

# **Vibrating the Web:**

## **Sonospheric Studies of Media Infrastructure Ecologies**

Thesis submitted in partial fulfilment of the requirements for the  
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## ***Abstract***

How can the relationship between media infrastructures and the economies of noise foster the development of a sonospheric art practice? Media infrastructures are the material backbone of the Internet. Such sites underpin the digitally hyper-connected world, but as material assemblages are also imbricated in complex and divisive ecological, environmental, economic and affective practices. This thesis identifies a lack of sonic discourse within the body of growing critical art practice researching the field of media infrastructures, and will contribute to the field of sound studies by arguing, and defining a methodology, for listening sonospherically (Oliveros, 2011). Through six original artistic projects researching the presence of media infrastructures, the thesis will argue for the ‘sonospheric investigation’ as a methodology to engage in the politics of such divisive spaces. Vibrant, multisensory, and multimodal, the sonospheric investigation will be demonstrated as a novel approach for field-based research of spatial and technologically mediated environments. Each original artistic project develops what I call the ‘sonopalette’, a toolkit of field research methods which reveal the being of sounds, vibrations, noises and affective vibratory impulses. These methods include – but are not exhaustive of – field recording, oral history interviews, documentary filmmaking, deep listening, vibration sensors, electromagnetic sensors, data scraping and machine learning. A sonospheric engagement with space and place can generate new connections between human, nonhuman and nonorganic bodies that further our understanding of the conditions of the Anthropocene. Working with the scholarly critique of theorists, research by artists, and my own original practice, the thesis will demonstrate that the mixed registers of a sonospheric investigation are a generative area of research for sound studies scholars, artists, and spatial practitioners concerned with the localised impact of global digital material culture.

**Key words:** Anthropocene, culture, economy of noise, field recording, Internet, listening, media infrastructure, medianaturecultures, multimodal, sonopalette, sonosphere, sonospheric investigation, technology, vibration.



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Thank you to my friends and family for listening, especially Zara Dinnen.

## ***Digital media documentation and accessibility***

The digital media files which form a significant component of this thesis submission can be accessed using the provided SD Card or upon request will be shared using an Internet based file sharing platform.

I recommend the reader considers each work when prompted by the ‘media transition’ sections that will occur throughout the written body of the thesis. The works are intended to be experienced in sequence but I equally encourage the reader to revisit, repeat and engage with the documentation material as often as they like. ‘Appendix C: Media Transition Playback Guide’ offers recommendations for playback conditions which include environmental, procedural and technical configurations for each piece of digital media documentation.

1. *Electrostatic Borderlands* (2018), audio (53min 33sec)
2. *Palimpsest* (2017), film (06min 57sec)
3. *The People's Cloud* (2017)
  - 3a. *What is the cloud vs what existed before?* (2017), film (09min 05sec)
  - 3b. *Working out the Internet: it's a volume game* (2017), film (09min 29sec)
  - 3c. *The submarine cable network* (2017), film (12min 40sec)
  - 3d. *How much data is there?* (2017), film (07min 05sec)
  - 3e. *Convergence* (2017), film (07min 05sec)
4. *The People's Cloud (Original Soundtrack)* (2016), audio album (50min 03sec)
5. *White Mountain* (2016), dir. Emma Charles, film (20min 56sec) \*
6. *Memory Line* (2018)
  - 6a. *Memory Line [installation edition]* (2018), installation documentation (04min 00sec)
  - 6b. *Memory Line [four channel edition]* (2018), single channel reduction, film (27min 02sec)
7. *Fields of Athenry* (2016), installation documentation (04min 49sec)
8. *Project Antioch* (2017)
  - 8a. *Geophony* (2017), audio (04min 00sec)
  - 8b. *Machine Learning* (2017), audio (23min 42sec)

\* This work is directed by Emma Charles with sound by Matt Parker. The digital media file is unavailable due to copyright restriction.

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N.B. All images are created by the author unless otherwise stated.

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## ***Thesis introduction***

### ***Node maintainers***

When was the first time you heard about the Internet? Perhaps you're reading this online right now? Does your computer immediately connect to the Internet when switched on? How many connected devices do you have at home? Do you ever think about what is in play to make the Internet... the Internet? Have you ever tried to listen to it? Humans are increasingly reliant upon networked digital technologies to facilitate communication, entertainment, trade, and global data analysis. These global data flows are achievable due to a system of nodal hubs that enable the distribution of audiovisual signals and data. Media scholar Lisa Parks defines these hubs as "media infrastructures" (Parks, 2015: 356). Media infrastructures are the material backbone of audiovisual signals and data transmissions around the globe; the physical objects of the Internet and other digital-network platforms. They are imbricated in complex and divisive practices of extraction, labour, manufacturing, and operational processes (Parks and Starosielski, 2015). This includes the exploitative mining of rare minerals on controversial and politically contested lands (Klinger, 2018), the laying of a global mesh of steel, rubber and fibre optic data cables (Starosielski, 2015), and the daily carbon emission outputs of power hungry data factories operating twenty-four-hours-a-day (Hogan, 2017). This infrastructure is owned and operated by some of the world's best known companies including Alibaba, Alphabet/Google, Amazon, Apple, Baidu, Facebook, IBM and Microsoft, as well as some of the world's biggest but least known companies including Akamai, Cogent, Equant, Equinix, Priceline, Salesforce, Tata Communications and TC Subcom.<sup>1</sup> Each are critically responsible for the daily operations of the seemingly open, transparent, ever-present, and permanent experience of Internet consumption, yet the public's "black boxed" (Latour, 1999) experience of networked computing remains one where we work

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<sup>1</sup> This selection is not a top sixteen list according to market value but a snapshot of companies who are 'top tier' players in the media infrastructure and digital communications industries. Their operations at the hardware level range from Cloud platform provision, to data storage, e-commerce, fibre optic cable management, data storage and network interconnections.

with computers, enjoy “the effects they produce”, and yet have “no access to their mode of functioning” (Zielinski, 2008: 259). Following from Susan Leigh Star’s call for an ethnography of infrastructure (1999), this thesis investigates how to engage, investigate and interrogate the impact of media infrastructures through the sonosphere.

## ***Resonating spheres***

In a 2011 article, Pauline Oliveros articulated a new concept for discussion within sound studies, the ‘sonosphere’. For Oliveros, the sonosphere described the resonating energy consciously or unconsciously processed by all creatures of perception “using earth bio and technological systems” (Oliveros, 2011: 167). This thesis investigates how arts practitioners can find ways to make meaningful connections between culture, technology and the environment through the sonosphere. There are a number of overlapping concepts within sound studies that describe aspects of the sonosphere: acoustemology, (Feld, 2015, 1996), acoustic ecology (Schafer, 1994; Truax, 2001), audit (Mowitt, 2015), phonosphere (Cuciniello, 2015), sonority (Solomos, 2013), and soundscape (Schafer, 1977/1994). In addition, the semiosphere, a concept coined by Yuri Lotman to denote the space in which signification and communication takes place, has been described as a sphere “constituted by messages – movements, colors, electrical fields, chemical signals – the signs of life” (Hoffmeyer, 1997: vii). Oliveros similarly describes the sonosphere as a complex mesh of media and energy fields, but importantly, also notes the importance of attenuating, transducing, and listening to these energies through technology, as will be discussed throughout this thesis.

The overlapping concepts listed above form because vibration, sound and listening are at the foundation of a complex assemblage of concepts resonating across many research disciplines.<sup>2</sup> Sound studies in itself might be initially perceived as offering a narrow filter – that which can be heard with ears – but its reach is diverse. Additionally it can include the differentiations between individual subjective experiences, vibrations that may reach beyond the human borders of

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<sup>2</sup> The Arts and Humanities Research Council network project Listening Across Disciplines is one example of work across disciplinary boundaries on the emerging importance of sound and listening (Voegelin and Barney, 2018).

aural perception but are nonetheless present and perceivable (by nonhumans and technological means), the resonance between things in space, as well as connections to signals, communication and semiotics. Conceptual overlap within sound studies therefore demonstrates the difficulty in categorising phenomena occupied within the sonic realm. This thesis takes the sonosphere as its chosen position within a saturated conceptual field as it offers not only a broad categorisation of what we might think of as relevant sonic phenomena, but also because it offers a strategy, or mode of action, through which the listener can mobilise and adapt. In short the sonosphere, as presented throughout this thesis, can be considered as a more-than-representational (Anderson and Harrison, 2010: 11; Lorimer, 2008; Thrift, 2000) vibrational force, continuum, or mesh which spans the membrane between material reality and cognitive perception.

In recognition of this diverse and interdisciplinary application of contemporary sound studies, the central theoretical framework of this thesis draws from feminist scholars working across sound, vibration, ecology and meaning-making from multiple fields which hold a common interest in diversity, plurality and resonance. This position differs from a sound studies discourse emerging from the avant-garde and Fluxus movements which considers listening in all forms as a pleasure, irrespective of how such listening may “fall on the spectrum of our emotions” (Patrão, 2015). This thesis considers the complexity and “struggles of listening as much as its pleasures” (Patrão, 2015).

### ***Scapes or spheres***

Contemporary culture has become reliant upon technological instruments to measure, assess, objectify, categorise, and quantify the phenomena of the universe. Our capacity as a species in deploying technology to translate, transpose, and transduce, to re-encode planetary energies into meaningful sets of symbols within current scientific paradigms, is deployed across the Earth’s ecosystem. Biosphere (Suess, 1875); ecosphere (Cole, 1958); and Gaia (Lovelock, 1988), are each concepts used to describe the numerous interconnected circuits of the Earth’s ecosystem which support the conditions for Life. Humans are a comparatively new addition to the management of Earth systems. That which is made or modified by humans, or

the technosphere (Haff, 2013), has become an increasingly pivotal feature in the unfolding planetary drama of the Earth (Kassas and Polunin, 1989). The conceptual framework of the spheres includes not only physical material properties but also the aforementioned semiosphere: the semantic sphere of communicative exchange through symbolic structures (Lotman, 2005), and the noosphere: the influence of human thought (Teilhard de Chardin, 1958; Vernadsky, 1945). The energy of vibrations which form the sonosphere interweave the symbolic, cognitive, material and affective – or more-than-representational – entanglements of socio-cultural phenomenon with the Earth system's material and immaterial flows.

The sociologist Arjun Appadurai has argued that we should see the world in terms of “ethnoscapes, technoscapes, mediascapes, financescapes, ideoscapes” (Appadurai, 1990: 296). For Appadurai, the scape offers a “deeply perspectival” (Appadurai, 1990: 298) way of thinking about the world. Philosopher Thorsten Botz-Bornstein argues that as a metaphor the scape “sees economic, technological, and cultural structures not as fixed but as open, evolving and merging” (Botz-Bornstein, 2006: 393). The scape contrasts with the notion of the sphere which Peter Sloterdijk defines as “the interior, disclosed, shared realm inhabited by humans” (Sloterdijk, 2011: 28). The sphere is the formulation of the socio-cultural ‘bubble’ in which humans opt to encase themselves, and to which the scape seems to be in opposition; open and “without limits” of interpretation and multisensory input (Botz-Bornstein, 2006: 393). Botz-Bornstein thus holds the scape in preference to the sphere on the basis that the scape looks different from every angle, encouraging infinite interpretations, whereas the sphere puts a fixed point in relation to the centre of a bubble.

I have opted to work within the sphere as it offers coordinates from which the scape is formed. Take the example of an astronaut dislodged from planetary gravity and untethered from their vessel. The astronaut is in a state of vectorised free flow and cannot orient themselves upon a horizontal or vertical axis as there is no distinction. It is the atmospheric bubble of the planetary sphere that grounds us and allows us to form perspectives across the senses to – as Jean-Luc Nancy says – “open the resonant body, to its vibrations” but also to the “presence to something



other than itself” or an “*elsewhere*” of sense and meaning (Nancy, 2007: 25). Geomagnetic vibrational force generates an axis through which we orientate ourselves. The sphere offers coordinates from which the scape is formed. This thesis will argue that listening through the sonosphere enables a presencing of self, and multiple selves, in the spaces encountered within each case study.

The sonosphere embraces an approach to listening and sound studies practice which considers the economy of noise (Dyson, 2014: 144); a complex and interlinked set of registers stratified between the geological and ecological ‘out-there’, and the cultural, political and embodied ‘in-here’. In her conception of the economy of noise Frances Dyson has argued that noise crosses multiple registers. These registers include: environmental (that noise is often connected to the production of toxins and pollution); ecological (that noise drowns out the capacity and potential of the voices of other beings); economic (that noise has become an instrument of financialism); and psychic (that noise disturbs and smothers thinking). This thesis will demonstrate a gap within the body of growing critical art practice researching the field of media infrastructures, where the multiple registers conceptualised in the economy of noise become a critical area of investigation for sound studies, interdisciplinary scholars, and sound art practitioners alike. By thinking about media technology through these different modes, I will address the potential of studying the noise of technological assemblages, in particular media infrastructures, as a locus for investigation into a wider dialogue between the technological, human, and nonhuman conditions of the Anthropocene.

### ***Listen to the local, listen to the global***

In the Anthropocene, a proposed epoch in which humans have become the primary force of impact on the Earth’s ecosystem (Crutzen and Stoermer, 2000), globally networked digital technologies are the central tool towards determining, measuring, locating and quantifying the effects of human impact (Hogan, 2016). The concept of the Anthropocene has been criticised for presenting a myopic view that humans are unified within the earth-system and denies “the multi-species violence and inequality of capitalism” (Moore, 2016). The generalisation and broadness in which the concept of the Anthropocene is deployed is problematic.

The alluring optics of the Anthropocene as visualised – smokestacks, malnourished polar bears, satellite imagery of devastated lands caused by mining – are for Emily Eliza Scott, “unable to convey the multiplicity, relationality, and indeed opacity, of it all” (Scott, 2014). Instead she calls for us to “think, relentlessly, the geological and ecological together with the social, economic, political, and ethical, while keeping issues of power and justice always center stage” (Scott, 2014). Rather than understanding technology as the panacea to all of Earth’s problems, this thesis is interested in how the Anthropocene is, in the words of media scholar Jussi Parikka, “constitutive of social and technological relations and environmental and ecological realities” (Parikka, 2015: 46). Technology, embodied through the network of media infrastructure is simultaneously both the tool of measurement, and a significant contributor towards the planetary scale inequalities highlighted by the Anthropocene. Through a series of sonospheric investigations, this thesis explores the social and technological relations of the planetary scale. The thesis centres on the hubs of media infrastructure; primarily data centres as they form, operate, serve, store, and infiltrate lives of human and nonhuman users, workers and inhabitants within localised zones. As Bruno Latour and Christoph Leclercq write, we can “embed the global into the local so as not to be dazzled by the false promises of the global” (2016: 305). The research undertaken for this thesis is site-based and centred around individual infrastructural nodes – principally within Western Europe – but within these nodes, listens to economies of noise reaching far beyond their locale. This thesis combines sound studies with sound arts practice-based research. A practice-based research project studying the multi-layered impact of media infrastructures has not been done before and applying this research through the sonosphere opens the artist and potential audience to the complexity of media infrastructures that a primarily visual arts research approach couldn’t achieve. This thesis argues not for more data visualisations, lensing and angles through screens and visual media, but for assemblage, resonance, and empathy through multimodal listening.

## ***Multimodal listening***

In the work of Steph Ceraso and Lisbeth Lipari the physical and social conditions of hearing and listening are considered to be attenuating modalities. For Ceraso, multimodal listening is a way of connecting to the embodied, lived experience, and Lipari describes polymodal listening as a holistic process (Ceraso, 2014: 104; Lipari, 2014: 13). Ceraso and Lipari share a position that listening is not something which is split into an auditory binary of active listening and passive hearing; that we might always be *hearing* but *listening* requires attentiveness towards a subject or mode. They understand listening to be both auditory and nonauditory; as much a process of cultural technique as an affective response to external stimulus (Ceraso, 2014; Lipari, 2014: 50–51). Kate Lacey has warned against distinctions between active and passive listening in sound studies. She argues that being an active listener, as an attempt to “revive the classic liberal model of the free and rational individual” in opposition to the “gullible, faceless conformist, vulnerable” passive listener, is a questionable virtue (Lacey, 2013: 185). The multimodal listening approach within this thesis encourages a mindfulness of the “fractal nature”, and “complex and often mutually contradictory ways” (Lacey, 2013: 186) listening may take place.

Attended through a multimodal listening practice, where the “affective, embodied, *lived* experience” (Ceraso, 2014: 104) is addressed alongside and in addition to the semiotic and symbolic, this thesis will introduce an original creative research practice methodology which I call the sonospheric investigation. Each original artistic project within the thesis develops what I call the ‘sonopalette’, a toolkit of field research methods which bring sounds, vibrations, noises and affective vibratory impulses into being. These methods include, but are not exhaustive of, phonographic field recording, oral history interviews, documentary filmmaking, deep listening, vibration sensors, electromagnetic sensors, data scraping, and machine learning. Crucial to the sonospheric investigation is for the artist to listen sonospherically. The sonospheric investigation is as much research methodology as it is a research disposition, an approach towards empathic, resonating encounters in the world. The sonopalette is therefore a set of tools to be used, interchanged, and expanded upon within an array of multimodal encounters.

As an artistic, practice-based research project, the process of artwork production is core to developing the research theme of this thesis. I distinguish the stages of artwork production into five interlaced phases:

- Conception and pre-production – setting the conditions to carry out the collection of data or material to be developed into an exhibited artwork;
- Production – the collecting of data or material within a specific field or site of research;
- Post-production – compiling, editing and developing materials into a prototypical work for potential public exhibition;
- Exhibition – the presentation and dissemination of an artwork to an audience in a particular physical or virtual space.
- Documentation and evaluation – the collection and structuring of material that provides both evidence and demonstration of what was exhibited in order to continue to tell the story of the work beyond the duration of any given exhibition format.

The artworks in this thesis explore space, place and the sonosphere and have each been publicly exhibited in galleries, public spaces, or online. The output of the exhibition is important for public visibility of the work and to have an opportunity to begin to determine audience responses to the work. In order to formulate what a sonospheric art practice is and what potential impacts such a process can have as a research practice, this thesis will mainly consider the process of making the artwork and how that developed my thinking in response to the primary research question rather than a given works' impact in the exhibition context.

### ***Research questions and contribution to knowledge***

The five chapters of this thesis explore the possibilities of listening through a sonospheric art practice to the historical and everyday “co-becoming” and

“becoming-with” human, nonhuman and inorganic bodies (Haraway, 2016: 16, 2003). Each chapter comprises creative practice in the form of digital multimedia documentation and descriptions of the encounter, process and output of artworks, interwoven with further theoretical underpinnings as text. The chapters develop a response to the central research question of this thesis: how can the relationships between the ecology of media infrastructures and the economy of noise foster the development of a sonospheric art practice? Using media infrastructures as a subject and the economy of noise as a set of filters for my investigation, I will introduce how using a set of tools determined for a sonospheric enquiry has the potential to make powerful connections between sound art practice and the technological, networked conditions of contemporary culture.

This thesis offers three particular original contributions to scholarly knowledge within the fields of sound arts, sound studies and infrastructure studies. First, the original research methodology of the sonospheric investigation is a unique approach towards environmental listening within the field of sound arts that critiques the role of media technologies within the climatic regime of the Anthropocene. It emphasises a recalibration of how we understand listening and sound studies practice in the digital age. Second, this interdisciplinary thesis uniquely connects existing academic research within the field of media infrastructure studies to ongoing discourse within sound studies, offering novel theoretical and practical guidance for research across these disciplines. Finally, this thesis presents the technologies that comprise the Internet as sonospheric. I argue here that the Internet can be understood and attended to through the resonances of its infrastructures, which is to say, through their cultural, environmental, economic and ecological noise. By achieving the above, the thesis demonstrates how a sonospheric approach to listening, filtered through the economies of noise, offers a significant opportunity compared with other arts practices to critically engage with the complex stratifications of technologically mediated culture, politics and planetary eco-systems; amplifying the foundational role that sound, vibration and the sonosphere play in networked ecologies.

## ***Chapter summaries***

The chapters of this thesis break down the research question into five themes: methodology, access, subject, time and memory, and economies of noise. Chapter One, 'On listening sonospherically', introduces the sonospheric investigation, the research methodology of this thesis, through a review of sound studies literature engaging with the vibratory registers and potential of multimodal listening as a creative practice. The chapter considers the production of the artwork *Electrostatic Borderlands* (Parker, 2018a), the result of an artists' residency at an off-grid site, as a test-bed for multimodal listening with the sonopalette toolkit, and how this enables a connection to the nodes of media infrastructures even from remote and seemingly disconnected locations.

Chapter Two, 'Access all areas: negotiation, communication, and compromise', asks which territories might noise occupy within the politics of space and place, and how should a sonospheric art practice negotiate access to such spaces. The artwork *Palimpsest* (Parker, 2017b), a sonospheric investigation into the agency of media within the ancient monuments of Rome explores the importance of site-specificity, being present, and presencing the materiality of media infrastructures central to the sonospheric investigations of this thesis. However, accessing such often private and secluded sites generates a number of practical and ethical considerations. This chapter considers the role of the artists' residency as a model for accessing research sites. I discuss the efficacy of the residency model with reference to three aspects of my own experience as an artist-in-residence: techniques for negotiating access to critical sites; the compromises met in the process of listening within these spaces; and how the sonospheric encounter demonstrates a communication layer embedded within the earth and diffused in the air.

Having discussed negotiating access, Chapter Three, 'The whirl and whoosh of media infrastructure', directly accesses the research subject of media infrastructures. The chapter introduces what media infrastructures are, how artists are responding to and critiquing media infrastructures in their practice and reflects on how a sonospheric art practice may resonate within this existing critical field. *The People's Cloud* (2017) and *The People's Cloud (Original Soundtrack)* (Parker,

2016b) interrogate through the mediums of documentary, phonography, and electroacoustic composition, the material locations of media infrastructures as well as the voices of senior employees within European data industry. The works coexist with a review of other contemporary artists engaging with media infrastructures. In these works, the voices of industry and individual artists represent various concerns that are key to the sonospheric investigation, including industrial proximity (Vonderau, 2014), compromise, workplace hierarchies and privilege.

Having listened to the dominant voices and platforms of media technology, Chapter Four is concerned with which voices are being ignored and forgotten within the dominating contemporary neoliberal narrative of technological progress. 'The terminal heat sink: temporality, rhythmicity and memory' explores how the sonospheric investigation can activate a deep listening of the ecology of media, the temporalities and rhythms of media, but also how media itself listens, and how by listening to, and with media, we listen both/and to nature, culture and media. The chapter is divided into two sections. The first section investigates the geological deep time of media infrastructures as a collapsing of dualist notions of nature and culture. This notion becomes animated through the process of multimodal listening explored through a collaboration with artist filmmaker Emma Charles on the film *White Mountain* (2016). The second section considers memory, temporality and media through an investigation of one of the world's first computers, the Electronic Delay Storage Automatic Calculator (EDSAC). Combining research into EDSAC's physical, acoustic delay-line memory technology, the memories of individuals who worked on the machine during its operational lifetime, and memories of retired engineers building a reconstruction of EDSAC in the present day, the artwork *Memory Line* (Parker, 2018b), is a sonospheric investigation into the materiality of media memory, and of memories of media and culture in the nascent British computing industry.

If Chapter Four demonstrates how media infrastructure and computing's impact reaches far beyond the situated location of the technical media object itself, affecting the geological and social conditions of individuals connected to them, Chapter Five expands this research towards the perimeters. 'Living on the edge of

media infrastructure' considers various layers and modes of impact created by Apple when the world's richest technology company applied for planning permission to build one of the largest data centre complexes on the planet, in Athenry, Ireland. The chapter outlines how the economy of noise is situated in the attempts by communities and activist groups to appeal and resist an emergence of the media infrastructural complex in Athenry, but also across North America and Western Europe. The artwork *Fields of Athenry* (Parker, 2016a), a multimedia installation investigating how the medium of YouTube is a way of connecting what Athenry is, to what it might become, and the two part artwork *Project Antioch* (Parker, 2017c; d), explore Athenry through a sensory awareness to voice, agency, presence and vibrations from human, nonhuman, and machinic perspectives.



## **1.0 On listening sonospherically**

### **1.1 Introduction**

This chapter introduces the ‘sonospheric investigation’ research methodology which puts listening and the sonosphere at the core of this thesis. I will introduce the sonosphere through a review of sound studies literature engaging with the vitality of vibrations, energy, signal and communication. This chapter will define the concept of the sonosphere; the sonospheric investigation methodology, and the research methods that comprise the sonopalette. A sonospheric investigation requires openness to the reception of vibrational spectra (frequency, charge, energy), and this chapter will, in particular, demonstrate how listening through field recording, is well positioned as an entry point for attending to such a practice. The chapter ends with the description of a specific field recording-based sonospheric investigation which culminated in the production of the exhibited sound-based artwork *Electrostatic Borderlands* (Parker, 2018a). The piece was produced following an off-grid artists’ residency in the south of Spain where a number of sonospheric research methods were experimented with in the field. This thesis is concerned with how a sonospheric research methodology has the potential to enable thinking through the four pillars of what techno-cultural sound scholar Frances Dyson has named “the economy of noise” (Dyson, 2014: 144). By introducing the economy of noise later in this chapter, the thesis will argue that the methods of the sonospheric investigation offer a multimodal approach to thinking through the presence of noise as vibration. By centring this research process round a critical engagement with global media technologies, I will argue that sonospheric investigations have the potential to open up new ways of understanding the relationships between the nodes of noise, technology, culture and ecology in our ‘superconnected’ world (Chayko, 2016). This chapter opens with the noisy beginnings of the Bang. From this point of origin, I will identify the interconnected fibres that network noise, sound studies, and global media technologies.

## 1.2 *Noise: an origins story*

For almost a century, scientific research has gravitated towards The Big Bang Theory as explanation for the origins of the cosmos. This started with astronomer Georges Lemaître's (1931, op. 1929) claim that it is possible to trace the universe backwards because it is constantly expanding. The notion was further supported by telescopic observations of galaxies drifting apart (Hubble, 1929) and the later observation of Cosmic Microwave Background, the echoic remnants of thermal radiation glow (Penzias and Wilson, 1965). The Big Bang theory for the origin of the universe follows that we exist in the aftermath of this Bang which is scientifically observed as noise.

Social historian Hillel Schwartz has formed a historical narrative for 'Bang' related phenomena: the noisy cosmic aftershocks we experience every nanosecond. Schwartz's book *Making Noise: From Babel to the Big Bang & Beyond* (Schwartz, 2011) opens with a series of noisy confrontations within historical narratives reaching as far back as pre-Socratic times, the Babylonians, Egyptian, Hellenic, Mayan and Chinese dynasties. The Bang, and its distant afterglow of emergence, matter and vitality in the cosmos becomes evident across the entire distribution of waveform frequencies that make up the electromagnetic spectrum (Weik, 2000). For Schwartz the presence of noise is by extension observable in environmental phenomena. He provides examples of chirping cicadas in ancient Greece, where "song was created for the first time" (Schwartz, 2011: 19), and of technological interference on the USS *Maddox* where naval navigators mistook spurious "noise spokes" (Schwartz, 2011: 26) on their sonar/radar system for torpedoes, subsequently leading to the escalation of military action between USA and Vietnam. Schwartz's argument proposes that noise is the cosmic aftershock of the creation of the universe and as such permeates across all things for all time, manifesting as both a desirable and objective source of all signals that make up the world, simultaneously operating as political, embodied, cultural, subjective and affective.

Mathematician Claude Shannon's Master's thesis introduced 'information theory' in 1948 to create a model for understanding the flow of signals and noise in the world. In 1963 he republished this work in a book co-authored with scientist

Warren Weaver titled *The Mathematical Theory of Communication* (Shannon and Weaver, 1998). The book includes a 'schematic for general communication' (Image 1), now widely known as the Shannon-Weaver Model. The model has been so influential in communication theory across both physical and social sciences that it has been dubbed the "mother of all models" (Hollnagel and Woods, 2005: 11). The model demonstrates a signal path commencing with an originator of a message or *source*; a *transmitter* encodes a message into a transmission which is sent over a *channel*, and then collected by a *receiver*. At the *channel* stage, the message may be corrupted by *noise*. As Shannon's biographer Erico Guizzo states, "noise is everywhere: it is in space, where magnetic storms can disturb signal; inside electronic equipment, where spurious currents can corrupt data; within an optical fiber, where energy losses degrade the light transmitted" (Guizzo, 2003: 28–29). When considering information signals between objects in the material world, it is the interactions between frequencies within the electromagnetic spectrum that Shannon and Weaver argue are the basis of communication.

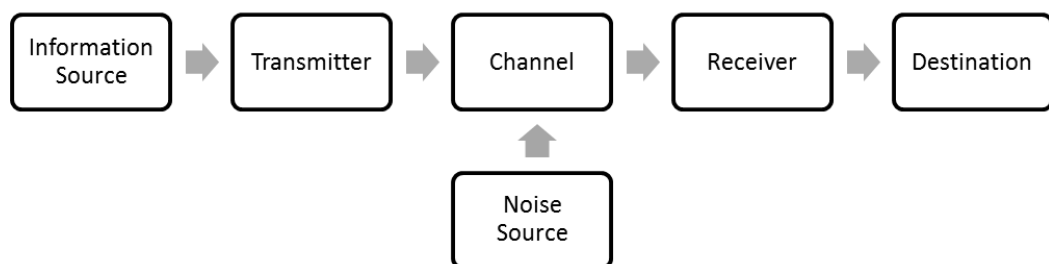


Image 1

Shannon's schematic diagram of a general communication system (Shannon, 1948)

Shannon and Weaver's information theory is a functionalist model of communication where all information sources have meaning if they make sense to the receiver. To return to Schwartz's example, when the naval navigator cannot recognise the signal message they receive on their sonar scope, or that they hear through their sonar transducer headphones, the navigator becomes aware that a signal is being transmitted, but the meaning is lost. Noise is the interference, whether it be technological (the device representing the signal inaccurately) or psychological (the navigator misinterpreting the signal). In the ancient suburbs of

Athens, the cicada transmits a signal but the human ear receives a noise that doesn't necessarily convey a clear communicative gesture. As Guizzo states, "[w]hat is meaningful to a person – a certain kind of music, a text in a foreign language – can be meaningless to another" (Guizzo, 2003: 30). If this is the case, we are left in a world full of noises, signals and receivers, transmitting across potentially unlimited frequencies, only a fraction of which ever contain semantic meaning to the receiver, or listener, if appropriately decoded. Information theory offers valuable principles for signal chains but it doesn't allow for the potentiality of noise being everywhere as suggested by The Big Bang. Shannon's model demonstrates noise interferences exclusively at the *channel* stage. The inflexibility of the information theory model is reflective of the time period in which it was developed, where psychologists such as Ivan Pavlov (2003 org. 1927), Edward Thorndike (1905, 1911) and B. F. Skinner (1938) formed models for behaviourism that reduced action, learning and behaviour to stimulus and response; input and output. Behaviourist models have been hugely informative for psychological and cognitive research just as Boolean algebra presented binary variables, true (1) and false (0), and operators (NOT, NOR, XOR, AND) that became the building blocks of classical computing. Both models aim to reduce behaviours, action, and truth to an essentialist form.

Philosopher Christoph Cox suggests that "[f]or the information theorist, noise is the muck that accumulates on or around a message as it makes its way from sender to receiver" (Cox, 2009: 20). Cox has argued for a 'sonic materialism' that rejects the essentialist idea that materials operate according to function; the information theory model of sender-receiver is one such example. He calls for noise to be thought of in terms of a materialist distinction that would "eliminate the dual planes of culture/nature, human/non-human, sign/world, text/matter" (Cox, 2011: 148) and instead would encourage a process of noise as dynamic "complexes of forces materially inflected by other forces and force-complexes" (Cox, 2011: 157). Steve Goodman offers a similar position of noise as part of his ontology of vibrational force. Following Brian Massumi's note in his translation of *A Thousand Plateaus: Capitalism and Schizophrenia* (1987) by Gilles Deleuze and Félix Guattari which states that affect does not denote a personal feeling (or sentiment) but is "a

prepersonal intensity” (Deleuze *et al.*, 1987: xvi), for Goodman vibration is affective and experienced through the body at the point of proprioception, leading him to coin the concept of “unsound” (Goodman, 2012: 48). Unsound is explored at the thresholds of audition, typically infrasonic (low frequency) and ultrasonic (high frequency) registers, as well as at the subjective thresholds of cognition. As such, unsound is a middle space that collapses the dualist nature/culture relationship of noise. Cox and Goodman have been criticised for rejecting the linguistic and cultural symbolism of noise, sound and vibration, whilst inadvertently setting up a “rigid temporal and theoretical separation of affective ... [and] cognitive realm[s]” (Kane, 2015: 8).<sup>3</sup> Philosopher Brian Kane claims that Cox and Goodman’s models neglect “the constitutive role that auditory culture plays in determining its object of study” (Kane, 2015: 16). Furthermore, sound scholar Marie Thompson has argued that sonic ontologies, particularly that of Christoph Cox’s sonic materialism, attempt “to scission the ontological (and, by proxy, the real; material/materiality) from the realm of politics and social life (and death)” (Thompson, 2017b: 268). The problematic assertion contained within Cox and Goodman’s work for Kane and Thompson is that noise and in particular sonic, vibratory noise, as agential transmitters of information across bodies, is registered as an affective collective consensus between bodies without culture, without perceiving bodies as situated. For Cox this is understanding sound as an object in-itself (2011: 150), and Goodman as understanding the unsound between matter and cognition. Goodman states that there is a “split-second” (2012: 48) between the proprioception and cognitive response and this “microrhythmic” (2012: 28) lag between sensation and cognition is formed by a “vibratory nexus” that “produces the very division between subjective and objective, time and space” (2012: 82). Goodman’s project is premised on the condition that everything is vibrating. This in essence is the vibratory nexus that puts vibration as an ontological prior to culture. However, as a musician, DJ, artist, and writer, Goodman forefronts examples of vibratory force rooted in cultural formations which include the military-entertainment complex, soundsystem culture, Muzak and cinema. Whilst for Kane, any hierarchical staging

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<sup>3</sup> Both Cox and Goodman draw from the work of Gilles Deleuze whose definition of ontological boundaries of the ‘actual’ and the ‘virtual’ (Deleuze, 1968) underpins both their positions. An in-depth analysis of the work of Deleuze can be found in (Shields and Vallee, 2012; Stivale, 2005).

reasserts the dualism's that Goodman aims to reject, Goodman's project attempts to restage the process between the proprioceptive, the cognitive and the cultural. Thompson argues that Cox's sonic materialism, however, is a "technology of forgetting" (2017b: 269) that disregards history of lived difference and places emphasis instead upon "the pure productivity of matter" (2017b: 269) where the sonic is removed from the social. This thesis will continue to explore vibratory force as situated and grounded as well as how such forces are constitutive of the social conditions of hearing, listening and communicating which might be heard otherwise.

Philosopher of language Lisbeth Lipari explores the social conditions of communication, calling for a "polymodality" (Lipari, 2014: 51) of listening as a "holistic embodied process". A similarly aligned "multimodal" (Ceraso, 2014: 103) conception of listening is proposed by Steph Ceraso that attends to the "material and environmental aspects that comprise and shape one's embodied experience of sound" (2014: 105). Lipari and Ceraso expand their definitions of listening to "include nonauditory phenomena" (Lipari, 2014: 50) in contrast to the biological process of auditory hearing of sound pressures detected by the mechanics of the ear. Lipari describes a "perceptual mobility" of the body and of bodies to waveform vibrations and calls for a polymodal approach to social linguistics that includes words, gestures, visual cues and body language, intonation, proximity, tactility and discourse features such as interruptions and turn taking. Through polymodal listening Lipari argues that "most of our conscious and unconscious selections about what to notice and what to ignore ... [come from culture]" (2014: 51). Describing the "hypersonic effect" (Oohashi *et al.*, 2000) – when high frequency sound waves are imperceptible to the ear but are still perceived by the listener – sound scholar Eleni Ikoniadou attends to the "potential participation of nonauditory sensory systems for which vibration does not necessarily translate to sound" (Ikoniadou, 2014: 47). Ikoniadou argues that such hypersonic events "reveal perception as independent from subjectivity and belonging to the event itself" (2014: 86), a position in alignment with Goodman and to an extent Cox. Ikoniadou's work leaves space for inaudible resonances to create "a confrontation with the complex modulations of perception" (2014: 86); resisting a full dismissal of culture

and cognition's role in the affective potential of vibrations and communication. Each theorist brought into this nature/culture binary debate further demonstrates how scholars in the field of sound studies continue to determine ratios of different proportions between the constitutive roles of affect, cognition, semantics and semiotics within the vibratory encounter. Brian Massumi understands the proportions between these factors in a given event to be part of a "conscious-autonomic mix" of palpable and cognitive responses resonating in parallel alignment with an affective "never-to-be-conscious autonomic remainder" (1995: 85). These two systems operating together do not perpetuate the binary narrative because they coexist and are interconnected "resonating levels" (1995: 94) which at times resonate vigorously, and at others, barely at all. These changeable conditions are important in understanding how the sonospheric investigation, which this thesis sets itself upon, is a way of recalibrating the resonating levels of vibratory encounters. Shelley Trower describes this collective vibratory experience as a "sympathetic vibration" within the body that subsequently "radiate[s] outwards into the world beyond, in turn vibrating another sensitive person" (Trower, 2012: 11). Whether as affective response, conscious act or the middle-space of unsound, vibration is the receptive bond interconnecting people, species and organisms.

The Shannon and Weaver model claims that a rigid step-sequence structure underpins communication. Schwartz has provided a social history of noise, tracing its presence and subsequently its ontological importance to the formation of the universe as observed by The Big Bang. All noise is a source of information, which has potential to be decoded by a receiver into something meaningful. Theorists such as Kane, Lipari and Ceraso have each suggested that there are many surfaces of information and knowledge transference that cross the stages of information theory and put sociocultural symbols and representation at the forefront of communication. Cox rejects culture and representation seeking to ground the sonic, noise and vibration as forming material ontologies, which are affectively experienced in time prior to cultural formation. Goodman and more so Ikoniadou, whilst primarily concerned with affective, nonauditory phenomena (or at least the thresholds between auditory and nonauditory), open up the possibility that the

fleeting moments of vibratory noise that occur across bodies and at multiple points of entry share or at least cohabit a complex multi-layered experiential platform.

At stake within these scholars' work is determining what is meaningful and non-meaningful and whether meaning is derived through culture and representation or affective phenomena in vibratory encounters. Rather than replacing one binary with another, nature/culture with affect/cognition, Thompson follows the mixed levels proposed by Massumi and offers an "ethico-affective approach to noise" (Thompson, 2017a: 35), that "is not 'either/or' but 'both-and'" (2017a: 8). Thompson calls for an approach that focuses on the "formative and transformative influence of the relations between entities, backgrounds and environments" (2017a: 42). Following Thompson, we might think of the world of sound and noise initially as acoustic disturbance but also beyond the acoustic, existing in other interpretations of 'noise'.<sup>4</sup> In order to remove the binary concerns of noise as objectively bad or good – and vibratory noise as a medium of communication that is meaningful or non-meaningful – Thompson combines sound theory and Shannon's information theory to introduce her ethico-affective approach, which demonstrates noise as present beyond just the acoustic. Tracing western scientific research into frequency analysis in the mid-19<sup>th</sup> century, through to bass and club culture in the late-20<sup>th</sup> century, Shelley Trower demonstrates sound as always having been "a way of making manifest for the sense those vibrations that exist beyond the limits of sensitivity" (Trower, 2012: 4). Observing an affective continuum of shifting forms, Lipari describes the sonic universe as part of the spectrum which encourages "an awareness of and attention to the harmonic interconnectivity of all beings and objects" (Lipari, 2014: 2–3). This interconnectivity can be consciously imperceptible but is not necessarily less meaningful than that which is cognitively perceived. These modes and channels of reception for Lipari are to be tuned in and listened to. She understands listening as "the warp and woof of human interaction" (2014: 4) and an action that is inclusive of "listening *with, in, and out* of our bodies; *with, in, and out* of language; or *with, in, and out* of others" (2014: 4). At the level of communication, Lipari suggests that misunderstandings can't be avoided, that the

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<sup>4</sup> Two non-acoustic examples of noise include includes spurious currents in electrical equipment and optical fibre energy loss (Guizzo, 2003).



speaker (transmitter) is not at the centre of the communication model, and that communication is not the heart of accuracy in 'successful' exchanges of messages. All noise has the potential to be meaningful but only if the receiver is equipped with an appropriate codec to transcode the relevant information from the signal. Not only is noise both meaningful and not-meaningful, the misunderstandings that occur within communication necessarily remind us "that our conversational partners are truly 'other' than us" (Lipari, 2014: 8). As such Lipari sees communication not as transmission but "a mode of creation, not merely one of representation" (2014: 133). The context of vibration, sound, noise, and communication are therefore both representational (symbolic and cognitive), and non-representational (material and affective), and what political geographers refer to as "more-than-representational" (Anderson and Harrison, 2010: 11; Lorimer, 2008; Thrift, 2000). In this thinking noise is a dynamic force which is both a subjective construction, and an action placed in the world. This thesis and in particular its practice of sound art will continue to aggregate a syncretic mix across a more-than representational understanding of the complexity of noise and sound, embraced by the concept of the sonosphere. The sonospheric investigation supports a practice-based research project where listening can be embodied, material, and responsive to the complexity of vibration.

To make a case for the importance of listening, and in particular, to an embodied, holistic methodology of listening that I refer to as sonospheric, I have introduced theories of noise from social history, communication theory, linguistics, and sound studies; each of which traditionally tend to position noise as a disturbance, as interference or undesirable. Following the recent work of Lipari, Thompson and Trower, noise can be considered as embedded within the continuum of material and subjective waveforms rather than existing within a binary formulation of input/output, good/bad, wanted/unwanted either/or; noise can be understood from a both/and approach where it acts *both* as carrier of information *and* carrier of disruption. Noise's universality of presence suggests it as a form of both material and non-material energy flows, manifesting the potential for interconnectivity between all things. Throughout this thesis, I aim to make

affective connections between things through a sonospheric art practice of listening both to, and through, digital technologies.

I will now turn to listening to begin to investigate the platform which this thesis sits upon, the sonospheric investigation, and probe two key research questions for this thesis: what is a sonospheric investigation, and how do we listen sonospherically? Addressing these questions, I aim to position this practice-based methodology as a new mode of engagement within the field of sound studies, and the primary mode of research for this thesis.

### ***1.3 Sound, noise, vibration, and the sonosphere***

There may seem to be a degree of interchangeability between three key words that constantly arise within this thesis; sound, noise, and vibration. Each word offers slippery definitions that commence as a material property or phenomena but also extend into metaphorical and representational analogy. The Cambridge Dictionary offers multiple definitions for sound as: something that you can hear or that can be heard; how something seems to be, from what is said or written; or to make a noise (McIntosh, 2013b). Noise appears here as a noun of sound and is typically defined as: a sound or sounds especially when it is unwanted, unpleasant, or loud; any bad change in a signal, especially in a signal produced by an electronic device; and unexplained or unexpected information in a sample that is not useful and that can be ignored (McIntosh, 2013a). Vibration is narrowly defined as: continuous quick, slight shaking movement (McIntosh, 2013c); but may also be defined as both a characteristic emanation, aura, or spirit that infuses or vitalises someone or something and that can be instinctively sensed or experienced; or a distinctive usually emotional atmosphere capable of being sensed (2018). Based on common usage, dictionaries give a sense of how words cut across the materialities of these properties which are addressed throughout this thesis. It is my intention to give a wide breadth to these definitions, even expanding the multiplicities that already exist with reference to the sonosphere. The definitions cross material and cultural formations as they are formed in language so it would be useful to also provide a definition of how I will interpret materials and materiality throughout this thesis.

### **1.3.1 *Materials and materiality***

A core concern of this thesis is to position noise – the source of both communication and disruption – as a force into ways of connecting the ecological relationships of our current technologically-mediated-and-ecologically-compromised *material* world. Materiality as a concept is deeply problematic and widely debated within the humanities and social sciences. Jonathan Sterne states in an article questioning discourses of materiality that, “we can find dozens of calls for materiality, but often little agreement over what the term entails” (Sterne, 2014: 120). Sterne calls for any understanding of the term ‘materiality’ to refer always and simultaneously, “to both physical things and the irreducibly relational character of reality” (2014: 121). Anthropologist Tim Ingold argues scholarly work on materiality becomes heavily focussed around philosophical understandings of impenetrable language that include agency, semiosis, spatiality, embodiment, at no point providing an explanation as to what ‘materiality’ might actually mean, and remarks from his observations that “[to] understand materiality, it seems, we need to get as far away from material as possible” (Ingold, 2011: 20). Both Sterne and Ingold observe therefore that a study of materials would be a study of “the stuff that things are made of” (Ingold, 2011: 20), whilst a study of materiality, focusses on the difficult to determine relational striations between materials, “as they circulate, mix with one another, solidify and dissolve in the formation of more or less enduring things” (Ingold, 2011: 16). Throughout both this chapter and the remaining thesis, I discuss materials and materiality with this in mind. The stuff that things are made of and the interactions between stuff(s) occur across multiple registers: stuff you touch, stuff that touches you, and stuff seemingly imperceptible but nevertheless present. Complex layers of interaction occur between objects across material states through vibration which “is not itself a material object at all, but is bound up with materiality: vibration moves material, and moves through material” (Trower, 2012: 6). It is necessary to consider the vibratory nexus; the in-between stuff; the stitching between living bodies that links human perception of the world, “with the world’s perception of itself” (Ingold, 2011: 12). Noise, as vibrations within the world, is an example of such materialities. Vibrations act as

connective bonds, weaving between the human and nonhuman, threading together materials and perceptions and becoming both a medium of investigation and a medium through which investigations will take place in this thesis.

## **1.4 Sonospheric investigations**

Contemporary debates over noise, sound, vibration, and energy attempt to address an imbalance existing in studies of perception which privilege the visual (Dunn, 1999; Mowitt, 2015; Stokes *et al.*, 2014). Research into sensory experience other than visual has considered smell and the olfactory system as a prime sensory mode of engagement (Drobnick, 2006; Rhys-Taylor, 2017; Wilson and Stevenson, 2010); the significance of touch and haptic sensation (Fulkerson, 2013; Levent *et al.*, 2014; Marks, 2002; Millar, 2008); and the multisensory impacts of perception (Bennett and Hill, 2014; Calvert *et al.*, 2004; Haverkamp, 2013; Pink, 2009). In such work there remains a tendency to position the multisensory as something to be framed within a coexisting hierarchical structure where figurative, narrative and linguistic reference to the visual continues to dominate. Sound art practitioner Matilde Meireles proposes a “horizontal dialogue” (Meireles, 2018: 104) between image, sound and text within a practice of “extended phonography” (2018: 104) which explores relationships between the recordist and context of recording, and the audience within space. Meireles combines sound, narrative and visual components into complex multi-sited projects to overcome the fragmentation of the senses inherent in field recording. The sonospheric investigation in contrast is primarily concerned with the process the practitioner goes through; thinking in terms of the affective and behavioural qualities of listening, rather than the material properties of sound as propagating forces. The sonospheric investigation aims to offer a generative methodological approach towards engaging with multisensory vibratory encounters. As is also the case with extended phonography, the visual continues to coexist within this framework but is considered as part of the wider exercise in listening and interlocking of energetic materialities. The ear is not the dominating sense in this methodology either; multisensorial combinations differ according to the form of investigation. The proximity of haptic sensory apparatus of the body to the aural sensory apparatus of the ear has been discussed

in this chapter (see discussion on Goodman, 2012; Ikoniadou, 2014; Trower, 2012) but there is also potential for – as yet undetermined – other multisensory, cognitive and/or intuitive combinations to form within the sonospheric investigation.

In 2011, the composer Pauline Oliveros introduced her concept of the ‘sonosphere’ to define what she described as the “sonic envelope of the earth created by all vibrations set in motion” (Oliveros, 2011: 167), which functions in alignment with Earth’s resonating energy and beyond as waves and phonons. This resonating energy is both consciously and unconsciously processed by all creatures of perception “using earth bio and technological systems” (Oliveros, 2011: 167). Following Oliveros, Douglas Kahn more precisely defined the sonosphere to expand what he describes as atmospheric listening, embracing “a full sweep and barrage of energies, including the magnetic, electrical, electromagnetic, geomagnetic, and quantum, as well as acoustical” (Kahn, 2013: 13). The consequence of thinking ‘sonospherically’ for sound artist and writer Brandon LaBelle is the recognition that, “vibration extends the environmental soundscape deeper toward the physical material plane, to link the body into an expanded field of resonating energy” (LaBelle, 2010: 134). As previously suggested, the human body can only consciously perceive a subsection of frequencies of vibration that occur in the world. What we understand to be the audible realm is a subsection of vibrational forces that we can contextualise within the larger continuum of the sonosphere. By studying the relationship between the body and its position as a vibrating material assemblage, we can begin to make connections between the Earth’s energies and our own.

In her essay introducing the sonosphere, Oliveros (2011) discusses the ensemble work *Primordial/Lift* (1998) where an oscillator plays a slowly ascending sinewave sweep from 7.8Hz to 13Hz through a subwoofer at high decibel levels (dB SPL).<sup>5</sup> The sweep emulates an idea explored by science fiction author Greg Braden (1994) around a planetary shift of the ‘tone of prime unity’ (resonant rotational

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<sup>5</sup> Sound pressure level (dB SPL) is defined as:  $20 \log_{10} p_1/p_0$  where  $p_1$  is actually measured sound pressure level of a given sound, and  $p_0$  is a reference value of  $20\mu\text{Pa}$ , which corresponds to the lowest hearing threshold of the young, healthy ear.

frequency) of Earth.<sup>6</sup> In 1952 the global electromagnetic resonance of the Earth was measured by Winifred Otto Schumann with his colleague Herbert König to be 7.8Hz (König, 1979: 35).<sup>7</sup> *Primordial/Lift* aims to tune the listener in to this planetary scale vibration, suggesting that sound can be felt, if not heard, reinforcing the need to expand our understanding of perceptible sound as a subset of a broader vibrational continuum reaching beyond the limiting biology of human ear receptivity (around 20Hz to 20 kHz) (Goodman *et al.*, 2016). Such active flows of vibratory connection demonstrate how without technological mediation or a multimodal approach to listening, the relatively narrow bandwidth of human perception makes detection of the full breadth of environmental agency unattainable. As physicist and neuroscientist Seth Horowitz notes, “[a]nywhere there is energy, including the depths of intergalactic space, is a vibratory region” (2012: 4). Exploring the furthest fringes of electromagnetic space, contemporary artists and designers are deploying media technologies to listen in to the resonances of stars and exoplanets (Devine, 2016; Harger, 2004); the dynamic energies of electromagnetic radiation in the Earth’s ionosphere (Friz and Zunino, 2017; Hinterding and Haines, 2013; Tapper, 2018); the frequencies emitted from electronic devices as they operate, function and connect with one another (Dunne, 2005; Dunne and Raby, 2001; Kubisch, 2004); the vibratory energies of the air, earth and oceans (Ganchrow, 2015; Kirkegaard, 2010; Winderen, 2010); and the warping wax and wane of large architectural assemblages (Fontana, 2006; Vitiello, 1999).

These artists and designers each explore the material ontologies of vibratory force that make connections between energy states through processes of expanded listening broadly referred to as transduction. Transduction covers “[t]he movement from one energy state to another, either within or between large classes of energy (mechanics or electromagnetism” (Kahn, 2013: 3). It is made possible through the technological mediation of microphones, loudspeakers, sensors, probes, voltage differentials and state-converters. The sonospheric investigation is a research methodology that deploys methods of transduction to make possible interaction

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<sup>6</sup> The tone of prime unity is a concept explored by R. Murray Schafer (1994: 99) through electrical circuitry and more recently Will Schrimshaw (2018) who critiques Schafer’s use of prime unity through the concept of unsound, and sound artists that explore the concept in their work.

<sup>7</sup> This is now more commonly known as Schumann Resonance.

between sensory apparatus and geological, ionic and cosmic movements that may have previously been beyond the threshold of human experience. Transduction technologies also have the potential to bring closer into the observable realm the role of digital media technology themselves, as both the sensing device and the making-sense devices that assist in forming relationships between minerals, materialities and bodies, as they produce a “hertzian space” (Dunne, 2005: 21) of electromagnetic and physical interactivity between devices and people.

The attention towards extrasensory transducers does not diminish more established and conventional acoustic microphone and field recording techniques which also have potential to open the ears and body to environmental listening such as in the work of many environmental and ecologically attentive field recordists, anthropologists, ethnographers and geographers whose field of enquiry is navigated through an aural sensory engagement (Baron and Segerstad, 2013; Feld, 1996; Gilmurray, 2017; Helmreich, 2012; Karel, 2012; Lane and Carlyle, 2013; Pijanowski *et al.*, 2011b; Pink, 2009). Through this mixed method approach, a sonospheric investigation can potentially create affective bonds between listener and other vibrational forces be they human, nonhuman, organic, inorganic. Multimodal listening in this way can “allow users to hear infrastructural systems”, to sonify “projects that operate on a planetary scale” and to explore “the role of sound discourses of the local” as part of what Jacob Smith has called “eco-sonic media” (Smith, 2015: 160). Whilst Smith does not refer to the sonosphere, his claim that an attentive listening has the power to “vibrate at an ecological frequency” which “open the ears of eco-criticism” (2015: 5) resonates with the sonospheric concept. Sound, the sonic, and the waveforms of sound, are typically considered according to the longitudinal, mechanical soundwave created by the cyclical movement of a body in space creating the compression and release of air pressure. The sonosphere acknowledges a broader understanding of material waves that exist across the expanded realm of hertzian space (including electromagnetic and acoustical). Cyclical waves occur within our bodies as they pump blood in waves, the neurons fire in the brain, computer processors wave in cycles, the earth rotates

in a cyclical waveform, a dentist ultrasonic drill cycles at 800,000 times a minute.<sup>8</sup> The expanded potential of listening sonospherically offers a multimodal sensory awareness both of and within space as lived in, experienced in and mediated through. Such vibration for sound scholar Paul C. Jasen “opens onto the acoustics of bodies and buildings, inadvertent encounters with ambient waves, the unheard vibrations of infrasound and still more liminal events that can only be called *sound-like*” (Jasen, 2016: 3). It is not always the soundwave that forms perception but a sonospheric wave, a connective wave, a vibrant wave.

In her monograph *Vibrant Matter: A Political Ecology of Things* (2010), philosopher Jane Bennett refers to the ‘*Thing-Power*’ of objects and “the curious ability of inanimate things to animate, to act, to produce effects dramatic and subtle” (2010: 6). ‘Things’ in the world for Bennett are connected through vibration. The sonospheric investigation calls to explore what Bennett refers to as the “cognitive dissonance” (2010: 115) between the everyday ‘comingling’ of microbes, bacteria, humans and nonhumans within complex material assemblages to form a sense of what we might call an ecology (the interrelations of things to one another). If we are to find a way to listen to the emergence and flow of such material assemblages, we must do so by making meaningful connections which require ascribing to a form of symbolic cues. Whilst this doesn’t have to manifest as language, ascribing voices to things which can be listened to can be a generative form of meaning making between agential beings. Sound scholar Dominic Pettman asks “[m]ight the voice of the world, wherever we find it (whispering in a seashell, nestled in a bird’s nest, or rumbling in the giants blades of the wind farm), exhibit

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<sup>8</sup> The claim that everything vibrates at some level holds across a continuum of energy state transfers. The audible soundwave is a mechanical longitudinal wave which vibrates through other conductive mediums of the sonosphere, typically within the atmospheric particulates of the Earth. An electromagnetic wave consists of an electric field and a magnetic field at right angles to each other and to the direction of the motion of the wave. Vibrations expressed through the electromagnetic spectrum occur as oscillations between atoms producing phonon energy. Every photon is characterised by wavelength (the distance from the crest of one wave to the crest of the next wave), by frequency (the number of wave cycles that pass by in a given period, measured in Hertz, which stands for cycles per second), and by the energy it carries (measured in electron volts). Any change in wavelength demonstrates a change in state of energy over time, or more simply put the electric and magnetic fields vibrate. At a quantum molecular level, matter waves, or De Broglie waves demonstrate a frequency and energy excitation at the atomic scale known as phonons. The kinetic molecular vibration as hypothesised by De Broglie has been argued to be space-time vibration. Such depths into the quantum universe are beyond the edges of this thesis but for further reading see (de Broglie, 1923; Feynman, 1990; Heisenberg, 1930).



traces of the *aural punctum*?” (Pettman, 2017: 76). Pettman subverts the undefinable but mesmeric visual punctum of the photograph as described by Roland Barthes in *Camera Lucida* (2000, op. 1981) in order to ask whether listening can elicit the “prick” (Barthes, 2000: 26) of an affective charge that generates a sense of co-belonging between human and nonhuman organisms. The feeling you have when you hear something but you’re not quite sure what it was about but you know that it made you *feel* a certain way, is a feeling that this thesis, through a sonospheric art practice, aims to explore. The sonospheric investigation strives to encourage a sense of co-belonging as vibratory beings through cultural or symbolic meaning-making, even if the vibratory encounter is with that thing in the middle; the unsound vibratory nexus.

The art collective Audint (Steve Goodman, Toby Heys and Eleni Ikoniadou) refer to the vibrational force as a generator of a “third dimension between the real (i.e. what is known) and the imagined (i.e. the fictional, or speculative)” (Goodman *et al.*, 2016: 132). Audint follow from Goodman’s earlier argument that the affective bridge between materials in the world and perception *is* vibratory force. Paul C. Jasen argues that the body itself is a “sensate actor”, or “two-way interface” between nature and culture, making direct connection to that which lies beyond the body. But the body must also be recognised as a “cultural vector” (Jasen, 2016: 6): racialised, gendered and performative. These distinctions continue to rely on a separation of body and perception, nature and culture. Paraphrasing the work of Félix Guattari (2000), Jane Bennett challenges us to think ‘transversally’ on the “interlacing of the mechanosphere, the social sphere, and the inwardness of subjectivity” (Bennett, 2010: 114). If we are to acknowledge the vibrancy of matter and our bodies themselves as material assemblages operating across a vibratory mass of the Earth, we must acknowledge the affect of this upon our bodies, and how these vibrations are subsequently enacted through voices and actions within culture. It is here that the sonospheric investigation, importantly, transverses across a material study of vibration from objects in physical space and embraces the subjective, cognitive and social. Sonospheric investigations offer an opportunity to try to listen to organic, nonorganic, human, and nonhuman without removing that

process from the multiple cultural vectors also at play, as such acknowledging the inherent politics of listening. Lisbeth Lipari importantly states that listening,

relates to who speaks and who doesn't, what is and is not said, how what is said is said, as well as, of course, to whom it is said and what is and is not heard, and *how* what is heard is heard (Lipari, 2014: 53).

The multimodal act of listening as part of a sonospheric investigation must ask these questions of both speaker and listener, regardless of material form.

#### ***1.4.1 The myth of the continuum***

The concept of the vibrational continuum is not without its detractors and none more clearly stated than the French composer Michel Chion who calls it a “myth” (Chion, 2016: 124). Chion's position is set within a semantic framework where ‘sound’ is identified as exclusive to the frequencies receptive to the human ear. However, the exact reception of frequencies received by the human ear alters from person to person as some may have more sensitive hearing than others. Over the course of a lifetime the audible waveband contracts as hearing becomes desensitised. In application, ‘anti-loitering devices’ have been designed to only be perceived by those under 25 in order to disperse young people from public spaces (The Mosquito Anti-loitering Device, 2018) (Image 7). Many musicians who by the very form of their profession have highly trained and sensitive hearing develop tinnitus yet still remain able to tune their listening to fine degrees. The double GRAMMY award winning percussionist Evelyn Glennie is profoundly deaf yet listens with her body, making no distinction between “hearing a sound and feeling a vibration” (Glennie, 2015). Such listening practices also occur in nonhuman bodies: some species of dog hear frequencies up to 50kHz and bats as high as 100kHz (Giancoli, 2002). Digital recording and transduction technologies make it possible to listen to a broad territory of vibrations and if we are to attempt to understand the world around us as not a playground for human exceptionalism but as a confederation of throbbing vibratory forces, it is vital to understand sound as both the frequencies of vibration in the audible waveband and those beyond it. It is vital that the sonospheric investigation isn't contained by sound alone, but by the

potential modes of listening that our ears, bodies and the application of technologies can afford us.

#### **1.4.2 *The sonopalette***

In *Practice Research in the Arts* (2013), Robin Nelson states that affordance “signifies the potentiality of an object or an environment, which allows an individual to perform an action” (Nelson, 2013: 41). The sonopalette acts as a set of technical affordances or tools in which to enter different scales, mediums or vibrational flows within both Earth and sociocultural circuits of the sonosphere. The sonospheric investigation as a methodology has been discussed above as a process of listening to the broad range of frequencies and vibrational forces that exist in material and cultural modes. It is a way of remaining open and aware to registers that political geographer Anja Kanngieser describes as “unfamiliar, inaccessible, and maybe even monstrous” (Kanngieser, 2015: 81). It also encourages a mode of listening attentive to the planetary scale more-than-representational politics of socio-material assemblages. Political geographer Martin Müller describes more-than-representational research as “experimental”, as to attend to the multiple registers “requires novel modes of presenting and presencing research” (Müller, 2015: 412). The sonospheric investigation engages with vibratory flows through a collection of attentive methods of listening that make up the sonopalette; blending registers and offering mixed modes of representation; presencing and bringing into being, sounds, vibrations, noises and affective vibratory impulses.

The sonopalette is a neologism I introduce in this thesis derived from *sono* meaning ‘make a noise’ and *palette* meaning ‘a board used to lay and mix materials’. Not all materials need to be mixed in any one sonospheric investigation but each material is available to be selected depending on the aim, subjects and objects in question within a sonospheric investigation. These material methods include bodily acts of being in a place and encountering space through the body and through ears by holistic listening. They also include the transduction of energies into experiential forms. These methods of engagement sit within a broader category of field recording practices. Geographer Michael Gallagher defines field recording as “the production, circulation, and playback of audio recordings of the

myriad soundings of the world” (Gallagher, 2015: 560). Field recording is an activity of recording to an inscription media (for example analogue tape, digital SD card) that encourages a deep listening of the environmental surrounding of the recordist in situ. Field recordings typically attend to acoustic properties of a space, using microphones that respond to vibrations in the air which when making contact with a diaphragm, create pulses of electronic voltage which can be recorded or played back through loudspeakers. The process of reception of vibrations, recording, and playback is a valuable method of the sonopalette. The sound recordist not only records the sound, but must also attend to the registers of listening within a space. The recordist can monitor the input signal of the microphone on the recorder visually by looking at voltage meters but only by listening (usually with headphones) can the recordist hear what the recording device receives before committing the moment to a recording. The headphones and preamplifiers of modern sound recording devices make it possible for the recordist to amplify the signal received on the recorder, modulating the recordist’s perceptual depths, foregrounding different confederations of materials in flow as the microphone is moved in space and as other things move in space. The initial affective experience of being in the moment of recording itself is an important research method within the sonopalette and a reflection on this experience is encouraged both in the moment and after. Recording sounds are also important as they give the researcher an opportunity to reflect, develop, play and experiment with the representation of the recording beyond the single moment in time, making it possible to create new artworks or research outputs based upon the holistic listening practice of a sonospheric investigation.

Transduction technologies are important tools of application within the sonopalette and include: all variations of microphones (cardioid, hypercardioid, figure-8, shotgun, ribbon, parabolic); electromagnetic ‘coil pickups’; piezoelectric disc ‘contact mics’; hydrophones; single and multiple axis accelerometers; geophones; seismometers; ultrasound detectors; echolocation sensors; VLF recorders; radio receivers and transmitters; loudspeakers; machine based learning algorithmic sorters; Geiger counters. This is not an exhaustive list and the sonopalette remains open to new modes of interpretation and transduction that

can be incorporated into the active engagement of listening. The sonopalette aims to make listening and recording frequencies across the multiple registers of the vibratory continuum; allowing a sensing of otherness, mediated through the amplification and recording technology of digital recorders. Extrasensory haptic transduction and amplification is a tool available within the sonopalette to explore materials that expand the physical sensing of ears and offer an embodied listening experience. As the recording and inscription of data, as vibration or any other form, is predominantly done through computers, ways of listening or exploring techniques that computers use to 'listen', including machine learning algorithms, are also a method of exploration. Computers are the tools used to record, analyse and configure both our planetary and sociocultural states. The role of computers is not benign (as will be investigated through Chapters Three, Four and Five) and it is necessary for the toolbox of the sonopalette to consider algorithmic forms of listening; how computers operate, manipulate, and read data are important aspects of understanding ways of listening that are digitally modulated within the world.

The sonopalette also includes interview and ethnographic methods within the toolkit. For the sonospheric investigator, the interview is a mode of listening, engagement, interaction and participation that can combine human and nonhuman presences within a given subject domain. This method will be explored further in Chapters Three, Four and Five as an approach towards listening to combinations of human and nonhuman presences within media infrastructure assemblage on both an individual and mass scale. The approaches I adopted towards conducting interviews were in accordance with the University of the Arts London Code of Practice on Research Ethics.

This is an art practice-based thesis where up to this point I have only lightly referred to my art practice. Before enrolling onto the research degree programme, my practice was as a music composer and multimedia artist. I continue to compose music but what I understand to be 'musical' feels increasingly difficult to distinguish as my work becomes engaged in practices of listening and field recording. At first, I started to think of my developing practice as one of a field recordist and filmmaker; a documentary maker interested in composing narratives that investigated

multisensory engagement with media technologies, infrastructures, and users. As my research progressed I began to think more about my experiences ‘in the field’ as a listening practice, where my ‘being’ in a space and listening through the tools within the sonopalette would shape my engagement with the multiple registers of the sonosphere. As my practice continues to develop, I increasingly understand my presence within a particular space to be difficult to define, particularly as the implications of thinking and being affected by digital technologies have increased in presence within the work. A number of artists working with sound have helped me consider attentiveness to my bodily presence within my work, particularly in field recording practice. The field recording albums of Angus Carlyle (2016), Yan Jun (2009) and Mikel R. Nieto (2016) and the audiovisual, performative work of Mark Peter Wright (2015, 2014) resist a common trope in field recordings of hiding the presence of the recordist in place of a sublime representation of nature. In *Tasked to Hear* (Wright, 2014) the artist does not remove himself from the recording. Wright’s presence is persistent, fidgeting, against the common tropes of erasure. Nestled in a pocket, his phone interrupts the recording with electromagnetic interference. Wright attends to the ways “technological agency [is] performed and part of an ecological approach” to sound art (Wright, 2017: 1) . It is imperative to consider how the recordist’s awareness of presence, choice of investigatory tools, and subjects of technological mediation, animate a practice of field recording in alignment with the multimodality of the sonospheric investigation. Wright coins the phrase “post-natural sound art” (2017: 2) as a term for sound art practitioners that encourage an awareness of ‘presence’ in their work. The sonospheric investigation is as such, a form of post-natural sound art.

The processes of listening, and field recording within a certain space is not limited to exterior activities where one brandishes a microphone and headphones. The sonospheric investigation continues across multiple environments and as an art practice methodology, is performative, studio, and exhibition based.<sup>9</sup> In the studio and exhibition space, I continue to listen; listening to my bodily presence amongst

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<sup>9</sup> Descriptions of engagement in site-based field research, studio based practice and exhibition formatting/layout as part of a practice-based research engagement will be detailed throughout the individual investigations within this thesis.

the micro and macro clusters of acoustic and other vibratory phenomena. Site-based field recording material and memories of the experience combine with the additional cultural formations developed through observational documentary research and metaphor. These modes of engagement shape the crux of my practice, acting as a “socio-sonic” (Rennie, 2014: 117) method of composition. The sonopalette combines ethnography, interview, field recording, electroacoustic composition, film, and installation, allowing the formation of hybrid, listening centered, sonospheric artworks. The performative processes in the field – whether defined as the physical space of a landscape/location, in a studio or editing suite, an exhibition setting, or in the virtual, or metaphorical spaces of Internet based social media platforms and news broadcast websites – are channels and conduits for the socio-sonic act of listening. Whether engaging in interpersonal relationships between fellow humans, or listening to the hums of nonhuman and even nonorganic materials in the physical and digital environment, I find myself at first listening. This thesis sets out to determine not only ways of listening, but what is at stake in that listening, and more particularly, what is at stake in listening to vibrations on the micro and macro scale *now*.

### ***1.5 What is at stake? What if we don't listen? Technology and the Anthropocene***

The discourse of ‘new materialism’ which has been generated by philosophers interested in vitality and hybridity (Bennett, 2010; Haraway, 1991; Ingold, 2011, 2000; Latour, 2005) and those concerned with assemblages and affect (Barad, 2007; De Landa, 2006, 1997; Goodman, 2012; Grosz, 2008; Deleuze and Guattari, 1987; Massumi, 2002) share the position that objects – human, nonhuman, organic and nonorganic – express a form of agency through being. Human beings are enmeshed within these existing assemblages, networks and becomings. The unravelling destabilisation of globalisation and the experience of being superconnected is intimately tied to the increasingly problematic effects of the growing ecological crisis of climate. At the dawn of the millennium, the atmospheric chemist Paul J. Crutzen and ecologist Eugene Stoermer claimed that humans have entered a new geophysical epoch they call the “Anthropocene” (Crutzen and Stoermer, 2000;

Crutzen *et al.*, 2007). In recent years the term has had a powerful purchase on contemporary art, science and cultural discourse (Davis and Turpin, 2015; Figueroa, 2017; Schmitz, 2016; Wark, 2015). The Anthropocene marks a distinct shift into a new geological epoch where humans are the dominant force of change upon the climate and environment. As one begins to understand the interconnectivity of ‘things’, as agential and vibrant materials in the world, one can begin to listen to the cracks and fissures ruptured by anthropogenic endeavour both by, and through, our interrelationships with digital technologies. Philosopher Benjamin Bratton, whose term ‘The Stack’ (Bratton, 2016) has been used to describe the multiple layers of planetary scale digital media infrastructure, observes that it is “only through the medium of The Stack itself that we know so precisely how the carbon appetite of The Stack is contributing so decisively to our Anthropocenic predicament in the first place” (2016: 303). Our entire understanding of this catastrophic climate crisis is formed, measured, understood, and amplified, by the mass production of digital technologies. The Anthropocene is more than just a relationship between the application of technology to human habitable environments: other species and vibratory formations are equally embroiled within it. Cultural theorist Rosi Braidotti’s theory of the posthuman argues that our current global society “generates a global form of reactive mutual inter-dependence of all living organisms, including non-humans” (Braidotti, 2013: 49). As we listen to the vibrations (or fail to listen), humans are becoming vitally interlinked with the raw materials of the Earth through the production of technological assemblages. The Internet, computers, digital technologies, have on the one hand afforded us the potential to be closer than ever before to the Earth but on the other hand, as a species, we have never been so responsible for its ecological destruction.

In order to investigate the implications of the Anthropocene through the sonospheric investigation, we must turn our attention towards the core appendage of posthuman infrastructure – the Internet. The material assemblages of the Internet – media infrastructure, data centres, LTE towers, fibre optic cable networks and airborne data feeds in hertzian space – are key sites for investigating the contemporary predicament. The materialities of these infrastructures form cultural and affective bonds that shape the interrelational flows between humans and



nonhumans. The processes of listening that form a sonospheric investigation can be mobilised through understanding the kinds of modes of listening and remembering that occupy digital technologies. Digital technologies are strongly implicated in the global network, measurement and quantification of the ecological crises, but are equally the products of imbalanced anthropogenic processes of exploitation colonialism, extraction, mining, and ecological destruction. We must not allow the noises of such infrastructures to fade into the background of the hum of modern existence. France Dyson states that:

the economy of noise embraces disciplines across all fields: ecological (in that noise actually drowns out the voices of other living beings just as it stifles the possibility of their appreciation), economic (in that ‘financial noise’ has become an instrument of financialism), environmental (in that the noise we hear is often connected to the production of toxins and pollution), and psychic (in that to some degree, noise smothers thinking) (Dyson, 2014: 144).

The four economies of noise can be understood to be at the root of a sonification of *The Three Ecologies* (2000) by Félix Guattari. Originally published in French in 1989, the book stems from recognition of the crushing weight of capitalism on the ecology of the planet. Situating ecology within its Greek formulation *oikos* or ‘home’, ecology is about a living world in which we exist that Guattari argues must “stop being associated with the image of a small nature-loving minority” (2000: 52). Ecology is an intermeshing of subjectivities, cultural formations and planetary processes. This is the foundation for what he calls *ecosophy* which comprises: the environment (planetary ecosophy), social relations (social ecosophy), and human subjectivity (mental ecosophy).

With regard to the sonospheric investigation, I understand the economy of noise as a more-than-representational mapping of sonospheric interrelationships between the three ecologies. The environmental, ecologic, economic and psychic noise floor is filtered in complex configurations between relationships of the environment, the social, and the subjective, resonating most strongly within the media infrastructures discussed throughout this thesis. Chapter Five of this thesis

will in particular demonstrate specific emergences of the economy of noise through media technology infrastructures. In the Anthropocene, noise is heard and felt everywhere in increasing magnitudes and frequency – rising rivers, mudslides, hurricanes, protests over fracking and gas pipelines – the noise is for Dyson “a mass that is material, worldly, and inhabited” (2014: 144). It is the highly networked digital sensory technologies of fieldwork that allow for the recording and subsequent playback/analysis of sound, environmental, and climate data sets to be possible; the power of such technologies must not be overlooked as merely tools.

## **1.6 *Electrostatic Borderlands***

In the spring of 2016, I applied to the *Art for the Environment International Residency Programme* (AER) organised by Professor Lucy Orta at University of the Arts London. The residency programme offers artists an opportunity to “explore concerns that define the twenty-first century – biodiversity, environmental sustainability, social economy, human rights – and through their artistic practice, envision a world of tomorrow” (Art for the Environment Residency Programme, 2018). My application was successful and in the summer of 2016, I spent fifteen days in El Cortijada de Los Gázquez, an off-grid residence located in an alpine desert, 1,000m above sea level in the Parque Natural Sierra María – Los Vélez, Spain. What struck me about the opportunity to visit Los Gázquez was the idea of spending two weeks off-grid. Two weeks disconnected. What might two weeks offline, away from the superconnectivity of urban living afford for me? What did off-grid mean? What kind of systems would be in place to live an off-grid sustainable life?<sup>10</sup>

I was also interested in listening to the off-grid environment of Los Gázquez; far from any built up metropolitan centre, far from where I tend to spend most of my life, in the anthropogenic urban wash of cars, generators, ambulance sirens and helicopters, WiFi signals and data roaming charges, impossible to distinguish between one set of signals and the next. I wondered what a rural and open landscape might offer as an alternative field to my listening and recording practice.

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<sup>10</sup> Donna and Simon Beckman, and their two children Sesame and Solomon moved from the UK to setup Los Gázquez in 2010.

In Los Gázquez, I wanted to experience being disconnected from the Internet but I also wanted to study the infrastructure of an off-grid site and its sustainability. The off-grid valleys of Southern Spain offered a potential baseline or comparative listening site for sonospheric investigation.

I spent most mornings exploring the estate and beyond into the National Park, recording sounds and vibrations using various combinations of tools from the sonopalette: acoustic microphones; a geophone (low frequency transducer); an electromagnetic coil transducer; and contact microphones. I amplified and recorded the material through a Sound Devices 442 ENG field mixer and onto a Tascam DR40 PCM digital audio recorder. With these field recordings I created a library which was led at first by personal curiosity, then by a series of experiments listening to anthropogenic noise and proximity, and finally according to a survey of favourite sounds that the residents associated with living in Los Gázquez. As a city dweller, Los Gázquez and the surrounding area felt incredibly remote at first, but the sense of what could be defined as being 'off-grid' became looser than I had anticipated. The family home had electricity, and Wi-Fi signal from a satellite uplink that connects to a suborbital network and bounces back to an exchange in Italy. The landscape surrounding Los Gázquez had signs of anthropogenic activity everywhere, from the failed and abandoned monoculture farm terraces, to the water catchment systems, to the artificial walls and tributaries built within the Barrancos (water drainage, fluvial systems drawing down from the mountainside).

I embarked on many solitary walks into the Parque Natural Sierra María, deciding upon an arbitrary bearing and heading off to find out what might happen. As I walked, I listened carefully to changes in sound; the flies, the trees, the wind, and affect; the nothingness, the everything-ness, and my unceasing internal monologue. I recorded infrasonic vibrations with geophones, contact transducer microphones on vibrating bodies of metal, stereo microphone recordings of my position in the landscape and electromagnetic frequencies with coil-tap transducers. I recorded myself, my breath, my movements, my thoughts, my voice and my presence in space. My ambition to remain disconnected from the Internet lasted for five days. On day five of the residency, whilst ascending the tallest

mountain in the park; rucksack full of equipment; head torch guiding the way in the early morning darkness, I encountered a fox, two vultures and an ibex in their natural habitats. During the previous four days I had no signal in the base of the valley but I carried my phone in my pocket at all times, to be used as a compact camera. Just after I witnessed the two vultures launch from the crag upon the mountain peak, my headphones were filled with electrostatic interference and a few moments later, my pocket began to vibrate. Atop a mountain, as far away as I thought I could get from anthropogenic din, at my most isolated, I discovered that in Europe you are never far away from indexes of human activity; whether it be road signs from the past 30-40 years, detritus from the past 300-400 years, or an edge network signal. The marks were everywhere, not just as visual scars on the terrain but as hertzian spectra floating through the atmosphere, unseen but heard.



Image 2

*Zona De Reserva* (2016), sign in the middle of the forest, copyright the author

Returning later that day to the studio the experience left an indelible mark on me. I entered my thoughts into a journal I had been writing which combined my investigatory experiences with reflections on post-apocalyptic dystopian fiction I was reading during the residency.<sup>11</sup> Over the course of the remaining days, I continued to explore the park, listening, through various deployments of the sonopalette. At the end of the residency I collated a collection of recordings into a

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<sup>11</sup> The novel *Station Eleven* by Emily St John Mandel (2014) was both instructive and entertaining.

flowing mix using the digital audio workstation (DAW) Ableton Live. No post-production processing took place other than selecting sections in time from each recording session to crossfade between one another and on occasion layer. The decisions as to what was included or excluded were based upon a somewhat instinctive and creative listening process but would bring into consideration whether a recording was too messy in technique; similar to other recordings; and most of all, whether I had a particular memory or experience that I wanted to revisit through playback of the recorded material. I played the material to the residents over dinner on the final night of the residency.

Several months passed before Lucy Orta and curator Camilla Palestra invited me to propose an artwork for the *Art for the Environment* exhibition. Over this time, I had listened to the mix of recordings a number of times on a number of different loudspeakers, headphones, and environments (walking, reading on the sofa, writing chapter drafts etc). I had found myself talking about the experience of the residency (in particular the moment on the mountain) to people who had asked about it. I made the decision to work through the selected recording materials, crossfading between sequences, looping segments and developing a sonic representation of the space in my memory as presented by the recorded material. The moment of disruption and signal interference on the mountain emerged as the crux of the research. I took an old phone handset and pay-as-you-go SIM card and sat it next to my Tascam recorder set to record. I then phoned the handset repeatedly and recorded electrostatic signals intermixing with the recorders circuitry. Throughout the composed selection of recordings that formed a looped stereo sound piece, I layered these new electrostatic recordings which then became subtly intermixed with the existing recorded material. Silent to the human ear, the electrostatic signal is transduced by the circuitry of the digital recording technology, accidentally revealing vibratory frequencies emitted across even the remotest terraforms of Southern Europe.

The exhibition was a group show featuring five other artists, (Annabel Duggleby, Magz Hall, Nana Maiolini, Noemi Niederhauser, and Matteo Valerio). I made a decision early on to be respectful of the varying dynamic vibrations presented from

the other artists' experiences, which is to say, in the space, my work was sonically and visually subtle. At times, the work is almost inaudible but nonetheless present, mixed amidst the vibratory flows of a resonant neo-gothic, former convent, and exhibition space. Upon the installation of the two, small discrete loudspeakers that played back the amplified work from a digital media player, I noticed a gallery technician repeatedly looking at her phone. She came to me and said 'I think there might be something causing a bit of interference with the work as my phone keeps making noises through the loudspeakers'. My hope is that as visitors walked through the space over the duration of the exhibition, that they found themselves reaching for their pockets only to discover there were no messages, nobody was calling them. Their devices and expectations playing tricks on them, as connected to the network as I was atop a mountain in the middle of nowhere.

### 1.6.1 Media transition

This is the first media transition of this thesis. In these sections I will ask for you to change modes of reception and turn to the digital media files included. Please playback the digital audio file *1. Electrostatic Borderlands (2018)*. This stereo digital audio file was played back on loop at a low volume in The Nunnery gallery for the AER exhibition.



Image 3

Sonopalette field bag 2.0 (2016), example field recording equipment layout, copyright the author





Image 4

*Electrostatic Borderlands* (2018), production still of electrostatic signal scanning, copyright the author



Image 5

*Electrostatic Borderlands* (2018), production still from recording on mountain peak, copyright the author



Image 6

*Electrostatic Borderlands* (2018), discrete speaker installation image, photo by Camilla Palestra

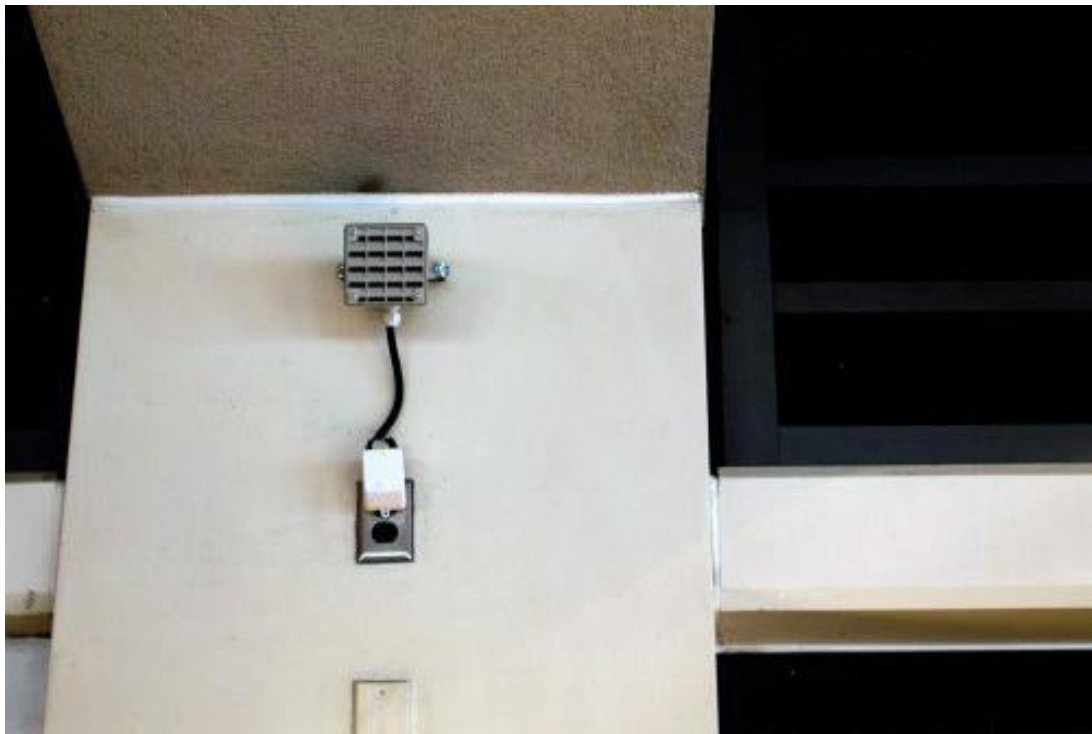


Image 7

A Mosquito anti-loitering device installation, image available online: <https://www.popville.com/wp-content/uploads/2017/10/anti-loitering.jpg>



## **1.7 Spherical conclusions**

This chapter has introduced the sonospheric investigation as a research methodology that is deployed throughout the vectors of artistic practice and text of this thesis. Noise is considered to be remnant evidence of the origins of the universe. Its presence is universal, timeless but in constant flux as vibrational force. Scientists, media and communication theorists, and socio-linguists have used noise as a baseline within models for communication as a disturbance preventing meaningful exchanges of information between senders and receivers. The universal presence of noise can be thought of as vibratory force that is affective but also as a signal that can be filtered out or in according to bodily and cultural formations. I have introduced a number of positions that consider listening as an embodied active process that embraces more than just the acoustical but also the nonverbal, the affective, the feeling, and that which does not fall within the range of human hearing. I have done so in order to account for an expanded way of thinking about what listening should be if we are to understand our bodies and agency to be complex assemblages of matter and materialities that form the energetic vibrant universe we inhabit and coexist within.

I introduced the work of Pauline Oliveros who coined the term sonosphere as a way to encourage thinking about the broader ranges and frequencies of noise, sound and vibrations that connect humans and nonhumans in a physical, metaphorical, and semantic sphere. Operating across the strands of what Frances Dyson has called the economy of noise, the sonospheric investigation draws together the sensory and the sensible. Using a mixed set of interchangeable, material and phenomenological tools, the sonopalette provides a multimodal structure for approaching sonospheric investigations. I have described my use of the sonopalette in conducting an experimental sonospheric investigation during a residency in the south of Spain that resulted in the production of the artwork *Electrostatic Borderlands*. A visual account of the off-grid surroundings of Los Gázquez wouldn't have revealed the presence of anthropogenic electrostatic signals in the atmosphere, yet unexpectedly, using tools from the sonopalette that included microphones, a sound recorder and mobile phone, presented the invisible vibrations and signals which became the foundation of this particular work. The

import and aim of the AER residency and exhibition was to amplify the dichotomy we as a species are encountering in the age of the Anthropocene, where our drive for technological mastery over our environment is both creator and potential saviour to the problems of the ecological crisis we are understood to be facing. I have stated a need to be critical of the digital sensory tools we use to expand our understanding and position of the vibratory forces within the world, but also a need to embrace and use them to enhance and help with the way we might listen to it. The residency in Spain was one of a number of field work sites visited as part of this practice-based research project. I use various configurations within the sonopalette to investigate the role of digital technologies from an ecological, financial, environmental and psychic perspective throughout this thesis. By listening sonospherically, I aim to encounter subjects within my practice with a revitalised sensibility towards their relationships amongst one another and myself. A subject may be a specific item or thing in space, be that a rock, a tree, a weather system, a human. The subject may be situated within spatiotemporal complexes of energy exchange and vibration. The sonospheric investigation must aim to be receptive to the subject: a broad set of potential markers of engagement. The following chapter describes the processes of conducting such studies in the field and presents challenging ethical implications for site based field work that must be addressed as part of an attentive listening centred research practice.

## ***2.0 Access all areas: negotiation, communication, and compromise***

### ***2.1 Introduction***

I have been privileged to attend two artists' residencies during the course of the research for this thesis. In Chapter One I presented how during the AER residency in Spain, I engaged with the context of multimodal listening and presencing through the sonospheric investigation. This culminated in the artwork *Electrostatic Borderlands* and an exhibition at The Nunnery gallery. The second residency I attended was the MEAD residency with the British School at Rome and arranged by University of the Arts London. During these residencies I interrogated what a sonospheric investigation is and how a sonospheric encounter can be documented, presented and translated into a research led, artistic outcome. These works are the result of substantial time spent in a unique and novel environment, grappling with different modes of sonospheric engagement as active proving grounds for the methodology.

Following these residencies, two observations emerged:

1. Access: A researcher benefits from having a privileged socio-economic background and a linguistic toolbox that makes it possible to engage with, and negotiate, various barriers to entry when attempting to access non-quotidian space, as a field recordist in the Western soundscape tradition.
2. Multimodal practice: If we embrace the messiness of experience in the sonospheric encounter, we can begin to unpack important connections of time-space-geology-culture-technology.

This following chapter considers the structures of the artists' residency model; raising questions around what an artists' residency affords and what kinds of

conditions it privileges the artist. It makes distinctions between types of artists' residencies; as models that provide access to resources, sites, spaces, and people for an artist researching a particular subject. It will also place the residency model in contrast to other modes for researching space and place, in particular urban exploration. Secondly it will consider how by gaining access to what I will describe as historical infrastructures of the Roman Republic/Empire, the sonospheric investigation became a powerful mode of research to enquire into the idea of how the monuments of ancient civilisations continue to act as multimodal media infrastructures.

This chapter demonstrates how the sonospheric investigation is as much about how an artist or researcher might initialise their research of a subject in the field—following the principles of multimodal listening—as it is about the work that takes place in the field, or indeed afterwards. Producing practice-based research through the sonospheric investigation is an iterative process where negotiation and renegotiation of the artist's perceived rights, permissions and privileges to access their research subject is of methodological significance. The sonospheric investigator aims to remain attentive to the resonances between things as vibrant and agential, whether they are human, nonhuman, more-than human or confederations of each. As such, the approach to investigating site and subject is to be done considering an ethical framework of equality between bodies.

Following from the work of *Electrostatic Borderlands* where I tested the limits of my available sensing technologies as a passive receiver, this chapter and its associated artwork *Palimpsest* (Parker, 2017b), presences me as a researcher interacting with the world and engaging in an active and activating relationship with the historic monument sites of Ancient Rome. As a form of resonant media archaeology, it considers these sites as more-than architectural ruins of tufa and marble, but as a complex interconnected set of material, geographical, historical, cultural, and bureaucratic vectors whose trajectories are folded into each other throughout the stages of a sonospheric investigation.

## **2.2 Artists' residency as research platform**

Artists' residencies are defined as providing artists with "time, space and resources to work, individually or collectively, on areas of their practice that reward heightened reflection or focus" (OMC, 2014: 9). Access to resources and monetary support are important motivations for artists seeking to take part in a residency programme. There are different durations and types of residencies including: 'classic' residencies hosted by recognised residency institutions; those connected with arts institutions and festivals; artist-led residency centres setup by art professionals themselves; research-based residencies which take place within closed organisations or places; thematic residencies that invite artists to contribute to a common theme; production based residencies where the realisation of an idea or project is the central aim (similar to a commission); and interdisciplinary and cross-sectorial residencies that explore the possibilities of working with organisations outside of the arts (where an artist becomes 'embedded' within an organisation) (OMC, 2014: 17–24). Cross-sectorial residencies require the artist to be able to converse and translate their practice to individuals working within institutions that may not necessarily have a knowledge or great interest in the arts. Examples of artists who have worked in cross-sectorial residencies, and those within non-arts-based public institutions include: Andrea Polli's seven-week National Science Foundation residency in Antarctica during the 2007/2008 season (Polli, 2009); British conceptual artist Martin John Callanan was artist-in-residence at The Bank of England, with sponsorship from the academic research institutions of University College London and the Leverhulme Trust (The Bank of England, 2015; Callanan, 2018); and the Arts at CERN Residency programme has provided opportunities for high profile artists including Bill Fontana, Ryoji Ikeda, Trevor Paglen, Haroon Mirza, Wolfgang Tillmans, Goshka Macuga and many others (CERN, 2017). Founder of artist residency programme *What do Artists Know?* Frances Whitehead argues that by embedding artists into public sector institutions, artists "bring new perspectives, mind-sets, and processes" (Whitehead, 2006) towards projects by deploying their skills within a setting of strategic governance (the City of Chicago in Whitehead's example). Cross-sectorial residencies are also hosted by private institutions. Allowing artists access within commercial companies as part of

a residency programme can lead to “product innovations” (Mikulay, 2008: 48) and inspiring employees according to Mikulay who writes about the longstanding residency programme by bathroom goods manufacturer Kohler. Both Whitehead and Mikulay demonstrate how through residencies, artists offer not only the capacity to restructure thinking in the corporate setting but also to encourage different modes of thinking within institutional workplaces, as opposed to the residency acting purely as corporate social responsibility and public relations content. Public relations however, are often the primary commercial interest for cross-sectorial organisations to engage with artists, within residency and more generalised collaborative conditions.

Prior to artists’ residencies becoming an established model for practicing artists to research and produce work within the institutional framework, the Artist Placement Group (1966-1989) was setup by artists John Latham and Barbara Steveni, as an attempt to broker residency opportunities. Steveni has described the difficulty in managing expectations between preserving “the integrity of art’s motivation vis-à-vis the commercial and political interests” whilst recognising the need to ensure that “both sides were getting something out of it” (Steveni, 2002). In the half century that has passed since the establishment of the Artist Placement Group, compromise continues to be a central concern in negotiating access for an artist residency. The AER residency discussed in Chapter One was an institutionally supported artist-led, thematic residency. The MEAD residency was a ‘classic’ residency supported by a major cultural research institution (the British School at Rome). The methods and techniques of how to approach a subject for sonospheric investigation are considered of significant importance throughout the practice-based research of this thesis and the artists’ residency is a major structural platform for artists to gain access to space within the private and public spheres of industry.

### ***2.3 Negotiating access in the private/public sphere***

As an artist I am particularly interested in how I am able to negotiate access into a field research environment for multimedia field recording where I may use a number of tools (the sonopalette), to actively explore, record and document affective experiences in space. In *The Production of Space* (1991, op. 1974), Henri

Lefebvre outlines how space is fundamentally a social process constructed by mental abstractions as well as physical material that become something concrete through a 'social contract' – the moral and political obligations one implicitly agrees upon to allow the formation of a society (Rousseau, 2003, op. 1762). Lefebvre considers the operationalisation of space within the social contract through a conceptual framework comprising three aspects of interrelated space: conceived space, perceived space, and lived space. Conceived space refers to how we create a mental construction and representation of space. Perceived space refers to the relatively objective locations of physical space encountered in our daily environment. Lived space is the combination of conceived and perceived space, representing the individual experience of space as a significant part of what makes up social life. The production of space therefore is tied to all aspects of the reproduction of social relations contained within it. Lefebvre's multimodal model of space works against a classical physical model of space as something definitive, identifiable and singular, re-identifying space as physical, social and mental, following a similar trajectory to Guattari's (2000) conditions of planetary, social, and mental ecosophy. Space for Lefebvre is understood as a mode of commodity and exchange which shapes social relations that become constantly undermined by the closure of public spaces, denying the individual's 'right to the city' (Lefebvre, 1996; Purcell, 2003). Within this spatial triad model, physical space is being constantly challenged by a declining enfranchisement of urban environments through the hegemonic structures of "privately owned public spaces" or "Pops" (Garrett, 2015) which are large pseudo public spaces (often squares) where members of the public can freely enter but are owned by commercial entities who operate their own private security, and enforced terms and conditions for entering such spaces.<sup>1</sup> Urban planning scholar Mark Purcell argues that the production of space is currently "driven by the needs of property owners" (Purcell, 2013: 149) and requires a reorientation back to the public in order to generate space "for encounter, connection, play, learning, difference, surprise, and novelty" (Purcell, 2013: 149). Whilst Lefebvre and Purcell both have aspirations towards a utopian

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<sup>1</sup> A particular example of such a space is the Granary Square in the King's Cross area of London, home to a University of the Arts London college site owned and monitored by property developer Argent LLP.

right to the city, such a negotiation of space in the present socio-economic environment of neoliberalism has yet to materialise. As such, any negotiation towards the access of space for the individual must take place within a process of exchange amongst other individuals or bodies that act as gatekeepers of that space. The attention from Lefebvre and Purcell on physical space can also be applied to virtual, “cybernetic space” (Mitra and Schwartz, 2001) or “networked space” (Cohen, 2007: 237). The most popular destinations of Internet consumption – particularly social media platforms – have, like Pops, also become space for ubiquitous interactions of the mundane features of daily life, or the digital banal (Dinnen, 2018; Nunes, 2006). These spaces are mediated and controlled Internet based privately owned public spaces, or what I would like to call ‘iPops’. Users of Pops and iPops have a sense of their right to the space but are in actuality submitting to the conditions of a given space’s commercial owner. Within my practice I have experienced friction with Pops and iPops in being denied access to a space as I attempt to conduct a sonospheric investigation. How to negotiate the friction in the relationship between user and owner plays a significant role in considering the challenges of how to successfully carry out research in the field.<sup>2</sup>

Thinking about the engagement and processes of exchange required to access space for research, we must consider the agency of the individual pursuing access against other agents that may-or-may-not choose to grant the request for access. I define ‘access’ throughout this thesis as: the compromises made by a researcher in order to be able to engage with a source, place, or subject that could be withheld were the researcher to offend the gatekeeper of the particular subject. This definition has evolved through an understanding of the ‘access journalism’ (Starkman, 2014) method, where journalists consent to certain compromises in order to be able to ‘gain access’ to a subject. Rather than being defined as the moment a researcher enters a site of investigation, access is situated throughout a research project as a process of negotiation and compromise. In this way it means that access is not something you are simply ‘given’ but is a process in constant development throughout a research period. Access as a process is in contrast to ‘investigative journalism’ which Hugo de Burgh defines as “going after what

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<sup>2</sup> I will discuss one particular iPop in greater detail in Chapter Five.



someone wants to hide” (de Burgh, 2000: 21). The clandestine ‘black boxing’ and obfuscation of media infrastructure come to mind in this journalistic attempt to uncover or reveal something hidden in culture. The electrostatic interference detected almost by accident during the AER residency became a primer for further sonospheric investigations which enable a search for something that *may* seem hidden rather than something purposefully hidden by human agents. Access consequently has become a process of negotiation and compromise that enables such an investigation.

In order for a sonospheric investigation or indeed any form of investigatory practice to take place, a formal dialogue is necessary between researcher and ‘gatekeeper’ of a space. Gatekeeper is a term commonly used by ethnographers and sociologists referring to “individuals in an organisation that have the power to grant or withhold access to people or situations for the purposes of research” (Burgess, 2002: 39). The gatekeeper of a space can be one individual, a collective, or even a corporate body comprising individual agents whose decisions are based on a combination of corporate or institutional protocol, instinct and personal intrigue. Gatekeepers could potentially even be the subject of intellectual enquiry (for example, directly negotiating a one-to-one interview). A significant amount of research and discussion on the topic of access in fieldwork is situated around the ethics of conducting human centred research with vulnerable communities from the position of the Anglo-American academic researcher. For example, conducting ethnographic anthropological research with Aboriginal groups in Australia (Holcombe, 2010), research into groups where the researcher may not have the same first language (Irvine *et al.*, 2008), ethnographic research within Probation Approved Premises of sex offenders (Reeves, 2010) or highlighting the inherent masculinist epistemological framework of fieldwork in Latin America (Sundberg, 2003). Methodological concerns consistently arise around the concept of ‘insider-outsider’; whether it is better, or even ethical, to conduct fieldwork from the position of an outsider observing a community or space, or an insider who is intimately linked with the community or space (Corbin Dwyer and Buckle, 2009). Research is also recognised as being impacted by “the power relations that

constitute researcher and 'objects of research,' as well as the geopolitical relations that create the very conditions that enable fieldwork" (Sundberg, 2003: 180).

Much of my research takes place within affluent communities in Europe, in connection with institutions or multi-national corporations. I am principally interested in 'unlocking' the gates and exploring the power relations as negotiated from the perspective of an artist researcher. In the process of seeking allies and building relationships of trust with individuals on a seemingly equal playing field (middle class Western Europeans), and by identifying a subject as an 'object of research', I am engaging with a practice of power balance between researcher and researched and therefore my relationship with the gatekeepers of my research, I argue, should be explicitly drawn out at the forefront of any site-specific activity. In addition, the sonospheric investigation differs from ethnographic research in that the aim is not exclusively humanist. Much of the practice requires attentive listening to phenomena that would be considered other than human, more-than-human, nonhuman, inorganic, posthuman *as well as* human, but this doesn't mean that there isn't a human gatekeeper somewhere along the research access trail. If "how a qualitative researcher enters the field is usually taken for granted" as an "administrative issue" (Chughtai and Myers, 2017: 796) and researchers using fieldwork "deal only briefly with the issue, if at all" (Reeves, 2010: 316), then the expectations of ethical transparency for artists conducting fieldwork will also continue to be insufficiently low. The sonospheric investigation relies on connectivity between people and things and as such is positioned as a methodology that doesn't take access for granted, understanding it as a process in constant negotiation within fieldwork. The remainder of this chapter will consider the process of negotiation exchange required to access spaces regarded as significant historical monument sites within the history of the Roman Republic and Empire.

## **2.4 *Palimpsest***

I was awarded the opportunity to attend a one month 'classic' artist residency with the British School at Rome (BSR) for September 2017. The residency opportunity was promoted internally through University of the Arts London (UAL) as a competitive process that needed to be applied for but was open to all practice-

based PhD students at the university. The opportunity had been negotiated by Mick Finch, a lecturer at UAL, with the directorship of BSR, and funding was provided to cover the cost of accommodation for three students for the residency period of one month. A fixed bursary fee of £200 would also be available to cover travel for each student to and from Rome. Funding came through an arrangement between UAL and the philanthropist, photographer and former partner at Goldman Sachs, Scott Mead. In addition to studio accommodation, residents could use the library at the BSR as well as have support to negotiate access to buildings and heritage sites around Rome. The BSR along with a number of other international schools/academies in Rome have fostered relationships with various gatekeepers within Rome's heritage institutions and formed a scheme called *Permessi* which opens direct dialogue with the gatekeepers to potentially provide official BSR residents access to sites around the city (typically for archival and archaeological research). In return, the selected artist would develop their research and write a short two page report covering the experience of the residency to be shared with Scott Mead and posted onto the UAL Postgraduate Community blog (see Parker, 2017a).

I spent a number of months progressively researching into the history of media infrastructures within Rome to determine if a viable project was plausible for my research. I began where most site-based research begins – Google – searching for data centres and other media infrastructures in Rome. I found six significant data centres in Rome at [www.datacentermap.com/italy/rome](http://www.datacentermap.com/italy/rome). I also searched for points of presence (landing stations where subsea fibre optic cables interlink with the terrestrial network) within the Lazio region, and the website called Submarine Cable Map pointed towards a location in Civitavecchia at <https://www.submarinecablemap.com/#/landing-point/civitavecchia-italy>.



Image 8

Janna submarine cable, image available online: <https://www.submarinecablemap.com/#/landing-point/civitavecchia-italy>

When devising a plan for a new research project, I often start with developing a geographical and political background of an investigation site. From this point I then begin to work through connections, histories, structures and any other pieces of information, regardless of how anecdotal they may initially seem, to begin to shape the direction I will initially pursue in the research. I consider this to be an initial phase of a sonospheric investigation; carefully listening out for how different materials resonate with each another. A key connection with my research began to emerge: that there may be parallels between the ancient monument structures of Rome and the “new form of monumentality” (de Vicente, 2014) that curator José Luis de Vicente has ascribed to media infrastructures. De Vicente claims that the physical infrastructures of the Internet, particularly data centres, are carefully chosen architectures which are becoming iconic representations of power in the digital age. I began to think about the complex architectural and cultural layering embedded within the city of Rome and how I might access Roman monuments of communication significance within the cities complex architectural and cultural layering. I began thinking of Rome as a palimpsest.

Palimpsest originally refers to an ancient document – often parchment – that has been written on, erased, rewritten over time. One can consider through the palimpsest how invented and imposed social relations that are otherwise hidden,

remain beneath the surface of the cultural text or how the built environment may be seen as a form of palimpsest. Prior to the revival of Rome and its birth as a tourist destination by the coming of age Grand Tours from the 17th century onwards, many buildings in Rome were not viewed as precious and were constantly built on top of, inside of, or stripped apart for the construction of new buildings – particularly for new Catholic/Papal Basilicas (Boorsch, 1982). During the dark ages, the Roman Forum, previous centre of the Roman Kingdom, Republic and Empires, became a grazing space and thoroughfare for the wider city. The monumental Baths of Caracalla, Rome's second largest bath house, was a storage quarry for bricks and marble. However, the layered remnants of history, social practices, and cultural memory became embedded into the tufa blocks, marble detailing, and relief sculptures of these now iconic spaces. Historian John Elsner has described Rome as the “embodiment of the complex cultural palimpsest into which Europeans have been born” (Elsner, 1994: 18) and asserts that “[w]hile in most of Europe the palimpsest of our past can only be felt, in Rome it can be seen” but also that the phenomena of the architectural palimpsest “has many reverberations” (Elsner, 1994: 18).

For architecture historian Mark Crinson, to suggest that a city's building blocks possess a reverberating memory hints towards an anthropomorphism of the urban. Crinson argues that urban memory is stored within architectural space: buildings act as a cultural-collective-memory-typology possessing “a haunting absence” (Crinson, 2005 p. xv); the faint markers of culture embedded in the material of urban layers. Perhaps we cannot understand material memory without placing symbolic values upon objects; anthropomorphising them and placing them in a human centred role. The problem created by thinking in this way is a continued hierarchical structure of matter and agency. Jane Bennett however, argues that a little bit of anthropomorphism can go a long way, potentially uncovering “a whole world of resonances and resemblances – sounds and sights that echo and bounce far more than would be possible were the universe to have a hierarchical structure” (Bennett, 2010: 99). Philosopher Nathan Stormer defends Bennett's approach claiming “anthropomorphism can illuminate how much we are like other things, organically and inorganically. It can show us common stakes with entities that

cannot otherwise explain their stake in the world” (Stormer, 2015: 320). Not only can urban spaces convey the socio-cultural memories of human agents across time but perhaps even reveal within this ‘haunting absence’, confederations of throbbing materials that identify “structural parallels between material forms in ‘nature’ and those in ‘culture’” (Bennett, 2010: 99).

Literary scholar Sarah Dillon describes how a ‘palimpsestuous’ reading of space involves making sense of a meshwork of patterns in motion and argues that the analysis of contemporary culture is best accomplished by reading palimpsestuously (Dillon, 2005: 254). As a major global tourist destination, Rome has become a site for remembering the ‘palimpsestuous’ monuments of western civilisation in a role mediated almost entirely through optics. The tourist gazes at the architectural and sculptural forms but is not permitted to touch the monument. Nor can tourists listen to monuments, other than hearing the reverb of large monuments in a subtle reverential form.<sup>3</sup> Rarely is a loud noise made by visitors who are collectively hushed in their reverence, swept through the complex layers of architectural form. Additionally the concept of palimpsest suggests an erasure and dormancy of historical layers but history is a process “undergoing different kinds of *intensification*” (De Landa, 1997: 265). It is layered and interweaving with “points of connection, proximity and action between various pasts” (Witmore, 2007: 556), where non-traditional practice-led research methods “allow us to acknowledge our media cities as multisensory and to appreciate that these myriad sensory registers are integral to mediation” (Mattern, 2015: 25). If we are to not deny the many ways that space is inhabited, and to be open to the multimodal potentials of a nonhuman connection to urban memory, perhaps the analysis of contemporary culture is best accomplished not by reading palimpsestuously but by listening sonospherically.

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<sup>3</sup> In 2017, Museo dell'Ara Pacis in collaboration with Tooteko and Antenna International began to offer *Art for the Blind* tours where a tactile museum experience for visually impaired users was offered, including the option to touch Augustinian busts amongst other aural and haptic technologically mediated experiences. More information is available from [http://www.arapacis.it/didattica/progetti\\_speciali/art\\_for\\_the\\_blind](http://www.arapacis.it/didattica/progetti_speciali/art_for_the_blind) [Accessed 20 November 2017].

### **2.4.1 Monumental expectation / urban exploration**

The Grand Tour created the conditions for residents of Rome to form an industry of tourism around the urban history of their city. Rome is a city filled with a wealth of antiquities and monuments pointing to some of the earliest developments of Western Civilisation but much of this was left destitute following the fall of the Roman Empire until the Renaissance. The engraver Giovanni Battista Piranesi (1720-1778) is widely considered responsible for creating the first visual memories of Rome in its modern form (Cooper, 2001). Piranesi is quoted in 1743 as saying he “first saw the remains of the ancient buildings of Rome lying as they do in cultivated fields or gardens and wasting away under the ravages of time, or being destroyed by greedy owners who sell them as materials for modern building” (Piranesi 1743, quoted in Cooper, 2001: 111). In *Prima Parte di Architetture e Prospettive*, the 1743 publication by Piranesi, he describes the monuments of Rome as 'speaking ruins' that fill his 'spirit' (Cooper, 2001: 111). It is unclear how the monuments spoke to Piranesi, but he produced engravings that exaggerated the detail, grandeur and proximity of the monuments of Rome whilst also situating them as ruins within the contemporary city. His engravings, which were sold, copied and exported widely across Europe created an imaginary of what Rome might look like. It evokes what sociologist John Urry refers to as “the tourist gaze” that is “endlessly reproduced and recaptured” (Urry, 2002: 3). In an era of mass visual media, the tourist is always pre-primed for the encounter of the monument spectacle and seeing it in person is often just another replication of the image already gazed upon. However, the images produced by Piranesi left tourists gazing at odds with their expectation and Grand Tourers were forced to reconcile what they saw with the image they had been enthusiastically crafting in advance of their arrival. As such, Cooper argues that “Rome became a sort of dialogue between the remembered and the real” (Cooper, 2001: 114), where “recognition of the decay, but not destruction” would become an important “part of the enchantment of monumental ruins” (Cooper, 2001: 123).

Rome has become the most popular tourist destination in the world (World's best places to visit, 2017). The majority of the architectural sites and museums in

Rome are managed by a small number of institutional bodies who aim to preserve the buildings and sites of Rome's tourist industry in a perpetual state of Piranesian ruin whilst also leveraging capital from the tourism industry through entrance fees, other commercial opportunities such as filming movies or sound recording, as well as providing limited access to PhD sound art research students and other academic researchers (on a case-by-case basis). Multiple conditions determine which architectural structure or spatial phenomena become recognised as 'heritage monuments' that require protection, preservation, maintenance and placement within a canon of historical artefacts. Much of the decision-making process in what makes Rome's city centre a heritage centre of global significance is determined formally by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) who cite the criterion for Rome's heritage value by considering how the "property includes a series of testimonies of incomparable artistic value", as well as Rome's "decisive influence on the development of urban planning, architecture, technology and the arts throughout the world" and an architecturally "uninterrupted sequence of three millennia of history" (UNESCO, 2017). Historian David Gross argues that "particular elites, groups, or institutions have attempted to dictate which values, facts, or historical events are recalled, how this information is remembered, and the types of emotions attached to these memories" (Gross, 2000: 77). As such we can begin to think of these historical monuments as a form of media; objects purposed to convey information to a populous. What is considered to be a monument in Rome today becomes a powerful site for media transmission of power, sovereignty and Western European culture. Some of these monuments were always sites of media – such as commemorative arches like the Arch of Septimius Severus – but they were not always regarded as important and may not continue to be in the future. Others were buildings that facilitated communication – the Baths of Caracalla for example – but over time are recognised as important monumental artefacts. The palimpsestuous layers of Roman architecture continue to be remodelled, preserved, categorised and inscribed meaning by the elite institutions of the present and their presence as media objects in the life of Rome, both as a city and as a global digitally mediated imaginary (through Google image search and iPops like TripAdvisor). A multimodal approach can be a way to explore



the material agency of the media monuments of the past, as well as the monuments of the future, such as media infrastructures.

### ***2.4.2 Urban exploration***

Geographer and ethnographer Bradley Garrett is both a researcher and practitioner of a subcultural activity referred to as urban exploration or ‘urbex’. Urbex is defined by Garrett as “the discovery and exploration of unseen parts of the built environment” (Garrett, 2011: 1048) which potentially “recodes people’s normalised relationships to city space” (Garrett in Macfarlane, 2013). Garrett argues that ‘urbexers’ do not share the “material preservation instinct” (Garrett, 2011: 1050) of those involved in the heritage industry and reject – as spectators of ruin or heritage sites – a need to attach the mediated political voice inscribed by the institutional gatekeepers of such spaces, instead opting to “explore ruins of the past” on their “own terms” (Garrett, 2011: 1052). To engage with heritage space in this particular way makes trespass a necessary condition of urban exploration. As a result urban exploring doesn’t engage in an official capacity with major heritage sites, remaining a practice occupying liminal spaces of urban terrain.<sup>4</sup> Finding interest primarily in abandonment and ruin demonstrates an interest for the memory inscribed within architectural objects in a similar way to how Susanne Küchler describes the purpose of the monument as enshrining the “knowledge of

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<sup>4</sup> Despite its questionable legality, urban exploring has become a lucrative profession with book publishing deals (Garrett, 2013; Govia, 2014; Ninjalicious, 2015; Sipes, 2014), rising subscriptions on YouTube Channels (Berindei and Weissman, 2014, 523k subscribers; Sight, 2016, 77k subscribers), photography equipment endorsements (Nikon Europe, 2015) and the brokering of commercial fashion deals (Klausen, 2017).



Image 9

*The Arch of Septimius Severus, (Arco di Settimio Severo) (ca. 1759), Giovanni Battista Piranesi: Public domain*



Image 10

*Palimpsest (2017), production still at the Arch of Septimius Severus (Subpac M2 in view), copyright the author*

the cultural past for the sake of future generations” (Küchler, 2001: 53). Whether in ruin or not, the monuments of Rome transmit a form of knowledge and communicate a message to onlookers, but I am also interested in what else might be embedded within the ruin. Garrett offers an interesting proposition for ‘playfulness’ within ruins; something difficult to fully explore through the official tourist channels. Garrett proposes that “we reconsider the possibility that ruins have agency beyond representation and human engagements: they are sites for performative events, encounters between beings, places where material and immaterial, human and animal, animate and inanimate begin to fall away” (Garrett, 2011: 1065). This provocation for performativity and encounter resonates with the development of my research in Rome but unlike the urban explorers, I am interested in legitimised access to monuments and ruins of Rome and a more direct rather than figurative performance with these spaces.

Urban exploration is a method but not the sole option for visiting protected spaces and the discourse within urbex subculture is not without its problems. Garrett describes urban explorers as “safekeepers” protecting “the fragile derelict materiality of sites by not disclosing their locations” (Garrett, 2011: 1064) but this begs a question of what permission the urban explorer presumes, to act as a ‘safekeeper’ or ‘gatekeeper’ to trespassed ruins. This elitist stance mirrors the wider concerns of hyper-masculinity and white privilege apparent within urbex subculture. Carrie Mott and Susan Roberts point towards urbexer’s troubling descriptions of “themselves as ‘penetrating’ places often characterized as ‘virgin’” (Mott and Roberts, 2014: 238). The urban explorer “who subverts and penetrates (urban) capitalist space” (Klausen, 2017: 376) is argued by Maja Klausen as acting as an embodied transmitter and receiver in an affected way that is in the words of Bruno Latour, “put into motion by other entities, humans or non-humans” (Latour, 2004: 205). The performative encounters described by Garrett suggest a potential for play between the investigatory human agent and non-human agents already embodying the monument space. My research activity in Rome shares this sense of engagement through play, but importantly, the BSR Permessi scheme granted me legitimised access making it possible to conduct overt, performative actions during

my field work without (theoretically) the risk of negative reactions from the gatekeepers of the space.

The sonospheric investigation is a research methodology that opens up an artist to an embodied holistic listening practice. In order to investigate specific sites and phenomena in the world, the artist must be aware of the complex structures in place that require negotiation to access. Access to a subject of research interest is an ongoing process of negotiation between artist-researcher and other agents (not exclusive but inclusive of people and institutions) referred to as gatekeepers. Relationships with gatekeepers are at the centre of research in the public/private sphere. The protocols managed, and privileges expressed by the artist-researcher should be made clear to understand the complexity of arrangements that are negotiated prior, during and potentially after engaging with a space. Having considered these concerns with access, I have argued that the historic monuments of Rome are an exemplar of how the built environment acts as a socio-political media-container of urban memory. Having described the principal background and research process leading up towards the residency at the BSR, I will now continue to describe negotiations, compromises and aesthetic direction of the work *Palimpsest*.

### **2.4.3 Producing Palimpsest**

Having written a proposal on investigating Rome as a palimpsest (as discussed earlier in the chapter), I was invited to attend a short interview with a selection panel of three senior academics who would determine whether I would be selected as one of three artists to attend. My presentation essentially followed the form of my proposal: I would investigate media infrastructural sites within Rome and experiment with the notions of the tourist gaze and palimpsest as part of a sonospheric investigation. In addition to my application, presentation and interview, one of my PhD supervisory team (an established Professor within the University) was asked to provide a letter of recommendation. After a month of waiting I was notified that the selection panel had decided to offer me the residency. It was brought to my attention at this point that I would be able to make requests to the BSR with regard to the *Permessi* scheme. I was first put in contact

with the Residence Manager at the BSR who subsequently passed me onto the Permission Officer (PO) who would be able to negotiate access to restricted sites. I provided the PO with detailed information about my intentions and my research topic and asked if the PO could advise on which spaces I might be able to negotiate access for. I explained I would like to make sound and video recordings. The first reply explained how the PO would not be able to help until I had determined what sites I would want to access. This was particularly challenging as I had previously only been to Rome once, for one day on a work trip. Further online-based research into Rome was required to draw up a list of potential sites but without understanding the full extent of reach that the *Permessi* scheme offered. I speculatively compiled my list in hope that the *Permessi* scheme would act as an artist-researcher's golden ticket to Rome's built environment. I researched into underground quarry and excavation sites such as San Clemente, San Callisto, the Capuchin Crypt and the crypt beneath Palazzao della Cancelleria as potential subterranean, multi-layered and submerged sites of relationality. I considered modern buildings such as Torre Eurosky which towers above the city but draws its architectural inspiration from Roman Empire era-structures; a conversation between the urban memory of the Empire and Mussolini's fascist architecture. I also enquired into the medieval Torre delle Milizie, the Baths of Caracalla, and the Roman Forum and Palatine Hill.

At this time I decided I would attempt to produce Impulse Response recordings within these monumental sites, in order to create artificial 'convolution reverb' profiles. An Impulse Response (IR) recording is an acoustic snapshot of a given space responding to every acoustic frequency. Typically IR's are produced by recording loudspeaker playback of a sinewave sweep (from 10Hz to 20kHz) that can then be processed within a computer using Fast Fourier Transform (FFT) to modulate or 'colour' another sound source according to the spectral characteristics of the IR. If it is not possible to produce an IR with loudspeakers, such as in outdoor environments, often a starter pistol is used. Assuming that various institutions of Rome wouldn't be particularly happy with me walking around with a starter pistol (neither would I), I proposed that I could use a balloon instead, popping it to create a similar broadband spectral effect.

I received confirmation letters from the Palatine Hill and Roman Forum, the Baths of Caracalla and Torre delle Milizie only. In contrast to visiting the monuments through the standard 'tourist channel', the *Permessi* scheme opened up a privileged access opportunity through the 'artist-researcher' channel, making possible a performativity and exploratory engagement with the space that would usually be prohibited. The established institutional dialogue between the PO at the BSR and the Soprintendenza or the Sovrintendenza created a series of proxy gatekeepers in my negotiations for access but once the day arrived to explore the site, I would become directly accountable.

#### ***2.4.4 Activating site, embodying space, convolving memory***

Prior to my arranged *Permessi* sessions, I visited these three spaces as a tourist with a small handheld sound recorder (Tascam DR40), micro four thirds digital camera (Lumix GH4) and sunscreen (SPF 30). I wandered the plotted paths and shared moments between myself and other tourists as we each quietly contemplated the potential socio-cultural significance of each site. I took photographs and briefly recorded sounds without any significant engagement or direction but made notes on which areas might be easily accessible with a more substantial recording kit and planned a mental route on how best to cover as much ground with as best detail as possible within my one-to-two hour allotted *Permessi* time slot. Geographer Michael Gallagher claims that attentive listening in ruinous spaces amplifies their haunted spectral qualities (Gallagher, 2015: 468). The space did not feel haunted. It felt alive and vibrant with other human bodies. However, my engagement with the objects of the space seemed difficult to attend to as I was distracted by the overpowering sensation of constant low volume anthropogenic activity. The following week I returned to each site for my official visit at the Forum. I walked to my first site to setup, to listen and to record. In addition to my camera and handheld recorder, I expanded the sonopalette field-kit with multichannel channel sound recorder (Sound Devices MixPre6), a pair of DPA4060 microphones in a Rycote windshield, a custom modified Geophone, a Subpac M2 transducer bodypack, a pack of party balloons and a pin (as seen in the final work *Palimpsest*). With this equipment my plan would be to make IR recordings whilst simultaneously recording from the geophone inserted into the ground around the monument. I

would listen, slowly, through this dynamic process. The Subpac M2 is a portable transducer bodypack that is tuned to respond to frequencies between 10Hz and 80Hz. Combined with headphones I was interested in whether I could experience through the field recording process, a vibratory energy throughout the frequency range of 10Hz to 20Khz, and by extending my sensory range below that of auditory hearing (40Hz). I went from site to site, activating the space with balloons bursts and between activations I would sit or stand and listen to the differences in texture. The ground was, as warned, very slippery in places and negotiating these spaces was difficult. Once in place and prepared to record an IR at the Reggia, two members of the facilities staff started up chainsaws about 200 metres away and began to cut at the trees. I suddenly became attuned not just to the space but that even once I had negotiated access to the Forum, I would still need to be aware of other humans in the space, working. As the time approached 8am, car traffic and general city din began to fill the space. I had made so much effort to get this privileged access but it was not exclusive. You cannot ask the entirety of Rome to stop making any noise. I embraced the combination of ancient monument and reverential space, with its contemporary city existing, throbbing and vitalised above and below it.

Almost nine months after the BSR residency, I was introduced to the work of Italian artist Davide Tidoni. Tidoni playfully experiments with space, including his performance work *A Balloon for Linz* (2011) where the artist walks through the city of Linz, popping balloons in order to bring light to architectural acoustics. His work *In the Blink of an Ear* (2015a) plays with transitioning between reverberation and the visual. These works share some uncanny similarities with my exploration of the monuments of Rome which has since led me to consider what purpose the performance of producing IR's served in the work *Palimpsest*. I find thinking about the studio process, after capturing the initial performance, productive. In creating a number of sound based artworks in the area of the Falkland Estate in Fife, Scotland, David Chapman and Louise K. Wilson produced a number of impulse responses to explore "the process of creating a simulation of the past acoustic of the *Temple of Decision*" (Chapman and Wilson, 2010: 240). In this work they aim to use convolution reverb as a way to deterritorialise geographic markers by convolving

indoor recordings with outdoor IR's. In the studio, I used the IR's I had created not to simulate and synthesise but to amplify the resonances present at the monument sites. Using the Max4Live Convolution Pro plugin in Ableton Live, I layered the original IR recording with the IR convolution of itself repeatedly until the original impact and quality of the recording had been spectrally broken down, leaving the low frequency resonances of the deep, geological, palimpsestuous city.

In the seminal sound work *I am Sitting in a Room* (Lucier, 1981 op. 1969) Alvin Lucier repeats a sentence explaining his actions of recording his words in a room and then plays back the recording into the room again, and again until all that remains are the fundamental resonant frequencies of that room. Repeatedly convolving the recordings of IR's broke down the spatio-temporal barriers of the spaces I recorded in. The present 'act' of bursting the balloon became replaced with the resonances of the space that could only be experienced with a very low frequency loudspeaker (subwoofer) or use of the Subpac M2. Whilst I could sit or stand in an institutionally protected space with special access permission for one to two hours, attempting to actively embody that space through the use of geophone, microphones, headphones and body transducers, the experience of the investigation in situ is unique. It is possible that the experience could be replicated by another person who embarked on the same residency proposal and contacted the same institutions through the BSR *Permessi* scheme and performed the same actions to produce IR's in the same spots within the Roman Forum, but even then, the outcomes will likely be different due to the vibratory agency of things within time and space. The artwork is in itself a transduction of the singular experience, but that is not to say it is exclusive or elitist. The person who retraces my actions may find similar experiences but not identical ones, and the individual who experiences *Palimpsest*, is opened up to the possibility to experience my individual realisation of embodying that space, creating a sense of play but also a deep historical sonic gravity that weighs each featured monument with socio-political and environmental presence; the presence of urban memory at play.



### 2.4.5 Media transition

Please watch the digital video file 2. *Palimpsest* (2017).



Image 11

Sonopalette field bag 3.0 (2017), example field recording equipment layout, copyright the author

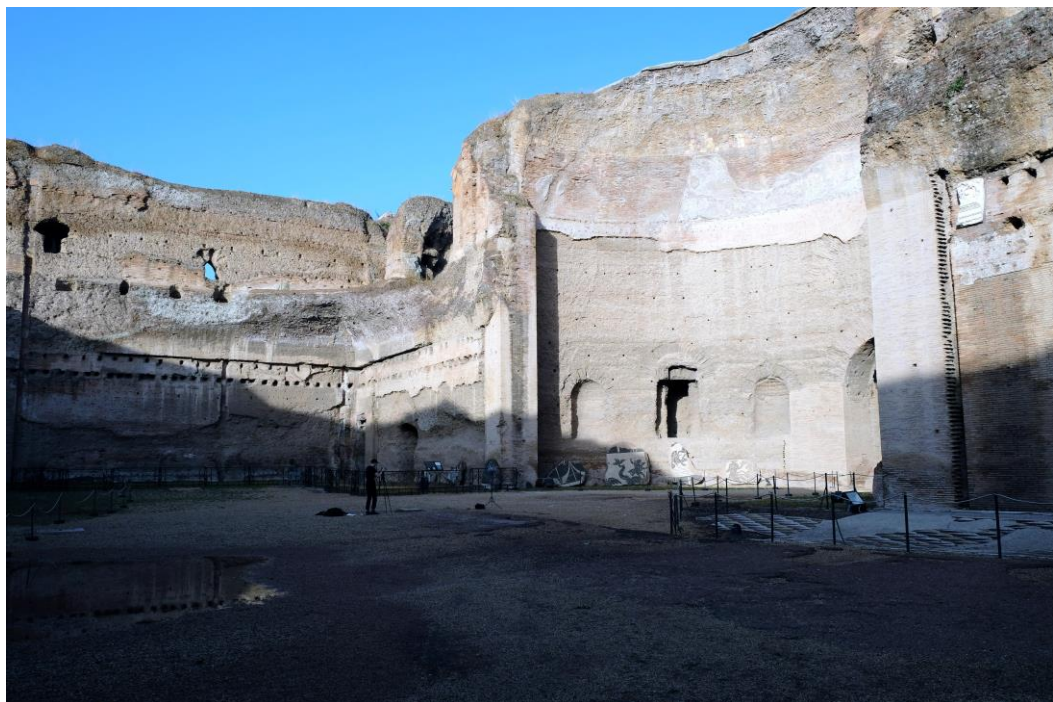


Image 12

*Palimpsest* (2017), production still whilst establishing shots at the Baths of Caracalla, photo by Kate Fahey



Image 13

*Palimpsest* (2017), production still at the Reggia (red geophone inserted into ground and Subpac M2 protected underneath jacket), copyright the author

## 2.5 *Monuments as media*

In this chapter I have discussed access; what it means to gain access and how an artist-researcher might negotiate access to space. I define my understanding of space according to Lefebvre's spatial triad model which presents space as physical, social and mental. I have considered how artists' residencies, in particular those with institutional and/or cross-sectorial support, are a valuable platform for artists to negotiate access into otherwise guarded spaces, however the process involved and compromises made in order to gain such access is rarely discussed, in favour of the 'output' of artwork and its potential public relations impact. Urban explorers offer an alternative mode of engagement with accessing space but through problematic means of trespass. Reflecting on the processes involved in gaining access to monuments through an artists' residency with the British School at Rome, I have shown how I have worked to consider the complications of access throughout my work and in doing so have found it necessary to put it at the forefront of the documentation of my practice. The subsequent work *Palimpsest* brings playfulness to the tourist activity of visiting historical monuments in Rome whilst also attempting to actively engage with such spaces as vibrant media objects that transmit urban memory. *Palimpsest* expanded the sonopalette to include architectural space, a bodypack transducer, impulse response (IR) techniques and

convolution audio processing. The process of palimpsestuously layering the IR through a convolution process mimics the architectural layering of the city of Rome making it possible to both conceive and feel the obscured but vibrant energies embedded within the ancient tufa and marble monuments of the city. The use of the transducer bodypack allowed me both on-site and in the studio to amplify the haptic vibratory energies of each monument, as it was activated by IR's, to feel as opposed to only hear through headphones, rebalancing sensation and perception across the wider sonospheric vibratory continuum.

Whilst in Rome, I visited Civitavecchia and tried to locate the point of presence but was unable to get anywhere near to it due to the security perimeter fencing around the port area. In Rome I visited a number of data centre sites but it was not possible for me to negotiate access to go inside and investigate them further. I had hoped that my position at the BSR would have had as much impact within the realms of private industry as it did with archaeological historical sites but this was not the case and access was a challenge I couldn't overcome. However, the next chapter turns to presencing contemporary media infrastructures as well the practice and methods of how other artists and researchers are investigating this new form of monumentality.



### **3.0 *The whir and whoosh of media infrastructure***

#### **3.1 *Introduction***

This chapter is about media infrastructures: what they are; how they operate on a planetary scale; and how they resonate across socio-cultural and economic platforms. It will show how a sonospheric investigation of such sites is important towards developing a rationale and ontological framework for exploring media infrastructures. I ask that the reader begins this chapter by watching the documentary series *The People's Cloud* (Parker, 2017) to form a configuration of industrial and commercial representations of media infrastructures. Returning to the text of this thesis, I will introduce a number of critical theorists' work on infrastructural studies and in particular media infrastructures, how to study them and what relationship they have within 'the new climatic regime' (Latour, 2017) of the Anthropocene. I will then engage with other art practitioners' work, particularly within the international touring exhibition *Big Bang Data* (2014-2018) which includes a number of media infrastructural themed artworks, before considering other artists' work in this field. I will discuss concerns around access and industrial proximity created by collaborating or working with/for corporate companies in the production of challenging artworks and how artists have attempted, or chanced upon, ways around this issue. I will consider how the production of *The People's Cloud* acted as an introduction to the media infrastructural-complex for me as both researcher and arts practitioner and how the project offers a multimodal engagement within an insulated and often secretive sector. Finally, I will ask the networked reader to decouple and listen to the meshwork infrastructural soundscape of *The People's Cloud (Original Soundtrack)* (Parker, 2016b).

#### **3.2 *The People's Cloud***

This chapter is bookended by *The People's Cloud*, an ongoing, collaborative project comprising (at the point of thesis submission) a five part artist documentary video series and an extended original soundtrack.

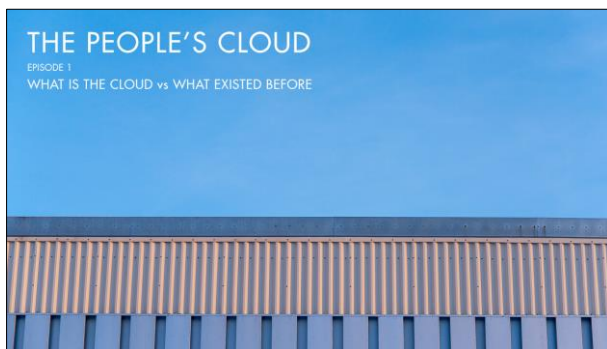


### 3.2.1 Media transition

Please watch all five episodes of 3. *The People's Cloud* (2017). The episodes are briefly introduced below with the corresponding descriptions for each.

#### Episode 1 What is the Cloud vs what existed before? (09min 05sec)

*"There's a universe of millions of people who are behind the scenes, programming and connecting, building connections and building computers that make all of this happen. But it's become a magical land."* (Michael Winterson in What is the Cloud vs What Existed Before?, 2017)



Episode 1 of *The People's Cloud* presents the origins of the accidental megastructure of the Internet through the voice and memory of two veteran engineers of the industry who think back to the moment the first transatlantic Internet connection was made, and the early days of personal computing where floppy disks were shared between friends in a garage.

**Episode 2      Working out the Internet: it's a volume game! (09min 29sec)**

*"It's a volume game. The Internet is a volume game."*

(Örn Orrason in Working out the Internet: It's a Volume Game, 2017)



In Episode 2 of *The People's Cloud* some of the most prominent Internet infrastructure technicians in the world are asked to explain how the Internet works as concisely as possible. End result? It turns out that the Internet is pretty complicated!

**Episode 3      The submarine cable network (12min 40sec)**

*"The Internet is not defined by country borders."*

(Henk Steenman in The Submarine Cable Network, 2017)



In Episode 3 we talk about the history of submarine telecommunications cables with some of Europe's experts in the industry as well as the problems that the fibre optic cable industry faces today. We investigate where these cabled infrastructures operate, physically, on land, and at sea, and find them existing in the most unexpected places.

#### **Episode 4      How much data is there? (07min 05sec)**

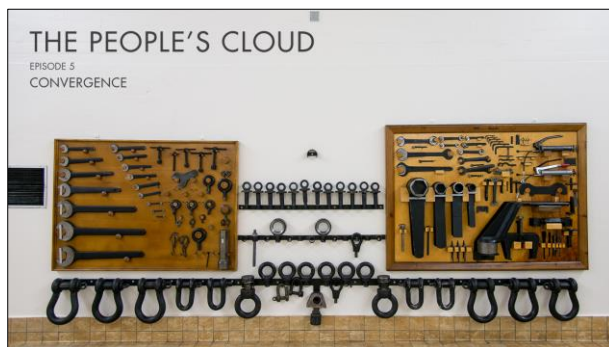
*“Will this exponential growth continue forever?” (Örn Orrason in How Much Data is There?, 2017)*



How much data is there? It's exponentially increasing but at what cost to global ecology? This episode is an introduction into the blunt materiality of digital media and the efforts made by companies to continue facilitating demand and driving costs down through efficiency. Save money for the shareholders. Use less energy. Save the planet.

#### **Episode 5      Convergence (08min 56sec)**

*“If you don't know you're designing the infrastructure to the future, you're going to make some assumptions.” (Steven Pemberton in Convergence, 2017)*



Our electronic devices are converging. More and more devices are taking up the near infinite tags offered through IPV6. The Internet of Things, the connected house, the driverless car. Who owns this? What is the demand for the infrastructure underpinning its success? What are the risks? What does the industry think it needs to do to offer this hyper speed increase into a sensor-laden world?



### **3.3 Media infrastructure matters**

This following section gives space for critique of media infrastructures and argues for their significance within emerging ontologies of the Anthropocene, positioning them as a locus of research within the practice of this thesis. Rather than repeating what has already been explored within *The People's Cloud*, this section offers an alternative mode of thought for media infrastructures to that posited by industry professionals interviewed within the series. In turn it provides further argument for the approaches taken in the production of *The People's Cloud* and sets up the conditions for the production of artworks discussed in subsequent chapters.

#### **3.3.1 Revealing media infrastructures**

In the collected memoirs of *A Field Guide to Getting Lost* (Solnit, 2006), Rebecca Solnit refers to the ecologist Gary Paul Nabhan observing his children in comparison to adults at the Grand Canyon and their different perspectives towards the spectacle. Nabhan describes, “how much time adults spend scanning the landscape for picturesque panoramas and scenic overlooks. Whilst the kids were on their hands and knees, engaged with what was immediately before them, we adults travelled by abstraction” (Nabhan in Solnit, 2006: 39). Solnit notes how for a child, everything is immediate, instant and direct, “[w]hatever is absent is impossible, irretrievable, unreachable” (2006: 39). Similar to a medieval-era painting, everything is foreground. Infrastructures operate simultaneously at the level of foreground and abstraction. In metropolitan cities worldwide, many unthinkingly take for granted the ability to access drinking water from a tap, jump on a bus, a metro, take a flight somewhere, send an email, or purchase a mail order item online with guaranteed next day delivery. The complex material processes behind these actions are abstracted from their point of delivery, and back through to their opaque material and logistical manifestation. Infrastructure only becomes foreground when something goes wrong: a giant ‘fatberg’ clogs the waste water system and all water pipes become temporarily disconnected; the pipe is under a road and whilst repairs are underway, the road is closed causing traffic and halting bus services; the metro becomes overcrowded with users due to the lack of buses;

a flight from the airport is missed due to the delay in accessing the metro; an email composed to apologise to the friend waiting at the other end of the flight fails to send as the network carrier is down; and upon arrival at home, a note has been pushed through the letterbox explaining how someone tried to drop off a parcel but nobody was in, leaving no information on how to reschedule the delivery. Seamless interactions with infrastructure become frayed in these quotidian ways. This chapter is about those moments when infrastructures emerge into the popular consciousness. It's about thinking through these moments and listening to what the mechanisms of infrastructure have to say.

Infrastructures have been defined as “big, durable, well-functioning systems and services” (Edwards *et al.*, 2009: 365) that “encompass hardware and software, spectacular installations and imperceptible processes, synthetic objects and human personnel, rural and urban environments” (Parks and Starosielski, 2015: 5). It is precisely this complexity that encourages a muting of the senses: physical yet abstracted; imperceptible yet spectacular. Developed across substantial time frames within the era of human civilisation, infrastructures are not reducible to a frame; they are intangible in their entirety to any one person (Parks, 2015: 370). Within the myriad of infrastructural systems, I place my attention on media infrastructures, defined by Lisa Parks as “the material sites and objects involved in the local, national, and/or global distribution of audiovisual signals and data” (2015: 356). Materially, media infrastructures include “phenomena such as broadcast transmitters, transoceanic cables, satellite earth stations, mobile telephone towers, and Internet data centres” (Parks, 2015: 356). Parks proposes that a study of infrastructures is necessary to emphasise the materiality and physicality of hardware, localisation and distribution systems through which digital media signals are transmitted. Such a proposal extends humanities research into the digital beyond that of the interface (Bolter, 2000; Drucker, 2014; Galloway, 2012; Manovich, 2002 and others) accounting for resources that include “the sun, electricity, land, water, petroleum, chemicals, heavy metals, plastics and spectrum” (Parks, 2015: 356). In particular, data centres, which act as central nodes, junctions, storage facilities and processing hubs of media network infrastructure exist “at the border between the dematerialized space of data and the resolutely physical

buildings they occupy” (Hu, 2015a: 81). Internet technologies and, in particular, technologies of the Cloud, epitomise this nexus crossover where “a consumer may think of ‘cloud’ as the cloud drive on his phone; [...] a software developer may use ‘cloud’ to mean ‘software as a service’ [...], while a network engineer may continue to use ‘cloud’ to mean a ‘network of networks’” (Hu, 2015a: xxvi). This confusion over the abstract terminology of network infrastructures is what brings my research into the site of infrastructure itself, to recalibrate crosstalk between definitions of ‘cloud’ from position of user, software engineer, and infrastructure engineer.

### **3.3.2 How to study media infrastructures**

Former network engineer and media scholar Tung-Hui Hu states that “[t]he network is always more than its digital or physical infrastructure” (Hu, 2015a: 10). An approach towards generating an operative understanding of media transmissions, must account not only for interactions at the level of ‘user’ interface, or at the level of hardware, but move across differing scales, recognising media infrastructures as part of “multivalent sociotechnical relations” (Parks and Starosielski, 2015: 8). Lisa Parks and Nicole Starosielski, editors of *Signal Traffic: Critical Studies of Media Infrastructure* (2015), call for an approach towards media infrastructure studies that combines “archaeology, political economy, phenomenology, ethnography and discourse analysis” (2015: 6). I add sonospheric investigations to this list of methodologies as an approach that can potentially align the materials, and materialities within complex multimodal meshworks of media assemblage. To clarify, I have described my understanding of ‘multimodality’ within the context of this thesis in Chapter One, as the near infinite multimedia modes of communication, referring particularly to the work of Steph Ceraso and Lisbeth Lipari. My understanding of ‘meshworks’ is primarily sourced from Manuel De Landa’s use of the term to describe complex fluid structures comprising a mixture of geological, biological, social, and linguistic constructions (De Landa, 1997: 25). The non-hierarchical structures of meshworked network formations described by Jane Bennett that form her understanding of ‘assemblage’ (2010: 23–24) is used here in recognition of Gilles Deleuze and Félix Guattari’s concept of ‘agencement’. An aim of this thesis is to avoid fixating exclusively upon transmission, reception, and interface; working within media infrastructural network formations as

assemblages/agencements, prioritises thinking about their in-between-ness as multimodal and agential. This thesis proposes that people can do this by listening to infrastructures.

Anthropologist Anna Harris has researched the sonic infrastructure of pneumatic tube networks, arguing for “greater methodological attention to be paid to the sensory dimensions of infrastructure” (Harris, 2017: 22) by attending to their sonic traces. Harris claims that infrastructures “refuse to remain silent, yet in their efforts to make infrastructures more visible, social scientists and humanities scholars often forget to make them audible too” (Harris, 2017: 21). Harris points towards a possible future discipline of infrastructure studies that combines the visual ‘reveal’ of infrastructures with a sensory multimodal approach, which can be listened to sonospherically, in particular by considering:

not only physical stuff but the relations between people, stuff and the space in which infrastructure operate; the skills entailed in working with material assemblages; connections between bodies and things, which are constantly created through everyday practices (Harris, 2017: 47).

This position is shared by Parks and Starosielski who argue that an affective approach to infrastructure studies might “begin by excavating the various dispositions, feelings, moods, or sensations people experience during encounters with infrastructural objects, sites, and processes” (2015: 15). Historian Gerard Alberts found in a series of interviews with retired IT technicians that an emotional connection had formed between the technician and the machine on a one-to-one personal level (Alberts, 2011). The electromechanical noise of early machines created a sense of stability that comforted users during day-to-day programming and use. This sentiment was explored by the late composer Jóhann Jóhannsson whose work *IBM 1401, A User's Manual* (2006) explores an IBM technician's audio guide LP and the distinctive tones of Iceland's first digital computer.<sup>1</sup> Void of sentimentality for individual computer units, interviewees within *The People's Cloud* offer no such personal relationships to their technical media equipment.

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<sup>1</sup> The experiences of early computing pioneers will be explored further in Chapter Four.

Users know their media originates from somewhere, but that somewhere can be diffuse and abstract, and affects users both directly and indirectly. The spatial properties of media infrastructures equally resonate with the sonospheric investigation as the vibrant spectral forces of electromagnetic enclosures store vast quantities of data harvested through interactive networks. As material sites, media infrastructures – particularly data centres – lose their sentimentality but virtually they graft the “enclosure of the Internet onto the physical spaces of daily life” (Andrejevic, 2007: 309). As an exponentially growing platform, they “loom on the landscape like depopulated afterimages of industrial-era factories, inhabited not by workers, inmates, or patients, but by the combined data doubles of all of them” (Andrejevic, 2007: 310). Attending to the ‘sonic’ and sonospheric traces of these spaces enables a recalibration between space, data and affect.

### ***3.3.3 Media infrastructures and the Anthropocene***

As stated in Chapter One (pp.35-37), digital technologies perform a role as measurer, catalyst and potential solution for the Anthropocene. As demand for data-quantification of the world increases so does the environmental, ecological, economical, and psychological residue of the economy of noise. The building out of a media infrastructure capable of meeting the scale of demand turns into a race between how much energy can be generated to power the quantified world of sensors (smart cities, driverless cars, smart home devices, fitness bands, environmental sensors) and the data centres processing this harvested data. With the US data centre market alone consuming over 70bn kilowatt-hours of electricity annually (Sverdlik, 2016b), Benjamin Bratton asks whether the multiple layers of planetary scale infrastructure, or ‘The Stack’ can “be built fast enough to save us from the costs of building The Stack?” (Bratton, 2016: 96). Media scholar Mél Hogan’s research into data centres as ‘environmental media’ formulates this question around a need to better grasp the reconfigurations of the “concepts of ‘nature’ and the ‘environment’” (Hogan, 2015: 5) so as not to understand them merely as there to serve media infrastructure but as properties of media infrastructure themselves. She argues that the “very idea of” a transoceanic subsea cable that crosses the Arctic from London to Tokyo “is a project of the Anthropocene” (Hogan, 2016: 48). Data centres merge “with the landscape, relying

on it, and altering it” (Hogan, 2015: 9), in return contributing towards the Anthropocene.<sup>2</sup>

A challenge for the media infrastructure industry is to maintain profits and operate on huge economies of scale and in doing so perpetuate the techno-futurist model of late capitalism that positions big tech as “savior and custodian of the planet by driving home the idea that technology will save us from our environmental conundrums, if only we invest in it enough” (Hogan, 2016: 50). Planetary scale media infrastructures comprise a complex, interwoven mesh of mineralogy, data, sensors, energy, labour, and affect. Hogan calls for a turn towards qualitative inquiries of “small scale, or ‘small data’ projects” (2016: 47) which collectively may speak towards the planetary scale concerns of the Anthropocene. Through sonospheric investigations, it is the intention of artworks in this thesis to contribute towards the political critique of media infrastructure ecology, taking the call from media scholar Sean Cubitt to “address the human as well as the organic” (2017: 10). In doing so I recognise how the environment of media infrastructures are an important site of concern and in confluence with more widely acknowledged climatic concerns such as Antarctic glacial decline.<sup>3</sup>

### ***3.4 Artistic interrogations of media infrastructures***

In this following section I will consider how other artists have addressed media infrastructures as a site and object of concern in contemporary culture. Such works have the capacity to both challenge and reinforce the corporate narratives of media infrastructure industry, such as the narratives presented by the interviews held in the production of *The People’s Cloud*. Concerns around negotiating access to sites and subjects for artistic practice discussed within Chapter Two of this thesis will re-emerge within other artists’ work on media infrastructure and also become a feature in the production of *The People’s Cloud*. This discussion of artists’ work provides an overview of the conditions of artistic production within the field and contributes towards the more-than-representational of media infrastructures within my own practice.

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<sup>2</sup> The average UK home uses approximately 4,000kWh of electricity annually.

<sup>3</sup> The subject of artist Andrea Polli’s National Science Foundation residency project *Sonic Antarctica* (2009), mentioned in Chapter Two.

### 3.4.1 *Big Bang Data*

*Big Bang Data* (2014-2018) is an internationally touring exhibition, curated by Olga Subirós and José Luis de Vicente, and described as exploring, “the phenomenon of the information explosion we are currently experiencing” (Big Bang Data, 2014). I have chosen to consider the work of this exhibition in particular for three reasons: it opened at Somerset House in London at the same time I began work on this thesis (2015); it has significant global reach and longevity having toured internationally for several years; the exhibition’s corporate partners raise issues of access and compromise. My assessment of the exhibition is based on the iteration at Somerset House between 3 December 2015 and 20 May 2016. Much of this large-scale exhibition focuses upon digital data and its potential software-based application which is not a central concern for this chapter.<sup>4</sup> The exhibition additionally acknowledges the material presence of ‘datafication’. A wall-text at the entrance to the main exhibition space states:

[t]he cloud is actually supported by an enormous network of physical servers which process and store information, devouring huge amounts of energy. These monumental buildings hide in wastelands around the world, linked by a spiderweb of subterranean cables and electromagnetic waves (Subirós and de Vicente, 2015).

Several works address media infrastructure as the physical objects of ‘the cloud’ including *Submarine Cable Map* (Krisetya et al., 2015), *Del Secret al Monument* (de Vicente, 2014) and *Internet Machine* (Arnall, 2014a).<sup>5</sup> The privileging of visual media in artwork addressing media infrastructures is often compromised by corporate interest and is apparent in each of these works: *Submarine Cable Map* is a large floor print of an annually updated map produced by commercial data informatics company TeleGeography; *Del Secret al Monument* comprises postcards of data centre corporate marketing images, and *Internet Machine* is a multichannel

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<sup>4</sup> Works at *Big Bang Data* addressing data flow and software application included: *London Data Streams* (Tekja and Future Cities Catapult, 2015); *Black Shoals*; *Dark Matter* (Autogena and Portway, 2015); *data.tron [WUXGA version]* (Ikeda, 2007); *Selfiecity* (Manovich, 2015); *1:1, 1999* (Jevbrat, 1999) and many others which are swapped in and out according to each iteration of the exhibition.

<sup>5</sup> *Del Secret al Monument* is a work by de Vicente which explored his curatorial statement about the monumentality of data centres, as discussed in Chapter Two.

film using animated photographic material recorded inside a commercial data centre. The owners of media infrastructure ultimately choose which aspects of their wasteland monuments can be used to reveal the “hidden materiality of our data” (Arnall, 2014b). These works demonstrate what anthropologist Brian Larkin refers to as the “poetic mode” (Larkin, 2013: 335) of infrastructures that both excite and distract us from the materials that are connecting and being connected to.

Timo Arnall’s *Internet Machine* puts the physical material of computing at the forefront of the exhibition. The purpose of Arnall’s work is to reveal ‘the cloud’, yet for media theorists Jennifer Holt and Patrick Vonderau, images aestheticising data centre facilities “gesture toward the notion of transparency, all while working to conceal or obscure less picturesque dimensions of cloud infrastructure” (Holt and Vonderau, 2015: 74). The process is a black boxing of digital media infrastructure, obfuscating the material reality of what this equipment does; the work does not reveal the physical process, design and manufacture required to run a computational program. Arnall is perhaps parodying the marketing method of corporations such as Telefónica but as the corporation’s charitable arm Telefónica Fundación is lead sponsor for the exhibition and the work is filmed in their flagship Madrid data centre, it is more likely to be a compromise. Such a compromise is an effect of “industrial proximity” (Vonderau, 2014), where those researching and producing work on digital media infrastructure must negotiate industries’ expectations in the final output to ensure, as Barbara Steveni noted (in Chapter Two), that everyone gets something out of it, but also to protect the brand and intellectual property of the commercial partner. *Internet Machine* presents an image of the exoskeleton of Telefónica’s physical data storage infrastructure, as well as an image of the mechanics of the global data industry at large. It highlights the negotiation and power relationships that must occur in the production of such works between artist and corporate facilitator/gatekeeper. To investigate the global digital industry in this immediate and direct way, the artist must negotiate access; reflecting a privileging of access to the spaces that monitor and manage our labour, our work, our social lives, our movements but their property and their data cache.



*Internet Machine* turns the functional industrial factory into an exotic, fetishised location with no human coordinate.<sup>6</sup> The corporate image of media infrastructures is well documented on YouTube in HD Steadicam-balanced promotional videos (Parker, 2014). It is difficult to assess the operational properties of media infrastructures when presented by “slick, artful images of buildings, wires, pipes, servers” (Holt and Vonderau, 2015: 71). Alexander Taylor, who has produced an ethnographic study into the UK data centre industry argues that the production of photographic and filmic media of data centres creates “aestheticised whitescapes” which obfuscate the “structures of knowledge and the vested interests that configure the conditions of data centre visibility” (Taylor, 2017). In 2012 Google invited people towards a special access Street View App, to ‘see where the Internet lives’. This form of content delivery is a practice adopted by many of the multi-national corporation tech-giants in the media infrastructure industry, and evokes what sociologists John Urry and Jonas Larsen refer to as “the tourist gaze” (Urry and Larsen, 2011), which across online platforms enables a ‘virtual tourism’ where one can – through screen based media – explore spaces they wouldn’t otherwise be able to access. Beyond the simple ‘reveal’ of a data centre, companies have also begun to invite artists to alter and glamorise their spaces for marketing purposes: the musician Tim Exile was invited to make sound recordings inside an IBM data centre and use these recordings as sample-clips for inclusion in an electronic dance music track performed inside the data hall for promotional content (RemixIT, 2016). Google commissioned artists Oli-B and Jenny Oddell to paint murals across the concrete husks of their data centres in Mayes County, USA and St. Ghislain, Belgium (Google, s.d.). *The Art of the Data Center* (Alger, 2012) is a coffee-table photo book explicitly placing the architecture of data centres within an exoticised gaze. Even in the pre-internet era, IBM worked with Charles and Ray Eames on films, installations and playing cards to ‘reveal’ the digital object in two films *IBM Fair Presentation Film #1* (1962), and *IBM Fair Presentation Film #2* (1963), and the title of Arnall’s work alludes to a third, *The Information Machine* (1957). The relationship between tech companies and artists providing ‘content’ is an enduring one that must be

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<sup>6</sup> A limited number of still images have been made available for promotional use during later iterations of the touring exhibition which include signs of human presence within the clinical settings depicted in the installation piece but these images are not within the exhibited work itself.

recognised in our attempts to critically assess the aestheticised imagery of media infrastructure as well as the presentation and understanding for the general consumer of how complex media infrastructures operate.



Image 14

*Big Bang Data* (2015), installation of *Submarine Cable Map* (Krisetya et al., 2015) and *Del Secret al Monument* (de Vicente, 2014), copyright Echo Studios Ltd.

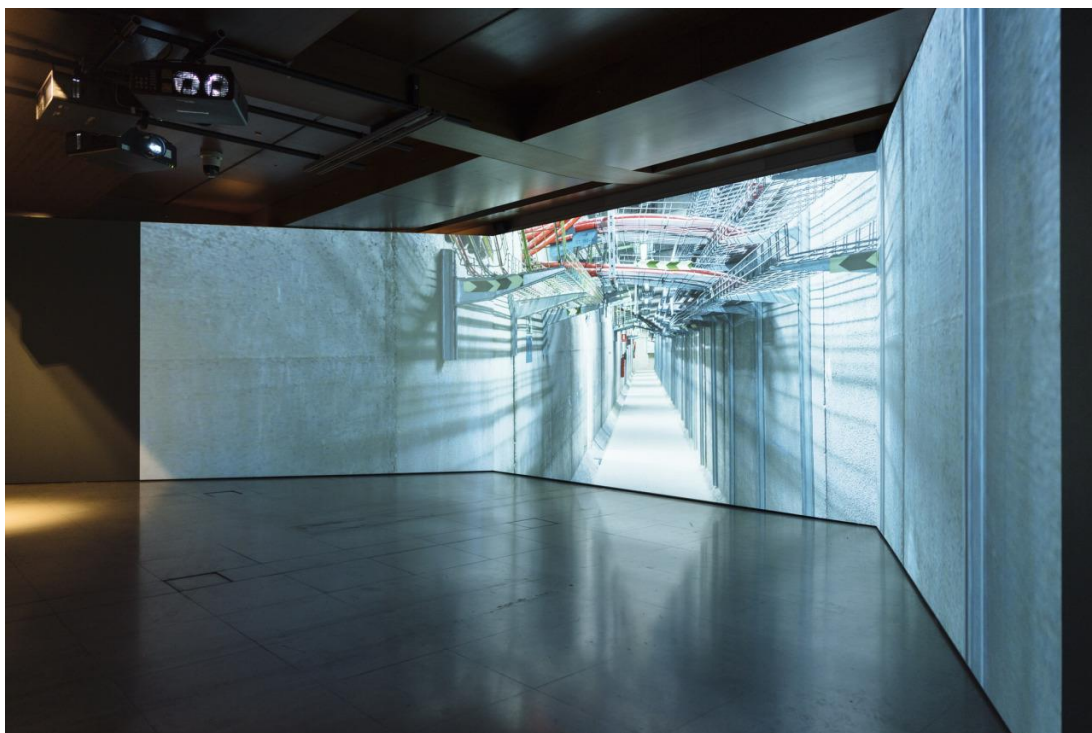


Image 15

*Internet Machine* (2015), installation at *Big Bang Data*, Somerset House, UK, copyright Timo Arnall



Image 16

Mayes County data centre mural, Jenny Odell, copyright Google

### ***3.4.2 Media infrastructure as object of artistic exploration***

A number of artists have recently produced works interrogating the socio-political and environmental issues surrounding media infrastructures that were not featured in *Big Bang Data* nor commissioned by big-tech. Their research burrows deep into the minerals within the earth, to the remote nodes of network interconnection, to the deep sea, the airborne and atmospheric, the public/private boundaries, borders and even the paranormal. Filmmakers hailing from Western Europe have explored the ecology, politics and violence of e-recycling and neo-colonial mining of rare-earth metals across various African nations, including the artist's film *All that is Solid* (2014) by Louis Henderson and the commercial documentary film *Blood in the Mobile* (2011). The Congolese artist Eddy Kamuanga Ilunga produces paintings depicting the subjugation of Congolese people throughout colonial history and within the contemporary moment of rare earth mining practices by placing in relation, colonial artefacts, traditional dress and black bodies with computer circuits creeping across their skin (Kamuanga Ilunga, 2018). The raw, elemental materials of media technologies are explored in the sculptural object *B/NdAlTaAu* (2015) by Revital Cohen and Tuur Van Balen. The duo work with discarded computer parts to reverse engineer hard drives and motherboards, producing 'artificial-ore' sculptures that reflect transnational production lines in which such materials are "mined out of soil, designed in the United States, made in China, destroyed in England" (Cohen and Van Balen, 2016). The work gestures toward a future of e-waste meshworks that will be left behind or buried in the ground at the end of the common era of civilisation: network cables, abandoned data centres and burial sites of iPhones, to be dug up by archaeologists of the future, examined and reconfigured as historical network traces, relics and monuments (Mattern, 2015: 9–10).



Image 17 (left)

*Fragile 1* (2018), Eddy Kamuanga Ilunga, online:

[www.octobergallery.co.uk/artists/kamuanga/images/760x570/Fragile-1\\_adobe\\_RGB\\_207cm-x-180cm,-Acrylic-and-oil-on-canvas,-2018---Copy-2.jpg](http://www.octobergallery.co.uk/artists/kamuanga/images/760x570/Fragile-1_adobe_RGB_207cm-x-180cm,-Acrylic-and-oil-on-canvas,-2018---Copy-2.jpg)

Image 18 (right)

*B/NdAlTaAu* (2015), Revital Cohen and Tuur Van Balen, copyright Jens Ziehe

Returning to the contemporary where the objects of technical media have yet to be fully fossilised, artists have developed methods to explore the sites of media infrastructure by producing Internet infrastructure field guides (Burrington, 2014); photographing their external architectures (Greer, 2015); building models of tech company ‘campus’ headquarters (Langlands and Bell, 2018); observing the notification signs of fibre optic cables buried in the ground (Charles, 2015); ‘exploring’ fibre optic cable networks by walking their terraform routes whilst tracking network presence through IP addresses and remotely tethering to the GPS network (Woon *et al.*, 2002); through video and drone footage on sites of cable landing stations (Fish, 2018; *The Farthest Distance*, 2017); generating virtual environments inside game engine applications that are based on photographs of a data centre taken from a helicopter (Gerrard, 2015); using experimental methods of recording and measurement such as ghost detector kits, frequency scanners and infrared cameras (Roth, 2015b); building network map sculptures with Raspberry Pi microcomputers, plumbing tubes, and smoke machines (van Loon, 2015); developing web-browser extensions to determine the “Algorithmic Citizenship” of users (Bridle, 2015); and interactive online maps (Starosielski *et al.*, 2014).



A web-based archive mapping the nodes of submarine cable networks, *Surfacing* (Starosielski *et al.*, 2014) combines images of cable landing sites with narratives of ecology, isolated labour practices, and histories of colonial networks. It demonstrates how media infrastructures exist upon layered “strategies of insulation” (Starosielski, 2015: 19) where not only is a data cable encased in an airtight steel and rubber manifold, it is buried deep on the ocean floor, only interconnecting with other networks that form the Internet at cable landing spokes, on remote, military controlled islands. Location in each of these works is of primary interest. The artists situate themselves on the outside perimeters of media infrastructure, peaking above and digging below to gain glimpses inside (whether from the perimeter of a cable landing station or data centre). Online they sift for schemes in the public record of architectural drawings of headquarter buildings. They explore the flow and dredge of insulated cables and their associated spatio-temporal symbology, and the labour practices and culture of the inhabitants and employees living on isolated network-hubs in the centre of vast oceans such as the Faroe Islands, Marshall Islands, or Guam. Cultural anthropologist and filmmaker Adam Fish argues that gazing upon these material sites reveals “little about their function as they provide no beginnings nor endings but instead act as mediating nodes in a net of evolving technologies” (Fish *et al.*, 2017: 75). It is not necessarily a requirement to understanding their function in the industrial sense, but understanding the mechanics of media infrastructures as nodes of evolving technologies, alongside the cultural practices entwined within their presence on the small and locatable scale, can provide critical and engaging resonances with the broader narrative arc of planetary media infrastructures.

Exploring the undersea cable network, experimental geographer Trevor Paglen has produced a series of subsea photographic works. *Bahamas Internet Cable System (BICS-1), NSA/GCHQ-Tapped Undersea Cable, Atlantic Ocean* (Paglen, 2015) offers a stark image of the undersea cable infrastructure. Through the long title, Paglen contextualises the murky image of a subsea cable that is allegedly tapped by USA’s National Security Agency (NSA). Paglen’s work is less interested in the natural resources, labour and colonial histories imbricated within media infrastructures than the material of data flow as an abundant resource to be mined. The image

depicts a seemingly nonhuman terrain but Paglen emphasises the personal endeavour undertaken to access it. In an interview for *The New Yorker*, Tim Sohn explains how Paglen “did not know how to scuba dive, so he learned” (Sohn, 2015). Investigating such extreme locations for Paglen seems to be as exclusive as the network itself; scuba lessons, expensive underwater cameras, a crew of specialist assistants, all adding to Paglen’s accomplishment in searching for the prize (image). This approach to exploration, aiming to ‘uncover’ or ‘discover’ the “uncomfortable truths” (Rothstein, 2015) underpinning media infrastructures echoes the hyper-masculine practices of urban exploration (discussed in Chapter Two). As media scholar Shannon Mattern states, “that infrastructures are ‘hidden’ or ‘magic’, and thus require demystification through a field trip [...] signals great privilege” (Mattern, 2016). Building on Eve Kosofsky Sedgwick’s (1990) work on the ‘epistemology of the closet’, Hu refers to this as an “epistemology of exposure” (Hu, 2015b). Here Hu is calling out an aesthetics of paranoia whereby naming or revealing the thing is understood as more important, or the same as, direct action. For example, a photograph of an NSA tapped cable is understood as revealing the structural violence that enables it to be there. However, the work affirms a paradox of the reality of media infrastructure operations in that “you can never see it by looking directly at it” (Hu, 2015a: xx). The revealing of media infrastructures through spectacle not only reinforces the narrative of infrastructures’ importance within global cultures of capital but the method offers free labour, PR, and solutions of insulation for media infrastructure owners. Paraphrasing Geert Lovink, Hu notes that “hacktivists do their mods and capitalism says ‘thanks for the improvement, our beta version of this has now been improved by you helping’” (Hu, 2015b). There is a significant scope for valuable research to be achieved from the outside-gazing-in position, but perhaps to fully appreciate the complexities of media infrastructural sites, the challenges of industrial proximity must be explored and work must take place inside the spaces of industry, whilst minimising the effects of industrial proximity.

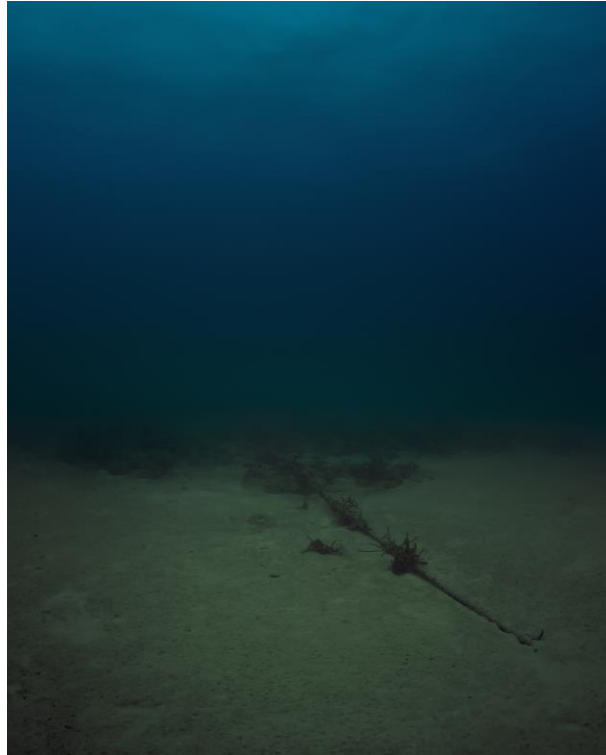


Image 19

*Bahamas Internet Cable System (BICS-1), NSA/GCHQ-Tapped Undersea Cable, Atlantic Ocean (2015), copyright*

Trevor Paglen

### ***3.4.3 Accessing media infrastructures for artistic research***

In contrast to the other works previously discussed, in making *Surfacing*, Starosielski researched the Pacific subsea cable nodes as human-centred ethnographic experiences filled with staff negotiations at each site. She initially gained trust of gatekeepers of the industry by negotiating the project plan with representatives at the International Cable Protection Committee (ICPC) and continued to maintain personal relationships with those who she encountered in the field.<sup>7</sup> Sensory ethnographer Sarah Pink writes about how the traditional, embedded methodology of ethnography is not always possible as it is difficult to embed oneself into a culture, to observe and listen to work commitments, social commitments, and scenarios. Such generalised access is often a privilege that is difficult to obtain, particularly within commercial settings but adapted techniques to gather presence in a field of enquiry are not any less valuable or valid. For Pink “the primary context for any piece of research is place” (2015: 34). Place becomes a liminal set of animate and inanimate entities where ethnographic research is

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<sup>7</sup> More information on the work of the ICPC can be found at <https://www.iscpc.org/>.



performed to “understand how people's lives are lived out and felt” (2015: 35). As I have argued in Chapter Two, there are significant issues that should be considered in the creation of artworks produced once having been granted access to an industrial or commercial partner’s facility. Access requests are often refused – and even more often outright ignored – but even if a request for access to a data centre facility for artistic research is rejected, one can still generate attention if one has substantial budget. John Gerrard’s work *Farm (Pryor Creek, Oklahoma)* (2015) highlights the brick wall privacy of the colourful and seemingly friendly Internet giant Google. Following a (general) request by Gerrard to visit the data centre that was (unsurprisingly) refused, the artist decided to hire a helicopter to fly over it. He took photographs that were later used as material to compile a game engine simulation that slowly pans around the data centre perimeter. The press material for the work makes great effort to emphasise the stunt which – much like in Paglen’s work – demonstrates a sense of entitlement to, in Paglen’s words, “insist on one's right to photograph” (Paglen in Trevor Paglen, 2015). I recall Lipari’s request to think about “who speaks and who doesn’t, what is and is not said, how what is said is said, as well as, of course, to whom it is said and what is and is not heard, and *how* what is heard is heard” (Lipari, 2014: 53). Paglen’s ‘right to photograph’ is premised on funding bodies and commissions which enable the purchase of equipment and training. This privilege equips him with telephotographic lenses, underwater cameras and scuba diving teams that other individuals, with equal or more at stake in the material investigated, cannot access.

The artists I have introduced are mostly from Europe or North America and are largely in receipt of institutional support. Those conducting fieldwork on the perimeters of media sites partake in a problematic western colonial tradition of ‘expedition’ that Shannon Mattern argues is tantamount to “infrastructural tourism” (2013). Joana Demers refers to a similar concept of “sonic tourism” to describe the cultural appropriation of non-Western soundscapes and genres into Western music and soundscape compositions which offer “an exotic trip through a foreign land without attention to the economics or politics of such activity” (Demers, 2010: 173). These are important concerns, however Lisa Parks whilst recognising these complications argues that it is only by being aware of media

systems and infrastructures that “citizen/users” (2009) are able to collectively engage in their locations and manifestations. This chapter discusses a number of artists engaging in media infrastructures, each close to my cultural background as British white European. As artists and citizen/users, how can we listen to and talk about media infrastructures, understand them as part of a planetary scale media apparatus and as locally determined and locative? If artists do not have the exhaustive budgets of Gerrard and Paglen, or identify themselves as being owed the right of access, how do we listen in to the economies of noise of infrastructures? How can artists gain the trust of gatekeepers without losing artistic integrity?



Image 20 (left)

*Farm (Pryor Creek, Oklahoma)* (2015), pre-production still, copyright John Gerrard

Image 21 (right)

*Farm (Pryor Creek, Oklahoma)* (2015), installation at Thomas Dane Gallery, London, UK, copyright Thomas Dane Gallery

Two artist filmmakers who have explored data centre infrastructures from the inside reveal a different aesthetic to that of the clinical spaces depicted by commissions for Telefonica, IBM and Google. The artist’s film *Fragments on Machines* (2013) by Emma Charles explores the geopolitics and labour of media infrastructures with a particular focus on the proximity of the Verizon Headquarters within New York City’s financial district and the enabling of hierarchical autonomous networks within high-frequency trading practices. Yuri Pattison produces a “full survey of life on the bitcoin mine” in his film *the ideal (v. 0.1)* (2016) which navigates the inner and outer space of the HaoBTC Bitcoin mine located near a dam built by The People’s Republic of China in Kanding, Sichuan, a remote area of occupied Tibet. Both works offer an un-manicured presentation of

media infrastructural sites from within. In conversation with Emma Charles, I was told that she had no prior request for access to the Verizon HQ until one day, she walked up to the reception desk and asked. Her permission was granted to access the space – a vital node within the financial hub of New York – to freely film and record sound with her Steadicam operator colleague. The human coordinates, fragility and temporality of the space are explored with little-to-no expectations from the commercial giant who owns the building. The work reveals a chaotic space of media infrastructure that is sonically enveloping. The sanitised, soft air-flow sounds heard in the installation of *Internet Machine* are replaced by compressed, intense mechanical vibrations, whirs and whooshes, which are aligned with slow images of decaying pipes and messy bundles of wire, chairs, and engineers, all men, with New York accents, knelt between racks, discussing fault finding. Charles' opportunistic request for access does however echo the issues of access discussed in Chapter Two and demonstrates how various privileges are embodied. A right is only a right if you feel enabled to assert it. Charles felt confident enough to approach the reception desk and request permission. This is an act that only those whose daily experiences allow them to move freely – without sensing the risk of being stopped and searched, or questioned at airports or other public sites – would be confident in doing. I have similarly experienced such privilege when gaining access to the monument sites of Rome, as discussed in Chapter Two.

Pattison persuaded the Chief Marketing Officer of HaoBTC to film the building of their Bitcoin mine. The camera operator uses a HD wide angle camera and HD drone camera, sending his digital footage to Pattison over the Internet. Pattison's footprint in obtaining footage is subsequently minimised. The raw, shaky images and compressed audio of the work depicts a collapse of the rural and the technological, where the sonic presence of the facility, insulated geographically through remoteness, but like an open sore atop its raised platform, vibrates, echoes, and resonates across the surrounding valley it occupies.

The access negotiated by Pattison being entirely complicit and specifically generated by a company representative, demonstrates a quite different perception for the need of secrecy and control of the corporate image that is held by

comparable companies in Europe and North America. Mattern has equally observed an “‘Anglo’ romanticization of cables and tubes” (2016), as some non-Western European nations situate infrastructure as part of their public referenda, limiting the cause for mystery. Yet in the West, there is a longstanding lineage of mystique around the transmission of data through technology dating back to 1876 and the first telephone call between Alexander Graham Bell and Thomas Watson. This period hailed an emergent fascination with the whispers of aetherial spectres of sound on the airwaves. In Evan Roth’s *Internet Landscapes* (2015a) series, the artist performs a sonospheric investigation of the embodiment of the arterial infrastructure of subsea fibre optic cables. Using a consumer grade SLR camera hand-modified to record infrared spectrum and an Electromagnetic frequency (EMF) reader or ‘ghost-box’ used by paranormal investigators to scan for electromagnetic frequency fluctuations, Roth takes a DIY electronics approach as he searches for the ‘ghosts’ in the internet machine; the disembodied human energy packaged inside the fibres. By using transducers, Roth reaches beyond his sensory faculties and transduces the world beyond him in hope of finding meaning in the relationships between media infrastructure, space, time, place, landscape, and culture, as he battles with listening to what’s ‘out-there’ against hearing his own internal monologue.<sup>8</sup>

In this section, I have discussed the *Big Bang Data* exhibition as a major exhibition aiming to provide context for the world of digital data that we inhabit. I argue that the key works within the exhibition designed to explain what the Internet is, are compromised by industrial proximity and as such do not go far enough into investigating what is at stake in terms of material, labour, and ecology of media infrastructures. I then introduced a number of works that inventively explore what is at stake within media infrastructures but raise issues of access and privilege in different ways. Finally the works of Charles, Pattison, and Roth each explore media infrastructures through negotiations of access that minimise the compromises of industrial proximity, but still express a level of embodied privilege.

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<sup>8</sup> Transducers and transduction practices have been raised in Chapter One and Chapter Two prior to thinking about Roth’s work. As a significant sonopalette tool, transduction as a concept and process will receive greater attention in Chapter Four.

The works do however allow for an increased sensitivity towards experiencing the physical infrastructures that exist and their vibratory residues.

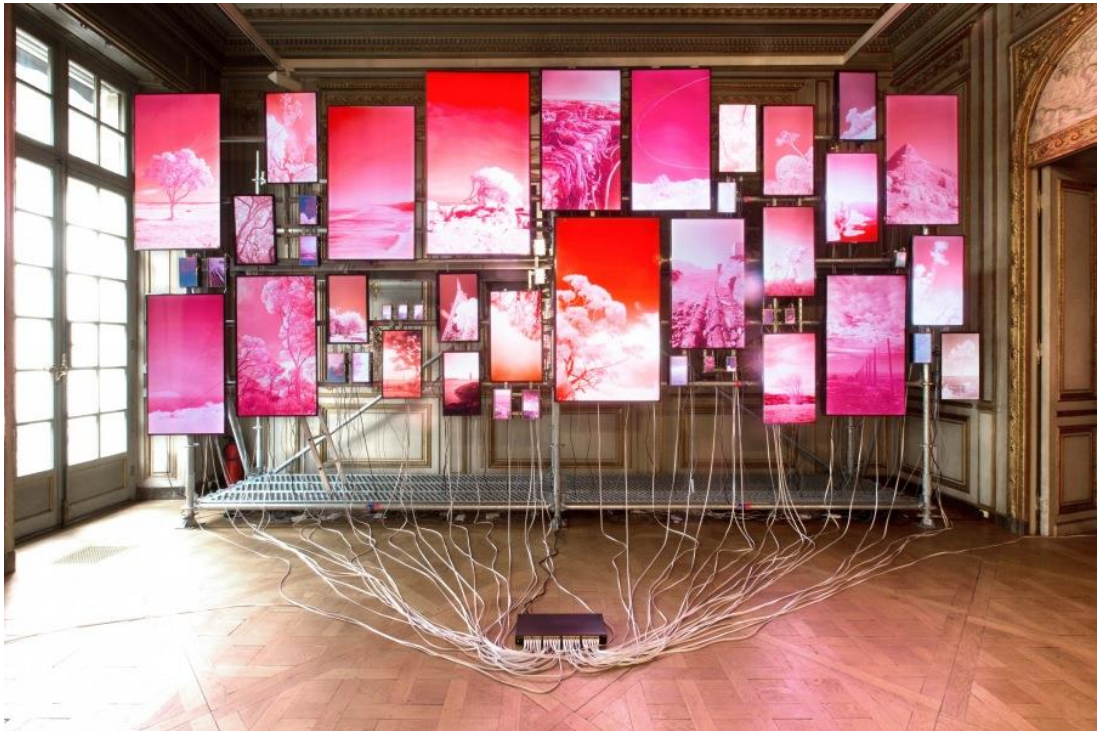


Image 22

*Landscape with a Ruin* (2018), Evan Roth, photo by Vinciane Lebrun-Verguethen, copyright Mona Bismarck  
American Center

### ***3.5 The People's Cloud as sonospheric investigation***

I was awarded the Deutsche Bank Award for Creative Enterprise (DBACE), a competition to gain financial and business support of £10,000 and a year's mentorship from a senior staff member at Deutsche Bank. My proposal for this award came in the form of a business plan which stated that I would produce a sonic documentary about media infrastructures. As recipient of the funding and Deutsche Bank's validation for the project, my work on *The People's Cloud* benefitted from a degree of financial security but also industrial proximity. In writing the business plan, I had begun to develop a commercial language to structure and describe the project. This formal underpinning would prove to be valuable in negotiations with media infrastructure companies and personnel that would feature in *The People's Cloud*. I will now discuss the issues that emerged within the pre-production, production, and post-production phases in making *The People's Cloud*. I have defined how research in the field for me is a listening practice

where I listen through the tools within the sonopalette, to engage with the multiple registers of the sonosphere. This is a performative process ‘in the field’ that extends beyond site-specificity to centre upon media specificity. The three phases of production for media artworks in this documentary video style speak towards the sonospheric investigation.

### ***3.5.1 Pre-production: negotiation, access and gatekeepers***

Prior to *The People’s Cloud*, I had produced a series of recordings from inside two data centres at Birmingham City University which had been released online through the Cities and Memory website (Fowkes, 2014). This work managed to draw interest from online media including *The Atlantic* (Garber, 2014) and *New Scientist* (Rutkin, 2014). This initial press attention combined with the validation of having received the DBACE prize was vital in enabling me to approach media infrastructure companies, requesting permission to visit them and record sounds in their facilities. This is how the project started. Initially I received no response to my email requests but over time I began to modify, and ‘pad-out’ the edges of the initial emails (mostly directed initially towards PR agencies representing companies I aimed to speak with). I began to increase the ambition of the project, to become a multimodal investigation into the facilities in question and to expand the medium of research to include interviews, film as well as sound recordings. Those engaging with my request were of a significant minority. Many emails never received a reply. Follow up phones calls were often met with enthusiasm but lead to dead ends. This was a slow and time-consuming process to reach a position where the gatekeepers within marketing teams were happy for me and a collaborator to visit a negotiated site.<sup>9</sup>

A few key observations were made during this process in relation to access and developing gatekeeper trust. PR executives within the sector tended to be able to make sense of a project if it was worded in a familiar business language to that which the sector operates in. As such, I tried to break my initial enquiry into one of: setup (this is briefly what I want to achieve); how it will benefit you (final outputs

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<sup>9</sup> The production of *The People’s Cloud* was made with assistance from camera operators Sébastien Dehesdin and Michael James Lewis, and included an amazing road trip of the Suffolk and East Anglia coastline with Carol Parker (my mum) who acted as photographer.

and why it will be helpful for your business to take part); my track record (how my previous work and current relationships will guarantee a valuable piece of marketing presence for your company). By requesting to interview a member of senior staff, the company identified the project as an opportunity for them to have a platform for a voice within their industry. Interviews became an additional method within the sonopalette, and central towards shaping my perception of how media infrastructure personnel understood their industry. During this research phase all the gatekeepers I made contact with, usually through a PR department, were women; where initial inquiries went well all the 'experts' I went on to meet, and eventually received permission to interview, were men. I asked a number of gatekeepers – once I recognised a familiar pattern emerging – if I could speak to a woman from other relevant departments in the company but no permissions were made possible. In particular this issue highlights a significant concern with identifying who operates and runs the Internet and speaks to wider concerns within contemporary society about gender inequality in the workplace. The IT industry, as part of the disciplinary fields of science, technology, engineering and mathematics (STEM) are increasingly recognised as having significant gaps between women and men within career progression, types of roles and rate of pay (Hicks, 2017, 2010; Schinzel, 2017). Recognising the limitations of *The People's Cloud* project and the difficulty I experienced in attempting to access a diverse collection of infrastructural sites but also a diverse workforce within the industry, my research shifted towards the work of women in computing, becoming a key feature in the artwork *Memory Line* (2018) which will be discussed in Chapter Four of this thesis.

### ***3.5.2 Production: recording and interviewing in the field***

Towards the end of the production period for *The People's Cloud*, I had visited nearly twenty sites of critical media infrastructure across the UK, Netherlands and Iceland, bringing with me a collection of sonopalette recording devices, predominantly including microphones and cameras. I occasionally attempted to attach a contact microphone to a data hall rack unit but was often instructed not to touch any equipment by the sub-contracted security chaperones that we found ourselves with on each shoot. Having spent the last year telling a narrative to prospective participants about the uniqueness of the sonic qualities of media

infrastructures, I myself had begun to experience data centre fatigue. A participant company, Equinix, has a uniform branded identity across each of its data centres. Proud in the consistency that their data centre in Illinois will look the same as their data centre in Amsterdam, the monocultures of internationally distributed data centres became increasingly apparent and over time exhaustingly repetitive to encounter. Equally apparent as a monoculture, were the responses from interview questions. All participants had a certain expectation of what an interview *should* sound like and when requested to perhaps walk whilst being interviewed, were suddenly very uncomfortable. It began to feel like every senior representative within the industry had been through the same media-training scheme. It was only whilst in Iceland, where I was particularly struck by the candid conversation had with CTO of Farice, Örn Orrasson that an interviewee was happy to go 'off brand' and respond more openly in conversation. I realised that interviews within the relatively short timeframes made available for busy professionals were the best I could do, but would leave many questions unsatisfied. I subsequently sought to conduct future interviews with more time and with greater empathy between myself and the interviewee, which reflects across the conversational walking interviews I took with stakeholders in the production of *Project Antioch* (2017) which will be discussed in Chapter Five, as well as in the long form interviews and intimate home-setting I planned for the production of *Memory Line*.

For *The People's Cloud*, production was split across sites where access was negotiated (primarily data centres) but also work where I was on the outside looking in, at the perimeters of infrastructural sites, or tracing the fibre optic landings across the UK and Dutch coastlines. Balancing the introspective investigation of the internal infrastructures and corporate voices, with the resonance of rural locations of hidden interconnections buried in the ocean floor, generated a blend between the approaches taken by other artists who seemed more focussed on one aspect or the other. Listening in these environments using microphones in a fairly conventional manner became meditative. Inside the infrastructural sites I would listen out for peculiarities of sound, where perhaps moments of rupture or fault were exposed in the otherwise clean-room aesthetics of the site. Outside, I would listen to the by-products of digital infrastructure



(residues of waste noise, waste heat and wasted capital), and how it seeped into the external environments of media infrastructures. In particular, the material infrastructures relationship to the environmental and geological material comprising the technologies within the data centre began to merge closer into each other. How could I explore the minerals of the machine and the minerals embedded in the landscape surrounding the machine as part of a flow of emerging assemblages and throbbing confederations of energy? This question became one of urgency through my research and would be something I would take forward to explore in the sound production for *White Mountain* (2017) which will be discussed in Chapter Four of this thesis.

### ***3.5.3 Post-production: reviewing, fault finding, abstracting and composing***

In the studio, I listened through and catalogued raw sound recordings and video clips, creating small libraries to draw from. I listened to and transcribed every interview and began to build a script for each episode within the series. My voice from the conversations would be removed, and a narrative structure would be formed by combining the voices of each interviewee with a soundtrack devised exclusively from recordings taken on-site. The episodes move between traditional documentary form and abstract soundscape and visualisation, from ambient sound recordings to heavily manipulated electroacoustic composition. This mix of styles and forms was intended to add to the drama of the episodes and to turn over a relatively stable conversational thread into an abstracted audiovisual world, breaking up the human voices to flow between the throbbing generators, whistling fans and rolling shorelines. On writing about the *The Forgotten Space* (2012) by Allan Sekula and Noël Burch, a film about life, employment, and activity around four major shipping ports across the world, geographer Ashley Dawson states “the film questions the art-versus-journalism binary that functions as grounds for exclusion of much politically engaged documentary work from the art world” (Dawson, 2015: 167). *The People’s Cloud* is an experiment in documentary making as a sonospheric investigation. It listens to the material of media infrastructures from human and non-human centred positions, within and outside the critical nodes it seeks to

navigate and as such sits between documentary and art, and perhaps fits into neither neatly.

In my initial promotional material for *The People's Cloud* I stated that opinions and perceptions of 'the cloud' would be explored within the project by not just those who worked in it but others that were affected by its presence. However, at the end of post-production, I was missing voices reflecting the sentiments of non-professionals towards the presence of media infrastructures. How would this project speak to those outside of the industry walls that are affected by the impacts of data centres? Whilst I had been negotiating industrial proximity, other people were physically proximate but without a voice within the industry itself. What of those lacking the agency to speak towards the location and impact of these spaces? This became a core concern in the research and production for *Fields of Athenry* (2016) and *Project Antioch* (2017) which will be discussed in Chapter Five of this thesis. By the point that *The People's Cloud* was ready for its online release, a number of initial gatekeepers had left their respective roles, Deutsche Bank had gone through a series of redundancies and my mentor was no longer actively engaged in my project. Interest had faded from the industry press but the project continues to exist, acting as a platform for opening discussions around how the Internet works, who looks after it, and most importantly, how its infrastructures resonate spatially, politically and culturally.



Image 23 (left)

*The People's Cloud* (2017), production still outside KEF201C, photo by Sébastien Dehesdin, copyright the author

Image 24 (right)

*The People's Cloud* (2017), production still at Ljósafoss hydroelectric power station, photo by Sébastien Dehesdin, copyright the author

### 3.6 *The People's Cloud (Original Soundtrack)*

#### 3.6.1 *Media transition*



Image 25

*The People's Cloud (Original Soundtrack)* (2016), album artwork, copyright the author

Please listen to the digital audio album 4. *The People's Cloud (Original Soundtrack)* (2016). The soundtrack extends the work heard in the documentary series and combines it into a flowing sequence of soundscapes. The work is a combination of unedited field recordings, and heavily processed electroacoustic compositions, with all material sourced on location during the field work phase of the project.<sup>10</sup> The soundtrack operates both as complementary and independently to the documentary series, creating atmospheric presence in the film but also *presencing* the spatial and experiential qualities of media infrastructure environments. It also creates bridges between the mystical, imagined, black boxed, natural and technological environments explored within the project. The soundtrack removes the human conversation from the work as heard in the film series, offering an emphasis towards the nonhuman energies of data centre infrastructure. It foregrounds the soundscape and nodal connections between data, space and environment, which are repeatedly 'ducked' in the mix, under a dominating male voice within the traditional conventions of editing documentary film. I was interested in exploring the unique sonospheric world of media infrastructures as much as exchanging conversation and opinion with technological

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<sup>10</sup> Track 6 'Quantum Leaps' uses separately sourced synthesiser sounds.

specialists and so I ask for you to immerse yourself in these ambient environments, to consider the network connections and the artefacts of waste heat and energy as agential becomings in themselves. At times, my presence can be heard in the recordings, as I walk a microphone array through a data hall or crunch my feet in the snow outside the perimeter of a data centre's fan outlets. These moments of human dis-rupture are not to be thought of as interference, but as a post-natural sound art project, they become part of the technological posthuman assemblage as it performs and bleeds across space and time, infused with human compositional creativity and imagination.

*The People's Cloud* was released as an online web-series and artistic investigative project. It has received a positive reception from the UK's major data centre industry magazine *Data Centre Dynamics* (Smolaks, 2016) and its US-based counterpart *Data Center Knowledge* (Sverdlik, 2016a). A feature article was written for the art and culture website *Hyperallergic* (Meier, 2017) and a review of the soundtrack release was written for *A Closer Listen* (Allen, 2017). Technology and culture websites *The Motherboard* by Vice Magazine (Sullivan, 2017), *The A.V. Club* (Neilan, 2017) and *Fast Company* magazine (Schwab, 2017) each featured interviews and descriptions of the project, reaching a wide audience of ambient music enthusiasts, industry professionals, tech industry consumers, and art and culture consumers. As such, using Vimeo as a generic online platform for video release and the audio streaming website Bandcamp for the soundtrack release seemed an appropriate way to showcase the work and encourage the immediate response of its audience to recognise, connect and question the very object they engage, interact and consume the project through. The critical observations I have made about the production of *The People's Cloud* are not to diminish the value of the project. It initially enabled me to expand the sonopalette to include conversation, interview, documentary film and electroacoustic composition as investigative research methods; as ways to listen to the combinations of human and nonhuman presences within the media infrastructure assemblage. Additionally, I have outlined some of the success of the project, in terms of reviews and press. But it has also helped position me as a specialist within the critical study of media infrastructures. For example, I have been informed by a number of academics

whom I cite in this chapter that they have begun to show episodes to their students as part of their teaching programmes on infrastructures. The track KEF201C, taken from the soundtrack was nominated for the Prix Field Recording (doté par le Musée de la Camargue) category of the 2018 Phonurgia Nova Awards.

### **3.7 *Concluding the cloud***

The concluding remarks of this chapter will remain brief as I intend for the reader to end this section by listening to *The People's Cloud (Original Soundtrack)*. Through this chapter, I have detailed what media infrastructures are and how they operate as critical nodes within techno-capitalist society. I have reviewed the approach taken by the major touring exhibition *Big Bang Data* as a way to understand how industrial proximity is a concern for any artist seeking to investigate the ways in which telecommunications and media infrastructures operate. I have considered how other artists outside of *Big Bang Data* have also attempted to work within or circumvent the pitfalls of industrial proximity when researching aspects of media infrastructure for their work. Lastly I reflect on the processes, challenges and conclusions that I have made in making *The People's Cloud* throughout the stages of development of the work as a way to consider how the voices within the industry might be considered or challenged in future works. These observations and my response to them will develop through the following chapters in this thesis.



## ***4.0 The terminal heat sink: temporality, rhythmicity and memory***

### ***4.1 Introduction***

This chapter is interested in how the sonospheric investigation can activate a deep listening of the ecology of media, the temporalities and rhythms of media, but also how media itself listens, and how by listening through media, we listen both to nature and culture; as naturecultures (Haraway, 2003); medianatures (Parikka, 2012); and medianaturecultures (Braidotti, 2016).

Broken into two sections, this chapter begins with the sonospheric investigation of a significant site of media assemblage, the Pionen data centre owned by Swedish internet service provider (ISP), Bahnhof. As a sound artist working on the film *White Mountain* (2016), I was able to explore the 'deep time of media' (Zielinski, 2008), data, materiality, and agency. The collapsing of dualist notions of nature and culture is animated within the industrial data space of media infrastructures through multimodal listening. The second section of this chapter considers the temporalities and rhythms of digital media, particularly through a sonospheric investigation into one of the world's earliest digital computers, the Electronic Delay Storage Automatic Calculator (EDSAC). Built at the University of Cambridge, shortly after the Second World War, EDSAC was the first digital computer to be able to store and recall data in the machine through subroutines (software). This section will explore the sonic properties of this pioneering memory system through the personal memories of women researchers, programmers, and operators who worked on the machine during its operational period of 1949-1958, and the memories of a group of volunteer veteran male computer programmers and engineers, currently building a replica of EDSAC at The National Museum of Computing, Bletchley Park (TNMOC). The interviewees contribute to the artwork *Memory Line* (Parker, 2018b), a sonospheric investigation into the materiality of media memory, and of memories of media and culture in the early days of the British computing industry.

## **4.2 *Geology of media***

### **4.2.1 *White Mountain***

Data centres exist, as Tung-Hui Hu articulates, “at the border between the dematerialized space of data and the resolutely physical buildings they occupy” (Hu, 2015a: 81). Situated 100ft deep beneath the granite rock of Vitabergsparken, in the Södermalm area of Stockholm, is Swedish ISP Bahnhof’s colocation data centre named Pionen.<sup>11</sup> Built during the Cold War by the Swedish government as a secure bunker facility capable of withstanding a nuclear blast, the space was decommissioned at the end of the Cold War, after which it lived a brief life as an underground rave destination (Ederyd, 2014a), a wedding location (McMillan, 2012) and since 2008, the site of Pionen data centre. Pionen became the site for a sonospheric investigation of data, space and geology following an invitation from the artist filmmaker Emma Charles to collaborate with her and director of photography Emile Kelly on the production of the film *White Mountain* (2016). The following section will consider the activities in both production and post-production that formed the sound for the film, how it interconnects with Charles’ visual direction, and its narrative text performed by Linda Malmgren and written by media scholar Jussi Parikka. Prior to working on the project, I agreed with Charles that I would provide sound recording, editing, mixing and mastering work towards the film in a mutually beneficial collaboration where I, through her arrangement, would gain access to Pionen and have full freedom to experiment with sound recordings in the space.<sup>12</sup>

### **4.2.2 *Media transition***

Please watch the film 5. *White Mountain* (2016) dir. Emma Charles.

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<sup>11</sup> ‘Vita berg’ translates from Swedish to ‘white mountain’.

<sup>12</sup> *White Mountain* was commissioned by Bruno Latour for the *Reset Modernity!* (GLOBALE: Reset Modernity!, 2016) exhibition at ZKM Gallery in Karlsruhe, Germany and received additional support through Arts Council England’s Grants for the Arts programme.





Image 26 (left)

*White Mountain* (2016), production still, copyright Emma Charles



Image 27 (right)

*White Mountain* (2016), production still, copyright Emma Charles

### **4.2.3 Deep time temporal dissipation**

Pionen was already the subject of various media works prior to my visit with Emma Charles: the set for time travel themed exploration of data and science fiction in Yuri Pattison's film *Colocation, Time, Displacement* (2014); the front cover of the coffee book reader *The Art of the Data Centre* (Alger, 2012); shortlisted for the DatacenterDynamics award for *World's most beautiful data center* (Moss and Smolaks, 2017); and numerous academic, journalistic and photographic pieces (Ederyd, 2014a; 2014b; McMillan, 2012; Sutter, 2010; Jakobsson and Stiernstedt, 2012). The visual spectacle and cinematographic aesthetic of Pionen is not new territory for exploration; the visualising tactics of marketing for Pionen contribute towards a subterranean-bunker-variation on the data centre aestheticised whitescape (Taylor, 2017) presented so explicitly at the *Big Bang Data* exhibition discussed in Chapter Three. Situating oneself physically on site in Pionen is a different experience to that which comes across in still photographs and moving image work. Inside the space, you encounter a notable humidity, heat, and steady pummelling of industrial fan noise. Looking closer at the walls, one begins to realise that the space itself is a caricature of a film set; disco-grade Par Can LED lights wired and screw-mounted onto the exposed rock; the rock itself, industrially sculpted to appear like a naturally formed cave; a glass box suspended meeting room which is utterly inhospitable for meetings due to the acoustic power and temperature of the server units, bouncing off the hard granite shell, bleeding in through the reinforced

glass from below.<sup>13</sup> Pionen is a fossilised monument of late capitalism, trapped in an ever tightening perpetual hum. It is a critical Internet service node used as an alluring marketing tool for other less spectacular modern data centre facilities owned by Bahnhof where the majority of their clients are actually based. It is also a parody of techno-dystopian futures created by writers and filmmakers such as JG Ballard, Arthur C. Clarke, Ken Adams and Douglas Trumbull. In an interview with Robert McMillan for *Wired* magazine, CEO of Bahnhof, Jon Karlung, claimed that “he immediately thought of putting plants in the underground caves to capture the computers-meet-plants vibe of *Silent Running*” (McMillan, 2012). The design of the space itself was a nod to the 1972 Trumbull directed science fiction movie where all flora has become extinct on Earth.<sup>14</sup> Deep underground rather than drifting into space, the server racks and plant machinery of the present create a “retroactive sense of futurity” (Jakobsson and Stiernstedt, 2012: 112) that considers nostalgia and a connection with the past more perhaps than with anything attainable for the future. In the bunker, the shifting temporalities of futurity and past become weightless, timeless, underground, and incorporating “a phantasmic time outside the boundaries of lived time” (Hu, 2015a: 103). Such conditions make for ideal explorations into time. As a medium that operates in time, the sonospheric world of Pionen acts as a powerful metaphor for the deep time of media, opening up a realm that previous artistic projects had yet to attend to within the space.

The concept of deep time, initially expressed by the geologist James Hutton in the late eighteenth century (Baxter, 2004) describes the cycles of sedimentation and erosion of rock formations across vast time scales far beyond that of humans or indeed any species. Digging deeper into deep time, media archaeologist Wolfgang Ernst argues for a recalibration of temporality or “tempor(e)alities” in an age of digital technical media (Ernst, 2012: 31, 2014: 43, 2018: 178). Ernst argues that archaeology has always been about the folding of time and that media archaeology

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<sup>13</sup> I attended a two day symposium hosted by Stockholm University titled *Data Centers: Investigating Socio-Technological Assemblages of the Cloud* in December 2017. Day one was arranged to take place in the Pionen meeting room. It was interesting revisiting the space following the film production, to see how others at the symposium encountered it and to collectively agree that whilst novel, the meeting room was a difficult environment to work in.

<sup>14</sup> Philip Conway offers a more in-depth description of *Silent Running* as a movie embroiled in the concerns of the Earth, atmosphere and anomie in *Reset Modernity!* (Conway, 2016), a companion book to the exhibition *White Mountain* was commissioned for.

is concerned with the macrotemporalities that shape our historical relationship with media and the microtemporalities that shape the technical processes of digital media technology (Ernst, 2011: 241). The temporal for Ernst is regarded not solely as human measured and experiential time but of multiple realities or stratifications of temporality depending on how, who and what listens for it. Pionen is a site which intensifies the tempor(e)alities of the earth-layer geological deep time and the high frequency algorithmic computational deep time. The temporality of geological compression forming minerals, metals and materials that become components within media objects, could be understood within processes spanning macrotemporalities of millennia, of Earth time, not human time, as brief interludes in geological media histories. The glass-fibre-optic wires and server racks occupy similar conditions to the granite; compressed beneath the earth, containing energy generated by The Big Bang, but whose energies are expressed as photons and phonons vibrating on a micro-temporal scale. For granite mineralogy and fibre optic alike, the carbon data, the forensic material inscription of history, is embedded within its sonospheric form. Today, time can be compressed to the point where conversations across different time-zones occur in near real-time via Internet platforms, which traverse the submerged and compressed fibre optic cables of the world, through junctions such as Pionen. Today, when financial trade options are algorithmically manipulated in microseconds across the global network, there is always compression and decompression; fastness and slowness emerge from media infrastructure. These processes are vibratory. Media theorist and contributor to *White Mountain* Jussi Parikka conceptualises a media theoretical deep time where geology “refers to the affordances that enable digital media to exist as a materially complex and politically economically mediated realm of production and process” (Parikka, 2015: 44), and deep time “becomes an alternative account as concretely linked to the nonhuman earth times of decay and renewal” (2015: 44). These are also the conditions of the current ecological crisis formations of the Anthropocene. Parikka notes that data centres are “geophysically determined organizations, reliant on energy, and efficient cooling systems” (2015: 135) and identifies the geology of media as one way to understand the changing scales of deep time being as “reliant on as much as *about* the planet and its resources” (2015: 135).

It is only through media infrastructures themselves that we are able to determine how media infrastructures are decisive to the conditions of the Anthropocene. The objects of technical media, including media infrastructures, are objects of geological formations, influenced by biological intervention, but still very much integrated into the “Earth’s thermal system” of “atmosphere, hydrosphere, cryosphere, lithosphere, biosphere” which comprise what Finn Brunton calls “the terminal heat sink” (Brunton, 2015: 168). The Earth layer’s terminal heat sink acts as a thermal regulatory system, but as large scale computational sites such as data centres continue to proliferate – much like the heat sink of an overclocked CPU – the Earth’s thermal system is unable to effectively dissipate and circulate energy across the system. The sonosphere, as vibratory agential layer within the Earth’s system, is a medium through which we can hear the strains. “The earth roars and has a sound” (Parikka, 2015: 9). Sound is a temporal phenomenon. Through phonographic techniques and other technological devices such as sonification and sensors, we can resound experiences otherwise too slow within the geophysical realm, or too fast in the technical media realm, operating in frequencies and durations on the fringe of what can be detected by the human sensory apparatus alone. However, listening to the vibrations alone will not necessarily generate empathy to actant vibratory bodies within the sonospheric realm. Parikka argues that “[q]uestions of aesthetics unfold in a different way if you start to ask them from a nonhuman perspective” (2015: 61). The field recording project of *White Mountain* enabled a listening to the shifting temporalities and modes of media infrastructure from a sonospheric and geological perspective.

#### **4.2.4 Deep time transduction**

*White Mountain* explores the deep time of media infrastructural formations in the age of the Anthropocene. The film calls for us to “listen slow. Listen to millions of years” (White Mountain, 2016). This is time on the geological, macro scale. Similar to the investigations of ancient monuments of Rome in *Palimpsest*, the granite rock of Pionen can be understood as a “data carrier” (Müller, 2016: 178) possessing vibrant potential on a macro-temporal scale. Space-time compressions are possible through field recording and editing by a process of audification – to alter the frequency of vibrational recordings by an arbitrarily defined factor or *n*th

degree – in order to place geo-energies within human timescales and human experiential registers. This is a process explored by seismologists and sound artists interested in creating aesthetic experiences that help foster an embodied and cognitive proximity between human and planetary energies (Dombois and Eckel, 2011; McGee and Rogers, 2016). Other sound artists are channelling macro scale energies of infrastructural and architectural energies through audification and transduction processes including Bill Fontana (2006), Jacob Kirkegaard (2010), Jana Winderen (2010), David Haines and Joyce Hinterding (2013), Jez Riley-French (2014), amongst others. Mark Peter Wright has questioned the phonographers' tendency, particularly when deploying transduction methods, to entirely remove the human presence in a bid to reveal nonhuman and nonauditory registers. He argues that there is a "transductive context loss" (Wright, 2017: 5) which presents a set of registers beyond human faculties but also erases the context of the recordist's presence in space. Steven Connor is also critical of transduction methods, suggesting it follows a faulty Shannon and Weaver mode that processes "noise into signal, and therefore make[s] it over into our terms" (Connor, 2010: 228). For Connor the act becomes a processing outcome that diminishes the power of the inhuman as it is contracted into the human rather than investigating vibrant ontological overflows. Critiquing the *Electrical Walks* (2004) of sound artist Christina Kubisch, where participants are given specially made headphone sets with coil pickup sensors which transpose and amplify frequencies within the electromagnetic spectrum in urban environments, Seth Kim-Cohen argues that revealing previously inaudible spectral energies through transduction "decline[s] to engage the rich cultural, technical, social ontological implications of their origins" (Kim-Cohen, 2009: 115). By stating this, Kim-Cohen is suggesting that transduction and audification may introduce a listener to previously inaudible by-products of city activities but these methods do not offer new aesthetic values whereby the cultural and political embeddedness of the material is explored. If however, we consider transduction and sonospheric processes as an expansion of human sensibility, via technological extension rather than the contraction of nonhuman energies, humans are able to become aware of broader registers, of something that before wasn't known, to create new sense meanings of the world. Contrasting Kim-Cohen, artist

Andrea Polli states that within Kubisch's *Electrical Walks*, the "electrical fields that the work makes audible are not presented as 'natural', but rather as man-made, and their inaudibility cloaks them in a kind of subterfuge" (Polli, 2012: 261). Transduction in this regard is inherently both a political and aesthetic act. The disclosing of frequencies previously indiscernible to human sensibilities are nonetheless of potential impact to nonhuman species and are representational of different scales within a mixture of cultural paradigms. This cross modality of scales is also part of what made *Electrostatic Borderlands* an effective sonospheric investigation. Within the media infrastructural complex, these energies are representative of energy consumption, fitting into the wider ecological questions surrounding the mass consumption of digital technologies and their combined carbon footprint; their direct and indirect inter-relationality with the terminal heat sink.

As a company familiar with external researchers and artists visiting their space, Bahnhof left our small production crew almost entirely unsupervised in Pionen. Distinct from the data centre companies with whom I had collaborated with for *The People's Cloud*, I was free to work with vibration transducers from the sonopalette including piezo disc contact microphones, electromagnetic coil pickups and a geophone, and recorded the deep throb of the Pionen data centre from inside, and above ground; probing the instruments as deep as I could into the earth layer. These recordings were amplified and at times audified (transposed) in the studio, forming the underlying low-frequency energy, drone and pulse for *White Mountain*. In the space, it was difficult to determine what was being heard without using closed-back headphones with the headphone amplifier set very high. It made the listening and recording encounter of the space especially intense, amplifying that which was already very loud (the server racks, UPS and cooling systems) in order to explore the slower rhythms of the low frequency vibrations emanating from geological and infrastructural sources, or the minutiae details from specific elements at higher frequency registers. Rather than setting up the transducers and walking away, I attended to the recordings in a way that would "animate and agitate different forms of scale in relation to the subject explored" (Wright, 2017: 5). The data centre became a performative space, where I wandered, scanning

objects with microphones and electromagnetic coil pickup sensors, transposing, audifying, and amplifying the mechanical, geological, and radial emissions of the technical assemblage. The phonographically based sonospheric investigation of media infrastructures, and in particular Pionen, is charged with site specificity. Each media infrastructural site I have visited has its own unique set of spatio-temporal and socio-political qualities that are navigated through the encounter in the field but are also pre-determined by negotiations to access these sites, to frame them within cultural and political dimensions that are unique to each investigation. However, each site speaks to a wider planetary scale project of media infrastructures: geological and mineral formations, excavation, operation, and ultimately disintegration, heat-energy loss, and destruction.

The sonospheric investigation of *White Mountain* was only ever able to be conducted within the allocated timeframe of the production schedule, a limited budget, and the access granted by Bahnhof. In the studio, the recordings enabled me to revisit the phonographic representation of Pionen, and to explore processes of transposition, time-stretching, and other audio manipulation techniques that would pull and test the elasticity of vibrations recorded on site. In the studio I developed methods of filtering fundamental resonant frequencies of the site by searching for frequency peaks in the recordings, using my ears via loudspeakers, my eyes via spectrum analyser, my chest via subwoofer. The filtered fundamental frequencies, combined with a mix of other located recordings became the basis for the compositional arrangements which were embedded with the film material and monologue in the post-production stage.

Whilst the visual representations of many artist documentaries remain site-specific, their soundtracks are often layered solely as a post-production exercise, with lush musical scores to deliver emotional weight without really addressing the sonic environment visualised in the film. Recent examples include *Anthropocene: The Human Epoch* (2018), scored by Rose Bolton and Norah Lorway; *Points of Presence* (2017) scored by Jon Christopher Nelson; and Richard Mosse's multichannel film installation *Incoming* (2017) scored by Ben Frost. These works highlight how rare production sound is considered as a significant contribution to a

film's atmosphere and meaning. There are exceptional artist documentary filmmakers working in this way (in particular the filmmakers within the Harvard Sensory Ethnography Lab who produced *Leviathan* (2012) and *Manakamana* (2013). In my experience of working on *White Mountain*, being on site, examining it through the sonospheric investigation, created an environment that allowed me to resonate with the space, the objects, the materiality of data space as more than just a collection of sounds, but as a throbbing assemblage of material energy configurations. The space itself, pushed at my very understandings of what is natural, what is man-made, what is a cultural production or naturally formed. Beneath the manicured granite rock, in the heart of the media infrastructural assemblage, such distinctions became increasingly less clear.

### **4.3 *Medianaturecultures***

There is no such thing as nature or culture, each is a highly relativised concept whose ultimate significance must ultimately be derived from its place within a specific metaphysics. No single meaning can be given to nature or culture in Westernized thought; there is no consistent dichotomy, only a matrix of contrasts (Strathern, 1980: 177).

Marilyn Strathern's anthropological research in the late 1970's and early 1980's, demonstrated how the Hagen people of Papua New Guinea didn't make a clear conceptual distinction between 'nature' and 'culture'. Strathern's observation and conclusions have become foundational in work breaking down the ontological binary status of social construction and natural formation by suggesting that nature is not an innate concept to humans, or is at least representational within a complex array. In the words of sociologist Joanna Latimer and geographer Mara Miele, "what we identify as natural – is not just determined by culture but is also the result of specific historical, material and political conditions of possibility" (Latimer and Miele, 2013: 11). Philosopher Timothy Morton has also recently written extensively on the need to recalibrate the understanding of 'Nature' as something out-there, rugged and in need of taming, instead being part of an entangled mesh of presences and absences interlinked with culture (Morton, 2012: 104, 2009, 2013, 2018). These conditions are defined by Donna Haraway in *The Companion Species*



*Manifesto* (2003) as “emergent naturecultures” (2003: 1), which point towards the “multidirectional flows of bodies and values” (2003: 9). Layers, complexity, and emergence are key to naturecultures in what Haraway calls the ‘co-becoming’ emergent symbiosis between ‘kin’. An example of co-becoming is the symbiogenetic evolutionary origins of mitochondria and endogenous retroviruses, which are understood to each influence their counterparts evolutionary morphology (Ryan, 2016). It demonstrates that any biological question has a historical dimension and history is entangled with biological processes (van der Tuin, 2018).

By interlinking nonhuman and nonorganic matter with the bio-scientific and technological foundations of Haraway’s emergent naturecultures, Jussi Parikka introduces the concept of medianatures. The concept illustrates “the specific and situated material interactions that underpin media technological practices” (Parikka, 2018: 252) so as to demonstrate how media itself is a complex becoming of geological and geophysical forces reliant on global sense networks (see also Gabrys, 2016). For Parikka, “mediation happens across a whole spectrum of material realities irreducible to the media devices” (Parikka, 2018: 252), thus the nonhuman of medianatures resonates the geophysical, astronomical, environmental, and organic, with sensation, memory, time and media; emergent conditions of the sonosphere. The proposition follows a similar call from John Durham Peters “to think of the media as environmental, as part of the habitat” (Peters, 2015: 4). Peters considers the contemporary moment to be one where “natural facts are media, and cultural facts have elemental imprint” (Peters, 2015: 49). As I have repeated throughout this thesis, media infrastructures are built out of raw minerals and metals, and operate within conditions of energy transfer. Their manifestation as technical media is the result of millennia of natureculture symbioses. The development from naturecultures to medianatures is reflective of the growing interest in postanthropocentrism, an area concerning aesthetics, technology and the environment within “a new ecology of relations between humans, animals, and the nonorganic” (Parikka, 2015: 62). Culture is more than just human formed; it derives as a relational balance between biological, geological and climatic forces. Naturecultures position the human and natural as indiscernible and

the result of emergent and symbiotic co-becomings. Medianatures presence media (a manifestation of culture) as an emergent co-becoming with nature and displaces humans in favour of nonhumans or what Rosi Braidotti calls “medianaturecultures” (Braidotti, 2016: 383). In an era where “subjects are technologically mediated to an unprecedented degree” (Braidotti, 2013: 57), the conditions of that mediation become medianaturecultural as “ethical relations and forces” (Braidotti, 2016: 380). I have introduced the genealogy of naturecultures, medianatures and medianaturecultures in order to demonstrate the rationale for a field of research investigating the multiple, complex positions, of media, environment and culture through critical media infrastructural nodes. The sonospheric investigation is interested in the processes, possibilities and techniques of a multimodal listening to emergent energies, of medianaturecultures expressed across a wide potentiality of waveforms and vibrations. The investigation of Pionen is an example of listening to nonhuman, geological and technical media materiality where human presence was limited to the role of the recordist as a performer in the space, attempting to engage, animate and audify the entanglement of energies surrounding Pionen. The genealogy of technical media is medianaturecultural; embodied, and both human and non-human.

#### **4.4 Memory media drive**

The production of *White Mountain* was characterised by our (the film crew’s) physical presence inside the underground and contained media infrastructural environment of Pionen which was then followed by a probing at the roots, tendrils, and nodes that reached beyond the glass fibre nervous system, steel endoskeleton, and granite shell. The sonospheric investigation remained at a distance from individual media objects, instead opting to listen to conglomerates and totalities of the infrastructural space as living entity. As a listener I probed at the surface but never reached inside the server cages, to the hardware, to the microprocessors that have enabled the compression of time within the media assemblage. Listening took aim at the by-products of energetic transmission from technical media infrastructure, and their interrelations with the slower, geophysical earth layer. However inside the cages, the hardware, microprocessors, and fibre optic cables

were individually under-explored. The film gazes at the enclosures of these objects however I continued to feel that whilst I had developed a new understanding about energy transmission and the topology of media infrastructures from the project, I still wanted to know more about how the machines worked in a material sense, to go deeper into the microtemporal. As I listened to the locus of twenty-first century media infrastructure, miniaturised, standardised, homogenised, I began to wonder if it was possible to climb inside one of the small server racks and walk around it; to become miniaturised myself, and navigate the servers. Accepting that I can't miniaturise myself I instead began to work backwards through computer history, to a period when media infrastructures were not clusters of hundreds of mass produced small computer rack units filling a room, but instead a single individual computer was the size of a room in itself. If I could step inside the machine, would the harmonic structures of media materiality be exposed as having their own individual and unique modes, or rhythms? What would happen if I was to follow the call by Henri Lefebvre to "[g]o deeper, dig beneath the surface, listen attentively instead of simply looking" (Lefebvre, 2004: 31)? Would I discover for myself then how "each *being*, each *body*" (2004: 31) has its own temporality, its own rhythm? Or to ask the question in the words of Lisbeth Lipari, "[w]hat rhythms or counterhythms resound when the pulse of the human body commingles with that of the machine?" (Lipari, 2014: 32). The following section considers the rhythms of media as forming multiple realities that exist through the multiple tempor(e)alities of technical media, but also how shifting rhythms form the basis of medianaturecultural memory. The artwork *Memory Line* (Parker, 2018b), which will be discussed shortly, demonstrates how media memory and memory of media can both be read and listened to sonospherically.

#### **4.4.1 Rhythmanalysis**

Henri Lefebvre's concept of rhythmanalysis considers how when breaking down any cultural process, a new set of functions emerge operating both independently and associatively at multiple scales. For example, the fruit, seeds, leaves and flowers of trees, operate within their own temporal rhythms, but combined comprise the polyrhythmicity of what a tree is (Lefebvre, 2004: 31). The multiple temporal rhythms operate within independent realities each existing at any one

time. A perceptual experience of reality is only a subjective reality according to one's tempor(e)ality (Ernst, 2012, 2018). To become a 'rhythmanalyst' of meaning in culture, one must be concerned with not just words, but how the words setup the conditions of computational logic driven by the rhythms of their temporality and "their relations within wholes" (Lefebvre, 2004: 24). Tempor(e)alities are distinguishable according to their rhythmicity in time. To understand the conditions of medianaturecultures, we may begin by listening to the rhythmicity of media. Within the digital realm, time is predicated on clock pulses created by the electrical charge of quartz crystals in the CPU (Collin, 2010). The digital clock is a medianaturecultural "quasi-object" (Serres, 2007: 225) which makes the experiential moments of chronological time measureable through the – albeit unstable – standardised rhythmic pulse of technical media.

#### ***4.4.2 Algorhythmics***

Rhythmanalysis for Lefebvre was a tool for thinking about urbanism in a time of analogue audiovisual media. In a time of software, digital communications and algorithmic supremacy, Shintaro Miyazaki's algorhythmics project is a form of rhythmanalysis inquiring into "time-based, technological processes, which occur when matter is modulated by symbolic and logical structures, such as instructions written in code" (Miyazaki, 2016). Computational speed in modern computing is so fast it is practically imperceptible to humans. Miyazaki transduces these scales through a computational programme that sonifies the micro-temporal events of computer processes. The project slows down the process to become something experiential, to enable relationality between observer and the mechanical process of computation; from computer time to human time. Miyazaki gives examples of standard operating system processes to demonstrate the different temporal adjustments technology undergoes in performing basic tasks, emphasising how computation happens in time. The time-critical functionality of computational media is exploded; to be understood as a tactile material event, and demonstrates how memory and instruction within computation may appear to occur in an instant, but always operate in time. Time-critical functionality of computational media is predicated on the clock pulse and then additionally on the rhythms of technical media in operation. Sound scholar Aden Evens considers how digital technologies

are built upon time-based abstractions of binary code which measure the condition of voltage or magnetic field strengths to determine a 0 or a 1 in binary value. The analogue values are not precise, and move in time only to be approximated as determinate binary values through a voltage compiler circuit. Our increasingly digitised navigation of the world challenges the criticism of transduction made by Seth Kim-Cohen. All digital data is “utterly useless by itself” but is made useful by “additional technologies that mediate [transduce] between digital and actual” (Evens, 2005: 78). For Kim-Cohen, the transduction from electromagnetic to sonic waveforms causes a loss in translation but in any digital process abstract code “must be turned into electrical current, which flows through logic gates on silicon chips, ultimately imposing magnetic charges on the surface of a hard disk” (Evens, 2005: 78). Digital data is a collection of snapshots of voltage variables in time which are squared to create bits.

Interaction with digital objects has become common practice for many humans navigating, experiencing, understanding and remembering the world they inhabit. Such interactions are predicated on techniques of mediation and of transduction in time. During the Second World War, Colossus, the first digital computer, was built in the UK to aid in the cryptanalysis and deciphering of coded messages transmitted by the German High Command. At its optimal speed it was able to read 25,000 characters (200,000 bits) per second (Copeland, 2006: 100). The Hard Disk Drive (HDD), an ubiquitous archival unit used in data centres and home PCs, operates at standardised speeds that reach up to 15,728,640 characters (120,000,000 bits) per second. In the brief seventy years since the first digital computers were switched on, the speeds in which data is retrieved and inscribed on digital devices has increased to a point of imperceptibility by humans, but is still based on the same principles of sampling, squaring and sequencing analogue (voltage) processes. The capitalist techno-drive towards better, faster, more efficient digital memory technologies has moved at a rapid rate. Projects such as Miyazaki’s *algorhythmics* present how fast paced computational processes continue to develop.

Following on from the work of media and cultural scholars interested in the data techniques of modernity (Derrida, 1998, 2005; Gitelman, 2000; Kittler, 1999),

researchers have sought to trace the techniques of memory and media inscription through pre-digital forms (mark making, paper, the printing press), demonstrating their cultural specificity and genealogy (Chun and Keenan, 2006; Kittler, 2009; Sterne, 2003). Time-based inscription and transmission of digital data and memory storage has been demonstrated to operate as rhythmic in multiple temporalities (Ernst, 2012; Miyazaki, 2012, s.d.). Experimental sonic performance research aimed at extracting data inscribed in the electrochemistry of the ground and exploring the Earth's potential to act as a BIOS boot-loader for computational, demonstrates the potential emergent data inscription of planetary media environments (Howse, 2015). Media functions through the rhythms of matter, time, and culture and the forensic materiality of digital inscription devices demonstrates there is more to the media object than the data inscribed but also a history of techniques, methods, culture, manufacturing and labour practices (Kirschenbaum, 2008).

Understanding media infrastructures as both networked depositories and distributors of cultural memory and knowledge is possible through the material analyses of rhythm, frequency and energy. Jonathan Sterne notes that understanding what a hard drive is and does, is only achievable "if we consider those technologies as social artifacts that in turn lead us beyond themselves into other fields of practice" (Sterne, 2003: 338). Technologies all sit within a framework of larger complex systems and to understand the technology, we need to know how that is aligned with the wider context of the technology within culture at a particular moment in history. Shortly after the Second World War, the mathematician Maurice Wilkes read a copy of American-Hungarian mathematician John von Neumann's *First Draft of a Report on the EDVAC* (1945). He soon began work on a project to build the world's first usable stored-program computer which in 1949 was launched and called the Electronic Delay Storage Automatic Calculator (EDSAC). To understand digital storage and memory through their material and cultural formation, I will discuss the particular sonospheric investigation of memory as media and media as memory that formed the artwork *Memory Line*. This work considers the ground-breaking technology of memory storage deployed on EDSAC as a sonospheric placeholder for the socio-cultural environment of the then nascent computer industry.

### 4.4.3 *Memory Line*

On 6 May 1949 a team of engineers led by Sir Maurice Wilkes at the University of Cambridge Mathematical Laboratory ran the first programme on a new digital computer called EDSAC. As is the case with most aspects of the history of digital computing, EDSAC was born out of repurposed military applications. The delay line technology which was at the core of its revolutionary memory storage system was developed by Tommy Gold during the Second World War to reduce radar clutter (such as the spurious noise spokes experienced on the *USS Maddox* in Chapter One). EDSAC used tubes filled with mercury to create a circuit feedback loop, sending ultrasonic pulses triggered by a quartz crystal that acted as a piezoelectric ultrasonic transmitter “modulated on a 13.5 MHz radio frequency carrier” (Linington, 2017: 3) which pulsed through the mercury. The electronic circuitry ‘squared’ off the sonic pulses to generate binary data in rhythm to a regulated master crystal clock pulse. This was the first form of retrievable, programmable memory on a computer; the computer’s memory was literally soundwaves. The formal history of EDSAC has been extensively documented by computer historian Martin Campbell-Kelly (Campbell-Kelly, 1990, 1998, 2013; Campbell-Kelly *et al.*, 2014) as well as by a group of retired computer engineers currently working on building a fully functioning reconstruction of EDSAC at The National Museum of Computing (TNMOC) at Bletchley Park in the UK (EDSAC, s.d.). The project has seen spare rooms, garden sheds, attics and kitchen tables converted into project and prototype laboratories across the UK as the team build a machine which is the size of a whole room, in their respective homes. *Memory Line* is a multimedia artwork reflecting on the techniques used for memory storage during those early days of digital computing, and listens to individual testimonies of those who remember their experiences of the first programmable memory machine.

In his autobiography, Sir Maurice Wilkes noted that it was only the memory that would require any “significant technological innovation” (Wilkes, 1985: 127) but due to the unreliability of the mercury, it was quickly superseded as a memory technology by nickel wire. The EDSAC replica project volunteers are not able to work with the original mercury acoustic delay line memory storage system and instead have opted to use a similar nickel wire acoustic delay line. Nickel delay lines

are principled on generating a magnetostrictive effect where if a “magnetic field is applied to them, their shape changes” (Linington, 2017: 4). Inversely, by straining the material, it can induce a change in magnetic field. The nickel wires vibrate precisely to cause shape changes in the wire that are registered as voltage markers measured against the master clock and thus readable by the machine. Wires have been used extensively as vibration monitoring devices or “vibrating wire strain gauges” (Bordes and Debreuille, 1985: 26). They have also been used as Aeolian instruments responding to changing environmental conditions in land art and sound art projects (Burraston, 2012; Lamb, 1991; Riley French, 2016), complex acoustic instruments performed in concerts and on record (Fullman, 1993), and as digitally networked interactive sonic trigger devices (Tanaka and Toeplitz, 2001). The work *Music on a Long Thin Wire* (1977) by Alvin Lucier uses taut wire passed through poles of a magnet and driven by an oscillator producing a set of complex vibrating and changing harmonics and chords amplified by piezoelectric transducers and loudspeakers. The interaction between magnetic field and electric current create an electromagnetic field in which the wire begins to vibrate. *Memory Line* operates as a memory machine, loading the memories of ten interviewed computing veterans via four nickel wires spooled across a prototype project rack. Five Raspberry Pi microcomputers containing multimedia data files, feed data via analogue 3.5mm jack output, as electrical current, through a signal amplifier, into the wire assembly; using a similar electromagnetic principle to Alvin Lucier. The signal is however fed back into the installation system which contains a display of eight analogue screens and five loudspeakers configured in a 19” rack unit. This aspect of the work aims to bring together the processes of early delay line memory techniques with the audification, activation and vibratory sensing techniques of long-wire instruments.

Shintaro Miyazaki calls for “critical immersion into the wire and wiring” (Miyazaki, 2017) of technical media by researchers in order to better understand the material mechanisms underlying the growth of what Nick Srnicek describes as ‘platform capitalism’ (Srnicek, 2016). Rhythm for Miyazaki “is the timing of matter, bodies and signals” (Miyazaki, 2017) that make up algorithmic computation. Historically, as previously mentioned in Chapter Three, computer engineers listened to the sounds of computers as a diagnostic tool; or as Finn Brunton hears it, a



“rattling click track for the operation of an algorithm” (Brunton, 2015: 160). Brunton describes the delay line memory technology of EDSAC as the “equivalent of repeating a phone number over and over to yourself as you hunt for a pen with which to write it down” (2015: 160). Over the years these noises have moved from the discrete sounds of waves through mercury tubes, to the vibrations in wires, to the roar of air-conditioners (as heard in *White Mountain*). The objects of hard drives and mercury delay lines remind us of how memory is a “remediated material event” (Parikka, 2015: 122) that is looped and held on repeat until called back. The repeated cycles of memory making through the material objects of early computing are potentially instructive of the material foundations of platform capitalism; vibratory, energetic and imprecise only to become averaged out and standardised as binary units.

The materials of technical media also require presencing within their specific socio-cultural conditions. *Memory Line* engages with the memory storage system it deployed as well as the people, who built, worked, and reconstructed the EDSAC machine, and the culture they worked within as early computing pioneers. Cathy Lane has claimed that sound artists often “avoid working with the voice” (Lane, 2017), leaving this work to ethnographers and oral historians. She asks sound artists to “hear beneath the surfaces of the visible” and to ask “whose voice am I *not* listening to?” (Lane, 2017), echoing the question asked by Lisbeth Lipari, raised in Chapter One of this thesis. *Memory Line* responds to this call by contextualising the voices of ten retired computer engineers, and in particular, three of the women who worked on the original EDSAC machine. The work offers a counter-narrative to a computing history dominated by the men who have been celebrated as fundamental in the industry (such as Eckert, Mauchly, Turing, von Neumann, Wheeler and Wilkes).<sup>15</sup> I encouraged the interviewees to reflect on their earliest memories and their memories of working both with and as women in the early years of the industry.

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<sup>15</sup> Wheeler and Wilkes are both mentioned alongside computer engineer Eric Mutch as they worked alongside the women interviewed for *Memory Line*. Joyce Wheeler married David Wheeler and Margaret Marrs married Eric Mutch having each met working on EDSAC.

There is a growing acknowledgement of the important role of women in computing history beginning with Ada Lovelace (Plant, 1998). Foundational research by Jennifer Light and subsequently David Alan Grier gives particular presence to human ‘computers’, the term used to describe a pool of (typically) women, tasked with providing complex mathematical calculations for astronomy, ballistics, and eventually computer programming in the development of the ENIAC and UNIVAC computers (Grier, 2007; Light, 1999). The issue has been brought to particular public attention through the book (and subsequent movie) *Hidden Figures* (2016) by Margot Lee-Settler which traces the stories of three African American women (Katherine Johnson, Dorothy Vaughn and Mary Jackson) employed as computers within NASA who along with their colleagues played a crucial role in providing calculations during the Space Race. This field of research has also extended into what Marie Hicks describes as the ‘programmed inequality’ of women in computing in the UK (Hicks, 2017). The stories of women working in computing recorded for *Memory Line*, and the stories recorded in the histories of computing included above evidence an environment determined by structural inequalities. *Memory Line* recognises how womens’ participation in computing broke down in the middle of the 1980s with the introduction of home-computers, PC’s, the gaming industry and the growth of economic importance in software, according to interviewee Eileen Bennee. German mathematician Britta Schinzel’s research into women in computing supports this claim further. She recognises the significant roles played in devising the early programming languages in the 1950’s by Grace Hopper (COBOL), Jean Sammett (FORTRAN), and later Adele Goldberg (Smalltalk) (Schinzel, 2017: 87–88). Schinzel also demonstrates by an analysis of recruitment into computing subjects across Anglo-American and Germanic, Slavic and former Soviet Union, and Latin and Middle Eastern regions that the problem in recruitment of women into computing is a typically Anglo-American and German concern. In other regions, recruitment of women into computing has been relatively strong. This brings into question the ideology of media infrastructure technologies with respect to the dominating nations within the industry. Schinzel concludes:

[a]s software like every technology is value loaded, it is relevant, who is shaping it, because later on the values baked into software is [*sic*] shaping us, the whole society. As software and the Internet is heavily dominated by the US and an English speaking culture, there is a heavy danger of implementing this gendered culture of computing onto the whole world (Schinzel, 2017: 97).

The testimonials forming *Memory Line* are the basis of understanding not just what it is for women to work in computing, but what opportunities young men had/have in contrast to young women based on their gender, and the challenges women face to break into tech industries within English speaking culture. The patriarchal hierarchy of the computing industry continues in the present day, as was made apparent during the production of *The People's Cloud*.

An interview may only ever be seen as a representation of an experienced reality, rather than authentic or real. Sharing the space and engaging in place that the interviewee occupies in their day to day does produce a situation where one may, according to ethnographer Sarah Pink:

interact in ways often more intense than in every day life, producing heightened reflections and new ways of knowing. Interviews are not only places where researchers learn about other people's experiences, but where interviewees might arrive at new levels of awareness about their own lives and experiences (Pink, 2015: 80).

I travelled across the country with my colleague Bella Riza to interview women and men who worked in the early days of computing. Bella's role as cinematographer was vital in the media production but also gave our two person team a gender balance, and sensitivity which was crucial during long afternoons of drinking tea and chatting with our interviewees, some of whom were vulnerable, elderly women living on their own. Each interviewee is connected to EDSAC but we met within the intimacy of their homes, their workspaces and living rooms. Listening to their histories, I began to realise how my own imagination of computer pasts and presents are formed within a typical English and American culture. My research has

taken place at the construction point between experience and memory (which becomes the gap/void/hinterland of imagination). The collective memory or imagination of computer time, cultural time, and deep time, is only ever present in the material realities and discourses that produce outcomes of action amongst a community, be that human, nonhuman or a multimodal combination of both, and their subsequent position within culture.

#### **4.4.4 Media transition**

*Memory Line* was exhibited at the Milton Keynes Central Library, Milton Keynes, UK in July 2018. Milton Keynes is the nearest city to Bletchley Park where TNMOC is based and it was agreed with the museum, MK Gallery, and MK Library teams to exhibit the work in the Central Library; the public archive of history and knowledge in the city centre. In October 2018, the work was exhibited at the Computer Laboratory, University of Cambridge, the spiritual home of EDSAC.

Please watch the digital video files *6. Memory Line (2018)*. The video documentation file *6a. Memory Line [installation edition] (2018)*, *installation documentation* is a short introduction to the work as installed in Milton Keynes. In addition the documentation file *6b. Memory Line [four channel edition] (2018)*, *single channel reduction film* is a full colour four channel screen version of the work which will be shown at TNMOC in 2019 as part of the official launch of the EDSAC replica, and to commemorate 70 years since the launch of EDSAC in 1949. This documentation contains the full video sequence of 27 minutes 02 seconds (reduced to single screen). Structurally the work is divided into three narrative chapters based on the memories of women in computing, the lives and relationships between men and women in computing, and the earliest memories of veteran computing engineers and what makes them tick. Each section is broken up with bootload sequences based on ultrasonic data files which have been audified. The files were generously provided by Peter Linington who is responsible for development of the EDSAC replica nickel delay lines.<sup>16</sup>

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<sup>16</sup> Bootloading is the process of a computer loading a software programme to run.

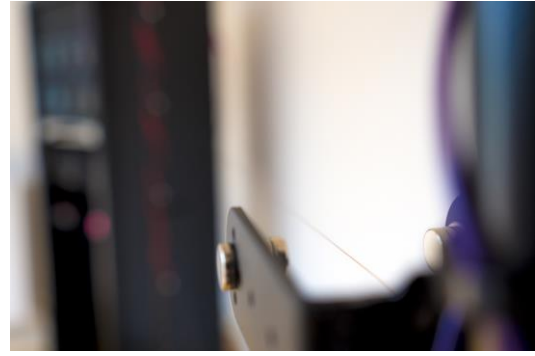


Image 28 (left)

*Memory Line* (2018), Milton Keynes Central Library, perspective, copyright the author

Image 29 (right)

*Memory Line* (2018), nickel wire, copyright the author

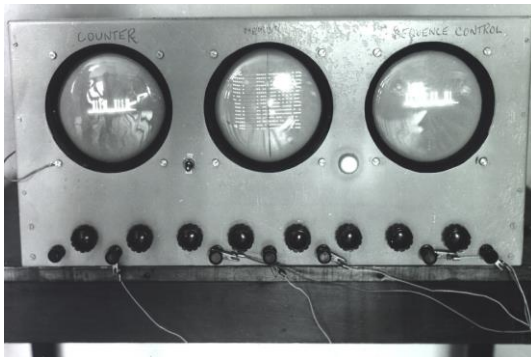


Image 30 (left)

Original EDSAC Display unit with binary counter, source and date unknown, courtesy of EDSAC Charitable Trust

Image 31 (right)

*Memory Line* (2018), screen data matrix, copyright the author

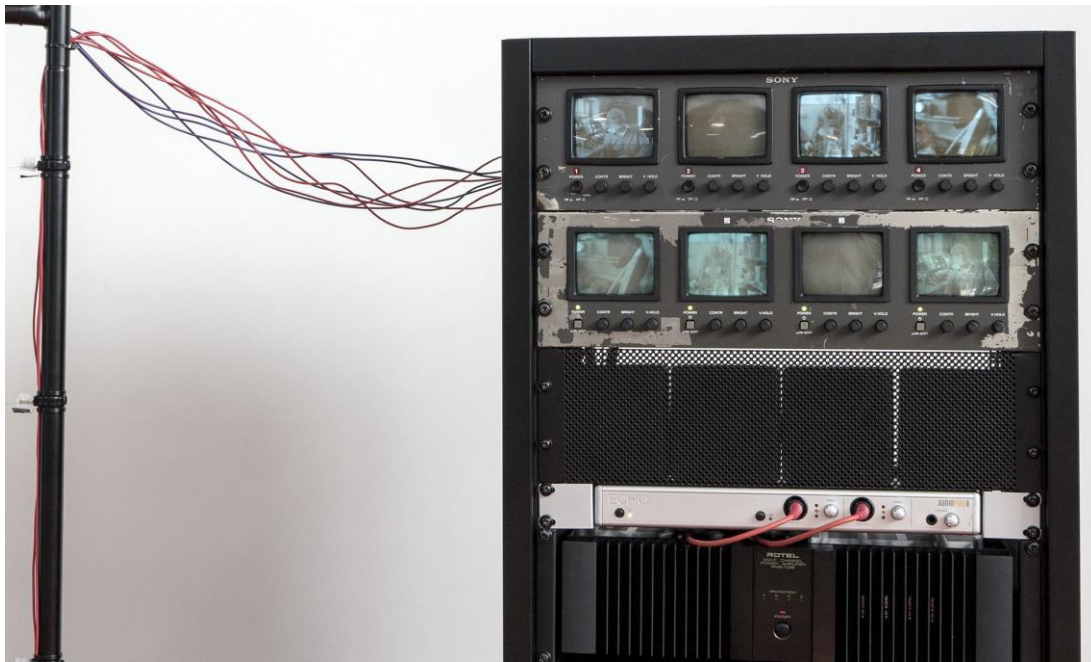


Image 32

*Memory Line* (2018), installation view at Milton Keynes Central Library, copyright the author

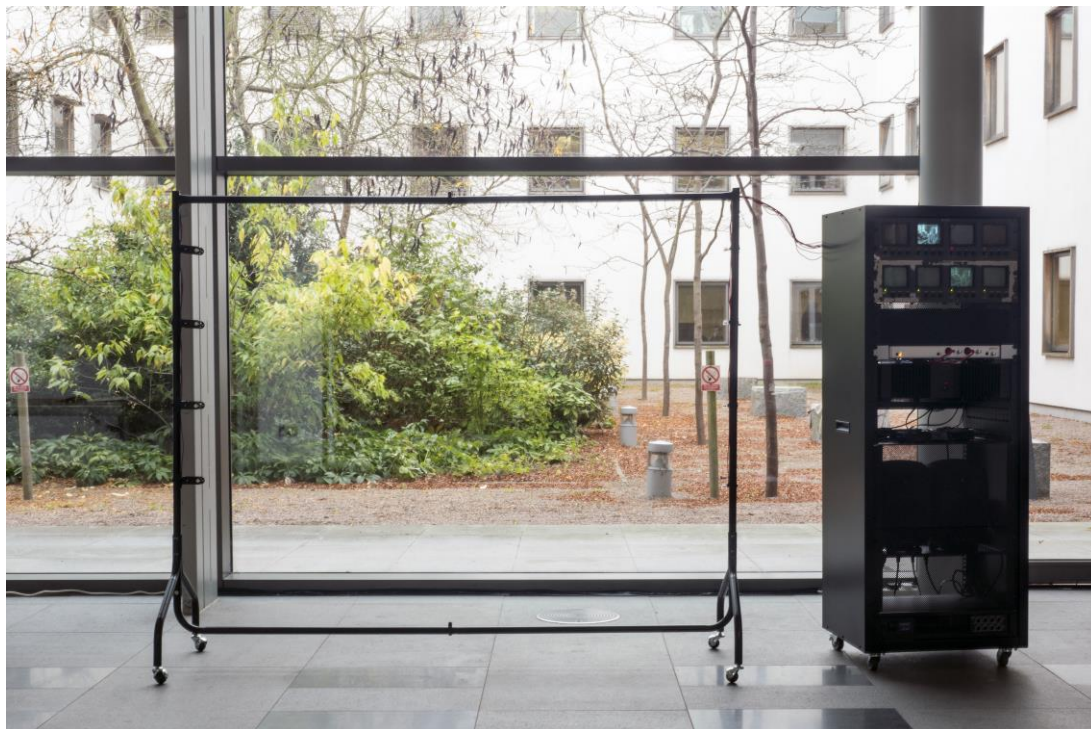


Image 33

*Memory Line* (2018), installation view at the Computer Laboratory, University of Cambridge, copyright the author

#### **4.5 Conclusion: triple stacks (mind, body, off site storage)**

This chapter has combined two major projects which at first listen may seem to be resonating at quite different frequencies. *White Mountain* is a collaborative film project investigating the role of science-fiction and geology in the cultural imagination of data centres and gives voice to the subterranean and geological deep time vibrations of media infrastructures. *Memory Line* is an investigation into the sonic materiality of memory inscription, and the cultural formations of the early British computing industry. It explores the multiple histories of the EDSAC machine as a vector through which we can understand human and digital memory as sonospheric vibrations and feedback loops subject to slippage, forgetting and erasure. The two works occupy the same chapter as both offer modes of encounter towards what Rosi Braidotti has termed ‘medianatureculture’, where the biopolitical effect of technologies upon the embodied subject have resulted in technology becoming part of the “enfleshed and extended, relational self” (Braidotti, 2013: 90). Media technologies, even prior to the wonders of digital media memory storage, have been considered by Andy Clark and David Chalmers as objects of the ‘extended mind’ (Clark and Chalmers, 1998). We use inscription of media, be it a notebook with pencil or a smartphone with cloud integrated calendar reminder to extend our capacity to remember. Understanding media as an extensor for remembering, or inscribing histories, counter histories and geological histories of deep time, requires an appreciation for the symbiotic co-becomings of human and nonhuman technologies, sensors and temporal mapping techniques that digital media affords.

The Anthropocene is marked by the environmental conditions tied directly to the technological condition we exist within. We use and consider technology itself if we are to successfully discuss the status, and co-becoming of technology and biology in the world. Artistic interrogation of the technological apparatus of the Anthropocene allows for a bridging between the concepts of the humanities and the chemical, metallic, and material discourses of the global digital economy. Jussi Parikka claims that the Anthropocene is “a way to demonstrate that geology does not refer exclusively to the ground under our feet. It is constitutive of social and technological relations and environmental and ecological realities” (Parikka, 2015:

46). Those realities are explored through listening to the voices of the nonhuman agents operating within culture that compose media infrastructural devices in both the present, past and past-present realities of Pionen and EDSAC. Who or what voices are being neglected in our histories and memories of media? This thesis argues that human users must recognise the nonhuman within media. *Memory Line* explores the possibility that sonic events can be operationalised as memory, and by exploring this we find that technology not only shapes how we as individuals remember but how culture remembers, specifically with regard to the workplace, labour and gender within the early British computing industry. *White Mountain* expanded the sonopalette to include not just the expanded listening transducers and microphone technologies previously tested within the sonopalette for *Electrostatic Borderlands* but also the embodied and performative act within the field as a method for experimenting and resonating with various entanglements of media assemblage. Meanwhile, the process of interview and oral history documentation which had been established within the sonopalette and explored in *The People's Cloud* was – outside of any conflicts of industrial proximity – experimented with as a way to develop an intimate investigation of memories and media for *Memory Line*. The sonospheric investigations in this chapter listen to deep time, machine time and cultural time; and adjust the rhythm of the clock by thinking through media materiality as ecological, political, cultural and more-than-human.



## **5.0 *Living on the edge of media infrastructure***

### **5.1 *Introduction***

After developing relationships and building trust with professionals working within the media infrastructure and ICT industry to produce *The People's Cloud* and *White Mountain*, I had begun to question whether it was possible to avoid, or at the very least limit the compromises of industrial proximity within site-based sonospheric investigations of media infrastructures without resorting to acts of trespass as per the urban explorer. My initial intentions for *The People's Cloud* project were to not only engage with the spaces of media infrastructures and the staff who maintain them, but with external stakeholders, the family members of those who worked in the industry, and consumers who knowingly or unknowingly connect and engage with such technological sites. Having only been able to have a few hours of time allocated with each interviewee and in each media infrastructural site, I found it challenging to develop a more in depth appreciation for the subjects I encountered. I also found it difficult to switch registers and speak with people on the fringes of industry, those not directly employed but nonetheless linked in intimate ways, through geography, kinship or other as of yet unknown means. I began to turn my attention towards environmental listening outside of the data centres; listening to and recording the proximal hums of the space; making associative connections to the city and surrounding areas of media infrastructure. These experiences encouraged me to think more about the effect of data centres upon both human and nonhuman occupants of these proximal zones. In this chapter I will consider various layers and modes of impact created by one of the world's richest companies when they applied for planning permission to build one of the world's largest data centre complexes near the small town of Athenry, in County Galway, Ireland. The chapter is broken into three sections: firstly, I will consider examples of how the four pillars of the economy of noise set out by Frances Dyson (as environmental, economical, ecological and psychic) are situated in the attempts by communities and activist groups to object, appeal and resist the emergence of data centre complexes across North America and Western Europe. Secondly, I will discuss the production of the artwork *Fields of Athenry* (Parker,

2016a) a multimedia installation investigating how the medium of YouTube is a way of connecting what Athenry is, to what it might have become, as the small rural town prepared for the arrival of one of the world's largest data centre complexes. Thirdly, I will discuss the production of the two-part artwork series *Project Antioch: Geophony* (Parker, 2017c) and *Project Antioch: Machine Learning* (Parker, 2017d). These works approach the sonospheric investigation through a sensory awareness to voice, agency, presence and vibrations from human, nonhuman, nonorganic and machinic perspectives. As a collection of works, they explore the modulating multimodal sites of Athenry and the changing attitudes and presence of voices and sentiments across a near two year period.

## 5.2 *Clicking clean*

During an interview for episode two of *The People's Cloud* (Working out the Internet: It's a Volume Game, 2017), Michael Winterson explained how when Greenpeace published *Make IT Green: Cloud Computing and its Contribution to Climate Change* (Cook, 2011) – the organisation's first research report on the environmental impact of media infrastructures – the industry widely ignored it. The report revealed how Facebook had commissioned a data centre project in Oregon which, "committed to a power service provider agreement with PacificCorp, a utility that gets the majority of its energy from coal-fired power stations" (2011: 3). The report also referred heavily to a study claiming to be the first to identify ICT industries as a significant contribution to the global carbon economy titled *SMART 2020: Enabling the Low-carbon Economy in the Information Age* (Webb, 2008). *SMART 2020* was supported by many international telecoms and ICT companies and, with an optimistic tone, presented ICT growth amidst climate change as "an opportunity that cannot be overlooked" (2008: 9). This 'opportunity' becomes apparent in a series of forecasts projecting carbon emissions from ICT / media Infrastructures to treble by 2020 (2008: 10). Greenpeace reinterpreted the forecasting within *Smart 2020* to challenge the commercial opportunity it presented. Whilst only referring to a few major data centre providers in the US (Google, Apple, Microsoft, Yahoo), Greenpeace demonstrated how 50.5% of Apple's electricity source for its data centre operation in Maiden, North Carolina

was from coal-fired power plants, 38.7% nuclear and a mere 3.8% from renewables (Cook, 2011: 9). Greenpeace continues to publish updated reports and expanded its source index to include many more data centre providers, reaching into the global sector (Cook *et al.*, 2017, 2014; Cook and Pomerantz, 2015; Pomerantz *et al.*, 2015).<sup>17</sup> Winterson explained that the initial Greenpeace campaign had little influence on anyone in the industry other than Apple. By 2013 Apple claimed that all of its data centres were fully powered by renewable energy (Sverdlik, 2013) and by 2017, Greenpeace celebrated Apple for “its leadership spot for the third year in a row among platform operators” (Cook *et al.*, 2017: 7). The green ambitions of major data centre providers including Apple have mainly been achieved through large scale, wholesale energy schemes called Power Purchase Agreements (PPA) (Apple International, 2016: 9). No energy consumer on the grid can guarantee sourcing energy from one location, but wealthy companies can make long standing agreements with an energy provider for a specific megawatt value that is argued to guarantee renewable sourced energy provision in a system referred to as Guarantee of Origin (GoO) in the EU and Renewable Energy Certificates (RECs) in the US/Canada. Google state this is a “convoluted system, but long-term PPA contracts do offer Google the certainty of knowing how much we’ll be paying for future energy, while providing renewable energy developers the stability to finance and build new projects” (Google, s.d.). However, it is also noted that the “plain truth is that the electric grid, with its mix of renewable and fossil generation, is an extremely useful and important tool for a data center operator” (Google, 2013: 2). The world’s biggest Internet companies cannot truly guarantee direct access to renewable energy but are required to offset it through PPA, GoO and RECs, and smaller industry providers have even fewer options for divestment and renewable purchasing (see Dale *et al.*, 2012). Media infrastructures – particularly data centre facilities – are a significant environmental concern and demand a higher level of scrutiny than Greenpeace alone can provide. By listening to these sites we can hear the environmental economy of noise through the material of fans, air conditioning and cooling which make up the primary energy wastage of the data centre. We can

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<sup>17</sup> The Global South and China have proven challenging for Greenpeace to obtain clear data for on this issue although their reports are improving as China becomes an increasingly significant market for the sector.

also listen to the commercial and political arrangements negotiated through PPAs as enabling the masking of an alarming reality that there is no guarantee of powering such facilities with truly environmentally sound renewable sources.<sup>18</sup> Reliable energy comes from a dirty mix. This is a source of environmental noise which becomes particularly concerning when considering the growing energy demand by industry players within the blockchain and cryptocurrency market.

### ***5.2.1 Attack the block(chain)***

Blockchain has been described as “a protocol that can be used to distribute and enact smart contracts (and smart contracts are pieces of software that can manipulate and move around information, and now digital assets)” (Catlow, 2017: 25). Blockchain technology underpins the distribution of cryptocurrencies that include Bitcoin, a virtual currency protocol first described in 2008 in a white paper authored under the pseudonym of Satoshi Nakamoto. Blockchain technology became a mainstream conversation topic at the close of 2017 after Bitcoin prices surged by 2,000% between 2016/2017 (Raza, 2018) in what has become a volatile and speculative market place driven by an increasing number of massive data centre facilities ‘mining’ coins to generate new currency values in the cryptocurrency marketplace (Bloomberg, 2017). Popular media outlets have increased the awareness of blockchain due to these phenomenal currency yields but also due to the environmental impact of ‘mining’ data centres where users are “tapping into the power grid, turning electrons into dollars” in Venezuela (Chun, 2017). Tax-break incentives in Montana, a US State with abundant energy resources following the collapse of a heavy mining industry, has been described as forming a “second gold rush” (Warzel, 2018). It is no coincidence that the language of ‘mining’ for precious metals has been co-opted into the language of the blockchain as prospectors use computational systems to dig harder and faster than their competitors in an attempt to virtualise a new “gold standard” of currency (Golumbia, 2016: 32). These speculative projects do not have the future forecasting of major data centre providers. In search for short term economic gain, any space big enough to facilitate a factory that can provide cheap energy, regardless of its

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<sup>18</sup> Iceland is one of only a few exceptional nations which operate a 100% renewable energy grid.

'brown' non-renewable source, will suffice. As a particular product of the blockchain, Bitcoin is claimed to be "unsustainable" (Malmo, 2015). Commercial mining operations according to Bitcoin 'prospector' Laren Mieke require "30 megawatts, or enough to power a neighbourhood of 13,000 homes" (Mieke in Roberts, 2018).

The growth in media infrastructure through data centres, cryptocurrency mines and other associated facilities has been enormous over the past ten years (2008 – 2018). The biggest companies with the biggest assets are the companies who were initially the biggest villains in terms of environmental impact but now present themselves as the biggest reformers through PPA, GoO and RECs. Smaller companies may share green energy aspirations but at present the carbon appetite of the blockchain is significant, and cryptocurrency mining operations are typically short-term quick-gain projects with substantial environmental risk. The sonospheric energies of these sites are identifiable through the remnants of waste heat, and waste energy; the cryptocurrency mining infrastructure market's contribution towards climate change. The recording 'KEF201C' from *The People's Cloud (Original Soundtrack)* (2017) was taken during a walkthrough of an undisclosed Icelandic location which at the time of recording was considered to be one of the largest blockchain facilities in Europe. The intensity of energy and air pressure in this space was comparable to, but more intense than, my experience in Pionen. Listening to its environmental outpouring, the force and pressure of thousands of fans acted as a powerful representation of the environmental noise of media infrastructure. Whilst the KEF201C site is uniquely connected to the 100% renewable Icelandic energy grid, most blockchain facilities worldwide cannot make such a claim. Consequently, through their energy demands, these virtual mining operations produce toxins and pollution comparable to the mineral mining operations they aim to supersede.

### ***5.2.2 Rejecting dirty data***

Frances Dyson's economies of noise can be heard through the process of data centre site selection; the environmental noise of their energy demands and the financial noise created by commercial and political arrangements of PPA, GoO and RECs. Media infrastructural economies of noise also further impact local ecologies,

and the psychic well-being of individuals who live in their proximity. Facebook, Google/Alphabet and Apple each have hyperscale data centre sites in North Carolina (NC) referred to by Greenpeace in 2011 as the “dirty data triangle” (Cook and Van Hom, 2011: 19).<sup>19</sup> Each project benefitted from low cost power in the region and significant state approved tax incentives generated in a drive to replace the significant loss of income from the collapse of the region’s core manufacturing industries of textiles and furniture.<sup>20</sup> Apple’s Maiden, NC data centre is one of the first hyperscale sites to be scrutinised post-construction.<sup>21</sup> The primary driver was not due to the carbon emissions of the site, or concerns of noise pollution, but rather due to the guarantee of just 50 permanent jobs to be made available (not including a forecasted 3,000 indirect short-term jobs in construction). The 50 full-time jobs, which were for highly trained experts, did little to help replace the large manufacturing and textile industry that had previously occupied the area, even though the data centre was still on an industrial scale both in output and cost. *The Washington Post* published an article shortly after Apple opened the facility which explained how “[b]lue-collar workers laid off during the downturn find far fewer job openings in the high-tech sector and usually lack the necessary skills” (Rosenwald, 2011). This is an example of Dyson’s ‘economic noise’ emanating from data centre projects in socio-political terms. Data centre site selection is predicated on access to cheap power, often made available in locations with underused energy infrastructures in place following an industrial decline. It also relies on local councils willing to accept business opportunities that offer a short term boost to the local economy through construction, or that create associations with their region to a global brand such as Apple. These conditions are paralleled by a lack of long-term direct investment into the region through permanent employment prospects due to the low number of permanent staff required to actually operate a data centre.

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<sup>19</sup> Hyperscale data centres are very large sites with highly customisable physical and virtual architecture that make them easily scalable for increased growth over time.

<sup>20</sup> The official minutes of a meeting introducing ‘Project Dolphin’, the codename for the Apple data centre project between Apple, The Catawba County Board of Commissioners and Maiden Town Council in NC, formally declared incentives which includes a \$1.0 Billion pledge for investment to build the site by Apple in exchange for 258 acres of land, a \$46 million tax break, a 50% reduction in real property tax, and 85% reduction in personal property tax over 10 years (The Catawba County Board of Commissioners, 2009: 384).

<sup>21</sup> In 2002, residents of the TriBeCa area of New York objected to plans for increased diesel fuel storage at 60 Hudson Street, a major landmark and infrastructural connection point for US Internet network traffic (Medina, 2005).

Once constructed, data centres can make their presence felt through material vibrations that rupture local communities. At Facebook's corner of the dirty triangle, in Forest City, Rutherford County NC, formal complaints were made by a group of local residents citing a noise disturbance that affected their daily home life. The complainants made the Western North Carolina local news in 2013 (Facebook Noise Complaints, 2013) where local resident Jim Bennett claimed he couldn't maintain a conversation on the patio of his house due to the noise level. Two years later, a follow up item was broadcast with the complainants still disturbed by the constant din of the data centre, even though Facebook claimed to have spent hundreds of thousands of dollars on acoustic panels and additional trees to mitigate the acoustic spill (Residents Still Concerned About Noise From Facebook, 2015). For Ryan Barron and Lynne Foster, residents of Labrador City in Newfoundland, Canada, the arrival of a Bitcoin mine impacted upon their "health" and "mental well-being" (Foster in Barker, 2016), particularly after a substation and transformer were installed in the middle of their residential district to power the facility. In the Parisian suburb of Seine-Saint-Denis a local action group called The Urbaxion'93 Association filed to have planning permission withdrawn for a data centre in 2015 owned by global colocation provider Interxion. The site, named PAR7, which had been in operation since 2012, had become a cause for concern for the residents on the basis of noise, and risk caused by diesel fuel stores in close proximity to residential housing. The case was covered heavily by industry trade magazine *Data Centre Dynamics (DCD)*. *DCD* provided near weekly updates following the initial objection in early October 2015, where one local resident and member of Urbaxion'93, Matilda Mijajlovic, reported that the site "makes a constant noise, and is in a residential area with some people living only 10m away", and had failed to deliver "on a promise to create local jobs" (Judge, 2015). On 21<sup>st</sup> October 2015, the Administrative Court of the Parisian suburb of Montreuil withdrew Interxion's licence to operate based "specifically on the noise pollution the refrigeration and backup generator systems produce" (Boyle, 2015a).

Most data centres in the Paris region are located in industrial zones, but 'edge' data centres are being developed nearer to urban areas in order to support streaming media services (Boyle, 2015a). By early November 2015 Interxion had the

ruling against them overturned by taking the case to a higher level commercial court. Interxion France’s MD Fabrice Coquio offered a formal comment to *DCD* stating, “[t]he demand for inner city data centers is rising rapidly”. Coquio referred to another data centre owned by competitor Telehouse on Boulevard Voltaire, “which is right in the middle of the city, and has not attracted complaints” (Coquio in Boyle, 2015b). Coquio’s decision to compare one site to another owned by a different company in a different location showed no empathy; completely disregarding the collective experience expressed by the neighbours to the PAR7 he was responsible for. These isolated examples of where media infrastructural sites become the subject of ire for local residents in their proximity, demonstrate how data centres operate in Dyson’s economies of psychic noise. They literally interfere with human wellbeing, smothering individuals’ capacity for thought and sleep. They deliver ecological noise as they drown out the voices of conversations, but also through their financial capital and power drown out the voices of objection from local communities in place of their own homeostatic regime.



Image 34

*Travaux D'Extension* (2016), architects impression poster for Interxion on Rue Rateau, copyright the author

The sonospheric vibrations of media infrastructures, data centre operation, and site selection extend beyond the human, as discussed in Chapter Four of this thesis. A case study presented by Lisa Parks demonstrated how ospreys, an endangered species of bird in the US, have begun to nest atop telecommunication masts,



causing network outage but also a resurgence in their population (Parks, 2017). Rumours of a shark biting an undersea network cable as its plastic skin and electromagnetic radiation carved through the seabed suggests animals are developing hypersensitivity to planetary scale network infrastructure (Shark attack on subcable.wmv, 2010). An online tally keeping a log of nonhuman disruptors to power infrastructure outages demonstrates squirrels to be the lead culprit in worldwide disruption (Disrupting at the Highest Levels, its #CyberWar4Ever!, 2018; Thomas, 2016). Media infrastructures connect to other critical infrastructures and proximal environments. In the Bavarian town of Eching, north of Munich, local trout farmers took a data centre company developer to court for their proposed facility which they argued would heat the stream and ground water sources of the area due to the data centre's design to use groundwater for cooling its servers before returning it back into the ground. A 2°C increase in temperature has potentially significant knock-on effects to the entire waterway ecosystem, argued farm owner Anton Kurz (MacGregor, 2015). The proposal was approved by the local authorities and several years have now passed. Kurz's farm is still active and claiming to offer "the highest quality standards" (Kurz, 2018). In this potential example of the environmental noise of data centres, the evidence is more anecdotal than quantitative, but there are clear relationships and risks forming for human and nonhuman agents within network assemblages.

Data centres pose a significant infrastructural and political complexity for local communities where they are proposed to be built and have pros and cons attached to them. In Prineville Oregon, home to fully operational Apple and Facebook hyperscale sites, there are now an estimated 400 staff in permanent full-time jobs working in data centres, in a town of 10,000 (although how many staff actually live in Prineville is unclear). The municipality also receives a 5% fee on electricity bills which come up to \$2.2 million a year (Schneider, 2018). Mayor Betty Roppe, having seen the towns unemployment rate stagnating at 24% felt the need to "[diversify] the economy and seeking companies willing to pay living wages" (Roppe in Schneider, 2018). It is a difficult balancing act that county councils and municipal bodies must take into account when a tech giant expresses interest in developing a huge infrastructural project in their town. In most cases, these projects will be

proposed to happen in rural locations, following the collapse of industry, or in the case of 'edge' sites, on the peripheral margins of cities where low-income families lack the financial resources and political agency to challenge their construction. Such areas typically have high unemployment rates and negative migration, and those responsible for making decisions on the area's behalf will be keen to inject any sense of optimism into the region. This is done even if it requires significant tax breaks and disappointing employment outcomes. The financial, ecological, and health costs for those neighbouring such sites must be considered carefully by the corporations who have the power and capital to be sensitive to communities. Local authorities also have much at stake in tempering the rippling vibrations of such giant technological infrastructure sites within their communities.

Data centre infrastructures across Europe and North America have been demonstrative of the anthropocenic effects of Frances Dyson's economy of noise. Such infrastructures have been criticised as bearers of environmental noise in that what is heard from them is connected to toxins and pollution from energy providers utilising the grid, particularly for smaller sites operating in the blockchain market. The economic noise of the neoliberal, globalised supply chain and collapse of US industry resonates through the data centre market as companies develop in former industrial towns now suffering from high unemployment. Such towns possess industrial scale access to energy resources but the developments offer little in terms of long-term permanent job opportunities. Data centres have caused distress to those living around their perimeters claiming to experience psychological and physiological harm through exposure to sustained droning noise. It is not only human and environmental impacts caused by data centres and other media infrastructures which have been demonstrated to be potential causes of harm. In some cases, media infrastructures have also been connected to the adaptation of ecological conditions for nonhuman species too.

### 5.3 *Fields of Athenry*



Image 35

*Fields of Athenry* (2016), installation view, Brighton Digital Festival, copyright the author



Image 36 (left)

*Fields of Athenry* (2016), iPod wall perspective, Brighton Digital Festival, copyright the author

Image 37 (right)

*Fields of Athenry* (2016) iPod wall angle, Brighton Digital Festival, copyright the author

#### 5.3.1 *Media transition*

Please watch and listen to the video documentation file *7. Fields of Athenry* (2016).

### **5.3.2 Planning permission**

Having learned about the protest action in Paris between Urbaxion'93 and Interxion I began to search online for other examples of active protests, objections and appeals against data centre sites elsewhere in Europe. I came across one particular case that had been making news not only within niche industry trade magazines, but the local and national news in Ireland. In April 2015, Ove Arup & Partners Ireland Ltd. submitted planning applications on behalf of Apple Distribution International to Galway County Council described as "Apple Data Centre & Assoc. Services" (2015) for the townland of Palmerstown & Toberroe. The application was for:

a 24,505m<sup>2</sup> single storey Data Centre Building, a 5,232m<sup>2</sup> single storey Logistics & Administration Building, a 269m<sup>2</sup> single storey Maintenance Building, a 18m<sup>2</sup> Security Hut and associated barriers, 2 number 48m<sup>2</sup> fibre Huts (max building eaves height = 10m), 16 external standby generators, all associated external plant, a 20kV Electricity Substation, contractor facilities, a main entrance including a new right turning lane, internal access roads and associated infrastructure, proprietary waste water treatment plants including percolation areas, mains water connection, fire water storage tanks, rainwater harvesting, provision of fibre optic data connections, car parking (207 spaces including 7 visitor spaces, 50 internal staff mobility spaces and disabled parking spaces), bike parking, an amenity walkway and associated parking, site levelling for a laydown area and a 220kV substation, 2.4m high perimeter security fencing, landscaping including supplementary tree planting and all associated works. (Apple Data Centre and Assoc. Services, 2015: 4)

The initial application was for a single 24,505m<sup>2</sup> data centre. However, all documentation submitted included specifications for a further seven 24,505m<sup>2</sup> data centres making a total of 196,040m<sup>2</sup> of data centre plus all additional facilities; one of the largest data centre schemes anywhere in the world (Weckler, 2016). The proposed site, a green field area named Derrydonnell Forest (also referred to as Toberroe Woods), was owned by Coillte, Ireland's main forest and land custodian, a

commercial semi-state enterprise formerly owned by Ireland's Civil Service. Derrydonnell Forest is a space enjoyed by people local to the area as a place to walk their dogs, go for runs or bike rides and to get some fresh air.

An in-depth analysis of the entire planning application goes far beyond my expertise and the breadth of this thesis but as is the case with all applications for planning permission in Ireland, documentation can be found through the database held online by An Bord Pleanála, the planning authority for Ireland under the application registration reference number 15/488 (An Bord Pleanála, 2017). Along with the request for planning permission, environmental impact survey and other formal documentation provided by Ove Arup, exist 23 letters from appellants (both individuals and groups) stating their formal concerns for the planning permission. My sonospheric investigation begins here.

### ***5.3.3 Listening to the multiplicity of 15/488***

I read through the letters of appeal alongside the planning documents, listening to the arguments presented as a layperson to planning regulations and processes. The appellant's letters expressed concerns around preservation of wildlife (in particular the protected species of Wood Bitter-vetch which had been identified in the area, and two species of bats that exist in the forest), proximity of an industrial site of its size to a local primary school and residential homes, lack of industrial zoning for the particular land, the forecasted carbon footprint of powering the site, and the risk of flooding to the area (Planning and Sustainable Development Unit, 2015). I sent emails to local councillors asking for comment and enquiring into whether it might be possible for me to meet with them to discuss the situation as part of an academic doctoral research project. The appellants had all of their personal details redacted from their letters but it was possible to work through them and find contact details through basic web searching on Google and using social networking site LinkedIn. I wrote each appellant a letter which I sent in the post or as an email, asking whether I might be able to offer them research support by undertaking a geoacoustic and biophonic forensic acoustic survey of the area concerned.



Image 38

Optimistic posting of letters to appellants, photo by Zara Dinnen

The initial approach to conduct a sonospheric survey through field recording was informed by the work of soundscape ecologists whose research aims to address the health of a specific space according to acoustical analysis of “all sounds heard at a location that are biological, geological, or anthropogenic” (Pijanowski *et al.*, 2011a: 204). Bernie Krause has worked across individual sites in longitudinal studies using what he argues are non-invasive or passive recording techniques or ‘ecoacoustics’ to analyse the depreciation of biophonic activity within a place as a predictor for climate change (Krause and Farina, 2016). For Krause, changes in biophony (sonic presence of nonhuman organisms) are a direct result of the anthropogenic activity of deforestation and urban development (Krause *et al.*, 2011). Krause’s method comprises long-term sound recording projects where he makes repeated sound recordings from identical locations over time. Inspired by Krause’s method, initially I planned to visit the forest, produce sound recordings according to the locations marked out in the Arup authored environmental impact survey (EIS) and then attempt over the course of construction – which at first I assumed was inevitably going to be approved and go ahead quickly due to Apple’s financial influence and status – to return, monitor and eventually demonstrate the altering soundscape ecology of the forest pre and post construction. I made plans to visit Derrydonnell Forest, applying for additional funding from University of the Arts London’s Student Support Fund to cover the travel costs of a short visit.



Image 39

Plan of Derrydonnell Forest with three sound assessment stations, source: Arup 2015

Visiting Derrydonnell Forest, I conducted phonographic recordings across three particular locations that had been marked as sites for noise measurement for the EIS in the east, southwest and northwest areas. I made recordings at 05:30, 13:00, 16:00 and 19:00 using the microphone, geophone and contact microphone sonopalette configuration and also filmed at the site markers. It was early May 2016; height of the dawn chorus, and bird song was a prevalent feature of the recordings in the morning. The wash of motorway traffic from the adjacent M6 was faint at 05:30 but still present and became increasingly so across the day. After spending many hours recording, and only occasionally seeing people walking through the forest, I had begun to question what I was working on, but hoped that over time the recordings would amount to a significant correlation as per the ecoacoustic methodology.

Around the forest perimeter I observed a number of anti-protest placards that had been posted. These signs demonstrated that the situation in Derrydonnell Forest was not a clear-cut David versus Goliath story. The narrative was not about how the big multinational corporation was using its money and power to take land at will but was being prevented by the little-guy; the local hero who was compelled to say no. It was far more complex. The sonospheric investigation demands a closer

appreciation of the multiplicity of factors that interconnect within a particular case study than the ecoacoustic method alone can offer. As a multimodal practice, I aimed to complement this research through interviews with appellants and other members of the public.

I visited the small, medieval town of Athenry and spoke to people in cafes, pubs and the Athenry Heritage Centre. Athenry is the nearby town to Derrydonnell Forest which Apple had attributed the project to. It is a popular marketing tool for digital technology sites to be highlighted next to the history and culture of a place, where medieval towns are able to be “perceived as both a symbol of the historic, old and durable and simultaneously as a town that is modern and progressive” (Jakobsson and Stiernstedt, 2012: 108). Most people I spoke with had heard about the Apple proposal but didn’t have particularly strong feelings either way. I began to think perhaps the local sentiment was far more ambivalent than the press articles I had read suggested. Two days prior to my visit I received a phone call from Damian Egan, a local resident and part of the ‘Concerned Residents of Lisheenkyle’ group who had submitted an appeal against the proposal. He agreed to meet with me on the final evening of my visit along with two other appellants, Sinead Fitzpatrick and Allan Daly. It was a privilege to discuss their appeals with them.<sup>22</sup> During our conversation I realised that any ‘evidential’ outcomes derived from the ecoacoustic methodology would come too late to be of any benefit towards their appeals. Interested in how an artistic project may have benefits of creating a wider audience and field of interest towards their case, we discussed activities that could offer a more immediate response, but came to nothing conclusive. Deploying this mixed mode of research – exploring multiple registers for listening through the sonopalette blend of ecoacoustics, geophonic vibration sensing, sound-walking through the forest, document analysis of the EIS, and oral interviews with appellants and other public – left me with stacks of data but no clear direction on where to take the research. I returned home and to the studio.

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<sup>22</sup> Damien Egan didn’t attend in the end but Sinead Fitzpatrick and Allan Daly did.



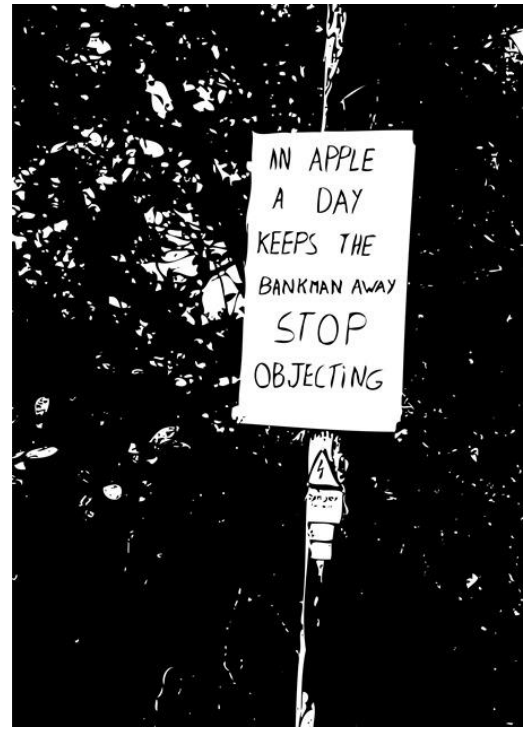


Image 40 (left)

*An apple a day* (2016), digital image, copyright the author

Image 41 (right)

*Local jobs for local people* (2016), digital image, copyright the author

### **5.3.4 Studio developments**

Returning home with my collected sound recordings, diary entries, video and photographs, I began to work through the various encounters I had recorded and experienced in Athenry, Derrydonnell Forest and the wider surrounding area. The set of recordings bridged the connections between different infrastructural nodes including the Cashla 220kV power substation that the proposed site would draw from, and the nearby Derrybrien Windfarm. Visiting the wind farm gave me an opportunity to consider the link between turbines, fans, energy and environment in a direct way, especially as wind is the primary renewable energy resource in Ireland. Listening through the field recording material helped me structure a sonic impression of the infrastructures that would eventually combine to service the vast interconnectivity hub that would be Apple's data centre; and situate the environmental acoustics within a potential digital infrastructure of the future. By reaching further afield from the forest, to networked nodes, I began to develop a

multimodal position which connected Athenry to the Apple project. In particular, I became inspired by the folksong *The Fields of Athenry* (1980).

### **5.3.5 21:20 GMT, Thursday 14 June 2012. PGE Arena Gdańsk, Poland**

During my meeting with the appellants I was informed of the popular Irish song *The Fields of Athenry* written by Pete St. John and first recorded by folk singer Danny Doyle. The song has subsequently been re-released numerous times by other artists to popular acclaim in Ireland and has become a popular chant for Irish sports fans at international matches and tournaments. During the Euro 2012 football tournament in Poland and Ukraine, Ireland were on the receiving end of a comprehensive 4-0 thrashing by the World and European champions Spain, which would see them knocked out of the tournament. Irish supporters decked out in green, orange and white took over the stadium as the game drew to a close, breaking out in a heartrending rendition of *The Fields of Athenry*, an Irish folk song about the struggle of a man to feed his family. It's hard to believe that any rendition of the song could top the performance at Euro 2012, where fans facing a debilitating recession at home came to Poland with the hope of getting a temporary respite from problems that made them, like the then World champions, debtors to richer neighbouring countries. Supporters reached for their phones and recorded the moment from around the stadium. Commentators and pundits from across the world paused in contemplation, allowing the collective power of the moment to ring through to their TV viewers. Fans uploaded their footage to the Internet, to be stored in a giant data centre somewhere unknown... somewhere like Athenry.



Image 42

Infrastructural connectivity (2016), digital image, copyright the author

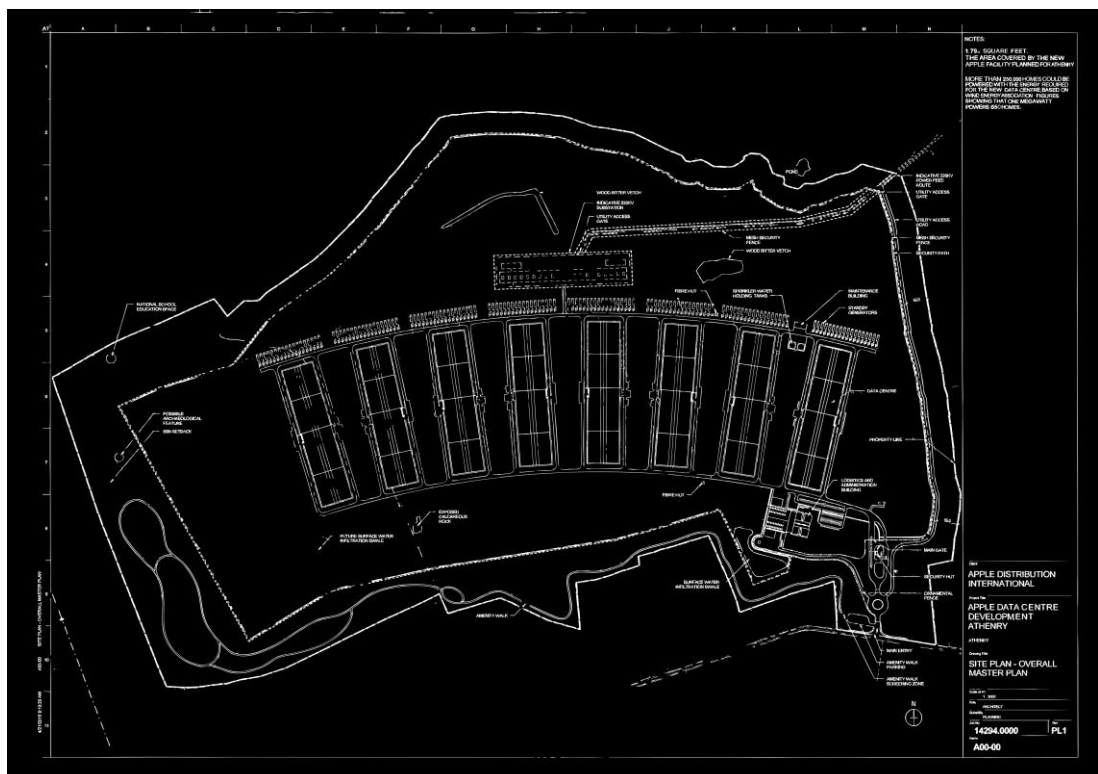


Image 43

Forest floorplan (2016), digital image, copyright the author

I applied to an open call for the Brighton Digital Festival 2016 seeking to commission new works on the theme of 'Place, Ecology and the Digital' for the *Digital Research in the Humanities and Arts Conference 2016* to be held at University of Brighton during the festival period. My proposal was to produce a new artwork that would make connections between Derrydonnell Forest, Apple and Irish football fans. My application was successful and I was awarded with a production budget to purchase 16x used Apple iPod Touch 4<sup>th</sup> Generation devices and an Apple AirPort Extreme A1408 wireless router. Using old Apple products points to the non-renewable materiality of Apple devices in response to Apple's claims of sustainability in their data centre operations. Using Apple products also situates Apple as a manufacturer of "Zombie media" (Hertz and Parikka, 2012: 425) who actively untether functional products from their ecosystem through system updates that are known to reduce battery life in an active process of planned obsolescence (Pogue, 2013; Sarhan, 2017). New-media artist Nick Briz has made a particularly incisive work titled *Apple Computers* (2013) which critiques the challenges faced by new-media artists encountering the operating system and appliance updates generated by their product choice. The work *Fields of Athenry* uses the exhibition space to resurrect these obsolete products.

Searching YouTube, I located a total of 40 unique videos uploaded with first person phone recorded video footage from the six minute period at the end of the game where fans sang. I began to make copies of the videos with YTD, an easy to use and readily available software (YouTube Downloader and Converter, 2018). International sporting events are known to increase nationalism and create social cohesion (Houlihan, 1997) although the effects of such events to unite national identity have been shown to be temporary (Heere *et al.*, 2013, 2016). Sound artist David Tidoni has listened to the football fan chants of the "ultras" group Brescia 1911 where he claims "[e]very supporter invests an extreme emotional capital towards the team. For this reason the real owners of the team are not the presidents but the supporters: the team belongs to those who love it not to those

who bought it” (Tidoni, 2015b: 12).<sup>23</sup> Duncan Whitley’s film *Things Fall Apart* (2017) depicts a disenfranchised community (Coventry City Football Club’s *Sky Blue Army* supporters group) and a local battle for the intangible values of place, identity and belonging, in which a major international hedge fund (club owners Sisu Capital Ltd.) dictates all club proceedings. The relationship between locality, space and community is rich within football heritage and the culture of chants is actively pursued both on the terraces and in the protests against multinational owners. Collective singing is viewed as an important component of social movements and protests (Bensimon, 2012). Phonographer Christopher DeLaurenti has been listening to the sounds of the Occupy movement in New York since the late-2000s. He states that “[u]nlike chants at sporting events, every echoing group of voices has its own timbre, spatial location, and variably passionate presence” (DeLaurenti, 2014). DeLaurenti hails the collective voice of Occupy and dismisses the work of the sporting chant as being for “someone’s corporation” (2014), but the fans in Brescia and Coventry argue their community goes beyond the corporate entity of the football club. The national pride of the Irish fans is channelled through the medium of YouTube and re-contextualised within the Apple and Athenry situation in *Fields of Athenry*. In the work, the fan’s collective song becomes a sonic lament for the loss of agency of people in Athenry against the financial capital of – the non-native corporation – Apple. The work also goes beyond the human, finding echoing voices and spatial locations across the networks of digital social media platforms, as well as the nonhuman communities and platforms of Derrydonnell Forest. Field recordings made whilst visiting the EIS sites are combined across time and spatial location within the forest and are then layered as a ‘forest-floor supporters group’, chanting in juxtaposition to the human supporters singing in the digital archives of YouTube. The work plays across relationships between space, place and ecology of the data centre, imagining a place that is already data driven and distributed through the existing ecological habitat but simultaneously is in opposition to a multinational media infrastructural threat.

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<sup>23</sup> Supporter groups for football teams are often referred to as ‘ultras’ as a shortened way of saying ‘ultra-fanatical’. Such groups are not without their controversy and links to violence, hooliganism and organised crime have been made with some ‘ultras’ groups. These wider political issues fall outside the argument presented within this thesis but an article by Tobias Jones for *The Guardian* offers an engaging introduction (2016).

*Fields of Athenry* is the result of a nine month sonospheric investigation into the application for planning permission made by Arup on behalf of Apple Distribution International. Utilising a multitude of research methods from within the sonopalette, it was enacted through the documentary analysis of industry trade magazines, local, national and international news vendors (mostly online), and documentation published by An Bord Pleanála with regard to the application and appeals. In addition to this remote research process, which aimed to listen to the intentions of Apple and other stakeholders as well as the mediated perception, the sonospheric investigation drew into regional and national sentiment of Athenry through metaphor, interlinking national pride (Irish football/sport fans) to the processes that occur within such media infrastructural nodes. The site of Derrydonnell Forest and Athenry was investigated through a sonopalette of interviews, phonography, low frequency recording and walking within the space. I found the birdsong of the forest to be a powerful analogue to the twittering energy of football fans, and the sense of irony, melancholy, naivety and potential loss these two media brought to each other, offered potent material for studio-based exploration. With Apple providing an operational lifespan estimate of around 20 years for the project, the iPod devices used for playback acted as a further metaphor for the planned obsolescence of Derrydonnell Forest and Athenry as infrastructure. Images pasted to the gallery walls in a fly poster style contained adapted photographs of signs counter-protesting the appellants of the project. These were placed alongside adapted architectural plans offering alternative data for the project to offer further recognition that in spite of the monochrome Apple branding, the situation was not black and white.

## **5.4 *Project Antioch***

### **5.4.1 *Media transition***

Please listen to *8a. Geophony (2017), audio (04min 00sec)*. Listen carefully, ideally in a quiet room without distraction.



Image 44

*Project Antioch* (2018), Watermans Arts Centre, London, UK, copyright the author



Image 45 (left)

*Project Antioch* (2017) installation perspective. The LAB, Dublin, IE, copyright Ros Kavanagh

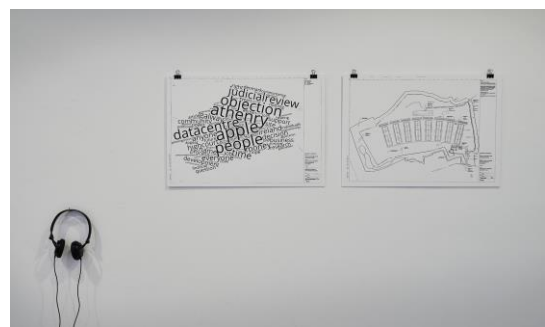


Image 46 (right)

*Project Antioch* (2017) installation close-up. The LAB, Dublin, IE, copyright Ros Kavanagh

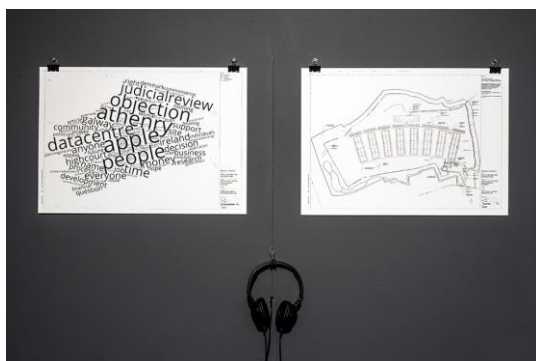


Image 47 (left)

*Project Antioch* (2018) Machine Learning close-up. Watermans Arts Centre, London, UK, copyright the author



Image 48 (right)

*Project Antioch* (2018) installation perspectives. Watermans Arts Centre, London, UK, copyright the author

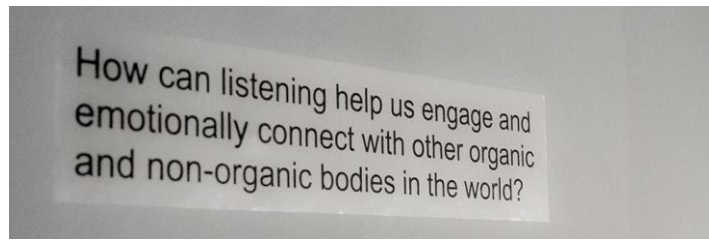


Image 49

Wall text for *Project Antioch* by exhibition curator Mirena Papadimitriou (2018), copyright the author

#### **5.4.2 Revisiting Athenry**

There were and are many strong feelings being explored both for and against ‘Project Antioch’ (the codename attributed by Apple for the Derrydonnell data centre). These various sentiments are held and expressed by local, national and international residents and stakeholders alike. Following a successful application for further funding from the Student Support Fund at UAL, I returned to Ireland for a follow up visit in January 2017. *Fields of Athenry* had been exhibited twice in the UK and had garnered interest within the Irish art community. As part of the return visit I was invited to speak at The LAB gallery in Dublin and facilitate a seminar for MA Art and Science students at Dún Laoghaire Institute of Art, Design and Technology. My primary aims for the on-site field visit were to continue with the ecoacoustic recording project of Derrydonnell Forest and to conduct a series of walking interviews with a number of key community stakeholders through the forest itself. This following section will reflect on the experience of four interviews I conducted during the visit that aimed to help inform and balance perspectives between objectors, supporters, politicians and the forest itself as part of the continued sonospheric investigation of Derrydonnell Forest. I met with Allan Daly, a key appellant whom I met on my first visit; Paul Keane, co-founder of ‘Athenry for Apple’, a pro-development action group with an active public Facebook group page; Ciarán Cannon TD, Minister of State for the Diaspora and International Development, a TD (elected politician) who represents Galway East (the location of Athenry), and Derrydonnell Forest itself. I considered the forest as a multiplicity of organisms and nonorganic bodies, a cohabitation of mixed material actants, throbbing confederations, and potential future habitat for Apple’s ‘Project Antioch’.



### 5.4.3 Interviews



Image 50

Allan Daly at entrance to Derrydonnell Forest (2017), copyright the author

Personally, looking at other data centre communities, I don't think a data centre attracts other major businesses, except for possibly other data centres. You see data centre clusters (Daly, 2017).



Image 51

Paul Keane at entrance to Derrydonnell Forest (2017), copyright the author

There is irreparable damage done through the planning process and objections but if they do come it will be a huge boost for the area. And most recognise that as well you know (Keane, 2017).



Image 52

Entrance to Derrydonnell Forest (2017), copyright the author

burrerrrrrrhmpbrrrrruuumrrrrrrbrrrrr (Derrydonnell Forest in Parker, 2017c).



Image 53

Ciarán Cannon TD outside his Athenry office (2017), copyright the author

Looking from the outside in, another potential investor looking at a similar thing of a similar scale, might cause them to think twice and I think we need to be cognisant of that but I also think we need to be cognisant of our citizens right, which I think is inalienable (Cannon, 2017).

Twenty months had passed since Apple's initial application for planning permission had been submitted before I met with the interviewees. The process was still held up in the courts of Ireland and had been further complicated by the European Commission's conclusion that Ireland had "granted undue tax benefits of up to €13 billion to Apple" (European Commission, 2016) between 2003-2014, requesting that Ireland recover the tax from Apple.<sup>24</sup> I was keen to ascertain if such a ruling would have soured the relationship between Apple and Athenry or galvanised those who

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<sup>24</sup> The European Commission has subsequently referred Ireland to the European Court of Justice for failing to recover the €13 billion in question from Apple (European Commission, 2017).

had expressed sentiment that the prosperity of the region – through the capital investment of Apple – was held at the mercy of a small number of appellants interested simply in lining their back pockets with pay-outs from Apple. I had observed such conversations unfolding on the ‘Athenry for Apple’ Facebook group comment threads.

We met at the forest entrance. I then fitted myself and the interviewee with a wireless microphone and started recording. We would walk for however long they felt comfortable. My interview with the forest took a slightly different design format, as I fitted it with a stereo microphone and a geophone located at each of the EIS zones. A variation of interview methods to the sonopalette, the semi-structured walking interview intended to explore how by walking in the forest we would be encouraged to not refer to Derrydonnell as an abstract parcel of land viewed through specification, technical documentation and planning permission forms, but as situated, rhythmic and teeming with energy. Following several hours of walking and listening with each participant they each presented new information to me, and I hope and believe that in return, they each felt as though they had an opportunity to impartially discuss their position. Allan’s argument continued to demonstrate the emotional labour he had put into his case. The cost to his home life and his family had been very difficult. Paul articulated how the pro-Apple community was a complex mix trying to make sense of an opportunity to inject cash and hope into the local area, but also acknowledged that some of the users of the Athenry for Apple Facebook group had voiced their feelings in an unacceptable, counterproductive, and at times abusive tone. Ciaran offered his optimistic and ultimately political perspective on the benefits of major foreign investment into the region, but also acknowledged how the delays in the project revealed how planning regulation in Ireland needed reform (whilst continuing to support the individual’s right to appeal). Early in the morning, the forest floor gurgled and emanated so much energy into the geophone. Listening to the vibrant matter of the forest, the fauna and flora that occupied it, and how this sonic energy merged with the anthroponic drones of motorised vehicles in the distance, and the clattering of loose wire fences rocking in the wind, I considered how this space may never be the same again.

In Chapter Four, I investigated media infrastructure and media technologies through time-space compressions, micro and macro temporalities within technologically and geologically determined flows. Navigating space is no longer only about a physical embodiment of space, but is reconfigured through globally distributed spatial relationships and transit points within digitally mediated nodal networks. Shifting from place to displacement, places themselves sometimes seem to be on the point of dissolving. My concern with this project was to ensure the presencing of Derrydonnell Forest through the sonospheric investigation. Through this presencing the forest had become more than its material constituent parts, as *Fields of Athenry* set out to demonstrate. The interview process encouraged me to listen further, through the rhythms of the bipedal pedestrian conversation had amongst men in the woods, and to the geological and ecological forces present in and around the forest, but also to the networked resonance of the computational.

#### **5.4.4 Machine learning**

As the project continued, three key stakeholders, Allan, Ciaran, and Paul, generously offered their time and thoughts towards this project. Their voices were important nodes, but situated within a broader ecosystem of conversation and opinion, there remained many other un-listened voices. The interviews were informative for my personal understanding and sentiment analysis of Derrydonnell Forest, Project Antioch and Athenry. However, to expand my field of reference I shifted registers towards a much larger conversation pool, and began to ask how it might be possible to listen, through technological means, to large data sets of sentiment and opinion. To investigate this idea, I turned towards the Athenry for Apple public Facebook group page created by Paul Keane. Following the initial objections to build the data centre, Paul Keane created Athenry for Apple at 04:48GMT on November 25, 2015. Boasting over 350 active contributors, 2,000 followers and 3,000 comments the page became a central platform for anyone concerned with the objections preventing the site being approved for development. Paul described to me his intention to create a site where people from all positions and views could come together and find out information about Project Antioch. I spent months following the conversation topics on the page and found there to be many different opinions even within the groups who clearly were pro-Apple.

Interested in what media-artist Nick Briz describes as “tactical misuse” (Jaffer, 2018) – using a digital media platform in a way it wasn’t designed through creative use of the debugging tools and programming scripts – I wanted to find out if I could create the conditions for listening to the 2,000 followers as a collective, and if so how to present their voice.

In creating *Project Antioch: Machine Learning* (Parker, 2017d), I began with the Facebook group page. I wanted to listen to all of the discussion that had taken place between the start of the page, to the nearest significant date within the ongoing case. I chose the planned date for a judicial review in the High Court of Ireland, 610 days after the page was founded (July 27, 2017). In order to collect the conversation thread from the public group page, I used a programming technique called data-scraping. This entailed writing a customised script to collate data provided freely by the Facebook Application programming interface (API). I tested a number of different methods for this process: using third-party vendor services; Microsoft’s PowerBi software; and JavaScript. I settled upon using Python, a programming language I was marginally familiar with. I based the script on guides I had seen for the process gathered from two online sources (Paulo, 2016; Woolf, 2017) and modified to suit my specific purposes of generating anonymised comment lists that could be stored in a secure, offline database or password protected Excel spreadsheet. Following an online tutorial series (sentdex, 2016), I then used a basic machine learning algorithm in Python to perform Natural Language Processing (NLP), Keyword Extraction and Sentiment Analysis of the data. In this way I was able to practice the deep-listening of the machine-read methodology of social media data harvesting in relation to the predicament in Athenry. This was all new territory for me to explore and most of the AI terminology was unfamiliar. The machine learning techniques deployed for *Project Antioch* can be described briefly as:

- Natural Language Processing: an area of computer science connected to artificial intelligence that processes and analyses natural human language

data to make the information accessible within other computational operations.

- Keyword Extraction: closely linked with NLP, it is the automatic identification of words or strings of words that most effectively describe the subject of a textual language data set.
- Sentiment Analysis: also known as opinion mining, it uses NLP methods such as keyword extraction to quantify affective and subjective states expressed through data sets, based on a control (corpus data set that provides prior knowledge groupings).

At the end of this process, I generated a list of keywords (with a maximum character string of three words together) most used throughout the 3,000 comments. I then asked a number of human and nonhuman performers (a mix of text-to-speech software algorithms and software voice assistant programmes) to read these keywords to make a series of recordings that would form a digitally recorded sonic sample library. The performers included friends and programmes (in alphabetical order):

- Caitlin (CereProc)
- Cortana (Microsoft)
- Google Assistant (Google)
- Ina Niemelä (Finland)
- Jon Kennedy (United Kingdom)
- Ruth Gilligan (Ireland)
- Sara Kracht (Denmark)
- Siri (Apple)

The subsequent output of *Machine Learning* is an algorithmic libretto of 610 bars. The audio comprises algorithmically determined keywords, vocalised by text-to-speech machine based voices (which are modelled on advanced machine learning algorithms that deploy NLP, keyword extraction and sentiment analysis methods), and human voices alike. The audio is played back according to algorithmically

determined principles of conditional probability, informed by a sentiment analysis data set created using the 'Sentiment Analysis Tutorial' provided by Google Cloud using Python (Google, 2018). The probability of playback of each keyword was broken into sentiments of 'good', 'neutral' or 'bad' based on the sentiment analysis data set. The sentiment data set was based on the use of an existing publicly available data set used for teaching and prototyping tools made by the Stanford Artificial Intelligence Laboratory which uses a corpus of movie reviews from the Internet Movie Database (IMDB) (Maas *et al.*, 2011). The final audio output was generated using Ableton Live software and the Max for Live programming environment. The probability of a keyword sample being selected for playback was structured in Max for Live with the most popular keywords having the highest probability. Sentiment analysis for each keyword was then mapped to the channel output configuration (1-4 on loudspeaker or L-R in headphones). The human voice contributors come from Galway (site of Derrydonnell Forest), London (where I live), Denmark (where Apple completed construction of a sister data centre complex in the summer of 2017) and Finland (where Google built a data centre in a former paper mill (Virki, 2009)).

#### **5.4.5 Facebook data ethics**

Facebook stores its data in data centres. Facebook Ireland Ltd is the central hub of European operations for Facebook with offices in Dublin and a number of 'edge' data centres surrounding the perimeter of the city. Its core European data halls are based in Luleå, Sweden. In 2018 Facebook came under heavy scrutiny following a series of investigative journalism exposés by Carole Cadwalladr, *The Guardian* and Channel 4 News (Cadwalladr and Graham-Harrison, 2018). Cadwalladr and her team worked with the whistle blower Christopher Wylie to reveal how the data analytics firm Cambridge Analytica had extracted and misused over 50 million Facebook user's personal data sets. Following the exposé Facebook have amended their platform and policies to prevent data-mining and extraction (see Terms of Service, 2018). *Machine Learning* didn't extract any personal data beyond the comments made on the public group page. It was made prior to the April 2018 changes in terms of service from Facebook, and prior to any backend code that Facebook have written into their platform since the exposé which prevents Python scripts from

extracting data. However, the fast pace of change in terms of service and regulation of data from major data custodians such as Facebook demonstrates a significantly altering dynamic in the way data is collected, secured, and what the distinctions between private and public data are. Whilst there is a growing literature from academic research predominantly within the social sciences (Salganik, 2017; Townsend and Wallace, 2016; Utrecht Data School, 2017; Vitak *et al.*, 2017; Zimmer, 2010), the role and ethical dimensions of artistic work and the use of social media data is unclear. Collecting the data set from the Athenry for Apple public group required the consideration of ethical safeguarding of individual contributors to the page. I considered what Townsend and Wallace (2016: 5–8) regard as key areas of concern within social media research: distinctions between private and public social media posting; informed consent; anonymity; and risk of harm. As the group was a publicly visible page that anyone could see, and the individual users had consented to the existing terms of service for the group, I determined that their posts were publicly accessible and potentially of use by third-party-researchers. Paul Keane, the creator and group admin for the page during our interview agreed that he was happy for me to work with the content providing it was fully anonymised. I determined that there would be no risk of harm to any individuals from the group which again followed the recommendations from Townsend and Wallace as well as met the ethical guidelines of my host institution, UAL.

#### **5.4.5 Media transition**

Please listen to *8b. Machine Learning (2017), audio (23min 42sec)*.





Image 54

*Project Antioch: Machine Learning* (2017). 2x giclée print on hahnemühle photo rag, 420 x 594 mm, copyright

the author

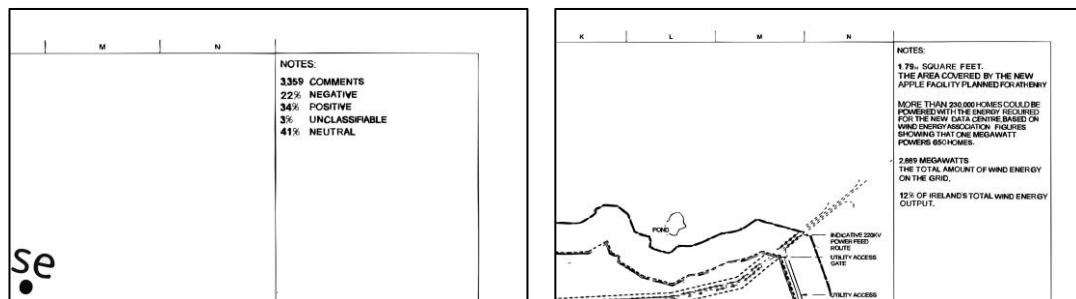


Image 55 (left)

*Project Antioch: Machine Learning* (2017). Close up of architectural title block A, copyright the author

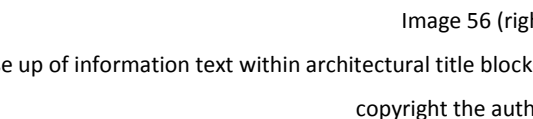


Image 56 (right)

*Project Antioch: Machine Learning* (2017). Close up of information text within architectural title block B,

copyright the author

## 5.5 Conclusion

This chapter provided a series of case studies demonstrating how the presence of data centres can have a significant impact to the environmental, ecological, economical and psychic modes of what Frances Dyson describes as the economy of noise. These cases show how data centres and more generally media infrastructures play a complex role across not just global media distribution, but also hyper-local, community centred discourse. Listening throughout this chapter was enacted through ecoacoustic, socio-cultural, and machinic modes that connected to the economies of noise. In order to investigate the affective impact of media infrastructures upon both human and nonhuman local communities, I

developed a project based around a controversial data centre proposal made by Apple in Ireland. The sonopalette was expanded to include listening to the historical and cultural reverberations of Athenry, a small town on the West Coast of Ireland with a significant presence in the popular imaginary of Ireland due to the contemporary folk song *The Fields of Athenry*, and its purchase across national sporting culture. This studio based fieldwork was combined with site specific fieldwork using ecoacoustic methods of phonography in the contested site of Derrydonnell Forest. Using machine learning techniques as a proxy for listening to large quantities of data, the chapter additionally considered how collective agency and voice could be used to explore both unified and differing perspectives, or harmonic and discordant vibrations, that connect the sites of Athenry and Derrydonnell Forest, with the iPops of YouTube and Facebook as communal platforms for voicing and sounding sentiment, energy and opinion. Taking this multimodal approach to the sonospheric investigation of one particular site and its impact on a local community opened a wide range of entanglements enmeshed within the economies of noise of media infrastructure. Locally, residents of all kinds were conflicted and affected in different ways. Nationally and internationally, the topic became enmeshed with questions around local/global, urban/rural, native/non-native dichotomies that were most explicitly revealed through the platform of Facebook. Using modern tools of computational analysis as a mode of listening to large volumes of data had the effect of removing the intimacy from individual users' group posts in *Project Antioch*. Sounding these sentiments through a combination of human and machine generated voices provided a way to create a new intimate situation, and act as a reminder that human and nonhuman voices were equally at play in this case.

Apple officially now own the land of Derrydonnell Forest but in May 2018 the company decided to withdraw from Project Antioch as a direct result of the delays created by the appeal process and State Aid controversy in Ireland (Goodbody, 2018). Meanwhile, three years after planning permission was requested, a twin site located in Viborg, Denmark, is constructed and operational, and Apple have moved their attention to the development of a second site in Denmark (expected to go live in spring 2019) as a replacement for their Irish plan.

## ***Thesis conclusion***

### ***Contributions to knowledge***

This thesis offers three particular original contributions to scholarly knowledge within an interdisciplinary field of sound studies, sound arts, and infrastructure studies. First, the original research methodology of the sonospheric investigation uses a novel multimodal approach to listening – the sonopalette – which enables sound art practitioners and other disciplines interested in the resonances between things, to critique how media technologies are consumed and are consuming within the contemporary conditions of the Anthropocene. Second, whilst a growing output of research on media infrastructures is apparent across many disciplines within the arts and humanities, this thesis uniquely connects contemporary sound studies and sound arts practice-based research to the discursive field of media infrastructure studies, as well as offering guidance towards the practical application of research within the field. Third, the thesis presents the technologies that comprise the Internet as sonospheric, which is to say that media infrastructure assemblages resonate across an extraordinarily broad spectrum; across the micro and macro scales of size, register, temporality and force. Through the cultural, environmental, economic and ecological modes of the economy of noise, the resonances of Internet infrastructure can be listened and attended to.

### ***Responding to the research question***

The primary research question of this thesis has been how can relationships between the ecology of media infrastructures and the economy of noise foster the development of a sonospheric art practice? I have approached this research through five themes, presented within the five chapters of this thesis: methodology, access, subject, time and memory, and economies of noise. The practice-based research projects within this thesis do not neatly conform to the thematic containers of each chapter theme; however, to develop the argument of this thesis, the artworks presented across the chapters were interwoven within this thematic structure.

## ***Methodology***

In order to develop a sonospheric art practice, it was necessary to define it first. Chapter One set out the ontological conditions of a sonospheric art practice and introduced the sonospheric investigation as an original research methodology that would be deployed and refined throughout the chapters of this thesis. The sonospheric investigation is concerned with the qualities of listening, as multisensory vibratory encounters between other vibrant bodies.

The sonosphere concept offered by Pauline Oliveros suggested and encouraged a need to think big; to think planetary scale force. To avoid being overcome by grand projects aimed at recording or sensing planetary forces, I developed my own definition of the sonosphere to consider localised actants, forces and force complexes.<sup>25</sup> My understanding of the sonosphere throughout this thesis became particularly attentive to the interplay of vibrations through a complex and interlinked set of registers stratified between the geological and ecological 'out-there', and the cultural, political and embodied 'in-here'. In other words, the sonosphere, as presented throughout this thesis, is considered as a more-than-representational vibrational force overlapping and in-between material reality and cognitive perception. More simply, regardless of the material or cultural form, this thesis has been interested in how things resonate with each another. The sonospheric investigation therefore became a methodological approach to the multimodal ways in which things resonate.

## ***Access***

Chapter Two was concerned with the role and responsibility of the researcher towards their research subject and considered the ethics of gaining access to the subject of research for a sonospheric investigation. Analysing the production of the artwork *Palimpsest* allowed me to expose the process of negotiating access to research sites. Access to the site and space of the sonospheric investigation became an ongoing evaluative process whereby I would develop and modify methods of

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<sup>25</sup> Planetary scale forces are effectively explored by other artists such as Joyce Hinterding, mentioned in Chapter One.

how to engage with a site of investigation and become receptive to what resonated most within that environment.

### ***Subject***

Chapter Three introduced media infrastructures as the critical nodes of networked media communication and transmission, which exist within an industrial culture of secrecy and obfuscation. The documentary series *The People's Cloud* and *The People's Cloud (Original Soundtrack)* presented media infrastructures as highly complex meshworks of technical media objects dependent on huge quantities and flows of energy. Such infrastructures are also reliant upon a set of expertise from engineers who run, manage and develop information systems which are offered to consumers as Internet products, services and platforms. The works within this chapter also position the sounding vibrations of their materiality at the forefront of practice-based research within the field.

Chapter Three drew heavily from scholarly research to provide a context for what media infrastructures are and how they operate but other than Anna Harris's superb work on pneumatic tubes and her call to listen to infrastructure, I found little research indicating a cross engagement with sound studies and infrastructure studies. There is a growing discourse on infrastructure studies and the significant more-than-human connections to ecology, but sound studies and sound art has only just begun to enter into this conversation. The field's interest in networks continues to be dominated by the application of telematic performance and the big-data acquisition projects of large collections of sound recordings such as in the sub-discipline of soundscape ecology. The concern here is with what media infrastructure can offer collaborative and networked practice, instead of critically evaluating the infrastructure itself. This shift is necessary to further our understandings of the sonospheric and networked conditions of the Anthropocene.

### ***Time and memory***

Whilst producing *The People's Cloud* I reflected upon how the industry contacts I accessed for interview were all middle aged, white European or North American men. The issue of representation within media infrastructures became a particular

concern of subsequent work. Chapter Four comprised two sonospheric investigations working through time and memory: firstly, the deep time of geological voices within the media assemblage; and secondly, the memories of media histories voiced by a group of pioneering women in computing. For the collaborative film *White Mountain* I experimented with transduction microphones, geophones, and electromagnetic sensors in order to listen to the vibratory energies and deep time of media infrastructure at the Pionen data centre. *Memory Line*, an artwork about media and memory, invited a number of women and men who are pioneers of the digital computing era to discuss their memories of working with EDSAC, one of the first ever computers to store digital memory. The work contributes towards readdressing the balance of voices of those represented in the history of computing.

### ***Economies of noise***

The artworks *Fields of Athenry* and *Project Antioch*, which featured in the final chapter of this thesis, are a culmination of the strategies and techniques developed throughout the preceeding chapters in how to research media infrastructures through the sonospheric investigation. The chapter expanded Frances Dyson's concept of the economy of noise, which situates the complexity of noise through four modes: economic, environmental, ecologic, and psychic. I considered here how the psychic becomes a cultural and affective mode situated through the other three modes. Whilst all of the artworks throughout the thesis respond to one or more modes of the economy of noise, the final chapter specifically introduced the impact of media infrastructure site selection through the four modes. The multimodal approach to the sonospheric investigations of this chapter pushed at the edges of what media infrastructures are understood to be; bridging the geological and ecological with the social, cultural and political.

### ***Revisiting the sonopalette***

I introduced the sonopalette as a set of swappable tools, approaches, and methods to be deployed within a sonospheric investigation. Initially I understood these tools to be a practical set of objects such as microphones and portable sound recorders that could be deployed in field-recording activities. The strength of the

sonopalette emerged once I realised that what I had considered to be ‘the field’ became more than just being present and observing a specific physical location. Artwork production – including fieldwork – occurs across five interlaced stages; conception and pre-production, production, post-production, exhibition, and documentation and evaluation. The sonospheric investigation happens continuously through these stages. Listening to the way things resonate – the central feature of the sonospheric investigation – can influence the direction and result of work anywhere; from within the library, in a specific geographic location, interacting with a particular person or thing, navigating the world-wide-web, in the studio, and in the display or exhibition of work. The tools of the sonopalette are not fixed and are entirely interchangeable to suit the investigation. The key is for the practitioner to use whichever tool they find most useful to find resonances between things. Sound art and sound studies often feel overly concerned with the ontological discussion of what is sound. But at this time of critical transition in planetary climate, resources, and politics, the sonopalette can become a powerful application of methods towards producing research and art works using sound to address issues happening right now.

The field recording research activity for *Electrostatic Borderlands* primarily sought to engage with this multimodal realm of material energies and introduced the complex role of using and encountering media technologies in the field. The unexpected encounter with the invisible but audible presence of electrostatic interference through my sound recorder device whilst in the Parque Natural Sierra María, demonstrated the significant purchase that media infrastructure transmissions have in mainland Europe in a way that visual media wouldn’t have so readily detected. It evidenced the value of the phonographic methods within the sonopalette. For *Palimpsest* the vibrations of the architectural space itself became part of the sonopalette. The geophone and Subpac bodypack transducers enabled me to detect, sense, and playback frequencies far below the range of hearing. Using these technologies amplified infrasound, making it palpable whilst I actively engaged in the production research environment, but also within the post-production exhibition environment. The performativity that the portable package presented to me for site-based research was also put to use when navigating the

multiple frequencies I encountered as I recorded and explored the Pionen data centre. Rather than statically placing microphones, I increasingly used my body as a performative extension of the sonopalette, by walking and rustling through spaces, such as in the *KEF201C* recording in *The People's Cloud*; or as an embodied backdrop sharing the environment of Derrydonnell Forest with other beings in *Project Antioch: Geophony*; or as deep-time navigator of the subterranean data halls in *White Mountain*. The sonopalette also includes interview and ethnographic methods within the toolkit which were extensively explored through *The People's Cloud*, *Memory Line* and in developing work around Derrydonnell Forest. Encouraging people to voice their memories and opinions whilst – where possible – occupying spaces connected to the conversation topic (a data centre, a laboratory/workshop, a forest), helped develop immersive conversations in direct relation to the space, object or type of environment that the interview was concerned with. It also presented the cultural with the material distinctions at play within the field as I investigated the sculptural form of early digital memory technologies found in the nickel wire delay lines of EDSAC. Where intimate conversations were not possible, I turned to social media platforms YouTube and Facebook to listen deeper. Whilst a relative novice in machine learning techniques, my use of natural language processing and sentiment analysis provided an intriguing method of interrogation into large data sets of opinions expressed online. Future sonospheric investigators with greater skills in coding and machine learning will certainly be able to expand on this method as a way of deep listening to human and online environments that comprise a substantial portion of daily human-to-media infrastructure interaction. The sonopalette is about an approach to how one uses tools, technologies and their bodies for listening as opposed to a rigid set of options. Future sonospheric investigators are advised to revise, develop and add their own methods to the sonopalette which best suits their individual listening needs.

### ***Limitations of the sonopalette***

The sonopalette is as much about the approach a researcher might take towards researching their subject – by listening sonospherically – as it is about the specific methods used. A given researcher's interpretation is limited by the



technological conditions of the current time; what sensing technologies are available to the researcher, and what acknowledged methods of ethically approvable fieldwork techniques are considered to be informative in seeking answers to a given research question. These conditions are paradigmatic. The conceptual framework of the sonospheric investigation offers a critically informed foundational structure underpinning the creative research process regardless of technological innovation and current trends in field-based research and artistic practice. As such, the sonopalette remains a valuable and most importantly adaptable toolkit for research throughout changing conditions.

One of the research methods I undertook to produce the work *Project Antioch* was data scraping the 'Athenry for Apple' Facebook group page. This research method would be difficult to produce now, just a short time later, due to a change in technology, a shift in Facebook's usage policy, and an altering ethical research landscape following the Cambridge Analytica scandal. This demonstrates that changing political and technological climate will have a significant impact on how one might approach the sonopalette for future research projects.

### ***Reflections on the Anthropocene***

The literature and practice discussed in this thesis enforces the sonospheric investigation as an alternative method to the saturation of visual media that dominates aesthetic approaches to infrastructure and the Anthropocene in contemporary art practice.<sup>26</sup> Despite their centrality, media infrastructures are not presently the definitive sound of the Anthropocene. The sound of the Anthropocene is most often characterised through the explicit objects and events that have become identifiers of anthropogenic change; atomic bomb blast recordings and clicky Geiger counters, scrunchy polythene bags and squeaky latex, the crackling sound of ice melting. Plastics, water wastage, and e-waste, are issues central to the operation of media infrastructure, but the sonic study of these objects in themselves neglects everyday human interrelationships that form their

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<sup>26</sup> The e-flux Architecture and Daniel A. Barber project *Accumulation* (Barber, 2017) gives a particularly in-depth overview of how sense technologies, planetary data and networked systems are built on a process of accumulation in the Anthropocene, but achieves this aim through a discourse of image making practices above other sensory techniques.

existence, function and being in the Anthropocene. Not only should we be observing the signs of the Anthropocene through the observational tools of the technosphere, we should be observing it within the technosphere itself; its entanglement with human, nonhuman, nonorganic systems. My artistic-practice throughout this thesis evolved into a semi-ethnographic project to identify how media infrastructures are as much material objects as operational projects, or co-becomings between people and things. As such, this thesis offers a different mode for thinking about the Anthropocene, not just in terms of the objects representative of waste, but as a study of the assemblage of these objects and their functioning in culture. Through the development of a sonospheric art practice, my interest in media infrastructures as sites of e-waste, energy consumption, and global data transmission has expanded to include not only material properties and impact, but a multimodal, sonospheric appreciation for the ways in which media infrastructures are embedded into the environmental, ecological, financial and psychic economies of noise described by Frances Dyson.

### ***Public engagement***

The contributions of this thesis resonate beyond the written words, images and digital documentation. Each artwork has been exhibited publicly, offering audiences an opportunity to experience the outcomes of a sonospheric art practice first hand. *Electrostatic Borderlands* was exhibited at the Nunnery Gallery as part of a group show concerned with art and the environment. I observed visitors (and staff) reach for their phones in anticipation that a call was about to be received, assuming they were at fault for the interference heard subtly over the speakers. The work acted as a representation of my engagement with the off-grid space the sounds were recorded in, but also offered a further dimension of human-to-machine conditioning through sound. Each time a person reacted to the interference, was a small reminder of the pervasiveness of digital wireless signals and infrastructure.

Shown at an open studios event at the BSR, *Palimpsest* was experienced by an audience made predominantly out of archaeologists. One in particular told me how excited they were to hear the sounds of ancient monuments come to life. Their reaction to the convolutions and vibrations they experienced suggested to me that

they had not expected such a visceral encounter with the spaces they were watching me stand inside, on the video screen. The sonic archaeology of the space was animated beyond the expectation of the visual monumental remains.

*The People's Cloud* was released via the online platform [www.thepeoplescloud.org](http://www.thepeoplescloud.org), and has received reviews and press attention from tech, culture, and art magazines. It has had a significant reach with over 6,000 complete plays across the series (according to Vimeo statistics). Through this work I have been invited to speak at two symposia interested in infrastructures with eminent researchers in the field whom I have cited in this thesis. A number of them have told me that they have been using the videos as an introduction to media infrastructures for their students. This project laid the foundations of this thesis, as an introduction to the field, and an opportunity for me to think about what was most important to consider when applying the sonospheric investigation to other works.

Whilst my initial intention of carrying out the sonospheric investigation of Derrydonnell Forest was to be able to contribute in some way to the activity of appellants in the area, upon meeting them I soon realised the significant complexity of doing so. However, exhibiting *Fields of Athenry* and *Project Antioch* several times in both the UK and Ireland provided an opportunity to engage with the public and introduce this complex story to an audience outside Athenry. Subsequent public presentations that I have given about the work (including at Science Gallery Dublin) were met with intrigue and concern from audience members who had not considered the carbon contribution and ecological impact of their everyday smartphone activity.

Collaborating with Emma Charles on *White Mountain* has resulted in my soundwork being shown at a number of film festivals and exhibitions connected to topics of the Anthropocene. Charles has since worked on a number of films where she has experimented with some of the techniques I deployed in the production; using contact microphones, geophone, and coil-pickups as extended techniques for listening to her research environment. Charles has begun to approach her research sonospherically.

*Memory Line* was exhibited twice, first at the Milton Keynes Central Library and for a second time at the Computer Laboratory, University of Cambridge as part of the *Cambridge Festival of Ideas*. In addition to the exhibition of the work, I co-ran a workshop aimed at young women that introduced them to live coding. I also gave a public lecture about my research in general which was introduced by the Deputy Director of the Computer Laboratory, Professor Alan Blackwell. He offered a series of closing comments at the end. He said the Computer Laboratory never had visitors, contributors or discussions with people from the arts and humanities. The work and my presentation in general he claimed, should remind the audience that the computers and software they are developing for the future, also have a human, social, and political past and present. During my presentation, I made several apologies for making ham-fisted statements about how computers work (I was after all surrounded by computer experts). Alan confessed that he, and probably all of his colleagues, didn't fully understand how a computer works either but as lecturers and professors, their job is to stand in front of an impressionable audience and pretend that they do. These comments resonated with me. I certainly felt anxious about exhibiting a work about a computer in a place of computer experts, but his comments validate why it is important to make this kind of work. The sonospheric investigation, in the case of *Memory Line*, and other works in this thesis, helped me structure an approach to producing artwork about media infrastructures and computational systems that not only had impact upon an audience within the niche fields of sound studies and infrastructure studies in the arts and humanities, but with a general public audience, and a specialist computer science audience, leaving lasting impressions.

### ***Sonospheric futures and limitations***

A concern for the sonospheric investigation, which is raised in Chapter Four, is context loss through mediation; the process of translation and transduction that occurs in any act of recording or interpreting signals from the outside world. This is a criticism levelled at noise studies by Steven Connor whose argument would suggest that expanding into the sonosphere through transduction methods in order to find seemingly "sonorous correlatives for that which lies beyond or beneath our

sensory notice” is problematic as it is also “accompanied by a denaturing of sound itself” (Connor, 2010: 228). For Connor, transduction becomes a processing outcome. The power of a vibration once transduced is diminished as the natural is contracted into the human. I have argued throughout this thesis that technologies offer an expanding of human sensibility which can help us appreciate the existence and power of broader registers beyond our comparatively limited sensory apparatus. Connor’s argument suggests that multimodal listening methods might ‘denature’ sound. Is sound denatured no longer sound? Moreover, is vibration no longer a natural phenomenon if transduced with technology? The work of naturecultures, medianatures and medianaturecultures by Haraway, Parikka and Braidotti respectively, demonstrates how the co-becoming of things in the world, including sound and vibration, are the result of collaboration between different assemblages. We are dealing here with two paradigms, one of nature vs culture and one of naturecultures. If a human snaps a twig, the sound produced is no less natural than if a bird snaps a twig; or a robotic arm snaps a twig for that matter. The sound is the result of a significant energetic force causing vibration at a certain set of frequencies. Whilst it is possible that transduction of vibratory frequencies into human audible ranges may alter how that vibration performs and interacts in the world, the original source is still acting in the world. Transduction doesn’t alter the original vibration but rather creates a new indexical pathway, re-contextualising registers that may seem magical, obfuscated, or even monstrous to human perception. This thesis argues throughout that we are always expanding our sensibilities to appreciate broader registers; to determine what we didn’t think was there before and in doing so acknowledge the entanglement of naturecultures. These registers apply both within the material and phenomenological world – understanding as much about affect, perception and cognition as about the material flows of energies in the physical realm – and this is where the multimodal listening of the sonospheric investigation is at its most effective.

Whilst I have argued for the necessity to understand the global through research on the local, a global sounding of the ecological impact of media infrastructures requires further localised research in areas outside of Western Europe. Following on from the affective impact of media infrastructure construction

projects explored in Chapter Five, there is a need for continued research within other global regions. The ethics and practicalities of such research need to be carefully considered and are likely best conducted by, or in collaboration with, other sonospheric investigators from those regions. There are many political, economic, and environmental concerns resonating in areas with huge economic growth such as Brazil, Russia, India, China, South Africa and Nigeria as well as regions that are resource rich but cash poor such as Bolivia, the DRC and Venezuela. Each would be intriguing locations for further sonospheric investigation. What the sonospheric investigation can uniquely offer in such (already visualised) regions is a methodology whereby the spectacular can be equally situated alongside the quotidian, global environments of urban centres, suburban residential sprawl and even virtual/online cultures. All are pertinent sites to be listened to, explored and better understood. All are contextually, sonospherically rich spaces for artistic and scholarly exploration (as are Europe and North America). The work in this thesis can contribute towards this broader global collection of research and art making.

The chapters within this thesis demonstrate potential for a broad range of interdisciplinary applications for the sonospheric investigation. Through a more-than-representational process, the methodology has the capacity to combine the geological and ecological with the social, economic and political as a set of complex, interdependent conditions. The multimodal listening approach of the sonospheric investigation invites researchers to consider their position within their field and to understand their presence within it, as a constant state of negotiation and interaction with any subject medium. As such the sonospheric investigation could be deployed by a number of researchers across different fields interested in concerns of agency, environment, ecology, economy and culture. This includes art practitioners but also other humanities disciplines such as geography, media studies, documentary, ethnography and anthropology. The tools of the sonopalette are flexible, adaptable and expandable so as to assist a researcher in recalibrating their senses, to become listeners to the complexity of things in the world.

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## ***Appendix A: Collaborators and contributions***

This thesis would not have been possible without the support of a number of stakeholders ranging from financial awardees, gatekeepers, interviewees and collaborative partners, all of which are listed below in relation to respective artworks/projects.

### ***Research stipend award***

*TECHNE AHRC Doctoral Training Partnership.*

### ***Electrostatic Borderlands***

#### **Financial and institutional support**

*Art for the Environment Residency Programme, London College of Fashion, UAL:*  
Lucy Orta and Camilla Palestra.

*Arts Council England.*

*Joya: AiR:* Donna Beckmann, Sesame Beckmann, Simon Beckmann, and Solomon Beckmann.

*Bow Arts Trust / the Nunnery:* Rosamond Murdoch.

### ***Palimpsest***

#### **Financial and institutional support**

*The MEAD Fellowship Programme:* Scott Mead.

*University of the Arts London:* Jane D'Aulby, Mick Finch, Joanne Morra, and Daniel Sturgis.

*The British School at Rome:* Christine Martin, Stefania Peterlini.

*Beniculturali* (Terme di Caracalla, Palatino-Foro Romano): Marina Piranomonte and Maurizio Rulli.

#### **Collaborators**

Kate Fahey (second camera assistant, Terme di Caracalla).

## ***The People's Cloud***

### **Financial and institutional support**

*Deutsche Bank*: Vanessa James and Rosie Towe.

### **Collaborators**

Sébastien Dehesdin (cinematography and colourist), Michael James Lewis (additional cinematography), Carol Parker (additional cinematography), Chris Amblin (dubbing mixer), Gary Salomon (assistant music editor), Zara Dinnen (production assistant).

### **Contributions**

*Amsterdam Internet Exchange (AMSIX)*: Pauline Hartsuiker (coordinator). Henk Steenman (interview).

*Centrum Wiskunde & Informatica (CWI)*: Annette Kik (coordinator). Harry Buhrman, Steven Pemberton, Arjen de Rijke, Ronald de Wolf (interviews).

*Equinix*: Antonella Crimi (coordinator). Michael Winterson (interview).

*Farice*: Berglind Ran Olafsdottir (coordinator). Örn Orrason (interview).

*Landsvirkjun*: Berglind Ran Olafsdottir (coordinator).

*The National Museum of Computing*: Stephen Fleming (coordinator).

*SurfSARA*: Lykkle Voort, (coordinator and interview), Ander Astudillo (interview).

*Verne Global*: Megan Bozman (coordinator). Tate Cantrell (interview).

*Virgin Media*: Alice Lam (coordinator). Peter Jamieson (interview).

## ***White Mountain***

### **Financial and institutional support**

*Arts Council England*.

*ZKM | Centre for Media and Art Karlsruhe*.

*Sciences Po*.

*Jerwood Space*.

*Spike Island*.

## **Collaborators**

Emma Charles (artist), Emile Kelly (cinematographer), Jussi Parikka (writer), Linda Malmgren (voiceover), Faith Millin (colourist), Hans Lo (title design).

## **Contributions**

*Bahnhof*: Kristian Thorin (coordinator), Albert France-Lanord (architect).

## ***Memory Line***

## **Financial and institutional support**

*Arts Council England*.

*The National Museum of Computing*: Stephen Fleming (coordinator).

*EDSAC Charitable Trust*: Andy Herbert (director), Martin Campbell-Kelly (project historian), David Hartley (fixer for women veterans of EDSAC).

*Computer Laboratory, University of Cambridge*: Andy Hopper (ex-director) Anne Copestake (director), Alan Blackwell (interim-deputy director).

*MK Gallery / MK Festival Fringe*: Simon Wright (curator / director).

## **Collaborators**

Bella Riza (cinematography).

## **Contributions**

James Barr (interview), Nick Barron (coordinator), Valerie Barron (interview), Eileen Bennee (interview), Nigel Bennee (interview), Chris Burton (interview), Alan Clarke (interview), Peter Haworth (interview), Peter Linington (interview and design consultancy), Margaret Marrs (interview), John Sanderson (interview), Tom Toth (interview), Joyce Wheeler (interview).

## ***Project Antioch***

### **Financial and institutional support**

*TECHNE AHRC Doctoral Training Partnership* (travel support).

*The LAB*: Sheena Barrett (curator), Ros Kavanagh (photography).

*Waterman's Arts Centre*: Irini Papadimitriou (curator).

### **Collaborators**

Derrydonnell Forest (voice), Ruth Gilligan (voice), Sara Kracht (voice), Jon Kennedy (voice), Ina Niemelä (voice), Google Now (voice), Alexa (voice), Caitlin Pro rec (voice), Cortana (voice).

### **Contributions**

Ciarán Cannon TD (interview), Allan Daly (interview), Sinead Fitzpatrick (interview), Paul Keane (interview), Sentdex (NLTK tutorials), 'Athenry for Apple' Facebook Group Page (public page moderated by Paul Keane).

## ***Fields of Athenry***

### **Financial and institutional support**

*Arts Council England*.

*Brighton Digital Festival*: Laurence Hill (director), Will Foster (technician).

*ASC Gallery*: Ana Rosa Ibanez Bulnes (curator), Josephine Legrand (curator).

*Birmingham Museum and Art Gallery / New Art West Midlands*: Craig Ashley (director), Indra Khanna (curator), Matt Lessimore (technician), Ryan Hughes (technician).

### **Contributions**

*Stampa Printing*, Lucy Dinnen (image editing).

YouTube user profiles (stadium footage uploads): Aidan Burns, Alan Tormey, ballycotton, breizh44eh, Brónagh Tumulty, Dan Kerins, David Pini, Declan Walsh, desserv, djsaoirse, euro2012adventure, FansOfFootballTV, foksiakk,

Fuechslein61, Gerard Fatrous, IRISHEURO2012, jamesr58, Jason Byrne, Keepitonthedeck, koza198666, Kris Kelvin, kylowawa12, Lynda Mc Donald, macailz21, madziarka66, micksul67, Misiata25, ncfc2609, Paul McClay, Phil Murphy, Przemek Hal, RiotFanTV, smythy25's channel, Soccerportal, stephenhealy, TED21212, Tickets Luxury, Today FM, Tomek Krueger.



## ***Appendix B: Research outputs***

Byrne, G. and Anderson, S. (2018) *Visibility Matrix*. [Multichannel audiovisual installation] film contribution by Parker, M. Dublin, IE: Douglas Hyde Gallery.

Parker, M. (2019) 'An Apple a Day: Listening to Data Centre Site Selection through a Sonospheric Investigation' In: *Culture Machine* 18 pp.1-15

Parker, M. (2018) *Art for the Environment*. [Field recording workshop] London, UK: The Nunnery Gallery.

Parker, M. (2018) *Electrostatic Borderlands*. [Stereo sound installation] London, UK: The Nunnery Gallery.

Parker, M. (2018) *Have you Listened to the Internet Today?*. [Keynote presentation] Dublin, IE: Science Gallery.

Parker, M. (2018) *Invisible Internet*. [Paper presentation] London, UK: Iklektic Art Lab.

Parker, M. and Allan, J.L. (2018) *Large Objects Moving Air*. [Co-Director for one day international conference and 2x artwork commissions] London, UK: London College of Communication, UAL.

Parker, M. (2018) *Memory Line*. [8x 4" CRT monitor screens, 1x 34U 19" rack cabinet on castors, 4x Raspberry Pi model B+, 4x loudspeakers, 8x channel power amp, 4x 2m piano wires, neodymium magnets, powder-coated steel frame with electrical wiring] Cambridge, UK: The Computer Laboratory, University of Cambridge.

Parker, M. (2018) *Memory Line*. [8x 4" CRT monitor screens, 1x 34U 19" rack cabinet on castors, 4x Raspberry Pi model B+, 4x loudspeakers, 8x channel power amp, 4x 2m piano wires, neodymium magnets, powder-coated steel frame with electrical wiring] Milton Keynes, UK: Milton Keynes Fringe Festival at MK Central Library.

- Parker, M. (2018) *Memory Line*. [Lecture] Cambridge, UK: The Computer Laboratory, University of Cambridge.
- Parker, M. (2018) *Memory Line: Live Coding Women in Computing*. [Workshop for 12-18 year olds] Cambridge, UK: The Computer Laboratory, University of Cambridge.
- Parker, M. (2018) *Sonospheric Investigations*. [Paper presentation] Sheffield, UK: Investigating infrastructure: Sheffield Hallam University Space and Place Group interdisciplinary conference.
- Parker, M. (2017) *Access and Documentation*. [Lecture] London, UK: London College of Communication, UAL.
- Parker, M. (2017) *CASHLA-220kW-SUBSTATION.mp3*. [Stereo sound] Venice, IT: Helicotrema. At: <http://helicotrema.blauerhase.com/crisap/> (Accessed on 15 May 2018).
- Parker, M. (2017) *Data Centers: Investigating Socio-Technological Assemblages of the Cloud*. [Paper presentation] Stockholm, SE: Stockholm University.
- Parker, M. (2017) *DERRYBRIEN-PEATBOG-WINDFARM-DPA-STR.mp3*. [Stereo sound] Venice, IT: Helicotrema. At: <http://helicotrema.blauerhase.com/crisap/> (Accessed on 15 May 2018).
- Parker, M. (2017) *Listening to the Internet*. [Guest Lecture for MA in Art and Research Collaboration] Dublin, IE: The LAB with Dún Laoghaire Institute of Art, Design and Technology.
- Parker, M. and Dooley, J. (2017) *#medianatures*. [Audiovisual installation, Internet connection, LED TV screen, cash box, thermal printer, Python script on Linux, Twitter API, soil owned by Apple Distribution International, 1x International Space Station] London, UK: TATA Digital Consultancy Services.
- Parker, M. (2017) *Palimpsest*. [Stereo sound with HD video and transducer bodypack] Rome, IT: British School at Rome.



Parker, M. (2017) *Peak Wood [FHD]*. [HD video with stereo sound] Rome, IT: British School at Rome.

Parker, M. (2017) *PIONEN\_VITABERGSPARKEN-VENT-MAIN-STR-4060.mp3*. [Stereo sound] Venice, IT: Helicotrema. At: <http://helicotrema.blauerhase.com/crisap/> (Accessed on 15 May 2018).

Parker, M. (2017) *Project Antioch: Geophony*. [Digital stereo audio loop, borosilicate glass measuring beaker, forest soil, and geophone] Dublin, IE: The LAB.

Parker, M. (2017) *Project Antioch: Machine Learning*. [Algorithmically produced digital stereo audio loop, 2x giclée print on hahnemühle photo rag] Dublin, IE: The LAB.

Parker, M. (2017) *Project Antioch: Geophony*. [Digital stereo audio loop, borosilicate glass measuring beaker, forest soil, and geophone] London, UK: Waterman's Arts Centre.

Parker, M. (2017) *Project Antioch: Machine Learning*. [Algorithmically produced digital stereo audio loop, 2x giclée print on hahnemühle photo rag] London, UK: Waterman's Arts Centre.

Parker, M. (2017) *'Socially Engaged Artists' and the Residency Model*. [Paper presentation] Croome, UK: Croome House, National Trust.

Parker, M. (2017) *Sound and the Environment*. [Paper presentation] Hull, UK: University of Hull.

Parker, M. (2017) *The People's Cloud (Original Soundtrack)*. [Audio Album (Digital)] London, UK; Athens, GR: Audiogamma.

*The People's Cloud SE01E01. What is the cloud vs what existed before?* (2017) Directed by Parker, M. [HD video with 5.1 surround sound] Audiogamma. At: <http://www.thepeoplescloud.org/documentary/episode-1/>

*The People's Cloud SE01E02. Working out the Internet: it's a volume game.* (2017) Directed by Parker, M. [HD video with 5.1 surround sound] Audiogamma. At: <http://www.thepeoplescloud.org/documentary/episode-2/>

*The People's Cloud SE01E03. The submarine cable network.* (2017) Directed by Parker, M. [HD video with 5.1 surround sound] Audiogamma. At: <http://www.thepeoplescloud.org/documentary/episode-3/>

*The People's Cloud SE01E04. How much data is there?* (2017) Directed by Parker, M. [HD video with 5.1 surround sound] Audiogamma. At: <http://www.thepeoplescloud.org/documentary/episode-4/>

*The People's Cloud SE01E05. Convergence.* (2017) Directed by Parker, M. [HD video with 5.1 surround sound] Audiogamma. At: <http://www.thepeoplescloud.org/documentary/episode-5/>

Parker, M. (2017) *The Sound of Memory: Sound-track / Sound-scape.* [Paper presentation] London, UK: Whitechapel Gallery.

Parker, M. (2017) *Thorney Bay Geophone Hydrophone Shipping Lane 031017 1243.mp3.* [Stereo sound] Venice, IT: Helicotrema. At: <http://helicotrema.blauerhase.com/crisap/> (Accessed on 15 May 2018).

Charles, E. (2016) *White Mountain.* [HD video with 5.1 surround sound]. Sound contribution by Parker, M. Karlsruhe, DE: ZKM

Parker, M. (2016) *Fields of Athenry.* [Audiovisual installation: 16x Apple iPod Touch 4th Generation (obsolete), 1x Apple iPhone 4 (obsolete), 1x Apple AirPort Extreme A1408 (obsolete), 4x large format news roll prints, 16x consumer fan videos (source: YouTube), 16x videos and sound recordings (source: Derrydonnell Forest, Athenry)] Brighton, UK: Brighton Digital Festival.

Parker, M. (2016) *Fields of Athenry*. [Audiovisual installation: 16x Apple iPod Touch 4th Generation (obsolete), 1x Apple iPhone 4 (obsolete), 1x Apple AirPort Extreme A1408 (obsolete), 4x large format news roll prints, 16x consumer fan videos (source: YouTube), 16x videos and sound recordings (source: Derrydonnell Forest, Athenry)] London, UK: ASC Gallery.

Parker, M. (2016) *Fields of Athenry*. [Audiovisual installation: 16x Apple iPod Touch 4th Generation (obsolete), 1x Apple iPhone 4 (obsolete), 1x Apple AirPort Extreme A1408 (obsolete), 4x large format news roll prints, 16x consumer fan videos (source: YouTube), 16x videos and sound recordings (source: Derrydonnell Forest, Athenry)] Birmingham, UK: Birmingham Museum and Art Gallery.

Parker, M. (2016) *Mechanical Calculators*. [HD video with stereo sound] London, UK: Photomediations Machine. At: <http://photomediationsmachine.net/2016/02/01/mechanical-calculators/> (Accessed on 15 May 2018).

Parker, M. (2016) *Open Fields: Vibrating the Web*. [Paper presentation] Riga, LV: RIXC Festival, The National Library of Latvia.

Parker, M. (2016) *Points of Listening: Listening to the Internet*. [Interactive presentation] London, UK: London College of Communication, UAL.

Parker, M. (2016) *What Does the Internet Sound Like?*. [Visiting practitioner guest lecture] London College of Communication, UAL.

Parker, M. (2015) *Sound Passages: Passaggi di Suono*. [Paper presentation] Venice, IT: Università Iuav di Venezia (IUAV).



## ***Appendix C: Media transition playback guide***

1. *Electrostatic Borderlands* (2018), audio (53min 33sec)

Please listen at a volume of your own choosing, using good quality loudspeakers or headphones. You may like to listen whilst doing another activity or you may wish to intently listen without distraction. Listen once, listen more than once. Does the electrostatic interference disturb you? Do you find yourself glancing at your phone? What other signals might be circling around you that you are not able to register?

2. *Palimpsest* (2017), film (06min 57sec)

Set your room with minimal lighting and use a good set of headphones with a HD screen. If available, use a full range soundsystem with subwoofer or a Subpac M2 of equivalent transducer bodypack and HD Projector. The work was initially shown at the BSR in a dark room with a 55" HD screen surrounded by balloons, with good quality headphones and a Subpac M2.

3. *The People's Cloud* (2017)

- 3a. *What is the cloud vs what existed before?* (2017), film (09min 05sec)

- 3b. *Working out the Internet: it's a volume game* (2017), film (09min 29sec)

- 3c. *The submarine cable network* (2017), film (12min 40sec)

- 3d. *How much data is there?* (2017), film (07min 05sec)

- 3e. *Convergence* (2017), film (07min 05sec)

Each video is Full HD with stereo sound. I recommend listening with good quality headphones or loudspeakers. As this work has been formally released online via the Vimeo video streaming service, it is possible that viewers will only watch it with laptop speakers, earbuds, or at a compressed quality on a smartphone screen. I recommend that the reader aims for the maximum quality experience possible. Each episode is between seven to

twelve minutes in duration. You do not have to watch all five episodes back-to-back. Take a break in between if you like but do watch them in the episodic sequence.

4. *The People's Cloud (Original Soundtrack)* (2016), audio album (50min 03sec)

Please listen with good quality headphones or stereo loudspeakers.

5. *White Mountain* (2016), dir. Emma Charles, film (20min 56sec) \*

Please use good quality closed-back headphones and a full-HD screen as minimum playback specification. Use of a projection screen and full range loudspeakers including subwoofer is recommended for optimum playback due to the film's low frequency sonic content. At a number of screenings I have attended for the film, I have observed how the low frequency content can be an intense experience for some audience members. The low frequency balance is a decision made within the sound editing and mixing process for the film to generate an intensity that best conveys the slow, deep, vibrational force of the subterranean, the air-pressure differential, and claustrophobia that we as a film crew experienced on site at Pionen. This isn't a health warning but rather an invitation to allow yourself to be immersed in the multimedia playback environment you create.

N.B. This work is not available due to copyright ownership.

6. *Memory Line* (2018)

- 6a. *Memory Line [installation edition]* (2018), installation documentation (04min 00sec)

- 6b. *Memory Line [four channel edition]* (2018), single channel reduction, film (27min 02sec)

For both of these items, please use a Full HD screen and good quality closed back headphones for playback.

7. *Fields of Athenry* (2016), installation documentation (04min 49sec)

Please use a Full HD screen and good quality closed back headphones for playback of this media.

8. *Project Antioch* (2017)

- 8a. *Geophony* (2017), audio (04min 00sec)

The recording is a stereo sound file containing low frequency material. Use the best quality headphones or loudspeakers that you have available. If you are in possession of a subwoofer, haptic low frequency body transducer, or vibroacoustic device, please also use this. After you have listened enough times to feel satisfied in your experience, feel free to either stop listening to the recording or optionally, turn the recording down to a background volume, set your player to loop the file and continue reading with the recording gently throbbing.

- 8b. *Machine Learning* (2017), audio (23min 42sec)

This stereo excerpt of the sound work will best be experienced using stereo loudspeakers. This work is composed with a looping structure. You are free to skip to any point in the file before commencing playback. Volume should be at a conversational level.

Playback media files *8a* and *8b* together across two different speaker systems if possible. Doing so will allow you to place these two pieces in conversation: the geological vibration in conversation with anthropogenic flow of *Geophony*; and the operatic libretto between human and machine in *Machine Learning*.