

Uniting against COVID-19:

What our national pandemic response could reveal about science and society
in Aotearoa New Zealand

by

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Abstract

Writing in 1954, Hannah Arendt describes crises as an “opportunity[...]to explore and inquire into whatever has been laid bare of the essence of the matter”. Globally, the COVID-19 crisis has torn away at existing facades, bringing to light not only taken-for-granted structures and processes, but new ways of conceptualising them.

Currently, Aotearoa New Zealand’s national pandemic response to COVID-19 is one of the most highly regarded in the world. This success has predominantly been attributed to our government’s receptivity to the advice of scientific experts. This research thesis therefore endeavours to understand the nature of our ‘science-based’ response. Drawing on semi-structured interviews with fourteen scientific and non-scientific actors involved in our national COVID-19 response, this research investigates how science is involved in interactions between scientists, government and the public, and how it is involved in the way those social groups interact with the underlying systems that produce and maintain our modern society in Aotearoa. Where those systems typically *underlie* structures and processes of modern Aotearoa, Thomas Gieryn’s theory of ‘boundary work’ is used to draw attention to how typically invisible relationship networks between scientists, scientific knowledge-making processes, scientific legacies of colonialism, and systemic weaknesses in our health and scientific infrastructure have been rendered visible by Aotearoa’s national response to this crisis. By recognising the dynamics of our national response, including factors that enabled and restrained important strategies, this research provides insights into our so far successful crisis response that can be utilised for crises responses in the future.

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Table of Contents

Introduction.....	i
COVID-19.....	iii
COVID-19 comes to Aotearoa.....	v
A brief introduction to STS studies.....	viii
Boundary work.....	ix
Methodology.....	xi
Participants.....	xii
Data collection.....	xiv
Data analysis.....	xvi
Statement of Argument.....	xvii
Chapter Outlines.....	xvii
1 Chapter 1. Forming the Response Network.....	1
1.1 Affect and concern for communities.....	1
1.2 “I guess it felt like my responsibility”: Actors initiated involvement themselves.....	5
1.3 “Not everyone has their own personal scientist”, but some people do: How informal relationships were utilised.....	9
1.4 “I just got someone to give him my phone number”: Chief Science Advisors as key interlocutors.....	13
1.5 Invisible colleges become visible.....	19
1.6 “Remarkable consensus”, Plan B, and “the right thing to do”.....	21
1.7 Chapter conclusion.....	28
2 Chapter 2. SARS-CoV-2 at the Science-Policy Interface.....	30
2.1 Cautious scientists.....	31
2.1.1 Responding to the disease its revealed to be.....	32
2.1.2 Peer review.....	37
2.2 Trying to convert science into policy.....	39
2.3 “Finding out stuff and then finding out it was wrong”: Delivering science advice.....	42
2.4 The unknown virus.....	46
2.5 The ungovernable virus.....	49
2.6 “It’s not normally played out in the public”.....	51
2.7 Chapter conclusion.....	56
3 Chapter 3. Coloniality and expertise.....	57
3.1 Engaging with people who have a different reality.....	59

3.2	Coloniality and Healthcare	64
3.3	“Opening up the idea of what science is and what evidence is”	68
3.4	Excluding expertise.....	70
3.5	Diversifying expertise for a better science and a better society.....	73
3.6	Chapter conclusion.....	77
4	Chapter 4. Neoliberal constraints to the science and health systems in the response	78
4.1	“It wasn’t an integral part of the response”: The genome sequencing story	78
4.2	Neoliberalization of scientific management in Aotearoa.....	84
4.3	Neoliberalization of Healthcare in Aotearoa	86
4.4	Inadequate workforce at the Ministry of Health	87
4.5	Expertise in crisis/es	89
4.6	“Small changes in the ocean liner don't seem like much when you begin”	92
4.7	Chapter conclusion.....	97
	Conclusion	98
	Reference	104
	Appendix.....	114

Introduction

On April 11, 2020, I submitted a research proposal for this project after spending the course of Aotearoa's Alert Level 4 lockdown writing it from my family home in Te Papa-i-Oea. The proposal was titled, "Mapping the Actor-Network Associated with New Zealand's COVID-19 National Pandemic Response".

It is amusing to read over this proposal today, one year on. "SARS-CoV-2 has recently been classified as the virus responsible for COVID-19", I wrote, continuing to state that "relatively little is known about its unique virological and epidemiological patterns".

While it was true that relatively little was known about this novel coronavirus in April 2020, when I submitted my proposal, as I approach my thesis submission date in April 2021, I am aware that I will be contributing to academic literature – scientific and sociological – about the most popular research topic in the world right now. Advances in knowledge about one particular issue have occurred more rapidly than perhaps they ever have before. Over the course of this last year, as I've studied the COVID-19 pandemic *during* the COVID-19 pandemic, I have seen images of the biggest and busiest cities in the world entirely emptied of people while seeing images of tiny hospitals overflowing with them. I have waited in line to shop at socially barren supermarkets and have used my phone to scan in at various locations in order to help my government track my movements and interactions with people I thought I was just passing on the street. I heard about skies clearing in polluted cities and bird song touring empty motorways as people around the world shared the experience of 'staying home to save lives'.

If I have learned anything from undertaking this project during a global pandemic crisis, it is that a lot can change over a very short space of time.

In an essay from 1954, Hannah Arendt describes crises as an “opportunity[...]to explore and inquire into whatever has been laid bare of the essence of the matter”. Crisis, she ruminates, “tears away facades and obliterates prejudices”, where “the disappearance of prejudices simply means that we have lost the answers on which we ordinarily rely without even realising they were originally answers to questions” (Arendt, 1954).

In tearing away the facades of the conventional, suspending judgements of the old and the taken-for-granted (Norberg, 2011), she explains that in critiquing crises we can bring to light new ways of conceptualising the conditions that brought about the crisis in question. This might prompt opportunities to normalise new conceptualisations that encourage “build[ing] meanings and bodies that have a chance for life” (Haraway, 1988).

When I began conducting my research, Aotearoa had just about achieved elimination. Our national response was already being praised by media outlets around the world. As COVID-19 played out as a large-scale tragedy in other nations, I wanted to understand why it didn’t wreak as much havoc here.

A lot of the noise being made about our national response was about its being ‘science-based’. But what did that actually mean? Who decided it was a *scientific* thing to restrict the *social* behaviours of people, how was that decided, and why?

My research intention was to answer these questions. Initially, I thought I would answer them using Bruno Latour and Michel Callon’s Actor Network Theory. I therefore interviewed 14 scientific and non-scientific ‘actors’ who I perceived were involved in some kind of social ‘network’ that was central to formulating our national response.

But as I set out trying to understand the experiences of these actors, I began to realise how this crisis was, in Arendt’s (1954) words, “lay[ing] bare of the essence of the matter” of science as it is interpreted, practised and displayed in Aotearoa. In this thesis, I will employ

Thomas Gieryn's theory of 'boundary work' to attempt to argue how science's place in Aotearoa's COVID-19 response has divulged ideas about what science's place in Aotearoa is in general.

COVID-19

Though it is now recognised that the first case of COVID-19 was covertly recorded in November of 2019, Wuhan's Municipal Health Commission first notified the World Health Organisation's (WHO) Country Office in the Peoples Republic of China of a series of acute respiratory disease cases on the 31st of December, 2019 (WHO, 2021). Research has since shown that person-to-person transmission of the virus had likely been occurring since mid-December (Li et al., 2020). After spreading rapidly across China, the disease, unofficially referred to as the '2019 novel coronavirus' quickly reached various borders around the world until transmission was considered severe enough for the World Health Organisation (WHO) to declare a Public Health Emergency of International Concern (PHEIC) on the 30th of January, 2020.

As the novel virus gradually infiltrated the borders of nation after nation, governments around the world successively declared national states of emergency. The disease was already engendering a global crisis. Economic, political and social rules were consecutively written and re-written in attempts to intervene in the unfolding tragedy. By the 11th of March, driven by the "alarming levels of spread and severity and by the alarming levels of inaction", Dr. Tedros Adhanom Ghebreyesus, Director General of the WHO, was compelled to declare a global pandemic (Cucinotta & Vanelli, 2020).

By this point, 'SARS-CoV-2' had been announced as the official name for the spreading virus by the WHO – on the 11th of February. This name was eventually affirmed as appropriate by the Coronaviridae Study Group of the International Committee on Taxonomy of Viruses in March, after assessment of the phylogeny, taxonomy and established practice of

the virus showed its relationship to the species *Severe acute respiratory syndrome coronaviruses* (SARS-CoVs) (Gorbalenya et al., 2020).

Scientific literature about SARS-CoV-2 now informs us that SARS-CoV-2 predominantly spreads person-to-person via respiratory droplets from infected people, especially through coughing or sneezing. Though it is genetically similar to SARS-CoV-1, SARS-CoV-2 has a higher reproductive number (R_0), meaning it has a higher rate of transmission (Cevik et al., 2020). Structural differences, such as SARS-CoV-2's ability to bind more strongly to the ACE-2 receptor of epithelial cells (Wrapp et al., 2020), its greater efficiency at invading host cells (Cevik et al., 2020), and its greater affinity for invading the upper respiratory tract (Wölfel et al., 2020), have been associated with this characteristic (Cevik et al., 2020). Notably, pre-symptomatic or asymptomatic individuals can act as carriers of the virus and pass it on to others without having experienced COVID-19 symptoms themselves (Casella et al., 2021). This particular characteristic of the disease has proved especially challenging for attempts at controlling COVID-19, as it allows the virus to pass on from people who do not realise they are infected, contributing to its “greater epidemic potential” (Ferretti et al., 2020). Potential aerosol and surface transmission of SARS-CoV-2 have also been acknowledged (van Doremalen et al., 2020).

As a disease, COVID-19 primarily implicates the respiratory system of infected individuals, where severe infection can result in respiratory failure and multiple organ failure (Yuki et al., 2020). The SARS-CoV-2 virus infects alveolar epithelial cells of the alveoli in the lungs through the entry receptor angiotensin-converting enzyme 2 (ACE2), where viral replication can facilitate damage such as cellular apoptosis and vascular leakage, which triggers excessive pro-inflammatory cytokine and chemokine release (Fu et al., 2020). COVID-19 mortality has been linked to this “cytokine storm”, as it aggravates acute

respiratory distress syndrome (ARDS) and widespread tissue damage, culminating in multi-organ failure that leads to patient death (Ragab et al., 2020).

COVID-19 comes to Aotearoa

Aotearoa's government were first alerted to COVID-19 in early January after first hearing word from the WHO about the emergence of a novel coronavirus. In a press conference from the 28th of January, 2020, with Dr Ashley Bloomfield (Director General of Health at the Ministry of Health) and the Prime Minister, Hon Dr David Clark (Minister of Health at the time) acknowledges “the work of many Government organisations in responding to the coronavirus. They have been kept busy responding from 6 January”. Concerns about the emerging pandemic initially sat with Julie Ann Genter who was “responsible for public health as her delegated field” at the time (pulled from research data). But as the spread of the virus progressed, it “became apparent over time that it was an issue with international implications, and a rather larger issue than a straight-forward public health matter”, incentivising Prime Minister Jacinda Ardern to hand over lead responsibility of the issue to Hon. Dr. David Clark, on the 26th of January (pulled from research data). On the 28th of January, the National Health Coordination Centre at the Ministry of Health was activated to coordinate a national response to the novel virus, and on the 30th – the same day the World Health Organisation declared a PHEIC – cabinet's authorisation of an infectious and notifiable disease order to recognise the novel coronavirus as a notifiable disease came in to effect.

This period marks a beginning to the emergency response period my thesis will speak to. My understanding from this research is that around this time, processes of recruiting people into the national response were being initiated. The roles of Chief Science Advisors across various Ministries started to become more COVID-19 oriented, while initial steps were being also taken to set up the Ministry of Health's COVID-19 Technical Advisory

Group, whose membership, structure and leadership would change through the course of the pandemic. In labs across Aotearoa, scientists – especially those with expertise in infectious disease epidemiology – were connecting with colleagues to discuss who had what resources and how they could be used; for example, for setting up diagnostic testing for when COVID-19 inevitably arrived in Aotearoa.

Aotearoa diagnosed its first case of COVID-19 on the 26th of February. By mid-March, as it became clear that community transmission was occurring, the government switched from its initial mitigation strategy to an elimination strategy. Mitigation approaches to pandemics are designed to allow the occurrence of controlled outbreaks that do not overload healthcare systems and gradually promote herd immunity in the population (James et al., 2020). These strategies are typical of influenza focussed pandemic strategies, such as is drawn up in the New Zealand Influenza Pandemic Plan.

In an interview for a video produced by the WHO, ‘Sharing COVID-19 experiences: the New Zealand response’, Prime Minister’s Chief Science Advisor, Professor Dame Juliet Gerard, is seen explaining that “New Zealand had a pandemic plan and it was designed around the flu”. She is then followed by the Ministry of Health’s Director General of Health Dr Ashley Bloomfield, who asserts that “it became apparent that if we followed the steps in our pandemic plan, we would go down the track of other countries in not being able to manage the outbreak in our communities, so we had to change tack” (World Health Organisation, 2020). As identified by researchers at the University of Otago in Wellington, this was because “COVID-19 is not pandemic influenza” as there is a key difference in the function and biology of the respective infections (Baker et al., 2020). As officials in Aotearoa’s government watched the mitigation approach perform poorly overseas, “with COVID-19 cases overwhelming health services”, they saw that “by early March, the evidence

base for elimination was growing, with the increasing realisation that COVID-19 was markedly different to pandemic influenza in terms of its transmission dynamics” (Baker et al., 2020).

Inspired by the success of containment strategies for disease elimination in China and other east and south-east Asian jurisdictions, Aotearoa switched its strategy to follow an elimination path.

The goal of the elimination strategy is to reduce “the incidence of a disease to zero in a defined geographical area”. When disease incidence is reduced to zero globally, it is known as eradication (Baker et al., 2020). While a range of control measures can contribute to the pursuit of an elimination strategy, a significant measure requires the closure of national borders to international arrivals – enforced by Aotearoa’s government on the 19th of March. As nations cannot legally bar the entry of citizens, part of practically enacting an elimination strategy involved accepting the potential for outbreak occurrences if measures taken at the border failed (Baker et al., 2020).

A compelling elimination approach also requires the presence of strong public health infrastructure. Baker et al. (2020) cite that Aotearoa’s public health infrastructure was “at a low point after decades of neglect”, (see Chapter 4) thus necessitating a nationwide lockdown, enforced on the 26th of March. The lockdown enabled the expansion of “essential activities such as testing and contact tracing” under a less-pressured environment (Baker et al., 2020).

After a four-week nation-wide lockdown at Alert Level 4, the country moved into Alert Level 3 on the 28th of April, where on the 4th of May it recorded its first day with no new cases of COVID-19 since the 16th of March. As the country slowly returned to ‘normal

life', albeit with a few restrictions imposed at Alert Level 1, Aotearoa celebrated 100 days without community transmission on the 9th of August, 2020.

In their paper, 'Successful Elimination of Covid-19 Transmission in New Zealand', University of Otago Scientists Professor Michael Baker and Professor Nick Wilson attribute Aotearoa's successful enforcement of the scientific elimination strategy to social factors such as "early, decisive government action", the "emphatic leadership" and "effective communicat[ion]" of Prime Minister Jacinda Ardern, and "high public confidence and adherence to a suite of relatively burdensome pandemic-control measures" (Baker et al., 2020).

It is this interaction between scientific and social factors that my research intends to explore as I attempt to better understand the place that scientific knowledge has in institutional, social and political contexts in Aotearoa. This therefore situates my research in the field of Science, Technology and Society studies.

A brief introduction to STS studies

Science, Technology and Society (STS) studies is a relatively young research field. Because of this, it is an interdisciplinary field that borrows methodologically and theoretically from more established disciplines, such as the social sciences, history, philosophy and anthropology.

According to sociologist Sergio Sismondo (2010), STS studies start "from an assumption that science and technology are thoroughly social activities" (Sismondo, 2010, p10). This is because scientists are *people* who are members of *communities*, trained into enacting specific behaviours and practices as determined by the traditional conventions of those communities. These communities enforce historically produced research standards and evaluate knowledge claims. As Sismondo says, "there is no abstract and logical scientific

method apart from evolving community norms” (Sismondo, 2010, p11). This field therefore investigates how scientific knowledge is *constructed*, focussing particularly on social, political and historical factors that influence modes of knowledge production and forms of knowledge output. This often involves investigating who is included in locations of knowledge production, who is excluded, and why.

Alongside reminding us that science is social, social constructivist perspectives of STS also reminds us that it is active, and that the products of science are not themselves natural. “Science and technology do not provide a direct route from nature to ideas about nature” as science is always done through the medium of people who sit at social, historical and political intersections of identity and experience that inevitably influence whatever knowledge they create. Historically, the scientific institution was only welcome to certain members of society – people who were white, male and rich. The rules, priorities and approaches of modern science, constructed by these men, are therefore pervaded by their ideals, which have now become institutionalised and normalised through years of reproduction and re-enforcement (Sismondo, 2010).

In recognising these cultures, we allow ourselves to challenge how modern methods of science may actually restrict the accuracy and utility of the knowledge it produces. Additionally, it allows us to investigate how the scientific institution has been historically constructed to produce arrangements of knowledge making, knowledge validation and knowledge authority that we know today. I draw on these main ideas from STS to analyse my interview material.

Boundary work

Boundary work theory is employed within the wider domain of STS to explore how science is defined, preserved and upheld as a community of practice. It unfolds from Thomas F. Gieryn’s theory of ‘boundary work’, which explores the various forms of ‘work’ scientists

have done to demarcate science from non-science. Rather than philosophically questioning *why* boundary work is done, Gieryn recognises that it *is* done in society anyway, so seeks to explore *how*, in order to identify what is being tacitly achieved by that work.

Often, “boundary disputes” are had over claims to “intellectual turf”, where the outcomes of boundary work are often in the domain of epistemic authority over social, political and economic issues. Authority is gained primarily through the process of demarcation, in which one group employs various objects of persuasion to distinguish themselves from another in order to convince relevant actors (e.g. the government, the public) that their own group is deserving of support and authority while the other group is not.

Historically, one of science’s great leaps in achieving authority through boundary work in the West was through its demarcation from religion. Historical boundary work contributed to the production of “ideologies of science for the public” that emphasised distinguishing features that would disclose how ‘obviously’ closer to reality scientific knowledge was than religious knowledge.

In this work, science constructed and employed self-interested notions of utility, credibility and skepticism as objects of persuasion against the epistemic authority of religion. It distinguished its *utility* by pointing to how it has improved the material conditions of people, compared with religion’s only being able to offer “aid and comfort in emotional matters”. It demonstrated its *credibility* through experimentation and observations of nature, compared to religion’s metaphysical approach to dealing with unverified, unseen forces. And it assured of its *skepticity*, as science “respects no authority other than the facts of nature” in comparison with religion’s dogmatic, “worn-out ideas and their creators” (Gieryn, 1983).

One need only look to one’s own attitude when comparing scientific knowledge with religious knowledge to recognise the implicit legacy of this work.

While this is one example, boundary work can be done through numerous tactics of tacit persuasion. In their conceptualisation of ‘boundary objects’, for example, Star & Griesemer recognise how within a shared space like a boundary, where a “sense of here and there are confounded”, common objects can “form boundaries between groups through flexibility and shared structure”. Boundary work can therefore be done on boundary objects to construct them in particular ways that, not only enables shared understandings of a circumstance of interest between implicated actors but also advances the interests of the actor(s) doing the work.

To point out the social construction of scientific knowledge’s epistemic hegemony is not to invalidate its credibility as a method of knowledge-making. It also is not to “reduce ideologies of science to illusions concocted only to serve professional interests”, as that “assumes an unrealistically gullible public and a cynical and *merely* instrumentalist scientific community” (Gieryn, 1983). Rather, it is to contest how contemporary, reductionist understandings of “scientific objects, practices and disciplines [...] come to be black boxed, clothed in illusions of inevitability, timelessness and cultural neutrality” (Addison, 2017).

By recognising the contingency of scientific authority to socio-political environments and eras, the theory of boundary work can be used to identify who or what is elevated in society, and likewise compromised, by these ongoing, dynamic efforts to reveal how science can produce “new kinds of people and forms of life” as a result (Addison, 2017).

Methodology

My initial object of study was to track and interpret how specialised (scientific) knowledge moved and mediated relationships between and amongst social actors, structures and systems. These are *social aspects* of knowledge construction and transmission. Sociologists of Scientific Knowledge recognise that the production of scientific knowledge,

“in which scientific order is constructed out of chaos”(Latour et al., 1986), is historically and socially contingent. For example, scientific ‘facts’ can only emerge when historically composed rules are followed and can only be validated once members in the scientific community are convinced they are ‘real’. This literature therefore appreciates how scientific knowledge is always attached to people, how it is argued for or against by different people and how that knowledge requires particular access, forms of expertise, skills and resources to be interpreted and utilised. The object of my study was therefore to investigate how these social interactions and processes were happening in the context of Aotearoa’s national response to COVID-19.

I therefore deliberated that the best way to learn about how people interacted with scientific knowledge was to ask people involved in those interactions. As Susan Weller states, “Most of what we know about what people think and do comes from interviews” (Bernard & Gravlee, 2014, p. 343). I therefore designed my research to be based on interviews with people who were publicly associated with our national response to COVID-19. I gathered data by interviewing people who were likely to have interacted with this knowledge, rather than gathering data by assessing publications relaying that knowledge and its construction, upon the assumption that knowledge was social at every interaction.

Given that I was exploring an entirely new circumstance, where in fact part of the research interest was about how that newness shaped peoples’ interactions with scientific knowledge, I used semi-structured interviews to ask people about their attitudes regarding scientific knowledge, while asking them to recount their experiences with Aotearoa’s COVID-19 national response, so as to place their attitudes within my context of interest.

Participants

Participants were recruited according to their publicly recorded involvement in our national response. Selection was based on participants primarily having a notable official,

media, or publication presence in regard to COVID-19, while other participants were selected based on connections to Te Herenga Waka’s Centre for Science and Society. Dr Sarah-Jane O’Connor, a participant herself, was particularly influential in recommending potential participants thanks to her role as senior advisor at the Science Media Centre.

Participant	Self-described professional role, institution and location	Selection criteria	Interview date
Dr Caroline McElnay	Director of Public Health at the Ministry of Health (Te Whanga-nui-a-Tara)	Govt. Official	27 August 2020
Associate Professor Collin Tukuitonga	Associate Professor of Public Health at the University of Auckland, Dean for Pacific Programs in the Faculty of Medical and Health Sciences (Tāmaki-makau-rau)	Member of COVID-19 TAG	11 September 2020
Professor David Hayman	Professor of Infectious Disease Ecology at Massey University (Te Papa-i-Oea)	Recommended by Dr Sarah-Jane O’Connor	28 August 2020
Dr Donna Cormack	Senior lecturer and researcher in Māori health, ethnic health inequalities, racism and it’s impacts on health, and data sovereignty. Works mostly for Te Kupenga Hauora Māori (Māori Health Department in the Faculty of Medical and Health Sciences), University of Auckland; Te Rōpū Rangahau Hauora a Eru Pōmare, University of Otago (Te Whanga-nui-a-Tara)	Publication presence	6 October 2020
Dr Jemma Geoghegan	Senior Lecturer at the University of Otago in the Department of Microbiology and Immunology; Associate Scientist with ESR (Ōtepoti)	Media presence	29 September 2020
Dr Josh Freeman	Clinical Director of Microbiology and Virology at Canterbury DHB; Clinical Director of Infection Prevention and Control, Canterbury (Ōtautahi)	Recommended by Dr Sarah-Jane O’Connor	11 September 2020
Professor Dame Juliet Gerrard	Prime Minister’s Chief Science Advisor (Tāmaki-makau-rau)	Govt. Official	16 September 2020
Professor Nick Wilson	Professor of Public Health at the University of Otago (Te Whanga-nui-a-Tara)	Publication presence	19 August 2020
Dr Sarah-Jane O’Connor	Senior Media Advisor with the Science Media Centre; Teaching Fellow in science communication with Centre for Science in Society, Te Herenga Waka, Victoria University of Wellington (Te Whanga-nui-a-Tara)	Connections to CSIS	13 August 2020

Professor Sean Hendy	Director of Te Punaha Matatini; Professor of Physics, University of Auckland (Tāmaki-makau-rau)	Media presence	14 September 2020
Associate Professor Siouxsie Wiles	Associate Professor in the Faculty of Medical and Health Science and Department of Molecular Medicine and Pathology (Tāmaki-makau-rau)	Media presence	
Anonymous politician			1 September 2020
Anonymous epidemiologist			16 September 2020
Anonymous health practitioner/researcher			31 August 2020

*Anonymous participants are referred using the pronouns ‘they/them’ throughout the thesis to protect their identity, not to suggest that they are non-binary individuals.

While I sought to recruit participants from a range of personal and professional backgrounds, the sample of people I could justifiably approach was always going to be intrinsically restricted by the types of people that were being recruited for our official response in the first place – the process of which I explore and critique in my first chapter. Regardless, I tried to include a variety of perspectives in my research by reaching out to people from across professional backgrounds, genders, races, locations and institutions. Additionally, it is important to note that my selection of participants do not necessarily reflect the wider makeup of people involved in setting up our response but are instead a sample of that larger group.

Data collection

Participants were all contacted by email between October, using their publicly available professional email addresses. 19 people were approached for recruitment, from whom I received 14 acceptance replies. One person politely declined participation, while four did not reply.

I interviewed people according to the conventions of semi-structured interviewing in order to collect “items, statements, and themes relevant to” how participants interacted with scientific knowledge within the context of our national response to COVID-19 (Bernard & Gravlee, 2014, p. 345). Before these interviews, I designed questions I thought would be relevant to ask participants, where the semi-structured format gave me the flexibility to ask questions specifically in response to participant answers. The advantage of conducting semi-structured interviews is therefore that they facilitate collection of new information while enabling conversational exploration of emerging topics of interest in further detail (Bernard & Gravlee, 2014).

Before each interview, I drafted up potential questions to ask that seemed relevant to each participant, their experience and their expertise – which I gathered based on publicly available information about them (such as media contributions, media profiles or institutional profiles). Every interview begun with a question asking participants to recount their experience with COVID-19 and ended with asking them what big picture lessons they thought Aotearoa had learned from our collective experience. Other questions included asking about their interactions with other actors in the response, why they thought it was important for scientific knowledge to be included in the response and what aspects of the response they thought were important. A draft of a question-sheet, designed for participant Dr Josh Freeman, is available in Appendix 1.

Since interviews were semi-structured, I mostly asked participants follow-up questions to previous answers, rather than strictly asking what was on each question-sheet. For my interview with the politician, their office requested some questions prior to the interview that they could prepare answers to. This politician gave me answers to both these prepared questions and to follow-up questions I asked them spontaneously in the interview.

Since the Prime Minister declared an outbreak of COVID-19 in Auckland on August 12, 2020, imposing a move into Alert Level 4 for Auckland and Alert Level 3 for the rest of the country, all interviews were conducted through Zoom's video-conferencing software, except for one with Dr Caroline McElnay which was conducted at the Ministry of Health, notably straight after her speaking at the 1pm Daily Briefing. Conversations in these interviews therefore tended to refer to the August outbreak. Interviews lasted between 30 and 60 minutes and were recorded using the in-built recording function on my personal Apple Macbook Pro laptop. I transcribed these recordings by dictation through the online software Wreally.

The interview with Associate Professor Siouxsie Wiles was not conducted by me and I did not influence the questions asked of her. I instead borrowed interview transcripts from multiple interviews conducted by Associate Professor Rebecca Priestly from the Centre for Science in Society, as we thought it best to not burden Associate Professor Wiles with multiple interview requests when her time was already in high demand due to the nature of her role in the pandemic response.

Data analysis

I thematically analysed interview transcriptions using the data analysis software NVivo. Participant answers were predominantly analysed by emerging themes, where if I identified a subject of interest I would code for that subject in the first round of analysis. In further rounds of analysis, I merged specific themes that seemed to relate to each other into broader themes. Early emerging themes for example included coding for references to relationships between scientists, politicians and the public, explicit references to various subjects such as public health, environmental issues or inequity, and references to feelings and opinions such as concern, caution and hopes for the future.

Statement of Argument

My research intends to present descriptions and analysis of 14 experts' experiences with Aotearoa's official COVID-19 national response in order to elucidate how science is involved in interactions between scientists, government and the public, and how it is involved in the way those social groups interact with the underlying systems that produce and maintain our modern society in Aotearoa. Where those systems typically *underlie* structures and processes of modern Aotearoa, I will employ the theory of boundary work to recognise how the COVID-19 pandemic has “[torn] away the façade” (Arendt, 1954) of taken-for-granted conventions, in order to draw attention to how typically invisible networks, knowledge making processes, legacies and systemic weaknesses have been rendered visible by this crisis.

Chapter Outlines

In my first chapter, I draw on participant descriptions of informal, established connections and behaviours to outline how scientific-political networks formed and became central to Aotearoa's COVID-19 response. I draw on the theory of ‘invisible colleges’ to point out how pre-existing informal relationships, formed prior to the pandemic through interactions in professional settings, meant that there was already an invisible network of relevant actors, including participants, that simply became more and more visible as actors continued to recruit people they “already knew and trust[ed]” (Professor David Hayman) into the response formulation process. I finish the chapter with remarks on how this pre-formulation of the response network ensured the exclusion of actors promoting the ‘Plan B’ approach to the pandemic. I call attention to how scientists in the response network do boundary work to justify their own science's place in formulating the response, while rejecting Plan B's science.

In my second chapter, I identify the nexus between science and policy as a unique and contested boundary that does not adhere entirely to either political or scientific norms. This resulted in participants from each group having to compromise on institutional familiarities to effectively cooperate within an unfamiliar domain. I draw on the theory of boundary objects to understand how the SARS-CoV-2 virus was constructed by scientific advisors in a way that could implicitly advance the interests of both scientists and politicians in Aotearoa. By rendering the virus unpredictable and unknown, scientists could implicitly highlight the lack of support for research in infectious diseases in Aotearoa. This rendering allowed justification for their claims that funding and support for this area should be increased. Additionally, rendering the virus unpredictable enabled an inherent understanding that the virus's movements and interactions were ungovernable. This was therefore useful and desirable for politicians as it justified their approach to governing the public's movements and interactions instead. I additionally argue that in utilising the SARS-CoV-2 as a boundary object, scientific and political actors in the response ensured shared interpretations of wider situations at hand. This advanced public support for both groups as it promoted consistency in science communication strategies to the public, facilitating widespread compliance to restrictive public health measures.

In my third chapter, I situate Aotearoa's COVID-19 response specifically within the context of its history as a neo-colonial country. I use this context to recognise how currently systemically marginalised groups, including Māori and Pacific Island communities, in Aotearoa's society are at risk of being left behind when policy is devised without explicit acknowledgement of their needs and social and historical place in Aotearoa. In this chapter, I also recognise the role that the scientific institution has played in bringing about these inequities in lived experience and ask what it can do to re-write its future in a way that does not compromise the accuracy of scientific knowledge, but actually furthers it. I draw on

feminist scholarship of science to argue that in being more inclusive of wider knowledges, such as social and Indigenous Māori knowledges, the scientific institution in Aotearoa can construct a future for itself where it holds itself accountable and produces more accurate and utilisable knowledge. In noting how social expertise of participants was either unique within, or excluded from, Aotearoa's response formulation processes, I recognise how evidence from my first chapter suggests that a key initial step to achieving this future is to improve inclusivity of diverse knowledges in professional settings that facilitate the formation of informal networks that can later become formalised in crisis scenarios when necessitated.

In my fourth and final chapter, I situate Aotearoa's pandemic response within the context of neoliberalism, the dominant system that dictates current global proceedings of modern economic activity and management. By recognising how Aotearoa's genome sequencing project initially struggled to get off the ground because of existing funding procedures, I recognise that neoliberal management of science restricts the way science is done in Aotearoa. I also draw on participant calls for a need to improve public health infrastructure to divulge their frustrations with the neoliberal model of organising healthcare in Aotearoa, including their frustrations about the lack of expert workforces that can anticipate and enforce pandemic responses when necessary. Participants outline that such workforces are crucial given how evolving social and environmental crises contribute to the emergence of urgent crises like pandemics. I argue that the infrastructures participants are frustrated about and the futures they are worried about emerge from processes pervaded by the same neoliberal logic.

1 Chapter 1. Forming the Response Network

There has been plenty of media noise, here and abroad, about Aotearoa's 'science-based response' to COVID-19. However, less noise has actually been made about what a 'science-based response' actually means. I asked some of my participants for their thoughts on the phrase. Participants I asked this question to tended to respond along similar lines – they believed that our response was 'science-based' because it involved scientists, and because science was used to inform decision making. I will explore the first part of that attestation in this chapter and the second part in the next.

If our response involved scientists in decision-making processes, how did they get there? Government doesn't have a reserve workforce of experts it can call on whenever a pandemic hits (a topic I will speak to in Chapter 4). Somehow, scientific actors that came to be involved in our response must have gone from having no formal government affiliations to then being integral to a government led policy project. I therefore begin my account of Aotearoa's COVID-19 response by exploring how scientific actors made their way into decision-making spaces. In investigating this, I draw on participant accounts of their experiences and opinions to explain how a *specific* group of scientific experts were recruited into our response, while others were excluded. I use the theory of boundary work to analyse this process.

1.1 Affect and concern for communities

Professor Nick Wilson, begins his account of how he came in to his relationship with the government by recounting his concern at its slow initial response to the emerging crisis:

“My colleague Michael Baker and I were concerned that the government wasn't responding to this potential pandemic in a strong enough way, particularly in terms of thinking about border control...So we persuaded the

government to, through the chief health science advisor Dr Ian Town, to give a small contract to the University of Otago to do some modelling work and to provide some related discussion papers... From my perspective it was basically all self-initiated. I mean, we initiated that process with the Ministry to get the contract to do the modelling so once that contract was signed I was committed. But I was already fully paid by my other job, so I didn't get any extra money at all.”

His account highlights patterns common to multiple participants' experiences of network formations involving scientific institutions and government institutions. Like Professor Wilson, other participants also begin recounting their COVID-19 experience by informing me of their early feelings of nervousness, worry and concern.

Dr Donna Cormack, a member of Te Rōpū Whakakaupapa Urutā (National Māori Pandemic Group), discusses how she felt nervous about how COVID-19 might play out in Aotearoa after seeing how it was playing out overseas:

“I work in public health and health sciences, so my experience, I think, started around January/February, watching what was happening overseas and getting a bit nervous about how things might play out when COVID arrived here.”

Dr Cormack expressed concerns about whether Aotearoa's COVID-19 response would be an equitable response that could address the needs of other systemically marginalised groups such as those with particular health concerns, refugee/migrant communities and Pacific Island communities.

Her concern that Pacific Island New Zealanders could be negatively affected by an inequitable response was shared by Associate Professor Collin Tukuitonga, Dean for Pacific Programs in the Faculty of Medical and Health Sciences:

“So initially when we had the first wave, I guess you could call it, back in February, I was concerned that the Ministry of Health at the time didn't have any capability to deal with the Pacific Components of the outbreak.”

STS studies are “ideally placed to explore and critique the ways the varied landscape of human emotional experience and expression” can shift in response to changes in knowledge environments (Stark, 2019), such as in media reports, which were inarguably becoming more and more COVID-19 focussed throughout January, 2020. Most participants told me that they first heard about the rapidly spreading SARS-CoV-2 virus through media reports, much like the rest of us. STS scholars like Latimer & Miele (2013), have recognised that there is an “affective dimension of the meaning and politics of human/non-human relations” (Latimer & Miele, 2013). Given their eventual involvement in Aotearoa’s COVID-19 response, it is evident that participants bearing witness to the horrors of COVID-19 through media coverage of it underwent *affective experiences* that set them on a path towards that involvement.

Benedict de Spinoza (1994) defines ‘affect’ as an intense primary experience where “the body’s power of activity is increased or diminished, assisted or checked”(Spinoza, 1994). Munro & Belova (2008) elaborate on this theory to suggest that ‘affect’ is a “world-shifting” experience, where bodies suddenly find themselves “out of place” – it refers to “moments in which ‘place’ has changed, not simply because I have moved on; but because my very chance to ‘go on’ as before has vanished”(Munro & Belova, 2008). Similarly, Blackman & Cromby (2007) highlight “the movement of the subject who is always in a process of becoming”, where affect refers to a “force or intensity that can belie” this movement (Blackman & Cromby, 2007). Luke Stark distinguishes affect from emotion by drawing on Deborah Gould’s (2010) distinction of it as “non-conscious and unnamed, but

nonetheless registered”, where *emotion* is when “the potential of [affective] bodily intensities get actualised or concretized”(Gould, 2010; Kagan, 2007; Stark, 2019). Participants labelling their experiences with emotional language pertaining to nervousness, worry and concern suggest at this actualisation.

Dr Josh Freeman, for example, informs me that witnessing the seriousness of the situation in Italy in March made it clear to him that COVID-19’s arrival in New Zealand would be inevitable. Professor Wilson suspected these same images were similarly ‘affecting’ the government:

“[The government] could see that things [were] very bad in Italy, and Italy has more ICU beds than New Zealand per capita, and possibly even more functional high-quality hospitals...[so] they started to appreciate how serious it was when Italian hospitals were being overloaded”.

Professor Wilson’s concerns about the government’s slow response to what he saw was an emerging crisis were tied to his “20 years” of experience in “doing pandemic related research” and the “50 odd publications” he has in this area. Dr Cormack’s concerns were tied to her expertise in Māori health and health inequity research, as well as to her heightened awareness of how pandemics in the past “wiped out Māori communities...which affected us for a long time”. Associate Professor Tukuitonga’s expertise in Pacific Island health, as well as his situatedness as a Niuean Pacific Island New Zealander, meant that he recognised how community nuances (such as cultures, geographies, privileges and comorbidities) could influence the way that disease transmission could play out across specific populations.

These participants therefore exemplify how expertise and experience were implicated in converting participants’ affective responses into emotional responses, as participants used their expert backgrounds to anticipate how disease transmission would play out across

communities they obviously cared about. Their professional backgrounds meant that they had understandings of the structural, historical and social landscapes of modern Aotearoa, and this understanding contributed to their feeling nervous, worried and concerned once they affectively acknowledged that COVID-19 – already proving to be a high mortality disease – could spread here. .

That participants cared enough about their communities to be nervous, worried and concerned for them also provides key context for subsequent network formation. Shapin (2008) argues that “the closer you get to the scenes in which technoscientific futures are made, greater is the acknowledged role of the personal, the familiar and even the charismatic” (Shapin, 2008, p. 3). Given the involvement of scientific actors in the official processes of Aotearoa’s national response, the response can be recognised as one such scene. With the aforementioned participants all either being scientists or interacting with science in some way, their accounts of caring about their communities enough to be concerned for their safety certainly speaks to Shapin’s position that the personal is implicated in “science-as-it-now-actually-was” (Shapin, 2008, p. 49). It sets up the context for their coming experience as one where, as much as they would be acting in their scientific/research capacity, the “human-side” of making and interacting with scientific knowledge was not going to be a “marginal factor” (Shapin, 2008, p. 49). From an understanding of my participants’ experiences, their human experiences of affect and emotion were essential facilitators of their eventual involvement in our national response.

1.2 “I guess it felt like my responsibility”: Actors initiated involvement themselves

In hearing their accounts, I noticed the emergence of a similar story: participants register concern, they reach out to other people, a formal contract or entity is produced.

This sequence of events appears in some shape or form in the experiences recounted by many participants, which suggests to me that participants’ initiative to act on their concern

was essential in producing any semblance of our response. What is especially notable is that in many cases, during the early days of the emerging pandemic, participants' relationships with government were initiated by participants *themselves*, as opposed to, for example, their being recruited to fill roles government had already established. Professor Wilson, for example, describes needing to *persuade* government that a relationship with his group would prove fruitful. That such a relationship was not only initiated but *officiated* signals that the government, despite not thinking of forming such a relationship themselves, eventually recognised the benefits of that relationship.

When I asked Professor David Hayman *why* academic experts had the drive to get involved in our response, his first response was to remind me that “well, some don't”. His own perspective was that “a lot of us do the work because we want, it... protects people's health, the environment, or whatever it be. You know, we want... We don't want people being sick”. He did, however, acknowledge that it “depends on the person”, referring to Associate Professor Siouxsie Wiles, another one of my participants, and how she “just sort of dropped everything” to front the media. “I'm not saying they're happy to do it”, he said, “but they're willing to do it”.

Associate Professor Wiles, who was described by her colleague Professor Sean Hendy (another participant) as probably the “most prominent science communicator during the outbreak”, suggested that her decision to commit full time to the response was in fulfilment of an unwritten expectation that she would be involved. Referring to her experiences as a regular science communicator and prominent expert during past scientific incidences, such as the Fonterra botulism scare and the Zika and Ebola outbreaks, she said that “I tend to just, you know, pop up and say ‘this is what this organism is; this is what we need to know’, or ‘this is how we need to do things’”. She did the same as COVID-19 emerged. “I just felt like

it was -- like a duty... I guess it felt like my responsibility to be part of answering people's questions”.

Feelings of duty and responsibility were common when participants described *why* they acted on their concern. Some, like Professor Nick Wilson, linked their sense of duty to their understanding of their own expertise – noting that he “felt quite a strong personal commitment because [he’d] done lots of previous work on pandemics so [he] could bring that knowledge to bear”. Associate Professor Tukuitonga linked his early involvement in COVID-19 to past experiences, and to his personal biography. He told me he was Director of Public at the Ministry of Health in Wellington during the SARS threat – “the then Ashley Bloomfield equivalent” – so had “fronted the SARS issue in the media” in the early 2000s. “Because of [his] professional background, [he] was already in tune to what was going on” by monitoring material from the WHO, including media material and the science behind it. Additionally, his background as a Niuean New Zealander and a Niuean speaker meant that “services were starting to have people like myself and my colleagues who speak Pacific language share information with the public”. Like Dr Wiles, keeping up with scientific literature “wasn't just idle interest on [his] part – [he] had to do the work because [he] would often get asked a question”. Part of his sense of duty, like Dr Wiles’, was bound to an understanding that his involvement would be expected. Professor Hayman links his involvement to “social duty”, as well. “My salary is paid by taxpayers”, he says, “so why shouldn’t I do it”.

Feelings of duty, or personal responsibility, therefore appear to have critically motivated participants’ early initiative. These feelings were also tied to participants’ professional, experiential and biographical understandings of themselves, just as their feelings of concern had been.

However, as Professor Hayman reminded me, not every scientist was incentivised to initiate their involvement. When I asked Professor Sean Hendy whether experts involved themselves in our response because of their values or because it is their duty to be the ‘critic and conscience of society’ (Education Act 1989, s 162), he responded by saying that “both of those things are quite strongly coupled”. He told me that while the ‘critic and conscience’ aspect of the Education Act refers to the University as a whole, as a way of defining academic freedom, “it does not mean everybody has to engage in it”. In order to fulfil that criteria of the Act, people and the University need to be enabled to do it, he says. “Some people will, and that decision will often be values based”.

My scientific participants therefore distinguish themselves from other scientific people through their lived investment in societal outcomes. Their lived investment is expressed through their *direct* involvement in Aotearoa’s national response which they *initiated themselves*. Professor Hendy referred to the particular group of scientists directly involved in our national response as the ‘core group’ – a term I will use from now on.

Scientific participants in ‘the core group’ use their ‘values’ and goals to distinguish themselves from other known or imagined scientists who are seen either as not having these same values and/or goals, or as having them but not wanting to act on them. By referring to their own active role, they imply that a group of scientists with relevant expertise but no incentive to centrally get involved exist.

But it cannot just be shared goals that resulted in participant incorporation into the official response network. Dr Donna Cormack was *also* driven by similar motives of concern but described struggling to get in to official response processes. Like scientists, she tried initiating relationships with government after registering concern:

“Seeing that there were things that I wasn't comfortable with or worrying that some conversations that I thought should be happening might not be happening made me motivated, I guess, to try to find space to have those conversations”

But in her experience, the relationship between Te Rōpū Whakakaupapa Urutā and the government only changed “at a very surface level”. While I will expand on the nuances of Dr Cormack’s experiences in Chapter 3, her sharing the affective experiences and emotions of people in the core group but being excluded from it suggests that it is insufficient to demarcate that group from other scientists solely on their having specific, shared intentions. There must be more context to the story of how this group was produced.

1.3 “Not everyone has their own personal scientist”, but some people do: How informal relationships were utilised

When non-government-associated participants took the initiative to form a relationship with government, this was rarely done on their own. An important step that preceded any reaching out to officials was to first reach out to people participants already knew and trusted. Earlier mentioned quotes indicate that doing so was intrinsic to the process – first enlisting the support of like-minded colleagues or peers seemed simply habitual. As Professor David Hayman puts it, “I think we've seen that elsewhere, you know, when things get difficult, people go to the people they know and trust – always those connections”.

For example, Dr Jemma Geoghegan came to lead Aotearoa’s genomic sequencing efforts after reaching out to people across the country that she knew had expertise in the area of genomic sequencing.

Engaging with established relationships was therefore a requisite action that facilitated a scientific participant’s eventual involvement in the response (compared to

political participants whose involvement in our response was an assumed as part of their role). Informal relationships between actors within and across scientific and government institutions were crucial to getting what would eventually become our national response off the ground.

For example, one politician explains how “personal connections” would reach out to them to keep them updated on certain developments:

“Friends who were scientists would be in touch with this or that, or medical experts, across the health system who are of course themselves all highly opinionated and are also quite educated about technologies, breathing apparatuses, masks [...] You know, I feel comfortable enough ringing up the Vice-chancellor and saying, "can you help me out with this person or this person, I've tried to reach their landline and can't get them", you know, being able to access, very easily ,the leading scientists and researchers and have conversations with them. So [...] through personal connections, through already knowing these people.”

Their anecdote indicates that early formations of the response network happened within a context of familiarity, amicability and convenience. Participants were notably first engaging with people they already knew – people they worked with, had worked with, or were friends with.

Associate Professor Collin Tukuitonga described *being* one of these informal advisors, to the Associate Minister for Health, Hon Jenny Salesa:

“So minister Salesa, for example, Associate Minister of Health, she'd ring me and ask me things independently of the official channels. I imagine that kind of thing would be quite common. Ministers would often speak to the scientists that they trust and have confidence in, that's just the way things work.”

While acknowledging that official science advice channels he was also part of were also important, Associate Professor Tukuitonga explained to me that in his experience, it is common for ministers to have personal scientific advisors that they trust and engage with informally, stating, “I’m sure most ministers, and I’ve worked with a lot of ministers, would have their own science advisors that they deal with directly”. Professor David Hayman also indirectly acknowledges his awareness of these kinds of relationships between policy-makers and scientists when he quips that “not everyone has their own personal scientist”, implying that some, however, do.

Existing links between government and scientists did not only function to support politicians when they needed advice. They also gave scientists an avenue to advance their own concerns or pursue projects they thought needed to happen. For example, Dr Josh Freeman used his connections “with people like the Chief Medical Officer at the Ministry [of Health] who [he’d] worked with before”, and through “contacts [he had] in the, sort of, political system, that [he’d] encountered in various domains before” to communicate the urgency of arising issues in the logistics of setting up national diagnostic testing. Professor Dame Juliet Gerrard attested that the ease with which connections can be established and contacted in Aotearoa is partly down to its being a small country. She stated that “because it’s a small country, you know, if you suddenly need to know about diagnostic tests,” you can find out who “a good person to talk to” is in “two messages”.

For Professor Sean Hendy, part of the “small country effect” meant that “we tend to have high levels of trust in scientists in New Zealand”. In his experience, however, he mentioned how he still had to utilise existing connections to expand that sense of trust in his team. Having “informal links to the Department of Prime Minister and Cabinet and to science advisors, you know, from previous things I’ve done and worked with them on” enabled his team at Te Pūnaha Matatini get their modelling project started. He suggested that these

relationships were an important point of entry into expanding his team's relationships throughout government, because his established rapport with some people involved meant that others felt they could also trust him (and his team) before they knew him themselves. This trust was essential to the integrity of the scientific knowledge his team were producing too, as he states:

“It's really important for us to get good data. So, for that you really need to establish trust with the whole Ministry, as opposed to just one or two people in that Ministry, because no one person will have oversight over a particular data set. So, to be able to access that data set, you know, you have multiple people that have to understand why you need it, that you're going to be responsible with that data, and then you have a chance of getting access to it.”

Writing for the Guardian, Professor Hendy has publicly characterised ‘trust’ as the “secret sauce of our response”. Commenting on the relationship between science and the government in Aotearoa's national response, he writes that “for the relationship to work well, scientists need to trust the politicians they advise as much as the politicians need to trust them”(Hendy, 2020). The anecdote he shares with me indicates that part of establishing trust with a wider set of politicians was contingent upon his already being trusted by a few that already knew him.

Bryan Wynne (1995) recognises how “the trust dimension” in manifesting acceptance or rejection of science is critical. They assert that “the basic framework of public responses [to science and technology] rests upon the experience and perception of the relevant institutions or social actors” (Wynne, 1995). Cairney & Wellstead (2021) attempt to categorize a variety of ways that trust between experts, governments and the public was necessary for desirable outcomes in COVID-19 responses. They specifically recognise that while trust can be difficult to measure, “people miss it when it's gone”, positing that

polycymaker distrust in scientific advice “contribute[s] to poor policy design or outcomes” (Cairney & Wellstead, 2021). Professor Hendy’s experience provides a practical example of how polycymaker trust in him was crucial for his team’s acquisition of reliable data, making the science they were feeding in to policy decisions more robust which would have then come back and contributed to the robustness of the policies that were being driven by that science.

Professor Hendy’s informal connections to people in government not only helped facilitate the transmission of scientific knowledge from scientific institutions to government institutions, they facilitated the production of more accurate science within that decision-making space, as his connections promoted trust in him throughout the response network.

One example of connections he had that facilitated trust in him and his group were his connections to the Chief Science Advisor for the Ministry of Health, Dr Ian Town, and the Prime Minister’s Chief Science Advisor, Professor Dame Juliet Gerrard. In fact, various participants also mention these two actors as key to their involvement in our response.

1.4 “I just got someone to give him my phone number”: Chief Science Advisors as key interlocutors

Director of Public Health at the Ministry of Health, Dr Caroline McElnay told me that, though it was eventually disregarded, the existing influenza-focussed pandemic plan was initially influential in that it provided the Ministry of Health “a good frame to start off with” once the reality of the emerging pandemic was recognised. An early recommendation set out in the plan was to convene an expert advisory group. “We didn't have an existing group that we could immediately go to and base our new structure on that - we did have to create it”, Dr McElnay said. Associate Professor Collin Tukuitonga informed me that the Ministry of Health has often had advisory groups in the past, “called different names at different points in time”. This would have meant that the structure of the COVID-19 TAG was probably based

on past structures and preconceived notions of the kinds of expertise they needed to have in this group. But as much as the official TAG was a formal structure, informal and established relationships were utilised by key actors to recruit the members they thought would be appropriate for it.

Dr Ian Town, the Ministry of Health's Chief Science Advisor, is recognised by Dr McElnay and other participants as someone who had an influential role in shaping the expert make-up of the TAG and what its role would be. Initially, it was Dr McElnay who chaired the group, but Dr Town shortly took over that position. Dr McElnay recognised how

“His involvement also meant that it was able to bring in and reach out to maybe a broader science community because what we had established, or what I'd had established, early on was very health focussed.”

Here, she implies how Dr Town's existing connections were influential in shaping the TAG by recognising that if she had kept chairing it, the eventual expert make-up of the group could have looked different.

One participant explains to me that they came to be on the TAG through an existing connection to Dr Town, who invited them on to the group. In this instance, the participant had worked with Dr Town on previous health projects:

“The Scientific Advisor for Health, Ian Town, I know from when I used to sit on the Health Research Council and we had done a lot of work on developing the health research strategy for New Zealand. So, I knew Ian already through that process, so he asked if I would be interested in going on the Technical Advisory Group and that conversation grew just through that, sort of, connection.”

Though another eventual member wasn't "completely sure who [the original members] were, or how they were chosen", they correctly suspected that "the people that they brought in initially were people they already knew from other things". The particular participant in question was themselves brought on to the TAG through "word of mouth":

"I was sitting down here going 'I have something to offer!' but I'm not the kind of person who rings them up and says 'put me on your committee!'. But I had someone else who I work with and know who was on the TAG who said, 'oh this is another epidemiologist who is quite good', and so then they asked me."

This particular participant's suspicions that formal groups were being established through informal connections, alongside Professor David Hayman's earlier quote about everyone not having "their own personal scientist", divulges how members in scientific communities have an implicit awareness of these processes. It indicates that these behaviours must be common enough to network formation processes in the scientific community for participants to not only be unsurprised by their occurrence, but to be able to predict them as well.

Prime Minister's Chief Science Advisor, Professor Dame Juliet Gerrard also worked very closely with Dr Town. This was not a relationship they came in to cold. Professor Dame Gerrard told me that one thing she was grateful she had done two years earlier when she had come in to her role was to organise the "group of [government wide] science advisors into more of a forum" to normalise the "swapping [of] science advice" so that advisors could stay up to date with "what's happening in different government departments". This meant that by the time the pandemic reached Aotearoa, Professor Dame Gerrard had an existing relationship with Dr Town, including established routines for keeping up to date with each other. She however goes on to explain that those communication routines informalized as the urgency of the pandemic became salient:

“I worked incredibly closely with him during the whole thing. He complained that he talked to me more often than he talked to his wife... We were on the phone all the time swapping notes.”

That these Chief Science Advisors shared a joke about talking more to each other than to their partners implies an informal familiarity with each other – an amiable relationship as opposed to one that was strict and brusquely professional.

Professor Dame Gerrard’s interactions with Prime Minister Jacinda Ardern also became more frequent and informal, conducted verbally through a designated phone she nicknamed “the bat-phone”:

“In terms of advice straight to the PM, that tended to be verbal. So, she called me, she texted me [...] And obviously, normal business, we might meet once a month, and she might flick me a text if she had a quick question. But during the peak of the decision-making, there was lots of phone communication.

Professor Dame Gerrard attested that the frequency of her interactions with the Prime Minister to the fact that “decisions just had to be made faster than normal because the virus was moving faster than the government processes.” She elaborates:

“As we got into crisis mode, all the formal boundaries of the roles began to blur. So, normally I wouldn't be in a room with politicians and political advisors, senior civil servants and science advisors all at once. As you go into crisis mode there's just no time to go through the formal process of 'they're providing advice, you're providing the independent check', so it was all hands on deck. So, the decisions around locking down, the ones about shutting borders, all tended to be done in rooms that wouldn't normally have been constituted as rooms.”

Where she describes Dr Town's role as being part of a formal line of communication during the emergency response – as the chair of the MoH's official COVID-19 TAG – Professor Dame Gerrard describes herself acting as more of an informal interlocutor who could deliver scientific advice straight from the scientific community directly to the Prime Minister, or to other appropriate recipients:

“The science community was amazing. So I just had an open line and open inbox and people connected all the time. So the formal advice goes in through a Technical Advisory Group to the Ministry of Health, and I was the informal [contact] [...] So, any and all scientists would contact me and I would filter that information to the PM or to the right place.”

Alongside using informal methods to deliver information to the Prime Minister, she was also using informal methods to access that information in the first place, for example in recruiting the knowledge and advice of certain scientists:

“I proactively contacted people who were commenting in the media - people like Sir David Skegg who were obviously very-well respected experts not necessarily directing the Ministry of Health directly, but commentating in the press - just to let them know that they could let me know anything that was feeding in. I really relied on the science network to get the right contacts.”

In some cases, she was also using existing networks to informally establish new connections to people she felt she needed to have connections to:

“For instance, I'd never met Michael Baker. But I just got someone to give him my phone number and said, 'oh let me know... what do I need to know? What should we do? What shouldn't we do?', so yeah, just chat to him whenever required. So clearly he was a person that had a vision of how we could solve the problem in New Zealand. [...] He's also on the Technical Advisory Group to the Ministry of Health. So, he had that formal role and I tended not to engage with those people so much because they already had a

segue in, but because he was such a key thinker in the whole response and had such an influential role, I'd check in with him quite often.”

Professor Dame Gerrard accounts the ease with which she could access relevant expertise in Aotearoa to “New Zealand being small”, acknowledging that within this context, “the relationships were strong” and “those informal relationship networks worked well”. A political participant echoes her thoughts:

“Because it's a small country, you know these people, and I've always just felt comfortable just ringing them up and saying, ‘I've been reading this paper, what do you think about that’ and they would say, ‘ah! Well I haven't read that paper but if you give me till tomorrow I'll go away and consult, and consult scientific friends and we'll come back to you’ and you know, I felt that science was made very accessible and it wasn't that hard to get.”

Participant anecdotes about habitually reaching out to “friends” and even colleagues by informal means evidences STS claims that science is a fundamentally social institution. Sismondo, for example, states how scientists “are always in the position of having to convince their peers and others of the value of their favourite ideas and plans” (Sismondo, 2010, p.11). Morris & Ven der Veer Martens (2008) note how these social interactions can result in the formation of distinct groups within the scientific community. For example, “researchers who tend to study the same research topics” will “attend the same conferences, read and cite each other's research papers and publish in the same research journals” (Morris & Van der Veer Martens, 2008). As we have seen, participants mentioned they had established connections with other actors from working with them in the past. The politician, for example, discusses how they met the PMCSA “through a [...] conference”. These social interactions from the past, it seems, were particularly influential in selecting expertise for our present national response.

1.5 Invisible colleges become visible

Sheila Jasanoff (1987), citing D. E. Chubin (1985), notes how “informal networks”, like the ones described so far, can “control the diffusion of scientific knowledge” within the scientific institution (Funtowicz & Ravetz, 1993). These informal networks emerge when scientific actors interact and communicate with one another in professional or publication contexts, resulting in a self-organised community of experts familiar with one another. The term ‘invisible college’ has been used to describe and “emphasize informal patterns of interpersonal contact among scientists” (Zuccala, 2006). Within these groups, interactions between scientists in the process of making scientific knowledge in similar fields tend to be informal as they share ideas and advice through casual exchanges. Over time, then, informal networks across institutions and research centres develop to a point where, as Derek De Solla Price (1963) notes, “everybody who is anybody has worked with everybody else in the same category” (Price, 1963). Professor David Hayman alludes to this culture when he mentions that though he was included in some newly facilitated networks during the emergency response period, “[he] knew of most people” within them.

I use Lievrow’s definition of an invisible college as a social phenomenon where it “is a set of informal communication relations among scholars or researchers who share a specific common interest or goal” (Lievrow, 1989). Earlier in this chapter, I established that my participants (and others like them involved in our response) were driven to get involved in our response out of feelings of responsibility that emerged from shared feelings of concern for the safety of their communities. Their common goal, then, was to protect Aotearoa and its various communities from living the terrifying realities they saw happening overseas. The informality of their relationships to each other, and other people involved in the eventual response, suggests ‘the core group’ were not so much a network produced, as an invisible network made visible.

Where ‘invisible colleges’ are produced tacitly through an understanding that informal interactions between scientists occur, Zuccala states that they can become more ‘visible’ when “scientists are grouped together within a defined boundary, [...] engage in a formal selection process and shared research vision, and participate in mandatory group meetings”. Participants recounted that their eventual inclusion in formal structures – such as through official contracts or the TAG – began through informal processes of reaching out to people they knew. These informal processes involved contacts with Dr Ian Town or phone calls with PMCSA Professor Dame Juliet Gerrard. Professor Hendy recounts messaging Professor Dame Gerrard in order to get information for his colleague, another scientist in the core group, Associate Professor Siouxsie Wiles. Dr Jemma Geoghegan describes extensively using Twitter to connect with people thinking along the same lines as her, and Professor David Hayman mentions that calls initially went out “through the network of researchers saying who’s got what” in order to help set up lab diagnostic testing facilities.

These accounts indicate that there were underlying informal networks between the scientists that formed the ‘core group’, that became visible, and then formalised, through normalised behaviours amongst them. These behaviours included collaborating with each other, communicating with each other and trusting each other not only as expert knowers but also as people that had shared goals and experiences. For me, these underlying networks first became apparent as I was interviewing participants, hearing them name-drop each other without my inviting them to.

Within this context, we can understand the official response network as actually being a pre-formed, tacit network of actors that materialized as the emerging pandemic necessitated their expertise. As the pandemic progressed, this network became formalised.

1.6 “Remarkable consensus”, Plan B, and “the right thing to do”

When we acknowledge that ‘the core group’ already existed prior to the pandemic as an invisible college, we can begin to understand why there might have been what Dr Josh Freeman describes as “remarkable consensus” among scientific actors during the pandemic:

“Not complete consensus - at the margins not so much - but with the elimination strategy and around most of the core sort of acts there's been fairly good agreement across the board. On the direction of travel, where we should be going, and why.”

Professor Dame Juliet Gerrard told me how she “was actually startled when we locked down that all scientists seemed to agree. All business people seemed to agree by the day we locked down”. She then, however, continues:

“As we got out of the crisis the consensus broke, [...] It was unfortunate in my mind that the group that obviously disagreed organised in a very political way and have engaged a PR company [...] So they were very political and outside the general discourse and were clear outliers. Everybody else was pretty much happy to swap notes.”

In their essay ‘Ways in which Australia’s coronavirus response was a triumph, and ways in which it fell short’, Duckett and Stobart identify “the lack of a clear, overarching crisis strategy resulted in a reactive policy approach, featuring confusing messages” as a key failure in Australia’s pandemic response (Glasse, 2020). They discuss how “debate raged between people who argued for ‘herd immunity’...and those who pushed for the ‘elimination’ of COVID-19 in Australia”, led to “tension and confusion about how far Australia’s lockdown restrictions should go” (Glasse, 2020). In comparison to the

“remarkable consensus” described by my participants, the lack of consensus made it difficult for Australia’s public to comply with public health orders.

Aotearoa also saw the rise of a vocal anti-lockdown group dubbed ‘Plan B’ by our media. This group argued that Aotearoa should have let COVID-19 spread through the population to achieve ‘herd immunity’. They have been accused of having beliefs that “only elderly people, or ill people who would die soon anyway, will die from coronavirus”, proposing how “some deaths might be necessary for the greater good achieved from re-starting the economy” (Norris & Stokes, 2020). Participants that were part of ‘the core group’, were quick to distinguish themselves from Plan B. Associate Professor Collin Tukuitonga elaborates:

“There's also been in New Zealand a group called 'Plan B'. Plan B are colleagues of ours who have chosen the Swedish route. [...]I was one of the 60 scientists from the University of Auckland who signed the letter to Ardern saying that we fundamentally agree with her approach and supported the decision of the government.”

In general, participants were vexed at the mention of Plan B and were quick to demarcate the integrity of their ‘core group’ from them in various ways.

Some participants criticised Plan B by criticising the validity of their science. Professor Nick Wilson, for example, explained how in countries like Sweden (whose national strategy inspires Plan B’s argument, as Associate Professor Tukuitonga explained above) “hardly 10% of the population have been infected” where the herd immunity strategy “requires 60% of the population to be infected”. Professor David Hayman, too, told me how he emailed one member of the Plan B group after their interview on the national radio channel, Newstalk ZB:

“So in principle [...] I'm quite sympathetic to people not wanting to shut down the economy[...] I do have a slight problem with... So some of the ways information has been presented. Very recently, one person from that team went on Newstalk ZB and I listened to the interview and listened very carefully, and the lowest mortality figure that the person gave is effectively not possible. [...] I'm not saying the numbers on mortality are right in the US – they're wrong, all the numbers are wrong – but they can't be so wrong by that order of magnitude, and that being presented as a kind of fact to the public through a radio station that's listened to by half a million people, that's an issue for me.”

Another participant, an infectious disease epidemiologist, questioned how groups like Plan B reach their final conclusions:

“One thing is that they seem to be people who think that coming out of left field with something that nobody else has thought of is the way that you are clever. Whereas actually, if you are in a field and there's a huge body of knowledge and a lot of clever people who are working on it, the possibility that you as one person with a way left field idea is right and they are all wrong, it's not zero, but it's quite low, you know. So, people who think that they are coming out with a sort of wild card makes them clever I don't have a lot of tolerance for.”

For these scientists, their rejection of Plan B is about the integrity of the scientific knowledge Plan B promoted. While acknowledging that a scientific “proof” is in general imperfect in that it is contingent upon using statistical assessments of patterns in an imperfect world to represent reality (“all the numbers are wrong – but they can't be so wrong by that order of magnitude”; “it's not zero, but it's quite low”), these participants see the Plan B

group's science as having no rigor, and therefore, no integrity. In this case, it is their *science* that is given no credence.

Other participants criticise Plan B by criticising their expertise. Dr Jemma Geoghegan, for example, identified that they did not have *relevant* expertise while being unsure of what exactly they did have expertise in:

“So, for example the Plan B people have expertise in... what is it, nutrition or economics, or something? So, you know if it was me I wouldn't be commenting on a viral disease if I didn't have knowledge of a viral disease. So yeah I do think people need to remain a bit humble. You know, stick to their area of expertise”

The epidemiologist mentions how the reputations of some members of Plan B have been called in to question even within their own fields:

“The Plan B people... I mean these are not epidemiologists who are massively well respected within the fields they work in by the experienced epidemiologists who work in those fields. Some of them more than others. I don't work in any of their fields and I don't know them well, but I do know I've heard people going “Oh God!” with some of them – not all of them – but with some of them”

Interestingly, Dr Sarah-Jane O'Connor, Senior Advisor at the Science Media Centre whose personal opinion was also that Plan B were commenting outside of their expertise, mentioned how some of their members had been called upon by the Science Media Centre for commentary in the past, elaborating on the nuances of expertise and public discussion of science that Dr Geoghegan alluded to earlier:

“We know this group well from some of their other work which is within their expertise[...] So it was surprising to see them coming out on this [...] So they were people that we are we are aware of their expertise that we have gone to on sugar taxes and sugar-sweetened beverages, and that kind of

thing. They were not on our radar at all for COVID because that's not their area”

She identifies that there are ethical dimensions to being a science communicator, questioning whether Plan B had considered these:

“And that's something that can be quite tricky to navigate - scientific experts in general. So the Science Media Centre, we do encourage experts to talk more broadly than, you know, their one particular area that their PhD was on[...]So it's that kind of, yes, you're expertise is broad, and universities have academic freedom, it's enshrined in the Education Act, so they can say whatever they want. But there are some limits that I guess are self-enforced within academia. You still need to be responsible for what you're saying.”

Her concern for the values driving Plan B’s argument are shared by other participants like Professor Dame Gerrard who was obviously concerned by their political associations and connections to a PR company. Professor Sean Hendy also compares the values of ‘the core group’ to Plan B’s values:

“If you look at the Plan B group, and the sort of mainstream science response, the Plan B group – they haven't taken an equity lens. They’ve very much taken a personal freedom lens. The kind of underlying value for them is that it's wrong to take away the rights of many to spare a few. Whereas I think for the people who had been working in the mainstream response, that’re interested in combating infectious disease, they understand – and their beliefs are, as well – if you can't solve the problem of infectious disease, at least we share the burden equally. *And that's the right thing to do*”

From a country that did pursue the ‘herd immunity’ strategy promoted by Plan B, University of Sweden researchers Giritli Nygren & Olofsson (2021) note that competing ideologies of *herd immunity* and *herd humanism* played out as key interpretations of the Swedish response. They note how the Swedish herd immunity strategy “was constructed as

having sacrificed the life of the elderly in pursuit of herd immunity” (Giritli Nygren & Olofsson, 2021). Quoting a (translated) media article in Sweden’s largest morning newspaper, *Dagens Nyheter*, Ekström & Löfqvis observe that within the goals of the herd immunity strategy, despite their high susceptibility to COVID-19, “the principle of equal value does not seem to apply to the elderly” as they were publicly identified as a social group being “sacrificed for the greater good” (Ekström, 2020).

By stating that taking an equity lens is ‘the right thing to do’, Professor Hendy ethically justifies the version of science he was advocating for, constructing it as legitimate. In doing so, he co-constructs Plan B’s science as flawed by exposing their lack of awareness for the wider – inequitable – implications of their strategy, allowing him to not only insinuate that Plan B’s ethics had shortcomings, but that those ethical shortcomings simultaneously challenged the empiric legitimacy of their claims as they restricted the scope of what factors Plan B were including in the making of their claims.

In their accounts, then, my participants demarcate the validity of their own science by openly discrediting the validity of Plan B’s. They do this by challenging the legitimacy of Plan B’s knowledge, doubting the relevance of their particular expertise and questioning their intentions and values.

These methods of demarcation are all cited by Thomas Gieryn as mechanisms through which scientists distinguish themselves from perceived non-scientists. In his theory of boundary work, Gieryn posits that scientists gain epistemic authority over other epistemologies by distinguishing themselves in ways that are favourable to whoever they are trying to convince – usually a public or a government. For example, 18th century anatomists challenged the empirical methods of phrenologists, contesting their expertise by accusing

phrenologists of relying on popular opinion while questioning phrenologists' intentions by exposing their political and religious intentions (Gieryn, 1983). While social realities have undoubted complexity beyond the neat superimposition of two scenarios, my data shows how scientific participants in 'the core group' of our response employed similar tactics to distinguish their expertise from Plan B's. By contesting Plan B's empirical basis, their expert reputations and their intentions, participants worked to justify their own inclusion in our response as "*the right thing to do*".

Where science might be considered the dominant authority in modern knowledge making, Gieryn's theory of boundary work acknowledges that historically, scientists have had to demarcate themselves from other knowledge forms – such as religion – to gain authority over this intellectual turf (Boulding, 1980; Gieryn, 1983). Modern science can however be understood as heterogenous – as conversations with my participants indicate, different scientists see themselves differently, have different connections and different goals and intentions. Overall, participant accounts have shown how various actors construct their ideas of science distinctly, and then tend to gravitate towards others that share their perceptions. Where I discussed how one invisible network of scientists was made visible by the emergence of the pandemic, I acknowledge that there are probably other invisible networks of scientists in Aotearoa that are connected to each other through their own sets of intentions, goals and beliefs. The Plan B group seem to be one such group whose invisible college was also made visible by the pandemic, though not because they were being included in the response. Part of Plan B's visibility came from scientific actors in 'the core group' publicly distinguishing 'the core group' from them.

Participant dialogue therefore indicates that a significant portion of their boundary work during the pandemic was not necessarily to prove the worth of science against other knowledge forms, but to prove the worth of *their* science against *other versions* of science.

They did this by convincing non-scientific actors, such as politicians, to trust their credibility, using connections they already had to people in other institutions to expand their reputation and trustworthiness within those institutional spaces, by communicating that their intentions and goals were in line with other non-scientific actors' goals while exposing that other scientific groups' goals weren't, and by using their reputations as experts to discredit the science and expertise of other scientific groups.

Part of their work was also historical – it was in the strengthening of their invisible, informal network over time and in the work done to connect those networks to government institutions, for example through people like Dr Ian Town and Professor Dame Juliet Gerrard, not to mention through their roles as casual advisors and friends to politicians.

1.7 Chapter conclusion

In this chapter, I have explored why my scientific participants, members of 'the core group', were included in decision-making processes that determined the formulations and outcomes of Aotearoa's national response while another visible scientific group with different epistemologies and goals were not. I conclude that this was because an 'invisible college' had already formed prior to the pandemic through formal and informal interactions in professional settings. As the pandemic emerged, and key actors like Chief Science Advisors connected with people they already knew, this invisible network gradually materialised into the network of scientific actors that made up who Professor Hendy called 'the core group'.

In the next chapter, I will explore how this ‘core group’ of scientists interacted with political actors at the science-policy boundary through a shared understanding of the SARS-CoV-2 virus as a boundary object. I argue that a specific rendering of this boundary object by science advice-giving actors helped justify the inclusion of scientific actors in the response while advancing both scientific and political incentives and facilitating public compliance. Through this argument, I attempt to highlight how influential this core group of scientists were in formulating the policies and outcomes of our response.

2 Chapter 2. SARS-CoV-2 at the Science-Policy Interface

In the previous chapter I alluded to how participants justified the labelling of our response as ‘science-based’ using two rationale – because it included scientific experts in decision-making, and because science was used to inform decisions. I explored how that first rationale came about (it was facilitated by informal, established connections to other scientific and political actors). In this chapter then, I investigate what it means to have science “inform” decisions.

How did scientific actors gain access to scientific knowledge about COVID-19? Was it difficult to interpret that knowledge? How did they interpret it amongst themselves as a community with unique skills and established cultures? And how did they use it to ‘inform’ politicians of the COVID-19 scientific landscape? These were the questions I set out to answer.

In this chapter I will argue that scientific participants accessed information about COVID-19 informally, through social media, and formally, through early scientific publications. While rapid knowledge making about COVID-19 made it easier to access that knowledge, I argue that the ballooning scientific publication landscape complicated scientific participant attempts at interpreting that knowledge. I then recognise how scientific participants incorporated their uncertainty from that experience into the way they rendered the SARS-CoV-2 virus for their own understanding and for shared political understanding before exploring the implications of these renderings on our wider response.

2.1 Cautious scientists

As described in the previous chapter, pre-existing informal networks were eventually formalised into official scientific decision-making structures, like the Ministry of Health's COVID-19 Technical Advisory Group, with the emergence of the pandemic. Once these networks were formalised, however, a political participant describes that tensions emerged in collaboration attempts between scientific and political institutions. This participant told me that while “around the table there are people who generally think science is very important”, and “there is a general view [amongst politicians] that we need to read and understand the science and have scientific input” as a starting point, they also felt that “through the whole period, the science was too slow”. “Scientists”, they told me, “were much more cautious than the politicians and if we had waited for scientists to be sure about the way we needed to act, we would not be where we are today in terms of our COVID response”.

Before I expand on these science-policy tensions, I'd like to use my scientific participants' accounts of early information gathering to give context to why scientists may have approached these decision-making circumstances with cautiousness.

According to Dr Josh Freeman, an essential part of being a scientist means that “when you're looking at the scientific literature, you've got to look at everything”, and “you've got to look at everything in context”. This means taking a committed, thorough approach to assessing scientific literature about whatever your object of study is. But what if your object of study is a brand-new virus that nobody knew anything about before? And what if increasing demand for instantaneous knowledge about that brand-new virus facilitates the emergence of a knowledge production culture that bypasses traditional means of evaluating the credibility of the knowledge being produced?

2.1.1 Responding to the disease its revealed to be

In the very early days of the pandemic, the World Health Organisation (WHO) were a key international information disseminator. Established in 1948, the WHO is “the directing and coordinating authority on international health work”. During the pandemic, it’s role has included “gathering and analysing data from around the world, supporting clinical trials on drugs and vaccines, and providing technical guidance to countries” (Agartan et al., 2020). As a significant information disseminator, it provided formal disease outbreak guidance packages and mission reports from Wuhan throughout January. Dr Josh Freeman, who was involved in setting up COVID-19 diagnostic testing in Aotearoa, claims that “the WHO mission report was quite influential in our thinking early on”. Informally, the WHO also regularly updated its various social media platforms, including Twitter – on which it publicised the genome sequence of the SARS-CoV-2 virus for subsequent scientific use. Dr Jemma Geoghegan, who came to lead Aotearoa’s genome sequencing project, notes how people (including scientists) on “Twitter sharing stuff” was influential in enabling access to early information and “shar[ing] scientific methods really quickly”.

Associate Professor Collin Tukuitonga, who once worked for the WHO and has since maintained his interest in its work, used information shared by them to shape how he made sense of the virus and its transmission around the world:

“I’d seen this material from WHO about the origins of the virus in China and how it was spreading, and it seemed to me at the time it was pretty inevitable that we were going to be affected.”

Early in the pandemic, Associate Professor Tukuitonga was therefore already linking scientific information about the virus, such as its transmission rate (R_0), to potential socio-political implications. In the last chapter, I described how he was especially thinking about

how this transmission of the virus might implicate Pacific Island communities in Aotearoa and in the next chapter I will expand on that.

Associate Professor Siouxsie Wiles was on holiday in the UK when she first heard of the virus through WHO updates on Twitter:

“ So, I was on holiday actually from about mid – mid-December to mid-January in the UK, and I was trying to mostly switch off from stuff, and so about, I think, was in -- so in early January, I started hearing about this unknown pneumonia in China and it's a sort of thing -- so on Twitter, I follow a lot of scientists. You know, I get all sorts of kind of alerts around the WHO and stuff.”

Dr Donna Cormack also used Twitter as a resource to get information about the virus in the early days, though not just for scientific aspects of it:

“So I use Twitter quite a lot, and a lot of researchers that I follow, we work with people in the UK and I guess the UK was sort of a little bit ahead of us in terms of the outbreak. So racism and health equity researchers in the UK were kind of starting to raise issues around what was happening in the response, or lack of response, there.”

While Dr Wiles, who is herself a scientist and describes following lots of scientists on Twitter, Dr Cormack described herself as a health equity researcher with a social science background in our interview, so it is notable that she describes following lots of *researchers*, broadening the scope of who she might be following beyond just scientists. This meant she was getting nuanced insights into social aspects of how COVID-19 was playing out overseas. As much as scientific participants were looking at “everything in context,” as Dr Freeman expressed was necessary, Dr Cormack’s background as a social researcher broadened her

scope to do that. I will expand on how social knowledges can help situate and improve scientific understandings in the next chapter.

Another health practitioner and researcher mentioned using the social media platform Facebook as a resource to get information specifically about early Indigenous experiences of COVID-19 from somewhere closer to home:

“Certainly, looking to Australia, reaching out to our Indigenous colleagues in Australia... And it might have even just been on Facebook sometimes. It was just the stories of what they were seeing, and just knowing 'ok that's what's happening there, we need to make sure that we set up’”

The ability to gain access to “factual material, timely updates and relevant advice” has been recognised as an advantage of early information dissemination on social media, where the rapid sharing of accredited information from reputable organisations such as the WHO, who have made their social media presence “an integral part of their communications strategy”, played a critical role in giving the public, scientists and medical practitioners insights into each other’s experiences of the early pandemic (O’Brien et al., 2020).

Participants were not solely relying on social media to access information, of course. Participants had to improve their scientific literacy about the newly named SARS-CoV-2 virus and COVID-19 disease if science was going to be a key input in our response. Dr Caroline McElnay speculated that the reason our response turned to a science-base in the early days of the pandemic was because “it was a new thing”. “Particularly in the early days we didn't really know what this new virus, what the potential of this new virus really was,” she stated. Her sentiment is shared by Prime Minister’s Chief Science Advisor, Professor Dame Juliet Gerrard:

“I think it was just a brand-new virus. I mean the PM kept saying ‘there's no playbook for this’. It's not like flu where we understand the flu - we know

what flu does. We know its side effects, we know there's good ones and there's bad ones. There's a deep understanding in the medical profession of influenza, or measles. [...] But for COVID we didn't know. It was a brand-new disease. So, it was the scientific community worldwide that was revealing what the problems were and therefore providing the tools. So, I think without the science voice you get a weaker response because people are responding to the disease they think it might be rather than the disease it's revealed to be.”

Professor Dame Gerrard indicates that knowledge produced and published by the worldwide scientific community helped *make sense* of the virus, the disease, and the way they could interact with society

Participants mentioned regularly keeping up with the scientific literature to make sense of these things themselves. Dr. Donna Cormack, who I mentioned was originally using Twitter as a source of information, soon began accessing papers from open access journals before publishing really took off. She says,

“There wasn't very much in those first few weeks, but [I was] kind of trying to follow along. It was a lot easier, I guess, though, in those first few weeks because you could kind of keep up with that, and then suddenly in about May it became overwhelming, so you couldn't read all the articles.”

An epidemiologist shared a similar experience:

“And I mean initially I was reading the papers that were coming out but very quickly that became impossible to be across the literature because there was just so much of it.”

Dr Josh Freeman told me how a month before our interview he tried to check up on some of the literature:

“I looked on PubMed, entered COVID-19, and there's something like 38,000 hits for papers, and that's over a month ago. It wouldn't surprise me if it's close to double that now.”

Prime Minister's Chief Science Advisor Professor Dame Juliet Gerrard attributes the explosion of scientific publishing about COVID-19 to “a huge degree of urgency” for information about the virus. Decision-makers needed to make decisions “faster than normal because the virus was moving faster than the government processes”. This demand resulted in an international boom of information. But as Sun-ha Hong (2020) proposes, having access to an overwhelming amount of information “does not create the informed, rational, and deliberating public that it assumes, but actually obscures what can be reasonably known by the individual” (Burton, 2020; Hong, 2020). A total of 2062 journal articles and 1425 preprint publications have been identified as coming out of the first three months of COVID-19 publishing, with contributions from up to 73 countries. In March, the days leading up to Aotearoa's Level 4 Lockdown, up to 51 papers were being published per day (Nowakowska et al., 2020). Aotearoa's scientists, who we must remember were at the same time going through processes of being recruited into the COVID-19 response network, were additionally having keep up with this tremendous literature growth to fulfil expectations of them to deliver rigorous science advice. This adds complexity to Dr McElnay and Professor Dame Gerrard's assertions that, as much as scientific knowledge was seen as a “tool” that could be helpful for understanding what the disease was actually revealed to be, the overwhelming publication environment actually made achieving that understanding a challenge.

In recognising that overwhelming publication environments “obscure what can be reasonably known” (Hong, 2020), we can begin to understand that Aotearoa's scientists that were involved in decision-making processes with politicians were cautious in these spaces

because they had reason to be uncertain about the knowledge they were employing. The publication environment during the early pandemic produced too much literature for scientists to be able to feasibly “look at everything” and “look at everything in context”, as Dr Freeman recognised as being key to the scientific process. Scientists were therefore having to come to terms with knowing that there was a lot they didn’t know and couldn’t know.

2.1.2 Peer review

Professor Dame Juliet Gerrard described how, within the decision-making processes of the early pandemic, mechanisms “carefully set up to make peer-reviewed quality decisions” had to be disregarded, as “some of the decisions just had to be made faster than normal because the virus was moving faster than the government processes”. “So the formal mechanism for an emergency is something called ODESC”, she said, referring to the Officials Committee for Domestic and External Security Coordination which manages Aotearoa’s national security in both governance and response situations (DPMC, 2020). Professor Dame Gerrard explained that in the formal mechanism, “all the relevant chief executives get put in a room and it's like ‘okay we need an all of government response to this emergency’” where “you feed into that ODESC, and then the actions filter out”. But with COVID-19, “because we were having to completely lock down the country and shut the borders at crazy speed, a lot of the actions weren't formally going through those mechanisms”. Her account provides a description of how typical political procedures of allocating credibility were being compromised within the science-policy space.

Typical scientific procedures of allocating credibility were also being compromised in this space. As the seriousness of the spreading disease began to properly register with international scientists, another issue in the emerging publication environment was the issue

of evaluating the legitimacy of scientific knowledge being produced. Dr Freeman noted how journals “were publishing things everyday, a lot of which was creating a lot of confusion - it wasn't being subjected to the normal process of peer review”.

Traditionally within science, the legitimacy and credibility of scientific knowledge is established partly through the process of peer-review. Sheila Jasanoff, a notable scholar in the field of STS research, has noted how this process is especially compromised within the science-policy regulatory space as “the structural features that define and motivate peer review in other settings [...] are absent in the regulatory context” (Jasanoff, 1987).

Professor Sean Hendy and his group group Te Pūnaha Matatini provide an example of having to adapt to these compromises. His group were involved in providing scientific modelling information to the government, but found that time pressures meant they couldn't rely on traditional methods of authenticating their data. Instead, they had to set up an approximate version of the peer-review process to compensate:

“What we did in the end was set up informal peer review panels. So, within TPM, we set up a couple of different panels who could look at our work and give us- not formal peer review, because it wasn't blind peer review. But we could get a second set of eyes on the work [who could] try and tell us if we made any crucial mistakes. It also turned out to be quite important for the direction that we took, and some of the work as well, the response we'd get back from some of our peer reviewers. Yeah, so that's how we kind of managed that trade-off between transparency and making sure you're not putting out stuff that's wrong.”

Jasanoff has recognised that “distinctive issues of credibility, legitimacy, risk and benefit arise” for scientists acting in science-policy contexts. This is especially true in a pandemic when “the knowledge needed for action is rarely definitive and the safety and well-being of many lives may hang on acting in time and acting well” (Jasanoff, 2011). My

scientific participants assert that in this space, it was impossible to achieve sound science, as they knew it, through the means they were used to. They had to instead adapt and exercise what Professor Dame Gerrard described as “the precautionary principle”. Scientific participants’ discomfort about the scientific knowledge they were producing or interacting with speaks to contentions in STS studies that highlight how science does not “provide a direct route from nature to ideas about nature”(Sismondo, 2010, p57). Ideas about nature are instead validated by social means. Methods like peer review, pertaining to the social landscape of science, are part of the work typically done by scientists to make scientific claims become important (Sismondo, 2010). Where the influence of this work on knowledge claims might be taken for granted under non-pandemic contexts, a pandemic context that compromised their achievability made their influence salient to participants.

2.2 Trying to convert science into policy

I return, then, to the politicians account of feeling frustrated at having to interact with “cautious” scientists whose “dithering nature” meant that they often “tr[ie]d to have a quid each way on things... to the frustration of politicians”:

“So, it was really up to, you know, the politicians to read the science, reach their own judgements and move ahead of it. And I think we’d really struggle to find a case where the science didn’t reach there eventually. But the scientist’s instinct is to always say well ‘we need more research’, and ‘we can see that something’s happening here but this hasn’t been peer-reviewed’, or ‘we don’t know what’s causing that effect so we can’t make a firm recommendation to you’ and that caused lots of frustration on behalf of the politicians who wanted answers, and who wanted to be able to act with some confidence – with scientific backing, and essentially that’s meant a great deal of pragmatism, and the politicians having to make judgements on the balance of what they themselves already were reading because [the scientists weren’t] confident to tell them”

Here, the politician refers directly to scientists' apprehension about making un-peer-reviewed claims. They stipulate that decisions made by politicians in Aotearoa, though technically scientifically un-peer-reviewed, were eventually proven to be scientifically valid once the science eventually caught up, stating that "the public has seen that we've taken the "right decisions" (in quotes marks in case your recording doesn't pick that up)". The politician therefore challenges whether traditional processes of legitimizing scientific knowledge are useful in science-policy contexts. By pointing to how decisions made by politicians without scientific confidence were eventually proven scientifically sound, they highlight how there are shortcomings to these processes that enable challenges to the legitimacy of science's place in decision-making spaces.

Sheila Jasanoff acknowledges that while "it cannot be questioned" that "science is necessary for making sound policy decisions in modern societies" (Jasanoff, 1987), the nexus between science and policy emerges as a key contested boundary "not merely because the science is indeterminate, but because the effort to make such distinctions is politically charged". In this space, multiple actors attempt to leverage what are supposed to be joint goals to meet their own expectations. It is therefore unsurprising that tensions arise. As the politician explains:

"trying to convert science into policy, that nexus was a point of frustration [...] I just think some frustration that scientists didn't have all the answers at times. Or sometimes were unwilling to make judgements because of the responsibility that it might carry".

Some of my participants refer to these responsibilities, specifically in terms of how their presence in decision-making circumstances could easily be exploited by politicians. "If it all goes pear-shaped, they can blame the experts!", laughed one epidemiologist, citing how in the UK,

“they got this big committee together, [and kept] saying ‘we’re just following the science’. You know, the scientists would tell them stuff, and they didn’t necessarily always get it right. And then when things went wrong they would say ‘well we followed the science.’”.

Professor Sean Hendy re-iterates this concern. “There is also the potential for politicians to throw scientists to the wall”, he told me.

Jasanoff designates this contested space where science and policy interact upon a shared turf as a ‘trans-science’ territory (Jasanoff, 1987). Trans-science is a term coined by Alvin Weinberg (Weinberg, 1972) to distinguish how science exists in policy settings differently from how it is understood in traditional scientific cultures. Jasanoff expands on this by stating that “policy-relevant science comes into being in a territory of its own that is subject to neither purely scientific nor wholly political rules of the game”(Jasanoff, 2011). The politician, for example, describes it as a “real tussle to get the advice we wanted”, saying that they “had to push officials really hard to get a really clear rationale”, which they told me went against their political instinct, which was to act quickly in response to fast-paced changes:

“It felt like a lot of the advice we got that science informed said, you know, ‘we just have to wait a little bit longer till we understand this better to best advise you’ and it just didn’t feel like we had a little bit longer so we made decisions.”

Political cultures were therefore being challenged by cautious scientific cultures. And as I mentioned earlier, traditional scientific cultures, such as the peer-review process, being challenged by the fast-paced demands of politicians at the same time.

In initiating a relationship with each other, scientific and political actors commit to engaging in decision-making processes within a territory, the trans-scientific space as I will call it from now on that was unfamiliar and tense for both agencies as they sought to work

together while simultaneously attempting to assert the legitimacy of knowledge claims over each other.

2.3 “Finding out stuff and then finding out it was wrong”: Delivering science advice

Dr Caroline McElnay explained to me that the role of the Ministry of Health was to “seek the advice, collate that advice, [and] interpret that advice for our politicians”. Getting that advice first involved scientific actors seeking scientific information, collating that information and interpreting that information, however. This meant scientists were having to construct order from the chaos of the publication environment (Latour et al., 1986).

Sociologists of Scientific Knowledge have recognised various tactics scientists use to do this, one of which is through the use of working objects.

Daston & Galison (1992) use the term ‘working object’ to describe the way scientists render “unrefined natural objects” as “materials from which concepts are formed and to which they are applied”. Working objects are used by scientists to represent “the sector of nature under investigation”(Daston & Galison, 1992). In this case, we might understand the SARS-CoV-2 virus as the working object that represented the wider pandemic that was under investigation. Parikka (2020) postulates that in collaborative, multidisciplinary contexts, working objects can “enable formalizable knowledge” that have a sense of a “hybrid agenda”, when they are rendered to refer to a variety of material and social contexts (Parikka, 2020).

By wading through and collating information from an overwhelming scientific publication landscape, scientific actors in our national response were engaging with scientific literature and using scientific tactics to render the SARS-CoV-2 virus an object of science. In rendering the virus a *scientific* object, they exclude politicians from being able to understand it without scientific help. If we remember from the last chapter how scientific participants were initiating relationships with politicians themselves, we realise that in constructing the

virus in this way, they were necessitating their help in the decision-making process. By making their place in the decision-making process necessary, scientists ensure that their own visions and interests can be advanced.

This adds complexity to the politician's account of feeling frustrated with cautious scientists. On the one hand, they saw scientists' attitudes as unhelpful, but on the other hand their help was necessary.

But despite their expressions of frustration at cautious scientists, the politician actually mentions how the government themselves took a cautious approach to a COVID-19 related situation:

“Our cautious approach to bringing people back from Wuhan, setting up a military facility and so on, all of those actions played out very publicly and proved to be the right ones in hindsight”

Prime Minister Jacinda Ardern, too, described how “from the beginning we have taken an extraordinarily cautious approach at the border” (RNZ, 2020), speaking in June 2020, and again, in February 2021, used an explanation of “what we believe the cautious approach requires” to justify a 3 day alert level change as “the right thing to do” (Menon, 2021).

As much as the politician complained about cautious scientists, there seemed to be a shared culture of caution within the trans-scientific boundary. I argue that this shared approach to the pandemic was also a consequence of scientific rendering of the SARS-CoV-2 virus.

When discussing how they interacted with scientists within the trans-scientific space, the politician touches on some of the ways scientific and political actors “worked through things”. One of these involved encouraging science advisors to give them their understanding

of a variety of options, “*including* [the] cautious, conservative approach” they expressed frustration at.

Professor Dame Juliet Gerrard and her office were involved in providing direct advice to politicians about the scientific landscape at the time, and about understandings of the virus. “So one of the things I could help with was how to distil the summary of the evidence so it was simple but still correct”, she explained.

Her experience of providing science advice during the pandemic involved specifically curating understating of the virus for usability in pandemic policy making. “The big challenge was we were finding stuff out, and then finding out it was wrong”, she says. Her office dealt with this issue by delivering a range of advice that would specifically apply to relevant contexts. They chose to *incorporate* the possibility of information being wrong into the knowledge they were delivering. For example, in our interview, she held up a document depicting a table of scientific advice they were passing on, featuring the level of confidence they had in it, and “all the things that changed every week” which they’d “update as often as was useful”. For example, just after the stage where there had been the possibility of containment in China, they’d updated this document with information about the possible “remaining scenarios”. Additional to delivering a range of scientific advice for various possible situations, they would deliver advice in ways that acknowledged how some of the information that advice was based on could be false – for example using phrases like “if that’s true then...” or “if that’s not true then...” etc.

Her recount of delivering scientific advice about the virus suggests that part of science advisors’ role in the response was to take the scientifically rendered virus and do further work on it to render it in a way that facilitated shared understandings between scientific and political actors who would need to continue using that conceptualisation of the virus over the

course of the pandemic. Instead of telling politicians what to do outright, science advisors used their specialised skills in science –interpreting the jargon-rich communications of the scientific community – to help politicians understand the virus in a way they may not have been able to on their own. Where the SARS-CoV-2 virus was rendered as a ‘working object’ to get scientists *into* the decision-making process, it was then rendered by science advisors as a ‘*boundary object*’ to justify their place in it.

Star & Griesemer (1989) first characterised boundary objects as “objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across site. They are weakly structured in common use, and become strongly structured in individual site use. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation”(Star & Griesemer, 1989). The way the boundary artefact is constructed can be crucial for achieving the goals of collaborating groups doing joint work (Rajão, 2011). As Chien (2013) recognises, a boundary object can facilitate an understanding of how multiple interest groups are intertwined in a given scenario which “legitimize[s] participation by all agencies in knowledge and policy construction” (Chien, 2013).

Hellsten and Nerlich (2010) identify how boundary objects facilitate interactions between collaborating groups by serving “as translation tools across various subsystems, or discourses in society”. Their research found that the conceptual framing of “bird flu” H5N1 avian influenza as a potential pandemic “functioned as a boundary object” that enabled general discussions about the threat of new influenza pandemics, enabling increased allocation of research funding into biomedical research (Hellsten & Nerlich, 2010). In constructing boundary objects, scientists not only justify their place in decision-making

processes, they get the opportunity to promote understandings of circumstances in a way that can advance their own interests.

When Professor Dame Gerrard's team used their "precautionary principle" to render the virus as uncertain and unpredictable, they highlight the deficit of knowledge about it rather than the overwhelming abundance of it that scientific actors were dealing with. I argue that rendering it this way allowed them to (implicitly) promote an agenda calling for improved government support for scientific research in Aotearoa. I also then argue that this rendering was picked up by politicians not merely because boundary objects can facilitate shared understandings, but also because this rendering was useful and desirable for advancing political interests. By rendering the virus unpredictable, politicians could designate it ungovernable. Since the virus was ungovernable, this justified political governance of the public instead.

2.4 The unknown virus

Multiple participants expressed concern at the lack of government support for infectious disease research in Aotearoa. One epidemiologist lamented that "when the Science Challenges were devised, Peter Gluckman [the previous PMCSA] [...] explicitly excluded Infectious Diseases from being one of the science challenges. Frankly, that was a big mistake in retrospect". They continued:

"There's been a widespread view amongst a lot of researchers that we don't need to worry about infectious diseases in New Zealand - we've got them beaten, we've got antibiotics, what's your problem? Infectious disease epidemiology is minute in New Zealand. I mean a tiny number of people under normal circumstances would consider themselves to be infectious disease epidemiologists. There's not much funding, there's no science challenge and also, there's no Centre of Research Excellence that focuses on infectious disease epidemiology and response."

Professor David Hayman, speaking to a question about pandemic preparedness, also mentions being involved in plans alongside Professor Michael Baker to “try pull together a CORE Centre of Research Excellence around this”.

The above epidemiologist recognises how the lack of support for such entities are politically conditional:

“Public health, if it's working well... nothing happens. And politicians are not exercised by nothing happening. Politicians don't go ‘oh my god nothing's happening, let's give them more money because you're doing such a great job with making nothing happen!’”

Since a pandemic is inarguably a circumstance where ‘something’ (to use the epidemiologist’s framing) happens in public health, it gave scientific actors an opportunity to engage politicians in their concerns. Here, their intention is for politicians to recognise the threat of infectious diseases and therefore the necessity for infectious disease research in Aotearoa.

Professor Dame Juliet Gerrard, for example, also described how her team, when delivering scientific advice, “erred on the side of caution”, because “our pandemic preparedness was seen to be not particularly good, and our scientific expertise wasn't very well-organised” as “[there was] no Centre of Excellence in infectious disease or anything like that. So, we were set up to not do so well”. She directly links the lack of an infectious disease research entity in Aotearoa to her team’s method of delivering science advice. As I explained earlier, this method involved highlighting the inherent uncertainty of the virus’s potential when constructing an understanding of it for scientific and political actors.

Highlighting its uncertainty meant highlighting an area where there was a deficit of research understanding. The lack of this research understanding was linked to pandemic unpreparedness by people like Professor Dame Gerrard. People like Professor Hayman were

then involved in drawing attention to that unpreparedness as a way of persuading government to improve support for research in an area that was perceived as being neglected, especially by participants in infectious disease research.

Rendering the virus as an object inherently fraught with uncertainty was therefore an act of boundary work by scientific participants and their colleagues to advance political support for their institutional concerns.

As Gieryn notes, boundary work is often done by scientists to promote agendas that are usually part of a struggle for authority, power, and resources (Gieryn, 1983). Scientific actors implemented their authority of the SARS-CoV-2 virus to necessitate their inclusion in COVID-19 response decision-making. This inclusion gave them access to political power which facilitated an opportunity for Aotearoa's infectious disease researchers to (tacitly) persuade government into allocating support their way.

It seems, too, that they made *some* gains. For example, the politician conveyed to me their “expect[ation] that the Ministry [of Health] will become a population health Ministry”, explaining that as much as “memories are short”, they think that “for a period of time people will be quite alert to the dangers of the public health area”.

As I mentioned earlier, boundary work done to achieve these gains usually involves promoting scientific ideals in a way that can be seen as useful or desirable for politicians too,. Scientific actors needed to construct the SARS-CoV-2 virus in a way that politicians would favourably co-opt. I argue that, as much as highlighting the uncertainty of the virus promoted scientific agendas, it also facilitated political agendas by enabling an understanding of the virus as ungovernable. This understanding justified political governance of the public instead. The interactions and movements of the virus could not be controlled, so the government resorted to controlling the behaviours of the public.

2.5 The ungovernable virus

The politician explained to me that a key aspect of decision-making involves recruiting public support for decisions that are made:

“The challenge for politicians is to take the public on a journey to make sure they have confidence in the decisions that are made and that involves making good decisions and good decisions are often science-based”

That science *should* be involved in decision making is a perspective shared by Professor Sean Hendy:

“So people expect there to be science to back up out what's going on, and certainly a media and the Opposition Party expect there to be science behind decisions. So there's an expectation that science gets used.”

Funtowicz & Ravetz (1993) assert that this attitude, where “the rationality of public decision making must appear to be scientific” is a tradition that stems from “a universal assumption (however superficial and laced with cynicism) that scientific expertise is the crucial component of decision making, whether concerning Nature or society” (Funtowicz & Ravetz, 1993). Dr Josh Freeman speaks to this with his contention that “a big part of addressing [environmental issues and social issues] needs to be grounded and rooted in some sort of scientific enquiry” because “science allows us to make predictions about the consequences of our actions or predictions about the future based on processes that are already in play”.

In this quote, Dr Freeman refers to two types of predictions that can be made: predictions about how our actions can influence the future and predictions about how existing, assumedly natural, processes can influence the future. I have already established that scientists involved in COVID-19 response decision making designated the virus as relatively *unpredictable*. Science therefore could not predict how its behaviours would play out in the

future. The unpredictability of the virus rendered it ungovernable. The ungovernability of the virus meant that instead, the public was the entity to be governed.

Science was therefore used to predict how *human* actions could influence future outcomes. For example, a selection of early modelling reports delivered to the Ministry of Health – many of which include the mahi of participant, Professor Nick Wilson – provide scientific rationale for things like border interventions that would restrict public movement in and out of the country, self-quarantine for incoming travellers and a full set of major control measures. An initially confidential report authored solely by Professor Wilson's models predicted what a worst-case scenario situation would look like in Aotearoa if elimination failed (Wilson, 2020).

Returning to an earlier used quote, the politician remarked that early in the pandemic, during peak uncertainty, politicians had to “reach their own judgements and move ahead of [the science]. And I think we'd really struggle to find a case where the science didn't reach there eventually”. The scientific rendering of the virus as unpredictable and ungovernable was therefore useful to politicians because it justified their pre-conceived notions that restricting public movements and behaviours were necessary.

This specific construction of the virus encouraged a kind of prepared reactivity – scientific advisors considered the possible scenarios and gave advice on what could happen in each. However the virus's movements played out, politicians had some kind of preparation for what to do in each scenario. These preparations were made using approaches politicians were already familiar with – governing publics – rather than as an approach to governing a virus.

2.6 “It’s not normally played out in the public”

As I referred to earlier, the politician discussed how “the challenge for politicians is to take the public on a journey to make sure they have confidence in the decisions that are made”. They mentioned that one of the ways they opened their decision-making processes up to the public was through the typical procedures of parliament:

“My early answers to oral questions in parliament were basically that we were going to take the advice of the science. You know we're going to do this on the science. Because it became clear that it was about to become a quite extraordinary thing, and that would give us a firm footing for the decisions we took. It seemed the logical and best way of doing it.”

Oral question-time refers to when Members of Parliament (MPs) ask questions of government in the Debating Chamber as a way of further exploring key issues and to hold the government to account. These debates can be watched or listened to by the public, where transcripts are also eventually made available. Within this context of parliamentary ritualization and public accessibility to proceedings, this politician’s anecdote about valuing science-based reasoning in early decision-making processes divulges how part of incorporating scientific reasoning into decision-making processes wasn’t just to bolster the decision-making process, but was to *show* the public that its (assumed) expectations were being fulfilled.

Politicians were therefore recognising the underlying competence and authority of scientific knowledge in modern society and utilising that to their own gain by openly associating themselves with it to reassert their own competence and authority. They did this not only by being transparent about their use of science, but by publicly adopting behaviours

and attitudes, like caution, that they attributed to science and scientists. Public association with science was seen as a tactic for garnering public compliance with public health measures.

Many participants commented on Aotearoa's tremendous public compliance, with Professor Nick Wilson stating that "when New Zealand works together and there's good leadership and good science advice, you know, big things can happen", and another epidemiologist commenting that "I think we've learnt that, you know, if we all pull together we can do amazing things".

In order to achieve this outcome, participants perceived that it was important for the public to understand the scientific rationale behind scientifically influenced decisions so as to engage their support for the decisions being made. Professor Dame Juliet Gerrard notes the importance of this, especially given how seriously restrictive public health orders were:

"Well, it's a big ask, isn't it? [To say] let's lock the border and stay at home. I don't think people will take that at face value if they don't have a depth of understanding of the scale of the problem and how our collective actions could help."

Dr Caroline McElnay acknowledged the criticality of science communicators, particularly those who were acting of their own initiative, in explaining the reasoning behind certain decisions to the public:

"And that's where there's actually been a... Not through the formal government structures, but I think that's where the science community as a whole has actually come together to help with that communication to the public and that's been really useful. To get those others to say actually this is what it means. And that's been great to see that."

Professor David Hayman contended that “the more knowledgeable people are, usually, not always, but usually, the better decisions they can make [...] And they also understand why decisions are being made”. He also recognised how scientific cultures pervaded the way it was communicated:

“It's been brilliant in terms of communication. And also at saying sorry we got that wrong. They've also been good at saying we've got that wrong. We made an error and we're going to learn from it and go on. And that actually is often science right – ‘oh no that didn't work’. But it's not normally played out in the public”

The government's active promotion of their relationship with scientists to garner public support for their decisions was putting the scientific institution and its cultures in the public eye in ways it was not used to. The public eye can be a risky place for science to be, as vulnerability to public critique can act to delegitimize its authority. Effective science communication was therefore not only necessary for explaining political decisions, it was also necessary for mediating public opinions of science.

Dr Sarah-Jane O'Connor, Senior Media Advisor at the Science Media Centre, expands on this point:

“Something that we really push for is that we're not just... Wait two years and then say ‘yeah we've got a vaccine now’, like, people want to see the machinery. They want to know what's happening. And there's lots and lots of updates in between it's not just a case of ‘oh, we'll all go away to our labs and not talk to you and not tell you what the results are’. That doesn't fly anymore – not in this Global 24-hour news cycle. But also, not in the middle of a pandemic. People want to know what's happening.”

She described how being transparent about science can engender public buy-in for the scientific institution and its goals, where opacity can engender mistrust and suspicion.

The public had the opportunity to learn about science, *and* science's place in politics through a variety of communicators including official leaders like Prime Minister Jacinda Ardern and Director General of Health Dr Ashley Bloomfield, and traditional scientists like Associate Professor Siouxsie Wiles, Professor Sean Hendy and Professor Michael Baker. Participants, like Professor Hayman, recognised how “consistent messaging” between these individuals, despite their disciplinary differences have been a hallmark of effective communication strategies. We might recognise that consistent messaging can occur when there are shared understandings of situations by actors participating in a shared boundary.

In constructing a shared understanding of the virus, actors within the trans-scientific space not only facilitated the formulation of policies, they facilitated consensus among themselves that mean that their communication about COVID-19 was consistent with each other. Participants that interacted with her directly attested that Prime Minister Jacinda Ardern, who was communicating about COVID-19 every day during the emergency response period, made especially sure that her communication would be in line with what scientists were saying. Her Chief Science Advisor Professor Dame Juliet Gerrard, who was interacting with the Prime Minister more frequently at the height of emergency decision-making, mentioned that even before the pandemic, she “never got the sense that evidence wasn't welcome”. She described her experience at the peak of decision-making to me:

“There was lots of phone communication - just constantly checking in on two things. One was the international evidence, and one was the communication of the science.”

Professor Dame Gerrard linked the Prime Minister's enthusiasm to interrogate and engage with scientific knowledge to her communication approach, stating that the Prime Minister is “a brilliant communicator and she's very keen to get herself all the details of the evidence”.

Shared understanding of the SARS-CoV-2 virus – of its biological and epidemiological characteristics – between both scientific and political actors meant that when each of these actors communicated their understandings to the public, the ideas they communicated were consistent. Part of this was because some public science communicators, like Professor Sean Hendy, were also the scientists providing scientific advice to the government. Professor Hendy, while chuckling, admitted that “it's very hard work for the experts. It's twice the work”. As a government advisor *and* science communicator, he mentioned needing to be careful about letting his speculations influence his communication. “You can for example get some hint as to how the decision might go based on the questions that you're asked by government”, he explained to me, “so you've got to be careful about how you frame that”, especially knowing that “you won't have seen all the pieces that cabinet is looking at”.

Although scientific actors were only providing advice from one knowledge perspective amongst many, *their* knowledge perspective was as essential for garnering public support for decision-making, which was why politicians made that particular relationship publicly explicit. This made the role of the SARS-CoV-2 as a boundary object especially significant as by facilitating shared understanding within this relationship it enabled consistent communication coming out of it from different actors. Participants felt that this engendered public trust in that relationship.

My research indicates that in the early pandemic, scientific actors had designated the virus a scientific entity so were seeking information about it from scientific literature.

Additionally, because scientific actors were seeking to make sense of the novel virus in a publication environment that was overwhelming and unfamiliar, they were having to

grapple with the inherent uncertainty of knowledge about the virus they were accessing. Without their familiar credibility checks, scientific advisors like Professor Dame Juliet Gerrard delivered scientific advice about the virus by constructing it as inherently uncertain and unpredictable. In rendering it so, both scientific and political actors were able to advance their interests.

Research by Centre for Science in Society student Max Soar reminds us that “scientists construct uncertainties as a cultural practice, but not necessarily as a deliberate (or disingenuous) act. The way uncertainty is constructed nevertheless serves as a discursive tool embedded in social interests and commitments” (Soar, 2020).

2.7 Chapter conclusion

In this chapter, I have recognised how scientists rendered the SARS-CoV-2 virus as unpredictable and ungovernable, which justified and made desirable their inclusion in decision-making spaces in our response. These renderings were ultimately influential in garnering public support for the decisions made in those spaces.

In the next chapter, however, I explore the limitations of reaching solely to scientific knowledge as the central epistemology in pandemic scenarios. I draw on critiques from participants who represent or work with people and knowledges from currently systemically marginalised communities in Aotearoa to present how the experience of crises like a pandemic have social, political and historical contingencies, especially in a neo-colonial country like Aotearoa. I ask whether approaches that centre scientific assumptions are appropriate for crises responses in a society that hosts a variety of inequities, when science’s very practice seeks to erase those social, political and historical contingencies in its knowledge making process.

3 Chapter 3. Coloniality and expertise

In a paper from June, 2020, Fuentes (2020) notes that while COVID-19 “threatens humanity with illness and death”, disease from the SARS-CoV-2 “microbe is not the only hazard to human health and well-being” – “the threats of the COVID-19 era are deeply biosocial, disrupting body, mind and community” (Fuentes, 2020).

This was made particularly evident when an emerging “Valentine’s Day” cluster of cases featuring the highly transmissible and therefore particularly deadly SARS-CoV-2 B.1.1.7 variant (first identified in the United Kingdom) provoked a move for Auckland into Alert Level 3 and the rest of the country into Alert Level 2 twice, in the space of two weeks (Daalder, 2021). During the short stint between Auckland’s Alert Level 3 lockdowns, genome sequencing and epidemiological investigation revealed that the movements of three individuals had violated official public health orders.

These were the movements of employees at a laundry service, a KFC and a Kmart. All three of these jobs are technically classified as ‘lower-skilled jobs’, as they are paid below 85% of the median wage (MBIE, 2021). Additionally, Papatoetoe High School, attended by some of the individuals in this cluster, is currently a decile 3 high school, indicating a high proportion of students as coming from low socio-economic background (Education Counts, 2021).

Of all the other times Aotearoa has been directed to change Alert levels, most have involved low-income communities in South Auckland. Indeed, this region might be described as a ‘super-spreader’ location in the same way individuals have been. But designating people in this way can impose assumptions that individuals are personally responsible for their interactions with, and wider spread of, a virus that, in reality, is driven by as “pre-existing

conditions such as hypertension, diabetes, respiratory disorders, system racism, mistrust in science and leadership, and a fragmented health-care system” (Mendenhall, 2020). The “multi-scalar entanglements in the differential impacts of COVID 19” should therefore be unpacked (Lopez & Neely, 2021).

Emily Mendenhall, citing Richard Horton (2020), uses these circumstances to distinguish COVID-19 as a syndemic – not a pandemic – given how these pre-existing conditions interact with COVID-19 clusters. “Driven by larger political, economic and social factors [...] synergistic failures” in these interactions “have caused more death and devastation than many other contexts” (Mendenhall, 2020; Horton, 2020). Intriguingly, Mendenhall does not think COVID-19 has been a syndemic in Aotearoa. While explaining that “US political failures have driven COVID-19 morbidity and mortality, and this cannot be divorced from our historical legacy of systemic racism or our crisis of political leadership”, they claim that “this matters because in other contexts COVID-19 is not syndemic. New Zealand's political leadership in response to the crisis has been exemplary. COVID-19 is not syndemic there” (Mendenhall, 2020).

But if there was ever a case to be made that COVID-19 would have manifested as a syndemic under different political circumstances, the consistent risk re-emergence in South Auckland, one of the most ethnically diverse and low-income regions in Aotearoa, provides one. As a neo-colonial nation, Aotearoa also has a legacy of systemic racism *and* crises in political leadership and design, particularly in health (Came, 2014; Robson & Harris, 2007). Notably, science and scientists have been implicated in these histories, and unless an active effort is made to address both deliberate and ignorant mistake in the past, will continue to be so despite best intentions (Quijano, 2000; Sismondo, 2010).

In this chapter, I intend to explore how the lasting effects of colonisation, through coloniality, have contributed to producing various inequities in Aotearoa's society. I will also explore how science can be improved to not only improve the conditions of these circumstances, but also improve its own processes of knowledge production.

3.1 Engaging with people who have a different reality

Dr Donna Cormack, who described herself as someone who does a lot of work “around racism and healthcare” tells me that as the pandemic was first emerging, she was thinking about how “Māori don't have equitable access to equality of healthcare”, so she was “worried about how if [a pandemic] did hit, how those inequities that already existed in the healthcare system might be exacerbated and play out”. She then expanded on her point:

“I think we were also really worried at the beginning that if it became widespread in the community, a lot of the factors people were talking about that made COVID likely to be more severe were the factors that we also knew weren't evenly distributed. So, things like household overcrowding, and the ability to safely isolate if you're in a kind of crowded home. Comorbidities and things like that. We knew that if it got kind of into community outbreak situations, people's risks weren't the same. Not because of anything inherent to those communities but because of the risky environments that are created.”

Her concerns about how housing inequities could influence our pandemic response were shared by Associate Professor Collin Tukuitonga, representative of the Pacific Island response team on the COVID-19 Technical Advisory Group (TAG). When I asked him what factors he was thinking about that other members might not have been thinking about, he replied off the bat. Social distancing, he responded immediately:

“Social distancing, right. It's a catch cry, social distancing. And I was sitting there thinking, social distancing to many of us means you've got another spare room in the house to go and isolate yourself, or keep away, and so on.

It's a privilege for many in the Pacific community. I think you may have heard that 40% of the households in Pacific communities are crowded or overcrowded. So, when you say 'social distancing' and 'isolate yourself', it's not as easy”

Dr Cormack points out that she knew what it could be like in those policy spaces where “people think everyone has a smartphone, and Wi-Fi and a bedroom with an ensuite that they can self-isolate in”. She acknowledged that in these spaces, “engaging with people who have a different reality” can be easily neglected.

Long before the 'Valentine's day' cluster, Dr Cormack told me about her concerns about how the contact tracing system didn't seem to consider the nuances of lived realities of inequity in Aotearoa:

“You need to tell people specifically that they are going to get a call from an unknown number. Because that's the debt collector number, and the bill overdue number, and people are not necessarily going to answer those calls. But [the government] didn't think to do things like that, because they don't worry about those calls and their lives [...] They didn't think that people might not want to tell you how many people live in their house. If they're living in a housing New Zealand house and they're allowed so many people on a tenancy [...], have you thought about what guarantees you'll give them to make it safe for them to tell? Say things like, you know, no one was telling people 'we can't share this information'. People didn't know that if they tell public health something, that isn't going to suddenly get to WINZ or someone else. *So it's kind of that community knowledge, and knowledge about what different groups of people might need to have trust in a system [I].*”

A health practitioner who practices in South Auckland, where nuanced realities of inequity are already prevalent, told me that, like Dr Cormack, they were “a bit worried [that] the

response to COVID [was] not going to work for Māori” in the early days of the pandemic. They explained how “public health colleagues” of theirs who work in “Māori health were worried that the response of the government might actually *create inequities* for Māori” [I]

“We were already seeing that in terms of things like Tangi, and they were making up weird rules for whanau that didn't really seem to be evidence-based”.

This practitioner referred to how the 1918 influenza pandemic shaped these concerns about how poorly considered COVID-19 policies could create long-term social consequences for Māori communities:

“When you look at the influenza that hit New Zealand in 1915, 16, 17, it wiped out Māori communities and there was a whole lot of policy and legislation that was brought in by the government which affected us for a long time... Things like the Tohunga Suppression Act came in at that time, and while some might argue that it was there to try keep people safe and stop them coming together, I guess, and potentially spreading germs, the person – the politician – that brought it in was worried about people using charlatan medicines, you know, so trying to prevent that from happening. But actually, the Tohunga Suppression Act meant that people didn't practice Indigenous traditional health practices for a long time as a result of that, because they thought they might be arrested.”

Accounts like these exemplify how pandemics participate in threatening not only the health and well-being of Indigenous people and communities, they also participate in threatening the health and well-being of Indigenous cultures and their futures. Where other participants were concerned about the health and wellbeing of Māori and Pacific Island communities, participants who are close to these communities were additionally worrying about their socio-cultural presents and futures. I will argue that this difference in understanding is a manifestation of the scientific institution's implication in the colonial project of the 1500s

(Mignolo, 2007). First, however, I will explain how colonialism has brought about modern inequities and how the presence of that colonial legacy has been made especially salient by the COVID-19 pandemic.

In their book ‘A History of the World in Seven Cheap things’, Patel and Moore (2018) describe how hopeful empires used capitalist incentives to look beyond their own borders, and finite resources, for wealth accumulation. These “frontiers”, they state, “were to become an organising principle of metropolitan wealth” (Patel & Moore, 2018, p8). Crises were however intrinsic to this new economic order. Capitalist crises at new frontiers are the result of economic externalities, “a cost or benefit, private or social, that doesn’t appear in the calculus of production” (Patel & Moore, 2018, p12), undesirably inserting themselves into that calculus. These crises, they argue, were addressed through a process they call ‘cheapening’. As a form of life-making, “cheap is not the same as low cost—though that’s part of it. Cheap is a strategy, a practice, a violence that mobilizes all kinds of work—human and animal, botanical and geological—with as little compensation as possible” (Patel & Moore, 2018, p12). They use the term ‘cheap’ to “talk about the process through which capitalism transmutes these undenominated relationships of life-making into circuits of production and consumption, in which these relations come to have as low a price as possible”(Patel & Moore, 2018, p12; Mignolo, 2007; Young, 2016). This process is similar to what Anibal Quijano describes as “the constitution of a new structure of control of labor and its resources and products”. This “new model of power [...] was an articulation of all historically known previous structures of control of labor, slavery, serfdom, small independent commodity production and reciprocity, together around and upon the basis of capital and the world market” (Quijano, 2000).

Nelson Maldonado-Torres (2007) designates this process of world economic order making as one of “the two axes of power that became operative and defined the spatio-temporal matrix” of colonised lands, where the other axes was “the codification of the differences between conquerors and conquered in the idea of ‘race’, a supposedly different biological structure that placed some in a natural situation of inferiority to others”. Their idea of *coloniality* emerges from this interaction between capitalism and colonialism through “long-standing patterns of power” that “define culture, labor, intersubjective relations, and knowledge production well beyond the strict limits of colonial administrations” (Maldonado-Torres, 2007). In a paper co-authored by participant Dr Donna Cormack, Reid et al., (2019) distinguish coloniality from colonialism by emphasising that “while many formal colonial administrations have ended internationally”, coloniality refers to how “old colonial power hierarchies have been re-inscribed” through the “ongoing oppression and marginalisation of Indigenous and other racialised people within ‘new’ nation-states by way of ““global hierarch[ies] of superiority and inferiority along the line of the human”, embedded in social, political, economic and cultural systems” (Grosfoguel, 2016; Reid et al., 2019).

Leonie Pihama (2017) identifies race, gender and class as British ideologies imported through imperialism, subsequently weaponised to ensure the deliberate alienation of Indigenous Māori from new colonial political and social structures established in Aotearoa (Pihama, 2017). They identify “the construction of race, gender, and class within colonial discourses [as] a means [for] understanding underpinning ideologies that exist in the maintenance of unequal power relationships”.

The presence of these unequal power relationships is implicit in the descriptions of modern day inequities participants shared with me.

Aotearoa has a known context of health inequity (Hobbs et al., 2019), which has manifested as things like geographically polarised socio-economic deprivation scores (Pearce & Dorling, 2006) and ethnic disparities in access to publicly funded health procedures (Rahiri et al., 2020). The actual lived experiences of individuals experiencing these inequities can consist of complex, intersectional interactions between different socio-political inequities in categories like race, gender, class, ability and sexuality (Cormack et al., 2018; Hickey & Wilson, 2017; Lawrenson et al., 2016; Tan et al., 2019). Feminist scholar, Kimberlé Crenshaw is generally credited with proposing this theory of intersectionality and its role in shaping the multiple dimensions of lived social experience (Crenshaw, 1990).

3.2 Coloniality and Healthcare

Participant descriptions and concerns about how the realities of societal inequities can be easily neglected in health-related policy prompts me to delineate, and then explicate, how processes of coloniality pervade Aotearoa's health system – institutionally and socially. Such a system has “obvious shortcomings” as it builds on an “ideology that calls on each of us to be personally responsible for our own resilience and disaster preparedness – when power, wealth and income are distributed so unequally” (Dominey-Howes, 2021).

I therefore present the pandemic as *participating* in threatening the health and well-being of Māori community cultural futures, rather than presenting it as the threat itself. Drawing on Frantz Fanon's characterization of the colonized person as “perceiving life not as a flowering or development of an essential productiveness”, as Heidegger did, “but as a permanent struggle against an omnipresent death”, Maldonado-Torres recapitulates that for a colonised person, “the extraordinary event of confronting mortality”, including cultural mortality, “turns into an ordinary affair” through experiences of what Fanon lists as “unemployment, a high death rate, an inferiority complex and the absence of any hope for

the future” (Maldonado-Torres, 2007). These are not things a pandemic *newly presents* a colonialisised society, as they are *already present*. COVID-19, however, brings to light what are usually tacit processes of coloniality, while simultaneously possessing the potential to exacerbate the intensity and breadth of colonial experiences discussed by Fanon and Maldonado-Torres.

In one instance, the health practitioner described how complex and confusing experiences of coloniality can be. They used their experience of trying to practice through the Alert level 4 lockdown to explain this:

“You know the concern for me is that, as a practitioner in South Auckland, not everybody has a telephone, they don't have data to do video consultations. They were all very afraid to come in and see us because of the worry of picking up COVID from other patients, potentially. They certainly didn't want to go to hospital, they were worried about getting COVID there, so hospitalisations [...] in Auckland dropped dramatically [...] What happened after the last lockdown, when we first opened up again, we just had a surge of very sick people who hadn't come in to see their doctor. And that's put added pressure on to our system.”

The health practitioner began a discussion of their experience by identifying how digital access inequality – necessitated by the nationwide lockdown that engendered a need for a “change to the way [the participant] saw patients and practiced” – was a concern.

Digital access inequality in the context of COVID-19 has also been cited elsewhere for its involvement in exacerbating social exclusion during lockdown – where social connection to the internet was seen as key to fostering a “sense of community that'd otherwise be impossible” (Teng, 2021). In light of a report released by the Department of Internal Affairs – the Digital Inclusion Blueprint – stating how “research shows that Māori are also less likely to be digitally included than the wider population” (Forbes,

2021), the colonial performativity of digital access inequality becomes clear: experiences from COVID-19 have highlighted how inequality not only increased risk of poor wellbeing outcomes, it has perpetuated the continued alienation of groups that have been targeted. We see the process of coloniality at play when wellbeing practices – whether they be physical or social – move into inherently exclusive online spaces, resulting in whanau and other social groups who are already marginalised by colonial ideologies, being left behind.

The participant then discussed how, during lockdown, people were staying away from hospitals, out of fear of getting COVID-19, but how doing so provoked concerns that *other* illnesses were being given the opportunity to intensify without diagnosis. The complexity of this situation emerges when compared to Associate Professor Collin Tukuitonga’s account of his experience as a Pacific Island community health advocate. He gives reason to why already disadvantaged individuals and communities were particularly incentivised to evade contracting the virus:

“Viral illnesses like COVID-19... put at risk vulnerable communities. Communities like the Pacific community where there's household crowding, there's high prevalence of comorbid conditions like diabetes and heart disease, that people had increased risk of infection and increased risk of dying. So we were already concerned that if there was a community outbreak that the Pacific and Māori communities would be most affected.”

Associate Professor Tukuitonga therefore saw it was essential to effectively communicate basic information – “stay home, wash your hands, all that stuff” – which was translated into 9 different languages, where “people by and large followed the advice that was offered”:

“I mean this is a new threat and Pacific Islanders are just like all human beings - a bit nervous and anxious and scared, this is not something that people knew a lot about. They heard about horrendous death rates in Italy in those early days, and in France, so people were scared.”

Like the afore-mentioned participant, Associate Professor Tukuitonga cites fear as a key emotional response in dictating the behaviours of individuals in the Pacific Island community. But he also cites an added layer to this behaviour – how it was “an opportunity for the Pacific community” to “[step] up big time”:

“The Pacific community response - the church leaders, the community groups, the radio stations and the TV stations, the healthcare providers the social support agencies, everybody came together and mounted pretty much what I thought was an impressive response and that to me signals to the rest of New Zealand that you know Pacific people are not just bludgers, they make an important contribution, unique contribution to New Zealand.”

In staying at home, as the rest of the country has been asked to do, the community sees an opportunity to break a stereotype and gain respect as a community that can make a “unique contribution to New Zealand”. That a harmful stereotype had to be broken implies that there was one in the first place.

Associate Professor Tukuitonga’s account suggest that Pacific Island New Zealanders had multiple incentives to stay home and social distance, including protecting their own health, protecting the health of their community and a perceived need to prove to the rest of Aotearoa their value as members of our society. But as I mentioned earlier, Associate Professor Tukuitonga told me how the actual reality of “staying home” to “save lives” was a difficult goal to achieve safely for lower socio-economic Pacific Island households prone to household crowding:

“I’m thinking how on earth do we make this advice practical, pragmatic, and to make it such that the community’s likely to respond to it. [...] So to my non-Pacific colleagues, they never thought any more about it. They just said, ‘social distance, keep your distance’ and that was it. For us, we had to think through what that meant because simply to say that to the community and have not thought about it again would have been a complete failure”

Like everyone else, individual bodies in these communities were seen to need protection from the threat posed by the SARS-CoV-2 virus, but their intersectional experiences of other socio-political systems meant that they needed to be catered to specifically, and in ways that were familiar to them. These susceptibilities were of course brought about by histories of systemic racism, in Aotearoa and across the Pacific.

3.3 “Opening up the idea of what science is and what evidence is”

In my previous chapter, I outlined how scientists predominantly asserted autonomy over the rendering of the SARS-CoV-2 virus. Their role in rendering it a scientific entity facilitated their entry into the national response network. Simultaneously, their recruitment into the response was also abetted by their being part of invisible colleges of informal networks, which I discussed in the first chapter. I mentioned, in Chapter 2, however that scientific information was not the only kind of information available for participants to seek. Dr Donna Cormack was utilising her connections to international social researchers to widen the scope of her understanding of the virus. Additional to scientific information, she was looking specifically for information about how the virus was interacting with underlying social, political and economic systems, brought about by historical legacies, to produce unequal disease and mortality distribution in other countries. I have established that her incentive to do so was out of concern that Aotearoa would also see similar outcomes given the inequities in our society.

But Dr Cormack, as I suggested in Chapter 1, struggled to get meaningfully involved in our official national response despite her advocacy. By the time she was included, “at a very surface level”, it was too late for her and Te Rōpu Whakakaupapa Urutāto have much influence:

“So we had more meetings and we were invited to participate in groups. I guess the issue was that a lot of the decisions had already been made by that point in time, and systems had been set up”.

As much as scientists did acknowledge there were equity concerns that needed addressing in their rendering of SARS-CoV-2, with Professor Hendy using this logic to distinguish ‘the core group’ of scientists from Plan B, this was still done based on scientists’ understandings of these aspects. As I mentioned, however, none of my scientific participants discussed the social aspects with as much nuance and detail as did participants like Dr Cormack, the health practitioner and Associate Professor Tukuitonga.

By using their value for equity as a tactic to demarcate themselves from the Plan B group of scientists, ‘the core group’ implied the authority of their knowledge in this domain. Professor Hendy, for example, described how his group at Te Punaha Matatini – a science-centred interdisciplinary research organisation – mediated networks between Māori public health researchers and modellers:

“Then there's demographic issues - so we needed people to be doing work on looking at impact on Māori and Pacific people for example. So there's a lot of Māori public health experts but who don't necessarily have the modelling capacity. So Te Punaha Matatini brings this network of people together and work on these things that we couldn't just learn overseas”

Incorporating equity aspects was therefore done in a way that still centred scientific understandings of the virus and scientific understandings of society. While government recognised that science and scientists had valuable advice to offer, this recognition, Dr Donna Cormack speculates, was not necessarily extended to other knowledge-making communities in Aotearoa, such as the wider Māori community. The government’s approach and discussion of these communities, she contends, shows how it saw Māori communities as ones that *needed* help rather than ones that could *offer* help to the wider nation:

“I don't know that they really actually think that Māori communities have something to offer in terms of like knowledge and technical expertise. I remember that there's an interview that the Prime Minister did and they... Mihingarangi Forbes asked about engagement with Māori and when the Prime Minister responded, she talked about doing targeted messaging. So it felt to me like Māori communities were viewed as kind of stakeholders or people that you give a message to rather than actually, there's a whole lot of expertise in working in community, about relationships, about pandemics that we could draw on to have a response that is more inclusive and more equitable.”

While agreeing that the overall elimination strategy taken by the government was the “right thing to do”, Dr Cormack describes how relying singularly on “epidemiology and a particular idea of biomedical science” as the ‘evidence’ being referred to in ‘evidence-based decision-making’, can produce policies that are limited in their scope. Whereas, the potential to produce a wider set of solutions becomes possible if “the Crown would open up its idea of what science is and what evidence is”.

3.4 Excluding expertise

As I have drawn on before, Professor Nick Wilson mentioned how his public-health based perceptions of the inadequacy of our early response motivated him to get involved:

“At various stages I was a bit alarmed by the suboptimal response of the government in various ways, and that the concern about what were gaps in our defences as a country concerned me and motivated me to think through things [...] [and] alarmed me and made me work harder.”

Dr Cormack similarly expressed that it was concerns about gaps in the response that motivated her to advocate for an improved response, to the point where she “felt like [she] was doing another PhD” as her “workload increased” of her own initiative:

“Seeing that there were things that I wasn't comfortable with or worrying that some conversations that I thought should be happening might not be

happening made me motivated I guess to try to find space to have those conversations.”

But of course, Professor Wilson and Dr Cormack’s experiences with the official response diverged from there.

Dr Wilson’s frustration with government responses to public health concerns was not a COVID-19 specific development. He told me of his attempts in the past to share his expertise with government to urge them to update their pandemic plan and improve border preparedness for inevitable crises, sending them papers and recommendations as recently as 2018 and 2019:

“They had no interest in the papers we published... and a draft of the border control which I sent them about the start of last year, they had no interest because they said that the pandemic plan was sufficient, and they thought this discussion about more severe pandemics was just bordering on science fiction”

In early days of the pandemic, however, after persuading the Ministry of Health to give him and Professor Baker a contract to do modelling, he told me the government “were receptive and the models did have some impact. So that was very satisfying”. After years of offering guidance on public issues such as tobacco control and reducing salt in the food supply as a means of stroke and heart attack prevention, Professor Wilson’s advice were finally heeded in the context of a global pandemic. In the past, participants describe how science-centred strategies have typically struggled to have the influence in government they have been afforded during COVID-19, as Associate Professor Collin Tukuitonga attests to. Like Professor Wilson, he told me he “spent [his] life lobbying ministers and Prime Ministers and leaders”:

“You know you put all the information together, you present it, go back and do it again and then you go back and do it again and you go back and do it

again, and sometimes you get lucky. But this, the COVID response from Ardern's government has been absolutely stunning. I've never seen anything like it before. they basically took the advice of the science from Ashley Bloomfield and the scientists and acted on it.”

While government was receptive to scientific expertise during this pandemic, Dr Cormack's experiences indicate how this receptivity was not afforded to social or Indigenous expertise in the same way. She recognises that this could be seen as an act of “epistemic violence - the denial of Indigenous knowledges as having any sort of value or a scientific credibility”. She expanded on this point:

“I think that what was playing out in the response was the idea that Māori wouldn't have anything to offer. Even in their own community responses let alone in the universal COVID response. To me that was just a kind of re-enactment I guess of colonisation and that sort of epistemic oppression”.

Her view was that pandemic strategies should be designed in a way that can adequately address THE socio-political nuances of the lived experiences of Aotearoa's communities, positing that doing so requires inclusion of a wide range of voices that can speak to the experiences of those communities. In the response we *did* have, this looked like having people like Associate Professor Tukuitonga involved who could speak up on the complexity of universally enforcing social distancing measures.

By recognising the context of colonisation and the coloniality of the experiences of communities in Aotearoa, social and Indigenous expertise can work in conjunction with scientific expertise in decision-making processes by placing scientific understandings within socio-political contexts that encourage scientists to explore the nuances of their understandings in ways they would not have been able to without those contexts.

3.5 Diversifying expertise for a better science and a better society

Mormina et al. (2020) contend that the globally eminent phrase ‘following the science’, which has been used frequently in Aotearoa, including by some of my participants, is a “politicised phraseology underpinned by the problematic assumption that there is ‘one’ objective science to follow”. They consider how “current structures of local and global expertise” have been produced by “particular ideological and epistemic commitments” that participate in narrowing policy horizons (Mormina, 2020).

The evidence presented in this chapter support their claims in two ways: by highlighting how the inclusion of experts like Associate Professor Tukuitonga in official policy making processes was advantageous to the plight of designing equitable policy, given his ability to speak to the realities of how policies could specifically affect communities that have historically been vulnerable to exploitation by narrow-interests. By ensuring that the professional and lived expertise of people like Dr Tukuitonga were involved in national response formulations, unintentional exploitation of and disregard for already marginalised groups can be avoided.

This is thanks to these experts’ being close to people in systemically marginalised communities who are intrinsically implicated in intersectioning systems of social and political phenomena. The significance of having experts like this in the trans-scientific boundary is recognised by other participants, with one epidemiologist mentioning how essential members with Māori and Pacific Island backgrounds were to their COVID-19 TAG subgroup, often “reminding [the group] about the equity aspects’ which they describe as being “something really important to keep bringing people back to in discussions”.

In Chapter 1, I established who the included group of experts were and how they came to be included through informal connections formed over time through participation in various professional settings. But if the legacy of coloniality has influenced the way different

knowledges are valued, it may mean that experts with knowledges that can enhance the accuracy and scope of scientific knowledge are actively excluded from those professional settings as their knowledges are seen as irrelevant or niche. Whereas I've shown that informal networks formed out of scientists' pre-existing social and collegial relationships, here I suggest that those discipline-based networks also made it hard for people with different knowledges to gain entry into Aotearoa's decision-making spaces during COVID-19.

The formation of invisible networks that are mutually exclusive of each other (bar perhaps a few connections) can impede experts with complementary scientific and non-scientific knowledges from engaging with each other. This can contribute to discipline-specific group formations that materialise independently of each other, such as in this pandemic where Te Rōpu Whakakaupapa Urutā and “the core group” of scientists emerged as mutually exclusive groups, when the country could have really benefitted from their forming as one.

Dr Donna Cormack contends that this division is unnecessary as different knowledges “can support and complement each other”, especially in policy settings:

“When you're recruiting people into policy work, they possibly come from, kind of, one discipline or another discipline. I think that's one thing that I find really exciting around kaupapa Māori and other Indigenous methodologies... is they kind of push back against the idea of disciplines in the first place. So Linda Tuhiwai-Smith talks about how 'disciplines discipline'. They teach us to behave in a certain way and have certain habits and, you know, conform to particular assumptions [...] whereas Indigenous methodologies seem to me a lot more open, and move across disciplines. I think if we could get to something like that, and policy where it's more about what's relevant, what's the most appropriate methodology for people to engage with on this particular issue, we could come up with different solutions”

The advantages of knowledge inclusivity have been long recognised by feminist and post-colonial scholars. Sandra Harding, for example, has dedicated her scholarship to pointing out how scientific communities themselves have historically been exclusionary of social groups outside of traditional expectations (usually older, richer, whiter men). Since knowledge construction then comes from a specific monoculture, science's image of objectivity must be called into question as it disregards other narratives that would otherwise offer alternative or complimentary accounts of reality. Challenging the monoculture of science challenges the simplistic view of reality it is conditioned to produce (Harding, 1992). Feminist scholars acknowledge that reality, including lived and natural realities, are complex and therefore require contributions from multiple standpoints that can speak to social and political contexts that produce both consistencies and paradoxes in scientific phenomena.

Feminist scholars like Harding, and Donna Haraway, call on science to do better by making its practice "and method more democratic and diverse" (Appleton & Addison, 2020; Harding, 1992). Their central idea in respective theories of 'standpoint epistemologies' and 'situated knowledges' is that positionality is not only unavoidable, but an approach to science that affords an alternative and illuminating perspective (Haraway, 1988; Harding, 1992).

Harding contends that current science, biased towards a privileged monoculture is only 'weakly objective', emphasising that achieving 'strong objectivity' for a more robust reconstitution of science will require pluralistic contributions from multiple cultures, which will in turn ensure that "science works in and for society democratically" (Appleton & Addison, 2020; Harding, 1992).

Haraway additionally recognises that "engaged, accountable positioning", can engender science's production of "better accounts of the world". Scientific accuracy in

situated knowledge theory is therefore contingent upon plurality of diversity and participation (Haraway, 1988).

Expanding on these western feminist theories, Chandra Mohanty introduces a post-colonial perspective that challenges universalizing methodologies that can be used to “serve the narrow self-interest of Western feminism”. Mohanty recognises that oppression does not emerge arbitrarily – it has been historically produced through processes of colonialism, capitalism and neoliberalism. The legacy of these histories have significantly contributed to the inequities my participants discussed. Mohanty contends that modern epistemologies must therefore inherently recognise these histories if they are to produce knowledges that are more accurate representations of reality. For example, they state that “cross-cultural feminist work must be attentive to the micropolitics of context, subjectivity, and struggles, as well as to the micropolitics of global economic and political systems and processes” (Mohanty, 1988; Mohanty, 2003).

Eugene Richardson (2019) exemplifies this approach in the area of public health by recognising how purely quantitative research about vaccine mistrust in Democratic Republic of Congo – another nation experiencing the continued legacy of colonialism and imperialism – completely misses the fact that attitudes of mistrust have actually been facilitated by histories violent colonial events (Richardson, 2019). This contention speaks to Dr Cormack’s speculation about how individuals from marginalised communities in Aotearoa might mistrust unfamiliar officials coming into their homes for official contact tracing procedures and how that can impede cooperation and necessary honesty.

Richardson criticises “ahistorical analyses” in colonially contested spaces as “anaemic approaches to the study and achievement of global health equity”. Citing the work of Boaventura de Sousa Santos (who Dr Donna Cormack also mentions in our conversation),

Richardson asserts that “global social injustice is by and large epistemological injustice”, exhorting that global health can only be transformed “when its representations are transformed” (de Sousa Santos, 2015; Richardson, 2019).

3.6 Chapter conclusion

This chapter draws particularly on the experiences and insights of three participants who work closely with systemically marginalised communities in Aotearoa. I argue that their presence in decision-making or decision-critiquing spaces benefitted our response in that they were able to contribute nuanced understandings of the lived reality of inequity to these spaces and similarly to my interviews with them. I however argue, in line with feminist and post-colonial scholars, that increasing representation of people like them in official decision-making and scientific knowledge making spaces is crucial for producing equitable responses to crises in the future. By promoting pluralised and contextualised mechanisms of making scientific knowledge, I argue that representations of reality can become more accurate, advancing their potential for utility in society.

This utility will be markedly necessary in the context of coming crises, of both urgent and gradual kinds, which I will explore in the next chapter.

4 Chapter 4. Neoliberal constraints to the science and health systems in the response

In previous chapters, I have discussed how scientific actors gained epistemic authority over our national response, how they justified their place and how our response was constrained by their dominating that place. While, in that last chapter, I outlined how *scientists* could constrain our response, in this chapter, I use a term not explicitly mentioned by any participant to outline *what scientists saw as* constraining our response.

Neoliberalism is this term, one that has “travelled from economic philosophy” into society. “Characterised by the retrenchment of the welfare state and an increased role of the state in preserving market competition” (Morningstar, 2020), neoliberalism exists in society through varied expressions that have core principles (Canaan & Shumar, 2008). Economic interpretations of neoliberalism understand it as the current form of capitalism (Fine & Saad-Filho, 2016) while anthropological approaches recognise how it is “a structural force that affects people's life-chances” and “an ideology of governance that shapes subjectivities” (Ganti, 2014).

Beginning with a discussion about how Aotearoa’s genome sequencing team had trouble getting their project off the ground, I trace a wider set of participant concerns about public health infrastructure and expert workforces to underlying neoliberal agendas in Aotearoa. In this chapter, I hope to reveal how the experiences of the pandemic response tore away at facades of neoliberal efficiency to reveal how the dominant method of organising our economy and society is one that exacerbates inefficiencies.

4.1 “It wasn’t an integral part of the response”: The genome sequencing story

In general, participants often described the way science is managed in Aotearoa as inefficient and undesirable. One participant, for example, described the research community

as “small” and “scrabbling around for competitive funding”, where overall, “research is almost entirely[...]competitive”. Professor Sean Hendy acknowledged that during our main response period, typical funding mechanisms constrained the potential of some of its scientific aspects:

“I recognise that the mechanisms for funding science and getting science done don't really work well in the short term. So, without centres like ours [at Te Pūnaha Matatini] being able to step up quickly and deliver work, we wouldn't have got that science done. You know? I don't think we have very good mechanisms in New Zealand for doing science quickly. And it was very very difficult getting funding [...] [The government] could spend a lot of money in lots of different ways, but they didn't have the mechanisms for spending on science funding”

He uses Aotearoa’s genome sequencing project as an example of how the funding system held back the uptake of practical research during the pandemic:

“So, in the first crisis, the genomics didn't really help at all [...] There wasn't an organised system in place to get the samples to the facilities where they'd be sequenced and none of those things really work fast enough. That's one of the things that hadn't been prepared.”

Dr Jemma Geoghegan’s experience as one of the leaders of Aotearoa’s genome sequencing project clearly speaks to the issue Professor Hendy briefly outlines.

She told me that in the early days of COVID-19 she saw the “utility” of incorporating genomic sequencing into our official pandemic response:

“At the start of this pandemic, I saw an opportunity that genomics could actually play for the first time, like, a real time role in integrating genomic data with epidemiological data to actually inform the pandemic response. This never really happened before the COVID-19 outbreak. Countries around the world were doing this and I thought New Zealand needed to do this too.”

She discussed how during the Ebola virus outbreak in 2014, it took one year to publish the sequence of the viral genome, whereas the SARS-CoV-2 viral genome “was publicly shared about 12 days after the coronavirus was first recognised”. Alongside the capacity to do genomic sequencing “easier, quicker, and cheaper” thanks to “really rapid sequencing technology advances”, Dr Geoghegan attests to the importance of transparency and open data-sharing in the early days of the pandemic – sharing that primarily took place through informal communication channels such as Twitter and through preprint publishing:

“There's been an enormous effort to share publicly rapid methods [sic]. So, the first primers to sequence this genome were shared and people were sending them around the world. We got our first primers from a guy at Oxford. Everyone was just really happy to share methods really quickly. And honestly, I would put that down to Twitter. People are just on Twitter sharing stuff. And preprints, you know [...] So, if you send a paper out to a journal and it goes under review it takes months, right? And you still do that. But while it's being reviewed you also post it on a preprint server so if you're finding new things that could be important, that people need to know now and not in 3 months. So, you know I think the rapid sharing and open sharing of data has really accelerated the pace that we can do things now.”

Her account indicates that the technology, knowledge, and data to support real-time genome sequencing were available to scientists in Aotearoa during the early days of the pandemic.

However, Dr Geoghegan's team couldn't pursue such a project at a large scale in a meaningful way. The discrepancy seemed to be down to the issue of funding:

“I think during the first wave, we had to get this funded through a research grant - it wasn't part of the response... [We] were successful in funding but you know all that took a few months. So during the first wave of the pandemic in New Zealand, like in March and April, we were sequencing as many positive cases as arrived in the laboratory around New Zealand, and that represented about over half of the cases, and we were sequencing them, but not probably in real time.”

While Dr Geoghegan recognises that the work her team were doing during this period was “really good scholarly research” that they “were able to see interesting results from”, the work wasn’t contributing to our national response in the way she knew it could.

Despite their enthusiasm, and easy informal access to national and international expertise, Dr. Geoghegan’s team had to wait before they could secure the funding that would eventually fuel the kind of project they wanted to pursue early in the pandemic – to integrate genomic data with epidemiological data. Because securing funding took “a few months”, the project could not become what she knew it could be until the Auckland community outbreak in August 2020:

“Yeah, so, I think during the first wave, we had to get this funded through a research grant - it wasn't part of the response. It wasn't like the Ministry of Health required genome sequences of all cases. It wasn't an integral part of the response. We were doing it anyway because we were interested in it...So then when the virus re-emerged in the community...we were able to, within 24hrs of a sample being taken, we were able to say what the genome looked like and if it was linked to any other cases and stuff.”

Dr Geoghegan notes that during the initial outbreak, genome sequencing was seen by the Ministry of Health as a relatively obscure method that they didn’t know much about. This is reflected in my conversation with Dr Caroline McElnay, who cites genome sequencing (and blood tests) as “probably a couple of the newish areas that have been things that we didn’t know” that had “really come to the fore in terms of what it can contribute to our understanding”.

Despite the initial difficulty in getting it set up, participants like Professor David Hayman praised the sequencing effort and its contribution to our response. He actually made sure to add this comment to a previous answer to a question after I’d moved on to another:

“By the way, one more thing. The use of genomics now, it took a bit of time, but that use of genomics now is really interesting. New Zealand’s done a great job at sequencing a huge amount of viruses and now it’s coming into its own in terms of investigating the clusters. Anyway, I just want to make that point because I know a lot of people have done some great work with that. We’ve got some great experts in the country.

Though both Dr Geoghegan and Dr McElnay point to how the Ministry of Health was unfamiliar with the potential role genome sequencing could play in our response, in contrast to genomic scientists’ understanding of it, Dr Geoghegan described how just before the outbreak in Auckland, the Ministry had at least become aware of the work her team were doing.

“Probably about a week before [the re-emergence], we published a preprint article on the genomics of the first wave. Before that was posted online, that went through the Ministry of Health to make sure they were happy with it. So they were very aware of what we were doing. I don’t know if they knew the utility of genomics before the re-emergence, but clearly they knew what it could do. Straight away they came to us to ask if we could sequence the cases and stuff. I think that over time, the utility of this became quite well known.”

Since receiving support, Dr Geoghegan’s genome sequencing project has become integral to Aotearoa’s national response. She notes how overall, “people have an interest in this and it’s a really good thing”, laughing at how that interest manifested in her being called a “genome detective” by the media at times, which she told me she thought was “kind of a little bit OTT”.

The genome sequencing project has been notably essential to alerting the government to uncertainty each time cases have been picked up in the community. The group’s efforts at the genomic level have been used to inform epidemiological insights which in turn have been used to inform policy decisions about every subsequent outbreak.

Genomic linkage to existing clusters have reassured the government that they are ‘control[ling] the spread’ while lack of linkage to clusters has resulted in the government exercising caution. For example, In November 2020, after COVID-19 was picked up in a New Zealand Defence Force worker out in the community, genomic linkage to an existing ‘quarantine cluster’ was used as reason enough for the government to feel that they were still epidemiologically in control of the situation, so no decision was made to change Auckland’s alert levels (1 News, 2020).

In contrast, in February 2021, to limit the spread of the “Valentine’s day cluster” (Daalder, 2021) Aotearoa moved up Alert Levels (Auckland to Level 3, rest of the country to Level 2) for three days, where the possibility for the country to move back down levels was reported as depending “firstly on the results of ongoing genome sequencing seeking to determine whether[...]community cases were infected with one of the newer, more transmissible variants of COVID-19”(Daalder, 2021). Sequencing later confirmed that the variant present in the community was that same transmissible variant, Lineage B.1.1.7, that originated in the UK (RNZ, 2021). A few days after moving back down alert levels, genome sequencing directly linking newly emerged community cases to the Valentine’s day cluster insinuated the occurrence of exposure events the government had not expected, inciting another move up Alert Levels for the whole country (RNZ, 2021).

When genomic links between cases were established, the government perceived circumstances as having low uncertainty and therefore made lenient political decisions. When links couldn’t be established, the government acknowledged uncertainty and, in line with their typical strategy of ‘going hard and early’, exercised a cautionary approach.

Dr Geoghegan’s genome sequencing project has therefore clearly been influential in dictating policy decisions that have affected the outcomes of our national response in

Aotearoa. But her recount suggests that the genome sequencing project could not be utilised effectively during the initial outbreak due to constraints in funding mechanisms and because official institutions like the Ministry of Health were not aware of how genome sequencing technologies could be helpful. Once finally gaining funding, and after making the Ministry aware of how genomics could be utilised, Dr Geoghegan's team received immediate support to kickstart their project that other participants praised in their interviews.

4.2 Neoliberalization of scientific management in Aotearoa

STS scholar Rebecca Lave has posited that the source and guiding philosophy of science funding and management at a particular place and time deeply shapes scientists' conditions of production, the content they produce, and how that content is circulated and applied. Scientists “have never worked under circumstances of their own choosing”, but “those circumstances shape (but do not determine) their research practice and even their findings” (Lave, 2012; Pestre, 2003). In another paper, they argue that as the dominant ideology of *our* time, neoliberalism influences scientific knowledge production through the growing neoliberalization of scientific management (Lave et al., 2010).

Lave recognises how neoliberal approaches to scientific management produce outcomes that include attempts to “commercialize knowledge, impeding the production and dissemination of science” (Lave et al., 2010). In general, the neoliberalization of scientific management promotes a shift toward market-based solutions. The production of neoliberally desirable outputs are incentivised when reductions to scientific funding, especially in public institutions, “increase vulnerability” and therefore “compliance” with neoliberal ideals (Davies, 2005). In Aotearoa, this has resulted in what the epidemiologist earlier described as “a research community scrabbling around for competitive funding”.

Successive governments in Aotearoa have enforced a neoliberal vision since the early 90s. For universities and public research institutions, this has looked like the introduction of

“new funding mechanisms” where “research is not seen as primarily academic, or necessarily connected to scholarship and teaching”, but instead as “a source of income to the University” (Shore, 2010). Goven & Pavone, recapitulate this by noting that “while the path dependency of neoliberalization leads to diverse outcomes, neoliberal projects are marked by particular tendencies, and not least among these is the deployment of an actively “marketizing” state as part of a particularly aggressive approach to maximizing returns to capital” (Goven & Pavone, 2014).

In this neoliberal funding environment, research that “will have the greatest positive impact on national, social and economic performance” is prioritised. ‘Blue-skies’ or non-marketable research, whose applications may not be evident at the time of discovery, are not (Shore, 2010).

When even an official entity like the Ministry of Health was unaware of how a genome sequencing project could be applied to benefit a pandemic response, it is easy to see why Dr Geoghegan’s team struggled to access competitive funds. Her experience with time-consuming funding procedures is representative of the wider shift towards a neoliberal agenda in Aotearoa.

Additionally hallmark of the neoliberal agenda is its justification for cutting social services, like healthcare, as they are not seen to directly benefit the market. This affects how research projects like Dr Geoghegan’s get funded. Research that focus on addressing issues in public health can get left behind by neoliberal agendas as they produce outcomes that contribute to public welfare and not to the market. Additionally, healthcare systems can get left behind for the same reasons. Aotearoa’s healthcare system has not been immune to these influences.

4.3 Neoliberalization of Healthcare in Aotearoa

Prince et al. (2006) describe how the 1991 “Your Health and the Public Health” document, known as the Green and White paper, introduced early neoliberal restructurings of the healthcare system in Aotearoa. This document asserted that “the ‘invisible hand’ of the market will allocate resources most efficiently and that this can be achieved by creating a quasi-market through the purchaser–provider split” (Prince et al., 2006). In this neoliberalized approach to healthcare, “the rational self-maximising individual [...] acts primarily as a consumer of healthcare taking the responsibility upon themselves to make wise choices about their health” (Prince et al., 2006). In an individualised, neoliberal approach to health, “illness comes to be seen as an outward sign of neglect of one’s corporeal self” – a sentiment then normalised as “common sense among policymakers and the population” (Brown & Baker, 2013, p28). Governance strategies therefore focus more on “individuals who are believed not to be meeting their obligations as active and self-responsible citizens in ensuring their own wellbeing” (Brown & Baker, 2013, p13).

Trnka & Trundle (2014) remark that “one of the central themes of neoliberalism” is “the portrayal of a personal choice and autonomy as the means through which responsibility is enacted”. They define ‘responsibility’ as “individual or collective accountability through judgments of one's rational capacities, assessments of legal liabilities, and notions of moral blame” (Trnka & Trundle, 2014).

In “The Health of the People” (2019), Sir David Skegg laments that “the ministry [of Health] is overwhelmingly concerned with the provision of personal health services, to the detriment of public health initiatives”, citing how all six of the National Health Targets “focused on individuals, not public health policy” until they were “scrapped” in 2018 by the Minister of Health at the time, Hon Dr David Clark (Skegg, 2019, p98). Similarly, Goodyear-Smith and Ashton (2019) note how health policy development has focussed on support for

“individual-level secondary services and performance targets” (Goodyear-Smith & Ashton, 2019).

Sir David continues his recount of neoliberal reforms in Aotearoa’s healthcare system by describing “progressive downsizing of the public health expertise in the Department of Health (as it was then called)” (Skegg, 2019, p56). Barnett & Bagshaw (2020) speak to this by contending that, despite some retreat from neoliberal policy-making in health after the year 2000, “there has been persistent marginalisation of health professionals through the dominance of rules and guidelines over clinical judgment” (Barnett & Bagshaw, 2020).

4.4 Inadequate workforce at the Ministry of Health

The Ministry of Health’s relative lack of understanding about genome sequencing and its utility for pandemic responses compares to what Dr Geoghegan told me of her understanding. She described this technology as having gradually developed since the Ebola and Zika outbreaks, and indicates that these developments were well known to genomic researchers like herself and her team thanks to international collaborations and sharing of technical resources and information.

Dr Josh Freeman also referred to international collaborations as being critical for setting up diagnostic testing in Aotearoa:

“Well it was important the Chinese published the whole sequence of the virus, and a German group came up with the test and published their test - the sequence of what we call primers that are needed for the assay and that sort of thing, and we were able to use that, so yeah, it was absolutely important. International collaboration and openness was critical right throughout that time for setting up the testing, and in determining the nature of our response.”

As the Clinical Director of Infection Prevention and Control in Canterbury, Dr Freeman could speak to the experiences of people actually setting up diagnostic testing processes. His

account of this however suggests there were discrepancies between his experiences and the government's understanding of the logistics involved in setting up these processes.

He explains that the dissonance between what he was experiencing and what the government was publicly conveying became especially desperate at one point:

“There were a few instances where, as a country, we may have only had 24 hours left of tests, and we had to flag this. It seemed that a lot of people at the top were not aware of this, and the messaging they were giving to the public at that stage gave absolutely no indication that things were that desperate and close to the line”

In Dr Freeman's recount, government lack of situated knowledge (Haraway, 1988) about the actual logistics of doing diagnostic testing put the nation at risk more than once.

These narratives about the dissonance between the government's understanding of advancing technologies and the logistics around actually doing them play in to a key concern of Professor Nick Wilson's. He realised that the current expertise at the Ministry of Health needed to be improved once he saw how slowly the government was initially responding to the emerging pandemic:

“I was very concerned that this reflects the inadequate workforce in the Ministry - they don't read enough of the scientific literature to see the potential of new pathogens as natural zoonotic agents or arising from biotechnology...I mean this is quite a legitimate international concern from a lot of scholars and yet the Ministry knew zero about any of this in their pandemic plans and they had zero interest in looking at how borders could be controlled quickly if a really bad pandemic emerged”

His concern that there is not enough scientific expertise at the Ministry, of which he has been publicly critical (Daalder, 2020), is also shared by other participants. An epidemiologist, for example, expresses their frustration that only a “tiny number of people” had “experience in

managing infectious disease” - essentially only the “Director of Public Health”, Dr Caroline McElnay (one of my participants) “who has worked in a public health unit, and therefore has managed, at least in principle, infectious disease outbreaks”. They considered how a workforce specifically employed to focus on infectious diseases could have better supported Dr McElnay’s expertise during the current pandemic context, compared to the reality which was a civil service workforce who had to somehow adapt to this context despite their lack of expertise:

“So there were plans, but what there wasn't was a kind of workforce that could just swing into action... It means that you really need to employ people and they can do other stuff if there's no pandemic, but they need to be able to turn on the dime and start working on the pandemic. Whereas what we have is a government workforce, you know, a civil service workforce which is fully occupied with whatever they're doing on a daily basis.”

Hon Dr Ayesha Verrall, now a member of cabinet, emphasised this flaw in Aotearoa’s public health capacity in her ‘Rapid Audit of Contact Tracing for Covid-19 in New Zealand’, released in April 2020. She recognised that “expansion of the Public Health Unit [PHU] workforce is an urgent need” after observing that “workload of PHUs exceeded their capacity to conduct rapid contact tracing on occasion” (Verrall, 2020). By observing how COVID-19 could harmfully interact with Aotearoa’s neoliberalised healthcare system, this report brought to light the tacit weaknesses of its infrastructure in a way that demanded urgent action from pandemic response decision-makers.

4.5 Expertise in crisis/es

In these anecdotes are allusions to potential opportunities missed and risks fortuitously averted by politicians. Accounts from specialists like Dr Freeman and Dr Geoghegan indicate that Aotearoa is not in general lacking in expertise that could help

advance those opportunities or avert those risks. Instead, participant opinions indicate that the relevant infrastructures, like the public health workforce, is lacking in presence of, and respect for, expertise.

In the case of genome sequencing, this is academic expertise – people who can keep up with scientific literature and inform Ministry plans and procedures of emerging threats and the advancing technologies that could be utilised to address them. In the case of diagnostic testing, this is practical expertise – people who have lived understandings of the possibilities and limitations related to actually enacting scientific procedures at capacity. In the previous chapter, I also outlined in detail the importance of having Māori, Pacific Island, and other social expertise.

Some participants suggest that the experience with COVID-19 is already contributing to establishing early inklings of some kind of expertise workforce. For example, while Professor Sean Hendy confirms that “people who really didn’t have the expertise in these particular jobs” were pulled from across government as part of the emergency response, he sees some of these people as *becoming* experts out of that experience, given their intense involvement with the response through that emergency period:

“In that emergency response, a lot of people were doing things that they weren't experts in, maybe weren't comfortable with, didn't have the networks to support. But I think what happened over the sort of hundred days, things relaxed a lot. It certainly wasn't intense. People went back to their normal jobs in government, *but there's been a few people who have stayed on as specialists [1].*”

That these nascent “specialists” have been formally affirmed in their pandemic-specific roles signals that, coming out of the COVID-19 experience, the public sector are conceding that having public health expertise in the workforce is useful. This affirmation is being seen by participants hoping to train the next generation of public health specialists. As a member of

the New Zealand College of Public Health Medicine, Associate Professor Colin Tukuitonga had been “lobbying for years to the Ministry of Health to give us more money to train more young doctors in public health medicine”. Over the course of the last 10 years, they’d get enough funding to support one or two doctors a year. “It’s been really disappointing”, he lamented. But already, COVID-19 has impacted that:

“This year, for the 2021 intake, we're taking 13. The government suddenly gave us money saying, ‘here it is, train 13 public health doctors for New Zealand’ and so on. That's a very real-world example of the change in attitude from where we were to where we are now, and the change in attitude at least at the political level”.

This “real-world example” of change relates back to my second chapter where I argued that scientific actors in decision-making spaces highlighted the lack of support for infectious disease research in Aotearoa through their renderings of the SARS-CoV-2 virus, which contributed to bringing about these real-world changes that Associate Professor Tukuitonga was witnessing.

Based on their frustrations about the lack of an expert public health workforce during this pandemic, participants will likely see it as promising that changes are being witnessed. The epidemiologist however is reserved in their hopes. “It’ll be interesting in 3 or 5 years’ time”, they told me, explaining that their reservations were based on past experiences of being hopeful at seeing improvements:

“With the 2009 pandemic, within public health circles there was a lot of talk about how finally the Minister of Health understood how useful public health was and [how] the Minister was all impressed with all these people he never even knew existed, who were doing all this fabulous work. And everyone went ‘yay! At last! They’ll finally fund public health properly. And of course, 6 months later it’s all done [...] so that sort of properly funded properly organised public health provision system never happened”

Again, this participant's concerns link back to evidence I present in Chapter 2 about how scientific actors in Aotearoa propose a need for an official infectious disease research entity. These goals are linked to their concerns about the future. This epidemiologist, who mentions having done "some influenza research actually prior to the 2009 influenza pandemic" suggests how "everyone who thinks about [a potential pandemic] for more than 5 seconds can realise that it's definitely going to happen".

Competitive funding regimes and marginalisation of expertise within crippled healthcare infrastructures are seen as undesirable, if not dangerous, by participants who believe that responses to crises in the future 'should have some sort of grounding in science' (as I'll expand on shortly). I additionally argue that not only do neoliberal agendas marginalise experts, they are in fact linked to the conditions bringing about the very issues participants are concerned about.

4.6 "Small changes in the ocean liner don't seem like much when you begin"

When I asked participants about their hopes for the future, implicit in their answers are their concerns about the present. Dr Donna Cormack for example, hopes that equity considerations become embedded into societal institutions and attitudes:

"I hope one of the lessons people would learn is that if you actually want to have equitable responses you actually have to do something different. You can't just talk about it you actually have to think about it at every step of every process. At every decision."

The health practitioner shares Dr Cormack's hopes, especially with regard to equal Māori inclusion and participation in these institutions:

"I think the lesson for me is that if you have true Māori partnership, and if you have the right people around the table, it is going to be beneficial to everybody. I just don't understand why we have to keep asking to be at the table, I'd love for them to know immediately that they need us there, we're

there to help, and actually everything we've done so far has benefited everybody in Aotearoa, so just do it *chuckles*”.

These participants recognise that improving expert workforces to address future crises means diversifying them at the same time, in line with my argument from the previous chapter. Diversification, they posit, strengthens Aotearoa’s chances to get through inevitable challenges.

Other participants bring up their hopes for how Aotearoa might address gradually evolving risks like climate change in the future. Professor Nick Wilson contends that climate change has “existential risk elements to it”, speculating that “any thoughtful scholarly considerations says that it does make sense for a society to try and prevent these things, and if it can't even prevent them, how best to mitigate the adverse consequences”.

Professor Dame Juliet Gerrard also hopes that Aotearoa has learned about how collective action could be utilised for future climate crisis intervention. When I ask her what big picture lessons she hopes Aotearoa will come out of this experience with, she replies:

“I hope it's the piece about collective action. So there's always a big problem getting people to collectively act to achieve a common goal but we did it. My hope is that translates to things like climate change where we've got the same problem. People have understood that collective action is useful and powerful if you can empower individuals to buy in to the collective vision.”

Like her, Professor David Hayman hopes we might learn how to improve our interactions with the environment. To a similar question he answers,

“The environmental thing. I'd love people on Earth to take a different view to how we deal with... how we live on this Earth. Because there's absolutely no reason why tomorrow we won't have another outbreak of a different infection. Because we haven't changed much. I mean there are some changes

right now, there are some changes with lockdowns and stuff, but in principle, if we keep on abusing the planet we'll end up having the same again.”

Dr Josh Freeman discusses the importance of the science-policy relationship in addressing these various issues that can play out over longer periods of time:

“Pandemics are very rapidly evolving events, where the, sort of, cause and effect is very rapid, between not listening to science and the repercussions of not listening to science... are apparent very quickly. Other more slowly evolving problems that we are facing, that's less clear [...] Decisions made in the 1990s, 1980s, for our society have repercussions that are felt a decade later. *You know, it's like small changes in the ocean liner don't seem like much when you begin but then sometime later you are a long way off course* [I]. So I think with issues like... you know, we're facing environmental issues, so climate change and things like that... and societal issues. So things like various inequities and various other social issues that we are facing, you know, those issues... a big part of addressing those needs to be grounded and rooted in some sort of scientific enquiry and it needs to be science informed.”

His account almost outright refers to the role that neoliberal reforms have had in producing the concerns participants have today. For example, in the case of inequality, and healthcare inequality, Bagshaw & Barnett cite how widespread neoliberal reforms in the 1980s led to Aotearoa's significantly increasing economic inequality – a problematic consequence for health given that for “virtually all health indicators across countries of all types, health outcomes from the most obvious (such as mortality rates and life expectancy) to the more subtle (mental health problems and chronic disease) are related to levels of inequality” (Barnett & Bagshaw, 2020).

Participants who discussed environmental issues, and had a background in infectious disease or epidemiology, understood that the COVID-19 crisis and the environmental crisis are intrinsically linked. They acknowledge that the COVID-19 crisis emerged as a

consequence of climate change and biodiversity loss. Associate Professor Colin Tukuitonga, for example, refers to the scholarship of people in climate-related areas to explain why this emergence of this pandemic was, in fact, inevitable:

“Broadly, the people involved in environmental management and biodiversity management and climate change had warned us in hell that we were destroying the habitats, that we were changing the dynamics of the natural environment. [...] So, in a sense, we were always expecting something to happen... So, as I say my colleagues in the climate change area would say that it was inevitable”

Another epidemiologist shares his view. When I ask them whether in their pre-pandemic work they were concerned that a pandemic could be looming, their immediate response is “of course. Absolutely. I mean, it’s a fact”. Like Associate Professor Tukuitonga, they link globalized practices of environmental encroachment to increased pandemic emergence risk:

“We are increasingly impinging upon environments where these viruses often arise or exist in animals. So the combination of destroying environments, that means that viruses move from animals to humans, and rapid spread by travel means that this is going to happen one way or another.”

Professor David Hayman expands on this:

“Where do these new infections come from? They don't magically appear. Most human infections come from another species... Basically humans are gradually turning the Earth in to a farm, we're gradually encroaching on all wildlife habitat... I mean it's sort of obvious - you've got a forest you've got lots of different infections in animals there, if more people go into it then more are the chances that the infection could go from that species to the person... if you're not in there there's no risk, if you're in there there's risk.

And if it's gone there's no risk. But then you've lost it. The forest – you've lost whatever, it all. It doesn't have to be the forest.”

In the recent Intergovernmental Science-Policy Platform On Biodiversity And Ecosystem Services (IPBES) Workshop on Biodiversity and Pandemics Report, to which Professor Hayman contributed, it is recognised that “on a global scale, the emergence of new zoonoses correlates with wildlife (mammalian) diversity, human population density and anthropogenic environmental change” (IPBES, 2020), where zoonoses refers to the transmission of pathogens from wildlife to humans. Patterns in the relationship between humans, non-human species and the environment do not occur in political, social or economic vacuums. They were produced and have continued to reproduce themselves through political, social and economic mechanisms that are inherently tied to the current underlying global systems that organise modern society, namely that of modern neoliberal capitalism.

Neoliberal attitudes to capital accumulation have been recognised as driving and justifying natural resource extraction (Mezzadra & Neilson, 2017; Veltmeyer, 2013) while obstructing efficient and effective conservation management strategies (Sullivan, 2006). Neoliberalism therefore interacts with the world ecology in a way that engenders biodiversity loss, human population density and environmental change, recognised by IPBES as majorly influencing the chances of zoonotic disease transfer events occurring. Major disease outbreaks begin with these kinds of events – Vincente Navarro (2020) rather saliently observes how over the last 40 years, as neoliberal ideology has expanded its reach across the globe, “the world has witnessed no fewer than 4 large epidemics (Ebola, SARS, MERS and now COVID-19)”(Navarro, 2020).

It seems then, that the issues participants expressed frustrations about underlie some of the issues they are concerned about for the future. The system that constrains how they do research and promotes the marginalisation of their expertise is the same system that produces

the conditions that they research and build their expertise in. But as much as participants described how feelings of duty and responsibility influenced their eventual involvement in our response, likening their perception of science to a calling, we must also remind ourselves that it is also their living (Shapin, 2008).

4.7 Chapter conclusion

In this chapter I have drawn on participant concerns about Aotearoa's science management system, public health infrastructure and wider social issues to reveal that, though they did not explicitly mention it by name, participant concerns were directly linked to neoliberal influences in our society.

This chapter therefore recognises how scientists in Aotearoa are caught in a complex, neoliberal web. Neoliberal agendas produce the conditions that they are concerned about and therefore might research (like infectious diseases or public health) which they will make money from doing. That same agenda has contributed to making science a modern living, where it was once considered "outside of and above the intrusion of the marketplace", reserved for the morally curious to exemplify their "character[s] of merit" (Shapin, 1988, 2008; Ward, 2012). This agenda however additionally administers the way science is done, and even what kind of knowledge can be produced. That administration does not necessarily favour research about things like infectious diseases and public health, as outputs are unlikely to be marketable. Though it is beyond the scope of this thesis to explore the nature of this web, it is understandable as to why participants have frustrations about the neoliberal system – because it affects them quite directly.

Conclusion

The initial aim of this thesis was to explore the ways scientific and non-scientific actors interacted with scientific knowledge in their experience of Aotearoa's COVID-19 response. I investigated this aim by identifying 14 relevant actors and asking them about their overall experience, their accounts of interactions with scientific knowledge and their opinions about those interactions.

I found that as much as science informed our COVID-19 response, this response also revealed tacit behaviours, processes and constraints that influence scientists, the way science is done, and the scientific landscape in Aotearoa. Here I will reiterate some of them.

In my first chapter, I investigated how scientists came to be involved in our national response. I specifically wanted to know why that specific circle of scientists were recruited, and not others. My research suggested that pre-existing informal connections to people in the scientific and political communities facilitated scientist inclusion through the employment of *informal* behaviours and communication channels. Scientific participants informally asked others for advice and were advisors themselves.

As the nature of these invisible networks were materialising, scientific actors were seeking information about the SARS-CoV-2 virus from an overwhelming publication environment, as I discussed in Chapter 2. Being a unique community with specialised skills, scientific participants felt it was their duty and responsibility to seek, collate and interpret rapidly emerging scientific literature. Doing so gave them the opportunity to justify their recruitment into the response to political actors. In turn, political actors used scientifically rendered understandings of the SARS-CoV-2 virus as an ungovernable entity to justify public governance. Shared understandings of the virus between scientific and political actors

engendered consistent science communication to the public from either agent, which encouraged compliance with public health measures.

The inclusion of scientists in our national response has therefore greatly influenced the formulation and outcomes of our national response, but not without a lot of work done by those actors. Right from the start, with the changes to media environments, like Twitter, for example, scientific (and non-scientific) actors were being ‘affected’ by changed knowledge landscapes.

A “novel” virus implies an unfamiliar virus, so for scientists – whose institution’s validity, and therefore authority, is contingent upon the successful enforcement of familiar rules – this early environment would have been uncomfortable. I have argued that actions scientific participants took in those early days contributed to key developments, in both our response and in serving their own scientific interests. Against the context of STS literature, developments that served scientific interests in this response included gaining access to a powerful decision-making space and gaining public support for their place there, in turn justifying the authority of scientific epistemology. Against the context of Aotearoa’s specific science landscape, scientific actors made gains in addressing their concerns about the lack of support for infectious disease research by highlighting how this response was made weaker because of it.

In Chapter 3, I explored how the processes of including scientific actors in the response were not extended to actors with other knowledge expertise. This also put the success of our response at risk, because, like participants described, assumed universal experiences cannot speak to the nuanced lived realities of individuals living with the legacy of Aotearoa’s colonial past.

Though the inclusion of some participants in the response ensured these nuances were understood and addressed to an extent, I argued that increasing the diversity of expertise in decision-making processes can help produce responses that are fairer to people vulnerable to being exploited by poorly considered policy decisions. I additionally argued that improving diversity of expertise in traditionally science-centred spaces is not only in the interest of equity, but in the interest of the scientific institution as pluralistic knowledge-making approaches can improve the accuracy, scope and utility of science in society by encouraging science to reposition its place within global social, political and economic orders.

In my final chapter, I discuss how systemic neoliberalisation of modern society has influenced the way science is managed in Aotearoa, constraining knowledge production and its modes of production to suit market-based ideals. Within this management system, scientists must scabble for competitive funding which does not necessarily encourage cross-disciplinary research efforts. I linked participant frustrations about scientific management in Aotearoa to participant frustrations about the marginalisation of expertise in public health workforce and the decrepit state of public health infrastructure. I recognised how these frustrations were all essentially frustrations about the consequences of the global neoliberal agenda.

A key limitation of my research is that the testimonials of 14 people involved in organising our national response to COVID-19 obviously does not speak to the wide variety of voices that could be heard from. For example, I did not speak to economic experts in this research, but if I had, perhaps it would have provided some interesting insights for or against the other participants' neoliberal frustrations. Because of the way I recruited participants, by identifying their media appearances where they talked about science or through their

publications about scientific insights, I inherently ensured that the people I was going to talk to were somewhat familiar with interacting with scientific knowledge. While this was beneficial for answering my specific research question, and in fact contributed to findings specific to their competent handling of scientific knowledge, interviewing people who did not have obvious scientific backgrounds or did not obviously interact with science often could have added interesting depth and complexity to understanding how scientific knowledge might have transformed as it transmitted between various actors and institutions in our response. Perhaps my research could complement another researcher's attempts to explore this as a specific question in the future.

Through all of my conversations with participants, I was made aware that there are a variety of issues in Aotearoa that they are concerned about. Most of them express hope that by successfully “uniting against COVID-19” we might be able to unite against other challenges in the future.

If scientific actors, like my participants, are serious about addressing their big picture concerns, my argument suggests that it may be in their interest to first address underlying systems that constrain their ability to achieve them. For example, both scientific and political participants mentioned being concerned about the kinds of inequities I described in Chapter 3 while many also express concerns about the environment and climate change.

My research indicates that to address these challenges effectively, scientists will need to open up their ideas of what science is (to use Dr Donna Cormack's words) and begin including experts that represent a diversity of knowledges in their professional, day-to-day scientific cultures and interactions. For example, extending conference invites to experts from broader knowledge bases, engaging with them on research projects where possible and, in

general, listening and learning from them. This will ensure that scientists do not continue to tacitly do work that maintains their epistemic authority over other highly valuable, rather than inviting those knowledges in. Scholars in STS have reminded us that reality, especially lived reality, is socially and politically contingent. If scientists wish to make accurate, useful knowledge about issues that are inherently social, my investigation suggests that they will need to be able to incorporate social and political *qualitative* understandings into their own *quantitative* research methods and outputs.

Who better to ask for advice on how to do that than experts in those fields?

Additionally, as we have seen, forming informal relationships with other researchers in professional settings can help facilitate the formation of invisible networks in the research community. If scientists do work to include a range of experts in their invisible colleges *now*, those experts will likely be organically included in official responses to crises in the future. And as participants reminded me, these crises are inevitable. One of them is happening as we speak. If it is true that we must organise ourselves to effectively address climate change by 2030 (IPCC, 2018), I would very much like to urge scientists in Aotearoa to start engaging in these practices *ASAP*.

In conclusion, my research found that every single participant interacted with scientific knowledge in some way (arguably, my thesis proposes that actions they took ensured that the whole ‘Team of 5 Million’ did). The nature of these interactions were undoubtedly unique to each participant – for example, a frustrated politician compares to an overwhelmed scientist to a nervous health equity researcher. But there were also places of overlap. Notably, one of these was that all participants saw that scientific knowledge *could* be used to bring about better outcomes for society.

My research has attempted to highlight how it has in Aotearoa's national response to COVID-19. Additionally, I return to Arendt's (1954) rumination about how crises can 'tear away facades' to highlight how it *can* for other crises in the future.

This research has exposed behaviours, networks, processes, experiences, biases and constraints about science, scientists and the scientific landscape in Aotearoa. It has also provided insights into how these things can be improved and why they must from 14 people involved in a national response that successfully saved the lives of a possible 27,600 New Zealanders (Wilson, 2020). My hope, then, is that these insights will be sought, collated and interpreted for future crises our nation will have to face. Because I, like my 14 participants, would also like to see better, if not *the best*, outcomes for our society too.

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Appendix

Draft question sheet designed for participant Dr Josh Freeman

1. So, for context, could you please introduce yourself?
2. To help me situate your role within the events of the pandemic, could you please give me an overview of your personal experience with COVID-19 and NZ's national response to it?
3. So if we take it back to before the pandemic, what kind of work were you doing day to day and how did that change with the pandemic?
4. In a Stuff article from April, you described yourself as "intermediary between frontline doctors and the scientists processing the samples" what do you think is the advantage of having someone like going between these two worlds?
5. Does the way you use or interact with scientific knowledge between these two worlds differ?
6. As an expert who has been part of the testing side of things, could you give me an overview of the positives and negatives of this process, and an account of how it's evolved over the course of the pandemic?
7. In terms of the people you were interacting with as part of our response, who were you newly interacting with and how did that network evolve over the course of the pandemic?
8. Were you ever part of any key disagreements about how we should approach COVID?
 - a. How were those resolved?
9. NZ has gotten quite a bit of media attention nationally and internationally for our "science-based" response. What exactly about our response do you think is 'scientific'?
10. Do you think it is important that the public understands the scientific rationale behind decision-making?
11. Why do you think it's important for scientific experts to be involved in political decision-making in general, and in the context of a pandemic?
12. What big picture lessons have been learned for NZ going forward from this?

