**Uncanny Landscapes: Experiential encounters with ecological data**

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## Introduction

Communicating complex ecological issues such as anthropogenic climate change and the effects of capitalist culture on diverse ecologies is difficult. Challenges include: communicating phenomena that occur over unimaginable timescales and are often invisible to the naked eye; making these global phenomena relatable on a local and individual scale, and; instilling an understanding of the human species as *enmeshed* (Morton 2012) and *entangled* (Tsing et al. 2017) within complex ecologies, in order to foster attention and care for the world. Moreover, coming to terms with such issues can lead to despair and hopelessness. Glenn Albrecht (2007) coined the term 'solastalgia' to describe a form of existential distress caused by facing environmental change at a local scale. Beyond individual distress, psychologist Per Espen Stoknes (2015) describes a 'psychological climate paradox', a form of political inertia in which voter concern for climate change in wealthy democracies falls as scientific evidence mounts, due to psychological barriers triggered by current science communication. Like many other scholars, scientists and journalists addressing the climate paradox, Stoknes identifies an urgent need for new kinds of ecological narrative if we, as a species, are to demand and enact the systemic economic, cultural and political changes required to transition to more sustainable ways of being in the world. Environmental humanist Rob Nixon frames the narrative problem at the heart of the current, anthropogenic ecological crisis:

> 'How can we convert into image and narrative the disasters that are slow moving and long in the making […] How can we turn the long emergencies of slow violence into stories dramatic enough to rouse public sentiment and warrant political interventions, these emergencies whose repercussions have given rise to some of the most critical challenges of our time?' (2011)

Traditional science communication relies on visualisations such as charts, graphs and maps, which aim to accurately represent data but often fail to clearly inform or engage non-expert audiences. In turn, these scientific methods of communication are utilised by journalists, activists and lobbyists alike as they seek to engage this non-expert audience, yet they often still miss their mark. At its core this failure may relate directly to a mismatch in an understanding of scales; for example, a scientific understanding of geological timescales differs significantly to a non-expert's phenomenological understanding of a lived human-historical timescale.

One way that science communicators are addressing this narrative problem is by embedding human stories into empirical information visualisations. An example comes from Professor of Biology Lesley Hughes, who altered a well-known graph of rising global temperature over the next hundred years by adding three lines: 'me, my kids, my grandkids?' (Climate Commission 2013) This simple alteration, with its anxious question mark, puts the distance of decades into terms we can empathise with. This altered graph represents a new communication approach in which scientists recognise the value of extending quantitative data with qualitative information. Or, as science communicator Ketan Joshi (2017) puts it: 'it's time to build a bridge between data and emotion.' This example also highlights human inability to comprehend time (beyond our day to day terms of reference); an implied inability to understand the significance of the

next hundred years signifies the almost impossible task of understanding deep time (the concept of geological time) and our entangled relationship with a planet billions of years old.

Three years after his call for ways to convert 'disasters that are slow moving and long in the making' into image and narrative, Rob Nixon was involved in a project which invited artists, scientists and scholars to pitch objects for inclusion in an 'Anthropocene Cabinet of Curiosities'. Shifting from image to object as carrier of narrative is significant:

> 'For in a world deluged with data, arresting stories and images matter immeasurably, playing a critical role in the making of environmental publics and the shaping of environmental policy. [...] What objects might jolt us into reimagining environmental time across diverse scales, from the recent past to deep history? How might certain kinds of objects make visible the differential impacts—past, present, and future—that have come to shape the relationships among human and non-human beings, living in an era of extreme hydrocarbon extraction, extreme weather events, and extreme economic disparity?'
>
> (Mitman and Nixon, quoted in Robin and Muir 2015)

The *Cabinet of Curiosities* project sought existing objects that offer allegories for the Anthropocene, such as the stories of the invention, use and consequences of an insecticide pump spray, batteries or a room thermostat.[1] However, the idea of objects as a narrative vehicle is also relevant for designing data visualisations in innovative forms. How could ecological data be communicated beyond the scientific chart, into objects and spaces that can be encountered, experienced, inhabited? How might such encounters affect our engagement with and reception of ecological issues and the data that describes them?

This chapter critiques a range of projects in which ecological datasets are communicated to non-expert audiences as 'uncanny encounters'; the data is materialised as an unsettling object or experience, rather than a visualisation on page or screen.[2] Instead of foregrounding 'scientific truth' in the data set, the projects discussed below all use narrative to foster understanding of complex human and nonhuman entanglements, and instil a sense of agency (and urgency) in relation to the larger ecological issues at play. Narrative-based approaches to communicating ecological science can draw out conversations around the social, cultural and ethical impacts of scientific data, for non-expert audiences. This use of narrative goes beyond what has traditionally been referred to as data storytelling; the objects in question do not merely take on the role of illustrative story-teller imparting structured wisdom, but instead attempt to entangle our presence within the narrative, as encounter.

A sample of thirty-six projects were critiqued (not all are included in this chapter), considering how narrative is embedded in or generated within each project, and how this narrative points to, highlights, or even creates moments of uncanny encounter. Although every experience of the world could be read as an encounter, the encounters highlighted here intentionally allow audiences to think through human/nonhuman entanglement.

In this next section the idea of an encounter is elaborated, particularly in relation to the writing of anthropologist Anna Tsing, then projects which exemplify the use of 'uncanny encounters' to communicate ecological data are critiqued.

**Encountering Data**

Data visualisation's authority as a means of knowledge production and circulation is often underwritten by the assumption of representationalism: that data accurately and objectively mirrors the world (Drucker 2014: 125). As a practice of knowledge production and communication, data visualisation is generally conveyed and taught as a process of discovering a story or points of interest within a data set. However, treating the practice of data visualisation as simple discovery fails to acknowledge the productive character of its work. Where drawing out 'things of interest' from data via selection and recombination alters the 'meaning and value of data' (Amoore & Piotukh 2015: 344). Disconnected from the time and place of its writing and now transpiring at extensive scales, data in numerical form can be intractable and difficult to comprehend. Therefore, graphical presentation is often used to make visible and perceptible the complex, invisible or large-scale phenomena being reported. Such visualisations tend to focus on the communication of a singular, coherent *story* through the combination and presentation of quantitative information in graphical form (Drucker 2012). Narrative has become a critical addition to data communication, according to N. Katherine Hayles (2012: 176), as it renders data structures meaningful; data structures alone are incapable of explaining the relational comparisons they perform. Hayles views narrative and data structures as *natural symbionts*; in turn data can bolster the authority and credibility of narratives.

In an account of big data analysis and its use in governance, Amoore and Piotukh (2015) detail how the heterogeneity and material contexts from which data emerges is pared back in data practice when data is shaped into calculable forms. Algorithmic techniques have become a key means through which to explore and comprehend data, especially when we are confronted by the sheer scales of contemporary data availability and production (Hayles 2012: 230). The immense quantities of data and the ability to scale it algorithmically, Amoore and Piotukh (2015: 361) suggest, engenders a claim that data analytics and visualisation represents the world, because 'it appears as though everything is calculable, everything about the uncertain future is nonetheless decidable.' This representationalism, we argue, is one of the key problems faced by data visualisation[3]. Through its claim to show a certain and objective mirror of the world, its storytelling can render passive and deterministic the material realities and relations that it seeks to communicate[4]. This makes it difficult for us to grasp the messy and indeterminate entanglements of the world from which the data emerged, and to consider possible narratives or potential futures that worldly entanglements may engender. And moreover, our own human involvement and agency within the unfolding narrative. Donna Haraway (2016) asserts that in our time of ecological devastation we need to think *tentacularly*, or in other words, we need to think and build more liveable worlds through our entanglements with the rest of the world. For Haraway there is no 'arrow of time' or pre-determined story, rather in order to compose more liveable futures we need to be able to imagine ourselves as agential and collective participants in potential stories that are yet to occur.

At the heart of each of the following examples lies an *encounter* with data and the material realities and interrelations from which data emerge. Conceptually, the term 'encounter' is understood here through the work of anthropologist Anna Tsing. In Tsing's accounts of disturbance-based ecologies, different ways of living emerge through entangled ecologies of the human, non-human, living and non-living. For Tsing, ecology is not merely the interaction of stable pre-given entities; instead, ecologies – including the entities within them – become themselves through, and can be transformed by, encounter. This is exemplified in Tsing's (2015) account of the ruins of human-disturbed forests where pines, oaks and matsutake mushrooms assemble and form a fragmented ecology that fosters unexpected inter-relations and possibilities. For example, the specific conditions and symbiotic relations required for matsutake to grow, and the human livelihoods and global trade and commerce around sites where the mushroom crops up. In her narration of the collective actions of mushroom, oak and pine, Tsing demonstrates how encounters are indeterminate; the ways in which entities may or may not affect one another can never be settled or assumed prior to their interrelation. This extends to who we are as a human species and as individuals, as our ways of being also emerge out of encounter.

Therefore, we frame the examples below as 'encounters' because finding ourselves entangled within encounters means not only noticing the action that unfolds in the indeterminate histories of assemblages but can also lead to grasping human co-entanglement and how we are also 'unpredictably transformed' in encounters (Tsing 2015: 46). Encounters are less about 'coherence' or neatly pre-formatted depictions or stories, in the sense of how data visualisation in its general form was described above, than noticing the 'potential histories in the making' that emerge in heterogeneous assemblages of human, non-human, living and non-living (ibid: 23)[5]. This means that rather than being told a story after the event, we see and are potentially implicated in the action of the story as it is unfolding.

In encounter we experience things unfolding as part of ecological interconnections, we see relationships and can imagine how these might iteratively alter over (often very long) periods of time. Encounters are experienced as narrative structures by which we begin to understand and notice things outside of the usual scope and scale of our perception. They are perceived from within, we are directly implicated in the story being told, and unlike traditional scientific data visualisation our own phenomenological positioning is vital; the encounter invites a subjective reading and writing of data to take place.

**Uncanny encounters with ecological datasets**

Figure 1: Film still from Clever Country, Zakpage 2019.

Zakpage is a collaboration between designer Alison Page, descendant of the Walbanga and Wadi Wadi people of the Yuin nation, and film-maker Nik Lachajczak. Their three-part documentary *Clever Country*, co-produced by the National Museum of Australia, aims to communicate the science and technology embedded within Indigenous Australian cultural practices and knowledge sharing, to a broad audience. Western scientists are recognising the potential for Indigenous knowledge to help solve urgent problems related to anthropogenic climate change – such as bushfires and floods – and finding alternative medicines.

Key to comprehending Indigenous Australian knowledge is the concept of 'songlines'[6] – an ancient mnemonic system of oral storytelling that produces a complex 'ancestral library of embedded knowledge' (Page 2020), a knowledge system which has allowed cultural and environmental data to be passed down for more than 60,000 years without written language.

In the documentary, Page demonstrates how songlines work by constructing a fishing-lure data visualisation (Fig. 1). She strings a network of fishing lines from the branches of a mangrove tree, and threads colourful lures along the lines to represent individual knowledge holders and markers on Country. Page talks through one line and set of lures at a time, explaining how one songline crosses another at certain lure-points. For example, a sequence of lures represent an Aunty who knows how to find and use hundreds of plants on her country and a grandfather who knows where to find sacred white ochre for Ceremony, who share the story-song of the River, which connects to a constellation that appears on the horizon pointing to where to find waterholes during the dry, what time of year fish are running and when a particular animal is good to eat. Page translates story into data; the fishing line/lure installation allows Page to perform storytelling in time and space, to communicate the way Indigenous Australians perform their own storytelling across time and Country. Although we are not invited 'into' this encounter directly, Page's demonstration on Country invites us to see the world around us anew.

In the documentary, Page describes songlines as a multidimensional ancestral library made up of complex datasets, with people as: 'key to activating this ancestral library, because as they

moved around Country over time, they would upload and download knowledge at sites of learning, sharing it with each other and back into the land, until it became embedded knowledge.' Songlines work like a memory palace; spiritual and ecological knowledge is encoded into objects (such as constellations, distinct rock formations, bodies of water) and geographical locations on Country, which function as mnemonic devices to remember invisible forces (such as seasonal cues for harvesting or hunting), wayfinding, land and sea management, cultural stories and law. The oral storytelling of songlines by Elders is a living system; no single dialect group or tribe knows all the songlines, tribes come together in cross cultural exchange and Ceremony to share knowledge.

A different example of passing down ancestral knowledge is Erich Berger and Mari Keto's work *Inheritance* (2016). *Inheritance* is a set of precious yet radioactive jewellery pieces: a necklace, earrings and a brooch made using gold, thorianite, thoriate and uraninite. Uraninite, commonly referred to as pitchblende, is highly radioactive. The radioactive nature of the jewellery renders it harmful to human bodies. Although as 'heirlooms' they may be passed down generations, they are unwearable for deep time; the gradual process of radioactive decay would take many human generations for the jewellery to be safe to wear. The jewellery is encased, along with time and radiation measuring apparatuses, in a stackable concrete container. Concrete contains the emission of high-energy particles as the radioactive materials decay, and symbolically reference the concrete shielding in nuclear reactors, and a container for radioactive waste materials.

Humans cannot immediately or easily sense, see or smell radiation, although high doses of radiation poisoning can produce a metallic 'taste sensation' while it damages human cells. Jane Bennett (2010) argues that much of the earth's activity occurs beyond the threshold of human perception not only due to the limitations of our senses, but also because humans generally figure much of the non-human world as inanimate[7]. For Bennett, this view of matter obstructs humans from developing more ecological modes of understanding and engaging with the world, as we fail to recognise the affective power of the non-human and our entanglement with it. *Inheritance* asks us to consider that beyond providing energy for today, nuclear power produces millions of years of harmful radioactive waste that multiple future generations will be required to handle[8].

It is only through measurement apparatus' that we are able to detect and measure radiation's invisible presence and *Inheritance* includes a gold-leaf electroscope for each generation to test if the jewellery is safe to wear yet. Here data is not presented in a static chart or prediction of the objects' future radioactive decay but generated in the undertaking of a ritual, set out by Berger and Keto, by which each generation performs a measurement of the jewellery's radioactivity. When the ritual is performed, if the gold leaf of the electroscope falls faster when it is near the jewellery than when it is not, the items are still radioactive. The faster the leaf falls the more radioactive it is. Engaging with, or imagining engaging with, *Inheritance* creates an encounter with the invisible yet potentially harmful presence of radioactive material to our bodies, other bodies, and future bodies, making apparent the affective capacity of radioactive materials as well as our ongoing entanglements with it.

Figure 2: Semiconductor's 'Cosmos' in Alice Holt Forest, UK. Photograph by Laura Hodgson, 2014.

Another encounter with the data of invisible forces comes from Ruth Jarman and Joe Gerhardt (aka Semiconductor)'s *Cosmos*, a two-metre wooden, spherical sculpture which represents a dataset of a forest's carbon uptake and loss. Commissioned by Jerwood Open Forest in 2014, the sculpture is situated in the Alice Holt Forest, a recreational site which attracts almost half a million visitors a year (Fig. 2). The sculpture appears in the forest clearing like an alien relic, its charcoal-hue and large, spherical form an uncanny object within the pine glade. Closer inspection reveals a surface rippled in patterns similar to disturbed water, made by abstracting one year's worth of measurements of the uptake and loss of carbon dioxide from the forest trees, collected from a nearby research station. The complex interference pattern is created by wave forms and patterns in the data, digitally modelled, then rendered by a CNC wood router machine. [9]

Through this work, the artists explore the difference between how scientists represent the physical world, and how humans experience it. Re-contextualising the carbon data from 'strings of numbers' into a tangible sculpture involved translating polar plot representations created by the scientists – a circular, 2D graph which plots a year's worth of carbon data from various instruments – into a 3D fabricated form which can be experienced in the environment it represents (the forest the data is drawn from).

However, through this translation the data is abstracted: 'These sculptural forms become unreadable within the context of science, yet become a physical form we can see, touch, experience and readable in a new way. Here, humanising the data offers a new perspective of the natural world it is documenting, introducing a new visual experience.' (Jarman & Gerhardt 2014) In other words, the sculpture does not attempt to communicate the scientific data in a conventional way – which would be incomprehensible without a sophisticated understanding of

carbon cycles – but to provide a surprising encounter through which to reflect upon the invisible ecological processes occurring around us.

Yet more than the invisible carbon cycles, an encounter with *Cosmos* invites us to reflect on the data collector, as well as data collected. Jarman explains (personal correspondence 2019):

'The digital nature of the work also suggests the presence of man in the forest; the collecting, observing and processing of scientific measurements. Semiconductor want people to consider the material nature of the forest in a new way; the hidden layers of matter, events and processes that occur beyond our sensory perceptions, whilst also appreciating the art works striking complex form.'

Where the 'authorship' of the scientist is largely invisible in the conventional polar plot diagram – we are trained to see the data not the graphic form – the obviously human-made structure in the forest prevents us from ignoring the presence of the human in *Cosmos*. *Cosmos'* evocation of the work of the data collector in the forest draws attention to the human practices and material engagements from which data emerges. Rather than attempting to be a physical representation of the forest and its carbon cycle, *Cosmos* creates a nexus point, connecting the people experiencing the work, the forest, scientific practices and the forests ongoing invisible cycles of relinquishing and storing carbon.

Dillon Marsh takes a visually similar approach to communicating hidden layers of matter, events and processes in his project *For What It's Worth*, visualising the quantities of copper extracted from seven defunct South African mines. Marsh photographs the mines, then digitally imposes large copper spheres into these ruined landscapes, accurately scaled by the quantity of copper extracted over the lifetime of the mine. One image captioned 'Jubilee Mine, Concordia (1971 to 1973) Over 100m deep, 6,500 tonnes of copper extracted' shows a gaping hole filled with murky green water in the foreground, with steps of excavated rock rising to a mountainous horizon in the background. A shiny, copper sphere rests in the water – impossibly enormous to fabricate so perfectly, yet significantly smaller than the hole it was extracted from, pointing to the immense quantity of excavation needed to extract the precious metal. The narrative is drawn by connecting caption and image, relating the data to the source.

The description of the project on Marsh's website states: 'Whether they are active or long dormant, mines speak of a combination of sacrifice and gain. The intention is to create a kind of visualisation of the merits and shortfalls of mining in South Africa, an industry that has shaped the history and economy of the country so radically.' (Marsh 2020) As with the *Cosmos* sculpture, although the data underpinning the work is accurate the primary aim is to communicate a sense of vast processes that are difficult to comprehend, by creating a surreal encounter with a landscape. Knowing that the work is based on scientifically accurate data, yet seeing the uncanny in the familiar, is a powerful communication strategy.

An obvious difference between these projects is in how we encounter them. Where Jarman and Gerhardt's *Cosmos* sphere can be encountered in the forest, Marsh's CGI works can only be viewed on screen, separated from the environments they depict. The immersiveness of *Cosmos* affords an opportunity for quiet reflection, a space to consider the relationship between trees, invisible carbon, and ourselves as living actors entangled in nature. Experiences that may shift a visitor's sense of connectedness with the natural world.

Another difference is the 'authorial intervention'. Marsh's work is overtly political about the impact of human conquest of the earth. His image captions and the project rationale on his

website point us toward an intended interpretation, in the same way the title and labels on an information graphic might. Conversely, although the location of *Cosmos* is included on the forest map and a 'making of' video is shown at the forest entrance hut, no signage or explanatory text is included on or around the work in situ. Where *Cosmos* communicates subtly, Marsh uses a combination of image and caption to spell out his intent.

In a subsequent series titled *Counting the Costs*, Marsh applies the same photographic manipulation technique to visualise the loss of glacial ice. From scientific reports, Marsh compiled data on the rate that particular glaciers in India and Nepal are losing mass, then digitally created accurately scaled balls of ice and imposed them on urban landscapes in these countries. Unlike his mining series, these landscapes feature people going about their everyday lives, captioned with statistics the ice balls are based on. An image of a young family walking hand in hand through a residential area, oblivious to the huge ball of ice on the road behind them, is captioned '92.58 cubic meters – the average volume of ice lost on Neh Nar glacier every hour'. In a ramshackle marketplace, three men talk over a cart of papayas, oblivious to the ball of melting ice metres away: '7.06 cubic meters – the average volume of ice lost on Naradu glacier every minute.' Bringing humans into the uncanny landscape adds an emotional hook. In particular, rather than depicting people reacting in shock, that Marsh's images depict people oblivious to the metaphorical problem as they move through daily life, strikes a powerful chord.

Olafur Eliasson's *Ice Watch* (2014-2019) communicates glacial melting in a more tangible way, by placing twelve blocks of ice – cast offs from the Greenland ice sheet – in a clock formation in a prominent location. The work presents 'a tangible and immediate testimony of the dramatic effects of climate change.' Unlike Marsh's oblivious people, documentation of *Ice Watch* on Eliasson's website has multiple photographs of visitors, young and old, embracing the ice, eyes closed and faces pressed against the cold surface of the melting blocks. We see in them a sense of awe at these actual ice blocks, a distant crisis brought in view – the vastness, the speed of melt. Janet Brown, Associate Director of Climate Generation describes her experience (2015): 'Pictures and words don't do justice to the visceral effect of standing in the middle of these massive pieces of ice while the bells tolled in the plaza. I openly wept. Not the teary-eyed, this-is-so-sad kind of cry, but a guttural, wrenching wail.'

On Eliasson's site, translucent phrases scroll over the documentary images, including: being with, looking up close, feeling present, community, connecting space, destabilisation. These function as captions of Eliasson's communication aim. Eliasson's work is necessarily less permanent than *Cosmos* – the melting ice-clock being the material and the problem – so documentation is important. The first narrative was in the encounter, the secondary narrative is encountering the experience vicariously through the documentary images of others' encounters.

Eliasson's work also recalls a precedent to some of the projects under discussion here, that of the practice of Land and Environment art, which saw sculptural artists directly engaging with the landscape around them. Robert Smithson's *Spiral Jetty* (1970) is perhaps the most famous of this genre of work, representing what may have been seen as poetic and embedded engagements with the landscape at the time, but in hindsight appear as colonial intrusions upon it. Smithson does however create an environment for encounter to place, as does Mark Dion's *A Meter of Jungle* (1992), where by literally bringing a meter of Amazon Jungle into the gallery, and dissecting and classifying the contents of this (again in an ultimately western and colonizing manner), Dion asks a viewer to begin to comprehend the immensity of scale of the natural elements that make up the Amazon, and how they may themselves be entangled in such a system.

Moving data installation to a more community-based setting, Pekka Niittyvirta and Timo Aho's (2018) installation *Lines (57° 59′ N, 7° 16'W)* is an eerie site-specific installation which communicates the impact of rising sea levels on the Scottish coastal town North Uist. Activated at high tide, sensors shine three beams of light which represent estimates of sea level rise based on current scientific modelling. A glowing line cuts across doors and windows of the towns' buildings – a luminous flood-mark from a speculative future – and across fields to illuminate the anticipated new shoreline. The town is already experiencing the adverse effects of climate change, with building development stunted due to storm surge threats. For this community, the installation is a nightly warning, making it impossible to ignore ecological and infrastructural problems ahead. The artists state: 'Art has the potential to convey scientific data, complex ideas and concepts, in a powerful way that words or graphs fall short of. Hopefully, through this work, people can better visualise and relate to [the] reality.' (quoted in Yalcinkaya 2019) It is difficult to ignore slow moving ecological threats when faced with a 'real time' visual reference to changes ahead. The narrative is community specific, but also generalisable when we empathise with North Uist by imagining those lines cutting across our own homes and shores.

Similarly, Natalie Jeremijenko and David Benjamin's site-specific installation *Amphibious Architecture* (2009) used a range of sensors in New York's East River and Bronx River to monitor water quality, presence of fish and 'human interest' in the river ecosystem, and represent this data through lights which illuminate the water's surface. Fish leave a trail of lights as they travel and another line of sensors track oxygen levels in the water. Via an SMS interface, people receive updates about the river's health and can text-message the fish or contribute to a display which shows 'collective interest in the environment'. Benjamin and Jeremijenko describe the work as a 'data-driven dialogue between humans, fish and their shared environment.' (2009)

In 2017, Jeremijenko installed an iteration of the project in Hobart's River Derwent. There, the lights bobbing on buoys in the river respond to sensors measuring oxygen levels – markers of water contamination and warming due to climate change. Rather than trying to communicate complex data, the lights simply illuminate red or green – with additional white lights indicating text messages received from the community. Reviewing this work, Jeff Malpas (2017) reports Jeremijenko's aim is to 'shift our conceptions of ourselves and of our environment so as to enable a shift in the kinds and possibilities of agency' and notes that beyond communicating information, the work is underpinned by playfulness which is 'surely also part of the freeing-up of thinking that is necessary if we are to enable a healthier environment.' Jeremijenko's playfulness opens new ways of thinking about kinship – of course the fish can't receive text messages, but the act of sending one anyway makes you a participant in this ludic encounter.

Jeremijenko's *Amphibious Architecture* and the *Lines (57° 59′ N, 7° 16'W)* installations are examples of projects in which we see and are potentially implicated in the action of the story as it is unfolding, rather than being told a story after the event. Jodi Newcombe describes a new breed of environmental artists united by an aim to reconnect humans to the non-human world, to provide a counterpoint to the:

'often disempowering and disengaging stream of numbers and statistics presented to us about climate change, pollution, and species and habitat loss. By responding to the local environment, art as barometer can seek engagement at a community level and spur on grassroots activism and management efforts.' (Newcombe nd)

**Conclusion**

While the works explored here do not represent an exhaustive survey of narrative objects that give rise to encounter mediated via data, they do paint a picture of this emerging genre of visualisation. The encounter at the center of each project makes space for experiences which invite us to pause, feel, imagine and converse in order to bring scientific data into public discourse: ZakPage's performance of songlines demonstrates how indigenous Australian storytelling on Country is part of a long-standing mnemonic system of recording and sharing ecological data; Berger and Keto's tantalisingly impossible encounter with radioactive jewellery that can be inherited but not worn invites us to consider deep time and the consequences for future generation of the energy we are harnessing now; Jarman and Gerhardt's encounter invites us to consider the carbon cycles occurring imperceptibly in the surrounding forest, and conjures ghosts of the scientists who collect and graph such data; Marsh's surreal landscapes provoke us to comprehend the mass scarring of earth due to mining and other human interventions; Eliasson's melting ice-clocks, Niittyvirta and Aho's digital watermarks, Jeremijenko and Benjamin's river interventions which allow us to 'talk back' to nature, all bring climate disasters into the lives of people removed from the sites of actual destruction, but soon to be affected by the global consequences.

An encounter with these projects reveals entangled relationships between human and nonhuman, phenomenological time and deep time. Through realisation of this state of entanglement, a narrative arises; for each viewer, the narrative is unique. An encounter with an object, or within a physical space, is fundamentally different to viewing a visualisation on page or screen, because in the encounter, the viewer becomes a participant – a character among other characters within an unfolding narrative. An encounter invites a subjective reading and writing of data to take place.

We also see a familiar form of encounter emerging in each of the projects – one that can be described as 'uncanny'; a making-strange or de-familiarisation as a result of rendering the unfamiliar in the familiar, or vice versa, to reveal human entanglement within the world. As Delphi Carstens and Mel Roberts point out 'The uncanny describes troubled nature-culture relations, a ghostlike porosity of boundaries between fiction and fact celebrated by indigenous peoples but denied and reviled by post-Enlightenment Western ways of seeing.' (2017) This points to why we see these methods starting to appear as we begin to realise that these post-Enlightenment Western ways of seeing have not served us well, and have been devastating on multiple levels.

To move forward, we offer a provocation: how do we (those of us perpetuating a Western capitalist world view) represent, visualise, understand, exist within an entangled world without continuing to engage in ongoing colonial practices of collecting, labelling and boxing, and find alternatives to extending these practices into our approaches to fields such as big data? Indeed, if we think of one of the most celebrated historic symbols of this very thing, we may ask what a Wunder minus the Kammer may look like? The beginning of an answer is starting to appear in the projects outlined in this chapter, and while none of them may provide a solution, they do help to frame a way of looking for a solution in a new (yet ancient) way.

NOTES

[1] The project was documented in the 2017 book *Future Remains: A cabinet of curiosities for the Anthropocene*, University of Chicago Press.
[2] In *The Great Derangement*, Amitav Ghosh (2016) points to the increasing use of the term uncanny to describe both the freakish weather events associated with climate change, and the awareness of human entanglement in nature that is stirred by such events. See also 'Uncanny Objects in the Anthropocene', a special edition of *Australian Humanities Review* for a collection of essays exploring how 'the Anthropocene uncanny invites us to re-consider histories and objects in new and unexpected ways.' (Stark, Schlunke & Edmonds 2018)

[3] This is not to state that data practices are not useful and critical ways in which to investigate and communicate ideas about the world. However, they must be understood as 'material, contingent and fallible processes' that have specific ways of generating knowledge (Amoore and Pitoukh 2015: 361).
[4] Engagement with charts, graphs and the like of climate data via representationalism also generates a public discourse focussed on which more 'truly' pictures the current status of the world or its future. See Latour 2014 and Latour 2010.
[5] Monin, M. *Coding Materialities* (forthcoming doctoral dissertation), University of NSW, Sydney, uses Tsing's concept of encounter to describe artworks that enable us to notice the material and epistemological actualities of recent machine learning assemblages and how they are reconfiguring knowing and seeing.
[6] See www.commonground.org.au/learn/songlines for an overview of songlines, and the difficulty of explaining this knowledge system to non-Indigenous people, or Margo Neale's book *Songlines* for a more detailed account.

[7] Long-living cultures with an ecological disposition must be noted here, such as the Australian first nations people's enduring interdependent connection to Country. An example of this connection to an animate Country over deep time, is the Garuwanga calendar cycle of the D'harawal people of now-Sydney which encompasses four deep time seasons, taking into account ice-ages and massive sea level changes. As described by Frances Bodkin, D'harawal Woman of the Bidigal Clan, 'The Garuwanga Cycle is the longest cycle of all, lasting from 12,000 to 20,000 years. It has four seasons, and our position in this cycle is judged only by the sea levels.' (Bodkin in Malone et al. 2017)

[8] An example of future impacts of radioactive waste as well as the indeterminacies of encounter is evident in the failing security of the concrete Runit Dome in the Marshall Islands. This site contains nuclear waste from atom bomb tests undertaken by the United States in the 1940s. Today, the containment site is threatened by the effects of climate change such as rising sea levels and more frequent storms. More immediately, the impacts of these tests have destroyed the livelihoods and health of the dri-Enewetak, people of Enewetak. See Jose et al 2016.
[9] See Jarman and Gerhardt 2014 for a short film communicating the laborious design and production process.

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