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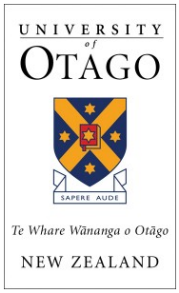

Activism, Science and the Infinite Game

Exploring the relationship between science and environmental activism

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Abstract

According to James Carse, humanity plays two types of games. We play games that are finite and games that are infinite. As human activity alters the biosphere, ecosystems are collapsing, biodiversity is declining, and the climate is changing. In the face of these challenges, the games of scientists, science communicators and environmental activists often align or intersect. This thesis explores the relationship between science and environmental activism, and how they affect one another's finite and infinite games. The discussion covers how they positively affect one another's games and how they negatively affect one another's games, with case studies to illustrate each relationship. I found that science can be a tool in activists' games to reform policy, challenge industries, and empower communities at the forefront of environmental conflicts. Activism can motivate scientific investigations, strategically further the public and political reach of research, and contribute to the epistemic integrity of the sciences. Activism can negatively affect science by obscuring scientific findings, jeopardising the credibility of scientific efforts, and perpetuating a combative approach to environmental challenges. Furthermore, science can negatively affect activism by diverting the public imagination from relationships that enable environmental injustice, by perpetuating epistemic injustice, and undermining emotions in environmental conflicts. This exploration sheds light on how the games of activists and scientists can further the infinite game for environmental justice, but also on the ways their games reinforce socio-political systems that underpin environmental injustices.

Preface

In a garden behind a white cottage grew a tree. This tree was a friend of mine. Someone cut it down. A life that was suddenly wasn't. At seven years old, I could not understand how. At twenty-seven, I still don't. But I do understand that the sudden shock of loss and love set me on a path towards environmental activism, and to the piece of writing you're about to read.

I have found most environmental harms are systemic. Like a tree, the supporting roots of our systems are deep and unseen. Sometimes you can dig through the soil, gradually uncovering a single root. But sometimes there's a windfall, the tree and earth are upturned and thousands of roots are laid bare at once—each as tangled, significant and interconnected as the next. Choosing to turn any one into words without the others has been exceedingly difficult. This thesis, and the two years it took to write it, have challenged me in ways I could never have expected. I have been offered a lot of support and advice throughout this process. Whether I have been wise enough to take it or not, I am exceedingly grateful.

I will start by saying thanks to my compassionate and resilient partner Harry, for being my rock and point of reference through the storms. To my supervisor Fabien Medvecky, for going above and beyond—your insights, patience, and encouragement have been invaluable to me as a student and as a human. To my family, for the love and support that made this possible for me. To Scott, for your kindness. To my friends, classmates, and flatmates, for the hugs and dark humour. To the professors and staff at the science communication department for the lessons, smiles, and support—particularly Sue Harvey, for having time and making space. My heartfelt gratitude to all those involved in the diverse struggles I have mentioned throughout this discussion. And to you, for taking the time to read it.

Finally, thank you to my black and white rabbit, the magical Mr Mistoffelees. For hearing what humans can't hear, for giving advice humans can't give.
Thank you for your wit, thank you for your wisdom.

Structural Overview

This science communication thesis has an academic component and a creative non-fiction writing component. While both components can exist as complete and independent pieces of work, they are connected by the themes and environmental conflicts they explore. Both components were developed simultaneously, with the academic and creative process each shaping and informing the other.

Academic component

The previous abstract describes the content of my academic component. Following my introduction, the background chapter provides the theoretical backdrops to terms and concepts that I draw upon throughout my discussion. The third chapter introduces the theory of finite and infinite games, which I use to explore the relationship between science and environmental activism. Chapters four and five explore how science and environmental activism positively affect one another. Chapters six and seven explore how science and environmental activism negatively affect one another. Chapter eight contains a short summary of findings, recommendations and concluding remarks.

Creative component

My creative component is an electronic iBook, 'Acting Out: the nature of disobedience'. A short introduction to the project appears after the references section of my academic component. The book itself is on a disc in the back cover of this thesis, with a PDF option available. It tells the stories of environmental activists in Aotearoa, spanning from 1997 until 2018. Drawing on a mixture of personal experiences and interviews with other activists, the stories paint a picture of the games we play during environmental conflicts, and the communicative challenges we encounter while playing them.

Contents

1 Introduction

The spark for this thesis came long before I thought to write one. Four years ago, I was sitting in a conference room at the University of Canterbury, sweating. The grey elephant jumpsuit under my jacket was monstrously warm. Anthony and I had (somehow) managed to get our names on the list for a presentation by Bathurst Resources Ltd, a coal mining company. Hamish Bohannan, the managing director, had come to talk to engineering professionals about the future of coal in New Zealand's South Island. Bathurst were trying to expand coal mining on the West Coast, relying on the intensifying dairy industry to float the demand for coal with milk dehydration factories. Bohannan acknowledged that coal was a contentious issue, and asked for the following discussion not to leave the room. I was waiting for an opportune moment to remove my jacket, don the large elephant head hidden in my bag, and raise my cardboard sign, 'CLIMATE CHANGE'. The elephant in the room. But Bohannan beat me to it. Climate change, he began, was happening. Undoubtedly. It would change the way humans and our industries operate. Just as AIDS was one of the crises of the 80's and 90's, he said, climate change was now the biggest current challenge faced by humanity.

In a glance, Anthony and I decided not to disrupt the presentation, but to listen. Bohannan explained that while climate change was important to address, coal was currently a vital resource for humankind, and opportunities lay ahead in New Zealand for more efficient and effective coal use. I stood up, and asked how he could justify starting new coal mines when the Intergovernmental Panel on Climate Change had recently reported that to remain within two degrees of global temperature rise we must leave eighty per cent of known fossil fuel reserves in the ground. Bohannan smiled, and reminded me I was only picking statistics that suited my argument. He said that capping the production of coal would hinder many countries' efforts to develop infrastructure—could we deny those communities the opportunities and standards of living that we enjoyed? I replied that many of those same communities are the most at risk from the sea level rise, droughts, floods, fires and disease that we can expect in a warming world. As coal remains *the* most potent fuel contributing to climate change, we

should cease to open any more mines. The moderator directed the conversation elsewhere, and other audience members asked questions about technicalities and efficiency.

At the end of the presentation, the moderator motioned towards us, thanking us for our "emotional" contribution. He then thanked Bohannan and the rest of the audience for their discussion of practical and scientific factors. Anthony and I were angry. Afterwards, we told the presenters our concerns were more than emotional—they were backed by huge bodies of scientific knowledge and expertise. We were met with the same polite and accommodating condescension. I could not comprehend what I saw as friendly, but firm resistance to the implications of climate research. New coalmines were fuelling a humanitarian crisis to burn water out of milk. Could the presenters see and accept the effects of decisions he played a part in? Then again—can anyone? Hamish Bohannan requested that his discussion of the coal industry did not leave the room. I requested that he cease to support operations that would make for a more dangerous world. Unfortunately, neither request was granted.

In discussions such as these, decisions that diminish the life-giving capacity of ecosystems can be supported, or resisted. Resistance comes in many forms. One can demonstrate resistance to actions that compromise the behaviour of ecosystems and the safety of people who live in them; or one can create resistance to knowledge of how our behaviour affects ecosystems and each other. In this instance, as in so many others, the second mode of resistance proved more effective than the first. It left me feeling like we were playing a lost game. In my experiences of environmental activism, every act, action, and interaction, feels like a game. It can be a game to win someone over, a game to get media attention, or a game to outmanoeuvre a ship exploring for oil. When you land on a piece of emotive communication that affects someone, it's a win. When ancient trees are torn to shreds, or when the media tear you to shreds, it's a loss. We play games to save forests and games to save face. Not all strategies are strategic; some tactics are less tactical than others. There are rules to breaking the rules. Scoring points isn't always the point. Like in any game, there

can be tears of joy and relief, and tears of shock and grief. It's hard to hedge your bets when you're gambling the planet. I was losing enough games to know I wanted to get better at them. Articulating environmental crises, and negotiating the barriers that prevent people from connecting with them, is a very difficult game. There is often a communicative gulf between those with the most power to affect our environmental decisions and the diverse communities affected by them. I wanted to be a more sensitive communicator in spaces where environmental decisions are made. This led me into the discipline of science communication.

Global challenges like climate change create fertile common ground between environmental activists and scientists, with science communication woven throughout and between. Authors in the science communication community have started exploring the role they can play in political activism (Roche and Davis, 2017; Weitkamp, 2017). As I was eyeing up the science communicators' game, science communicators were eyeing up the activists' game. This dance revealed the grounds of my thesis topic. In the following, I will explore the relationship between science and environmental activism. How does environmental activism affect the games scientists are playing, and how does science affect the games activists are playing? I will look at some of the ways scientific knowledge is communicated within the environmental movement, and how this influences the games of both activists and scientists. How do science and activism help one another's play, and how do they hinder it? I hope that this exploration will yield some useful insights for activists, scientists, and science communicators in various areas of the environmental justice playing field. It is fluid and important territory to explore, because in many cases, our ultimate game is the same– keep life, human and otherwise, living. The aim of the game is to keep the game going. And sometimes it doesn't feel like a game.

2 Background chapter

This chapter outlines the theoretical backdrops of concepts that I draw upon in this thesis. Before exploring the relationship between science and environmental activism, I will look at how science is defined, the role of science in decision-making, the discipline of science communication, and what constitutes environmental activism. This will give some context as to how I will use these terms throughout this discussion.

2.1 Defining 'science'

The term 'science' slips in and out of our everyday conversations so often it has become invisible. Our familiarity with 'science' veils its elusiveness as a concept. In this section I will outline some past and ongoing discussions of what is thought to characterise 'science'. As science evolved, and cultural and political landscapes changed, there have been shifts in the ways knowledge is approached, applied and accepted. We use the word 'science' simultaneously to refer both to processes of inquiry, and the pieces of knowledge acquired through those processes. The fluidity of social circumstances and language over time make it challenging to define what science is and what it is not.

A.F. Chalmers (2013) collated discussions and accounts of the scientific method in his book 'What is This Thing Called Science?', first published in 1976. These philosophical accounts aim to determine if there are inherent characteristics of what we label as 'science', and if so, what these might be. In the seventeenth and eighteenth centuries, empiricists like John Locke ([1690] 1967) and David Hume ([1739] 1933) maintained that sense perception alone could plant seeds of knowledge in the mind. Empiricists argue that scientific knowledge must be arrived at through observations of the world's phenomena, obtained via our experience and perception. At this point, what we now call 'scientific' knowledge

was regarded as being derived from observable 'facts' (Chalmers, 2013). This view is insufficient, as our very conception of 'facts' relies on our own theories (Chalmers, 2013). Many authors have critiqued versions of empiricism because they underemphasise the importance of social liberation movements in their accounts of scientific development (Harding, 1986). Softer empiricist positions maintain that something can only be known by our experience (Longino, 1990).

Scientists do not merely record what they witness; they aim to explain these observations with generalising theories (Okasha, 2016). Scientists can use experimentation and intervention to narrow the spectrum of material under observation, and improve the chances that they will observe a particular phenomenon. An explanation of science must then address how theories are reasoned from observations. Scientists can derive theories by deductive and inductive reasoning. An inference is deductive if the premises (or observations) entail the conclusion (Okasha, 2016). If theories are deduced from observations they rely on the implicit truth of observations. Observations are fallible, and deductive reasoning cannot guarantee a correct link between observations and theories. Theories can be deductively sound even when the relationship between phenomena is misinterpreted. Deductive reasoning cannot account for the development of reliable knowledge. Alternatively, inductive reasoning allows theories to extrapolate about the general behaviour of a phenomenon from finite observations of this phenomenon (Chalmers, 2013). The observations do not necessarily entail the conclusion. Scientific theories generated by inductive reasoning do not stand up to deductive reasoning, but they do often provide reliable predictions about the world (Okasha, 2016). The reliability of inductive theories is established by the quantity of observations that support the theory, and the absence of observations that contradict it.

Karl Popper (1969) was the most vocal challenger of inductivism. He argued that theories created by inductive reasoning were too easily adjusted to accommodate new observations. He introduced falsification as a way of determining whether theories were scientific; a theory could only be scientific in nature if observations could be made to falsify it. For example, I might state that I

have the power to turn invisible, but only when no one is looking. Try as one might, no one can definitively prove me otherwise. The falsificationist account maintains that my theory cannot be scientific, because no observations can be made to prove it wrong. Falsificationalists do not hold that unfalsified theories are true, only that scientific knowledge can evolve more efficiently when evidence is sought to disprove theories as opposed to supporting them. The more straightforward it is to falsify a theory, the stronger the theory. However, both the inductivist and the falsificationist positions fall short of providing an account of science that is compatible with some of the field's major developments, such as the Copernican Revolution (Chalmers, 2013). The Copernican Revolution showed a theory (in this case, that the earth was not the centre of the universe) that inductive reasoning could not account for until over a century later when a whole new system of physics developed that enabled observations to match the theory. Early falsifications of the Copernicus theory were relative to the scientific assumptions of the day, and the theory proved itself in spite of falsification, not owing to it. This highlights the complexity of social circumstances that constrain and facilitate scientific discovery.

Thomas Kuhn (1970) challenged the falsificationist and inductivist accounts of science by posing that science is characterised instead by its dominant paradigms. He connected science with revolutions, whereby structures of thinking are continually broken down and replaced by entirely new structures. These new structures form the new norms of the discipline, a new set of baseline assumptions that form a paradigm. Here knowledge can be classed as scientific if it can be accommodated by the prevailing paradigm of the field. Scientific communities become more organised when they conform to a single paradigm, which guides the scientific endeavours in a field until these norms are challenged, collapse, and overturn (Kuhn, 1970). This formation and subsequent breakdown of scientific paradigms provides a more dynamic account of how science moves and changes, but it does not describe consistent characteristics that set science apart from other forms of knowledge. Chalmers (2013) concluded that there was no universal account of the scientific method that could span the spectrum of scientific activity, but that combinations of the

characteristics described could help identify the physical sciences against a background of other knowledge claims.

While many have attempted to identify science amidst other types of knowledge, some argued that it has no intrinsic characteristics that grant it special status. Paul Feyerabend (1975) claimed that no account of science was able to accommodate various scientific movements, challenging all efforts to account for the scientific method in a way that afforded it privilege above other forms of knowledge. He proposed an anarchistic account of knowledge whereby the power held by the supposed epistemic authority of the sciences could be disputed and reclaimed (Feyerabend, 1975).

The mythical objective

Part of the allure of science is that it is observation-based. It was once thought to offer ways of understanding the world beyond the biases of subjective viewpoints. Scientific endeavours inquire for reliable knowledge about the biophysical world, and they have attracted respect and support for their attempts to limit the influence of subjective beliefs and biases over its findings. Simultaneously, science relies on our capacity to observe, a process enabled by subjective positions. Consider the following.

> My experience is no illusion. The objects I see on my desk really exist and are located precisely where I see them. I can prove that: With vision as my only guide, I can reach out directly to the pencil and pick it up... Sensation entails the registration and coding of light, sound, and other energies that impinge on the sense organs... The ability to interpret this information, to extract from it meaningful and useful representations of our world, is called perception.
>
> —Peter Gray, *Psychology* (Tredinnick, 2006, p. 37)

It is our ability to perceive that allows us to make the observations science requires. However, what is a 'meaningful' or 'useful' representation will lie in the eyes of the perceiver. Different beliefs and life experiences guide our attribution of utility and meaning. The verbs 'interpret' and 'extract' demonstrate the active

process that determines what 'meaningful' or 'useful' observations we will make. Our drive to meet social and survival needs play a huge role in our perception, and thankfully so. But does this extend the truth of our observations beyond what *works* for the perceiver in a given context? It has become increasingly clear that our beliefs and theories affect observation processes at a variety of stages. Internal mechanisms called modules control the initial stages of our perception unconsciously, and appear to be influenced by portions of our background knowledge (Godfrey-Smith, 2003). This makes it unclear what theories, or parts of theories are affecting different stages of our observation. Final observations are the reconstructed portions of information we receive through filters of our perception. Yet science is often driven by the belief that there are objects sitting on a desk that we can observe, the belief that there is an objective world. Or, objectively, a world.

It became a norm in the scientific approach to distance the subjective observer from the material observed. The use of first person perspective in scientific observations or results is still often deemed detrimental to the integrity of the discipline. By distancing the observer from the observations, the observations are distanced from the complex patterns of selection and reconstruction that characterises our observation process. Although it is now widely accepted that science is not value-free, the myth of scientific objectivity was well-entrenched in societies where science was regarded as liberating and illuminating (Irwin and Wynne, 1996). These myths of neutrality and objectivity still prevail in various forms and varying degrees (Gray and Campbell, 2009). The values of impartiality and objectivity have been attached to the sciences historically, and may still be mistaken for characteristics of scientific knowledge. These myths can have severe social consequences when science is wielded for political power under guises of rationality and objectivity (Guston, 2001).

My thesis explores science communication within environmental activism. The systemic nature of most environmental challenges makes them inextricable from social inequality. Not only does social inequality affect our physical interaction with our environment; it also shapes our observations and interpretations of the

world. For much of the past three hundred years many people regarded scientific knowledge as an anti-authoritarian influence that could challenge entrenched ideological norms (Godfrey-Smith, 2003). However, there is now a large body of work demonstrating the ways that science performs and reinforces norms and ideologies. Although many authors have rigorously contested notions of universal objectivity, I am choosing to focus on the challenges provided by feminist theorists. This reflects my interest in the ways inequalities affect our construction and perception of knowledge. Of course inequality is not limited to that of a gendered nature, but many of the themes raised in feminist critiques can (and should) be made intersectional to address other forms of inequality. Oppressed publics can be well positioned to challenge the epistemic ground science springs from, because these grounds often fail to account for diversity in the human experience (Medina, 2013).

Assumptions arising from gendered norms and inequality are often central to feminist critiques of science (Nelson, 2008). Numerous authors have documented the ways androcentrism and gendered norms drastically shaped how biological phenomena were observed and recorded in the sciences (Nelson, 2008; Hrdy, 1981; Keller, 1985; Bleier, 1998; Martin, 1991). These criticisms show the extent to which experienced social norms and power dynamics are mirrored in scientists' investigations and observations. They demonstrate that the hierarchies and conventions we internalise play a large role in constructing our accounts of reality. As social assumptions and power imbalances have such a fundamental impact on our perceptions and reconstructions of phenomena, attempts to remove or downplay the subjectivity of the scientist denies accountability for what they have learned to observe (Haraway, 1988).

Donna Haraway (1988) described the suggestions of universal objectivity as a 'god-trick', because it disembodies knowledge. She challenges the transcendence implied by conventional notions of scientific objectivity, where knowledge becomes detached from the particular embodied experience of those who acquired it. Both Harding (1986) and Haraway (1988) emphasise importance of 'situatedness', both of knowers and knowledge. This makes the location and

embodiment of knowers central to knowledge claims. Haraway (1988) proposes a feminist objectivity, sought through the 'partial vision' available to particularly embodied and specifically located knowers. In this account movement towards objective knowledge can only be sought through situated experiences, instead of being sought in spite of them. These works seek to improve the epistemic quality of knowledge produced throughout the sciences, and to revisit the standards for what is considered scientific knowledge.

The real question

The conversations about what science is or should be are thick and tangled. In discussing what we think science is it pays to consider what we think science does. The obvious answer would be that science tries to describe the world (Godfrey-Smith, 2003). But the 'world' that science is trying to describe is up for consideration. Is it a world that exists independently of our experiences of it, and theories about it? A positive response to this question would send us in the direction of scientific realism. Peter Godfrey-Smith (2003) moves towards this position by providing a naturalistic account of 'common-sense realism'.

> We all inhabit a common reality, which has a structure that exists independently of what people think and say about it, except insofar as reality is comprised of thoughts, theories, and other symbols, and except insofar as reality is dependent on thoughts, theories, and other symbols in ways that might be uncovered by science.
>
> —Peter Godfrey-Smith, 2003, p.176

This account is responsive to future scientific discoveries that may reveal new relationships between thoughts and reality. Godfrey-Smith (2003) then goes on to describe a 'scientific realism' as 'common-sense realism naturalised', where an 'actual' and 'reasonable' goal of science is to provide accurate descriptions of reality, and to depict the unobservable elements of reality. If this is an 'actual' and 'reasonable' goal of science then the scientific realist must allow for the *possibility* that scientific descriptions can match the actual behaviour of a universe that exists regardless of our experience and descriptions (Godfrey-

Smith, 2003). A scientific realist can be sceptical that any current theory does in fact describe a universal reality, but not pessimistic to the point that one believes this could never be the case. Godfrey-Smith (2003) positions himself a scientific realist, and it has become a relatively popular viewpoint. I imagine that a large proportion of science practitioners would subscribe to some variation of scientific realism.

Alternatively, science could be trying to describe a world that only exists in response to our experiences and theories. Forms of constructivism and empiricism have challenged scientific realism. Godfrey-Smith (2003) uses the term 'metaphysical constructivism' for the view that it is impossible for a scientific theory to accurately describe a world that exists independently from our experience, because reality inherently depends on what we think. Authors such as Nelson Goodman (1996) occupy the metaphysical constructivist position, using construction to describe the relationship between theories and reality. From this perspective reality is constructed by thoughts and experience. Godfrey-Smith (2003) distinguishes 'metaphysical constructivism' from 'social constructivism', a similar position, which he takes issue with because it does not separate construction of ideas from the construction of reality. I find myself wary of those kinds of separations. Our very preoccupation with 'reality' is enabled by our ideas of what it could be. Separating the construction of ideas from the construction of reality still requires us to have some kind of idea of what a constructed reality might be, thus assuming we can separate the two kinds of construction could be misleading.

Some constructivist positions developed from the works of Immanuel Kant ([1781] 1998), who differentiated the 'noumenal' world, which exists in and of itself, from the 'phenomenal' world, which is the world we experience. Although we can have knowledge about the phenomenal world, we play a part in its construction, and it does not exist beyond our minds (Godfrey-Smith, 2003). Phenomenalism is the position that descriptions and discussions of the 'real' are merely discussions about the patterns of our sensations (Godfrey-Smith, 2003). Perhaps here it is useful to differentiate between existence and access. While the

Kantian view allows for the existence of a reality beyond our experience of it, it does not allow it to be corroborated from our phenomenal world. In other words, existence does not entail access. For the scientific realist, the existence of a 'noumenal' world entails the possibility of access to it and description of it. Michael Devitt (1997) described the position of constructive antirealism in his analysis of realism debates. This is the view that different publics construct different phenomenal worlds by overlaying various concepts to their experience (Devitt, 1997; Godfrey-Smith, 2003). This adds relativism into the mix, where 'reality' varies across cultures and situations. This position does not allow for the existence of a 'noumenal' world that operates beyond people and our subjective variations, because relativism asserts that reality is dependent on, and subject to, context.

Bas van Frassen (1980) puts forward a more moderate challenge to scientific realism. He describes a version of instrumentalism, whereby scientific theories should be tools to help with our experience of the world. Whether or not it is possible to describe a 'real' world with the tools of science is immaterial– what matters is their practical use, and ability to help us make predictions. Van Frassen (1980) suggests that we should aim to develop theories that accurately describe observable parts of the world, but as Godfrey-Smith (2003) points out, there are no clear boundaries around what is observable or what could be made observable by science. However, the idea of science as a pragmatic tool to navigate our phenomenal worlds is appealing. This allows us to use and discuss science without necessarily committing to a position on the existence of a 'noumenal' reality, or the ability of science to describe it.

Towards a working definition

As we've seen, science is not so straightforward to define. Although various criteria have been developed through the ages to demarcate science, no clear set of characteristics has meaningfully set science apart from other types of knowledge (Evans, 2005). Helen E. Longino's *Science as Social Knowledge* (1990) emphasises the social nature of the scientific practice, and the contextual values

and interactions that shape the endeavours of scientists. This view suggests that science is better understood through its social as opposed to its epistemic or methodological characteristics. Irwin and Wynne (1996) also argue that science is socially negotiated, and that institutional structures and relations shape what we accept as science. Sociologists use the term 'boundary work' to describe the process of socially constructing boundaries between science and non-science (Gieryn, 1983). Boundary work is concerned with the fluidity of social interactions and behaviour that characterise the non-fixed territories of the sciences (Guston, 2001; Gieryn, 1999). Practically speaking, what gets classed as 'science' has social justice as well as epistemic implications. It can affect the way we accept and apply knowledge about our world, influencing our behaviour as social agents.

Providing a simplified explanation of 'science' risks understating the immeasurably rich and diverse collective of human experiences that simultaneously create, contest, expand and apply the sciences. However, our continued use of scientific categories suggests that we may perceive some value in imagining an identifiable 'science' (Evans, 2005). With that in mind, in the context of this thesis I will use 'science' to refer to the biophysical, or natural sciences. Drawing particularly on the work of Donna Haraway and Thomas Kuhn, I take the 'biophysical sciences' to be the cumulative methodical efforts to observe and understand the density and distribution of matter and energy around the biosphere, by situated knowers. As I will be discussing science communication within activist movements, social negotiation of what counts as scientific knowledge will depend on the culture and social norms in each context. Paradigms of scientific approach, method and interpretation are constantly being revisited and revised. Loosely, I regard communication as 'science communication' if it echoes a generally accepted paradigm of the scientific community. Here it seems appropriate to defer (perhaps evasively) to Wittgenstein's approach, whereby the meaning of a word is embedded in the social context in which it is used (Wittgenstein, 1965).

2.2 The role of science in decision making

Making decisions is difficult. Making responsible decisions is even more so. Against a backdrop of unnerving social, environmental and climatic change, we're tasked with making decisions regarding an increasingly uncertain future (Chatterton and Pickerill, 2010; Homer-Dixon, 2006). Whether decisions are made at an individual, community or societal level, they present a host of challenges and complexities. In most countries, the power to make decisions that affect how we organise ourselves and interact with the non-human world is concentrated in governing bodies and institutions. These governing bodies are responsible for forming and overseeing policies that direct, enable and constrain human activity. Policies have a huge bearing on most facets of our lives including health, equality, natural hazards, industrial practices, food security, and the non-human environment. Science produces knowledge that is vital to these areas. The interplay between science and policy has massive implications for the trajectories of industrial and community behaviour. In the face of ecological collapse, it is widely argued that we need science to reveal the impacts of existing social and environmental practices, and make recommendations for future policies and problem solving (Kropp and Wagner, 2010; Likens, 2004; Skolnikoff, 1999).

The feedback between science and policy has been the subject of extensive discussion and analysis in science and technology studies (Luján and Todt, 2007; Sarewitz, 1996). Each affect the development of the other, and both shape the movement and interactions of citizens. Scientific knowledge can increase the range of policy options available and makes predictions about their impacts (Dowd and Yosie, 1981). There are greater volumes of research, evaluation tools and identified areas of uncertainty than ever before, making policy formation a tangled and multifaceted process (Kropp and Wagner, 2010). Scientific recommendations for policy are sought at a range of scales. 'Strategic advice' involves a broad long-term scope; such as emission reduction plans to address climate change (Taylor et al, 2003). 'Operational advice' guides the practical implementation of policy, such as developing more energy efficient insulation

and heating methods (Taylor et al, 2003). And importantly, policy makers do not take scientific advice in isolation, but consider it as part of a broad range of intersecting social and economic interests.

Academics take various stances on the roles that science and scientists should play in policy-making (Gray and Campbell, 2009). Public controversy typically arises in response to science in policy areas like natural hazards, health, and ecological wellbeing (Luján and Todt, 2007; Tesh, 2000). Authors such as Blockstein (2002) argue that there are ethical imperatives for scientists to advocate for certain policies. Others, including Lackey (2007), think the scientific community should inform decision processes but refrain from actively advocating for or against policies. This position stems from a belief that political advocacy falls outside the realm of appropriate scientific practice (Gray and Campbell, 2009). It also reflects the concern that scientific knowledge will be taken out of context to satisfy political motivations. Distancing science from politics for the sake of disciplinary integrity raises questions about its social integrity, for political stances of every kind have social and environmental justice implications. David Sarewitz (2004) contended it is unavoidable that science will become politicised both to defend and contest normative frameworks and behaviours. When science reveals the inadequacy of existing policies it can be politicised to further social and environmental justice movements (Gamson, 1992). However, political processes can also erode public trust in science with severe consequences. Following Japan's devastating earthquake and nuclear disaster in 2011, a lack of coherent communication between scientists and the government lead to disinformation and divergent advice around disaster response, jeopardising recovery efforts (Arimoto and Sato, 2012).

Despite increasingly diverse scientific approaches to disputes and solutions, policy-making on urgent matters like climate change continues to be characterised by political gridlock and inertia (Sarewitz, 2004). Jasanoff (2003) contends that the opportunities for scientists to positively influence policy decisions depend on how the issue is framed. Policy makers play large roles in constructing what counts as relevant knowledge, with institutional norms

shaping the ways science is accepted and applied (Nursey-Bray et al, 2014). Kropp and Wagner (2010) suggest the utility of scientific expertise is gauged by its ability to conform to institutional practices and requirements. Power imbalances result in certain values and norms being disproportionately reflected in policy-making processes. With divisions between industrial and governmental science dissolving, the production of science that serves prevailing economic interests is often favoured over science conducted for public interest (Krimsky, 2003; Frickel, 2004). In spite of scientists' efforts to provide recommendations on policy, corporate lobbying has a strong bearing over decisions (McCormick, 2007).

Although the need for science-guided environmental policies is widely recognised, many research efforts continue to be ignored or excluded from political discourse, leading to the 'science-policy gap' (Nursey-Bray et al, 2014). Cash et al. (2006) suggests that this gap is caused by cultural discontinuity between knowledge and governance, which prevents science from being successfully integrated into policies. This reflects tensions between the production of knowledge and its application (Jasanoff, 2003). Improving cooperation between the scientific community and policy-makers is seen as increasingly important (Bultitude et al, 2012). The gap between knowledge generation and implementation has been addressed by developing mechanisms to translate and connect different areas of knowledge (Vogel et al., 2007). These can take the form of boundary objects, such as conceptual models and other resources that enable the transfer of understanding from one social context to another (Guston, 2001). They can also take the shape of boundary organisations such as NGOs or independent bodies that facilitate and mediate communication between disciplines or social groups (Guston, 2001).

One of the challenges in shaping science-based policy is the interpretation of uncertainty. Scientific uncertainty is often made central to socio-environmental controversies (Skolnikoff, 1999). Sarewitz (2004) interprets scientific uncertainty as a lack of continuity between different scientific approaches; however it is often framed as a lack of understanding and used to ignore

scientific recommendations to policy. The broad spectrum of research and expert opinions creates fertile ground for political leaders to cast doubt on the utility and necessity of expertise (Higgins, 2016). This can create serious misinterpretation of policy options and outcomes, with untold social and environmental consequences. Authors such as Ralph Keyes (2004) and Kathleen Higgins (2016) have raised concerns that we are entering a post-truth era. Leaders' claims are no longer held up to rigorous scrutiny because commitment to truth is no longer required nor expected. Apathy towards political dishonesty is enabled in part by strategic public attacks on scientists and intellectuals, and their inability to provide definitive answers to complex questions (Hager, 2014). This has caused major concerns both within and outside of the scientific community. It has sparked discussions about the incentives for scientists and academics to play more active and vocal roles in policy discourse and political dissent (Frickel, 2004; Barton and Tan, 2010; Lemons and Brown, 2011; Conde, 2014).

Of course science does not influence decision-making solely in the confines of policy meeting rooms. Science produces knowledge that interacts with wider publics and our values. Diverse publics both affect, and are affected by, the trajectories of science and policy. Policy decisions are only meaningful to the extent that citizens enact them. The public's daily decisions simultaneously reflect, reinforce, and resist political structures and policies. Science can affect public decisions regarding their health, intellectual pursuits, recreation, and surrounding environment. In addition to this science contributes to the public knowledge of global issues. Scientific knowledge can subvert or enable beliefs about the world (Kitcher, 2003). Insofar as science is regarded as revealing 'truths', it may help shape, reinforce, or erode people's political identities. Scientific knowledge may influence public attitudes towards policy options and political candidates. In other words, it can affect the ways we practice democracy. Over the last two decades it has been more widely recognised that diverse publics have unique access to local knowledge and can valuably contribute to policy decisions (Burgess, 2014). This has seen greater inclusion of publics in policy-making processes about a wide range of biosocial issues. In

discussing the interaction between science and decision-making it is important to consider how scientific discourses interact with the values of diverse publics. Publics determine the characters and policy options that make it to decision tables; they also ultimately determine what and how decisions play out.

2.3 Science communication

The sciences influence a great many facets of life. From the transport, technology and food systems we have come to rely on, to the big challenges we face as the climate, oceans and ecosystems change around us. The scientific community works across regions and across scales, observing, tweaking and testing elements of the physical world, attempting to build us a picture of it. The natural sciences reveal and predict the impacts of anthropogenic activity on the environment, often producing knowledge that sparks and fuels social controversies (Hess, 2011; Venturini, 2009). The vast amounts of observations, hypotheses and theories held in the sciences are not always communicated to wider publics in an accessible manner. Historically, limiting access to scientific knowledge has been a means of maintaining political power and control (McCormick, 2007). Bennett (2003) highlighted the importance of developing communication methods for the development of democracy. The science communication discipline emerged to address the need for scientific knowledge to be disseminated more effectively and equitably to those without a formal background in science. The field also aims to increase awareness about the processes, possibilities, and limitations of the sciences. Science communication has become an immensely broad discipline. Science communicators can be found working with policy makers, developing citizen science programs, making natural history documentaries, curating museum displays, working with NGOs, or assisting with post-disaster communication. In academia, science communication authors evaluate and explore the ways scientific knowledge is distributed, received and applied. Additionally, science communication can aim to popularise science and technology; however this is not an aspect of the field that I will focus on. Predominately I will be discussing science communication that is angled towards social and environmental justice goals.

The field of science communication was once characterised by the 'deficit model' of communication (Sturgis and Allum, 2004). This model assumed that the public deficit in scientific understanding could be rectified by a one-way flow of information from professionals to non-professionals. The assumptions embodied by the deficit model inadvertently reinforced the elitism and exclusivity of the sciences. There are differences between communicating *at* people and communicating with *people*. Much social commentary and research now rejects the deficit model as vastly inadequate for effective communication (Hess, 2011). The notion of the 'public' presented by the deficit model does not account for heterogeneity of prior knowledge, experience and interests present in society. There are no fundamental characteristics of the 'public' because it does not exist as a homogenous entity, rather as multiple non-stagnant groups (Hess, 2011). The critique of the deficit model by Wynne (1992) and other authors lead to participatory models of communication and consultation being developed to involve publics in science-related issues.

Developing better models of science communication is important for helping communities alleviate risks to their health and wellbeing. These risks can come from rapid hazards such as landslides, disease outbreaks, forest fires, earthquakes or tsunamis (Arimoto and Sato, 2012). They can also take the shape of slower hazards such as erosion, desertification, and pollution of air, soil and water. Public engagement models of science communication encourage a reciprocal exchange of knowledge, whereby scientists and publics gain a more comprehensive understanding of each other (Irwin, 2001). These models aim to recognise the broad spectrum of public values that influence the ways scientific knowledge is received and applied. They can also help the scientific community to be more reflexive, and sensitive towards the diverse needs and experiences of publics. In addition to this, newer models recognise the significant contributions the public can make to scientific inquiries. Communities often hold specific knowledge of local history and environmental conditions that can be invaluable to researchers (Burgess, 2014).

Improving dialogue between scientists and non-scientists can help groups navigate social controversies that affect them. The movement towards an inclusive, participatory approach has been dubbed 'democratising science', a campaign to open up access to scientific tools for social empowerment (McCormick, 2007). Effective communication of science can help citizens feel better informed to participate in democratic processes such as referendums, policy submissions, public consultations, and elections. Empowerment can also occur through science-informed community-lead projects. Democratising scientific knowledge can also help bring attention to industrial activities that pose a threat to nearby communities. Marta Conde (2014) observed that knowledge has often been manufactured and manipulated in corporate interests to the detriment of affected publics. More equitable distribution of scientific knowledge can help communities resist corporate co-option and exploitation (Conde, 2014). In these situations effective communication between scientists and communities can create knowledge that positively affects social justice movements.

Science communication is considered an important tool for a healthy democracy. This role requires that science communication be inclusive of all audiences (Massarani and Merzagora, 2014). Although the field has experienced rapid expansion, it is still in its infancy. Guentha and Joubert (2017) recently released a report analysing the trends in science communication research and found a significant bias in the research literature towards Western English-speaking countries. This means that many of the academic works on science communication will come from a Western-centric perspective. This is concerning, because we live in a globalised world. Our activities affect the biosphere, and the major ecological and social challenges we face cut across borders, they are not confined to English-speaking nations. Countries that stand to experience the most significant effects of environmental change are under-represented in the current science communication literature (Guentha and Joubert, 2017). Luisa Massarani (2015) commented on the distinct lack of science communication research being conducted in Africa, South America, and other regions in the global South. Between countries there are epistemological,

cultural and situational differences that will likely cultivate very different relationships between citizens and science. Models of science communication developed in Western countries may not be appropriate or effective across cultures, as there can be large differences in how science is received (Massarani, 2015). Social inclusion is not only important with regards to access of knowledge, but across all phases of knowledge governance and production (Massarani and Merzagora, 2014). In addition to geographical underrepresentation, Guentha and Joubert (2017) noted that male authors from English speaking countries were significantly over-represented in the published literature, showing that gender imbalance is also a feature of the science communication field. While these gaps are gradually being identified and addressed, science communication is currently a Western-centric field of research with predominately male authors. This raises long-term concerns about its impact on democracies and global systems, and creates incentives for continuing efforts to make the field more diverse, sensitive and inclusive.

In the above, I have outlined some of the ways science communication can complement the democratic process, and some of the current challenges and gaps within the field. The broad nature of the discipline requires that it remains responsive to changes both within and outside of the sciences. Andrea Bandelli encourages reflection "on the values that drive scientific endeavour and how they interface, overlap, reinforce or conflict with social and political ones." (Bandelli, 2015, p.1). In the last year there have been an increasing number of discussions over how the field could enhance its contribution to democratic systems. Some have pushed for science communicators to become more outspoken in political spaces and more critical of the status quo. By many accounts, 2016 was a tumultuous year for Western politics. In a recent letter to the Journal of Science Communication, Joseph Roche and Nicola Davis (2017) reflected on how the relationship between science and society may have been compromised by vocal political characters that denounced the value of science-based policies. This sent ripples of alarm through many communities and disciplines, as media air time of climate denialist claims can further delay an already lethargic response to the climate and ecological crises. A number of

social groups also came under appalling fire from political figureheads, provoking criticism of the socio-political trends that saw these viewpoints gain popularity. Discussions of incentives for science communicators to participate more actively in political activism are very much alive within the field (Roche and Davis, 2017). Emma Weitkamp (2017) recently encouraged consideration of the roles science communicators could play in political spaces. Roche and Davis (2017) requested guidance from more experienced members in the field on how to navigate the parallel worlds of social and professional responsibility, expressing concerns about the career risks of being more politically vocal. Rod Lamberts (2017) called on the science communication community to be a lot more vocal and brave by embracing more publicly political spaces. This displays the belief that more vocal communication of science on political stages would have positive social impacts, and benefits to democracy. These discussions join increasing levels of academic interest in the feedback between science and activism (Frickel, 2004; Barton and Tan, 2010; Lemons and Brown, 2011; Conde, 2014).

2.4 Defining activism

Activism is a loaded term. It can prompt assumptions of civil unrest, disruption and idealism. As political protest is so quickly sensationalised, its complexity often goes underappreciated (Huish, 2013). While it may be common to associate 'activism' with illegal activity or social disturbance, the term encapsulates a much broader and intricate set of processes and behaviours. Mounting ecological and socioeconomic challenges have sparked unprecedented movements for social and environmental welfare across the globe (Chatterton and Pickerill, 2010). This makes it a good time to consider what we might mean by 'activism', and how it fits into tumultuous tides of social change.

> As an assemblage of encounters pushing the system towards new states, activism is one of the causes bringing about evolution and re-creation within the system.
>
> —Marcelo Svirsky, 2010, p. 168

Here, Svirsky (2010) describes activism as a series of interactions aimed at changing a social pattern. Just as with evolution in ecological systems, there are pressures and incentives for change within social systems. These pressures come from perceived moral ills and harmful practices, and incentives are created when those processes are re-imagined. Activism attempts to remove the cap from the bottleneck, alleviating social pressures and allowing society to disperse into new spaces and shapes. To define activism, we must first consider the conditions driving social change and recreation. Drawing on literature in geographies of contestation, I will look at how hegemony creates controversies, which drives the emergence of counterpublics, then activist groups. Next I will review some of the qualities that typically distinguish 'activism' from other types of dissent. I will then move towards defining activism by exploring it as a form of political expression, an embodiment of 'self', and a practice. This will help give a better understanding of activism and what I will take it to mean in this thesis.

Broadly, social movements occur to challenge or reinvent status quos. But what forms a 'status quo' and what keeps it in place? The status quo is partially kept in place by what Joseph Gusfield (1981) describes as pervasive 'moral orders', which influence our daily decision-making and standardise behaviour within society. These orders become so entrenched they become invisible, and are often obliviously accepted without due consideration of alternatives. Gusfield (1981) gives the example of the status quo condemnation of driving drunk. The condemnation is so strong that it can prevent a wider conception of the problem and obscure our determination of its causes. For example, the urban design that keeps cars a dominant form of transport, or the increasing distances between the places where we live, work and socialise (Gusfield, 1981). Pervasive 'moral orders' can leave wider structural factors less examined.

These moral orders form part of a society's hegemonic norms. 'Hegemonic norms' are the baseline social assumptions and enactments that often go unquestioned in day-to-day public discourse (Young, 2001). Hegemony can be visualised as what water is to a fish (Anderson, 2004). A fish doesn't know that it's wet, 'wetness' only occurs to those who are dry. Hegemonic norms help to reproduce and reinforce the dominant social structure. When these norms are co-opted and constructed to serve the interests of those in power, it can subdue and manipulate discussion on matters of public interest (Gross, 2005). Social controversies occur when underlying tensions in society come to the surface and erupt to polarise publics and reinvent status quos (Turner, 1978; Gross, 2005). Tomasso Venturini (2009) defines controversies as irreducibly complex social phenomena in which actors disagree. They can span across social groups, including all biological and non-biological entities affected by the disagreement (Venturini, 2009). Controversies can prompt social transformation, whereby publics are created, polarise and dissipate.

Social controversies can highlight the limited capacity of the current social structure to serve a public's interests or provide opportunities. According to a paper brought out by the Free Association (2010), recognising these limitations creates a 'cramped space'. Gilles Deleuze (1995) originally used the term 'cramped space' to describe the constrained conditions that spark a re-imagination of social possibilities. 'Cramped spaces' are where social movements typically germinate (Free Association, 2010). These spaces prompt what Pickerill and Chatterton (2006) call 'autonomous geographies'; "where there is a questioning of the laws and social norms of society" (Pickerill and Chatterton, 2006, p.1). When enough of the public comes together to question current laws or norms, they form what's called a counterpublic (Hess, 2011). Counterpublics often arise in response to moral gaps in human activity, or where avenues for democratic participation are being constricted (Burns and Medvecky, 2018). David Hess (2011) describes counterpublics as an actively informed social mobilisation that counters official publics. They can be made up of networks that advocate for public interest more effectively than existing political power structures (Hess, 2011). As they tend to challenge hegemonic structures of

power, political institutions often attempt to distinguish counterpublics from the lay public opinion (Lezaun and Soneryd, 2007).

Counterpublics challenge dominant social narratives and engage in forms of political contestation and dissent. Robert Huish (2013) describes dissent as contesting dominant 'narratives of place' to mount symbolic challenges to authority, which are then communicated to a wider public. 'Activism' exists as a part of these broad forms of dissent. The term 'activism' is often used in association with groups that act against a power structure, either by influencing policy or attempting to change public attitudes and behaviour (Shaw, 2001; Huish, 2013). This encompasses a broad range of contesting behaviours and advocacy. Activism is often conducted by, or alongside, marginalised groups (Huish, 2013). However, though we often associate activism with counter-hegemonic movements, it is not a necessary feature of activism that it challenges power structures. As Frances Fox Piven (2010) pointed out, activists can also advocate for authority and hegemony. Distribution of the label 'activist' is heavily influenced by presumed political discourses, with left-aligning groups more likely to earn themselves 'activist' titles (Huish, 2013). Authors such as Gavin Brown and Jenny Pickerill (2009) have acknowledged that the concept of activism is inherently fluid, meaning there are no clear distinctions between activist and non-activist. This means there are no distinct values or political ideologies that constitute activism, though these are often implied.

> Activism is the process of understanding, contextualising, and negotiating issues with and on behalf of a have-not community. […] When one becomes an activist, she or he demonstrates a voluntary willingness to effect change.
>
> —Forenza and Germak, 2015, p. 230

In this description, activism is strongly associated with a desire to bring about some kind of change in society. This change is usually sought because of an identified social or environmental injustice. These injustices can be real or perceived. For example, the grievances brought to light by white supremacist activism are likely to be brought about by perceived as opposed to actual

injustices. In his discussion of 'activist geographies' Paul Routledge (2009) kept his definition of 'activism' deliberately broad to account for diverse embodied forms of contestation. Activism exists at a range of scales, involving a fluid congregation and dispersal of citizens around localised and global issues. Grassroots groups often form in response to a particular local issue, and may dissipate once that issue has been addressed. More structured, formal groups, such as Amnesty International or Greenpeace, may address multiple issues. Shared experiences during campaigns or protests contribute to feelings of commonality and collective identity, which help characterise and define activist networks (Brown and Pickerill, 2009). Although size, methods and approaches will differ between groups, a key feature of community activism is the 'relational empowerment' that occurs within and between communities (Christens, 2012). When communities are created to address localised issues, they form a set of norms and articulate a set of values. These localised values constitute what Paul Routledge (2003) calls 'militant particularisms'. Localised campaigns become 'movements' when they converge with other groups across wider scales (Routledge, 2003). From 'militant particularisms' more universal, collective visions and values can emerge (Reid and Taylor, 2000). These collective visions can stretch across different spaces and scales. Instances of activism will involve the 'militant particularisms' of geographically situated campaigns, and also the threads of 'universalisms' that emerge to connect and inform local actions. By enacting both 'militant particularisms' and more universal ideals activism becomes a way of embodying and articulating political values, if only temporarily.

Within academic theory notions of what constitute activism are broad and wide ranging. Yet in public discourse, 'activism' tends to be associated with a narrower set of behaviours, often involving acts of civil disobedience. Civil disobedience is defined as citizens engaging in unlawful behaviour to expose a lack of moral legitimacy in a lawful action or pursuit (Thomassen, 2007). It can bring attention to social injustice or call for a change in policy or governance (Bedau, 1961). Civil disobedience embodies direct physical resistance to a process or system, and is tied to the principle of non-violence (Bedau, 1961;

Lefkowitz, 2007; Thomassen, 2007). While civil disobedience is not a defining feature of activism, it plays an important social and philosophical role in dissent. It demonstrates a deep discontent with social, political, or economic systems. Without legal systems to shape social convention and allocate 'legitimacy' to various actions, civil disobedience would not exist. The existence of legal systems and legitimacy shape 'activism' as a concept, because activism can be characterised by what it appears in contrast to. The controversial nature of disobedience means that it is likely to receive media attention. Communication put out by activist groups around acts of civil disobedience is more likely to enter public and political discourse. For this reason, I will pay particular attention to activism involving civil disobedience in this thesis.

Although the concept of activism is fluid and contested, we often associate certain qualities with activist movements. In Iris Young's 'Activist challenges to deliberative democracy' (2001), Young creates a dialogue between two characters, the activist and the deliberative democrat, to demonstrate some tensions between the two positions. These tensions help characterise activism and the qualities that may distinguish it from other types of political engagement. Deliberative democracy suggests ways for issues to be addressed through public deliberation to promote equality and social justice (Young, 2001). It aims to express a set of ideals that democratic processes can be evaluated against (Young, 2001). The activist character argues that deliberative settings are managed and influenced by prevailing power structures, restricting the outcomes available within deliberations (Young, 2001). They also stress the pervasiveness of normative discourses, and the unequal interests they can represent within deliberative settings. These include power inequalities, discriminative assumptions, and dominant narratives about how society can and should work (Young, 2001). This can make consensus agreements within deliberative settings 'false' or 'distorted', as wider systems of oppression and inequality can distort communication, affecting participants' capacity to conceive of their own interests and others' (Young, 2001; Habermas, 1970). Therefore, the activist contends that social justice cannot be adequately expressed in the deliberative conditions described by the deliberative democrat. The description

of these challenges brings a common characteristic of 'activist' groups to light; that they are likely to level constant challenges at any 'legitimate' process of political engagement and consensus decision-making. Further than that, they may not believe any formalised political process can be capable of delivering social justice outcomes. Their actions may be "aimed not at commanding assent but disturbing complacency." (Young, 2001, p. 687).

> Because [the activist] suspects some agreements of masking unjust power relations, the activist believes it is important to challenge discourses and the deliberative processes that rely on them […] One of the activist's goals is to make us *wonder* about what we're doing, to rupture a stream of thought, rather than to weave an argument.
>
> —Iris Young, 2001, p. 687

These fictional characterisations touch on some important themes of activism and how it might be perceived in contrast with other social change efforts, including those typically seen in science communication. Young (2001) emphasises the need for both deliberative and activist approaches while recognising the tension between them. Activism may not only exist to challenge the particular decisions or actions of bodies, but to also challenge and disrupt the processes of how decisions are made and the structures that they are made within. Behaving in ways that are socially unacceptable can be a way of challenging what's considered acceptable, and how and why it's accepted. Activism cannot be characterised by a fixed set of values, but often by its position relative to an accepted, entrenched, or official process or action. Activists are in a constant process of deconstructing and negating hegemonic norms that thread through society (King, 2005). Because activist groups tend to challenge social structures and modes of organisation, within their networks they often experiment with horizontal organisation and de-centralised methods of decision-making (Chatterton and Pickerill, 2010). The constant process of re-imagining modes of co-operation and decision-making helps activist groups embody the societal shifts they're advocating. Of course, there is great variation in activist groups' actual ability or willingness to embody their political values,

and attempts to embrace alternative horizontal decision-making practices are not always successful (or, I regret to say, practical).

'Activism' can also be understood as a form of political expression. Hannah Arendt (1958) defined 'the political' as action performed in public. 'The political' can refer one's ideas of how society could or should work, informed by values, interior experience, knowledge and ideology (Pulido, 2003). Activism is an expression of how people think society ought to function, often in contrast to the way that it actually functions. Although activism often appears as embodied dissent against isolated operations or processes, these cannot be separated from the wider socio-political contexts in which we live. Hence activism is an embodiment of an alternative politics to the one performed in the operation activists oppose. However, although we often associate activism with antagonism, activism can also enact 'pre-figurative' politics, whereby activists create space to define themselves beyond what they oppose (Free Association, 2010). For example, it is becoming more common for activist groups to set up spaces for emotional reflexivity, processing of trauma, and vulnerability to build emotional connections and a politics of care outside of actions (Brown and Pickerill, 2009). If we employ a broad conception of politics then every action can, in a sense, be counted as political expression. It is more useful to think of activism as a more deliberate form of political expression than the politics we perform day to day, or unconsciously. It is usually aimed at communicating and spreading a particular politics. In his paper towards a defining activism, Marcelo Svirsky (2010) emphasised that activism was an extroverted, public process. This fits with Arendt's (1958) definition of political expression being a public event. However, Joanna Hedva (2016) contested this in her articulation of private forms of 'the political', dissent and resistance, through her experience with chronic illness. Here, political dissent was embodied in private, every day, just by virtue of existing in a state that *the* state does not hold as profitable, valuable, or visible (Hedva, 2016). Defining either the political, or activism as a public affair excludes and diminishes the experiences of those most negatively affected by the status quo. If a characteristic of activism is that it contends with hegemonic norms and current political structures, then challenging the power of

systems to dictate and constrain our intrapersonal worlds should also be considered activism.

Laura Pulido (2003) emphasises that social movements can't be understood without considering their interior dimensions, such as emotions, passions and psychological development. These interior dimensions compose the 'self'. Gavin Brown and Jenny Pickerill (2009) identify the 'self' as an important location of meaning for 'activism'. Often, it is through our interior emotional responses to a behaviour, injustice or political event that we recognise our own dissent towards an action (Forenza and Germak, 2015). Through these experiences we come to identify parts of our 'self' that are harmed by, or disagree with, existing structures or actions. The 'self' is a site where we try to process the internal effects of norms and injustices, and reconcile our emotions with our politics (Brown and Pickerill, 2009). The post modern conception of identity is that it consists of conflicting, fractured 'selves' that are constructed across intersecting social discourses (Anderson, 2004). Daily, we enact 'selves' that are complicit within structures that conflict with other political identities that we hold. We may experience feelings of dissent towards a particular action, and it's the choice to embody and express this experience constitutes activism. We could describe 'activism' as a temporary enactment of a 'self' that demands a change in our behavior or social structure; or the active process of embodying our 'interior dimensions' that conflict with an existing norm or practice (Pulido, 2003). Social movements can be opportunities for individuals to engage in behaviours and expressions of self that align with their social or ecological values (Anderson, 2004). Through participating in political action, alternative expressions of self can adhere to identities of activism (Anderson, 2004). While citizens may only engage with activism movements temporarily, it can affect life-long processes of empowerment, identity formation, and political consciousness (Svirsky, 2010). From an individual's point of view, activism may not be defined by one's appearance at an event or time spent on a project, but in the intricate and subtle ways that dissent shapes and informs our imagination and expression of identity.

However, participation in activism does not necessarily lead to self-identification as an 'activist'. Chris Bobel (2007) found that many participants in a movement did not consider themselves to be activists. This contrasts literature that positions 'activist' as a collective identity formed by participation in a social movement (Bobel, 2007). It is useful, therefore, to think of activism as a practice or performance that individuals may engage in at discreet points in time. This creates a distinction between 'being an activist' and 'doing activism' (Bobel, 2007). This highlights the temporary and contextual nature of activism, and the blurry boundaries between 'activist' and 'non-activist'. People may assume certain roles for a short time or in a particular place, but distinguishing these roles as 'activist' is not always straightforward. A reason that many participants did not identify themselves as activists was because the standards perceived within 'activist' identities were unattainable (Bobel, 2007). 'Activism' was seen as requiring a larger degree of perfection and self-sacrifice that many participants regard as achievable (Bobel, 2007). This may betray a wider trend in assumptions about what activism is, what it looks like, and who activists are. If those engaging in activism could not comfortably assume 'activist' identities, it could mean that their assumptions of what activism is, and who engages in it, are largely disconnected from the actual processes and diverse, fluid communities involved in dissenting movements. Activism involves a wide aggregation of behaviour and identities, some of which persist across spaces and time, and some of which are discreet instances. Conceiving of activism as practice allows us to distinguish it from the identities and political orientations that are commonly associated with activism.

From the discussion above, we can see that activism is a diverse, complex, and multi-scalar phenomena, aimed at transforming our world and the worlds of others. While I do not believe political action has to be public to be considered activism, in this thesis I will narrowly my focus to activism that is performed in the public domain, sometimes involving civil disobedience, which attempts to communicate with a broader public. My working definition is that activism is active and embodied dissent, aimed at changing a practice, norm or structure to achieve social and environmental justice outcomes. As the vast majority of

environmental harms are systemic, I believe activism must involve a broader challenge to political structures and power inequalities that drive our behaviour. I will refer to the aims of 'activists' and 'activism' interchangeably, although I recognise that this is a clumsy, and potentially problematic use of language. When I refer to 'activists' I will refer to a crude aggregation of values and practices that individuals engage with when they participate deliberately and actively in social change movements. Finally, although the distinctions between 'social' and 'environmental' activism are imagined and constructed, I will focus primarily on activities dubbed as 'environmental' activism. One important aspect of environmental activism is that it tends to draw significantly on the biophysical sciences. This creates an interesting relationship between science and activism, which this thesis will explore.

3 Exploring the relationship between science and activism

We live in, and depend on, the biosphere. Geological, hydrological and climatological systems interact to spread life over the planet. In turn, communities of living beings affect the ways these systems work. This makes for an irreducibly complex (and irresistibly interesting) world. A world science tries to explain and activism tries to change (Godfrey-Smith, 2003; Young, 2001). Both science and activism have rocked, swayed and reinvented our societies for centuries (Godfrey-Smith, 2003; Taylor, 2000). Environmental sciences are producing ever more ideas and knowledge about the dynamics of geophysical and ecological systems (Kropp and Wagner, 2010). Establishing the impact of human agency on the environment is exceedingly difficult and exceedingly important for the practical needs of humanity and the goals of science alike (Phillips, 2001). As we develop our understanding of biophysical systems, we are also changing them with accelerating speed and intensity (Lambin et al, 2001). There no longer exists an ecosystem on earth that is not affected by humans (Vitousek et al, 1997). Enter environmental activism from stage left (usually), which aims to influence behaviours that affect the biosphere and its living systems (Chatterton and Pickerill, 2010). Environmental conflicts and controversies like climate change, land degradation, pollution, overfishing and biodiversity loss intersect with environmental science disciplines such as biology, ecology, climatology, oceanography, and geology (Hess, 2011; Venturini, 2009). When I use the term 'environmental science' in the following sections, I'll be referring to the scientific narratives created within these disciplines, which are often used to frame and understand environmental challenges (Conde, 2014).

In the previous chapter, we saw that gaps often exist between knowledge produced in the environmental sciences and our environmental policies and behaviour (Nursey-Bray et al, 2014). The work of environmental activists often intersects with these gaps, and research from the natural sciences often informs the work of activists and NGOs seeking to affect policy and behaviour change (Martinez-Alier et al, 2011). Yet in addition to addressing this policy gap,

activists often take issue with the social structures behind policy processes and decisions. While both environmental scientists and activists attempt to affect the course of environmental conflicts, their values, strategies and goals can differ, clash or align in different contexts. From our current social and ecological predicament, it seems fitting to ask how science and environmental activism might affect each other's causes. Exploring this relationship could provide useful insights to science communicators, who often attempt to bridge communicative gaps and disseminate knowledge during environmental conflicts. These communications affect the trajectories of those conflicts. Current discussions around the role of science communicators in political activism make it timely to consider the scientific narratives used in activism, and their implications for social and environmental justice (Roche and Davis, 2017; Lamberts, 2017; Weitkamp, 2017).

3.1 Finite and infinite games

To explore the relationship between science and activism, I'll draw on the theory of finite and infinite games (Carse, 1986). Humanity plays two types of games– the finite and the infinite (Carse, 1986). Our finite games are fixed in space and time– there is an end– and there is a winner (Harré et al, 2017). Stopping a particular company's logging project is a finite game—those are specific trees you are trying to save, and if you stop that company logging the game is won. Infinite games are not fixed in space and time; the aim of the game is to keep the game going (Harré et al, 2017). Keeping a forest alive is an infinite game– there will always be changes and threats to contend with, the lives of individual beings will start and end, but the aim of the game is to keep the lives coming. Using the concept of finite and infinite games, I will explore the relationship between science and activism from four angles. First I will look at the ways science positively affects activism. Second I will look at how activism can positively affect science. Next, at how activism can negatively affect science, and finally, how science can negatively affect activism. I hope this discussion will give both activist and scientific communities a deeper understanding of one another's

games, and how our finite and infinite games can help and hinder one another. While environmental crises are escalating, so are our abilities to share ideas about our world, and how to shape it. Let's look closely at the narratives we're creating about humanity's current challenges. How might they be affecting our imagination of the world, each other, and all the finite and infinite games we play?

3.3 The games of environmental activism

Environmental movements can be transformative forces, drivers of social and political change (Giugni and Grasso, 2015; Touraine, 1981; Wapner, 2002). To explore the ways that science and activism may affect one another, first we need to consider the social change objectives of environmental activism. At its core, environmental activism endeavours to preserve life, and the capacity of physical systems to support it (Wapner, 2002). It can aim to preserve the lives of individuals, a species, a community of species, or unknown numbers of future species. Conflicts over environmental protection are becoming larger, more diverse and transnational (Gould, Pellow and Schnaiberg, 2004). In spite of this, the world's ecosystems are collapsing under human influence (Bland et al, 2017). The environmental movement aims to alter our behaviour in order to avert, or at least to soften, this collapse.

Environmental activist objectives concern the interaction between human beings and the non-human environment (Wapner, 2002). The vast expanse of human desires, and the elaborate forms of organization and technology we create to meet them, have had a profound impact on the biosphere (Stern, 2000). Environmental activists perceive some of these impacts as harmful. I say 'perceive' because people do not share a homogenous conception of 'the environment', or what constitutes 'harm'. Human behaviour is environmentally significant when it changes the distribution of an ecosystem's materials and energy, or alters the structure of an ecological system (Stern, 2000). Behaviours such as clearing forests or dumping pollutants have a direct effect on

environments (Stern, 2000). Other behaviours can indirectly affect environments by shaping the social context in which people make environmental decisions (Stern, 2000). Indirect behaviours can include supporting or opposing policies that affect our interaction with ecosystems. Environmental activists aim to change behaviours they regard as directly or indirectly degrading land, air, water or species diversity (Wapner, 2002). These efforts and objectives vary widely in terms of organizational characteristics, location, focus, ideology, political stance, and inclusivity of other issues and actors (Wapner, 2002).

Environmental activists' objectives will depend on what dimension of the environment they value, which human behaviours they perceive as harming those dimensions, and what actions they believe would alleviate that harm (Wapner, 2002). Views about which human behaviours are damaging, or whether activism has a positive effect on the environment, are contested. Paul Stern (2000) makes a distinction between environmental intent and environmental impact. The pro-environmental intent of activists in their objectives, strategies, actions, or ideologies, does not necessarily correspond with their environmental impact. The ways we perceive cause and effect, and environmental change, are greatly affected by our norms, hegemonies and cultural contexts. For example, campaigns aimed around better recycling systems may be publicly perceived as having a positive effect on the environment (Pellow et al, 2007). However, the effect of recycling is only 'positive' relative to its hegemonic counterpart. Recycling temporarily stems the volume of human waste entering ecosystems, yet it remains an industrial system, requiring energy and material input; therefore it still operates as a consuming force on ecosystems (Pellow et al, 2007). This shows the objectives of environmental activism do not always align with our perceptions of these objectives, or their environmental outcomes.

In addition to this, the motivations behind 'pro-environmental' activism are by no means homogenous. Stern and Dietz (1994) and Schultz (2000) describe belief norm theory, whereby people demonstrate environmental concern for markedly different reasons. These motivations can roughly be classed as egoistic,

social altruistic, or biospheric (Schultz, 2000). In other words, environmental behaviour can be motivated by concern for the self, other humans, and other living things. Of course distinction between these three classes is arbitrary– these concerns are not exclusive or independent of one another (Schultz, 2000). Perceptions, interpretations and representations of the self, others, and the biosphere will differ between cultures, and between people. Schultz (2000) proposes that we value other people and dimensions of the non-human environment through their perceived relationship to our selves. We vary in the degree to which we include other people and non-human beings in our representations of self (Schultz, 2000). I agree with Schultz (2000) that our feelings of connectivity and interdependence with other living things will affect our environmental concerns; however I do not believe feelings of inclusion, connection, or interdependence are necessary to form, or act out of, concern for others and the environment. The degree to which different concerns motivate activists will affect the scope of their objectives, and the outcomes experienced by different people and ecosystems (Schultz, 2000). Environmental activism motivated predominately by biospheric concerns may downplay its potential to negatively affect groups of people. When concern for humans is the prime motivational factor, activist objectives may display narrower conceptions of the biosphere (Holifield, 2001). Environmental activism motivated predominately by egoistic concern might obscure the effects of activism both on other people and the biosphere, yet activism motivated predominately by concern for others and the biosphere can do harm to the self (Brown and Pickerill, 2009). The scale and motivations of environmental activist objectives are heterogenous, and outcomes may vary in their alignment or abrasion with social justice goals.

Both the formation and analysis of environmental activist objectives depends on how we socially construct the 'environment' (Taylor, 2000). Dorceta Taylor (2000) advocates a social constructivist perspective, suggesting that the 'environment' does not refer to a set of visible, objective, or identifiable conditions, but a set of shared perceptions, meanings and interpretations brought about by collective processes. From this perspective, 'the environment' is not something that lies outside our social world, but is encapsulated in our

assignment of meaning to our social world (Taylor, 2000). Differences in social location such as culture, race, gender and class lead to different experiences of the environment, different relationships with it, and different representations of it (Holifield, 2001; Taylor, 2000). This in turn will lead to differences among social groups in the ways environmental harms and grievances are perceived, constructed and communicated. Different groups of environmental activists will have plural conceptions of the 'environment', which will shape the development of their objectives (Holifield, 2001).

In Western nations environmental activism was initially concerned with discreet conservation campaigns (Park, 2013). Their main objectives included wilderness preservation and encouraging conservative use of resources. These movements were characterized by the Romantic Environmental Paradigm (REP), and included many middle to upper class professionals who benefitted from localized environmental conservation (Taylor, 2000). After the 1960s there was a shift to the New Environmental Paradigm (NEP), which expanded activist objectives to address wider social, economic and political regimes that contributed to environmental degradation (Park, 2013; Taylor, 2000). The objectives fostered by the NEP involve incremental changes to the socio-political system, which is still characteristic of many mainstream environmental movements (Taylor, 2000). Rigorous critiques have been leveled at objectives born out of the REP and the NEP, for they often rest on inherently racist and classist constructions of the environment and environmental controversies (Sandler and Pezzulo, 2007). These critiques and revelations lead to the rise of the Environmental Justice Paradigm (EJP), which challenged the traditional, more narrowly conceived objectives of the REP and NEP (Holifield, 2001; Taylor, 2000). The EJP constructs and communicates environmental conflicts differently based on the recognitions that environmental injustice is inextricable from social discrimination, and that people of colour have fundamentally different environmental experiences to white people (Taylor, 2000).

The EJP arose in response to the social inequality, power imbalances and conflict central to our relationship with ecosystems (Gould, Pellow and Schnaiberg,

2004). While the effects of industrial operations and waste are borne by 'the commons', we do not share common experiences of those effects (Gould, Pellow and Schnaiberg, 2004). Environmental racism constitutes discrimination in environmental decision-making, the targeted exposure of marginalised communities to toxic waste, and the exclusion of people of colour from mainstream environmental movements (Holifield, 2001). By making issues of race, class, gender and culture more central components of environmental activism, the EJP addresses the processes of colonial violence, dispossession, marginalization and oppression that have fundamentally altered interactions and relationships between people of colour and ecosystems (Taylor, 2000; Holifield, 2001). The EJP has lead many environmental activists to develop more contentious and multifaceted objectives to address socio-economic and political systems that a) render some groups more vulnerable with the degradation of ecosystems and b) entrench inequalities in the ways the effects of environmental degradation are distributed or experienced (Gould, Pellow and Schnaiberg, 2004).

The varied campaigns, objectives, and actions of environmental activists can still roughly be classed as arising from the REP, the NEP or the EJP (Taylor, 2000). Objectives will take a variety of forms– both finite and infinite games get played in the environmental movement (Harré et al, 2017). The environmental sciences can feed into these games and affect their trajectories. The finite games of activists involve the objectives you can achieve, in a place or in a time. For example, a finite game to stop a coalmine from opening, to change a law for marine protection, to ban an object like plastic bags, or a practice like whaling. Finite games dominate much of the communications of environmental activism, as campaigns are most effective when they clearly state actionable and achievable goals. The infinite games environmental activism plays are harder to place on a map or a calendar, but they fundamentally affect our relationship with the environment, and all the finite games we play within it. Activists play infinite games to shape narratives, discourses, cultural systems of symbolism, meaning, patterns and norms (Wapner, 2002). Infinite games can be played for intangible things—like perceptions, relationships, emotional connections, and values like

love, care, justice and equality. There are infinite games to tease out the internalized 'social fields' of power and relationships that influence our cultural understanding and behavior (Wapner, 2002). For example, an infinite game might be to address our internalized biases that keep the experiences of other people, or non-people, less visible to us. There is no end to that game, as we are continually learning and changing in the ways we see one another. Communication is another example of an infinite game. What we have the capacity to experience changes, and what we have the capacity to communicate changes, but we will forever be approaching our ability to communicate the human experience in full. These are the infinite games we play and learn by playing, and they won't finish until we do. The changeability of both ecosystems and society means there is no clear or stagnant model for what a healthy relationship between humans and environments look like, but environmental activists strive for it nonetheless.

4 How does science positively influence environmental activism?

The natural sciences yield knowledge about biophysical systems, how we affect them, and how we can live more safely within them. Science is often mobilized as a tool for pursuing environmental justice (Conde, 2014). In the following section, I will look at ways science positively influences environmental activism.

- How does science help activist groups challenge environmental behaviour?
- How does science empower communities in socio-environmental conflicts?
- How does science contribute to activists' credibility?

4.1 How does science help activists challenge environmental behaviour?

While environmental activists try to convince us that some of our interactions with ecosystems are harmful, the environmental sciences try to shed light on the ways humans change ecosystems. Descriptions like 'degradation' and 'harm' are subjective and often anthropocentric, but I interpret ecological harm to be actions that reduce a system's capacity to support an abundance and diversity of life (Bradley et al, 2012). The combination of capitalism, global trade, and commercialism means that most peoples' patterns of consumption in wealthy nations are sustained by industrial alteration of ecosystems (Gould, Pellow and Schnaiberg, 2004). If it's not grown, it's mined—so the saying refers to everything we consume. Where 'it' grows and how 'it' is mined is usually invisible to us; not to mention the who's that harvest, catch, or mine 'it'. In a globalized world, we live at increasing distances from the production processes of materials we connect with (Gould, Pellow and Schnaiberg, 2004). The

environmental effects of our behaviour are not visible or easily anticipated from the social location of our decisions.

Our patterns of consumption are largely determined and driven by production, as outlined in Allan Schnaiberg's 'treadmill of production' theory (Gould, Pellow and Schnaiberg, 2004). The theory shows that production processes evolved to take less time and human labour, but to take more environmental materials and energy. While consumers may 'choose' between the products available to them, decisions regarding production methods, materials, technologies, ecological entities and human labour are beyond their realms of choice (Gould, Pellow and Schnaider, 2004). Positioned at the very end of the treadmill, we sit at various stages of unawareness of the processes that bring us the majority of what we see, eat and touch. We live largely unconscious of what our system takes to function. From land to ocean to climate, our impact is indescribable, but science tries to describe it. Science can help identify, describe, and make visible some of the environmental impacts of behaviours entrenched in our socio-economic system, thus giving activist groups more substantial grounds to contest them (Young, 2001; Wapner, 2002; Gould, Pellow and Schnaiberg, 2004). Knowledge yielded in the sciences can help bring us closer to the distant effects of our system, and help close the gap of understanding between the decisions we make and the impact they have.

Case study:

For much of the population in wealthy countries, purchasing food from supermarkets is a behavioural norm. The vast commercial availability of fish makes it difficult to convince publics that many species are overfished and in rapid decline. Supermarket shelves stocked with fish are visible to many of us– population collapses are not. Our ability to take fish from the sea often outstrips our ability to see what's left. Untold unknowns are at play in the ocean, making any assessment of the world's fish populations exceedingly difficult (Jackson et al, 2001; Clover, 2004). The 2009 advocacy documentary, 'The End of the Line', casts a light on the devastation of the ocean's ecosystems at the hands of

industrial fisheries (Hird and Murray, 2009). Directed by Rupert Murray, the film is a good example of science-informed activism. It explores overfishing through interviews with marine ecologists, fisheries scientists, members of indigenous communities and ex-fishermen. The combined knowledge of fish population dynamics, food webs, environmental pressures, and industrial catch rates to help map the extent of overfishing and its effects (Jackson et al, 2001). The stories link corporate exploitation of the oceans, poor government regulation, and increased fish consumption to steep drops in fish populations, biodiversity, and overall ecological decline (Clover, 2004; Hird and Murray, 2009). This degradation of marine ecosystems contributes to economic instability and food insecurity for coastal communities around the world (Clover, 2004; Hird and Murray, 2009). The marine science communicated throughout the documentary shows viewers how patterns of consumption and production fit into the broader global patterns of ecosystem change.

By incorporating knowledge from fisheries and marine scientists into 'The End of the Line', producers were able to make the implications of our behaviour more visible. Scientists were also able to make predictions about the future ecological consequences of industrial fishing if it continues unchecked (Hird and Murray, 2009). Heavily exploited species like Blue Fin tuna are expected to be extinct before 2050 (Hird and Murray, 2009). This gave the film grounds to challenge the inadequate regulation by governments; the ecologically destructive practices of fishing industries, and citizens' consumption of endangered species (Clover, 2004). Around the film's release, activists launched websites that collated research from the Marine Stewardship Council on the sustainability status of fish species sold in supermarkets (Levitt and Thomas, 2011). Greenpeace activists also orchestrated a stunt against a restaurant serving Bluefin tuna in London (Levitt and Thomas, 2011). The combined pressure of these tactics saw Marks & Spencer terminate their sale of Bluefin tuna, while Waitrose and Sainsburys supermarkets reported an increase in sales of sustainable fish species following the release of the film and websites (Levitt and Thomas, 2011). Richard Harrington, spokesperson for the MSC, said 'The End of the Line' had a lasting impact because it connected fisheries management science with marine

conservation and biodiversity issues, which hadn't been done before (Levitt and Thomas, 2011).

The strategic use of scientific material in 'The End of the Line' helped advance a number of finite and infinite games for environmental activism. The finite games in this campaign were to reduce the supply of threatened fish species by commercial outlets. Another successful finite game was achieving a measurable change in consumer decisions over species consumption. Many of our desires are socially constructed, and industries play a large role in constructing those desires (Schiller, 1996). The marine science communicated in the film might help to socially deconstruct our desire for certain fish species. However, suggesting that consumer decisions drive the behaviour of the fishing industry would ignore the unequal distributions of power intrinsic to the political economy (Gould, Pellow and Schnaiberg, 2004). An infinite game is to foster a culture of ecological responsibility (Wapner, 2002). This documentary made visible the lives and challenges of diverse species that we often consume without question. This has the potential to influence our cognitive patterns of association between our behaviour and its effects on others. Marine ecologists demonstrated that our industrial behaviour is causing a collapse of the ocean's ecosystems (Hird and Murray, 2009). Although science is not morally prescriptive, it may trigger emotional responses that raise uncomfortable questions about what our industrial systems take from earth. By extending our field of vision, science can make us more aware of those our behaviour is ultimately affecting, which helps citizens hold industries and government accountable for their practices (McCormick, 2009). This contributes to the infinite game of environmental activism to change our relationship with ecosystems, and to foster respect for non-human forms of life that share the world with us.

4.2 How does science empower communities in socio-environmental conflicts?

We are part of the ecosystem we inhabit. Rarely does ecological harm take place without collateral harm to communities (Schlosberg, 2013). Socio-economic systems that incentivize ecologically destructive behaviour usually rely on social inequality and exploitation (Schlosberg, 2013). Structural inequality can be maintained through an uneven dispersion of profits, risks, resources and environmental impacts (Paulson et al., 2003; Conde, 2014). This allows the effects of environmental harm to fall disproportionately hard on certain devalued groups (Schlosberg, 2013; Cole and Foster, 2001). Prevailing socio-economic discourses can reinforce socio-political discrimination, oppression, and environmental dispossession. For example, development discourses can help industries maintain control over land and water catchments (Conde, 2014). The gap between those with power over environmental policies and those subjected to their worst effects forms the basis of the environmental justice movement (Taylor, 2000). Power structures that drive social inequality also drive ecologically destructive practices, and an infinite game of environmental activism is to challenge those structures. Addressing power distribution is an infinite game because power is in constant movement and flux, with non-stagnant groups and individuals trying to gain, or regain power over themselves or others. Science, like any form of knowledge, has the potential to affect the balance of power (Conde, 2014). Creating and utilizing scientific knowledge can help marginalised groups pursue environmental justice through political processes and power contestation (Paulson et al., 2003; Conde, 2014; Schlosberg, 2013).

Case study:

Globally, market incentives and mineral depletion are driving extractive industries into more socially and ecologically vulnerable areas (Conde, 2014). Increasing numbers of activist groups, particularly in the global south, are

collaborating with scientists to uncover the ecological and public health hazards posed by industries (Martinez-Alier, 2003; Conde, 2014). Uranium mining has taken place in Niger for over 30 years in colonial and post-colonial conditions, leaving power imbalances deeply entrenched (Conde, 2014). Marta Conde (2014) documented grassroots organisations co-operating with scientists to address the impacts of mining. Marginalised residents of Arlit and Akokan towns are heavily dependent on two Areva mines, giving the company power over communities and sway over policy decisions (Conde, 2014). After a number of workers died, NGO Aghir in'man collaborated with independent radiation-testing laboratory, CRIIRAD (Commission de recherché et d'information independantes sur la radioactivite) to gather contamination samples (Conde, 2014). Combining local knowledge with the scientific expertise revealed a more complete understanding of the mine's impacts (Conde, 2014). The results were later published and publicly released. Accessing and reproducing scientific knowledge helped the activist group to gain legitimacy and visibility; to comprehend and respond to hazards of mining; and to challenge misinformation produced and amplified by industries (Conde, 2014; Michaels and Monforton, 2005). O'Rourke (2002) describes another example of 'community driven regulation' where community groups in Vietnam pressured government bodies with scientific findings until they created better pollution regulation policies.

Scientific expertise can empower communities caught in environmental conflicts by identifying the scale and nature of industrial threats to public health and ecosystems. From a finite game perspective, this provides communities with immediate practical recommendations to alleviate hazardous effects. Activist groups can increase government and corporate accountability by making research publicly available (McCormick, 2009). This can contribute to another finite game of securing safer, and more equitable environmental policies. In terms of the infinite games of environmental justice, the collaboration between communities and scientific experts can positively affect their self-determination regarding health and surrounding ecosystems. Scientific methods can uncover information that challenges the discourses and power structures that keep people subject to disproportionate environmental harm, and keep environments

subject to disproportionate harm by people. This remains an infinite game because we're perpetually in the process of discovering what equality, autonomy and healthy relationships with ecosystems look like, and how we can move towards them.

4.3 How does science contribute to activists' credibility?

Whether environmental activists' objectives are finite or infinite, they must attempt to communicate them. Socio-environmental conflicts involve disagreement over the significance and meaning of an aspect of reality (Benford, 1993). What we determine to be significant and meaningful in the world has a bearing on how we represent and articulate reality. 'Framing' is the term social movement scholars give to processes of signification and meaning construction (Gamson et al, 1982; Benford and Snow, 2000). Activists must 'frame' their environmental grievances and proposed changes. Framing involves deciding what of our world to make visible to others. Activists' framing processes will depend on their construction of the 'environment', how they perceive harm, and where they situate the cause of, and responsibility for, that harm (Benford and Snow, 2000). Frames become the interpretive schemes that help us recognize, process and position events within our experience (Goffman, 1974). They help us attribute meaning to our perceptions, and decide on courses of action (Benford and Snow, 2000). Environmental sciences feed into these framing processes, influencing how environmental controversies are constructed and communicated. This can affect how credible environmental activists' campaigns and actions are taken to be.

Dominant social paradigms encompass the worldview, values, habits and social filters that people use to interpret the world. They are difficult to challenge or replace because peoples' identities and constructed interpretations of reality are entrenched within them (Taylor, 2000). Knowledge produced by the environmental sciences can help give activists more credible grounds to challenge narratives that have previously dominated in environmental conflicts (Conde, 2015). For example, indexes such as GDP are often used to counter

activist narratives, yet they do not adequately account for human reliance on ecological entities that do not pass through the monetary economy (Martinez-Allier, 2003). Water pollution and deforestation by industries may affect a rural community's immediate survival needs, but through a GDP index such ecological losses will appear less significant relative to the economic incentives of extractive projects (Martinez-Alier, 2003). By researching peoples' reliance on their surrounding environment and the ecological effects of industry, scientists can create alternative indexes to rival dominant ones like GDP (Martinez-Alier et al, 2011). This knowledge gives activist groups more credible grounds to challenge narratives that downplay the risks and losses that are invisible in capital assessments (Martinez-Alier, 2003).

Taylor (2000) observes that activist groups tend to shift from a 'rhetoric of rectitude' to a 'rhetoric of rationality'. Scientific narratives can contribute to this shift, as they have historically been associated with values such as objectivity (Haraway, 1988). Governments, institutions, and industries often 'counterframe' activist narratives, by undermining or neutralizing their articulation of reality (Benford and Snow, 2000). Activist groups can use scientific narratives to respond to seemingly legitimate counter-frames. For example, campaigns against oil extraction can now be framed in the context of the global climate crisis (Greenpeace, 2018). Climate change framing can counteract diverting assurances from the oil industry about operational safety in regards to spills and blowouts, and combat criticisms of NIMBYism (not in my back yard) leveled at anti-drilling campaigns. Scientific narratives can also help activists reframe campaigns that are labeled as overly idealistic or emotional.

Case study:

In Namibia, environmental NGO Earthlife campaigned against the expansion of Rio Tinto's Rössing uranium mine, condemning the mine's ill-effects on the health of workers (Shindondola-Mote, 2008; Conde, 2014). However, Rössing denounced their campaign and claims as unscientific and emotional (Conde, 2014). To combat delegitimizing narratives, Earthlife collaborated with CRIIRAD

to conduct the research they needed to launch formal challenges to mining legislation (Conde, 2014). The scientific expertise of CRIIRAD gave Earthlife more credibility when co-produced knowledge was presented to the public (Conde, 2014). This shows that science-informed activism is more likely to be taken seriously in institutional or policy settings.

Accusations of being overly emotional, idealistic or irrational are common tactics used to delegitmise environmental activism. This keeps the depth and complexity of environmental change obscured, and plays a role in disempowering, derailing, and de-energising movements. Finding new narratives for environmental grievances, and our options of response, is an infinite and daunting game of environmental activism that science can make a positive contribution to.

5 How does activism positively influence science?

The objectives of science are as broad and diverse as the persons involved. They span across a vast landscape of interests and values. Although mounting socio-economic pressures favour the production of industrial or profitable science, many scientists' efforts are still directed at producing knowledge for publics' interests (Frickel, 2004). What is (or is not) in public 'interest' is not for any one of us to say, but it can include factors like health, equality, mental wellbeing, ecosystem quality, and safety from violence and environmental hazards. These issues are often entwined with the environmental sciences. In my working definition of the environmental sciences, I describe them as the cumulative methodological efforts to observe and understand the density and distribution of matter and energy around the biosphere. These efforts are often undertaken in the interests of affecting our behaviour within and towards ecosystems. Increasingly, corporate lobbying is influencing the environmental decisions that scientists wish to affect (McCormick, 2007). When science synchronises with political movements it reveals more ways in which science can be used for public benefit (Moore, 1996). Collaborations between scientists and activists can inform the values and strategies of both activists and scientists alike (McCormick, Brown and Zavestoski, 2003). I will look at the following ways environmental activism can contribute positively to the environmental sciences.

- How does activism increase the application of science in environmental conflicts?
- How does activism contribute to methods in the sciences?
- How does activism contribute to the epistemic development of science?

5.1 How does activism increase the application of science in environmental conflicts?

In the face of rapidly changing ecosystems, science can be a tool for social change movements and environmental problem-solving (Kropp and Wager, 2010; Likens, 2004; Skolnikoff, 1999; McCormick, 2009). Although the sciences can help establish the viability, or non-viability, of solutions to environmental challenges, there is debate over the extent to which scientists should be involved in policy advocacy (Gray and Campbell, 2009; Martinez-Alier et al, 2011). Some authors argue that scientists are ethically obligated to advocate for their preferred policies (Blockstein, 2002). Others believe scientists should contribute to policy, but not actively engage in advocacy (Lackey, 2007). Activists groups and NGOs can help alleviate this tension by advocating for the policy changes illuminated by scientists (Gordon, 2006; Gray and Campbell, 2009). This allows scientists to keep their distance from moral and political interpretations of their research. This distance can help preserve publics' faith in the integrity of research processes. Scientists may jeopardise their careers or future research opportunities if they are perceived as having a partisan agenda. This means there are times when activist groups positively contribute to the games of scientists by being politically vocal on their behalf. Activists have more freedom to reframe science to reveal its socio-political and ethical implications (McCormick, 2007). This can extend the influence and relevance of science by putting it in the context of peoples' social, environmental, and political experiences.

During socio-environmental conflicts there is often contestation over possible responses to an environmental grievance. The creation of Marine Protected Areas (MPAs) is a good example of tensions that can arise between scientific and local approaches to ecological restoration. Developing strategies that allow marine environments and fish populations to recover from destructive fishing is a huge challenge. It requires integrated knowledge of spawning rates, migration routes, environmental conditions, and population buffers (Lauk et al, 1998). The

marine sciences have a huge amount to contribute to the development MPAs. Governments, scientists and other interest groups often favour top-down scientific approaches to MPAs, because of prevailing beliefs in a positivist conception of science (Weible et al, 2004). However, these top-down approaches often fail, as they sideline citizens and local knowledge (Weible et al, 2004). The positive environmental effects of scientific strategies are compromised when those strategies don't fit into specific social contexts. Environmental activist groups can facilitate communication between scientists, publics, and policy makers, and help integrate local and scientific knowledge (Gray and Campbell, 2009). They can mediate the tensions and conflicts that arise between actors who advocate for purely scientific approaches to conservation, and those who support more collaborative approaches (Gray and Campbell, 2009). This contributes positively to the environmental sciences because it allows research to be understood and used practically in different socio-political contexts (Lundquist and Granek, 2005).

Activist movements can bring scientific ideas onto the public's radar (de Saille, 2014). Grassroots groups and NGOs often make science more accessible and relevant to communities during environmental justice conflicts (Conde, 2014; McCormick, 2009). They also combat misrepresentations of scientific findings in the media and political discourses (McCormick, 2009). Industries and governments often amplify or manufacture scientific uncertainty in order to downplay the hazardous effects of their behaviour on public health and ecosystems (Michaels and Monforton, 2005). This can erode public trust in the value and reliability of environmental science. Activists' investigations have found that information is often manufactured or withheld by powerful interest groups to manipulate public discourse (McCormick, 2009; Muggli et al, 2001). Activist groups make research available to the public by translating it into articles, stories and reports that are accessible to non-experts (McCormick, 2009). Putting environmental science in context can help publics connect to different facets of a socio-environmental conflict. Environmental activists have strategic expertise, along with media and communication skills that help them maximise the reach and influence of the science they communicate. They can

also identify political pressure points where scientific research can inform and influence the attitudes of publics and policy makers towards environmental conflicts.

Case study:

When the New Zealand government began opening up large areas of ocean for deep-sea oil and gas exploration in 2008, activist groups around the country formed a network of resistance (Bond et al, 2015). In 2012 the Exclusive Economic Zone (EEZ) Act made oil and gas exploration 'non-notified discretionary'; excluding the public from consultation on any phase of the process, including seismic surveying and exploratory drilling. The only groups consulted on the Oil and Gas Block Offers are Iwi, hapu and local body councils. At local council meetings, members of the public can ask to speak to items on the council's agenda. Oil Free activists gathered research regarding the ecological effects of seismic ocean blasting, the predicted risks and impacts of an oil spill, and the contributions of oil and gas to climate change. They presented this knowledge through deputations at the council meetings discussing the Oil and Gas Block Offers.

In Christchurch, the city council strengthened their submission against the Oil and Gas Block Offers with climate research provided by Oil Free activists (Christchurch City Council, 2016). More council members became publicly vocal about the issue (Mitchell, 2016; Small and Hayward, 2016). A media article following an Oil Free deputation quoted the group's claims that further use of fossil fuels would contribute to rising temperatures, and subsequent increases in disease and food insecurity worldwide (Small and Hayward, 2016). At a council meeting in Dunedin, media quoted Oil Free activists' claims that current known oil and gas reserves cannot not be burned if climate change is to be limited to two degrees of warming, a claim which aligns with the scientific consensus (Green, 2015). In both cities some council members resisted discussion of climate change in relation to oil exploration (Green, 2015; Small and Hayward, 2016). These tensions sparked the media's interest, and activist's claims about

climate change were given more space in their articles (Green, 2015; Small and Hayward, 2016). This suggests council discussions and media coverage of the Block Offers would have been much narrower without input from the Oil Free groups.

The Oil Free groups' well-researched deputations raised the profile of council positions on the Block Offers, and made climate change more central to the deep-sea oil controversy (Green, 2015; Small and Hayward, 2016). Stevienna de Saille (2014) describes similar scenarios whereby activists choose to demonstrate through more formal avenues to affect social change. Activists can develop skills to communicate scientific information, or 'interactional expertise', which allows them to be recognised as contributors of expert knowledge (Habermas 1969, 1987; de Saille, 2014). Grounding values-based arguments with scientific knowledge can help activists challenge normative discourses (de Saille, 2014). The global context of climate research collated by Oil Free activists challenged councils' normative discussions on oil and gas exploration, which are often limited to localised risks and benefits. The media coverage of meetings and deputations allowed environmental knowledge to be widely disseminated, broadening the scope of public discourse on deep-sea oil. The councils' previously limited knowledge of oil exploration impacts, combined with the media's validation of activists' scientific claims, positioned the Oil Free groups as valuable sources of knowledge. Activists increased the uptake and application of the environmental sciences by collating and presenting research strategically to inform the attitudes of local councils, making sharp use of a political opportunity.

5.2 How does activism contribute to methods in the sciences?

Environmental activism can affect the direction and practice of scientific research. When activists become involved in scientific endeavours their experiences can help inform research, and facilitate new understanding between publics and scientists (McCormick, 2009). Environmental justice groups often integrate public health issues with ecosystem concerns, and have contributed to

the development of new concepts of science such as postnormal science and public ecology (Bullard, 1990; McCormick, 2009; Gray and Campbell, 2009). These allow for contestation of values and concepts within science (Gray and Campbell, 2009). 'Co-production' is described as a simultaneous evolution of knowledge and social change (Conde, 2014; Forsyth, 2003). It refers to the processes of scientific and local knowledge being gathered, framed and diffused (Jasanoff, 2004). Grassroots environmental groups often possess local knowledge that is invaluable to scientists trying to establish the impacts of industries (Conde, 2014). These groups can often mobilise networks of local volunteers to contribute to scientific research. This can help reveal research gaps, and enhance scientific methodologies and findings.

Case study:

Corburn (2005) described activists in a low-income Brooklyn community calling attention to scientists' inadequate investigation into pollution exposure. Community activists pushed for scientists to take local knowledge into account, and to involve citizens in the research process (Corburn, 2005). A collaboration of science professionals and residents looked further into the effects of local air pollution, the hazards of fishing from a polluted river, and the high asthma rates in the Latino community (Corburn, 2005). New scientific knowledge was co-produced from that research and integrated into policy (Corburn, 2005). These kinds of collaborations can affect scientific strategies, findings, norms and methods, but not without controversy (McCormick, 2009). However, Corburn (2005) argues that this type of co-production does not compromise the value of environmental science, but enhances the value of other types of knowledge. In this case activists were able to push science professionals into including residents' local knowledge in research processes, which lead to more successful approaches to environmental health issues (Corburn, 2005). This contributes positively to the environmental sciences by directing research to areas where it will have the most social relevance.

Additionally, environmental activism can contribute to the practice of environmental science by attracting public attention to scientific controversies. Activists groups publicise scientific controversies with their campaigns, acts of civil disobedience, and media stunts. In addition to raising the profile of various scientific endeavours, this can affect the funding and resources allocated to the environmental sciences. Environmental activism can help reveal the ways environmental science is undermined and underfunded in comparison to industrial science.

Case study:

Days before the Paris Climate Talks in 2015, activists in New Zealand boarded a government-owned scientific research vessel that had recently been refitted to do prospecting work for oil and gas companies. The National Institute of Water and Atmospheric research (NIWA) vessel had previously been used for ocean and climate research. The taxpayer funded refit allowed the vessel to be contracted out to companies prospecting for deep-sea oil and gas off New Zealand's coastline. The activists occupied the vessel and held it in port to draw public attention to the allocation of scientific resources towards private industrial interests and away from public and environmental interests. The controversial nature of civil disobedience granted the action substantial attention in the media (RNZ, 2015). This allowed communications about climate change and the misallocation of scientific resources to reach a wide audience. Actions like this can highlight the market forces that marginalize environmental science and favour industrial science.

These examples show some of the ways activism contributes to the finite games of environmental science. These finite games include raising interest in, and funding for, particular research projects. Environmental activism can assist these games with their media strategies and public awareness campaigns. Other finite games of the environmental sciences include developing methods to answer specific research questions. Activist groups can contribute to these games by facilitating local residents' involvement in research, and calling attention to gaps

in research questions and methods. These efforts also contribute positively to the infinite game of science to develop its processes for producing knowledge that helps us address social and environmental challenges. The game is infinite because different challenges will arise in perpetuity, and new knowledge will always be required to help us meet them.

5.3 How does activism contribute to the epistemic development of science?

Developing and maintaining epistemic integrity is an infinite game in the environmental sciences. It is an infinite game because there is no epistemic standard that we can know of before we reach it, and there's no way of knowing when we reach it. The sciences are constantly reworking and reimagining their practices to produce more 'reliable' knowledge. Those in the social studies of science (SSS) have often criticized the modern sciences for presenting itself as objective or neutral (Gray and Campbell, 2009). Critics maintain that science is socially and culturally contextual, constructing a specific representation of reality through power relationships (Haraway, 1991; Gray and Campbell, 2009). Political activism can challenge and change the way formal knowledge in the sciences is produced (de Saille, 2014). The normative discourses that inform scientific disciplines can lack (or deliberately exclude) significant information that could enhance our knowledge claims and opinions (de Saille, 2014). As environmental activism often appears in opposition to many hegemonic norms, it can inform science of the power relationships and cultural assumptions that direct and constrain its production of knowledge. Environmental justice groups have brought to light the racial discrimination embedded in many environmental research practices (Holifield, 2001). This contributes to the epistemic development of the sciences because it demonstrates that social discrimination can dictate scientific representations of environmental 'realities'.

Epistemic development is an infinite game that is only played if people want to play it. For the game to be played, potential participants in the game have to value integrity and the pursuit of reliable knowledge. Dissent can be epistemically productive (Medina, 2013). Environmental activism can contribute to the epistemic development of the sciences by holding powerful institutions to account for their knowledge claims. Activist efforts to illuminate the actors and strategies behind climate change denial are an example of this. The 'science' manufactured to serve corporate oil interests is not always peer-reviewed, and can lead to confusion and distrust around science as a discipline. By demonstrating the creation of misinformation, and the public relations campaigns that manipulate public and political discourses, environmental activism can help to preserve the value of scientific endeavours in a world some authors are describing as 'post-truth' (Keyes, 2004; Higgins, 2016). Trying to preserve the integrity of, and respect for, the sciences in a 'post-truth' era is an infinite game, because the very concepts of 'truth' and 'integrity' are elusive. They are not necessarily achievable goals, yet we strive for them nonetheless.

6 How does activism negatively influence science?

In their attempts to protect ecosystems, activists often aim to hinder some type of human activity. But activism can also hinder efforts from within the environmental sciences that aim to protect ecosystems. The environmental sciences aim to produce reliable knowledge that can guide our response to environmental challenges, and also to preserve the value and integrity of the discipline. I will explore some of the ways environmental activism can undermine these aims.

- How does activism prevent science from informing environmental controversies?
- How does activism obscure scientific discourses?
- How does activism inhibit engagement with science?

6.1 How does activism prevent science from informing environmental controversies?

Global environmental crises, like climate change, have captured the attention of environmental scientists and activists alike. Keeping ecosystems intact, healthy and functioning is an infinite game of many environmental scientists, and by its nature it can never be 'won'. The environmental sciences try to enhance our understanding of the biosphere and how we affect and respond to environmental change. Activism contests the relationship between humans and ecosystems—by its nature it is controversial. With controversial activism comes a high risk of public backlash, which can create stigma towards certain actors and positions within socio-environmental conflicts. This can have an effect on the environmental science community, whose knowledge keenly intersects environmental controversies. Many activist groups use sensational tactics to call attention to environmental injustice (Fassin, 2009; Juris, 2008). These can involve 'spectacular actions' that put activist concerns into the spotlight and onto

the political agenda (Fassin, 2009; Kapstein, 2001). Environmental science associated with controversial activist tactics risks becoming stigmatised. When activists perform sensational actions, governments and institutions often respond by delegitimising or trivialising a group's behaviour, narratives and campaign (Juris, 2008). Counter-framing is an attempt to undermine a group's articulation of reality (Benford and Snow, 2000). Powerful actors may strategically cast doubt on the credibility of activist knowledge when economic interests are threatened by campaigns (Conde, 2015). If activists have incorporated scientific discourses into their campaigns or actions, publics can encounter this knowledge in the context of these delegitimising counter-narratives. The sciences have done a great deal to establish the scale and urgency of environmental crises, and this urgency is often used to justify controversial stunts. This can mean scientists' work to build knowledge and facilitate action on challenges like climate change can become linked to, and tarnished by, the behaviour of activists.

Activism can prevent science from informing socio-environmental conflicts by derailing, distracting, or dominating public discourse about environmental challenges. Environmental activists often use civil disobedience as part of a strategy to interrupt industrial action, or strategically in itself, as a 'stunt', to stir up media and public attention (Lefkowitz, 2007). When activists perform stunts, the media can construct them as irresponsible, ill informed, irrational, and disruptive (Diprose et al, 2017; Juris, 2008). These constructions help maintain the status quo, because those advocating for change are presented as unacceptable or 'other' (Diprose et al, 2017). Activists can choose tactics that inadvertently distract publics from the complexity, nuances, and implications of environmental crises. Sensational or controversial actions can orient media coverage towards a group's action on an issue, which can dominate the media space, overshadowing knowledge of the issue itself. Scientific discourses that could help facilitate public responses to an environmental challenge may be sidelined or underemphasised in favour of social drama. The actions designed to make an issue more visible can paradoxically keep the depth, context and*-*

complexity of an issue invisible. In these instances the environmental sciences can receive collateral damage by being incorporated into activism.

Case study:

In 2015, Greenpeace performed a publicity stunt to communicate the urgency of climate action to delegates gathered at the UN climate talks in Lima (Collyns, 2015). Activists trespassed on grounds adjacent to the ancient Nazca lines, a UNESCO world heritage site, to lay out large material letters that spelt 'Time for Change! The Future is Renewable'. In doing so, the group left tracks in the earth around the ancient symbols, damaging the fragile historical site. Indigenous peoples of the Nasca culture carved the lines over 1500 years ago (Silverman and Browne, 1991). By trespassing and causing damage to the sacred site, Greenpeace caused widespread offence and outrage in Peru (Collyns, 2015). The action received extensive coverage by major international media outlets such as Vice, BBC, The Guardian, and NBC. In all international media articles the action came across as careless, arrogant, and culturally insensitive (Collyns, 2015). The physical and emotional damage of the action undoubtedly delegitimized the message, and was a profound distraction from the controversies inherent to the UN climate talks. Well-established NGOs often collate and distribute scientific knowledge during socio-environmental conflicts (de Saille, 2014). When NGOs demonstrate poor judgment, it can affect their credibility and the public's trust in the knowledge they provide. Sensational actions like this can derail more informative and constructive discourse around climate change, and conceal opportunities for systemic change.

Case study:

In addition to sensational actions, activists sometimes demonstrate extreme behavior that can lead to stigma and prejudice towards environmental campaigns. In Tasmania, clashes between grassroots activists, police and loggers escalated to the point of violence on many occasions (Safi, 2014). For decades, activists have set up occupations and sabotaged commercial logging operations

to protect Tasmania's old-growth forests. In an article published in the Guardian, Michael Safi (2014) begins his story of the conflict with a description of loggers arriving to work to find human excrement smeared over their equipment and safety gear. The article proceeds with the clashes between activists and loggers, and the painful division it caused within the Tasmanian community. The interpersonal conflict and personalities formed the train of the story. A tactic that employs the use of human feces deviates rather sharply from social norms. It is easy to construct this behaviour as 'extreme'. Commercial logging is less easy to construct as 'extreme' behaviour, even though ecologically and climatologically speaking it has extreme consequences (Milman, 2012). If industries can link environmental research with 'extreme' activism they have more public license to delegitimise or dismiss it. This can create public and institutional prejudice towards, or resistance to, the research and recommendations of environmental scientists. In this case the activists' behaviour did not resonate with the environmental experiences of the majority. Instead, their tactics provoked an emotive response sufficient to divert public attention from the social and environmental effects of commercial logging. Tactics like this can help the media maintain status quos by constructing environmentalists as unacceptable or 'other' (Diprose et al, 2017). This presents a significant barrier to publics engaging with the sheer scale of ecological change wrought by human behavior.

The controversy and polarity sparked by sensational actions can dominate media and public discussion (Juris, 2008). Fassin (2009) asserts that activists' tactics are not always directed at finding meaningful solutions; it's easier to make strong statements about the need for change than it is to change things. In both of these cases, activism prevented science from informing socio-environmental controversies by derailing public discourse. This can negatively affect the finite games of science to provide knowledge that enriches public discussion on particular environmental conflicts, such as deforestation in Tasmania. The distracting elements of sensational or 'extreme' activism can also hinder the infinite game of environmental scientists to build our understanding of the biosphere and its response to human activity.

6.2 How does activism obscure scientific discourses?

In any campaign, environmental activists have a set of goals they are trying to achieve. Science is a part of the wide range of experiences, values and knowledge that contribute to activist objectives (Conde, 2015; Brown and Pickerill, 2009). Activist groups will cherry pick scientific knowledge to support their actions and campaign. In their messaging, activists do not give a full or detailed impression of scientific discourses; rather they select pieces of knowledge for their communicative impact. Sensationalising certain research can obscure publics' understanding of the science intersecting an environmental conflict. Information can become distorted through activist campaigns (Fassin, 2009). Environmental activists communicate science with a view to prompting a particular response, be it a change in behaviour or change in attitude towards an industrial activity. Groups may take knowledge out of context to inspire a desired response from publics or officials. This can inhibit peoples' understanding of the spatial and temporal variation in environments, and our relationships with them. Knowledge particular to localised environmental conflicts may be extrapolated out to broader, more general campaigns. Alternatively, more universalised knowledge may be mobilised to address localised environmental conflicts. In both cases, there is spatial and temporal discontinuity between the environmental challenge and the scientific knowledge being mobilised to address it. This discontinuity will always exist, but it can be exacerbated when activist agendas conceal nuances and differences between environmental conflicts.

Environmental activist groups often use strategies similar to those in marketing or public relations to secure public visibility and support for their cause (Fassin, 2009; Spar and La Mure, 2003). Securing public support for a campaign is often achieved by creating a very clear, simple message, which can be readily understood by publics. The strategic need for clarity and non-ambiguity can appear in tension with scientific discourses, as the environmental sciences are fertile grounds for uncertainty, limitations, variables and competing claims. In their efforts to be clear, inspire confidence, and appear *right* activists can

obscure the nuances and complexities of the environmental sciences. Activist groups and NGOs have often been accused of instrumentalism, whereby the perceived ends justify their means (Fassin, 2009). In cases, NGOs have made false scientific claims to further a particular environmental agenda (Fassin, 2009). Actions like this can have serious ramifications for publics' understanding of, and trust in, the environmental sciences. This can impede scientists' ability to provide publics with useful and reliable information about environmental challenges.

There are times when activist and scientific communities directly clash over responses to environmental challenges. In these cases there is significant potential for environmental activism to disrupt the efforts of environmental scientists. Controversy over genetically modified organisms (GMOs) is a good example of this. Genetic modification technology manipulates the genetic material of organisms by transferring it within and between species. The applications of the science range from advancing particular industrial interests to combatting malnutrition (Mayer, 2005). GMO projects vary widely in their objectives and predicted effects, and most have been met with staunch opposition from environmental activists (Mayer, 2005). Many anti-GMO campaigns are values-based, expressing opposition to humans altering the physical structure of life. This is valid in itself, however the campaigns often default to messaging around unpredictable and hazardous effects, and scientific uncertainty. This messaging is often at odds with the information put out by the scientific community, thus the public understanding of where the concerns and risks are actually thought to lie is obscured. Activist groups successfully created stigma around GMOs, which can simplify and conceal the complex differences between GMO projects, their potential, who benefits from them, and who or what is put at risk. This tension between scientific and activist communities reveals some of the ways environmental activism can distort and derail scientific discourses and public discussion.

Case study:

The development of Golden Rice is a good example of activist and scientific narratives clashing over solutions to environmental challenges. Golden Rice is a genetically modified strain of rice capable of containing far more provitamin A than other species (Paine et al, 2005). Developing more nutritionally dense food would contribute to public health, and lower the amount of arable land needed to meet our nutritional needs. Much of the scientific community involved in the development of Golden Rice celebrated its potential for alleviating malnutrition; however many environmental NGOs, including Greenpeace, remained opposed to its distribution (Mayer, 2005). While many scientists deny that Golden Rice poses any risks to public health or the environment, anti-GMO campaigns are often centred around the unpredictable environmental and public health hazards associated with their development and distribution (Lu and Snow, 2005; Mayer, 2005). By framing many anti-GMO campaigns around scientific uncertainty, activist groups created a blanket stigma against genetic modification. Each GMO project will have vastly different social and environmental effects, and different risks and rewards associated with it. The nature of these differences is obscured by reactionary campaigns. This stigma has lead much of the public to reject GMO projects on principle, and created many more hurdles in GMO research and regulation processes (Mayer, 2005). This has come as great frustration to scientific communities who see genetic modification as a solution to health and environmental crises (Paine et al, 2005; Mayer, 2005). Hardline and polarised positions can distract us from more thorough discussions regarding the potential of GMO projects, and the genuine ethical concerns and risks associated with them. Furthermore, in campaign communications activist groups can conflate the environmental and social health risks of genetic engineering with the hazards of corporate control, power abuse and industrial malpractice. This can create confusion between the dangers posed by GM science itself, and the dangers of power inequality. Obscuring the scientific landscape of an issue can prevent more rigorous discussions about the moral implications of GMOs from taking place. This impedes environmental scientists' efforts to explore and develop options of response to environmental crises. It also harms constructive dialogues

between scientists and publics—an infinite game that, although not always explicit in scientific practices, affects the production and use of scientific knowledge in global environmental conflicts.

6.3 How does activism inhibit engagement with science?

Responding to environmental crises requires us to be receptive to knowledge of an issue and the courses of action available to us. Many powerful institutions have a vested interest in directing public attention away from the implications of environmental science research (Conde, 2014). Knowledge uncovered by the environmental sciences can improve our capacity to respond to, and mitigate the impacts of collapsing ecosystems (Kropp and Wagner, 2010). However, knowledge alone is not enough. To face our current challenges we need a collective response to knowledge. Finding resourceful ways to build community resilience, restore ecosystems, and alleviate the effects of environmental hazards requires that we communicate and co-operate with one another well. There are times when activism can hinder the ability of communities to be receptive to environmental knowledge, and to find the common ground needed to communicate, co-operate and act collectively in the face of challenges (Chatterton, 2006). This usually happens when activists rely on combative tactics that polarise publics (Diprose et al, 2017). This can prevent the environmental sciences from informing our response to ecosystem collapse, and from positively affecting the pursuit of environmental justice.

Although climate change is already proving catastrophic for communities around the world, there is still no agreement over a clear and meaningful path of action (Diprose et al, 2017). Authors have given numerous reasons as to why inertia around climate change prevails, including global complexity, public apathy and helplessness, and no clear adversaries (Chatterton, Featherstone and Routledge, 2013; Randall, 2005). Some responses to climate change, like carbon trading, can occur within the frameworks of a capitalist socio-economic system (Diprose et al, 2017). Many groups, however, argue that climate change cannot be addressed

within the system that caused it, and advocate for more radical actions, changes, and politics (McAfee, 2016; Diprose et al, 2017). With no consensus over what actions should be taken on climate change, binaries emerge between radical action and reformist actions (Diprose et al, 2017). Reformist actions occur within current political and economic structures, while those advocating for more radical changes often find themselves in conflict with prevailing socio-political structures and practices (Diprose et al, 2017). As such, environmental activists often engage in combative strategies of power play that mimic the art of war (Fassin, 2009). Much of the time, political activism relies on the construction of 'friends' and 'foes' (Chatterton, 2006). This creates a feedback loop, as the activist tactics that arise from polarising theories of change can further polarise publics on issues.

Often, activist groups strategically mobilise science to contest power relationships and identify opponents (Conde, 2015). When scientific knowledge is continually used as a strategic tool in political power negotiation, people may come to value science for its argumentative power, as opposed to valuing the knowledge for how it might inform and facilitate creative responses to environmental crises. As environmental activism often aligns with 'leftist' politics, there is a risk that science communicated by activist groups will become associated with a narrow band of the politics. Science is not extricable from the socio-political circumstances that shape it, in other words, it is not apolitical (Harraway, 1988). However, if certain scientific knowledge is strongly associated with one 'end' of a political spectrum, it can become stigmatised, sidelined or discredited in mainstream discourse. The polarity and confrontational communication that activism reinforces can distract people from the broad implications of the knowledge being communicated. This can prevent richer, more intersectional discussions of responses to environmental challenges from occurring amongst publics across the political spectrum. Division can limit the ability of communities to address broader economic and socio-political conditions, which are often the source of communities' environmental conflicts (Diprose et al, 2017).

Combative forms of activism can prevent common ground from being established amongst publics (Chatterton, 2006). Recognising shared ground with other humans is an essential part of transferring knowledge and collectively responding to it. Paul Chatterton (2006) describes the ways egocentricism can overshadow collectivism in spaces were direct actions are taking place. Communication between activists and publics can break down during invasive demonstrations (Chatterton, 2006). This constrains opportunities for co-operative dialogue, and reinforces biases and divisions between 'activist' and 'non-activist' members of the community. Combative situations also impede the dissemination of knowledge, as people often resist information they interpret as a threat to their political beliefs and identities (Pulido, 2003). This can inhibit communication, entrench stigmas or prejudice, and reinforce narratives that prevent publics from engaging with the effects of our behaviour towards ecosystems, and their implications for humanity (Chatterton, 2006).

Case study:

In May 2016, 350.org launched 'Break Free from Fossil Fuels', a global invitation to take non-violent direct action against fossil fuel extraction (Diprose et al, 2017). Over 30,000 people took part in 20 actions around the world (Diprose et al, 2017). In New Zealand, grassroots groups focused on pressuring the ANZ Bank to divest from fossil fuels. These investments amount to 13.5 billion dollars, and help fund companies' extraction of oil, coal and gas (350 Aotearoa, 2016). Diprose et al (2017) interviewed the activists that participated in the Dunedin protest. Around 180 activists sat in rows to block the entrances of three ANZ bank ranches. In previous ANZ actions around the country activists had only targeted a single branch, which had remained closed, but in Dunedin the three branches remained open. Presumably at the request of ANZ, the police made no attempts to move or arrest the protesters, and customers were encouraged to walk over lines of seated activists to get into the bank. The groups' tactic to blockade three banks put them into direct confrontation with ANZ customers, who were not the intended target of the protest. Blockaders reported angry reactions from passers by, and physical violence from customers who kicked,

pushed and stood on them to get to through bank doors (Diprose et al, 2017). Police sanctioned this violence by actively encouraging customers to walk over protesters (Diprose et al, 2017).

The Dunedin action received much greater media attention than other ANZ actions because of the escalated conflict between customers and activists. The most widely circulated video captured an eighty-year-old woman being helped over lines of activists by police (McNeilly, 2016). This footage sparked a far greater public response than previous coverage of ANZ protests around the country (Diprose et al, 2017). Media coverage of the Dunedin action focused on the 'disrespectful' behaviour of activists, who 'forced' the woman to walk through them at her own risk (Diprose et al, 2017). There was widespread outrage at the customers' ordeal, with large volumes of comments on articles and social media, including accusations that the protest had harmed the climate movement (Diprose et al, 2017). The disproportionate amount of media on the confrontation in Dunedin diverted attention from ANZ's fossil fuel investments, the scientific consensus on the hazardous effects and urgency of the climate crisis, and the opportunities we have for collective action.

The polarity and division that combative activism creates can affect the ways we interact with environmental knowledge. Our interaction with environmental knowledge will shape our interaction with the biosphere. Creating reliable knowledge is an infinite game, and the environmental science community is a player. Knowledge can only be 'reliable' if we can rely on it as a practical guide for our thought and action in the world. For knowledge to become reliable, we must try relying on it, and to do this we must be receptive and responsive to it. Countless authors have lamented the inertia on environmental crises despite the large body of knowledge and response options available to us (Chatterton, Featherstone and Routledge, 2013; Randall, 2005; Diprose et al, 2017). Erik Swyngedouw (2009) argues that responses to challenges like climate change are impeded by the self-correcting power structures of capitalism, which delegitimise alternatives and resistance with post-political discourses. These self-correcting power structures affect the ways we receive and process

knowledge. Narratives that reinforce competition, distrust, and division between social groups hinder a collective and co-operative response of the critical mass to environmental knowledge. Actions that reinforce these narratives impede the infinite game of environmental science to help inform humanity on how to live more safely within a variable and limited biosphere.

Our socio-economic 'systems' and self-correcting structures of power are the cumulative effects of our interactions, with one another and our environment. We learn and perform the systems that surround us. The ways we use and communicate knowledge performs a pattern that we demonstrate to others. Activist campaigns often rely on the construction of 'friends' and 'foes', echoing classic narrative structures based on the triad of a hero, a villain and a victim (Chatterton, 2006). This narrative structure is familiar and allows activist campaigns to be understood more easily; however it relies on division between the three positions. During a direct action or campaign, this formula is used to position activists as 'heroes', 'victims' or 'villains' in media and public discourses. This simplistic division results in combative actions and narratives being deployed to address our environmental behaviour. In the context of a campaign, science is often used to assert or justify a position in one of these three roles, or position another group in one of these roles in a narrative. Combative campaigns and behaviour by activists can perpetuate the use of knowledge as a tool of division. This can affect peoples' reception of environmental knowledge and perception of its implications. It can create barriers to engagement with, and trust in, environmental science. If knowledge and its implications are not trusted and explored, that knowledge is not given the chance to become a reliable guide for our behaviour. The combative narratives perpetuated by activists can disrupt the infinite game of environmental scientists to make knowledge of our changing biosphere visible, and reliable.

7 How does science negatively influence environmental activism?

Increasingly, environmental activist groups are looking beyond specific campaigns and calling for systemic change (Chatterton, Featherstone and Routledge, 2013). This demonstrates a growing awareness that most environmental harms are inseparable from the unequal socio-political relationships that enable them (Godfrey and Torres, 2016). Climate change, in particular, is widely acknowledged to be systemic (Godfrey and Torres, 2016). If a major game of environmental activism is to strive for environmental justice, a requisite game must address the power imbalances that regulate our interactions with ecosystems. Changing our systems is a complex game. While many activists' campaigns traditionally positioned targets, tactics and objectives in tangible locations, socio-political systems of inequality are created throughout any and all of our relationships. Pursuing systemic change requires that activists pose a deep challenge to often-invisible norms of interaction and communication (Lamberts, 2017). Scientific narratives have become normative and 'status quo' in our communications about climate change (Kahan et al, 2012; Medvecky, 2017). These prominent narratives influence our imagination of the world. They affect how we perceive and interact with one another, and how we create or challenge inequality. In their letter to the science communication community, Roche and Davis (2017) asked, "Is it not our responsibility to call out inequality in whatever form we encounter it, be it social inequality, oppression of cultural groups, violence against women or any other threats to democracy?" (Roche and Davis, 2017, L01). In this section, I argue that the dominance of scientific narratives in public discourse can prevent us from encountering inequality, oppression, and violence; and prevents us from being deeply confronted by inequality, oppression and violence. Consequently, scientific narratives can see systems of social and environmental injustice upheld and unchallenged. The following questions explore three ways that science negatively influences the games of environmental activism. Although there are three questions, the themes examined in each section are overlapping, interrelated and often

inseparable from one another. These questions explore how prevalent scientific narratives maintain socio-economic and political systems that activists are trying to change.

- How does science constrain the social imagination of environmental conflicts?
- How does science contribute to epistemic injustice?
- How does science undermine emotion in environmental conflicts?

7.1 How does science constrain the social imagination of environmental conflicts?

Our imagination of the world affects how we behave within it. We construct, contest and contemplate our conceptions of reality by sharing imaginings of what the world is, how it works, and how we experience it (Diprose et al, 2017). When we communicate, we can reinforce or challenge systems of inequality by affecting the 'social imagination' (Medina, 2013). Our imaginative inclinations are affected by what is made visible to each of us, and what has remained (or been kept) invisible. In turn, this hones our selective attention, leading us to highlight aspects of societies and environments over others (Longino, 1990; Medina, 2011). The prevailing social imagination that we're exposed to affects what we learn to notice, and what we learn not to notice. We become sensitised to certain knowledge and knowledge systems, and desensitised to others. This shapes what we 'know', what we conceive as being possible to 'know', and the ways we conceive of 'knowing'. This determines the kinds of environmental interactions we pursue. An infinite game of environmental activism is to explore, or re-explore, healthy human-ecosystem relationships. The aim of the game is to keep healthy relationships going. How well we play that game depends on what we imagine ecosystems, ourselves, and others to be.

> Both our ability and our inability to relate to others (and to particular aspects of ourselves) is mediated by the social imagination, the kind of imagination that opens our eyes and hearts to certain things and not others, enabling and constraining our social gaze.
>
> —Jose Medina, 2011, p.22

The social imagination shapes and informs the scientific process, and simultaneously scientific narratives enhance the collective imagination. Historically, the 'myth' of dispassionate inquiry has granted the sciences epistemic dominance, giving them prestige and prominence within the 'social imagination' (Jaggar, 1989; Nowotny et al, 2005; Medina, 2013). But just as scientific narratives can open our eyes and hearts to certain things, they can close them to others. When science directs our social gaze towards certain phenomena, our gaze can be diverted from aspects of our relationships that shape our perceptions, our knowledge, and our behaviour. Scientific narratives can conceal and perpetuate social assumptions that lie at the root of structural injustices. As Alison Jaggar noted, "the modern Western conception of science […] reflects the imperialism, racism, and misogyny of the societies that created it." (Jaggar, 1989, p.162). Scientific narratives position social assumptions as features of the world, and the epistemic credibility of the sciences means they are less likely to be recognised or challenged. Consequently, science has power to perpetuate the assumptions and prejudices that underlie structural injustice.

For example, Emily Martin (1991) describes how patriarchal assumptions and traditional male-female romance narratives heavily influenced biologists' observations of human fertilisation. Researchers recorded active, competitive behaviour of the sperm on a 'mission' to 'assault' or 'penetrate' the egg; and the passive, 'dormant' behaviour of the egg waiting for 'rescue' (Martin, 1991, p.490). A gendered social imagination kept early researchers' gaze from seeking or seeing an egg's pro-active chemical processes to aid or hinder fertilisation by different sperm cells (Martin, 1991). Researchers' language to describe female sex cell processes implied wastefulness, fragility, passivity and dependence, while language used to describe male sex cell processes implied strength, action and efficiency (Martin, 1991). The very notion of assigning *cells* a 'gender'

demonstrates how strongly the social imagination encourages us to create sexist divisions. Gendered assumptions determined the ways scientists perceived, constructed and communicated these biological processes. These observations formed an account of reality that assumes, and relies on, differential attribution of qualities based on gender. These narratives were then fed into the social imagination. Social constructions such as 'gender' are often implicit in scientific constructions, which grants them legitimacy. Because science proclaims to describe the biophysical world, unjust social assumptions embedded within scientific narratives are easily imagined as characteristics of 'nature', as opposed to learned patterns of relating to one another. These learned patterns affect how, and who, we come to be. Martin's (1991) account of the egg and sperm's gendered romance provides a good metaphor for this. At the time of conception, cells that become human are already having their motivations, qualities, abilities and limitations projected onto them by onlookers. Before we even come to 'be', what is true, or possible of us is already being guessed and assumed; and thereby directed and constrained. Scientific narratives help embed unjust assumptions into our processes of 'knowing' the world. If structures of inequality manifest in our imaginations of one another and ourselves, then science can maintain these structures by acting as a vehicle for assumptions that create prejudice and power imbalance between people. This hinders environmental activists' play in the game for environmental injustice by perpetuating systemic inequality.

Scientific frames are usually favoured to make complex crises like climate change visible and conceptually available (Kahan et al, 2012; Medvecky, 2017). This means scientific narratives contribute significantly to the social imagination of environmental conflicts. Public and political discussions refer to climate change as it is understood and framed by science (Taylor et al, 2003). Consequently, environmental activists often appeal to science for explanations of climate change causes and responses. However, valuing science as a resource for addressing environmental challenges is different from accepting science's framing of those challenges (Irwin and Wynne, 1996). The narrowness and particularity of these frames may not be acknowledged because they reflect the social context of dominant groups (Forsyth, 2003). Science tells climate change

as a story of rising emissions, parts per million of carbon in the atmosphere, fossil fuels, global temperature rise, and changing weather patterns. These stories allow us to separate the physical manifestations of climate change from the social relations that drive our environmental behaviour (Giddens, 2009; Chatterton, Featherstone and Routledge, 2013). While stories of energy use and the greenhouse effect are most familiar to many of us, climate change is also a story of colonisation, oppression, racism, social exploitation, and cultural genocide (Powys Whyte, 2017). Scientific narratives, however, typically locate the causes of climate change at the extraction and combustion of fossil fuels. They divert our social gaze from the power relationships and systemic violence that precede climate-changing actions. The epistemic dominance of the sciences allows the causes located and emphasised by science to become more rigid, more real, in the social imagination. This prevents people from acknowledging fundamental and interconnected reasons for the climate crisis (Shellenberger and Nordhaus, 2009). Scientific explanations allow us to imagine climate change's causes and responses without deep and critical reflection on how aspects of our inter and intrapersonal relationships constitute inequality colonialism and oppression. This makes many scientific narratives complicit in the systems that reinforce social and environmental injustice. Not only do popular climate narratives obscure the inequality that lies at the root of climate change, they also obscure the ways systemic inequality affects the distribution and experiences of climate change effects around the world. Science-orientated constructions of the climate crisis dominate our social imagination; diverting our social gaze from the raw and challenging insights of groups most affected by a changing climate, and industrial operations that change it (Forsyth, 2003).

Case study:

On the 22nd of March 2017, a collaboration of groups blockaded the New Zealand Petroleum conference in New Plymouth. The region has a history of colonial violence, indigenous resistance, and occupation by oil and gas industries. The blockade groups were Climate Justice Taranaki, Friends of Waitara River, Frack Free, members of the Parihaka community, Oil Free Wellington, Oil Free

Auckland, Greenpeace, Auckland Peace Action, 350 Aotearoa, Pacific Panthers, and Ngatiawa Ki Taranaki Trust. Many indigenous activists in the blockade made speeches, positioning climate change as conceptually and experientially inextricable from the processes of colonial oppression and systemic inequality. However, most articles about the blockade did not draw attention to these links. The New Zealand Herald quoted a non-indigenous activist, "We have the technology and science now to move away from fossil fuels, it is time to get cracking and do it" (Hanne, 2017). This reflects climate activists' habitual direction of the social gaze towards science as a motivator for social change. An online article in the popular media outlet Stuff included this excerpt,

> [The Petroleum conference] began with keynote speaker Iain Stewart,University of Plymouth geoscience communication and BBC series *Planet Oil* presenter, who spoke on how the science community needed to connect with the public to dispel myths and ease unrest. […] "People over-estimate the hazards and people are angry," he said. "But it's the science community who failed to properly educate and communicate the technical science." Those in the petroleum industry were well aware of climate change and agreed with the utilisation of renewable resources, but the reality was "the very use of oil defines us", Stewart said. (Baker, 2017)

The social gaze is directed again towards science as the most (or only) appropriate body of knowledge that defines and addresses climate issues. Controversy over 'technical science' is positioned as the reason for social friction over oil exploration. 'Hazards' are positioned as both 'estimated' and in the future, diverting public attention from the current harmful feedbacks between fossil fuel exploration, climate change, and oppression. This is an example of the "testimonial exclusion" of oppressed groups, whose perspectives hold transformative potential for our social relationships and environmental behaviour (Anderson, 2012, p. 166; Medina, 2013).

Deep political conflicts entwined with ecological damage often remain underemphasised or concealed in scientific constructions of environmental issues (Forsyth, 2003). While scientific narratives encourage reflection on fossil fuel use, they are part of the socially sanctioned silence that insulates us,

particularly dominant groups, from the effects of our behaviour (Chatterton, 2006). When environmental science narratives dominate the social imagination they divert our gaze from how we may uphold (or resist) injustice in the intimate spaces within and between us. This negatively affects the infinite game of environmental activism to pursue fair environmental relations.

7.2 How does science contribute to epistemic injustice?

Scientific narratives often take centre stage in environmental conflicts. They are given the spotlight on public platforms; be it in media articles, news items, or panel debates. Public platforms and professionalised 'science communication' efforts are testament to the epistemic privilege that science enjoys over other fields of knowledge (Medvecky, 2017). This grants science 'credibility excess', a form of epistemic injustice (Medina, 2013). Miranda Fricker (2003), Elizabeth Anderson (2012) and Jose Medina (2013) have covered significant ground on 'epistemic injustices'. They occur when an individual or group is excluded from epistemic activities such as creating knowledge and making-meaning, or when peoples' experiences of the world are obscured and undermined by prevailing epistemic practices (Medina 2013; Fricker, 2007). For example, women's testimonies of the fear and discomfort of sexual harassment were (are) often minimised or disbelieved (Jaggar, 1989). This constitutes epistemic injustice because it denies women knowledge of their own experiences. Furthermore, disaffirmation creates epistemic obstacles to their making sense of those experiences. Patriarchal narratives create epistemic biases against women, which subsequently maintain patriarchal power by rendering facets of women's experiences de-realised. Structural inequality affects our epistemic sensibilities, in other words, what and whose knowledge we habitually accept—or reject. We commit epistemic injustices by attributing an agent too much credibility (credibility excess) or too little (credibility deficit) (Fricker, 2007; Medina, 2013). Credibility is inherently comparative; we could not grant a level of credibility to knowers or knowledge without perceiving counterparts as more or less credible (Medina, 2013). Science cannot receive credibility excess without

others experiencing associated credibility deficits. This negatively affects activists' game for environmental justice in a number of ways.

Firstly, when science receives credibility excess it can strengthen the *structures* of injustice—epistemic and otherwise. This is because epistemic injustice and systemic oppression enjoy a mutually constitutive relationship (Medina, 2013; Jaggar, 1989). As Alison Jaggar (1989) points out, the "alleged epistemic authority of the dominant groups then justifies their political authority" (Jaggar, 1989, p.165). Our mechanisms for assigning credibility to knowers and knowledge are largely unconscious, sculpted by prevailing epistemic paradigms and 'standards' of credibility that tend to reflect the experience of dominant groups (Anderson, 2012; Medina, 2013). Platforms and credibility excess give science power to calibrate these mechanisms, thus influencing our habits of attributing or withholding epistemic credibility in our interactions. Typically, we deflect knowledge that does not fit our filtered standards of rationality (Trocco, 2002). This can lead to credibility deficits against systemically oppressed groups, whose knowledge and experiences often contradict prevailing depictions of reality (Medina, 2013). These epistemic injustices reproduce unequal social relations. Even when groups recognise biases embedded in prevailing narratives, epistemic biases against them prevent their grievances from being heard or accepted (Medina, 2013). The prevalence and epistemic authority of the sciences cannot be separated from its role in reinforcing structures of power and axes of oppression. This impedes activists' infinite game for environmental justice, as systemic inequality positively contributes to ecological harm.

Secondly, the credibility excess of the sciences limits our range of epistemological resources to address environmental challenges. When scientific narratives are repeatedly in the spotlight, it keeps other types of knowledge backstage, understudied, and unfamiliar. The theory that 'diversity trumps ability' maintains that if a group is trying to address a complex problem (a changing atmosphere, for example), epistemic diversity amongst group members will serve them better than an abundance of excellent 'problem-solvers' (Medina, 2013; Anderson, 2006). When 'excellent' scientific narratives receive excessive

credibility and media space it constricts the epistemic diversity of public discourse. Ian Werkheiser (2017) describes a mutually reinforcing relationship between ecological and epistemic loss. During environmental challenges, communities often have their epistemic self-determination undermined by external scientific experts (Werkheiser, 2017). The perceived superiority of the sciences can be used to dismiss the efficacy of localised systems of knowledge, with indigenous knowledge particularly at risk (Werkheiser, 2017). This is an epistemic injustice to groups' whose ways of knowing ecosystems are eradicated. Diverse epistemologies yield a broader range of adaptive responses to environmental change, and when the range of epistemological methods is diminished, so too is community resilience (Werkheiser, 2017).

Finally, emphasis on the sciences in environmental conflicts comes at the expense of ethical discourses. While science remains a hero on the stage of ecological crises, ethical discourses appear as a side character. Science is granted a public platform because of its epistemic authority, but platforms also *give* science practitioners authority, so credibility excess becomes self-reinforcing (Medvecky, 2017). This gives scientific knowledge permission to be more *real* than ethical discourses. Consequently, in public and political discourses, appeals to science are often more acceptable than ethical appeals. It may be politically legitimate to talk about changing the composition of the entire atmosphere, but less legitimate to address the fact that we know our daily habits are killing people, and still we cannot change them. Science can tell us why Pacific peoples will lose their islands, but they cannot tell us why we should take responsibility for our role in their plight. When activist groups adhere to unspoken standards of 'credibility', they may censor moral appeals in favour of scientific narratives that will grant them legitimacy. This further minimises the visibility of ethical discourses, inhibiting our connection with ecological crises and the deeper motivations we may have for addressing them.

Case study:

I shall approach this case study differently, with an auto ethnographic account of a presentation by coal mining company Bathurst Resources Ltd, described in my introduction. In 2014, Hamish Bohannan (former CEO) talked to engineering professionals in Canterbury about the future of coal in New Zealand's South Island, and the company's proposed mining projects. Bohannan acknowledged climate change, but reminded the audience of the essential services coal provides around the world. I asked Bohannan how he could justify new mines when eighty per cent of known fossil fuels must be left in the ground to keep global warming within two degrees. I also mentioned people would suffer in the face of sea level rise, droughts, floods, fires and disease in a warming world. At the end of the presentation, the moderator acknowledged our "emotional argument", and thanked Bohannan and the rest of the audience for their discussion of practical and scientific factors around coal use. I proceeded to cite the bodies of scientific research that supported my concerns about climate change.

Positioning my comments as 'emotional' was a strategic move to minimise their legitimacy. This is an example of epistemic injustice. The moderator undermined my appeals by suggesting the presenters' testimonies had more scientific and technical credibility. This reflects the Western tradition to associate 'reason' with dominant social groups, and to position less dominant groups as excessively emotional (Jaggar, 1989). It also shows how the implied 'impartiality' of the sciences can help maintain power imbalances (Guston, 2001). This shows another systemic bias—that the presence of emotion diminishes the reliability of a knower's testimony. My initial aversion to being labelled 'emotional' shows how deeply this bias is embedded. By defaulting to scientific reasoning to gain legitimacy, I endorsed the moderator's unseen formulas for attributing credibility. Adhering to unjust criteria for credibility reinforces their power and influence, perpetuating the hierarchies that rely on them (Jagger, 1989). My response to the moderator was scientifically sound, epistemically 'credible', but completely irrelevant. I should have said, "We are discussing the burning of a fuel

that will increase the likelihood of human suffering around the planet—an emotional response is pretty fucking appropriate don't you think?"

I missed an opportunity to focus directly, and openly, on ethics. Although scientific knowledge is credited with epistemic reliability, it cannot always be *relied* upon to deliver fair epistemic interactions. The credibility excess of the sciences impeded our finite game to connect the audience with the ethical consequences of coal expansion. It also obstructed our infinite game to make social and environmental ethics core motivating factors of human decision-making. This game is infinite because we are forever disputing and uncovering the nature of the 'ethical' relationships we're seeking, and the extended consequences of decisions we're making. These biases prevent us from having frank ethical discussions about who we think we are and why we're doing what we're doing here.

7.3 How does science undermine emotion in environmental conflicts?

We tend to think that sharing knowledge is a good thing. Particularly if we think it's useful knowledge. Consider, for a moment, all of the public and private conversations about climate change you have ever encountered. How many of those turned into debates over the degree to which climate change was 'happening', or contentions over aspects of biophysical research? We have spent a lot of time convincing and resisting one another about the scientific 'reality' of a changing climate (Forsyth, 2003; Taylor et al, 2003). Habitually performing or referring to the climate 'debate', regardless of its outcome, keeps our conversations within scientific parameters. In public, private, and political discussions about climate change, appealing to science is a knowledge sharing norm. This observation is supported by the views of other authors that science is the most popular frame for discussing climate change (Kahan et al, 2012; Medvecky, 2017). Knowledge sharing norms (KSNs) are formal or informal

expectations of what knowledge we should share and what knowledge to withhold in any given situation (Grasswick, 2011). Typically, increasing the volume of knowledge that we share is positioned as a *prima facie* good, a KSN commonly associated with movements towards social liberation (Grasswick, 2011). It is not difficult then, to see why activists would readily communicate the knowledge most regularly positioned as relevant to the climate crisis—science. This has been our mistake. In this final section, I argue that science KNSs in the climate movement impede the development of epistemic practices that would serve us better in the infinite game for environmental justice. As Heidi Grasswick (2011) points out, positioning knowledge sharing as a *prima facie* good drastically understates the roles that KSNs play in hindering the development of the *types* of knowledge necessary for liberatory social change.

Throughout this discussion so far, we have looked at ways our creation, distribution, and communication of knowledge affects the course of our social and environmental relationships. Another theme I have emphasised is the mutually reinforcing relationship between systemic oppression and environmental damage (Godfrey and Torres, 2016). In the previous section, we saw that prevailing epistemic practices play a role in creating and maintaining oppressive social relations (Medina, 2013). If environmental activists want to transform the social relations that underpin ecological harms, they need new epistemologies that will facilitate this transition (Medina, 2013). Not only is this a game to change what we know, it's a game to change *how* we know. This is similar to Heidi Grasswick's (2011) description of a 'liberatory epistemology', which "seeks to develop epistemological tools […] that will help generate the kind of knowledge required to bring about positive (liberatory) social change." (Grasswick, 2011, p. 244). This prompts a tangle of investigations far too broad and deep to do justice to in this section, but I shall pull a thread and look at just one way I believe science impedes activists' movement towards such a liberatory epistemology, and that is when science KSNs in the climate movement undermine our emotions and their epistemic potential. Emotions can help unlock liberatory perspectives and new ways of knowing (Grasswick, 2011; Jaggar, 1989). Science KSNs can keep us from emotional tools to illuminate, subvert and

transform epistemic paradigms and social relations that lie at the heart of environmental injustice.

Traditionally, Western science claimed epistemic authority by positioning emotions as epistemically subversive (Jaggar, 1989; Nelson, 2008; Longino, 1990). According to Alison Jaggar (1989), this helped reproduce social hierarchies by allowing dominant groups to undermine the epistemic authority of groups culturally associated with 'emotion', such as women and people of colour. Emotional responses to experiences of systemic injustice stoked narratives that positioned marginalised subjects as more 'emotional' and their testimonies as less reliable (Jaggar, 1989; Medina, 2013). Consequently, both expression, and suppression, of emotions are politically significant (Brown and Pickerill, 2009). The case study in the previous section describes the credibility excess of science being used to undermine my emotions in a dispute about coal. This is not an isolated incident—this is a pattern. Although it is now widely acknowledged that science is not value-free, it cannot separate itself from its history, nor from the values of 'rationality' and 'dispassionate investigation' that continue to affect the ways science is used and perceived (Jaggar, 1989; Irwin and Wynne, 1996; Guston, 2001). Consciously or unconsciously, science is still used to censor our expression of emotions in environmental conflicts. This limits our epistemic potential. As Jaggar (1989) argues, emotions are valuable sources of knowledge, and play a fundamental (but underestimated) role in knowledge construction. Emotions, particularly those of oppressed groups, can be powerful epistemic resources for recognising injustices, challenging power imbalances and re-imagining social relations (Medina, 2013; Jaggar, 1989; Wilkinson, 2009; Brown and Pickerill, 2009). By helping to suppress and subordinate emotions, science restricts us from the transformative knowledge that we could receive from emotional expression—each other's and our own.

The game for liberatory epistemologies is truly infinite. The more we liberate our knowledge practices, the more we are able to recognise the ways they have been oppressed—or oppressive. The limitations of our current epistemic paradigms will always restrict our ability to imagine new ways of knowing and perceiving.

Our emotions are epistemically liberatory when they help us overcome these 'obstacles of unimaginability' by subverting blind spots and internalised 'structures' of injustice (Medina, 2013). As it stands, systemic inequality helps mediate our epistemic boundaries by shaping our cognitive-affective structures of belief, which limit our capacities to see, hear, and relate to others (Medina, 2013). For example, 'active ignorance' involves cognitive defence mechanisms that keep dominant groups from recognising the experiences of marginalised subjects, insulating them from knowledge of systemic oppression (Medina, 2013; Grasswick, 2011; Anderson, 2018). These patterns of selective attention allow us to make some lives more real, more 'grievable', than others (Butler, 2004). Jaggar (1989) suggests that "outlaw" emotions have the power to subvert our epistemic boundaries and illuminate untruths in oppressive systems of belief.

> Conventionally unexpected or inappropriate emotions may precede our conscious recognition that accepted descriptions and justifications often conceal as much as reveal the prevailing state of affairs […] They may help us to realize that what are taken generally to be facts have been constructed in a way that obscures the reality of subordinated people.
>
> —Alison Jaggar, 1989, p. 167

Outlaw emotions disrupt previous cognitive-affective links, creating friction that can prompt us to reconcile between our feelings and beliefs (Brown and Pickerill, 2009). If our internal status quo is what water is to a fish (water's not wet unless you're dry) 'outlaw' emotions are when a fish is unexpectedly shot into the air by a whale's blowhole. These emotions can prompt 'meta-lucidity', whereby one 'sees' the effect of epistemic norms on one's perceptions and social relations (Medina, 2013). This can disarrange the epistemic boundaries that reproduce systems of inequality. By making new cognitive pathways available, outlaw emotions open up new possibilities for seeing, hearing, knowing and relating to one another (Jaggar, 1989; Medina, 2013; Fricker, 2007). Emotions are not, by any means, above epistemic scrutiny, but they should be considered seriously rather than being dismissed (Jaggar, 1989). Science's history of invalidating emotions continues to understate their epistemic significance in environmental conflicts.

For example, consider the following exchanges of knowledge. First, when I attended lectures on climate change in my geography degree, I received knowledge that helped me campaign against fossil fuel use, and critically assess social behaviour and policy in terms of its affect on the climate. This changed what I knew, but not how I knew it. Second, in a decolonisation workshop for activists in Waitangi, 2016, people of colour reacted emotionally when I obliviously dominated discussions. Experiencing this exchange of emotions forced me to address the psychological depth of systemic inequalities, and gave me a more intimate sense of its roots in my cognitive, perceptive, and communicative habits. The exchange increased not only what I know, but what and how I have the *capacity* to 'know'. In all my previous acquisition of knowledge about climate change, not once had my social and epistemic behaviour been challenged in such a way. This makes the second exchange of knowledge more epistemically liberating than the first, and therefore a better source of resistance to the social structures that underpin environmental injustice, even though the exchange itself did not contain knowledge about the environment. Although not formally justified, my claim here is based on my 'moral intuition', a common tool in ethical theorising, Rawls' Theory of Equilibrium being one example (Daniels, 2018). While science KSNs persist in environmental conflicts, they may stifle opportunities for emotional dialogues that could liberate our relationships and expand our epistemic capacities.

A possible objection is that science KSNs needn't come at the expense of such emotional exchanges and testimonies—both types of discourse could be valued in tandem. However, as Grasswick (2011) points out, KSNs are not only habits of sharing knowledge, but also of withholding knowledge. The KSNs of science in environmental conflicts does not have to invalidate emotional testimonies to suppress them—they create social pressure that prevents them from being expressed. Marginalised groups in particular have a long history of withholding knowledge for their own epistemic and social survival of, and resistance to, oppression (Grasswick, 2011). When others invalidate our emotions, they can de-realise our experience and obscure self-knowledge, undermining us in our

humanity (Fricker, 2007). As science has been used historically to invalidate peoples' emotional experiences, certain testimonies may be habitually withheld in contexts like environmental conflicts where scientific paradigms are prevalent. This means science KSNs can jeopardise the safety and trust required for exchanges of emotions and knowledge across structures of power, a vital aspect of the infinite game for environmental justice (Anderson, 2018; Medina, 2013; Grasswick, 2011). Furthermore, the knowledge habitually withheld may have transformative potential for our inter and intrapersonal relationships, meaning penalty shots missed in the infinite game for liberatory epistemologies.

Finally, our expressions of emotion are more than an epistemic tool—they are an embodiment of our vulnerability. Although we differ in our experience, interpretation, and construction of 'emotions'—we feel (Brown and Pickerill, 2009; Jaggar, 1989). When we talk about the climate crisis, we're talking about our vulnerability to change, danger, violence, grief, fear, and death. While scientific narratives preserve an emotional distance from the human impacts of climate change, we gain an intellectual understanding of the crisis without understanding it *affectively*. Without these affective links, we're likely to maintain cognitive mechanisms of resistance, both to our own vulnerability and that of others' (Medina, 2013). In this sense, science KSNs can be socially alienating, because they help us keep a fundamental aspect of our humanity denied (Broks, 2017). This hinders the infinite game for environmental justice, because typically, when people feel alienated, they don't want to play.

8 Summary, recommendations and concluding remarks

Throughout this thesis, we have covered some rough and variable terrain. We have seen snapshots of finite and infinite games being played around the world, for a better world. While the diversity and intensity of efforts is profoundly moving, it is distressing that they are so urgently needed. To briefly recap, first I looked at how scientific knowledge can be an invaluable tool in activists' games to reform policy, challenge industrial operations, and deliver material improvements to ecosystems and communities at the forefront of environmental conflicts. Next, I described instances where activism positively affects the sciences by motivating new investigations, strategically furthering the public and political reach of scientific research, and contributing to the epistemic integrity of the sciences. Thirdly, I described ways that environmental activism negatively affects the work of scientists by obscuring scientific findings, jeopardising the credibility of scientific efforts, and perpetuating a combative approach to environmental challenges. Finally, I explored how science can negatively affect the games of activists, by diverting the public imagination from the social relations that drive environmental injustice, committing epistemic injustice, and hindering activists' game for a liberatory epistemology by undermining emotions in environmental conflicts. I believe this final section revealed an aspect of the science/activism relationship that is often unrecognised and underestimated, particularly in the climate movement. Investigation into the role of knowledge sharing norms within environmental movements may reveal ways they create stagnation and inertia that obstruct our games for social and epistemic change. In our communications, we often consider how we want to affect what we each 'know'. We are less likely to consider how our communications affect what we each have the capacity to know, and how ways of knowing are suppressed—or liberate. Out of all the ground covered throughout this discussion, I think this final section reveals the most significant and interesting territory for further exploration.

With conversations arising about the potential roles (and responsibilities) of science communicators in political activism, I hope we can be more discerning

about contexts where sharing scientific knowledge can further the game for environmental justice, and contexts where it can be obstructive. I strongly encourage activists, scientists and science communicators alike to critically reflect on ways their finite games keep deeply rooted structures of socio-environmental injustice supported. Activists and science communicators often share a commitment to environmental justice, and both could benefit from more dialogue, co-operation and skills sharing. This could help build capacity for new research, but more importantly it could build capacity for new relationships. I hope this discussion has given activist and scientific communities a greater appreciation, understanding, and respect for one another's games, and the challenges of playing them. Because the aim of our games is so often the same—the aim of the game is to keep the game going.

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Creative component

'Acting Out: The Nature of Disobedience' was written alongside the academic component of the thesis, and is intended for a broader audience. It follows stories of environmental activism in Aotearoa, New Zealand. These stories draw on a combination of my own experiences, my research into historical campaigns, and interviews with Steve Abel and Jojo McVeagh. From defending native forests, to fighting coalmines, to communicating about climate change, these stories create an intimate picture of past and present environmental conflicts. They shed light on the communicative gulfs we face in the infinite game for environmental justice, weaving together personal and scientific narratives to connect readers with environmental crises and complexity. Although the project is about the games of environmental activists, it is also a game itself. Roaming between physical, theoretical, and mental landscapes, the game of this project is to explore the epistemic and emotional boundaries that distance us from environmental changes and challenges.

The majority of photographs and images throughout this book are my own. Some photos I have used with permission from members of the Native Forest Action group, the Save Happy Valley coalition, and Greenpeace New Zealand. A small number of images were obtained from the Creative Commons website, and used under Creative Commons licensing laws. Image attributions are either placed on the image itself, or will pop up when the image is double clicked.

My heartfelt thanks to all those who appear in this book, particularly to Steve Abel and Jojo McVeagh. Without their insights and support this project would not have been possible. Thank you to those who shared their images with me, and to those who gave suggestions throughout my research. And thank you Scott Bagley, for your love and your guidance.

Files

The attached disc contains the creative project as an iBooks file and a PDF file, with a word doc explaining the difference between them.