic limitations, recycled material does not have the ethical problems of other materials I tried to use. My final choice of material, HDPE, is what I used in the works of art I submitted for examination and this worked perfectly because this was the material that featured in my speculative narrative: ocean gyre plastic was recycled to make the CO$_2$ absorption machines.

However, the question of materials was merely the beginning.

Beyond ranking materials I was also researching forms I could use to express my concerns. Various abstract forms I produced were not easily ‘interpreted’ by viewers, and then I decided on the symbol of a cloud, a form I had used prior to this research. As discussed, clouds became an appropriate symbol for climate change and related to my concerns about the geo-engineering method ‘global dimming’. I made maquettes from timber and clay-cob, and a student suggested using rubbish. Again my imagination could only picture an ugly mass of garbage. But after more thought I realised that waste did not have to look like waste, and the more I considered them the more they made sense.

An examination of the artistic discourse of climate change revealed gap in the sculptural practices that deal with climate change. These practices are largely split between highly ethical but mostly non-political works of ephemeral art – by artists like Andy Goldsworthy and Richard Long – and large scale often political works that use high-emission materials to create experiential installation-based works – by artists like Olafur Eliasson and Tomás Saraceno. The middle ground seems quite spartan but includes artists like Chris Drury – who treads a fine line between ephemeral and political work – and Theo Jansen – whose kinetic works are powered sustainably. Perhaps my practice sits beside these artists and shares this middle ground as well.

While elements of all of these practices have influenced my own, so have the philosophies of Martin Heidegger, Bruno Latour and Karen Barad with regards to their examinations of the relations between humans and technology. And none of these investigations would have occurred if climate change psychology had not driven my initial interest in this research project. The work of Robert Gifford and Clive Hamilton led me to the works of James Lovelock, Garret Hardin and Leon Festinger. These distinguished artists and intellectuals influenced my pathway to understanding what the root of climate change is and how as an artist I could speculate about how we might restructure our society to deal with the consequences.

The broad question of restructing our society led me to investigate the systems that define our existence. One of them is the earth’s biosphere: it is responsible for the air, water and minerals upon the planet and the plants and animals it supports. We know this because of science. The other system is technology: it is responsible for agriculture, medicine, transport, electricity and more. James Lovelock’s theory of Gaia and Heidegger’s essence of technology consider each of these systems respectively. Neither can be described as divine but both are understood through their behavioural impacts and which seem to be in conflict. This view is conflated in some ways as the details of both concepts are based on very different ideas and perspectives, yet there is no denying that through our use of technology we continue to impact the natural world. Pushing the
homeostasis of Gaia further out of balance and handing the natural world to technology transforms it into a series of standing reserves.

It would appear that the outcome of the battle between Gaia and Technology has already been decided, but Karen Barad suggests that we need to find a ‘politics of the possible’ – a way to responsibly manage current and emerging technologies. This could help control our relationship with technology, to find a way to maintain a standard of living without losing existential freedoms or causing irreparable damage to the environment. Heidegger says the false choice of putting up with technology or avoiding it altogether should be replaced by entering a free relationship with technology – using creativity and wisdom or a piety of thought to work with technology for the good of all. To do this Heidegger suggests that the fine arts could help reveal the truth of the human-technology relationship so it can be renegotiated.

Perhaps creativity lies beyond the entanglements of technology or the homeostasis of Gaia.

...the creative act, by connecting previously unrelated dimension of experience, enables him (the artist) to attain to a higher level of mental evolution. It is an act of liberation – The defeat of habit by originality. (Koestler 1964, 96).

Humans have the capacity to overcome incredible obstacles and in the 20th and 21st century we have done this with the aid of technology and nature. However, we have developed an enframed perception of nature and a submissive relationship to technology. Our future depends on re-establishing respect for nature and renegotiating our relationship with technology. To do this humanity needs to re-imagine and redefine how to achieve sustained action(s), which comes from individual and societal responsibility. As Barad suggests, our politics must also change to suit a course of action.

I believe that we must cease to submit to fossil fuel companies who are responsible for an annual increase of around 1% every year of all CO₂ released into the atmosphere, slowly but cumulatively unbalancing the carbon cycle (Brahic 2007, p1) and recognise humanity as being more than an enframed resource within technology. The balance of natural systems needs to take precedence over economic ones, as according to Hamilton we have already lost the battle for our own survival. Although there are psychological barriers that will always deny it, my sincere wish is for humanity to realise we are destroying the planet and do something about it.

I am not a scientist or an engineer, a politician or an economist. I am a sculptor and not even an eminent one. But I think we must all contribute towards action on climate change for it to be effective. Heidegger suggests that imagination and creativity are keys to poetic revealing. In the context of my research Heidegger’s idea might make it sound like I want my work to change the world. Regardless of whether I do or I don’t, it doesn’t change the fact that no individual can solve a problem like climate change as it creates the various forms of ‘commons dilemma’ I discussed.

My research project is not concerned with how my voice gets heard or how to distinguish myself as an artist. It has been a vehicle for dealing with my own cognitive dissonance, faults and shortcomings in my understandings of environmental issues, climate change and an investigation of other sculptural practices that deal with these subjects. The conceptual and contextual problems of attempting to examine climate change in my own work posed an irresistible challenge for self-improvement. I saw that other artists, much greater than me, had similar problems and that the most successful at getting their message(s) across had achieved it with thoughtfulness.
and compassion. The realisation that the strength of a work of art does not lie in its capacity to answer a question but to ask the right question took some time to arrive at as a large part of my research was devoted to finding answers to the many questions that arose along the way. This created a momentum that was difficult to overcome. As a result, my work appears to suggest possible solutions to climate change. Why couldn’t we absorb CO₂? Why can’t we use the plastic in the ocean? Why shouldn’t we use advanced technologies to seek environmental balance? How could we survive climate change? These questions are beyond my abilities to answer but they are within my capacity to ask. In a sense it seems easy to ask questions compared to the vast amount of hardship required to answer them, but I am not asking these questions without research or qualification, I am asking them with openness and sincerity, with the intention that they will find their way into artistic discourses regarding climate change.
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Appendix:

The Diary
7 December 2184

I’m sitting in the gravel, drinking a cup of coffee while looking at the red sun creeping over the hills, illuminating broken roads and derelict buildings. It must have been a remarkable city before the world ran out of oil, and the sea swallowed entire nations. Before the west Antarctic shelf slid into the sea, and the long droughts scorched the fields. Before they darkened the sky. Before the old world fell, before INZMAT. Winter has set in now and the city’s once famous fog is making a rare appearance. It rolls in over the rusted pillars of the bridge, a gate to a once golden city. It makes me wonder what blue skies must have looked like.

As I get up something falls from my pocket. It’s a dollar. Picking it up the dollar appears in the foreground of the broken city below. A moment of uncertainty and then I carefully return it to my pocket and turn my back to the devastation.

The INZMAT consulate is a bunker on top of a twin peaked hill overlooking the city. A uniformed woman in a spartan four-wheel drive looks at my backpack and offers me a lift down to the jetty. She speaks in the familiar clipped sentences of the Defence services. “I could use the walk,” I say. Her stony gaze returns to the road and as the vehicle rolls away with a faint electric whir and her voice fades as she tells me to avoid the back streets.
I walk down the steep, barren hill which flattens out as I pass vacant lots that had been weatherboard houses, burnt as firewood in the decades since the fall of the lost world. Turning on to Market Street, I can see my path to the docks down the broad and broken street to the sea. Eventually I reach an area with taller buildings. There are more signs of life and I realise I haven’t seen a person for the past hour. A rusty station wagon pulled by a tired grey horse passes by, the car’s windscreen removed in favour of reins, the smell of rancid seal blubber ebbs in its wake. Hidden onlookers in glassless skyscrapers gaze downward. Smoke billows from the upper floors, veiling the slice of grey sky above me.

My job occasionally takes me to places like this, places that were once full of life but now are populated by a few hundred. Somehow this place is different from others, most of the big cities were completely lost. Taken by the sea, seared by drought or pounded by decades of war. In many cases all three. This city’s survival is a miracle wrapped in a tragedy.

A group of kids run across the street, the leader is holding a pen above his head and laughing. The others follow as if he were a celebrity except for the last, who is wiping hot tears from her grimy face.

The old Hobart building where the decision to darken the sky was taken ninety years ago seems ready to topple over and I give it a wide birth. A group of locals huddle around a fire, eating pink and grey flesh. One glances at me, and then my back pocket.
The locals hang about near the waterfront most days, smoking and scowling and sending their kids to beg coins from passing strangers. They dress in sealskin jackets and hemp pants, the combination of stink and itch a possible explanation for their permanent bad temper.

The Endurance is an eighty-foot trimaran from the 2020’s, a relic from the lost world. Its crew work on the CAT program (CO₂ Absorption Technology). A short leathery-faced man approaches me and offers me his hand.

“Frank?” I nod.
“Captain Shackleton?” He nods, grunts.
“You need an induction, we set sail in one hour.”
The Captain shows me around the boat and the safety gear. The aged but functioning components of the rigging and the clean but cloudy resin of the hull and deck seem to be a source of pride for the captain, as if he were introducing me to an old friend. There’s a logo etched on the wall of the cabin, ‘AC 2023’. The tour ends at a narrow shelf with a curtain over it where I will sleep. A lanky man in a black beanie lies awake on the top bunk. “Night watch,” grunts the captain. He scans me skeptically for a moment, then makes his way back on deck.

My last ten minutes are spent on the jetty. The ship’s cook, Rod is new and eager to please, and he hands me a couple of oranges as I pass through the galley.
A local boy, about six years old, stands on the jetty looking at me with piercing blue eyes.
“Where you from?”
“New Zealand” I say. He smiles, revealing widely spaced yellow teeth.
“Got a dollar?” he asks.
I throw him an orange and his eyes light up. He jogs back down the jetty devouring the orange. He says something to the waiting group and holds out the orange. A man slaps him and the fruit flies from his hand and falls into the sea.

A crewman calls to me from the ship, “Time to go.”

The ropes holding us to the dock are released and the sails catch the breeze. The Endurance eases toward a gap in the break wall, the crew line up on the port side. They are reaching into the water. I make my way to the back of the line and see a bronze statue, half submerged, with a hand poking through the surface. One by one the crew touch the hand as they move past. I lean over to touch it too but it’s just beyond my reach. The crew look at me with a mix of anxiety and frustration. “It’s bad luck to miss the hand,” one says.

The bay isn’t busy, just a few fishermen in sealskin canoes. The Endurance, a time traveller, is out of place. It’s big and as we find the wind it feels as though we are flying over the water. The yacht leans to one side, lifting two of the three hulls out of the water. I grab at the air, trying to balance. The crew exchange glances. We pass the bridge and the fog begins to clear, an airship passes us heading southeast on the long trip to New Zealand and I can’t help but think of home.
We head for the Farallon islands, which jut from the sea like a massive set of teeth from some long dead titan. It takes hours to reach them. There’s no sign of life on the islands, just bare rock and the ruin of a concrete lookout at the top of one peak. The shoreline is thick with translucent white sludge. Something in front catches my eye; a storm or land on the horizon.

“CAT off the bow!” shouts a voice.

The enormous vessel reveals itself in cloud grey hues. It has two vast hulls that are connected with a series of steel supports and a platform that bridges the gap between. I take a snap but it’s hard to get a steady shot.

As we push on we see more of the white sludge floating in the sea.

“We’ve hit gold,” says the captain turning to one of the crew. “Set a watch at the bow, lets not hit any nuggets today.”
The sludge, known as ‘gyre gold’ in the program, consists of tiny pieces of plastic from the lost world.

The wind is changing and the deck is constantly busy. I do my best to keep out of the way and find myself at the wheelhouse, which is more like a foxhole than a building. A tall, hefty man is at the wheel.

“Mind if I...”

“No worries,” I offer my hand but he ignores the gesture.

“I’m Frank,”

“Dave.”

“How long do you reckon?” I ask, looking at the ship

“Depends,”

“So we’re in a gyre?”

“Yep,”

“Is it all the plastic that makes it a gyre?” A faint smirk gathers on his face but his gaze never leaves the horizon.

The wind settles behind us and within the hour the Endurance is rolling on the swell below the ship’s sign ‘CAT07’. Its size is staggering. The captain barks orders at the crew and the lifeboat is prepared. I grab as many shots as I can of CAT07 and the crew’s activity.

“Frank!” Shouts the captain.

I step forward, shoving my camera back into its bag.

“You’re with Dave. Be at G deck at six. This is your ID.” He hands me a clear plastic card with my name on it. I have no idea where G deck is but I nod. The crew grin.

I hand my camera bag to Dave in the lifeboat. He flings it to the bow and it slams against the floor.
Five more bodies pile in and the smell of mouldy rain jackets and body odour fills the air.

We are only in the sea for a couple of minutes before we reach a battered staircase attached to the side of the ship, which stains its black hull orange with rust. I get up to go with the crew but Dave holds me back.

The others disappear up the stairs. We make our way to the bow. “Waterproof?” he asks looking at my camera. I nod. We sit in silence as he rows and I take a few shots. The massive bow is beaten and scratched but considering it’s over one hundred years old I have a new respect for our ancestors. I twist the camera strap around my wrist and lean over to get a better angle. Suddenly the lifeboat tips dramatically and I fall in. The water is cold and I struggle for breath. “What did you do that for?” I shout. “Who sent you?” “What?” “You’re here to shut us down! Don’t try to fool me.” “OK, let’s say I’m here to shut you down, even though I’m not, do you think you would be making my job harder or easier right now?” “Write in favour of the program and I’ll let you back in.” “You think I’m here with some secret agenda and you’re going to accept a promise like that? I’m a journalist, I’ll write what I write because it’s newsworthy, and right now you’re in the headlines.” “I’m done talking.” My laughter turns to disbelief as Dave lifts an oar over his shoulder and makes to swing. I dive under
the surface and see a massive structure beneath the ship. I can just make out the bottom of it. It’s a giant net with some kind of pump or turbine at the back. I surface a few meters away from the lifeboat. “So you’re plan is to kill me?” “Stop!” A deep whirring noise makes Dave’s eyes widen. “They’ve started the filter engines” Dave drops the oar and sticks his hand over the side and I grab it. “Don’t make me regret this,” he says.

We return to the stairs and walk up to the deck. I leave a trail of water everywhere. There’s a red board with identity cards on it saying ‘G deck’. Dave points and I put my ID on it.
“I’m sorry I had to do that earlier,” he says, “Don’t be, you’re going to make a great story.”

I follow him around the corner to the top deck of the ship. The scale is mind-blowing. At a guess it seems that the deck is about three hundred metres long and maybe two hundred metres wide. It seems to hold two things, solar panels and vast pipelines of green slime.

“So the panels power the ship?”

“Yes.”

“And the tubes?” Dave walks toward a doorway and I follow. We walk down a long flight of stairs and into some kind of factory.

“The algae go in here.”

“So what do all these machines do?”

“I’ll spare you the details;” He points to a group of machines toward the front, “These ones make clouds,” then the back “And these guys make shells.”

“Why do you call them clouds and shells?” Dave moves toward a vast clear cylinder. Inside are four or five translucent balloon-like objects floating in mid-air like geometric jellyfish.
“This ship sucks up the gold and make these guys.” He gestures toward the clouds, “They absorb carbon dioxide from the sky, and the shells do the same for the sea.”
I take some shots and then we walk toward the shells.

They are in another tank, and have a geometric pattern similar to the clouds but adapted to the spiral form of the shell.
“So how do these things absorb carbon dioxide?”
“See that green colour? Algae.”
“How long will the clouds be up there?”
“Three months usually”
“And then?”
“They navigate by GPS, riding the air currents at different altitudes back to harvest stations.”
“Really? But how...”
“We’ve got enough clouds up there now sharing weather information that they can tell each other what the weather is doing and how to get home.”
“A network.”
“Yep.”

Dave retraces our steps back to G deck where the crew are gathering. I swap data cards from my camera, putting the recorded images in a dry-case for the crossing to the Endurance. I grab my identity card and head down the stairs.

9 December 2184

The weather has taken a turn for the worse and the Endurance is taking a beating. The massive swell is
The Captain dares not set sail as he’s spotted a crack in the mast. The waves seem to be getting bigger and the forecast has a low pressure trough approaching. The intercom’s loudspeaker opens up with a crackle. It’s the Captain. He sounds distracted. “Close the hatches…”

For a moment the crew look at each other, fear overcoming their misery, one runs for the main hatch. The yacht is hit as if by a giant hand that slaps us down into the water. The boat flips over then rolls again, the roar of the wind and waves disappear in snatches as I’m flung about. I can feel that we’re coming back up again. The cabin is filling with water; I can make out the hatch. I scramble toward it. Water is pouring in. A crewman shoves his hand into the torrent and pulls the hatch door. It slams shut under the pressure and he spins the lock wheel.

We look at each other and realise that water is still pouring in further down. Bodies are floating in the water. Some move, some don’t. We crawl over the debris toward the sound of rushing water. The hull is cracked and the hole gushes like a fire hose. One of us grabs a jacket and holds it against the...
torrent. The gushing eventually eases and the roar of the surface returns. The lock wheel on the hatch turns and the Captain’s face appears.

“Get to the lifeboat!” We scramble on deck and see how badly the Endurance is listing. Mountains of water bear down on us. The wheelhouse is a mass of twisted steel and the mast is shattered. I feel in my pocket. The dry-case is still there. There is shouting and moaning. The water is at our ankles. We swing the lifeboat out and cut the lines, scrambling in as the Endurance slips away in the swell.

The Captain takes a head count. Rod the cook has managed to get himself out and into the boat. Dave was in the wheelhouse when the wave hit but somehow held on. His leg looks like a banana and his eye is swollen closed. We are all shaking and swearing, Dave is groaning in pain and the lifeboat continues to roll and dive among the waves.

As the light dies we stretch the canopy over the sides. Some of us can’t shut up - others remain quiet. None of us have anything left to vomit except bile. Its stench makes us gag all the more. For the first time in my life I pray to Gaia. Sometime during the night the seas ease but fear and sickness keep us awake.

In the dawn light we pull back the canopy, I can see the Farallon Islands and beyond that the bay. Sleep finally claims me.

I’m in my bed at home asleep, the room begins to fill up with water but I can’t move; I can only open my eyes. The water reaches the ceiling and I feel the
presence of a large creature gliding through the room. It thrashes its finned tail, rolling its eyes back into its head and flashing its triangular teeth as it rushes toward me...

I open my eyes and Rod is shaking me, “Your turn.” Exhausted, he releases the oars and slumps to the floor of the lifeboat. We’re somewhere between the islands and the bay. I snatch glances over my shoulder until my neck gets sore.

I’ve been at it for a couple of hours and the crew are asleep. I can’t stop my arms from shaking and my back aches. The Captain lifts his head and motions for me to stop. I slide to the floor and he takes the oars. He hums a tune, rowing to the rhythm.

Hours drift by until we pass point Bonita. We head for Fort Point. A few military four-wheel drives are waiting. Although he’s exhausted the Captain clings to the oars until we hit the shore.

I climb out with as much composure as I can muster. Uniformed men and women hand out food and water. A woman pats me on the back, “I told you to avoid the back streets,” We make our way back to the consulate. The quiet whirring of the electric motor sounds unreal, as if I’m somehow meant to be hearing the ocean instead. As we drive up the hill I look at the vacant lots and dismantled buildings and I wonder what will become of the crew without the Endurance. We pull up at the consulate, and everyone gets out except for myself, Dave and the Captain.
We drive down the hill to the waterfront clinic. I collapse into a hard seat in the waiting room and my body seems surprised that it isn’t moving. A pimply orderly wheels Dave toward the operating room. Shackleton stops them; looks Dave in the eye and says, “If you die I’ll bloody kill you,”

I’m tired and head to the canvas shelter of the four-wheel drive to see if I can get some sleep. As I open the door the kid from the jetty tugs my sleeve, “Hey buddy,” I say “Mister New Zealand, you back” “You want a dollar?” the kid looks around and lowers his voice; “Got any oranges?”