

Introduction

Representing Extinction

Art, Science and Afterimages

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Exordium: Afterimages

In his remarkable study of the Upper Palaeolithic parietal art of Western Europe, *The Mind in the Cave*, David Lewis-Williams suggests that some imagery present in caves such as Chauvet and Lascaux was inspired by experiences of altered states of consciousness.¹ Emergence from such altered states can be accompanied by the appearance of afterimages, mental pictures that hang suspended in the field of vision for a minute or more. These images gradually lessen in intensity and clarity, slowly blending with the background of the surrounding visual field before ultimately disappearing. Lewis-Williams suggests that through their drawings and paintings, prehistoric people sought to ‘fix’ such fleeting images, granting them a measure of permanence. Many images in the caves are of animals, including bears, bison, deer, horses, ibex and mammoths.²

Some cave imagery reveals characteristics about these animals that cannot be gleaned from the fossil record, such as the likely belt patterning on Eurasian rhinoceroses or the partial striping of horses in the Late Pleistocene.³ Species such as the cave bear (*Ursus spelaeus*) and the woolly mammoth (*Mammuthus primigenius*) that appear in parietal art are now extinct. Prehistoric paintings and engravings tell us much about the appearance and distribution of these animals.⁴ Insights about extinct animals provided by ancient rock art are not restricted to Europe. In mainland Australia, for instance, there are numerous depictions of thylacines (*Thylacinus*

cynocephalus), an animal that probably became extinct there roughly three thousand years ago.⁵ A petroglyph in Murujuga in Western Australia has been interpreted by Ken Mulvaney as registering Aboriginal recognition of a local decline in the species and incorporating efforts to remedy it.⁶

The ways in which afterimages have been understood has changed through time. In modernity, as Jonathan Crary examines, they became associated with autonomous vision, with sensory perception ‘cut from any necessary link with the external referent’.⁷ Afterimages, as durational, were subject to quantitative study, and efforts were made to formally classify them based on their appearance. Pioneered by Johann (Jan) Purkinje, these efforts at classification, which necessitated making drawings of afterimages, also involved efforts to ‘fix’ transient optical phenomena in the present. In both prehistory and modern times, afterimages have been linked to the desire to keep something that is transitory from disappearing. Writing in 1819, Purkinje describes the effort that must be expended to keep an afterimage in the field of vision, as it ‘disappears as soon as the will slackens’.⁸ His sketches, abstract forms, provide artful records of the persistence of vision while simultaneously indexing his own tenacity, his scientific resolve. The study of afterimages in the nineteenth century occurred at the intersection of art and science.

Both Crary and Lewis-Williams refer to afterimages as physiological phenomena, but, as is the case here, the word is also often used figuratively.⁹ One of the reasons that Laura Mulvey, for example, employs the term ‘afterimages’ is that she hears echoes of the term ‘afterwardsness’ (as Sigmund Freud’s term *Nachträglichkeit* is often translated into English) in it.¹⁰ For Freud, ‘afterwardsness’ describes a belated grasp of the significance of an event, particularly a traumatic one.¹¹ Extinction is linked etymologically to the Latin verb *extinguo*, which means to put out, quench, extinguish, kill or destroy. It is therefore unsurprising that extinction, the dying out of a particular species of organism, is frequently conceived as a trauma. In *Imagining Extinction*, for example, Ursula Heise explores how the disappearance of the ivory-billed woodpecker (*Campephilus principalis*) ‘points to a traumatic past, the history of large-scale ecological exploitation and deforestation of the American South’.¹² Heise also reads the conclusion to Lydia Millet’s novel *Magnificence* – in which a hidden collection of endangered and extinct species is revealed – through the prism of ideas about trauma and genocide.¹³

Trauma is frequently conceived as an unassimilated, unsymbolized experience.¹⁴ It refers to occurrences the significance of which are only retrospectively *realized*. Much trauma theory relates to individuals with pathological conditions that prevent them coming to terms with past events from their personal histories. Relief emerges through therapy that encourages the

articulation of the experience, its representation through words or images. Thinkers such as Heise, however, conceive of trauma in broader, cultural terms as impacting group rather than individual consciousness. When comprehended as a cultural phenomenon, efforts to alleviate trauma become bound up with ‘public acts of commemoration, cultural representation, and public political struggle’.¹⁵ Whether related to the individual or the collective, practices of representation therefore have a key role to play in expressing traumatic events and coming to know them.¹⁶ It is for this reason that Griselda Pollock links artistic responses to personal or cultural traumatic experiences with afterimages. For her, art as after-image is potentially transformative, opening a space for aesthetic encounter with ‘that which, by definition, is not yet in the grasp of representation’.¹⁷ Art, in this conception, helps something of a traumatic event to be processed.

While not making direct reference to trauma, several of the chapters in this volume reflect on extinction in ways that encourage making links between species disappearance and traumatic experience. The chapters by David Maynard and Kathryn Medlock, for instance, which explore museum exhibits devoted to the thylacine and its destruction, recognize that the marsupial’s fate was bound up with colonial conquest. European settler colonists decimated lutruwita’s (Tasmania’s) Indigenous population. They also eradicated native species including the Tasmanian emu (*Dromaius novaehollandiae diemensis*) and the thylacine.¹⁸ The emu and the thylacine formed part of Aboriginal Country.¹⁹ Their indiscriminate killing by settler colonists would have gone against the sustainable use of resources associated with ‘caring for Country’.²⁰ Colonialism’s after-effects also feature prominently in *hagwil hayetsk’s* chapter, which examines the impact of overharvesting of *bilhaa* or Northern abalone (*Haliotis kamtschatkana*) by Canadian settler colonists upon traditional cultural practices of the Gitxaala people of Laxyuup Gitxaala.

Mulvey’s use of the term ‘afterimage’ is not solely motivated by its association with trauma. For Mulvey, with her particular interest in cinema, afterimages also evoke a kind of visual afterlife that can be granted to things by motion picture technology: ‘the medium preserves the living presence of human figures, often long dead, through the film machine’.²¹ Film is therefore often haunted by its images, its capacity to revive the past in the present.²² Murray Leeder describes cinema as having become ‘[d]eliberately or accidentally . . . a storehouse for our dead’.²³ Mulvey uses ‘the figure of the ghost and haunting to evoke the complex implication of a past persisting into its future’.²⁴ This implication as it relates to representations of extinction is one that extends well beyond film. Photographs and sound recordings of many recently vanished species endure that grant them a

phantom presence in the present. Physical remains of numerous extinct organisms also persist, including taxidermy mounts which are sometimes presented as if alive, a phenomenon Barbara Creed discusses in her chapter in this volume. Taxidermy mounts, highly illusionistic forms of representation which Rachel Poliquin understands as always bound up with remembrance, are also discussed in several other chapters.²⁵

Meditating on a stuffed parrot, Poliquin notes that taxidermy forms a haunting spectacle, affording an animal a kind of diminished yet enduring afterlife.²⁶ Mark Barrow's book on American efforts to recognize and legislate against human-caused extinction is titled *Nature's Ghosts*.²⁷ Much of the book is dedicated to examining how the threat of extinction haunted American naturalists, with haunting understood as a troubling or discomfiting.²⁸ Clearly, however, 'nature's ghosts' are species that have disappeared, such as the taxidermied Carolina parakeet (*Conuropsis carolinensis*) which graces the book's cover. In *British Animals Extinct Within Historic Times*, James Edmund Harting writes of extinction as 'disappearance beyond recall'.²⁹ The idea of absence also underpins Tim Flannery and Peter Schouten's titling of their book on extinct animals: *A Gap in Nature*.³⁰ Despite the emphasis on loss and vanishment, these books all attest to an extensive capacity to remember extinct species through drawing on sources such as physical remains and textual accounts. The disappearance of a known species is never total. There is always some trace, some after-image, even if it is no more than a name and the picture it conjures, that endures, that haunts us. Avery Gordon observes of apparitions in general that they are felt, sensed, rather than known.³¹ Conceived in this way, extinction is affectively charged, amorphous and elusive.

Sight Unseen

Disappearance, with its etymological roots in the Latin *parere* (to come into view), and vanishment, which has its origins in the Latin *evanescere* (fading from sight), are both visual metaphors used regularly to describe extinction. The disappeared and the vanished can no longer be *seen*. Through these synonyms, extinction is therefore conceived as something rendered visibly absent. The artist Lucienne Rickard, whose work is examined in Jeanette Hoorn's chapter for this volume, gave literal expression to this idea. Her durational performance, *Extinction Studies* (2019–21), involved a palimpsestic process of meticulously drawing and then erasing examples of recently extinct plant and animal species. Two such images, *Half-erased Camballerus alvarezzi* and *Erasing Madhuca insignis*, are reproduced on the cover of this volume. The traces of earlier erased species persist as wraithlike

afterimages within these later drawings. The title of Rickard's performance was intended to connote both art and science: a study is a technical term in art for a preparatory work, yet it can also refer to a practice of knowledge acquisition.³² Although an exploration of vanishment, Rickard's erasures leave visible traces. If they are to be known, all extinctions must leave some remnant, some kind of remainder acting as a reminder.

The reminder may be a physical specimen or a part thereof, sometimes it is a visual or aural record, and, occasionally, it is only a pictorial or textual reference. These last forms of visibility are referred to by Alexander Lees and Stuart Pimm as 'anecdotal evidence' of the existence of a species – an eyewitness (or, more rarely, earwitness) account.³³ Samuel Turvey has analysed paintings, for instance, to substantiate the presence of a now extinct species of macaw in Jamaica.³⁴ The *Anapurú* parrot, which is referred to by the Portuguese Jesuit administrator Fernão Cardim in his *Treatise on the Land and Climate of Brazil*, offers another example.³⁵ Cardim, who was in Brazil from 1583 to 1590, describes the 'very beautiful' bird as reportedly having a body 'splashed and bespeckled' [*salpicado e espargado*] with 'red, green, yellow, black, blue, brown [and] lavender [*côr de rosmaninho*]'.³⁶ As Luciano Moreira-Lima notes, the identity of this 'mysterious parrot' remains unknown today.³⁷ Cardim also refers to an example mentioned by Lees and Pimm, a black macaw, the *Ararúna*, which seems distinct from Brazil's known macaws.³⁸ The bird was already identified as rare by Cardim.³⁹ The *Anapurú* and the *Araréna* have a shadowy ornithological existence, as no holotypes (type specimens) exist for the birds. They persist only as words.

The textual descriptions nonetheless grant a kind of afterlife to the birds. Something, no matter how slight and/or vague, survives of them. Many organisms exit this world unnoted. Elizabeth Kolbert notes this in relation to the present plight of amphibians, a number of which have disappeared before their existence was scientifically recorded.⁴⁰ A comparable situation exists for plants. In an article discussing how many plant species potentially exist, Stuart Pimm and Lucas Joppa suggest that some 'missing species', plants not named and catalogued, 'went extinct before we could even estimate that they were missing from the taxonomic catalogue'.⁴¹ They use orchids from lowland areas of the Atlantic Coast as an example, noting that 'many species could have lived in areas completely destroyed before taxonomists explored them'.⁴² Recent research on Malagasy grasses suggests 'at least a 50% rate of unrecorded extinctions'.⁴³ This figure is region specific, but it gives an indication of the potential scale of unnoted extinctions in range-restricted areas with high endemic plant populations. Given that they have never been noted, to speak of these hypothetical species as 'disappeared' or 'vanished' is disjunctive.

For a species to ‘exist’, a necessary precursor to it becoming extinct, it must first be described. Description is a key dimension of taxonomy: the study of naming, defining and classifying organisms. Usually a holotype, a physical example of an organism, forms the basis for such a description.⁴⁴ Taxonomy as a practice has changed considerably through the ages. Contemporary taxonomic methods are usually traced back to Carl Linnaeus (1707–1778), particularly to the publication of *Species Plantarum* [The species of plants] in 1753, and the 10th edition of *Systema Naturae* [System of nature] in two volumes in 1758 and 1759. Linnaean innovations such as the consistent use of Latin binomials and of divisions such as class, order, genus and species, continue to inform taxonomic practices today.⁴⁵ As Staffan Müller-Wille summarizes, Linnaeus’s descriptions were arrived at through ‘a straightforward inductive process that involved the careful comparison of individual species’.⁴⁶ The botanist’s notion of description was subsequently understood in varied ways by different people. Harriet Ritvo cites an unpublished manuscript by an English devotee of Linnaeus, Leonard Chappelow, which ‘equated taxonomy with works of art’ and characterized the Linnaean system as ‘a series of descriptive pictures’.⁴⁷ Chappelow’s account suggests an artful aspect to scientific description. It is in the context of art that Michael Baxandall notes that the description of a picture ‘is a representation of thinking about a picture more than a representation of a picture’.⁴⁸ It might similarly be said that description of a specimen is a representation of thinking about that specimen rather than a representation of the specimen.

As a kind of representation, description shapes our perceptions of what it refers to. Pollock defines representation as ‘something refashioned, coded in rhetorical, textual or pictorial terms’.⁴⁹ Representations of species (extinct or otherwise), as coding, are related to, yet distinct from, the physical organisms they describe.⁵⁰ The gap between a species and the ways in which it is represented is one that many of the chapters in this volume examine. This consideration is not motivated by the aim of establishing a ‘true’ picture of a given organism and assessing how specific representations deviate from it, but rather addressing the kinds of ideas and beliefs that underpin particular examples.⁵¹ The way a species is represented raises important ethical issues. Depictions that portray a species as potentially dangerous to humans and human interests, for instance, can reduce sympathy for the plight of that species.⁵² Even descriptions that aim to be precise and unambiguous, including those linked to morphology, are equivocal. Morphology, the study of the form and structure of organisms, necessarily involves processes of explanation.⁵³ Morphological form is not pre-given in any simple sense. It must be described by way of text and/or images. These descriptions then circulate as data about a given organism.

Becoming an Afterimage

Morphological data, as description, is linguistic in a broad sense. Language, for example, moulds the way shape is used as a descriptor of an organism. Yet shape, as Norman MacLeod and Peter Forey have noted, involves employing terms that possess ambiguity. Using the example of ‘leaf shape: oval, round’, they ask: ‘where in the context of any particular systematic comparison does “round” stop and “oval” begin?’.⁵⁴ The question draws attention to an instance of arbitrary decision-making in relation to the description of shape. The shift from observation of phenomena to their description, from things to their conceptualization, is complex and necessarily transformative. Language ‘puts pressure on us to discriminate in its way and in this sense every language is tendentious’.⁵⁵ Valérie Bienvenue’s chapter in this volume reflects on how a language can be developed that refuses to generalize and to ‘overwrite’ the particularities of an individual example of an extinct species, respecting instead something of its singularity.

The tendentiousness of language is well demonstrated by William Harvey’s summary of the general characteristics of the (now extinct) protist Bennett’s seaweed (*Vanvoorstia bennettiana* also known as *Claudea bennettiana*):

Fronde stipitate; stipes filiform, merging in the marginal rib of a flat, unilateral, open network, formed of several series of anastomosing, slender leaflets. *Fructification*: 1, *ceramidia* containing within a membranaceous pericarp a tuft of pear-shaped spores; 2, *stichidia* formed from the bars of the network, and studded with triangularly parted tetraspores in transverse rows. –CLAUDEA (*Lamour.*), in honour of Claude Lamouroux, father of the botanist of that name.⁵⁶

Harvey’s description of the alga is scrupulous but not dispassionate, manifesting a poetic rather than prosaic precision. By accident or design, the account is lyrical, including considerable alliteration and assonance (notably more so than in other of Harvey’s descriptions). We would suggest that this probably stems from Harvey’s sense of the organism’s exquisiteness and uniqueness. He calls it a ‘beautiful and curious species’ that he finds ‘very remarkable’.⁵⁷ Something of this splendour and extraordinary significance registers into the exceptionally crafted description he accords it. The *feel* Harvey has for the frond inflects the textual depiction. In the guise of a quest for precise elaboration, he is able to provide a paean. The idea that emotional investment in a species influences morphological description would be anathema to many scientists, but Harvey’s short sketch gestures towards just such a possibility.⁵⁸

Some words in the description also manifest ambiguity of the kind that troubles MacLeod and Forey. Calling the spores ‘pear-shaped’, for instance, evidently suggests an image of a spore that tapers towards the top. To arrive at this image, however, requires working back from another image, that of a common or garden pear. Pears come in many shapes and sizes, some of which, such as the Asian pear (*Pyrus pyrifolia*), are not ‘pear-shaped’. The analogy functions only for a specific audience, one that, when they hear ‘pear-shaped’, form a mental image of the European pear (*Pyrus communis*).⁵⁹ The reference to a tuft is also ambiguous. Tufts are bunches or clumps or clusters of small things. The physical appearance of some alga has encouraged visual analogies with tufts or tresses of hair.⁶⁰ Clearly, for Bennett’s seaweed and other species (such as *Euchema speciosum*), Harvey also perceives this resemblance in their spores. The tuft as a descriptor is nonetheless vague, implying something held together at its base but also having loose ends.

To supplement his text, Harvey also included a plate, a lithograph by Vincent Brooks. The lithograph features three illustrations of the alga, one showing it at natural size (which is small) and two providing magnifications.⁶¹ The illustrations seem designed to reflect the description, to show the alga as network. Preserved examples of *Vanvoorstia bennettiana* do not give such a neat demonstration of their own structure, despite Harvey’s claim that the life-size illustration ‘is an exact facsimile as to form and size’.⁶² Harvey clearly believes that combining images and text enables him to augment the accuracy of his description. For morphological purposes, images can never describe organisms in themselves, they require textual supplementation. Images do nevertheless ‘serve as visual support and provide empirical substantiation for a given descriptive statement by documenting the observational basis for this description’.⁶³ Harvey employs the image in this way, showing the importance of visual representation for taxonomy and, by extension, of art for science.⁶⁴

Although Harvey’s focus on morphology is not absolute (he also provides limited information regarding the alga’s geographical distribution, which he lists as New South Wales), form is clearly of paramount importance. Yet form is only one mode of understanding an organism and its significance – a mode that privileges external and internal structure over, for example, behaviour and that organism’s role in the broader ecosystem.⁶⁵ In the plate showing *Vanvoorstia bennettiana* the background is the blank of the page, the alga has become free-floating, ecologically unmoored. There is no sense of a marine environment. The importance of form to taxonomic practice comes at the expense of an acknowledgement of the entanglement of Bennett’s seaweed with other organisms. The alga was a source of nutrition and of shelter for other marine life. Brooks’s lithograph artificially

disentangles the protist from its coastal community and all the dynamic interactions with other organisms that accompanied it. It is a mode of representation that visibly negates interrelationality among species, concealing their often co-dependence. Brooks relocates the seaweed to an abstract realm the better to communicate taxonomic knowledge. This raises ethical issues about privileging morphology over ecological integratedness as a mode of (visually) knowing the protist. The lithograph produces a particular kind of seaweed, self-contained and self-sufficient, shaping how the alga is perceived and understood.⁶⁶ In this sense, the representation manifests agency, acting on the world rather than simply reflecting it.

The previously mentioned petroglyph from Murujuga was also conceived as agential. Mulvaney suggests the carving, which is of a thylacine, was used as part of thalu or increase ceremonies. These ceremonies are employed to encourage the regeneration of plants or animals.⁶⁷ The site located at what is now known as Patterson Valley must therefore have been strongly associated with the Dreaming power of the thylacine.⁶⁸ In Australian Aboriginal culture (which is not homogeneous), the ancestor spirits of specific animals, plants and insects remain at particular sites. Patterson Valley was a sacred site linked to the thylacine. Mulvaney indicates that the ceremony at Murujuga involved pounding the interior of the thylacine motif, a process which caused large cupules to be produced. The patination of the cupules suggests that they are of a similar age to the motif. In addition, 'pecked and scored lines radiate out from the quadruped, and several of these lines continue over the surface of adjacent boulders'.⁶⁹ The weathering is less pronounced for the lines, implying that they are of a more recent date. Additionally, surrounding the petroglyph in an area of 200 square metres are twenty-three carvings of macropods.⁷⁰

Mulvaney observes that '[t]here appears to be a spatial and arguably a symbolic association between the macropod and the quadruped motifs'.⁷¹ For him, the relationship between the thylacine and the macropods is distinctive:

There is something unique about this combination and treatment of images. With the evident demise of the thylacine 4000–3000 years ago, those charged with its ritual maintenance would have been inevitably challenged. For the custodians of the site, the sacramental practitioners, altering the usual may have constituted a final and desperate attempt to ensure the continued existence of *Thylacinus cynocephalus*. What we may have documented is a continuity of ritual practice which has an antiquity spanning an extinction event.⁷²

The group of petroglyphs, as imagery that foregrounds the fundamental material entanglement of species (here of thylacine and macropod), dif-

fer radically from Brooks's lithograph.⁷³ In the petroglyphs (which form part of the very habitat of the animals they portray), predator and prey are shown as mutually dependent. Mulvaney reads the lines as radiating out from the thylacine, yet they should, perhaps, be read as bidirectional.⁷⁴ Prey sustain predators and predators often perform an important role in maintaining the health of prey.⁷⁵ Additionally, Mulvaney gestures towards the symbolic entanglement of the custodians of the site with the animals. The desperation he believes the incised lines index might be linked to the totemic importance of the thylacine for the custodians.⁷⁶ Another kind of enmeshing, one also running counter to views of species as discrete, is explored by *hagwil hayetsk* in this volume.⁷⁷ He explains that the symbolic entanglement of the Gitaaxla people with *bilhaa* potentially generates respect for the latter.⁷⁸

Indigenous Knowledge and Extinction

Indigenous peoples such as the First Nations Gitaaxla frequently stress respect for nature and call attention to the need for ecological balance. Too often, however, Indigenous voices are still marginalized in discussions about extinction. The protest coalition Wretched of the Earth (which includes the activist group Indigenous Environmental Network) has drawn attention to how movements such as the Extinction Rebellion view ecological and environmental issues from a position of White privilege, and sideline Indigenous voices and expertise.⁷⁹ Considerable efforts are now being made to foster pan-Indigenous solidarity regarding environmental and other issues, while also recognizing each community's singularity.⁸⁰ A delicate balancing act is underway aimed towards alliance that is respectful of difference. Such efforts must continually guard against linguistic and other forms of exclusion.⁸¹ Decolonization is a long-standing and key shared concern. Thohahoken Michael Doxtater notes that Indigenous scholarship has been confronting colonial-power-knowledge since the 1960s.⁸² There are, however, some Indigenous communities that have not been subject to colonization yet are also at risk of losing traditional knowledge. A Chinese minority community such as the Chuanqing, for example, possess considerable expertise relating to the flora of the mountainous regions of central Guizhou. Until recently, no efforts had been made outside the community to record that understanding.⁸³ Samuel Turvey's chapter in this volume, which focuses on the Yangtze ecosystem and Hainan in China, foregrounds the speed with which Indigenous knowledge about extinct species can be lost.

For a long time, the value of Indigenous knowledge for sustainable development has been recognized. Writing thirty years ago, André Lalonde listed numerous kinds of knowledge held by Indigenous African societies that could contribute to conservation efforts, including social taxonomy, pest management, agronomic practices and approaches to anti-desertification.⁸⁴ Yet Abayneh Unasho Gandile, Solomon Mengitsu Tessema and Fisha Mesfine Nake suggest that Indigenous knowledge continues to be overlooked, is inadequately recorded and is itself at risk of extinction.⁸⁵ They do not view Indigenous knowledge as antithetical to Western scientific knowledge and think that bringing different belief systems into dialogue can be mutually enriching. A similar perspective is advanced in the context of Abya Yala (South America) by C. Dustin Becker and Kabita Ghimire, who examine how synergy between traditional knowledge and Western knowledge has aided forest preservation in Ecuador.⁸⁶

Many Indigenous peoples, however, are circumspect about how their knowledge has been sourced and used by non-Indigenous conservationists. In a report on the topic of Indigenous knowledge as it links to extinction-related research, Audra Mitchell, Zoe Todd and Pitseolak Pfeifer draw attention to the way Western secular scientific logics continue to restrictively shape responses to the contemporary extinction crisis through entrenching divisions between human and ‘nature’, framing non-humans as resources for instrumental use and privileging technoscientific and economic management solutions to ecological crises.⁸⁷ Focusing on Canada’s First Nations, Inuit and Métis communities, Mitchell, Todd and Pfeifer note that the turn to Indigenous knowledge to aid conservation initiatives is usually accompanied by a failure to recognize the distinct ontologies and epistemologies of the communities from which the insights are derived. Indigenous communities are mined for ‘data’ and then sidelined. Our decision to place the section on ‘Indigenous Peoples and Extinction’ early in the volume is motivated by a wish to avoid this kind of marginalization and foreground the importance of traditional knowledges for ongoing efforts to address today’s biodiversity crisis. The issues raised in the section by *hagwil hayetsk* regarding interspecies relations, kinship and the toxic legacy of colonialism, have profound implications in terms of the uneven power relations that characterize many discussions and representations of extinction and possess broad relevance.

In the context of representation, natural history museums often maintain colonial values and unreflectively display artefacts that are of cultural significance to Indigenous peoples. Natural history is always also cultural history, with many valuable collections built on colonial exploitation and violence. Scholarship in this area has tended to focus on how ethnographic

displays perpetuate racist worldviews.⁸⁸ The entire classificatory system (Linnaean taxonomy) used in most natural history museums is a form of descriptive domination. Many species with Latin binomials were historically well known to Indigenous peoples yet by other names. Subhadra Das and Miranda Lowe discuss the presence of a panel in the Hintze Hall of the Natural History Museum in London that portrays the plant *Quassia amara*, the binomial chosen by Linnaeus to commemorate the Ghanaian slave Kwasi Mukamba (Graman Quassi) who brought the medicinal qualities of the Surinamese shrub to the attention of Europeans. Das and Lowe lament the failure of the museum to commemorate Kwasi Mukamba, an important figure in Black history, or the plant that now bears his name. Their discussion, however, obscures the reality that the medicinal properties of the shrub were already recognized in Surinam.⁸⁹ The plant is widespread through the Caribbean and Abya Yala (Central America). Most of its current regional names are derived from the languages of the colonizers (Dutch, English, French, Portuguese and Spanish) but some, such as the Ulwa name of *battaka di basta*, are Indigenous.⁹⁰ Continuing to solely use the standardizing Latin binomial, even if it harbours a hidden dimension of Afro-Surinamese history and foregrounds the role of extra-European expertise in botanical discovery, erases historical Indigenous recognition of the plant. This example shows in microcosm some of the difficulties that accompany the ongoing process of decolonizing natural history museums.

Das and Lowe rightly stress the value of narratives as part of decolonization efforts. Anna Guasco similarly argues that extinction storytelling in the museum ‘may allow us to pay closer attention to the ways in which political and economic inequity, racism, (neo)colonialism, imperialism and ecological debt amongst nations intersect with issues of extinction and biodiversity loss’.⁹¹ Storytelling, for Guasco, seems a reflexive form of narrative that embraces interdisciplinarity and is attentive to social justice issues. There should also be space for Indigenous storytelling in contemporary natural history museums. In many Indigenous cultures, storytelling is an embodied mode of knowledge sharing. The storyteller, their status and the language they use, is often inseparable from the ‘content’ of a given story. Elements such as facial expression, gesture and vocal intonation are crucial.⁹²

Mitchell, Todd and Pfeifer suggest that researchers concerned with Indigenous conceptions of extinction need to look beyond scientific narratives and engage with oral history and other cultural forms such as art, film and poetry. Music might be added to the list. The Inuk singer Tanya Tagaq has powerfully demonstrated how music can embody Indigenous activism, cultural revitalization and political critique. We want briefly to examine her music here, as it ably demonstrates the kinds of insights into

Indigenous understandings of the land and its ecology that a non-scientific account can potentially offer. Tagaq is inspired by *katajjaq*, an Inuit throat-singing game of stamina usually played by two women in which each mimics aspects of their regional soundscape, such as the elements, fauna and human activities. On her albums, Tagaq throat-sings solo, accompanied by Western classical instruments and electronica. As Alexa Woloshyn has noted, Tagaq's 'musical practice demonstrates the limits of the easy binaries of traditional/modern and past/present'.⁹³ Her vocalizations run the gamut from aggression and pain, to the highly erotic, the breathy and the ecstatic.⁹⁴ The songs are strongly affective, achieving their political force through the conjuring of moods, of atmospheres that refuse to coalesce into clearly defined messages. Although lyrics are often present, there is a studied refusal to offer slogans or platitudes. In her thoughtful and nuanced engagement with Tagaq's music, Kate Galloway suggests that the singer gives voice to 'ecological trauma' and also invites a reconnection of human bodies to the land, fostering an ethics of kinship with the non-human.⁹⁵

The album *Animism* (2014) includes songs that highlight human and non-human animal connectedness in Inuit culture. In 'Tulugak', Tagaq voices the *tulugak* or raven (*Corvus corax*), her larynx transformed to syrinx. Through her vocal inhabiting of the bird, Tagaq embodies her connection with it. What she accomplishes using her voice is frequently signalled in Inuit culture by other means such as through clothing. As Heather Iglooliorte explains, clothing can symbolize 'the correlation and affinity between humans and animals, and is a form of transformation iconography'.⁹⁶ Clothing that resembles a given animal, such as a caribou, transfers something of the qualities of that animal to the wearer. In this context, Tagaq's singing, her replication of non-human animal communication, should not be understood as mimicry where she simply 'sounds like' a raven or other animal. In Inuit cosmology, an extended sense of personhood exists and, as such, Tagaq's vocal practice can be heard to perform the unity of human and non-human animals.⁹⁷

The short film *Tungijjuq* (Dir. Félix Lajeunesse and Paul Raphaël, Canada, 2009), starring Tagaq, is about the value of hunting to the Arctic ecosystem and gives the reality of human and non-human interconnection visual expression through employing CGI and prosthetics. The latter are used to give Tagaq lupine eyes and a tail. In the film, she also embodies a dying caribou and a seal. One scene shows Tagaq naked against the arctic landscape, a cut of meat nestled between her breasts and on her abdomen. She caresses the bloody flesh, joying in the meat.⁹⁸ Later Tagaq eats raw seal, a smile flickering across her face. Like *Angry Inuk* (Dir. Alethea Arnaquq-Baril, Canada, 2016), *Tungijjuq* foregrounds the importance of

seal hunting to Inuit culture. Canadian Inuit have faced social opprobrium for their continued hunting of *nattiq* or ringed seal (*Pusa hispida*) despite protests against sealing historically being prompted by settler colonial killing of harp seal (*Pagophilus groenlandicus*). Like the Gitxaala Nation discussed by *hagwil hayetsk*, who must now endure considerable restrictions on their harvesting of *bilbaa* because of settler colonial over exploitation of the marine snails, the Inuit pay the price for the actions and practices of others.

One of Tagaq's best-known songs, 'Fracking' (from the album *Animism*) is a vocal condemnation of hydraulic fracturing, a process used to extract fossil fuels such as natural gas and petroleum from rock formations. This technique has been condemned because of its environmental impact, which includes ground- and surface-water contamination, noise pollution, and seismic activity. Nunavut possesses shale that is rich in natural gas and might be mined using fracking. In addition to resource exploitation, the Arctic has been heavily impacted by climate change, with declining insect numbers noted and populations of some species of shorebird also diminishing.⁹⁹ *Tuktu* or Peary caribou (*Rangifer tarandus*) have decreased dramatically because of recent severe winters, making 'anthropogenic climate change . . . the caribou's worst enemy'.¹⁰⁰ Overhunting by Europeans historically also led to the extinction of the *isarukitsok* or great auk (*Pinguinus impennis*) and the *akpingak* or Eskimo curlew (*Numenius borealis*).¹⁰¹ Galloway suggests that 'Fracking' 'gives voice to the trauma inflicted on the non-human environment', a reading that presumes humans exist as separate from the environment rather than being on a continuum with it. We believe that through compositions such as 'Fracking', Tagaq is signalling that the land is a part of her, not set apart from her. The cover version of Nirvana's 'Rape Me', from Tagaq's album *Retribution* (2016), is interpreted by Galloway as alluding 'to the actual and metaphorical violation of Indigenous lands'.¹⁰² 'Fracking' is clearly also a song about assault, about fucking (with) the earth without its consent. Tagaq has, in fact, said fracking is like 'earth-rape'.¹⁰³

In 'Fracking', Tagaq's vocal energy transmits a powerful sense of a land in pain, one that makes the hairs stand on end. Her voice physically affects the listener, registering corporeally as horripilation. VK Preston, writing of a live performance by Tagaq, describes the singer as communicating a 'felt politics'.¹⁰⁴ Olivia Michiko Gagnon similarly calls Tagaq's music a 'sensate politics'.¹⁰⁵ Tagaq does not offer a representation of earth violence but rather provides an affective enactment of it. In this sense, her music expresses 'active agencies that reach beyond representational logic and any anthropocentric perspective'.¹⁰⁶ D. Ferrett's notion of 'dark sound' as potentially articulating both the darkness of humanity's violent effects on the

environment and the usually unperceived inaudible frequencies of nature, has considerable relevance in the context of albums such as *Animism* and *Retribution*.¹⁰⁷ For Ferrett eco-activist music that embraces ‘dark sound’ can shift understandings, alter human perception and introduce ‘the possibility of change in behaviour’.¹⁰⁸ Tagaq’s music exhibits agency of this kind, not simply representing the Arctic environment but embodying it and working to change perceptions of it.

How to Do Things with Pictures

Both the petroglyph and the lithograph discussed previously are agential kinds of image. The petroglyph, like Tagaq’s music, was knowingly conceived to effect change in the world. It is unlikely Brooks and Harvey thought of the lithograph and its accompanying text in this way. Yet images are commonly accorded vitality in Western culture. In *What do Pictures Want?*, motivated by ideas of animism, W.J.T. Mitchell describes images as like living organisms. One example he uses for what he calls ‘living images’ or ‘animated icons’ is Dolly the sheep, the first mammal cloned from an adult somatic cell. For Mitchell, Dolly foregrounds the reality that living things are also images. Dolly conjures wonder and dread as *idea*, as ‘icon of cloning and biotechnology’.¹⁰⁹ In a similar sense, even before Harvey embarked on naming and describing Bennett’s seaweed, as a marine botanist he saw the alga through the prism of phycology, he had an *idea* of what it was. He knew what he was ‘doing’ when he named and described the seaweed. Naming a taxon also creates that taxon.¹¹⁰ It is as much a doing as a describing. The lithograph of the seaweed contributed to this process of species realization. It produced rather than simply reflected *Vanvoorstia bennettiana*.

The idea that pictures possess agency and can act upon the world, potentially changing it, also inspires many contemporary artists. Mark Dion’s artworks, for instance, which are examined by Anne-Sophie Miclo in her chapter for this volume, are intended to contribute to the building of ‘a culture of nature that features regeneration over destruction, sustainability over depletion [and] nurturing over domination’.¹¹¹ Dion hopes his art practice will encourage change in relation to attitudes towards conservation and the environment. Rickard’s semi-erasure of the critically endangered swift parrot (*Lathamus discolor*) for her *Extinction Studies* has also been interpreted as ‘a moving call to action’ regarding the fate of the bird.¹¹² There is a varied relationship between images and agency across time and geographical contexts.¹¹³ Although Harvey’s nineteenth-century description and the accompanying lithograph can be conceived as perfor-

mative, their symbolic dimension renders them readily assimilable to ideas of representation. This cannot be said for the thalu site discussed earlier. It includes renderings of animals that might be praised for their mimetic competence, yet it was a place of process rather than of the re-presentation of things in the world, a reflection of the pre-existent. The action of striking was intended to provoke a response that would positively impact the physical animal. Striking the image was to strike a thylacine Dreaming. The image is not representational, it is the Dreaming. Although this volume is subtitled 'The Art and Science of Representing Extinction', it is clear that extinction as it appears in art and visual culture is not always representational, nor is it wholly explicable through theories of representation.

Images that feature extinct organisms can, for example, often generate a strong affective response. Affect is conceived in varied ways. In psychoanalysis, it is understood as an accumulation of excitation that is, by its very nature, resistant to identification and formulation. It refers to responses to stimuli that are 'not as specific as the emotions' being 'more diffused and shapeless'.¹¹⁴ Melancholy provides a good example of such a response. Melancholia is experienced as a feeling of loss that bypasses signification.¹¹⁵ It is registered intensely but cannot be put into words. Often extinction involves knowing we have lost something, a species, but not knowing what it is that we have lost. In many instances, the nature of this loss necessarily remains unresolved. Our knowledge of most extinct species is fragmentary and unlikely to increase significantly. To look at an image of a vanished organism is never to see the whole picture.

Works such as Rickard's *Extinction Studies*, in which loss is given powerful visual expression, are not melancholic in Freud's understanding of the term because what is being lost, the artist's detailed drawing, is readily knowable and recorded. Bill Hammond's 1995 acrylic work *Living Large 6*, which references the extinct Aotearoa/New Zealand bird the huia (*Heteralocha acutirostris*), gives a better sense of melancholy as an affective state. The sombre, surreal scene, painted in varying shades of blue and grey, shows a hippocephalic humanoid in evening dress on what may be a dais. The figure has a cello and seems about to give a performance. Their audience is a flock of bird's heads, specifically huia heads. Hammond leaves drips of paint across the picture that Cameron Boyle equates with tears. Boyle describes the painting as a 'melancholic scene'.¹¹⁶ He rightly suggests it has the air of a requiem. As Boyle also notes, Hammond eschews straightforward imitations: the huia in the painting are spectral, elusive. The drips of paint draw the viewer earthwards, downwards, signalling the gravity of the scene. These drips also imply fluidity, a refusal of form. Suffused by affect, the work gives off a downbeat air. It is allusive, registering as a mood rather than communicating a meaning and coalescing into a specific emotion.

Sarah Bezan's chapter in this volume also attends to the affective dimension of artworks, specifically Jakob Kudsk Steensen's recent Virtual Reality (VR) installation, *Re-Animated*. Bezan's chapter additionally draws attention to how technological innovations such as VR potentially open new directions for the portrayal of extinction. This potential is also affirmed in Jeffrey Benca's chapter, which explains how he used measuring data from a fossil of a lycopsid (a form of lycophyte, a spore-bearing vascular plant) and a vector software program to reconstruct the plant's structural intricacies.

The Fossil Record

The lycopsid branch of the tree of life is still extant today, having survived several mass extinction events. These events form part of background or natural extinctions, which are to be differentiated from anthropogenic extinctions.¹¹⁷ In his description of the tree of life, Charles Darwin noted that: '[f]rom the first growth of the tree, many a limb and branch has decayed and dropped off; and those lost branches of various sizes may represent the whole orders, families, and genera which have now no living representatives, and which are now known to us only from having been found in a fossil state'.¹¹⁸ Darwin's description of limbs and branches dropping off the tree through decay suggests a kind of gradual failure. Extinction, so figured, is a slow process; yet some extinctions in the deep past, those associated with mass extinction events, occurred relatively abruptly. Darwin's metaphor also forecloses tree branches being sawn off, extinctions being caused by human actions. The mass extinctions that have been identified across geological time all occurred prior to the emergence of humankind. Five mass extinctions are generally accepted to have happened but there is a strong argument to also acknowledge a sixth.¹¹⁹ Any human-made representations of these extinctions have been produced retrospectively, millions or billions of years after the disappearance of the organisms they depict.

We know of these organisms because some have left fossil traces. Perhaps the earliest such traces, from the Archean era, exist as biogenic graphite. Using electron microscopy, it has been established that graphite in western Greenland is probably composed of carbonate sediments from marine organisms. The graphite, dating from 3.7 billion years ago, therefore indexes early ocean life. The scientific paper that discussed the graphite sample was accompanied by several figures, including a graph, bar charts and transmission electron microscopy images.¹²⁰ The microscopy images show polygonal grains of graphite, their shape indicating they derive from biological material, from once living matter. The graphite is not, however, identifiable

as a specific life form. The earliest *identifiable* life forms are fossil stromatolites. The fossil record from the Archean era is meagre, meaning that reconstructing the nature of life at that time is difficult. Fossils from later in geological time are more numerous.

W.J.T. Mitchell describes the fossil record as ‘a material and pictorial record, a vast iconic and indexical archive of species, most of them extinct’.¹²¹ He also notes their allegorical potency, seeing them as *memento mori*.¹²² Fossils are often conceived as solid, as durable, despite many being incredibly fragile. Their perceived hardness seems to lend them substantial evidential value: fossils offer ‘rock solid’ data concerning extinct organisms. In reality, the organisms preserved as fossils have often been compressed and deformed. The process of fossilization, which is varied, transforms the organism. Soft tissue decays and, in a process known as diagenesis, hard tissue becomes modified geochemically and physically. Most ancient species are only known through this distorted record, a geological archive which, as with any archive, is partial. The majority of organisms that die do not fossilize.

The organisms that are most likely to fossilize are those with tissues resistant to decay. There is also a greater likelihood of finding more common organisms in the fossil record. Organisms living in low-energy environments are more likely to be preserved as their environment is less abrasive. Yet organisms in high-energy environments may develop protective coverings, dermises or shells, that increase their chances of fossilization.¹²³ Organisms from marine environments have more prospect of becoming fossilized than those on land. Norman MacLeod notes that fossil assemblages where a group of organisms overcome by a sudden catastrophe are conserved together ‘often [preserve] important aspects of the spatial systems, ecological systems, behavioural systems, developmental systems and in some cases even the social systems of which the living organisms were part’.¹²⁴ As our picture of the natural world of the past is built from out of the fossil record, it is a highly incomplete and uncertain one. The way we represent ancient biota is influenced by what life became fossilized and by how those fossils are now interpreted.

It was through the study of fossils that the reality of extinction was first recognized. In the sixteenth century, Bernard Palissy correctly surmised that fossils embodied once living organisms.¹²⁵ In the early nineteenth century, through analyses of the fossil record, Georges Cuvier would argue for the possibility of species becoming extinct. Responding to critics of his ideas, Cuvier suggested that the considerable morphological differences between superficially similar living species of quadrupeds and those in the fossil record could not be explained away through gradual modification, as no traces of such modifications were visible in the record: ‘the bowels

of the earth have not preserved monuments of this strange genealogy'.¹²⁶ The absence of such data implied a catastrophic event had caused the sudden disappearance of some species. Much of Cuvier's work involved the Elephantidae family and the Mammutidae family. These fossil materials he worked from (of mammoths and mastodons) were relatively familiar and identifiable. Most remains of ancient organisms are unrecognizable for what they once were.

Fossil fuels, for example, are formed through the decomposition of dead organisms. These organisms are now unknowable but the species they belonged to will, almost invariably, be extinct. Fossil fuels such as coal, natural gas and crude oil are side effects of death and extinction. These side effects are now contributing to the current Holocene (or Anthropocene) extinction. Most anthropogenic carbon dioxide emissions are caused by the burning of fossil fuels. These emissions massively impact global warming. The extinction of the Bramble Cays melomys (*Melomys rubicola*), a rodent endemic to a coral cay in the Torres Strait, was directly attributed to climate change. Rising sea levels and extreme weather events had caused erosion and significant vegetation loss on the cay. A report on the demise of the rodent suggested: 'repeated ocean inundation driven by anthropogenic climate change posed the most severe, immediate and all-pervasive threat to this rodent population, ultimately sealing its fate'.¹²⁷ Through human intervention, the remains of past extinction events have generated a new one.

Crude oil is formed principally from algae and zooplankton that have degraded and gradually broken down into their chemical constituents, chemicals that have subsequently recombined and transformed. The chemical terms used to describe the composition of crude oil – hydrocarbon compounds (including alkanes and naphthenes), non-hydrocarbon compounds and organometallic compounds – gives only an abstract and limited sense of its living origins.¹²⁸ During the refining of crude oil, petrochemicals such as aromatics and olefins are obtained which are used in many everyday products. Olefins such as ethylene and propylene contribute to the production of numerous plastics. Plastics used in bags, films and bottles are composed of polyethylene (which utilizes ethylene) and those used to manufacture many bottle tops and containers feature polypropylene (which has propene as a foundation). Benzene, an aromatic, contributes to the production of polystyrene (among many others uses, employed to make petri dishes and test tubes) and some nylons (often present in clothing). The housing and the keyboard of the computer being used to type these lines is probably derived from petrochemicals, the fingers of our hands touching material that once formed living organisms, life forms which are now extinct species. Traces of extinction, in this sense, are literally beneath our fingertips.

The sheer quantity of materials surrounding us that derive from fossil fuels provides insight into the underlying omnipresence of extinction in the history of life on earth. As Norman MacLeod's chapter in this volume discusses, these events have involved a massive loss of biodiversity while also enabling new organisms to emerge. There is sometimes a productive dimension to extinction. Mass extinctions are unusual, but background extinctions are common. The majority of extinctions that have occurred – 95 per cent of all species – are background extinctions.¹²⁹ Most species that have lived are now extinct. These extinctions are so numerous as to resist conceptualization. This may explain why extinction is usually pictured in relation to very recent examples. The current Wikipedia page devoted to 'Extinction', for example, includes images of the thylacine, the golden toad (*Incilius periglenes*), the dodo (*Raphus cucullatus*), Haast's eagle or pouakai (*Hieraaetus moorei*), the moa (possibly *Diornis novaeseelandiae*), the passenger pigeon (*Ectopistes migratorius*) and the critically endangered great hammerhead (*Sphyrna mokarran*). These animals all became extinct or endangered in the last six hundred years. At the time of writing, there are no images of recently extinct plants included in the encyclopedia entry. Older examples of extinction are provided by a composite image of skeletons of six extinct dinosaurs, a drawing of a tyrannosaurus, a plate from Cuvier's 1799 essay 'Mémoire sur les espèces d'éléphants vivantes et fossiles' that compares mammoth and elephant jaws, and a photograph of an external mould (the imprint of the outside) of a prehistoric plant, *Lepidodendron*, from the Upper Carboniferous period (roughly 320 million to 298 million years ago). The majority of images on Wikipedia therefore relate to recent extinctions. If we look beyond modern times, it is invariably to the age of the dinosaurs that we turn. Excepting the ancestors of modern birds, most dinosaurs lived between 240 million and 66 million years ago.

Given life on earth has existed for approximately 2.4 billion years, the visible emphasis on organisms from only a span of 174 million years is highly restrictive. This volume similarly focuses predominantly on recent extinctions. The chapters by Jeffrey Benca, Norman MacLeod, W.J.T. Mitchell and Jingmai O'Connor are, however, intended to give an indication of how the rich research currently being undertaken regarding ancient extinct species intersects with issues of representation. MacLeod's chapter considers how museums should exhibit extinction, including the natural mass extinctions of prehistory. Mitchell revisits ideas from the *The Last Dinosaur Book*, in which he analysed the modern and contemporary cultural significance of dinosaurs.¹³⁰ Benca and O'Connor use case studies from specific clades, lycophytes and enantiornithines respectively, to discuss issues of reconstruction in relation to extinct species. Benca details the reconstruction of a lycopsid or clubmoss from the Middle Devonian

period (roughly 385 million years ago). O'Connor examines the many insights that the fossil record provides about enantiornithines (a group of extinct avialans) from the Cretaceous period. Her chapter demonstrates that sometimes, if the fossil record is relatively substantial, a remarkable amount of data can be deduced from fossils regarding issues such as behaviour and colouration. Techniques of representation, including palaeo-art, form a vital means of communicating such insights.

A major technology of representation used to impart knowledge gleaned from the fossil record is photography. Joanna Zylińska has argued that photographs can themselves be conceived as a kind of fossil: 'a light-induced process of fossilization'.¹³¹ Using Louis-Jacques-Mandé Daguerre's 1839 daguerreotype *Shells and Fossils* [*Coquillages*] as an example, Zylińska also draws attention to how fossils feature as a subject almost from photography's inception. The image *Shells and Fossils* was taken in the Muséum national d'Histoire naturelle in Paris and is carefully framed so that an ammonite is at the centre of the composition. For Zylińska, *Shells and Fossils* 'showing deep-time artefacts carefully arranged into a sculptural grid reflecting light at various angles, placed photography in its very nascence between science and art, while also hinting at its geological entanglement'.¹³² Nicholas Mirzoeff has also recognized that the choice of subject-matter is not coincidental, given debates about extinction in the period. For him, the photograph denotes human technological potency, embodying the ability to 'fossilize' things or events as images almost instantaneously, in contrast to the slow process of preservation associated with geological time that produces traditional fossils.¹³³

Zylińska is attentive to how the arrangement of shells and fossils is illuminated. Photographing fossils is often difficult because of a lack of contrast or relief between the fossil and its surrounds.¹³⁴ There is therefore considerable discussion in palaeontology about how best to photograph them as photographs of fossils are a key means of presenting data. For this reason, Hans Kerp and Benjamin Bomfleur suggest that '[w]hen illustrating fossils, the same care should be taken as when describing and interpreting them'.¹³⁵ Illustrating here seems to be understood as 'explanation through pictures', with pre-existing descriptions exemplified by way of images. This supports Kerp and Bomfleur's claim that photography 'forms the least subjective means of presenting . . . fossils'.¹³⁶ Their qualified endorsement indicates that feelings and judgements still potentially inflect photographic images, including those of extinct species. Kerp and Bomfleur focus on fossil plant photography, examining its history and the impact of new technology on its practice.¹³⁷ We, however, would like to briefly examine photographs that record more recent extinct species. Photographs of extinct species have a significant power as representations, because of the

truth status accorded to them. They are little discussed in other chapters in the volume, W.J.T. Mitchell's being the exception, so we now devote some attention to them here.

On Photography

On Tuesday 1 September 1914, the last-known passenger pigeon, a female called Martha, was found dead on the floor of her cage. She is often identified as an endling, as the last surviving individual of her species. After her death, Martha was skinned and mounted. Her internal organs were also studied and preserved. In addition to these physical remains, several black-and-white photographs exist of her that were taken in life. These include two that are included in Errol Fuller's remarkable volume of photographs of extinct bird and mammal species, *Lost Animals: Extinction and the Photographic Record*. Another bird featured in Fuller's book is the Aldabra brush warbler (*Nesillas aldabranus*), an avian that was endemic to the coral atoll of Aldabra in the Seychelles.¹³⁸ The warbler was discovered in 1967 when a Royal Society expedition to Aldabra sourced two adult specimens and three eggs.¹³⁹ The holotype is an adult female caught on 11 December 1967.¹⁴⁰ Her nest, which contained the three eggs, was collected on the same day.¹⁴¹ The other specimen is an adult male caught on 29 January 1968. Unlike the passenger pigeon, which was first described in the eighteenth century by Mark Catesby and once numbered in the millions, the warbler population was always small, estimated in the 1970s at not more than twenty-five individuals.¹⁴² The warbler is described by Fuller as 'virtually unknown', whereas the pigeon has become a poster bird for anthropogenic extinction.¹⁴³ Fuller reproduces two colour photographs of the warbler (Illustrations 0.1 and 0.2), both taken by Robert Prÿs-Jones in 1975. These images show solitary birds perched on plant limbs against a backdrop of tropical vegetation.

Similarities and differences between the photographs of Martha and the unnamed warblers are revealing about photography as a record, a form of evidence about the past. In the first photograph Fuller reproduces of Martha, she is photographed from below, alighted on a metal pole, the wire mesh of her aviary visible above her. She is clearly a captive bird, held in a humanmade environment. The second photograph grants Martha an illusory freedom.¹⁴⁴ The pigeon is perched on what is either a branch or twined wire, framed against a backdrop that could be interpreted as open sky. Both photographs are in black and white, a medium associated with agedness and artfulness. In the context of Martha, the black and white images date her, distancing her from the present. The colour photographs



Illustration 0.1 Aldabra brush warbler (*Nesillas aldaбранus*). Photo: Robert Prýs-Jones.

of the warblers seem at less of a temporal remove. The warblers are also pictured in their natural habitat, tropical understory.¹⁴⁵ One bird is shown amid pandanus and the other, photographed at head height, is surrounded by what look like the leaves of *Cissampelos pareira* (also known as velvet-leaf).¹⁴⁶ Both birds have been ringed. The bird bounded by pandanus has a silver metal British Trust for Ornithology (BTO) ring visible on their right leg. The ring gave the bird a unique identification number. The other bird has a yellow ring visible on his left leg. This identifies him as a pair-bonded male, first observed by Prýs-Jones on 17 December 1974.¹⁴⁷

In the photographs of the pigeon and the warblers, the birds are all positioned at the centre of the composition.¹⁴⁸ This is intuitively how most people photograph a specific thing. Centring helps to affirm what constitutes the main subject. It also gives a sense of balance. In the black and white photographs, when coupled with the colourless surrounds, it also contributes to a sense of isolation. The colour photographs, with their verdant, sun-dappled backgrounds, do not share this seclusion. Our using the term composition in the context of the four images foregrounds that, even for those pictures that were taken in the wild, a process of framing has occurred. In each instance, there was a modicum of reflection about how best to ‘capture’ or represent the bird.¹⁴⁹ The way the photographs are set up reveals that they do not provide straightforward mechanically produced

objective depictions but index subjectively informed perspectives regarding their avian subject matter. The set-up also shows recognition of the technical constraints of the medium. The birds are all ‘flightless’ as any pictures taken of a bird on the wing would be out of focus and unsatisfactory. In *Lost Animals*, the only bird shown in flight is the Imperial woodpecker (*Campephilus imperialis*), and the image is a film still rather than a photograph.¹⁵⁰ The historical limitations imposed by the camera therefore shape the kind of bird that can be represented.

The second photograph (Illustration 0.2) from Aldabra shows the greatest spontaneity. Foliage in the right foreground is out of focus and lens flare obscures the bottom left of the image. This phenomenon, caused by bright light scattering in the lens system of a camera, is sometimes perceived as a sign of authenticity, the imperfection foregrounding the reality that a given photograph was taken *en plein air*. Flare, however, is also viewed negatively as it obscures aspects of the image and draws attention to the mediating presence of the camera.¹⁵¹ The blur and the flare suggest this was a snapshot, a quickly taken picture, perhaps a reaction to the sound of the bird’s call. This warbler has his beak open, seemingly in song, chirruping. Recordings of warbler vocalizations were used by Prÿs-Jones to try to attract individuals.¹⁵² Bird calls are linked to communicating location, demarcating territory and attracting a mate. In this image, the bird

Illustration 0.2 Aldabra brush warbler (*Nesillas aldabranus*). Photo: Robert Prÿs-Jones.



may be responding to one of Prÿs-Jones's recordings, he may potentially be answering a call from himself. The calls of the warbler have been described by David Pearson as a short 'chickachoy' or 'chak-chir', a repeated 'tak' and a high-pitched rattle of varying rhythm.¹⁵³ These calls were recorded in the wild. Most of the information about the vocalizations of passenger pigeons was derived from Wallace Craig listening to non-breeding birds held in captivity and is therefore, by his own admission, partial.¹⁵⁴ There are no audio recordings of passenger pigeons. Their voice is now purely textual.

The photographs in *Lost Animals*, mechanically produced images, embody varied codes of representation. Prÿs-Jones was carrying out fieldwork, his gaze, at least in part, that of a scientist. This shaped his actions behind the camera. The photographs, recording rare instances of encounter, were probably intended primarily as data. A desire to showcase the morphology of the bird likely contributed to the structuring of some of the shots or to retrospective judgements about which images were deemed a success. If fidelity to form was an underlying concern, then Prÿs-Jones would have privileged compositions (and resultant photographs) that most resembled his sense of the 'ideal form' of the Aldabra brush warbler. A preening warbler, in such a context, would fall foul of his formal concerns as the bird would likely have their head at an 'odd' angle and other parts of their body twisted. In *Lost Animals*, none of the birds seem to be engaged in preening, this despite the fact preening 'takes up a considerable proportion of the time budget of birds'.¹⁵⁵ The photographic record of these extinct species as presented by Fuller is therefore lacking when it comes to cataloguing common behaviours (few of the birds are shown feeding either). This could be because the photographers concerned were focused on recording appearance rather than behaviour, enacting a kind of morphological objectification. Their image-taking is influenced by concerns about often scientifically predefined visible criteria of form and structure.

The first photograph of Martha in *Lost Animals* might have been taken by the animal painter Enno Meyer (who worked as a photographer at the Cincinnati Zoological Gardens) or the pharmacologist and amateur ornithologist William C. Herman (Fuller suggests both men as the possible photographer).¹⁵⁶ The second photograph is regularly attributed to Meyer although Fuller notes that the circumstances of its taking are unknown.¹⁵⁷ These photographs were more likely produced to memorialize Martha, created in the knowledge that when she died, her species would die with her. Martha is burdened with representing the last of her kind. Prÿs-Jones knew the warbler was endangered but not that the extinction of the species was imminent. He could not foresee that in just over a decade the bird would disappear, joining the passenger pigeon and other species of bird, such as the Laysan rail (*Zapornia palmeri*) and the laughing owl (*Sceloglaux*

albifacies), that died out in the twentieth century and also feature in *Lost Animals*. Even if the photographers we are discussing fantasized a particular reception for their images, the responses of real readers to verbal or visual texts are ‘idiosyncratic, unpredictable and/or undisciplined’.¹⁵⁸

In the cases of the Laysan rail and the laughing owl, Fuller additionally includes reproductions of artworks of the birds, an acrylic painting featuring the rail and a hand-coloured lithograph of the owl. There is also an acrylic painting of a passel of passenger pigeons. Fuller clarifies that these images feature as aids to a better visualization of the birds because the relevant photographs are either blurred or in black and white. The other visual media are therefore called upon to supplement the book’s lens-based images, the ‘photographic record’. Mechanically reproduced images are sometimes found visually wanting, inadequate to the task of bearing witness to an animal that has been ‘lost’. Fuller explains that there are, however, no drawings or paintings of the Guam flycatcher (*Myiagra freycineti*), because it is ‘clearly depicted in the existing photos’.¹⁵⁹ He openly shares his rationale for what renders a photograph adequately intelligible for him: colour and clarity. There are three photographs of the flycatcher, two in black and white of a nestling and an adult, both at liberty, and one in colour of a male adult being gently held in profile. It may be the photographer, the field biologist Anne Maben, whose right hand is visible clasping the bird. The male was captured in an effort to establish a breeding programme, but unfortunately no female could be found. The quantity and quality of images of a given animal do not, however, seem to fully explain Fuller’s decision-making. In a similar way to how Harvey’s refined description of Bennett’s seaweed betrays his enthusiasm for that particular protist, Fuller’s species preferences can be seen to manifest in *Lost Animals*.

Icons of Extinction

Most animals and birds in *Lost Animals* are represented by four or five photographs and four or five pages of accompanying text. Some species, such as the ivory-billed woodpecker (*Campephilus principalis*), the passenger pigeon and the thylacine are granted more extended analyses. Of these, the thylacine is the most disproportionately represented. The cover image to the book is of a ‘yawning’ thylacine.¹⁶⁰ An image of them also features in the Introduction (as does one of the ivory-billed woodpecker). There is a ten-page entry dedicated to the carnivorous marsupial, which includes seven photographs. A hand-coloured lithograph of the species features in the appendix. A photograph of the last captive thylacine, ‘Benjamin’, is reproduced across two pages after the Further Reading section.¹⁶¹ A dif-

ferent photograph of 'Benjamin' is repeated six times across the two pages that precede the Index, each time the image is more bleached (a practice comparable to Rickard's erasures) causing the animal to fade away. Finally, on the last numbered page of the book, an 1864 photograph by Frank Haes of a thylacine in London Zoo is reproduced. The sheer number of images of the thylacine indicate that Fuller seems to remark the loss of the animal more acutely than any of the other species featured in *Lost Animals*. The iconic status of the thylacine probably informed the decision to use a photograph of the species as a cover image: the vanished marsupial circulates widely as 'a symbol of extinction, or a reminder of the fragile state of the environment; a figure that evokes feelings of sadness, curiosity and concern'.¹⁶²

Fuller's varied emotional investments in the species he includes also manifests through the minimal attention accorded another mammal, the greater short-tailed bat (*Mystacina robusta*) or pekapeka. A single photograph of the bat is included in *Lost Animals*, yet despite it offering a restricted view (only the head and a wing is shown), Fuller includes no further illustrations.¹⁶³ Drawings and other photographs of the bat do, however, exist. In 1962, Peter Dwyer, for instance, sketched a specimen from the collection of what was then the Dominion Museum (now the Museum of New Zealand/Te Papa Tongarewa) which features in his article 'Studies on the Two New Zealand Bats'.¹⁶⁴ His drawing includes two views of the bat's head (lateral and ventral) and one of his body and his left wing, as seen from above. The drawing also includes lateral and ventral views of the head of a subspecies (*Mystacina tuberculata tuberculata*) of the lesser short-tailed bat. Fuller is not averse to including works that feature more than one species in *Lost Animals*, the painting of the Laysan rail also includes an albatross (*Phoebastria immutabilis*). If he was familiar with Dwyer's drawing, it probably did not appeal because it is a monochrome scientific illustration that is openly instrumental, too obviously designed to support an argument (about morphological differences). The bat also looks lifeless.

Dwyer's drawing can productively be compared with the scientific illustrations that do appear in *Lost Animals*, most notably several hand-coloured lithographs by John Gerrard Keulemans. These highly detailed works were created to accompany scientific texts.¹⁶⁵ Dwyer's work is also meticulous, noting minutiae. Additionally, he extracts details: the head of the bat is accorded particular significance through being separated from the body, with the placement of the bat's ears and the form of his nostrils carefully foregrounded. The dorsal view of the bat also omits his right wing. The mammal is shown as parts or only in part. Keulemans usually portrays birds in their entirety, as is the case with the lithograph of the Hawai'i mamos (*Drepanis pacifica*) that Fuller sourced from *Avifauna of*

Laysan. In this desire for wholeness, Keulemans is similar to the artist John James Audubon, whose works are examined in Gordon Sayre's chapter for this volume.

In *Avifauna of Laysan* there are details of the mamo included on a separate plate alongside those of other birds, namely drawings of their bill (with a close-up), tongue (at life-size, and magnified by 10) and sternum. These were not produced by Keulemans but by Frederick William Frohawk. The tongue and sternum could not be drawn from life, and call attention to the reality that the works were produced post-mortem. Both the birds that Keulemans portrays as alive, perching on foliage, were based on collected specimens.¹⁶⁶ Dwyer's subject is far more obviously dead. As Fuller's narrative of loss relies on pictures of living (or seemingly living) animals, drawings such as Dwyer's or photographs of dead extinct animals have no place. The emotiveness of Fuller's images derives from their being open to reading at the same time as foreshadowing extinction and following on from it: '*This will be and this has been*'.¹⁶⁷ To paraphrase Roland Barthes in *Camera Lucida*, we observe with horror an anterior future of which extinction is the stake.¹⁶⁸

More than this, however, we believe Fuller accords less attention to the bat because it is a bat. Bats have traditionally been viewed negatively in Western culture as carriers of disease.¹⁶⁹ Their association with vampirism has also contributed to their stigmatization. In fact, only three extant species of bat (out of the approximately one thousand known species) feed exclusively on blood. The positive contributions which bats make to human well-being are not popular knowledge. They destroy agricultural 'pests' thereby contributing to increased crop yields. They also aid the pollination of many plants. Since 1900, at least five species of bat have become extinct. In addition to the greater short-tailed bat, the Philippine bare-backed fruit bat (*Dobsonia chapmani*), the Nendo tube-nosed bat (*Nyctimene sanctacrucis*), Sturdee's pipistrelle (*Pipistrellus sturdeeii*) and the Guam flying fox (*Pteropus tokudae*) have vanished. None of these mammal extinctions, however, has a high profile. Bats, like rodents, fall foul of what might be called 'species aesthetics'.¹⁷⁰ They are not seen as beautiful or striking and do not possess 'cuteness'.¹⁷¹ Steve Baker has drawn attention to the need to combat harmful stereotypes that are embodied in representations of some species.¹⁷² The bat requires a representational rehabilitation in order to counteract the half-truths and untruths that circulate about the mammal.

Fuller wrongly affirms that the photograph he reproduces is '[t]he only known photo of a greater short-tailed bat'.¹⁷³ In fact, there are at least two others. The first of these photographs (Illustration 0.3) was taken in what was referred to as the 'bat cave' at Taukihepa/Big South Cape Island in April 1961.¹⁷⁴ It shows a colony of bats at liberty in part of their natural



Illustration 0.3 Greater short-tailed bats (*Mystacina robusta*) in the ‘bat cave’, Taukihepa/Big South Cape Island, April 1961. Credit: Brian D. Bell.

environment. Their guano has visibly accreted on the rock surface beneath them. This situated-in-the-environment depiction is much less able to communicate form than Dwyer’s out-of-the-environment post-mortem portrayal. The photograph, however, foregrounds bat sociality. As a form of representation, it draws attention to the reality that the extinction of the greater short-tailed bat involved the loss of a specific bat society.¹⁷⁵ The second photograph (Illustration 0.4), which was taken in the same month, shows the conservationist Don Merton holding a bat that was caught in a mist net.¹⁷⁶ The ornithologist Brian Bell took both the photographs. Although greater short-tailed bats were unusually terrestrial in their habits, Merton carefully holds the captured bat’s wings open to show the span and structure. The bat population on Taukihepa/Big South Cape Island was decimated after the inadvertent introduction of rats to the isle in 1964. The greater short-tailed bat was last sighted in 1967. The species is significant enough to merit mention in *Lost Animals* but is accorded none of the attention granted the thylacine or the ivory-billed woodpecker.

The issue of iconic status is of great importance in relation to issues of conservation and memorialization. Endangered species perceived as aesthetically appealing are likely to secure public sympathy for their plight (often accompanied by financial contributions to help safeguard the future

of the species) to the potential detriment of other flora and fauna. The Save the Panda campaign of the 1970s and 1980s provides a good example. A Save the Central Rock Rat campaign would be unlikely to generate comparable publicity or support. The vulnerable giant panda (*Ailuropoda melanoleuca*) is seen as huggable and adorable and thus high profile; the central rock rat (*Zyzomys pendunculatus*), a critically endangered Australian rodent, has no public profile, but as a rodent the species would probably generate negative reactions. Birds also have both iconic and ignored extinct and endangered species. The dodo and the passenger pigeon are household names whereas the Aldabra brush warbler and the Ryukyu wood pigeon (*Columba jousi*) are little known.¹⁷⁷ As Mark Halsey has foregrounded, however, there are also risks in singling out species as endangered or vulnerable. Halsey notes that ‘in naming certain species as rare, more precious, more vital than others, there . . . marches the problems attending the hierarchization of the earth’.¹⁷⁸ The endangered births the expendable.

Our aim in this volume has been to engage with some iconic extinct species and how they are represented, such as the thylacine, the quagga (*Equus quagga quagga*) and the great auk, and also to consider relatively neglected examples. Almost the entire kingdom of plants, for instance, is still largely overlooked in extinction debates, despite the many species that are disappearing. Naming a specific species of plant that has gone extinct in the past hundred years would probably be difficult for many people. Unsurprisingly, the issue of plant blindness or plant awareness disparity is therefore referenced in all the chapters in this volume relating to plants. Jeffrey Benca’s chapter is on prehistoric plants, yet plant blindness is still an issue in that context. He foregrounds how such blindness impacts on the ways the palaeontological record is approached and interpreted. Plant blindness, a failure to notice plants and/or an inability to distinguish between plant species and/or to recognize the general importance of plants to the biosphere, is not culturally uniform. Some cultures demonstrate a highly nuanced understanding and appreciation of plant life.¹⁷⁹ In Western culture, however, plants, if they are perceived, are often seen as boring.¹⁸⁰ They do not generally tend to generate strong emotions, with trees forming the most notable exception. Historically, trees have held considerable cultural significance in Western and other cultures.¹⁸¹ Darwin’s tree of life metaphor, which we discussed earlier, reflects this notability.¹⁸² Exploiting arboreal symbolic capital, the practice of tree sitting (building and occupying a platform in a tree to stall its felling) features in many contemporary environmental protests.¹⁸³ Because of the status accorded to trees, silviculture is also an area where Indigenous knowledge is increasingly being sought, with insights regarding sustainability incorporated into forest management.¹⁸⁴

Debates about plant rights are still in their infancy.¹⁸⁵ There is no Plant Liberation Front equivalent to the Animal Liberation Front. In 1972, Christopher D. Stone published his classic essay (subsequently developed into a book), ‘Should Trees Have Standing? – Toward Legal Rights for Natural Objects’, in which he used forestry as one example among several to argue for environmental rights, ultimately calling for a shift in perception such that we ‘get away from the view that Nature is a collection of useful senseless objects’.¹⁸⁶ Stone emphasizes a need to acknowledge human entwinement with the environment and to develop humility about humanity’s role within it. His example to illustrate such a change in consciousness is a short story by Carson McCullers, thereby foregrounding how an art form such as literature can contribute to altering outlooks. In the specific context of flora, early education has been identified as crucial to shifting opinions.¹⁸⁷ The potential role of textual or visual representation in this process is emphasized by Howard Thomas, Helen Ougham and Dawn Sanders in their article ‘Plant Blindness and Sustainability’, which mentions art-based research practice and literary creativity as important ways of raising awareness of plants.¹⁸⁸

In relation to plant extinction, initiatives such as the art installation *Resurrecting the Sublime* have helped to draw attention to specific extinctions.¹⁸⁹ The installation was the result of a collaboration between the artists Daisy Ginsberg and Sissel Tolaas, and the scientist Christina Agapakis, and involved drawing on palaeogenomic expertise to recreate the smells of extinct plants. Three plants featured in the project, all from the United States. One, Maui hau kuahiwi (*Hibiscadelphus wilderianus*), was known from a single specimen discovered circa 1910. A fragment of this shrub is held in the Harvard herbarium. There, a branch is carefully attached to a white card backing, its brown leaves, dry and creased, stark against an artificial sky that is itself made from cellulose fibres.

Besides the species of *hibiscadelphus* featured in the project, many other plant species from Oceania have disappeared in modern times, including the Daintree banana (*Musa fitzalanii*) in Queensland, Australia, and the Philip Island glory pea (*Streblorrhiza speciosa*) formerly endemic to Philip Island in the Norfolk Island group. In his entry dedicated to the shrub, which he calls the flesh-coloured glory pea and seeks to transfer to the *Clianthus* genus as *Clianthus carneus*, John Lindley hopes that the figure he includes illustrating the plant will convince his readers of its relative beauty when in flower.¹⁹⁰ The plate in question is by the British artist Sarah Anne Drake. Drake was a botanical illustrator who contributed to important botanical publications in the 1830s and 1840s, producing drawings and paintings of approximately 1,300 plants.¹⁹¹ Women such as Drake have historically played a crucial, yet under-appreciated, role in botanical re-

search. Jeanette Hoorn's chapter in this volume examines the work of an Australian botanical illustrator, Ellis Rowan. Rowan's work is noteworthy for eschewing a purely morphological approach in favour of emphasizing a plant's surroundings or habitat. Her choice of subject, however, was restrictive. She had a definite hierarchy, preferring to depict big, orchidaceous species rather than small, unshowy ones. To her, tiny-flowered, herbaceous plants seemingly lacked sufficient visual interest to merit transforming into art.¹⁹²

The Lens of Compassion

As well as plant extinctions, those of amphibians, reptiles and invertebrates are also overshadowed by the attention accorded to birds and mammals. Among invertebrates, insects are ecologically of immense importance, yet their high contemporary extinction rate is not common knowledge.¹⁹³ The behaviours by insects that directly or indirectly benefit humans include preying on 'pest' insects, pollinating plants and consuming waste. Pedro Cardoso's chapter in this volume considers ways in which representational strategies in museums might help to draw attention to the plight of arachnids and insects. A key issue for Cardoso is to foster an increase in empathy towards insects. Cary Wolfe has proposed the idea of 'trans-species empathy', an empathy that foregrounds similarities rather than differences across species.¹⁹⁴ Cardoso's suggestion is to create artificial similarities. In the case of insects, he notes that issues of scale need to be considered when seeking to generate fellow-feeling towards insects. As adult humans are much bigger than all insects, using representations that magnify insects can help to overcome size differentials that may impede identification and empathy.¹⁹⁵ Insects, as arthropods, as creatures that have jointed appendages, already bear some similarity to humans and may therefore lend themselves to recognition in ways that non-arthropod invertebrates may not. The sediment-dwelling marine invertebrates the Loricifera, for instance, appear far more 'alien'.¹⁹⁶ Encouraging sympathy for other species may consequently require different strategies dependent upon issues of morphology and, perhaps, behaviour.

The role of feelings in relation to animal ethics has long been debated. In 1996, for instance, Josephine Donovan argued the merits for an ethics grounded in sympathy and compassion rather than abstract reasoning.¹⁹⁷ Sympathy in Donovan's terms involves thoughtful compassion. She frames her call for a sympathetic considerateness towards other species as grounded in an expanded visual field, a capacity to see the bigger political picture: 'people exercising attentive love *see* the tree; but they also see the

logging industry'.¹⁹⁸ Some visual representations gesture towards such an ethic of care. One example is the second photograph (Illustration 0.4) of the greater short-tailed bat, which shows Don Merton gently, if firmly, holding the mammal. The night-time photograph merits sustained analysis. Seemingly illuminated by torch light, Merton's blue-grey-black check shirt visually mirrors the blue-black of the bat's wing membranes. The conservationist's mud-caked hands and dirt-ingrained fingernails attest to the fieldwork he has been engaged in. This is a particular type of nature photograph, comparable in some ways to the archaeological 'hand-held artefact shot' in which a 'still-dirty artefact' is shown in the excavator's hands.¹⁹⁹ As Kelsie Martinez has discussed, such archaeological photographs are imbued with 'the romantic conditions of discovery'. Dirt signals that the artefact is 'fresh from the trench', granting it an imprimatur of authenticity. The soil adhering to Merton's hands signifies differently. It draws attention to him being out in the field, unafraid to get his hands dirty in the interests of conservation. The grime derives from the bat's natural habitat. Something of this habitat now adheres to the outsider.

The visibility of Merton's hands also foregrounds human presence in a way many wildlife photographs do not.²⁰⁰ In the photograph of the 'bat cave', for instance, Brian Bell's being there is only implied. He remains invisible. This enables the shot of the cave to offer the illusion of an 'untouched

Illustration 0.4 Greater short-tailed bat (*Mystacina robusta*) held by D.V. Merton, Taukihepa/Big South Cape Island, April 1961. Credit: Brian D. Bell.



wilderness'. Bell's photograph featuring Merton, by contrast, foregrounds human interaction with the environment. That Merton has touched the bat's island habitat is clear from his hands. Human entanglement with the natural world is affirmed rather than suppressed. Other photographs attest to this entanglement in a markedly different way. A picture of the 'bullocky' Albert Quarrell with a dead thylacine resting across his lap – his right hand cradling the marsupial's muzzle, his left holding his work dog against his chest – also evinces entanglement.²⁰¹

Quarrell shot the thylacine in late 1911 or in 1912 (accounts vary), close to Fitzgerald near Maydena in the Derwent Valley of Tasmania. He had initially hoped to capture the animal alive to sell it to a zoo and therefore viewed the thylacine as an economic opportunity, a commodity. The trees that form the backdrop to the photograph were also commodities. Quarrell's team of bullocks were used to haul timber. The township of Fitzgerald benefited from logging and the harvesting of trees such as eucalyptus and myrtle.²⁰² When Quarrell's efforts to catch the thylacine by the tail ended in failure, he killed the animal with his shotgun. Two other men are visible in the photograph: a man usually identified as the trapper D. Pearce is seated behind and to the left of Quarrell, and the hand of an anonymous figure can be seen to his right holding the stiff tail of the thylacine aloft.²⁰³ A fourth figure, the photographer, is implied but invisible. In this photograph the thylacine is displayed as a trophy. The death of the animal is celebrated and memorialized. Quarrell, with his muddy boots, and Merton, with his dirty hands, are both marked by the environment in which they are pictured. Their attitude to the fauna of those environments is, however, qualitatively different. Merton's taking care not to injure the bat is palpable. Quarrell, by contrast, revels in the thylacine's destruction. Barbara Creed's chapter in this volume offers an explanation of where celebratory destructivity such as that exhibited by Quarrell comes from, as does Nicholas Chare's chapter, with its consideration of animal genocide.

Quarrell supports the animal's deadweight the better to showcase his achievement: the killing of the 'pest'. Both photographs are posed, employing comparable logics of display. The marsupial carnivore is shot in profile to best exhibit the animal's size and banding. The bat is photographed from the front and below to display body size and wing structure. That these animal subjects were seen as unusual is attested by the very taking of the photographs. Quarrell knew the thylacine was rare yet he shot it anyway. Merton was aware the bat was uncommon, but probably not how critically endangered it was. Had he been, he might not have released the mammal but considered his or her capture and relocation.

The bat looks towards the camera, opening the possibility of an exchange of gazes between species. Being netted and manhandled was probably

traumatic. This is not an image of a non-dominative interspecies relationship. The bat does not give consent to be photographed. Their perspective on events remains opaque, yet the framing of the image affords the bat a potential subjectivity. In the photograph of the thylacine, the marsupial's lifeless eyes are closed. Quarrell's dog, however, looks at the photographer. The inclusion of the domesticated animal is noteworthy. The dog, perhaps a kelpie, is clearly valued. Quarrell also makes his living from using bullocks as draught animals. He perceives merit in non-human animals but only those that have been rendered dependent and offer labour power. Merton's sensitive grasp of the bat suggests care towards other species is not contingent upon their usefulness (in any direct sense). The photographs therefore both represent extinct species, vanished mammals, but the interspecies relations they embody are highly dissimilar. Bell and Merton provide a vision of compassion towards another species, one communicated by way of a medium, photography, often associated with mechanical detachment and inhumanity.²⁰⁴ Images have the capacity to reinforce or reshape our existing perceptions of extinct animals. At times, this power, while related to species that have disappeared, has considerable importance for influencing our understanding and behaviour in the present.

Beyond Species Extinction

Extinction is usually thought of as linked to the disappearance of a species, making it of potentially limited value when addressing major ecosystem changes. As one of the peer reviewers for this volume emphasized, however, there are potentially extinct landscapes.²⁰⁵ Landscape is often considered a visual phenomenon and thought of in aesthetic terms.²⁰⁶ Here we understand the term more broadly, equating it with an ecosystem. This is how the wildlife biologist David E. Brown understood the word when, writing in 1979, he noted that due to arroyo-cutting, river rechanneling and groundwater pumping, the beaver-friendly riverine marshlands of the Turtle Island (North American) Southwest have become 'an almost extinct landscape'.²⁰⁷ Brown's example of an almost vanished ecosystem is modern. Many extinct landscapes are ancient; Antarctica, for instance, used to be temperate rainforest.²⁰⁸ Similarly, the Arctic was once warm and forested.²⁰⁹ Most landmasses have undergone substantial ecological change across geological periods. For example, the province of Quebec in Canada, where we write these words, was once part of a far warmer region made up of temperate forests rather than the boreal forests and tundra of today. In the Cretaceous period, the landmass forming Quebec and Ontario was separated from the landmass that is British Columbia not by

the Canadian Prairies but by the Western Interior Seaway, by water not grassland.

Envisioning such vastly different, vanished topographies is immensely difficult. Maps and drawings, for instance, offer a flat earth, cultivating a detached engagement. Computer modelling provides useful insights but findings are usually presented as graphs, the lost world rendered only in abstract terms.²¹⁰ Fossils, as small fragments of a complex assemblage of plants and animals that inhabited a landscape, cannot usually provide the lay of an ancient land either. Only occasionally do they give a sense of terrain. Petrified forests, for example, particularly where some tree trunks still stand upright, seem like meeting points of different geological times and places. Ichnites are also sometimes highly evocative. Frequently derived from ancient shorelines, when they are excavated the tracks are feted for the information they hold about the organisms that made them. Dinosaur prints, for instance, can potentially reveal data about foot shape, skin texture, behaviour and locomotion, among other things.²¹¹ Tracks capture the imagination because they were made in life and index vitality. More than that, while now sometimes preserved in bedrock, the impressions also suggest regolith, sand or soft mud, something malleable and changeable. They summon images of a dynamic, lived-in landscape.

Beyond the imaginings prompted by evocative fossils of this kind, ancient landscapes are potentially best conveyed through immersive media such as film and video games. Immersion fosters the ‘feeling of being enveloped’ and ‘of being transported into a non-immediate reality’.²¹² It is associated with what Carl Therrien identifies as a credible and vivid representation.²¹³ Sarah Bezan’s chapter in this volume discusses immersive VR technology in the context of a modern avian extinction, the Kaua‘i ‘ō‘ō (*Moho braccatus*). In the context of the remote past, video games such as the dinosaur simulator *Saurian* (2017) set in the Upper Cretaceous, and the action-adventure *Far Cry Primal* (2016) set in the Upper Palaeolithic, conjure simulated prehistoric worlds, visually reviving extinct landscapes.²¹⁴ *Saurian* is particularly noteworthy as it strives for a scientifically accurate depiction of an Upper Cretaceous ecosystem, drawing inspiration from fossil finds from the Hell Creek Formation in the United States. A survival game set 66 million years ago, *Saurian* invites players to choose one of six species of dinosaur and then seek to nurture the animal from birth to maturity. The game designers consulted palaeontologists as they endeavoured to produce plausible reconstructions of flora and fauna from six distinct biomes.

Saurian gives a sense of the sights, sounds and textures of the Upper Cretaceous, of an extinct landscape, in a way a still image cannot. The game, however, also gives the appearance of a seamless reconstruction. In reality,

there are gaps in our knowledge of the Hell Creek ecosystems. Insect fossils, for example, are extremely rare, although the discovery of dipteran and zygopteran insects in amber this century has augmented our knowledge.²¹⁵ Some vertebrate species are also only known from microfossils such as teeth, as their small body size, fragile skeletons and/or small populations make them rare as macrofossils.²¹⁶ Any vision of the ecosystems of the Upper Cretaceous, traces of which are now preserved at Hell Creek, is therefore partial. In the same way that ethical approaches to the restoration of cultural artefacts (rather than their mere conservation) frequently call for transparency about repair work, an argument can be made that gaps in the reconstruction of an extinct landscape should be foregrounded. In the case of *Saurian*, this might, perhaps, take the form of an intentional, intermittent ethical pixilation or the incorporation of blank spaces.²¹⁷

The success of projects such as *Saurian* is also not haphazard. The simulator secured considerable funding through Kickstarter because dinosaurs possess popular appeal. The idea of a game called *Ostracoderm* in which the player is an *Astrapsis* from the Ordovician seems far-fetched. Market forces dictate the kinds of extinct ecosystems that are likely to be reconstructed as video games. The Upper Cretaceous has a financial power that the Ordovician does not. Museums, however, have slightly more flexibility and can potentially design immersive reconstructions of less ‘exciting’ extinct land and seascapes.

Landscape change continues to occur today but now the causes are predominantly anthropogenic. Various human activities such as damming, farming, logging and mining have impacted the environment, harming and even destroying ecosystems.²¹⁸ Habitat loss and fragmentation accompany landscape change and are a well-known extinction driver. The ecosystem within which habitats are found is less commonly recognized as subject to extinction. There has historically been clear recognition that, with colonization and modernization, landscapes and ways of life have disappeared, often rapidly. Nancy C. Shour reads James Fenimore Cooper’s novel *The Pathfinder; or, The Inland Sea* (1840) as a re-envisioning of ‘the extinct landscape of the western prairies’.²¹⁹ This echoes Cooper’s explicit aim in his tale centred on Lake Ontario to give a ‘passing glimpse . . . of what that vast region so lately was’.²²⁰ Cooper is referring not solely to the landscape but to its First Nations inhabitants. Sometimes it is not the landscape that vanishes but a way of experiencing it. Augustin Berque uses the example of the Anangu, Aboriginal peoples of Australia’s Western Desert, to illustrate his idea of ‘*cosmoctonie*’ (cosmocide), the destruction not of the land but of a mode of conceiving it.²²¹ Berque goes on to note that the Anangu are now reaffirming their understanding and connection to Country.

Today, certain landscapes, while not extinct, also take on the appearance of ‘museum pieces’. Abayneh Unasho Gandile, Solomon Mengitsu Tessema and Fisha Mesfine Nake write of tropical dry forest reserves in Tanzania that have benefited from protection through Indigenous belief systems (including taboos linked to some species of tree) that they now ‘stand out as ecological museums of local vegetation’.²²² In this understanding, patches of landscape become something like display cases, giving us a peek into an ecosystem that once was. The forests, living museums, are viewed as relicts. Representing extinction is therefore not necessarily restricted to single species but can encompass broader ecological loss.

Conclusion: Thinking across Art and Science

This volume includes chapters by scholars working in the humanities and natural sciences, or across those fields (as is particularly the case for some of the museum curators who have contributed). Scientific modes of enquiry are usually distinct from humanistic approaches to the study of nature and culture, each field employing different languages and epistemologies. Differences at the level of language certainly register in the chapters included here. When contributors use terms from their respective disciplines that might be unfamiliar to some readers, we have asked them to provide a gloss. There is also a greater emphasis on empirical knowledge in some of the scientific chapters, with ethical and political issues more to the fore in several of the humanities chapters. All the contributors share a commitment to thinking through how art and science intersect or combine in efforts to represent extinct species.

Each contributor agreed to participate in the project in the knowledge that the aim was to create a space for research from scholars in both the humanities and natural sciences to appear together. There have been previous efforts to discuss extinction in the humanities drawing on scientific insights but the involvement of members of the scientific community in these projects has been limited.²²³ Here, however, the work of biologists, ecologists, palaeontologists and zoologists appears alongside that of art historians, comparative literature scholars, historians and screen studies specialists. Additionally, museum curators who work at the interface between science and visual culture have contributed. Although humanities and science scholars often display methodological divergences, there are shared areas of concern. These chapters are therefore each in dialogue at some level. Issues such as fidelity regarding representations to a given species, questions of empathy or sympathy, and problems associated with hierarchies of perceived interest or importance (such as the undue emphasis

given to mammals in extinction discourse) form common points of reference. Extant publications concerning representations of multiple extinct species often simply reproduce such representations without critically engaging with them.²²⁴ This is the case, for example, with the previously discussed *A Gap in Nature* (paintings) or *Lost Animals* (photographs). Similar volumes include David Day's poetic meditation *Nevermore* and his more encyclopedic *Vanished Species*. Our book differs in that each contributor reflects on the effects of images of extinction, considering the potentials and pitfalls of varied representational strategies for shaping understanding of a given disappeared species and of extinction events more broadly.

Part I, 'Dialogues about Extinction', comprises three conversations. This part sets the tone for the rest of the volume, which we also view as an expanded conversation regarding extinction and its representation. In the first chapter, 'The Dinosaur as Cultural Symbol and Totem', W.J.T. Mitchell returns to his ground-breaking research on the cultural symbolism and function of dinosaurs in modern and contemporary society. In a rich, wide-ranging discussion, Mitchell reflects at length on what images of extinction, including fossils, reveal about the nature of images more broadly. He also discusses gender issues in relation to depictions of dinosaurs and the discipline of palaeontology.²²⁵ Contemporary portrayals of endangered species, such as Joel Sartore's 'Photo Ark', are also addressed. The next chapter, 'Visualizing Extinction' by Harriet Ritvo, centres upon extinct species that have accrued 'significant human interest' such as the dodo, the mammoth and the thylacine. Ritvo provides a compelling meditation on the ways these species have historically been represented, with some co-opted for nationalist or political ends. The chapter also mulls the specificities of animal history, including the need for a broad-minded approach that draws extensively on scientific sources. The final chapter in this part, Stuart Pimm's 'Putting Nature Back Together Again', discusses several key issues that recur in later chapters, including the pitfalls of the tendency to hierarchize species (to the detriment of, for instance, plants), the problem of generating interest in non-aesthetically pleasing or visually interesting fauna and flora, and the role of museums in engaging public interest in biodiversity and related conservation issues. Additionally, Pimm provides fascinating insights into extinct species known only anecdotally, particularly avifauna.

Part II, 'Indigenous Peoples and Extinction', features chapters engaging with Canadian and Chinese Indigenous perspectives on extinction. The first chapter in the part, Nicholas Chare's chapter 'The Beothuk, the Greck Auk and the Newfoundland Wolf', focuses on animal and human genocide in Newfoundland. Chare examines negative representations of the Beothuk, a First Nations people of Newfoundland, and of the New-

foundland wolf (*Canis lupus beothucus*) produced by settler colonists. The next chapter, ‘Cultural Memory of Recent Extinction’ by Samuel Turvey, addresses the relative neglect accorded to Indigenous knowledge of local biodiversity and extinctions. Using China as a case study, Turvey presents a careful examination of the way representations and understandings of recently extinct species articulated by local peoples provide important insights into those species. Using extinct species of apes, cetaceans and paddlefish as examples, Turvey also forcefully demonstrates how quickly such knowledge is lost. The final chapter in the part, *hagwil hayetsk’s* (Charles Menzies’s) ‘Grief, Extinction and *Bilhaa* (Abalone)’ is a moving reflection regarding the impact of protective legislation designed to safeguard the *bilhaa* upon the First Nations Gitxaala people of Laxyuup Gitxaala, a national territory located in British Columbia. The legislation was enacted in response to overharvesting of the marine snails by settler colonists, yet it has had a profound impact on Gitxaala culture because of the profound symbolic significance of *bilhaa*. *hagwil hayetsk* also draws attention to the value that Indigenous knowledge of sustainability offers to efforts to safeguard against future extinctions.

Part III, ‘Representing Avian and Insect Extinctions’, contains four chapters, three relating to avian extinctions and one to insects. It begins with Jingmai O’Connor’s remarkable study of efforts to represent enantiornithines, ‘Sparrows with Teeth and Claws?’ Enantiornithines are a group of extinct avialans, similar in some respects to what are today called birds. Although they are known only from the fossil record, O’Connor provides a highly textured picture of these avialans, including their form and behaviour. The wealth of available fossil data feeds into the work of palaeoartists, some of whose art is reproduced in the chapter. Collaborative portrayals of this kind, in which professional palaeontologists offer advice, are invaluable for counteracting speculative depictions of enantiornithines and other prehistoric species. These circulate widely on the internet, creating false impressions of extinct life. The next chapter, Gordon Sayre’s ‘Rare Birds and Rare Books’, is a beautiful meditation on the portrayal of the great auk and the Californian condor (*Gymnogyps californianus*) in John James Audubon’s *Birds of America*. Sayre examines tensions also identified by Pimm between the drive to collect and the need to preserve species. He also invites reflection on the modern practice of initiating breeding programmes for endangered species in zoos, a process that transforms the species into a work of art that, like a painting or sculpture, is dependent upon humans for its preservation and value. The third chapter, Sarah Bezan’s ‘The Species Revivalist Sublime’, considers the use of virtual reality (VR) technologies to stage encounters with extinct species. Bezan uses Jakob Kudsk Steensen’s installation *Re-Animated*, which features the Kauhūi ʻōʻō

bird (*Moho braccatus*) as a case study. Bezan argues that the highly affective sublime experience engendered by Steensen's staging of virtual encounters with the extinct bird moves away from the elegiac responses commonly associated with the contemplation of disappeared wildlife. The part concludes with Pedro Cardoso's 'Insects, Spiders, Snails and Empathy', which considers negative public perceptions of invertebrates such as insects and assesses ways in which natural history museum exhibitions might help to change such opinions. Like Bezan, Cardoso sees considerable value in VR technology because of the immersive, multisensory experiences they can provide.

Part IV, 'Representing Extinct Plants and Fungi', contains three chapters about plants and one about yeasts. It begins with a chapter considering reconstructions of extinct plants from the fossil record, Jeffrey Benca's 'Reconstructing Lycopods Lost to the Deep Past'. Benca is a palaeontologist and a palaeoartist, and his chapter includes an example of his extraordinary, incredibly detailed work. In the chapter, he draws attention to how contemporary perceptions of plants inflect palaeontological practice, with the portrayal of plants in reconstructions of prehistoric ecosystems often unrealistic. The next chapter, 'Ellis Rowan, Extinction and the Politics of Flower Painting' by Jeanette Hoorn, presents exquisite readings of some of Rowan's botanical illustrations and salon paintings. Hoorn suggests the artist-scientist accords plants a subjectivity that has important implications for today, given that plant extinction is a pressing contemporary issue. Dawn Sanders's powerful chapter 'Towards Extinction' offers close analyses of three art installations by Snæbjörnsdóttir/Wilson. Sanders suggests that, by way of artworks such as these, contact zones between plant and human can be generated. Discussions of scale and immersivity in the chapter resonate with issues raised in earlier chapters by Cardoso and Bezan. For Sanders, contact zones encourage greater recognition and understanding of plants, extinct or otherwise. The final chapter by Robert Dunn, Monica Sanchez and Matthew Booker explores yeast extinctions. Yeasts, a kind of fungi, are often overlooked despite their importance and their omnipresence through history. Dunn, Sanchez and Booker seek to grant yeasts a new measure of visibility through the history they provide. They draw attention to the mutually beneficial relationship that exists between many insects and yeasts and to the key role insects play in yeast ecology. Insects are umbrella species, so protecting them would also safeguard yeast diversity. The authors also reflect on the need to think about yeasts beyond optical representation, as they are visually uninteresting. Their remarkableness resides in what they enable, not what they look like.

Part V, 'Representing Extinct Mammals', includes a broad discussion of mammal extinction and then two species-specific case studies. It begins

with Barbara Creed's 'Animal Extinction, Film and the Death Drive', a persuasive, psychoanalytically informed meditation on extinction drivers in the Anthropocene. Creed suggests that the death drive, the drive towards death and destruction identified by Sabrina Spielrein and developed by Sigmund Freud, has played a notable but little-understood role in many recent extinctions. Her exploration of the drive is structured around a consideration of three animal documentaries by Nicolas Philibert, and also the art practice of Janet Laurence. The next chapter by David Maynard, 'Tasmanian Tiger: Precious Little Remains', provides a fascinating account of the rationale underpinning an ongoing exhibition dedicated to the thylacine. The exhibition draws on both art and science to trace the animal's fate and to reflect on its continuing importance within Tasmanian society. The final chapter in the part, 'From the General to the Particular', focuses on an individual quagga located at the Muséum national d'Histoire naturelle in Paris. By weaving together insights derived from the physical, textual and visual archives relating to this particular quagga's life and afterlife, Valérie Bienvenue enables something of the singularity of this specific individual, an animal once owned by Louis XVI, to emerge. Now labelled simply as A544, the quagga appears abstract, a 'specimen' rather than an individual. Bienvenue's aim in reconstructing aspects of his life is to grant him a personality, to render him noteworthy, so that we have a tangible sense of what we lost when he died and can therefore begin to grieve that loss.

The final part of the volume, Part VI, 'Exhibiting Extinction', contains three chapters that examine the significance of museums as spaces through which extinction is represented.²²⁶ Museum exhibitions, as Serge Chaumier notes, provide narratives that express particular ideas and draw attention to pressing issues.²²⁷ Thom van Dooren's emphasis on the value of storytelling is of note in this context. He suggests that stories about extinction can 'add flesh to the bones of the dead and dying', breathing life into specific species disappearances through sharing the 'intimate particularities' of a given organism.²²⁸ Writing of textual representations, he understands his 'thick descriptions' as ethically purposive, potentially giving rise 'to genuine care and concern'.²²⁹ For him, stories act upon the world rather than simply reflect dimensions of it.²³⁰ These three chapters on museum exhibitions embody a similar perspective.

The first chapter in this part, 'Three Variations on the Theme of Extinction' by Anne-Sophie Miclo, provides an extended consideration of the art practice of Mark Dion. Dion's art, which frequently explores extinction issues, is always informed by scientific research. His works have been displayed in contemporary art galleries and in natural history museums, bringing art into the domain of science and science into the sphere of

art. Miclo persuasively argues that the playful seriousness associated with Dion's earlier works has now been replaced by an urgent gravitas. These later works, which invite critical reflection on contemporary ecological issues, form a call to action. The middle chapter, Norman MacLeod's 'The Exhibition of Extinct Species', offers a measured critique of contemporary museum approaches to the exhibition of extinction. MacLeod suggests many museums have adopted an overly sentimental vision of extinction that fails to adequately acknowledge the complexities of past extinction events. For example, the mass extinctions of deep time led to the disappearance of some species but also ultimately promoted biodiversity. In this context, the melancholic discourse associated with extinctions in general is misplaced. Modern human-driven extinctions should not be conflated with the natural mass extinctions of the past. The final chapter, 'Exhibiting Extinction' by Kathryn Medlock, offers an absorbing exhibition history of the thylacine at the Tasmanian Museum and Art Gallery (TMAG) from the 1850s to the present. Medlock traces the shifting ideologies underpinning how the thylacine has been represented by the museum over time, culminating with the present exhibition in which the thylacine display functions both to share knowledge and elicit feelings of 'sadness and guilt' at this striking example of anthropogenic extinction. Today, the thylacine exhibition at TMAG provides a powerful warning of the dangers humans sometimes pose to the world they are a part of and, thus, to themselves.

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Notes

1. Lewis-Williams focuses on afterimages caused by sensory deprivation or psychotropic experiences. Images that persist in the field of vision can also be caused in other ways, such as by looking into bright light and then turning away.
2. Prehistoric cave art elsewhere in the world also includes depictions of animals. The oldest known cave painting, which was made at least 43,900 years ago in a limestone cave in South Sulawesi, is of a warty pig (*Sus celebensis*). See Brumm et al., 'Oldest Cave Art Found'.
3. Guthrie, *The Nature of Paleolithic Art*, 79–84, 109.
4. For an overview of mammoth imagery, see Braun and Palombo, 'Mammutbus primigenius'. The majority of works depicting bears probably show the brown bear (*Ursus arctos*) but cave bears are also depicted. See Stiner, 'Cave Bear Ecology', 53.
5. A relict population survived on the island of Iutruwita/Tasmania into the twentieth century. For an exploration of the mainland extinction, see Johnson, *Australia's Mammal Extinctions*, 154–55. Johnson suggests overhunting as an explanation for the extinction of the mainland thylacine. Robert Paddle argues the thylacine also survived in mainland Australia into the nineteenth century. See Paddle, *The Last Tasmanian Tiger*, 23–24.
6. Mulvaney, 'Dating the Dreaming'. Mulvaney refers to the image simply as a 'quadruped' for much of his essay before finally suggesting it is a thylacine (46). His attribution is lent plausibility by the probable age of the image (it cannot be a dingo, for instance). For a general discussion of the petroglyphs at Murujuga, see Chare, 'Vision and Indifference'. For a reading of the petroglyph that builds on Mulvaney's ideas, see Chare, 'After the Thylacine', 139–42. Mulvaney provides further discussion of thylacine imagery in *Murujuga Marni*, 225–35.
7. Crary, 'Techniques of the Observer', 9.
8. Our translation. All translations are our own unless otherwise stated. Purkinje, *Beiträge zur Kenntnifs des Sehens*, 167.
9. As part of a summary of Jonathan Crary's work, W.J.T Mitchell refers to 'afterimages' as psychophysiological phenomena and associates their emergence in the nineteenth century as something to be studied with a shift to more bodily conceptions of visual experience. See Mitchell, *Picture Theory*, 19–20.
10. Mulvey, *Afterimages*, 10.
11. The ready association between afterimages and afterwardness as a belated recognition of trauma also registers in the title of Hirsch's *Afterimage*, a book that examines ethical and political issues related to representations of the Shoah. For a brief but insightful overview of Freud's idea of *Nachträglichkeit*, see De Lauretis, *Freud's Drive*, 118. The performance artwork *Becoming an Image* by Cassils has been interpreted as exploiting the artificial encouragement of afterimages through the use of flash photography as a means to explore the trauma-inducing violence perpetrated against trans* people. See Steinbock, 'Photographic Flashes', 261.
12. Heise, *Imagining Extinction*, 42. There are periodic claims that the woodpecker is not extinct. See, for instance, Hill et al. 'Evidence'.
13. Heise, *Imagining Extinction*, 60–61.
14. See, for instance, Caruth, *Unclaimed Experience*. For a problematizing of this understanding of trauma, see Chare and Williams, *Matters of Testimony*. For an incisive overview of trauma theory generally, see Ball, 'Introduction'.
15. Alexander, 'Toward a Theory of Cultural Trauma', 7.

16. Communicating a traumatic experience and grasping its significance does not equate with recovering from it. For a discussion of debates about trauma and healing, see Ionescu and Margaroni, 'Introduction'.
17. Pollock, *After-affects/After-images*, xxvi.
18. Fat from the emu was mixed with pulverized metal (the metal, referred to as 'lateenar', was pounded using a tool referred to as a 'patener') and used as body paint by Tasmanian Aborigines. See Anonymous, 'A Relic from the Past', *The Mercury*, 29 January 1874, p. 2. The importance of the emu to the Aboriginal population is also signalled by the recorded existence of a now lost charcoal drawing of the bird made on bark. The drawing of the bird was located at an abandoned settlement in an area known by the Europeans as Painter's Plains (a name inspired by the presence of the artworks). See Burn, 'Narrative of the Overland Journey', 373.
19. The importance of the emu to Aboriginal ceremony in lutruwita (Tasmania) is attested by Adolphus Schayer. See McFarlane, 'Adolphus Schayer', 112–13.
20. Country is all encompassing and attacks on part of it therefore injure the whole rather than a part. For a discussion of trauma theory in relation to Indigenous trauma in a Canadian context (focusing on the Beothuk), see Chare, 'In Her Hands'.
21. Mulvey, *Afterimages*, 10.
22. For further discussion of the idea of 'the past in the present' as it relates to film, see Chare, 'Once More with Feeling'.
23. Leeder, 'Introduction', 3.
24. Mulvey, *Afterimages*, 10.
25. Poliquin, *The Breathless Zoo*.
26. *Ibid.*, 203.
27. Barrow, *Nature's Ghosts*.
28. See, for example, *ibid.*, 100, 107, 139.
29. Harting, *British Animals Extinct*, 3. Harting's aim in writing his book was to bridge a gap in British scholarship between the study of the fossil record and research into the natural world in the present day. This gap related to 'such animals as have become extinct in Britain *within historic times* (v)'; emphasis in the original. Harting is essentially offering animals a history to supplement the prehistory already accorded them.
30. For Flannery and Schouten, however, their collaboration is conceived as filling in gaps, resurrecting vanished species through creating life-sized artwork of them (Flannery and Schouten, *A Gap in Nature*, xii–xiii).
31. Gordon, *Ghostly Matters*, 18. In this sense, their social and political effects might be said to register affectively.
32. Bird specimens in natural history collections are also referred to as 'study skins'. For further information on Rickard's project, see the Tasmanian Museum and Art Gallery website: https://www.tmag.tas.gov.au/whats_on/exhibitions/current_upcoming/info/extinction_studies (last accessed 4 February 2021).
33. Lees and Pimm, 'Species, Extinct Before We Know Them?', R177.
34. Turvey, 'New Historical Record'.
35. William Dean suggests that both 'now unidentifiable' birds mentioned by Cardim might constitute 'the first extinctions brought about in the Atlantic Forest by the European invasion'. Dean, *With Broadax and Firebrand*, 49.
36. Cardim, *Tratados*, 50–51. The Portuguese word *rosmaninho* used by Cardim to describe the parrots colouring is often translated as 'rosemary' in English but actually refers to lavender, and probably indicates a mauve colour. It is presumably because of this confusion with rosemary, which can have pink flowers, that the first English

- translation of Cardim's text in 1625 referred to 'the colour of the Bulfinch [*sic*]'. Bullfinches are pink-breasted. See Purchas, *Hakluytus Posthumus*, 461.
37. Moreira-Lima, 'Aves de Mata Atlântica', 9.
 38. Cardim, *Tratados*, 119.
 39. The feathers were used to fabricate diadems and colourings (*esmaltes*) by Indigenous peoples. Cardim, *Tratados*, 51.
 40. Kolbert, *The Sixth Extinction*, 10.
 41. Pimm and Joppa, 'How Many Plant Species', 174. See also Pimm, 'What We Need to Know', 10.
 42. Pimm and Joppa, 'How Many Plant Species', 174.
 43. Vorontsova et al., 'Inequality in Plant Diversity Knowledge', 56.
 44. For a discussion of possible exceptions, see Stuart Pimm's chapter in this volume.
 45. For an extended discussion of binomials and species naming more generally, see Chapter 2 of Ritvo, *The Platypus and the Mermaid*.
 46. Müller-Wille, 'Systems and How Linnaeus Looked', 314. Susanne Renner detects an important diagnostic dimension to Linnaeus's approach. See Renner, 'A Return to Linnaeus's Focus on Diagnosis'.
 47. Ritvo, 'New Presbyter or Old Priest?', 265.
 48. Baxandall, *Patterns of Intention*, 5.
 49. Pollock, *Vision and Difference*, 6.
 50. We understand coding here to refer to language (verbal, visual or of another kind) as a social system that substitutes symbols for things and experiences. These symbols, which are subject to convention and open to variation, are used as a means to intentional communication. The choice that exists of which symbols to use demonstrates that language is both coded and behavioural in character.
 51. Steve Baker rightly cautions against the idea of 'better or more true' images of animals that escape any misconceptions about a given species. See Baker, *Picturing the Beast*, 189.
 52. See Carol Freeman's extended analysis in *Paper Tiger* of the demonization of the thylacine, and how this may have hindered efforts to protect the species.
 53. Genetic information about species gleaned from tissue samples also involves an element of description. Species identifications based on morphology and molecular genetics sometimes diverge, with physical appearance and genetic make-up failing to generate the same outcome. The existence of cryptic species – ones that look the same but are different – demonstrates the limits of appearance or form as a guide to distinctiveness.
 54. MacLeod and Forey, 'Introduction', 1.
 55. Baxandall, *Giotto and the Orators*, 9.
 56. Harvey, *Phycologia Australica*, unpaginated. The seaweed was first collected in the vicinity of Spectacle Island in 1855 and finally near Shark Island in 1886. See Millar, 'Bennett's Seaweed'.
 57. Harvey, *Phycologia Australica*, unpaginated.
 58. Harvey is writing in the nineteenth century. Nowadays, taxonomic descriptions are more standardized, so the opportunity for feelings to manifest through data representation is significantly reduced but not, we would suggest, entirely extinguished.
 59. The influence of European flora and fauna on perceptions of Australian species is also registered in the plant species now known as the woody pear (*Xylomelum pyriforme*). The non-pear-related Aboriginal name for the plant, which went unnoted when it was classified, is Meridja couroo. See Maiden, *The Useful Native Plants of Australia*, 615.

60. In his entry for the red alga *Plocamium preissianum*, Harvey explains that etymologically the *Plocamium* derive their name for the Greek for 'tuft of hair'. See Harvey, *Phycologia Australica*, unpaginated.
61. Harvey acknowledges that the example he is using is 'only in a young state, and probably the fully developed frond would be of different shape and considerably larger'. He is, however, unconcerned by this as he feels he has been able to establish the essential character of the organism.
62. Harvey, *Phycologia Australica*, unpaginated. Both Harvey's Plate (number 61) and a photograph of a preserved specimen are reproduced as part of the entry for *Vanvoorstia bennettiana* at AlgaeBase. https://www.algaebase.org/search/species/detail/?species_id=23738&-session=abv4:AC1F22890327930DD6wQ6E2349F5 (last accessed 29 January 2021). The vivid red colour of the alga in the Plate probably reflects how *Vanvoorstia bennettiana* appeared in life. The dry specimen is a dull maroon.
63. Vogt, Bartolomaeus and Giribet, 'The Linguistic Problem of Morphology', 308.
64. In the context of morphology, Johann Wolfgang von Goethe's aesthetically informed morphological studies offer a particularly complex historical affirmation of how art and science can combine in the study of nature. See Steigerwald, 'Goethe's Morphology'.
65. Australian Aboriginal notions of species difference, for example, include attention to form but also to colour, behaviour and habitat. See Rose, *Dingo Makes Us Human*, 45.
66. In its natural environment, seaweed is reliant upon microbial communities for nutrients and well-being. See Singh and Reddy, 'Seaweed–Microbial Interactions'.
67. David Daniel discusses thalu sites for birds, fish, insects, mammals and plants in *Thalu Sites of the West Pilbara*.
68. For an overview of the Dreaming, see Chapter 3 of Rose, *Dingo Makes Us Human*.
69. Mulvaney, 'Dating the Dreaming', 43.
70. Mulvaney identifies these as fat-tailed and argues they may portray an extinct species of macropod. Although the petroglyph identified as a quadruped looks like one, it is not impossible that the largely obliterated image could be the same macropod found engraved on surrounding rocks. Mulvaney's argument about the ritual significance of the site would not change (as the macropod also appears to be extinct) but there would no longer be a predator–prey dynamic present. Katie Glaskin has recently critiqued Mulvaney's reading and questioned whether the disappearance of the thylacine would have been understood in terms of extinction. Glaskin notes that increase rituals are usually seasonal rather than 'specifically reactive to apparently scare supply' (9). This, however, ignores Mulvaney's identification of the Patterson Valley thalu as qualitatively different to other increase sites in the region. See Glaskin, 'Extinction, Inscription and the Dreaming'. In *Thalu Sites*, Daniel notes of a whale thalu in the vicinity of Murujuga which was formerly used by the Yaburara, that how it functioned is now unknown. Each site requires the use of specific traditional knowledge.
71. Mulvaney, 'Dating the Dreaming', 44. He also notes that petroglyphs embodying a spatial relation of predator–prey are found elsewhere in Murujuga, at Gum Tree Valley.
72. Mulvaney, 'Dating the Dreaming', 46. Mulvaney's use of the Latin binomial is, of course, anachronistic. The name given by the Aboriginal custodians to the animal now known as *Thylacinus cynocephalus* is lost. It was not the cynocephalic or 'dog-headed' thylacine they strove to save but an animal viewed very differently.
73. Writing specifically of rock engravings of fat-tailed macropods (but also with a knowledge of Mulvaney's discussion of the thalu site featuring the thylacine), Steve Brown, in 'Tales of a Fat-Tailed Macropod', suggests the production of such images 'solidifies the relationship between human and non-human' (253). He also argues the petro-

- glyphs should not be viewed as representations but instead as ‘emergent relational entanglements across human/non-human/more-than-human domains’ (254).
74. Reading the lines as radiating outwards institutes a hierarchy and conceives of species difference in oppositional terms. Aboriginal understandings of difference, however, usually emphasize complementarity. See Rose, ‘Common Property Regimes’, 138.
 75. Macropods such as kangaroos and some wallabies live in mobs (groups). When faced with a group of prey animals, predators often do not kill indiscriminately but select prey they perceive as weaker. See Allen, *Wolves of Minong*, 88–112.
 76. For a discussion of totemism in relation to Aboriginal Australia, see Rose, ‘Common Property Regimes’; Merlan, ‘Ghost Twitter’.
 77. The idea of species as discrete entities forms part of a metaphysics of individualism. See Vint, ‘Entangled Posthumanism’, 315. Summarizing Karen Barad’s ideas, Vint suggests terms such as ‘interaction’ should be replaced by ‘intra-action’ to foreground the ontological inseparability of phenomena.
 78. See also Menzies, ‘Dm sibilhaa’nm da laxyuubm Gitxaała’, 216.
 79. We are grateful to one of the anonymous peer reviewers of this volume for helping us to refine our thinking regarding Indigenous knowledge and extinction.
 80. The Creature Collective formed in 2016, for instance, unites scholars with ties to Australia, Canada, Malaysian Borneo, the Philippines and the United States of America. See Hernández et al., ‘The Creature Collective’.
 81. Bagele Chilisa notes the overemphasis on English in research and stresses the need for bilingual research. Indigenous cultures without numerous English-speakers risk being sidelined from contemporary collaborations and debates. See Chilisa, *Indigenous Research Methodologies*, 205–6.
 82. Doxtater, ‘Indigenous Knowledge in the Decolonial Era’, 626.
 83. A recent study has started to rectify this problem. See Wang et al., ‘Ethnobotanical Study’.
 84. Lalonde, ‘African Indigenous Knowledge’, 56. Luc Hens discusses the value of Indigenous knowledge in the specific context of Ghana in his article ‘Indigenous Knowledge and Biodiversity’.
 85. Gandile, Tessema and Nake, ‘Biodiversity Conservation’. It is noteworthy that of the fifty-five members of the Zeysa, Zergula and Ganta communities interviewed for the study, fifty-three were men. As women in rural areas provide the majority of agricultural labour, their lack of representation in the study is regrettable.
 86. Becker and Ghimire, ‘Synergy’. We use the Guna name Abya Yala for South America in deference to the region’s Indigenous communities but recognize there are alternative terms such as the Nahuatl name Ixachilan.
 87. Mitchell, Todd and Pfeifer, ‘Aboriginal Knowledge Systems’, 6.
 88. See, for example, the important article by Das and Lowe, ‘Nature Read in Black and White’.
 89. See Londa Schiebinger’s discussion of the plant, where she notes its discoverer (displaced African or Indigenous Surinamese) is actually unknown. Schiebinger, ‘Naming and Knowing’, 99.
 90. The Ulwa are a people of the eastern part of what is now called Nicaragua. For a discussion of various names ascribed to the plant, see Duke, *Duke’s Handbook*, 589–90. *Battaka di basta* is referenced in Coe and Anderson, ‘Ethnobotany’, 383.
 91. Guasco, ‘As Dead as a Dodo’.
 92. For a discussion of Indigenous storytelling (*récits*), see Brais-Dussault, ‘Art du tatouage’. See also Chare, ‘Memory’.
 93. Woloshyn, ‘Welcome to the Tundra’, 4.

94. The song 'Hunger' on the album *Auk/Blood* is particularly sensual. Tagaq's tongue becomes an erotic instrument, articulating a softly spoke desire that simultaneously voices a hard-edged refusal of binary logic through lyrics such as 'I want to be your slave and your master'.
95. Galloway, 'The Aurality of Pipeline Politics', 122.
96. Igloliorte, 'Nunatsiavummi Sananguagusigisimajangit', 206.
97. Boerchers, "To Bring a Little Bit of the Land", 31.
98. We believe that through its bloody eroticism, the scene forms a deliberate nod to Carolee Schneemann's performance *Meat Joy* (1964). It is interpreted differently by Boerchers, being seen as a continuation of the preceding scene in which Tagaq is shown embodying a dying caribou, clad in reindeer fur and bleeding. See Boerchers, "To Bring a Little Bit of the Land", 33.
99. For references to literature on the decline of Arctic insects, see Wagner, 'Insect Declines'.
100. Aniskowicz-Fowler, 'Terrestrial Arctic Fauna', 113.
101. *Isarukitsok* or *isarokitsok* is the name used by the Kalaallit or Greenland Inuit for the auk. See Buffon, *Histoire naturelle*, 409n2. The Inuit name *akpingak* is noted by Austin in *The Birds of Newfoundland Labrador*, 90. Writing in 1932, Austin already believed the *akpingak*/curlew extinct.
102. Galloway, 'The Aurality of Pipeline Politics', 140.
103. Cited in Drew Nelles, 'The Rise of Tanya Tagaq', *The Walrus* (2015). <https://thewalrus.ca/howl/> (last accessed 14 October 2021)
104. Preston, 'Tanya Tagaq in Concert', 649.
105. Gagnon, 'Singing with *Nanook of the North*', 48.
106. Ferrett, *Dark Sound*, 146.
107. One of Ferrett's case studies is Jana Winderen's composition *The Listener* (2016) which records the sounds of underwater insects. See Chapter 5 of *Dark Sound*.
108. Ferrett, *Dark Sound*, 146–47.
109. Mitchell, *What do Pictures Want?*, 15. For a discussion of cloning in relation to species de-extinction, see Martinelli, Oksanen and Siipi, 'De-extinction'.
110. Cambefort, 'Zoological Nomenclature', 145.
111. See 'Q+A with Mark Dion' (2017) <https://www.icaboston.org/articles/qa-mark-dion> (last accessed 4 February 2021). In this interview, Dion stresses that he does not view himself an activist, but his work clearly lends itself to environmental activism.
112. Stephanie Eslake, "I almost cracked": 16-month artistic performance of mass extinction comes to a close', *The Guardian*, 25 January 2021. <https://www.theguardian.com/artanddesign/2021/jan/25/i-almost-cracked-16-month-artistic-performance-of-mass-extinction-comes-to-a-close> (last accessed 4 February 2021).
113. For an in-depth examination of this topic, see Gell, *Art and Agency*.
114. Pollock, *Art in the Time-Space*, 54.
115. Pollock, *After-affects/After-images*, 193.
116. Boyle, 'Remembering the Huia', 81.
117. Samuel Turvey identifies the Holocene as a particularly important period for studying how anthropogenic factors contribute to extinctions, this because of the epoch's relatively stable climatic conditions in contrast to the Pleistocene. See Turvey, 'Preface', ix. Cary Wolfe cautions against uncritical uses of the term 'anthropogenic' that fail to acknowledge the varied implication of human groups and societies in extinction events. See Wolfe, 'Foreword'.
118. Darwin, *Origin of Species*, 129–30.
119. In 1982, David M. Raup and J. John Seposki identified five clearly defined mass

- extinctions in the Late Ordovician, Late Devonian, Late Permian, Late Triassic and Late Cretaceous. See Raup and Seposki, 'Mass Extinctions', 1502. The Great Oxygenation Event, which occurred roughly 2.4 billion years ago, was the first mass extinction and, if added to Raup and Seposki's list, means we have already experienced six mass extinctions. The current mass extinction would therefore be the seventh rather than, as it is commonly called, the sixth.
120. Ohtomo et al., 'Evidence for Biogenic Graphite'.
 121. Mitchell, *Image Science*, 35.
 122. Ibid., 36.
 123. For an incisive discussion of biases in the fossil record, see Milsom and Rigby, *Fossils at a Glance*, 7.
 124. MacLeod, *The Great Extinctions*, 40.
 125. For a discussion of Palissy's understanding of fossils, see Delord, *L'extinction d'espèce*, 93–136; Shell, 'Casting Life, Recasting Experience', 24–29.
 126. Cuvier, *Theory of the Earth*, 115.
 127. Gynther, Waller and Leung, 'Confirmation of the Extinction', 26.
 128. For a brief summary of the composition of crude oil, see Matar and Hatch, *Chemistry of Petrochemical Processes*, 12–19.
 129. MacLeod, *The Great Extinctions*, 45.
 130. Mitchell, *The Last Dinosaur Book*.
 131. Zylinska, *Nonhuman Photography*, 104.
 132. Ibid., 111.
 133. Mirzoeff, *How to See the World*, 23.
 134. This issue is evident from Daguerre's photograph. Several of the fossils are backed by white card which helps them to stand out.
 135. Kerp and Bomfleur, 'Photography of Plant Fossils', 118.
 136. Ibid.
 137. Probably the first fossil plant photograph, a salt print, was produced in 1857 by Auguste-Adolphe Bertsch, and shows a magnification of a section of fossilized wood. The image was labelled 'Bois fossile du Kingia'. Kerp and Bomfleur, 'Photography of Plant Fossils', 119.
 138. The warbler probably disappeared in the 1980s. Its extinction is attributed to the introduction of rats to the island. Writing in 1893, W.L. Abbott described the rats on Aldabra as swarming everywhere and as 'very destructive'. See Abbott, 'Notes on the Natural History of Aldabra', 762.
 139. Given the small population of the bird, this act of collecting was potentially devastating. A photograph by Malcolm Penny of the nest in situ is reproduced in Benson and Penny, 'A New Species of Warbler', 104. Benson and Penny describe the warbler as a 'dingy coloured species' (102). A colour hierarchy is clearly in operation here, with brown plumage being viewed as dull and drab.
 140. The bird is catalogued at the Natural History Museum as 1968.43.1.
 141. Wherever possible in this chapter, we have adopted his or her pronouns to reflect the known gender of specific animals. When we do not know the gender of a given animal, we have opted for they, their or them. These decisions impose human conceptions of gender on non-human animals but aid us to resist objectifying the animals we are referring to. We have not extended this approach to our writing about plants, but perhaps we should have. Plants are more resistant to having human conceptions of gender mapped onto them (often they are 'hermaphroditic' but sometimes they are 'dioecious') but, in the context of flora, we could have adopted they, their or them pronouns.

142. Catesby describes the passenger pigeon (referred to by him as *Palumbus migratorius*, the pigeon of passage) and includes an illustration of it in *The Natural History of Carolina, Florida and the Bahama Islands*. He attributes some of his knowledge of the bird to an unnamed ‘Canada Indian’ (23).
143. Fuller, *Lost Animals*, 130.
144. Our reading of these images is inspired by Carol Freeman’s remarkable work on photographs featuring the thylacine in captivity. See chapters 5 and 6 of Freeman’s *Paper Tiger*.
145. Prÿs-Jones used Ektachrome 400 slide film when photographing the birds (Robert Prÿs-Jones, email message to Nicholas Chare, 18 January 2021). This kind of film is well suited to for reproducing colours faithfully and with saturation, even in dim light.
146. We are indebted to Anne Bruneau for proposing a possible identification for this plant. That *Cissampelos pareira* is native to Aldabra is confirmed by William Hemsley in his study of the island’s flora. Hemsley also cites a report by Rivalz Dupont that draws on local perspectives, which refers to the flowering season on Aldabra as unlike anywhere else in the Seychelles, such is the ‘display of wild flowers with its accompaniment of insects and birds’ (110). It seems probable that the as yet unnamed Aldabra brush warbler was one of the species of birds included in this description. See Hemsley, ‘Flora of Aldabra’.
147. We are grateful to Robert Prÿs-Jones for clarifying information about the rings (Robert Prÿs-Jones, email message to Nicholas Chare, 10 February 2021). Prÿs-Jones stated to Fuller that he took all his photographs of warblers in 1975.
148. Fuller notes that the photographs he reproduces have not been tampered with or enhanced, but in the case of the second picture of Martha he appears to have reproduced a version that had been cropped in the past. Fuller, *Lost Animals*, 10.
149. This reflection extends to which photographs of the birds to circulate. Exercising his aesthetic judgement, Prÿs-Jones has only digitized two of his slides of the warbler because he believes the others are probably not of acceptable quality for reproduction (Robert Prÿs-Jones, email message to Nicholas Chare, 10 February 2021). A blurred picture of the warbler, for instance, may appear to hold little informational worth, although it attests to the difficulties involved in photographing a small, energetic bird and therefore possesses a significant story with a different kind of value.
150. Films of birds do not always provide clear depictions. The April 2004 video footage of what is identified by some as an ivory-billed woodpecker is a case in point. The attribution has been questioned. Stills from the video are reproduced in Fitzpatrick et al., ‘Ivory-billed Woodpecker.’
151. For a useful discussion of lens flare, see Campbell, *Science, Entertainment*, 68.
152. Whether the vocalizations were calls or songs and whether of male or female warblers (or of warblers of unknown sex) is not noted by Prÿs-Jones in ‘The Ecology and Conservation’, 212.
153. Pearson, ‘Aldabra Brush-Warbler’.
154. Craig, ‘Expressions of Emotion’.
155. Delius, ‘Preening’, 40.
156. For a discussion of aspects of Meyer’s career, see Greenland, ‘Connections in the Collections’. A month and a half after Martha’s death, Herman wrote a letter to the editor of the *Journal of the American Medical Association* arguing for the importance of ducks as destroyers of insects and suggesting their usefulness could be exploited to guard against their extinction. Herman, ‘The Duck as an Insect

- Destroyer', 1410. Herman wrote a well-known article about Martha for *The Auk* in which he compared her to the 'Last of the Mohicans'. Herman, 'The Last Passenger Pigeon', 80.
157. Fuller, *Lost Animals*, 71.
 158. Willis, *Reception*, 74.
 159. Fuller, *Lost Animals*, 9.
 160. The 'yawn' is actually a sign of distress. Fuller's book is therefore fronted by an animal signalling immense anxiety in response to the act of being photographed. For further discussion of the 'yawn', see Chare, 'After the Thylacine', 132.
 161. For an account of 'Benjamin', see Sleightholme, 'Confirmation of the Gender'.
 162. Freeman, *Paper Tiger*, 180.
 163. See Bell, Bell and Merton, 'The Legacy of Big South Cape', 215.
 164. Dwyer identifies the specimen he sketched as 1083. This seems to be the bat now catalogued as LM001893, which is the holotype for *Mystacina robusta*. The bat was collected by L. Bell on 29 April 1955 from Pukeotakeo (Big South Cape Island). See Dwyer, 'Studies on the Two New Zealand Bats', 4.
 165. Like Dwyer, Keulemans worked in monochrome. The colouring of the lithographs in his name was outsourced to others.
 166. Rothschild, *The Avifauna of Laysan*, 162.
 167. Barthes, *Camera Lucida*, 96.
 168. Ibid.
 169. Some bats do carry disease. Rabies, for instance, likely exists in the United Kingdom bat populations. Not all bats, however, carry diseases in equal measure. See Hoffmaster, Vonk and Mies, 'Education to Action'.
 170. For further discussion of this phenomenon, see our conversation with Stuart Pimm in this volume.
 171. For an extended discussion of cuteness in the context of felines, see Lavoie, *Trop mignon*. Lavoie interprets cuteness as an ambiguous value judgement that holds painful as well as pleasant connotations.
 172. Baker provides a subtle and sophisticated analysis of how stereotypical representations of animals can encourage conceptual closure. For him, stereotypes are simplistic and prejudicial (Baker, *Picturing the Beast*, 28–29).
 173. Fuller, *Lost Animals*, 180.
 174. The name provides a good literal description of the location but also seems intended to connote Batman's Batcave, which was first mentioned in 1943 (it was initially populated by bats as well as by the eponymous superhero). The affectionate name given to the bat roost in Aotearoa/New Zealand demonstrates the influence that popular culture can have upon species and habitat perception. See also the discussion of the 'Skywalker' hoolock gibbon in Stuart Pimm's chapter in this volume.
 175. For a general overview of bat sociality, see Kerth, 'Causes and Consequences'.
 176. We are grateful to Elizabeth Bell for providing information about the circumstances in which the two photographs were taken (Elizabeth Bell, email message to Nicholas Chare, 21 January 2021).
 177. The Ryukyu wood pigeon was described as 'of little importance zoogeographically' in an article on Ryukyu Island zoogeography. This demonstrates that the attention accorded a species by naturalists also varies significantly dependent upon the kinds of issues that interest them. See Short, 'Notes on Okinawan Birds', 265.
 178. Halsey, *Deleuze and Environmental Damage*, 235.
 179. See Balding and Williams, 'Plant Blindness'.

180. Plants that produce 'impressive' flowers, however, are cherished. Some orchid species are much admired. In botanical science, a disproportionate number of researchers seem to work on orchids.
181. For a discussion of trees as cultural symbols, see Rival, 'Trees'. For insights into the significance that timber might have held in the Neolithic period, see Chare and Price, 'The Dagenham Idol', 30–35.
182. Darwin also countenanced the 'coral of life'. See Hellström, 'Darwin and the Tree of Life'.
183. For a summary of a specific case of tree sitting ('Hector the Forest Protector') and its exploitation for media impact, see Lister and Hutchins, 'Power Games', 586–87. Most trees used for tree sitting are subsequently felled. An exception is the coast redwood (*Sequoia sempervirens*), Luna, that Julia Butterfly Hill occupied for 738 days in 1997–99.
184. For an exploration of this in relation to First Nations in Canada, see Wyatt, 'First Nations, Forest Lands'.
185. The relative lack of debate about plant rights is linked to a failure to countenance ideas of plant cognition and plant sentience. As recognition of the complexity of plant behaviour increases, calls for plant rights may become more energetic. For a recent investigation into plant cognition, see Parise, Gagliano and Souza, 'Extended Cognition in Plants'.
186. Stone, 'Should Trees Have Standing?', 496. Stone employs the term 'standing' to refer to legal standing and to general status. The term might also indicate why a tree is his natural object of choice, as uprightness is associated with being human and, as Adriana Cavarero notes, trees are often linked with the phallus and, by extension, with masculinity. See Chapter 5 of Cavarero's *Inclinations*.
187. See Jose, Wu and Kamoun, 'Overcoming Plant Blindness', 171.
188. Thomas, Ougham and Sanders, 'Plant Blindness and Sustainability'.
189. For a discussion of this project, see <https://www.ginkgobioworks.com/2019/05/03/reviving-the-smell-of-extinct-plants/> (last accessed 12 February 2021).
190. Entry 51 in Lindley, *Edwards's Botanical Register*, unpaginated.
191. Pardoe and Lazarus, 'Images of Botany', 554.
192. See McKay, 'Ellis Rowan', 93.
193. See, for example, Robert Dunn, 'Modern Insect Extinctions'.
194. For an excellent summary of Wolfe's position, see Chiew, 'Posthuman Ethics'.
195. Some adult stick insects (*Phasmatodea*) such as *Ctenomorpha gargantua* exceed the average length of a human newborn. Another option for fostering empathy would be to scale down, as has occurred in wildlife television series such as *Bellamy's Backyard Safari* (1981), in which the naturalist David Bellamy was filmed to appear smaller than the insects he was studying. Maria Fernanda Cardoso blends art and science in her installation artwork exploring the genitalia of Harvestman spiders, 'It Is Not Size That Matters, It Is Shape', to critique the hierarchy regarding sexual anatomy in which size is privileged over form but also to demonstrate the need for scientific technologies of visual enlargement to realize the sculptural beauty of arachnid penises. See Buiani and Genosko, 'Putting Penises under the Microscope'.
196. No Loricifera of the roughly forty species identified since 1983 (when the phylum was discovered) has become extinct.
197. More recently, yet in a similar vein, ethologist and activist Jane Goodall delivered a powerful speech about the need for empathy in scientific research, and for the head and the heart to work together. 'Journey from the Jungle', 2019 Beatty Lecture, McGill University, 26 September 2019.

198. Donovan, 'Attention to Suffering', 98.
199. See Martinez, 'Excavating Experience', 69–70.
200. Photographs produced during fieldwork often do feature the hands of researchers, but these are not commonly reproduced outside scientific papers unless no alternative images exist. See, for instance, the small number of photographs of birds in the hand in Brewer's *Birds New to Science*.
201. For an extended discussion of this image, see Bailey, 'Tales of the Old Tasmanian Bushmen', 3. A second photograph exists of Quarrell standing and holding the thylacine.
202. For an early examination of the Tasmanian timber industry, see Penny, *Tasmanian Forestry*. The cover image for Penny's book is of a bullock team of the kind driven by Quarrell.
203. David Pearce was born in Hamilton to John Pearce and Sarah Pearce (née Jones) on 24 January 1856. He died on 23 March 1898 so he cannot be the man in the photograph. See Scott Cook, 'David Pearce (1856–1898).' <https://www.wikitree.com/wiki/Pearce-4736> (last accessed 15 October 2021). Many of the Pearce clan lived in the vicinity of Fitzgerald so the man could be another member of the family.
204. Pollock, *Art in the Time-Space*, 14.
205. The term 'landscape', with its emphasis on land that has been shaped, suggests human intervention; yet we use it here to describe all topography, including that which existed prior to humankind.
206. Landscape (*paysage*), as Augustin Berque affirms, is also a modern Western concept. He cautions that it implies a subject/object dichotomy and stresses that landscapes must not be conflated with environments. See Chapter 4 of Berque, *Médiance*.
207. Brown, 'Southwestern Wetlands', 280.
208. See Klages et al., 'Temperate Rainforests'.
209. See Greenwood and Basinger, 'Paleoecology of High-Latitude Eocene Swamp Forests'.
210. See, for instance, Winder, 'Dynamic Modelling of an Extinct Ecosystem'.
211. For an overview of methods of studying dinosaur tracks and the kind and quality of information that can be derived from them, see Falkingham, Marty and Richter, *Dinosaur Tracks*.
212. Therrien, 'Immersion', 451.
213. Ibid.
214. *Far Cry Primal* features several distinct ecosystems including coniferous forest and tundra. Megaherbivores and extinct carnivores such as the dire wolf (*Aenocyon dirus*) appear in the game's open world.
215. See DePalma et al., 'Preliminary Notes'.
216. See Gates, Zanno and Makovicky, 'Theropod Teeth'.
217. The issue of whether mends to ceramics or paintings should be visible or concealed, of whether intervention should be acknowledged or instead hidden for reasons of aesthetic unity, are ongoing. For a brief discussion of the topic, see Chare, 'Material Witness'.
218. Sometimes these activities cause damage indirectly. Roads built for logging in West Africa, for example, have also served to facilitate trade in bushmeat and may have caused the extinction of Miss Waldron's red colobus monkey (*Procolobus badius waldroni*). A relict population of the monkey might survive in Côte d'Ivoire. See Laverty and Gibbs, 'Ecosystem Loss and Fragmentation', 80.
219. Shour, *The Prospect of a Nation*, 255.
220. Cooper, *The Pathfinder or the Inland Sea*, viii.

221. Berque, *Écoumène*, 41n27.
222. Gandile, Tessema and Nake, 'Biodiversity Conservation', 169.
223. Although it does not focus on extinction, for its efforts to bring together voices from the humanities and sciences, see Tsing et al., *Arts of Living on a Damaged Planet*.
224. Books dedicated to the exploration of the extinction of a single species often provide far more nuanced explorations of representation. This is particularly the case for Freeman's ground-breaking book *Paper Tiger* about portrayals of the thylacine.
225. The phenomenon of ArtActivistBarbie is notable in this context. The brainchild of artist-academic Sarah Williamson, ArtActivistBarbie has drawn attention to sexism in the nineteenth century and to how the discoveries of Mary Anning were often used by male scientists without her being acknowledged. In a series of photographs, a bonneted Barbie in Victorian dress poses with a bucket beside fossils on the shoreline of Lyme Regis. Williamson was inspired to stage the photograph by the film *Ammonite* (Dir. Francis Lee, UK, 2020).
226. The role of the museum as a site of public engagement with extinction is of increasing interest in museology. See, for example, the forthcoming special issue of *Museum and Society* (edited by Dolly Jørgensen) on the theme of 'Exhibiting Extinction'.
227. Chaumier, 'Writing and the Museum'.
228. Van Dooren's focus is on birds.
229. Van Dooren, *Flight Ways*, 9.
230. *Ibid.*, 10.

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