

Data Ecologies: Relational Strategies for Communicating Complexity in Media Artworks

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Data Ecologies

Relational Strategies for Communicating Complexity in Media Artworks

Sarah Janet Waterson

A thesis in fulfilment of the requirements for the
degree of Doctor of Philosophy

School of Art & Design
Faculty of Arts, Design and Architecture
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Thesis/Dissertation Sheet

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Abstract 350 words maximum: (PLEASE TYPE)

This thesis argues that in order to understand contemporary media artworks that use and address data, we need to develop what I term a 'relational understanding' of data. This can be achieved by challenging common assumptions of data as somehow being 'pure', 'raw', or taken as a given.

For this thesis, data is not considered as a pre-existing instantiated object (as is the case in object-oriented programming for instance). Instead, I consider the complex and relational nature of data—both as it emerges from human systems, and as it produces those systems. Through a creative-practice-as-research approach, this thesis moves beyond the idea that there is such a thing as “raw” data, and advances the novel idea of “data as ecology”. This thesis articulates the complex network of relations that make, shape and create media artworks. At its core, this involves exploring the materiality of data. In order to better understand this, I analyse the processes that bring data into existence, and conduct an investigation into the more precise nature of the interconnections that the world of data both creates and puts into action.

In this thesis, ecologies of both practice and media are explored in order to propose a working model of “data ecologies”. This is established by means of a number of original interactive, reactive, and generative new-media works that have been made and exhibited during the course of this investigation. I consider this original creative practice within the broader field of investigation and against the backdrop of a wider body of creative works that have been made by artists over the past decade.

To advance this analysis of how data ecologies perform across these clearly delineated fields, I review and asses a number of key media artworks (including my own original creative practice components made during the course of this research, specifically, Laika's Dérive and Hothouse).

The data ecologies that this thesis outlines and analyses enable a new productive approach for media art practices to attend to the processual quality of data in a novel ecological framework that can be used to communicate complex poetic knowledge systems.

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Viewing Documentary Material

The practice component of this thesis, the *Laika's Dérive* series and *Hothouse*, may be found on the following website:

<https://documentation.sarahwaterson.net/>

This website documents the projects and includes development material.

Appendix A of this text document contains a narrative as well as images of the projects.

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Abstract

Data Ecologies: Relational Strategies for Communicating Complexity in Media
Artworks

This thesis argues that in order to understand contemporary media artworks that use and address data, we need to develop what I term a ‘relational understanding’ of data. This can be achieved by challenging common assumptions of data as somehow being ‘pure’, ‘raw’, or taken as a given.

For this thesis, data is not considered as a pre-existing instantiated object (as is the case in object-oriented programming for instance). Instead, I consider the complex and relational nature of data—both as it emerges from human systems, and as it produces those systems. Through a creative-practice-as-research approach, this thesis moves beyond the idea that there is such a thing as “raw” data, and advances the novel idea of “data as ecology”.

This thesis articulates the complex network of relations that make, shape and create media artworks. At its core, this involves exploring the materiality of data. In order to better understand this, I analyse the processes that bring data into existence, and conduct an investigation into the more precise nature of the interconnections that the world of data both creates and puts into action.

In this thesis, ecologies of both practice and media are explored in order to propose a working model of “data ecologies”. This is established by means of a number of original interactive, reactive, and generative new-media works that have been made and exhibited during the course of this investigation. I consider this original creative practice within the broader field of investigation and against the backdrop of a wider body of creative works that have been made by artists over the past decade.

To advance this analysis of how data ecologies perform across these clearly delineated fields, I review and assess a number of key media artworks (including my own original creative practice components made during the course of this research, specifically, *Laika's Dérive* and *Hothouse*).

The data ecologies that this thesis outlines and analyses enable a new productive approach for media art practices to attend to the processual quality of data in a novel ecological framework that can be used to communicate complex poetic knowledge systems.

CHAPTER

01

Introduction

1.1 Background

Data matters and has matter. The give and take of data is increasingly significant for life on earth. It permeates all aspects of human and non-human contemporary life, from governmental policy to individual subjectivity and everything in between. Data is used to reshape how knowledge is produced, business conducted, and governance enacted. This use raises many questions concerning surveillance, privacy, security, profiling, social sorting, and intellectual property rights. As data becomes an increasing force in contemporary life, more attention needs to be paid on how the forms of data itself and how it is conceptually framed.

This dissertation seeks to understand and contribute to how data functions within the media artworks produced during the course of this doctorate, and asks how media artwork practices can contribute to our understanding of data more generally.

Apart from the impacts of data, it is vital to understand that data embodies values. Although data often refers to measurements, observations, images and other raw materials, it is more than an “objective” measurement and more than raw material. Data is both “an abstraction and a mediation of actual phenomena” (Diamond, 2010, p. 9). Data, like knowledge, is “situated, partial, and constitutive” (Drucker & Studies, 2011, p. 2). The measurement itself carries its own meaning, particularly as a stand-in for the thing – the instance in time – that it is measuring. Despite this intrinsic signification, within the field of data visualisation generally, data traditionally is seen to have no meaning in and of itself and, in order for it to have meaning and become information, it must be interpreted and presented. This thesis contributes to how we view data in media artworks by attending to its qualitative components from the practices that developed the data, and the assemblages that are made from it. In examining data through this context, data can then be thought of as being entirely about relations, and not about information *per se*. By information here I mean information that is generally thought of as processed, organised and structured data. This thesis

presents the view that data is information already, particularly as it embodies relations and practices. In considering this, the concept of data ecologies is furthered, which includes the processes and methods of the data production and reception as an integral part of the work. The practices surrounding the data in the works examined and produced for this thesis attend to the qualitative components of data, including a recognition of provenance. This introduces a dynamism inherent in any ecological thinking that requires examining an evolving or changing set of relations within those processes and methods.

The term ‘ecology’ has vast political dimensions that impact the ways in which we are able to conceptualise data and media art practice. In this era of the Anthropocene, and within the looming threat and current effects of our ongoing environmental crisis, there is an urgency for art (in this case, media art specifically) to attend to these issues. While the term ‘ecology’ is itself broad and at times highly contested, the socio-technical practices inherent in media art tend to emphasise the social, political and economic forces that remain centre stage to media art practices. As theorist Sean Cubitt states, “[e]cologies are not networks connecting previously separate things: Every element of an ecology mediates every other.” He further states, “[t]he flow of mediation precedes all separations, all distinctions, all thingliness, objects and objectivity. It precedes the separation of the human and the environmental”(Cubitt, 2017, p. 4).

In other words, everything is relational, and as we will see, data in context mediates experience and is mediated experience even prior to the presentation or visualisation stage.

Throughout this practice-led thesis, both ecology and data are viewed as entangled in both processes and practices. In order to understand these relational processes, the practice-based works presented as part of this research can be thought of as designed experiences that ask participants to also consider their place within the encounter, and the broader assemblage of the work.

As Lev Manovich reminds us, in *The Language of New Media*, the era of post-media aesthetics, requires an examination of the strategies by which new media (i.e. cultural objects) organise data and structures the user's experience of that data (Manovich, 2001, p.5). The affordances of contemporary data presentation allow for the reading of complex relational works, which, within this thesis, are classified as data ecologies. These data ecologies are located in current debates and discourse about mapping, data mapping and representation (from both the fields of visualisation and software studies) and intersect with concepts about the representation of space/place in new media contexts. From this perspective data ecologies can be seen as an art of networks, and of territories that can be rendered as a mapping of temporal flows and relationships – relationships that remain both fluid and dynamic within a work. De Landa's (2013) perspective

on the concept of the assemblage including its material role, expressive role, territorialisation and deterritorialisation aids as a starting point for locating the conceptual practice of using data as streams and as an ecology. These flows allow for more complex readings and presentations than traditional data visualisation.

Theorist Ned Rossiter's early articulation of processual media has also influenced the approach to unpacking data with the media artworks in this written exegesis. Processual media recognises that "process is something ongoing in nature, an emergent quality whose expression is shaped by the contingencies and field of forces of any particular situation" (Rossiter, 2003, p. 104). Data in this context can also be thought of as deeply processual when used within media artworks. This idea is taken up in Chapters 3 and 4, where the data within the works described is not fixed, but rather can be read according to both its relation and context, or as Haraway (1988) puts it, its "situatedness".

Matthew Fuller's take on materialism has also made a significant contribution as to how an ecology may be framed around data in this practice-based thesis. His view that everything is relational extends how we might think about media art practices, and how data may be viewed:

[J]ust as powers are inherent in all matter, materialism also requires that the capacities of activity, thought, sensation, and affect possible to each composition whether organic or not are shaped by what it is, what it connects to, and the dimensions of relationality around it. (2005, p. 174)

In applying Fuller's framework when looking at the practice components, we can see the ecologies of that practice extending beyond the physical material of the works, into an entanglement of processes that include both reception and participation.

1.2 Research methodology

Just as theory should be seen as situated practice, we can also consider practice as theory. As media archaeologist Jussi Parikka puts it:

Practices are in themselves theoretical excavations into the world of 'things', objects of (cultural) research conducted in a manner that makes the two inseparable. Practices probe, investigate, track, interrupt, intervene and question. Practices point towards the primacy of the experiment as a formation inseparable from theory. Practices are theories in the very dynamic mode that makes 'theories' work. (2011, p. 34)

In this thesis the practice has been developed to treat data as relational, and as having an ecological context and frame. The written components of this thesis have been woven in to contextualise that work, and to inform the practices presented.

Donna Haraway extends how we might think about the practice and theory relationship when she writes, "[b]oundaries are drawn by mapping practices; 'objects' do not pre-exist as such. Objects are boundary projects" (1988, p.595). This is to say, what we know about practice from a theoretical perspective and

how we know about it from a practitioner point of view, cannot be separated into non-communicating spheres. As Karen Barad also reminds us, “phenomena are the embodiment of cultural practices within theory” (Barad, 1996, p. 183). The written component of this thesis supports the reading of the practice-based components and *vice versa*.

In *Art practice as research: Inquiry in the visual arts*, Sullivan (2005)

outlines a method of art practice as research as “visual arts knowing”. This model accounts for the action research and experience design approaches that I have adopted in this thesis by identifying the ideas, forms, and situations (contexts) that

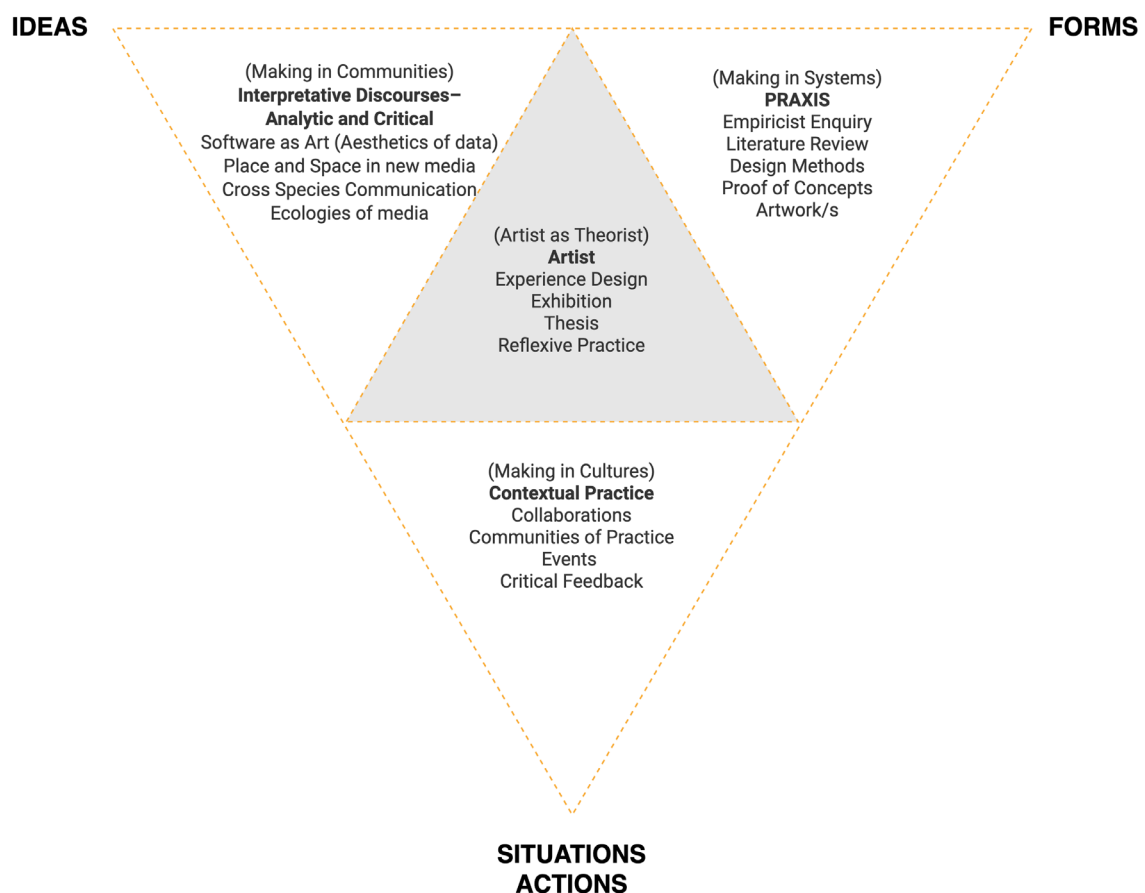


Figure 1: Diagram of practice approach. Adapted from Sullivan's (2005) *Framework of Visual Arts Practice* (p 153).

contribute to the practice as research. Discourse, practice, inquiry and critique are key components of this model.

In outlining an approach for this practice-led project, the following diagram (Figure 1) describes how the key domains of discourse, practice and critical enquiry inform my practice as research. Each of the four domains described in the diagram also involve iterative processes in which the various enquiries are re-integrated within each of the artworks and their associated written

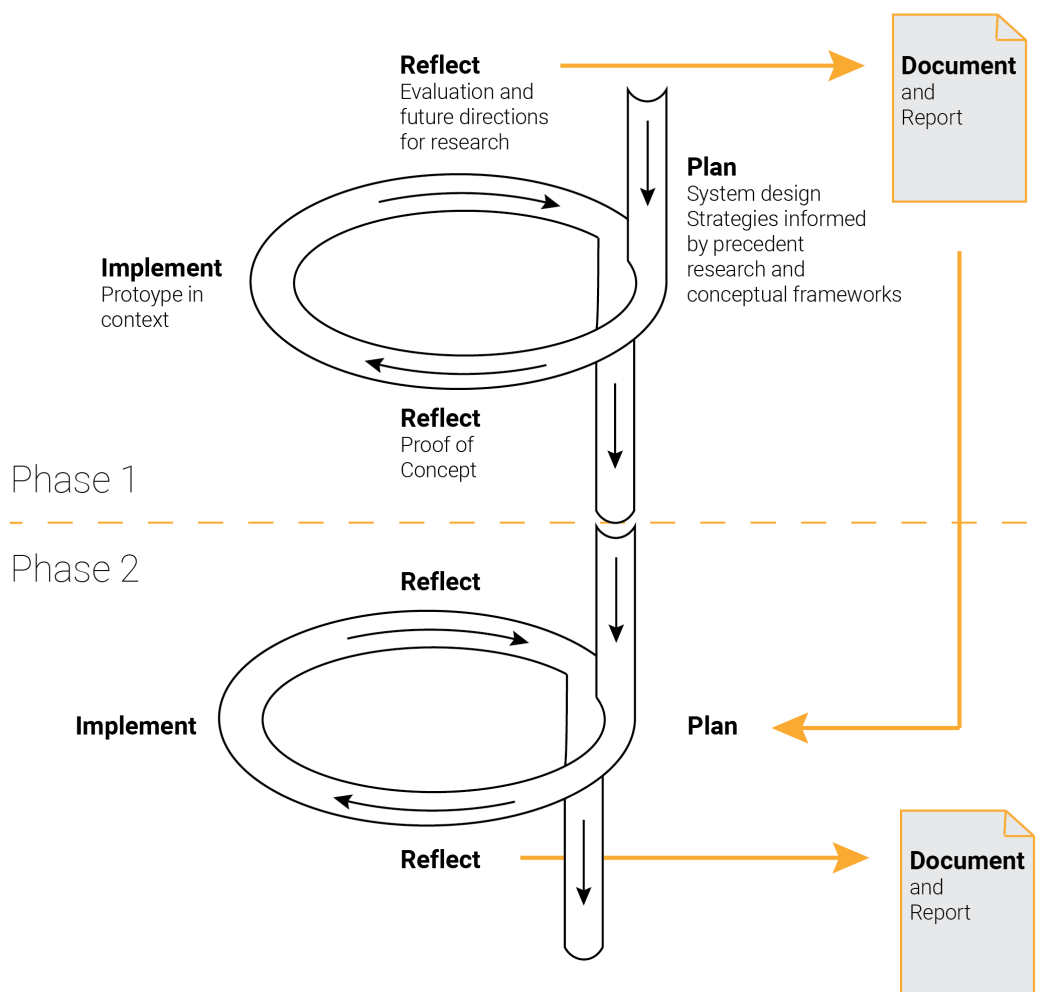


Figure 2: Methodology for reflective practice

components. This model describes how the domains can be articulated in order to make sense of the ongoing dialogue between, within, and around the practitioner, the artworks, viewers, and settings, where each is used to help create new understandings for practice.

A reflective practice approach (action research model) is being applied in the practice, and the following diagram (Figure 2) illustrates this approach in a simpler form. I have included it here to demonstrate the relationship between the paper and practice components of this research. The key elements are cyclic acting and reflecting before acting again in a continuing response to learning outcomes from reflection. The academic research leads the practice, and the practice leads the academic writing and research in an iterative process. The practice is structured as a method for collecting data systematically and as a means to allow structured reflection upon practice. Appendix A: Documentation section as part of the written component extends these relationships outside of the chapter sections in this thesis.

The key steps during the development of my practice works, *Laika's Dérive* and *Hothouse*, were cyclic: acting and reflecting, before acting again in a continuing response to the outcomes from reflection. The academic research, including the literature review and contextual research, informs the practice, and

the practice leads the academic writing and research in an iterative process. This is reflected in Chapter 4 of this thesis.

The broad aims of the research, both theoretical and practice based are to:

- investigate how data operates as an ecology
- present the novel concept of data ecologies as a representational strategy for communicating complexity, and as a method for knowledge-making relevant to a data saturated world
- develop practice that addresses data within the broad concept of data ecologies.

1.3 Theoretical frameworks and thesis structure

As this is a practice-led PhD, the literature review was led by the practice where possible. The key areas relative to the field of research in the practice fall into five key areas:

- mapping: data-mapping and representation (Visualisation/Software Studies), space/place in new media contexts
- data visualisation
- media ecologies
- ecologies, including interspecies communication
- technical practice/s – including data acquisition, processing, visualisation, app development, web development, horticultural practices and electronic circuit design.

The following diagram shows a field mapping for the practice research:

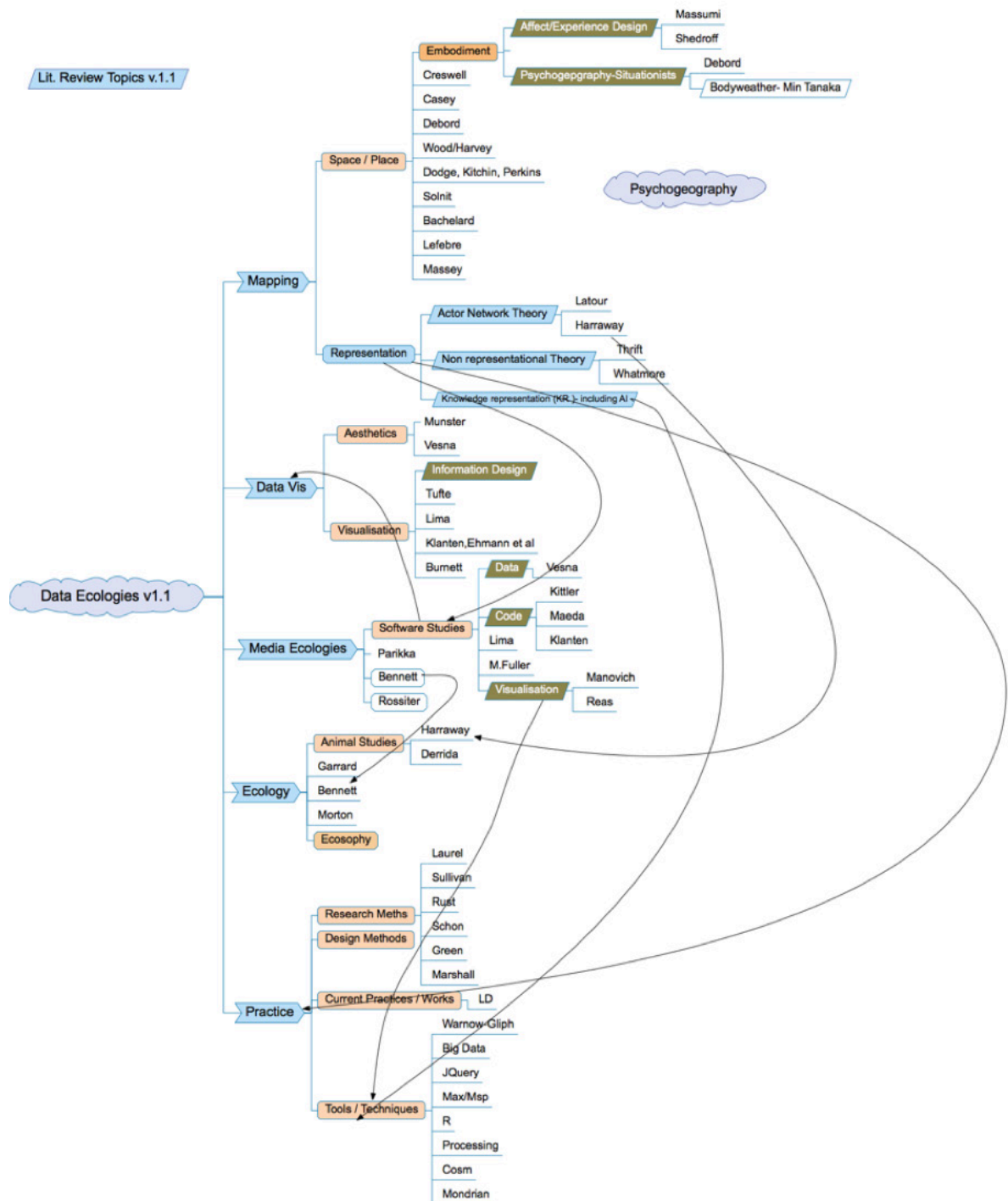


Figure 3: Area Mapping of literature review for practice components.

The written component of this thesis is structured in the following way. In Chapter 2: Conceptual Frameworks (the field) I outline key historically specific ways in which the term ecology has been framed, and situate this broad historical context in relation to the changing definition and role of data, particularly as it applies to the field of media art works. I also unpack some of the complexities associated with the various types of ecologies and set up how contemporary media practices are being driven by an engagement with a variety of generative systems and media assemblages that can best be understood within this overall framework. Chapter 2 works through some of the fundamental concepts and terminology associated with these systems and assemblages, in order to define how data forms ecologies more generally. This chapter acts to frame the key themes emerging from the practice research and projects.

In Chapter 3: Context & Precedents, I provide a review of data artworks that address key themes from Chapter 2. These media artworks perform a range of representational strategies and are selected as examples within four broad groupings:

- as locative media;
- as data mapping;
- as data networks/generative systems;
- as data networks/scalar assemblages.

Chapter 4: The Original Creative Artworks, outlines what my creative practice as research shows in relation to the field, including my original contribution to knowledge. The chapter advances how representational strategy performs across the delineated fields outlined in Chapters 2 and 3, notably ecology, media ecology and how we can frame data within those areas. This chapter describes two of the original creative practice components made during the course of this research – the locative media work, *Laika's Dérive* (Waterson, 2011) and the installation work *Hothouse* (Waterson, 2017). This chapter presents both of these works as performing parallel histories through the data trajectory and data ecology in order to demonstrate how a representational strategy can be used as a method for knowledge-making relevant to a data saturated world.

The key understandings emerging from the research and consequent implications for practice are outlined in Chapter 5: Conclusion.

In Appendix A: Documentation of Artworks, the original works are documented, including some of the development sketches, coding and other technical details, alongside installation and project photography. This section also contains a narrative about the development methodology.

1.4 Personal Motivations

The research project presented here is an extension of my early data mapping artworks, including *SubscapeBALTIC* (Waterson and Richards, 2004) exhibited at ISEA (International Symposium of Electronic Art), and *subscapePROOF* (Waterson and Richards, 2006) commissioned by the Australian Centre for the Moving Image for the exhibition “Proof – the act of seeing with one’s own eyes”, in Melbourne.

For *sub_scapeBALTIC*, exhibited on a Helsinki-Tallinn passenger ship as part of ISEA 2004, data sets from the Baltic Sea (bathymetry transects of the ship’s course obtained via live sonar, pollutants found in grey seals and fish, historical and contemporary fish finds, etc) were transcoded and mapped in real



Figure 4: *sub_scapeBALTIC* v1.0 Installation view, ISEA 2004. Photo: Sarah Waterson. CC-BY 4.0

time onto audio and video data modules of Australian Simpson desert, both pristine and polluted. The key idea for this work was that the data and system design generate meaning and produce an otherworld mapped by the data. This approach is fundamental to the development of both *Laika's Dérive* and *Hothouse* presented in this thesis.

The approach to data mapping was developed further for the *subscapePROOF* work where literary texts, annual reports, and confessional television streams were all treated as material to generate meaning. Both of these projects used data as a central concern and were both designed as machines and systems for making sense. The projects were playful and ironic critiques on the traditional politics and power dynamics of knowledge-through-mapping. Data

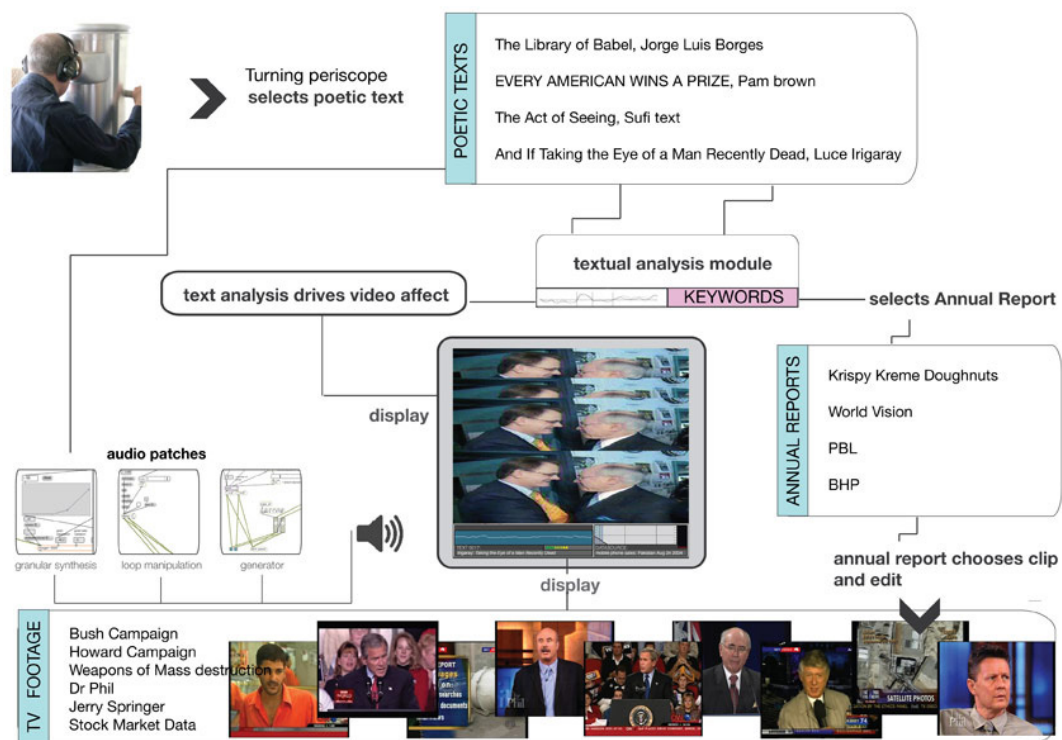


Figure 5: *subscapePROOF* system diagram, 2005. Waterson.

sets including: “secular confessional” TV (such as Dr Phil); advertisements; TV reportage; geographical data; and historical weather data covering the Southern Oscillation index amongst others. These sets were designed to flow together to produce an audio-visual stream for the audiences. Firmly situated within cybernetics approaches, the works were designed as alternatives to conventional data visualisations at that time. They were designed to have the capacity for pattern formation, recursive effect, unexpected behaviours, and densities, all emerging from simple algorithms applied to and extracted from the data streams.

In developing and producing these works, it was obvious to me that the works were just as much about the techniques and systems design as the content, as they were about the resulting installation and audience experiences. From this work I became focussed on developing data techniques to interrogate, celebrate and account for more speculative ideas about what data is and what data can do. The data mapping used for these projects told its own a story about value, scale, and the politics of data selection as central to media arts practices. Through the curation of datasets each work generated a new ecology of meaning, particularly through the system and mapping design. The works presented in this thesis continue these ideas, and further them through developing techniques for data production and collection as part of the practice.

The following chapter provides an overview of the key conceptual frameworks in order to delineate the scope of my investigation, and to provide a framework for developing the concept of data ecologies more fully.

CHAPTER

02

Conceptual Frameworks

The ecological is arguably the most urgent and hotly contested areas of our current era. When speaking about ecology, we are often speaking about very different ideas, frameworks and concepts. These framings of what ecology is, and can be seen to be, have far reaching consequences on how we might view data, and media art practices specifically. The political dimension of those practices varies considerably depending on how we view both environment and ecology. The socio-technical practices inherent in media art can be seen to emphasise the social, political and economic forces of those practice ecologies. For this reason, it is vital to track how ecology is used, and how media ecologies have been framed according to how we view ecology more broadly and our place as humans within it.

In this chapter, I will outline a number of key historically-specific ways in which the term ecology has been framed, and situate this broad historical context in relation to the changing definition and role of data, particularly as it applies to the field of media art works. I will also unpack some of the complexities associated with the various types of ecologies outlined in this section, and will show how contemporary media practices are being driven by an engagement with a variety of generative systems and media assemblages that can best be understood within the overall framework. This chapter will work through some of the fundamental concepts and terminology associated with these systems and assemblages in order to define how data forms ecologies more generally.

2.0 Media ecologies

2.0.1 Ecology: A thousand ecologies – Haeckel and the practitioner

Over the past 300 years, we have seen a wide proliferation of ways in which the notion of ecologies can be applied (from the natural environment, to the social, from behaviour, to the fields of information and media). This expansion of territory beyond its original domain has given the term ecology a broad range of meanings as well as contexts of use. This means that ecologies are not always expressed in the same way, and their utility in communicating a set of relations is not always even, or indeed interchangeable between contexts. The term, ecology, has become pervasive in many disciplines. As we shall shortly see, ecologies run

rampant everywhere. Ecology can be used in multiple ways and contexts, from a disciplinary descriptor in the biological sciences, to the transfer of matter within networks in a media artwork. In this sense, there are “a thousand ecologies” (Hörl, 2013). Some of these ecologies include “ecologies of sensation, perception, cognition, desire, attention, power, values, information, participation, media, the mind, relations, practices, behaviour, belonging, the social, the political” (Hörl, 2017, p. 1).

Notably, the term ecology was first coined by German scientist and botanic artist Ernst Haeckel in 1886. He writes: “By ecology we mean the entire science of organismal relationships with the surrounding environment, including in the broadest sense, all the conditions of existence” (in Golley, 2005, p. 148). For Haeckel the organism was at the centre of any relationship, which in terms of his practice as an illustrator and position as a marine biologist is understandable (his focus was on individual organisms, which he studied and illustrated one species at a time). This centring of the organism generates a hierarchy through both classification, and the research process itself. In Haeckel’s hierarchical framework, the term ecology is used to speak about individual creatures/organisms (and ultimately evolution) in a stratified visual framework (a genealogical “tree of life”) that serves as an illustration of their “natural” environment. In this sense, Haeckel’s definition of ecology relates to the organic world in a very situated way; his tree orders nature according to how complex he views an organism – from the

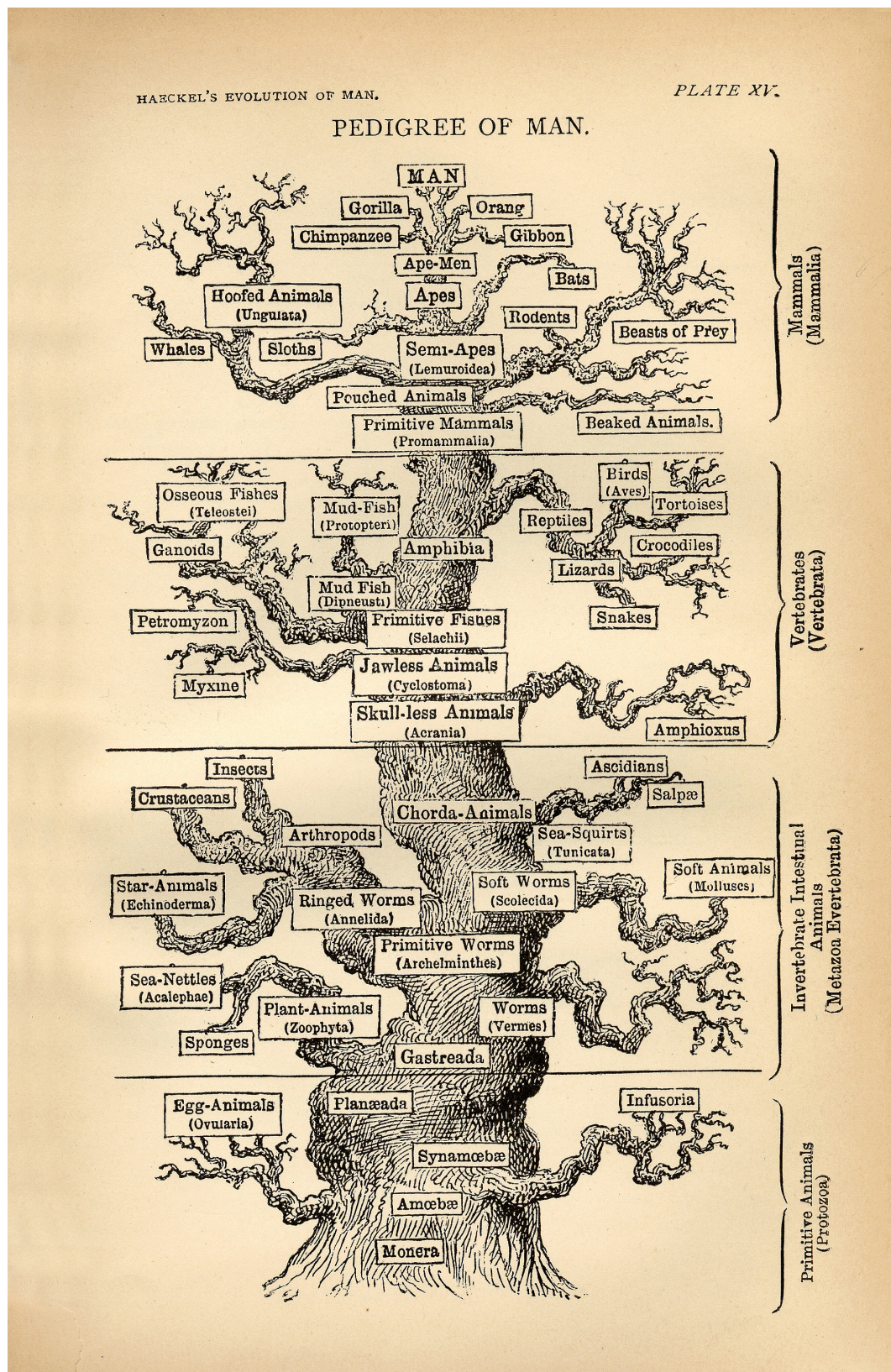


Figure 6: Tree of Life by Haeckel in the *The Evolution of Man* (Published 1879). Uploaded from <http://www.scienceinschool.org/repository/images/issue2tre>. Public Domain

simple (biologically) to the complex. The metaphor of the tree as an explanation of ecological relations permeates a lot of current practices. This thinking will be challenged shortly in the Media Ecologies sub-section below where vibrant matter of all kinds (organic or inorganic) can be seen to be central to a non-hierarchical ecology, or what Rosi Braidotti and Simone Bignall refer to as “dynamic ecologies of reciprocal determination and influence” (Braidotti & Bignall, 2019, p. 5).

Etymologically speaking, the word ecology comes from the Greek *oikos* — meaning house, household or dwelling place – and *logy* meaning *logos* or knowledge. Hence ecology is literally the study of the household. It is the study of the interconnections, and relationships within the household, and importantly, not just the “things in themselves”. Ecology not only pertains to the environment, it is about relationships of all kinds. It is about organic and inorganic things, and it is about the forces of change that are created through the inter-relationships that exist between all things. Ecology thus recognises and joins together relationships of all kinds. In creating forces of change, it is important to note the significance of this understanding when framing how data ecologies might operate within media art projects.

In the context of media art practice, changes in ecological systems are brought about not only at the level of data presentation, but via sets of relations and practices that produce and enact the work. This particular framing of ecology

is also enacted in many of the historical descriptions that apply to the mobilisation of the term within “media ecologies”. In the same way that “natural” ecologies work, these technical ecologies seek to connect the technical within the broader socio-technical networks that underpin social organisations and media systems. The term technical is used here in a broad sense: data, databases, algorithms and technical structures. The socio-technical refers to the interrelatedness of the social and technical aspects of these as a whole.

2.0.2 Media Ecology: early responses to mass media complexity

Media ecology is the Toronto School, and the New York School. It is technological determinism, hard and soft, and technological evolution. It is media logic, medium theory, mediology. (Lance Strate, 1999)

The term “media ecology” has been in use since 1968 (Livingstone, 2004, p. 18) by theorists such as Marshall McLuhan and Neil Postman, for whom the term refers to an interdisciplinary field of media theory and media design. The definition becomes increasingly nuanced over time. For instance, the North American Media Ecology Association’s website tracks an early genealogy of evolving definitions, beginning in the 1970s with Canadian systems theory scholar Christine Nystrom who described media ecology as “the study of complex communication systems as environments”. For media theorists, ecology encompasses the medium itself, the societal environment and the effects of the medium. Again, according to the Media Ecology Association (M.E.A), Neil Postman used the term *media ecology* in an effort to articulate how humans

interact and are affected by mass media. Postman acknowledges the implied environmental framing, explaining that “the word ecology implies the study of environments: their structure, content, and impact on people. Media ecology is the study of media as environments.” (Media Ecology Association, para. 8).

The framing of media as environment is significant here as it moves us away from the concept of media as content and transmission only, and allows for the effects of media to be included alongside the content critique. The effect on the audience in this framing is now part of the media environment, which is an implicit motivation for contemporary media art practices. Despite the utility in seeing media as environment, this version of media ecology doesn’t go far enough in thinking through the relationship of cause and effect. Contemporary media theorists, as will be discussed later, see media ecology as already relational, and not just relations that are ‘caused’ by the various subjects and objects doing the relating.

McLuhan’s famous phrase, “the medium is the message” (Levine & McLuhan, 1964) contributed to an understanding of mass media that included the impact of the technology itself, and is in itself an excellent example of media ecological thinking in action. This was in contrast to what McLuhan described as “our conventional response to all media, namely that it is how it is used that counts” (McLuhan, 1994, p. 8). At the core of McLuhan’s theory is the idea

that media act as extensions of ourselves. He writes that “...all technologies are extensions of our physical and nervous systems to increase power and speed” and that “any extension, whether of skin, hand, or foot, affects the whole psychic and social complex.” (Levine & McLuhan, 1994, p. 4). As North American theorist David Bobbitt puts it:

[For McLuhan] the wheel extends our feet, the phone extends our voice, television extends our eyes and ears, the computer extends our brain, and electronic media, in general, extends our central nervous system, and these extensions have consequences (Bobbitt, 2011, p. 2)

While McLuhan and others advanced an ecological framework for media, their framework essentialises technology, and withholds any agency for viewers to disrupt or challenge media. Agency here is defined as the capacity for human beings to act (powers of action) as distinct from the causal or deterministic system inferred by McLuhan. To revisit the ecology in media ecology for McLuhan, the implication is that the system is a set of relations that plays out. In a response to McLuhan, Raymond Williams argues that:

The technical abstractions in their unnoticed projections into the social world, have the effect of cancelling all attention to existing and developing (and already challenged) social institutions. If the effect of the medium is the same, whoever controls or uses it then we can forget ordinary political and cultural argument and let the technology run itself. (Williams, 2003, p. 131)

New Zealand academic Sy Taffel states that Williams

is concerned with understanding the power relations which are implicit within forms of mediation, and how these power relations promote

particular forms of social relationship which in turn support dominant ideological formations within society. (Williams, cited in Taffel, 2014, para. 4)

So, for Williams the ways in which media are used are important, particularly as new technologies could offer momentary opportunities outside of the sway of transnational corporations for new forms of self and political expression. In terms of media ecology, Williams is articulating an approach where people and technological systems can influence each other in multiple ways. The emphasis here is on each other. While Williams' work was mostly understood as a contribution to cultural and political understandings of the way media systems work in 20th century industrialised countries, his emphasis on the relationship between people as active agents and technological systems as embedded material objects and infrastructure helps point the way toward a more complex understanding of the term "environment". This is useful in starting to articulate a more nuanced understanding of how ecology can operate as a metaphor for media, beyond the limitations of a media environment, as well as contributing a useful way of understanding the media as an environmental system. It is not only that media (or mass media) operates "within or as" an environment, the ecological metaphor also provides more room to acknowledge the range and the qualities of inputs including the non-human, agency, co-creation and interrelationships.

Media theorist Michael Goddard also critiques the use of an environmental model in North American media ecologies, insisting that an environmental conception is different from a truly ecological metaphor.

[The] ecological as opposed to environmental conception of media ecologies (and the plural is also essential here) is necessarily activist, intervening in established knowledges about media systems and tracking the radical dynamisms that constitute them, however stable they might appear to be. (Goddard, 2011, p. 8)

Such activism has a power to disturb, disrupt and to distract the otherwise cold logic of technology which views media as content and transmission only. This power to disturb taps into a different logic that avoids the essentialism of McLuhan's approaches to the media.

The term environment as it is used within the North American media ecology framework (McLuhan, Postman and others) also suggests something outside of human systems – as if there were a natural exterior in which humans did not participate. This anthropocentric orientation will be examined more fully in the next section, where I will reframe the “organic, cultural, technical and political” (Barker 2015, p. 55) environments as set of interrelated dynamic assemblages constituted and dispersed by both human and non-human actors (who quite literally have the powers to act).

In sum, we can see that early concepts of media ecologies as advanced by the North American model introduced a wider perspective for understanding

what media are and what media do. The situating of media practices within a wider social and technological environmental context and framing media as an environment, enables a richer and more complex thinking about media than the concept of media as content and transmission only. By acknowledging the effects of media on audiences, this conceptual framing provides a particular ecological model, although it is still not sufficiently able to articulate and account for the complexities of co-creation, activist interventions, the non-human and other inputs and processes that contemporary practitioners engage with. It also overlooks the design and affordances of the technology itself. This version of media ecology is ultimately problematic in that it sees ecology as environment, with the human at the centre, and nature outside.

It is valuable at this point to articulate how recent scholars have built upon the media ecology concept, and to trace some of the lineage of the field. In the next section, Media Ecologies, I will outline some of the key concepts that will help develop a more dynamic and complex framing for understanding media in our contemporary networked media landscape (which is increasingly defined as data-driven).

2.0.3 Media Ecologies version 2.0 — processes and objects, beings and things, patterns and matter

The North American model of media ecology has recently been reconceived, and reframed in vastly expanded ways by British media theorist

Matthew Fuller (2005) and European philosopher and cultural theorist Erich Hörl (2013), who amongst others, move far beyond the anthropocentric framing of media ecology to instead think “ecologically about the ‘powers of action’ dispersed via organic, cultural, technical and political systems” (Barker, 2015, p. 55). Here the “power of action”, and agency, operates as the central idea for articulating the systems within which media can be explored. This is significant, as it reframes the way in which media ecologies operate. They are no longer constrained by an anthropocentric conception of information (i.e. as environment that also conceives of nature as other). The organic, cultural, technical and political environments here are reframed as set of interrelated dynamic assemblages constituted and dispersed by the powers of action. Within this model, media is seen as complex and dynamic, and involves the study of the connections between both processes and actors in those systems.

2.0.4 Ecosophy: thinking matters

According to Goddard, media ecologies are not an extension of the North American’s media ecology, but rather an application of “eco-philosophical or ‘ecosophical’ thinking to the field of media studies” (2015, np). This lineage of media ecologies is important to explore here, as it signals a departure from the North American media ecology, and allows for the interrelationship of various ecologies and frames.

In *The Three Ecologies*, Felix Guattari uses the term “ecosophy” to describe the interconnected ecologies of the environmental, the social and the mental (Genosko, 1996, p. 264). As others have noted, this concept of the three interacting and interdependent ecologies of mind, society, and environment was also articulated by anthropologist and cyberneticist Gregory Bateson in *Steps to an Ecology of Mind* in 1972. For Guattari the interconnection between these ecologies is important to recognise as he puts it, “[w]ithout modifications to the social and material environment, there can be no change in mentalities” (Guattari in Genosko, 1996, p. 264).

So, as a term, ecosophy emphasises the need for a change in mentality and practice through this recognition of the organism-environment as the central relation from which everything else stems. There is no ecology of the environment without an ecology of the social and of subjectivity, and for Guattari in particular, the development of new kinds of socio-environmental subjects (new kinds of people) rather than increased productivism (the means of exchange by which existing social subjects are replicated and their world extended) is required.

Guattari goes further to in *The Three Ecologies* (2000) to talk about “order-words”, and “order-worlds”, and the effect these have on relations, where he writes:

[It] will no longer be a question of depending on reductionist, stereotypical order-words which only expropriate other more singular problematics and

lead to the promotion of charismatic leaders... In the final account, the ecosophic problematic is that of the production of human existence itself in new historical contexts. (Guattari, 2000, p. 34)

What is important for Guattari is that there is no longer any “stereotypical order-worlds” comprising individualised units such as species, families, and genus (for example Haeckel’s trees) that can be nested within each other. The epistemological turn for this ‘order-less’ world from Bateson onwards becomes relational, thus enabling an epistemological system based on an understanding of nonlinear systems and the network of relations that define the system¹.

In the book *Media Ecologies* (2005), Fuller advances a considered outline of media systems. Fuller pluralises the concept of media ecology, and proposes an alternative approach to the study of media systems and networks in a materialist framework. Fuller describes the importance and usefulness of the term ecology by stating that: “The term ecology is used here because it is one of the most expressive language has to indicate the dynamic interrelation(s) of processes and objects, beings and things, patterns and matter” (Fuller, 2005, p. 2). Significant here is the emphasis on “processes and objects, beings and things, patterns and matter”, signalling a complex framing of ecology where dynamic interrelationships can be described. Media ecologies here are presented as a post-structuralist² political perspective on media as complex and dynamic systems

¹ Non-linear refers to the type of system where the output from the system does not vary directly with respect to input to the system.

² The approach here is post-structuralist in that it argues that to understand an object (e.g. a media work), it is necessary to study both the object itself and the systems of knowledge that produced the object.

(plural), and is the study of both the connections between processes and actors in those systems, and the interrelation of the systems themselves. In other words, an ecosophy where everything is relational. If we were to consider data within this framework, then we would consider both the data and the systems of knowledge that produced that data.

2.0.5 New Materialisms and naturecultures

The ways we produce, reproduce and consume our material environment are also a central driver to the New Materialist field, which aims to re-frame ecology by placing materialist energies as primary. New Materialism is centred around the primacy of matter and its properties and actions, and responds to the need for new accounts of agency, nature and social relationships in an era where questions have arisen about our place as embodied humans in the world.

According to Dolphijn and Tuin, Manuel DeLanda and Rosi Braidotti –independently of one another – first started using “neo-materialism” or “new materialism” in the second half of the 1990s to describe a cultural theory that does not privilege the side of culture, but focuses on what Donna Haraway (2003) would call “naturecultures” or what Bruno Latour simply referred to as “collectives” (Dolphijn & Tuin, 2012, p. 93). Here, Haraway’s natureculture is a synthesis of nature and culture that recognises their inseparability in ecological relationships that are both biophysically and socially formed (Haraway, 2003). Natureculture’s conceptual ambition, like ecosophical thinking, is to disrupt

an ecological arrangement that situates the human at the centre of activity and subsequently meaning-making. As such, naturecultures move away from the dualisms of human/animal and nature/culture which have tended to dissociate humans and nature, sometimes to the point of exempting humans from basic physical properties and laws of nature. Haraway's naturecultures can be seen as an assemblage of "people, things, laws, politics, techniques and ethical strategies" (Muecke. 2008, p. 132). Important here is the decentring of the human, and reframing an account of ecology where relationships are not hierarchical, but are both bio-physically and socially formed. That is, they are formed from relations.

The question of the materialisation and the distribution of agency present here in new materialisms can be seen to be operating through two key concepts; the assemblage and apparatus. Both of which are concerned with agency, power, and knowledge.

2.0.6 Assemblage: connections and arrangements

The term assemblage originally stems from the French word *agencement*, whose meaning translates narrowly to English as "arrangement", "fitting, or "fixing". *Agencement* asserts that it is the connection between specific concepts and the arrangement of those concepts with each other that creates meaning. Assemblage, on the other hand, can be more accurately described as the integration and connection of these concepts. Moreover, it is both the connections *and* the arrangements of those connections that provide context for assigned

meanings. Although both apparatus and assemblage are most often understood as referring to a material arrangement, within New Materialisms they are groupings of agencies which generate various histories, states, and future possibilities.

Apparatus and assemblage within this framework can be viewed as analytical frameworks for what Barad (2012) describes as “*ac/counting*” for agential phenomena. This difference is important as we move into thinking about ecologies where everything is alive and expressed as inter-relationships, that is both connected *and* an arrangement of those connections.

2.0.7 Vitalism: connected and alive

In her book *Vibrant Matter: A Political Ecology of Things*, Jane Bennett makes a useful contribution to this territory where she shifts the focus from the human experience of things to the things themselves. Just as Haraway’s *naturecultures* reframes an account of ecology where relationships are not hierarchical, but are both bio-physically and socially formed, Bennett’s emphasis on the active powers of materials also produces an ecology where all relations (human or non-human) produce effects, challenging the traditional definition of matter as passive. Most of the time, we think of objects as stable, and passive things, but Bennett wants to dissolve the binary between subject and object, showing how worms, a dead rat, or a gunshot residue sample can all be ‘actants’³: that is, they have the capacity to “animate, to act, to produce effects dramatic

³ Bennett shares Bruno Latour’s term ‘actant’; a source of action that can be either human or nonhuman.

and subtle ” (Bennett, 2009, p. 6). For Bennett, there is a “vital materiality” in everything, whether human or non-human, and this ‘vibrant matter’ is capable of producing effects and altering events. As an example of an actant she talks about omega-3 fatty acids which are able to transform brain chemistry and mood in humans and other animals. The active powers of materials are emphasised in what she calls vibrant matter. According to her, substances aren’t simply alive in a mechanistic way (i.e. composed of electrons and atoms in motion), or infused with spirit. They are alive in their complex inter-connections and inter-relations.

Thus things are alive because they have potential and efficacy. They possess capacities to make a difference in the world, to have effects, to shape the inter-relationships of which they are a part. Things, as she describes them, come into being through an ever-evolving set of relationships between themselves, other things, and other actors. While human perceptions of objects are often skewed to the position of the human subject’s perception, Bennett insists on the interconnected distinctiveness of things. Things are caught up in a set of relationships that allow them to produce certain effects, effects that are not always stable. In this framework there is not an essentialism in things, and they are not static. They are formed through complex inter-relationships, each with their own potentials.

By theorising the intrinsic vitalism in materiality, the binaries of life and matter, human and animal, organic and inorganic are removed, moving us towards an ecology where everything is alive (vibrant) and is expressed as an inter-relationship.

The ecologies briefly presented here challenge us to invent new ways to understand the contemporary world, and by extension new ways to practice. For the media artist, media ecologies can articulate and give agency to existing creative processes, and offer opportunities for new modes of authorship and expanded interpretations of materials and objects and our relationships with them. In the next section I will be addressing ecologies of practice for specific media works.

2.0.8 Ecologies of practice: how we do what we do matters

Just as media ecologies address the interrelations of processes, Isabelle Stengers (2010) extends this in thinking about ecologies of practice. She argues that understanding science's particular practices is vital. That is to say what science discovers about the world cannot be separated from how it also impacts the world. This means it is necessary to consider how particular practices – technological in particular – impinge upon and relate to other practices. For Stengers, science is a constructive enterprise, a diverse, interdependent, and highly contingent system that does not simply discover pre-existing truths but, through specific practices and processes, helps shape them. Although Stengers

is approaching this from a science, technology and society ⁴ (STS) position, the arguments she makes are an extension of contemporary concepts of media ecologies, which we could define as inter-relations ecologies. Stengers also goes on to say that “it is becoming urgent to create a contrast between the earth valorized as a set of resources and the earth taken into account as a set of interdependent processes” (Stengers, 2011, p. 163). Theorist Adrian Mackenzie also contributes to this view, stating that “attention to the specificity of practices is an elementary pre-requisite to understanding human-machine relations and their transformations” (MacKenzie, 2017, p. 9). This also brings into question how data practices, data visualisation in particular, impact the world, and what methods and processes of working with data can do to produce a particular (media) ecology. If we consider that data is formed through complex inter-relationships, each with their own potentials, then practices can reveal something of these relationships, as data and through presentation methods.

In thinking through the specificity of artistic practices, and their impacts, the works produced and discussed in Chapters 3 and 4 of this thesis use practice relations to a greater and lesser degree to have impact for audiences. In his book, *Relational Aesthetics*, Bourriaud argues that

“The ambition of artists who include their practice within the slipstream of historical modernity is to repeat neither its forms nor its claims, and

⁴ Science, technology and society studies (STS) is the study of how society, politics, and culture affect scientific research and technological innovation, and how these, in turn, affect society, politics and culture.

even less assign to art the same functions as it... Otherwise put, the role of artworks is no longer to form imaginary and utopian realities, but to actually be ways of living and models of action within the existing real...” (Bourriaud, 2002. p 13).

The ‘utility’ of the media artwork to perform a specific set of relations is important here and will be taken up when considering the assemblages produced by the practice works.

2.0.9 Scalar assemblages

As discussed earlier, Haraway’s naturecultures reframes an account of ecology where relationships are not hierarchical, but are both bio-physically and socially formed. As we will see in Chapter 3, where the media and data ecology of Natalie Jeremijenko’s *The Environmental Health Clinic* (Jeremijenko, 2011) is discussed; bio-physically and socially formed relations transform familiar practices through a modification and redesign of the social and material environments. Through the restructuring of the health care assemblage, Guattari’s statement about change in mentalities is enacted.

The problems of agentic power and scale are also explored within the examples presented in Chapter 3 and 4, particularly when we move attention to the data driven practice examples. Before considering those data practices, some consideration and discussion about networks, materiality, and their relationship to the concept of ecology is required.

2.0.10 Networks and mediation

Media studies uses the concept of mediation to examine how forces such as culture, economics and history – are expressed as values or indeed meaning in the material world. This involves identifying an instantiation of these factors in any given medium, and the impacts of actors within it. As media digital networks are important to examine as mediating technologies within the material world.

The rise of digital/electronic networks has provided a major shift in representation for media art (alongside other art practices). As an assemblage, the network provides an obvious example for the re-territorialising and re-scaling of relations to and with media art practice, particularly in terms of data, and an ecology of data. Flows and relations are often traceable, and mappable, they are also just as easily remapped. Within the digital network, data is defined through processes, operations and flows. But are networks ecologies? In a discussion about the concept of mediation, Cubitt states that “[e]cologies are not networks connecting previously separate things: Every element of an ecology mediates every other” and further that “[t]he flow of mediation precedes all separations, all distinctions, all thingliness, objects and objectivity. It precedes the separation of the human and the environmental ” (Cubitt, 2017, p. 4). Thus we can see the network as a framework for telling us more about what German media theorist Kittler defined as *Aufshreibesysteme* (translated as discourse networks), “the network that allow[s] a given culture to select, store, and process relevant data”

(Kittler, 1990, p. 8). For Kittler, what matters are not the messages or the content, but rather “their circuits, the very schematism of perceptibility” (Kittler, 1986, p. xl-xli).

2.1 Data and towards a data ecology

2.1.0 Data

It is useful to understand that data is value, and embodies value. As previously discussed, data often refers to measurements, observations, images and other raw materials but it is much more than these singular items.

Theorist and designer Sara Diamond usefully describes “data” [as] both an abstraction and mediation of actual phenomena” (Diamond, 2010, para.1). Data are not events or objects but always records or descriptions or memories of events or objects. Gregory Bateson also notes, there is

always a transformation or recoding of the raw event which intervenes between the scientist and his object. The weight of an object is measured against the weight of some other object or registered on a meter. The human voice is transformed into variable magnetizations of tape. Moreover, always and inevitably, there is a selection of data because the total universe, past and present, is not subject to observation from any given observer’s position. (Bateson & Bateson, 1972, p. 4)

Australian digital media academic Mitchell Whitelaw also describes data as “a set of measurements extracted from the flux of the real [that] are abstract, blank, meaningless” and become information only when they are placed into an

interpretive context (Whitelaw, 2008, para. 6). We should go further than that to see that the measurement itself has a qualitative component that can be expressed in and through an ecology of practice, as described earlier. By framing data within an ecology of practice here, data is not meaningless, but rather a complex set of relations that are not fixed. But what is that set of relations?

Data, like knowledge, is situated, partial, and constructed, or as Johanna Drucker puts it “all data is *capta*”. By “*capta*” she means that it is qualitative, and co-dependently constituted, rather than “quantitative, self-evident, value neutral, or observer-independent” (Drucker, 2011, p. 1). As a measurement, data carries its own meaning, particularly as a stand in for the thing, the instance in time, that it is measuring. An example of this might be the geo-location of a timed event, such as the recording of a dog sniff. What we see as a plotted moment on a graph is not an objective datum, but a qualitative data of that dog’s embodiment in time, the recording methods and techniques and intentions of that moment and the interpretation of the viewer. As previously discussed, within the field of data visualisation, data itself traditionally has no meaning. For data to become information, it must be interpreted and take on a meaning. It needs to be presented, be it a spreadsheet, table, pie graph, or raw values scribbled on a napkin. For example, the sniff location of a dog could generally be considered as “data”, a visualisation of that sniff on a map may be considered as “information”, and a report containing practical information on the best way to find that sniff spot may be considered as “knowledge”.

To build on this approach further, and giving consideration to data as having a qualitative component, data then can be thought of as being entirely about relations, and not about information *per se*. In considering a concept of data ecologies, we would then also include the processes and methods of the data production, and reception as part of the data presentation. That is, the strategies to present that “data” should attend to its qualitative component, including a recognition of its provenance. Given this, we should go further to investigate and articulate an evolving or changing set of relations within those processes and methods as situated across historical time.

2.1.1 Data and Materiality

Viewing digital phenomena as material objects is important as it serves the purpose of acknowledging their existence, effects and power (Langlois, 2013, Marres, 2012). As a very literal example of one of these effects, in 2009 Urs Hözle proposed that 0.0003kWh of energy is used for every google search, which is equivalent to 0.2 grams of CO₂ (Hözle as cited in (Cubitt 2017, p.18). If the daily search rate of 1.2 billion (in 2021 that’s 3.5 billion) is multiplied, this would result in the production of 240 million grams, or 240 metric tonnes of CO₂ per day, which is a very significant and quantifiable effect globally.

Data, whether digital or analogue, also has materiality. In her book, *How We Became Posthuman*, Katherine Hayles (1999) gives an account of how “information lost its body”. She argues that cybernetic theory from the post

WWII era unsatisfactorily treated data as an abstraction, as something that could be extracted from its materiality, embodiment and reflexivity, or as she puts it “relations”. Further to this media theorists have also recently argued, that digital data are neither immaterial nor only miniscule components of a larger material entity (Gitelman 2013, Hochnam and Manovich, 2013, Lupton, 2015). Digital data are both “the products of sociotechnical devices and such devices themselves, possessing their own agency and power” (Lupton, 2015, p. 49).

Viewing data both as a product and a device in itself allows us to expand how data is defined as set of relations, as a data ecology.

2.1.3 Data Ecologies

Given, as we have seen, that ecologies can be thought of as relational, and as a set of relations, and that data is both simultaneously material and process, then in thinking through data as an ecology (a set of relations and processes), this concept of data ecologies can now open up new ideas of thinking about what that data can do, be and become. For media arts practice this includes the processes and methods of the data production, and the assemblages of complex interactions of economic, technological, social and cultural logics imbued in the work (Langlois, 2013, Mackenzie, 2006, Mackenzie and Vurdubakis, 2011).

Strategies to present or work with data within a data ecological practice, attend to data’s qualitative component, including a recognition of its provenance, including those practices that articulate it. Data ecologies express the evolving

and changing sets of relations within processes and methods as situated across historical time. Data ecologies ask that the data presentation be entirely about relations in all forms, and be viewed as “relational assemblages” in the broadest sense.

The next chapter, Chapter 3: Context and Precedents, will proceed with applying a data ecology approach to a number of contemporary artworks, which employ a range of representational strategies categorised within four broad groupings: as locative media; as net art; as data mapping; and as data networks.

03

Context and Precedents

3.0 Overview of relevant works in the field

In the previous chapter, I examined the historically-specific ways in which the term “ecology” has been framed by critical thinkers and theorists. Moving from Haeckel’s trees – hierarchies that describe a set of fixed relations in biological systems – to focus on the significance of Braidotti’s notion that we should also consider “dynamic ecologies of reciprocal determination and influence” (Braidotti & Bignall, 2019, p. 5). I concluded with a definition of ecologies as “relational assemblages” in the broadest sense, and it is from this basis that I will now proceed with an overview of how this approach can be applied to a number of contemporary artworks that deal with issues of dynamic data ecologies.

In describing these relational assemblages in media environments, the prevailing literature from Chapter 2, particularly Hörl and Burton, 2017, Shaw, 2015, Bateson & Bateson, 1972, and Deleuze & Guattari, 1987, has informed a working definition of media ecologies that sees media works as environment, and also interrogates how they function within that environment (Fuller, 2005).

As outlined in the last chapter, it's important to underscore that there will always be a "multiplicity of meanings related to the constituent-binding relations of information objects contained within a specific ecology" (Joel Slayton in Fuller, 2005, p.x), and that these ecologies can be conceived as "relational assemblages" in the broadest sense. Relational assemblages are changing sets of relations within processes and methods as situated across historical time.

In order to further the concept of data ecologies, this chapter will examine how the binding of relations is performed within a small number of media artworks, paying particular attention to the parallel relations and affordances of context that pertain to these artworks. These relations include the ecologies of practice that I have described earlier. Here I will offer a range of ways that data can be conceived and framed as an ecology, and an analysis of how those ecologies operate. The media artworks I will examine have been selected because they each perform a range of representational strategies within four broad groupings:

1. Locative media;
2. Data mapping;
3. Networks and generative systems;
4. Data networks and scalar assemblages.

This chapter will move from English artists Blast Theory's work *Rider Spoke* (used here as an example of locative media where experience design provides an approach to data that is highly situated) to Alessandro Ludovico and Paolo Cirio's *Face to Facebook* (a net art example that mimics an assemblage directly taken from a social media platform). These two examples allow a commentary on the ways that data provenance and the politics of use-value can pertain to the broader data ecologies they enact. Continuing this approach, I then outline how Japanese artist Ryoichi Kurokawa's artwork *unfold* can be seen to utilise what might be termed "alternate assemblages" as well as data-mapping practices to challenge traditional data-visualisation practices. I conclude with a discussion of Natalie Jeremijenko's *The Environmental Health Clinic* project as a concrete example of a "scalar assemblage" that offers what the artist calls "action prescriptions" that she mobilises to expand the range of the limited options made available by the highly medicalised health care practices available to citizens of the United States of America.

In particular, I focus on how collection methods are embedded in these artworks in order to show how these assemblages can serve to produce specific parallel histories for the data as a practice strategy. Each of the artworks considered will further the novel idea of “data as ecology”. I do so in order to articulate the complex network of relations that make, shape and create the works under consideration. I also pay particular attention to how the outcomes in these artworks are not always manifest in the form of data visualisation *per se*. Instead, I seek to show how they follow particular strategies and approaches that might be considered as part of a broader ecology that situates data both as a function of the work itself, and as a signpost to the relationships that are established between users, platforms and processes.

Often data visualisations are typically presented as though they are an impartial, unbiased or even a transcendent view – what Donna Haraway in *Situated Knowledges* (1988, p. 589) calls “view from above, from nowhere” or “the god trick”. As we have seen, data is not impartial (nor are the presentation techniques and methods that bring it into existence). Examining these different framings of data within these media artworks highlights the situatedness of the knowledges and corresponding relationships that are presented through their respective data ecologies. We can extend this idea to view data as situated as well – it has a provenance and history that plays out within the systems of presentation. By seeing data as situated, with its own history and embedded practices, we can



Figure 7: Participant in the Sydney iteration of *Rider Spoke*, 2009. <https://www.blasttheory.co.uk/wp-content/uploads/2020/08/Rider-Spoke-Testing.jpg> Photo: Blast Theory. Courtesy of the artists.

be attendant to how it is framed and what claims can be made about it. This also allows for practices that can produce an experience of the data that includes its situatedness as part of the display or experience system.

3.1.0 Data and locative media

3.1.1 Blast Theory, *Rider Spoke*

Over the past several decades, “urban social life has rapidly and pervasively become geocoded, mediated, augmented and anticipated by location-sensitive technologies and services” (Graham & Zook, 2013, as cited in Perng et al., 2016, n.p.). Commercial platforms including Facebook, Snapchat,

Instagram, Twitter and TikTok have been rapidly assimilated into everyday life via smartphone apps that use the geolocation features of the device to produce, generate and utilise big, personal, and locative data of all kinds (Perng et al., 2016).

While these types of locative media provide users with the functionalities of sharing local knowledge about visited sites – via checking-in to stores, sharing and geo-tagging photography, sending messages, posting updates and messaging friends, they also by way of these processes and platforms track daily mobility patterns (Graham & Zook, 2013). These processes of data collection are also driven and framed by the ‘extraction’ requirements of capitalist practices. Extraction processes basically exploit the value that is created by the users of these locative media networks. Each piece of data the individual user creates or contributes to the network in the process of utilising the locative service is maximised for profit by the corporations that own these platforms.

It is clear that this exploitation of data is the foundation of the business models these companies use. This commercial fact is mostly masked by the way these platforms operate – including by their user interfaces which obscure their back-end functions, and the contractual conditions that underpin the smooth functioning of the for-profit services that are offered ‘freely’ to the users of these services. This fundamentally extractive approach has been critiqued through

a number of media artworks (including those under discussion here), that are developed to generate new values, and different types of data ecologies.

As I outlined in the last chapter, it's important to underscore the point that there will always be a multiplicity of uses and meanings related to what Fuller described as "the constituent binding relations of information objects" contained within a specific ecology. Most importantly, I want to highlight the notion that these ecologies can be conceived (after Braidotti) as "dynamic ecologies of reciprocal determination and influence" (Braidotti & Bignall, 2019, p. 5).

As detailed in Chapter 2, the question of the materialisation and the distribution of agency present within such new-materialist practices operates through the key concepts of the assemblage. Put simply assemblage refers to a specific arrangement of elements. Assemblages are concerned with agency, power, and knowledge. However, within new materialisms they can be thought of as groupings of agencies that generate various histories, states, and future possibilities. As previously noted the assemblage can be viewed as a framework for Barad's notion of "ac/counting" for agential phenomena (Barad, 2012, p. 47). For Barad, looking at what materialises and what is excluded is vital to identifying specific material relations. This difference is important as we move into thinking about the data ecology of *Rider Spoke*, where the generation of more nuanced interrelationships within the data is deliberately staged, orchestrated, and produced.

Let me illustrate this more explicitly. If we were to map the data flow in social media networks, we would see that in order to feed a machine-learning scenario for extraction, the flow must follow a particular procedural order. In this case it goes from data, to algorithm, to (extraction) model. *Rider Spoke* begins at the level of this particular model, and hopefully directs its audience to human learning (via experience). Whether the *Rider Spoke* approach can interrupt the machine-learning flow in big media and big data networks remains to be seen, but it is a worthwhile question to ask, and informs the approach I take for analysing *Rider Spoke*.

Rider Spoke is a mobile interactive artwork for cyclists, developed by the United Kingdom artist group Blast Theory in collaboration with the Mixed Reality Lab (MRL) based at the University of Nottingham. The work debuted in London in October 2007, and was presented in Sydney during 2009 by the British Council and Sydney Harbour Foreshore Authority, in association with the Museum of Contemporary Art, Sydney. *Rider Spoke* is useful in considering how GPS⁵ data “performs” within an ecology of practices, and how questions of provenance may contribute to an expanded data ecology. Alongside this, *Rider Spoke* can also be seen to contribute to the creation of a new approach to generating and sharing “data” in urban spaces.

In this artwork, participants of the locative-experience-game ride a bicycle

⁵ GPS stands for Global Positioning System, is a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time.

that has been fitted with a handlebar-mounted GPS-enabled mobile device, an earphone, and a microphone. Each rider is given an hour to explore the streets at night, guided along the journey by the voice of Blast Theory co-founder Ju Row-Farr. During the work, participants record intimate stories about their lives, and are also given the opportunity to listen to other people's contributions. Using geolocation, these recordings stay attached to a particular geographic spot for other riders to find and play back at a later point in time. These recordings form an ongoing database of anecdotes, narratives, and personal accounts that have been inspired within the participants' active involvement in the artwork.

As data, these recordings embody place, space, time and subjective experience, and as such generate an expanded dataset of the urban space in which they are produced. *Rider Spoke* creates a novel hybrid social space in which the private and the public are both valued as part of the map making and data collection. In terms of affordance, the *Rider Spoke* system design encourages users to connect the personal (through story prompts) and inter-personal narratives, with the map figuring as a central part of how participation is framed in the work. The subsequent behaviours of riders contribute to a relational conception of the environment, performing a new assemblage of the map.

It is important to note that *Rider Spoke* was designed as a game as this underscores the playful approach mobilised in the interests of direct participant

behaviour. As Larissa Hjorth points out, these types of games serve to remind us that “places are constructed by an ongoing accumulation of stories, memories and social practices”. They also encourage a questioning of what are often the all-too-familiar routines of daily life. They often expose us to “new ways of experiencing place, play... identity,” and social interaction (Hjorth, 2011b, p. 360).

In terms of an ecology and scalar assemblage, *Rider Spoke* intersects with personal, local, regional, national, international and global media assemblages. These assemblages have practices attached to them that are problematised within *Rider Spoke*. For example, as a set of practices, geolocation data (via GPS) and subsequent visualisation possibilities can typically be seen to embody a Cartesian model of mapping. In mapping, the Cartesian coordinate system specifies each point in a plane by using a set of numerical coordinates; also known as x /y coordinates. (Encyclopedia of Mathematics, 2014).

Google Maps and Open Street maps, for example, use geo-coordinate data to outline territories such as suburbs, infrastructural elements such as streets, and private and public ownership boundaries as the key points for their use as navigation tools. Considered part of a much wider historical practice, this type of cartographic approach privileges a distinct set of connections and flows across the economic, social and cultural spheres. *Rider Spoke* goes some way to expand and question these connections by mapping areas based on embodied experience and

storytelling, generating a personal media assemblage. This mapping is designed to articulate a set of very personal experiences of place and personal history. In describing the project, Blast Theory state that

As the riders roll through the streets, their focus is outward, looking for good places to hide, speculating about the hiding places of others, and in the process becoming completely immersed into this “overlaid” world as the voices of strangers draws them into new and unknown places. The streets may be familiar to the rider, but the platform encourages them to give themselves up to the pleasure of being lost. (Blast Theory, 2009, np.)

This novel approach opens up questions about the historical and political assumptions that underpin the technologies used to create these data-driven locative experiences. The data collected from the individual riders appears as a series of geo-located audio recordings, which in turn provides an expanded map of place that embeds the location, personal histories and system design into the heart of this particular data ecology. These choices accord with a key aim of the project: to produce an ever-changing and evolving commentary on the establishment and sustenance of interpersonal intimacy via mobile devices.

In terms of system design and data collection methodology, *Rider Spoke* follows on from the practice of geocaching, where participants navigate to a specific set of GPS coordinates and then attempt to find the physical geocache (container) hidden at that location, sign the logbook, and then return the geocache to its original location. This approach embeds data within the project (such as

voice recordings), ensuring that participant experiences and locations become part of the ongoing project within that iteration. Taken out of that experience and set of relations, the data within *Rider Spoke* loses value for participants. While meta-tagged audio stories might be scraped from the system to generate value for researchers in various fields, the presentation of the data within the game environment is lost. So too is the nuanced meaning that is generated through the particularities and specificity of site.

Sociologist Jennifer Gabrys argues, that the environmental technologies in smart cities “mobilize urban citizens as operatives within the processing of urban environmental data” hence “citizen activities become extensions and expressions of informationalized and efficient material-political practices” (Gabrys, 2014, p. 41). So rather than the individual being governed, the individual becomes an ‘operative’ in a larger system. However, for *Rider Spoke*, the embodied experiences of weather, cycling, listening, viewing and participating are all values within the artwork that contribute to both the mapping and the experience. These experiences in many ways sit outside the material practices enacted by civic and city planners. The binding of these specific relations is in the artwork itself, and exists primarily for the participants. The data is situated and dependent on the project design for its ‘value’. Like the social media apps listed earlier – Facebook, Snapchat, Instagram, Twitter and TikTok – *Rider Spoke* presents data-value for participants in the form of communication, community building, and experience.

However, unlike those social media platforms, the data is not there for extraction or to generate value in new scalar assemblages for commercial purposes.

In *Rider Spoke* we can see that the system design retains the key value of user-experience data when considering this ecology. For social media apps, the publicly released, aggregated locative (mapping) data can be processed algorithmically for purposes such as city planning, developing navigation systems for automated vehicles, human cyclists or pedestrians, or indeed outdoor advertising and commercial enterprises, amongst many other purposes. In these cases, data is no longer primarily representational, as it is in *Rider Spoke*, rather it is operational (i.e. it is used by other algorithmic systems). The distinction between representational data and operational data here is valuable to make, as it assists with viewing the scalar assemblages and ecologies that the data and users-as-data inhabit.

In articulating *Rider Spoke's* approach to data collection and use, and contrasting it with that of commercial social media platforms, we can see that the data ecologies produced here are particular to the practices that generate them. For commercial social media examples (where data primarily exists operationally), the flow within that ecology follows a particular procedural order that is designed to feed a machine-learning scenario for later extraction: going from data, to algorithm, to subsequent data model. In contrast, *Rider Spoke* begins at the model

(using the affordances of geo-caching) in order to produce value through its experience design and binding of relations within the work – that is to say, the “data remains situated and representational”.

3.2 Data mapping

3.2.1 Ludovico and Cirio: *Face to Facebook*

Alessandro Ludovico and Paolo Cirio’s online and installation-based project *Face to Facebook* (Ludovico & Cirio, 2011) is an excellent example of a work that explicitly presents data provenance, and by extension data ecology, as a central concept. Data provenance is used here to describe data in terms of where

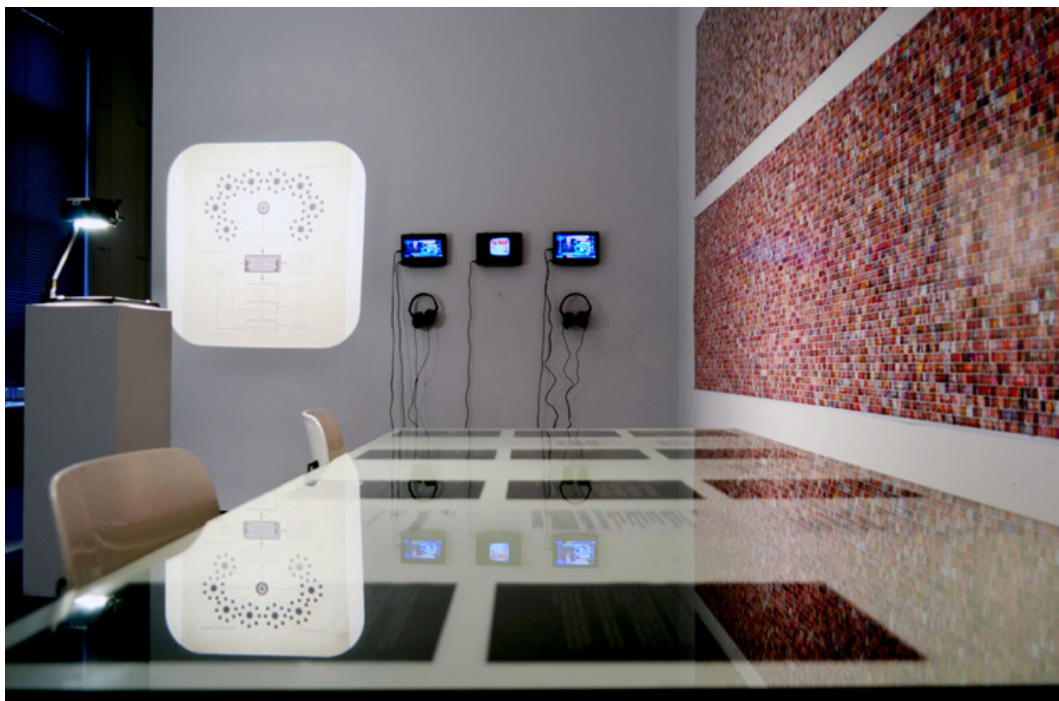


Figure 8: *Face to Facebook* Installation, Paulo Cirio & Alessandro Ludovico. Share Festival Cops & Robs, Turin, Italy. 2011. Retrieved from https://paolocirio.net/work/face-to-facebook/pics_impakt/DSC_0608.jpg

it comes from and the processes and methods by which it was produced. For *Face to Facebook*, data provenance is performed as a key element of the work by re-presenting scraped social media platform Facebook's data in an alternative system and context devised by the artists. In so doing, attention is drawn to the original source, Facebook, and by extension the extraction model that Facebook uses to monetise its platform.

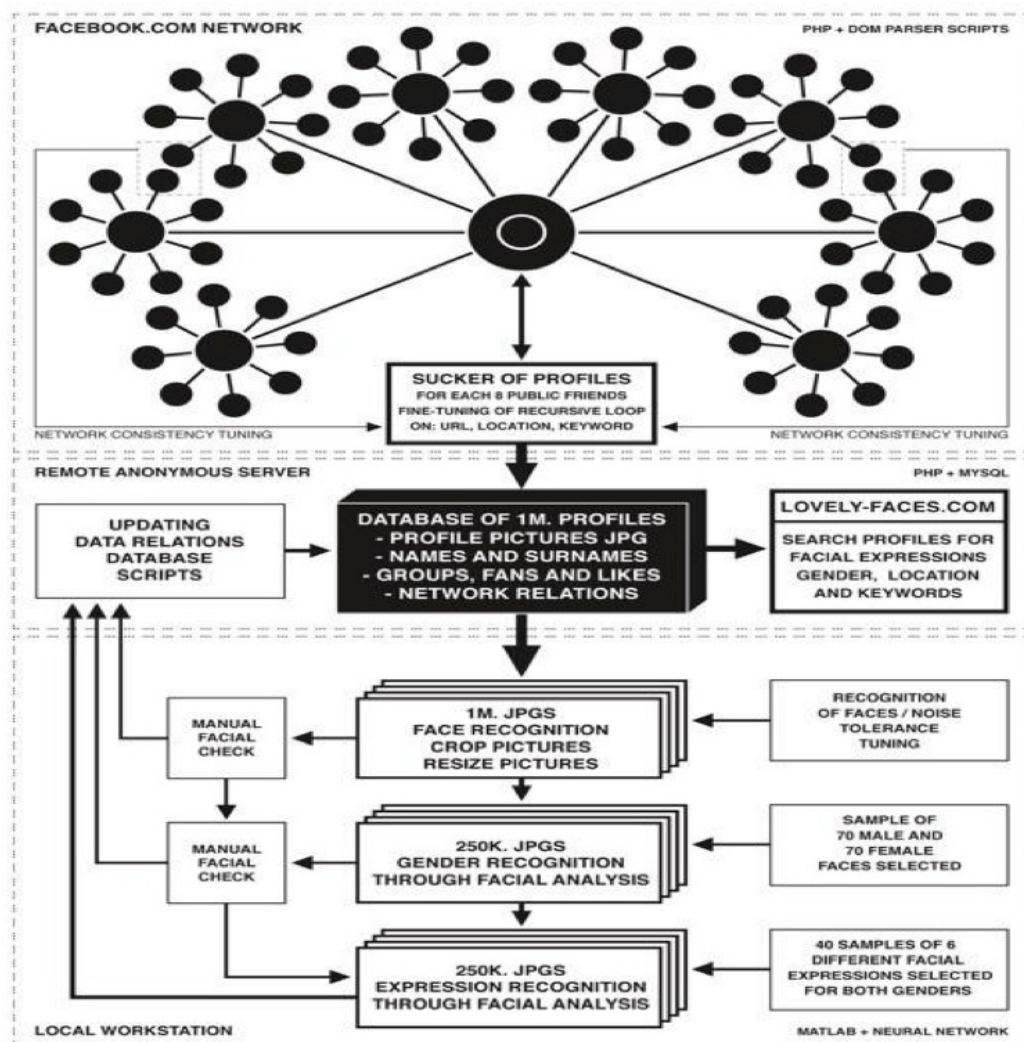


Figure 9: Face to Facebook system diagram 2011. Retrieved from https://www.paolocirio.net/work/face-to-facebook/diagram_face2facebook_positive_cirio.pdf

Face to Facebook involves the appropriation of one million Facebook profiles, filtering them with face-recognition software, and then re-posting them on a custom-made dating website (lovely-faces.com). This repositioning of the market value of the data into a new system of relations draws attention to the broader ecology of the data, and the assemblages required for each context.

As we saw with *Rider Spoke*, the historical and political assumptions that underpin the technologies used to create these data-driven experiences can drive system designs that enable the development of highly personalized experiences. At the same time that they provide a novel way of thinking about the ways data is organised for subsequent models that are developed for extractive purposes.

The ecology of practices used to develop the artworks under consideration in this chapter lead to very different outcomes. For *Rider Spoke*, the data was situated in place, as an integral part of the experience design. For Facebook, each piece of data the individual user creates and contributes to the network in the process of utilising the Facebook platform is maximised for profit by the corporations that own these platforms. The *Face to Facebook* artwork uses this same extraction model, but they do so in order to direct the viewer's attention to the data ecology that it is drawn from. It also exposes the set of practices that drive Facebook, showing clearly that these extractive practices are deliberately obscured by the data platforms that corporations develop and own.

Face to Facebook can be seen to be a data ecology in the sense that the data being re-presented is about relations, and not information *per se*. In viewing the exhibition component of this artwork, one could see this work as a visualisation of the multiple photographic approaches that are mobilised within the Facebook platform – each photograph acts as a data point in a large graph, but it is the processual content of the work that is important.

In terms of the processual content, we can see that the photographs have moved from a closed system to an open system of communication. Thus it becomes possible to acknowledge the ways in which the media ecologies develop as relational information systems. Moreover, as Rossiter states, “the concept of process undermines the logic of the grid, of categories, of codings and positions... Categories are only ever provisional, and emerge to suit specific ends, functions, interests, disciplinary regimes and institutional realities.” (Rossiter, 2003, p. 115).

We can see that the data relationships within *Face to Facebook* need to be considered not in terms of what categories say about their objects, but rather, in terms of what categories say about the movement between that which has emerged and the conditions of possibility. The process of transferring and re-mapping the data elements generates the meaning and conceptual content here for *Face to Facebook*. In other words, the data provenance is played out through the interrelationship with the original Facebook platform and its users. This is the crux of all such works that deal with complex sets of relations that exist between people, data and platforms.

Within the exhibition component of the artwork, a system diagram displays the data pathways and treatment that has been applied to the data in order to produce the new artwork. This type of transparency emphasises process over product, and directs attention to the ecology of practices that are inherent to the artwork itself.

The artists' conceit of a dating site platform working with the data from Facebook, highlights the unacknowledged assumption that Facebook profile photo data is there for the purposes of dating (itself based on certain other implied assumptions about attractiveness, for example). By exposing this inherent bias in the choice of image for a person's photographic representation, the artists signal a key component of the corporate data ecology: that cultural norms and stereotypes are codified in an opaque way into the core of this data ecology. This artwork exposes how the photographic representations embedded in Facebook are founded on an assumed desire of the users to be attractive to others. Hence the artwork provides a critical commentary about the qualitative component of Facebook profile data.

In *Face to Facebook* we can also see that the data provenance is retained in its new assemblage. Although the profile photographs are repositioned as dating profiles, the 'self' curatorial practice in the originals also performs this set of value propositions and their inherent assumptions in the new system created by the artists.

The original Facebook user's curated image is embedded in the new system of display after being extracted via a feature-extraction algorithm that sorts and selects based on gender, expression, and location. The new "users" of the dating site perform their own individuated pattern recognition on the extracted photographic faces in order to assign attractiveness a specific value via their selection – which of course can also be viewed as another type of classification process, with all of its attendant biases.

For the Facebook platform, a feature-extraction model is applied for commercial reasons (based on whatever feature is required, be it gender, expression, location, age, assumed race, participation, or any other data points available). Then a pattern-extraction algorithm works towards developing a pattern-prediction model that is exploited for commercial or political purposes. Here, for Facebook, classification is always already applied as part of the extraction algorithm.

For both *Face to Facebook* and the Facebook platform, practices and processes can be seen to illustrate human bias in categorising user photographs. But in terms of extraction, the Facebook model embeds that value and bias as part of its machinic and algorithmic structures, thus moving from data classification to generation of value based on prediction algorithms.

In thinking through how these two models operate, we can see that assemblage design is integral to revealing how Braidotti's "dynamic ecologies of reciprocal determination and influence" (Braidotti & Bignall, 2019, p. 5) perform within each of the works. This can be seen through the method of data mapping and system design, where the *Face to Facebook* work explicitly presents data provenance as a central concept and strategy to produce a new data ecology.

3.3 Data networks /generative systems

3.3.1 Ryoichi Kurokawa: *unfold*

unfold, an immersive installation created by Japanese artist Ryoichi Kurokawa, uses a combination of space-telescope imagery and data that presents seven billion years of the cosmic history of the sun. The artwork offers viewers an artistic representation of how the solar system was born and how galaxies may have evolved.

For this work, Kurokawa partnered with *Commissariat à l'énergie atomique (CEA) Saclay*, a research centre in Nantes, France, that allowed him unprecedented access to their data. The CEA conduct research into the state of matter using an atomic reactor named Orpheus, together with an array of various lasers and magnetic resonance devices. Using these collected images and data, Kurokawa creates an abstracted piece about the birth of the universe, providing

a multisensory experience of that data for audience participants. Unlike *Face to Facebook* – which re-presents data in a new ecology to reveal an assemblage design attendant to the social, cultural, historical, and political factors that influence the reading – *unfold* uses techniques of immersion within a practice of



Figure 10: *unfold* by Ryoichi Kurokawa. Installation view at FACT, 2016. Retrieved from https://tit-assets.s3.amazonaws.com/articles/3046/3._unfold_by_ryoichi_kurokawa_large.jpeg

visualisation and sonification in order to generate a synaesthetic experience and an embodied understanding of the rich datasets for participants.

In her review of the work and an analysis of Kurokawa's artistic strategy, Dominika Mackiewicz observes that:

The power of data with its immense diversity, unconceivable scale and sheer visual potency escapes definition, despite being encoded in definable systems. And in his artistic processes he uses a simple fact, that humans are a visual species that needs a powerful stimulus to remain in awe for longer than a split of a second. (Mackiewicz, 2016, para.4)

As a data visualisation, this work leaves little space for traditional data analysis. Instead the experience and embodied response to the data is the most important aspect of the work that I'd like to consider here. Experience design aside, in considering the data provenance for *unfold*, and by extension the parallel relations and affordances of context, we can see that the practical ecologies of this work are key when considering its greater ecology. As we saw in Chapter 2, data mining and data mapping are typically practices that speak to processes and techniques of working with data in order to drive certain visualisation outcomes. It is also worth noting that neither of these techniques are particularly good at capturing a flow of data, or in dealing with temporal shifts. For *unfold*, however, all of these data streams are mixed as a presentation strategy to generate emergent patterns and a variety of different affects. The network of relations played out in *unfold* is attendant to the data as much as it is to the new ecology that is performed through the work.

Returning to the notion that “the god trick” produces data visualisations that are typically presented as though they are a “view from above, from nowhere” (Haraway, 1988, p. 589), we can see that *unfold* has a much more complex relationship to data provenance, and subsequently produces a data ecology that does not rely on the god trick kind of approach. In the same way that *Face to Facebook* involves the transference and re-mapping of data elements in order to generate new meaning and conceptual content, *unfold* maps data elements and embeds the scientific practices that bring this data into existence within its own unique system of display.

The data for *unfold* comes from a variety of sources including scientific datasets: CEA (Herschel HOBYS, COAST, Frédéric Bournaud, Sacha Brun, Pascal Tremblin, Patrick Hennebelle, Rémi Hosseini-Kazeroni), ESA, NASA, BLAST Experiment, and SuperCOSMOS H-alpha Survey. Each of these datasets also encapsulate their own set of collection practices as part of this ecology which are too numerous to list here. It is important to note however that Kurokawa mobilises these data “expressively” under the supervision of CEA-IRFU astrophysicist Vincent Minier.

Minier has stated that Kurokawa’s work questions “the usual codes of nebulae at the atmospheric edge”, to imagine new forms of visualisation, “which enables the establishment of a pattern of results, a scientific interpretation, as well

as an expression of the technology that is behind these results”, more willingly playing “on the mathematical beauty” and “the “immersion in the significance of this data.” (*Unfold – STARTS PRIZE*, 2016).

The data sources within *unfold* include mathematical models, image-based telemetry, satellite images, and other scientific visualisations derived from magnetic resonance devices amongst many others. These are all interpretative scientific practices at their core. They are expressions of what Barad describes as an “inseparability of ethics, ontology and epistemology when engaging in (scientific) knowledge production, with scientific practices, and with the world itself and its inhabitants – human and non-human beings that intra-actively co-constitute the world” (Barad, 2007, p. 185).

Kurokawa’s work serves to remind us that neither the data and modelling nor the presentation techniques and methods used within the work is impartial. Instead, they can be seen as forming the constituent parts of an interpretative practice. By programming a display system from the various sources, mixing the various datasets, and developing a novel presentation system, *unfold* draws attention to ways in which the situatedness of these ‘knowledges’ are inseparable from their respective data ecologies.

3.4 Data as practice and scalar assemblage

3.4.1 Natalie Jeremijenko: *The Environmental Health Clinic*

A good example we can use to demonstrate the impact of specific practices and of media ecologies in particular is Natalie Jeremijenko's playful project, *The Environmental Health Clinic* (2007–), which offers original yet achievable solutions to New York City's environmental diseases. Within the artwork, individuals with asthma, allergies and other environmental-related diseases can consult the clinic and receive treatment. Rather than providing medical prescriptions, the artist's treatments consist of "action prescriptions". These are instructions that outline what the patients can do to improve their local environment, and hence attend to the root cause of their issues.



Figure 11: *The Environmental Health Clinic* by Natalie Jeremijenko, 2007. Retrieved from <http://www.nyu.edu/projects/xdesign/>

Some of these action prescriptions include collecting environmental data using digital sensors, planting green vegetation in local neighbourhoods, or being responsible for other kinds of urban interventions that can produce material change. This facilitation of community-based knowledge and open-ended prescriptions moves to put “empirical evidence in the public sphere”. As a result, the project prompts participants to actively explore complex environmental issues, which in turn helps restructure the way they participate in those issues (Lam et al., 2013).

The Environmental Health Clinic is about drawing attention to the interrelations of human health, the environment, and the processes and ecologies of treatments. It creates an unexpectedly activist assemblage of agency, nature and relationships, and restructures the ways in which liveable places for embodied humans might be established in direct relation to the health system and environment of a specific location.

As we saw earlier in this chapter, media ecologies involve the study of the connections between both processes and actors in those systems. It also includes the interrelation of the systems themselves. In other words, media ecologies involve an ecosophy where everything is relational. The media ecology of *The Environmental Health Clinic* changes an assemblage focussed on human relations – i.e. health issues and the usual (human-based technological) pharmacological

cure – to an assemblage that addresses health issue by locating the root cause (environmental degradation).

In this way *The Environmental Health Clinic* performs a media ecology as framed by Fuller (2005). Mobilising Bennett's (2009) approach, this might be framed slightly differently, because the agency of the assemblage directed by this work could result in the improved health of the human sufferers at its core. The conventional health assemblage of doctor-prescription-drug-symptom-cure gives agency to "big pharma" and other major corporate and government agencies. As ecosophy emphasises the need for a change in mentality and practice through this recognition of the organism-environment as relation from which everything else stems, the shift in this project from a human-centred technological cure to an environmental rehabilitation is key to reading the work.

As I have discussed in the previous chapter, mobilising Haraway's concept of naturecultures can help us to reframe an account of ecology where relationships are not hierarchical, but are both bio-physically and socially formed. The media ecology of *The Environmental Health Clinic* transforms the familiar practice of individualised care plans which prepare a patient's body for optimum reception to prescribed pharmaceutical treatment, into a care plan for the environment outside the body.

These are affective terms of engagement for everything else, in which the (previously passive, human) body performs the assemblage with and through other materialist matters in a perturbation of dominant discourses of extraction that characterises medical, scientific and natural resource industries and their attendant practices. For example, the prescription for asthma sufferers of medicated volumizers (puffers) is an assemblage that pivots on the delivery of medicine to effect a change in the generalised human body. It is a prescription that is calculated against economies of scale and public health policies that respond to but remain unacknowledged by mining and extraction-reliant manufacturing processes.

Within Jeremijenko's work, the modification to the social and material environment works to (hopefully) produce a change in participant mentalities. In this way, Guattari's concept of a change in mentalities is enacted. Politically this work also exposes the problem of individualising solutions to industrial issues, and the opt-in limits of the individual.

In Bennett's terms, we might say that the agency of the assemblage is important here, due to the uneven powers of action within those assemblages. The pervasive exhortations to individual action – in the neo-liberal environment, and the campaigns of mainstream environmental groups, especially in the west – are problematic, as they are inadequate responses to this complex assemblage. While

individuals busy themselves greening their personal lives, fossil fuel corporations and big pharma manipulate scale to eclipse these micro-actions of “agentic power”. In other words, the scale of the assemblage also matters, and this is what this artwork also plays with.

3.5 Summary: Context and precedents

In this chapter, I have explored some of the problematics of agentic power and scale within the data practices of four specific media artworks. In doing so, I have described a series of scalar assemblages and considered how these projects help us move towards a re-framing of data that is evident in the data-driven practices of these particular media artists. The range of representational strategies they use can be categorised within four broad groupings: as locative media; as net art; as data mapping; and as data networks.

I have posited *Rider Spoke* as an example of locative media where experience design provides an approach to data that is highly situated and framed. *Face to Facebook* has been considered as a net art example that mimics an assemblage from social media while providing a commentary on data provenance and the politics of use value. I continued the approach with *unfold*, which also utilises alternate assemblages and scientific practices to serve as a vector to

challenge perceptions of data presentation. *The Environmental Health Clinic* has been cited as a concrete example of a scalar assemblage that offers ‘action prescriptions’ to expand current health care practices.

All of these artworks contribute to furthering the question of how data ecologies can be thought of within media arts practice. Common to each project is a treatment of data that is attendant to its materiality and embeddedness in the design of the works, although the conceptual approach for each of the works vary widely.

Each of the works I have considered take a different approach to the binding of relations that I argue are central to the formation of any data ecology under the conditions of corporate social media and big data. The interventions that these artworks make into these platforms and logic help us envisage a different way of conceiving data as always relational and ecological. This approach has informed my own critical practice, which I will explore in the next chapter.

C H A P T E R

04

The Works

In the previous Chapter 3 we examined data practices within media artworks categorised as locative media, net art, data mapping, and data networks. We saw that approaches to practice in each of the works discussed offered a range of ways data can be seen within the greater ecology of practices being addressed. In Chapter 2, I outlined a number of key historically specific ways in which the term ecology has been framed, and situated the broad historical context in relation to the changing definition and role of data, particularly as it applies to the field of media art works. This chapter addresses the practice component of the thesis, and presents a series of art works and projects I have created as an integral part of this process. These projects perform a range of representational strategies have been created throughout the period of research that form the basis of the thesis.

These strategies include approaches to data provenance as a key component of the practice, how collection method embed participants as data, and how assemblages can serve to produce parallel histories. Each of the works presented further the novel idea of “data as ecology”, to articulate the complex network of relations that make, shape and create the works, where the outcome is not a visualisation, but rather an assemblage design.

In much of the prevailing literature from Chapter 2 (Bateson & Bateson, 1972, Deleuze & Guattari 1987, Hörl & Burton, 2017, Shaw, 2015) we have seen that the term media ecology is often used to refer to both an “interlaced topological analysis of media objects, as an environ, as well as an accounting of their function” (Slayton in Fuller, 2005 p.x). The term can also refer to the multiplicity of meanings attached to the binding of relations contained within the broader ecology of information systems (Fuller, 2005). In the next section we will examine how the data practices within the works, *Laika's Dérive* and *Hothouse* can attend to parallel histories and direct us to consider how contextual affordances within media art offer alternative viewing outcomes and participation to those traditionally discussed in media ecologies more broadly.

We will consider how the work contributes to articulating a media arts practice that is attendant to data provenance and generation as a key method. In Chapter 2, we saw that data provenance refers to records of the inputs, entities,

systems, and processes that influence data of interest, providing a historical record of the data and its origins. In outlining how data collection, data mining and data mapping processes have been designed and deployed within the works, we will address the specificity of practices as a pre-requisite for entering the work.

The key practice components produced for this thesis push concepts of media ecologies beyond human/machine interactions to include cross species sensing and mapping. The works produced include *Laika's Dérive v.1* (Incubator, Performance Space, Sydney), *Laika's Dérive v.2* (Carriageworks, Sydney, and Furtherfield, London), and the reactive weather system *Hothouse* (Cementa, Australia). Each of these projects approached data ecologies in different ways: from the collection methods and system design to the experience design components. Each project will be discussed in order to examine how data provenance works as a key component of the practice.

For *Laika's Dérive* we will see that the collection method embeds the participants as data, and for *Hothouse* we will see how weather data can perform across markets and location to generate a data ecology that serves to produce an experience of parallel histories. To further the novel idea of “data as ecology”, which articulates the complex network of relations that make, shape and create media artworks, I will address the specific ways in which ecologies of practice and data are performed within the works. This involves the exploration of the

materiality of data: the processes that bring it into existence, and an investigation into the more precise nature of the interconnections the world data creates and actions.

These projects will be considered in terms of their practice approach and as a platform for the concepts advanced in Chapter 2 of this thesis. We have previously established in both Chapter 2 and 3 that there are many ways in which the various ecologies play out within media artworks, and that these projects need therefore to be considered through their action as interventions into traditional practices.

Viewing Documentary Material

The following section about the practice components, *Laika's Dérive* series and *Hothouse*, are to be found at:

Appendix A of this thesis document, as well as:

<https://documentation.sarahwaterson.net/>

4.1 *Laika's Dérive*

We need not only invent or reinvoke concepts like conatus, actant, assemblage, small agency, operator, disruption, and the like but also to devise new procedures, technologies, and regimes of perception that enable us to consult nonhumans more closely, or to listen and respond more carefully to their outbreaks, objections, testimonies and propositions. For these offerings are profoundly important to the health of the political ecologies to which we belong. (Bennett, 2009, p. 108)

4.1.1 Cross species sensing and an ecology of practice

On November 3 1957, at 5:30 am, the Soviet Union launched Sputnik 2 into space. On board was a former street dog, Laika⁶, strapped into a constricted space module that allowed for only a few centimetres of movement. Just washed, loaded with sensors, and fitted with a sanitation device, she wore a spacesuit with metal restraints built-in (George, 2018, para. 5).

Laika was a young, mostly-Siberian husky, rescued from the streets of Moscow. It is presumed that Soviet scientists assumed that a stray dog would have already learned to endure harsh conditions of hunger and cold temperatures, and that female dogs would be more compliant and docile. She was trained for space travel by being kept in a small cage and learning to eat a nutritious gel that would be her food in space.

⁶ Laika is a Russian word for several breeds of dog similar to a husky. The dog's name was originally Kudryavka, or Little Curly, but due to translation she became known in international news circles as Laika.

The medical team had performed surgery on Laika, embedding devices into her body to monitor heart impulses, breathing rates, blood pressure and physical movement during the space travel. The data was transmitted back to earth via early telemetry. The mission provided scientists with the first data on the behaviour of a living organism in the space environment. Unfortunately, Laika survived for only a few hours instead of the planned ten days due to heat and stress. The scientists also knew from the start that Laika's orbit would be a death mission as technology at the time did not allow for the capsule to return to Earth in one piece. There was never any plan to bring her back to earth.

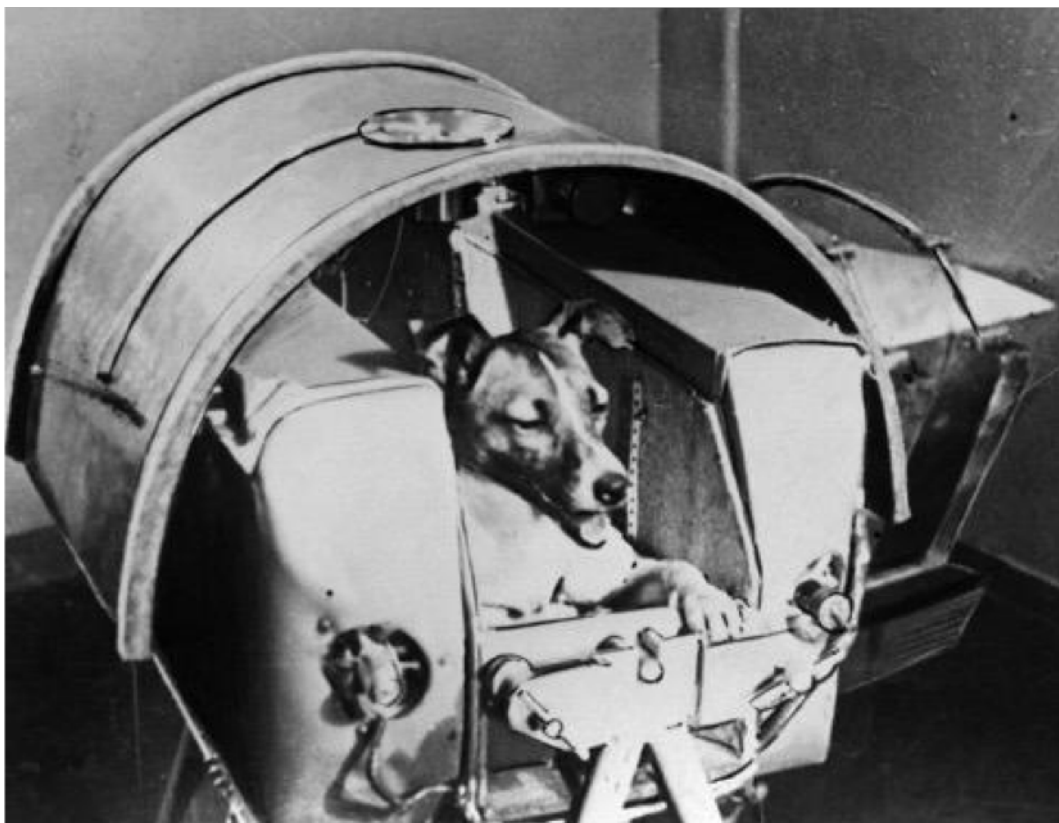


Figure 12: Laika, the dog who became the first living creature sent into space, aboard Sputnik 2, November 1957. Retrieved from <https://history.nasa.gov/SP-350/i2-2a.jpg>. Public Domain

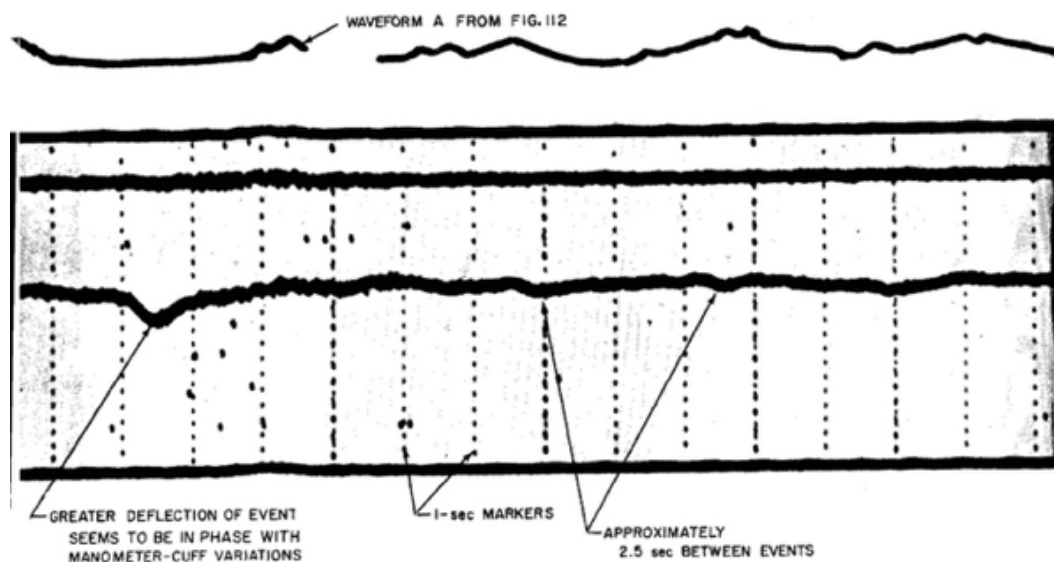
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Fig. 119. Sputnik-2 Telemetry Associated with Respiration

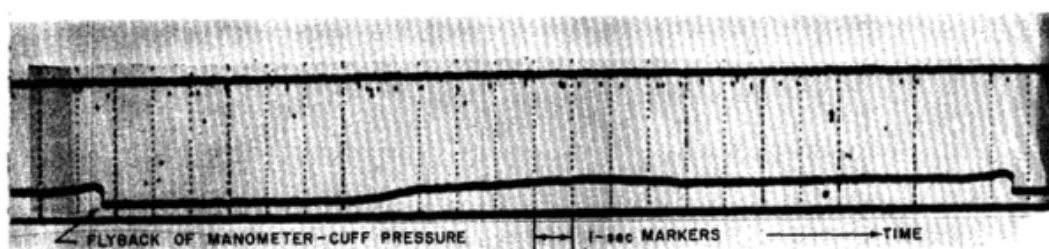


Fig. 120. Sputnik-2 Telemetry Associated with Manometer-Cuff Pressure

Declassified and approved for release by NSA on 07-06-2006 pursuant to E.O. 12958, as amended

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Figure 13: The first Soviet biomedical data intercepted from space from Laika, These are excerpts of declassified tapes that recorded Laika's heartbeat (top) and blood pressure (bottom). Retrieved from <https://airandspace.si.edu/sites/default/files/images/WEB11844-2011h.jpg> Public domain.

As part of the mission, Laika embodied multiple meanings, as a symbolic action, on both sides of the Iron Curtain. In simple terms,

For the Kremlin, her mission commemorated the fortieth anniversary of the ‘great October Socialist revolution’ and she emerged as a canine hero of the Soviet Union. Gazing up at the night sky, many Americans saw the small dog as a terrifying declaration of Communist technological supremacy and American vulnerability. (US Library of Medicine, *Animals as Cold Warriors*, 2012, para.1)

In looking at the data captured from Laika on Sputnik 2, we can know that she had an accelerated heart rate and that she ingested food. If we map cabin temperature and humidity readings using standard data mapping techniques⁷, we can extrapolate that she was stressed by heat. What we can’t know from this the depth of her experience. The data can tell us however, that the intention of the Soviet experiment was to support physical life in space, but looking back we can say the key intention was to score a point in the ongoing political gamesmanship of the Cold War Space Race (Burgess & Dubbs, 2007). The collection of the data chronicles a species in what Haraway calls an “obligatory, constitutive, historical, protean relationship with human beings” (Haraway, 2003, p. 12). It is in this relationship that the human intention and greater ecology of the data methods of the Laika mission play out.

The *Laika’s Dérive* project responds to the Sputnik 2 space program by bringing dogs and their humans together in a simple walk. During the

⁷ In computing and data management, data mapping is the process of creating data element mappings between two distinct data models. Data mapping is used as a first step for a wide variety of data integration tasks, including: Data transformation or data mediation between a data source and a destination.



Figure 14: *Laika's Dérive* participants at Furtherfield Gallery, London.

walk, participants use a custom electronic mapping system to record data, including sniff location, pathway, head position and photographs, to explore a psychogeography⁸ of place, and to provide a mapping of place that attends to embodied data. Unlike the original Sputnik 2 *Laika*, this project was designed as a collaboration between species, and a gentle and playful nudge towards disrupting

⁸ Psychogeography, originally coined by French theorist Guy Debord in 1955, is the interplay between psychology and geography.

the primacy of human senses and sensing in environments. The work addresses the practices of mapping, data collection and experience design, in order to produce an entanglement through data.

The practice-led methodology was based upon two distinct research stages with their respective creative outcomes. The first public iteration of the project was held in Sydney, culminating in a live event at Carriageworks, Sydney, Australia. The second iteration was held Finsbury Park and surrounds, with a gallery component at Furtherfield, London, United Kingdom.

4.1.2 Dogs and Walking

While walking with dogs, the psychogeography of place is changed and amplified, you are more aware of boundaries, dangers and the simplicity of enjoying both the moment, and the everyday. It is this entanglement and embodiment that the project draws attention to, with the data collection being used as a tool to focus attention. By collaborating with dogs and their differing perceptions and sensual capabilities, we are expanded from the everyday, and from the limits of our everyday human perception.

When Species Meet, an extension of Haraway's *The Companion Species Manifesto* is particularly relevant to this discussion about interspecies communication. For Haraway, exploration of our co-species existence is guided by two main questions "(1) Whom and what do I touch when I touch

my dog? And (2) How is ‘becoming with’ a practice of becoming worldly?” (Haraway, 2008, p. 3). Haraway argues for an epistemological and ontological shift to recognise non-human animals as agents that can also shape human lives and proposes that this co-constitution requires an ethical call for respect and responding to and for those other beings (Haraway, 2003). Ultimately, Haraway finds that respect, curiosity, and knowledge spring from animal-human associations and work powerfully against ideas about human exceptionalism. *Laika’s Dérive* was developed to provoke and enable an environment where human owners can consider the role their dog can have on their sense of place, and is meant as a collaborative communication tool across species; a data ecology that explores place, sensing, embodiment and representation.

While the data collected from *Laika’s Dérive*, and the visualisations developed from that data may tell us something about the most enjoyable spots for dogs in an environment, the data collection method, and walk, provided a subtler form of knowledge development⁹. This is not necessarily captured in the data visualisation, or in the database of over 30,000 photographs taken by dogs, and the many gigabytes of location and accelerometer CSV data that informs those photographs. As part of the broader knowledge development, participating in the project enabled participants space for reflection on their relationship to their dog,

⁹ Includes processes of external knowledge procurement (i.e. through cooperative efforts, new contacts, etc.), creation of specific knowledge resources like research and development and formation of personal/ technical knowledge networks.

and to experience what this co-constitution means within local geography. By walking with the data capture system, it was hoped that the human user's attention would be drawn to their walk relationship. The sign-up process on the *Laika's Dérive* app (v.2), and the presence of the harness and camera devices served as reminders about the data capture process that was happening, thus producing an extended, and focussed affect for the user. In this way, the project is very much about data and technological processes as the representation. The data collected and produced within the project was very much ancillary to the meaning that the participation produced.

Circling back to Chapter 2, where Bourriaud's idea that "the role of artworks is no longer to form imaginary and utopian realities, but to actually be ways of living and models of action within the existing real" (Bourriaud, 2002. p 13), *Laika's Dérive* simultaneously functions as a work that draws attention to existing practices, but also allows owners and dogs to perform the everyday within a new frame provided by both the context and the structure of the work. Rather than the artwork being an encounter between a viewer and an object, *Laika's Dérive* produces encounters between people, dogs and environments. Through these encounters, "meaning is elaborated collectively, rather than in the space of individual consumption." (Bourriaud, 2002. p.4).

In the ensuing photographs we can see evidence of the owner's values and desires, and relationship to their dog, as much as we can see the dog's hot spots within an area. The participants' embodiment brings a history of social, gendered, and cultural experiences, which is an intrinsic part of the data. The data also embeds local government rules about dog ownership including walk location and types (on leash, off leash, etc). The participants and project design *affect* each other and are embedded within the material conditions of their shared environment. One participant for example, used the project to have their dog take wedding photographs, while others used their participation to document friends, cats and café culture in Sydney's inner West. Others let their dog loose and followed them as a guide to new experiences in a local area. From this we can see that the data collected (co-ordinates, time, photographs and accelerometer readings) have already embodied values and produce "data as capta" (Drucker & Studies, 2011, p.1). The data here is not objective "information" but rather "capta", information that is captured because it conforms to the rules and hypothesis set for the experiment.

4.1.3 Research Phases

Phase 1- Carriageworks residency – Maps and walking

In the first phase of *Laika's Dérive* I developed a speculative practice-based approach for producing a technologically assisted psycho-geography.

Following on from the Situationists'¹⁰ constructed situation (Debord, 1958), *Laika's Dérive's* locative practices act to interrogate the qualities of the nascent data capture technologies, including the spatial practices of GPS mapping. As stated earlier, GPS relies on Cartesian space, that is, points in a grid. For this project a distinction was drawn between these points, and place. Place in this context is generated through relationships of the dog, the human and the spaces they travel through. These individuals are all involved in the placemaking constructed by their histories, narratives and associations. In this sense the project follows Henri Lefebvre's conception of lived space. Geographer Andrew Merrifield, in discussing Lefebvre, describes this lived space as "representational space... the space of everyday life. It is space experienced through the complex symbols and images of its 'inhabitants' and 'use'." (Merrifield, 1993 p. 523).

Research for this phase began with investigating geo-location data (via GPS technologies) and subsequent visualisation possibilities using a Cartesian model. Mapping is typically defined as a spatial practice where definitions of territory are represented. Both Google Maps and Open Street maps use geo-coordinates to outline territories such as suburbs, infrastructural elements such as streets, and private and public ownership boundaries as the key points for their use as navigation tools. This approach to cartography privileges a distinct set of connections and flows across the economic, social and cultural spheres,

¹⁰ The Situationist International (SI) was an organisation of avant-garde artists, intellectuals, and political theorists, 1957 to 1972. Prominent member, Guy Debord first articulated the drift, or *dérive*.

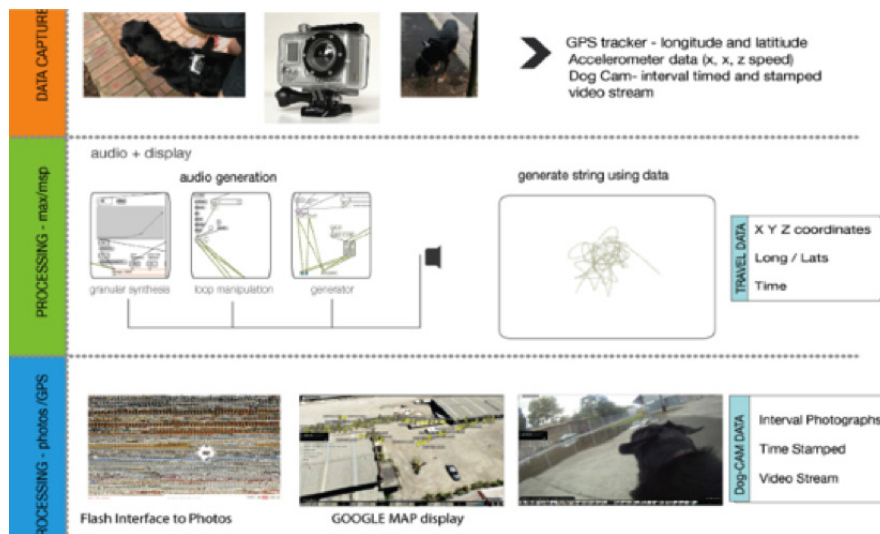


Figure 15: Data processes overview Laika's Dérive v.1

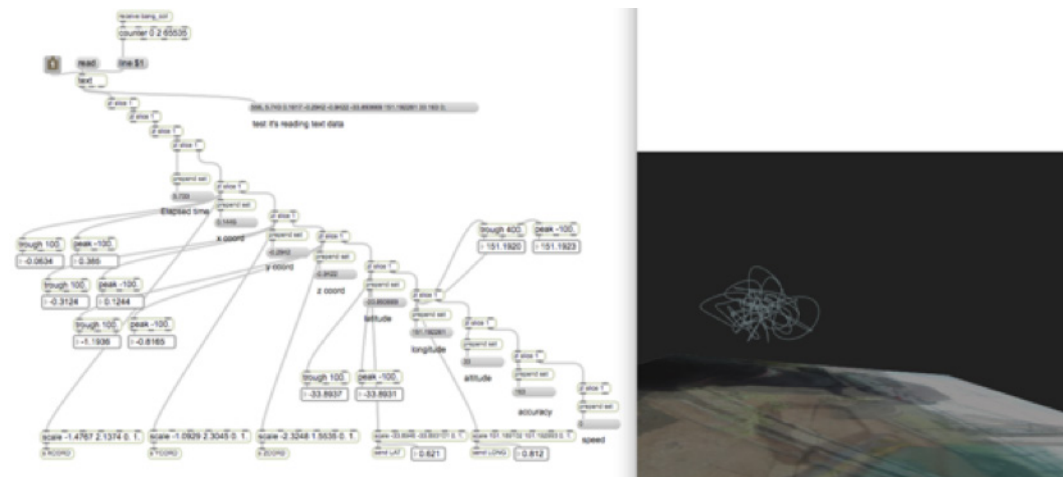
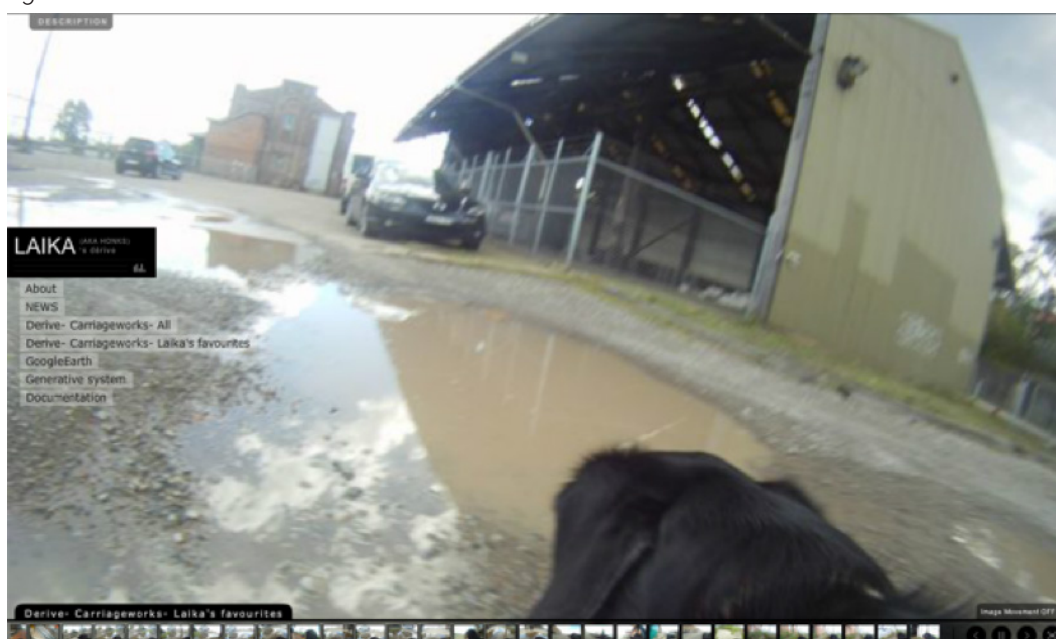


Figure 16: Laika's Dérive Phase 1 sniff visualisation.

Figure 17: Phase 1 documentation website showing Laika's favourites, http://www.sarahwaterson.net/Laika_miniSite/WEB/

normalising and expressing what can be seen as a colonial Cartesian geography. As a response, the research sought to ask what a map of an area would look like if it was based on embodied experience and knowledge?

To answer this question, the psycho-geographic mappings of the Situationists were explored, these mappings involved “drifting” through an environment and allowing yourself to be led by encounters and other attractors. As a technique of rapid passage through varied ambiances, these drifts (*dérive* in French) involve playful-constructive behaviour and awareness of psycho-geographical effects.

Taking the method of the *dérive*¹¹ what would be the attractors for dogs, and how could the dog and human walk could be mapped as a collaboration? What data would be required, and what methods and techniques could be used for representing that data relationship? Could we also attend to sensory data into the presentation, for example smell (dog sniffs) rather than sight? How could the project enable the human participants to explore their relationship to space and place with their dog?

¹¹ Debord’s description of the *dérive* is as follows: “One of the basic situationist practices is the *dérive* [literally: “drifting”], a technique of rapid passage through varied ambiances. The *dérive* involve playful-constructive behaviour and awareness of psychogeographical effects, and are thus quite different from the classic notions of journey or stroll. In a *dérive* one or more persons during a certain period drop their relations, their work and leisure activities, and all their other usual motives for movement and action, and let themselves be drawn by the attractions of the terrain and the encounters they find there. Chance is a less important factor in this activity than one might think: from a *dérive* point of view cities have psychogeographical contours, with constant currents, fixed points and vortexes that strongly discourage entry into or exit from certain zones” (Debord, 1958). <https://www.cddc.vt.edu/sionline/si/theory.html>

Mapping the *dérive*

For the mapping phase an approach was developed to record the canine's movements and sniff activity. Traditional navigation technologies use data within mapping to render 2D space, in contrast this approach was to record 3D movements generated by canine olfactory behaviours in space. To do this I developed a simple android app to record xyz coordinates (using the mobile's accelerometer) timestamp and location as longitude and latitude (using GPS). A GoPro camera was also mounted via a custom harness on the canine's back to record time-stamped photos at 25 FPS. The human user then would drift through the streets, following the canine's lead, with the recording devices.

The project emphasises the act of presence and passage (experience) over the function of mainstream mapping services (e.g Google Maps) which is about destination, getting from A to B without being lost.

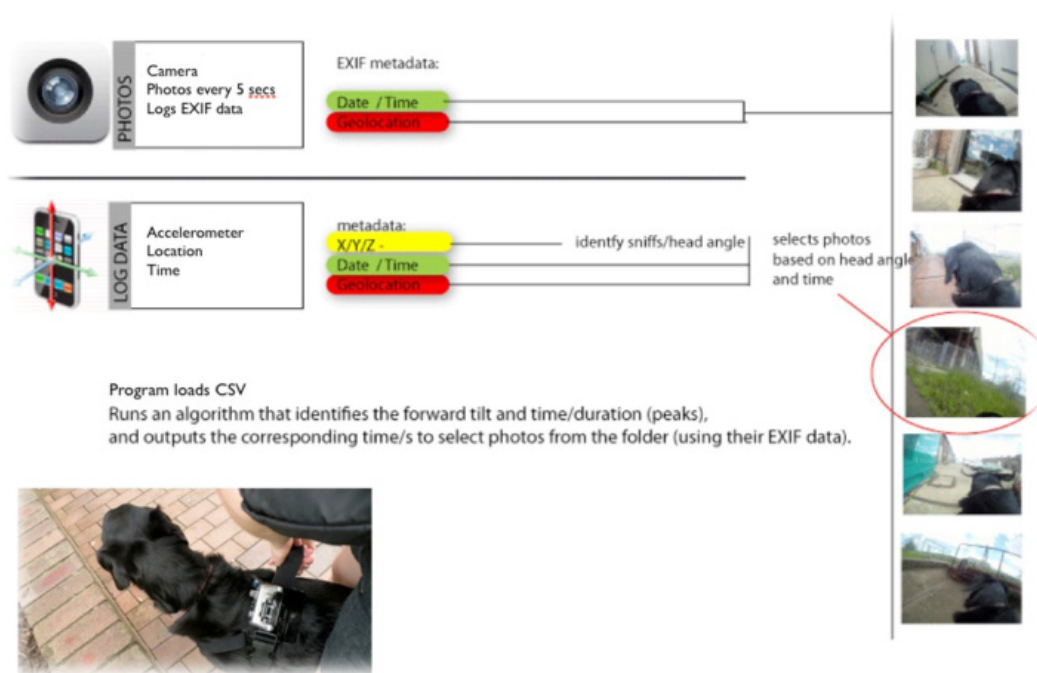


Figure 18: *Laika's Dérive v.1* data capture

At the conclusion of the *dérive*, the data was then downloaded to a desktop computer. For this first phase there were two main objectives in terms of visualisation. One was to develop a system for displaying the dog's sniff activities, and the other to use the dog's olfactory capabilities (sniffs) to select photographs from the *dérive* and to present them back to the human participants as a record of a shared journey. In the same way humans take snapshots during a tour, I wanted to see what dogs were "snapping" as placemarkers. As data, the photograph produced a sensory map across species.

For the first experiment, the accelerometer data was used in Max/MSP to sonify¹² and visualise the smell activity as a time-based display. A string was drawn in 3D space, and viewers could sense greater smell activities based on density of string and speed of drawing. To achieve this the accelerometer and time data were used to identify areas of most interest, mapping peaks via time stamps to the geo-tagged photographs (also timestamped via EXIF).

While useful as an autopoietic expression of the data, sense making of place was not captured in a form that was entirely satisfying for the human viewers. User feedback was that it was lovely to look at and experience and it had the affect of a walk, but the degree of abstraction in the representation meant

¹² Sonification is the practice of mapping aspects of the data to produce sound signals. In general, a technique can be called 'sonification' if it meets certain conditions. These include reproducibility (the same data can be transformed the same ways by other researchers and produce the same results) and what might be called intelligibility – that the 'objective' elements of the original data are reflected systematically in the resulting sound (Hermann, 2008, para.3).

that it was difficult to place in space. In other words, the referent of place was lost, the material conditions of their shared environment was not prominent in the presentation. This invited questions about what would need to be presented for humans to have a more situated experience of the entanglement. As a response to this the next experiment within Phase 1 used photographic imagery and Google earth to present the *dérive*. To do this a website was developed to document the experiments, first using a Google earth presentation of the data, then as a selection of photographs selected via dwell time (mapping canine interest to location photo).

As a result of these various experiments in data mapping, capture techniques and algorithmic selection, it was determined that the next phase (Phase 2) of the research be oriented towards making sense of the walk for the human participants, and finding a way to represent that walk that paid attention to the primacy of established documentation practices for humans, namely the snapshot. In short how can I map canine sniff interest as photographs for humans?

It is worth noting that a snapshot is a spontaneously taken photograph, hence its name. The aesthetic of the snapshot was chosen for *Laika's Dérive* as it supports the relationship of the canine to the human as personal and informal. The vernacular of the snapshot was accessible to users via what the Metropolitan Museum of Arts curator Mia Fineman describes as “its ubiquity, instantaneity, multiplicity and verisimilitude” (Fineman, 2004, para. 4).

Phase 2 – Developing for users – Public participation Carriageworks event

Up to this point the experiments were aimed at a single user and their dog. For this next phase the project was aimed at opening up the technology for multiple users for The Performance Space *Walk* program. This required a scalable solution and to consider how the *dérive* may be approached by a broad community of humans and dog breeds within Sydney. A key objective was to make the project understandable to those users, and to communicate a simple experience for them.

As a first step the focus was on developing a “sniff detector” system to work with many breeds¹³. This involved experimentation into what would

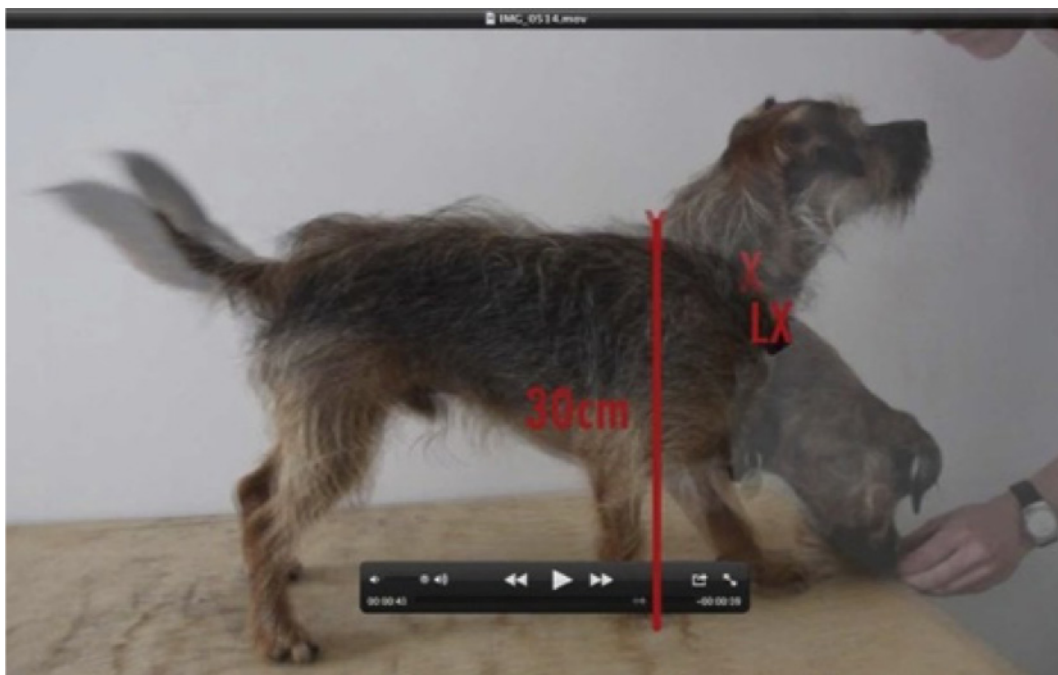


Figure 19: Development research, video recording of Trotsky to determine sniff movement.

¹³ Research undertaken during a residency at Blast Theory, UK with Trotsky a small terrier. The phase 1 design was for Laika, a 16 year old Kelpie cross.

constitute a sniff for any size breed. The accelerometer again would be used to determine position. As a result of this physical research (documented in Appendix A) it was found that neck angle would be used as data points to determine if a dog was interested in a particular “spot”. Dwell time would be an indicator of interest; if a dog had a head down position for significant time, then that constituted a sniff. This is admittedly a crude translation of canine interest, but like the original Laika space mission data it was based on an observable physical action on behalf of the dog. As a type of parallel practice, it was a reproduction of the crude techniques used by the Soviet Space Program. In terms of current scientific practices an invasive brain probe could provide a more accurate reading and reproducible experiment, but verifiable data collection in a scientific domain was less important than an observable action for the human participants.

In terms of system design *Laika's Dérive* phase 2 resulted in the development of a custom mobile app for participants, which included sign on information about the owner and the dog. When starting the *dérive* dog owners used the app to take a snap of themselves with their dog. This was designed to enhance and validate the user's relationship with their dog and to focus attention on that relationship for the duration of the walk. At the conclusion of the walk the journey was uploaded to the website. This included user and dog details (form based) and the photographs chosen by the sniff detector algorithm. A Facebook page was also used to let participants know their dog walk was ready. At the

conclusion of the project a Best in Show BBQ event was held at Carriageworks. During this event, guest curators from The Performance Space and the Australian Centre for Photography (ACP) gave out prizes for the best photographs taken by the dogs.

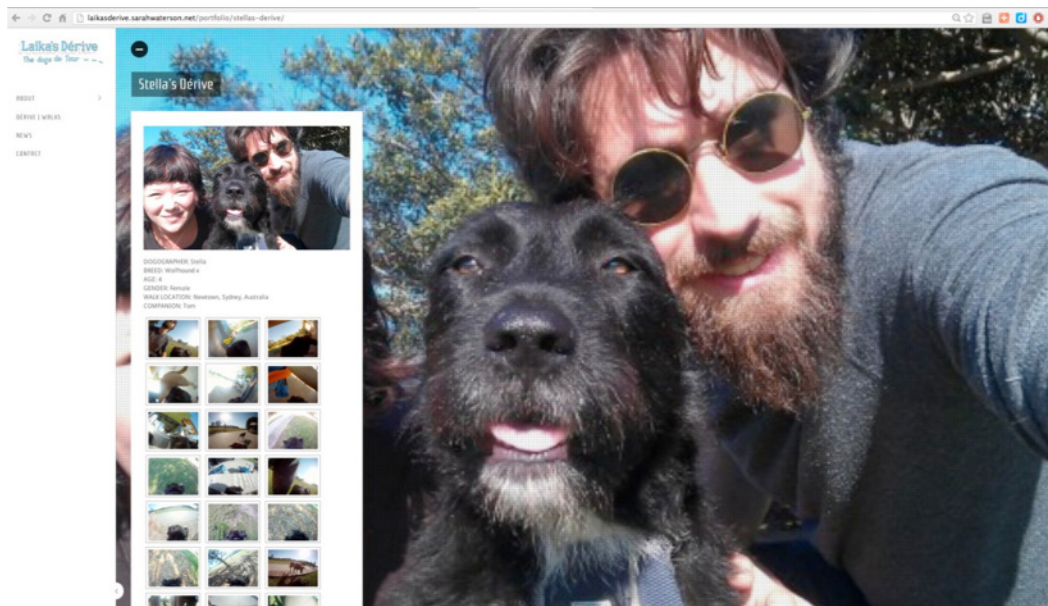


Figure 20: Laika's Derive project website and participant page. <http://laikasderive.sarahwaterson.net/>

The Best in Show BBQ was a key part of the conceptual development of the project. It drew together an unlikely assemblage and entanglement of traditional practices such as the BBQ, the Best in Show and the art award. The curator's choice awards for photographs taken by dogs served to draw attention to the greater ecology of art markets and art making more broadly. Although the event served to foster community and provide a debriefing space for all participants, the ambition was to comment on who gets to make art and how it is validated.



Figure 21: Laika's Derive Best In Show BBQ, Carriageworks, Sydney.

Returning to Haraway's co-species questions (1) who and what do I touch when I touch my dog? And (2) how is 'becoming with' a practice of becoming worldly? (2003), we can see that the approach for this phase recognises the primacy of the sight sense for the human, and olfactory sense for the canine. The "data" recorded, like a parallel history of the original Laika mission, is both incomplete and biased through the collection practices and approach. We can't know what the dog really finds interesting and we don't know what they are thinking. All we can know is how the idea of smell and canine interest can play out during a walk from a human perspective. Attention and head position (neck angle) are a very pared back set of data to use to determine interest. This interest happens within the bounds of differently trained (domesticated) dogs, in different areas of civil space – the street, the park, the café, the verge. The practice of "becoming worldly" in this project is about a recognition of the primacy of the human, and reflection on the scientific practice of distilling experience into very discrete, measurable elements.

As discussed in Chapter 2, Stengers wants us “to understand science in the specificity of its practices” (Stengers, 2010), the *Laika’s Dérive* projects attend to this idea by employing the data collection methods (practice) to reveal both intent, embodiment and emotive aspiration of behalf of the human participant. The “data” can thereby be seen as an ecology that includes both the practice to develop the project, as well as the participation within it. The obligations that the practice impose upon those who practice it, make use of *it*, or get affected by *it* are investigated as a key component of this phase of the work.

The ambition of the system design (practice) was to highlight the human relationship during the walk as a nod towards the human becoming *more* with the dog. Similar to the Laika Soviet Space mission, the data itself was not particularly important, but the act of participation and focus during data collection was. The human – dog entanglement that subsequently plays out in each project, although very similar in collection methods (sensors and measurements), constitutes markedly different ambitions. For the Laika Space mission the signalling of Soviet space superiority was paramount, for *Laika’s Dérive* the focus was on providing a tool to evoke reflection on non-human relations. In this way data can be thought of as being entirely about relations, and not about information per se. Those relations as we’ve seen include the nonhuman and the processes employed within the work. In this way the work (art practices) within *Laika’s Dérive* have contributed an alternative locative media practice which aims to evade the embedded systems of constraint found within traditional mapping applications (apps).

4.2 *Hothouse* – weather data and colonial practices, clouds in the clouds.

The well-defined nature of the possible histories is not to be approached by a mere mention of laws expressed as differential equations, but by an understanding of how such equations in fact individuate trajectories. (DeLanda, 2012, p36)

The western world's extractive current quest for more and more granular data, processed by exascale computing power, enabling more sophisticated algorithmic and artificial intelligences is eclipsing the greatest issue of our time, the collapse of natural systems and failure to think on a fundamental level about our entanglement, as "humans," with the rest of the universe, or the naturecultures (Haraway, 2008). As discussed in Chapter 2, natureculture's conceptual ambition, like ecosophical thinking, is to disrupt an ecological arrangement that situates the human at the centre of activity and subsequently meaning-making. They can be seen as an assemblage of "people, things, laws, politics, techniques and ethical strategies" (Muecke, 2008). That is, they are formed from relations. The practice work *Hothouse* was developed to produce an arrangement that foregrounds the problematic practices that arise from neglecting the entanglement of humans with the world. *Hothouse* is designed to do this by using extractive practices in producing the work, and by co-opting the audience into that set of relations.

Physically, *Hothouse* included an acrylic glasshouse-like structure that was used to deliver the weather system from Mt Kinabalu, Borneo in order to

sustain a *Paphiopedilum rothschildianum* from that area. *Hothouse* was exhibited at the Cementa 17 event in Kandos, NSW, Australia. It was developed to further examine practice-based ecologies with a view to develop a system for data and display that repositions those practices. These practices had their roots in the British Victorian era, and included meteorology, architecture, and horticulture. Following *Laika's Dérive*, I planned to develop a system for making sense of data by re-territorialising data systems within the media artwork as the central tenet for meaning-making within the work. As an orchid enthusiast, I was also concurrently developing an amateur greenhouse automation system for my orchid collection, which led to an examination of the practices which connected the automation to commercial systems.

Hothouse was developed as a site-specific installation within the Kandos Scout Hall in Kandos. It consisted of an acrylic-sheet house structure, an LED sign, and a framed botanical drawing of *Paphiopedilum rothschildianum*. Within the acrylic “hot” house was a live *Paph. rothschildianum* seedling that was being sustained by a bluetooth-enabled Arduino board that controlled water moisture, temperature and lighting effects. The house received weather data from the orchid’s indigenous location on Mt Kinabalu, Borneo, and used that to set environmental conditions within the house. The audience entered the darkened hall and encountered the lit house, a LED sign¹⁴ with the names of the world’s banks scrolling¹⁵, and a framed print of *Paphiopedilum rothschildianum* from 1888. The orchid seedling (obtained from a Taiwanese lab) could be viewed through a clear acrylic slit on one side of the house.

¹⁴ This sign was intended as a point towards conspiracy theorists’ websites that list the Rothschilds as ‘owners’ of various banks. It was intended as a humorous red-herring and link with the *Paphiopedilum* named after the Rothschild that funded its European ‘discovery’.



Figure 22: Hothouse Installation, CEMENTA, 2017.



Figure 23: Hothouse installation view, CEMENTA, 2017.



Figure 24: *Paphiopedilum rothschildeanum* in tube, Hothouse 2017.

Hothouse was designed to (re)produce a set of relations that are reflective of the failures inherent in technological solutions to support landscapes in historical and contemporary settings. These failures, as outlined above, are an outcome of practices that ignore entanglement and privilege extractive relations at the most fundamental level. The constituent practices for the work's development and implementation draw on those of the banking sector, free markets, horticulture, botany, meteorology, data services, cloud computing and colonial conservation. Respective data practices from atmospheric monitoring, computer

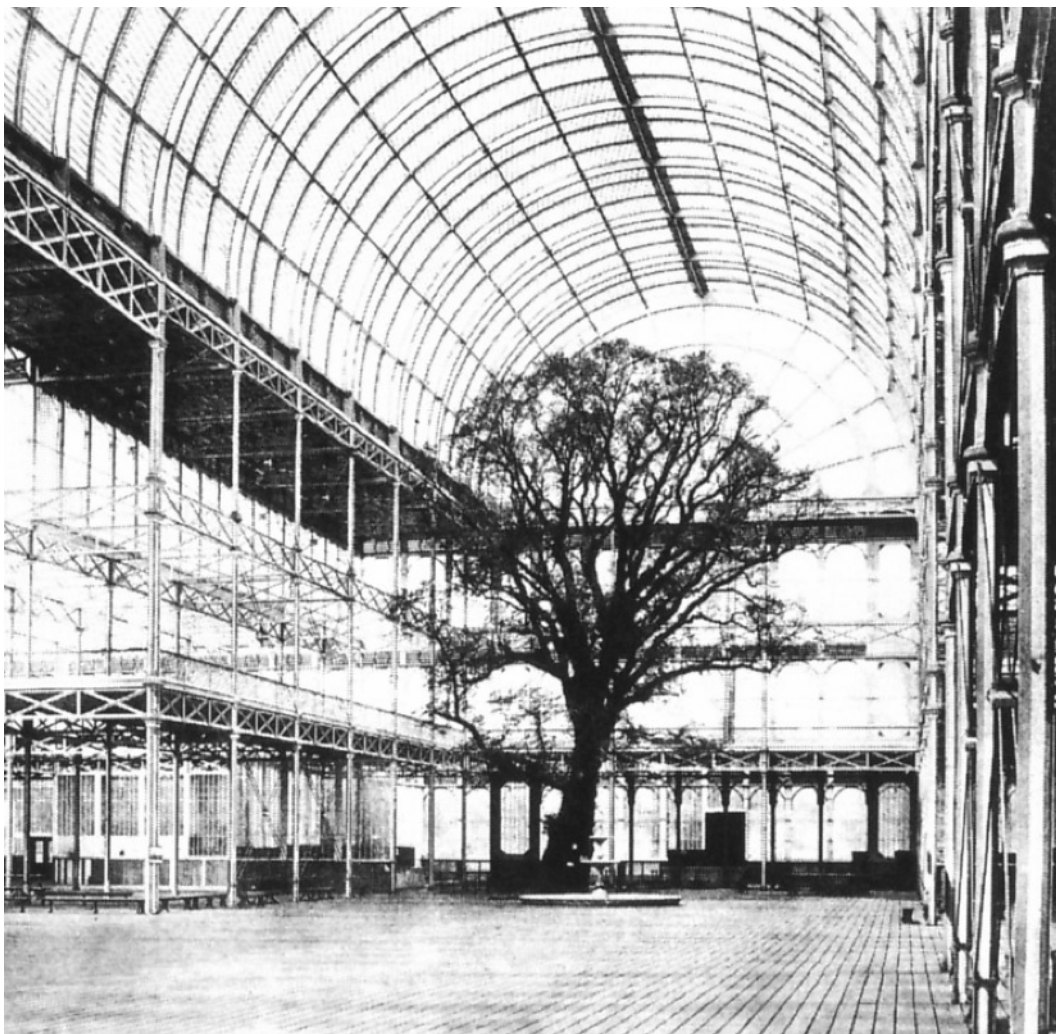


Figure 25: A tree in the Crystal Palace during the first Great Exhibition 1851, Royal Horticultural Society, Lindley Library. Public domain.

climate modelling and agriculture in all its forms are also utilised within the work, practices that impact agriculture, drive the futures market and climate change agendas, and in turn work to form social and economic conditions.

In terms of materialist practices, colonising landscapes was a Victorian era pre-occupation. *Hothouse* was designed to reflect this ecology of practices by reproducing an assemblage that mimics the Victorian conservatory, most notably the Crystal Palace Great Exhibition tree, from 1851.



Figure 26: Hothouse interior electronics.

The highly technologically dependent *Hothouse* and its rare orchid seedling was exhibited within a cement block Scout hall – a house within a house. The town Kandos, where *Hothouse* was located, was a company owned village originally set up to house predominantly migrant miners in the cement industry in 1915. The town is a result of the ongoing English colonialist practices of the early 20th century. Houses are imposed upon a landscape largely unsuitable to sustain them, with vast inputs required to maintain human activity. *Hothouse* was designed as an imposed architecture within an equally imposed place.

In bringing the weather system from Mount Kinabalu, Borneo to nurture the rare and fragile orchid, *Paph. rothschildianum*, *Hothouse* is designed to produce an uncomfortable affective natureculture. By inviting the audience to consider the relationship between weather and capital, at a time where we are witnessing unprecedented changes in the Earth's weather patterns, and where that weather also continues to drive the global futures market, *Hothouse* produces a set of relations reflective of colonialist practices. *Hothouse* develops what Stengers calls “operative constructs” (Stengers, 2011, p153). *Hothouse* as a construct allows for a further investigation into how to address both the qualities and the impacts of colonial structures. The material practices, and the history of those practices are vital to establishing [how] “the materiality of informational objects gets distributed, dispersed and takes effect”(Goddard & Parikka, 2011, para.3) to form the media ecology of *Hothouse*.



Figure 27: Plate 61. *Paphiopedilum rothschildianum* (as syn. *Cypripedium rothschildianum*) Sander, F. (1888). *Reichenbachia, Orchids illustrated and described. Volume 1*. London: H. Sotheran & Co.

Orchid hobbyists and industrialists continue to maintain the colonial legacy of conservation which is reproduced in *Hothouse*. Rather than thinking of an all-encompassing and controllable system, *Hothouse* challenge us to think about processes and practices as dynamic and relational. By selecting a pared down set of data and materials for the project, attention is drawn to the scale of requirements and inputs needed to sustain an orchid seedling outside of its indigenous environment. Notably the *Paph. rothschildianum* seedling used in *Hothouse* was imported from a Taiwanese cloning lab, part of an industrial complex supplying first world orchid fanciers.

A brief history of *Paph. rothschildianum*, while not seemingly related to data practices, is important to include here as an intrinsic part of the work, and as an historical set of relations that can be mapped into current practices and visions for technological solutions. What Fuller articulates as “a descriptor of the parallel histories and affordances of context”(Fuller, 2005 p. xi). In *Hothouse* these parallel histories include 19th century orchid mania, weather monitoring, and contemporary data services. The multiplicity of meanings associative to the constituent binding relations of these information objects (orchid mania, weather monitoring, network services etc) are contained within the ecology of the work, and are vital to how the work performs its representational strategy. As we saw in Chapter 2, there are no longer any stereotypical order-worlds, but from Bateson onwards thinking becomes more relational. There is now an epistemological

system based on an understanding of nonlinear systems and the network of relations that define the system (Bateson & Bateson, 1972, Genosko, 1996). The network of relations described in the remainder of this chapter describe how affordances of context perform the parallel histories in the *Hothouse* work.

*Paph. rothschildianum*¹⁶, named after Baron Ferdinand de Rothschild¹⁷ was the most sought-after orchid at the height of the British 19th century orchid mania (Cribb, 1998). This orchid symbolised, and continues to symbolise British colonial adventure, scientific investigation¹⁸, and religious debate during the late 18th and 19th centuries. It was introduced into cultivation in Europe and Britain in 1887, but was ‘lost’ to Europeans for almost a century as the original site was deliberately falsified by the collector, Sander & Sons, who gave the location as New Guinea to mislead rival collectors (Koopowitz, 2001).

Paph. rothschildianum can only be found growing indigenously on Mount Kinabalu, on the island of Borneo (Kalimantan) in the state of Sabah, Malaysia,

¹⁶ *Paphiopedilum rothschildianum*, has a history worthy of its nickname. In 1887, *Paphiopedilum rothschildianum* was published by Jean Jules Linden and was officially named after Ferdinand James Von Rothschild, whose family was famous not only for its financial prowess but also for its philanthropy toward horticultural science. Horticulturists at that time all agreed that “The King of Orchids” should be named after him.

¹⁷ Baron Ferdinand de Rothschild, was a British banker, art collector and politician, a member of the prominent Rothschild family of bankers.

¹⁸ Darwin’s most important work of botany was perhaps his 1862 book on orchids, titled *On the Various Contrivances by Which British and Foreign Orchids are Fertilised by Insects*. In this book he wrote about floral forms and cross-pollination, which would provide the rigorous experimental data that brought his theory of natural selection widespread acceptance in the scientific community.

at an elevation of 600 to 1200 meters above sea level on northeast facing slopes. It commonly grows as a terrestrial in ultramafic soil¹⁹ but is also found growing as a lithophyte in leaf-litter on ultramafic cliffs, usually near a river. In the late 1950s two populations were discovered at the base of Mt. Kinabalu, and in 1959 many of the plants in flower were collected to decorate a bower welcoming the British Prince Philip to Kota Kinabalu. Most *rothschildianum* in cultivation today, are descended from these specimens. In 1979 a third population was discovered in Kinabalu park. These plants are threatened by shifting agriculture, logging, mining and commercial development. An attempt at propagation and reintroduction onto Kinabalu in the 1980s ended catastrophically when the reintroduction site was burned. In 2020, only one of the three sites remain on Kinabalu, an area of four square kilometres. Plants inside the park, although they are protected, are not safe from determined poachers. The population trend is decreasing, and the number of mature indigenous individuals is very low (estimated to be less than 50). According to the International Union for Conservation of Nature (IUCN), *Paph. rothschildianum* remains on top of the critically-endangered orchid species list.

One of the other key practices within *Hothouse*, weather monitoring, which was an early form of networked computing, also serves as a useful narrative with which to enter the work. In describing this history, we can see that early data practices within networks reflect the affordances that cloud computing provides today, albeit on a much larger scale. The first weather forecast made

¹⁹ Ultramafic soils are weathered products of lithologies, such as peridotite and serpentinite bedrock, consisting predominantly of ferromagnesian silicate minerals (Galey et.al, 2017, p.1)

by Meteorological Statist to the Board of Trade, Robert FitzRoy in 1861 is an example of a network developed to deliver data that pre-dates computers and cloud computing by almost a century. FitzRoy had the original idea of setting up weather observatories long the British coastline, and linking these via the newly developed telegraph to deliver weather data to a centralised location in order to make predictions. These first daily weather forecasts were published in The Times in 1861 (Moore, 2015). FitzRoy's original office is now the site of Britain's Met Office – the national meteorological service for the UK and home to three Cray XC40 supercomputing systems capable of over 14,000 trillion arithmetic operations per second, with capacity to take in 215 billion weather observations from all over the world every day. As an assemblage *Hothouse* intersects with this parallel history through the cloud AccuWeather data service, a commercialisation of FitzRoy's original data plan.

By drawing on the technical practice of weather prediction, notably using cloud services, the data within Hothouse inhabits an ecology that performs both its current provenance, but also its historically located one. A history of practice that repositions Victorian values through exhibitions, conservation ideas, botany and networked weather computers. Given this, data within the work is about performing these relations, and not about information per se. In considering a concept of data ecologies, for *Hothouse* we would then also include these processes and methods are inherent to the meaning making within the work.

The assemblage of data performed across both time, and location, in *Hothouse* establishes that data as processual. That is to say *Hothouse* performs a complex data ecology. The data produces and reproduces its qualitative component, not only through its relations, but also through the practices (processes and methods) that produce it.

In Chapter 2 we saw that what matters for networks are not the messages or the content, but rather “their circuits, the very schematism of perceptibility.” (Kittler, 1986. p. xl-xli). In drawing on the historical settings and the constituent practices for the *Hothouse*’s development and implementation – those of the banking sector, free markets, horticulture, botany, meteorology, data services, cloud computing and colonial conservation, and the respective data practices (from atmospheric monitoring, computer climate modelling and agriculture in all its forms), a very particular data ecology is produced through the work. One that is attendant to ecologies of practice.

This Chapter has described a range of practices and methodologies that address the materiality of data: the processes that bring it into existence, and an investigation into the more precise nature of the interconnections the world data creates and actions. The projects presented in this Chapter push concepts of media ecologies beyond human/machine interactions to include cross species sensing and mapping. The works produced, *Laika’s Dérive* v.1 (Incubator, Performance

Space, Sydney), *Laika's Dérive* v.2 (Carriageworks, Sydney, and Furtherfield, London), and the reactive weather system *Hothouse* (Cementa, Australia) attended to data ecologies in very different and specific ways, from the collection methods and system design, to the experience design components. Although the data collected and produced within each project was ancillary to the meaning that the systems of participation produced, it produced meaning through each relational flow.

Each project utilised data provenance as a key component of the practice. *Laika's Dérive* demonstrated how the collection method embeds the participants as data, and uses a relational conception of data to reveal both intent, embodiment and emotive aspiration of behalf of the human participant. For *Hothouse* we saw how weather data performs across markets, history and location to generate an assemblage that serves to produce experiences of those parallel histories. Each of the works presented further the novel idea of “data as ecology”, to articulate the complex network of relations that make, shape and create the works, where the outcome is not a visualisation, but rather an assemblage design to produce meaning.

05

Conclusions and Implications for practice

Cooking with data

The research inquiry undertaken throughout the course of this practice-based study has sought to investigate how we can view data when we consider it as an ecology. As argued throughout this thesis, this can best be achieved by mobilising the novel concept of data ecologies as a strategy for practice. The original practice-based suite of works *Laika's Dérive* and the *Hothouse* project were developed specifically to produce a practice that addresses data within this framework according to what I refer to as a data ecological strategy. Throughout the written component of this research, there remains a palpable tension between what the writing and the creative work/s are able to articulate in terms of the data practices created and presented during the course of my doctoral research. There

is a definite tussle between accounting for the ways in which these individual works have been framed and exhibited, and the necessary elaboration of a wider context or framework that makes them comprehensible within the broader field of research my creative practice is part of.

The practice components documented in this thesis lay a foundation for considering a relational understanding of data – an understanding achieved by challenging a common assumption that data is somehow pure, raw, or taken as a given. My work insists on viewing both the ecology and the data as an “entanglement of transactional processes”. Throughout this thesis, data has not been considered as a pre-existing instantiated object, as is the case in object-oriented programming where reusable code blueprints dictate that data be flattened in order to have repeatable methods applied to them. In stark contrast, my approach has been to consider the complex and relational nature of data as it “emerges” from human systems, and as it “produces” those systems. Through a creative-practice-as-research approach, this thesis has consequently moved beyond the idea that there is such a thing as raw data, to advance the novel idea of “data as ecology”.

The data ecologies that this thesis outlines and analyses enable a productive approach for media art practices to attend to the processual quality of data in a novel ecological framework. As such this framework can be used to

communicate complex poetic knowledge systems. It is those knowledge systems in this written component that often elude the complexity of description that is presented in the practice works themselves, or indeed through participation in those works.

The practice presented in this thesis calls for a more sophisticated discourse about the varying temporalities, spatialities and materialities that we might represent in our approach to data. At the end of the day, this novel approach seeks to make a contribution to the ways we might design data systems for maximum flexibility, and to allow for as many potential behaviours and relations to emerge as possible. Raw data is both an oxymoron and a bad idea, particularly as it extends extraction mentalities. On the contrary, data should be “cooked with care” (Bowker, 2006, boyd & Crawford, 2012, Gitelman, 2013).

By articulating the complex network of relations that make, shape and create media artworks, I have attempted to further a method or practice that at its core attends to the “materiality of data”. In considering this new concept of data ecologies – that is, data as always relational – I could then also include the processes and methods of the data production, as well as its reception as part of the data presentation (as demonstrated in the practice-based works created and presented as part of this thesis).

Within this thesis, media artworks that have data as a central “material” have been shown to perform a range of representational strategies within four broad groupings:

1. Locative media
2. Data mapping
3. Data networks/generative systems
4. Data networks/scalar assemblages.

Although the design practices described within these groupings varies, the data ecologies all point towards a more complex readings of these works. These more complex readings have helped me to identify broader ecologies of practice, and subsequently helped me attend to the qualitative component of data as both matter and process. This runs counter to the current main components and ecosystems characteristic of big data, including analytical techniques such as A/B testing, machine learning, and natural language processing. All of these approaches assume the data is a material freed from its ledger. In the data practices and approaches outlined in this thesis, we can see that data must always be considered within its social, economic, political and historical contexts. The media artworks presented in Chapter 3 and 4 have furthered this by developing original systems that present this consideration as a fundamental part of the presentation and system design.

The media artworks presented in this thesis demonstrate how the conceptual and technical curation of datasets and processes in a structured artwork can have a range of relational consequences for, and with an audience. A key outcome of this research (when considering this concept of data ecologies) is where practices use data they should also include the processes and methods that produce the data. They also need to consider its reception as part of the data presentation. Put another way, the strategies to present “data” should always attend to its qualitative components, including recognition and acknowledgement of its provenance. Given this, when looking at such works, we should always investigate and articulate the evolving or changing set of relations within those processes and methods as also situated across historical time. Data ecologies ask that the data presentation be entirely about relations in all forms, and be viewed as “relational assemblages” in the broadest sense.

In simple terms, ecologies can be thought of as a set of relations, and data should be seen as simultaneously matter and process. In thinking through data as an ecology (a set of relations and processes), my notion of data ecologies opens up new ways of thinking about what that data can do, be and become.

For media arts practice, this includes the processes and methods of data production, and the assemblages of complex interactions of economic, technological, social and cultural logics imbued in the work (Langlois, 2013,

MacKenzie, 2017, Mackenzie & Vurdubakis, 2011). Instead of thinking about data in discrete categories, data can function as lines that continuously shift and move together, thereby rendering categorisation redundant. This refutes current extractive practices that see data only as resource for mining, where the more there is the better.

It might seem reasonable to expect that this research could outline a definite set of data practices that are reproducible and specific for working with data in media art contexts. But as I have demonstrated throughout this thesis, the way we record data, and the sets of technical, formal, and social practices that surround it, should always be driven by the relations imbued in each location. The *Hothouse* project, which draws on (English) nineteenth century practices of science, and horticulture as mapped onto the social and the natural world at that time, also drew on mid-twentieth-century cybernetics system design approaches. In the end, this revealed the impossibilities of such approaches to sustain life – in this case a rare and fragile orchid. The 21st century tools developed for use in this project (data via simple web-based API connectors) allows us access to the past, as we project onto nature our various modes and practices for organising knowledge.

In contrast, *Laika's Dérive* used an algorithmic approach to the data in order to extract 'sniff spots'. It also employed a simple data mapping technique

to correlate that spot with a photograph. The data practices there, while also reproducible, were not the key outcomes for the project. The data collection and system design, although firmly in the 21st century, had its roots in Cartesian mapping systems from the 17th century. As Bowker, Barad and Braidotti remind us, all practices, be they social statistics, geological processes, cybernetics, databases, or indeed biodiversity approaches, all became master models of and models for their times (Barad, 2003, Bowker, 2006, Braidotti & Bignall, 2019). For the practice-based projects presented in this thesis, the models and practices outlined are highly local and specific to that iteration. I have intentionally made an effort to resist a reproducible master model, or to make any claims as to the universality for the work's use of data. The contribution that this work aims to make is a reflection on the tools, practices and techniques for meaning making, as embedded in the projects.

Throughout this practice-led thesis, both ecology and data has been viewed as an entanglement of processes and practices. In order to understand these relational processes, the practice-based works presented as part of this research can be thought of as designed experiences that ask participants to consider their place within the encounter. Given our current ecological crisis brought on through extraction ideologies and methods, it is imperative that we attend to these practices more carefully.

The methodology employed in the practice components allow for multiple perspectives of meaning making from the tools provided. The experience, the system design, the outputs, and the respective uses all call for a flexible approach to designing technologies utilised for both data capture and display. *Laika's Dérive* embedded human and canine relations into the system, and described it as a data ecology. Through this approach the significance and value of data as relational is accounted for. It should be clear by now that outlining a single method and elaboration of a wider context or framework would be fraught. Any model requires an embeddedness, and attention to the varying temporalities, spatialities and materialities for that specific project, whether they be human or non-human. As Deleuze and Guattari remind us when talking about practices we need to remind ourselves that “... politics precedes being. Practice does not come after the emplacement of the terms and their relations, but actively participates in the drawing of the lines ...” (Deleuze and Guattari, 1987, p. 203).

In this regard it is helpful to return to the model of interactions between ideas, forms and situations/actions that has informed all of my research. The implications for future practice, particularly as we increasingly rely on machine learning and AI systems, is that we become ever more attendant to the provenance of the practice methodologies employed. For media artists, these methodologies currently occupy the space in the overlap between software development, data analytics, and the creative problem-solving disciplines. These disciplines include

user experience design (UX), design thinking, and interaction design (ID) more generally. The challenge presented by data ecologies encourages us to interrogate the underlying relations re-produced through these disciplines. Through the development of unique toolsets, media artists are well placed to contribute novel outcomes and practices attendant to the ecologies that surround data-driven works. Aside from producing representations and presentations from an often opaque back-end technical system, it is hoped that these creative practices can be developed to include an embeddedness of the forms, ideas and contextual practices employed. These practices by media artists need to continue to act as a strategic interventions into material, cultural and social discourses, where the artwork produced is an aesthetic materialisation of both the means of production and an intervention into those processes.

In addressing those discourses, the following diagram (previously presented in Chapter 1 of this thesis), outlines both how the practices and works themselves are integrated, drawn from ideas, forms and situational actions, with the media arts practice sitting in the centre.



Figure 28: Diagram of practice approach. Adapted from Sullivan's (2005) *Framework of Visual Arts Practice* (p 153)

This leads to a number of key questions for future research, and indeed the education requirements for artists into the future. In developing work, we should be asking the following:

- How do we design systems that reveal processes and methods within the work itself (Forms)?
- How do we continue to produce work that resists co-option into commercial software systems (Ideas), and should we?

- How do we resist current practice ecologies while at the same time practicing as artists (Situations)?

The works discussed in this thesis all contribute varying strategies to answering these questions. For instance, *Face to Facebook* does this by exposing the share practices and repositioning practices into a novel assemblage that can be displayed in a gallery and online space; *Rider Spoke* reveals these practices by using public space as a form of intimate space; *unfold* uses computer modelling to reveal a sublime experience outside of the data produced; *Laika's Dérive* uses multiple processes (both commercial and historical) to reveal an assemblage of practices that constitute an 'experience'. *Hothouse* also used industrial, historical and multi-faceted practices to reveal the politics of those practices in the work itself.

Common to all of the works discussed in this thesis, is the embeddedness of the practitioner, developing unique practice ecologies in order to perform as outlined above, strategic interventions into material, cultural and social discourses. All of the artworks produced from there are an aesthetic materialisation of both the means of production, including the practices that formed them, and an intervention into those practices. There exists no single method for this, but rather an attention to embedded practices within any context. Thus there is no singular design practice that can be derived from these discrete

works. Instead, my research has shown that they are situated, relational and conscious incursions into an ecology of practices set up to produce market value, amongst other things.

The ambition of the works presented in this thesis is to challenge how we both produce and present data. My hope is that future media artworks can expand towards new experiences and understandings of data for participants and practitioners alike. Data ecologies ask that the data presentation be about relations in all forms and methods. As a practitioner, approaches must always remain attendant to the tools, practices and techniques for meaning making, as much as the presentation and experience of the works produced. That is, they need to be cooked with care.

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A P P E N D I X

A

Documentation of practice works

To give the reader access to the original practice-based works I have included here documentation of the exhibition and development.

Full documentation can be found on the website:

<https://documentation.sarahwaterson.net/>

Laika's Dérive

Laika's Dérive 1.0

Kiss Club Residency: practice ecologies– Initial research and prototyping

In 2010 I was invited to be an artist in residence at Kiss Club, a studio residency hosted by Performance Space in Carriageworks, Sydney, Australia. The residency (with its working space) allowed me time to focus on developing and delivering a new work. Up to that point I was producing works for predominantly gallery settings. As part of the framing for my doctoral study I was speculating about how to develop work when we consider the broader ecologies of practice, and the arts in particular. I approached the residency as an opportunity to explore what art outside of the institutional exhibition could be. That is, thinking about what the artwork could do, rather than what the artwork means. With this question in mind, I set out to develop a project that provided an experience for users, and delivered this to non-experts, and non-art audiences to amplify and draw attention to relationships, and to environments.

At the beginning of the development I also sought to develop a project to enhance my communication with my dog, Laika. The simple act of walking through space with a dog, following interests brought in many issues, about boundaries observed by humans, but not dogs, about how spaces are mapped. In this early phase I saw the project as more than documentation of a human canine relationship, it was essentially a located experience mediated via technology, designed for myself and my dog.

During this residency I developed a system for capturing location data, and matching that to photographs in a simple data mapping arrangement. For this I used log-box, a basic and free mobile phone app for capturing and recording accelerometer and location data that exports CSV, and a GoPro camera mounted on my dog's shoulders, set to record 30 photos per minute in time lapse mode. Those photographs were then manually downloaded, the EXIF data read (time stamps) and matched to the time stamps data from log-box. A simple sort then found dwell times and head angle in the log-box data and returned the ID of the

photographs. This was done manually using Excel spreadsheets with a sorting formula.

For another sketch I took the data from log-box which recorded the sniff activity and wrote a program in Max/MSP to visualise the sniff data, and pull in photographs with the corresponding longitude and latitudes. The aim for this was to produce a time-based map of the derive, a visualisation and sonification of the sniff data. At this stage I was trying to develop sensory maps (visualisations) of place to produce a feeling based knowledge.

Outcomes from the residency included:

Web site – a repository for all of the photographs using XML and ActionScript 2.

Software for a visualisation and sonification of the sniff data: Using Max/MSP. XYZ accelerometer data was read from the log box data, then using jitter a line was continuously drawn in 3D. Photographs were selected from a folder based on the time and longitude /latitude stamp data to display on a plane below the line visualisation.

Exhibition: The sniff visualisation was exhibited as part of *Animals, People – A Shared Environment: 4th Biennial Australian Studies Group Conference*, POP Gallery, 2011, Griffith University, South bank Campus, Brisbane.

A Slide show talk: A simple slide show produced from the selected photographs to present a time-based experience of Laika, my dog's *dérive* to an audience at the completion of the residency. There was an emotional reaction from the audience, and many felt compelled to come and talk to me about their relationship to their dog. It was at this point I realised that other people would like to acknowledge and record their relationship with their dog using a similar system. It was apparent that the images were more than a photograph, they became a document of intimate relationship.

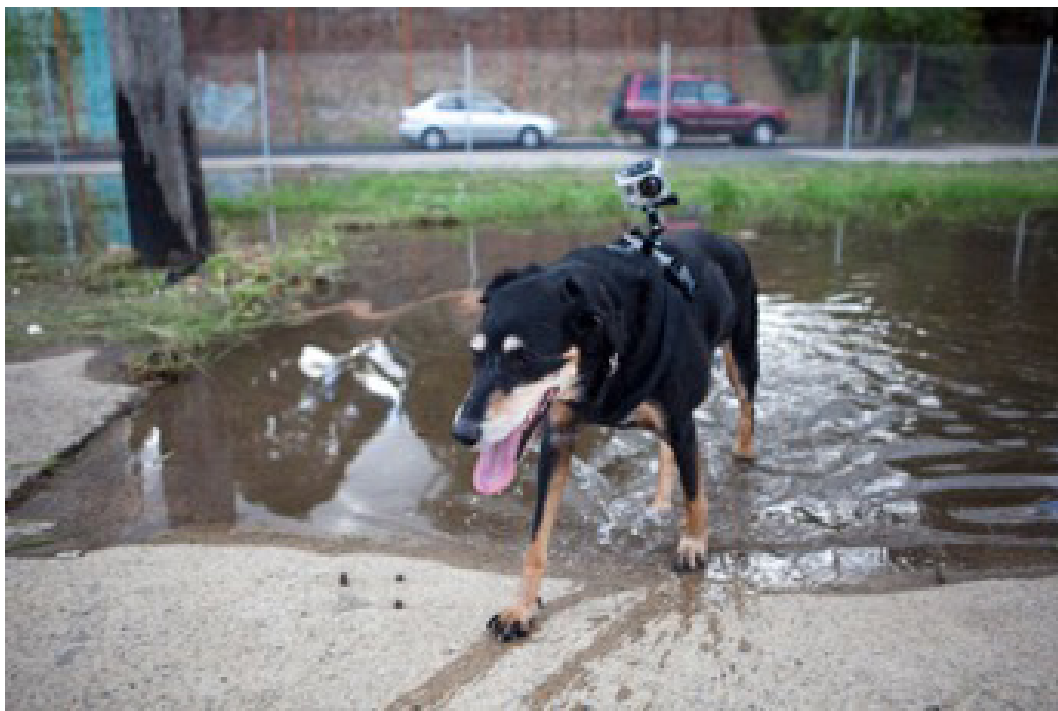


Figure 1: Laika testing the camera.

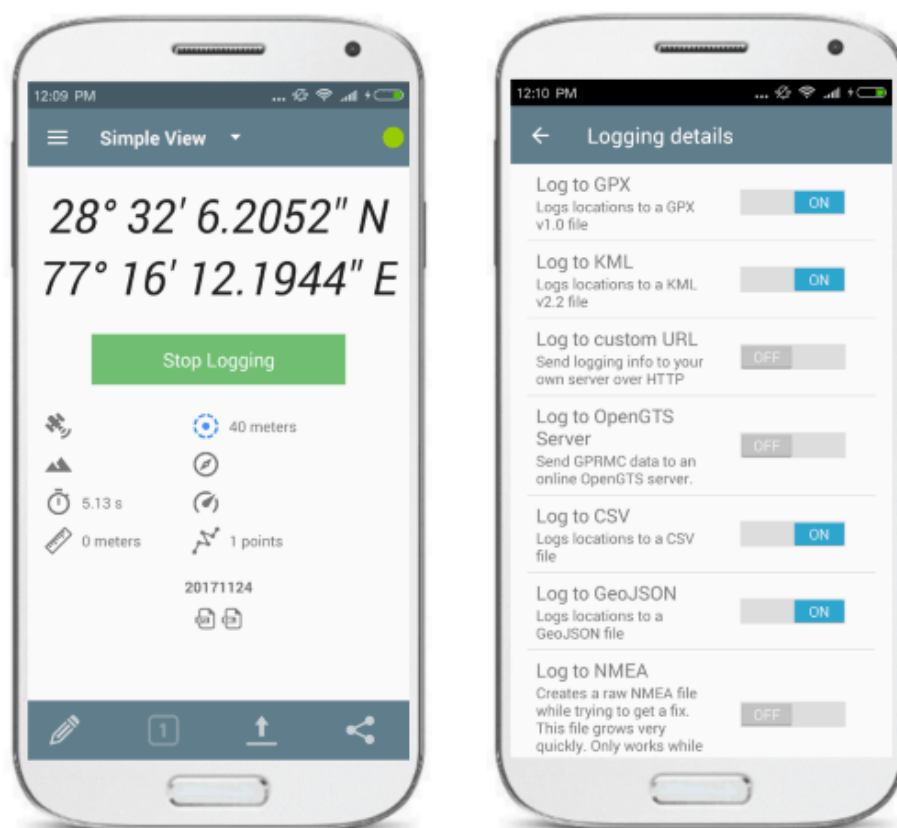


Figure 2: Location logging app with CSV export.

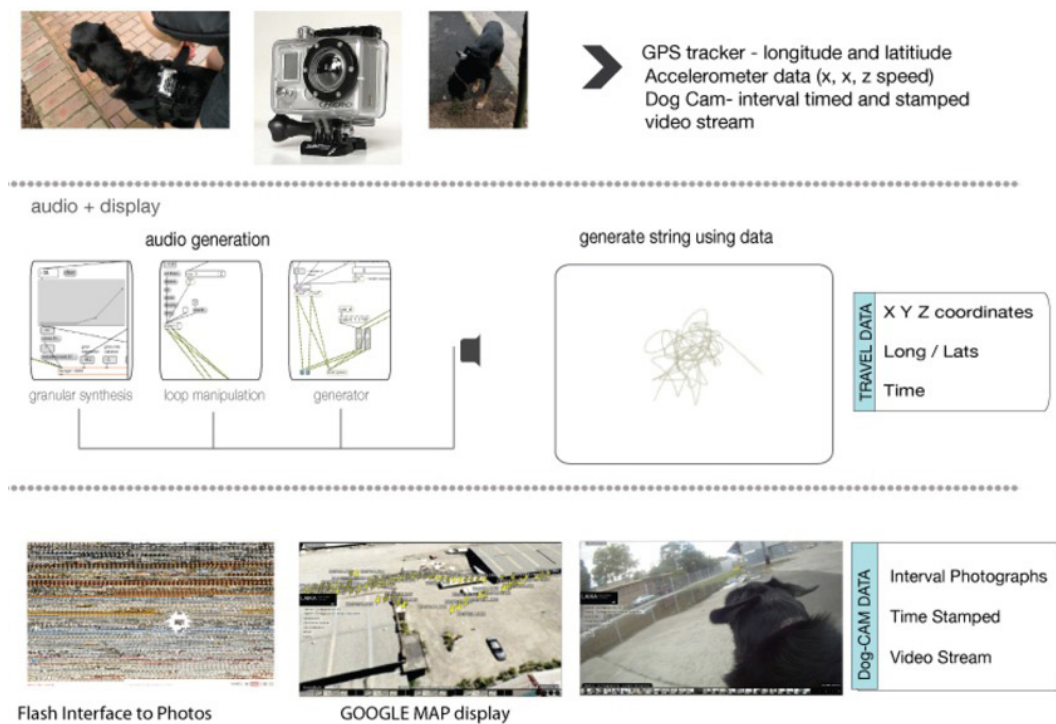


Figure 3: Overview of the data techniques developed during the Kiss Club residency; GoPro capture, Max patch design and web sketches.



Figure 4: Photograph from Laika's first walk. Photograph: Laika

Laika's Dérive website v.1.0 – photograph repository and early geo-mapping experiments:

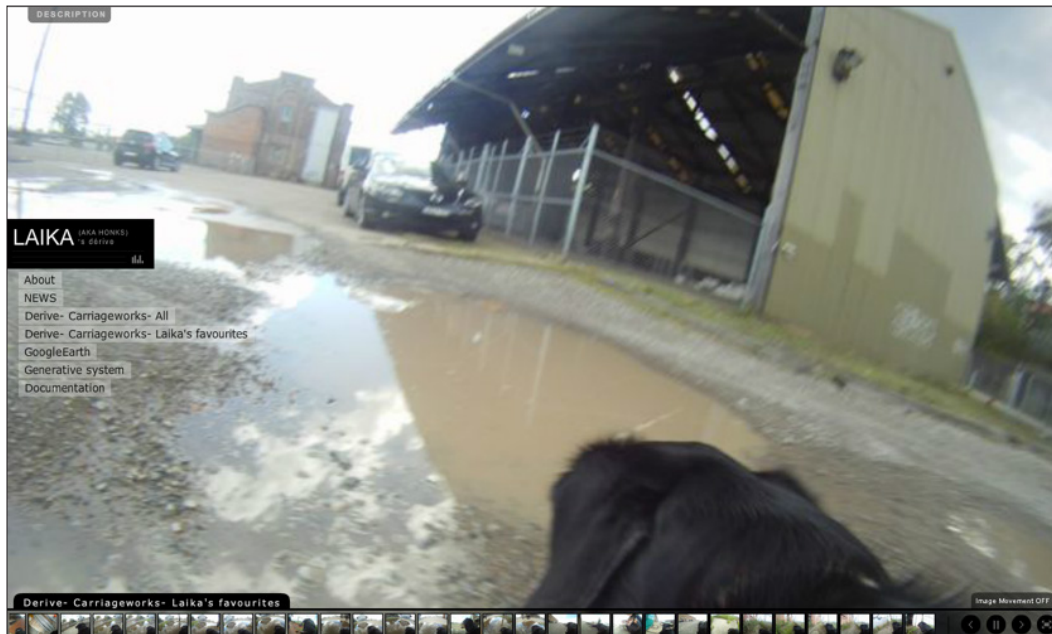


Figure 5: Phase 1 interface to photographic records. 2011



Figure 6: Phase 1 walk photo interface using co-ordinate mapping on google earth. 2011



Figure 7: GoPro Omni upload to Google Street View trial.



Figure 8: Sniff activity heat map from Centennial Park.

Laika's Dérive sniff visualisation using time and head angle, and time stamped photography:

Line no.	comma	Elapsed Time	X	Y	Z	Latitude	Longitude	Altitude
Speed	Column2							
1	"	0	0.196	-0.2035	-0.7267	-33.893105	151.191986	0
2	"	0.02	0.1531	-0.2761	-0.8793	-33.893105	151.191986	0
3	"	0.03	0.0586	-0.2035	-1.014	-33.893105	151.191986	0
4	"	0.04	-0.0281	-0.1127	-1.1397	-33.893105	151.191986	0
5	"	0.05	-0.0458	-0.0401	-1.0858	-33.893105	151.191986	0
6	"	0.06	-0.0811	0.0145	-1.032	-33.893105	151.191986	0
7	"	0.07	-0.0634	0.0145	-0.996	-33.893105	151.191986	0
8	"	0.08	-0.0634	-0.0583	-0.996	-33.893105	151.191986	0
9	"	0.09	-0.0104	-0.0946	-0.996	-33.893105	151.191986	0
10	"	0.1	0.0586	-0.1672	-0.996	-33.893105	151.191986	0
11	"	0.11	0.0929	-0.1853	-0.9601	-33.893105	151.191986	0
12	"	0.121	0.0929	-0.2035	-0.9422	-33.893105	151.191986	0
13	"	0.131	0.0929	-0.2035	-0.9422	-33.893105	151.191986	0
14	"	0.141	0.0758	-0.149	-0.9242	-33.893105	151.191986	0
15	"	0.151	0.0414	-0.149	-0.9781	-33.893105	151.191986	0
16	"	0.161	0.007	-0.149	-0.9781	-33.893105	151.191986	0
17	"	0.171	-0.0104	-0.1309	-0.9601	-33.893105	151.191986	0
18	"	0.181	-0.0104	-0.149	-0.9422	-33.893105	151.191986	0
19	"	0.191	0.0242	-0.1672	-0.9422	-33.893105	151.191986	0
20	"	0.201	0.0758	-0.1853	-0.9242	-33.893105	151.191986	0
21	"	0.211	0.0929	-0.1672	-0.9242	-33.893105	151.191986	0
22	"	0.221	0.0929	-0.1672	-0.9242	-33.893105	151.191986	0
23	"	0.231	0.0929	-0.1672	-0.9242	-33.893105	151.191986	0
24	"	0.241	0.0758	-0.1672	-0.9242	-33.893105	151.191986	0
25	"	0.251	0.0586	-0.1672	-0.9063	-33.893105	151.191986	0
26	"	0.261	0.0242	-0.1853	-0.9422	-33.893105	151.191986	0
27	"	0.271	0.0242	-0.149	-0.9781	-33.893105	151.191986	0
28	"	0.284	0.0242	-0.1309	-0.9781	-33.893105	151.191986	0
29	"	0.302	0.0758	-0.149	-0.9781	-33.893105	151.191986	0
30	"	0.322	0.0758	-0.1399	-0.9422	-33.893105	151.191986	0
31	"	0.332	0.0758	-0.149	-0.9422	-33.893105	151.191986	0
32	"	0.352	0.0414	-0.1581	-0.9242	-33.893105	151.191986	0
33	"	0.362	0.0242	-0.149	-0.9601	-33.893105	151.191986	0
34	"	0.382	0.0328	-0.1399	-0.9781	-33.893105	151.191986	0
35	"	0.392	0.0242	-0.1309	-0.9601	-33.893105	151.191986	0
36	"	0.412	0.0242	-0.1309	-0.9601	-33.893105	151.191986	0
37	"	0.422	0.0586	-0.149	-0.9422	-33.893105	151.191986	0
38	"	0.433	0.0758	-0.149	-0.9781	-33.893105	151.191986	0
39	"	0.442	0.0586	-0.149	-0.9601	-33.893105	151.191986	0
40	"	0.452	0.0586	-0.1309	-0.9781	-33.893105	151.191986	0
41	"	0.463	0.0586	-0.1309	-0.9781	-33.893105	151.191986	0

Figure 9: Raw Log Box CSV data. Eveleigh walk. 2011

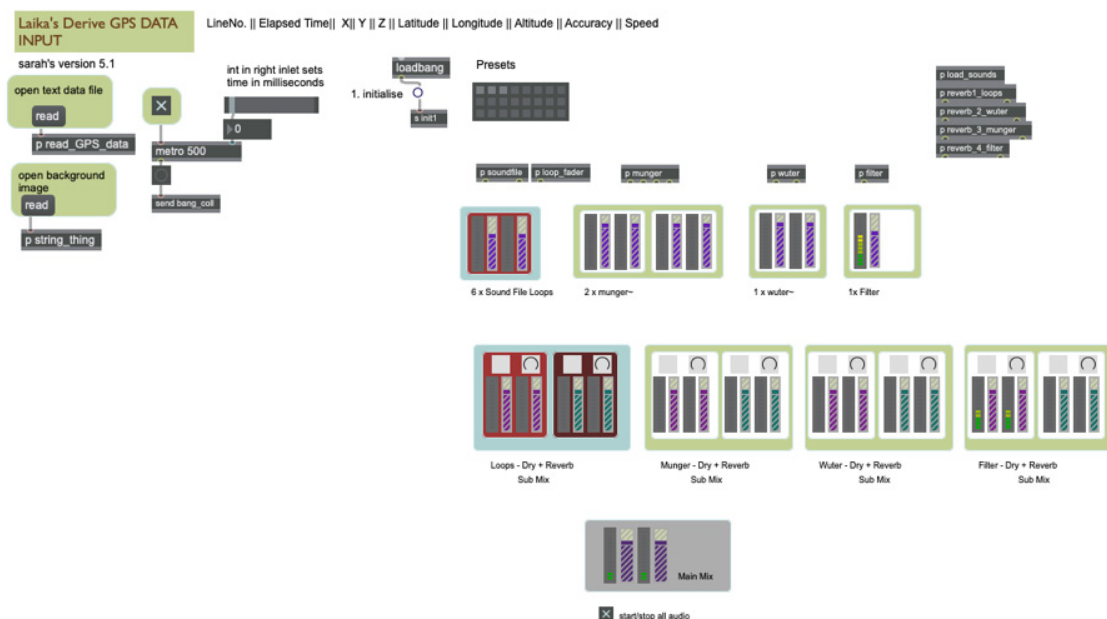


Figure 10: Phase 1 Max/MSP patch for sonification and visualisation using GPS data.

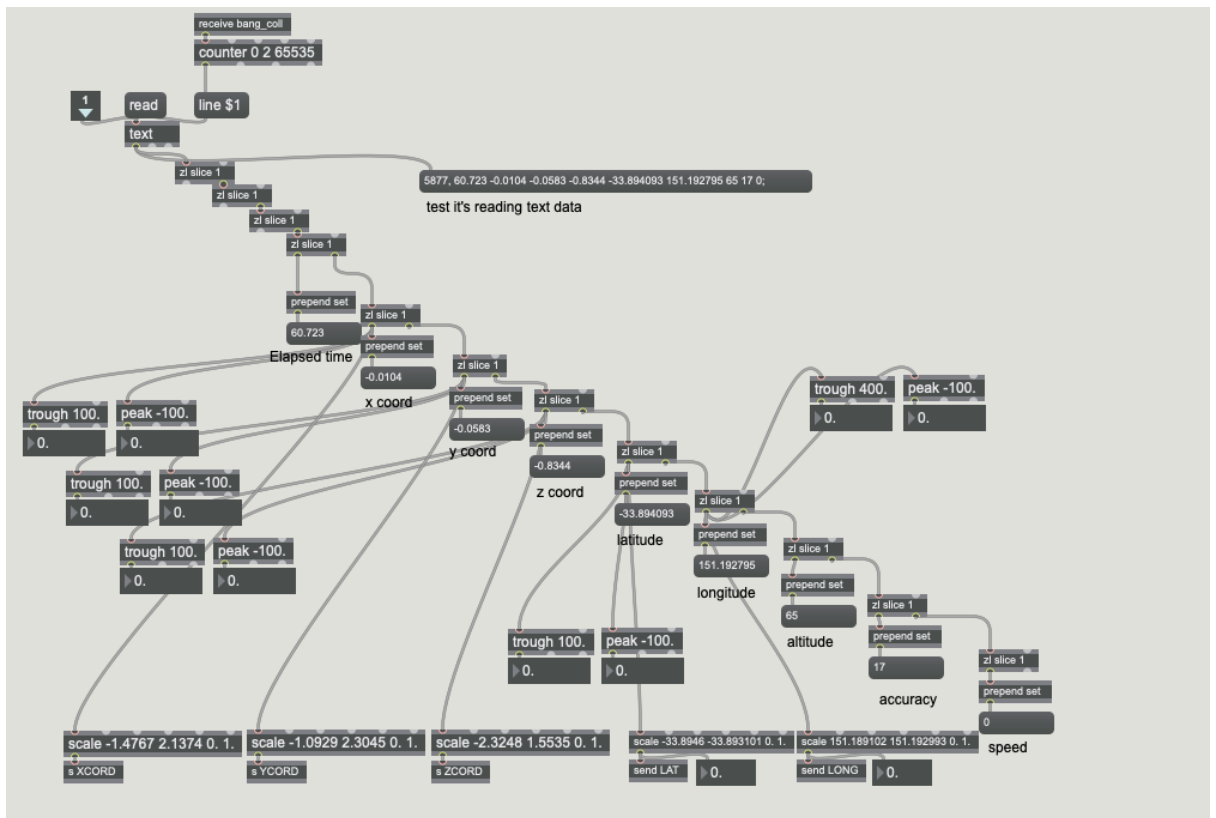


Figure 11: Phase 1 Max/MSP sub-patch for sniff processing location data.

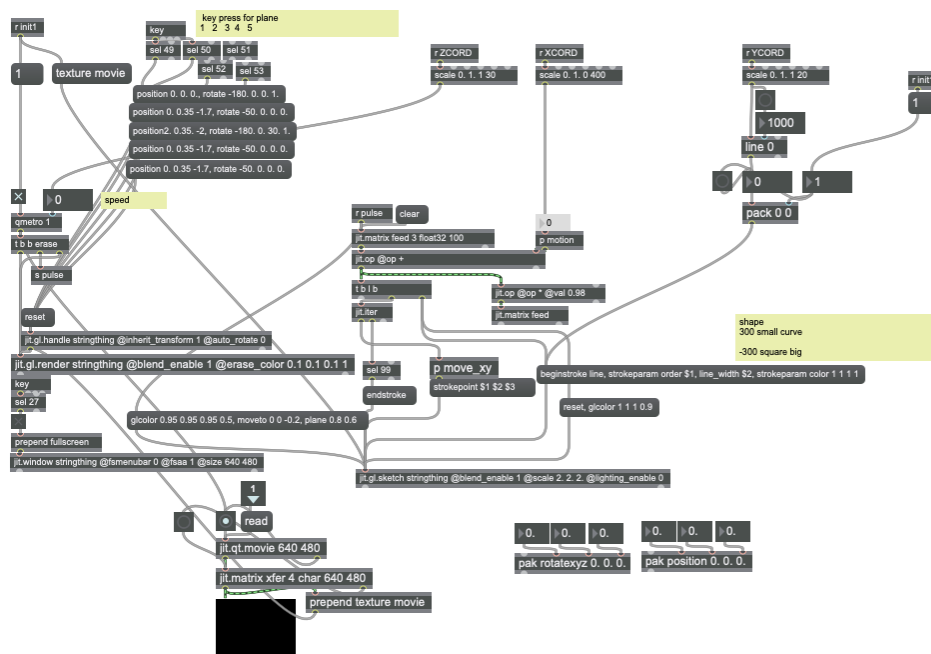


Figure 12: Phase 1 Max/MSP sub-patch for sniff visualisation.

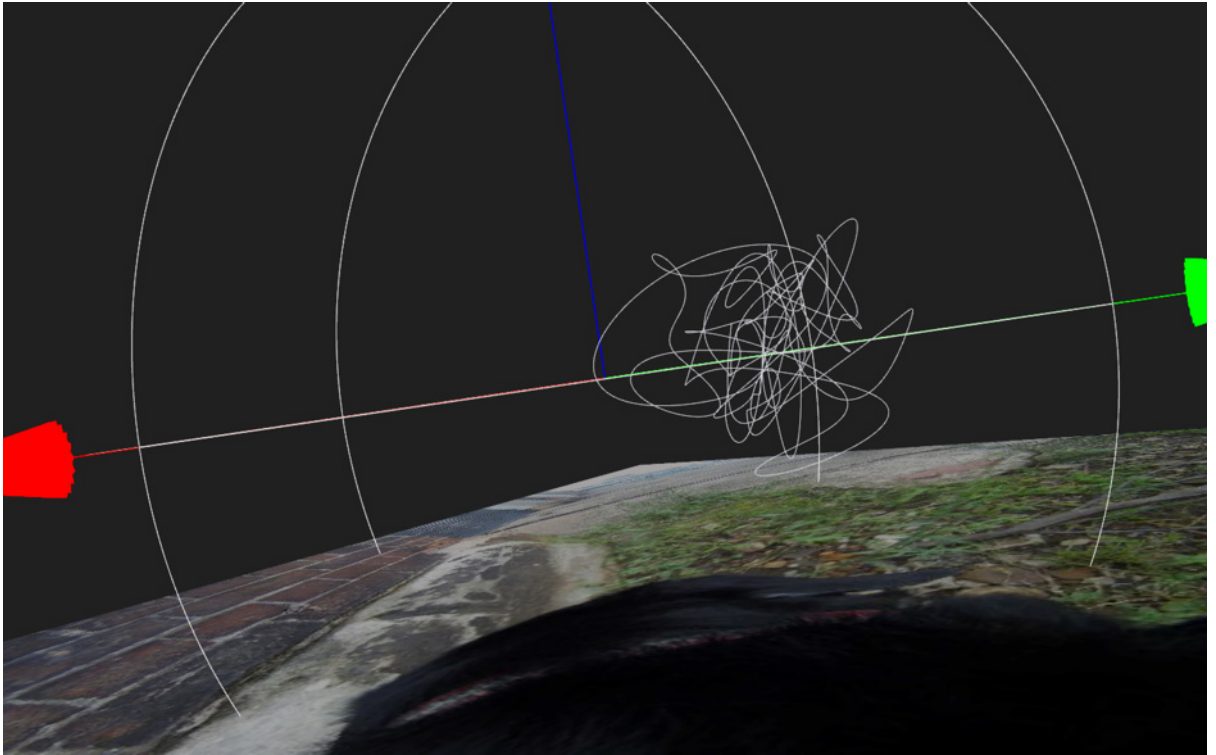


Figure 13: Sniff visualisation sketch from XYZ data with co-ordinate handle overlay. 2011

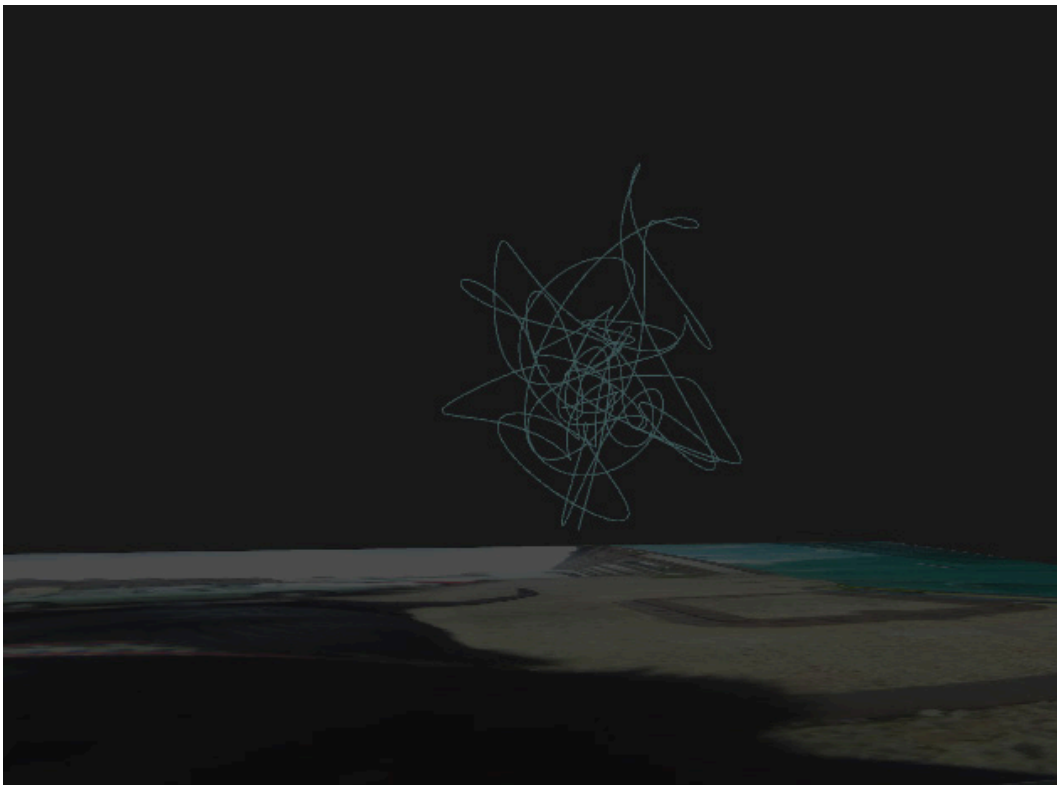


Figure 14: Screen still from Laika's Dérive Sniff. Animals, People – A Shared Environment, 4th Biennial Australian Studies Group Conference, 2011.

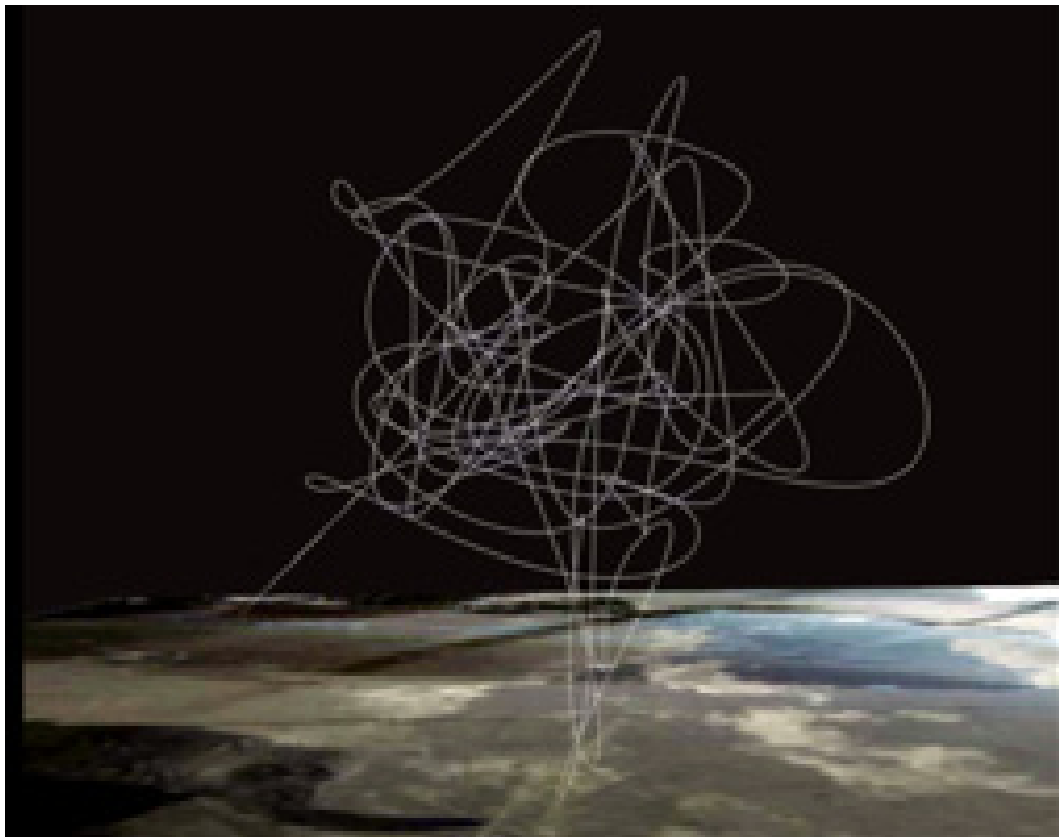


Figure 15: Screen still from *Laika's Dérive Sniff. Animals, People – A Shared Environment*, 4th Biennial Australian Studies Group Conference, 2011

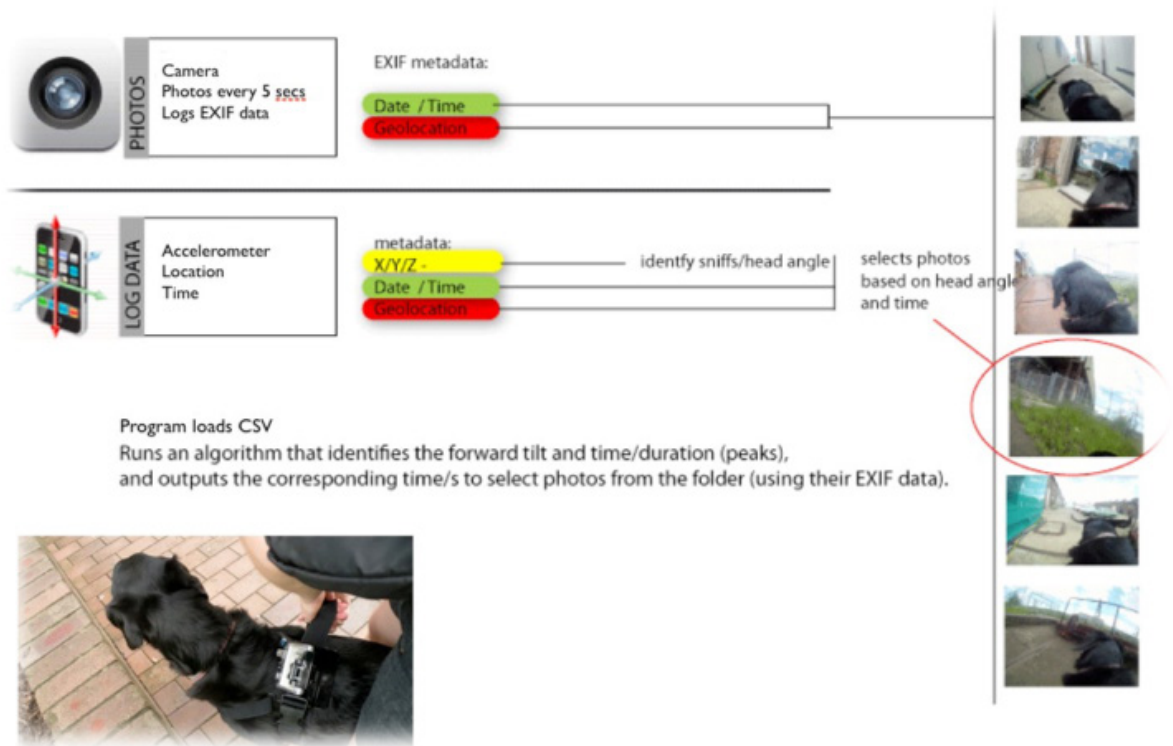


Figure 16: Data capture and mapping for returning photographs, 2011.

Laika's Dérive 2.0 – Development

Blast Theory Residency: scaling technology, user scripts

During my time at the Blast Theory studio residency I focussed on developing the project for other dog owners, and concentrated on an open and automated system design. The technical research was aimed at matching the requirements and specifications to existing technologies. Rather than developing a new technological solution, I aimed to use the location services of the mobile phone, and the sophisticated accelerometer that came with it, and integrate those data sources with those delivered by the GoPro camera. Note at this time GoPro cameras did not have dog harnesses or data extraction software for users. During the residency I developed the interactive elements of the project for users; including scripts for technology use, and participation. The Android App was also designed and built.

Technical development focussed on:

- System Development –making it scalable and robust

- Dog sniff hardware design– a tilting device to remove the need for 2 devices

- App design– for users that was simple to use and integrated the data into the online system

- Audience script– A script for others to brief users on the use of the app and camera for completing a walk.

At the completion of the residency I had a robust system for the first public offering, including a small kit that could be taken home for use with any size dog. At this point in my candidature I applied for Ethics clearance from the UNSW ethics committee for working with dogs, which was approved.

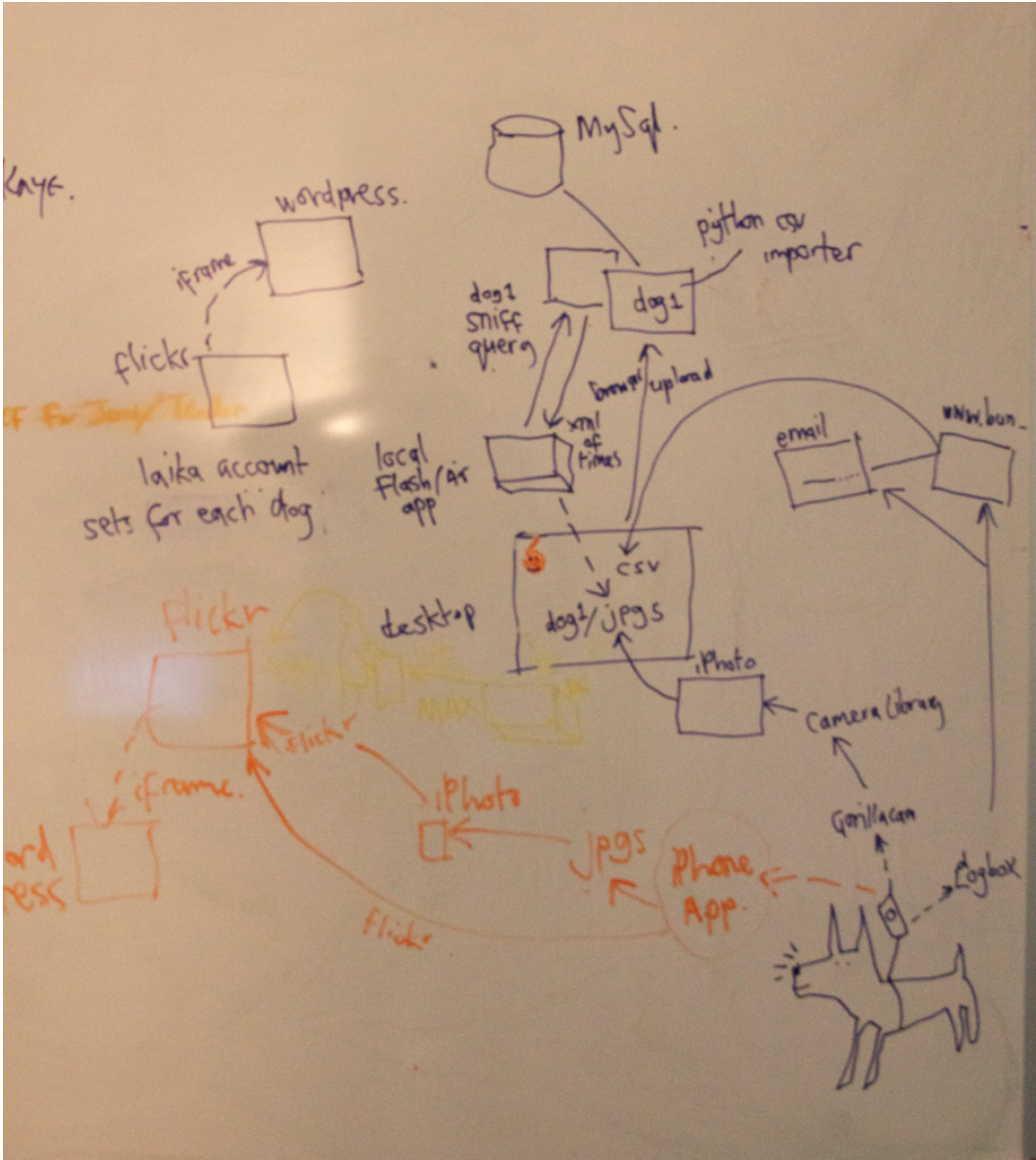


Figure 17: Blast Theory residency white board 2nd Iteration system design sketch. Orange drawing details file pathway using Flickr as a repository, Blue drawing details how the mobile app can work with the server side scripting.

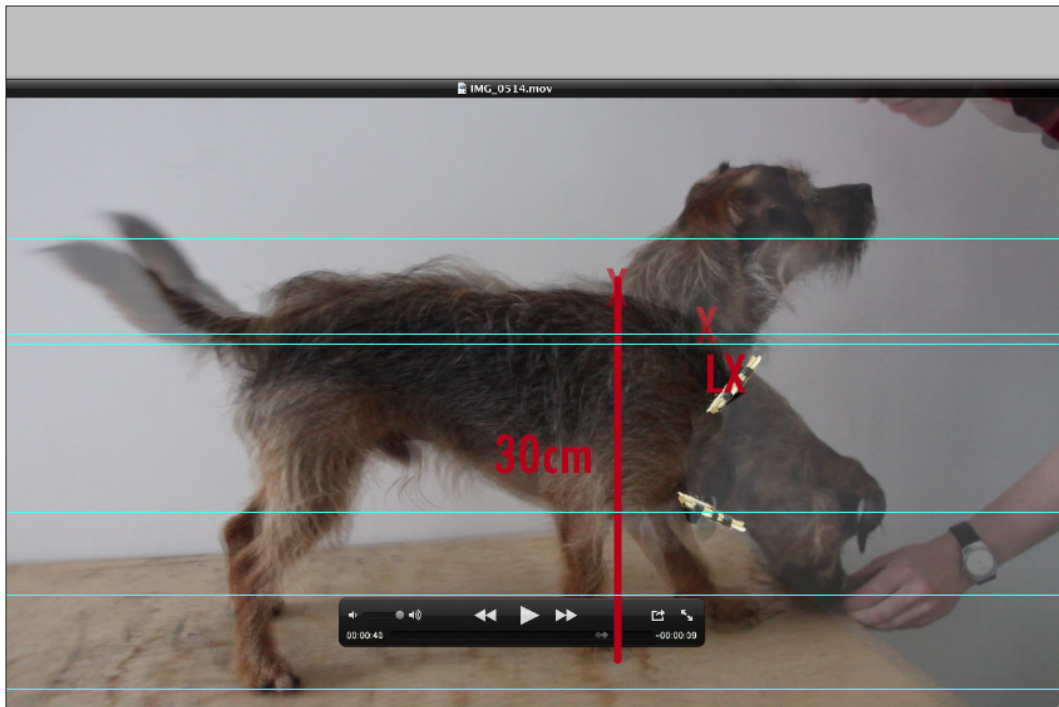


Figure 18: Video research for harness prototype. Measuring neck position in order to find tilt angle for sniff interest for ground level objects. (small dog)



Figure 19: Blast Theory's dog Trotsky trialling the harness and phone tilt design, Blast Theory Studio. The rubber band on the collar tilted the cardboard holder when the neck was down to sniff.

Laika's Dérive 2.0 – Public Exhibition and Participation

Laika's Dérive, 2011. Walk program, Performance Space, Carriageworks, Sydney, Australia.

The focus for this iteration was community development, engagement and mapping. I aimed to use the work to provide a framework for recording relationships as a way of placemaking. I also wanted to subvert, or at least provide an alternative to the mainstream art institution's regulation of cultural experiences.

For this iteration the project was opened to Sydney's inner west dogs and their owners.

Included as part of the Performance Space's *Walk* program, the project included the walk (*dérive*), and the Best in Show BBQ event. The *dérive* program was fully subscribed (it was booked out in 2 days). The online component had over 5,000 visitors, and the end of show event attracted full attendance

Participants booked a walk via a web form, and picked up a kit (mobile phone with the Laika's Dérive app installed, a harness based on dog size and a GoPro camera with custom mount) and were briefed by Performance Space staff.

At the beginning of each walk, owners filled out the form on the app, and took a snap of themselves with their dog. They then attached the mobile phone to the collar mount, and the harness with the GoPro camera. For this iteration it was found that the app accelerometer data from a mobile located within a pouch attached to the collar was sufficient to track head movement. This was calibrated to 5 dog size categories. Mapped to dwell time a sniff could be detected. The more complicated tilt device developed during the Blast Theory residency was not required. The app form captured the owner and dog details at the start of the walk. The app used the phone's GPS, and accelerometer to record data while the walk was in session. The GoPro camera recorded the photographs from an over the shoulder canine point of view.

At the return of the kit, the photographs and mobile phone data was uploaded to my server for backend processing. Each batch was automatically named according to the *dog name* field data from the app. The sniff algorithm mapped sniff and dwell time data (adjusted to dog size) to the EXIF data of the GoPro photo streams. Then the photo journey (dog's favourite location snaps) alongside

dog and owner details from the app's user form then populated the frontend of the Laika's Dérive public website. Participants and the general audience could then view their page and view the photo graphs as a sequence, or individually. A Laika's Derive Facebook page handled the announcements and served as a document of the social activity generated by the project.

At the culmination of the project a *Best in Show BBQ* was held, where dogs and their collaborators shared their stories, happy snaps and trails of discovery. This was well attended, with over 50 dogs and 100 people present. The event included a sausage sizzle (carnivore and vegan), a performance by Tess De Quincey and her giant poodles, and an awards ceremony. For the awards ceremony, the photographs were judged prior to the event by curators from The Australian Centre for photography (ACP), and prizes awarded for the best in show dog photographs. Categories included best overall dogographer, best abstract, best landscape and best magic realism. Certificates and dog prize packs (supplied through sponsorship from a local dog treat business) were awarded by the curators of ACP and Performance Space. Celebrant Victoria Spence was engaged as an event consultant and MC for the day.

For the performance component I commissioned bodyweather¹ practitioner Tess DeQuincey, to develop a piece titled *Dog-body*. This was a collaboration with her three giant poodles, with a soundtrack that included field recordings of Australian dingos. The dog audience joined in at key 'howling' moments. De Quincy was chosen for this role as her practice involves inhabiting and dancing atmospheres, which was a good analogue to the dog walk experiences.

During this iteration over 80,000 photographs of inner city Sydney were taken by the dogs, and over 8 gigabytes of data generated. Approximately 1200 photographs were displayed on the website as the sniff/interest spots for the dogs participating.

¹ "BODYWEATHER is a broad-based training that proposes a practical strategy to the mind and to the body. It is not just for 'professional dancers' or 'performance practitioners' alone but is an open investigation that can be relevant for anyone interested in exploring the body. The term and philosophical basis for BODYWEATHER was founded by butoh dancer Min Tanaka and his MAI-JUKU performance group, Japan. Drawing from both eastern and western dance, sports training, martial arts and theatre practice, it a ground training that develops a conscious relation devoid of any specific aesthetic. As a former dancer with Mai-Juku 1985-91, Tess de Quincey introduced the BODYWEATHER philosophy and methodology into Australia in 1989. BODYWEATHER is the basis of her practice as a performer and choreographer." (De Quincey, n.d).



Figure 21: Laika's Dérive Sydney Invite. Title font designed by Blood and Thunder.

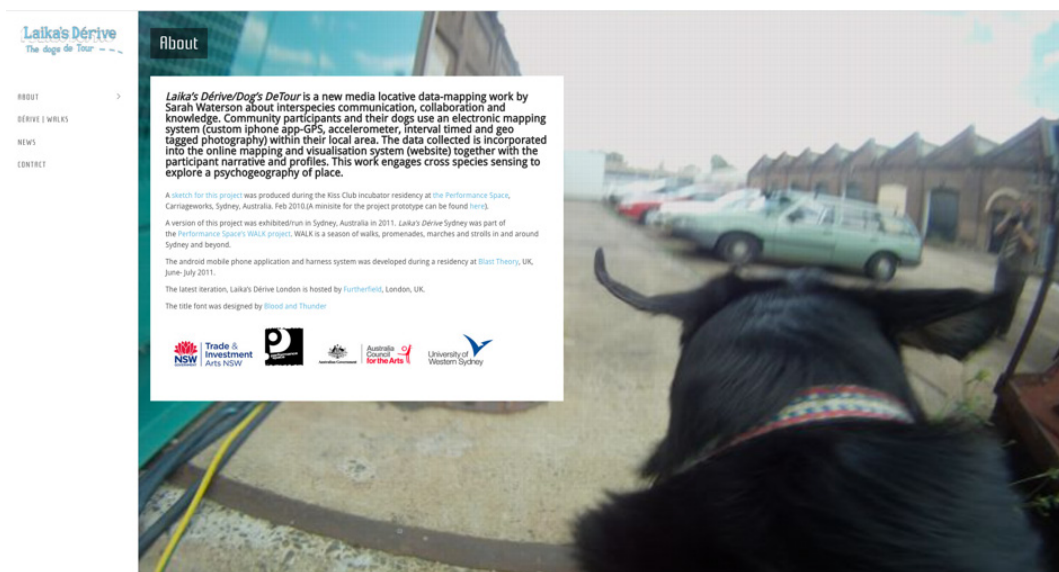


Figure 22: Laika's Derive website. Participant walks appeared here. <http://laikasderive.sarahwaterson.net/>



Figure 23: Kit contents, including GoPro cameras, harnesses, mounts and mobile phone pouches. 2011.

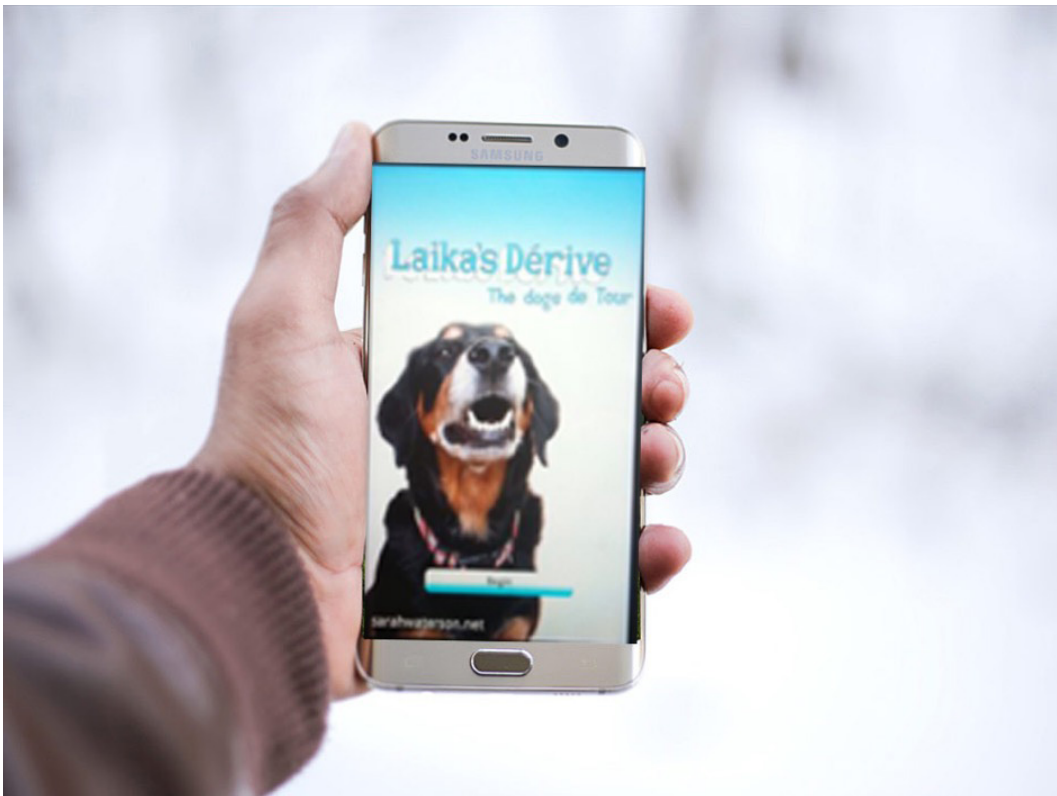


Figure 24: Laika's Dérive app front page.

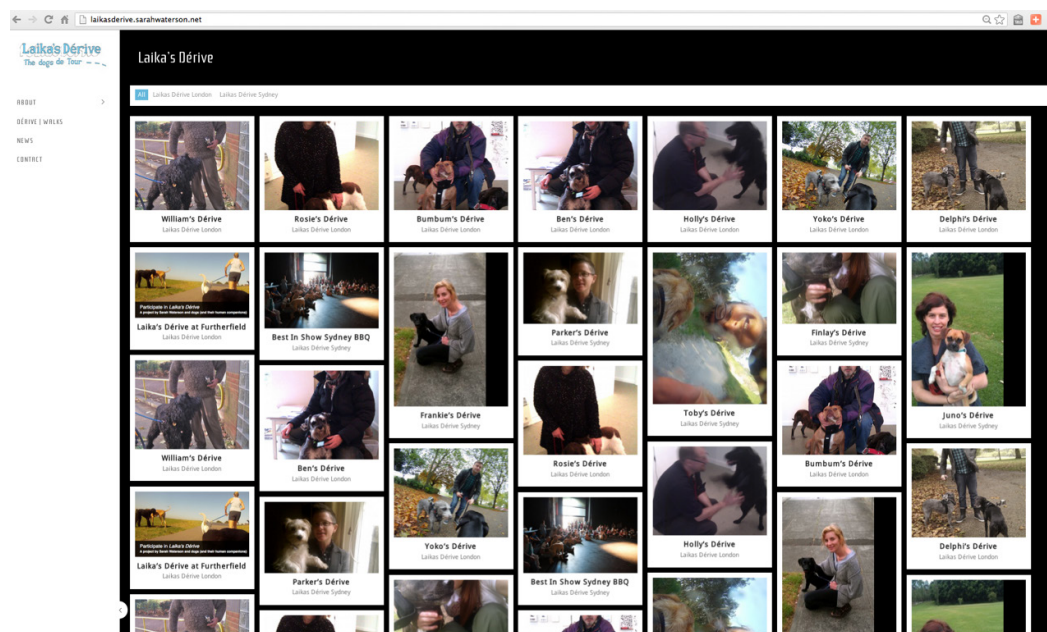


Figure 25: Laika's Dérive walks page. <http://laikasderive.sarahwaterson.net/>.

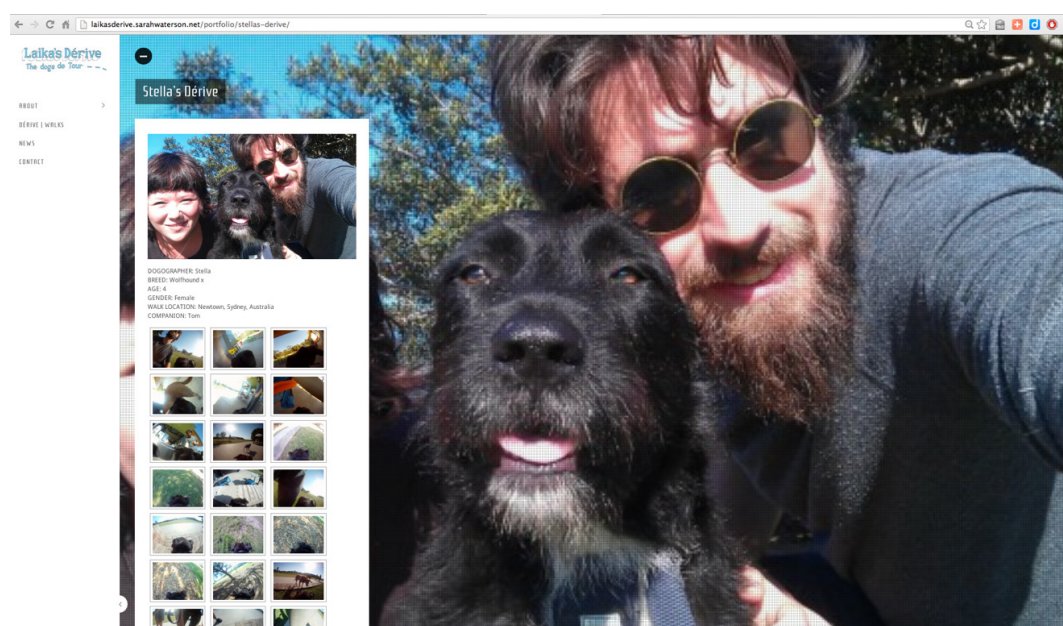


Figure 26: Laika's Dérive participant page. <http://laikasderive.sarahwaterson.net/>.



Figure 27: Prize giving at the Best in Show BBQ, Sydney. 2011. Photo: Alex Wisser.



Figure 28: E-flyer invitation to the Laika's Dérive Best in Show BBQ

Laika's Dérive Best in Show BBQ event documentation, 2011:

The following photographs document the *Best in Show BBQ* held at Carriageworks. Included are general audience images, the awards ceremony and *dogsbody* performance.

All photographs in this section: Alex Wisser, 2011. CC-BY 4.0



























Laika's Dérive Best in Show prize winners:



Figure 29: Best in Show prize: Best Social Photography. Photograph: Bruiser



Figure 30: Best in Show prize: Magic Realism. Photograph: Dafyyd



Figure 31: Best in Show prize: Best Candid Moment. Photograph: Leroy

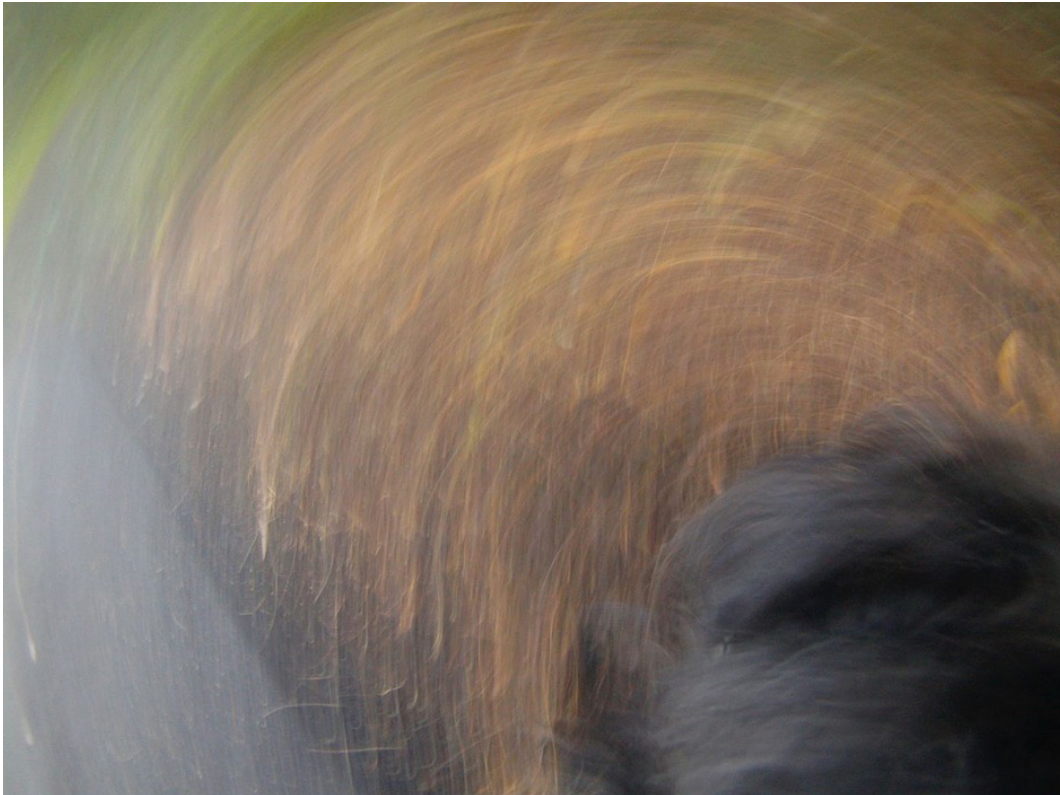


Figure 32: Best in Show prize winner. Best Sniff Abstraction. Photograph: Panda



Figure 33: Best in Show prize winner: Best Café Culture. Photograph: Parker

Laika's Derive 2.1 – Public Exhibition and Participation

Laika's Derive, 2012 – WWW: World Wild Web exhibition, Furtherfield, Finsbury Park, London, UK.

Laika's Dérive version 2.1 toured to London as part of Furtherfield's WWW: World Wild Web exhibition. For this iteration some refinements were made to the kit, and the app was updated to Android 2.2.

The event was run by the gallery staff with an identical set of procedures to *Laika's Dérive 2.0* (Sydney). There was a noticeable, and surprising difference in the outcomes for this version. Almost all owners in London that participated took their dog to a park, and then used the kit to record. Often a vehicle was used to get to the location. In contrast owners in Sydney actually went for a walk in their local area, often ending up at a park. I noticed the difference in behaviour too late to

adapt the project, but after some informal interviews with Furtherfield participants after the event, two key cultural differences were found. First dog owners were embarrassed to have the kit on their dog and draw attention to themselves on the street, so they waited to get to an open park environment. Secondly, the owner and dog relationship was framed by the perceived need to exercise the dog. Owners tended to stand in place and throw balls or sticks for their dog in an intense mode. This delivered a very different set of photographs as the sniff algorithm didn't have the dwell time component (the dogs were very busy all of the time), and the XYZ data was too erratic to make location choices that made sense of the interest value it was set to map. In true data as capta style, the data within this iteration of the project certainly reflected the differences in relationships and behaviour.

The most important outcome for me as a practitioner from these three iterations of the *Laika's Dérive* project was the understanding that data capture is not a neutral activity, even with the same technologies, and system design. Behaviours, and indeed cultural biases are imbued within the data capture, and that data can be both unpredictable, and surprising. However, when put into the system of display, it is difficult to discern those differences within the data, as it is flattened through presentation.

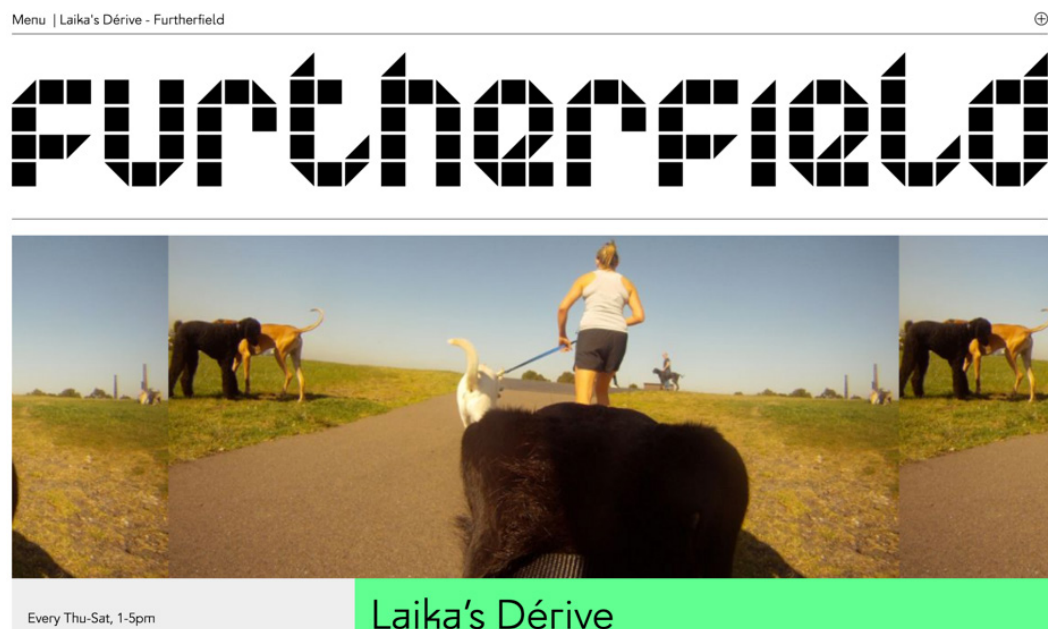


Figure 34: Furtherfield's website. <https://www.furtherfield.org/>



Figure 35: Bumbum and his companion, Kyriakis kitted for the *dérive*, London, 2012.



Figure 36: Laika Derive dog owners viewing their data, Furtherfield, 2012.



Figure 37: Laika Derive dog owners viewing their data, Furtherfield, 2012.

The website for this iteration can be found here:
<http://laikasderive.sarahwaterson.net/portfolio/dog-1/>

Hothouse

Initial research and prototyping

Hothouse is a reactive weather system designed to accept data via Bluetooth and generate weather based on that data within a house structure. In practical terms, it consists of a Bluetooth-enabled Arduino board with custom electronics that control mist (clouds), water (precipitation) and lighting effects. *Hothouse* produces the weather from Mt Kinabalu, Borneo to sustain a *Paphiopedilum rothschildianum* housed in a custom structure. The seedling was imported from a Taiwanese cloning lab. Live weather data is obtained via AccuWeather from a weather station at 1000m on Mt Kinabalu. *Hothouse* was exhibited at the Cementa 17 event in Kandos, NSW, Australia.

The *Hothouse* project was developed to further examine practice ecologies with a view to develop a system for data and display that repositions those practices. The practices had their roots in the British Victorian era, and included meteorology, architecture, and horticulture. Following *Laika's Dérive*, I planned to develop a system for making sense of data, that re-territorialised data systems within the media artwork as the central tenet for meaning making within the work. As an orchid enthusiast, I was also concurrently developing amateur greenhouse automation for my orchid collection, which led to an examination of the practices which connected the automation to commercial systems.

Hothouse as a project also grew out of my mixed fascination, and perplexity in learning about Singapore's *Gardens by the Bay*. *Gardens by the Bay* is, in essence, a very sophisticated biodome, hothousing botanic displays, and other structures such as the Supertree- solar collectors that provide a light show at night.

Their mission statement declares "We aim to be a model for sustainable development and conservation." This type of systems thinking was highly problematic, as evident by the famous Grasslands Experiment by George Van Dyne (1968-1976), where it didn't matter how many inputs were identified, the system ultimately failed to sustain itself.



Figure 38: Gardens by the Bay image. (2017) From: <https://www.gardensbythebay.com.sg/en/the-gardens/our-story/introduction.html>

In developing *Hothouse*, I was aiming to replicate some of the material practices used in *Gardens By the Bay*, as well as the *Great Exhibition of the Works of Industry of All Nations*, (also known as the *Great Exhibition* or the *Crystal Palace Exhibition*) in 1851 England.

Overview of key development processes

1. Site visit and research on location, Kandos
2. Literature research – historical practices and site
3. Sketch designs
4. Horticultural research- home glasshouse and automation systems
5. Technical research- sensors, data management, circuit design, Arduino sketches
6. Weather data acquisition- via AccuWeather from a weather station at 1000m on Mt Kinabalu, Malay Archipelago– Lat/Long: 6.08° N 116.55° E
7. Banking sector research and meetings with Banking executive
8. System designs
9. Circuit designs – GitHub
10. Working drawings for fabrication
11. Fabrication ply scale model and structure
12. First showing review and evaluation
13. Adjustments from review- interpretation panel and orchid info added
14. 2nd iteration
15. Final fabrication
16. Installation at Cementa
17. Artist talks and community feedback
18. Evaluation

The following table identifies the key hardware and software elements for this work:

Hardware	Software	Cloud Services	Installation Elements
MacBook 2.7Ghz (macOS 10.14.1)	PHP to handle CSV data Arduino IDE sketch	AccuWeather	Fabricated Acrylic structure
RedBoard - ATmega328P processor running Arduino			LED scrolling sign Framed botanical plate
Mist maker: modified Fountain Mister			Paph.rothchildianum sphagnum moss
Grove-Temperature & Humidity Sensor DHT22 module			
LED lighting strip LED scrolling sign			

Figure 39: Key hardware and software elements for Hothouse.

Technical research and development for this work was broken into 4 main areas:

1. Data acquisition and wrangling from Mt Kinabalu
2. Sensor and board design for the weather making
3. Orchid growing requirements and acquisition
4. House structure design and LED sign programming

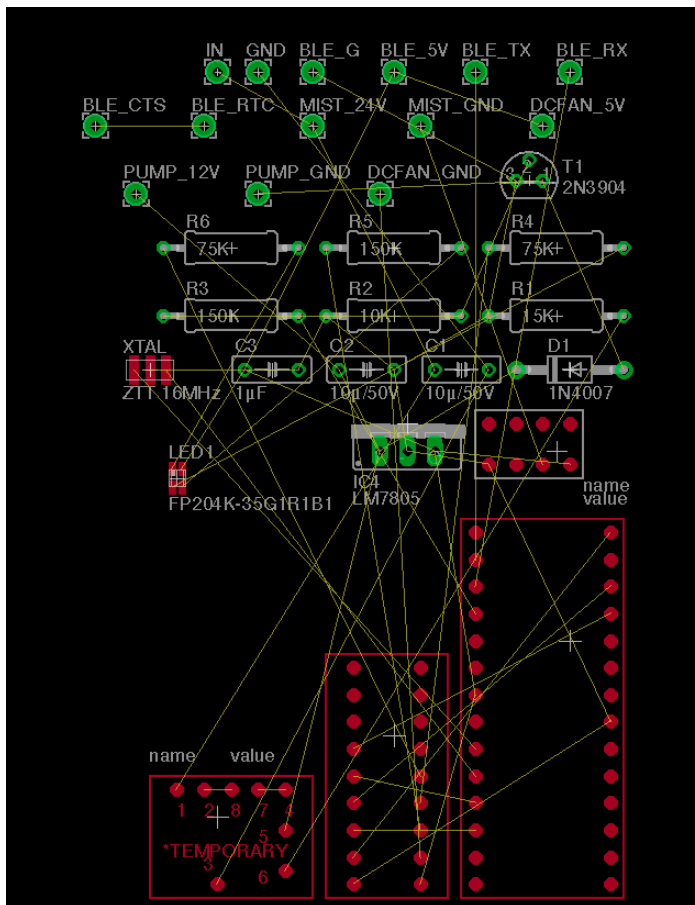


Figure 42: Hothouse breadboard design v.1. Based on OpenTempescope.



Figure 43: Hothouse interior showing working Arduino board.

Orchid growing requirements and acquisition



Figure 44: Orchid tissue culture laboratory, Taiwan. <https://www.icdf.org.tw/site/ICDF/public/MMO/icdf/.JPG>



Figures 45: *Paphiopedilum*. clone flasks.



Figure11: Detail of Plate 61. *Paphiopedilum rothschildianum* (as syn. *Cypripedium rothschildianum*) used in the Cementa exhibition. From, Sander, F. (1888). *Reichenbachia, Orchids illustrated and described*. Volume 1. London: H. Sotheran & Co. Public Domain.

House structure design and fabrication

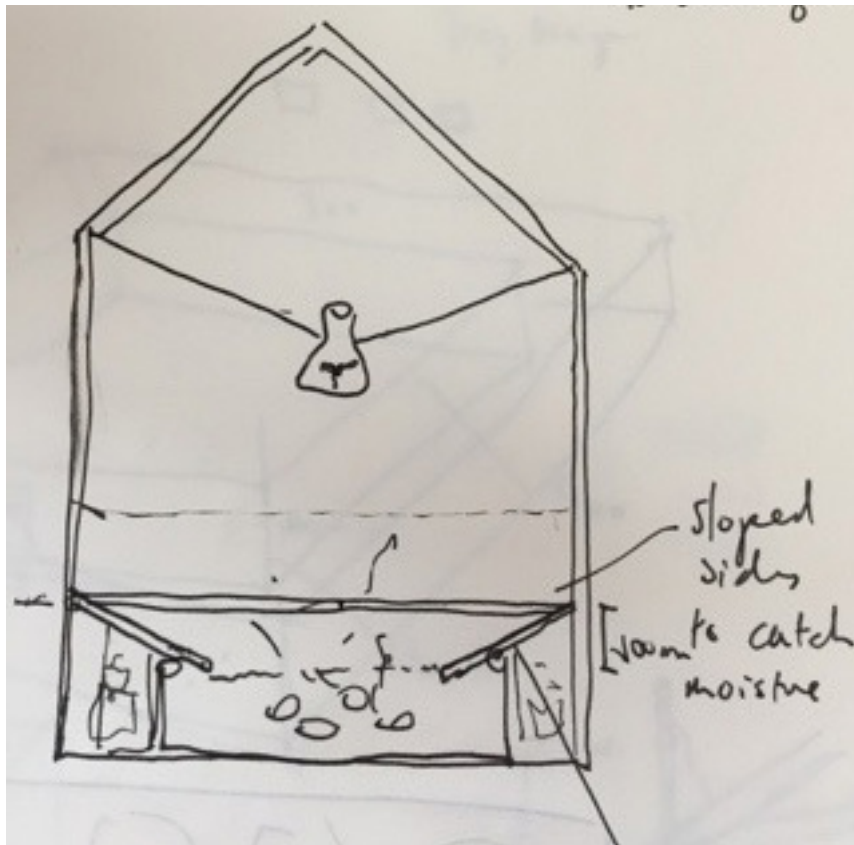


Figure 46: Hothouse sketch design detailing water re-use system

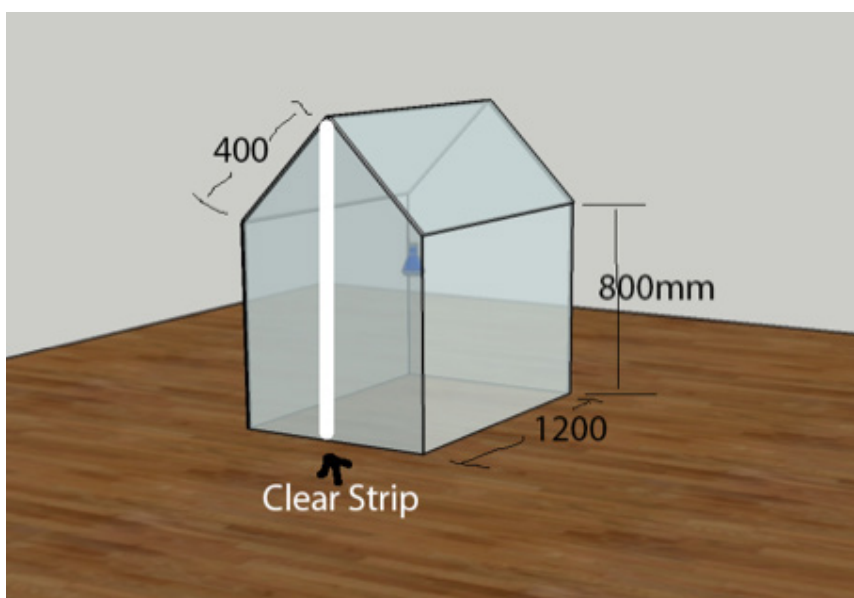


Figure 47: Google SketchUp of design.

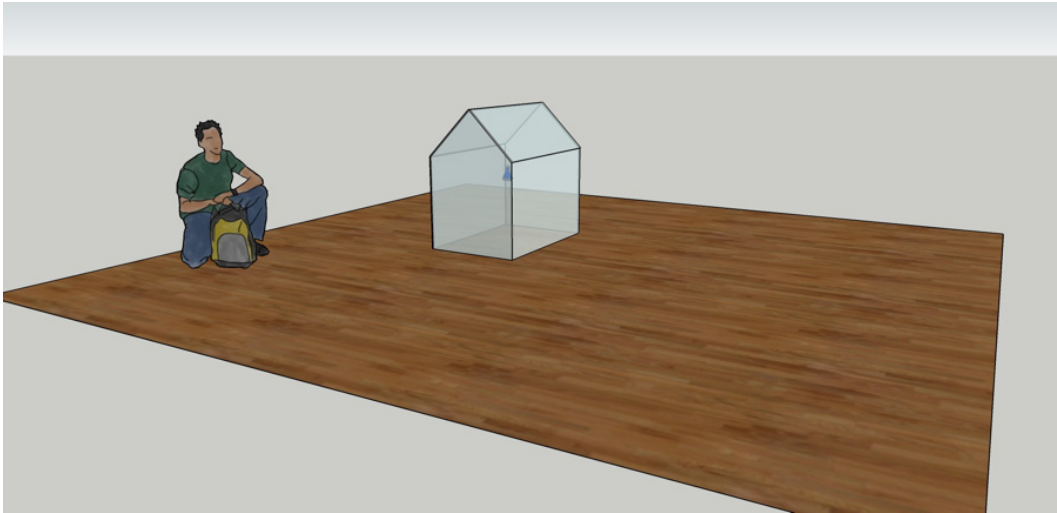


Figure 48: Google SketchUp of design.

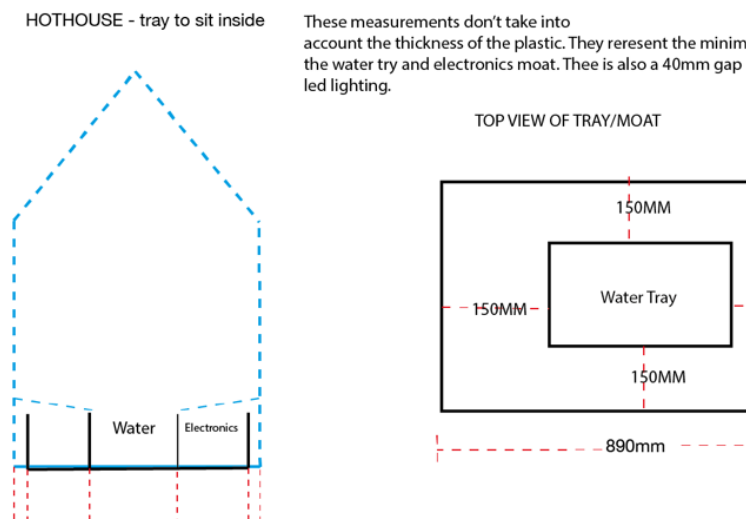


Figure 49: Working drawings for fabrication

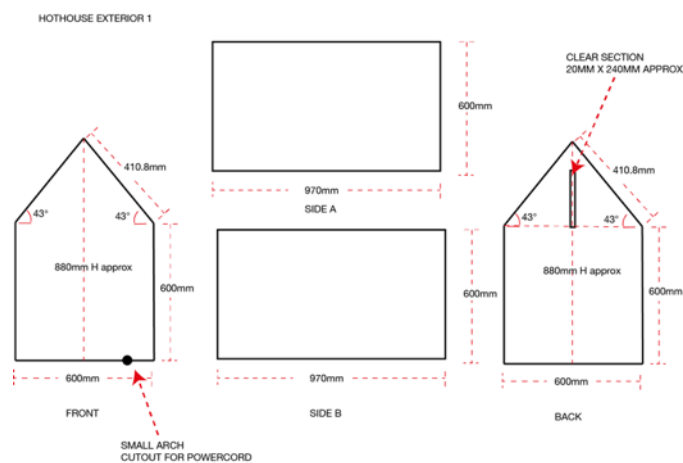


Figure 50: Working drawings for fabrication



Figure 51: Maquette and fabricated house from acrylic sheet.



Figure 52 Studio testing, depicting functioning house, LED and Paphiopedilum rothschildianum reproduction. print

Hothouse: Cementa17, exhibition

Hothouse was exhibited at the Cementa 17 event in Kandos, NSW, Australia. The audience consisted of art enthusiasts and local farmers and miners from the region. This meant that a broad range of responses and interpretations of the work. Local agricultural farmers were interested in the systems used to support the orchid, and pointed out the issues with the long term viability of the work to support the young clone orchid (keiki). As an 'art' experience the work was well received in terms of the aesthetic presentation. The data component and broader concerns signalled by the LED sign and orchid print helped with the translation of my original concerns.

The final installation consisted of the acrylic sheet house structure, a LED scrolling sign with all Rothschild associated banks listed (as listed on conspiracy theory websites), and a print of a botanical watercolour of *Paphiopedilum rothschildianum*.

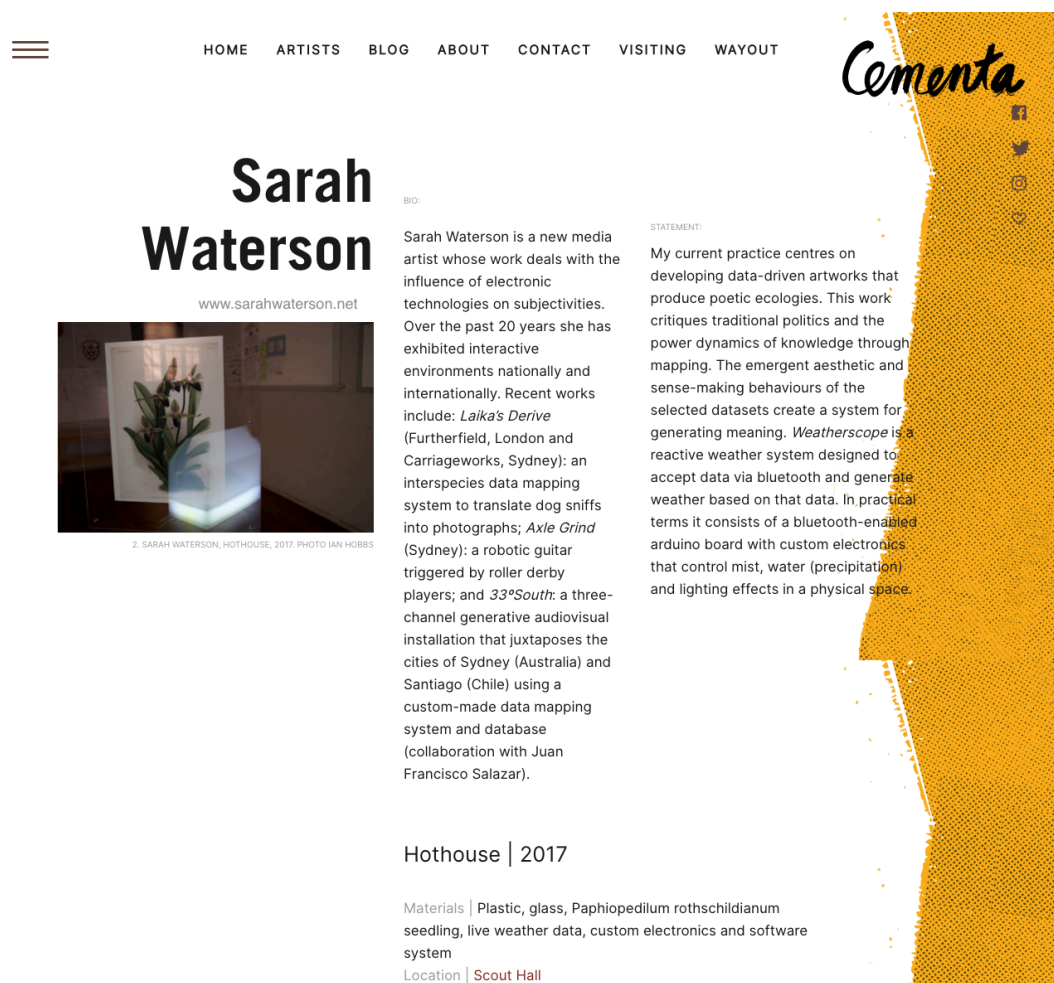


Figure 54: Cementa exhibition page for *Hothouse*, 2017. <https://cementa.com.au/archive/artist/sarah-waterson>

Hothouse, CEMENTA 17 images:



Figure 55: Hothouse installation view. Photo: Alex Wisser



Figure 56: Hothouse installation view



Figure 57: Hothouse installation view



Figure 58: Hothouse installation view



Figure 60: Hothouse installation view