

Humble geopolitics: rethinking natural hazards in South Iceland

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Thesis submitted for the Degree of Doctor of Philosophy
Trinity Term 2019

Abstract

This thesis is concerned with the ways that communities in South Iceland are negatively affected by their geologically active environment. I argue that contemporary theorisations of hazards in human geography retain a militaristic preoccupation with catastrophe, antagonism and annihilation that actively impedes a fuller attention to the ways that communities live with hazards. In this thesis, I develop a new set of theoretical concepts which together map out the dimensions of what I term a ‘humble geopolitics’ of natural hazards. Humble geopolitics draws attention to the complex spatio-temporal, non-catastrophic dimensions of geo-tectonic hazards and brings into relief the partialities of official programmes of hazard management in Iceland. I show the value of this reformulated geopolitics by working this concept through three empirical case studies that explore the role of a museum, citizen science and local community groups in catalysing experiences of earthly volatility and configuring modes of public response to it. These case studies illuminate the different space-times in which hazards are experienced, the diverse practices through which public participation is expressed and the different logics that underpin everyday modes of hazard governance. In the conclusion, I argue that this work opens up important new avenues for the geographical study of natural hazards, human geography more broadly, and for disaster risk reduction policy.

Acknowledgements

This research was made possible with the support of Economic and Social Research Council Award number: 1637962

I am indebted to the unfaltering kindness, guidance and patience of my supervisors Dr. Jamie Lorimer, Dr. Beth Greenhough and Dr. Kärge Kama. Also, at the School of Geography, Oxford, many thanks to Ruth Saxton, Professor Patricia Daley, Dr. Rich Grenyer and Professor Giles Wiggs. At the Department of Earth Sciences, Oxford, thanks to Professor David Pyle. Thanks also to Dr. David Mills from the ESRC Doctoral Training Centre. At the University of Iceland, thanks to Professor Karl Benediktsson, Dr. Gunnthóra Olafsdóttir and Dr. Ben Hennig for their generosity.

Thanks go to the generosity of the participants in South Iceland for their time and enthusiastic reception towards this work. In particular, thanks to Auður Finnboga, Oddur Oddsson, Hólmfríður Sigurðardóttir and Bergvin Oddsson.

Thank you to my teachers Rose Hames, Ruth Armstrong and Steve Turner for their friendship, encouragement and support. Finally, I am especially grateful to my friends, to my mother and to Eddie- thank you all so much.

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Chapter 1: Introduction

1. Reclaiming geopolitics

As I interviewed Guðrún - a former resident on Heimaey, a geologically active island off the coast of South Iceland (see Figure 1)- she described her experience of a 6.6 magnitude earthquake on 17th June 2000. Guðrún was standing in the Valley of Herjolfsdalur watching the Icelandic National Festival when the earthquake took place. Loose scree produced thick clouds of dust and rock avalanches fell from the valley sides. Guðrún clutched her wrist as she explained to me how she believed that her arthritis was triggered by the stress of the earthquake as it compounded traumatic memories of previously experiencing the 1973 eruption that occurred on Heimaey. Guðrún was determined to explain her experiences; she felt the emotional and physical effects of living with tectonic hazards are seldom talked about on Heimaey. She describes herself as one of those people on Heimaey who want to “get it all out in the open”.

Guðrún is not alone in describing the chronic effects of living on Heimaey. To find out more about the long-term, on-going emotional and physical effects of living on Heimaey, I spoke with Kristján, a senior pastor who was previously stationed on the island. Kristján described how the lasting impacts of the 1973 eruption generated a certain feeling of impermanence about living on Heimaey. He described how despite the effort put into rebuilding between 1974 and 1975, since this time many houses have not been maintained. He explained: “it was like there is no need to maintain houses- it will all be gone. This was the realisation that houses were not permanent property” despite the fact that “windows and roofs now need repairing”. This thesis is dedicated to exploring these less catastrophic, more mundane ways in which geological hazards become manifest and how these effects

challenge the taken-for-grantedness of what natural hazards are, the scope of their impact and what counts as hazard response.

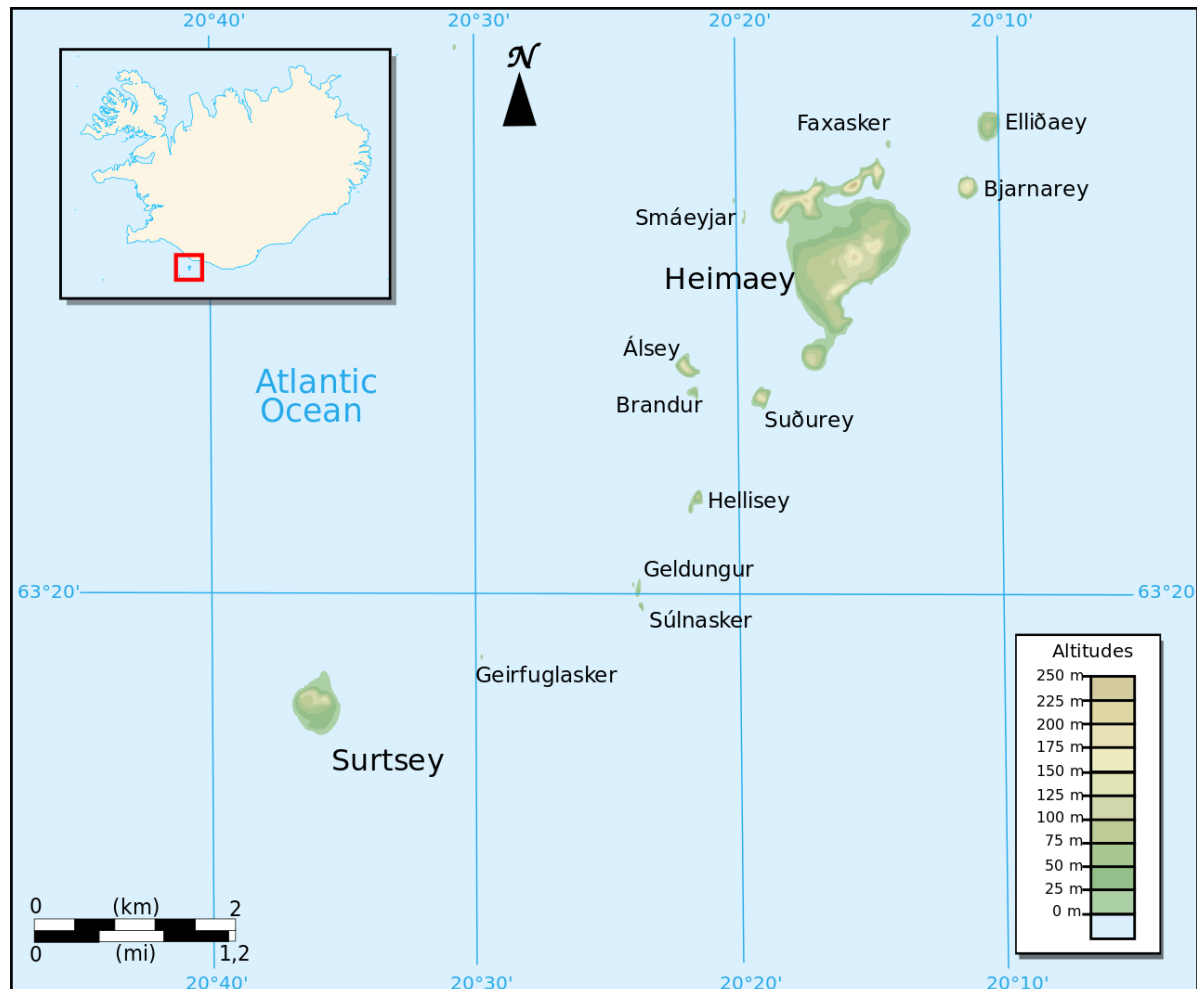


Figure 1. Location of the island of Heimaey in relation to the Westman Island archipelago and Iceland (inset) (Credit: P. S. Burton 2015 Source: Wikipedia Commons)¹

The concept of geophysical hazards as spectacular, catastrophic events that cause widespread deaths and which require international command-and-control responses is a relatively recent way of understanding and governing hazards. For Enrico Quarantelli, the pioneering American sociologist of natural disasters, the answer as to how we have come to inherit this understanding emerged through the highly influential work of military-

¹ https://commons.wikimedia.org/wiki/File:Vestmann_archipel_topographic_map-fr.svg [Accessed: 20/2/2019]

sponsored disaster studies research carried out in the United States (Quarantelli, 1987, 1998, 2009). A concern for the effects of wartime bombing in the 1960s meant that hazards such as tornados, floods, major fires and earthquakes were used as analogues for bombs. For Quarantelli, selecting events such as volcanic eruptions and high-magnitude earthquakes as analogues to study the effects of bombing meant that we have increasingly ‘accepted the notion of disaster as concentrated in space and time’ (1987: 303). In turn, Quarantelli (1987) argues this has also meant that modes of governing hazards have focused on reaction rather than prevention and tended to focus attention on space-times of emergency at the expense of the less spectacular struggles embedded in everyday life.

This focus on hazards as catastrophe has translated into an increased demand on states, international cooperation and human resources to manage and mitigate the effects of hazards. International organisations such as the United Nations and European Union are increasingly involved in preparing for and responding to hazard risk (Forino, Bonati, & Maria, 2018; Donovan, 2017). These institutions respond to disaster risk through programmes of disaster risk reduction (DRR), such as the most recent United Nations Sendi Framework for Disaster Risk Reduction (UNISDR, 2015a). DRR programmes focus on educating communities about hazards, planning for their occurrence and developing strategies for assisting community recovery in the aftermath of events (Forino, Bonati, & Maria, 2018). While these forms of national and international governance may well be critical during the moments during and just after a major natural hazard event, this thesis begins from the premise that a focus on catastrophe has precluded a more fulsome understanding of the space-times involved in living with hazards in both the official practices of hazard management and in geographical scholarship on hazards and disaster.

Shifting focus beyond space-times of catastrophe opens up new consideration not only of the way in which hazards are experienced, but also of the different modes of living with the effects of hazards in everyday life. For Isabelle Stengers this is about drawing attention to modes of ‘composing in and with the earth’ (2015: 53). This is not solely an academic exercise but offers provocations for thinking through the practical ways that communities can and do live with the problems of natural hazards. These strategies of living with hazards do not come with pre-made labels or classifications as forms of ‘hazard management’. Instead, they may be altogether more humble, modest attempts at living with hazards that involve a multitude of spaces, strategies and more-than-human actors orientated around negotiating the more mundane struggles that living in hazardous environments involves.

I therefore wish to develop a ‘humble geopolitics’ in order to move away from the earth’s catastrophic material dimensions, state-organised modes of official hazard management, and the tendency to associate geopolitics with war. Geopolitics has a long-established association with conflict, annihilation, asymmetrical forces and zero-sum power relations in geography. For the political geography of the twentieth century, geopolitics meant a focus on states. This work tended to focus on discourse and its role in conflicts between states, as a marked break with ideas of environmental determinism that dogged geographical thought through the early twentieth century (e.g. Agnew & Toal, 2002).

However, in its more contemporary manifestations, geopolitics has begun to move beyond questions of discourse to explore the roles that the earth also itself plays in giving rise to geopolitical tensions and conflicts (e.g. Powell et al., 2017; Squire, 2015; Elden, 2013). This has, for example, involved considering how natural hazards can play a role in creating

cross-border tensions between states (Donovan & Oppenheimer, 2019) as well as the way war and conflict play out beneath and above the earth's surface (e.g. Forsyth et al., 2013).

Geopolitics is also bound up with ideas of heroic, masculinist versions of the geo that focus on spectacular manifestations of the earth's power through events such as volcanic eruptions (e.g. Shaw, 2012; Clark, 2010a). In this thesis, I therefore wish to move beyond the idea of human - earth relations envisioned in terms of antagonistic, competing forces concerned with the relative agency or force of humans and the earth (e.g. Clark, 2013).

Defining the earth and its geo-tectonic forces in opposition to life seems to retain the same antagonistic logics that concern the work of scholars interested in conflict and states which impedes attention to the more banal, lived realities of life in hazardous environments. The version of geopolitics I present in this thesis opens up new space to explore what more humble relations with the earth look like when these begin from local acts of care and concern.

This thesis thus draws together recent work that highlights the need to attend to the materiality of the earth (Clark, 2010b, 2010a, 2010c, 2013, 2014, 2016b; Clark, Chhotray, & Few, 2013) with contemporary concerns in feminist philosophy with understanding the forces of the earth in less adversarial, apocalyptic terms (Grosz, 2008, 2011). I contend that drawing together these emerging ideas in feminist philosophy with the existing concerns for the materiality of the earth in human geography offers not only new directions for hazards research, but also applied possibilities for informing new ways of governing and living with hazards that are better able to attend to the everyday problems faced by people living in hazardous environments. In developing these new directions, this thesis is guided by three interrelated research questions:

- 1. What are the limitations of current hazard management approaches in South Iceland?**
- 2. What strategies do communities in South Iceland use to address these limitations?**
- 3. What do these strategies reveal about the different underlying logics of governing hazards?**

Through a series of three interrelated case studies, I explore different strategies for living with hazards that eschew the idea that hazard management begins and ends with official government programmes. I illuminate how these different strategies of governance draw attention to not only the variegated problems of living in hazardous environments but also to the variety of creative practices through which they are attended to. In common between the cases is that humans are not passive in the face of environmental upheaval. Living in hazardous environments involves a diverse array of strategies that take place across different locations. These include: the vast expanses around the slopes of volcanoes, the spaces of a museum, and virtual/ online spaces. They also involve a diverse assemblage of knowledges that rub up against official hazard management structures in different and interesting ways. These practices move us beyond a permanently anxious human subject awaiting loss and destruction towards the different ways of navigating volatile environments in which humans compose their lives alongside the earth and its upheavals. The outcome of this work enables new reflections on both the policies involved in managing natural hazards and the ways in which human geographers think about human-environmental relations in hazardous places.

2. Introducing Iceland and Heimaey

Iceland

This thesis draws on the experiences of those living in South Iceland as an empirical context for its investigations. Iceland straddles the mid-Atlantic ridge- the zone between the North American and Eurasian tectonic plates. The mid-Atlantic ridge is the fracture zone formed when the continental landmasses of Greenland and Newfoundland broke away from the British Isles some 70 million years ago. The divergence of the earth's crust led to the formation of Iceland beginning 24 million years ago with the oldest rocks emerging above sea level between 14 - 16 million years ago (Figure 2) (Thordarson, 2012).

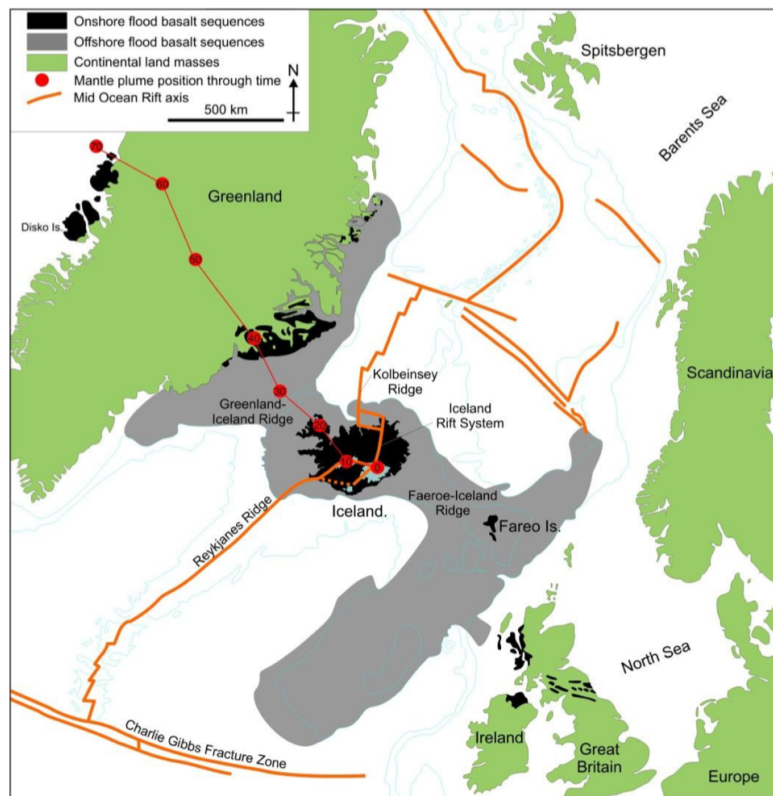


Figure 2. Location of Iceland and its geo-tectonic setting (Reproduced with permission. Map source from Thordarson, 2012²)

² Original map from: Saunders, A.D., Fitton, J.G., Kerr, A.C., Norry, M.J., Kent, R.W., 1997. The North Atlantic Igneous Province. In: Mahoney, J.J., Coffin, M.F.(Eds.), Large Igneous Provinces: Continental, Oceanic, and Planetary Flood Volcanism. Geophys. Monogr. 100. American Geophysical Union, Washington, DC, pp.

As a result of the divergence of the North American and Eurasian plates, the sea floor in the mid-Atlantic continues to be pulled apart which results in continued volcanic eruptions and earthquake activity. Arnalds (2008) suggests that this divergence has resulted in a volcanic eruption on average every 4 - 5 years in Iceland with an estimated 5 million volcanic eruptions since its formation 24 million years ago. The most recent was the eruption of the Bárðarbunga volcano in central Iceland in 2014-2015. The eruption was characterised by intense earthquake activity and it produced a lava field that covered an area of over 85 km²³. Other recent volcanic eruptions include the eruption of the Grímsvötn volcano in 2011 and of Eyjafjallajökull in 2010.

The fact no one died as a result of these events does not mean they are somehow unimportant or insignificant, rather it begins to spotlight the impacts of hazardous events that do not typically result in human death. Iceland is not an exception. It is very rare for people to die as a result of natural volcanic activity and research in archaeology stresses that popular treatments of 'volcanic eruptions have grossly overstated their capacity for death, destruction and societal collapse' (Grattan & Torrence, 2016: n.p.). It is certainly the case that geophysical hazards can cause unprecedented deaths (e.g. Greenhough, Jazeel, & Massey, 2005), but this conceals the broader picture of what it is like to inhabit hazardous environments and live with the less spectacular effects of these events. It is here that ethnographic insights from South Iceland have much to offer.

The region of South Iceland (Suðurland) includes the major volcanic systems of Hekla, Katla and Eyjafjallajökull (Figure 3). It also includes the archipelago of volcanic islands

³ <https://volcano.si.edu/showreport.cfm?doi=10.5479/si.GVP.BGVN201702-373030> [Accessed: 20/2/2019]

off the South coast of mainland Iceland collectively called Vestmannaeyjar (the Westman Islands). Vestmannaeyjar is the name of the largest and only inhabited island of the archipelago, which is also called Heimaey. Surtsey is the youngest island of the group having formed in 1963 from a sub-sea volcanic eruption. The administrative region of South Iceland has a population of 26,506 which includes the population of Heimaey which was 4282 in 2018⁴.



Figure 3. Map of volcanoes in South Iceland. Volcanoes circled in black. Red lines show road networks. Red dots depict a major volcanic fissure (Reproduced with permission. Figure adapted from Einarsson & Hjartardóttir, 2015)

Countries such as Iceland are well known for their geologically active landscapes but have tended to be ignored by recent scholarship in human geography on natural hazards. Recent work has instead focused principally on volcanic regions in the global South (e.g. Troll et al., 2015; Donovan, Oppenheimer, & Bravo, 2012; Donovan, Sidaway, & Stewart, 2011; Donovan, 2010). The spectacular, lethal, and destructive eruptions of volcanoes in

⁴ Statistics Iceland <https://statice.is> [Accessed: 20/2/2019]

countries such as Indonesia make them an attractive place to study human-environment problems. These countries also allow geographers to pursue an explicit agenda that enables them to address how indigenous knowledges have been excluded from processes of modern volcanology and hazard management. The broad implication is that the inclusion of indigenous knowledges may help make volcanology more democratic, add new understandings of the world, and aid the development of practical tools for managing hazards (e.g. Pardo et al., 2015).

A focus on Iceland marks a break from these studies by focusing on a different progressive politics. This is one in which human geographers do not need to find which humans are included and excluded from modern science, but to explore how even in developed Western societies communities are not somehow inoculated from Nature and its incursions into modern life. By exploring how people live with hazards in a developed country such as Iceland, concerns such as corrupt governments, racism and lack of sufficient preparedness become less important, along with approaches of political ecology developed in response to them. However, even in developed countries with an advanced welfare state and advanced civil protection infrastructures communities must still live with, prosper and struggle against the effects of a volatile earth.

Iceland thus opens up opportunities to foreground the complexities involved in living with the earth and its (im)material dimensions. Here the earth is destructive, but it gives rise to the particular ways of life that helps us to move beyond simplistic dichotomies of life and non-life in which the earth's forces are seen as an antagonistic force (see also Povinelli, 2016; Povinelli, Coleman, & Yusoff, 2014). Palsson & Swanson (2016), for example, document the ways that geothermal heat from the earth may have made possible early

forms of life. Similarly, geothermal heat from the earth supplies a quarter of all of Iceland's electricity and hot water to almost ninety percent of the population⁵. On Heimaey, the 1973 eruption provided the community with a plentiful supply of hot water for many decades and the exploitation of geothermal energy continues to underpin contemporary life in many parts of Iceland.

It is thus not the case that communities will simply evacuate these geologically active landscapes, as has been documented in case studies of volcanic eruptions on Montserrat, for example (Dittmer, 2004). Not only are there deep emotional attachments to these volcanic landscapes, but the geo also makes contemporary life in many parts of Iceland possible by heating homes, air and water (Shepherd, 2019). Communities in Iceland are therefore, in many ways, reliant on and sustained by the earth. South Iceland thus helps to open up attention to the aspects of human-geological relations that go beyond an attention to the spectacular. It also helps to foreground the complexities of living with the earth when the earth is not simply a force for the extinguishment of life (see also Grosz, 2008).

Heimaey

The first census was taken on Heimaey on 1703. The island at that time had recently transferred from ownership of Danish kings; it is now part of Iceland (also called the Republic of Iceland). While the population on Heimaey in 1703 was recorded as 318, this is thought to have expanded during times when fishing was good on the island and contracted when there were volcanic eruptions on mainland Iceland (Gunnarsson, 1973). In the early 20th century the population rose rapidly from 607 people in 1901 to 3393 in

⁵ <https://nea.is/geothermal/> [Accessed: 23/6/2019]

1930 and to its peak at 5186 in 1970⁶. This population growth was accompanied by a growth in businesses on Heimaey that ranged from shipyards to fish processing factories.

Residents describe the 1973 eruption on Heimaey as the most significant event since the island was inhabited. The eruption occurred suddenly in the early hours of the morning on 23rd January. News of the eruption spread quickly through the town and was broadcast on the radio. Residents responded in disbelief at the possibility of a volcanic eruption, fearing instead that the commotion might have been around the impending detonation of a nuclear bomb. It was the low, loud rumbling noise of the volcano erupting that awoke many people and the spectacle of a 100m high fountain of lava that lit up the sky (Figure 4). Town officials ordered residents to assemble by the harbour where they boarded local fishing boats to be transported the four-hour sailing distance to Thorlákshöfn, the nearest harbour on mainland Iceland.



Figure 4. Photograph of the volcanic eruption as it began on Heimaey in the early hours of 23rd January 1973 (Reproduced with permission. Source: Svienn Eiríkssen)

⁶ Statistics Iceland- Population by municipalities 1901-1990 [Data retrieved: 01/09/2017]

Those who experienced the evacuation described an ‘atmosphere of eeriness’ that hung over the early hours of 23rd January (see also Gunnarsson, 1973). The residents I spoke with described how there was no panic and within several hours of the initial volcanic fissure opening the vast majority of the population of Heimaey had been evacuated. Some residents described how this was because no one feared volcanoes. Residents had seen the eruption of Surtsey, some ten years previously, and it was this close proximity to an erupting volcano that made eruptions an ‘everyday affair’, as described by one academic commentator who wrote about the eruption at the time (Gunnarsson, 1973: 41).

Whilst in some ways eruptions might be considered ‘everyday’, given their relatively high frequency in Iceland, the events of 1973 have had a profound impact on Heimaey and its population. Fields were covered with ash and pumice, cattle on the island were slaughtered, neighbourhoods were destroyed by a wall of lava that advanced across the island, and residents were left without a permanent place to live, sometimes for several years. While the 1973 eruption is not the explicit focus of this thesis, it provides important historical context that helps to frame contemporary life on Heimaey. Houses have now been rebuilt and families returned to Heimaey relatively soon after the eruption ended in the summer of 1973. Many of these individuals and families continue to live on Heimaey.

Today, residents on Heimaey live relatively prosperous lives. Most people work in fishing, in the shipping industry or in fish processing factories. There is also a growing trend in employment in the tourist industry. Unemployment on Heimaey is currently at the lowest

level in Iceland at approximately 2% of the local population⁷. There is a hospital, school, bank and supermarket and many adult residents own cars. Heimaey thus offers insights into the complexities of living with natural hazards as it allows geographical concern to not solely focus on various forms of structural inequality, such as poverty, and instead focus can be placed on exploring the different ways in which communities navigate and respond to the material and immaterial effects of inhabiting a volatile earth.

Despite much of South Iceland experiencing frequent volcanic activity and earthquakes, for many Icelanders Heimaey is the place to learn about the effects of these events. Heimaey might thus be thought of as an ‘island laboratory’ (Greenhough, 2011) in the sense that there exists an assemblage of people, stories, artefacts, pictures and landscapes which enable the affective as well as physical materialities of hazards to be attested to and made knowable. This assemblage of people, memories, artefacts and experiences may be a product of the relative remoteness of Heimaey and the fact that it exists as an island off an island (mainland Iceland). This offers opportunities to explore geophysical hazards and their affective resonances while for other geophysically active places in Iceland this would be considerably harder given the predominantly rural nature of settlements and their sparse populations.

3. Thesis structure

In the following chapter, I sketch out three dimensions of a reformulated geopolitics that I use to investigate the effects of hazards and the way local communities in Iceland respond to these effects. The first dimension of this geopolitics is concerned with moving beyond

⁷ <https://www.statice.is/publications/news-archive/population/census-2011-main-results-by-output-areas/>
[Accessed: 20/2/2019]

the spectacular dimensions of natural hazards. The second dimension involves rethinking human-earth relationships in terms of immanence and emergence rather than conditions of stable states where hazards are seen as anomalous events that societies must recover from. The third dimension concerns affect and participation. I suggest these concepts can help us move beyond a sole focus on state participation in hazard management and instead help to focus attention on broadening consideration of the practices that count as participation in responding to the effects of hazards.

In chapter 3, I outline my methodology and methods. I describe how this project was made possible through ethnographic work in South Iceland and involved the process of building relationships with communities and individuals over several years. This not only involved visiting Iceland on repeated occasions, but becoming part of people's lives, making friends and cultivating these relationships beyond the narrow, instrumental remit of research objectives. This therefore involved an ethos of 'being at risk' (Haraway, 2016) that allowed opportunities for new politics of affected publics to emerge (see Liboiron, Tironi, & Calvillo, 2018; Tironi & Rodríguez-Giralt, 2017). It also involved the processes of embodied research that take account of the relational dimensions of experience and, connectedly, how the phenomena observed during fieldwork were made to materialise in and through the process of conducting research.

Chapter 4 develops the question of the limitations of current forms of hazard management (research question 1). It begins by departing from a recent concern in geographical literatures with the catastrophic, inhuman and monstrous capacities of the earth (e.g. Clark, 2016c, 2016a, 2014, 2013, 2010a). Instead I spotlight a multitude of geophysical events that become known when we look at their everyday effects as opposed to pre-determined

ideas of earthly agencies. I illustrate the analytical potential of ethnographic findings from South Iceland by using them to bring into relief the partialities of the governmental apparatus for managing natural hazards. I show that responses to the 1973 volcanic eruption on Heimaey were inflected by concerns of unliveable disaster rather than the specificities of the volcanic eruption that emerged. I suggest contemporary practices of hazard management also retain these same concerns built around responding to bomb-like catastrophic events and their immediate aftermath, rather than the subtler effects that impact people's lives in spaces and times in excess of the concern of hazard management. This chapter thus lays the groundwork for exploring the different ways in which collectives live with these consequences in their everyday lives, which I illuminate in the ensuing chapters.

In chapters 5, 6 and 7, I attend to the question of the everyday strategies communities deploy to live with hazards (research questions 2 and 3). In chapter 5, I focus on a case study of how the long-term emotional and psychological reverberations of experiencing the 1973 eruption on Heimaey are addressed in a recently constructed volcano museum on the island. I illustrate how the museum is a place where curators and a younger generation of local residents experiment with affective atmospheres to provide a setting conducive to telling stories about the past and sharing personal experiences. I highlight how these atmospheres contrast with ideas of hope and jubilation in the aftermath of hazard events and spotlight the alternative affects conducive to ideas of recovery some 45 years after the volcanic eruption. This chapter builds explicitly on recent geographical work on atmospheres and affect in post-disaster environments (e.g. Cloke & Conradson, 2018; Cloke, Dickinson, & Tupper, 2017; Barrios, 2017; Grove, 2014). It also builds on geographical work on museums, exhibits and art in which museums become more than

sites of education, but may also bring together new collectives, provoke new thought and bring about new practices related to environmental issues (Ingram, Forsyth, & Gauld, 2016; Barry & Born, 2013; Gabrys & Yusoff, 2012).

In chapter 6, I attend to the ways that residents on Heimaey modulate the anxieties of living with earthquakes through on-line blog posts and social media. In this chapter, I draw on the theme of storying as a mode of living with hazards and develop Jennifer Gabrys et al.'s concept of 'data stories' (Gabrys, Pritchard, & Barratt, 2016) to explore the ways in which residents on Heimaey negotiate the affective possibilities of earthquake data. I illuminate how residents take data from the Icelandic Met Office website and, through a variety of techniques, dampen the potential for this data to cause anxiety, panic and alarm. I illuminate how these practices do not rub up against the official earthquake 'data stories' presented by the Icelandic Met Office because the residents' 'data stories' attend to different spatio-temporalities of concern. This chapter thus builds on work that explores how citizen scientists are involved in generating affective experiences of the environment (Gabrys, 2016) alongside also being involved in various political strategies that try to address the very problems that are made knowable through digital sensing infrastructures (see Calvillo, 2018; Tironi & Calvillo, 2016).

In chapter 7, I attend to the ways that communities living proximate to the Hekla volcano in South Iceland attend to the problem of volcanic ash erosion. Ash erosion describes the situation in which ash produced by historical volcanic eruptions is mobilised by wind erosion long after an eruption has ended. In this example, I document the practices of the Hekluskógar project- Europe's largest afforestation project- which aims to prevent ash being eroded and to minimise its damage. I highlight how this project is less about

governing future hazards or the effects of the past, but regulating and responding to environmental problems as they materialise in the present. This project thus departs from the idea of set end goals and resonates with recent descriptions of governance by and through ‘experiment’ (Braun, 2016; Lorimer & Driessen, 2014). These experiments are variegated across space as different kinds of more-than-human ecologies are enrolled across the Hekla region, but they are also more open-ended in the sense that these practices are about responding dynamically to geological changes. This chapter thus brings into focus the role of a range of more-than-human actors in the form of the plants and trees involved in living with hazards as well as a suite of accompanying ecological and geological knowledges.

In chapter 8, I draw across chapters 5 - 7 to discuss the different logics of governing hazards and spatio-temporalities of governance that emerge. I also highlight the contributions made by this thesis to rethinking (i) contemporary policies for governing hazards at the national and international scale and (ii) geographical scholarship on politics and modes of governance in the Anthropocene. Indeed, one of the reasons for focusing on geophysically active environments is because these events also speak to the broader environmental problems faced by contemporary societies. The problem of climate change for example, prompts us to consider the limitations of governing based on ideas of the spatial separations of Society from Nature (Latour, 2018). This thesis thus highlights new ways of living with the materiality of the earth that do not simply involve giving up and doing nothing or resorting to problematic geoengineering strategies. It also opens up broader questions and unresolved tensions that provide potential avenues for future research.

Chapter 2: Mapping the dimensions of geopolitics

1. Introduction

Feminist philosopher Elizabeth Povinelli has recently described the need for research that has the potential to open-up more radical futures- the ‘radical otherwise’ (Povinelli, Coleman, & Yusoff, 2014). For Povinelli this means developing new research practices and concepts that attempt to illuminate alternative ‘practices of existence’ (Povinelli, 2016: 26). While Povinelli is concerned with the lives of Indigenous communities in Australia, her ideas provide powerful theoretical touchstones for investigating the way that communities in the global North must also endure, improvise and develop their own strategies for existing with environmental problems in the space-times beyond state concern.

What we need therefore is not more scholarship on hazards that anticipates in advance what issues of social justice look like for those in hazardous environments. Instead, there is a need to open up new political-theoretical dimensions along which forms of ethical concern can flow. This is to advocate for an ‘affectively and ethically engaged scholarship’ that ‘refuses to take for granted assumed categories and frameworks and in so doing opens up new possibilities’ (van Dooren, 2014: n.p.). My aim in this chapter is therefore to build on ideas from feminist science studies that understand ‘politics as a space of ethics’ (Liboiron, Tironi, & Calvillo, 2018; Puig de la Bellacasa, 2012, 2015; Tsing, 2015). This means that this review is not simply concerned with cataloguing work on hazards to-date but looks to create new theoretical spaces of concern and care by drawing together literatures from geography, anthropology and philosophy.

Below I sketch out three interrelated dimensions of a reformulated ‘geopolitics’- the term I am reclaiming from its geo-historical association with states, war and antagonistic human-earth relations. The first dimension of geopolitics positions this thesis against recent ways that geographers have sought to put forward new ontologies concerned with the ‘inhuman’ forces of the earth (e.g. Clark, 2010a). Instead of a catastrophic version of geological upheavals, I draw on recent literature that explores the concept of the Anthropocene and tries to dedramatize human-earth relations so that we might pay more attention on the ways that people live in and with the earth rather than on moments of death and dying in the immediate aftermath of a disaster (Tsing et al., 2017; Povinelli, 2016; Braidotti, 2010).

The second conceptual move I wish to make relates to ideas of ‘governance’. While geographers have outlined how practices of preparedness, precaution and pre-emption work by trying to prevent emergency situations from arising (e.g. Anderson, 2010), there is also a pressing need to explore the on-going ways that communities respond to the material effects of a volatile earth in everyday life. Response here is not about bracing one’s self, or returning communities to a ‘baseline’ condition after an event- a mode of thinking which dominates United Nations hazard policies (Donovan, 2017; UNISDR, 2015a)- but is about embracing the different ways that lives unfold with and alongside the earth. This is to draw on Deleuzian ideas of ‘immanence’ (e.g. Deleuze, 2014). Here, immanence helps us to move beyond ideas of pre- and post-disaster that are so pervasive in the way hazards are thought about in policy and geographical literatures and towards the different ways that the past and future are folded into the present. This directs attention to the on-going ways that communities respond to the agencies of volatile environments.

The third and fourth concepts I outline are affect and participation. Affect here is not the sole preserve of government, as is documented in literatures on preparedness, precaution and pre-emption, but is an altogether more ‘ordinary’ part of the everyday that describes the way that common feelings and sensations emerge in and through particular material encounters (e.g. McCormack, 2015; Thrift, 2004, 2008; Stewart, 2005). Here, I contend that affect is political in the sense that it shapes who, where and how different responses to hazards are carried out as well as the registers in which the volatile agencies of the earth are experienced. The responses to hazards I am concerned with here are not the official management strategies, but improvised strategies bringing together different more-than-human actors and expertise that move beyond finding ways of engineering public participation in hazard management (e.g. Fearnley, 2013; Lane et al., 2011). These methods expand the practices and space-times in and through which community participation is recognised to take place.

Together these four concepts help to open up new spaces of enquiry into natural hazards. These ideas individually and collectively mark a break with existing studies of natural hazards in human geography. The first concept explicitly helps to move beyond ideas of geological materialities as solely catastrophic such that it becomes possible to explore the ways that communities live with geophysical hazards in everyday life. The second concept- governance- helps to open up the on-going ways that communities respond to the agencies of the earth in the present. The third and fourth concepts- affect and participation- help to unpack the ‘politics’ that shape the collectives, the spaces and methods involved in the different community practices of managing hazards.

I now turn to outlining these dimensions of geopolitics in turn. I will then bring these concepts to bear in the empirical chapters of this thesis (chapters 4 - 7) to illuminate how they shed new light on the effects of natural hazards and the everyday practices involved in addressing these effects.

2. Geological materialities

Over the past decade, geographers have turned their attention to the materiality and forces of the ‘geo’ – the earth. In line with a broader turn towards attending to the non-human, these studies emerged as a critique to the perceived neglect of the earth in geographical scholarship in which the earth has done ‘little more than provide the stage for political dramas to unfold’ (Depledge, 2015: 90). Central to contemporary scholarship on hazards in human geography is a growing desire to put forward an ontology of human-earth relations that troubles any notion of human control over natural systems. Such works deliberately critique Latourian ideas of relational ontologies and the idea of a politics whose emancipatory potential lies in the idea that the world can be made otherwise (Clark, 2010a). For example, Yusoff argues for the need to: ““accommodate” the unfathomable “depth” of relations; relations that are discontinuous, fractured, voiding, radically asymmetrical, that bear little resemblance to that which is denoted or made available as relational’ (2015: 402).

These works use examples of geophysical hazards to advocate for ideas of ‘post-relational’ ontologies (Yusoff, 2015), predicated on the assertion that ‘most of material reality is not ours to make over’ (Clark, 2010a: xx, 2013, 2016a, 2016b). This is intended as an explicit critique of political ecology scholarship that has argued that the destructive effects of hazards are not ‘natural’ at all and are instead underpinned by socio-political inequalities

(e.g. Pelling & Dill, 2010; Bakker, McCarthy, & Braun, 2005; Blaikie et al., 2004; Pelling, 2001; O’Keefe, Westgate, & Wisner, 1976). Drawing on approaches from political ecology and its concerns with injustice and power asymmetries, geographers have previously focused on the role that factors such as: corruption, racism and free-market capitalism play in exacerbating the effects of natural hazards for particular social groups. Yet, the contemporary concern with the materiality of the earth has sought to highlight the limitations of work that ignores the non-human agencies of the earth itself.

Often drawing on philosophical ideas inspired by continental speculative philosophy, geographers interested in the geo have sought to radically deprivilege human existence by developing a concern with the ‘macro’ dimensions of objects and the agential forces of the non-human world. In particular, Tim Morton’s work on ‘hyper objects’ has been germane to the emergence of these ideas. For Morton ‘hyper objects’ are ‘objects that are massive from a human standpoint’ (2007: 64). Ideas of the huge scale of earth forces and their agential capacities also resonate closely with the way geographers have recently come to conceptualise natural hazards (e.g. Clark, 2010a).

For geographers, object orientated ontology is appealing because it makes arguments about the limitations of human control and agency. No longer do humans stand front and centre over Nature, but we are radically dependent on the non-human world. Any notion of human agency and control is thus recalibrated when contextualised against ‘hyper objects’ such as planets and natural hazards. Drawing on these ideas, Shaw develops the idea of an ‘evental geography’ in which natural hazards are: ‘smouldering furnaces of affects that are capable of creating, policing, and destroying the very contours of existence’ (2012: 613). Similarly, Nigel Clark outlines how: ‘we are utterly dependent on an earth and a cosmos

that is, to a large degree, indifferent to us' (Clark, 2010a: 50). For Clark, events such as volcanic eruptions help to illustrate his intention of 'facing up to forces that exceed our measure or reach which is not to disavow social agency, but to get it into perspective – with an ultimate aim of helping to understand when and where strategic human interventions are most effective' (Clark, 2010a: 107). Other scholars have referred to the earthly agencies in terms of 'earthly powers' (Whatmore, 2013) and 'geopower' (Donovan, 2017).

However, feminist philosophy takes a different approach to issues of anthropocentrism. This work impels us to 'notice landscapes of entanglement, bodies with other bodies, time with other times' (Tsing et al., 2017: M7). This approach requires us to deploy ethnographic methods, or 'arts of noticing', that do not seek to draw boundaries around natural and human phenomena but explore reality as it is lived and played out (Tsing et al., 2017; Tsing, 2015). Contemporary work on the Anthropocene helps us to recognise that lives are already lived in 'blasted landscapes' (Kirksey, Shapiro, & Brodine, 2013) and 'in ruins' (Wakefield, 2018a). For Tsing et al. (2017) this project is about exploring different 'arts of living'. In other words, rather than focus on pre-determined ideas of what catastrophe is, we are encouraged to explore the different ways in which lives play out on a dynamic and volatile earth. This is to explore the ways that disaster is already folded into the present rather than something that lies on the horizon of the future (cf. Anderson & Adey, 2012).

For Jane Bennett & Michael Shapiro (2013), these declarations of ontology relate to the concept of 'onto-stories' in which ideas of what threats are and how to prevent them emerge in historical, contextually specific ways (see also Schmidt, 2013). It is thus no

coincidence that a contemporary concern for catastrophic material agencies has emerged against the backdrop of the particular concerns of Western governments over the past half century that relate to the Cold War and threats of nuclear bombardment, major industrial accidents such as Chernobyl in the 1980s and threats of terrorism such as the events of September 11th 2001 (Diprose et al., 2008). For Joronen & Häkli statements about what reality is assumes a ‘mandate to speak in the name of reality rather than to question it’ (2017: 562). In other words, ontologies are not politically neutral, they enact particular cuts in the world that sensitise us to some aspects while dulling others (Woolgar & Lezaun, 2013; Law, 2004; Mol, 2002). While a focus on the inhuman powers of the earth may cause us to rethink the scope and scale of human agencies, this treatment of hazards is less helpful in exploring the complex ways that communities can and do live in hazardous environments. Indeed, in many parts of the world hazards bear little resemblance to the cataclysmic geological events that are described in the contemporary geographical literature.

The first move I wish to make here is thus to explore the subtler, less cataclysmic ways that communities are affected by natural hazards. This is important for opening up new avenues of geographical enquiry into the complex space-times of geological materialities and their interactions with those living in hazardous environments. This theoretical move builds on recent work in anthropology and philosophy that has sought to problematise an obsession with death and dying in the social sciences. For Elizabeth Povinelli (2016), the distinction between life and death is enacted and maintained through concepts such as Foucauldian notions of biopower (governing life through death) that hinder an ability to focus on the ways in which non-living entities give rise to and intermingle with human bodies. Rather than privilege self-sovereign distinct forms of being called ‘life’, Povinelli

argues it is more important to draw attention to different forms of existence. Similarly, for Braidotti (2010) a shift to post-anthropocentric scholarship comes not through imagining the limitations of the human body but from deprivileging categories such as life and death. Braidotti instead focuses on the generative processes through which particular forms of existence come into being. She argues 'death is only another phase' (2010: 6).

These observations are important as they do not situate geological realities in nomothetic or declarative statements about 'inhuman' forces but place humans back in the world and advocate for an openness, sensitivity and 'response-ability' (Haraway, 2008) towards realities that are amplified and foregrounded through research (Mol, 2010). What matters then is not simply making claims about the inhuman nature of reality but using ideas of reality as a tool that might make a difference for the specific human and more-than-human collectives we work with and are concerned about (Roe & Greenhough, 2014; Barad, 2007). Residents in South Iceland are less concerned about impending catastrophe, risk and the possibility that they might die at any time because of geophysical hazards. Instead, what matters in this context are the on-going, more banal ways that geophysical materialities shape the ways that lives are lived in these places in space-times quite removed from those of official state concern.

While there is currently a paucity of geographical work that explores the ways that communities live with and are affected by the less catastrophic aspects of geological materialities, anthropologists have recently made important steps in investigating the different ways that people live with and contest their polluted environments. Liboiron, Tironi, & Calvillo (2018) have explored the problems of living with the chronic effects of toxic pollution in South America. Lora-Wainright (2017) has similarly explored the effects

of toxic pollution in rural China. Rob Nixon (2011) has referred to these types of chronic, debilitating hazards as ‘slow hazards’. Building on early work that explored ‘invisible’ hazards of pollution and toxicity (Adam, 1998), these studies have sought to illuminate the different ways that communities actually live in and with debilitating environments (Alaimo, 2008, 2017; Shapiro & Kirksey, 2017; Tsing et al., 2017; Head, 2016; Shapiro, 2015; Kirksey, Shapiro, & Brodine, 2013). Some of these ideas have been drawn on by geographers looking to: ‘problematise and expand what counts as an event beyond the sense of dramatic “overthrowing”, “shattering”, and so on’ (Anderson & Gordon, 2017: 158). There are therefore calls to explore what some geographers have called ‘slow emergencies’ (Anderson et al., 2019), but there remains much to be done to explore how this interest translates to studies of natural hazards.

A focus on the less catastrophic dimensions of the geo may also open up new space-times of concern in studies of natural hazards that better capture the ways that communities live with, struggle against and prosper in and with hazardous environments. This is to follow the call by Braun and Whatmore that ‘more is to be gained from a closer attention to the *specificity* of the matter at hand’ (Braun & Whatmore, 2010: xxx, emphasis in original). In the context of geophysical hazards, this means paying closer attention to the different spatio-temporalities and affective intensities of the earth, rather than generic ideas of catastrophe that bear more resemblance to popular representations of disaster perpetuated by film (see Ekström, 2012, 2016; Ekström & Kverndokk, 2015).

There is therefore a certain degree of abstraction and detachment in the way that geological hazards have been treated in recent work on natural hazards. This abstraction has led to new ontologies of hazards that put forward claims about the inhuman forces of

the earth, but actually pay little attention to the complex spatio-temporalities of geological upheavals and materialities as they manifest in particular situated contexts. In other words, in efforts to make studies of natural hazards less anthropocentric by focusing on human death and annihilation, not only have human geographers entrenched this problem, but they also risk obfuscating the different ways in which communities are affected and effected by geophysical volatility thus serving to entrench rather than address certain inequalities.

Providing nomothetic declarations of the ontology of natural hazards is thus not the objective in this work and instead what becomes important is the way that research foregrounds ideas of hazards that are able to draw attention to the different ways that communities struggle, improvise and live with the complex spatio-temporalities of the earth. This shift opens up new ways of understanding the different effects of hazards on communities beyond death. It also promises to open up new possibilities for exploring the way that communities live with hazards beyond antagonistic human-earth relations that involve spatial ontologies of separation manifest through interventions such as: physical barriers (McPhee, 1991) and no-fly-zones (e.g. Lund & Benediktsson, 2011).

3. Governance

One of the ways in which states seek to protect and secure populations from possible future risks is to render unpredictable futures calculable. This facilitates and legitimatises particular actions of preparedness, precaution and pre-emption (Massumi, 2015; Anderson & Adey, 2012; Anderson, 2010; de Goede & Randalls, 2009). Scenario modelling and techniques of imagining various futures are then projected back into the present allowing governments and publics to take anticipatory actions. A broad variety of threats, from

terrorism, to biosecurity to the spectre of climate change and natural hazards are treated as ‘potentially catastrophic...[and] without some form of action, a threshold will be crossed and a disastrous future will come about’ (Anderson, 2010: 780). The concept of catastrophe has thus been mobilised to describe how societies anticipate a broad range of future scenarios from the prospect of fossil fuel depletion (Weszkalnys, 2014) to terror threats (Anderson, 2010; Massumi, 2010).

One of the problems with this scholarship, as it pertains to natural hazards events, is that it says very little about what actions of governance look like in a world of human-environment entanglements in which communities must respond to and negotiate hazards in the present. One exception is the literature on government responses to the eruption of the Icelandic volcano, Eyjafjallajökull, in 2010 (Bird et al., 2017; Lund & Benediktsson, 2011; Adey, Anderson, & Guerrero, 2011). For this event, scholarship focused on how the spaces of the ash cloud became an evacuated no-fly-zone whose area was defined by a computer model and ideas of ‘worst-case-scenarios’ (Lund & Benediktsson, 2011). Adey & Anderson describe how this no-fly-zone was imagined through the way ideas from the past ‘became a worst-case scenario, not so much removing uncertainty from the equation but intensifying a potential future of metal and people crashing out of the sky’ (2011: 13). In other words, this is governance based on spatial segregation of humans and ‘threat or risk’ which belies the complexity of modes of living with hazardous environments which move beyond ontologies of Nature-Society and their binary spatial demarcations.

While the Icelandic ash cloud reveals the logics through which geological hazards come to be enacted as evacuated spaces, this literature continues to be deficient in unpacking the different ways that people actually respond to and live with on-going geological volatility

beyond spatialities of human separation from hazardous areas. These ideas of ontological separation from hazards are also reinforced by current work on geological materialities which notes that humans experience the destructive forces of the earth but tend to focus on the aftermath of disaster rather than the condition of living in and negotiating the materialities, affects and effects of hazards as they manifest in the present (see Clark & Bettini, 2017; Pellizzoni, 2015; Clark, 2010b, 2010c). This echoes the claim by Anderson et al. that: ‘ways of governing through emergencies are, then, founded upon the geo-historically specific distinction between the everyday and the emergency – a distinction that has only ever been available to some forms of life’ (2019: 14).

Governing beyond emergency

Imagining the earth as an adversarial force that might be governed through emergency and the spatial separation of humans from areas deemed ‘hazardous’ is thus a common way of thinking about human-earth relations. However, philosophers such as Carolyn Merchant have devised the concept of a ‘partnership ethic’ that ‘may offer guidelines for moving beyond the rhetoric of environmental conflict and toward a discourse of cooperation’ between humans and natural hazards (Merchant, 2010: 16, 2015). Moreover, the feminist philosophies of Elizabeth Grosz (2005, 2008, 2011) share this conviction that there are other ways of relating to the earth than through entrenched ideas of spatial segregation and imagining geological agencies as in conflict with humans. For example, Grosz argues ‘territory is artistic, the consequence of love not war, of seduction not defence’ (Grosz, 2008: 69).

These philosophical ideas have been taken up in divergent ways by geographers to think about themes such as human evolution through time. For example, Clark & Yusoff (2014)

have explored how human evolution is tied up with the use of fire. Bosworth (2013, 2015, 2017: 1) explores the material conditions that ‘enable a heightened sense of the openness of our bodies to geological forces’. Similarly, Yusoff (2015) explores the way that cave art played an important role in ‘becoming human’ in which ‘subjects emerge as a constellation between inhuman time, non-human forces, and geologic materialities’ (Yusoff, 2015: 383). While this work draws on an interest in the ‘long durée’ that expand human geography’s temporal registers of concern into deep time, it is notably silent in problematising contemporary ways people live with geophysical hazards in the present time.

Resources for thinking through living with hazards can however be found in other disciplines, such as political science. For example, David Chandler (2018) has outlined the need to explore modes of governance that allow humans to navigate a world of entanglement, non-linearity and complexity. Chandler argues that: ‘the Anthropocene appears to bring to a close the human-centred or anthropocentric understanding of power and government agency’ and there is now a need to ‘govern adaptively and responsively in ways which increasingly appear to become at home in the Anthropocene condition’ (Chandler, 2018: 21). Chandler (2018) maps out three modes of governance associated with scholarship on the Anthropocene. The first, ‘mapping’, outlines governance not on the basis of top-down actions but through processes of tinkering with component parts to try and shift emergent, non-linear outcomes. The second mode of governance, ‘sensing’, works not at the level of ‘root causes’ but on emergent outcomes of processes by working to ‘minimise their impacts or disturbance’ (2018: 22). The third mode of governance, ‘hacking’, involves not working against threats and problems but to ‘encourage new forms

of creative experimentation and developing a greater awareness of new possibilities’ (2018: 23).

Each of these modes of governance provides fertile ground from which to explore ways of living with geological materialities. For example, in their studies of a breakwater made from oysters around the coast of New York City, Stephanie Wakefield and Bruce Braun (2018) highlight how these living infrastructures attenuate the forces of storm surges and act to ‘ward off’ the possibilities of coastal flooding. While Braun and Wakefield’s approach resonates with Chandler’s logic of ‘sensing’, in this thesis I am less concerned with partitioning different modes of governance. Instead I seek to open up the conditions that collectively allow these multiple forms of living with hazards to be explored. I want to shift discussion of governing hazards away from simplistic ideas of the relative agency of humans and the earth and of hazardous spaces as necessarily spaces to be evacuated of human life.

This concern with rethinking the logics of securing life from environmental threats resonates with emergent ideas around the ‘probiotic turn’ in geography and biosecurity debates (e.g. Hinchliffe et al., 2013, 2017, J. Lorimer, 2015b, 2017). These studies have explored the intricate ‘choreography’ of human and more-than-human life. In these studies humans do not suddenly come into contact with non-humans requiring us to build up resilience, instead ‘probiotic approaches figure the present as already disastrous’ (J. Lorimer, 2017: 33). The emphasis in these studies becomes not one of pre-emption or precaution but the emergence of new forms of biopower that attempt to manage more-than-life as part of entangled more-than-human ecologies. J. Lorimer (2017) suggests that ‘probiotic environmentalities’ manage the interaction between species with the aim of

shaping the emergent properties of these systems rather than attempts to head off change. The focus is thus on guiding and steering more-than-human ecologies within systems characterised by tipping points, thresholds and non-linearity.

These ideas of ‘making worlds’ is helpful in shifting governance away from pre-set ideas of pre-emption, preparedness and precaution. It provides a greater focus on the on-going, lived realities of those in hazardous environments. This is important as it means that geographers are able to expand the worlds which we legitimise and pay attention to in our research. No longer do these worlds have to revolve around ‘returning to normality’ - an artificial baseline of ‘bouncing back’ to pre hazard conditions, as is fundamental to the policies of the United Nations (Donovan, 2017; UNISDR, 2015a), but to open up consideration of the ‘radical otherwise’ (Povinelli, 2011b, 2013). The radical otherwise is here understood as the multiple ways of living with hazards that go beyond dominant ideas of evacuation, normality and permanent anxiety.

These ideas therefore resonate with philosophical ideas of immanence in which ‘bodies are impinged upon, shaped, and propelled along different pathways’ (Clark in Yusoff et al., 2012: 250). While a philosophical interest in Deleuzian ideas of immanence and becoming have been drawn on to describe how the earth and its elemental forces have played a role in human evolution and emergence (see also Grosz, 1999, 2005; Alcoff, 1999; De Landa, 1997), it also offers powerful ways of thinking about natural hazards. Immanence offers a way of thinking about human - geological relations that shifts focus from linear time punctuated by periods of large-scale geological events towards a more open-ended conception of time where emphasis is placed on the on-going negotiations and entanglements between humans and geological materialities. Often the focus in geography

and hazard management has left ideas of ‘recovery’ and ‘response’ unchallenged. Yet, understanding the governance of natural hazards through the concept of immanence is important for disrupting these linear notions of time and allowing a focus on how the present is imbued with the affects and hauntings of past events as well as the materialisations of future potentialities.

4. Participation and affect

Participation

Insights from science studies and laboratory ethnographies have foregrounded how realities are made in and through assemblages of technologies and knowledges (e.g. Latour, 1986, 1993, 2005; Law, 1999; Mol, 1999). Geographers have built on these insights to explore how decision-making around hazard mitigation might be made more democratic. If scientists do not have privileged access to reality ‘out there’ (Haraway, 1991), then the knowledges of other non-scientists might be brought into the mix to create democratic opportunities for debate and contestation.

The need to bring together lay and expert knowledges has been core to much work on participation in managing natural hazards. For example, Sarah Whatmore and her academic collaborators sought to create a methodology that would allow non-scientists to scrutinise various scientific ideas for flood risk mitigation in the small town of Pickering in North Yorkshire (Whatmore, 2013; Whatmore & Landström, 2011; Lane et al., 2011). Whatmore and her colleagues devised the idea of ‘competency groups’ that brought members of the local community in Pickering (North Yorkshire) together with flood risk scientists. Residents were able to scrutinise flood risk models and ideas for hazard defences. They were also able to make suggestions about what types of flood mitigation

strategy would work based on their intimate knowledge of Pickering. These ideas focus on ‘slowing down science’ (Stengers, 2003, 2005) to allow different human and more-than-human actors to be involved in deliberating what is to be done.

This model of thinking about engineering participation has now percolated into thinking about volcanoes and geophysical hazards more broadly. For example, Oppenheimer argues that risks from geophysical hazards in the twenty first century require the interdisciplinary skills ‘from physical and social scientists working in fields as diverse as geoscience, economics, politics, history and anthropology’ (2015: 245). Others interested in democratising the science of volcanology have investigated how volcano alert levels might be devised through combining lay and scientific knowledges that might reduce the occurrence of false alarms (Donovan, 2017; Fearnley, 2013; Donovan, Oppenheimer, & Bravo, 2012). There are also growing numbers of studies that are exploring how indigenous knowledges ‘match up’ with the ideas of contemporary volcanology science and therefore advocate for greater collaboration between scientific and indigenous knowledges (Pardo et al., 2015).

While studies interested in decision-making around volcanic hazard planning and mitigation have not gone as far as devising new methodologies for engineering scientific and community participation- perhaps because of the time and commitment such interventions require from researchers- these studies tend to hold on to the idea that public participation needs to be engineered. In other words, the logic consistent in these works is that there a number of activities through which ‘experts’ traditionally made decisions about hazards that publics should also have a say in.

One of the fundamental problems with this entrenched model of thinking of public participation and democratic decision-making is that it relies on a particular understanding of natural hazards as sudden, disruptive and potentially catastrophic rather than something that is part of the banalities of everyday life. In worlds in which the present is already disastrous, in the sense that we are not waiting for a charismatic geological event to come upon communities, we must recognise that the idea that publics suddenly coming into being over a ‘matter of concern’ is problematic. As Liboiron, Tironi, & Calvillo assert: ‘rather than understand politics through charismatic events with hard edges and ready narratives...conventional studies miss politics as a precarious and pragmatic achievement’ (2018: 337). The consequence is that politics and democracy understood in terms of emergent, deliberative collectives fails to take account of the ways that lay publics are already participating in making realities in space-times quite removed from moments of controversy.

These ideas have been particularly important for thinking about the ways that people live in and with toxic pollution. For example Tironi (2018) documents the ways that people living in polluted environments develop practices to live with pollution such as wiping the pollution off tomato plants. Similarly, other scholars have described practices such as carrying bunches of flowers to help to relieve the toxic smells of pollution as they go about their everyday lives in China (e.g. Lora-Wainwright, 2017; Lora-Wainwright et al., 2012). These practices necessitate that we broaden ideas of what it means to participate to include forms of ‘material participation’ that are part of everyday life, rather than following predetermined ideas of what participation looks like in environmental issues (Lezaun, Marres, & Tironi, 2016; Marres, 2011, 2013, 2014, 2015). These practices of participation may involve cobbling together new forms of knowledge and disparate actors. They may

involve multiple spaces. These practices are therefore not approaches that necessarily involve policy makers or large-scale urban planning (cf. Bulkeley & Castán Broto, 2013). They might be considered experimental in that they involve a degree of trial and error in how to manage hazards. They will emerge in the intimate space-times of everyday life.

Affect

A focus on the everyday realities of living with hazards also has important implications for how we understand ‘affect’ and how we draw on this concept to make sense of these different practices. Affect has been deployed in a diverse array of ways in geography. For example, affect in Whatmore’s studies of flooding hazards, describes how the ‘earthly powers’ of hazards create disruptions to the fabric of everyday life that causes collectives to look again at accepted ways of doing things and knowledges (Whatmore, 2013). In Anderson’s (2010) studies of pre-emption, precaution and preparedness, by contrast, affect becomes the ‘object target’ of government that enables state actors to bypass due political deliberation to effect change in the economic, social and political fabric of society (see Swyngedouw, 2010, 2011; Beck, 2006). However, while these understandings of affect and natural hazards focus on the affective power of the earth, and how affect is manipulated by government, they have tended to shift away from some of the earlier work on affect that sought to foreground how affect draws attention to the sensations, atmospheres and textures through which everyday life is experienced (e.g. Latham & McCormack, 2009; Thrift, 2008; Stewart, 2005; McCormack, 2003).

This is an important distinction because in this latter understanding affects are more than simply ‘shocking’ events that have a ‘capacity to force thought’ (Whatmore, 2013: 33).

Instead, affects can become more subtle emotions, sensations and atmospheres that might register through complex emotions such as fear, love and awe. It is easy to miss these more subtle aspects of everyday life in hazardous environments which on the surface seem to be simply overwhelmed by affects such as ‘grief’ and ‘loss’ (Barnett et al., 2016; Head, 2016).

Recent geographical studies have begun to draw attention to the ‘affective atmospheres’ that manifest in the aftermath of major geophysical hazards. For example, affect has been mobilised recently to discuss the way that communities in New Zealand come to re-inhabit the spaces left devastated by the Christchurch earthquakes in 2011 (Cloke & Conradson, 2018; Cloke, Dickinson, & Tupper, 2017). Other have also mobilised affect to think through the various ways that environmental hazards from the past still evoke particular feelings and emotions that allows ‘hauntings’ of the past to penetrate present realities (Hill, 2015). These studies open up new opportunities for exploring the ways that affect and affective atmospheres play an important role in living with hazards; yet, there is more to do to investigate the different affects that emerge in hazardous environments and how these affects give rise to different forms of public participation in responding to hazards. There is a need to draw together the role of affect in helping to understand forms of public participation and its consequences for shaping practices of who and how hazards are experienced and managed in everyday life.

More broadly then, there is a politics to thinking about affect and its role in living in hazardous environments. On the one hand, geographers have explored how affect can close down worlds through its mobilisation by government. On the other, there is fertile ground to explore the role of affect in opening up new worlds that draws attention to how

life is lived with hazards that are not all about anxiety, worry and understanding hazards as threats (Wakefield, 2018a; Anderson, 2017). I contend, attending to hazards is not all about the extent to which humans can influence the physical materialities of the earth such as lava and ash clouds (cf. Clark, 2010b), but also about who is able to participate in managing and mitigating hazards, even in a more expansive understanding of participation beyond official government strategies of hazard management and civil protection.

Mobilising affects such as fear may be one way in which populations are encouraged by government actors to evacuate hazardous spaces or to adopt routinised practices such as preparedness strategies. However, by paying attention to other affects and their spatio-temporalities, we are also able to explore their role in shaping the diverse array of human and more-than-human actors and knowledges, the multiple spaces involved and the logics involved in managing hazards that orientate actions of responding to hazards towards particular temporalities or entities. I understand affect in this thesis therefore as both the sensations, energies, feelings and emotions that emerge through material assemblages and relations (e.g. Roberts, 2012) and that these affects can orientate the politics of who, where and how hazards are responded to.

In this thesis, I spotlight three different dominant affects: trauma, anxiety and care. These affects provide a counterpoint to ideas of hope, loss and grief that are well documented in hazardous environments (Anderson, 2017; Barnett et al., 2016; Clark, 2010a; Solnit, 2010). Trauma, for example, has been written about extensively in studies of death and dying (e.g. Coddington & Micieli-Voutsinas, 2017; Alaimo, 2008; Parr, 2008). This body of research has also explored how memorials such as Auschwitz and those for September 11th try to cultivate affects such as trauma that link past atrocities to the present (Waterton

& Dittmer, 2014; Arnold-De Simine, 2013). Anxiety has been documented in studies of resilience where it comes to be understood as an affect that restricts human capacities to contest the conditions of vulnerability (Grove, 2013). There is also work that documents care in the aftermath of disaster (Anderson, 2017; Clark, 2010a; Solnit, 2010), but this is care afforded exclusively to human individuals rather than more-than human actors. While these affects have been written about in geography- not always specifically in reference to hazardous environments- little has been done to explore their spatio-temporal dynamics in empirical studies of hazardous environments. Nor have these studies explored the political ramifications of affects in giving rise to particular forms of public participation in responding to hazards, or considered affect as the register through which communities are affected by hazardous environments.

Important here is therefore how different collectives come to live with hazards and attune to the practices, spaces, and more-than-human actors that are involved in negotiating everyday life and geological materialities in volcanic environments. This is to recognise that there is difference and multiplicity in living with hazards that risks being eviscerated by entrenched ideas of hazards as solely catastrophic and disastrous and a focus on acts such as preparedness, anticipation and pre-emption. While these practices are helpful in thinking about the way that potentially hazardous futures are folded into the present, they tell us little about the ways that the effects of past events are negotiated in the present nor the on-going negotiations between communities and the physical vibrations, eruptions and effects of earthly materialities.

5. Conclusions

In this review, I have outlined several axes that describe new theoretical spaces for thinking through 1) the ontology of hazards 2) hazard governance and 3) affect and participation (Figure 5). These concepts take studies of natural hazards in new directions. In doing so they move well beyond ideas of a political ecology that aims to uncover the social inequalities that amplify the effects of hazard events. Problems such as racism, poverty and marginalisation are no less important today as in the 1990s and 2000s when this literature came to dominate geographical approaches to hazards. However, if we pre-figure studies of political ecology to involve uncovering underlying social inequalities, we miss out on analysing the complex ways in which communities suffer with the less catastrophic effects of hazards, the different ways they respond, and the different affects that orientate who participates and how these responses take place.

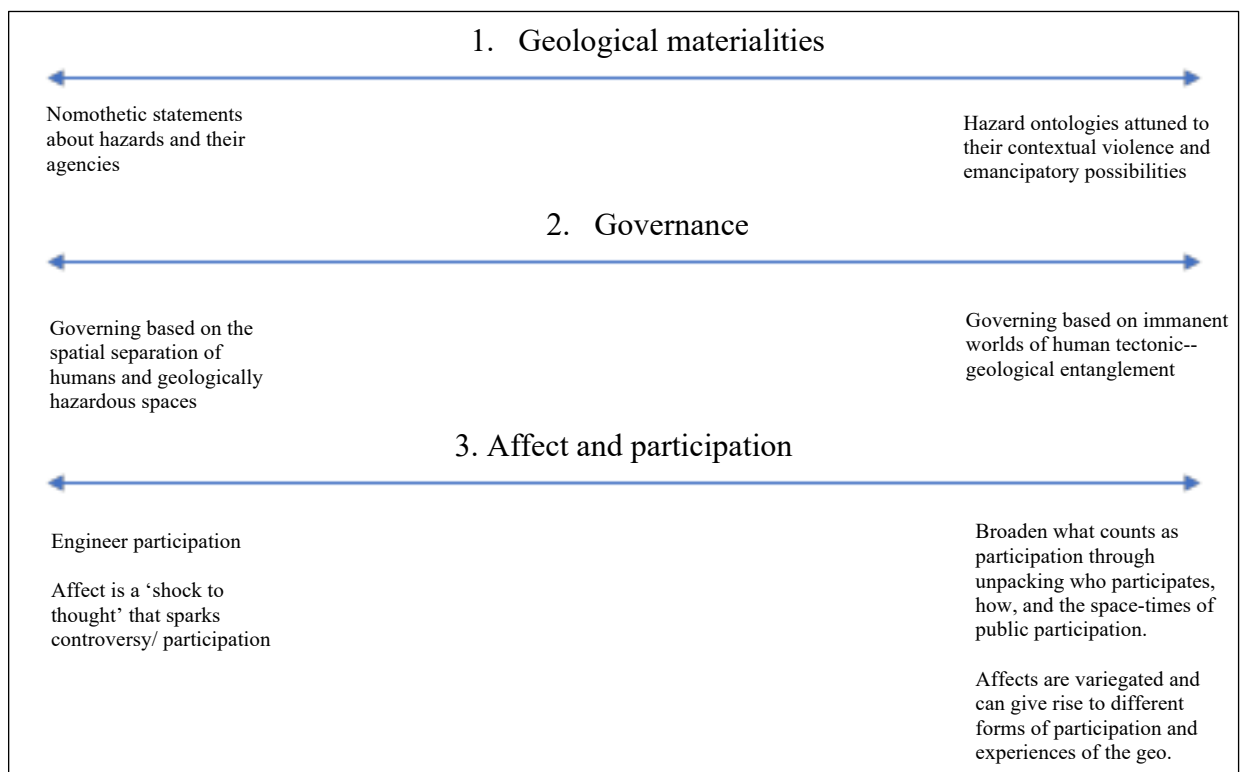


Figure 5. Conceptual dimensions of the geopolitics of natural hazards

Rethinking the emancipatory qualities of political ecology to reflect particular contexts is therefore critical for ensuring geographers are actually able to do important work in highlighting the breadth of social problems associated with hazards. In Iceland it is of course still possible to highlight how governments and citizens might collaborate more on hazard management policy issues. It is also possible to investigate how forms of social inequality still persist in Iceland and may make the effects of hazard events unevenly felt across a population. Yet, for those I lived and worked with these issues seem less pressing than forms of analysis that validate the ways they respond to hazards as part of their everyday lives, and must continue to live with the effects of the physical materiality of geological hazards in space-times quite removed from major earthquakes and volcanic eruptions. Those in South Iceland continue to protest that their ways of living in geologically active environments are not a question of being complacent to risk. This requires us as researchers to foreground and validate the strategies of living with hazards that emerge in the course of everyday life.

The concepts I have outlined here thus attempt to rectify the current way that natural hazards are approached in geographical research. Firstly, I contend, that there is a need to move beyond making declarative, nomothetic statements about the inhuman ontology of hazards. What matters more is thinking through ontology as a sensitising device, attuned to the particular violence it can achieve in particular contexts in taking attention away from particular struggles and types of human-environmental relations that matter to local people. In this thesis, I take this imperative to involve attuning to the less catastrophic, more mundane and insidious ways that people are affected by hazardous environments. In this way, my focus aligns with work on various forms of 'slow hazard' as documented in anthropology and recent geographical work (Anderson et al., 2019; Nixon, 2011; Davis,

2001). Yet, my objective is not to suggest hazards are ‘slow’, ‘fast’, ‘inhuman’ or otherwise, (though they may be all of these things); instead, I wish to foreground the specific types of hazardous materialities that come to effect those I worked with in South Iceland.

Secondly, I foregrounded the need to explore the different ways of governing hazards that go beyond ideas of separating humans from hazardous areas, practices of preparedness and ideas of ‘recovery’ in the aftermath of a major event. While these ideas are prominent in international policies for managing hazards and geographical studies, they say little about the on-going strategies that communities deploy to live in and with volatile environments. I contend, it is thus more productive to think through terms such as immanence where we can appreciate how past hazard events reverberate into the present, possibilities of future disaster are folded into the current time and people must find ways of navigating the effects and affects of hazards in their everyday lives. Immanence helps to focus attention on the different practices of living with hazards and their complex spatio-temporalities, rather than following abstract ideas of practices orientated around ‘pre’ and ‘post’ hazard demands.

Thirdly, I foregrounded how ideas of affect and participation are also crucial for thinking through the different forms that participation can take in responding to hazards, beyond government strategies. This also helps explore the political role of affect in shaping the actors, spaces and approaches involved in participation in these different strategies of response.

These concepts are interrelated and provide new opportunities for studying not only the effects of geophysically active environments but other environmental problems such as flooding, and the complex array of environmental problems associated with climate change. In the following methodology chapter, I explore the practices through which I became sensitised to the affects I describe here and also the practical, embodied strategies through which I became attuned to the ways that people in South Iceland are affected by hazards.

Chapter 3: Methodology and methods

1. Introduction

This chapter describes the messy, iterative processes through which I collected data, arrived at my case studies and wrote-up this work. The methodological commitments and methods that underpin the data I collected emerged through a process of continuous reflection and being open to the unexpected ways in which particular phenomena and ideas were revealed as this research progressed. This stands in contrast to a process of contrived rational detachment from the world that sees research as a linear process that can be neatly compartmentalised into discrete research processes.

This thesis also adopts methods attuned to the more-than-representational dimensions of the world. This approach therefore stands in contrast to approaches that see the human body as the locus from which experience begins and ends and instead foregrounds the ways in which objects, texts, events, people, atmospheres and the non-human world more broadly give rise to experiences. This is a methodological approach that resonates with ‘post-phenomenological’ work that seeks to ‘de-centre’ the human in the sense that experiences emerge in and through more-than-human relations (e.g. McCormack, 2017; Ash & Simpson, 2016). This makes it possible to radically expand what is considered the ‘empirical field’ beyond talk and text and enables an attuning to the intensities and energies emergent from a ‘charged “background” of more-than-human relations that ‘catalyse bodily performances and actions’ (Lea, 2009: 375). Ethnographic methods and approaches enable a sensory attunement to the more-than-representational dynamics of the world and bring into view the heterogeneous materials that give rise to how the world is experienced (H. Lorimer, 2006).

My aim of investigating the different ways that communities are affected by geological hazards resonates with recent work in anthropology, particularly with the methods and ideas involved in research that investigates people that live with the chronic effects of pollution and environmental degradation (e.g. Tironi & Rodríguez-Giralt, 2017; Alaimo, 2017; Lora-Wainwright, 2017; Shapiro, 2015; Lora-Wainwright, 2013). While there is a body of ethnographic research in tectonically active places in geography (e.g. Donovan, Sidaway, & Stewart, 2011; Donovan, 2010), this existing work has tended to focus on hazards and the spectacular space-times surrounding disaster events. There thus remains little in the way of research methodologies that have explored how to attune to the complex spatio-temporal dimensions of geological materialities, nor brought this together with a concern for the pre-personal affects and energies that make possible the different practices through which the effects of hazards are attended to. In this chapter, I outline my approach to investigating these phenomena.

This chapter has three main sections. I begin by outlining the methodological orientations involved in generating this research. In the second section, I describe the particular methods I deployed, and I document the processes of ordering and analysing the data that were collected. In the final section, I outline the rationale for my three case studies.

2. Methodological orientations

In this section, I outline the methodological touchstones that underpin the conduct of this research. This involves understanding research as an embodied process, involving practical forms of emotional and corporeal labour. It also involves understanding the purpose of writing research not as an unmediated window onto the world, but a process of becoming sensitised and sensitising others to particular aspects of reality.

Concepts and experimentation

In her discussion of Actor Network Theory (ANT), Anne Marie Mol argues that ANT has been mischaracterised as a coherent theory that works through unveiling material contingencies (Mol, 2010). Mol (2010) argues, 'if ANT is a theory, then a theory is a repository of terms and modes of engaging with the world, a set of contrary methodological reflexes. These help in getting a sense of what is going on, what deserves concern or care, anger or love, or simply attention' (2010: 262). ANT is important in this research as it helps us to move beyond ideas of critique towards an impetus for experimentation and putting forward realities, ideas and worlds that have hitherto been neglected and marginalised by geographical scholarship. ANT here is therefore not about deconstruction and showing that reality might be made according to different logics and ideas. Instead, it is about how we as researchers become sensitised to new aspects of reality that we can affirm. These ideas resonate with Deleuzian notions of research as a 'deterritorialising' practice that can challenge dominant ways of thinking and offer new 'lines of flight' over the repetition of the same (Deleuze, 2014; Deleuze & Guattari, 2004).

Latour argues that critique 'has all the limits of utopia: it relies on the certainty of the world beyond this world' (Latour, 2010: 474). For Latour critique simply 'subtracts' from the world- it takes away the givenness of realities as they are currently assembled but fails to 'add' anything to the world in its place. Latour and others such as Tim Ingold thus favour verbs such as 'making' (Ingold, 2011) and 'composing' (Latour, 2010) to describe the way that research can open up a diversity of possible worlds. As Anderson argues this approach 'differs from recent experiments with critique that invest hope in revealing the contingency of the apparently settled (as constructionist accounts) or in showing the

diversity of the seemingly singular (as in versions of ontological politics)' (2017: 473). Instead, the ethos of research becomes one of investing hope in revealing the 'radical otherwise' (Povinelli, 2011a). In the context of this thesis, the 'radical otherwise' refers to the different social-material existences that occur in hazardous environments beyond catastrophe and death.

Through conducting this research, I gradually left behind an impulse to critique and an impulse to find empirical examples that confirm dominant ways of thinking about hazards in geography, such as regarding their 'inhuman' nature and spectacular eventfulness (e.g. Clark, 2010a). This was a remarkably difficult task. I entered the field thinking through the inhuman nature of the earth and natural hazards and their concomitant relationship to imagining hazards as a particular kind of emergency scenario that mobilised governments and emergency services. This led me to become drawn to examples of evacuation, lava flows and confirmatory statements from research participants such as: "you cannot fight nature". Yet, I became increasingly concerned that much of the spatio-temporal complexity surrounding the ways that people are affected by hazards falls away. Over time, consequently I spent less time trying to impose pre-figured concepts onto what participants were telling me and instead learnt to leave these concepts to one side.

Another problem with concepts that foreground the 'asymmetrical' and 'inhuman' forces of the geo is that they also risk closing down the theoretical ideas that can and do make a difference to living with hazards. I found ideas of inhuman nature increasingly came to limit the possibilities of research which itself is made to seem inconsequential against the forces of geo. I became sensitised to new aspects of human-earth relationships over the different research trips to Iceland and by allowing the affective experiences that I

encountered to ‘rub up’ against existing geographical concepts for thinking through the geo. This is an approach that draws on the creative potential of ‘frictions’ (Tsing, 2005) between concepts and empirical findings and their iterative, co-constructive relationship. The conduct of this work therefore blurs neat divisions between the field and the desk, reading and writing, concepts and empirical findings.

I also tried to maintain a sense of openness to new empirical findings. This openness is manifest in how the project became much less about trying to impose preconceived ideas onto my research participants and more about creating opportunities to explore and become attuned to their everyday lives. For example, at the inception of the doctorate, I envisioned creating a ‘competency’ group methodology in Iceland in the style of Sarah Whatmore and her colleagues (e.g. Whatmore & Landström, 2011). I consulted with academics from the Earth Science department in Oxford and in Cambridge who were also thinking about similar projects in their own work relating to ideas of knowledge co-production between scientists and lay expertise. I imagined that there might be scope to bring together expert knowledge and publics in the formation of hazard management strategies that might be made more democratically. Consequently, I attended several modules of lectures in the Oxford Earth Science department at the beginning of my doctorate on volcanology and geophysics in the view that this might help me to navigate between different epistemic communities.

As part of this process of learning about hazards through speaking with volcanologists and earth sciences, I learnt about the various efforts currently being undertaken to work with communities affected by volcanic hazards. One such project is the STREVA project. The project website describes its goals as:

Our research area focus is on six volcanic sites across the Lesser Antilles, Ecuador and Colombia. These countries are faced with multiple volcanic threats often in close proximity to large towns and cities. However, by working across multiple sites STREVA will identify common issues in volcanic disaster risk in these settings and consider how lessons could be applied worldwide.⁸

The STREVA project focuses on facilitating collaboration between the communities living in volcanically active places and disaster managers and policy makers. This involves trying to identify possible ways of reducing risk and community ‘outreach’ projects between locals and volcanologists. I was invited to participate in the STREVA project as a ‘social scientist’ by one of the project coordinators to work on the volcanic island of St Vincent and the Grenadines. However, both the geographical areas of interest and a focus on ‘reducing risk’ through volcanologist community engagement programmes took me away from my interests in Iceland and my intrigue in how Iceland tended to throw up new questions for how to think of hazards and participation.

In Iceland, I found volcanologists at the University of Iceland who were keen on engaging with ‘affected publics’ about how hazard management practices could be improved. One official described how they would be keen on me finding out from people on Heimaey how residents would like to be controlled in the event of a future evacuation scenario. Yet, spending time on Heimaey and in South Iceland led me to become less concerned with their ideas of ‘opening up’ emergency plans and natural science to publics. Instead, I became more interested in spotlighting the everyday tasks involved in responding to and living with hazards that exceed policy documents and the official practices of hazard

⁸ <http://streva.ac.uk/what-we-do> [Accessed: 25/6/2019]

management. Interventions such as competency groups may well work in moments of controversy, and after major events when the disruption opens up spaces for new knowledges to guide the way forward, but they do little to acknowledge the ways that people are already engaged in managing the effects of hazards outside of the space-times of spectacular geological disruptions.

My commitment through this research thus became less to abstract and preconceived notions of the geo and of attending to injustices. Instead, it became more about interventions and concepts that try to do justice to the lives of those I lived and worked closely with in South Iceland. I visited South Iceland on two separate occasions in March 2016 and in July 2016 as part of a pilot project for my master's thesis. That pilot project was subsequently built on during the research visits for this doctoral project. I returned to Iceland between May and September 2017 to collect data for this thesis. From my first visits to South Iceland I built close relationships with the different individuals I met. For example, I became close friends with a family on Heimaey who were keen to support me in my research. I spent most evenings talking together with them. I helped them with everyday chores such as cleaning and shopping. We often ate together, and they have subsequently been to visit me in the UK. They introduced me to their friends and relatives and would often suggest people that I speak to who would be happy to talk about volcanoes and earthquakes.

These relationships form part of an ethos of 'being at risk' in the sense that the relationships I built may not necessarily have led to any particular research findings. However, cultivating these allowed me to continually discuss my research and thoughts. Rather than a process of feeding back research findings to participants at the end of a

project, through my on-going conversations I was keen that residents themselves were able to help me understand the issues that mattered and my interpretation of them. Sometimes participates and residents read sketches of chapters I was formulating. Other times, they would listen to brief ideas and politely tell me what they thought. In this way, the research emerged through those I worked and lived with on Heimaey, and in South Iceland more broadly, as well as through the concepts I was assembling to help spotlight aspects of reality that often seemed mundane and taken-for-granted. I also agreed to speak to reporters from the local Heimaey newspaper about my research while I was on the island to give residents a chance to know about my research ideas as they were developing⁹ (Figure 6).



Figure 6. Article in island newspaper (Eyjafréttir) about my work on Heimaey. The headline reads 'Much we can learn from a community like the Westman Islands'. Digital version shown (also in print format).

⁹ <https://eyjafrettir.is/2017/06/17/margt-sem-vid-getum-laert-af-samfelagi-eins-og-vestmannaeyjum/>
[Accessed: 15/5/2019]

In many ways, the close relationships I forged and the degree to which I was open about my research interests were a product of conducting research about a relatively uncontroversial topic in a country in which doctorate degrees and research are thought highly of. However, not only did these relationships grant me access to the intimate lifeworld of residents but they also helped me to attune to new issues that mattered to them. It was through this iterative process of spending time with research participants that helped me to put the concepts I was reading and thinking with to the test for the purposes of finding more adequate concepts to attune to participants' realities.

Research partnerships

Rather than standing outside of the world, Roe & Greenhough argue that 'knowledge is something formed processually, not only through [the] spoken word or text/image but through lived embodied practical experiences' (2014: 53). Knowledge is therefore forged through being-in-the world and our multi-sensual engagements with it (Pink, 2015).

However, an ethos grounded in the idea of the sensing human body is not only about attuning to affects, affective atmospheres and pre-cognitive sensations (e.g. Anderson, 2014), but also about considering how the researcher's body makes a difference to the research findings that come to materialise. In other words, this scholarship encourages us to not only turn to our senses, it also encourages to think through the realities that are made in and through the research process (see Barad, 2007).

As I spent time in South Iceland and on Heimaey, I built strong friendships with people on the island. Some of these relationships came about because I met people and those I spoke with referred me to speak to their friends. Other relationships came about serendipitously through getting involved in different aspects of community life on Heimaey. These

relationships necessarily focus attention on the scale of the everyday and the affects that emerge in intimate spaces that people encounter in everyday life. For example, in chapter 6, I document the ways that residents regulate the affective intensity of earthquake activity online. These observations did not emerge because I asked participants what they do to prepare for volcanoes or earthquakes, but because spending time with them opened up opportunities for them to show me the things that occupy their day.

On Heimaey, the relationships I built with participants emerged over several years. Figure 7, for example, shows one participant posting on social media about an orchid I bought her to say thank you for her help in the research. As I returned to Heimaey for subsequent research trips, residents came to collect me from the ferry port and to drop me off. They would invite me for dinner at their houses. These relationships were based on trust and residents' enthusiasm to help with the research process. Some called their friends on my behalf to ask if they would be interested in participating, while others drove me to meet new people and hoped that I had "found something useful". These friendships with research participants also endured longer than the time I was on Heimaey or in South Iceland and I keep in touch with those I met on Heimaey via social media and for the past few years I have received calls wishing me a Happy Christmas and New Year. I have also kept in contact with participants with cards and small gifts since being back in the UK and as I wrote up this research project.



Figure 7. 'My lovely orchids, gifts from good friends 🥰' is the photo caption. Participant shares a photograph of the orchid I bought her at the end of a trip to Heimaey on social media

Relationships were not only forged in person, but also through social media and text message. For example, Figure 8 shows a message exchange with a resident on Heimaey about earthquakes online. I had not been aware of the earthquake activity that the message was alerting me to, but I had discussed that I was interested in the way that people on Heimaey use the Icelandic Meteorological website to keep track of earthquake activity. Instances such as these helped to hone my attention onto particular matters of concern such as low magnitude earthquakes, ash and traumatic memories.



Figure 8. Noticing earthquakes online

Moreover, as Figure 8 shows, these relationships with research participants were not solely about earthquakes and volcanoes. Indeed, most of our interactions were about all manner of other matters that also shape everyday life. For example, I helped one middle-aged resident with the task of organising her extensive collection of salt and pepper pots that were occupying a whole room (Figure 9). These everyday activities meant that I could build trust with research participants and also that there was a degree of reciprocity in our relationship. Often these long-term friendships grew out of an initial interview or encounter with a resident and were often initiated by residents wanting to help and to continue the conversation we were having about their lives. Residents often described how they enjoyed our encounters. This continued to be the case when we would discuss emotive subjects and difficult experiences.



Figure 9. Organising a salt and pepper pot collection with a resident on Heimaey

I kept a daily field diary whilst in Iceland where I recorded my experiences and encounters. I also took photographs of the various phenomena that people showed me relating to their everyday lives in a geologically active place. This opened opportunities for tensions to arise between that which the participants were telling me as a friend and that which they were disclosing to me because of my research interests. In these situations, I would ask the participant if we could speak more about a certain issue when I could record the conversation. This means that devices such as the voice recorder also became participants in the research in the sense that set the affective tone of the situation to a slightly more formal register (see also Lury & Wakeford, 2014).

Attuning to geo-tectonic materialities and everyday practices

Swyngedouw argues that insisting ‘on the foundational role of inhuman nature...endorses what is mere ‘second nature’ to most natural scientists’ (2011a: 681). He suggests, what is troubling about a focus on the inhuman nature of hazards is a tendency to cordon off the

sensing human body as both ‘an object of analysis as well as an analytic subject’ (Swyngedouw, 2011a: 681). Shapiro & Kirksey note in their studies of pollution that: scientific concerns can displace ‘other pressing community concerns and limit conversations to the priorities of scientists, policy makers, and corporations’ (2017: 482-483). In this thesis, I therefore deprivilege science as the gatekeeper of knowledge about the earth (see also Bobbette & Donovan, 2019; Dixon & Beech, 2017) and explore the kinds of human - earth relations that emerge when we turn to our senses.

Shepherd recently described how the geothermal might be thought of not as simply ‘heat within the ground’ - as it is understood in geological science- but rather as a ‘field understood wherein the subterranean emerges and overlaps with the above-ground; embroiling heat, surfaces, and flows; and which is not merely physical but atmospheric and affective’ (2019: 225). I also want to think through geophysical hazards as both physical, material phenomena that are also profoundly affective. This troubles the idea that earthly volatility exists neatly below the earth’s surface and is experienced solely through direct human contact with ‘geological’ materials, such as lava. I envision the earth and its upheavals in a way that makes clear that its agential capacities are affective and emerge through the particular relations of human bodies and environmental dynamics. I therefore take the concept of ‘natural hazard’ quite broadly to mean any way in which the physical and affective attributes of living with the geological comes to negatively affect the wellbeing or quality of life of the people living in geo-tectonically active environments.

This research was therefore not conducted from the position of a detached, rational observer but through embodied practices and sensuous experiences. These experiences

were not forged through the panic or haste of escaping lava or eruptions, but through adjusting to the slow-pace of life in South Iceland. Walking around Heimaey allowed memories and hauntings of the past to come to affect the present, but also enabled residents to talk to me about traumatic experiences of the past. Through this research, I became used to slowing down my actions as I looked through photograph albums, drove around Heimaey and engaged with exhibits about the 1973 eruption at the Eldheimar museum. Similarly, attending to problems of ash erosion and earthquakes involves a change of pace that attunes to the slow, deliberative processes of everyday life, in contrast to active processes that orientate programmes of official emergency response.

In studies of pollution, there is a renewed focus on how lives come to be lived in these toxic environments which have seen scholars drawing on ethnography as a means of studying these ‘chemical spaces’ (Shapiro & Kirksey, 2017). What emerges is a desire for the researcher to gain an intimate and rich understanding of other’s lives. For example, Kirksey discusses how researchers might think of dispositions such as ‘care’ for others as ways of apprehending how some people live with cancer, including its ‘radioactive elements...and poisonous cures’ (2017: n.p). Other researchers have turned to autoethnographic descriptions of their own bodies struggling with diseases such as cancer in a way that allows the reader to attune to the hardships that cancer suffering involves in contrast to what have been perceived as sanitised accounts of living with everyday struggles (Madge, 2016, 2017).

Participating in daily activities such as attending hospital visits, eating, shopping and cleaning together with residents on Heimaey meant I gradually asked fewer questions about eruptions and instead learnt to attend to the effects of geophysical happenings on

people's lives. Becoming attuned to these effects resonates with the approach taken by Nicholas Shapiro who describes how the 'tracking of small changes to body and atmosphere across time and space can accumulate into a process ... which elevates minor enfeebling encounters into events that stir ethical consideration and potential intervention' (2015: 367). It is from the accumulation of 'small', personal stories (H. Lorimer 2003) and attending to the everyday struggles of people to live a good quality life that my findings emerged.

Attending to the less spectacular manifestations of the earth also involves attuning to the earth's various non-human rhythms and temporalities. When I first visited Heimaey in the winter of 2017, I became acutely aware of the long-term traumatic reverberations that manifest on Heimaey. However, by contrast, ash erosion does not occur when the ground is covered in snow. I only became aware of this when I visited in the summer and could see the way that residents were attending to the problems it caused. Residents report that ash erosion is considerably worse after volcanic eruptions and was especially acute on Heimaey in the years after 1973. I also only became aware of the role that low-magnitude earthquakes play in everyday life during my summer visits to Heimaey when residents were particularly worried about an impending eruption of Katla on mainland Iceland.

This research was therefore the result of becoming corporeally involved in the lives and environments of research participants. In many ways, it was through others' expertise and knowledge that I became attuned to the various consequences of living in hazardous environments and the practices through which these consequences are addressed. I heard the stories many told of on-going trauma, shared in their jokes and tried my best to react sensitively to those who wanted to use the opportunity of this research to speak about their

hardships. I also learnt to attune to those aspects of geological materialities that often did not take centre stage in accounts of experiencing hazards. While residents tended to narrate accounts of heroic actions from the time around 1973, it was not uncommon that whilst they were speaking about the past, they would also be attending to other aspects of living with volatile geology such as checking earthquake activity on their computer. I thus became not only interested in what people said, but what they do in their everyday lives and how their bodies were affected by the tectonically active environment.

The methodological concerns of attuning to the mundane, everyday effects and affects of the geo thus closely mirror parallel methodological development in anthropology that foreground the impacts of pollution on communities. These scholars have, for example, used new forms of technological sensing equipment to identify areas of toxicity (e.g. Gabrys, 2012). The problem of detecting the effects of geological activity using sensing equipment such as gas monitors or micro-earthquake detectors is not only that authorities still find ways of discrediting these readings (Tironi, 2018), but that many consequences of geo-tectonic hazards still cannot be made visible through these means. For example, on-going trauma and memories emerge through conversation rather than machinery.

3. Methods

The process of collecting data for this thesis did not begin and end in South Iceland. I contacted archivists, museum directors and volcanologists via email long before I arrived in Iceland. Similarly, data collection did not end when I left Iceland in September 2017. I kept in contact with research participants, clarified ideas and solicited their views on what I was writing. While in Iceland, the collection of data was also not confined to the moments when the dictaphone was recording. In fact, it was usually after interviews that

memories had been jogged and participants felt more relaxed that they showed me new things, took me to new places and revealed more about their lives.

Consequently, the methods of data collection I employ here do not see participants as vessels of data to be mined for information. Instead, methods such as life history interviews helped me to build relationships that led to more immersive relations in participants' lives. Here methods are therefore heterogeneous and part of a research journey into ever more immersive realities of research participants. It was out of these immersive relationships that I became aware of the different ways of managing hazards in everyday life and interviewed the key actors who were involved in these different practices of management. Table 1 shows an 'at a glance' overview of the different types of data I collected, the methods I employed to collect this and the different groups of individuals from whom I collected data.

Data type	Description of data	Method of collection	Who is represented?
Life history interviews (with residents in South Iceland)	I conducted twenty life history interviews with residents in South Iceland. Interviews with participants took place over several occasions and are each typically between 4-6 hours in length.	Life history interviews typically began in people's homes or in the Eldheimar volcano museum. Typically, interviews would begin by asking participants about their first memories of living proximate to a volcano. They were typically divided into two halves. The first half of the interview described life before and during the 1973 eruption and the second half related to the time after the eruption to the present. Topics of discussion ranged from: impacts on children and families, discussions about evacuation, impact on material possessions and houses, materials that people salvaged, people's jobs in the past and today and thoughts about the future.	Communities of residents living in the tectonically active landscapes of South Iceland
Interviews	I conducted 32 in-depth interviews with individuals in South Iceland who are, in various ways, responsible for official hazard management programmes. I also	In interviewed the major actors involved in managing geophysical hazards in Iceland. These individuals form part of the extensive array of agencies involved in preparing for, mitigating against and responding to hazards. These interviews typically took place in municipal offices in Reykjavik and on Heimaey.	1. Official practices of civil protection management in Iceland and those involved 2. Artists, curators, municipal leaders on

	interviewed individuals who participated in a variety of practices that were involved in addressing the effects of hazards outside of these practices. These interviews were typically several hours long and involved follow-up interviews.	I also interviewed individuals responsible for more everyday forms of hazard management that attend to the less spectacular dimensions of geological activity overlooked by official practices of hazard management. On many occasions, I found out about these practices having interviewed an individual about their life history. I then arranged a separate occasion when I would interview them about practices of hazard management as well as others involved in these particular practices.	Heimaey and the broader team of people responsible for commissioning, creating and running the Eldheimar Museum 3. Individuals who observe earthquake activity online and individuals who represent this data in blogs and on social media 4. Academics, participants and programme managers at the Hekluškógar tree planting project
Field diary	Ethnographic observations that accompany each interview and encounters with research participants.	I described encounters with research participants, feelings, affects and emotions in a fieldwork diary. This took the form of digital notes on my laptop and notes in a handwritten diary. These notes documented what people said and did and typically took the form of auto-ethnographic descriptions. I also took photos and short video clips as part of these ethnographic observations.	Describes encounters with research participants and residents on Heimaey. Describes auto-ethnographic observations of everyday life on Heimaey
Archival data, photographs and screenshots	I collected many hundreds of pages of newspaper clippings from the time of the 1973 eruption through the website http://timarit.is . I also collected books, brochures and a large number of screenshots on Heimaey that documented how residents attend to the problems of hazards.	On many occasions, residents showed me photographs, brochures and objects. On other occasions, they shared images with me online and described newspaper clippings. I collected these data either by taking photographs of them, describing them in my fieldwork diary or taking screenshots of online activity.	Offered and insight into more-than-representational dimensions of living with hazards on Heimaey

Table 1 Summary of data sources and methods

Ethics, anonymisation and consent

Before I interviewed each research participant, I explained the aims of this research and obtained written consent, including explicit consent from each participant to be voice recorded. I also made it clear to participants that I would take notes about what was said

and what I observed. I recorded interactions with participants during and after the interviews had ended and also wrote-up the more-than-representational dimensions of our conversations that related to emotions, movements and activities. I shared the observations I had written down with participants to ensure they consented to these descriptions. These conversations often prompted participants to offer further insights into what they said, were feeling or were doing.

I explained to each participant that their responses would be anonymised in line with formal research ethics procedures at Oxford (CUREC). However, in the field anonymisation posed some practical challenges. Firstly, changing the names of individuals but keeping a fidelity to their experiences and stories is unlikely to offer any anonymity for residents in South Iceland who know one another and would likely be able to identify the participant from their experiences. Secondly, anonymisation enacts a certain kind of violence to the research participants in that the experiences participants shared with me are bound up with who they are and their particular histories. To anonymise the names of participants is thus to remove this specificity and risks rendering particular experiences generic. Thirdly, participants largely thought it odd that they would be anonymised. Often people on Heimaey described how they wanted “their story to be told” and participating in this work was a way of breaking out of a culture which meant residents often had no way of expressing their experiences, feelings and emotions. For example, on discussing a draft of a chapter with one resident, she was visibly puzzled why she had been given a pseudonym when it was her particular experiences I was describing. With participants’ consent, I have therefore chosen to keep participants’ original names in this thesis. However, should excerpts of this work be distributed more widely than for the purposes of

examination, I would continue to reflect on balancing the need to protect participants' privacy with a desire to be faithful to their individual experiences.

Interviews

Central to exploring human – earth relationships was speaking to both residents who live in places prone to geological change and also various 'professionals' engaged with natural hazards in a more analytical capacity through their jobs, such as: volcanologists, hazard planners, seismologists and psychologists. A key part of this process involved conducting interviews. I divided these up into life history interviews, conducted with residents, and semi-structured interviews that were conducted with the 'professionals'. Approximately equal numbers of both groups were spoken to (Appendix 1).

In his recent work on the geothermal in Iceland, Matthew Shepherd notes that: 'factors such as educational attainment, religion, ethnicity and sexuality did not play a part in significantly affecting access to, and experience of, the geothermal' (2019: 88). I however did not explicitly ensure that those I spoke to represent a diverse range of religions, economic differences, ethnicities and sexualities. This was because the small 4,000-member population of residents on Heimaey tend to be relatively homogenous in terms of these characteristics (predominantly White, middle class, Icelandic and Christian). However, this opens up new questions about how experience of the geo-tectonic hazards is mediated by these socio-cultural differences. These questions are beginning to be discussed at a theoretical level with some scholars arguing for the need to take women's experiences of natural hazards more explicitly (Alaimo, 2017; Dixon, 2015; Tuana, 2009). Similarly, Tolia-Kelly's (2006) work on affectual and emotional geographies provides an important critique of an overemphasis on a universal understanding of embodied

experience which does not recognise forms of social difference in shaping that experience (see also Degen, Melhuish, & Rose, 2017).

Investigating how experiences of the geo-tectonic are mediated by differences such as sexuality, wealth and religion would be a particularly interesting part of future work. This might also mean speaking to those who are particularly poor or particularly wealthy, whom I did not speak to as part of this research. In the life history interviews, I noted how age comes to shape how people are affected by the geo through memory and I discuss this at length in chapter 5. However, particularly for future studies in more urban, cosmopolitan contexts, it would be particularly interesting to investigate how social difference affects the kinds of social networks that people turn to, the types of coping strategies that are deployed, and, potentially, how some forms of social difference might influence the kinds of resourceful that are made possible in responding to environmental change. This would require these groups to be selected for as part of the research design process.

Life history interviews

I conducted twenty life history interviews with residents on Heimaey and with a small number of former residents who now lived in Reykjavik (see Appendix 1). I recruited residents through a snowball method. Interviews were conducted in residents' homes and in various public places on Heimaey. Often the interviews led to driving or walking to other parts of Heimaey such as church yards and places of work. Over time, these interviews became oriented less around detailed descriptions of the past, and more focused on how these people were coping at the present time. During interviews I would sometimes bring up observations I had made about living with earthquakes, ash and

memories, for example, to the interviewees in order to get participants to reflect on aspects of living with hazards they often took for granted. I use data from these life history interviews to form the backdrop to chapter 4. These interviews and observations are also used in chapters 5 – 7. I conducted life history interviews until I found that I was finding limited new information, but rather only repetitions of the same ideas.

I interviewed both men and women who covered a broad section of ages and professions; this included people that had lived through the 1973 eruption and those born after the eruption. This was important as it meant that the experiences of those who were born after the eruption were not discounted as insignificant. It was also important as this research is not only about the 1973 eruption but about residents' experiences of living in geophysically active environment. Such experiences are not exclusive to the time around 1973 and enabled the effects of different kinds of geo-tectonic hazard to become known.

The residents participating in life-history interviews did so for a variety of reasons. For some, it was out their generosity to help with my research by sharing their experiences. For others, it was because of a certain sense of obligation to future generations that they wanted their experiences documented. A further reason was because research participants enjoyed the process of being asked about their lives and enjoyed having an opportunity to speak about this. Life history interviews thus often formed the first step in a longer process of getting to know residents in South Iceland.

Life-history narratives were thus a method of data collection, but they also enabled participants to learn about my research interests and to build further partnerships. Life history interviews might thus be understood as forming a 'research journey' (Lorimer &

Parr, 2014) in the sense that they often began in people's houses, a coffee shop or the Eldheimar volcano museum but these relationships were not rigidly bound in space and time. There were multiple occasions when residents invited me to go on various excursions with them around Heimaey to look at aspects of the topography or artefacts that were helpful for them in narrating their experiences. There were other times when I was invited to meet a participant's extended family.

I recorded these initial life-history interviews using a dictaphone. When this became impractical, such as because of loud background noises, I wrote-up an outline of what was said after the interview. No participant objected to being recorded. I typed out transcripts of what was discussed immediately after the interview. Often these interviews would be lengthy- many lasting over three hours- and took place on multiple occasions. I felt an obligation to transcribe and record these interviews in full not only for the purposes of my research but because residents wanted their stories to be documented. I considered writing a short book as one of the outputs from this doctoral project that would present these life history narratives in their full detail. This was something many participants encouraged me to do, however it was not possible in the time constraints of a three-year doctorate. I therefore had to be conscious of not overpromising on what I was able to deliver to balance feelings of enthusiasm for the research with the potential for disappointment.

In these interviews, I was keen to allow research participants the scope to lead the direction of the interview. I had a list of prompts and questions but was more focused on creating the possibilities for participants to tell their stories as they wished to. This more open approach to interviews led to participants being able to talk about their present lives and their on-going relationships with hazards. These findings would have likely not

emerged if I had kept rigidly to a set of pre-formed questions and a more structured interview style. For semi-structured interviews with hazard managers and those involved in managing hazards through practices other than formal civil protection mechanisms, the interviews tended to be focused on the participant's role in managing hazards, their motivations and the actual practice of managing hazards.

Semi-structured interviews

I undertook semi-structured interviews with individuals responsible for both official hazard management programmes in Iceland and the forms of hazard management practiced largely by local communities themselves that attend to the less spectacular material and immaterial dimensions of living with the geo. In some cases, those I interviewed for life history interviews showed me the things they do to manage the effects of hazards in their life. In these situations, life histories would often blend with semi-structured interviews about a particular topic related to contemporary ways of managing hazards.

Hazard managers

I conducted semi-structured interviews with hazard managers in Reykjavik and on Heimaey. I interviewed senior members of the Crisis Management and Coordination Centre, academics at the University of Iceland, senior members of the Red Cross, individuals involved in co-ordinating Search and Rescue (ICESAR), individuals working at the Icelandic Meteorological Office, and Icelandic volcanologists. On Heimaey, I interviewed individuals responsible for carrying out municipal crisis management. These included the: Chief of Police, Chief of the Fire brigade, Mayor, council executives and a doctor. Where possible, these individuals showed me how they carry out hazard

management in practice. For example, I was permitted to listen in on calls to Icelandic search and rescue and I was shown the process of providing psychological support after natural hazards by Red Cross officials. These interview data, fieldnotes and photographs provide a more-than- representational account of the practice of hazard management as it is carried out in Iceland. These interviews provided an in-depth account of the procedures and actors associated with official hazard management programmes in Iceland.

Vernacular hazard management practices

I conducted semi-structured interviews with museum employees at the Eldheimar museum; these included: individuals responsible for the architecture and curation of the Museum and local residents on Heimaey who visited the museum. These findings are presented in chapter 5. In these interviews, I wanted to find out the different types of expertise that went into producing the Museum, the techniques behind creating the affective atmosphere in the museum and the broader logics of constructing a museum that broke from dominant feelings of victory and jubilation. I interviewed visitors to the museum to find out why they visited the museum and what they did while they were there. I stopped conducting interviews about the Museum when I had interviewed the vast majority of people responsible for its construction and curation, including the museum architect, designer, town officials, the museum director, exhibitions design team, technology design team and local people on Heimaey involved in the design and consultation process.

I also conducted semi-structured interviews with individuals involved in representing earthquake data online. This included interviews with senior members of the Icelandic Met Office who provide official earthquake notifications and operate the infrastructure of

earthquake sensing devices in Iceland. I also conducted semi-structured interviews with individuals who re-present this official data. In particular, I interviewed one of the main residents in South Iceland who blogs about and redisplay earthquake data whose posts are very popular amongst residents as alternative sources of information on earthquakes. These findings are presented in chapter 6.

Semi-structured interviews were also conducted with individuals responsible for hazard mitigation measures that involved planting trees and vegetation. I first became aware of such practices on Heimaey, when I spoke with local people who were instrumental in designing and popularising these practices. I also spoke with academics at the University of Iceland and the Agricultural University of Iceland, the director of the Hekluslógar tree planting team in Selfoss (S. Iceland) and individuals that worked for the programme about these practices. In conducting these interviews, my objective was to build a comprehensive idea of the key actors involved in these practices, how the practices work and to trace how the ideas behind it had evolved over time.

Ethnographic observations and more-than-representational methods

The ethnographic observations used in chapters 4, 5, 6 and 7 were made while living on Heimaey and spending time with island residents. They were also made while undertaking various activities such as planting trees, monitoring earthquakes and discussing past traumatic events alongside local residents. These observations were made while conducting interviews with people involved in these activities and also involved auto-ethnographic notes of my experience as a participant observer in these activities which I collected in a research diary.

In my field diary and notes, I tried to capture the emotions of research participants, fleeting gestures, the rhythms of everyday life on Heimaey as well as my own feelings while living on Heimaey. I took notes, for example, on descriptions of my surroundings and the different journeys participants took me on while describing their life histories. Whilst it is inevitably difficult to translate the complex richness of being-in-the-world into text, such that the world always exceeds such descriptions, my research diary and associated descriptions helped me to build a picture of the routines and practices of life as well as capturing my on-going thoughts and reflections on these practices as I reflected on them and they generated new thoughts and ideas.

One major challenge is representing these more-than-representational and affective dimensions of everyday life in this thesis. One way I have tried to address this is through the use of photographs that help to convey the various effects and affects of living with geo-tectonic hazards and the situated practices of attending to them. As an extension to this, I could have also used video methods or given video cameras to participants (e.g. Garrett, 2010). This would have enabled residents to capture aspects of their own lives. However, it is possible that this would have also had its own challenges, given that residents often consider their ongoing hardships and the neglect of the state apparatus of hazard management as ‘normal’. Using video to become sensitised to people’s hardships would have required on-going dialogical reflection and residents also enjoyed the interaction of telling their stories to me which was key to the research partnerships I cultivated. It might however be possible to do this in a follow-up project given that residents are now aware of my research interests in phenomena such as low-magnitude earthquakes and ash erosion.

Archival materials and secondary sources

In addition to ethnographic notes I made about my experiences in South Iceland of participating in various practices of addressing hazard effects and living with hazards, I also document the affects and affective atmospheres that materials such as documents, images and computer screens participate in. In chapter 5, I draw on archival materials that document the 1973 eruption and its aftermath. In chapter 6, I use blog posts from the webpage of a prominent earthquake observer (<http://www.jonfr.com/volcano/>). In chapter 7, I draw on leaflets and books that describe the work of the Hekluskógar project. Here I understand these materials not as a deadened part of the material background, but as more-than-representational in the sense that they help to evoke particular affects and contribute to the material-political assemblages through which particular practices are performed. I found it helpful to follow some authors' suggestions that images, texts and documents can be thought of as 'affective surfaces' through which worlds are composed (Forsyth et al., 2013).

While this thesis does try to capture some aspects of the affective participation of objects, images and texts in everyday life through ethnographic description, ideas of being affected and affecting the world through the process of research also underpin the methodological ethos of this work. In this way, thinking through affect is not only important in the sense of the affects through which particular forms of hazard management practices take place, but also in the sense of becoming enmeshed and interwoven in the ordinary routines of participants that required learning new kinds of corporeal skills and adopting new dispositions (see Stewart, 2005).

4. Research geographies and case studies

Research geographies

This research took place over a number of sites in Iceland (Figure 10). When I started planning my itinerary for fieldwork in Iceland, I anticipated visiting the Icelandic National Archives in a Skógar, a small town close to major centres of volcanic activity. I also had planned a visit to a volcano museum on the Snaefellsnes Peninsula in East Iceland. I anticipated that the archival materials in each of these sites might open up questions about how we come to know the inhuman effects of forces such as volcanic eruptions through non-human materials and artefacts. However, trips to these particular sites never materialised due to those I met and interviewed during the research process who drew my attention to different aspects of living with hazards.

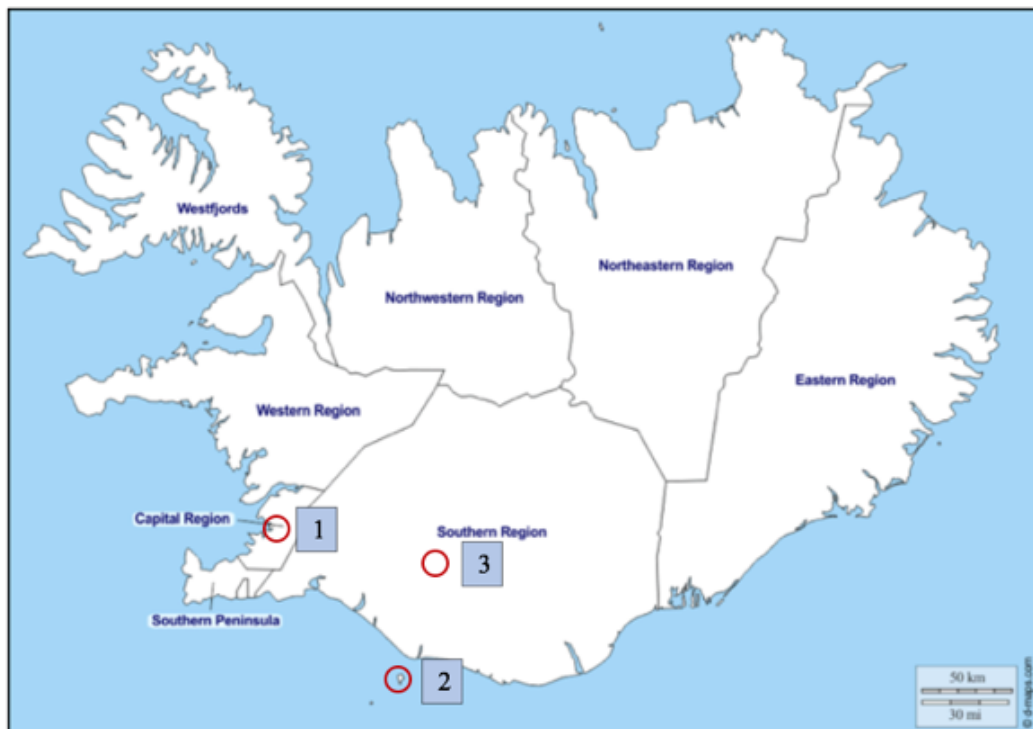


Figure 10. Map of key fieldwork locations. 1. Reykjavik 2. Island of Heimaey (Westman Islands) 3. Region around Hekla Volcano (especially Heklubýggd). Map modified with permission from: https://d-maps.com/carte.php?num_car=59545&lang=en

I began my fieldwork by spending time in Reykjavik interviewing members of the Icelandic Civil Protection department and academics from the University of Iceland about the different aspects of living with hazards in Iceland. I spoke with a diverse array of actors ranging from volcanologists to ecologists, local residents and civil servants. Sometimes this meant travelling quite some distance across Reykjavik to conduct interviews with particular individuals. For example, an academic at the University of Iceland helped to set up an interview with a couple who had lived through the 1973 eruption on Heimaey and now lived some 30 miles north of Reykjavik. I was also very fortunate that she offered to accompany me there; however, on other occasions this meant fairly long bus journeys and ferry rides to speak to people.

Through this research I found that there is a disconnect between the spaces where people are affected by hazards, such as in people's homes, and where practices of mitigating hazards take place. These differences between where people are affected by hazards and the places involved in mitigating their effects involves its own cartographies that are seldom discussed in studies of hazards where addressing hazards tends to be focused on the site where the problem is occurring. Navigating between these different assemblages took place in the field but it also took place as I was ordering my research notes and aggregating between the different assemblages of practices I encountered.

The research partnerships I built thus granted me in-depth access to the intimate details of everyday life in South Iceland. As these relationships developed, I learnt more about the habits of everyday life. For example, I was drawn to the volcano museum I describe in chapter 5 because it was this building that I originally used to speak to residents on

Heimaey about their life histories and experiences of the 1973 eruption. As the research progressed, I returned to the museum less frequently to conduct interviews and more as I participated in aspects of community life, such as for the ‘Intergenerational Conversation’ that I document in chapter 5. Spaces such as the online spaces that I document in chapter 6 in which residents on Heimaey interact with earthquake data, emerged much later in the research process. I was only made aware of actions such as viewing earthquakes online after spending more time in participants’ homes and being invited to spend time with them drinking tea, eating lunch, shopping, cleaning or watching TV and as these relationships developed. Finally, I became aware of the role of planting as a means of addressing volcanic ash erosion fairly late on during the time of my fieldwork after I had been invited to ‘plant up the volcano’ on Heimaey as part of an annual festival.

Case study selection

The case studies that emerge in this thesis did so through the encounters I experienced during my fieldwork. As the fieldwork progressed, I became more adept at aggregating between the different assemblages of actors involved in different processes of managing hazards outside of official responses. The choice of three case studies that I present here each capture a different dimension of living with geo-tectonic materialities. chapter 5 addresses the way geological upheavals from the past reverberate over time and come to haunt life in the present. Chapter 6 focuses on imperceptible, low-magnitude earthquakes. Chapter 7 addresses the effects of volcanic ash erosion. Each chapter serves as a contrast to the spectacular allure of events such as eruptions and earthquakes. In each of these case studies, I document the ways that residents in South Iceland address and respond to these different material dimensions of the geo. In common between them is a mode of governance that is not about returning to a state of normality- as in official forms of hazard

management- but developing on-going forms of response that foreground the dynamic, immanent relations between humans and geological materialities.

The case studies also capture the different contemporaneous affects that exist in hazardous environments. This includes both the affective dimensions of hazards and the affective atmospheres that emerge in and through hazard management procedures. Furthermore, these chapters capture the different spaces in which vernacular forms of hazard management take place. This is to eschew the idea of hazard management practices that take place solely in mock emergency scenarios in places such as government buildings and open up recognition of the more mundane, everyday spaces in which communities attend to the effects of hazards. These spaces shed new light on the importance of spaces such as museums for attending to hazards in that these spaces are more than places for learning about the past, but actively intervening in its on-going consequences for communities. The case studies also spotlight different kinds of expertise in these different spaces that involve artistic and ecological knowledge as well as citizen science.

The case studies I use here are not neutral descriptions from the field reported on in an impersonal, detached manner. Instead they emerge through a creative, embodied process. This is in line with Vannini's contention that while 'traditional and realist ethnography more-or-less posits the representation of their research subject(s) as a faithful rendition of the word "as is", non- representational ethnographers consider their work to be impressionistic and inevitably creative' (Vannini, 2015: 318). My aim in this project is not to claim that I am reporting the world in a manner that is indifferent to the phenomena that I describe. Instead, my aim is to spotlight and sensitise readers to the everyday habits and

struggles of what it is like to live with the complex spatio-temporal dimensions of the geo through the selection of these case studies.

Choosing these particular case studies was inevitably also the result of choices that meant some dimensions of my findings have not made it into this report. For example, I was particularly keen on exploring the more-than-representational ways in which the volcanic eruption on Heimaey in 1973 had been documented in newspapers both in the UK and Iceland. To do this, I made contact with Chalmers Clapperton- a Scottish geologist/geographer who produced a series of articles on the 1973 eruption for the *Geographical Magazine* whilst the eruption was active (see Clapperton, 1973a, 1973b). The difficulty with this was the amount of additional materials I would have had to gather in addition to those I was already assembling meant it was not possible in the time constraints of this thesis.

On the other hand, there were examples which I would have liked to have made into case studies but did not have enough data to do so. For example, I was particularly interested in the ways that animals experience the effects of hazards. This was inspired by the stories I heard of horses, cats and dogs being slaughtered because they inhaled volcanic gases. I was also interested in the ways that children under the age of 18 experience the deleterious effects of hazards in South Iceland, the discussions they have about this and the kinds of things they do to mitigate them. I did not interview anyone under the age of 18 for this project, but I heard stories of the way that young people often helped their parents address the impacts of traumatic experiences. Another possible case study chapter that I overlooked is the way that living with the geo brings many positive affects and emotions, such as those associated with an almost limitless supply of geothermal energy. The

decision to focus on the more deleterious dimensions of living with the earth meant that these materials did not make it into case studies.

Case 1 - Chapter 5: Attending to trauma in a volcano museum

In this case study, I focus on the space of a newly-constructed volcano remembrance museum on Heimaey to explore how residents have sought to recreate affective environments conducive to telling personal stories about their experiences from the time during and after the eruption. Museums are important sites for studying culture and affect and this has been documented extensively by human geographers (e.g. Ingram, Forsyth, & Gauld, 2016; Barry, 1998).

I contend that museums blur distinctions between science and art and in so doing may bring into being new emergent publics and practices (see also Barry & Born, 2013). Museums are therefore generative sites for studying the emergence of new practices that might transform our understanding of the possible solutions for addressing environmental problems. Gabrys & Yusoff draw on ideas of ‘aesthetics’ to describe the conditions that allow people ‘to materialize and articulate what would otherwise be un-sayable and un-thinkable’ (2012: 17). The volcano museum I explore in chapter 5 similarly operates in a manner that opens up new ways of addressing the effects of a volcanic eruption. In this way, the exhibits, artistry and affects in the Museum are important spaces not only for ‘educating’ publics about the natural world, but for enabling new ways of addressing on-going environmental problems in and through the museum space.

Case 2 - Chapter 6: Re-storying earthquakes

The second case study attends to the effects and affects provoked by low-magnitude earthquakes that occur across South Iceland. These earthquakes are not directly detectable through human senses of touch or hearing but are made knowable through seismic detection equipment whose technological advancement means that it is increasingly sensitive to small vibrations within the earth.

This chapter therefore directly builds on work which focuses on citizen science as a way of understanding human- environment interactions. Gabrys (2012, 2014, 2016) has foregrounded the need to explore the ubiquity of environmental sensing and the increasingly democratic way that the data generated are collected by individuals and shared via the internet. For example, Gabrys (2012) identifies practices of pollution sensing in cities undertaken by citizen scientists. The data generated by citizen sensing are also affective and can be manipulated in this way to help forward the arguments of citizens (Gabrys, Pritchard, & Barratt, 2016). This chapter builds on this work to investigate how sensing practices enable communities to be affected by the earth and its materiality. The affects that are brought about through presenting this data also present challenges for communities that bring into being new roles for citizen scientists where their role is not simply about presenting evidence to those in power but modulating the affective intensities of this information for the local community itself.

Case 3 – Chapter 7: Mitigating ash erosion on the slopes of the Hekla volcano

Ash erosion describes the processes through which volcanic ash from historical eruptions becomes transported by the wind. The majority of Icelandic soils are comprised of ash material (Arnalds, 2004, 2015). These andisol soils are liable to become eroded, especially

in areas where there is little vegetation. While ash clouds are now a well-documented consequence of volcanic eruptions (e.g. Lund & Benediktsson, 2011), the on-going erosion of volcanic ash is much less discussed. Ash erosion is not a spectacular event, it does not typically attract emergency service call-outs and it is often difficult to see the ash transported by the wind. Ash is a dull grey material, typically around a few millimetres in diameter. It can be eroded in small area where the ash may have little protection, or over much larger areas such as the vast area of the Icelandic Highlands.

Local environmental projects such as tree planting open up ways of exploring human-environmental relations. For example, Hawkins et al. (2015) document how local projects such as knitting birds in the UK and planting flowers in the USA as a process of pollution remediation are practices in and through which intractable environmental problems are tackled. Local environmental projects can also shed light on how non-humans are enrolled in the practice of addressing environmental problems (e.g. Wakefield, 2018; J. Lorimer, 2018; Wakefield & Braun, 2018; Hinchliffe & Whatmore, 2006). This chapter focuses on the role of plants and trees as participants in mitigating and managing the effects of volcanic ash erosion and, as such, documents the processes through which these non-human entities come to the foreground of geographical analysis and local community concern. These projects thus also reveal the different logics of governing natural hazards that escape the dominant ideas of official practices of hazard management by operating through the amalgamation of different kinds of expertise and logics of envisioning human-environmental relations.

5. Analysing, ordering and writing-up

The process of analysing and ordering the data I collected was conducted on an on-going basis whilst in Iceland and back in Oxford. I transcribed the majority of interviews in Iceland and reflected on the adequacy of existing geographical concepts to help analyse these findings at the same time as collecting data. This iterative process of collecting data, transcribing and reflecting allowed me to gradually leave behind pre-formed hypothesis and ideas and become sensitised to new aspects of living with hazards that were surprising and interesting.

This process of continuous reflection on the material I was gathering meant that over time I was able to explore new research questions and avenues of interest. As the collection of data progressed, I also began to attune to the new assemblages of people and practices involved in hazard management which then allowed me to spend more time exploring these new spaces of interest and the associated actors involved in the various practices. This meant that the processes of aggregating between different assemblages of hazard management emerged in the field as well as through the process of organising and coding research materials *ex post facto*.

On returning back to Oxford following my final period of fieldwork in Iceland, I used NVivo (Version 11) software to help me organise the different research materials I had gathered. I was able to code the different parts of transcripts, ethnographic notes and photos to particular chapters, which made it easier to identify where the material I gathered was going to sit in the thesis. On many occasions, I had to split information from the same interview or person into different chapters, particularly the individuals I ended up spending most time with on Heimaey. Hence, there is an artificial separation of these different

practices of managing hazards as those who participate in these different practices are not mutually exclusive. I chose to aggregate the chapters around the different dimensions of geological materialities. The long-term reverberations of past events, low-magnitude earthquakes and volcanic ash erosion generate different assemblages of people, which are addressed through distinctive practices and in distinct spaces.

This account is inevitably a simplification of the way that communities are affected by the earth and the practices involved in attending these struggles. This is not least because of the difficulty in capturing the richness and more-than-representational nature of the phenomena I encountered in the conventional confines of a thesis. It also is a simplification in the sense that I do not aim to provide a complete cartography of different geological effects and management practices. As I outlined earlier, my aim is to use these case studies and vignettes to open up new spaces of geographical analysis that can attend to the complex spatio-temporal dimensions of the earth and the on-going practices of everyday hazard management.

As I wrote-up the thesis, the process of writing leant itself to continuing to reflect on the material I had gathered, the concepts I was using to analyse the materials and the commonalities and differences between the case studies. At times, one of my frustrations was the difficulty in finding concepts that did justice to helping to elucidate the different phenomena I describe. This was particularly the case in chapter 5 and my descriptions of the Eldheimar museum. Here I experimented with concepts from museum geographies (e.g. Ingram, Forsyth, & Gauld, 2016), geographies of death and dying (e.g. Maddrell, 2016) and more philosophical ideas around art and the earth (e.g. Yusoff, 2015; Dixon, 2015; Grosz, 2008). In this process of experimenting with concepts and inventing new

ones (see Stengers, 2011), I challenged myself to think through what is at stake with these different concepts for the lives of those in South Iceland.

The process of writing is thus itself shot through with ethico-political considerations. These ideas resonate with long standing work in feminist science studies that foreground the role of the researcher in shaping the kinds of relations and phenomena that come into view through the research process (Puig de la Bellacasa, 2017; Roe & Greenhough, 2014; Barad, 2003, 2007). Thinking through the ‘cuts’ that my writing establishes has been a major challenge of composing this work. However, following Haraway's (2008) ideas of a practical, situated form of ethics, I have tried to be cognisant of the exclusions and absences in the writing of the thesis and tried to develop concepts that can both accommodate the richness of different encounters I experienced and do justice to the lives of those I worked with.

6. Conclusion

In this chapter, I have documented the complexities of collecting data, organising data and writing-up findings when a concern to represent the lives of research participants is made front and centre. I have shown how this involved a process of ongoing experimentation with concepts and an approach to building enduring relationships with research participants that allowed me access to their lives and their embodied expertise. The methodology and methods I have described therefore draw on heterogeneous ideas from Actor Network Theory, theories of affect and ideas from feminist science studies. They illustrate a commitment to the situated knowledges of research participants and to the maxim that research involves co-production.

Chapter 4: The problems with hazard management in Iceland

1. Introduction: nothing spectacular to report

I first met Guðrún on a cold, spring afternoon in 2016 in Skógarhlíð 14, downtown Reykjavík- the national command centre for Civil Protection in Iceland. Guðrún is a specialist at the Department for Civil Protection and Emergency Management. She was expecting me and I was escorted to a meeting room where we spoke at length about the Icelandic government's plans for responding to volcanoes, earthquakes and other natural hazards. I was also given a short tour around the 'crisis centre'- a large, windowless room on the ground floor of the building (Figure 11). Officially called the 'Joint Rescue Coordination Centre', it provides additional assistance to local authorities when the response to crisis events cannot be met by local resources. However, Guðrún explained that the room had not been in use for over a year since the eruption of Bardarbunga in 2015. Desks were empty, computers had been shut down - all was quiet.



Figure 11. Guðrún shows me around the Joint Rescue Coordination Centre in Skógarhlíð at 15:00 on 30th March 2016

It was not surprising to see the ‘crisis centre’ empty given that there were no well-known ‘crises’ occurring at the time. However, after spending time on Heimaey I began to

question the multitude of contemporary geological happenings and resonances that the empty crisis centre conceals. This chapter derives from my reflections on the partialities of emergency hazard management in Iceland. It is inspired by a shared concern amongst anthropologists (e.g. Oliver-Smith & Hoffman, 1999) and human geographers (Clark, 2010a) with the deleterious consequences of living in tectonically active places, and a concern with the various limitations of governmental civil protection responses to mitigating the effects of hazards (Lakoff, 2010). In this chapter, my objective is to investigate the adverse ways that tectonic environments impact the lives of communities on Heimaey. In doing so, I want to put to the test the ability of the recent geographical concern with the monstrous and inhuman capacities of the earth to illuminate forms of suffering associated with the impacts of hazard events (Clark, 2010a).

I argue that the focus in this work on catastrophe and associated concerns with mass-casualties, death and spectacular events overlooks the important ways that people's everyday lives are impacted by tectonic forces on Heimaey. This is because these impacts tend to be altogether subtler and less spectacular. To highlight these effects we cannot look to a singular idea of a natural hazard that is experienced differently by social groups (Bakker, McCarthy, & Braun, 2005; Pelling, 2001), but must begin by identifying the social collectives that emerge from various shared struggles and experiences. My intention is not to criticise (after Latour 2004), but to begin to 'add more to the world' (Hinchliffe, 2007: 192) by exploring how the struggles on Heimaey, and by extension the struggles of others living in geophysically active environments, can be illuminated and attended to.

This chapter is divided into four sections. In Section 2, I transport us to Heimaey where I describe empirical findings that emerge from a period of five months of ethnographic

fieldwork. I elucidate the deleterious impacts of tectonic hazards on the local community through three short vignettes. In Section 3, I draw on interview and ethnographic encounters with hazard managers in Iceland to highlight how a concern with the catastrophic means the kinds of effects I identified in Section 2 are overlooked by official hazard management. By way of conclusion, Section 4 outlines how the collectives identified in this chapter are not passive in the face of their struggles. To understand how such struggles are addressed however we need to expand the spaces and methods we consider important for managing and mitigating hazards. The subsequent chapters in this thesis are dedicated to exploring these practices.

2. Limits of state concern

To focus investigations on Heimaey is to commit to a place where for almost half a century there has been no well-known geophysical activity. It is therefore tempting to shift attention to other places in Iceland where findings are more certain, such as around the Bardarbunga volcano (erupted 2015), Grímsvötn (erupted 2011), Eyjafjallajökull (erupted 2010) or around the South Coast of Iceland where there is currently much concern about impending eruptions. However, I suggest, participating in the ‘ordinary’, ‘settled’ aspects of life on Heimaey constitutes being ‘at risk’ – an experimental approach that encourages pre-existing ‘sensibilities and convictions’ to be challenged (Haraway 1997: 190-191). This is to ‘create a space for hesitation’ creating opportunities to arouse ‘a different awareness of the problems and situations that mobilise us’ (Stengers, 2005: 994- 995).

Vignette one: resonances from the past

I sat with Frida in the Eymundsson coffee shop on the corner of the main street on Heimaey. We caught up on the headline news from our lives over the past eight months

since we last saw each other and she was keen to hear about my academic studies and research. Frida mentioned how she had just returned from the suburbs around Reykjavik to visit the temporary houses constructed with Norwegian help for evacuees fleeing Heimaey in 1973. She grimaced and clenched her fist as she explained how she went there to get rid of feelings of ‘hate’ and ‘anger’. I knew from our previous conversations that this anger was directed towards the eruption of 1973 and the impacts it has had on her life.

The eruption of the Eldfell volcano occurred in the early hours of January 23rd 1973 when a 1.5 km fissure opened close to a farm called Kirkjubaer in the far east part of Heimaey (McPhee, 1991). Almost all of the 5,300 inhabitants of Heimaey made their way to the harbour where they were evacuated by fishing boats to mainland Iceland. Some families stayed with relatives in Reykjavik while others like Frida and her four young children were re-located with a family they did not know as they waited for sheltered accommodation to become available. Frida recalled how she was desperate to return to Heimaey both because of the discrimination her family experienced as evacuee in Reykjavik and also because Heimaey is where she feels most at home. She returned to Heimaey in May 1973 and rented a house. Frida’s house, like three hundred other houses on Heimaey, was buried under a ten-metre-high wall of lava. The eruption was declared officially over on July 3rd 1973, at which point more evacuees began to return from mainland Iceland.

A 2013 Icelandic documentary film called ‘My Unfamiliar Home: Accepting the Volcano’ directed by Jóhanna Jónsdóttir and Sighvatur Jónsson (2013) illuminates how people on Heimaey address the long-term impacts of the 1973 eruption on their lives. I was invited to watch the DVD with Frida at her home the previous time we met. She bought fresh pastries and set aside the afternoon so that we could spend time watching it together. The

documentary consists of short interviews with a selection of islanders. Frida even makes an appearance in the film. Afterwards, we discussed the film and the different ways that her friends were addressing their memories and emotions. For example, we discussed Elizabeth who struggles to walk around certain parts of Heimaey, not because these parts are dangerous but because of the emotions associated with the destruction of places that were once ‘familiar’. In contrast to the increasingly well documented accounts of the immediate physical risks of geological hazards (e.g. Skelton 2005), we were talking about the deeply personal impacts of these hazards that often leave no visible marks and continue to impact people’s lives decades after the initial event.

In Nigel Clark’s (2010a) writings on natural hazards, he puts forward the idea that human agency is quite insignificant when we compare ourselves against the capacities of geophysical processes. Clark uses examples such as earthquakes, hurricanes and volcanoes to substantiate his arguments that disaster:

is the event so severe that in its tearing away of the foundations, structures, and relations that make the world legible, it also deprives those it afflicts of their capacity to absorb and process the event, to render it intelligible (2010a: 73).

Clark adds to a body of speculative philosophical work by suggesting that the ‘inhuman’ powers of natural disasters constitute examples where humans come up against the limits of our agential and thought-making capacities. Others have also emphasised the ‘earth-shattering’, inexplicably destructive capacities of geophysical hazards (Clope, Dickinson, & Tupper, 2017; Shaw, 2012). Whilst it would be equally possible to add Heimaey to the list of places characterised by the inhuman forces of the earth (Palsson & Swanson, 2016),

from my conversations with Frida we begin to see how this is a problematic move that risks silencing the less overt impacts of geophysical hazards that resonate long after geophysical events have ended.

Vignette two: spatial inflections

June 21st 2017: Auður posted on social media about a cluster of earthquakes occurring on the Icelandic mainland (Figure 12). The post links to Jón Frímann's webpage- Jón is a volcano/earthquake enthusiast who uses his own seismographic instruments and data from the Icelandic Met Office website¹⁰ to provide regular updates about geophysical activity around Iceland. For locals on Heimaey, his posts are a trusted source of information and commentary about earthquakes and geophysical events.

In his blog on June 21st 2017 Jón comments: 'it is **my view** that chances of an eruption happening soon (maybe in matter of hours) is high' (emphasis original¹¹)

¹⁰ en.vedur.is/earthquakes-and-volcanism/earthquakes/ [Accessed: 23/6/2019]

¹¹ Frímann, J. (2017). Katla Volcano Earthquake Activity – Update 2. from <http://www.jonfr.com/volcano/?p=6912> [Accessed: 23/11/2017]



Figure 12. Auður shares Jón Frímánn's blog post about increased earthquake activity around Katla on social media (June 21st 2017)

Concern about earthquakes was running high during the time I was on Heimaey. During the summer of 2017 there was much conversation about the eruption of Katla- a volcano beneath the Mýrdalsjökull glacier on the South Coast of Iceland. Earthquakes can be the precursor to volcanic activity; hence, the increased attention paid to the tremors beneath the Mýrdalsjökull glacier. An eruption of Katla could have significant consequences on Heimaey despite it being some 50 - 60 kilometres away. One risk is the possibility of a large tsunami wave caused by vast quantities of meltwater from the glacier. The tsunami could inundate the town of Heimaey and could cause ships from the harbour to be washed-up on land.

I was with Auður's son, Bergvin, when he switched the radio on to listen to the 10 o'clock news one evening when earthquake activity around Katla was high. He was anxious to find out new information. He pressed his ear against the loudspeaker so that it completely covered the circular bezel. Following little further insight from the news, he switched it off

abruptly and exclaimed: “they are not worried”. We experienced this heightened concern every few weeks over the summer of 2017 as seismic activity around Katla increased and diminished.

As we start to attune to the ways that contemporary life is infused with concern about spatially distant places, we also become aware of the role of technological networks through which information about the earth is conveyed. Networks of seismometers, GPS, gas monitoring and fixed sites for web-cam observations around areas of recurrent geophysical activity across Iceland allow communities to attentively keep track of this information in near real-time. The proliferation of sensing technologies gives rise to an understanding of new subterranean environments which ‘develop with and through sensor technologies’ (Gabrys, 2016: 9). While it has been well documented that sonic effects from voices and radio in domestic and other everyday spaces have the potential to move and affect bodies (Gallagher et al. 2017; Duffy & Waitt 2013; Kogawa & Kanngieser 2013), on Heimaey we see how communities are not only affected by sound but geophysical monitoring whereby sensing technologies make it possible to be concerned by distant, imperceptible vibrations proper to the earth itself.

Vignette three: non-event

Townspeople on Heimaey emphasised that while the eruption of Eldfell in 1973 was the event that achieved notoriety around the world, there were other happenings that I should be taking seriously. Some thought, for example, I should be more concerned with lesser known eruptions like Surtsey in 1963 and the eruptions that formed the islands of Jólnir and Syrtlingur in 1965 (Morgan, 2000). These eruptions occurred less than 30 kilometres

away from Heimaey and caused ash clouds over the island that contaminated the fresh water supply.

Ash in particular poses significant problems for the community on Heimaey. The 1973 eruption produced thick basaltic ash deposits on the eastern side of the island which continue to be eroded by the wind. Strong North Atlantic winds cause the ash to be entrained in the air; it then abrades house exteriors, contaminates interiors as well as causing psychological distress and breathing problems (Wilson et al., 2009). Frida put me in touch with Gísli, a former science teacher on Heimaey who since retiring indulges in film making, photography and an array of diverse academic research interests. Gísli told me that in the years after the eruption, ash was an on-going problem that made some people move away from Heimaey. He also shared with me his personal collection of photographs documenting the effects of the ash (Figure 13) and showed me his reports about ash written for the town council and broader academic readership. In a scientific journal article Gísli co-authored with a New Zealand volcanologist, they claim: ‘wind remobilisation of tephra deposits can be a significant post-eruption hazard that can be at least as significant and often more debilitating than the original tephra fall event’ (Wilson et al., 2009: 2).



Figure 13. Left - house on the south-eastern flank of Heimaey affected by wind-remobilised scoria dunes up to 0.2 m high. Right - house coated with scoria (Reproduced with permission from Gísli Óskarsson 1975)

Gísli has spent many years trying to raise awareness of the impacts of ash and of potential ways of mitigating the hazard. The countless folders on his computer dedicated to ash are testament to this concern. However, on an average summer's day in the middle of the tourist season on Heimaey it is not immediately apparent that such a problem exists or that it is as debilitating as Gísli suggests. Knowing that the erosion of ash is significant requires paying attention to traces the ash leaves behind. For example, I was drawn to the rolled-up towels at the bottom of window frames and the draught excluders by doors in people's houses. At other times, I noticed accumulations of ash that had found their way into hard-to-reach places (Figure 14). I also noticed that no sooner had I cleaned the window in the room in which I was staying that it was stained again with the grey residue of ash particles brought by the rain. Eventually, I gave up trying to keep it clean. It was not only the sight of ash that I began to notice over time but also differences in its texture and feel. Fine ash is the product of direct tephra fall from volcanic eruptions such as that of Eyjafjallajökull in 2010 and larger, rougher and sandier particles from the erosion of ash from the 1973 eruption. Ash does not usually make news headlines nor is it characterised by bright colours, high temperatures and loud noises like some volcanic eruptions, but ash impacts

the lives and the health of people on Heimaey in an altogether more silent and, as Gísli describes it, ‘debilitating’ manner.



Figure 14. Ash through window of the Eldheimar museum on Heimaey in 2017

Barbara Adam in her pioneering study of a range of environmental hazards argues: ‘we are dealing with phenomenon where the impacts...work below the surface until they materialise as symptoms – some time, somewhere’ (1998: 10). While Adam is principally concerned with exposure to harmful materials such as radiation, her broader intention is to ‘bring into view the in/visible, latent and implicit dimensions of socio-environmental phenomenon and processes’ (Adam, 1998: 11). In keeping with this objective and recognising the deleterious impacts of ash, Lauren Berlant argues that it is necessary to move beyond ‘melodramatic anti-foundational languages of nothingness, shattering, cleavage, and so on to describe impact’ and appreciate the ‘ordinary, forgettable,

charming, boring, inconsequential [and] subtle’ aspects of everyday happenings (Berlant 2011: 278, note 17). These occurrences of ash erosion on Heimaey therefore have an uneasy fit with the concept of ‘event’, an incident which can be neatly bounded in space and time (Anderson & Gordon 2017). Instead occurrences of ash erosion are prolonged in duration, sometimes imperceptible and without a clearly defined beginning and end.

In these three vignettes, we encounter several different ways that geophysical events affect the everyday lives of people and environments on Heimaey. In making these illustrations I want to caution against notions that there are simple cause-effect relationships between geological agencies and their impacts. Often when the effects of environmental hazards become detectable by sight, touch, taste and smell they may ‘no longer be traceable with certainty to original sources’ (Adam, 1998: 10). This may be precisely one of the reasons why these problems go unrecognised by official hazard management. Spackman & Burlingame (2018) argue that even when collectives try to create standardised, scientific representations of the way that invisible, toxic and ‘slow disasters’ impact their lives, these representations may never overcome the evidentiary burdens imposed by state authorities. In the following section I outline the operation of official hazard management in Iceland to account for further reasons why the deleterious effects I presented in this section are neglected by hazard management in Iceland.

3. Logics of Icelandic civil protection

In this section I address what is at stake by imposing pre-defined ideas of geophysical hazards in strategies to mitigate and manage the effects arising from tectonically active environments. Geography and cognate disciplines in the social sciences have begun to conceptualise environmental management as a situated practice. These analyses highlight

the importance of examining the ‘manifold socio-techno-natural relations through which “environmental management” is constituted’ (Lippert, Krause, & Hartmann, 2015: 107). In these studies, environmental management emerges as the ‘politically charged work of practices that need to be studied and theorised in their own right’ (Lippert, Krause, & Hartmann, 2015: 108). Practices of managing the environment are therefore understood not as the product of detached rational thought but enacted and constituted according to particular logics that emerge through human and more-than-human relations.

I now turn to interviews and ethnographic observations undertaken in exploring the operation of civil protection in Iceland. Civil protection refers to the state-based arrangements designed to mitigate the impact of ‘natural and technological hazards’ on populations (Alexander 2007). Contemporary civil protection as it has emerged in Europe and North America since the 1990s has embraced an ‘all hazards’ approach. In other words, response to individual hazards such as a flood or a volcanic eruption will be different, but the overarching framework structuring the response remains the same. In this section, I illuminate the partialities of civil protection as they emerge and touch down in Iceland. This section addresses both how and why the adverse effects of living on Heimaey that I identified in the previous section are neglected in contemporary hazard management. More broadly, this section provides the rationale for challenging the extant logics that underpin hazard management that I attend to in later chapters.

Catastrophe in Icelandic civil protection

Back in the offices of the Icelandic Civil Protection Department, Guðrún explained that the origins of the civil protection system in Iceland date back to the Second World War.

Threat of bombing by aircraft in British-occupied Iceland mandated new Air Raid

Committees which installed air raid sirens and planned for the evacuation of cities (Act No. 52/ 1941) (Bernhardsdottir & Svedin, 2004). At the end of the War, the Icelandic population chose to abolish their Union with Denmark and form a new republican constitution in 1944. Both then and now Iceland has no standing army; however, with rising Cold War tensions in 1961 there was pressure on the Icelandic government to protect civilians in the event of enemy attack, especially nuclear bombardment (Karlsdóttir, 2014). A new Act was drafted in December 1962 which created the ‘National Civil Defence Agency’ mandated to: ‘organize and implement measures in order to prevent bodily harm to the public or damage to property caused by military action’ (Act No. 94/1962). The main tasks of the National Civil Defence Agency at this time were to mitigate the risks of ‘military, nuclear and microbial attack’ on civilian populations (Civil Protection Iceland, 2017a). A nuclear engineer, Águst Valfells, was the first person appointed to lead the Agency from 1962 to 1964 (Friðfinnsson, 2005).

Following the eruption of Surtsey in 1963, the National Civil Defence Agency became concerned with the risks from volcanic eruptions. It is easy to imagine how the explosions caused by the rapid chilling of erupted materials by sea water had similarities with the types of event the Agency were already accustomed to expecting. In response to these concerns, the remit of the Agency was expanded by law in 1967 so that it involved:

- 1) organizing and implementing measures to prevent, as much as possible, bodily harm to the public or damage to property caused by military action, natural disasters or other hazards, and 2) of rendering relief and assistance on account of any loss which has occurred... (Act No. 94/1962b)

The changes meant the role of civil protection in Iceland was not only about responding to military events but also natural hazards. The work of the Agency began to consider the preparedness of municipal authorities for both natural hazards and military eventualities. Emergency plans were first drawn up for Húsavík town (N Iceland), Ísafjörður (NW Iceland), Höfn (SE Iceland) and a response plan for the eruption of Katla in South Iceland was written (Civil Protection Iceland 2017a). By coincidence, plans were also drawn up for a volcanic eruption on Heimaey the day before the eruption in January 1973 (Clapperton, 1973b). Written-up into a sixteen-page document several months into the eruption, the document outlines the procedures for an ‘organised evacuation from the Westman Islands [Heimaey]’ (Civil Protection Iceland, 1973). Several members of the current civil protection committee on Heimaey still own original copies and enjoyed telling me about the document and its use.

I was invited to take a look at the emergency plans and handle the original document in a municipal office on Heimaey. I raised and lowered my hand repeatedly with the document balanced on my palm - I was surprised at how lightweight it was for an item of such important consequence (Figure 15). In response, I was told the document is supposed to act like a ‘check-list’ of key tasks, responsibilities and procedures - designed for quick use rather than an exhaustive outline of what to do in a ‘crisis’. For example, it lists the ‘committee of senior officials’, ‘departure points’ and the ‘chain of command’. Crisis is defined by commentators on civil protection in Iceland as occurring when: ‘1) important values are being threatened, 2) limited time for decision making is available, 3) the circumstances of the crisis are marked by a deal of uncertainty’ (Sundelius et al. 1997 cited in Eydal & Arnadottir 2004: 53). Indeed, the contemporary plan for civil protection on Heimaey keeps to these principals - intended for quick reference in times of rapidly

developing situations. Hierarchy and efficiency of decision-making are prioritised over exhaustive deliberation.

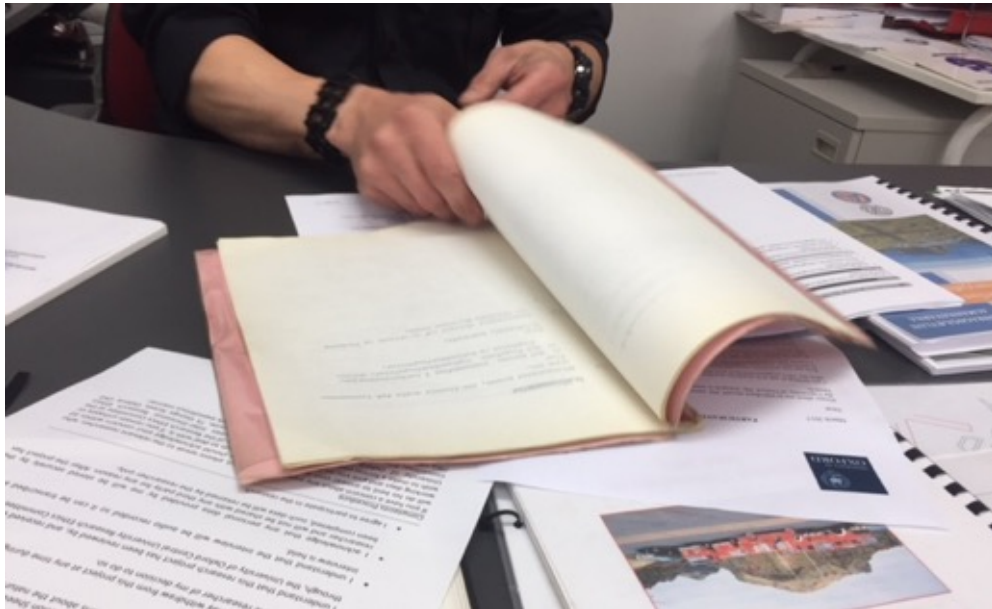


Figure 15. Examining an original hazard plan from 1973 with the chief of the fire department on Heimaey

Following the latest Civil Protection Act in 2008, local civil protection committees in each municipality must draw up similar plans to mitigate against the impacts of a wide range of hazards. The 2008 Act mandates that municipalities must:

prepare, organise and implement measures aimed at preventing and limiting, as far as possible, physical injury or damage to public health or property and the environment caused by natural or man-made disasters, epidemics, military action, or other causes and provide relief and assistance in the event of possible loss or damage (Act No. 82/2008)

Consequently, between 2008-2011 the first National Risk Assessment was performed in Iceland (Johannesdottir 2011). This involved fifteen ‘civil protection districts’ around Iceland each identifying specific risks to populations and developing plans to mitigate

these impacts. ‘Risks’ are identified based on: ‘consequences of threat to life and health, the environment, property and society’ and the ‘likelihood’ of occurrence (Johannesdottir 2011: n.p). Figure 16 shows the method for assessing the risk of events such as geophysical hazards. Here, the impacts of events are estimated on a scale from 1-5 where: ‘small direct impacts on health and lives’ are categorised as ‘insignificant’ while at the opposite end of the scale, ‘catastrophic effects’ are categorised as ‘extreme’.

Value	Lives and health of the population	The environment	Great economic values	Great social values – function of society	Consequences
5	Many fatalities and seriously injury Catastrophic direct/ extremely large indirect effects on Health and lives	Catastrophic damage to the environment – long-term and permanent	Catastrophic damage to property -	Solid mistrust towards social institutions and general instability, extreme disruptions in societal functionality,	Extreme
4	Extremely large direct or significant indirect effects on health,	Extremely serious damage to environment long-term effect	Extremely serious damage property	Extremely serious disruptions to societal functionality, continued distrust towards several social institutions and changed behavior	Critical
3	Significant direct or moderate serious effects on health	Serious short time damage to the environment -	Serious damage to property	Disruptions in societal functionality, continued mistrust towards several social institutions or changed behavior ,	Major
2	Moderate direct effects on health and lives,	Limited damage to the environment – little effect	Limited damage to property	Limited disruptions to societal functionality, transient mistrust towards several social institutions ,	Minor
1	Small direct effects on health and lives,	Extremely limited damage to environment	Extremely limited damage to property	Extremely limited disruptions to societal functionality	Insignificant

Figure 16. Method used to evaluate the consequences of hazards and target mitigation strategies by Icelandic Civil Protection Department (Jóhannesdóttir, 2011)

Anderson & Adey (2012: 67) suggest that adjectives such as ‘catastrophic’ concern the ‘intensity of disruption’ and describe ‘particular types of event that if lived through disrupt

what had been experienced as normal and so shatter, perturb and disturb'. Concern for catastrophic threats orientates the types of hazards of concern and the various responses that are appropriate to mitigate the risk. For example, the latest hazard plan for volcanic eruption on Heimaey details the creation of five 'mass casualty' centres (see Civil Protection Iceland 2017). In the event of an eruption or earthquake, inhabitants are to register in one of these centres and declare any people that they know that are deceased or injured. Mass casualty centres are opened by members of the Red Cross on Heimaey as soon as an eruption is underway. The precise location of the volcanic eruption will determine which casualty centres are used and the escape route from the island. This focus on evacuation speaks to the overall objective of civil protection which is focused on: 'saving lives, protecting property and the economy as well as preserving the environment' (Civil Protection Iceland 2017b).

Moreover, concern for catastrophic events not only informs the types of response authorities are attuned to but also the spaces and times of concern. De Goede & Randalls argue that catastrophe is characterised by 'a shortage of time in which to act, an immensity of tasks to accomplish, and the absolute necessity of taking precautionary action to prevent the very worst' (2009: 859). As the development of the first hazard plans for Heimaey illustrates, developments in civil protection tend to focus efforts on reducing response times. In the contemporary work of civil protection this is achieved through improvements to technology and scenario planning.

I discussed the priorities of civil protection on Heimaey with the current police commissioner, Páley. The police commissioner on Heimaey is responsible for the overall coordination and implementation of civil defence on the island. There are also several

other members including: the town mayor, director of the environment, commissioner of the fire department, members of the rescue team, and the director of the local hospital who together form a local civil protection committee. The conversation turned from a discussion on the way civil protection was organised in 1973 to how it would be different today. For Páley, civil protection involves creating order from the chaotic scenes in the immediate aftermath of an event. Hence, the need for clear, parsimonious planning to direct the actions of the civil protection committee. Of primary concern to Páley was the need to gain ‘control’ over a situation. She explained:

I know that in ‘73 there was no control...of course it is hard to control in the first hours, the first minutes...we can do it better- we should learn from it and try to control it (Interview 29/5/17)

Páley was also enthusiastic about various hypothetical scenarios involving where on Heimaey the next eruption would occur. If the eruption occurred in the harbour area, for example, an alternative escape route at the South tip of Heimaey might be the only way off the Island. New modelling software called, ‘VeTools’¹² developed by the European Union, University of Iceland and Spanish and Portuguese governments is becoming increasingly important for understanding how an eruption scenario might develop. It can be used to suggest the spatial development of lava flows, for example, which can be then used for deciding on evacuation scenarios. Other recent developments include the multi-million Euro FUTUREVOLC project¹³ funded by the EU- a near real-time on-line dashboard of volcano-earthquake activity around Iceland. This project is run jointly by the Icelandic

¹² <http://vetools.eu> [Accessed: 23/6/2019]

¹³ <http://futurevolc.vedur.is/> [Accessed: 23/6/2019]

Met Office who are responsible for the monitoring of geophysical activity around the Country and earth scientists at the University of Iceland. The aims of these tools are to provide institutions such as the Civil Protection Agency more information about developing hazard scenarios with a push to achieving ever-faster response times to unfolding hazard events.

This concern for faster response times in hazard management forms part of improvements to methods of ‘disaster risk reduction’ (A. Donovan, 2017). The latest framework guiding these objectives is presented in the ‘Sendai Framework for Disaster Risk Reduction 2015 – 2030’ (UNISDR 2015). Interestingly, the Framework notes how: ‘recurring small-scale disasters and slow-onset disasters particularly affect communities, households and small and medium-sized enterprises, constituting a high percentage of all losses’ (UNISDR 2015: 10). Therefore, a recent push towards hazard management orientated around mitigating the impact of disasters through ‘fast, evidence-based decision-making processes’ (Clarke & Dercon 2016: 1) is clearly targeted towards responding to sudden, large-scale events rather than the ways that geophysical events are experienced by collectives on Heimaey. Elizabeth Povinelli highlights the problem of orientating responses based on events that are ‘catastrophic’ by drawing on an analogy from Ursula Le Guin’s 1973 short story, ‘The Ones Who Walk Away from Omelas’ (Povinelli, 2011a). Povinelli argues that a focus on the catastrophic does political work that steers attention away from protracted forms of suffering. Suffering that is ‘chronic, acute and cruddy’ rather than ‘catastrophic, eventful and sublime’ goes unnoticed because ‘nothing happens that raises to the level of the event’ (Povinelli, 2011a: 11). Consequently, Povinelli argues: ‘any ethical impulse dependent on a certain kind of event and eventfulness flounders’ (Povinelli, 2011a: 13).

The hazard management cycle

The response to civil emergencies in Iceland is modelled by the ‘crisis cycle’ (Figure 17).

The crisis cycle was first proposed in a report for the EU Commission in 2006 authored by Michel Barnier (now of Brexit reputation) in an attempt to ‘improve the European Union’s crisis response capability’ (Barnier, 2006: 11). The crisis cycle is divided into three phases: pre-disaster, response and post-disaster. In Aligne & Mattioli’s analysis of the crisis cycle they suggest the pre-disaster phase is characterised by activities such as ‘watching, monitoring, intelligence gathering, detection, identification of the crisis, and assessment of induced risks’ (2011: 113). If a crisis occurs, the response phase becomes activated which involves evacuation, damage assessment and rescue operations. Aligne & Mattioli suggest: ‘this phase leads back to a normal (stabilised) situation and is more or less long and expensive depending on the resilience capacity of the organisation’ (2011: 120). Following a ‘crisis’, the post-disaster phase becomes active in which a process of ‘preparing, teaching, simulating, and training’ is enacted (2011: 120). The crisis cycle has become pervasive in structuring not only responses to hazards in Iceland but also shaping pan-European discussions about hazard management (see NORDRESS¹⁴- Nordic Centre of Excellence on Resilience and Social Security).

¹⁴ <http://nordress.hi.is> [Accessed: 23/6/2019]

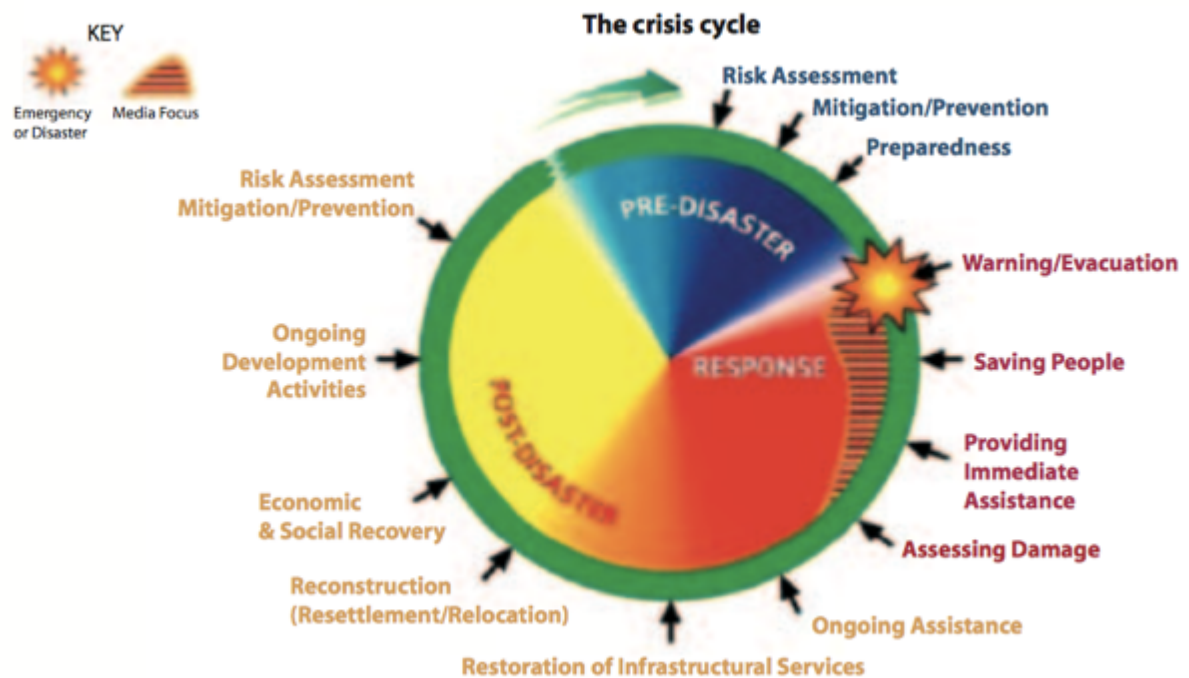


Figure 17. The crisis cycle model used by Icelandic civil protection authorities and in European Union countries (Original source: ESA-GSE Respond, 2008)

The disaster management cycle informs the activities undertaken by civil protection authorities in Iceland at any given time. On Heimaey, for example, some five decades after the last volcanic eruption, authorities are now concerned with making plans for large magnitude eventualities that may materialise in the future. While this is important and necessary work, it does not address the lingering, spatially distant or ‘imperceptible’ effects of hazards that we saw earlier in this chapter. However, there are more subtle logics that also underpin the crisis cycle. For example, in this model, other than monitoring, there appears little one can do to intervene in geophysical systems to minimise their impact. Quarantelli (1987) suggests this focus on reaction rather than prevention is the result of the emergence of hazard management from its applied origins in military conflict. Quarantelli argues: ‘the early focus on the emergency time period and on the emergency response’ arises if ‘a military situation is thought of as the generating context’ (1987: 303). While civil protection in Iceland is involved in communicating preparedness

plans to residents, such as duck and cover techniques during earthquakes, authorities are not directly involved in plans that involve trying to prevent the primary effects of geophysical hazards, such as the ash erosion in the previous section.

Moreover, in the model of the crisis cycle as practised by Icelandic civil protection, there is an absence of concern for the long-term post impact period after a major event.

Emphasis is placed on evacuation, restoration and rebuilding with no practical resources dedicated to assisting with or finding out about the long-term consequences of these events. This observation might also be applied more broadly to countries other than Iceland. For example, in their review of post-traumatic stress, Neria, Nandi, & Galea (2008) note the systematic lack of studies into the long-term effects of natural hazards. Yet on Heimaey, official hazard management is not engaged in any current attempts to manage the on-going emotional and physical impacts of this event which continue to reverberate into the present. Similarly, there are currently no state resources dedicated to the long-term impacts of the more recent 2010 Eyjafjallajökull eruption nor those related to the 2015 Bardarbunga eruption. This is not because there are no such long-term consequences. For example, recent findings published in the British Medical Journal concerning Eyjafjallajökull suggest there are ‘adverse respiratory symptoms following exposure to volcanic ash and clinical examinations have revealed increased cardiovascular disease, respiratory disease and mortality’ (Hlodversdottir et al., 2016). Moreover, in this study the authors argue: ‘our findings indicate that sleep difficulties among exposed participants in 2013 had increased since 2010... [and] musculoskeletal symptoms, back pain and myalgia increased significantly between 2010 and 2013. Other symptoms include headache, fatigue and irritable bowel syndrome’ (2016: 13).

While the organisation of civil protection activities using the ‘crisis cycle’ is concerned with standardising the response to hazards, my concern is that these actions increasingly seek to privilege attention to the space-times immediately surrounding catastrophic events. This comes at the expense of responding to the complex ways that communities are actually affected by natural hazards. Karen Barad (2017) makes a similar point in her recent discussion of nuclear catastrophe in Hiroshima. She begins her essay by describing how the nuclear bomb dropped in 1945 on Hiroshima seemingly arrested time in a flash. Clocks stopped at 8:45am. While we may proceed by focusing on the catastrophic and the ‘emptiness’ afterwards, Barad argues that this is a product of political choices that involve ‘preordained geometrical notion of scale’ (2017: G108). Similarly, rather than focus on the moments of an unfolding ‘catastrophe’, I argue that we also consider the complex impacts of eruptions and associated hazards that ripple into the present time in minds, bodies and environments in places like Heimaey.

While concern for catastrophic events may also legitimise particular types of government power (e.g. Swyngedouw 2010), my concern here is not with strategies to democratise decision-making in hazard management, in the sense that scientists and non-scientists might deliberate on hazard management options. Instead, I hope to expose the dominant logics that orientate governmental response towards particular, pre-defined aesthetic qualities of hazard events. In other words, attending to the non-catastrophic consequences of geophysical hazards does not necessarily have to fit with a model of enabling contestation and controversy between governments, scientists and publics. Here rethinking the geopolitics of natural hazards such that it reflects the struggles of people living in tectonic environments is accomplished by exposing a ‘radical otherwise’ (Povinelli, 2011b) that opens up space for alternative hazard management approaches to emerge.

Consequently, the possibilities for what can be debated and what can be changed about hazard management become radically expanded.

4. Conclusions: rethinking geophysical hazards and hazard management

The environmental uncertainties of the Anthropocene have brought concerns for earthly tipping-points, thresholds and catastrophe into the human geographical and social sciences lexicon (e.g. Connolly 2017; Clark 2014). Therefore, thinking the earth through its inhuman capacities and non-linear potentialities has become an important theoretical tool for examining human survival amidst environmental upheaval. However, rather than speculate about the unliveable forces of the earth, I suggest we might recognise how environmental change also impacts communities in more subtle ways. ‘Low magnitude’ disruptions, and the complex space-times of events/ happenings may cause struggles, concerns, worries, physical and emotional impacts that affect peoples’ everyday lives. In section two of this chapter, we saw the numerous ways that individuals and communities are affected by the forces of a rumbling earth on Heimaey. These effects are not always extinction, mass casualties or deaths that we have come to expect from debates around earthly change.

In section three of this chapter, I highlighted how ideas of natural hazards have implications for the types of happening that are paid attention to and modes of response. I argued that civil protection authorities in Iceland are charged with mitigating and responding to natural hazards but tend to be concerned with the ‘catastrophic’ which orientates concern around mass casualties and the space-times of large-scale events. Curiously, we find that a geopolitics advocating the inhuman potentialities of the earth (Clark, 2010a) resonates more with this ontology of sudden catastrophe and its militaristic

underpinning than it does with the multitude of geophysical happenings experienced on Heimaey. Consequently, I suggest there is a need for taking seriously the different material dimensions of the geo if the effects of hazards are to be attended to and management strategies must look beyond pre-determined ideas of what hazards are and do.

I have shown how the earth has capacities to affect human communities and environments in multifaceted ways. As Coole & Frost suggest ‘the challenge here is to give materiality its due while recognizing its plural dimensions and its complex, contingent modes of appearing’. They argue that recognising the politics of ontological constructions does not mean:

a) material objects or structures are devoid of efficacy in the way they affect either our moods or well-being, or our concepts and theories, b) matter is without recalcitrance or directedness in its own brutish way, or c) [that] acknowledging nondiscursive material efficacy is equivalent to espousing a metaphysical claim regarding the real as ultimate truth (Coole & Frost 2010: 27).

Indeed, my intention in this chapter has been to heighten recognition of earthly agencies and the ways in which communities are affected by them. To make this shift requires a move away from the extreme spectrum of the earth’s capacities and recognising the variegated and subtle ways that the earth also impacts social collectives.

Similarly, Rosi Braidotti argues: ‘I find the metaphysics of finitude to be a myopic way of putting the question of the limits of what we call “life”. It is not because Thanatos always wins out in the end that it should enjoy such conceptual high status. Death is overrated’

(2010: 212). I want to argue that focusing this analysis on the ways that communities live with the earth opens up new questions about the kinds of practices employed to manage the various effects of living on a volatile planet. When we accept that the earth affects communities in ways that are not only life-threatening, I suggest that it impels us to consider the possibility of new methods, actors and space-times of acting that both extend and complement conventional civil protection approaches.

Chapter 5: Attending to trauma in a volcano museum

1. Introduction

I arranged to interview Helga in Eldheimar, a newly-constructed volcano museum on Heimaey (Figure 18). Helga was 18 years old when the Eldfell volcano erupted on 23rd January 1973 and she was evacuated to Reykjavik while the eruption took place. As we walked around the Museum, she told me about the “sorrow and pain” involved in returning to Heimaey after the eruption. Helga described the on-going feelings of living on an island that had become “unfamiliar”. She also pointed to an enlarged photograph of the erupting Eldfell volcano and explained: “one of the sides broke into the town, under this ugly volcano is a beautiful place that we all miss.”



Figure 18. Inside the Eldheimar museum on Heimaey

Icelandic anthropologist Sigurjón Hafsteinsson observes that ‘from its founding, Eldheimar has aimed to preserve the memory of the eruption, present the geological history of southern Iceland, educate about the dangers of natural hazards- such as volcanic

eruptions and earthquakes- and attract and promote tourism' (2017: 6). While the Museum was financed from public funds, the idea for it was driven forward by locals who explicitly wanted to create a place to reflect on the past and to express their struggles in relation to the eruption. The Museum provides a public space for doing more than thinking about the past; its architecture, interactive exhibits and photographs also create an environment that makes it possible for residents to articulate their intimate, personal experiences and emotional responses to the eruption which they say was not possible before the Museum opened.

I argued in chapter 4 that hazard management in Iceland overlooks the non-catastrophic effects of geophysical hazards. This chapter continues to focus on the non-catastrophic effects of geophysical hazards by rethinking the temporalities of a volcanic eruption through the spaces of the Eldheimar museum. In current geographical thinking, hazards such as earthquakes and volcanoes are purported to have relatively short-lived physical and emotional effects. For example, geographer Lisa Hill suggests 'feelings of estrangement associated with natural disasters will often be temporary and short-lived; initially shocked and dazed, people are often quick to recover and seek to rebuild their lives' (2014: 147). In this chapter, I argue that conceptualising the effects of geological hazards as 'short-lived' and 'temporary' may be a product of the limited opportunities for public expression of struggles in post-disaster environments. I argue that if these long-term reverberations of natural hazards are to be known, we need to foreground the spaces in which the ability to articulate on-going, emotional and physical struggles is made possible.

In line with this aim of taking seriously the long-term reverberations of natural hazard events, I turn to the conceptual apparatus of affective atmospheres to acknowledge the

agency of diverse, more-than-human actors that can prompt individuals and collectives to act in particular ways. Ott suggests ‘we might begin to think of affect, and in particular the affective dimensions of embodied experience, as incipient attitudes, as energies, intensities, and sensations that...incline us to form and adopt some attitudes and not others’ (2010: 50). This chapter thus has two main aims. The first is to unpack the affective atmospheres that emerged in the aftermath of the 1973 eruption on Heimaey. By affective atmospheres, I am particularly interested in the diffuse, affective relations that constrain or enable possibilities to express the lingering, negative physical and emotional effects that impact on everyday life. The second aim is to unpack how the Eldheimar museum has become a space in which it is possible for island residents to articulate their worries, concerns and lingering struggles. My argument therefore builds on recent work on affective atmospheres in post-disaster environments (Cloke & Conradson, 2018; Barrios, 2017), but steps back to ask what kinds of post-disaster atmospheres are conducive to allowing ongoing physical and emotional struggles to be articulated and how is this made possible on Heimaey?

This chapter is divided into four sections. Section 2 draws on life history interviews with residents on Heimaey to explore the affective conditions on Heimaey in the aftermath of the 1973 eruption. Section 3 then turns to the Eldheimar museum to offer an example of the affective conditions through which alternative performances of post-disaster subjectivities are enabled. I conclude by arguing for the need to consider the long-term effects of natural hazard events that may continue to impact people’s lives many decades after the event is considered to be over and the affective conditions through which these struggles can be made present.

2. Post-disaster atmospheres on Heimaey

The concept of affective atmosphere has arisen in work concerned with more-than-representational accounts of social life. Kathleen Stewart (2011), for example, describes how life plays out with and alongside ‘force fields’ that can both condition and be conditioned such as to influence everyday human experience. A selection of different more-than-human agencies such as balloons (McCormack, 2009), air (Adey, 2015), light (Edensor, 2010) and ruins (DeSilvey & Edensor, 2013) have been detailed at length by human geographers. In this section, I want to build on this work to describe the atmospheres that emerged during the 1973 eruption and reverberate into the present day on Heimaey. These atmospheres are constructed not only by human actors but also by the affective agencies of advancing lava, destroyed houses, earthly rumblings and ash-darkened skies. Thinking with atmospheres helps to unpack how the events of the 1973 eruption became bound up with warfare in which the earth became the enemy and residents of Heimaey now claim to be the victors. I argue these atmospheres served to energise residents to pitch-in to help with recovery efforts and unite in community solidarity against a common volcanic enemy. Yet, I suggest these atmospheres also do work to constrain more overtly emotional and reflective actions that prevent corporeal expressions of vulnerability and articulations of on-going trauma.

The ‘battle with lava’

As the days passed lava swallowed dozens of new houses. It stretched itself into the centre of town, and the danger that it may block the harbour entrance and fill the harbour will be imminent as long as the eruption lasts. The pumping of sea water in order to cool the lava is going on day and night without interruption. No stone is left unturned in the endeavours to save the harbour, the very life-nerve of

this community. The inhabitants of Vestmannaeyjar [Heimaey] are not going to give up until all hope is futile and in vein. They wait in suspense for the day when they can return to their island. Whether the eruption will last half a year or four years, nobody knows – and whether anything will be left of this prosperous community when the catastrophe at last comes to a halt, no one knows either. We can only wait and hope- cling to hope as long as it is there. There is nothing else we can do (Gunnarsson, 1973: 94).

Written in the first months of 1973, Árni Gunnarsson articulates the intimate feelings that he and others on Heimaey experienced during the early stages of the eruption. These atmospheres of hope resonate with emotions evoked in other post-disaster locations and in particular after the 2011 Christchurch earthquake (Cloke & Conradson, 2018). While it could be argued that hope and optimism are characteristic emotions of human societies when faced with adversity (Clark, 2010a; Solnit, 2010), on Heimaey this future-oriented outlook was carefully cultivated to create particular kinds of post-disaster subjects. One way that these atmospheres of hope were established was through cartographic technologies in which the advancement of the lava flow was mapped by US military aircraft using aerial photography and ground measurements (Figure 19). Maps showing the advancement of lava were published in Icelandic newspapers and live images of the lava flow were broadcast on a dedicated channel on Icelandic television each day.

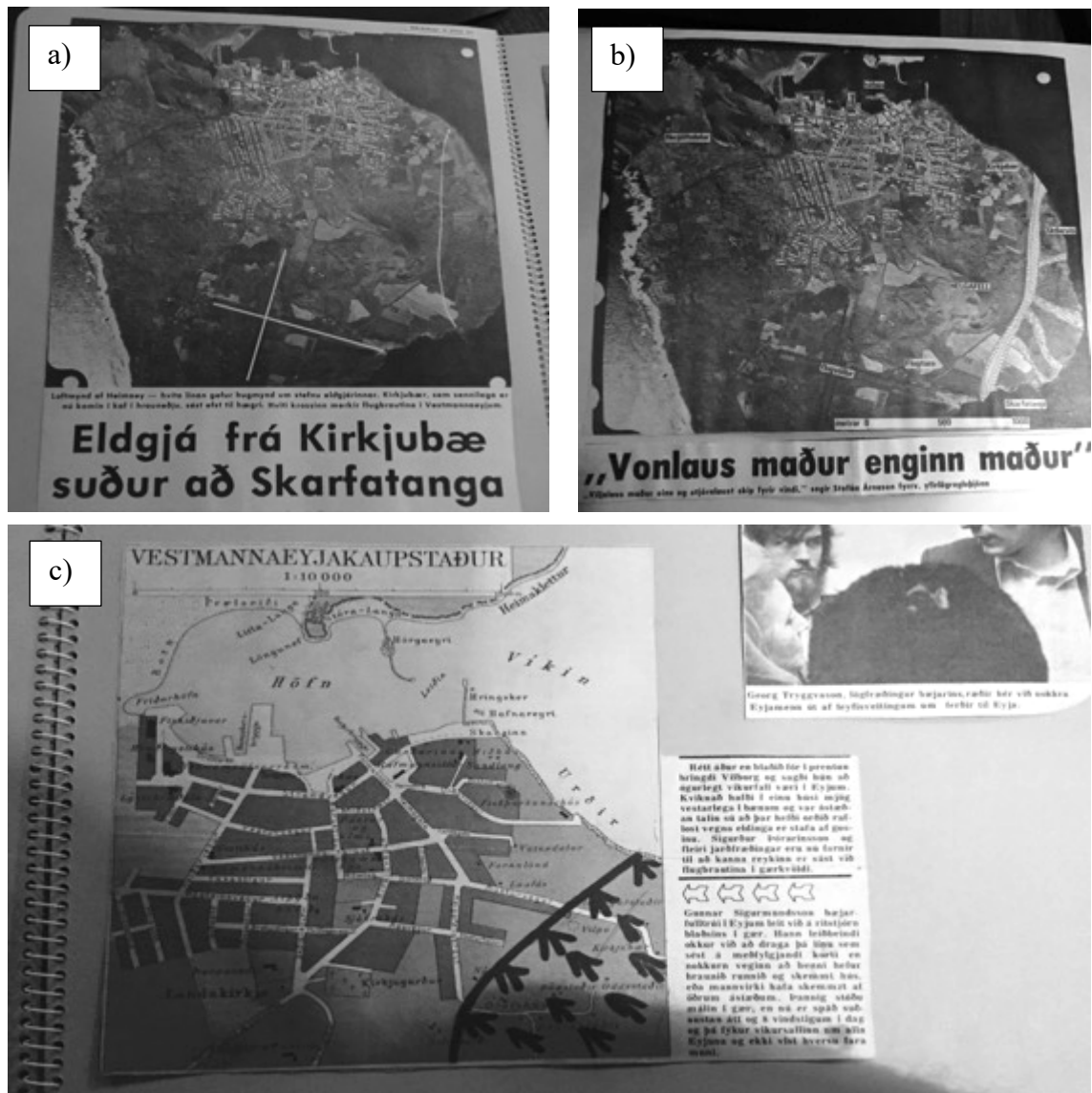


Figure 19. Newspaper clippings from the scrapbook of Heimaey resident Birgir Olafsson showing advancement of lava encroaching on the town of Vestmannaeyjar. Photo a) before the eruption b) lava flowing from fissures c) lava encroaching on town

Mapping the movements of lava is interesting for several reasons. Firstly, it illuminates how cartographic practices are not simply about delineating territories, but also affective in the sense that maps engineer affects and emotions. As Gerlach argues:

mapping is geopolitical, not just in its implication in the practices of statecraft and of delineating sovereignty in a “major” representational sense, but that it is also

geopolitical in the way in which it cultivates affects, attitudes, bodily dispositions, collectives, sensibilities, spaces and events that are transformative of the world, but often in a register largely ignored (Gerlach, 2015: 274-275).

It is also interesting because what is being mapped here is not an advancing military force during a wartime situation, but the movements of a wall of lava. The hand-drawn arrows on Figure 19c evoke a sense of Second World War military cartography in which rapidly changing geopolitical terrain means maps were improvised and adjusted as the situation evolved. In this sense, the agentive forces of the eruption were amplified through mapping technologies to create an affective sense of fear and encroachment by an adversary.

Residents on Heimaey and those who evacuated the island observed the movement of lava via these maps and on television. David, a resident on Heimaey, described how: “we ran home after school and saw how much the lava was taking of the town. The lava was closing in and it was very stressful. It is stuck in my memory. This picture of my hometown slowly getting demolished... it was fun to watch it, but it was always a disappointment- you run to the TV set and said: “no- it’s still going on”. We cheered every time the rift slowly closed and there was just one crater that remained and became Eldfell”. This mapping and surveilling of the eruption thus helped to create new understandings of the earth as a dynamic, unpredictable force with the capacity for unprecedented destruction but also as a force which could slow down, change direction and come to a stop. Consequently, mapping the eruption was not simply a matter of representation, but catalysed a set of affective dispositions that united Heimaey residents against a common enemy. This resonates with the work of Peter Adey who describes how an ‘airmindedness’

was engineered in the UK during the Second World War to create ‘a reactive and militarized subject-citizen who would defend and promote the nation’ (Adey, 2011: 72).

While residents on Heimaey were not exposed to rigorous training to inculcate particular bodily dispositions, techniques such as mapping served to create an awareness of an active geological adversary that demanded new ways of being and acting. Residents describe these obligations in the conversations I had with them about their experiences. For example, one resident explained: “you had to be tough with yourself...there was no use in crying... maybe we are just made of ice or something”. Mark Duffield (2007) argues, the idea of practising ‘community-based self-reliance’ in the wake of natural disasters reflects a broader neoliberal agenda in which people are expected to adapt to changing conditions and carry on as normal. I want to argue therefore that this endurance is less a product of individuals’ intrinsic ability to deal with problems but established through the encouragement of particular kinds of corporeal dispositions. For example, the eruption was personified as the devil in some newspapers who sought to antagonise the ‘enthusiasm of the Heimaey people’ (Figure 20).



Figure 20. Cartoon of Eldfell eruption published in Morgunblaðið newspaper on 13.2.1973

The language of fighting characterises descriptions of residents' actions during the time of the eruption. For example, one resident described his role in cleaning up the town after the eruption had ended. He explained:

“we were fighting- we should make everything as it was- but it took 30-40 years. If you look at pictures of the town before the eruption you can see a pretty town. Green hills, red roofs, white houses. Everything was clean and perfect. Everything was going well, and it was perfect - then came the eruption. We thought we will not let this [the eruption] stop us. We were so eager to get back on-track, so we hid all the old houses like the ruins and removed all that...we were so eager to overcome this shit”.

This readiness for action has been described by John Protevi (2013) in his discussion of the production of bodies made ready for contemporary warfare. Protevi describes how

bodies can become ‘action-ready’ which involves bodily actions becoming speeded-up, militarised and disciplined in how to think and act. While cartographic and popular representations of the volcanic eruption created a sense of a common enemy that needed to be overcome, the disciplining of emotions was also achieved through citizen participation in an experimental attempt to physically halt the advancing lava flow. On Heimaey, this has become known as the ‘battle with lava’.

The battle with lava involved a plan to cool the advancing lava wall using high pressure water. The plan was devised by an eccentric physicist from the University of Iceland, Þorbjörn Sigurgeirsson, and enabled through the donation of around 50 large water pumps from the United States Army which were airlifted to Heimaey from the US military base in Keflavik. Paid by the Icelandic government, Icelandic residents were subscribed into supporting these cooling operations by laying pipes, maintaining machinery and spraying the lava. Contrary to ideas about atmospheres of ‘loss and grief’ during times of environmental change (Head, 2016), one resident involved in the operation told me: “men were not crying all the time they were working- we tried to make it fun”. This model of citizen/fighter was not only established in the ‘battle with lava’ but also in the domestic spaces of the home. Helga, for example, describes how people cleared and restored their homes to achieve a “victory” against the eruption. She described how: “the streets and everybody’s back yards were covered with tephra. All the energy we had when we came back [to Heimaey] went to fix everything.”

These attempts to rebuild houses and attempts to cool the lava were especially dangerous. Palsson & Swanson note that ‘pumping crews would take the pipes onto the lava, approaching the crater itself in advancing steps, directing the pipes and the water flow onto

the advancing lava with the aid of a bulldozer and a crane. This was risky for the crew at the front, as their boots might burn, and they might not be able to return' (2016: 157).

Similarly, the only death of the 1973 eruption was on April 4th 1973 when Sigurgeir Orn Sigurgeirsson, a 30- year old, died breathing in poisonous gas that had collected inside a building. Sigurgeir was on Heimaey as part of efforts to protect buildings from damage by the eruption.

As the US Geological Survey noted in their report entitled 'man against volcano':

scientists and planning authorities had the benefit at Heimaey of detailed topographic maps rapidly produced from vertical aerial photographs. These maps, in connection with geodetic surveys, permitted measurement of the rate of movement of the main lava flow and an assessment of the best places to build lava diversion barriers. They also were critical in planning for administrative, engineering, and scientific purposes (USGS, 1976: 20).

Thus, to understand the various ways that people are affected by natural hazard events, there is a need to understand how earthly elements exceed brute physical matter such that they can be governed to produce particular embodied performances (Feigenbaum & Kanngieser, 2015; Adey, 2015).

During the eruption, we see how civilian bodies were mobilised at the expense of immediate safety and well-being. While the 'fight against the lava' has been hailed as an unprecedented success because residents have subsequently been able to re-inhabit Heimaey, the idea of celebrating a victory over the volcano continues to shape how people

act in relation to the eruption in contemporary life. For example, an ‘End of the Eruption Festival’ (Goslokahátíð) is held annually at the beginning of July to mark the date in 1973 when the eruption was declared over by geologists (Figure 21). The festival is an excuse for town officials to decorate the streets with orange and black balloons and bunting. Street parties are held with live music, bouncy castles, eating and drinking. In these celebrations the streets become packed with residents. These efforts to celebrate a victory over the volcano are part of broader contemporary efforts that one resident, David, describes as “our will to overcome this disaster and forget it”.



Figure 21. End of the Eruption Festival (Goslokahátíð) July 2017

Attempts to ‘forget’ involve ‘active embodied, material and spatial practices’ associated with deliberate attempts to ‘obscure if not obliterate memories that are personally traumatic and injurious to well-being’ (Muzaini, 2015: 105; Legg, 2007). However, as the End of the Eruption Festival illustrates, it is not that residents have forgotten about the eruption, but that ‘forgetting’ involves performing particular bodily enactments of

celebration and victory. The converse also holds that performances of sorrow, grief, regret and missing are relegated as a show of defeat. One resident, Perla, described these performances of forgetting: “it is like you put it [the eruption] over here- you know about it, but you do not talk about it – it is like behind your little ear”.

Since the eruption, great lengths have been taken to evoke more positive, celebratory attitudes towards the events of 1973. For example, Icelandic accounts of the eruption foreground the positive consequences of the eruption for providing a free source of hot water for island residents and an improved harbour (e.g. Vestmannaeyjar Town Council, 2012). Moreover, a large-scale planting operation has been active on Heimaey for over forty years in which grass seeds and flowers are planted on the lava field. The objective of this planning is principally aesthetic and an attempt to create more brightly coloured landscapes and more positive emotional performances in everyday life. These examples illustrate the diverse ways in which state authorities and residents themselves continue to engineer affective environments which maintain positive, optimistic corporeal performances in which people are encouraged to celebrate victory rather than reflecting on the deleterious ways in which bodies continue to suffer.

Yet, the pervasiveness of these atmospheres also generates questions about the implications of these atmospheres and what is at stake in their production. Kevin Grove describes this as the need for alternative performances of post-disaster subjectivity in which ‘place-specific historical trajectories and force relations create new capacities for thought and action and new possibilities for domination and resistance’ (2013: 198). In the next section I turn to the spaces of the Eldheimar museum to explore how these alternative

post-disaster subjectivities have emerged on Heimaey and explore how they rub up against more ‘optimistic’ dominant performances.

3. Curating atmospheres in the Eldheimar museum

Classen argues that studies of museums have long recognised that ‘museums and galleries have always served a number of purposes other than the evident one of enabling visitors to appreciate their collections of art and artefacts’ (Classen, 2007: 897). In this section, I explore how the Eldheimar museum fulfils a more expansive purpose than just informing visitors about a historical volcanic eruption. In addition, it makes it possible for residents to articulate their on-going physical and emotional struggles. The findings in this section thus complement recent work in geography that has explored how architecture, infrastructures and bodies interweave to create particular affective spaces and performances (Brettell, 2016; Feigenbaum & Kanngieser, 2015; Roberts, 2012; Grosz, 2001, 2008). The section begins by exploring the emergence of the Eldheimar museum and the kinds of emotional performances it enables. I then detail a specific example of an ‘intergenerational conversation’ event in July 2017 in which the Museum was used to facilitate the public sharing of these on-going emotional struggles. In the final part of this section, I discuss efforts to contain these emotional performances to prevent them spilling out from the Museum.

Making the Eldheimar museum

The Eldheimar museum is a £6 million (890 million Icelandic Krona) project jointly funded by a Regional Grant from the Icelandic government, the Westman Islands Town Council, Eimskip (an Icelandic transportation company) and the Icelandic Tourist Board. While the majority of the funds for the museum came from the Town Council, the idea for Eldheimar was driven forward by residents who felt that it was important to open up a

collective discussion about their experiences of the 1973 eruption. The Museum was opened on 23rd May 2014 and a large celebration was held to commemorate the opening with guests including The President of Iceland, Ólafur Ragnar Grímsson, the Minister of Culture and Education, Illugi Gunnarsson, as well as ambassadors from eight countries and four hundred guests. In the words of the Museum website, Eldheimar is:

A museum of remembrance, giving visitors the chance to go back in time and learn about this dramatic event. The highlight of the exhibition is the house on Gerðisbraut 10, the home of Mrs Gerður Sigurðardóttir and Mr. Guðni Ólafsson and their 3 young children. With the youngest one only a few weeks old they were forced to leave their home in the middle of the night taking with them only a bottle for the baby. A few days later their home had drowned in ash and lava. Gerðisbraut 10, after being buried in ash and lava for over 40 years, has now been excavated and shows how cruelly nature treated the homes of so many islanders¹⁵.

The construction of the Eldheimar museum was the culmination of various projects on Heimaey designed to allow collective remembrance of the 1973 eruption. The first of these projects began in 2005 and involved the excavation of several buildings on the eastern side of Heimaey that were buried under several meters of ash. In 2008, plans from a local architect to excavate a whole street of buried houses were unveiled. However, due to concerns that the excavated houses would deteriorate too rapidly in the open atmosphere the idea turned into a museum in which a single ruined house would be on display. Since it opened, Eldheimar has received several awards. In 2015, it was the winner of an Icelandic Design Award. The jury commented that Eldheimar ‘communicates a unique moment in

¹⁵ <http://eldheimar.is/en/about-museum/> [Accessed: 20/2/2017]

the Icelandic natural history in an extraordinary way, using creative, well implemented and functional solutions with powerful aesthetics to interact with the visitors'¹⁶. Eldheimar also won an award from the Society for Experiential Graphic Design in 2015 for its four specially-designed interactive exhibits.

As the description from the Eldheimar website begins to illuminate, the Museum is a carefully curated space. Margrét Gunnarsdóttir, the architect of Eldheimar, explained in an interview:

“I wanted it to be sincere and a confronting museum- I didn't want a museum with white walls and one that you had to put on your best clothes and be entertained. I wanted it to be a confronting place where you would feel it to be more than a pretty little museum- that was my intention”.

Margrét went on to describe how the architecture of the Museum building was designed to prolong visual and sensual encounters with the ruined house: “the whole museum is like a machine to see the house- you can go over the house to see it from the top- you can walk around the house, come up close to it and touch it and you can see it from the second story” . Eldheimar thus resonates with growing scholarship on museums as spaces of ‘thanotourism’ (e.g. Williams, 2008). Emma Willis describes this as ‘dark tourism or grief or trauma tourism’ which is ‘characterised by an engagement with experiences that produce ‘deathly’ affects or a more general willingness to open oneself to psychological or emotional wounding’ (2014: 102). While it could be argued that the public display of a

¹⁶ <http://eldheimar.is/en/general/eldheimar-wins-the-icelandic-design-award-2015/> [Accessed: 20/2/2017]

ruined family home constitutes a form of ‘ruin fetishism’ that commoditises events that have caused significant destruction (DeSilvey & Edensor, 2013), these installations also open up new spaces for individuals to enact alternative post-disaster subjectivities that bear testament to their struggles. For Grove this is an ethos that recognises the ‘difference and multiplicity’ of post-disaster subjectivities that ‘work within and against the confines of dominant political configurations’ (2013: 209).

In the Eldheimar museum, the work of artists, curators, architects and designers produces an atmosphere of discomfort, loss and struggle. The exhibition designer, Axel Hallkell Jóhannesson, explained: “we are not afraid to do some drama- we get you into a situation”. Minimal attempts to preserve the ruined house now at the centre of the Museum are closely associated with its changing function from a structure to keep people dry, safe and warm to a storytelling device designed to cultivate a sense of the inhuman and unjust consequences of the eruption. Affective atmospheres can circulate in museums and can be ‘engineered’ through curatorial practices (e.g. Ingram, Forsyth, & Gauld, 2016; Waterton & Dittmer, 2014). In relation to the September 11th memorial and museum, for example, Micieli-Voutsinas argues: ‘as visitors are encouraged to feel absences and sense presences at the memorial and museum, the trauma of 9/11 is no longer confined to the space and time of the past; rather, it exists presently through newly unfolding emotional and material registers’ (2017: 93). The emotional performances at Eldheimar similarly disrupt ideas about the effects of the 1973 eruption being confined to the past.

In addition to the ruined house at the centre of Eldheimar there are four interactive exhibits which include: 1) video terminals that allow visitors to explore the inside of the ruined house using a joystick to control CCTV cameras; 2) a sandbox in which visitors dig to

uncover information about destroyed houses (Figure 22), 3) an interactive puzzle in which photos of Heimaey can be pieced together, and 4) a ‘Wheel of Time’ that allows visitors to see how the landmass of Heimaey changed during the eruption (Figure 23). These forms of ‘interactivity’ enable various doings and sensory experiences such as digging, searching, moving and piecing together. These activities allow visitors to mimic the types of strenuous activity that inhabitants undertook as they moved back to Heimaey to rebuild their lives. They also allow residents to tell personal stories using the material apparatus of the Museum to articulate their personal stories and feelings.



Figure 22. Visitors to the Eldheimar museum using shovels to uncover images of ruined houses on the sand's surface (Reproduced with permission. Image credit: Gagarin (www.gagarin.is))

The ‘Wheel of Time’ (Figure 23), is a circular table on which a topographic projection of Heimaey is displayed. As the rim of the table is turned a video showing the course of the

eruption is scrolled forward and backwards. The day-by-day development of the eruption can be stopped, rewound and sped up as residents use the video to narrate their experiences. The rim of the table is heavy and made deliberately difficult to turn. Exhibition designers experimented with the weight of the wheel so that it requires multiple people standing around it to move it. The exhibition designer explained that getting this weight ‘correct’ took many weeks of experimentation— if it is moved too easily, the video of the eruption could be made to run too quickly from beginning to end— too heavy and it would not run at all. Several visitors must interact with the ‘Wheel of Time’ simultaneously in order to make it turn. Often members of the same family stand on opposite sides of the exhibit and negotiate when to stop, reverse and move on to new events. Negotiating when to move on and when to ruminate therefore became a collectively negotiated process. Writing in *Experimental Graphics Magazine*, Leslie Wolke describes how: ‘turning the wheel is a simple gesture, but when multiple visitors gather around the table, impromptu collaborations result in shared experiences’ (p. 35)¹⁷.

¹⁷ https://lesliewolke.files.wordpress.com/2015/11/eg14_eldheimar.pdf [Accessed: 17/6/2019]

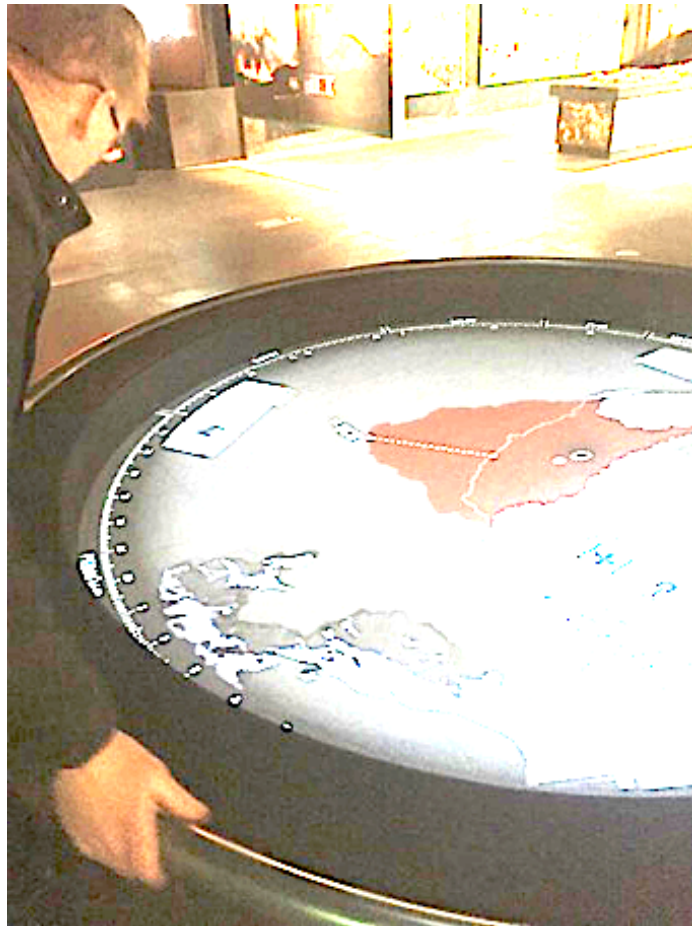


Figure 23. Hallgrímur uses the 'Wheel of Time' to narrate his life-history in Eldheimar

The exhibits and photographs in the Museum promoted participants to continue retelling their personal stories outside of the building. One example occurred while walking around the Museum with Hallgrímur who was keen to show me the ruins of his former house. Hallgrímur drove us to the site of the ruins and we got out of his pick-up truck to get closer to the site. Hallgrímur showed me a small strip of carpet protruding from an opening of what was the kitchen window (Figure 24). He explained how he keeps it there so he can think about his old house when he drives past.



Figure 24. Halgrimur pointing out the ruins of his house in the lava

While standing by his ruined house, I asked how it made him feel to see his ruined house for the first time. He explained:

Halgrimur: We were in a car and I saw the house. It was cracked and under lava and I saw the number of the house- Number 3- inside a little cave and there was also an outside lamp. It was glass and it was OK. I got some equipment to take this off and now the lamp and the number is in the living room of my mam and pa's house. It's very special.

Cyrus: That was quite dangerous.

H: Yes, that was very dangerous (laughing). This was my house- I had to take it out. I ran to this truck and asked if he had a screwdriver.

C: When you see the light in your parents' house does it bring back memories?

H: Of course- it's the only thing we have from our old house. We saved furniture from the kitchen but not many of our personal things.

Hallgrímur did not cry or get upset as he was narrating experiences; yet the destruction of his house, the few items he managed to salvage from it and the stories he was able to tell at the Museum illuminate a fidelity to the loss and hardship he and his family experienced.

On another occasion, I was in the Museum with Guðrún. Guðrún described her experience of a 6.6 magnitude earthquake on Heimaey on 17th June 2000. She was standing in the Valley of Herjolfsdalur watching the Icelandic National Festival when the earthquake took place. Thousands felt the ground shake in the Valley. Loose scree produced thick clouds of dust and rock avalanches fell from the valley sides. Guðrún clutched her wrist as she described how she believed that her arthritis was triggered by the stress of the earthquake and still worries about an earthquake starting at any time. For Guðrún, the earthquake brought back fears from living through the eruption of 1973 some thirty years earlier.

“I was in the valley and I suddenly felt the earth move and thought it was the band who were playing so I went from the concrete to the grass and it was still shaking. Then I looked up and saw the rocks coming down and I felt the smell of the volcano. I thought it was my last minute...I could not walk- then I asked someone “is it an eruption?”- “No it’s just an earthquake”- No! OK! It triggered all my fears maybe 30-40 years later”.

The Museum has thus become a space for residents to articulate and affirm their individual traumatic experiences in relation to the 1973 eruption. This observation chimes with recent

theoretical ideas that acknowledge how ideas of natural disasters are constructed in post-disaster places as a way of creating and maintaining particular truths. As Cloke, Dickinson and Tupper argue: ‘thinking about a disaster as an event can change perspectives on subjectivity; from assuming that the subject is simply getting by emotionally and physically as (s)he deals with the impacts of the event, to the possible identification of post-disaster subjects who show fidelity to the event through discourse, memory and performances’ (2017: 73). These authors develop the philosophical work of Alain Badiou (2007) to argue that identifying as a ‘post-disaster subject’ is not fixed in time but re-enacted and performed. I suggest the Eldheimar museum performs a similar role in allowing residents to attest to and affirm their individual, on-going traumatic experiences.

Atmospheres in the Eldheimar museum contrast markedly with those of the celebrations I described in the previous section and recent work that advocates more ‘hopeful’ performances in post-disaster environments. While hope may make possible ‘opportunities both for newly positive emotions and experiences’ (Cloke & Conradson, 2018: 9), the atmospheres and exhibits in the Eldheimar museum create environments in which it becomes possible to reflect, mourn and express the less optimistic aspects of experiencing natural hazards. As Joe Gerlach argues, ‘quick recourse to ‘hope’ in contemporary, liberal political narratives, including in their mildly agonistic forms, can be stifling, not least because they insist upon a duty to be hopeful, even in the face of the social-mental-ecological disasters’ (2016: 337). Instead, Gerlach argues that if ‘hope... attunes bodies and minds to a future or futurity that may never arrive’ (2016: 337), melancholy might be better for thinking through the past and how it comes to inflect on our present realities. Working backwards, if our aim is to do justice to the ways in which individuals are affected by natural hazard events and foreground their ongoing struggles, a micropolitics

of hope is conservative in the sense that it involves repetition of the same logics that close down opportunities for thinking, acting and reflecting on hardships.

By contrast, artistic and curatorial practices direct visitors' eyes and bodies to minute details of ruin and destruction in Eldheimar. Cracks in the wooden door frame of the ruined house, chips in the red paint and bottles in the bathroom window are illuminated. As I walked with residents around the Museum, some would periodically stop and reflect (Figure 25). As Bennett argues, reflection allows bodies to slow down: 'thoughts, but also limbs... are brought to rest, even as the senses continue to operate...indeed in high gear. You notice new colours, discern new details previously ignored, hear extraordinary sounds as familiar landscapes sharpen and intensify' (Bennett, 2001: 5).



Figure 25. A resident on Heimaey reflecting on the past while looking at the ruins in Eldheimar

Personal objects belonging to the ruined house's former owner, Gerður Sigurðardóttir and her family have been carefully positioned amongst the rubble inside the ruin. For example, items in the bathroom include toothpaste, hair curlers, jewellery, a baby book and a toy lorry. Visitors use a joystick to control a CCTV camera as they search for the objects, zooming in and out of different parts of the room. When an object is located, further information about the object's history appears on the screen. The exhibit encourages visitors to not only look but become invested in the exploration of these destroyed objects. Against the optimism, energy and promise of hope (Berlant, 2011), at the Museum bodily movements become slow and opportunities for reflection become possible. As Axel, the museum designer explained: "I heard a story on the opening day that people talked about it [the negative impacts of the eruption] for the first time." In this way, the Museum interrupts the previously limited possibilities and spaces to make personal and collective struggles known on Heimaey. In the next part of this section, I delve deeper into why and how the Museum came about.

A place to heal

On 7th July 2017, I observed as around fifty people gathered on the top floor of Eldheimar for an 'Intergenerational Conversation' hosted by Guðrún Erlingsdóttir, a former resident on Heimaey who returned from Reykjavik specifically for the event (Figure 26). Guðrún was completing her bachelor's degree in journalism at the University of Iceland at the time of our conversation and had previously worked for the town council on Heimaey. For this event, Guðrún assembled a panel of four speakers who had nominated themselves to participate in the discussion- the panel was comprised of two island residents who were children during the 1973 eruption and their mothers. The objective of the conversation was to create a public forum for discussing experiences of the eruption.



Figure 26. The Intergenerational Conversation held on the second floor of Eldheimar (Reproduced with permission. Image credit: Gylfi Sigurðsson)

After the event, I spoke with Guðrún about the idea behind the Intergenerational Conversation. She explained that: “the generations haven’t talked together because it was a very hard time for many people- we talk about how everyone was constantly working and saving buildings, but how did children and older people feel?” Guðrún explained that there is a desire amongst residents on Heimaey to share their experiences with others and Eldheimar had helped to “open up this conversation”. Guðrún went on to describe how:

“Most residents just have it inside their body, and it might be that it is not good for the body to keep such big things close inside. Hafdis [a resident on Heimaey] had talked to me a lot about how she wanted to open it up. She is not fond of talking usually- but thought it was a good opportunity for talking to others.”

During the Intergenerational Conversation, residents took it in turns to share their experiences of the eruption. At times there was laughter, applause and the telling of jokes and at other times speakers put their arms around each other to offer support and comfort. The audience also contributed their own experiences after the initial discussion. After the event, residents approached Guðrún to thank her for organising the discussion. One resident said: “my grandma never talks about feelings- it is the first time I heard about her stories”.

By bringing together personal stories, biographies and diversified memories, Arnold-De Simine (2013) suggests that museums have the potential not only to house collections of objects but become places of recollection. Similarly, drawing on the work of Deleuze and Guattari, Adrian Parr (2008) argues that museums have the potential to put traumatic memories to work in positive ways. Parr suggests that a culture of memorialising the past is not necessarily about ‘weeping over misfortune’ but acts of remembering can in themselves have positive transformative potential in creating new social collectives of support and solidarity. When I asked Guðrún about her motivations for organising the Intergenerational Conversation she explained:

“I am tired of hero stories- of the man who stood cooling down the lava with water and saving things- I am not reducing what they did- we would not be there if they did not do what they did. But all the mothers who stood at the harbour with 5/6 children- many of whom were pregnant- and they were stood there with no home, maybe no money. Their story has not been told. I’m not thinking about it scientifically. I am thinking more that this society needs healing”.

Guðrún articulated how her intervention through the Intergenerational Conversation did not emerge from a public controversy surrounding the effects of the 1973 eruption. Instead, the slow, disruptive manner in which the emotional/physical/psychological have come to affect people's life on Heimaey has impelled interventions driven by an ethical impulse to help and contribute to making things better. Projects like Eldheimar and the Intergenerational Conversation thus resonate with the ideas of Liboiron, Tironi and Calvillo who argue that such interventions of care can be made on the basis of 'obligations and solidarities among diverse collectives, human and otherwise' (2018: 341). The authors argue that action can be 'based in a politics not of effectiveness or change, not in purity or a shared commons, but in obligation and ethics' (2018: 340). In making such interventions to help others affected by the eruption, Guðrún engages in everyday acts of care for struggles which pass below the types of evidence required for official hazard management concern. In the interview we had after the Intergenerational Conversation, she described how she carefully attuned to the different participants' emotions. She explained:

"I tried to watch how people felt- I told the woman, "you don't have to say anything anymore; you just stop at your point." It was not my intention to create drama. It was not a scientific project- it was more a feeling- talking and listening to people- you have to listen- not to the words but what they are saying. It is not a good thing to make people cry for the sake of making people cry. If people come and tell their stories, I want to show their feelings the respect I can. In their laughter there is a lot of pain."

Guðrún's hosting of the Intergenerational Conversation to allow 'society to heal' is exemplary of the broader logics for the construction of the Eldheimar museum. In a conversation with the Mayor of Heimaey, he explained how the struggles of his own family motivated the construction of the Museum. He explained: "we were thinking- let us come to terms with the past... this is not just geology, it's real people. They are afraid. We really wanted to emphasise the people." In particular the Mayor was concerned about his father's experiences of the eruption, he explained: "this generation does not like to talk about their feelings- it was not until we opened Eldheimar and I took my father- 67 years old at that time- that all the flood-gates opened and he really went deeper into how it really was- how difficult it was to go inside of strangers' houses digging through personal items- it was not until we went through the exhibition in Eldheimar together that he told us of these emotions."

Conradson (2005: 339) argues that therapeutic experiences are 'positive physiological and psychological outcomes deriving from a person's imbrication within a particular socio-natural material setting'. However, I am less interested in the extent to which the Museum might be classed as healing or therapeutic and more interested in how its design and construction allows for particular performances. It is difficult to say if residents derive a 'positive psychological outcome' from their visits. Some, like Frida in chapter 4, claim the Museum has helped them to "accept their experiences of the eruption". Others described the experience of the Museum as like "tearing off an old wound". Of interest is how the Museum has been particularly successful in creating a space in which residents can attest to their traumatic experiences, render them knowable and share their struggles with others. This is particularly noteworthy against a backdrop of performing post-disaster subjectivities on Heimaey which inhibit these possibilities.

Containing affects and emotions

The success of Eldheimar in enabling performances of grief, missing, sorrow and trauma contrasts with the dominant post-disaster performances I described at the start of this chapter. Yet, the same town council officials responsible for organising celebrations of victory were also instrumental in driving forward the construction of the Museum. Thus, what becomes interesting is not only that Eldheimar creates a space that makes struggles visible and knowable, but how these performances are carefully controlled in space and time.

As James Ash (2013) argues, atmospheres are central for thinking about space and place precisely because they generate particular space-times in which particular corporeal performances are made possible. Similarly Duff argues, ‘to fail to attend to this affective dimension is to miss the push and pull of place’ (2010: 893). One way that post-disaster subjectivities have been prevented from disrupting atmospheres of jubilation and celebration is evident in the deliberate efforts to contain these performances to within the confines of the Museum. Eldheimar is located on the far edge of the town of Heimaey in a building that was designed to be indistinguishable from the surrounding landscape. As Figure 27 illuminates, the exhibitions and inside of the Museum are closed off from the outside by metal panels. This is in contrast with other museums dedicated to disaster around the world; for example, the Kobe Earthquake Memorial Museum in Japan¹⁸ is designed as a glass skyscraper.

¹⁸ www.dri.ne.jp/en [Accessed: 2/9/2018]



Figure 27. Eldheimar from the outside

In the Museum there is also a great deal of care taken in thinking about the fine balance of affects this environment generates. The architect of Eldheimar, Margrét, described this fine balance as she describes how she wanted to create an environment that allowed visitors “to feel something but not cry”. Over time, the exhibits have also been tinkered with. For example, when the Museum first opened it had a large 200 square meter glass roof. Subsequently, this has been blocked off with blackout curtains to dial up the intensity of affects and emotions. Thus, the designers of the Museum have gradually pushed the boundaries of the types of emotional performances that are permissible on Heimaey. The Museum staff also play an important role in regulating the emotional impact of the Museum. In a conversation with one Museum employee they described:

“I had this man; he came in with his granddaughter- she took him to Heimaey just to go to this museum- this was the first time he had been back to the island- it was her way of helping her grandad get over it- it was really difficult- he had a really difficult time going around- he just stopped in the darkest place so I took him upstairs and offered him cake”.

Mol, Moser, & Pols (2010) suggest, acts such as putting a hand on an arm at just the right time, can constitute care for others. However, this description also reveals the careful line the Museum staff take in curating responses of individuals to the exhibits. The carefully regulated affective environment of the Museum thus speaks to how atmospheres of joy and victory can give way to considerations of affects that promote ideas of ‘healing’ while trying hard not to disrupt established conventions of post-disaster island life. The Eldheimar museum therefore builds on geographical work on the spatial politics of affect and emotions in urban environments (Gandy, 2017; Latham & McCormack, 2004, 2009; Thrift, 2004) and shines light on what is at stake in considering a politics of affective atmospheres in post-disaster environments.

4. Conclusions

Atmospheres of hope in the aftermath of major natural disasters are becoming increasingly well known. For example, Rebecca Solnit (2010) argues that the time after natural disasters is a time for radical innovation and the emergence of kindness and grassroots attempts to solve problems (see also Anderson, 2017; Takazawa & Williams, 2011; Clark, 2010). Building towards the future may be propelled by an affective atmosphere of hopefulness that forge feelings of ‘being-in-common’ and brings people together in these post-disaster environments (Clope & Conradson, 2018). Similarly, Bloch (1998: 341)

writes that a characteristic of hope is that ‘it is open in a forward direction, in a future-orientated direction; it does not address instead to that which already exists’. As Gerlach (2016: 335) insists however: ‘perhaps the problem is not so much with ‘hope’ itself as it is an incipient worry about assumed, taken-for-granted tendencies towards hope and hopefulness’. Eldheimar acts as a caution towards a rush to spotlight atmospheres of hope in post-disaster environments. Hope may well be important and necessary for looking to the future, but at some point, hope may become complicit in inhibiting possibilities for the enactment of the less positive, more traumatic effects of natural hazards. The Eldheimar museum highlights the importance of alternative affective atmospheres that allow us to attend to the past, ask questions about what happened and learn about the struggles caused by its resonances.

Chapter 6: Re-storying earthquakes

1. Introduction

In 2010 Guðrún Jóhannesdóttir, the co-ordinator for the civil protection department in Iceland, alongside her colleague Guðrún Gísladóttir, a Professor of Geography at the University of Iceland, published an article in the journal of Natural Hazards and Earth System Science entitled: ‘people living under threat of volcanic hazard in southern Iceland: vulnerability and risk perception’ (Jóhannesdóttir & Gísladóttir, 2010). The article resonated with the discussions I had with residents on Heimaey about anxiety. One quote in particular from this study captures the disruptive effects of anxiety on everyday life and efforts to minimise such feelings:

There is this feeling within when you think about the risk from an eruption, it is something you don’t talk about as you make the kids scared and if you are scared all the time you just can’t live here, so you just put these thoughts aside, more or less let the thoughts sleep while you try to live a normal life (Jóhannesdóttir & Gísladóttir, 2010: 414).

This chapter focuses on one of the ways that residents in South Iceland negotiate a desire to be prepared for potential hazards while not succumbing to constant anxiety. I focus here on the ways that earthquake data collected by the Icelandic Meteorological Office is ‘re-storied’ by individuals living in South Iceland in blogs, websites and social media posts. Gabrys, Pritchard, & Barratt recently mobilised the term ‘data stories’ to describe the alternative ways that residents in Pennsylvania ‘created, valued and interpreted’ environmental data sets beyond their original uses (2016: 1). In this chapter, I draw on the concept of ‘data stories’ to describe how environmental data can be re-appropriated to

evoke alternative affects and atmospheres of collective feeling. This chapter thus uses earthquake data and its re-storying to open up new questions about the ways in which communities participate in managing the anxieties generated by the uncertainties of living with geophysical hazards.

I consider data stories to include the myriad of ways in which data originally sourced from the Icelandic Met Office is re-displayed, commented on and contextualised by residents in South Iceland. With the exception of a small handful of individuals in Iceland who own and operate their own earthquake sensing networks, the vast majority of data on earthquake events are supplied by the Icelandic Met Office- the government organisation dedicated to monitoring atmospheric and geophysical hazards. While the Icelandic Met Office website provides open-source, real-time data on earthquakes such as their location and magnitude, these data are re-displayed and reinterpreted on personal websites and blogs. In this chapter, I show how techniques such as commenting on maps of earthquake data on social media and re-contextualising earthquake activity through providing commentary and advice about earthquake events are ways in which earthquake data are re-storied. In addition to spotlighting these techniques, I use a short case study of the increased activity of the Katla volcano (S. Iceland) between summer 2017 and summer 2018 to argue that the affects generated by re-storying earthquake data do not seek to eliminate feelings of anxiety but seek to limit the space-times when such feelings are evoked.

I begin this chapter by outlining the technologies through which earthquakes are monitored in South Iceland and the tensions between the anxiety of monitoring earthquakes and a feeling of obligation to be prepared. Next, I describe how the data acquired by the

Icelandic Met Office are re-storied on a variety of different internet and social media platforms by residents. I then reflect on how these findings trouble ideas of what it means to be prepared for hazards by arguing that re-storying earthquake data does not mean residents contest authorities' decisions such as about when to evacuate, but it provides reassurances during periods of earthquake activity that are attuned to the everyday difficulties of living with geophysical hazards and not just the moments when lives might be at stake.

2. Preparedness, earthquakes and anxiety

Sensing tensions

The emergence of seismic monitoring has created new possibilities for detecting subsurface vibrations in Iceland. The first Icelandic instrument for monitoring earthquakes was installed in 1909 at the School of Navigation in Reykjavik by the state engineer Thorvald Krabbe and clockmaker Magnús Benjamínsson (Guðmundsson & Roberts, 2009). Since this time, more instruments were installed across Iceland that were increasingly sensitive to ground motion. Stefánsson (2011) notes how the first seismometers were only able to detect ground movements created by a magnitude four earthquake, these instruments were gradually upgraded to those which could detect magnitude three earthquakes in the 1970s and 1980s. As a result of improvements in the density of the seismic network and the sensitivity of the instruments, the Icelandic Met Office now describes how: 'improvements in recent years allow for the detection of smaller, and thus many more earthquakes, as well as enabling better constraints on earthquake location and depth... To date, seismometers in the region [of S. Iceland] are able to detect all earthquakes above magnitude 0.9, whereas in 2000 this threshold was

around 2.2’¹⁹. Moreover, while modern seismometers in Iceland are increasingly sensitive to ground movement, they are now also able to send data in near real time via a 3G link back to the Met Office HQ in Reykjavik. Previously seismic data was recorded on photographic paper which had to be collected from the monitoring station and sent to Reykjavik for processing.

To find out more about earthquake sensing networks, I arranged to speak with Sara at the Icelandic Meteorological Office on the outskirts of Reykjavik. Sara is the Volcanic Hazards Coordinator for the Met Office which in practice means she coordinates monitoring efforts and informs the civil protection authorities of the risks of increasing seismic activity in particular locations. In a boardroom in the Met Office, Sara informed me of the networks of GPS devices, tremor sensors and strain meters through which seismic activity is measured. This array of devices brings to the fore how subsurface vibrations are not only apprehended through ‘listening devices’ such as seismometers that amplify infrasonic vibrations (see Gallagher, Kanngieser, & Prior, 2017), but that earthquakes also become known through changes in the height of the ground surface and might be inferred through other measures such as ground stresses. Gabrys & Pritchard argue that sensing practices are ‘ways of articulating what matters, of signalling an expressive register of relevance, and affecting and being affected’ (2018: 396). For the Met Office, a premium is placed on knowing the subtle dynamics of changes in the earth’s subsurface with the view that these small changes might offer forewarning about large magnitude events such as the heralding of volcanic eruptions.

¹⁹ Icelandic Met Office (2016) Retrieved from: <https://en.vedur.is/earthquakes-and-volcanism/articles/monitoring-hekla> [Accessed: 23/6/2019]

Monitoring low magnitude earthquakes is thus an act of preparedness in which authorities calculate activity in real time as a way of becoming more responsive to potential volcanic threats. Yet, for Brian Massumi (2010), rather than mitigating future threats to life, attempts to prepare for them in advance can simply transpose these threats from the future into the present. Massumi draws on examples of how governments prepare for the possibility future terror attacks by staging mock terror incidents which have similar material consequences as an actual terror event by causing panic, anxiety and disruption to people's everyday activity. Similarly, Ben Anderson (2010) argues that taking anticipatory action to avert future threats matters because it is a way of legitimising particular actions in the present, such as culling birds to prevent the possibility of avian flu or justifying the profiling of air travellers as a way of preventing terrorist threats. In the same way, a state of anxiety about possible future geophysical hazards is justified as a legitimate response to the risks of catastrophic volcanic eruption events.

The Icelandic Met Office make these feelings of anxiety possible through both calculating low magnitude earthquakes and techniques of visualisation and narration. For example, the Met Office website's main graphic is a map of Iceland onto which the locations of the past 48 hours of earthquakes are overlaid (Figure 28). Over time, newer earthquakes appear on the map alongside older earthquakes that have occurred in the same area such that it is possible to see spatial clusters of earthquake activity. The colour of the earthquake symbol signifies the amount of time that has elapsed since the earthquake. Red signifies recent earthquakes and blue older events. Figure 28 also shows how earthquake data are also categorised by their magnitude. Earthquakes with magnitude 3 are displayed as a green star while lower magnitude events are displayed a circle.

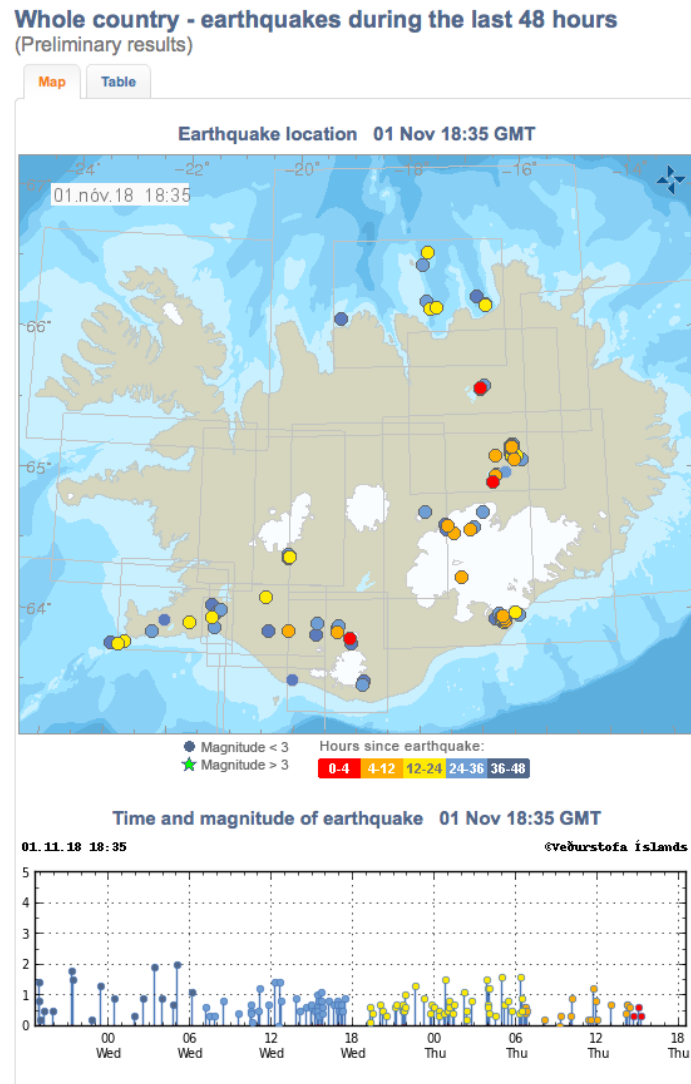


Figure 28. Screenshot showing the visualisation of real-time earthquake data on the Icelandic Met Office website (data as shown on 1st November 2018)

Anderson (2010: 785) argues: ‘making the future present becomes a question of creating affectively imbued representations that move and mobilize’. Anderson also argues that certain affects materialise in the present through forms of narration and visualisation which ‘harness imagination to make the future present’ (2010: 786). It is not that the Met Office use images of catastrophic future scenarios to warn people of the dangers of volcanic eruptions, but they allow the earthquake data to draw narratives through presenting its spatial clustering and the demarcation of larger magnitude events to create feelings of anticipation and expectation. The Met Office also accompanies the maps of earthquake

activity with a short textual narration that is updated weekly. The weekly updates typically help to draw out general patterns in the visualised data such as the locations in which there is increased activity, but this commentary does not tend to offer any further context such as if such activity is typical or atypical for a given time of year. Thus, allowing residents to keep open the opportunities for imagining worse-case scenarios.

Anderson & Adey's work on civil emergencies argues that in evoking affective atmospheres of anxiety, emergency and urgency, the desired aim of state authorities is to 'simulate the experiential conditions of response so as to develop the potential to respond' (2012: 1102). On Heimaey, increased earthquake activity triggers memories of the 1973 eruption on the island and the evacuation of residents to the mainland. My fieldwork diary from the time of increased seismic activity around Katla in the summer of 2017 reveals my personal response to the anxieties evoked by monitoring earthquakes on the Met Office website.

I am nervous. My friend messaged me to check I was ok. My rucksack with my notes and books in it is packed, ready to go by the door. I thought through various eruption scenarios involving what I would do if a fissure opened up in various parts of the town including by the building. I wondered what would happen if emergency warnings were sent out to my phone during the evening when it was on silent. I kept my phone off silent mode. (fieldwork diary 15/07/ 2017)

Whether provoking memories of the past or bracing oneself for the possibility of having to evacuate at a moment's notice, the possibility of a future catastrophe becomes bound up with a heightened state of readiness to act. For those charged with hazard management in

Iceland, this readiness would be celebrated as the ‘right’ kinds of demeanour for living with hazards. Yet, on Heimaey the rise and fall of earthquake activity and associated anxieties create a tension between wanting to be aware of possible emergent risks but not succumb to the ebb and flow of anxiety that accompanies the various small fluctuations in earthquake activity.

Residents spoke to me about the difficulty of ignoring periods of heightened earthquake activity. Friends and family call from around the country. There are media reports and radio broadcasts that are hard to avoid. However, residents also discussed how monitoring earthquakes is something that is also bound up with what it means to be Icelandic, in the sense that it is connected with a sense of being prepared for and not naïve to potential hazards. My research led me to visit Aurora and Bjarni. Aurora worked for the Icelandic tourist board and her husband, Bjarni, is an air traffic controller at Keflavik airport. Both Aurora and Bjarni were born on Heimaey but recently moved to Reykjavik. I wanted to talk to Bjarni and Aurora about their life history, experiences of the 1973 eruption and their decision to leave Heimaey. While we spent several hours discussing these themes, Aurora and Bjarni were more enthusiastic about discussing the on-going seismic activity in the Katla volcano. Aurora rushed inside her house to collect an iPad on which she had the Icelandic Meteorological office website pre-loaded with the latest earthquake updates. She pinched the screen with two fingers and inspected the map carefully through her sunglasses to check if any new earthquakes had appeared around the Katla area. Aurora and Bjarni were proud to tell me about how often they keep up-to-date with earthquake developments.

There were other residents who were enthusiastic about discussing their earthquake monitoring habits. For example, I visited a retired school teacher, Gísli, to discuss his various on-going research projects. Each visit would follow a predictable pattern. Coffee and general conversation in the kitchen was followed by a discussion of the various research projects he thought I should be carrying out. When I managed to steer the conversation back to experiences of living with volcanoes, Gísli loaded up webpages that showed real-time seismic data and pages displaying live webcams of the main active Icelandic volcanoes²⁰. I therefore discovered the trend of monitoring earthquakes by chance rather than through asking residents about their earthquake viewing habits. Indeed, while living on Heimaey, I too developed a habit of checking for earthquakes online at different points during the day to establish if there was any increased earthquake activity around South Iceland. The enthusiasm revealed by these residents illuminates the tensions involved in monitoring earthquakes. On the one hand, checking earthquakes is associated with being a prepared citizen. On the other, monitoring earthquakes also brings anxieties about the future into the present without offering any guarantee of safety in the event of an actual eruption.

Consequently, Peter Adey suggests we might thus ‘value the experimental and improvisory ways that societies have learnt to live and move under threat of emergency and disaster... without necessary submission to an emergency governance apparatus which seeks to overdetermine the response’ (2016: 41). Rather than simply exploring the techniques through which fear and anxiety are manipulated and made present (Anderson & Adey, 2012; Adey, 2008; Pain & Smith, 2008), I want to explore how affective atmospheres of anxiety are amplified and dampened through re-storying government

²⁰ <https://www.livefromiceland.is/webcams/katla/> [Accessed: 23/6/2019]

earthquake data. In this way, we arrive at an understanding of how affects are negotiated in everyday life and in turn consider how re-storying data is a strategy for coping with living against a backdrop of regular earthquake activity.

3. Re-storying earthquake data

Gabrys, Pritchard, & Barratt describe how data stories ‘generate other worlds and worlding processes from citizen data, in which citizens’ experiences matter’ (2016: 11). For Gabrys and her colleagues, data stories ‘establish patterns of evidence that can mobilise community responses...practices that give rise to contestations, collectives and relations that are the expression of democratic engagement with environmental problems’ (2016: 11-12). I suggest the practices of taking raw earthquake data in the form of numbers, graphs and visualisations produced by the Icelandic Met Office and re-interpreting this information also constitute the making of data stories in which official accounts are met with local concerns and priorities.

The distinction I wish to make from Gabrys and her collaborators’ accounts of data stories, is that I suggest these stories are not only important for providing different perspectives on the environmental problems such as drawing attention to pollution, but data stories also reshape the affective tone, temperature and types of affects evoked by official data. Storying in this way resonates more with the idea of stories as ‘an expressive method and an affective tool, designed both to demonstrate affective and emergent geographies and to move audiences toward new realms of thought and practice’ (Cameron, 2012: 575). Stories are thus more than representations of particular aspects of the world; stories move bodies in certain ways through the affects they evoke.

For Haraway (1997), storying is also about ‘figuring’ and ‘having a role’ (p. 11). The data stories that I draw on in this section bring to light the concerns of those living in South Iceland and making their stories figure, count, have a role. I focus here on a selection of the different forms that data stories take online, however, I predominantly discuss the social media posts, blogs and websites of South Icelandic resident, Jón Firmann. This is because his posts are a popular alternative source of information on earthquakes. As one person commented in the comments part of Jón’s website: ‘when I see something going on with the “official” volcanic or earthquake sites, I come here for more information!’²¹. Jón’s posts were also popular on Heimaey and residents often shared his blog posts on social media sites which is how I first became aware of his content. Jón has been tweeting about earthquake activity since 2010 under the name @icelandgeology and @jonfr500 describing himself on Twitter as: ‘a writer/citizen scientist’ who is ‘into geology and other science’. Jón also maintains a website where he blogs about earthquake activity (www.jonfr.com) and a Facebook page for his earthquake and volcano interests (@IcelandVolcanoAndEarthquakeBlog). The same content is typically posted across these different platforms in both Icelandic and English.

Drawing on the idea that environmental data can be storied in ways that reflect local concerns, this section investigates the different ways that earthquake data are storied with the aim of modulating concern about particular periods of seismic activity. I discuss two main ways in which this is achieved. The first involves re-contextualising the significance of particular earthquake events through various forms of textual commentary. The second involves techniques of re-sequencing and filtering seismic data. In the final part of this section, I use a short case study of increased seismic activity around South Iceland

²¹ https://www.jonfr.com/volcano/?page_id=2 [Accessed: 3/11/2018]

between 2017-2018 to investigate the spatio-temporal modulation of affect created by Jón Firmann. The case study helps to establish how re-storying earthquake data is not a way of preventing people being concerned about earthquake and volcano hazards but is involved in rethinking the space-times in which anxiety can emerge.

Re-contextualising seismic data

During times of increased seismic activity on Iceland residents on Heimaey would not only turn to the Icelandic Met Office for updates on earthquakes but share posts about earthquakes on social media written by other residents. In part the reason for doing so was to evaluate if particular earthquake events were worth worrying about or not. The Icelandic Met Office maintains an alert level system to describe periods of increased seismic ‘uncertainty’. Bird et al., (2017) document these alert level phases as: 1) Uncertainty phase (Óvissustig) 2) Alert phase (Heattustig) and 3) Emergency phase (Neydarstig). The ‘uncertainty phase’ is ‘characterised by an event which has already started and could lead to a threat to people, communities, or the environment’; the ‘alert phase’ is characterised by an ‘increased threat’ that requires ‘increasing preparedness of emergency and the security services’; finally, the ‘emergency phase’ is ‘characterised by an event which has already begun which could lead to, or has already led to, harm to people, communities, properties or the environment’ (Bird et al., 2017: 274). There are consequently many periods of increased seismic activity displayed on the Met Office website with no commentary or context for such events supplied by authorities, leading residents to expect the worst. Residents therefore turn to websites such as Jón’s and social media to seek reassurances about such activity.

Figure 29 is a Facebook post from the Lava Centre. The Lava Centre is a museum on the South Coast of Iceland. The post shows how an image of earthquake activity has been copied from the Icelandic Met Office website with a new commentary provided about the earthquakes clustering around the Öraefajökull volcano- Iceland's largest active volcano. The post came as a response to heightened media attention in both Iceland and internationally about the possibility of an eruption of Öraefajökull during September 2018. The post acknowledges that there have been 'lots of small earthquakes' but 'nothing big'. The post tries to establish that such activity is in-line with that might be expected. A type of background seismic activity in which patterns of geological activity do not warrant immediate concern. It is not that these comments contravene warning messages put out by the Icelandic Met Office, but such comments fill in the spaces where no commentary is supplied by these official sources.

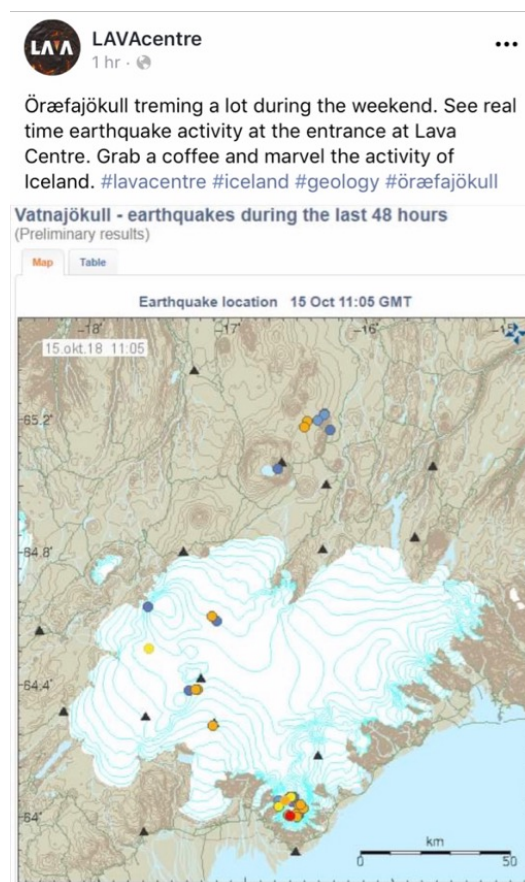


Figure 29. Lava Centre museum Facebook post about earthquakes (28th September 2018)

The commentary of the Lava Centre museum chimes with the types of commentary made by others living and working in South Iceland. Figure 30 shows Jón Frímann's response to a question on his website about increased low frequency vibrations detected by seismometers on the Met Office website. Jón uses his situated understanding of earthquake and seismic activity to fill in the gaps in storying earthquake data that the Met Office leaves open. Residents like Jón also have the advantage of being able to respond to earthquake patterns as they appear on the Met Office website. In the example in Figure 30, Jón replies within an hour to questions about increased seismicity that were raised late in the evening. It is therefore also noteworthy how residents' concerns lie with the fine-grained, sometimes hour by hour changes in seismic activity while Met Office resources are orientated both around identifying trends that materialise over longer periods of time, typically days and weeks. This difference in the types of seismic activity which concerns residents and the Met Office opens up space for alternative data stories about these patterns of events to be presented by local people. The commentary by Jón and the Lava Centre helps to provide reassurance by identifying alternative correlations and patterns in seismic data based on these individuals' lived experience and situated knowledge.



Larry says:

August 1, 2017 at 20:38

Mostly stations in the western parts of iceland are showing a sharp increase on the low frequency.



Jón Frímann says:

August 1, 2017 at 21:50

Just background noise. What you are looking for is activity as it appeared on 29-July-2017. Anything else is just background noise or some random pattern that doesn't matter (or just some changes in the hydrothermal activity in Katla volcano).

Figure 30. Questions about seismic activity on Jón Frímann website

Re-storying seismic data provided by the Icelandic Met office not only involves adding commentary in the form of text to accompany periods of seismic unrest, but it also involves filtering out the types of activity that residents should and should not concern themselves with. Filtering particular periods of geological activity is therefore an exercise in amplifying and dampening the affective significance of certain episodes of seismic activity. Matthew Fuller (2006) draws our attention to the particular technopolitical arrangements that amplify or dampen the affective materiality of the non-human world to shape their capacity to ‘force thought’ and move us. Similarly, Anderson & Adey suggest the need to attend to ‘the techniques and practices’ that ‘will animate and dampen affective relations and capacities’ (2012: 1096). For example, updates from Jón Frímann’s blog served to build up tension around an impending eruption, particularly on 17th June 2017 when Jón commented that ‘it is my view that chances of an eruption happening soon (maybe in a matter of hours) are high’. This selecting of particular events serves to elevate some seismic episodes in prominence while demoting the importance of others. I therefore want to argue that re-storying earthquake data is not only about dampening the anxiety generated by particular seismic events. To better attend to how re-storying data modifies collective feelings and moods we need to explore how data stories imbricate with the modulations of affective atmospheres generated by official sources of commentary put out by the IMO.

Space-times of storying

In attending to the spatio-temporal modulations of affect generated by the re-storying of earthquake data, I suggest it is helpful to return to the concept of affective atmospheres. McCormack suggests, ‘atmospheres are dynamic distributions of feeling...[which] provide a way of grasping the affects that circulate and emerge within discrete and relatively

constrained space-times – a theatre, or a railway carriage, for instance, or the room in which an emergency scenario is staged’ (2015: 139). In his study of price and atmospheres of emergency, McCormack encourages an attention to the ‘affective dimensions of life’ in which ‘we can think of the movement and relative volatility of prices and price-indices as indicators of waves of affect as they flow across bodies and their orientations’ (2015: 138). What is useful about the concept of affective atmospheres is that the concept draws attention to the spatio-temporalities of affect and feeling. For example, how the sudden drop in the price of an item of food on a supermarket shelf generates crowds of interested buyers and or how fluctuations in prices on the stock market create periods of buying and selling shares. These spatio-temporal dimensions of affect are not easily apprehended by taking data stories as individual, discrete narrations and instead we might take a slightly more zoomed out view to apprehend how sequences of individual stories modulate affect over particular time periods. This not only helps to explore how re-storying data evokes particular affects but allows us to build up a more comprehensive idea of how and when these affects rub up against official narratives.

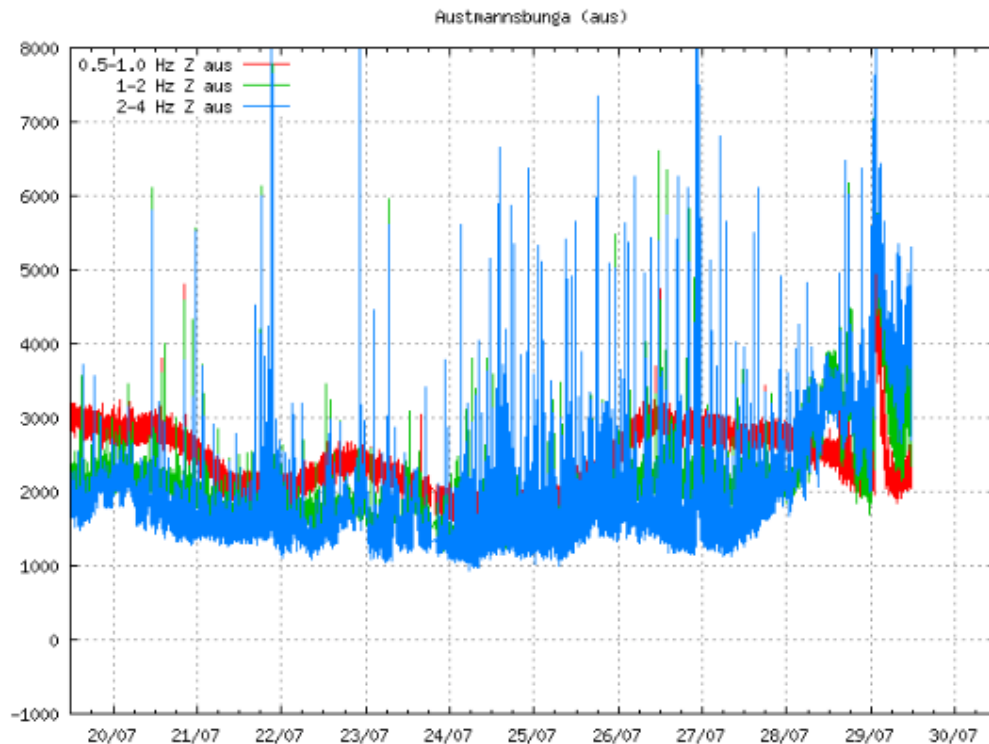
On the 29th July 2017, an alert was raised by the Icelandic Met Office for the Katla volcano in South Iceland. A glacial flood (jökulhlaup) had begun to occur in the Múlakvísl river close to Katla. Nearby seismic monitoring stations recorded a significant increase in 2-4 Hz tremors which were attributed to the flood and a possible subglacial eruption (Global Volcanism Program, 2017). Civil protection authorities temporarily raised the eruption alert level from green to yellow meaning: ‘the volcano is experiencing signs of elevated unrest above known background levels’²². Icelandic volcanologists have debated if the low-magnitude earthquakes occurring around Katla in the summer of 2017 led to an

²² <http://en.vedur.is/earthquakes-and-volcanism/volcanic-eruptions/> [Accessed: 21/9/2018]

actual volcanic eruption, but their occurrence nonetheless served to generate heightened worry and anxiety for those living on the South coast.

In the few days leading up to this activity and in the days after, residents on Heimaey shared Jón's Facebook updates commenting on this event. Jón's blog update published on the same day as the increase in activity did not seek to play down the anxiety of the eruption, but instead participated in amplifying such feelings. The family I lived with shared Jón's blog post not to reassure other residents but to encourage others to be aware of a possible volcanic eruption. As part of Jón's post on 29th July, he shared several graphs showing increased seismic activity around Katla²³ (Figure 31). Frequency of vibrations is divided between 0.5-1 Hz shown by the red line, green shows frequencies between 1-2 Hz and blue shows frequencies between 2-4 Hz. Even without being an expert in how to interpret these graphs, the jagged blue line of 2-4Hz tremors and its increase in number through the week (x axis) participates in conveying anticipation of an impending eruption of Katla.

²³ <https://www.jonfr.com/volcano/?p=6979> [Accessed: 2/10/2018]



Harmonic tremor in Austmannsbunga in Katla volcano at 12:09 UTC. It clearly shows the minor eruption and ongoing harmonic tremor pulse. *Copyright of this image belongs to Icelandic Met Office.*

Figure 31. Tremor plot copied from Icelandic Met Office shared by Jón Frímánn on 29th July 2017 with his accompanying commentary

Not only does Jón's post reinforce concern about an impending eruption of Katla, but he also signposts other residents to official advice from the Icelandic Met Office. He writes: 'Katla volcano has been moved to yellow alert. It is now possible to watch the glacier flood live from here (Rúv.is). Currently the glacier flood is getting smaller, but that might only be a temporarily thing if more water is on its way from Mýrdalsjökull glacier. There has also been a drop in conductivity for now in Múlavísk glacier river.' In doing so, Jón does not contest official advice about the need to stay away from particular areas around Katla but acts to reinforce atmospheres of anxiety and the need to be ready to take immediate preventative actions. Similarly, Massumi (2010) notes, the power of facts is not so much about using facts to win a debate, but the power to convey statements that

modulate the ambient feeling, tone or atmosphere. We see here how Jón's comments heighten alternates and in so doing imbricate with and amplify the affective narrative of the Icelandic authorities.

The earthquake activity around Katla appeared to gradually subside the week following 29th July 2017. Despite no official alert level being raised at this time, earthquake activity around the area of Katla appeared to increase again at the beginning of October 2017. In Jón's blog post on 3rd October 2017, he sought to downplay risks of an eruption and instead suggested the earthquakes on the Met Office website were likely to have been generated by the vibrations caused by poor weather conditions and possibly faulty instrumentation. What is interesting about Jón's commentary on earthquake activity is that his narratives address events at much finer spatial resolution and shorter scales of temporal change which do not register as matters of concern for the Met Office.

Eleni Ikoniadou (2017, 2012) writes about affect as a force that creates the rhythms of life beyond linear, chronological clock time. Ikoniadou suggests that 'rhythm no longer belongs to a body as a quality or asset and it is not attached to anything other than itself' (2014: 154). Drawing on Ikoniadou, we might then imagine how data stories prepared by the Met Office and the re-storying of data by residents are characterised by different rhythms. The former concerned with the build-up of earthquakes that might herald a volcanic eruption, the latter is also involved in providing stories and visualisations about these build-ups but also more frequent updates about earthquake events that generate worry and anxiety for those living in South Iceland. Anna Tsing (2015) writes that affective intensity arises through 'polyphony' - a type of assemblage through which interacting parts come together to produce sound and affect. Understanding the storying of

earthquake data in similar polyphonic terms helps to apprehend the moments when these ‘official’ and unofficial data stories overlap and the interstitial periods when residents like Jón Frímann step in to provide reassurance and modulate affective atmospheres of anxiety. As Jón explained in an interview:

“I sometimes update faster than official channels and news media. That depends if I am at a computer when something happens- that has not always been the case, but when I do update I often provide more detailed information on what is going on than official channels and news media in less time.”

Of course, not everyone living in South Iceland turns to the internet to monitor earthquake activity. For example, one evening I asked my seventy-year-old friend Oddur if he checks for earthquakes. He sat on the chair beside me. His eyes closed as he shook his head vigorously and said: “no. Some people do, but there are others like me who are just waiting. Waiting for something to happen”. Checking is stressful, obsessive and offers no guarantees. I reflected in my fieldwork diary that perhaps not keeping informed about hour by hour earthquake activity avoids the stress and obsession. Added to this, checking for earthquakes is a habitual activity. Some people check several times a day, others less frequently.

My objective here is not suggest that everyone has the same experiences of anxiety. It is possible that people like Oddur have developed their own strategies for managing the anxiety of earthquake activity through adapting different habits, Yet, given that life is increasingly played out through an ‘ecology of screens’ involved in ‘communicating, informing, entertaining [and] affecting life’ (Thrift, 2005: 233), I also suggest that it is

pressing to attend to the ways that people living in geologically active places balance competing logics of preparing for the future and living well in the present and the forms of data storytelling that emerge to help negotiate these tensions. Not least because the re-storying of earthquake data constitutes an important way in which residents can and do participate in attending to some of the struggles associated with living in an environment that are overlooked by official hazard management. In other words, while feelings of anxiety might not be felt universally, my aim is to attend to how data stories provide a means through which anxieties about earthquake activity are attended to..

In this section, I have illustrated how seismic data from the Icelandic met office are re-storied by people living in South Iceland on blogs, social media and personal websites. My objective is to highlight not only that re-storying data is a way of engineering affect (see Ash, 2013; Carter & McCormack, 2006), but about providing explanations and reassurances based on an attunement to local needs and concerns that governmental organisations have left unaddressed. Moreover, by thinking of storying data in affective terms and examining the spatio-temporal dimensions of how affect is modulated, we begin to open up a more nuanced picture of the periods when data stories rub up (or not) against official accounts. In the following section, I explore some of the implications of the re-storying of earthquake data in the context of how and why such forms of citizen participation have been able to persist without generating controversy and thus open up space so that re-storying earthquake data might be recognised as an important means through which people cope with living in an environment that experiences regular earthquakes.

4. Living with earthquakes

Beyond contestation

In his study of knowledge controversies associated with the Baku-Tbilisi-Ceyhan (BTC) oil pipeline, Andrew Barry (2013) argues that materials, and by extension the non-human world more broadly, are not the backdrop to human life but are themselves integral to sparking debates and contestation. Barry argues: ‘this occurs in part because the question of what the properties and behaviour of given materials are, or what they might become, can be focally what is in dispute’ (2013: 12). Barry goes on to argue that expert knowledge about the properties of certain materials might not settle disputes precisely because knowledge is itself uncertain and contested (see also Barry, 2010). While Barry’s work is mainly concerned with the material properties of metals, similarities with my concerns in this chapter about the volatile materiality of earthquakes is clear. Not least because of a shared concern with how the non-human world creates conditions of heightened indeterminacy and uncertainty.

A key aspect of Barry’s (2013) argument is to problematise what is meant by ‘controversy’, drawing our attention to his preferred term ‘political situation’ to describe the diffuse spatio-temporality of contestation. However, what we see emerging in the re-storying of earthquake data is not contestation with government officials around the disputed possibilities of a volcanic eruption occurring, but political engagement and participation during the times when the Icelandic Met Office has little commentary to add. It could be argued that a lack of controversy during periods of immanent risk - when, for example, a volcano is beginning to erupt - is an example of where more democratic engagement with decisions is paramount (e.g. Swyngedouw, 2009). Yet, what we miss with such a narrow focus is how participation in re-storying earthquake data springs up

either side of this narrow window of state concern. In other words, it is not that citizen participation is absent, it is just does not take recognisable forms. It does not seek to contest government decisions but addresses problems that go under the radar of government concern with strategies that are easily overlooked or dismissed as the fringe activity of citizen hobbyists and removed from any practical efficacy.

There are many examples of when controversy between state officials and affected publics arises in hazardous environments. For example, Donovan, Oppenheimer, & Bravo (2012) document how contestation can arise in the construction of hazard maps on Montserrat. Others, have explored how government volcano alert levels might involve more democratic engagement with publics (Fearnley, 2013). Nigel Clark argues however that a focus on controversy has: ‘much to do with the discipline’s turn away from its earlier imperial embroilments and toward a vision of space, place, and territory as interminably contested. When geography, along with other ‘progressive’ fields, regrouped around the imperative of the ‘political’, it tended to imagine the contents of politics in predominantly agonistic or adversarial terms’ (Clark in Yusoff et al., 2012: 976). While for Clark the corollary of these arguments is to explore aspects of reality that might not be so easily contestable such as the geological forces of the earth, I have been arguing that that these critiques can also take us in new, fruitful directions to widen the breadth of recognition of citizen participation in matters relating to living with hazards rather than a focus on those aspects of reality that are not open to negotiation (see Clark, 2013).

What is particularly interesting about a focus on how earthquake data are re-storied is that it brings to light the differential spatio-temporalities between matters of concern for residents living in South Iceland and the Icelandic government. Understanding

controversies as events that occur in particular snapshots of time might be helpful for investigating the mechanisms through which more citizen participation might be sought between ‘experts’ and publics but it may obscure the different forms of participation already existing and that attend to more mundane, everyday concerns. We might then begin not from the moments of controversy (cf. Stengers, 2015; Whatmore, 2013) and, instead, spend time understanding how everyday realities are made more liveable by the actions of residents themselves. It is clear from the re-storying of earthquake data that it is not the case that governmental authorities simply ignore earthquakes and their risks, but that residents use the same earthquake data to respond to a different set of priorities associated with earthquake events and the affects they generate. Recognising mundane practices, such as re-storying earthquake data, helps to diversify what counts as politics in volatile environments beyond narrowly defined actions such as contesting alert levels and re-drawing hazard maps.

The politics in this thesis is clearly not one that operates through contestation and debate. As Tironi argues: ‘politics is not about debates and argumentation but about the white noise of chronicity, while the composition of a common world often means surviving, coping and resisting’ (2018: 26). The data stories we encounter in this chapter are thus not attempts at subverting the Icelandic Met Office, but about attending to differential concerns that in part spring up as a result of increased efforts to monitor the earth and be prepared for possible eventualities. Through data-stories we might understand politics as less about conflict- in many ways these data stories deliberately attempt to avoid conflict - and as more a precarious achievement orientated around making life more liveable on a day to day basis rather than in the relatively short periods of ‘event-based’ catastrophe.

The low magnitude earthquakes that residents like Jón Frímann comment on, contextualise and attend to are not infrequent events. Jón posts about earthquakes on an almost daily basis and more frequently when there is increased earthquake activity in certain regions in Iceland. What is important is that Jón does not simply report these events, but he is concerned with how these periods of low-magnitude earthquake events are felt and lived with. Jón's data stories are thus orientated around concerns such as providing reassurances, sometimes even acknowledging others' worries directly in his posts. These practices of attending to the affective atmospheres of anxiety are thus less about competing against government messages of earthquake activity and its risks but rather about acknowledging that living in a state of constant preparedness is itself a struggle. Attempts to try and moderate such anxieties by providing timely updates about the significance of particular episodes of activity is an example of the strategies of living with hazards that radically extend our frame of reference for what counts as participation.

5. Conclusions

In this chapter my aim has been to spotlight the way that residents living in South Iceland attend to some of the everyday struggles associated with living with active volcanoes and earthquakes. My focus here has been on how the concept of 'data stories' helps us to apprehend how the tensions between preparing for future risks and living well in the present are negotiated. I used the term data stories to describe the ways that earthquake data obtained by the Icelandic Met Office is orientated around providing reassurances relating to the ebb and flow of small-scale earthquake events that can be a daily or weekly occurrence for people living in South Iceland.

I began the chapter by spotlighting how an increased drive to monitor the earth through ever denser and more sensitive sensing equipment, as well as strategies for visualising this data, fall into the mould of preparedness actions in which anxieties about an unknown, potentially cataclysmic future become folded into the present. This is a strategy which promotes a sense of alertness, but also one that creates tensions and anxiety. In the second section of this chapter, I focused on how blogs, social media and personal websites are ways in which some residents seek to dampen the anxieties generated by on-going earthquake activity using their situated knowledges and lay expertise. These data stories are popular on Heimaey and residents shared posts and looked to these commentaries for explanation after observing seismic events from official sources. I argue data stories are orientated around attending to the lived, everyday experiences of living with earthquakes and step into the void left by official hazard management. I suggest data stories act to reduce the times when anxiety felt rather than eliminating its occurrence all together, and in so doing may reinforce rather than contradict the temporalities of official concern. The fact that data stories do not seek to contradict government statements about particular risks may well be a contributing factor that enables their continued proliferation.

In the final part of this chapter, I reflected on the implications of data stories for recognising forms of participation that help to make life more liveable and in so doing help to broaden the types of activity that we recognise as making a difference rather than falling back on contesting familiar practices such as when an alert level should be raised or how a hazard map might be drawn. In so doing, we help to open up new spaces for political participation in which people live with hazards. We see in this chapter how such practices attend to everyday concerns neglected by government apparatus, but also in part caused by it.

Chapter 7: Mitigating ash erosion on the slopes of the Hekla volcano

1. Introduction

In June 2017, I stood at the foothills of the Hekla volcano with Hrefna, an employee of the Icelandic Forest Service (Skógræktin). Hrefna is one of three employees of the Forestry Service working on the Hekluskógar project- a major initiative that began in 2007 to afforest a vast 900 km² area around the geologically active Hekla volcano (Figure 32). Hrefna had driven us the two-hour journey from Reykjavik to inspect downy birch trees (*Betula pubescens*) planted around a new development of summer houses in the small area of Heklubyggd in South Iceland. After asking directions from a hotel, farmer and the Gunnarsholt research station in Hella we finally found our way there. The summer houses are located off the gravel road 268 that took us to the foothills of Hekla and an old lava field which was now colonized with mosses and short grasses. This new complex of plots was still under development with some plots still vacant while others featured large wooden summer houses looking over the volcano.

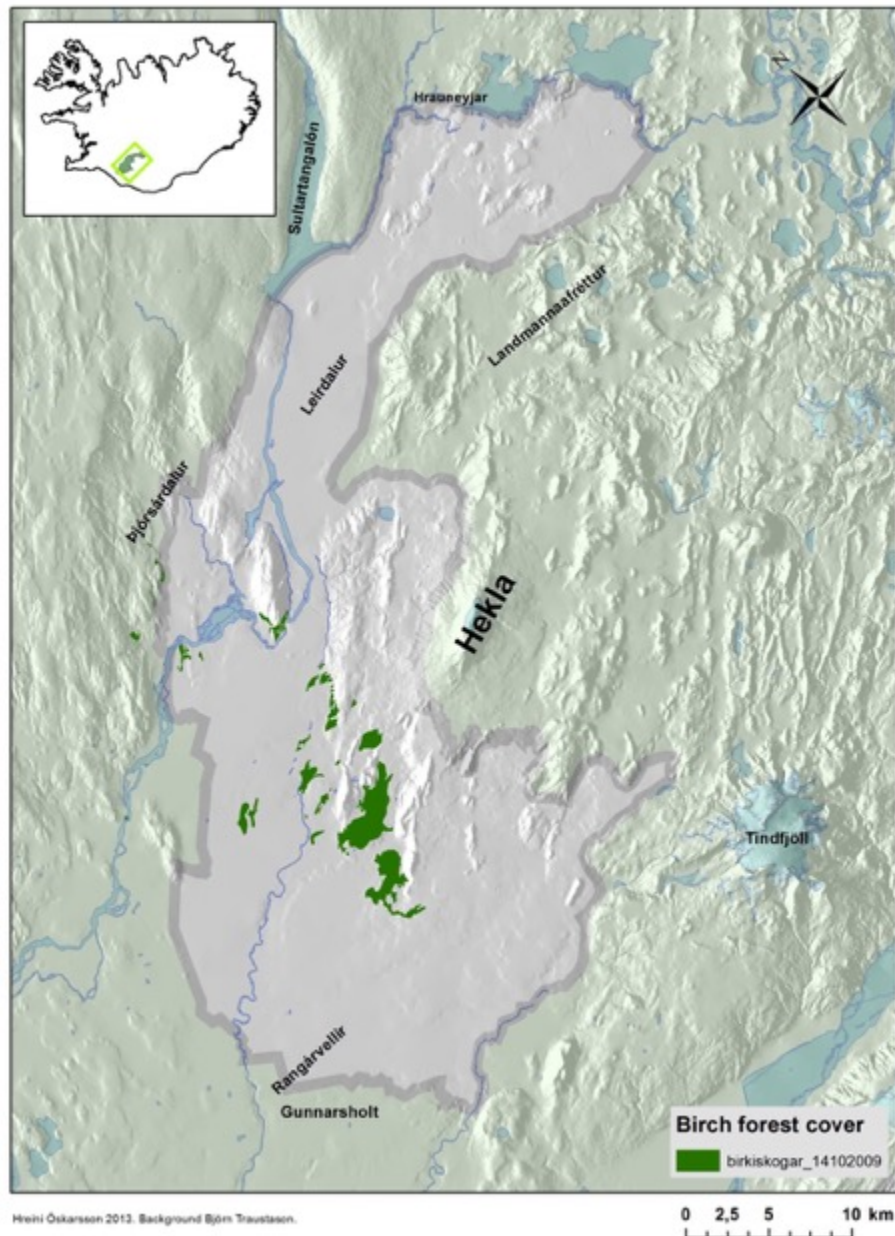


Figure 32. The location of Hekla Forest Project area in Iceland and locations of existing birch forest (Reproduced with permission. Image credit: Hreinn Óskarsson)

Planting trees as part of the Hekluskógar project is a means of restoring the extensive forested landscape that until relatively recently characterised this area. It is also an approach to living with on-going geophysical volatility presented by volcanic eruptions and the frequent problems of volcanic ash fall and volcanic ash erosion. The website for the Hekluskógar project states its objectives are:

to restore native birch (*Betula pubescens*) woodlands in the vicinity of the active volcano Mt. Hekla. The primary goals are to increase the resilience of the ecosystem to deposits of volcanic ash during eruptions of the volcano and prevent secondary distribution of the ash by wind and water.²⁴

What is striking about the Hekluskógar project is that resilience here is not about subjects enduring volcanic activity and their capacities to ‘bounce back’ (cf. Donovan, 2017; UNISDR, 2015a). Nor is the focus of the project about simply responding to the physical materialities and manifestations of volcanic eruptions through means of evacuation, such as the method of governance that underpins no-fly zones (Adey & Anderson, 2011; Benediktsson, Lund, & Huijbens, 2011; Budd et al., 2011). Instead, what we see here in the Hekluskógar project is an alternative understanding of resilience where communities are not passive, paralysed by anxiety, or simply awaiting their fate but actively involved in efforts to resist their vulnerabilities through the cultivation of relations between humans and more-than-human entities.

In the previous chapters, I explored how communities manage the emotional and psychological consequences of living in geologically volatile environments, I now wish to illustrate new possibilities for communities to respond to the physical materiality of geophysical hazards. The concept of resilience has been criticised because it ‘preaches the uncontrollable nature of the world [and] the powerlessness of the human subject’ (Reid, 2017: 255). In other words, communities appear passive in the face of the challenges they face rather than having the capacity to resist the inevitability of disasters. Grove & Chandler argue that resilience ‘never starts a process with goals or aims at transformation

²⁴ <https://hekluskogar.is/the-mt-hekla-afforestation-project/> [Accessed: 23/6/2019]

and instead is reactive and responsive rather than an initiation of beginnings, of creativity’ (2017: 55). In place of education programmes that might teach communities about their vulnerability or insurance schemes that encourage people to brace for the worst, in the Hekluskógar project I suggest we see glimpses of how resilience contains within it opportunities to radically change the conditions through which geophysical vulnerability becomes manifest.

This chapter contributes to recent moves in geography that argue that the concept of resilience can be turned to new ends that enhance the political capacities for communities to challenge their everyday struggles (e.g. Wakefield, 2018; Nelson, 2014a, 2014b; Wakefield & Braun, 2014; Grove, 2013). This is to act against the neoliberal impulses of resilience thinking that advocate for subjects to be more self-aware of their vulnerabilities towards creatively and imaginatively trying new approaches to living with hazards. The power to make change and make a difference is put in the hands of local communities rather than simply accepting the bleakness and inevitability of environmental destruction in which safety becomes ‘a matter of exclusivity’ (Evans & Reid, 2013: 96).

I draw on the Hekluskógar project to draw out the positive potential of the project to suggest how it leads us to new ways of thinking about living with geophysical risks. I begin this chapter by exploring the ideas behind the Hekluskógar project in more detail. In the following section, I explore how the Hekluskógar project can help us to rethink the idea of resilience away from responding to events and towards an ontology of interconnection and non-linearity in which ‘small actions can make a big difference’, as one participant described. Resilience here becomes about interconnection, relations and more-than-human partnerships. In the third section, I argue these actions are made possible

by substituting atmospherics of anxiety for alternative affective relations that accommodate the ability to care for plants and trees and their non-human temporalities. In the fourth section, I explore how the Hekluskógar project opens up hazard management to not only new actors and knowledges, but resets expectations of what hazard management is and has the potential to achieve. Here I mobilise the concept of ‘wild experimentation’ (Lorimer & Driessen, 2014) to highlight how the Hekluskógar project draws attention to new modes of governing hazards that bring to the fore the role of human and ‘plant agencies’ (see Head, 2017; Head, Atchison, & Phillips, 2015; Head & Atchison, 2009) in mitigating geological hazards.

2. Establishing interconnectedness

Ash fall and ash erosion cause ash to be forced into people’s houses. It blasts house exteriors and causes breathing problems. For a century, it made the area around the Hekla volcano uninhabitable and the countless abandoned farms in this area are testament to the destruction it causes. However, the presence of volcanic ash is not a spectacular occurrence. It is worse in high winds and may continue to occur long after a volcanic eruption has ended. In her ethnographic study on Montserrat, Victoria Sword-Daniels describes in detail the impact of volcanic ash by quoting a state official: “it gets into every part of the house, every fabric you can imagine, into your beds, into cupboards, into your food source, it gets everywhere. People say things like: “we’re fine.” “We’re living with ash.” “We’ve been living with it for a couple of years.” “We’re okay.” “We’re alive.” “We’re still here.”” (2011: 132). As I outlined in chapter 4, volcanic ash may not kill people, but it makes life an everyday struggle. Indeed, ash shifts focus away from death to the everyday modes of survival that characterise life around Hekla and on Heimaey.

Using birch trees to mitigate the effects of a volcanic eruption appears to be an odd choice. Indeed, planting trees does not make volcanic eruptions any less likely to occur, nor does vegetation stand much chance against the effects of lava flows or superheated gases. Yet, in the small office of the Hekluskógar project images hung on the wall showing the significant progress made towards afforesting large areas of land around the Hekla volcano. I was there with Hreinn Óskarsson who has been the project manager of the Hekluskógar programme since 2007 and helped to secure funds of over £3 million (500 million Icelandic Kronur)²⁵ from the Icelandic parliament. As we talked, Hreinn showed me images of how birch trees work to mitigate the effects of ash fall using an example from the 2010 eruption of Eyjafjallajökull (Figure 33). He told me how the birch woodland survived the ash fall and “recovered” several weeks after the eruption ended. Similar ideas of birch woodland mitigating against the effects of ash fall abound in the brochures and books published on the Hekluskógar project.



Figure 33. Thorsmörk in S. Iceland after the eruption of Eyjafjallajökull in 2010 and birch woodland covered by ash demonstrating its ecological capacities to minimise the damage caused by ash fall. (Reproduced with permission: Hreinn Óskarsson)

²⁵ <https://hekluskogar.is/frettir-2007/> [Accessed: 29/12/2018]

The Hekluskógar afforestation programme forms part of a growing trend for managing natural hazards through eco-system based solutions for disaster risk reduction that have emerged since the late 1960s. Moos et al. describe how the emergence of ‘eco-DRR’ measures have been ‘motivated by the negative aspects of structural measures, such as high costs due to construction and maintenance, negative environmental and aesthetical impacts, and effects in inducing further exposure of people and property’ (2018: 497). Examples of conserving, restoring and managing ecosystems with the aim of disaster management are not exclusive to Europe and are in place worldwide to manage a diverse range of natural hazards such as: floods, extreme temperatures, landslides, avalanches, and meteorological events (Renaund, Sudmeier-Rieux, & Estrella, 2015; Sudmeier-Rieux et al., 2006).

The capacity for birch trees to buffer against volcanic ash is made possible because they are fast growing and produce a large number of seeds. At ten years old, they average a height of 7 metres and can grow up to 28 metres in height after 60 years (Nieuwenhuis, 2002). The trees also take up a relatively large amount of space in a relatively short growing time, thus sheltering the ground surface from erosion by reducing the wind velocity close to the ground as well as trapping windborne particles of ash (Hagen & Casada, 2013). As the trees grow taller and the amount of sparsely vegetated areas in the Hekla region decreases, the organisers of the Hekluskógar project hope that the ability to mitigate the effects of tephra fall will increase in proportion to the ‘overall health of the vegetation’ thereby ‘reducing the associated costs to society’ (Ágústs dóttir, 2015: 1669). Until the twentieth century however birch trees in Iceland were used for firewood and making charcoal (Caseldine et al., 2005). The treeless landscapes across Iceland today are

thought to be result of these actions in which the turning of birch trees into fuel for heating and iron smelting was compounded by the pressures of temperature fluctuations and the poor management of sheep grazing (Benediktsson, 2015). The birch trees around the Hekla volcano are therefore now finding surprising new uses in re-establishing feedbacks and processes between vegetation and geological processes.

Back on the Heklubyggd, I observed Hrefna as she inspected the trees planted by the local land owners (Figure 34). She had pre-selected the plots we would visit based on prior telephone conversations with particular land owners who were keen on receiving advice about their trees. Holding a clipboard that detailed the location of different plots, the names of the land owners and the number of tree saplings they had been given as well as a camera and a GPS, Hrefna began by inspecting plot R50 (see Figure 34). R50 is less than 1km² in area but the land owner had already constructed a small, timber-framed summer house that was rented out to tourists when we visited. The owner of R50 had planted several hundred birch tree saplings around the hut, but on inspection Hrefna was concerned that the metre-high trees had been planted too close together meaning some would inevitably die as the trees outcompeted each other. Hrefna exclaimed how horrible this was while outstretching her arms in disdain before making a note on a printed-proforma to inform the land owner of her findings.

Next, we drove the short distance to plot R6. Hrefna logged the location of the trees with her GPS. This would be later added to the GIS database that maps the forest's development back at the Forestry Service headquarters in the small town of Selfoss.

However, more pressing was a concern that the birch trees in plot R6 had not received enough fertiliser. On another plot, Hrefna mapped out how the owner had planted the trees in a maze-like pattern in part of his plot, but some trees had become diseased. Small brown

leaves had developed, and the trees were stunted. At the final plot we visited, Hrefna found trees that had not been planted sufficiently deep in the ash such that the whole tree sapling had been forced out of the ground by frost heave that winter.

Crucially this mode of attending to hazards dispenses with a concern for ultimate causation- it does not look to address or fix the source of the problem- but works at the level of effects. The logics underpinning Hrefna's work thus do not deny the inhuman power of volcanoes but looks to the material contingencies that shape how hazards 'become' and their immanent relations. David Chandler notes this is a mode of environmental management that 'does not seek to drill down to discover the ontology of assemblages and processes of emergence but to trace these links on the surface, in the sphere of the actual' (2018: 93). This logic is expressed in the way that even when up against the destructive power of Hekla, Hrefna attends to the health of individual birch trees, the brown speckles of diseased leaves and the density of tree planting. As Hrefna drove me around the Hekla forest area, she pointed out the progress that the project had made over the past ten years. She explained how over 215 landowners are now signed up to the Hekluskógar project and over 2.5 million seedlings had been planted, covering an area of 13 km² (Óskarsson & Petursdottir, 2015). Indeed, the building of 'resilient ecologies' has required the work of many thousands of individuals. This has ranged from local land owners and farmers to volunteers such as an annual planting event led by the BMW motorbike owners' club of Iceland and groups of youth volunteers who also help with planting.



Figure 34. Intervening in eco-geological processes on the foothills of Hekla

This focus on restoring ecological- geological processes in the Hekla Forest resonates with contemporary ideas in geography that identify how interventions in environmental governance are increasingly concerned with securing flows, movements and socio-ecological systems (e.g. J. Lorimer 2017). In the Hekluskógar project, an ontology of volcanic eruptions emerges that foregrounds how volcanic eruptions and their effects are not simply visited on populations but emerge through complex material contingencies between ecologies of vegetation, human communities and geophysical hazards. Similarly, Joronen & Häkli argue for a version of ‘ontological thinking not as a way of having the last word regarding the structure of reality, but questioning the ways in which reality happens...[to] bring forth two aspects crucial for rethinking the relation between the

political and the onto-logical’ (2017: 563). In other words, imagining a world of geo-ecological feedbacks and relations is itself an onto-political move that pushes against recent trends in geography to imagine geological agencies as ‘fundamentally disconnected from everything else’ (e.g. Bosworth, 2013: n.p.). By starting from a position of interconnectedness, feedbacks and non-linear relations, what emerges are not passive citizens reliant on enduring geological forces but empowered to make interventions into the ways that the effects of hazards materialise. However, it is not only the local people who come to be seen as influential over ash erosion, but also the agency of plants which in Iceland specifically have a history of being seen only for their commodity value, if having any value at all.

The concept of resilience forms a key part of the vocabulary used in the literatures, presentations and conversations around the Hekluskógar project. For example, the project literatures describe the aim of creating ‘a resilient ecosystem that will survive ash deposits from future eruptions in Hekla and other volcanos and reduce windblown ash in inhabited areas’. Conceiving geological hazards in this way creates a shift from ideas of evacuation planning at times of volcanic eruptions (Merchant, 2015) or devising geo-engineering strategies such as ditches or barriers (McPhee, 1991). Neither of these strategies address the on-going and pernicious problems of volcanic ash, nor do they actively enable communities themselves to make a difference to their vulnerability. Evans & Reid argue that it is a ‘tragedy’ that entrenched ideas of resilience ‘force us to become active participants in our own de-politicisation’ (2013: 156). In other words, they argue against the ‘closing down’ of possibilities that might actually allow communities to intervene in environmental problems rather than having to accept the inevitability of having one’s existence threatened in the name of being resilient. Such ideas do not seek to promote human agency as able to ‘control’ geophysical events, but on the contrary foreground how

more-than-human relations and interconnections make a difference to who and how the effects of hazards are attended to.

Resilience in the Hekluskógar project thus resonates with what Stephanie Wakefield calls a form of ‘back loop management’... ‘that seeks to create and define “safe operating spaces” able to absorb and manage, rather than eliminate, disturbance’ (2018: 88). This is a fundamental shift in enacting resilience from that characterised by responding to disaster and ‘bouncing back’ (e.g. UNISDR, 2015) to one that recognises that problems of volcanic hazards do not exist in a bi-stable state of on and off, but are part of on-going life and emerge as products of more-than-human relations. The resilience discussed here is not about precaution or pre-emption, but functions on the premise of making a difference in the present. It is about making life liveable in the now as much as anticipating an eventful future to come.

When I visited the Hekluskógar project in 2017, approximately two hundred land owners were participating in the project. One of whom is Benedikt Benediktsson who took pictures of herself planting trees from the same place over a period of eight years (Figure 35). However, the participants in this project are not only those living proximate to Hekla. The birch seeds themselves are collected annually by members of the public and deposited in designated bins that are dotted around Reykjavik. Hreinn showed me photos of children shaking the seeds from birch trees and donating them via the bins to the Project. These seeds are usually dispersed by hand and by machines in the autumn months and also cultivated in nurseries to grow the trees until they reach 15-20 cm tall. The seeds and the saplings are then collected by land owners around May each year from Galtalækur- an area

approximately 100km east of Reykjavik. For those participating in the project the motivation is to reduce the impacts of volcanic ash, but as my experience with Hrefna highlighted, planting can also be an enjoyable activity. It represents a chance for communities to have lunch together, enjoy the summer sunshine and cultivate the landscape around their house with novel arrangements of trees and flowers.



Figure 35. Benedikt Benediktsson, one of the landowners that joined Hekla forest at early stage, documented the growth of the forest from the same location between 2006 to 2014. Top left: 2006, Top right: 2011, Bottom left: 2014 Source: Benedikt Benediktsson and Hreinn Óskarsson. Bottom right: children collecting seeds for the Hekluskógar project. (Reproduced with permission Hreinn Óskarsson. Source: Hreinn Óskarsson and Benedikt Benediktsson²⁶)

What is clear however from the Hekluskógar project is that the governance of natural hazards traverses any neat state/ non-state binaries. For Bruce Braun, the hybrid relations between government agencies and local enactments of resilience define a ‘contemporary

²⁶ Original source: <https://hekluskogar.is/2015/01/28/ur-eydimork-i-skog-a-atta-arum/>

form of biopolitics...which government seeks not to punish, nor to prevent or discipline, but rather to modulate “natural processes” (Braun, 2014: 61). Rather than attempt to control individuals or populations directly, some commentators have noted that in different contexts around the world society and nature have come to be envisioned in terms of a single integrated system as a new form of government through environmental relations. Recent examples include: how species such as oysters (Wakefield & Braun, 2018), worms (J. Lorimer, 2017) and microbes (J. Lorimer, 2016) are being re-valued as ‘ecological engineers’ that ‘build resilience in the face of imminent but unavoidable disaster’ (J. Lorimer, 2017: 36). Braun (2014) argues this ‘must be understood as a particular *mode* of government, one that may be less of a departure from already existing modes than an extension of a particular apparatus in which *molding life* is replaced by *modulating natural processes* are now extended to include the non-human world itself’ (Braun, 2014: 60, emphasis original).

Yet, my interest is less about how government may exert a form of control or regulation over a population through socio-technical assemblages and more about how the project allows participation in hazard management to be broadened beyond human actors. Rather than resilient subjects who ‘incorporate catastrophe, to accept and restructure one’s life around the imperative to prepare for cataclysmic violence’ (Grove, 2014: 245), the Hekluskógar illustrates an alternative approach where participation is directed towards challenging the inevitability of vulnerability. For Chandler & Pugh such alternative enactments of resilience are made possible by ‘human “response-abilities”, sensitivities and “attuning-to”, rather than enabling imaginaries of human control’ (2018: 2). In other words, participation of local community groups and plants and trees emerges through affective relations that dispense with the paralysing effects of anxiety and create new

space-times of care that allow for the cultivation of the more-than-human assemblages we see in the Hekluskógar project. These relations emerge from feelings of mutual and benefit between human and plants that emerge from feelings of interconnectedness (see also van Dooren, 2014b, 2017; Ginn, 2013)

3. Temporalities of care

Tree saplings propped up on the side of houses and the presence of trowels and gardening gloves on porches indicated that preventing ash erosion is a project that is continuously in process. Actions such as planting, tending and monitoring form part of the routines of living in proximate to Hekla. However, participation is not only a human affair, as in the previous two chapters. Instead, participation involves recognising the active role of non-human participants, the grasses, trees, lupin, birds etcetera that are interwoven in the Hekluskógar project and there are obligations to these non-human others that go beyond simple acceptance of their ecological functions.

For Puig de la Bellacasa, ‘inescapable troubles of interdependent existences’ necessitate forms of ‘care’ (Puig de la Bellacasa, 2012: 197). Care for de la Bellacasa is ‘a vital affective state, an ethical obligation and a practical labour’ (Puig de la Bellacasa, 2012). In this sense, to care for another is an everyday practical intervention that emerges from the recognition of living in a world in which we dispense with notions of the sovereign human subject. The interesting contribution that de la Bellacasa’s formulation of care makes is that it emphasises care as a set of practices, not exclusive to humans. In her example of caring for soils, de la Bellacasa describes the process of ‘learning to be affected’ by the temporalities of soil that disrupts notions of soil as simply an economic resource (Puig de la Bellacasa, 2015, 2017). Bellacasa argues: ‘thinking with care invites us to question

unilateral relations and exclusionary bifurcations of living, doings and agencies. It brings us to thinking from the perspective of a many-sided web of relations involved in the very possibility of ecosystem services rather than only of benefits to humans' (Puig de la Bellacasa, 2017: 188).

To address various environmental problems, not only living with volcanic hazards, involves bringing to the fore how humans can 'work with' non-human others through the recognition of our mutual interdependencies. Thinking back to the opening of this chapter and the examples of Hrefna attending to birch trees, we begin to see a glimpse of what this might look like in practice. For Hrefna and the many thousands of other land owners, farmers, tourists and volunteers who contribute to afforestation efforts in South Iceland, care in this context comes from an attention to the temporalities and fragilities of ecological in an environment in which it is easy to focus on the spectacular pulsations of geological upheaval. Putting one's energy, hopes and time into planting vegetation while living at the foothills of several of Iceland's most infamous volcanoes is not a given and is testament to the extent that residents are able to escape the debilitating effects of anxiety or fear that materialise into the present through imagining catastrophic futures (e.g. Massumi, 2015; Braun, 2007). In the previous chapter, I documented one way in which residents modulate the atmospheres of anxiety that permeate these environments through the practices of 're-storying' earthquake data. However, here we see how modulating anxiety is not as an end in itself but provides the starting point for new emancipatory interventions involved in contesting the givenness of physical vulnerability.

Grove argues that: 'resilience relies on anticipatory techniques that manipulate affective relations between people and things in order to create resilient subjects in need of

empowerment...disaster resilience thus reconfigures an immunity biopolitics on an intensive level: resilience attempts to restrict the possibilities for adaptation to those that maintain, rather than challenge, neoliberal political economic order' (2014: 252). For Grove, the affective relations that enhance communities' capacity to act in relation to their vulnerability are a prerequisite for enactments of resilience that are 'more than simply a process to avoid disturbance' (2014: 253). Indeed, for the Hekluskógar project to be successful it requires an investment in the slow, pensive project of reclaiming land and then nurturing trees through their life cycle from seed to maturity. This is a project that requires quite a different disposition to the panic of impending catastrophe or a concern about the inhuman force of volcanoes. The seeds for the birch trees are collected in Reykjavik by school children who collect the catkins, in which the seeds develop, from local trees and post them in various seed collection bins around the city. These are then collected by members of the Forestry Service in September of each year. The birch trees can take up to seventy years to fully mature and they take a significant amount of work to cultivate in this environment. This is a project that takes time.

For example, Hrefna drove us to a mid-sized plot with a large house that looked empty. After looking around the grounds we could not find any young saplings so Hrefna gave the owner a call. It turns out that he had been ill and in hospital so the trees he took from the project had died. Both he and Hrefna discussed how sad this was. They also discussed how he had not been having too much success with the tree planning project. He had planted the area in front of his home three times and each time the trees had died. These were poplar and *Sorbus* trees at first before birch (which mostly survived). He was now considering pulling out of the project because of the amount of work he had put into tree planting and his lack of success, but Hrefna reassured him that she could give him some

tips. She explained privately that there really is not much hope of living in the Heklubyggd if the trees are unsuccessful. Not only does this illustrate the emotional investment that people living in these places put into afforestation, but it also shows the extent that it is labour intensive, uncertain and strenuous work to maintain these ecologies. It takes patience in an environment when time is understood as a scarce commodity.

While it could also be argued that measures such as Hekluskógar are anthropocentric in that they are about trying to shape environments in ways that favours human life, what we see here is not a project that residents believe will stop an eruption or that will protect them against all types of geological effects. Instead, this is an attempt to put to one side a pre-occupation with those geological forces that might instil fear in favour of deliberate attempts to become invested in alternative temporalities of non-human ecologies. Perhaps, in some ways this maintains an anthropocentrism in the sense that this project is still about human survival, but we also see examples of what Donna Haraway calls the ‘Chthulucene’ in which species have a stake in one another and work together towards mutual flourishing (Haraway, 2016). Haraway (2016) suggests, ‘unlike the dominant dramas of Anthropocene and Capitalocene discourse, human beings are not the only important actors in the Chthulucene’ (p. 55) and that ‘ongoing practices of living in the ruins’ (p. 37) require acts of making and composing worlds with more-than-human others.

4. Experiments beyond hazard mitigation

Recently geographers have challenged how we navigate material agencies in ways that go beyond techno-managerial logics of control. In the context of rewilding projects in Europe, Lorimer & Driessen describe ‘wild experiments’ as ‘open-ended, uncertain and political negotiations between people and wildlife ... in inhabited places and involve[ing] multiple

forms of expertise, not all of which are human' (2014: 169). A key premise of 'wild experimentation' is the idea that nature conservation can involve producing new and unexpected ecological configurations that remain open to novelty and surprise. I suggest we understand the Hekluskógar project in similar terms: as an 'experiment' in living with physically destructive forces of the earth. It is experimental in the sense that the project is a means of trying something radically new in the space-times when official hazard management practice has few solutions and against a backdrop in which communities have typically been understood to have little political agency. It is also experimental in its procedures and methods of operation. This is both in the sense that the project is about finding ways of living in the now rather than succumbing to the powerful logics of evaluating the present against hypothetical future scenarios and cultivating a more open idea of what the project should achieve and who can participate.

In the same way that Lorimer & Driessen (2014) describe new conservation efforts that are adaptive to emergent events rather than seeking to restore ecological natures to a pristine state, the goal of Hekluskógar is similarly more open-ended and involves uncertain negotiation between communities of local people, expert ecologists and the more-than-human agencies. In part this might be attributed to the fact that this is a project conducted in the vast expanse of South Iceland with complex variables of undulating topography and weather, geophysical volatility. As Lorimer & Driessen suggest: 'field sites are much more public and visible than laboratories and interventions will have real-world consequences. Gaining authority within them involves very different social practices, including negotiating with and sometimes learning from heterogeneous epistemic communities like farmers, hunters and other amateur naturalists' (2014: 170). The vast majority of the landscapes of the Hekluskógar project are public land- there is no fee to enter or perimeter

fence. Despite illusions of the Hekluskógar area being a fixed and bounded area (Figure 32), these boundaries are less discrete in reality with residents within and outside of this area conducting their own methods of preventing ash fall and ash erosion.

Consequently, the project of re-afforestation is not conducted according to a single logic or method. There are general guidelines about how to plant trees, the processes of fertilising land and advice as to avoiding the problems of frost heave that can inhibit the growth of trees on the Hekluskógar websiteⁱ. However, in reality, the project is composed of a heterogeneous array of practices. For example, although Heimaey is not part of the official Hekluskógar project area residents there have their own version of re-planting efforts to reduce problems of volcanic ash. For example, the soils on Heimaey are particularly nutrient poor and trees such as birch struggle to become established in these soils. Since the 1973 eruption, the local council on Heimaey alongside volunteers from the town have been involved in planting grasses (*Leymus arenarius*) and nootka lupine (*Lupinus nootkatensis*) despite Heimaey not lying within the official Hekluskógar area (Figure 36).



Figure 36. A social media post organising a community planting session on Heimaey in July 2017
The headline reads: ‘join hands together’.

Nootka lupin grows to 60cm tall and each plant is characterised by vivid purple flowers (Figure 37). While lupin is viewed by some in Iceland as a weed, much of these areas of lupin have been deliberately planted with the aim of land reclamation, reducing the effects of ash erosion and nourishing the environmental conditions for birch trees. While birch trees are valued for their ability to directly intercept ash fall, lupins are valued for the large amount of nitrogen fixing bacteria that live in nodules on the roots of these plants. These fix the nitrogen in the atmosphere into compounds in the soil that are thought to improve soil conditions for further plant and tree growth (Moldenke, 1949). This interplay between

lupin, birch trees and volcanoes thus draws attention to the way lupin have become associated with the effective functioning of natural processes that buffer against geophysical hazards. Tsing describes these engagements by suggesting: ‘world-making projects overlap’ when the aims of human world-making align with the proclivities of other kinds of species (2015: 22).



Figure 37. Fields of lupin on Heimaey in 2017

Despite lupin’s reputation for rapidly colonising vast areas, it took a great deal of time and trial and error to understand the ecological conditions that would encourage lupin to grow. For example, it was found that the lupin should be planted in the summer months when long daylight hours and relatively high rainfall aided rapid germination while the cold of

winter killed the seedlings and enhanced ash erosion (Oskarsson, 1976). The plan for Heimaey in 1976 involved covering much of the island in a mix of grass seeds and fertiliser and planting dense rows of nootka lupin. The ‘invasiveness’ of lupin can therefore be understood as spatially and temporally contextual in the same way that Head, Atchison, & Phillips argue: ‘when acting as ‘invasives’, plants are understood to be not only mobile but aggressively so, marching across whole landscapes... their agency is clear but unwelcome, and resisted using practices of killing’ (2015: 410). Yet, such characteristics are specifically welcomed in areas afflicted by ash erosion in Iceland, in turn drawing attention to the specific materiality of lupin and the relations through which non-humans come to be seen as valued rather than as intrinsically ‘invasive’ (see Tsing, 2017b, 2017a; Lulka, 2009).

Large swathes of the landscape on Heimaey and around Hekla are now colonised by lupin. Its acceptance however is not without limitations. Indeed, for Jacques Derrida, in his development of the concept of ‘hospitality’, he argues that hospitality involves compromise and conditionality (Derrida & Dufourmantelle 2000). For lupin, this conditionality revolves around the work it and birch trees do. The use of lupin here brings into sharp relief how new alliances can be forged in place of human-ecological conflict through a close attention to context specific problems and the materiality of non-humans (see also Beisel & Boëte, 2013). However, it also raises questions about those non-humans who get excluded from such project because they do not act as disciplined co-workers. As Lorimer cautions, ‘there are many non-humans who cannot, or will not, work, and the contemporary is no place to be unemployed’ (J. Lorimer, 2018: n.p.). When we consider the Hekluskógar project and broader projects like soil stabilisation projects on Heimaey, it becomes clear that living with volcanic hazards mandates new forms of acceptance

towards species such as lupin. Puig de la Bellacasa suggests: ‘labours of care are often neglected because they are seen as less important- domestic, as petty, sentimental or personal-orientated tasks’ (2017: 162). Yet, glossing over these more embodied, relational negotiations that come with living and working with particular species negates the relations through which these experimental ecologies emerge.

While the Hekluskógar project, and similar projects elsewhere in South Iceland, inevitably create exclusions, such as corralling the sheep that once roamed freely over the Hekla region, the project is an example of where multiple forms of expertise, knowledges and ideas come together. There is no single plan for how the forest will develop- other than a general idea that planting trees and other types of vegetation are part of the solution. There is also no single strategy for how to plant trees nor is it mandated that birch trees must be planted. Indeed, lupins, grasses, willow trees and other types of vegetation have emerged as different planting strategies have developed across South Iceland over time. This idea of enabling a multiplicity of human and non-human collaboration is what Bruce Braun (2016) describes as a need to design experiments that ‘avoid closure’. He argues experiments are not about ‘normative judgments about what is ‘better’ or ‘worse’ when it comes to the new natures constructed...instead it takes us to a question and a method...how does one begin to design experiments in nature’s production that avoids closure- that is experiments that are dialogical, open to new actors, both human and non-human, and designed to generate surprises rather than confirm what is already known or expected’ (Braun, 2016: 111).

The advert in Figure 36 calling participants on Heimaey to help with replanting initiatives is one example of the open-ended nature of the replanting/ foresting initiatives. While there is a single aim to use vegetation to buffer against the problems of volcanic ash, what

has emerged is a fragmented mosaic of approaches and practices across the Hekla region and beyond. In this way, the project has not sought to create a single type of ecological climax vegetation, but rather experiment with differing ecological materialities of keystone species, local needs and different knowledges. Planting and afforestation activities are consequently not exclusive to local residents, those with special land access rights or particular kinds of ecological expertise. Groups of youth volunteers visit the area over summer to plant trees, just as members of BMW motorcycle owners' club organise impromptu visits to sow seeds. The three-member team of the Forestry Service that oversee the Hekluskógar project do not seek to police what can and cannot be done or who can participate but help to assist communities by providing advice and recording any activity that has taken place. There are no fines for incorrect planting, but within the official area of the Hekla forest employees such as Hrefna seek to keep a check on what has been done and are available in the summer months to land owners with the planting.

Another characteristic of the Hekluskógar project is that its focus is on the present rather than on evaluating its ability to prevent a future mega eruption of Hekla. The co-ordinator for the project discussed how the trees and plants to address the problem of ash erosion, improve groundwater, encourage the return of birds and wildlife to the Hekla region and how the forest may mitigate against climate change through carbon sequestration. The majority of these concerns were not inherent in the original conception of the Hekluskógar but rather emerged over time as unexpected consequences of the project. What is interesting about the project is that it challenges the future-orientated and goal-oriented approach to living with hazards that is so prevalent in discourses around hazard management. For example, approaches such as geo-engineering strategies seek to prevent possible futures by making targeted interventions in the present. The downside of this is

that these future-oriented approaches can also close down opportunities for radically alternative strategies to emerge (Braun, 2015a, 2015b).

Unexpected consequences of the project are indicative of its open-ended approach to mitigating hazards. There are however also negative risks associated with such an experimental approach. For example, much of the area around Hekla is still sparsely populated. There are growing numbers of summer houses and farms testament to the successes of the Hekluskógar project, but residents do not solely rely on this project to protect them from every type of geological hazard that Hekla might produce. There remains an understanding amongst people that live around Hekla and on Heimaey that if a volcanic eruption did occur, there is still a role for evacuation and civil protection authorities. These communities still think about escape routes and plans, yet there is a focus on living well in the present rather than allowing the anxieties of future catastrophe dictate life as it is lived in the present. There are other drawbacks to the open-ended nature of the Hekluskógar project. Problems such as frost heave in the winter inhibits the growth of trees, the fact that the growth of birch trees is limited to approximately 600 metres above sea level and the problem of nutrient-poor soils can mean trees die before becoming established.

Publics in this case are not so much ‘convened’ by disruptive environmental problems (e.g. Chilvers & Matthews, 2015; Lane et al., 2011), but implicated by virtue of on-going intertwinements with hazards in the everyday banalities of life. Yet, the Hekluskógar project does more than simply bring these ‘affected publics’ (Barry, 2013) together with scientists, ecologists and non-humans to discuss a singular best way forward. Instead, by design it makes possible the participation of communities, experts and a multiplicity of

non-human actors. The focus here is not on a singular solution that spans this vast area but to provide the mechanisms for different experimental ecologies to emerge. Similarly, there is not the expectation that these interventions will prevent the effects of a future volcanic eruption. Instead, emphasis is placed on what these ecologies can achieve in the present through preventing ash erosion, improving local biodiversity and improving water quality and embracing the possibility that new surprising results can emerge.

As Stephanie Wakefield argues: ‘instead of accepting the end of human agency except that of managing crisis- and rather than imagining ourselves as victims or managers...another possibility exists: deciding for ourselves locally, and in diverse ways’ (Wakefield, 2018a: 87). As Wakefield also makes clear, environmental management in a world in excess of human control need not be solely about struggles against an antagonistic nature. Instead, these ways of living with the earth may involve new forms of pleasure, creativity and enjoyment in which novelty can emerge. Elizabeth Grosz makes clear in her re-reading of Darwin that life is about more than mere survival but how life organises the ‘forces of the earth’ into new forms that involve ‘becoming expressive’, creating new textures, colours and affects (2008: 2). The same ideas might be seen in modest ways through the interventions of the Hekluskógar project in the sense that living with a volatile, unpredictable earth is not solely about living in desperation in which managing hazards is about survival’ or ‘just getting by’.

While the problems of ash erosion and ash fall make life a struggle, the processes of community planting open up new ways of being together with others- human and non-human- and bring new colours to an otherwise grey landscape. In other words, in the process of living with hazards more can be achieved than simply mitigating environmental

problems and mere survival. This is not only about new community bonds that might forge out of adversity in the aftermath of catastrophe, but the possibilities of living well with more-than-human others in the processes of living with volatile agencies.

5. Conclusions

In this chapter, I used a case study of the Hekluskógar afforestation project to describe how living with volcanic hazards does not mean communities must accept and endure these events in the name of being resilient citizens. Instead, I spotlighted how new ways of challenging these vulnerabilities can be cultivated through the positive potentialities of resilience that in this case shifted thinking away from the individual towards broader ecological-geological interrelations.

I showed how the Hekluskógar project points us towards the importance of more-than-human alliances for flourishing in geologically active places and how such relations involve forms of intimate, practical labours of cultivation and trial and error. It is these relations that illuminate how human communities might cultivate less anthropocentric relations which do not necessarily involve thinking of humans as insignificant or that the world would be better without us but aligning human aims with those of lively non-human others and that put aside human preoccupations with the spectacular and inhuman forces of the earth. This is a project that might involve ‘experimental’ relations with non-human others, these might breakdown and fail, but the point is that they may also generate novel and surprising outcomes.

I mobilised the concept of ‘wild experiments’ to take us beyond ideas of hazard management as something that must be fought over by different interests and ‘opened up’

to public participation. What we see here is the importance of recognising the complex ways communities are already entangled in practices of living with hazards that require their own validation and acknowledgment. These practices are not characterised by controversy, but involve diverse knowledges, ideas and more-than-human agencies that come together to produce a patchwork of different ways of managing hazards and a multiplicity of human-ecological relations. I highlighted how the concept of ‘wild experiment’ sheds light on the processes through which hazard management is composed, its methods and its ability to engender participation from diverse actors.

Another feature of ‘wild experiments’ is that these experiments are not only about ‘getting by’, ‘survival’ or ‘striving against the odds’. Instead, the Hekluskógar project offers glimpses of alternative modes of inhabiting these unstable environments that go beyond these narrow remits. This is not to impugn the potentially inhuman and destructive possibilities of the earth, but amidst environmental change it is a way of ‘discovering creative forms of pleasure in and with the earth’ (Wakefield, 2018a: 88). Here I use the Hekluskógar project to draw attention to a means of living with geophysical hazards that involves making room for new ways of knowing, new more-than-human partnerships and surprising outcomes that are not only about hazard management but about creating new possibilities for human and more-than-human communities that demand more from hazard management than the bare essentials of survival.

Chapter 8: Conclusions and reflections

1. Introduction

In this concluding chapter I will summarise my findings and reflect on them in light of my initial research questions stated in the introductory chapter. I will also draw out the broader contributions this thesis makes for human geography and outline the contributions this work makes to contemporary policy discussions around disaster risk reduction and hazard management. I end by suggesting some directions for future research.

2. Summary

In this thesis, my objective has been to reclaim the concept of geopolitics and repurpose it for studying natural hazards. In chapter 2, I put forward a series of propositions for the concept of geopolitics that seek to move away from a focus on the spectacular, inhuman manifestations of earthly power. Firstly, I argued that existing ideas of hazards in human geography are characterised by a fascination with death and hold onto an idea of spectacular eventfulness more closely associated with nuclear bombing and war. However, such spectacular manifestations of earthly power do much to neglect the complex spatio-temporal and affective dimensions of earthly materiality. They also do much to leave unquestioned the politics underpinning contemporary forms of hazard management. Secondly, I argued that geopolitics must rethink governance in a way that moves beyond ideas of preparedness, precaution and pre-emption that tell us little about the modes of social organisation involved in negotiating the material effects of hazards in the present. Thirdly, I argued that a geopolitical approach to hazards needs to embrace the idea that participation in hazard management goes beyond engineering situations of public participation in hazard management and recognises those practices already taking place in

peoples' everyday lives. I argued that affect is also key to how the dynamics of the earth are experienced and in catalysing particular modes of response to hazards.

Research question 1: What are the limitations of current hazard management approaches in South Iceland?

In chapters 4 - 7, I illuminated the utility of the geopolitical approach I set out in this thesis by applying these new ideas in the context of geophysical hazards in South Iceland. In chapter 4, I showed how the effects of natural disasters can reverberate in ways that fold space-times of the past into the present and move us beyond a focus on encounters with a rarefied set of volatile 'geological' materials and the immediate space-times when these encounters occur. I also drew attention to the role of low magnitude earthquakes and the considerable ways in which they disrupt everyday life in South Iceland. This is to recognise the complex spatiality of hazards as occurring beyond those which are immediately perceptible and in ways that fold spatialities of near and far together. In addition, I also drew attention to the effects of volcanic ash erosion and the problems it causes in South Iceland. Together, these three dimensions serve to map out a conceptual space of geological materialities that moves us beyond entrenched ideas of earthly catastrophe (Figure 38).

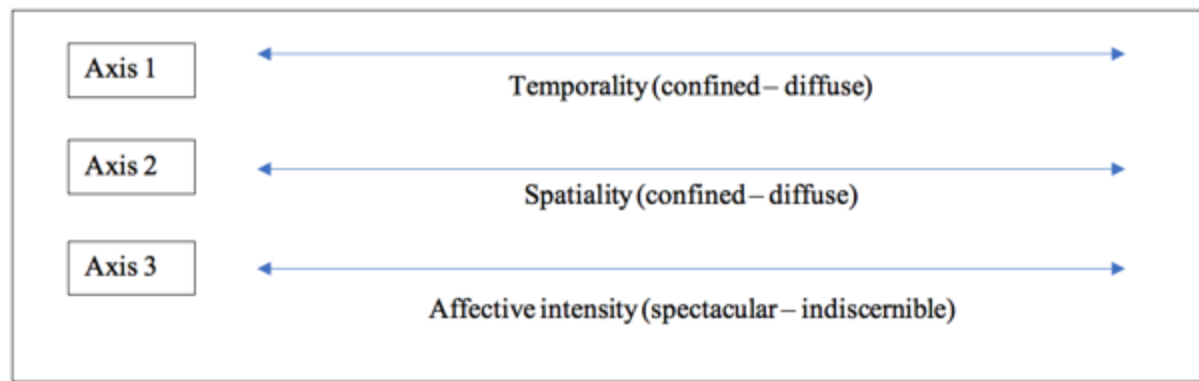


Figure 38. Conceptual space of geo-tectonic materialities

A focus on the complex spatio-temporal materialities of hazards offers geographers new tools for research that helps to draw attention to the everyday ways in which people are affected by hazardous environments. There are thus clear cross-overs with this thesis and work in anthropology that is turning its attention to the effects of ‘slow hazards’ such as pollution and the neglect of adequate state protections or concern (e.g. Liboiron, Tironi, & Calvillo, 2018; Lora-Wainright, 2017). The similarities between this thesis and emerging work on pollution emerge in part from a shared commitment to ethnographic fieldwork and a concern for the intimate scales in which people’s lives play out.

The complex spatio-temporalities of the earth do however offer important new tools for the study of natural hazards in a variety of contexts. For example, geographers might wish to investigate the less catastrophic dimensions of a range of other natural hazards such as flooding, drought or atmospheric hazards. It is easy to imagine how flooding events are more than simply the short moments when communities are submerged but might also involve concerns when water levels rise and fall yet do not result in flooding. Moreover, it is entirely possible that communities are turning to new kinds of technology that monitor floods and river levels to become aware of environmental hazards through online representations (e.g. <https://www.gaugemap.co.uk> that monitors river levels in real-time

across the UK). These aspects of natural hazards are not currently attended to by hazards and disaster scholarship in human geography and represent important new avenues for understanding the ways that hazards are experienced.

This focus on the spatio-temporal complexities of hazards also means that human geography might pay more attention to places such as the UK which have typically received little attention from scholars working on geophysical hazards. Future scholarship might well explore the ways that low magnitude earthquakes from fracking come to effect communities. In the United States, for example, there is a growing literature on earthquakes from fracking (e.g. Tootill, 2016; Klose, 2014). While these have tended to focus on the relatively large magnitude earthquakes generated from fracking, it is likely that the much smaller magnitude earthquakes permitted by current fracking regulations in the UK also have considerable effects on people's lives. While these earthquakes might not risk people dying or people's houses being flattened through vibrational forces, there is a pressing need to investigate the more subtle ways in which these events come to create new anxieties and physical/ emotional effects for communities in these areas. As such, this work brings new provocations for current work concerned with fracking and natural resource geographies (e.g. Kama, 2016, 2019).

In addition to spotlighting the less catastrophic dimensions of geo-tectonic materialities, I used these observations to bring into relief the partialities of official state programmes of hazard management in Iceland. While hazard management has tended to be critiqued for the fact it tends to be a technocratic exercise that excludes publics (Whatmore, 2013), my focus has been to show how hazard management is also political in the sense that follows a model of responding to catastrophe characterised by discrete space-times of concern. By

tracing the historical emergence of official hazard management in Iceland, I argued that this is informed by the origins of civil protection in the need to prepare for wartime bombing and nuclear attack. It could be argued that government programmes of hazard management should be less orientated towards emergency and more towards the different dimensions of hazard materialities that I sketch out in Figure 38. However, I held back from making such broad claims in this thesis given my focus is principally to provide new analytical tools that allow us to question contemporary practices and bring their politics into relief (after Foucault, 1990).

The politics of hazard management I outlined in chapter 4 may help to explore the limitations and partialities of hazard management in different parts of the world. Whilst it was beyond the scope of this thesis to investigate the extent to which state governance could reformulate itself to address these particularities, or indeed if this would be desirable, this provides fertile ground for future research. This thesis therefore took a different approach to studies of hazard management that attempted to go beyond reconciling differences between state governance strategies and lay knowledges (e.g. Whatmore, 2013). Instead, it turned attention away from state actors and official practices of hazard management in the substantive chapters (chapter 5 - 7) to explore the different practices involved in living with hazards that escape official government concern.

Research question 2: What strategies do communities in South Iceland use to address these limitations?

To address my second research question and its concerns with the different everyday practices of managing hazards, in chapters 5 – 7 I identified different practices of living on

a volatile earth that involved holding an ‘intergenerational conversation’, re-presenting earthquake data online and planting vegetation to minimise the effects of volcanic ash erosion. These practices foreground some of the different spaces involved in managing hazards that range from a museum, to online/ virtual spaces, to the spaces of the outdoors. They also foreground how living with hazards draws together different publics with different kinds of expertise including artistic knowledges, scientific knowledges and ecological expertise. These kinds of expertise might be thought of as improvisations or experiments which have emerged in the process of ‘making-do’ in the face of environmental problems (Wakefield, 2018a). While this is a useful framework to think through the improvised way in which many of these practices have come to exist through trial and error, this framing of ‘experiment’ also needs to take into account the role of affect in bringing certain practices, expertise and publics together.

Affect in this thesis therefore goes beyond the narrow spectrum of affects such as of loss (Barnett et al., 2016; Head, 2016) and hope (Cloke & Conradson, 2018; Anderson, 2017) that have previously been described in ‘blasted landscapes’ (see Kirksey, Shapiro, & Brodine, 2013). Instead, I identified a broader array of affects that exist such as trauma, anxiety, and care that can easily be overlooked if we focus on the panicked moments of disaster. These affects are not only important in their own sake in that they foreground the rich emotional, affective experiences of being in hazardous environments, but they are also important in the sense that they emerge in and through particular practices of living with hazards. In other words, I argue that affect plays an important role in giving rise to and creating the conditions through which particular forms of everyday hazard management practices can emerge.

In chapter 5, I described how hope has given way to more sombre affective atmospheres in the Eldheimar volcano museum that make possible forms of collective storytelling within the community on Heimaey. In chapter 6, I described how the anxieties generated through online earthquake data have given rise to members of the local community who attempt to regulate the space-times of this anxiety. In chapter 7, I described how care emerges between humans and plants through their mutual interdependences. In many ways the affects I describe are more excessive than these descriptors. My objective is to foreground the more-than-representational dimensions of hazardous environments and the importance of affect in making possible the conditions where particular practices of hazard management can materialise. In future works, it might be possible to experiment with how these affective dimensions of hazardous environments might be communicated in methods beyond the rather conservative photographs and descriptions I used here. For example, this could involve documentary video and audio recordings.

There is therefore a need for geographical work to continue to describe the affective atmospheres in hazardous environments, the technologies and techniques through which these are evoked and the kinds of practices they make possible. In this way, affect is a vital dimension for comprehending the more-than-representational dimensions of life and through which people come to be affected by hazards. What is also interesting is that this observation gives rise to a geography of hazard management in which the practices of addressing the effects of hazards may take place in space-times quite remote from the space-times in which people experience hazards. For example, I documented how people are affected by volcanic ash in their homes but important ways of attending to the problem take place in gardens and on the slopes of the volcano, some tens of miles away. It might therefore be possible that geographers have overlooked the ways that people attend to the

effects of hazards by maintaining a narrow view of what practices constitute hazard management. This observation might open up opportunities for future work to further explore the cartographies of hazard management and the different spatio-temporalities of these practices.

In addition to illuminating a range of different practices involved in living with hazards and how these practices spotlight new modes of governing hazard events, this thesis also highlighted the role of museums, citizen science and local community groups for understanding human-earth relationships. I argued that museums are not simply sites for being educated about science, but these carefully curated places can also bring into being new practices and possibilities for living with hazards. In this way, museums have the potential to be generative places in which they become sites of creativity, novelty and provide possibilities for local communities to address environmental problems.

I also argued that citizen scientists are important mediators in the way that the earth and its volatility become known and experienced. In chapter 6, I showed how the data citizen scientists present is not only important for illuminating environmental problems but also generates affects and emotions that participate in the everyday lives of local communities. Here, I illuminated how the presentation of earthquake data is important for regulating atmospheres of anxiety. I also illuminated how citizen scientists are key players in regulating these affects such that they help to calibrate between the priorities of state officials concerned with constant alertness and preparedness and local priorities that emphasise the need to carefully regulate the spatio-temporality of these affects.

I highlighted the role of local community groups in attending to the problems of ash erosion. This served to draw attention to the different human and more-than-human actors through which managing environmental problems takes places. They also served to blur lines between the state and community practices of hazard management. While in this thesis I made a distinction between official practices of hazard management and everyday forms of community participation in living with hazards, chapter 7 showed that these binaries are indeed somewhat simplistic. As geographers have documented in the past, the state does not only operate through official government institutions (e.g. Braun, 2014) and there is a crossover of individuals who participate in state programmes and more vernacular hazard management practices. State funding also makes its way into some organised programmes of everyday hazard management approaches such as planting trees, although on a much lower level than civil protection and emergency management programmes. This provides scope for a great deal of further work that explores the way that the state participates in more vernacular forms of hazard management through funding, personnel and through more diffuse forms of power and biopolitical regimes. It might be the case that in some contexts, forms of everyday hazard management are actively suppressed through the affective disciplinary power of state apparatus and this would provide much needed avenues for further exploration.

Research question 3: What do these strategies reveal about the different underlying logics of governing hazards?

Alongside the different practices for managing hazards, the role of affect in bringing these practices about and the different knowledges that are involved, my third research question explored how living with hazards spotlights new forms of governance that go beyond

human - earth antagonisms. In particular, each of the three practices that I focused on does not work through logics that look to seal off humans from geological forces, either through building barriers or evacuation. Nor is the earth conceptualised as an antagonistic force that must be pushed back or geoengineered in a battle of human versus geological power.

In chapter 7, I highlighted how these practices operate through modes of governance that respond to the effects of hazards rather than trying to tinker with underlying geological processes. These practices of governance work through developing on-going mechanisms that help to regulate the effects of hazards rather than to prevent them completely. This involves developing new modes of responsiveness whereby the physical, emotional and psychological effects of hazards are attended to. In chapter 7, I also outlined the role of non-humans in the processes of responding to ash erosion and how these entities help to respond to the effects of geological processes. These relationships are premised on the idea of non-linearity- the idea that small interventions can make big differences to geological effects. It also illuminates new ways in which non-humans come to be valued and governed according to their capacity to work with and for human uses.

Governing at the level of effects and through non-linear processes also takes us beyond military imaginaries of conflict. However, it does retain a sense of hazards as a force whose effects should be buffered and attended to. By contrast, David Chandler (2018) has recently argued that there may be modes of governing human-environmental relations that see environmental change as a dynamic force, spurring forms of creativity and change. In each of the case studies here geophysical hazards remain as various kinds of problem. There therefore remains much work to be done to explore situations in which hazards are seen in a more positive light. This work might look to emerging ideas around the

geothermal, the affects the geothermal participates in and the kinds of practices this enables (Shepherd, 2019).

3. Contributions

Geographical scholarship on natural hazards/ disaster studies

Natural hazards have been a staple of geographical scholarship since the mid-nineteenth century (see White, 1945). Key milestones in the study of hazards have involved exploring how underlying social vulnerabilities, discrimination and corrupt political institutions contribute to the effects of hazards (e.g. Pelling, 2001). More recently, scholarship has focused attention back on the destructive materiality of earth forces (e.g. Clark, 2010). However, this thesis has highlighted how this understanding of hazards is a distinct product of the twentieth century in which war-time concerns and hazards research became fungible. In this thesis, I have highlighted the need to be more reflective of this intermeshing such that hazard geographers might begin to move away from the concepts and imaginaries of war to study natural hazards.

Hazard geographers might thus take a different methodological approach to scholarship. What is needed therefore is not more scholarship on hazards, but more scholarship that recognises the embodied nature of the researcher and that is reflective about the silences created through hazard research that mean the particular concerns of affected communities are overlooked. There are thus a great number of new openings for hazard researchers to engage with the anthropological tools of ethnography, and new styles of writing and presentation that are able to better capture the fidelity of human-environment relations in hazardous environments. This is not simply a task of describing the people that live with

disaster, which has been written about extensively already (e.g. Orner & Lyon, 2017; Oliver-Smith & Hoffman, 1999), but about bringing distinctly geographical concerns to bear on these topics to help unpack the political dimensions that underpin different ways of living with hazards and to use the multi-disciplinary tools available to geographers.

This thesis has also opened up new space-times of concern for hazard geographers. Rather than the moments before and after disaster that have typically been investigated, geographers might also spend time investigating what goes on in the places and periods where on the surface nothing appears to be happening. Indeed, I have argued that places such as Heimaey, which were largely written off by hazard geographers fairly soon after the 1973 eruption in favour of places characterised by large scale eruptions, warrant further geographical attention. Hazard geographers might thus focus more on places around the world where large-scale hazard events have long since ended or people continue to live in places of geophysical volatility that never rises to the level of a large-scale volcanic eruption or event.

This also means moving beyond approaches that view those in hazardous environments through terms such as ‘vulnerability’ and ‘risk’. This has the potential to make communities the product of these categories in ways that perform marginalisation rather than offering avenues of emancipation (cf. Beck, 1992, 2006). While geographers and anthropologists have documented the impacts of geophysical hazard events on different communities around the world (e.g. Bobbette & Donovan, 2019; Orner & Lyon, 2017; Hill, 2014; Clark, 2007; Greenhough, Jazeel, & Massey, 2005; Skelton, 2005), we know little about the lives of those who live with hazards beyond the narrow space-times other than during which upheaval occurs.

I have documented how hazard researchers might think through a reformulated approach to geopolitics. However, intertwined with these ideas is also an (geo)ethical concern that works at the methodological level to rethink approaches and concepts suitable for studying hazards. While much of the way I discuss ethics in this thesis is shown through my methodological ethos and the way in which this thesis emerged from the situated realities of communities in Iceland rather than beginning from prefabricated concepts, this approach is also pertinent for hazards research more broadly. In other words, if the aim of hazards research is to address practical problems of suffering and inequality, what is urgently needed is to rethink ethics away from one-size-fits-all scholarship for every vulnerable group or community of concern. The key is to devise better methods to think through particular interventions, their violence and emancipatory potentialities. Hence, hazards geography may move away from more conservative forms of intervention that relate to documenting injustices to more activist approaches where the researcher is involved on the ground in addressing the effects of hazards on communities.

In this thesis, I suggest that if hazard geographers wish to address issues of vulnerability, inequality and suffering the best way to do this may not be approaches underpinned by structuralist concerns with causal factors. Instead, geographers need new tools and approaches that retain the same objectives and concerns but re-evaluate the theoretical-methodological processes through which this is achieved. For example, future work in hazards research may explore the forms of everyday participation in living with hazards, as I have done here, or it may seek to instigate different kinds of practical intervention in and with ‘affected publics’ (Barry, 2013). This may involve facilitating group activities, helping communities remember old possessions, bringing members of the community

together and helping with clean-up efforts. This is to orientate hazards research towards a contextual ethical approach that does not pre-figure what an ethics of hazards research looks like in advance but looks to become sensitised to specific situations and allows the aims and objectives of research to emerge from these.

Whilst there has been a tendency for hazard geographers to develop interdisciplinary links with natural scientist, volcanologists and physical geographers in recent years (e.g. Bobbette & Donovan, 2019), this thesis foregrounds the possibilities of hazard geographers to explore more diverse disciplinary pairings. For example, there are exciting possibilities for exploring the role of art and performance in living with hazards such that art therefore becomes more than a medium that helps to communicate science to publics (Gabrys & Yusoff, 2012). There are thus exciting opportunities to explore all manner of different practices that have been documented in geographical scholarship that range from: knitting (Hawkins et al., 2015) to painting (Ingram, Forsyth, & Gauld, 2016) to community cooking (Roe & Buser, 2016). Such practices should not remain distinct from the interests of hazard geographers and instead it is paramount that hazard geography experiments with these ideas in order to explore the ways that research might enable communities to live with hazards, prompt new ways of thinking about hazard effects and help to attune those who do not live in hazardous areas to the everyday realities of these environments.

Disaster Risk Reduction policy

Alongside the implications of these findings for hazards scholarship in geography, there are also practical implications for disaster risk reduction policy. Geographers recently have begun to make overt attempts at describing how disaster risk reduction policy- as formulated by the United Nations in documents such as the Sendi Framework (2015-2030) (UNISDR, 2015b, 2015a)- warrants greater geographical analysis. For example,

Donovan (2017) argues that the ‘framework for DRR 2015–30 provides an important opportunity for geographers to interrogate the interface between science and policy in disasters, alongside human geographical approaches to vulnerability and transformation (p. 44).

One implication of this research is to challenge the deeply entrenched view that natural hazards should be managed according to the ‘hazard management cycle’ (see chapter 4). While such approaches may well work in contexts of large magnitude, sudden disaster events, they do little to help address the various ways in which natural hazards become manifest outside of this model of spectacular eventfulness. The hazard management cycle envisions a singular event which emergency teams then respond to by rescuing casualties and evacuation. The second stage of intervention, typically beginning several months after an event, is the rebuilding effort. The third stage of intervention is structured around preparedness in which citizens become educated about the possibilities of recurrent events in the future and try to take anticipatory actions in the present.

As I showed in chapter 4, the hazard management cycle is the model the Icelandic Civil Protection use to plan their own disaster reduction processes. Yet, this model does virtually nothing to address the effects of hazards that do not conform to very specific dimensions of eventfulness. This is problematic given the targets of the United Nations in their latest disaster risk reduction framework are to: ‘substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015’ (UNISDR, 2017: 17). The UN also define being affected by hazards in a relatively broad sense, congruent with the approach in this thesis, to involve those people who are:

Directly affected: People who have suffered injury, illness or other health effects; who were evacuated, displaced, relocated; or have suffered direct damage to their livelihoods, economic, physical, social, cultural and environmental assets;

‘Indirectly affected: People who have suffered consequences, other than or in addition to direct effects, over time due to disruption or changes in economy, critical infrastructures, basic services, commerce, work or social, health and physiological consequences (UNISDR, 2017: 17).

If disaster risk reduction begins from the effects of hazards as they materialise in particular individuals and communities, a very different way of attending to hazard emerges. The hazard management cycle, underpinned by notions of the cyclical return of major disaster events, may well still have use for preparing for these particular events, but approaches couched in apprehending the on-going effects of hazardous environments also become important. This may require hazard management to become increasingly a practical, hands-on that is involved the processes of attuning to and revealing the ways that communities are affected by hazards. As I have illustrated here, the effects of hazards are not phenomena that simply appear, indeed many people may consider their suffering a normal part of living with hazards and it requires new, patient forms of noticing to grasp at the complex ways the effects of hazards materialise in and on bodies.

Furthermore, it is also clear that actions such as ‘preparedness, pre-emption and precaution’ practices that are fundamental to the operation of contemporary disaster risk reduction, fail to recognise the on-going, less spectacular dimensions of living in hazardous environments. These concepts have long been discussed and critiqued in studies of natural hazard policies (e.g. Altiok, 2013), however this research has also illuminated the need for disaster risk reduction policies to validate and spotlight the great variety of practices that communities employ as part of living with the everyday realities of being

intertwined with the volatility of hazardous environments. It also opens up fruitful new deliberations about the different ways that international, national and local official hazard management programmes might recognise and support these diverse range of practices. This may come in unconventional forms such as various kinds of support for museums, citizen scientists and local community groups, to draw on the examples I explored in this thesis.

Recommendations for DRR in Iceland

1. Begin hazard management practice from the situated context-specific needs of communities inhabiting volatile environments.
2. Broaden the practices and actors considered to be important for reducing the effects of hazards beyond emergency response and rebuilding efforts.
3. Acts of preparedness, preparation and pre-emption might be effective for addressing future hazard risk, but attention needs to be paid to the ways communities are already negotiating the effects of hazards in the present.
4. Addressing the effects of all manner of hazards from floods to drought requires attention to the affective dimensions of hazards as well as their direct material impacts.
5. Governing hazards should not be seen in terms of zero-sum games in which hazards must be geoengineered. Instead, governing hazards might be carried out at the level of their effects. This means thinking through the effects of hazards in terms of relations and non-linear dynamics between humans and broader ecologies of non-humans through which interventions might take place.
6. Hazard management might take place in a variety of settings, instigated by ‘non-expert’ actors. It is important to think through the different ways in which hazard

management might support these practices in ways which may exceed financial support.

4. Reflections and future directions

This thesis is the product of many thousands of hours of conversations with residents in South Iceland and the repeated visits I made there over several years. I have endeavoured to reflect the realities of those I met and think through the kind of hazards scholarship that reflects struggles in their lives as well as showing the value of human geography scholarship in attending to these. This has required rethinking key theoretical and methodological approaches associated with hazard scholarship by drawing on ideas from across human geography and the social sciences. The work I present in this report has thus aimed to do justice first and foremost to the experiences of people I lived and worked with in South Iceland, however it also has broader implications for rethinking deeply entrenched ideas about the earth and geo-tectonic materialities, hazard management policy and practice, participation, marginality and social justice.

However, in many ways Iceland is an ideal laboratory for conducting geographical research (Greenhough, 2011). There are relatively low levels of inequality such that the welfare state is available for residents who feel their emotional/ physical struggles warrant medical attention. Residents in Iceland were also welcoming of this research. They were happy to communicate in English and were supportive of my research aims and intentions. The same can be said for government officials in Iceland with whom I discussed this research. The same however cannot not be said for many countries around the world in which access to the everyday realities of people living with hazards would be much harder. This remains a challenge for future work as well as the complexities of disentangling

situations in which people live with both the crippling effects of poverty as well as the more mundane, less spectacular effects of natural hazards that I discussed here.

There are also further challenges for future work that takes this research forward. This involves rethinking the skills of the geographer perhaps beyond an academic-activist and towards developing new skills that might make a difference to the communities we work with. This may be for example, learning how to develop more imaginative practices of writing and engaging with publics that require artistic, practical and embodied forms of researcher expertise (see also Hawkins & Straughan, 2015). To produce insights into the ways that communities live with hazards also generates obligations to participants that overspill the time confines of a narrow research project. It requires an investment of time and friendship as well as the responsibilities that this brings.

Overall, this research makes an original contribution to the geographical study of natural hazards by thinking through the materiality of the earth, hazard management in practice and the different logics behind governance and participation in living with the earth. These conversations are increasingly pertinent beyond the study of natural hazards and might also be relevant to discussions of how humans live with the effects of environmental problems more broadly in the Anthropocene. In a world where the social and natural are intertwined, and it becomes increasingly problematic to think humans can geoengineer our way out of environmental problems, there remains much we can learn from the study of natural hazards and the lives of those people that live with the on-going volatility of the earth.

Natural hazards encourage us not to think of the limitations of human agency relative to the earth and the things that humans can change and the aspects of reality that lay beyond human reach. Instead hazards can be thought of as foregrounding the idea that to be less anthropocentric means to focus less on human death and annihilation. Instead, it means thinking through different ways of living in and with hazards that might involve aspects that enhance particular ways of life or make particular ways of life a struggle. This means that acknowledging the agency of the geo and the forces of the earth does not mean focusing on the extremes of their inhuman possibilities. In fact, what is needed is greater attention to the modes of relation and response through which human and more-than-human collectives negotiate environmental change.

In a future that looks increasingly catastrophic, beset by climate change and tipping points in the earth system (see Latour, 2018; Lenton, 2011) , I suggest we might take examples from how communities live with hazards in Iceland as instructive of how to research these complex environmental problems. Rising seas, warmer global temperatures and melting glaciers are phenomena that characterise contemporary climate change and are likely eliciting all manner of everyday, local responses within different communities. What is important is that geographers begin to recognise these practices of adaptation and mitigation that occur across the globe. Importantly, such strategies may not operate by directly trying to change underlying aspects of the earth system, but might instead involve acts of curation, story-telling and wild-experimentation- practices that challenge conventional ideas of what it means to live with environmental change and require geographers to continue to broaden the types of practices and (im)materialities that are made to matter.

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Appendix 1: List of interviewees

First name	Surname	Interviewee description	Date of first interview
Alfred	A	Resident on Heimaey	31/03/2016
Olafur	A	Ecologist at the University of Iceland	13/06/2017
Orn	A	Former Chief doctor on Heimaey	15/06/2017
Friðrik	A	Head of Fire Department on Heimaey	02/06/2017
Elizabeth	A	Resident on Heimaey	21/06/2016
Auður	A	Leader of the Trauma Team on Heimaey	05/07/2017
Ragnar	B	Resident on Heimaey	22/06/2016
Sara	B	Chief earthquake scientist at Icelandic Met Office	23/06/2017
Sólrún	B	Resident on Heimaey	02/06/2017
Jon	B	Head of Red Cross Iceland	13/06/2017
Leifur	B	Founder of Locatify (interactive exhibit company) used in the Eldheimar museum	18/06/2016
Kristján	B	Senior pastor in South Iceland	12/07/2017
Páley	B	Chief of Police on Heimaey	29/05/2017
Elfa	D	Head of Psychological Support for Red Cross Iceland	26/06/2017
Guðrún	E	Resident on Heimaey	09/07/2017
Audur	F	Resident on Heimaey	16/06/2016
Elva	F	Resident on Heimaey	17/06/2016
Aurora	F	Resident on Heimaey (now living in Reykjavik)	25/06/2017
Sigmar	G	Head of Red Cross on Heimaey	30/06/2017
David	G	Resident on Heimaey	18/06/2016
Margret	G	Architect of Eldheimar Musuem	19/06/2016
Themla	G	Chief psychologist on Heimaey	11/07/2017
Bjarki	G	Resident on Heimaey	22/02/2016

Axel	H	Exhibition designer for the Eldheimar museum on Heimaey	21/06/2016
Armann	H	Volcanologist at the University of Iceland	14/06/2017
Hrefna	J	Project worker for the Hekluskógar project	05/07/2017
Guðrún	J	Coordinator of Civil protection in Iceland	12/06/2017
Kristin	J	Resident on Heimaey, Director of Eldheimar Musuem	01/04/2016
Olafur	J	Volunteer for Icelandic Search and rescue Reykjavik area	15/06/2017
Helga	J	Resident on Heimaey	31/03/2016
Sigurður	J	Resident on Heimaey	01/07/2017
Perla	K	Resident on Heimaey	20/06/2016
Ásta	M	Project manager at Gagarin (interactive exhibit company) for Eldheimar museum	23/06/2016
Guðbrandur	Ö	Senior Leader of ICESAR (Icelandic Search and Rescue service)	21/06/2017
Gísli	O	Resident on Heimaey	26/05/2017
Hreinn	O	Director of the Hekluskógar project	16/06/2017
Friðjón	P	Head of Emergency Planning for Icelandic Civil Protection	13/06/2017
Vigdís	R	Resident on Heimaey	04/07/2017
Silla	S	Resident on Heimaey	03/07/2017
Hólmfríður	S	Resident on Heimaey	17/06/2016
Kjartan	S	Former pastor on Heimaey	20/07/2017
Olafur	S	Director of Municipal Services on Heimaey	20/06/2016
Hallgrímur	T	Resident on Heimaey	16/06/2016
Soffía	V	Resident on Heimaey	03/07/2017

Elliði	Vignisson	Resident on Heimaey and current Mayor of Heimaey	20/06/2016
Ruth	Z	Resident on Heimaey	22/06/2016
Pali	Z	Resident on Heimaey and former Mayor of Heimaey	15/06/2016
Geir	Þ	Former Police Commissioner on Heimaey	26/07/2017

Note: the majority of these interviewees were interviewed on multiple occasions- the date shown is the date of the first interview/ life history interview.
